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 Daryapur Taluka of Amravati District

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CENTRAL REGION, NAGPUR

जुलाई - 2016 / July - 2016

ARTIFICIAL RECHARGE PLAN AT A GLANCE

1.	Total Geographical Area of the Daryapur Block (Taluka)			793.8 0 km^2
	❖ Area occupied by Hard Rock (Basalt)			-
	❖ Area occupied by Soft Rock (Alluvium)			793.80 km^2
2.	Major land use pattern			Agriculture especially orange cultivation
3.	Average Annual Rainfall (mm)			638 mm
4.	Major Drainage			Purna 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)*			706.51 km^2
6.	Overall quality of groundwater			Suitable for domestic, industrial and irrigation use
7.	Availability of Surplus surface runoff (MCM)			16.867 MCM
8.	Surplus surface runoff considered for planning (MCM) *(70% of surplus surface runoff)*			11.81 MCM
9.	Run off for RWH in Urban Household			0.114 MCM
10.	Sub-surface storage potential available (MCM)			319.46 MCM
11.	Proposed Artificial Recharge & Water Conservation Plan			
	Item	**Percolation Tank**	**Recharge Shaft**	**Roof Top Rain Water Harvesting** (for 10% houses)
	❖ Proportionate Allocation of surplus runoff (MCM)	5.90	5.90	0.114
	❖ Feasible number of structures	30	98	4187
	❖ Unit cost of structure (crores)	0.70	0.025	0.0008
	❖ Estimated Cost (Crores)	21.00	2.45	3.35
	❖ Expected Recharge (MCM) (considering 85 % efficiency)	5.01	5.01	0.096
12.	Total estimated cost (Crores)	26.80 crores		

Artificial Recharge Plan for the Over Exploited Daryapur Taluka of Amravati 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 Daryapur taluka of Amravati district which will form the base for the future strategy.

2. LOCATION

Daryapur taluka covers an area of about 793.80 sq.km and is located in the SW part of Amravati district of Maharashtra. It lies between the North latitude 20° 51' 46" to 21°03'18" and East longitude 77°11' 17"to 77°26'06" (**Fig.1a and 1b)**. The population of the taluka is 1,75,061 persons as per 2011 census. There are 151 villages in the taluka.

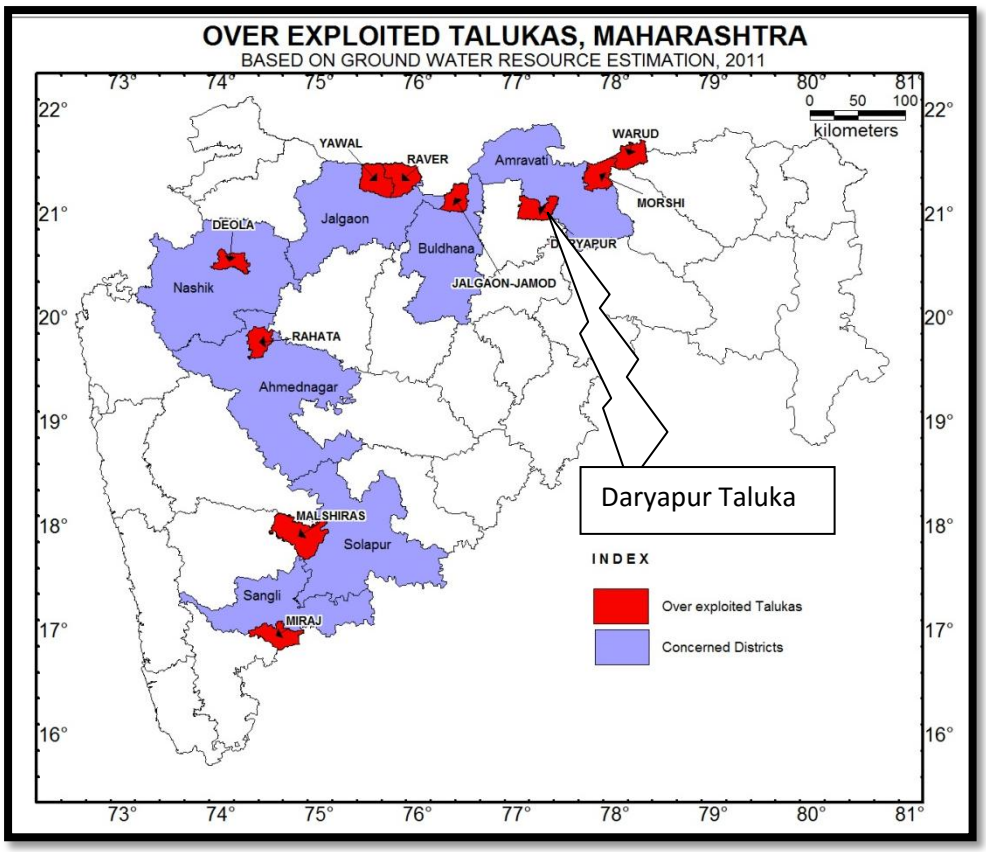


Figure1a: Location of Daryapur Taluka, Amravati District, Maharashtra

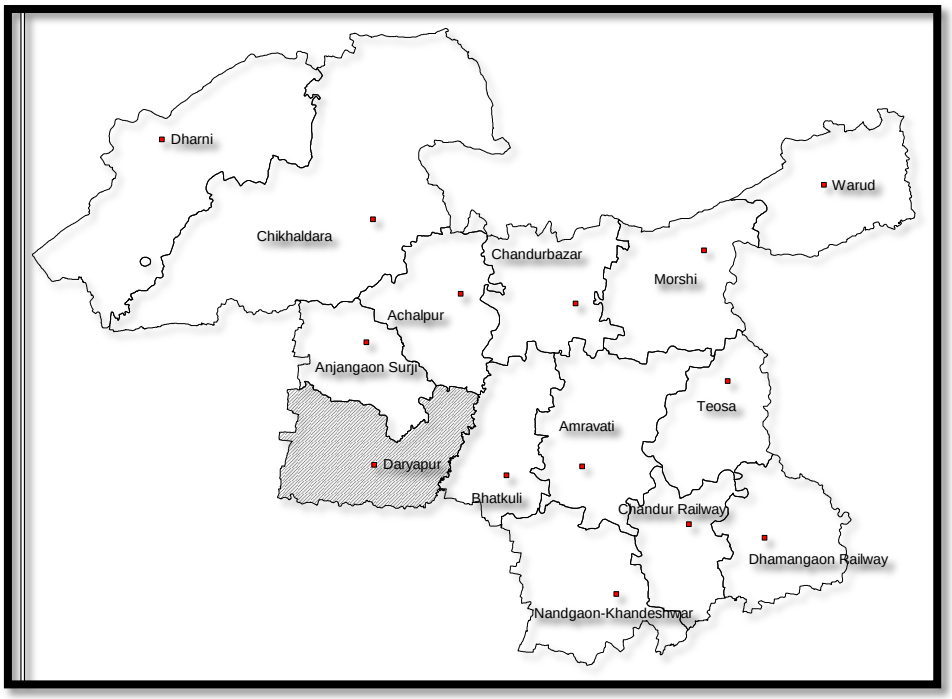


Figure1b: Location of Daryapur Taluka, Amravati District

3. PHYSIOGRAPHY & DRAINAGE

The taluka mostly has the plain area and is mainly drained by Purna river and its tributaries (**Fig. 2a**).A digital elevation model of Daryapur taluka indicating the village boundaries is shown in **figure 2b**.

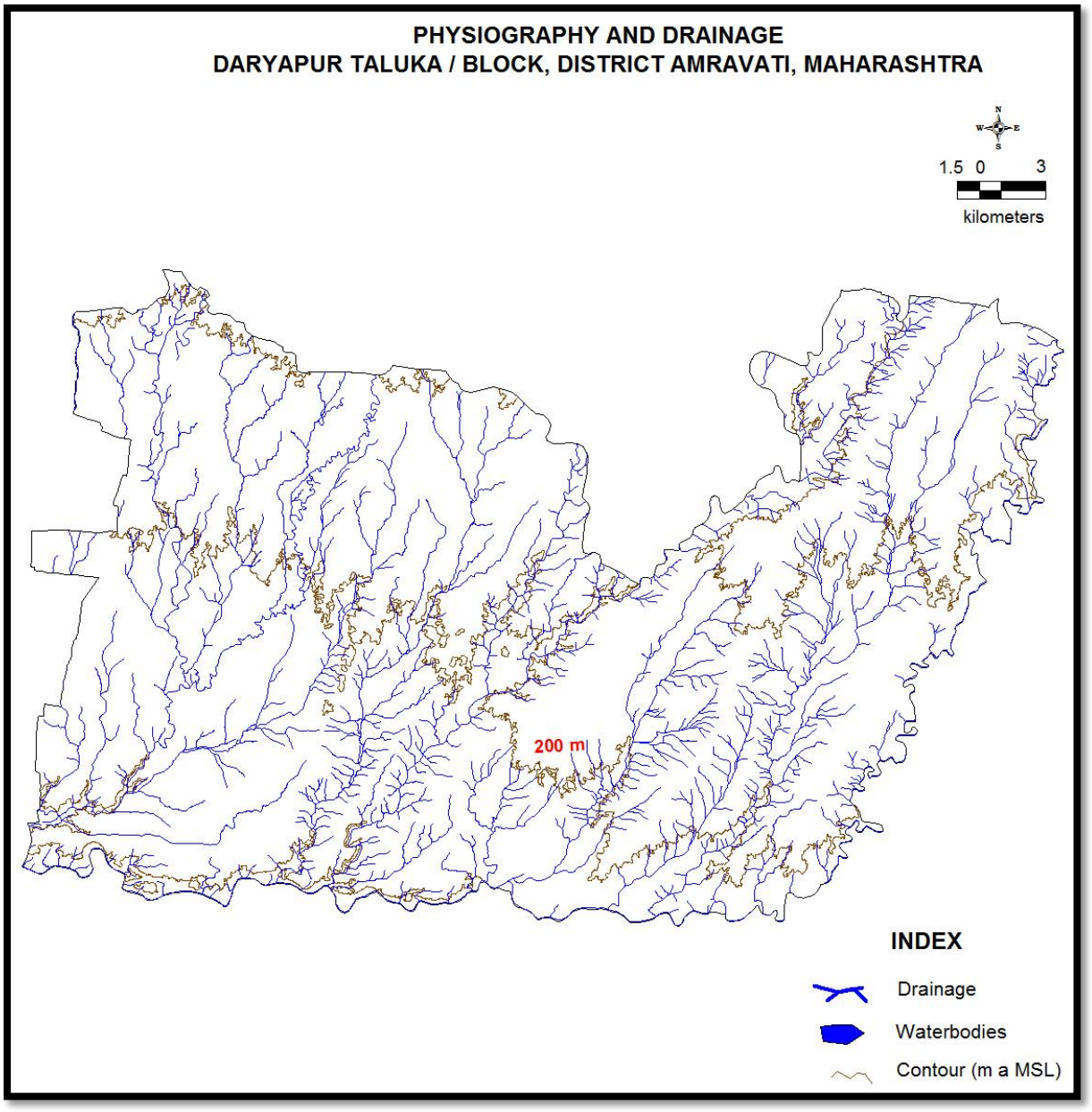


Figure 2a: Physiography and Drainage, Daryapur Taluka

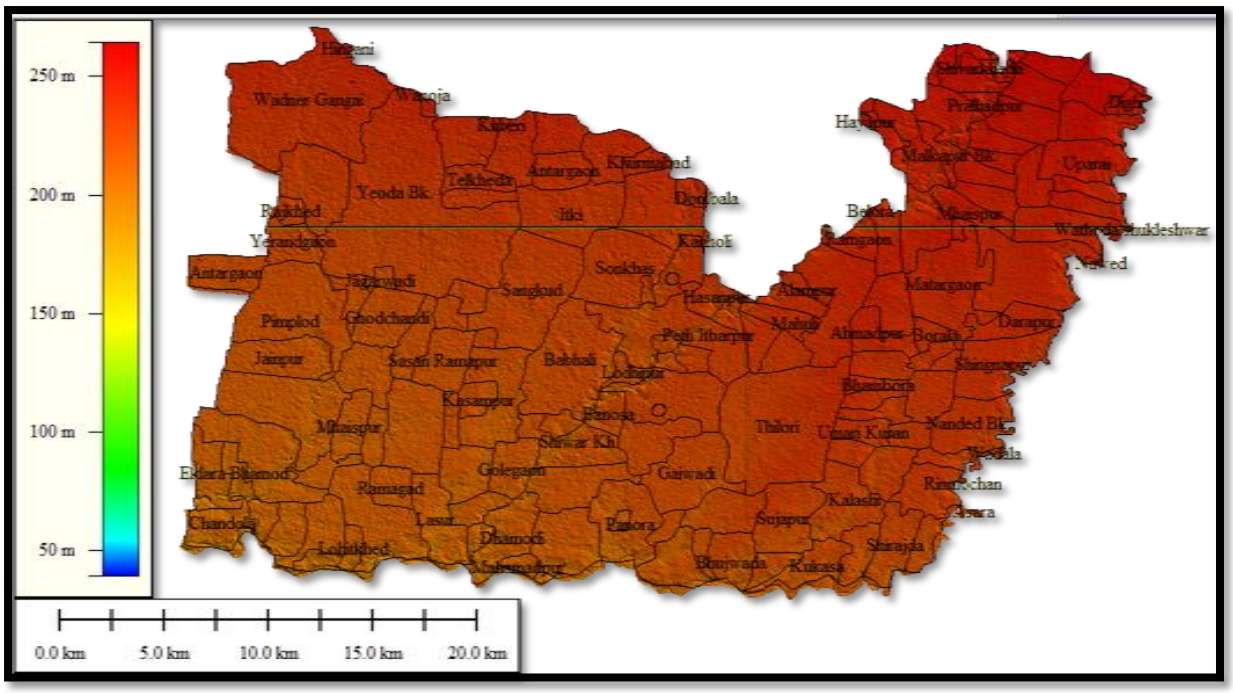


Figure2b: Digital Elevation Model, Daryapur Taluka

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 has a long-term normal rainfall of 638 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 while the horticultural activity (orange orchards) is significantly noticed and evenly distributed in the entire area of the taluka. Triple cropped (Kharif, Rabi and Summer) area is prominently observed along the major streams.

6. HYDROGEOLOGY

The entire area of Daryapur taluka is covered by the alluvium. **(Fig. 3)**. The alluvial deposits occupy entire taluka and is termed as Purna Alluvial deposit, as it has been deposited in the Purna valley during Pleistocene to Recent period.

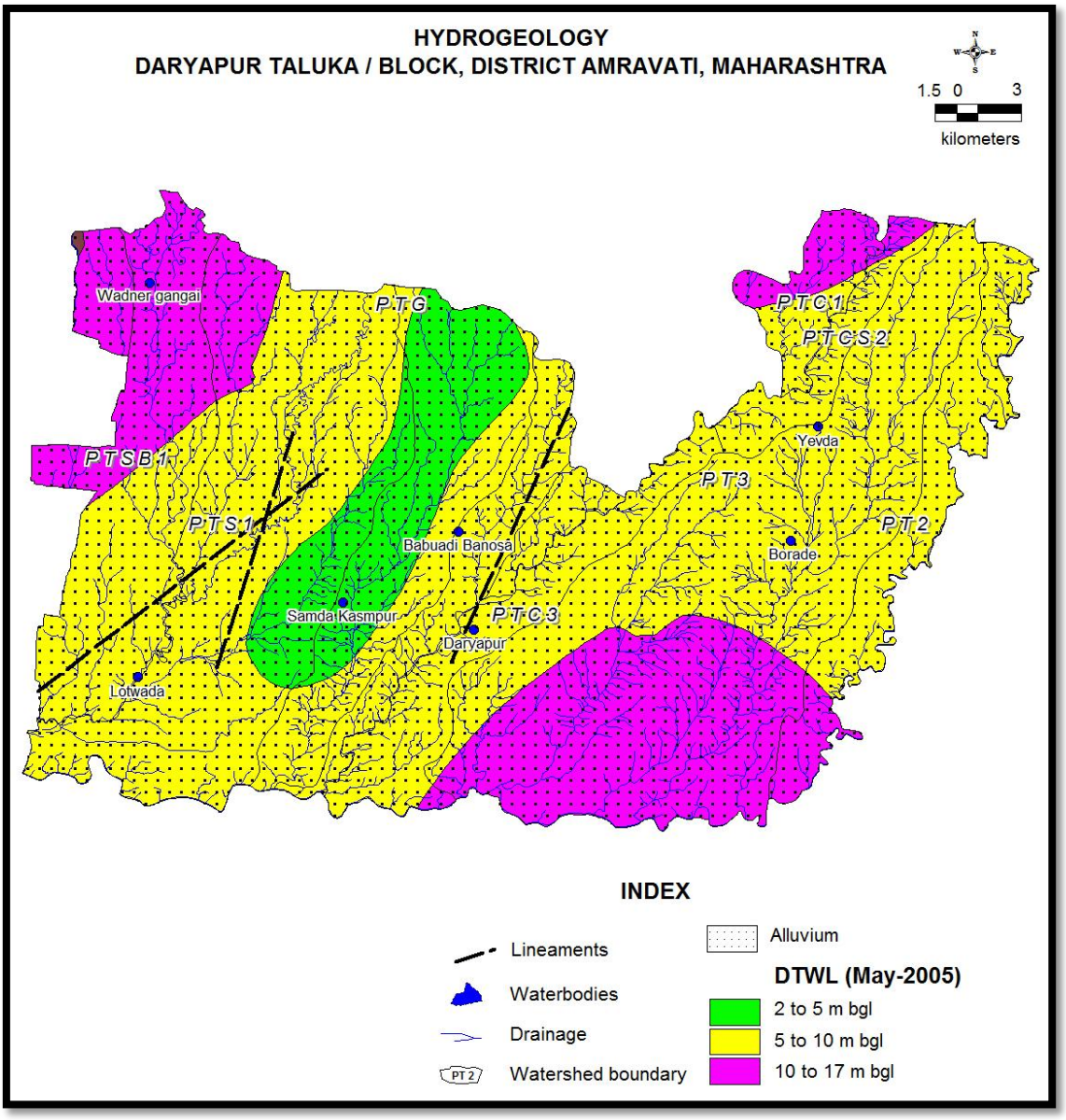


Figure 3: Hydrogeology, Daryapur Taluka

The maximum alluvium thickness encountered in the taluka during ground water exploration was 236 m. The alluvium is divided into younger and older Alluvium with the younger one being more granular and the older more clayey. Ground water occurs under phreatic and semi-confined conditions down to a depth of 80 m i.e., in the younger Alluvium

consisting of alternate beds of clay and sand. Two to five beds of coarse sand and gravel are encountered within the younger Alluvium, which form the productive aquifer. The older Alluvium is mostly clayey with only one or two thin beds of gravel at the base near the trap basement. In the deeper aquifers, ground water occurs in confined state. Younger Alluvium is lacustrine and older is marine in nature which has got inherent salinity and hence identified as 'saline ground water tract' (*Khar-Pan-Patta*").

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 4.2 to 15.1 m bgl. Shallow water levels within 10 m bgl are observed in major parts of the taluka covering western and eastern parts. Moderately deeper water levels between 10-20 m are observed in central parts of taluka **(Fig 4).** The water levels recorded in post-monsoon season (Nov. 2014) are ranging from 3.2-12.5 m bgl. Shallow water levels within 10 m bgl are observed in major parts of the taluka. Moderately deeper water levels between 10-20 m are observed in central parts of area **(Fig 5).**

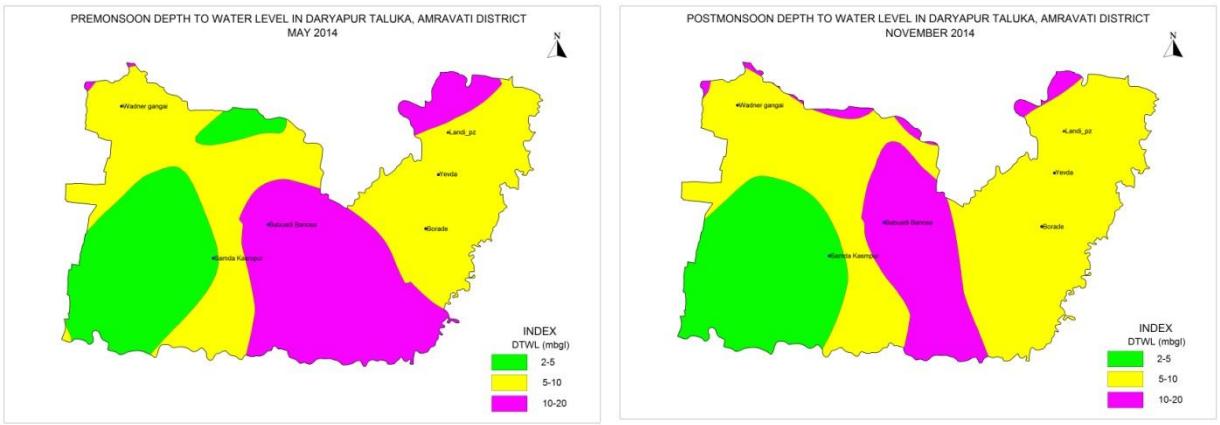


Fig 4 and 5: Pre and Post-monsoon (2014) Depth to Water Level, Daryapur Taluka

8. DYNAMIC GROUND WATER RESOURCE

Ground Water Resources Assessment for the year 2011 indicates Net Annual Ground Water Availability of 749.36ham, draft for all uses is 860.60 ham with irrigation being the

major consumer withdrawing 843.48 ham and stage of ground water development is also high about 114.85% **(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 decreased from 141.42% in 2009 to 114.85% in 2011. So far none of the taluka has been notified by CGWA/SGWA for ground water regulation.

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

S. No	Particulars	GW Resources (Ha.m)
1.	Net Annual Ground Water Availability	749.36
2.	Existing Gross Ground Water Draft for irrigation	843.48
3.	Existing Gross Ground Water Draft for domestic and industrial water supply	17.12
4.	Existing Gross Ground Water Draft for All uses	860.60
5.	Provision for domestic and industrial requirement supply to 2025	17.12
6.	Net Ground Water Availability for future irrigation development	0.0
7.	Stage of Ground Water Development	114.85 %
8.	Category of the Assessment Unit	Over Exploited

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION MEASURES

Alluvial soil of Daryapur taluka is highly fertile and since past, groundwater was the only assured source of water for agriculture in this area. 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

Daryapur taluka. However, a robust consolidated plan for artificial recharge measures are also required for converting the entire Over-Exploited Daryapur taluka into Critical / Semi-critical / Safe category.

11. FEASIBLE AREA FOR ARTIFICIAL RECHARGE OR CONSERVATION

The feasible area for artificial recharge to groundwater in Daryapur 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 water level data reveals the deepest water level of 17 m bgl. Water level contour map is prepared wherein 3 categories of observed water levels are made i.e. less than 5 m bgl, 5 to 10 m bgl and 10 to 17 m bgl **(Fig. 6)**. Area having depth to water level less than 5 m bgl is not recommended for artificial recharge to ground water since it may lead to water logging and leaching of salts problems.

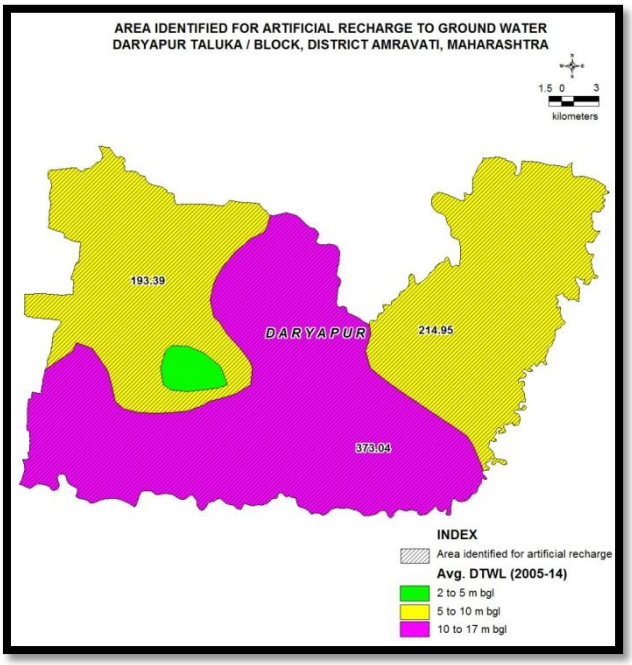


Fig 6: Average Decadal Post-monsoon depth to water level, Daryapur Taluka

Depth to Water level (DTWL) map of the Daryapur taluka reveals that an area of 781.30 sq.km has depth to water level more than 5 m bgl.

The long term water level trend map for the period 2005-2014 has been prepared and is shown in **Figure 7**. The water level trend map indicates a rise in water level between 0.0 to 0.2 m/year and fall in water level between 0.0 and 0.2 m/year & 0.2 to 0.4 m/year. 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 Daryapur taluka **(Fig 7).**

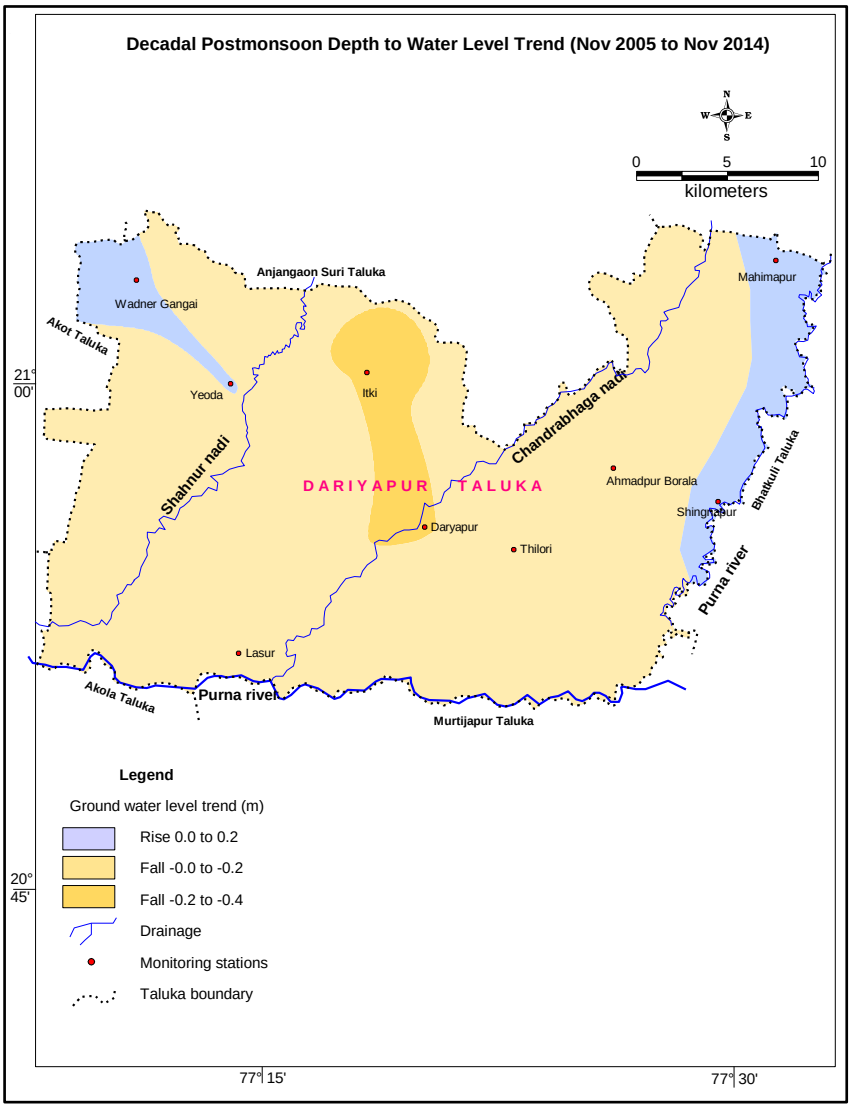


Figure 7: Map showing long term post monsoon water level trend (2005-14)

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 Daryapur taluka is having sufficient thickness of weathered zone varying from 10 to 20 m and therefore found feasible for artificial recharge to groundwater. Daryapur taluka is traversed by 2 major lineaments in the western and central (**Figure 9)** indicating promising scope for artificial recharge in that area.

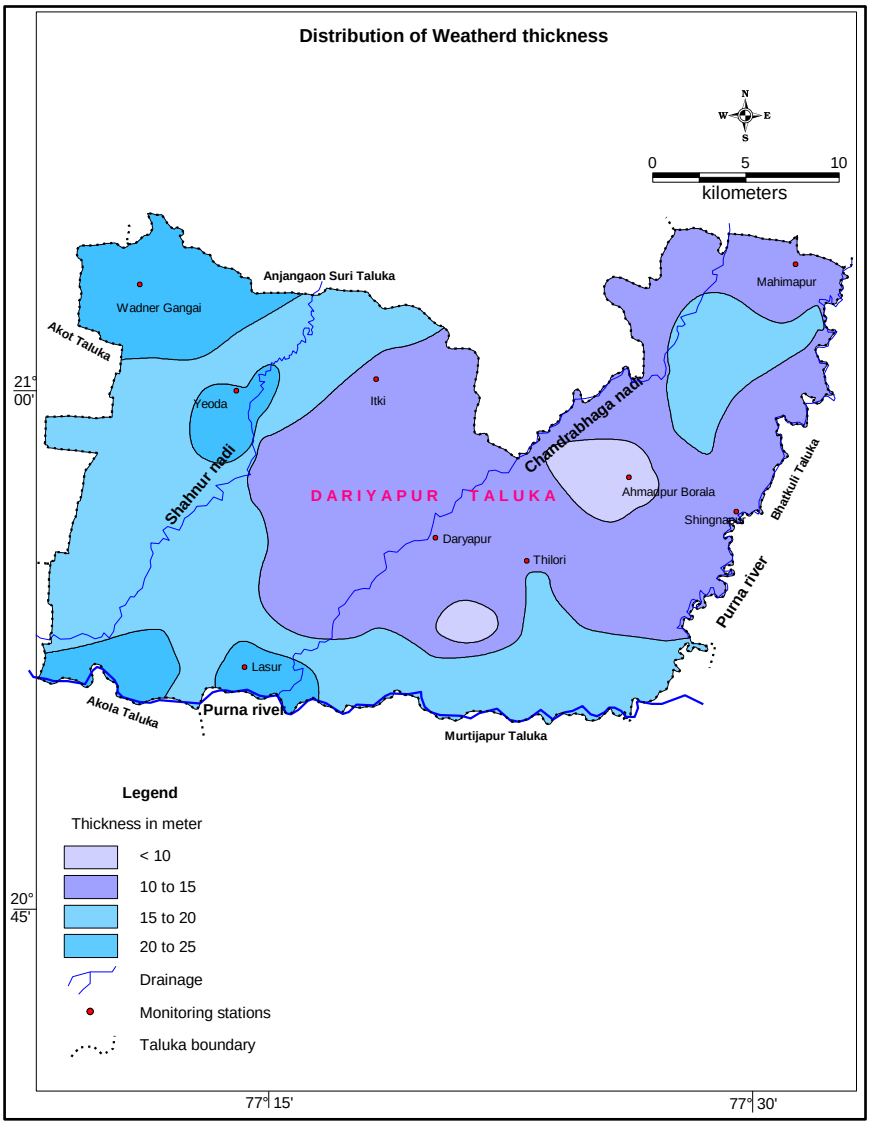


Figure 8: Map showing weathered thickness in Daryapur taluka

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**. The map indicates that an area of 706.51sq.km is identified for artificial recharge to groundwater.

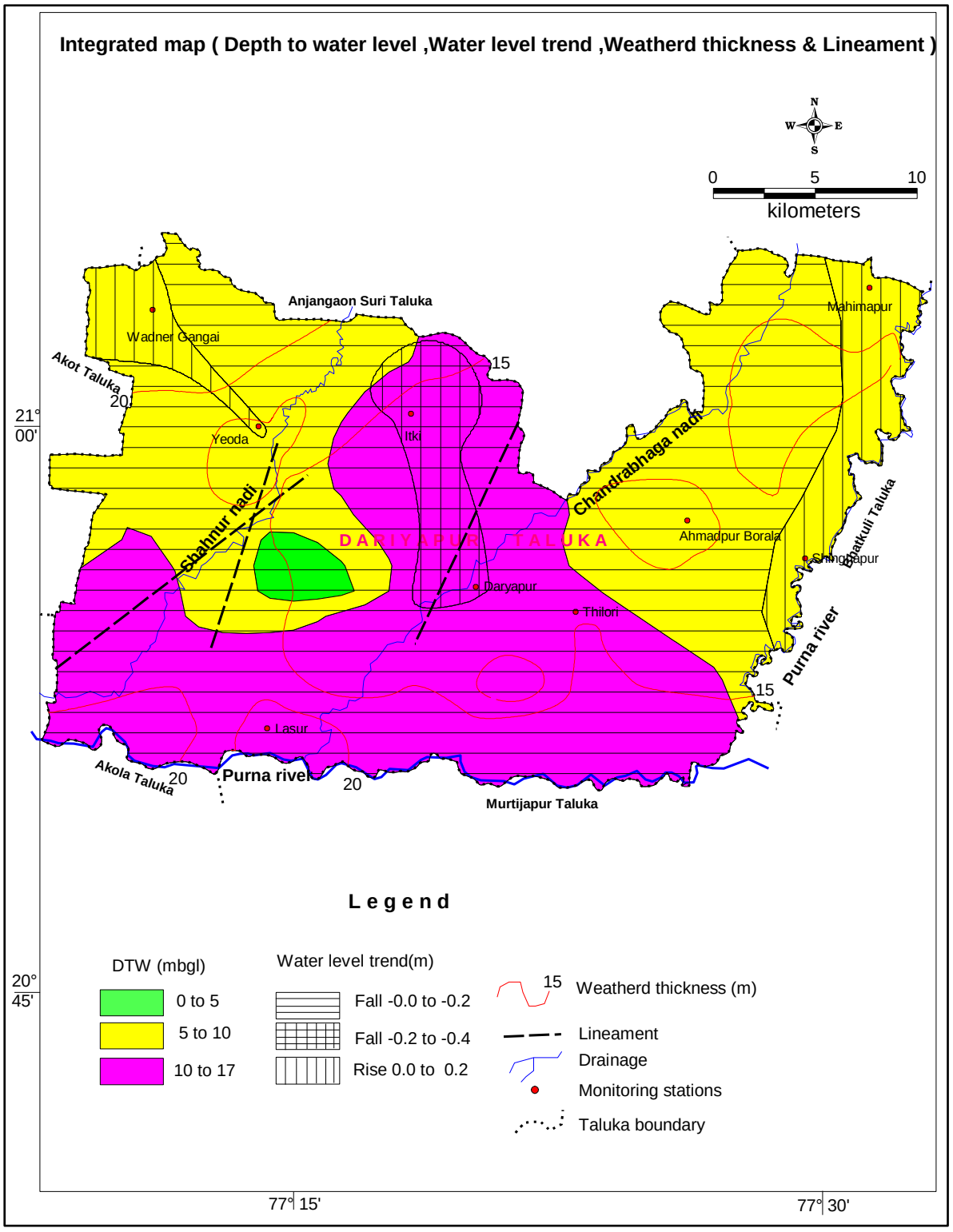


Figure 9: Integrated Map showing feasible area for artificial recharge to groundwater in Daryapur taluka

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.

Daryapur taluka of Amravati district falls in Tapi river basin. The data collected from Irrigation Department, Government of Maharashtra reveals that Tapi river basin covers an area of 51940 sq. km. The basin has surplus surface water runoff availability of 1240 MCM. Based on this data, it is estimated that the proportionate per sq.km. availability of surplus surface water runoff is 0.0239 MCM. Thus the proportionate surplus surface water availability for Daryapur taluka comes out to be 16.867 MCM. For estimation of volume of water to be utilised for recharge, 70% of surplus water availability has been considered. Thus about 11.81MCM surplus surface water can be considered for preparation and implementation of master plan for artificial recharge in the over-exploited Daryapur 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 Daryapur 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.

Earlier studies reveal that in alluvial areas of Maharashtra, recharge shaft is the main feasible artificial recharge structure. The recharge shaft on an average will recharge 1 TCM/day with 60 operational days during monsoon and post-monsoon. In addition to recharge shaft, few percolation tanks are also proposed in the area.

Based on the surplus surface water availability of 11.81 MCM, it is estimated that about 98 recharge shaft and 30 nos. percolation tanks are required to be constructed. The series of recharge shafts are proposed to construct in the stream / nala bed or along the major stream at identified locations. The field experiences of CGWB in Maharashtra indicate that an average recharge efficiency of 85% of the individual structure is possible. Thus it is expected that about 10.02 MCM of surface water shall be recharged to the sub-surface.

The tentative locations of proposed recharge shaft and percolation tanks are shown in **Figure 10** and the location of sites are listed in **Annexure-I.** The design details of recharge shaft and percolation tank 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.

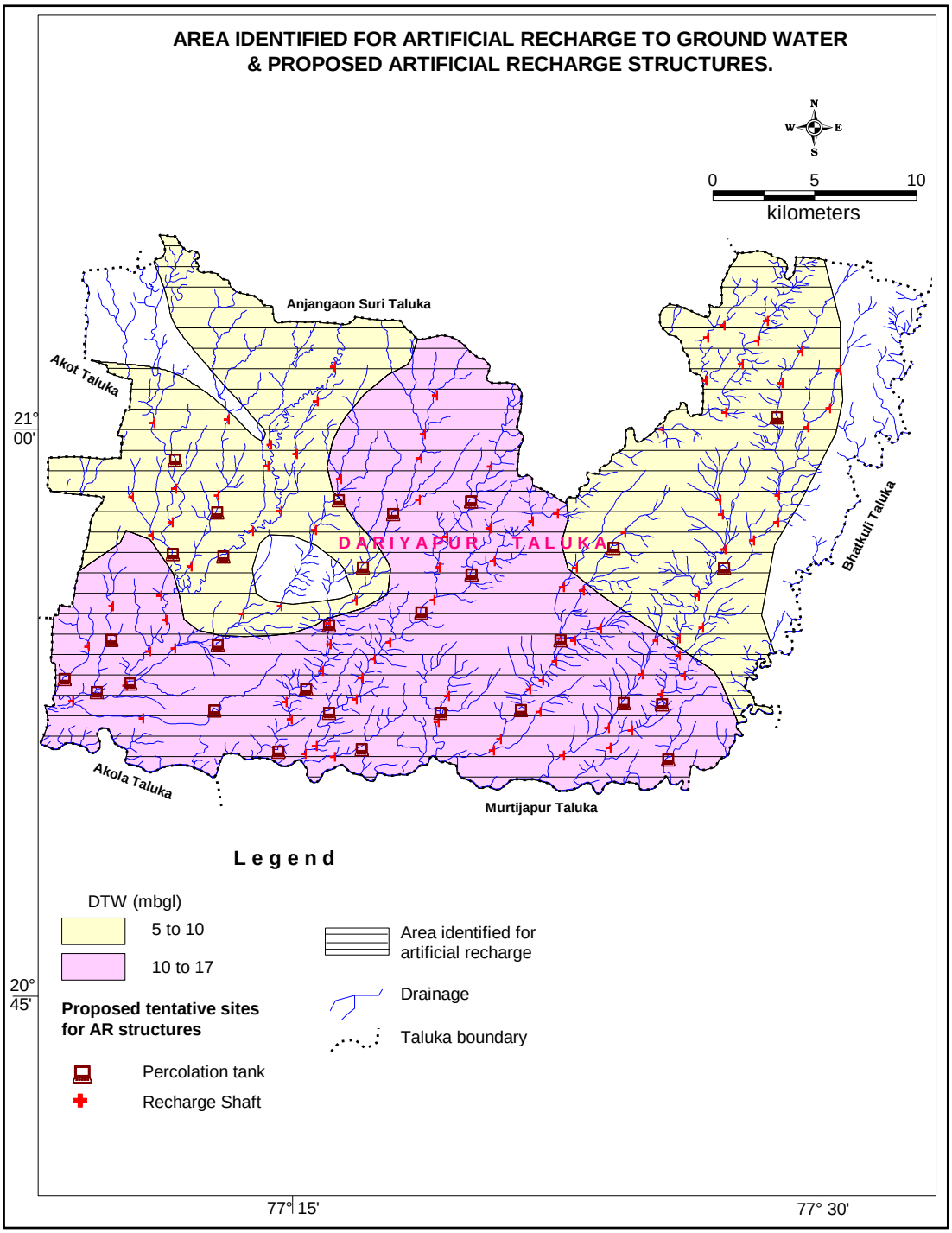


Figure 10: Tentative sites of recharge shaft, Daryapur Taluka

14. TENTATIVE COST ESTIMATES

For estimating the tentative cost for construction of percolation tanks and recharge shaft, 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 all structures would be Rs. 26.80 crores (As per 2011 SOR). However, it is likely that the actual cost will vary depending upon the period of construction and location of sites which will be finalised after detailed hydrogeological consultation and survey by the implementing agencies.

Recharge Shaft

The entire area of Daryapur taluka is underlain by the soft rock i.e. alluvium. Based on the earlier studies carried out by CGWB in the State of Maharashtra, Recharge shaft are the main feasible artificial recharge structures feasible in are underlain by the alluvium. The apportioned surface water availability for artificial recharge through recharge shaft in Daryapur taluka is 5.90 MCM. Considering the average gross recharge capacity of 60 TCM, it is estimated that about 98 nos. recharge shafts shall be required to be constructed. Earlier studies carried out by CGWB reveals that the recharge efficiency of recharge shaft is about 85%. For getting the contineous water to the recharge shaft for artificial recharge, it is proposed to consturct the recharge shafts either in the stream / nala bed or along their banks. Thus it is expected that the gross recharge will be about 5.01 MCM against the surface water allocation of 5.90 MCM. The SOR available for the year 2011 indicate that for construction of one recharge shaft 2.5 lakh will be required thus the total estimated cost for construction of 98 recharge shaft will be Rs.2.45 crores.

Percolation Tanks

To recharge the allocated surplus water to the tune of 5.90 MCM, it is estimated that about 30 percolation tanks will be required to be constructed in Daryapur taluka. Considering the recharge efficiency of 85%, it is expected that about 5.01 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 30 percolation tanks will be Rs. 21.00 crores. For enhancing the ground water recharge, it is proposed to utilise the stored water of the percolation tanks for irrigation of the surrounding areas.

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 Daryapur Taluka. As per census 2011, there are about 41867

households in Daryapur taluka. It is assumed that about 10 % of the households i.e. 4187 households may have the average roof area of about 50 sq.m. Therefore, considering the average annual rainfall of 638 mm, average roof area of 50 sq.m and runoff coefficient of 0.85, the total rainwater harvesting potential generated in the urban households of Daryapur taluka is about 0.114 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 1 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 0.097MCM water shall be recharged through adoption of rainwater harvesting in the urban households. It is estimated that the approximate cost for construction of RWH structure for individual household will be about Rs. 8000/-. Thus the total expenditure for 4187 (10%) houses will be Rs. 3.35 crores.

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 by the Implementing Agency
25 To 36 months	Impact Assessment by the Implementing Agency

Annexure - I

Tentative Location of Proposed Recharge Shaft in Daryapur Taluka, Amravati District

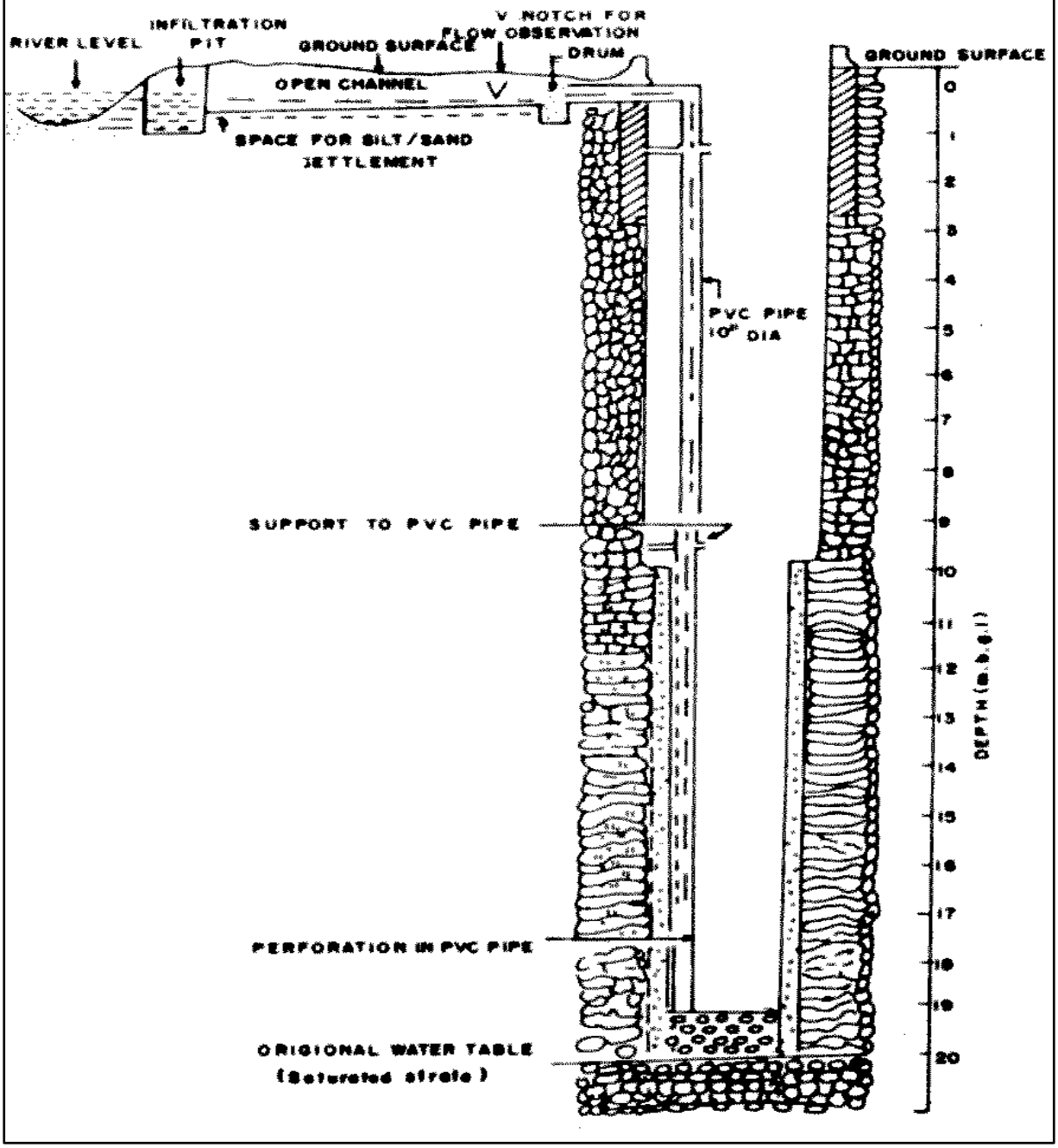
SN	Village	Latitude	Longitude	Structures
1	Pimplod	20.953638	77.183628	Recharge shaft
2	Rajkhed	21.003124	77.184285	Recharge shaft
3	Yeoda Bk.	21.00464	77.219323	Recharge shaft
4	Ghodchandi	20.971121	77.214732	Recharge shaft
5	Adula	20.939785	77.201706	Recharge shaft
6	Sasan Bk.	20.955681	77.230905	Recharge shaft
7	Yeoda Bk.	20.984211	77.237876	Recharge shaft
8	Yeoda Bk.	20.993542	77.239357	Recharge shaft
9	Pimpal Khuta	20.964301	77.244092	Recharge shaft
10	Sangkud	20.956069	77.260487	Recharge shaft
11	Nandrun	20.922647	77.24436	Recharge shaft
12	Sukali	20.880494	77.145955	Recharge shaft
13	Lotwada	20.887314	77.171236	Recharge shaft
14	Bhamod	20.903944	77.194287	Recharge shaft
15	Lotwada	20.902426	77.181994	Recharge shaft
16	Bhuikhed	20.872958	77.179056	Recharge shaft
17	Bhamod	20.922435	77.164737	Recharge shaft
18	Eklara Bhamod	20.904417	77.153292	Recharge shaft
19	Nandrun	20.918988	77.226481	Recharge shaft
20	Tongala Bad	20.872618	77.248897	Recharge shaft
21	Sawndli Hirapur	20.893791	77.26399	Recharge shaft
22	Golegaon	20.905587	77.267709	Recharge shaft
23	Samada	20.914875	77.267122	Recharge shaft
24	Samada	20.924858	77.279512	Recharge shaft
25	Sonkhas	20.987802	77.310165	Recharge shaft
26	Shahapur	20.959669	77.362887	Recharge shaft
27	Banosa	20.925198	77.316556	Recharge shaft
28	Shiwar Kh.	20.906655	77.295585	Recharge shaft
29	Dhamoli	20.881348	77.279748	Recharge shaft
30	Lasur	20.857458	77.25566	Recharge shaft
31	Indalwadi	20.871246	77.318382	Recharge shaft
32	Takali	20.858898	77.344579	Recharge shaft
33	Gaiwadi	20.889623	77.367911	Recharge shaft
34	Thilori	20.908244	77.376396	Recharge shaft
35	Bhujwada	20.856535	77.377423	Recharge shaft
36	Sujapur	20.868669	77.398857	Recharge shaft
37	Kalashi	20.892363	77.414785	Recharge shaft
38	Kukasa	20.860093	77.399617	Recharge shaft
39	Kalashi	20.883511	77.423849	Recharge shaft
40	Elichpur	20.900783	77.432368	Recharge shaft

41	Dhanora Jahagir	20.926977	77.441211	Recharge shaft
42	Borala	20.951359	77.467127	Recharge shaft
43	Ajitpur	20.947472	77.453736	Recharge shaft
44	Thilori	20.929512	77.386914	Recharge shaft
45	Thilori	20.930741	77.377338	Recharge shaft
46	Matargaon	20.962697	77.452594	Recharge shaft
47	Matargaon	20.959444	77.478632	Recharge shaft
48	Nalwada	21.00764	77.454076	Recharge shaft
49	Malkapur Bk.	21.028883	77.461788	Recharge shaft
50	Khalar	21.048285	77.473775	Recharge shaft
51	Belora	21.040755	77.445683	Recharge shaft
52	Belora	21.021947	77.445004	Recharge shaft
53	Khalarlandi	21.034665	77.489954	Recharge shaft
54	Uparai	21.026491	77.508333	Recharge shaft
55	Takar Kheda Kawade	21.001245	77.492896	Recharge shaft
56	Panora	20.882875	77.323217	Recharge shaft
57	Elichpur	20.891881	77.434763	Recharge shaft
58	Narsingpur	20.913075	77.443402	Recharge shaft
59	Thilori	20.912571	77.3951	Recharge shaft
60	Takali	20.863854	77.348042	Recharge shaft
61	Ramgaon	21.000271	77.424539	Recharge shaft
62	Mahuli	20.963204	77.374496	Recharge shaft
63	Peth Itbarpur	20.956705	77.342747	Recharge shaft
64	Gajipur	20.983989	77.343395	Recharge shaft
65	Sonkhas	20.99811	77.311757	Recharge shaft
66	Chendakapur	20.971132	77.479194	Recharge shaft
67	Shiwar Kh.	20.899106	77.288504	Recharge shaft
68	Shiwar Bk.	20.890698	77.282451	Recharge shaft
69	Dhamoli	20.856	77.269363	Recharge shaft
70	Dhamoli	20.860739	77.260856	Recharge shaft
71	Tongala Bad	20.880151	77.246623	Recharge shaft
72	Shinganwadi	20.885654	77.361632	Recharge shaft
73	Thilori	20.898188	77.373902	Recharge shaft
74	Bhamod	20.926925	77.187564	Recharge shaft
75	Umari Kurankhed	20.908277	77.432306	Recharge shaft
76	Babhali	20.939765	77.318769	Recharge shaft
77	Peth Itbarpur	20.952911	77.322369	Recharge shaft
78	Katkhed	21.012831	77.261184	Recharge shaft
79	Yeoda Bk.	20.989597	77.251695	Recharge shaft
80	Sangkud	20.978591	77.272308	Recharge shaft
81	Pimplod	20.959331	77.1928	Recharge shaft
82	Kalamgavhan	20.90736	77.421836	Recharge shaft
83	Matargaon	20.969114	77.451284	Recharge shaft
84	Thilori	20.90736	77.3829	Recharge shaft

85	Shinganwadi	20.875871	77.36654	Recharge shaft
86	Kalashi	20.867617	77.410057	Recharge shaft
87	Nardoda	20.954746	77.406785	Recharge shaft
88	Haibatpur	20.939154	77.383554	Recharge shaft
89	Khirgavhan	21.02078	77.480731	Recharge shaft
90	Khalar	21.039428	77.469606	Recharge shaft
91	Khalar	21.04646	77.453247	Recharge shaft
92	Gaurkheda	21.009774	77.503308	Recharge shaft
93	Itki	21.015276	77.317461	Recharge shaft
94	Umari Itbarpur	21.027811	77.269363	Recharge shaft
95	Bhamod	20.916226	77.190182	Recharge shaft
96	Pimplod	20.974311	77.194436	Recharge shaft
97	Pimplod	20.970642	77.17415	Recharge shaft
98	Sonkhas	20.969114	77.309608	Recharge shaft
99	Jainpur	20.9461	77.1932	Percolation tank
100	Yeoda Bk.	20.9876	77.1944	Percolation tank
101	Adula	20.9448	77.2172	Percolation tank
102	Sukali	20.8909	77.1422	Percolation tank
103	Eklara Bhamod	20.8851	77.1574	Percolation tank
104	Lotwada	20.8889	77.1732	Percolation tank
105	Ramtirtha	20.877	77.2129	Percolation tank
106	Lotwada	20.9082	77.1643	Percolation tank
107	Patharvira	20.9059	77.2145	Percolation tank
108	Lasur	20.8589	77.2432	Percolation tank
109	Sawndli Hirapur	20.8864	77.2562	Percolation tank
110	Babhali	20.94	77.283	Percolation tank
111	Babhali	20.9637	77.2974	Percolation tank
112	Sangkud	20.9697	77.2716	Percolation tank
113	Kharsanpur	20.9691	77.3341	Percolation tank
114	Daryapur Banosa	20.9369	77.3343	Percolation tank
115	Hingani Mirzapur	20.8599	77.2825	Percolation tank
116	Khairi	20.8555	77.4271	Percolation tank
117	Nardoda	20.9487	77.4013	Percolation tank
118	Mhaispur	21.0062	77.4784	Percolation tank
119	Kalashi	20.8799	77.4243	Percolation tank
120	Ghodchandi	20.9644	77.2143	Percolation tank
121	Shinganwadi	20.8772	77.3575	Percolation tank
122	Sujapur	20.8802	77.4061	Percolation tank
123	Thilori	20.908	77.3763	Percolation tank
124	Banosa	20.9203	77.3105	Percolation tank
125	Indalwadi	20.876	77.3197	Percolation tank
126	Samada	20.9144	77.2671	Percolation tank
127	Dhamoli	20.876	77.267	Percolation tank
128	Ajitpur	20.9399	77.4535	Percolation tank

Annexure-II

Design of Artificial Recharge Shaft



Design of Percolation Tank