केंद्रीय भूमि जल बोर्ड

जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय

भारत सरकार

Central Ground Water Board

Ministry of Water Resources, River Development and Ganga Rejuvenation

Government of India

AQUIFER MAPPING REPORT

Warud and Morshi Talukas, Amravati District, Maharashtra (Part-II)

मध्य क्षेत्र, नागपुर

Central Region, Nagpur

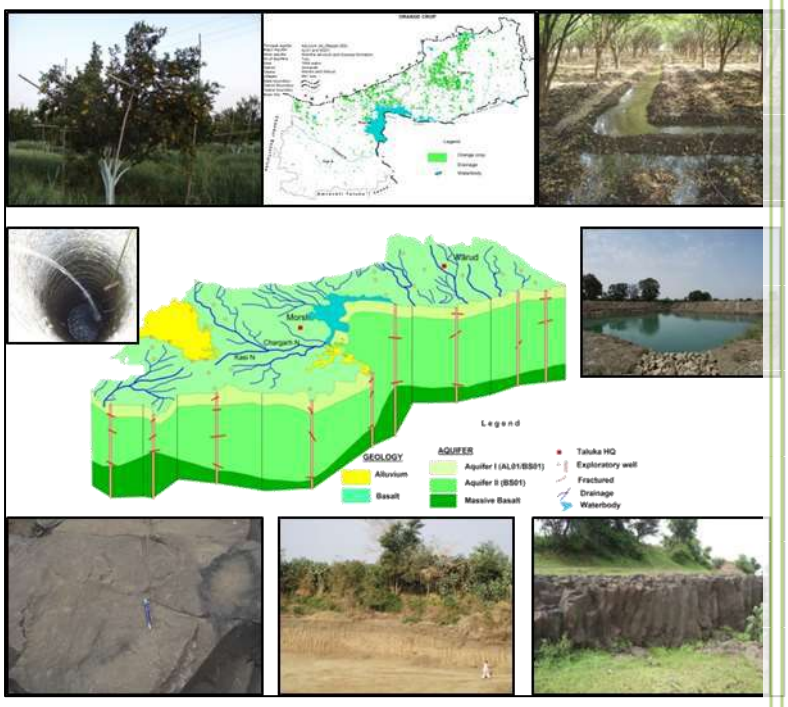
भारत सरकार
Government of India
जल संसाधन, नदी विकास एवं गंगा संरक्षण मंत्रालय
Ministry of Water Resources, River Development & Ganga Rejuvenation
केन्द्रीय भूमि जल बोर्ड
CENTRAL GROUND WATER BOARD

PART-II

जल बचत जल संचय

जलभृत नक्शे तथा भूजल प्रबंधन योजना

Aquifer Maps and Ground Water Management Plan



वरुड तथा मोर्शी तालुका, जिला अमरावती, महाराष्ट्र

WARUD AND MORSHI Talukas, AMRAVATI District, Maharashtra

मध्य क्षेत्र, नागपुर / Central Region, AMRAVATI

जून 2017 / June 2017

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AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, WARUD AND MORSHI TALUKAS, AMRAVATI DISTRICT MAHARASHTRA

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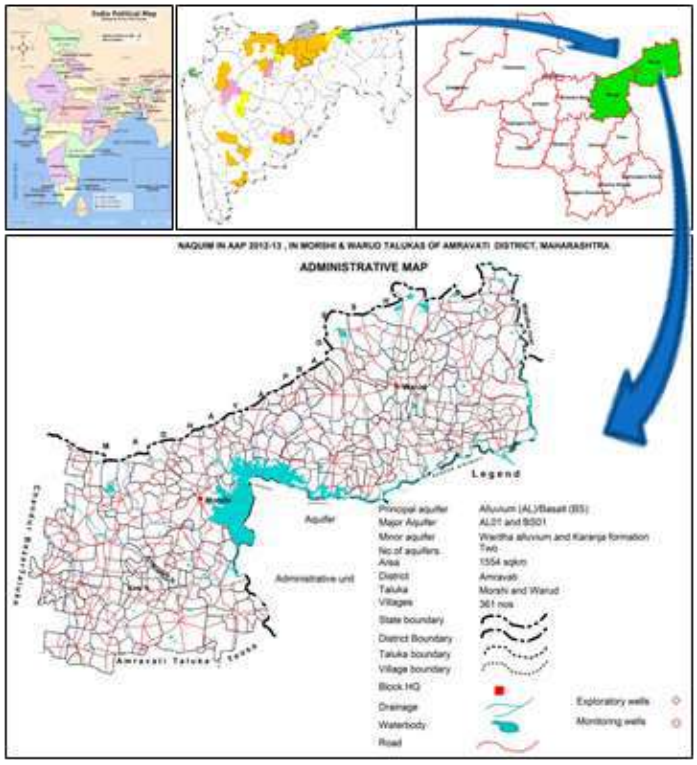
AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, WARUD AND MORSHI TALUKAS, AMRAVATI DISTRICT, MAHARASHTRA

1 BRIEF INTRODUCTION

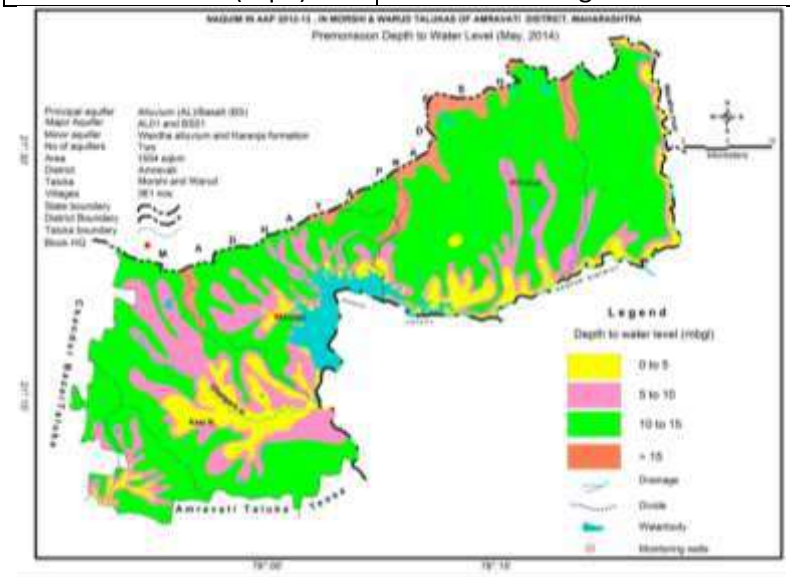
In XII five-year plan (2012-17), National Aquifer Mapping (NAQUIM) has been introduced to carry out detailed hydrogeological investigation on toposheet scale (1:50,000). Keeping in view the current demand vis-à-vis supply and futuristic requirement of water, Central Ground Water Board has taken up NAQUIM in Over-exploited, Critical and Semi-Critical talukas and prioritised stress areas. Hence, water stress area i.e., Warud and Morshi talukas of Amravati district has been taken up to carry out detailed hydrogeological investigation covering an area of 1554 sq.km. in the year 2012-13. The index map of the study area is presented as.

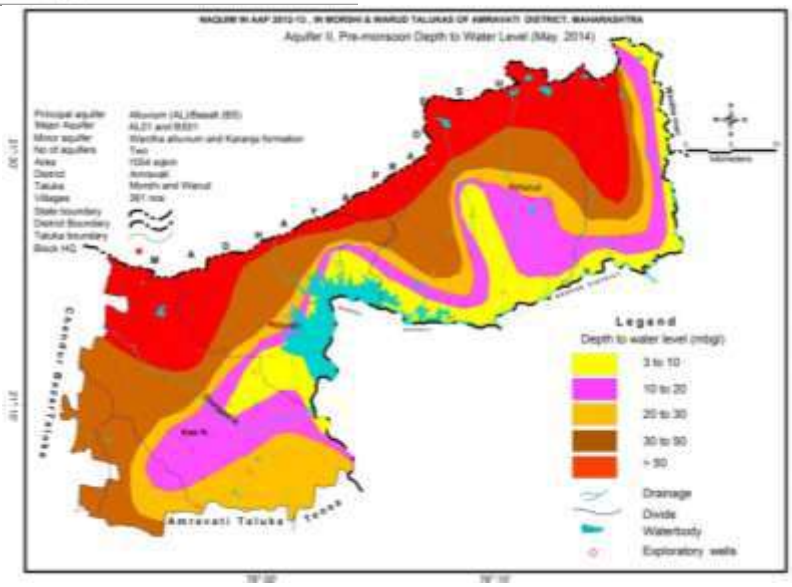


2 SALIENT FEATURES

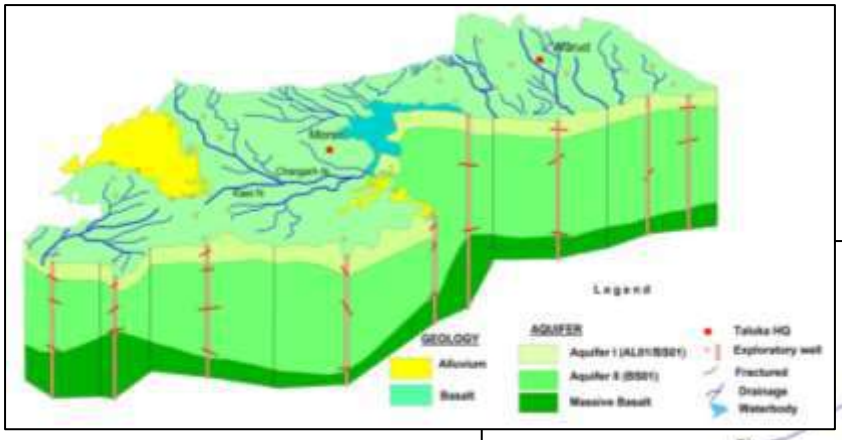
PARTICULARS	WARUD			MORSHI		
District/State	Amravati/Maharashtra			Amravati/Maharashtra		
Area (sq.km.)	745			809		
Population (no.'s)(2011)	2,02,523	1,56,995	45,528	1,82,127	1,44,868	37,258
	Total	Rural	Urban	Total	Rural	Urban
Rainfall (mm)						
i. Normal Annual Rainfall	940.10 mm			826.80		
ii. Current Rainfall (2014)	775.4 (17.51 % deficient)			694.8 (16 % deficient)		
iii. Rainfall Trend (mm/yr)	Rising 14.881 mm/yr(2005-14) Falling -1.849 mm/yr(1901-2015)			Rising 6.332 mm/yr (2005-14) Rising 0.092 mm/yr (1901-2015)		
Agriculture (sq.km.)						
i. Principal Crops	Cereals (194.30), Oranges (98.57), Cotton (68.59) ,Pulses (38.22), Oil seeds (33.91)			Oil seeds (268.32), Cotton (172.70), Pulses (90.16), Cereals (52.35), Oranges (43)		
ii. Cultivable Area	597.30			658.55		
iii. Net Sown Area	430.31			609.74		
iv. Forest	99.50			79.07		
Irrigation Sources (sq.km.)						
i. Ground water	119.37			86.76		
ii. Surface Water	24.70			290.45		

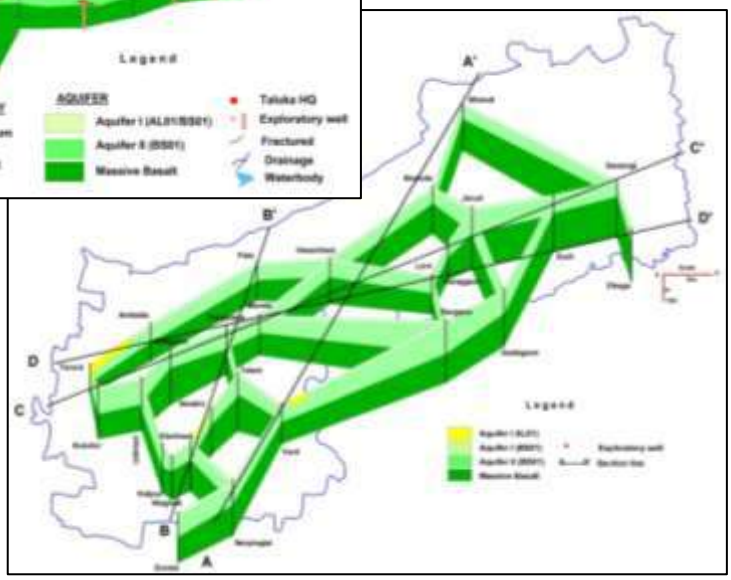
PARTICULARS	WARUD	MORSHI
Data Utilised		
i. Key Observation Wells	16	16
ii. GW exploration	5 EW+ 3 OW + 2 Pz	10 EW+ 3 OW + 4 Pz
iii. VES	47	70
iv. GWQ sampling locations	34 for Aquifer-I 6 for Aquifer-II	45 for Aquifer-I 8 for Aquifer-II
Existing / Future Water Demands (MCM)		
Domestic	2.68/ 2.69(2025)	3.14/ 4.71 (2025)
Industrial	-	-
Irrigation	136.99 / 00.00	84.42 / 12.65
Water Level Behaviour		
Premonsoon WL (Aq-I)	6.60 to 17.10 m bgl	4.70 to 20.40 m bgl
Postmonsoon WL (Aq-I)	3.65 to 16.60 m bgl	1.70 to 10.10 m bgl
Premon WL Trend (Aq-I)Rise	Upto 0.6 m/year	Upto 0.6 m/year
Premon WL Trend (Aq-I)Fall	Upto 0.4 m/year	Upto 0.2 m/year
Premonsoon WL (Aq-II)	6.78 to >50 m bgl	3.80 to >50 m bgl
Postmonsoon WL (Aq-II)	5.80 to >50 m bgl	3.20 to >50 m bgl

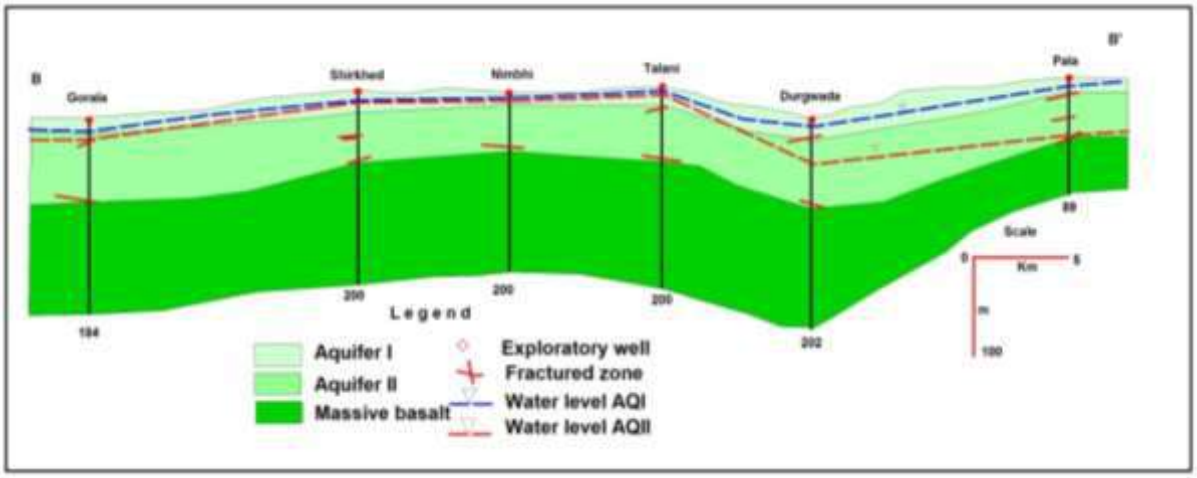


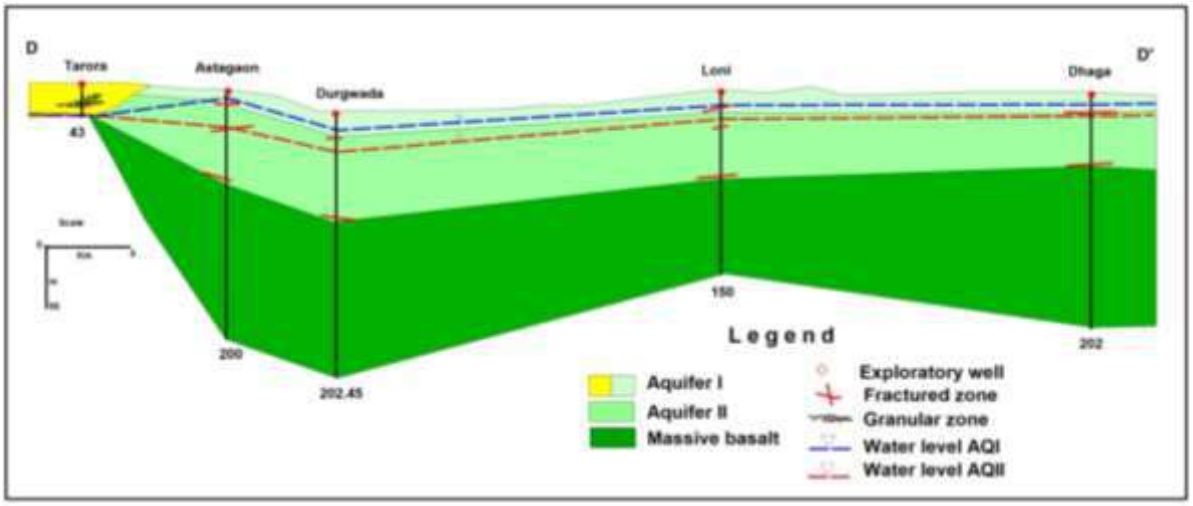


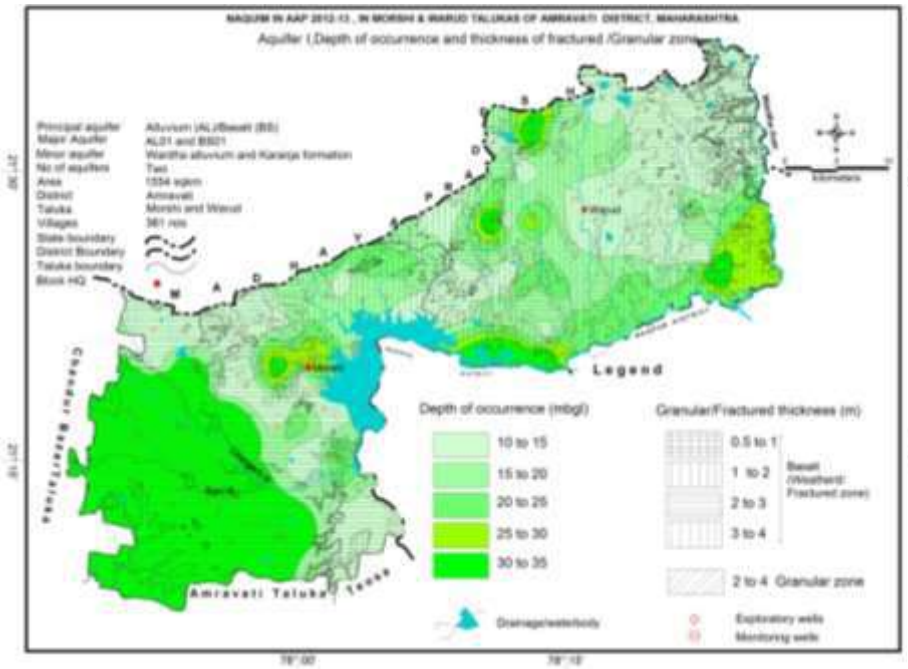
3 AQUIFER DISPOSITION

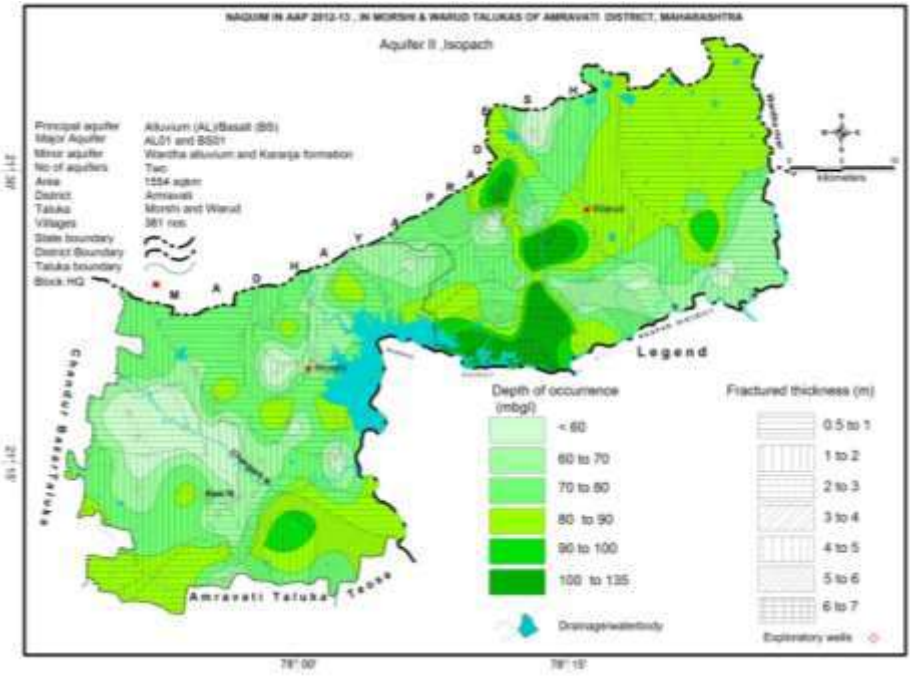












Type of Aquifer	Formation	Depth range (m bgl)	SWL (m bgl)	Thickness (m)	Fractures / Granular Zones encountered (m bgl)	Yield	Sustainability	Aquifer parameter (Transmissivity m^2/day)	Sy/S	Suitability for drinking/ irrigation
Aquifer-I	Deccan Trap-Weathered / Fractured Basalt	10-35	4.60 to 23.15	0.5 to 4.00	5 to 35	10 to 100 m^3/day	1 to 4 Hours recurring	-	0.02	Yes for both (except Nitrate affected villages for drinking)
Aquifer-I	Alluvium - Sand	12-35		3 to 6	8 to 35	50 to 100 m^3/day	2 to 4 hours	-	0.04 to 0.06	Yes for both
Aquifer-II	Jointed /Fractured Basalt	35-135	6 to > 50	0.5 to 7.0	35 to 135	25 - 200 LPM	2 to 4 hours	10-300	6×10^{-3} to 1.25×10^{-4}	Yes for both

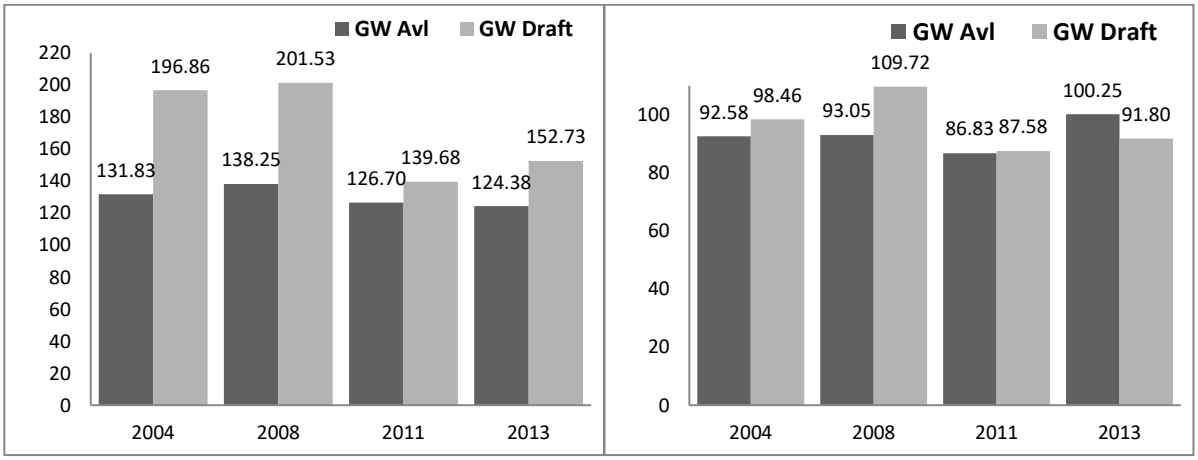
4 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

4.1 Ground Water Resources- Aquifer-I (Shallow, weathered/jointed Basalt)

Taluka	Command/Non-command	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses	Provision for domestic and industrial requirement supply to 2025	Net Ground Water Availability for future irrigation development	Stage of Ground Water Development (%)/Category
Warud	Command	1536.46	2374.71	83.48	2458.19	269.27	0.00	122.79/Over exploited
	Non Command	10901.51	12629.74	184.57	12814.31			
	Total	12437.97	15004.45	268.05	15272.50			
Morshi	Command	1649.29	552.39	43.69	596.08	471.20	1556.33	91.57/semi-critical
	Non Command	8375.46	8312.30	271.21	8583.51			
	Total	10024.75	8864.70	314.89	9179.59			
Area total		22462.72	23869.15	582.94	24452.09	740.47	1556.33	

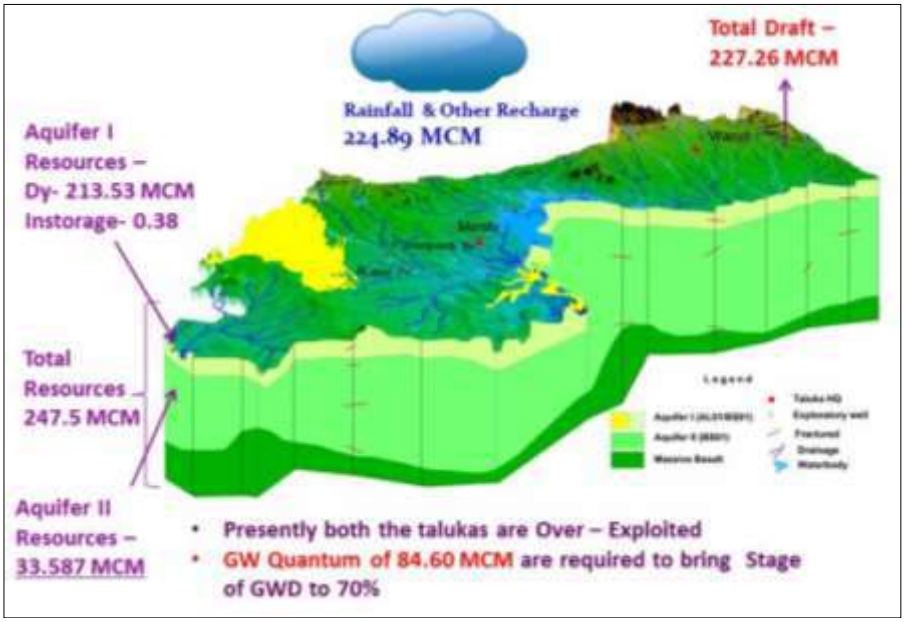
4.2 Ground Water Resources- Aquifer-II (Deep, fractured basalt)

SN	Mean thickness of fractured rocks	Taluka	Area(Sqkm)	Storativity	GW resource of AQII (MCM)
1	1.25	Morshi	189.279	0.006	1.419593
2	2.5	Morshi	345.282	0.006	5.17923
3	3.5	Morshi	188.443	0.006	3.957303
4	4.5	Morshi	57.8945	0.006	1.563152
5	5.5	Morshi	27.3387	0.006	0.902177
	Taluka Total				**13.02145**
6	1.25	Warud	251.691	0.0097	3.051753
7	2.5	Warud	205.09	0.0097	4.973433
8	3.5	Warud	130.07	0.0097	4.415877
9	4.5	Warud	76.6903	0.0097	3.347532
10	5.5	Warud	36.9286	0.0097	1.970141
11	6.5	Warud	44.5256	0.0097	2.807339
	Taluka Total				**20.56607**
	Grand total				**33.58753**



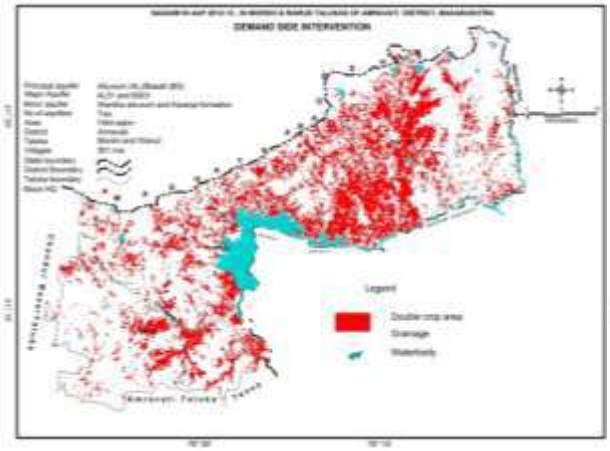
Ground water availability and draft, Warud and Morshi taluka, Amravati district

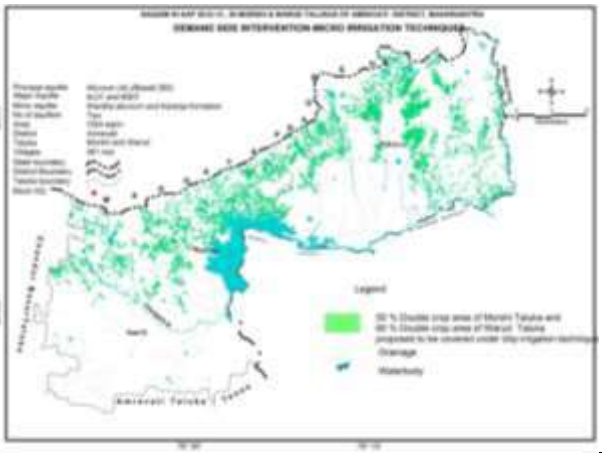
5 GROUND WATER RESOURCE ENHANCEMENT AND PROPOSED MANAGEMENT INTERVENTIONS



	WARUD	MORSHI	TOTAL
5.1 Ground Water Related Issues			
Over exploitation of ground water	Stage of GW Development has increased over the period of time. Exploitation of ground water for irrigation purpose.		
Declining Water Levels	Declining Water Levels (Falling Trend > 0.20 m/yr)		
GW based irrigation of cash crops like oranges	Major area under cash crop – Oranges (water intensive crop).		
Ground water quality	High nitrate concentration in Warud taluka and high EC in western part of Morshi taluka.		
5.2 Ground Water Resources			
Total Demand(MCM)	362.57	381.39	**743.96**
Total supply(MCM)	332.83	365.68	**698.51**
DEMAND - SUPPLY GAP (MCM)	29.74	15.71	45.45
Gap met from Existing Micro Irrigation Techniques in entire orange cropped area of 73.57 sq.km. @ WUE 0.4 m	29.43	15.50	**44.93**
Present demand - supply gap (MCM)	0.31	0.21	**0.52**
Gap to bring stage of GWD upto 70%	56.35	27.73	**84.08**
Total gap to bring stage of GWD upto 70%	56.66	27.94	**84.60**
5.3 Resource Enhancement by Supply Side Interventions			
volume of water required for recharge (Recharge Potential) (MCM)	27.72	82.50	110.22
Surface water requirement @ 75% efficiency	36.97	110.00	146.97
Availability of Surplus surface runoff considered for planning	16.45	13.80	30.25

	WARUD	MORSHI	TOTAL
5.3.1 Proposed Artificial Recharge Structures			
Percolation tank	65	50	115
Check dam	115	105	220
Recharge shaft	0	11	11
Volume of Water expected to be recharged / conserved by artificial recharge structures	17.25	4.95	0.50
5.3.2 Proposed RTRWH			
Households to be covered	12982	10614	23595.25
Total RWH potential	0.37	0.27	0.64
Rainwater harvested / recharged @ 80% runoff co-efficient	0.29	0.22	0.51
Estimated Expenditure (Rs. in Cr.)	19.47	15.92	35.39
RTRWH Economically not viable & Not Recommended. Total estimated Cost of RTRWH would be-35.39 Cr. for Harvesting 0.51 MCM of Rain Water.			
Total Estimated Expenditure for AR/above interventions (Rs. In Cr.)	**132**	**106.78**	**238.78**
5.4 Resource Enhancement by Demand Side Interventions			
5.4.1 Change in Cropping Pattern	None	None	None
5.4.2 Micro irrigation techniques			
Double crop area proposed to be covered under Drip (sq.km.)	122.736	62.11	184.85
Volume of Water expected to be saved (MCM). Surface Flooding req- 0.90 m. Drip Req. - 0.50, WUE- 0.4 m	49.09	24.84	73.94
Estimated Expenditure (Rs. in Cr.) @ Rs. 25,000/- per acre	75.82	38.37	114.19
5.5 Resource Enhancement by Alternate Sources			
Alternate source of water	No alternate source available		





5.6 Probable Benefits	WARUD	MORSHI	TOTAL
Additional GW resources available after implementing above measures (MCM) and mitigating the GAP TO BRING STAGE OF GWD UPTO 70% OR	4.77	7.26	12.03
Additional GW resources available after implementing above measures with current stage of	61.43	35.20	96.63

ground water development and			
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m OR	7.34	11.17	18.51
Rise in WL (m/yr)	**4.12**	**2.36**	--
Volume of Water expected to be saved (MCM) since GW draft above 100% is taking place from deeper aquifer	13.07	1.09	14.16
5.7 Regulatory Measures	**WARUD**	**MORSHI**	**TOTAL**
Regulatory Measures	Regulation of wells below 60 m		

6 SUM UP

A thorough study was carried out based on data gap analysis, data generated in-house, data acquired from State Govt. departments and GIS maps prepared for various themes. All the available data was brought on GIS platform and an integrated approach was adopted for preparation of aquifer maps and aquifer management plans of Warud and Morshi taluka of Amravati district.

The study area is spanning over 1554 sq.km., out of which 745 sq.km. falling in Warud and 809 sq. km. in Morshi taluka. Geologically, the area is occupied entirely by Basalt, however, Purna Alluvium is observed in western part of the Morshi taluka. Over exploitation of ground water, declining of ground water levels, limited aquifer thickness and, water scarcity during lean period are the major issues in the area. The stage of ground water development is 110.32 % in Warud and 101.26 % in Morshi taluka. The farmers are using traditional farming & irrigation methods (rainfed & flood irrigation) for oil seed, pulses, cereals, cotton etc. However, for orange/sweet lime orchards they have adopted micro irrigation techniques like drip irrigation. At present, there is scope for introducing the drip irrigation in double crop irrigated area.

The overall quality of ground water is found suitable for drinking, domestic, and irrigation purposes, except at few places, except in Aquifer-II nitrate concentration >45 mg/l is reported at Katpur in Morshi taluka. It is may be due to the interaction of aquifer-I as the first zone was encountered above 30 mbgl. Nitrate concentration of >45 mg/l is observed in southern part of Warud taluka, where intense agricultural activity is predominant. Rest of the parameters is within permissible limit.

It is recommended that the occurrence of red bole beds in local hydrogeological conditions should be consider as the red boles in basaltic terrain plays major role.

Ground water management plan has been prepared for Aquifer I (Weathered and jointed fracture Basalt and granular zones of Purna alluvium), Aquifer II (Jointed and Fractured Basalt) with the objective of bringing the current stage of ground water development down to 70% by adopting supply side and demand interventions. There is gap of 29.74 MCM and 15.71 MCM between demand and supply in Warud and Morshi taluka respectively. As a part of supply side interventions, feasible artificial recharge, water conservation measures like, percolation tank, check dam, recharge shaft, depending on the source water availability in the taluka, are recommended. Also, as demand side interventions, 184.85 sq km double crop area(122.74 & 62.11 sq km in Warud and Morshi taluka) has been identified for micro irrigation techniques like drip irrigation.

1. Additional ground water resources available after implementing above measures is 12.03 MCM (4.77 MCM in Warud taluka and 7.26 MCM in Morshi taluka) mitigating the gap to bring stage of gwd upto 70%. In other terms, about 96.63 MCM (61.43 MCM in Warud taluka and 35.20 MCM in Morshi taluka) of additional ground water resources available after implementing recommended measures with current stage of ground water development.
2. About 18.51 sq km (7.34 sq km in Warud taluka and 11.17 MCM in Morshi taluka) additional area will be covered under assured irrigation after implementation of artificial

recharge to ground water with estimated expenditure of 238.78 crore (Rs. 132 crore in Warud taluka and 106.78 crore in Morshi taluka).

3. About 184.85 sq km area (122.74 sq km in Warud and 62.11 sq km in Morshi taluka) additional area will be covered under assured irrigation after implementation of micro irrigational techniques with estimated expenditure of 114.19 crore (Rs. 75.82 crore in Warud taluka and 38.37 crore in Morshi taluka)..
4. There will be rise in water level in both the talukas at a rate of about 4.12 m/year in Warud taluka and 2.36 m in Morshi taluka.
5. About 14.16 MCM (13.07 MCM in Warud taluka and 1.09 MCM in Morshi taluka) water expected to be saved as ground water draft above 100% is taking place from deeper aquifer.

These interventions also need to be supported by regulation of deeper aquifer and hence it is recommended to regulate/ban deeper tubewells/borewells of more than 60 m depth in these talukas, so that the deeper ground water resources are protected for future generation and also serve as ground water sanctuary in times of distress/drought and shall be used as sanctuary for drinking water supply. IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory groundwater management.