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

Purandhar and Baramati Talukas, Pune 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

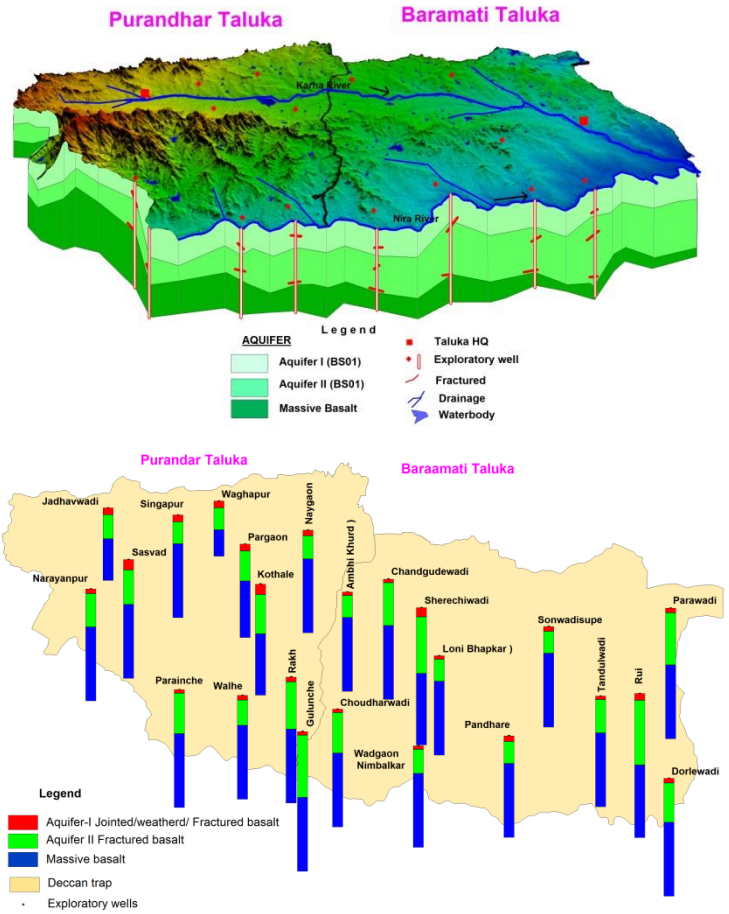
केन्द्रीय भूमि जल बोर्ड

CENTRAL GROUND WATER BOARD

जल बचत जल संचय

जलभृत नक्शे तथा भूजल प्रबंधन योजना

Aquifer Maps and Ground Water Management Plan



PURANDHAR AND BARAMATI TALUKAS, OF PUNE DISTRICT, MAHARASHTRA

पुरंधर व बारामती तालुका, पुणे जिल्हा, महाराष्ट्र

PART-II

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS PURANDHAR & BARAMATI TALUKAS, PUNE DISTRICT, MAHARASHTRA STATE

CONTRIBUTORS

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T. Dinesh Kumar	:	Assistant Chemist

PART-II

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS PURANDHAR & BARAMATI TALUKAS, PUNE DISTRICT, MAHARASHTRA STATE

CONTENTS

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS PURANDHAR & BARAMATI TALUKAS, PUNE DISTRICT, MAHARASHTRA STATE

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., Baramati & Purandhar Talukas of Pune district has been taken up to carry out detailed hydrogeological investigation covering an area of 1466.09 sq.km in the year 2016-17. The index map of the study area is presented below- **Fig 1.1**.

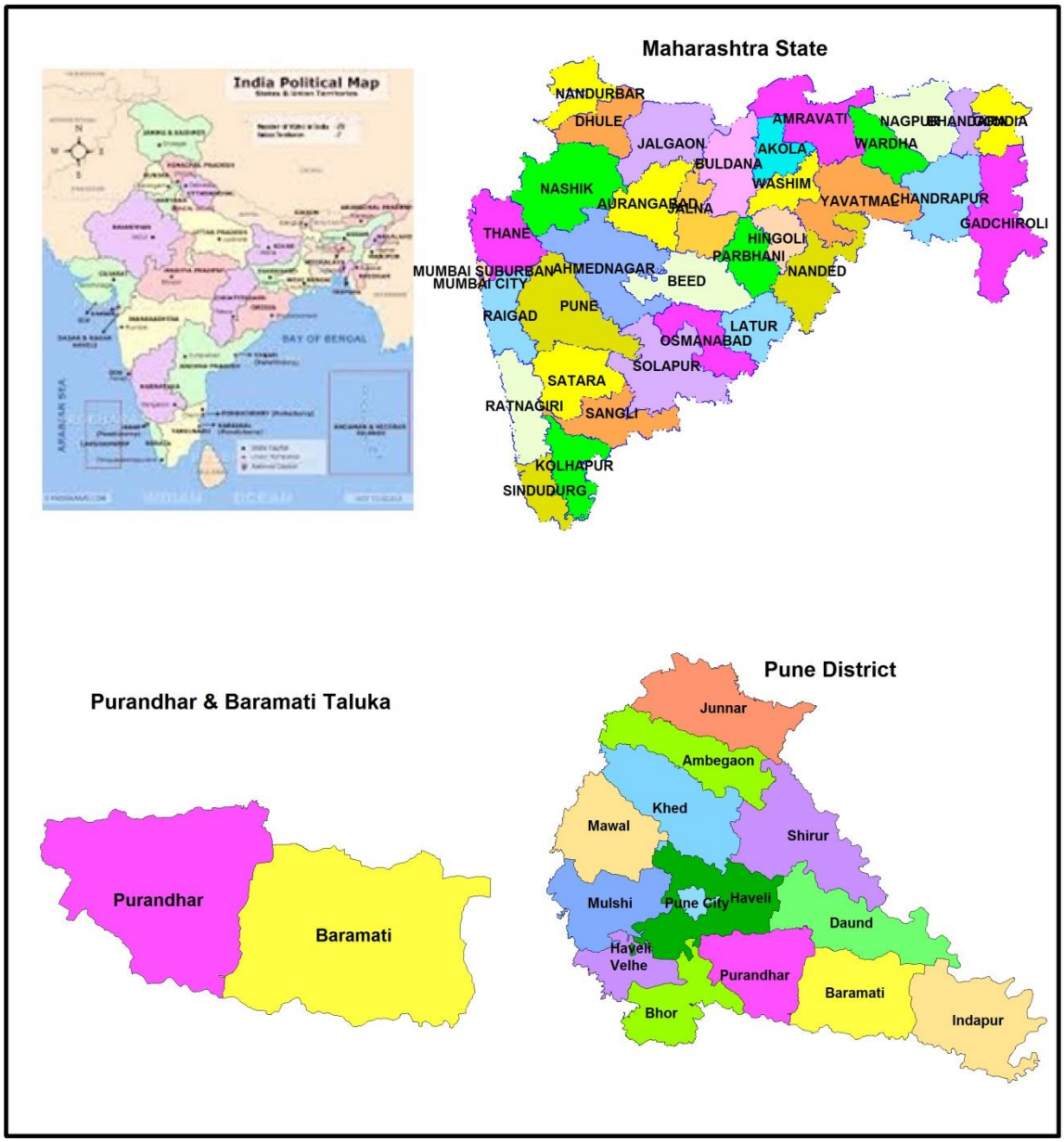
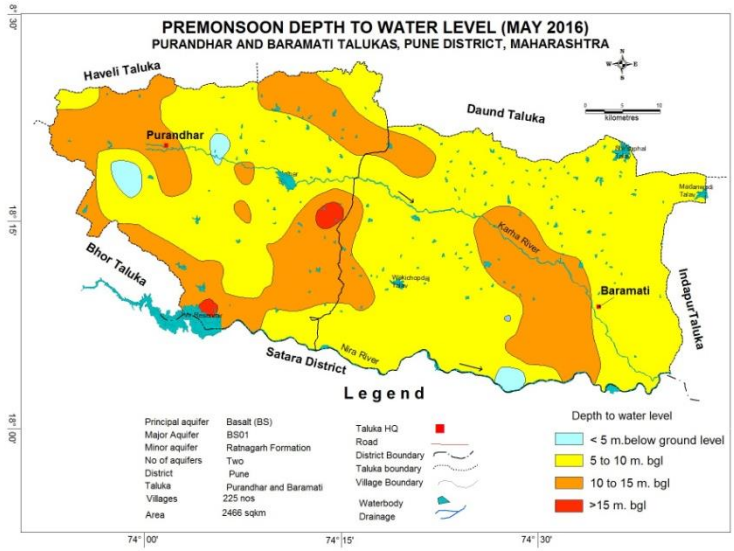
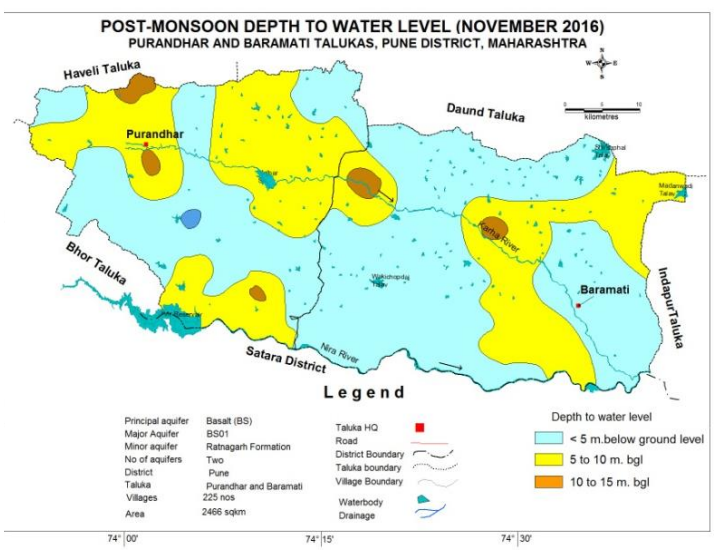


Fig 1.1 Index map of the Study area

2 SALIENT FEATURES

PARTICULARS	Baramati	Purandhar
District	Pune	Pune
State	Maharashtra	Maharashtra
Area (sq.km.)	1383.63	1082.46
Population (2011) Rural/Urban Total	 355839/73761 429600	 178095/57564 223659
Rainfall (mm) I. Normal Annual Rainfall II. Current Rainfall (2015) III. Rainfall Trend (mm/yr)	 494.5 mm 399.4 (-19 % deficient) 0.986 (1991 to 2015)	 581.2 mm 388.8(-33 % deficient) 1.002 (1991 to 2015)
Agriculture (sq.km.) i. Principal Crops Jawari Bajra Wheat Sugarcane Onion Gram Groundnut Sunflower ii. Cultivable Area iii. Net Sown Area iv. Forest	 617.91 40.79 88.8 155.3 35.08 77.91 39.08 1.9 1359.15 1041.06 49.29	 321.88 170.98 78.83 5.62 8.31 14.25 20.23 0.44 890.68 857.68 22.21
Irrigation Sources (sq.km.) i. Ground water ii. Surface Water	 181.54 233.79	 71.52 58.53
Data Utilised i. Key Observation Wells ii. GW exploration iii. VES iv. GWQ sampling locations- AQI AQII	 22 12EW+ 7 OW 0 19 20	 20 14 EW+ 1 OW 0 19 9
Existing / Future Water Demands (MCM) Domestic & Industrial Irrigation	 4.66/ 7.8 (2025) 174.51 / 10.63	 3.34/ 5.79 (2025) 120.26 / 9.92
Water Level Behaviour **Aquifer I** Pre-monsoon WL (m bgl) Post-monsoon WL (m bgl) Pre-monsoon WL Trend –Rise (m/yr) Pre-monsoon WL Trend-Fall(m/yr) Post-monsoon WL Trend -Rise(m/yr) Post-monsoon WL Trend -Fall(m/yr) **Aquifer II** Pre-monsoon WL (Aq-II) m bgl Post-monsoon WL (Aq-II) m bgl	 3.11 to 12.82 0.53 to 11 0.01 to 0.17 -0.01 to -1.38 0.002 to 0.14 -0.006 to -0.93 2.3 to 55 2 to 31	 2 to 17.5 0.2 to 12 0.07 to 0.16 -0.03 to-2.08 0.09 to 0.1 -0.015 to -1.588 5.1 to 60 1.5 to 41


PREMONSOON DEPTH TO WATER LEVEL (MAY 2016)
PURANDHAR AND BARAMATI TALUKAS, PUNE DISTRICT, MAHARASHTRA
Haveli Taluka
Purandhar
Daund Taluka
Bhor Taluka
Baramati
IndapurTaluka
Karha River
Nira River
Satara District
kilometres
Legend
Principal aquifer Basalt (BS)
Major Aquifer BS01
Minor aquifer Ratnagarh Formation
No of aquifers Two
District Pune
Taluka Purandhar and Baramati
Villages 225 nos
Area 2466 sqkm
Taluka HQ
Road
District Boundary
Taluka boundary
Village Boundary
Waterbody
Drainage
Depth to water level
< 5 m.below ground level
5 to 10 m. bgl
10 to 15 m. bgl
>15 m. bgl
74° 00'
74° 15'
74° 30'


POST-MONSOON DEPTH TO WATER LEVEL (NOVEMBER 2016)
PURANDHAR AND BARAMATI TALUKAS, PUNE DISTRICT, MAHARASHTRA
Haveli Taluka
Purandhar
Daund Taluka
Bhor Taluka
Baramati
IndapurTaluka
Karha River
Nira River
Satara District
kilometres
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Waterbody
Drainage
Depth to water level
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5 to 10 m. bgl
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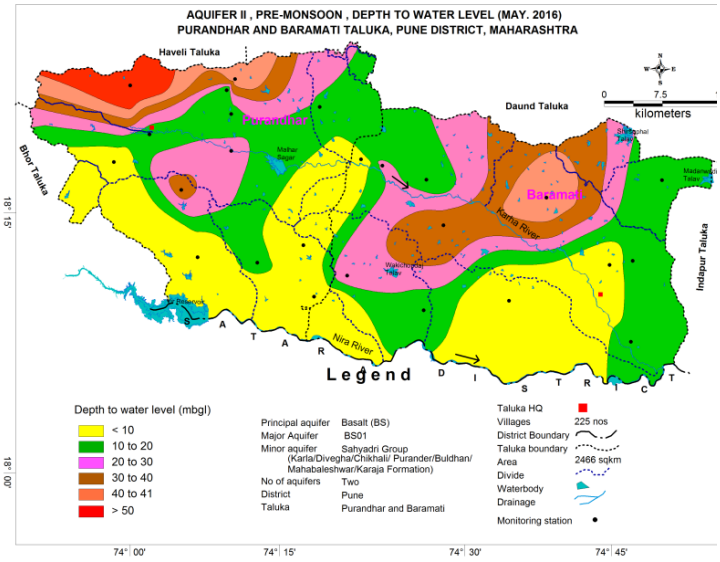
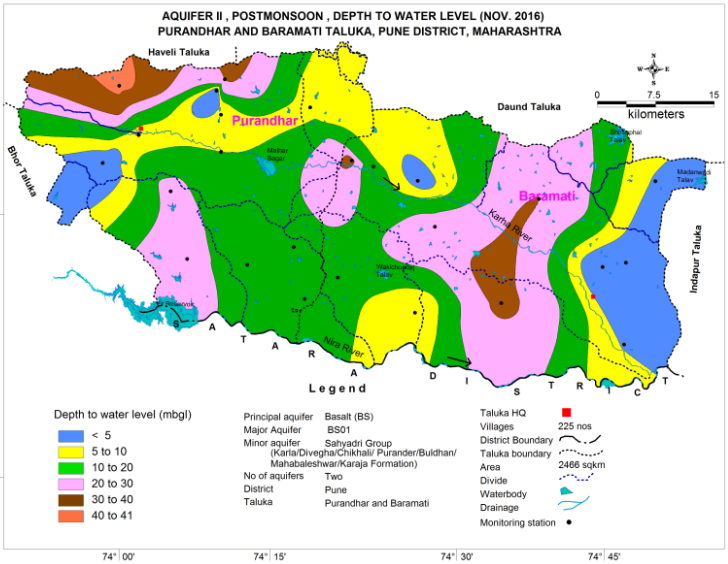
74° 15'
74° 30'


AQUIFER II , PRE-MONSOON , DEPTH TO WATER LEVEL (MAY. 2016)
PURANDHAR AND BARAMATI TALUKA, PUNE DISTRICT, MAHARASHTRA
Haveli Taluka
Purandhar
Daund Taluka
Bhor Taluka
Baramati
Indapur Taluka
Karha River
Nira River
SATARA DISTRICT
kilometers
Legend
Depth to water level (mbgl)
< 10
10 to 20
20 to 30
30 to 40
40 to 41
> 50
Principal aquifer Basalt (BS)
Major Aquifer BS01
Minor aquifer Sahyadri Group (Karla/Divegha/Chikhali/ Purander/Buldhan/ Mahabaleshwar/Karaja Formation)
No of aquifers Two
District Pune
Taluka Purandhar and Baramati
Taluka HQ
Villages 225 nos
District Boundary
Taluka boundary
Area 2466 sqkm
Divide
Waterbody
Drainage
Monitoring station
74° 00'
74° 15'
74° 30'
74° 45'


AQUIFER II , POSTMONSOON , DEPTH TO WATER LEVEL (NOV. 2016)
PURANDHAR AND BARAMATI TALUKA, PUNE DISTRICT, MAHARASHTRA
Haveli Taluka
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Daund Taluka
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Taluka boundary
Area 2466 sqkm
Divide
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Drainage
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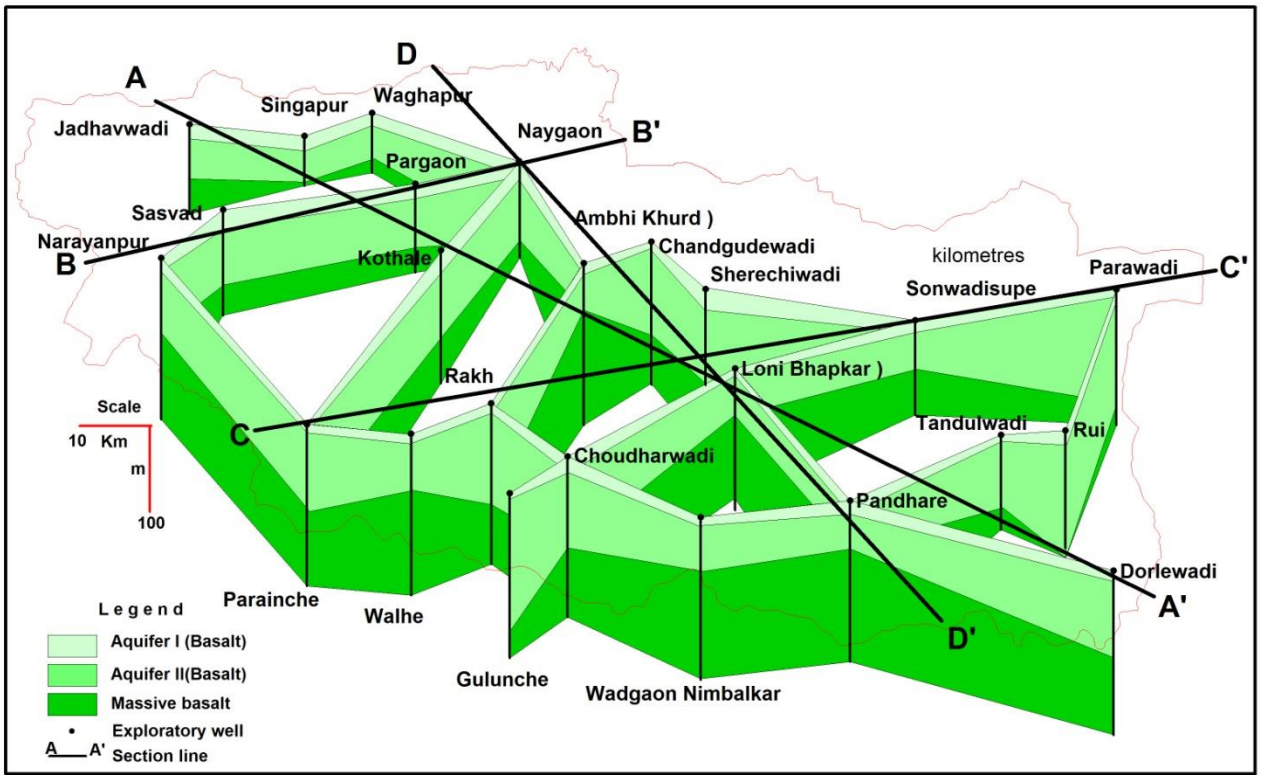
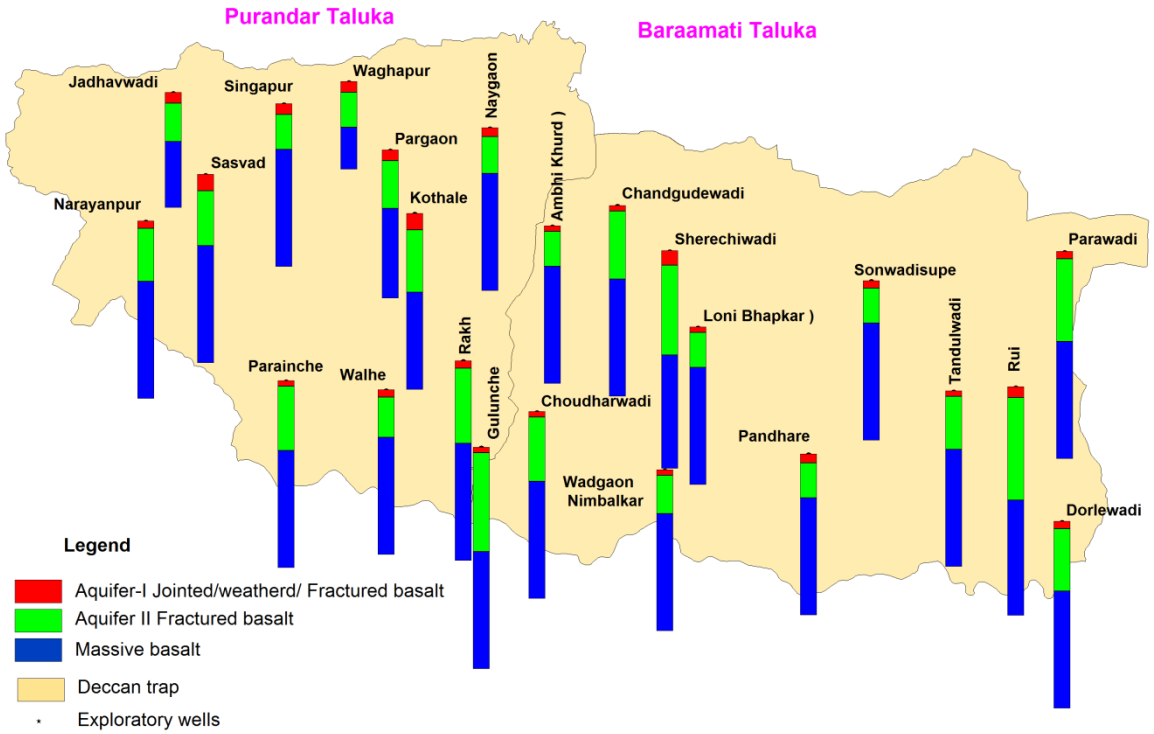
74° 00'
74° 15'
74° 30'
74° 45'

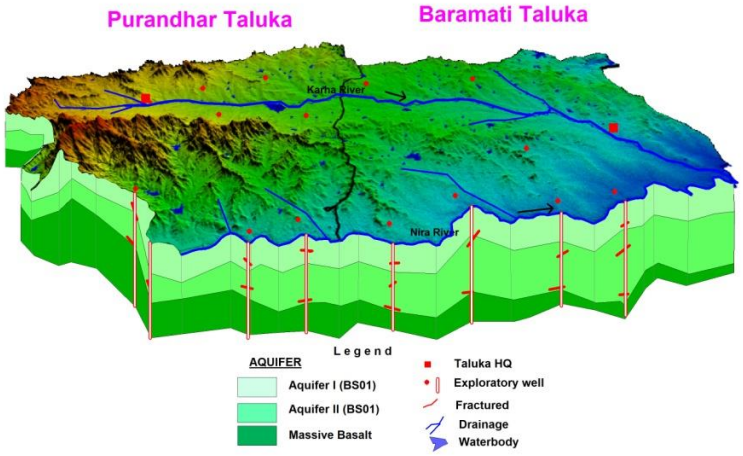
3 AQUIFER DISPOSITION

2-D and 3-D Aquifer Disposition	**Aquifer**: **Basalt**; **Aquifer I** - Weathered/Fractured Basalt: Depth range- 8 to 28 m and thickness of 5 to 18 m. **Aquifer II** - Jointed/Fractured Basalt: Depth range - 20 to 174 m, Thickness – 0.5 to 12 m

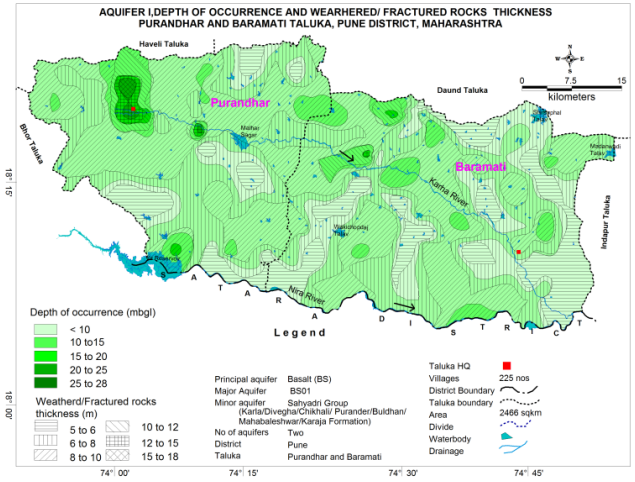




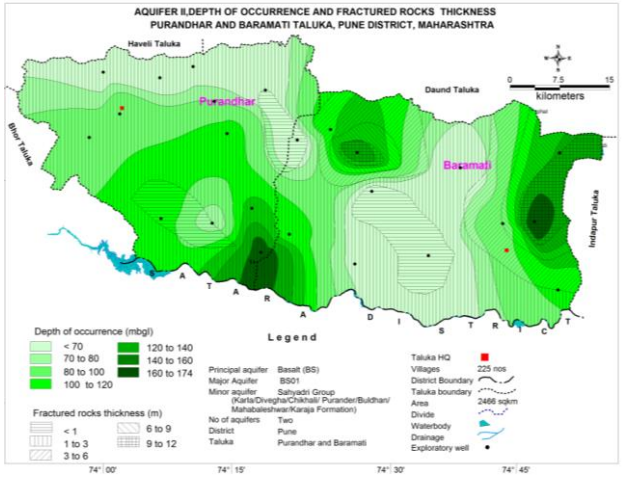
3-D Aquifer Disposition



Aquifer- I, Depth of occurrence & weathered/fractured rocks thickness



Aquifer-II, Depth of occurrence & fractured rocks thickness

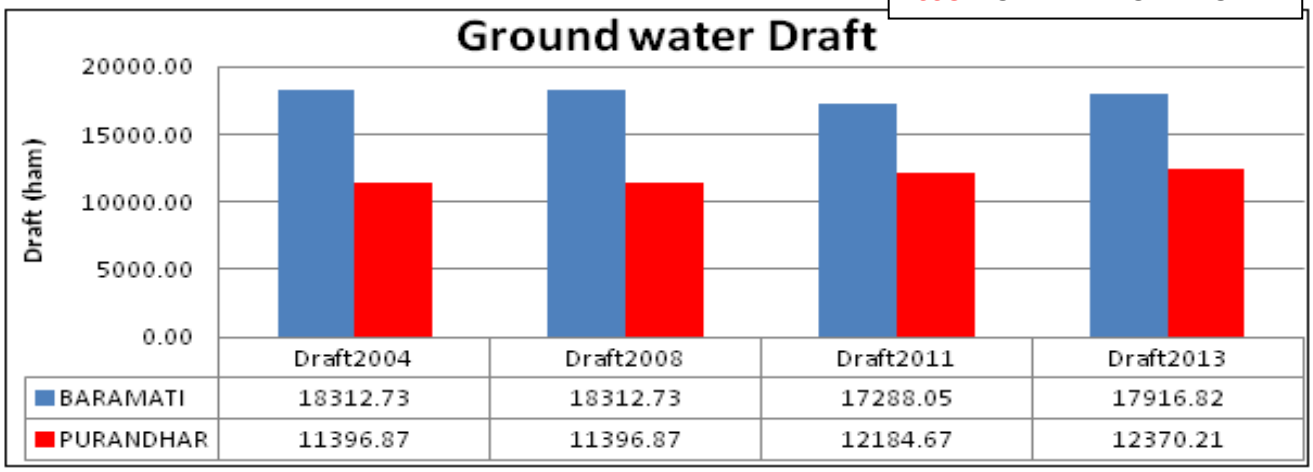


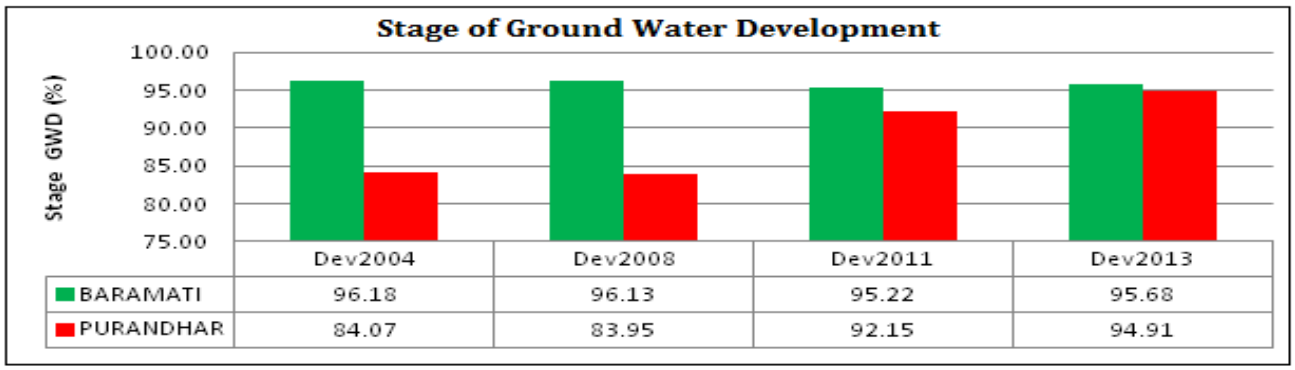
Aquifer	Formation	Depth range (mbgl)	SWL (mbgl)	Thickness (m)	Fractures Zones encountered (m bgl)	Yield	Sustaina-bility	Aquifer parameter (Transmissivity)	Sy/S	Suitability for drinking/ irrigation
Aquifer-I	Weathered/Fractured /Jointed Basalt	8-28	2 to 17.5	5 to 18	8 to 28	5 to 100 m^3/day	1 to 2 Hours – recurring	Sp capacity 1.7-18.9 lpm/m K 12 -65 m/day	0.02	Yes for both (except Nitrate affected villages for drinking)
Aquifer-II	Jointed/Fractured Basalt	20-174	1.5 to 60	0.5 to 12	20 to 174	25 - 200 LPM	1 to 2 hours	T-18-89 m^2/day	0.00034 to 6.37 $x10^{-4}$	Yes for both

4 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

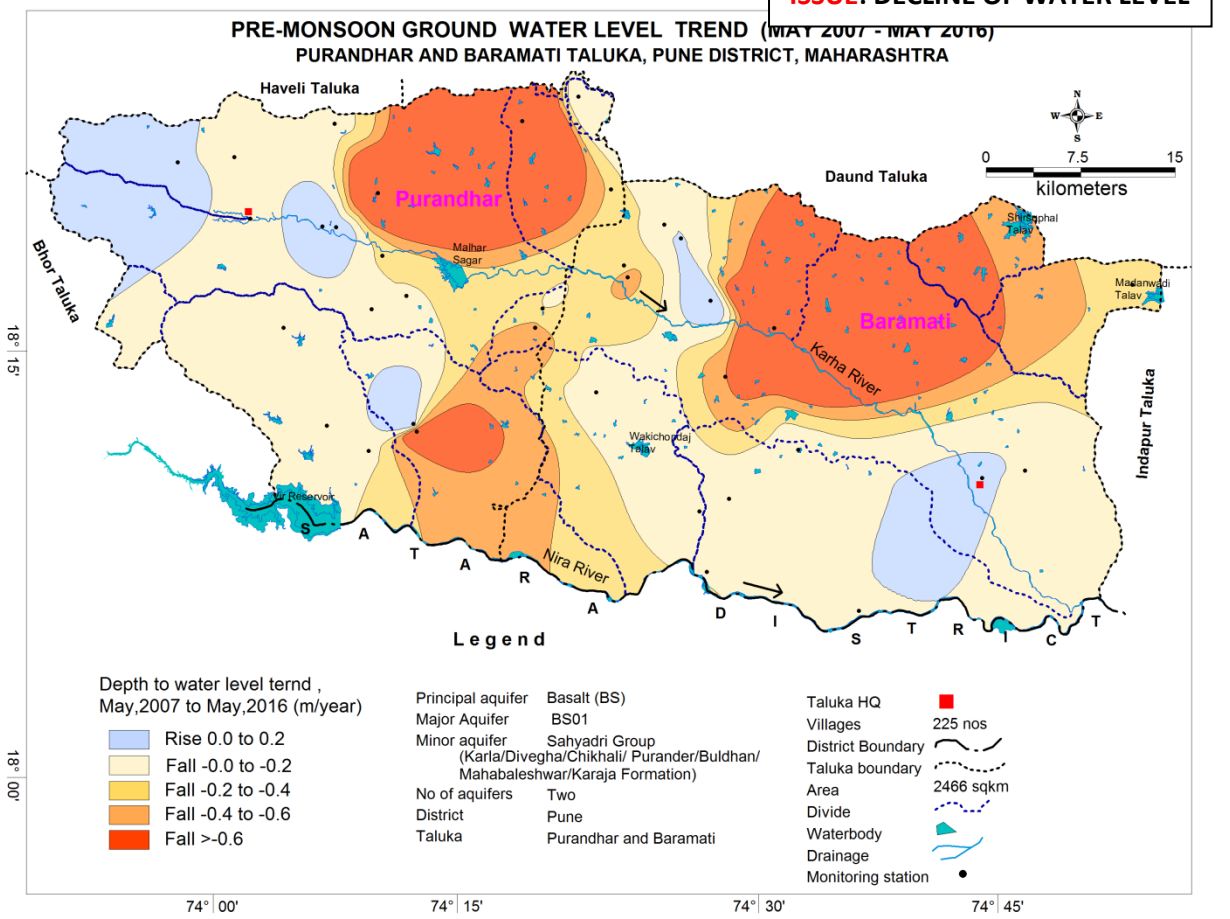
	Baramati	Purandhar
Aquifer wise Ground Water Resource availability and Extraction		
Ground Water Resource (MCM)		
Aquifer –I: upto 28 m		
Availability	187.25	130.34
Withdrawal	179.17	127.3
Ground Water Resource (MCM) **Aquifer –II:** 20 to 174 m		
Availability	1.73	0.73
Withdrawal	0	0
Stage of GW Development	95.68%	94.91%
Present Category	Safe	Safe
Ground Water Related Issues		
Over Exploitation	Stage of GW Development has increased over the period of time. Overdraft for irrigation purpose.	
Deeper Water Levels	In AQII Deeper Water Levels (DTW> 40 m) – Area 1980sq km	
Declining Water Levels	Declining Water Levels area –Pre-monsoon 2959 sq.km & Post-monsoon 1880 sq.km (Falling Trend > 0.20 m/yr)	
GW based irrigation of cash crops like sugarcane	Sugarcane crop (249.8.5sq.km)– water intensive crop.	

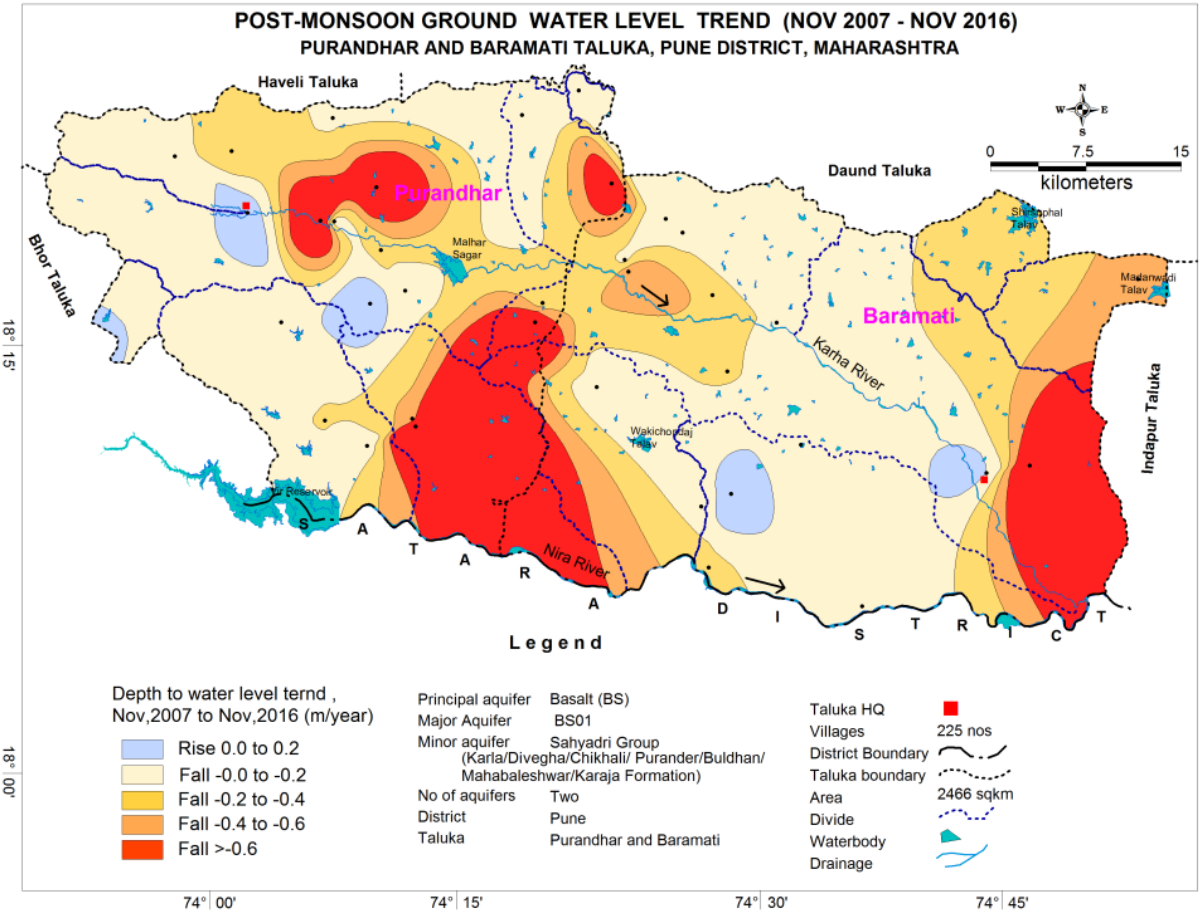
ISSUE: OVER-EXPLOITATION





ISSUE: DECLINE OF WATER LEVEL

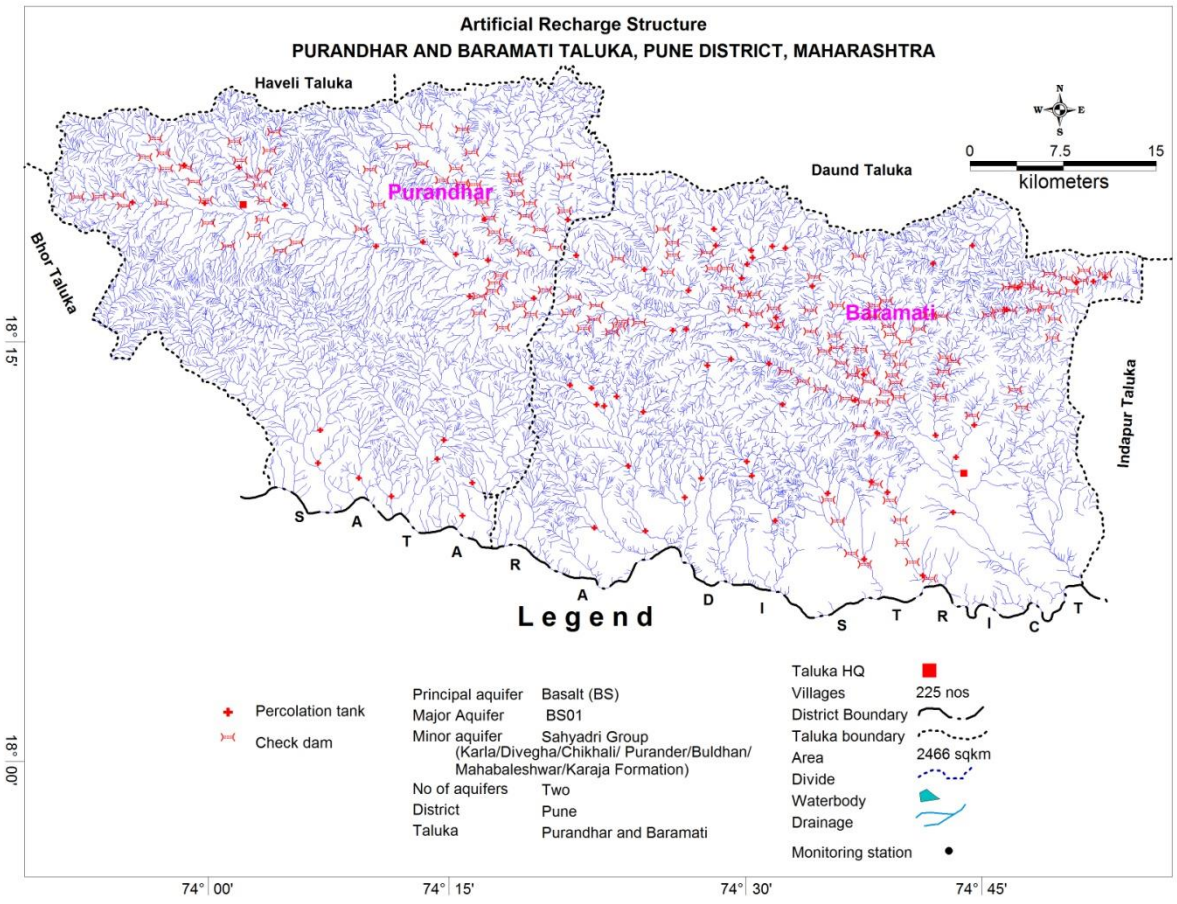


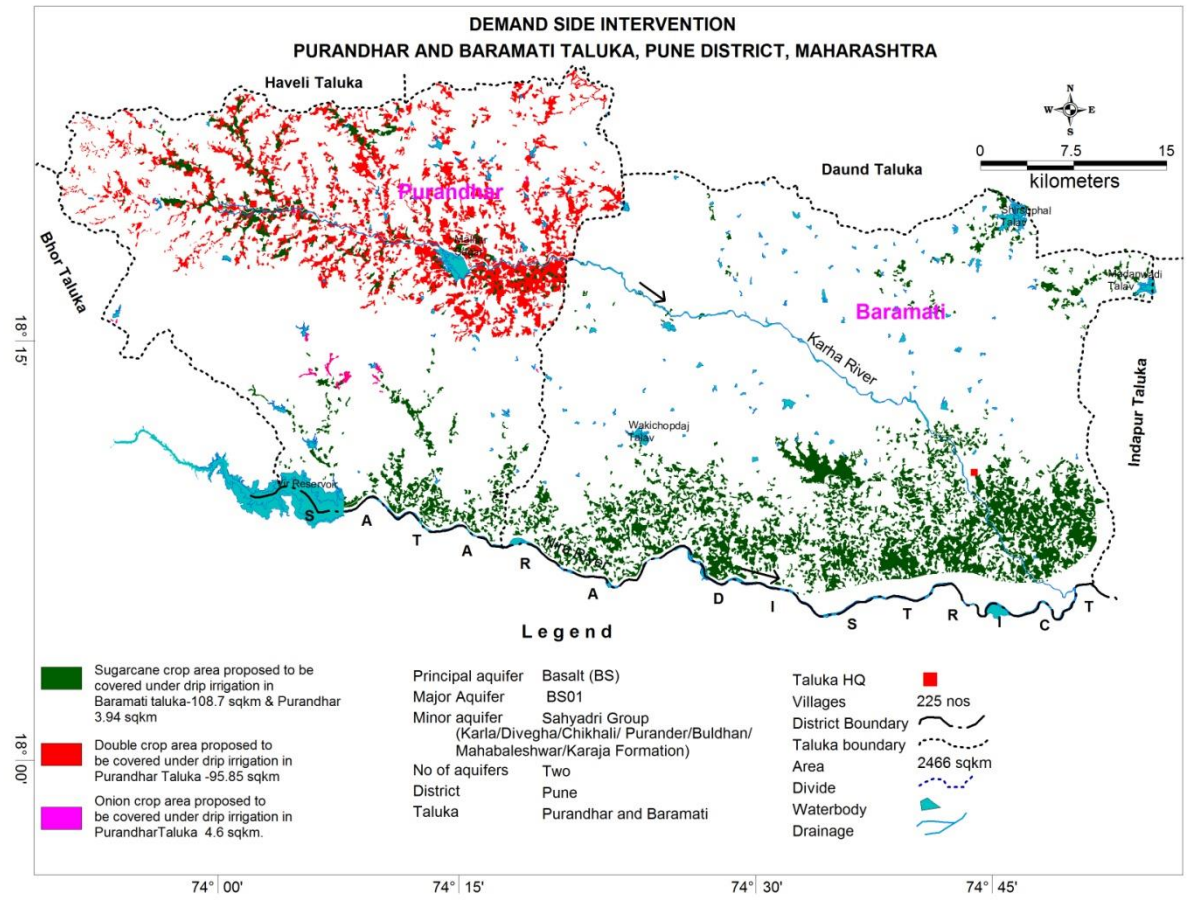


5 GROUND WATER RESOURCE ENHANCEMENT AND PROPOSED MANAGEMENT INTERVENTIONS

	Baramati	Purandhar	Total
5.1 Resource Enhancement by Supply Side Interventions			
Recharge Potential	22.39	10.00	32.39
Surface water requirement @ 75% efficiency	29.78	13.30	43.08
Availability of Surplus surface runoff	13.71	6.12	19.83
Surplus runoff considered for planning	13.71	6.12	19.83
Proposed Artificial Recharge Structures			0.00
PT	54	21	75.00
CD	96	62	158.00
Volume of Water expected to be recharged @ 75% efficiency (MCM)	10.26	4.55	14.81
Proposed RTRWH			
Households to be covered	9300	5126	14426.00
Total RWH potential	0.26	0.13	0.39
Rainwater harvested / recharged @ 80% runoff co-efficient	0.21	0.11	0.32
Estimated Expenditure (Rs. in Cr.)	13.95	7.69	21.64
RTRWH Economically not viable & Not Recommended. Total estimated Cost of RTRWH would be-21.64 Cr. For Harvesting 032 MCM of Rain Water.			
Total volume of water expected to be recharged/ conserved by AR	10.26	4.545	14.81
Total Estimated Expenditure for AR	109.80	50.1	159.90

Resource Enhancement by Supply Side Interventions			
DEMAND SIDE INTERVENTIONS	**Baramati**	**Purandhar**	**Total**
Proposed Cropping Pattern change	None	None	
Micro irrigation techniques			
Area proposed to be covered (sq.km.) 70% of sugarcane area	108.7	3.934	112.634
Volume of Water expected to be conserved (MCM). Sugarcane requirement - 2.45 m, Pomegranate with Drip - 0.7 m, WUE - 1.75 m	61.959	2.24238	64.20138
Estimated Expenditure	161.15862	5.8325484	166.9912
Area proposed to be covered (191.7sq.km.) 50% DC area drip/sprinkler		95.85	95.85
Volume of Water expected to be conserved (MCM). DC requirement - 0.90 m, Drip - 0.40 m,		38.34	38.34
Estimated Expenditure		59.2113375	59.21134
Area proposed to be covered (35.5sq.km.) 50%Onion area		17.75	17.75
Volume of Water expected to be conserved (MCM). Onion requirement - 0.78 m, Drip - 0.52 m,		4.615	4.615
Estimated Expenditure		10.9650625	10.96506


Artificial Recharge Structure
PURANDHAR AND BARAMATI TALUKA, PUNE DISTRICT, MAHARASHTRA
Haveli Taluka
Purandhar
Daund Taluka
Baramati
Bhor Taluka
Indapur Taluka
0 7.5 15
kilometers
S A T A R A D I S T R I C T
Legend
Percolation tank
Check dam
Principal aquifer Basalt (BS)
Major Aquifer BS01
Minor aquifer Sahyadri Group (Karla/Divegha/Chikhali/ Purander/Buldhan/ Mahabaleshwar/Karaja Formation)
No of aquifers Two
District Pune
Taluka Purandhar and Baramati
Taluka HQ
Villages 225 nos
District Boundary
Taluka boundary
Area 2466 sqkm
Divide
Waterbody
Drainage
Monitoring station
18° 15'
18° 00'
74° 00'
74° 15'
74° 30'
74° 45'


DEMAND SIDE INTERVENTION
PURANDHAR AND BARAMATI TALUKA, PUNE DISTRICT, MAHARASHTRA
Haveli Taluka
Purandhar
Daund Taluka
Baramati
Bhor Taluka
Indapur Taluka
Karha River
Wakichopdaj Talav
0 7.5 15
kilometers
S A T A R A D I S T R I C T
Legend
Sugarcane crop area proposed to be covered under drip irrigation in Baramati taluka-108.7 sqkm & Purandhar 3.94 sqkm
Double crop area proposed to be covered under drip irrigation in Purandhar Taluka -95.85 sqkm
Onion crop area proposed to be covered under drip irrigation in PurandharTaluka 4.6 sqkm.
Principal aquifer Basalt (BS)
Major Aquifer BS01
Minor aquifer Sahyadri Group (Karla/Divegha/Chikhali/ Purander/Buldhan/ Mahabaleshwar/Karaja Formation)
No of aquifers Two
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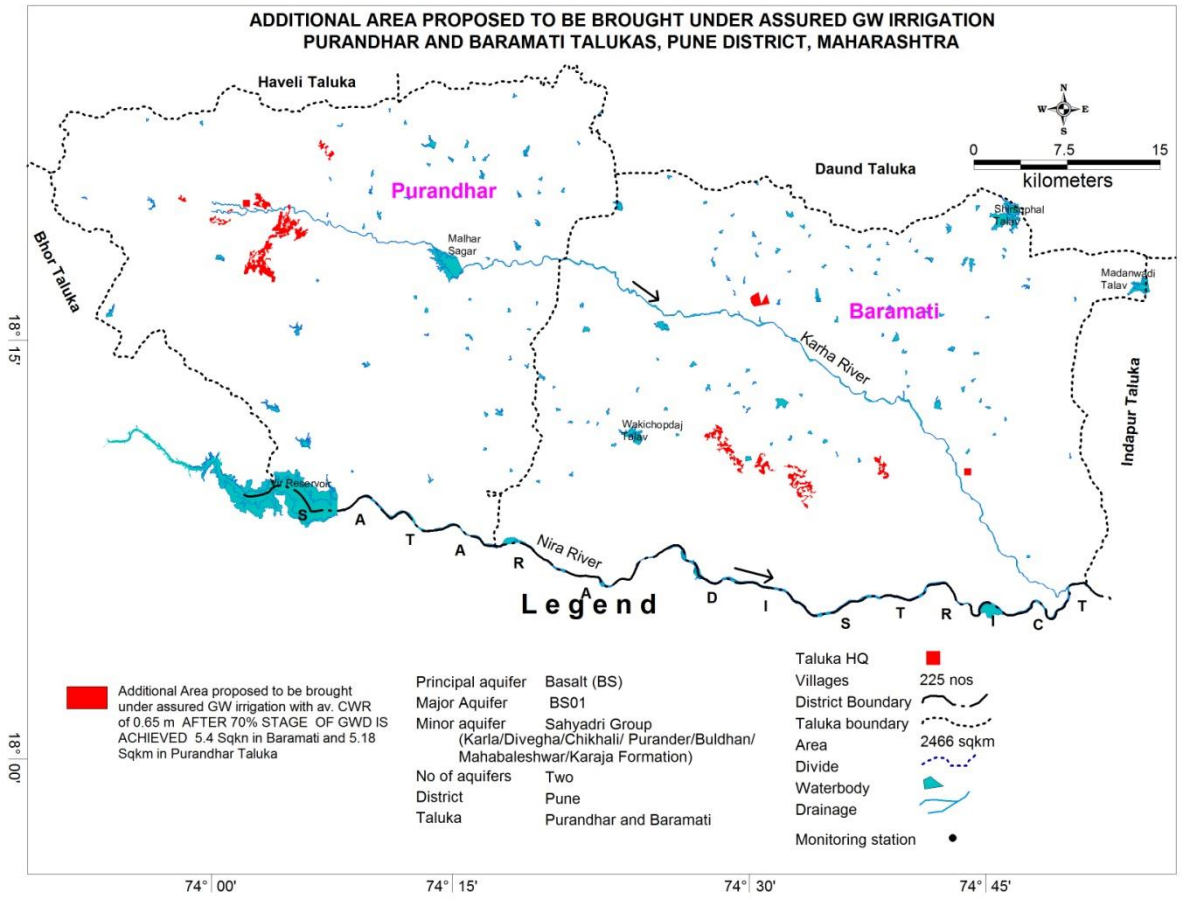
Villages 225 nos
District Boundary
Taluka boundary
Area 2466 sqkm
Divide
Waterbody
Drainage
18° 15'
18° 00'
74° 00'
74° 15'
74° 30'
74° 45'

5.1 Probable Benefits

Item	Baramati	Purandhar	Total
Additional GW resources available after implementing above measures (MCM)	72.219	49.74238	121.9614
Volume of Water Required TO BRING STAGE OF GWD UPTO 70%	68.70714286	46.37429	115.0814
Balance GWR available for GW Development after STAGE OF GWD is brought to 70%	3.511857143	3.368094	6.879951
Additional Area (sq.km.) proposed to be brought under assured GW irrigation with av. CWR of 0.65 m AFTER 70% STAGE OF GWD IS ACHIEVED OR	5.402857143	5.181684	10.58454

5.2 Regulatory Measures

	Baramati	Purandhar
Regulatory Measures	Regulation of wells below 60 m	Regulation of wells below 60 m



PROPOSED MANAGEMENT PLAN

115.08 mcm of GW quantum is required to be augmented/managed to bring stage of GWD @70%

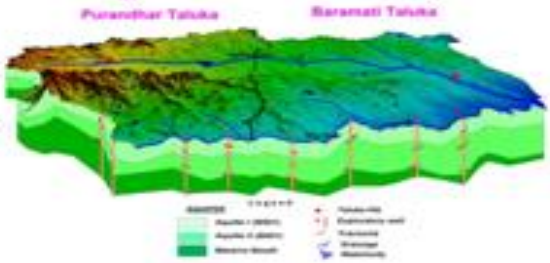
Augmentation by AR – 14.81 MCM

GW quantum saved by WUE – 107.16 MCM

Total Draft – 302.87MCM

Aquifer I Resources – Dy- 317.59 MCM Instorage- 0.16

Aquifer II Resources – 2.463 MCM



Total Resources – 320.21 MCM

ADDITIONAL RESOURCES CREATED/SAVED

14.81 MCM - by AR

107.16 MCM – by WUE

121.97 mcm – TOTAL

PROBABLE BENEFITS AFTER IMPLEMENTING AR & WUE MEASURES

STAGE OF GW DEVELOPMENT IN Purandhar and Baramati Taluka can be brought 70 % from Present stage of GW development of Purandhar and Baramati Taluka is 94.91% & 95.68 % respectively and about 10.58 Sqkm Additional Area proposed to be brought under assured GW irrigation after implementation of artificial recharge to ground water & micro irrigational techniques

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 Baramati and Purandhar Talukas of Pune district

The study area is spanning over 2466.09 sq.km. Geologically the area is occupied by Basalt and the stage of ground water development is 95.68 % in Baramati and 94.91% in Purandhar taluka. The area has witnessed ground water depletion and over exploitation over a period of time. In Aquifer-I, the deeper water levels of >15 m bgl has been observed in central and southern parts of Purandhar taluka and 10 to 15 mbgl along surface divide in Baramati and Purandhar taluka, while in Aquifer –II, deeper water levels of > 40 mbgl has been observed in north western parts of Purandhar taluka . The declining water level trend > 0.20 m/yr. has been observed in major part about 1188 sq km during pre-monsoon and 1978 sq km during post-monsoon trend (2007 to 2016). This has been due to cultivation of water intensive cash crop like Sugarcane (160.9 sq.km), which are completely dependent on ground water irrigation.

Ground water management plan has been prepared with the objective of bringing the current stage of ground water development down to 70% and decline of water level may be arrested, so that the taluka comes under Safe category by adopting both, supply side and demand side interventions.

As a part of supply side interventions, a total of 75 Percolation Tanks and 158 Check Dam is proposed in Baramati and Purandhar Talukas ,which will augment ground water resources to the tune of 14.81 MCM (11.25 MCM by Percolation Tanks and 3.56 MCM by Check Dam). The total cost of implementing these interventions will be Rs. 159.9 crore.

As a part of demand side interventions, change in irrigation techniques from surface flooding to drip irrigation is also proposed. A total of 112.63 sqkm of Sugarcane crop area in Baramati and Purandhar talukas is proposed to be covered under drip irrigation techniques instead of flood irrigation that will save 64.2 MCM of water resources. The total cost of implementing these interventions will be Rs 166.99 crore. Double crop of 95.85 sqkm and 17.75 Sqkm of Onion crop areas in Purandhar taluka are also proposed to be covered under drip irrigation techniques instead of flood irrigation that will save 42.955 MCM of water resources. The total cost of implementing these interventions will be Rs 70.176 crore

In Baramati and Purandhar Talukas, a total of 14.81 MCM resources will be augmented after adopting artificial recharge, whereas and 107.156 MCM will be saved after implementing water user efficiency measures (drip irrigation). This will bring the stage of ground water development to 70 % in Baramati and Purandhar talukas from the present stage of 95.68 % in Baramati and 94 91 % in Purandhar taluka and 10.58 sq.km area proposed to be brought under assured GW irrigation with av.CWR of 0.65 m.

This will probably result in arresting the decline of water levels. 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. Similarly IEC activities and capacity building activities needs to be aggressively propagated to establish the institutional framework for participatory groundwater management.