Draft Report

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

Report

on

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLAN

Bodvad Taluka (Jalgaon District) &

Motala Taluka (Buldana District), Maharashtra

(Part-II)

मध्य क्षेत्र, नागपुर

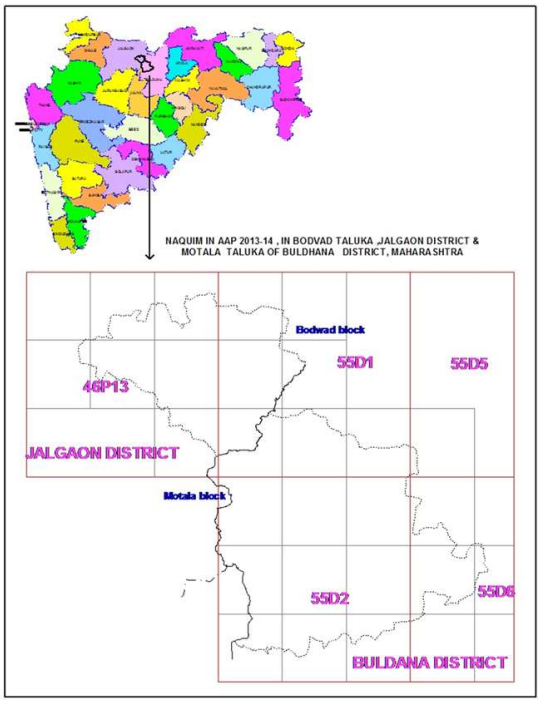
Central Region, Nagpur

भारतसरकार
Government of India
जल संसाधन, नदी विकास एवं गंगा संरक्षण मंत्रालय
Ministry of Water Resources, River Development & Ganga Rejuvenation
केन्द्रीयभूमिजलबोर्ड
CENTRAL GROUND WATER BOARD

जल बचत जल संचय

Aquifer Maps and Ground Water Management Plan

जलभृत नक्शे तथा भूजल प्रबंधन योजना



BodvadTaluka, **JALGAON** District,MotalaTaluka, Buldhana District Maharashtra

बोधवड तालुका, जिला जलगांव, मोटाला तालुका, जिला बुलढाणामहाराष्ट्र

PART-II

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, **BODVAD TALUKA, JALGAONDISTRICT AND MOTALA TALUKA, BULDHANA DISTRICT,** MAHARASHTRA STATE

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PART-II

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, **BODVAD TALUKA, JALGAONDISTRICT AND MOTALA TALUKA, BULDHANA DISTRICT,** MAHARASHTRA STATE

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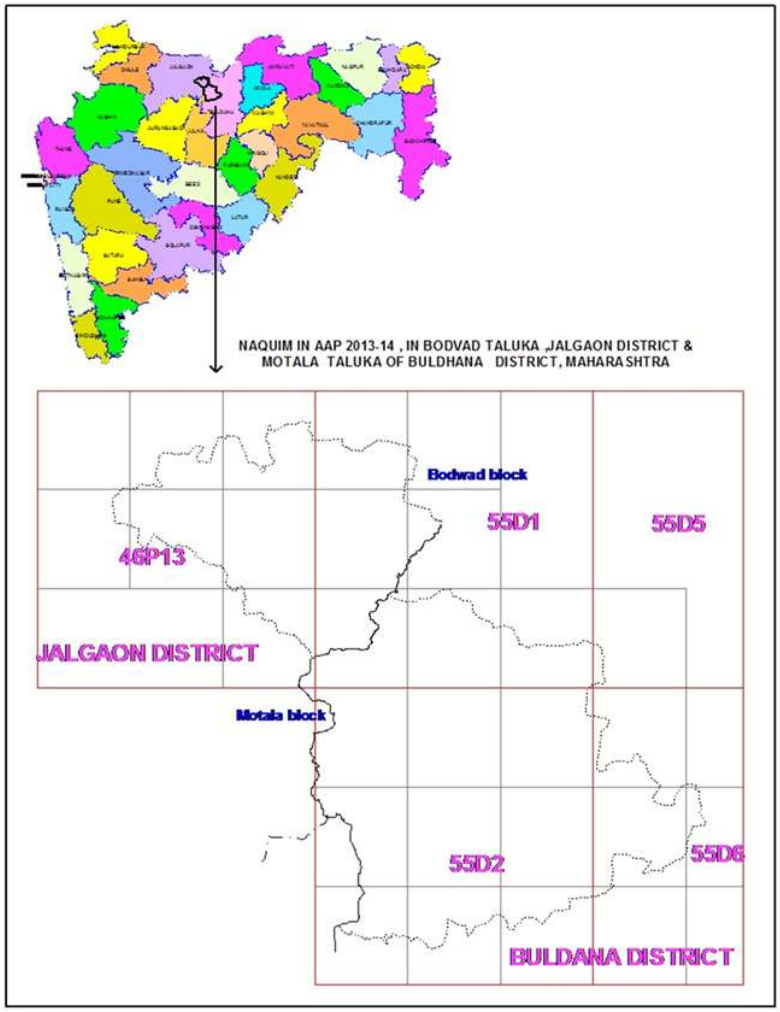
AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, **BODVAD TALUKA, JALGAONDISTRICT AND MOTALA TALUKA, BULDHANA DISTRICT,** MAHARASHTRA STATE

1 BRIEF INTRODUCTION

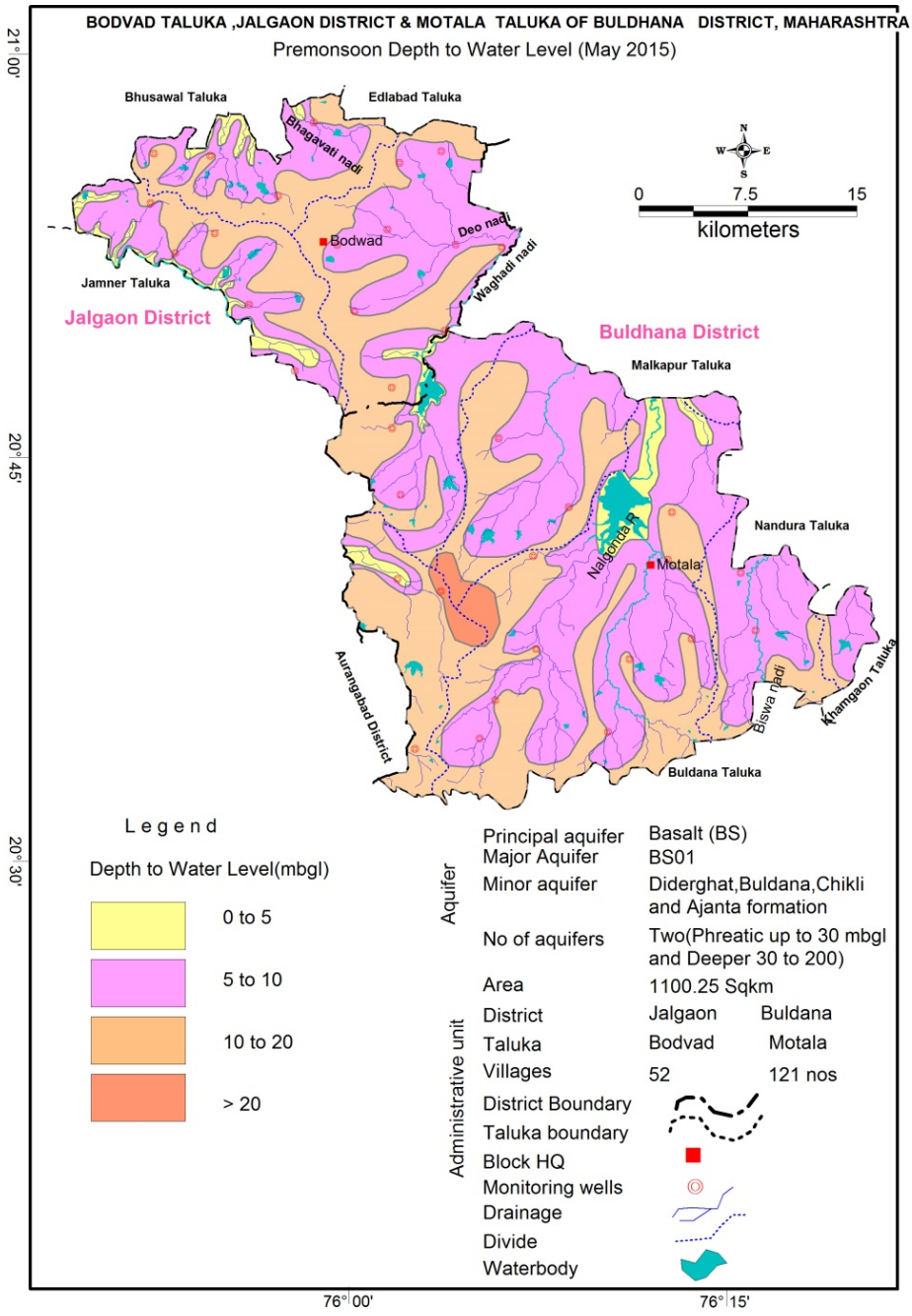
In XII five year plan (2012-17), National Aquifer Mapping (NAQUIM) has been introduced to carry out detailed hydrogeological investigation on topo-sheet scale (1:50,000).Keeping in view the current demand vis-à-vis supply and futuristic requirement of water, Central Ground Water Board has taken up NAQUIM inprioritised areas covering Over-exploited, Critical and Semi-Critical talukas. Hence, Semi-Critical talukas of Jalgaon and Buldhandistrict has been taken up to carry out detailed hydrogeological investigation in Bodvad (SC), Motala (SC), by covering an area of 1100.25 sq.km. in the year 2013-14. The index map of the study area is presented below.

Location Map



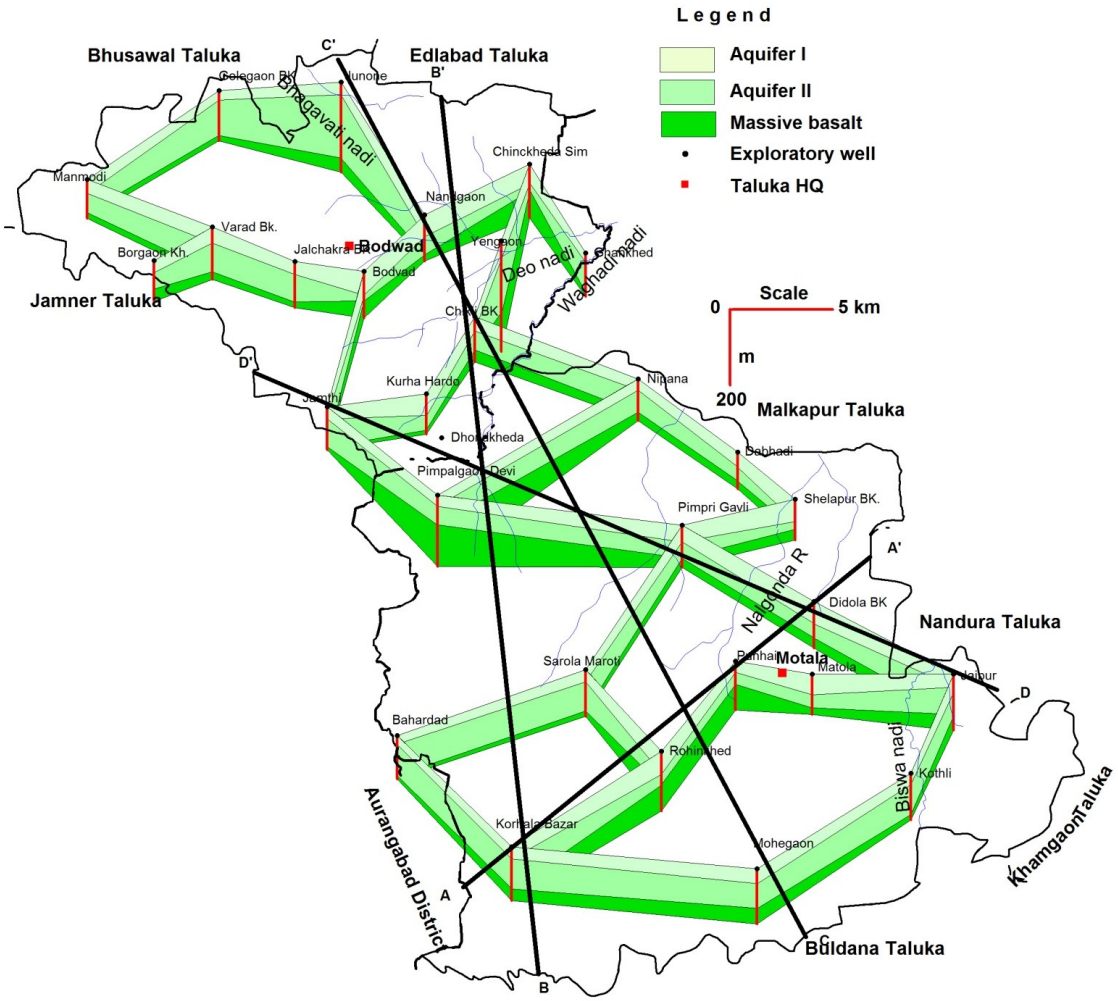
2 SALIENT FEATURES

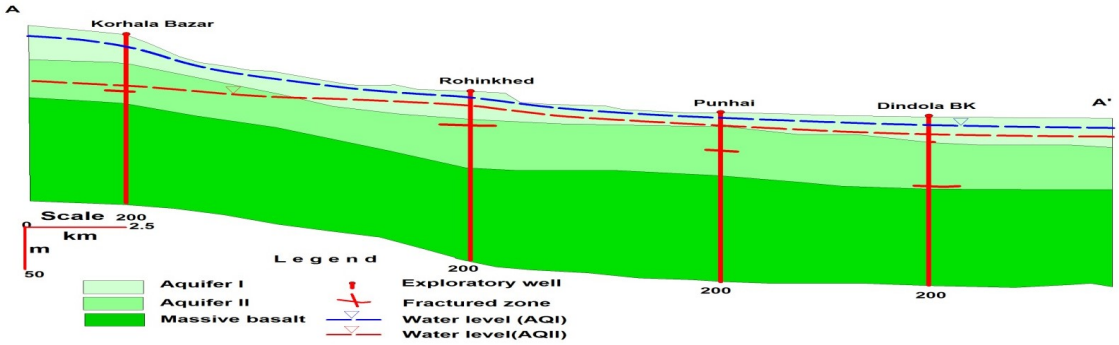
	Bodvad (Jalgaon)	**Motala (Buldhan)**
Area (sq.km.)	356.69	743.50
Population (no.'s) (2011)	91,799	1,66,598
Rainfall (mm)		
i. Normal Annual Rainfall	722	724.50
ii. Rainfall Trend (mm/yr)	Falling@7.53 mm /yr(1998-15)	Falling@9.75 mm /yr(1998-15)
iii. Current Rainfall (2015)	496.7 (31% deficient)	698.4 (4% deficient)
Agriculture (sq.km.)		
i. Principal Crops	Oil Seeds (108.39), Pulses (175.59) Cotton (222.92)	Jowari (67.44), Cereals (77.36) Cotton (140.77)
ii. Cultivable Area	285.32	638.24
iii. Net Sown Area	273.47	565.84
Irrigation Sources		
i. Ground water (sq.km.)	20.52	18.11
ii. Surface Water (sq.km.)	2.78	106.5
Data Utilised		
i. Key Observation Wells	18	19
ii. Exploratory & Observation Wells	9	18
iii. VES	-	-
iv. GWQ sampling locations	18	30
Existing / Future Water Demands (MCM)		
Domestic	2.18/ 6.09 (2025)	2.99/ 3.70 (2025)
Industrial	-	-
Irrigation	38.96 / 8.35	30.81 / 4.82
Water Level Behaviour		
Premonsoon WL (m bgl)	5.10 to 18.00	2.50 to 19.40
Postmonsoon WL (m bgl)	3.60 to 15.30	1.00 to 8.00
Premonsoon WL Trend (m /yr)	Rise – upto 0.40 Fall – upto 0.60	Rise – upto 0.40 Fall – upto 0.40

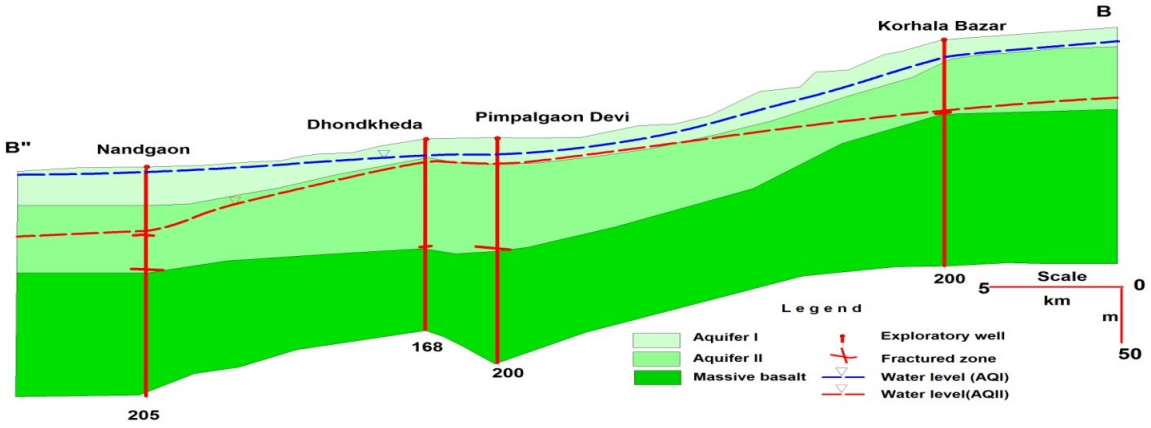

BODVAD TALUKA ,JALGAON DISTRICT & MOTALA TALUKA OF BULDHANA DISTRICT, MAHARASHTRA
Premonsoon Depth to Water Level (May 2015)
Bhusawal Taluka
Edlabad Taluka
Bhagavati nadi
Bodwad
Deo nadi
Waghadi nadi
Jamner Taluka
Jalgaon District
Buldhana District
Malkapur Taluka
Nandura Taluka
Nalganga R
Motala
Aurangabad District
Biswa nadi
Khamgaon Taluka
Buldana Taluka
N
W
E
S
0
7.5
15
kilometers
21° 00'
20° 45'
20° 30'
76° 00'
76° 15'
Legend
Depth to Water Level(mbgl)
0 to 5
5 to 10
10 to 20
> 20
Aquifer
Principal aquifer Basalt (BS)
Major Aquifer BS01
Minor aquifer Diderghat,Buldana,Chikli and Ajanta formation
No of aquifers Two(Phreatic up to 30 mbgl and Deeper 30 to 200)
Area 1100.25 Sqkm
Administrative unit
District Jalgaon Buldana
Taluka Bodvad Motala
Villages 52 121 nos
District Boundary
Taluka boundary
Block HQ
Monitoring wells
Drainage
Divide
Waterbody

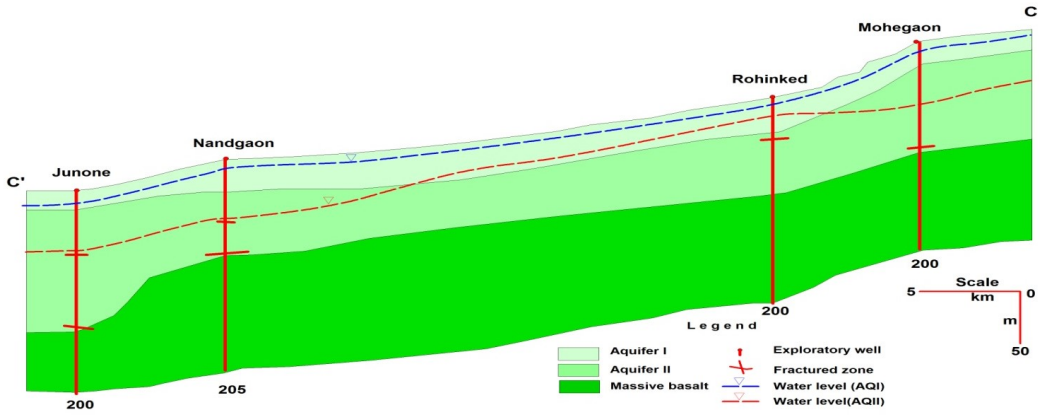
3 AQUIFER DISPOSITION

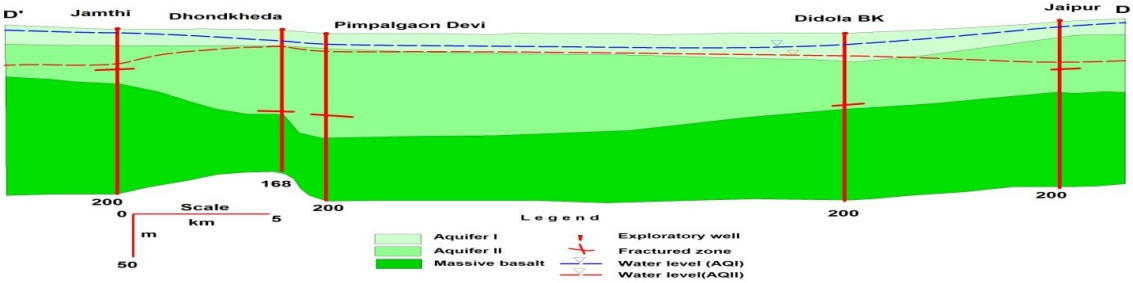
	Bodvad, Jalgaoan and Motala, Buldhan
3-D Aquifer Disposition	**Aquifer**:**Basalt**; Aquifer I - Weathered/Fractured Basalt: 5 to 30 m, Aquifer II - Jointed/Fractured Basalt: 30 to 160 m

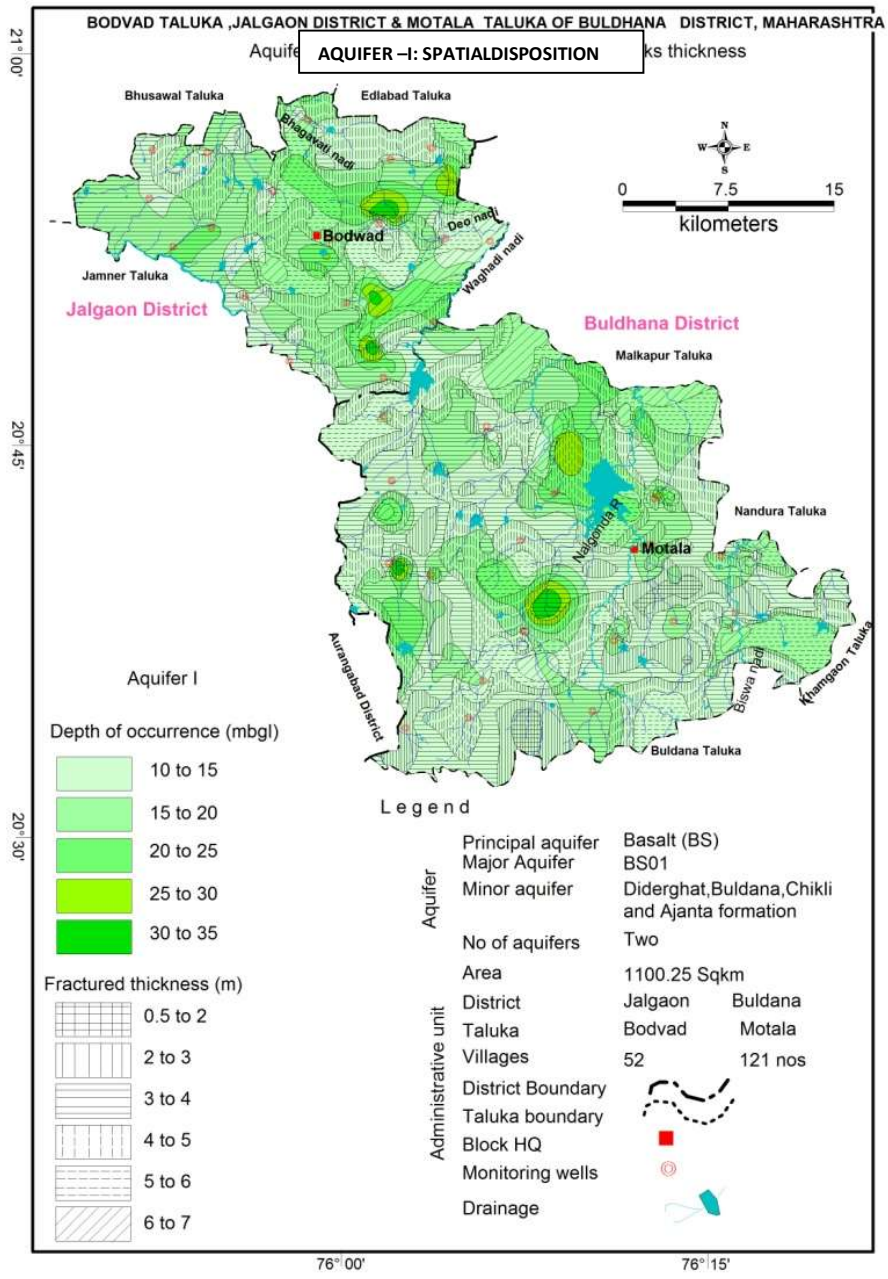


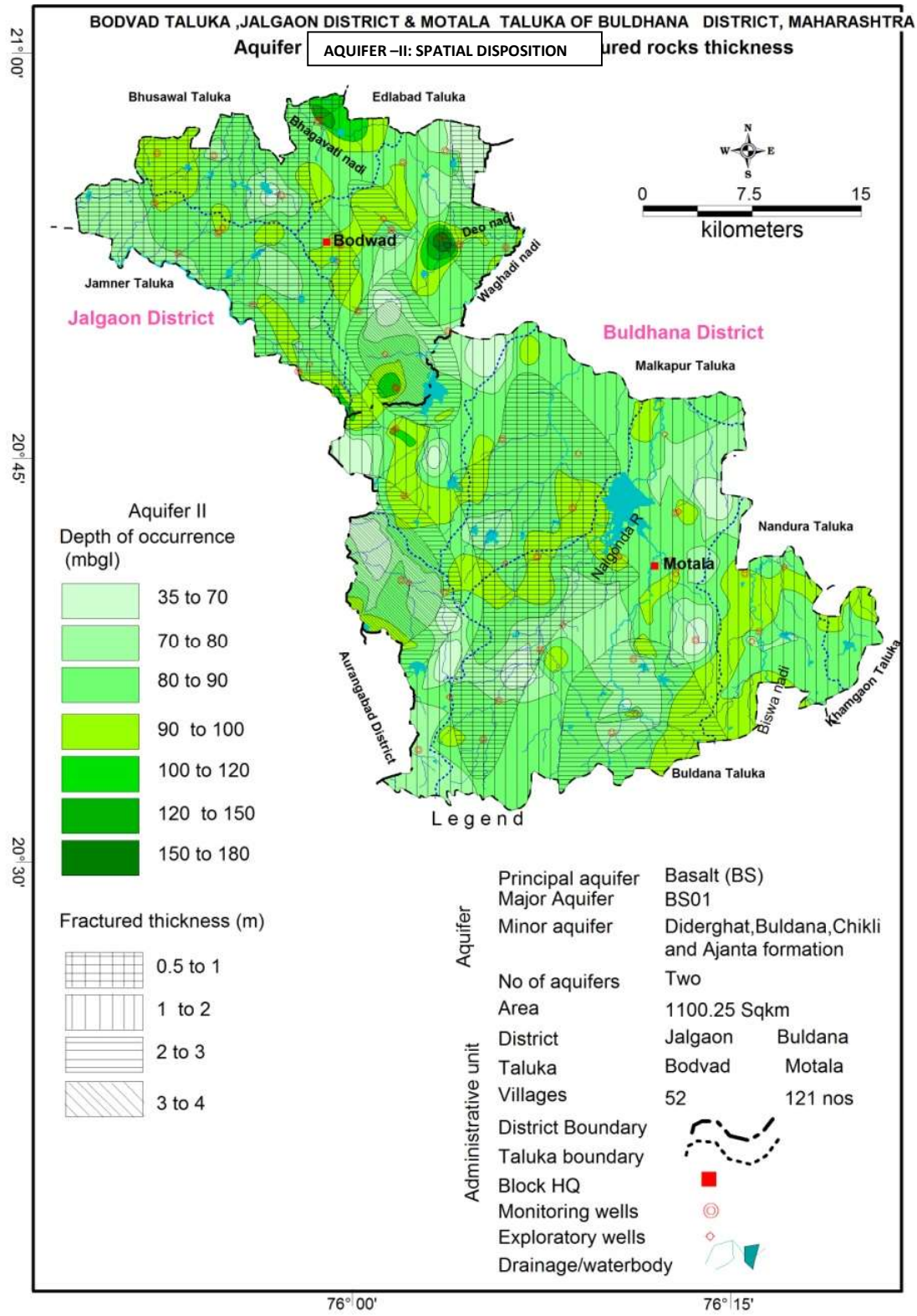

A
Korhala Bazar
Rohinkhed
Punhai
Dindola BK
A'
Scale
200
2.5
km
0
m
50
Legend
Aquifer I
Aquifer II
Massive basalt
Exploratory well
Fractured zone
Water level (AQI)
Water level(AQII)
200
200
200


B
Korhala Bazar
Dhondkheda
Pimpalgaon Devi
B"
Nandgaon
200
Scale
5
km
0
m
50
Legend
Aquifer I
Aquifer II
Massive basalt
Exploratory well
Fractured zone
Water level (AQI)
Water level(AQII)
168
200
205


C
Mohegaon
Rohinked
Nandgaon
C'
Junone
200
Scale
5
km
0
m
50
Legend
Aquifer I
Aquifer II
Massive basalt
Exploratory well
Fractured zone
Water level (AQI)
Water level(AQII)
200
205
200


D'
Jamthi
Dhondkheda
Pimpalgaon Devi
Didola BK
Jaipur
D
200
Scale
0
km
5
m
50
Legend
Aquifer I
Aquifer II
Massive basalt
Exploratory well
Fractured zone
Water level (AQI)
Water level(AQII)
168
200
200
200

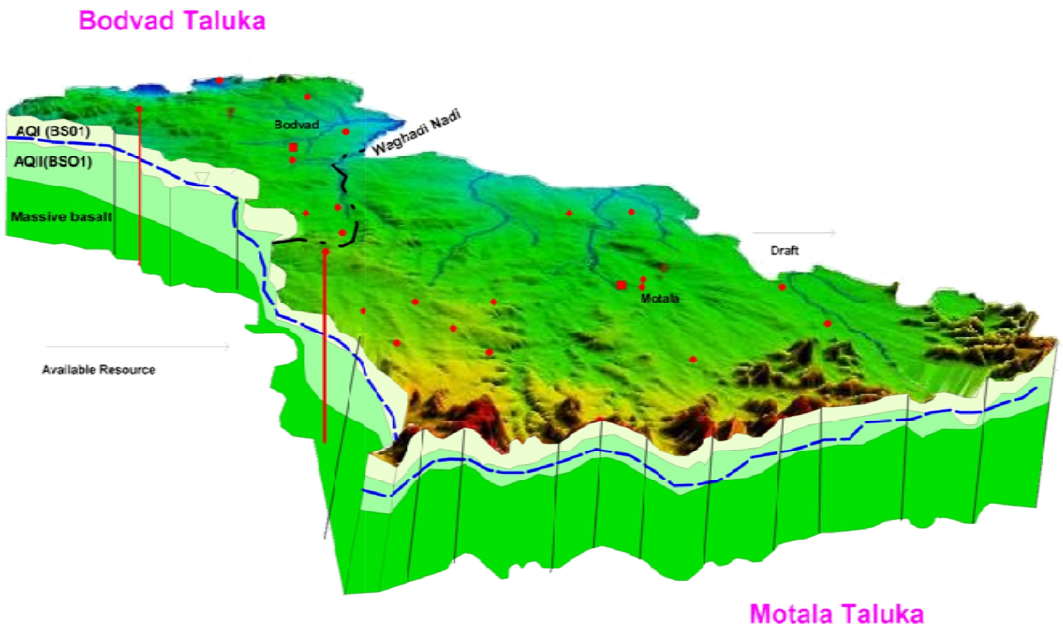

BODVAD TALUKA ,JALGAON DISTRICT & MOTALA TALUKA OF BULDHANA DISTRICT, MAHARASHTRA
AQUIFER –I: SPATIALDISPOSITION
Bhusawal Taluka
Edlabad Taluka
Bhagwati nadi
Bodwad
Deo nadi
Waghadi nadi
Jamner Taluka
Jalgaon District
Buldhana District
Malkapur Taluka
Nandura Taluka
Motala
Nalganga R.
Aurangabad District
Biswa nadi
Khamgaon Taluka
Buldana Taluka
N
W
E
S
0
7.5
15
kilometers
21° 00'
20° 45'
20° 30'
76° 00'
76° 15'
Aquifer I
Depth of occurrence (mbgl)
10 to 15
15 to 20
20 to 25
25 to 30
30 to 35
Fractured thickness (m)
0.5 to 2
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
Legend
Aquifer
Principal aquifer
Basalt (BS)
Major Aquifer
BS01
Minor aquifer
Diderghat,Buldana,Chikli and Ajanta formation
No of aquifers
Two
Area
1100.25 Sqkm
Administrative unit
District
Jalgaon
Buldana
Taluka
Bodvad
Motala
Villages
52
121 nos
District Boundary
Taluka boundary
Block HQ
Monitoring wells
Drainage


BODVAD TALUKA ,JALGAON DISTRICT & MOTALA TALUKA OF BULDHANA DISTRICT, MAHARASHTRA
Aquifer
AQUIFER –II: SPATIAL DISPOSITION
ured rocks thickness
Bhusawal Taluka
Edlabad Taluka
Bhagavati nadi
Bodwad
Deo nadi
Waghadi nadi
Jamner Taluka
Jalgaon District
Buldhana District
Malkapur Taluka
Nandura Taluka
Nalgonda R
Motala
Aurangabad District
Biswa nadi
Khamgaon Taluka
Buldana Taluka
N
W
E
S
0
7.5
15
kilometers
Aquifer II
Depth of occurrence
(mbgl)
35 to 70
70 to 80
80 to 90
90 to 100
100 to 120
120 to 150
150 to 180
Fractured thickness (m)
0.5 to 1
1 to 2
2 to 3
3 to 4
Legend
Aquifer
Principal aquifer
Basalt (BS)
Major Aquifer
BS01
Minor aquifer
Diderghat,Buldana,Chikli and Ajanta formation
No of aquifers
Two
Area
1100.25 Sqkm
Administrative unit
District
Jalgaon
Buldana
Taluka
Bodvad
Motala
Villages
52
121 nos
District Boundary
Taluka boundary
Block HQ
Monitoring wells
Exploratory wells
Drainage/waterbody
21° 00'
20° 45'
20° 30'
76° 00'
76° 15'

Aquifer –I Depth Range	**Upto 30 m**
Weathered/Fractured encountered	5 to 30 m
Fractured rock thickness	0.5 to 8 m
Yield range	50 to 120lpm
Water level	2.50 to 19.40 m (May-2015)
Sustainability	1 to 2 hours (recurring)
Quality	Mainly Potable. Except High EC & Nitrate in almost all parts of Bhokardan
Aquifer Parameters	Transmissivity-m2/day, Sp. Yield- 0.02

Aquifer –II Depth Range	**30 – 160 m**
Fractured encountered	30 to 160 m
Fractured rock thickness	0.5 to 3 (m)
Yield range	50 to 150 lpm
Water level	4 to >100 m (May-2015)
Sustainability	1 to 2 hours
Quality	Potable, Except Nitrate in isolated wells
Aquifer Parameters	Transmissivity- 20-150 m2/day, Storativity- 0.0024 to 1.38 x 10^{-6}

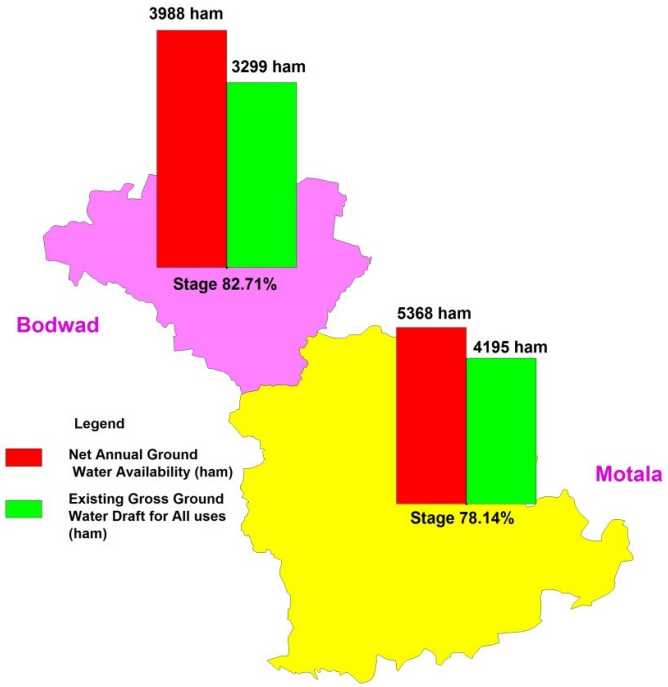
3-D Aquifer Disposition - Basalt



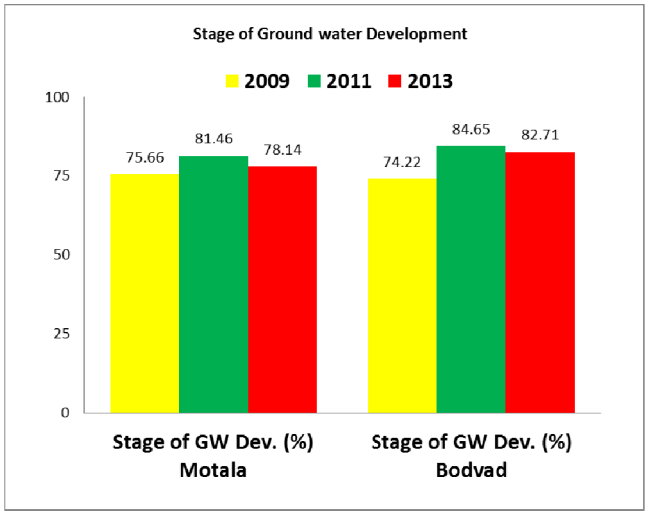
Type of Aquifer	Formation	Depth range (mbgl)	SWL (mbgl)	Fractures / weathered Zones encountered (m bgl)	Fractures / weathered rocks Thickness (m)	Yield (lpm)	Sustaina-bility	Aquifer parameter (Transmissivity – m^2/day)	Sy/S	Suitability for drinking/ irrigation
Aquifer-I	**Deccan Trap-Weathered / Fractured Basalt**	5-30	2.50 to 19.40 (May-15)	0.5 to 8.00	5 to 30	50 to 120	1 to 2 hours	-	0.02	Yes for both (except Nitrate and high EC affected villages for drinking)
Aquifer-II	**Jointed/ Fractured Basalt**	30-160	4 to >100 (May-15)	0.5 to 3.00	30 to 160	50-150	2 to 3 hours	20 to 150	$1.38x10^{-6}$	Yes for both (except Nitrate and high EC affected villages for drinking)

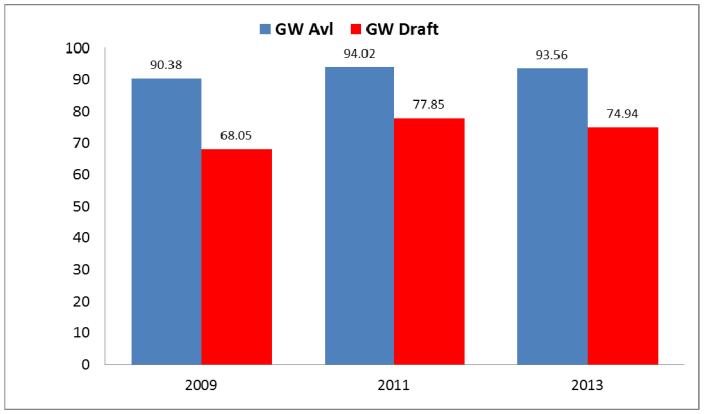
4 GROUND WATER RESOURCE, EXTRACTION, CONTAMINATION AND OTHER ISSUES

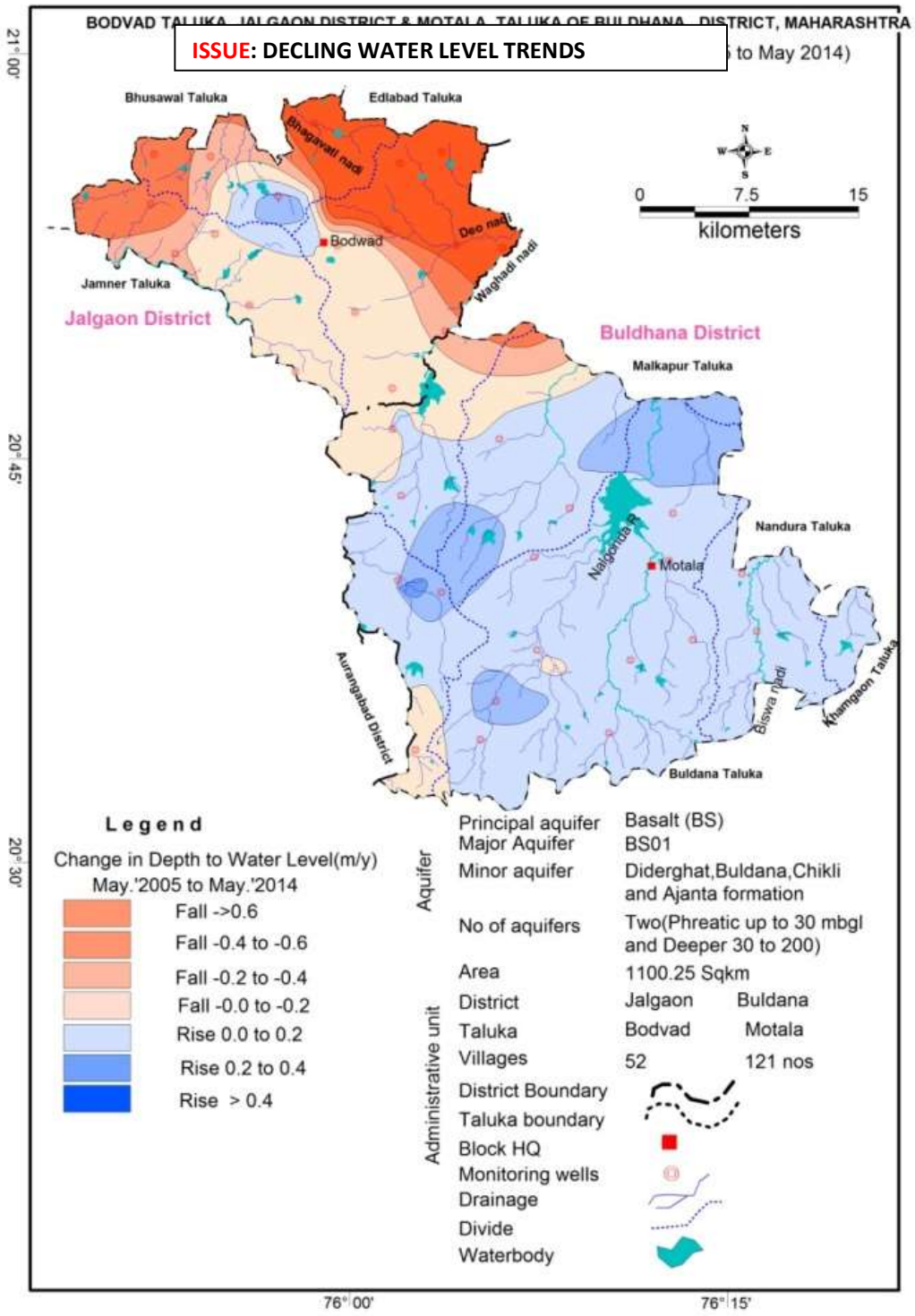
	Bodvad	Motala
Aquifer wise Ground Water Resource availability and Extraction		
Ground Water Resource (MCM) **Aquifer –I:**upto 30 m Availability Withdrawal	 39.88 32.99	 53.69 41.95
Ground Water Resource (MCM)**Aquifer –II:** 35 to 145 m Availability Withdrawal	0.80	3.03
Present Category	Semi Critical	Semi Critical
Ground Water Related Issues		
Over Exploitation	GW Development has increased from 2009 to 2013 in the tune of 10%.	
Limited deeper aquifer resources	Water scarcity in lean period, depends on dugwells only.	
Sustainability of unconfined aquifer	Sustainability of dugwells in lean period (Tanker Fed) from December onwards.	



ISSUE: OVER-EXPLOITATION

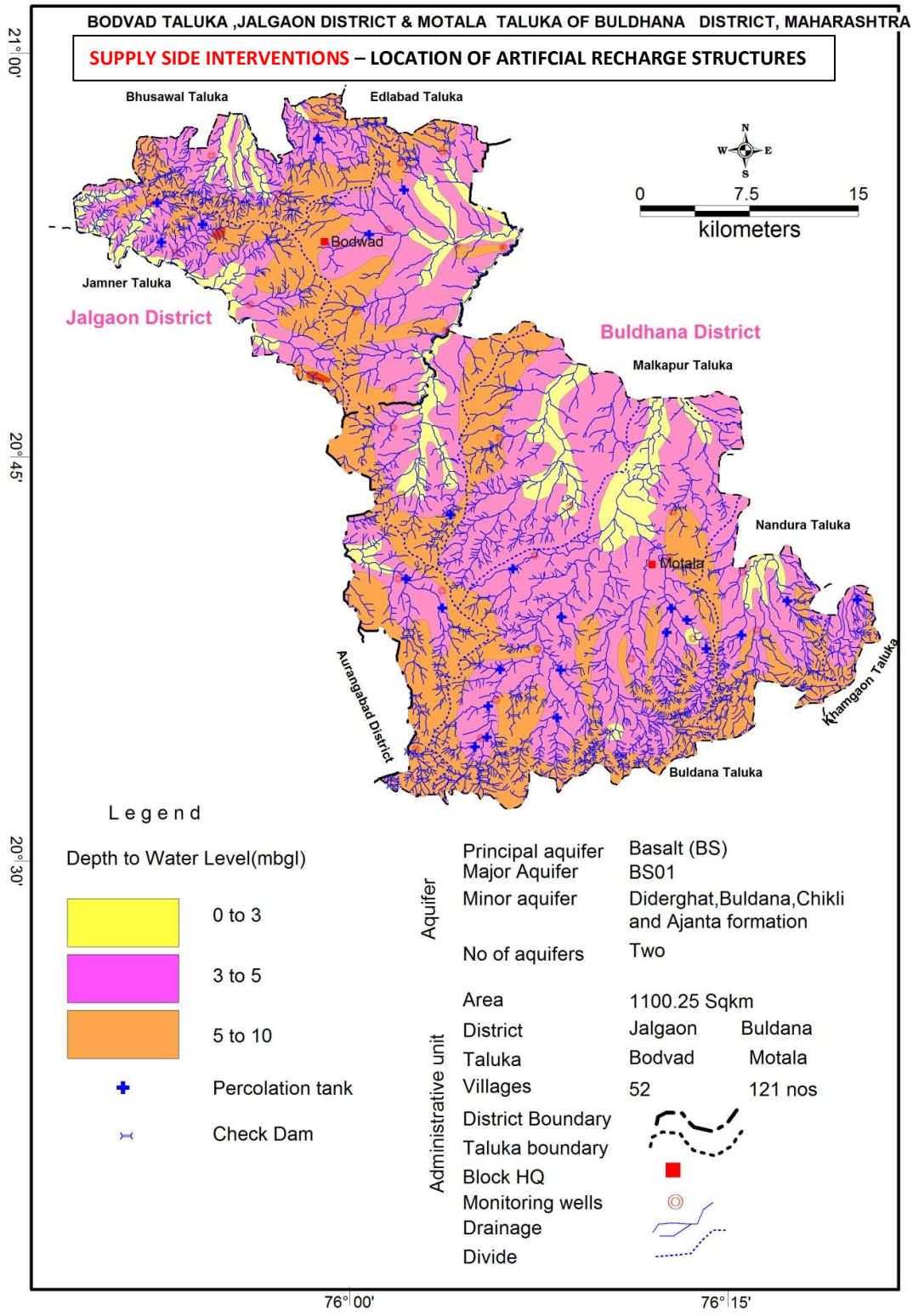





ISSUE: DECLING WATER LEVEL TRENDS
to May 2014)
Bhusawal Taluka
Edlabad Taluka
Bhagavati nadi
Deo nadi
Waghadi nadi
Bodwad
Jamner Taluka
Jalgaon District
Buldhana District
Malkapur Taluka
Nandura Taluka
Nalganga R
Motala
Aurangabad District
Biswa nadi
Khamgaon Taluka
Buldana Taluka
0 7.5 15
kilometers
21° 00'
20° 45'
20° 30'
76° 00'
76° 15'
Legend
Change in Depth to Water Level(m/y)
May.'2005 to May.'2014
Fall ->0.6
Fall -0.4 to -0.6
Fall -0.2 to -0.4
Fall -0.0 to -0.2
Rise 0.0 to 0.2
Rise 0.2 to 0.4
Rise > 0.4
Aquifer
Principal aquifer Basalt (BS)
Major Aquifer BS01
Minor aquifer Diderghat,Buldana,Chikli and Ajanta formation
No of aquifers Two(Phreatic up to 30 mbgl and Deeper 30 to 200)
Area 1100.25 Sqkm
Administrative unit
District Jalgaon Buldana
Taluka Bodvad Motala
Villages 52 121 nos
District Boundary
Taluka boundary
Block HQ
Monitoring wells
Drainage
Divide
Waterbody

5 GROUND WATER RESOURCE ENHANCEMENT AND PROPOSED MANAGEMENT INTERVENTIONS

5.1 Resource Enhancement		
Taluka	**Motala**	**Bodvad**
SUPPLY SIDE INTERVENTION		
Recharge Potential (MCM)	17.38	9.28
Surface water requirement @ 75% efficiency (MCM)	23.18	12.38
Availability of Surplus surface runoff (MCM)	6.55	2.42
Surplus runoff considered for planning (MCM)	6.55	2.42
Proposed Artificial Recharge Structures		
PT	20	7
CD	87	32
Volume of Water expected to be recharged @ 75% efficiency (MCM)	**4.92**	**1.82**
Total Estimated Expenditure for AR (Rs. in Cr.)	**56.10**	**20.10**
DEMAND SIDE INTERVENTION		
15% of Double crop area proposed to be covered under Drip (sq.km.) i.e. 4.6 sq.km.forMotala and 20% i.e. 14.50 sq. km. for Bodvad.	4.14	13.05
Volume of Water expected to be saved (MCM). Surface Flooding req- 0.90 m. Drip Req. - 0.50, WUE- 0.4 m	1.84	5.80
Estimated Expenditure (Rs. in Cr.) @ Rs. 25,000/- per acre	2.56	8.06
Proposed RTRWH		
Households to be covered	9084	5174
Total RWH potential (MCM)	0.33	0.20
Rainwater harvested / recharged @ 80% runoff co-efficient (MCM)	0.26	0.16
Estimated Expenditure (Rs. in Cr.)	13.63	7.76
RTRWH Economically not viable & Not Recommended. Total estimated Cost of RTRWH would be- Rs. 21.39 Cr. for Harvesting 0.42 MCM of Rain Water.		


BODVAD TALUKA ,JALGAON DISTRICT & MOTALA TALUKA OF BULDHANA DISTRICT, MAHARASHTRA
SUPPLY SIDE INTERVENTIONS – LOCATION OF ARTIFCIAL RECHARGE STRUCTURES
21° 00'
20° 45'
20° 30'
76° 00'
76° 15'
Bhusawal Taluka
Edlabad Taluka
Bodwad
Jamner Taluka
Jalgaon District
Buldhana District
Malkapur Taluka
Nandura Taluka
Motala
Aurangabad District
Khamgaon Taluka
Buldana Taluka
N
W
E
S
0
7.5
15
kilometers
Legend
Depth to Water Level(mbgl)
0 to 3
3 to 5
5 to 10
Percolation tank
Check Dam
Aquifer
Principal aquifer
Basalt (BS)
Major Aquifer
BS01
Minor aquifer
Diderghat,Buldana,Chikli and Ajanta formation
No of aquifers
Two
Administrative unit
Area
1100.25 Sqkm
District
Jalgaon
Buldana
Taluka
Bodvad
Motala
Villages
52
121 nos
District Boundary
Taluka boundary
Block HQ
Monitoring wells
Drainage
Divide

5.2 Resource Enhancement by Demand Side Interventions	
Change in Cropping Pattern	None
Micro irrigation techniques	15% of Double crop area proposed to be covered under Drip (sq.km.) i.e. 4.6 sq.km. forMotala and 20% i.e. 14.50 sq. km. for Bodvad.

5.3 Probable Benefits

Taluka	**Motala**	**Bodvad**
Additional GW resources available (MCM) after implementing above measures and mitigating the GAP TO BRING STAGE OF GWD UPTO 70% AND	**6.75**	**7.62**
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	**0.79**	**0.56**

5.4 Regulatory Measures

Regulatory Measures	Regulation of wells below 60 m

6 SUM UP

The highly diversified occurrence and considerable variations in the availability and utilization of groundwater makes its management a challenging task. Scientific development and management strategy for groundwater has become imperative to avert the looming water crisis. In this context, various issues such as, prioritization of areas for development of groundwater resources vis-a-vis its availability, augmentation of groundwater through rainwater harvesting and artificial recharge, pricing and sectoral allocation of resources and participation of the stakeholders must be considered. In view of the above, the present study area a systematic, economically sound and politically feasible framework for groundwater management is required.

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 Bodvad and Motalataluka.

The study area is spanning over 1100.25 sq.km, out of which 114.32 sq.km is forest area and land available for cultivation is 923.56 sq.km. Geologically the entire area is occupied by Deccan Trap Basalt.

In Bodvad and Motala, the main ground water issues are Low Ground Water Potential / Limited Aquifer Thickness / Sustainability, Deeper Water Levels particularly in Aquifer-II, Declining Water Levels and high Ground Water Development with respect to ground water availability which are all inter-related or inter dependent.

During postmonsoon seasons Rabi crop is entirely dependent on ground water. The low storage capacity of the basaltic aquifers. In Aquifer II, the deeper water levels of more than 50 mbgl. The ground water quality particularly of Aquifer-II is good both for irrigation and drinking.

The present stage of ground water development is 78.14 % in Motala and 82.71% in Bodvad with net ground water availability of 53.69 MCM and gross draft of 41.95 MCM in Motalataluka. Whereas, in Bodvad, the net ground water availability of 39.88 MCM and gross draft of 32.99 MCM. Both these talukas are categorised as semi-critical.

Thus the focus of proposed management plan was to use ground water very effectively with supply and demand side interventions. The perusal of above ground water management plan lays stress on adopting micro-irrigation techniques and artificial recharge measures.

However, considering the low storage potential of hard rock aquifer in the area this ground water development should also be coupled with ground water augmentation plan, so that there is no stress on ground water regime of the area.

The proposed management plan envisages Rainwater Harvesting and Artificial Recharge structuresin the areas feasible for construction of recharge structures based on the long term water level scenario and recharge potential of the aquifer. It envisages construction of 27 percolation tanks @ Rs. 1.50 crore each and 119 check dams @ Rs. 0.30 crores each in feasible areas to fulfil the recharge potential of 8.97 MCM available in Bodvad and Motala. The proposed expenditure on these structures will be Rs. 76.20crores.

The proposed management plan also envisages to change the present irrigation practices in double crop area through drip irrigation, for this 15% in Motala and 20% in Bodvadtaluka covering double crop area of 17.19 sq.km to be covered under drip irrigation. A total of 7.64 MCM water is expected to save with a cost estimate of Rs. 10.62 corers.

Feasibility of Roof Top Rain Water Harvesting (RTRWH) is preveals in these taluka, but to harvest 0.42 MCM water, a total of Rs. 11.39 corers is required. Hence, it is economically not viable and not recommended.

Tangible and Non Tangible Benefits

The timely and proper implementation of the above suggested management plan will have many tangible and non tangible benefits for Bodvad and Motala. Some of the major benefits are listed below.

The proposed construction of the artificial recharge structures viz., 27 percolation tanks and 119 check dams at the estimated cost of Rs. 76.25crores to augment the ground water resources to the tune of 8.97 MCM will probably bring an area of 1.35sq.km., under assured ground water irrigation considering an average crop water requirement of 0.65 m.

The proposed implementation of change in the present irrigation practices in double crop area through drip irrigation, for this 15% in Motala and 20% in Bodvadtaluka covering double crop area of 17.19 sq.km to be covered under drip irrigation. A total of 7.64 MCM water is expected to save with a cost estimate of Rs. 10.62 corers.

The implementation of above water conservation, artificial recharge and RTRWH measures will have a positive impact on drinking water sources of the area. It will ensure that the wells don't go dry during summer/lean/stress period in the areas of implementation and sufficient ground water availability is there in the wells even during the summer season. Thus the drinking and domestic water sources will be strengthened. These measures will also be able to arrest the decline in water levels of Aquifer-I and raise the water levels in Aquifer-II. This will result in reduction of electricity consumption as the water will need to be lifted from shallower depths from the borewells and the stage of ground water development would by down to 69.70% and would be comes under safe category.

Further the IEC activities and capacity building activities needs to be aggressively propagated to educate the end user and establish the institutional framework for participatory groundwater management.