Draft Report

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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

Katol and Narkhed Taluka, Nagpur District, Maharashtra

(Part-I)

मध्य क्षेत्र, नागपुर

Central Region, Nagpur

PART-I

AQUIFER MAPS AND GROUND WATER MANAGEMENT PLANS, KATOL AND NARKHED TALUKA, NAGPUR DISTRICT, MAHARASHTRA

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PART-I

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1 INTRODUCTION

In XII five year plan, National Aquifer Mapping (NAQUIM) had been taken up by CGWB to carry out detailed hydrogeological investigation on toposheet scale of 1:50,000. The NAQUIM has been prioritised to study Over-exploited, Critical and Semi-Critical talukas as well as the other stress areas recommended by the State Govt. Aquifer mapping is a process wherein a combination of geologic, geophysical, hydrologic and chemical analyses is applied to characterize the quantity, quality and sustainability of ground water in aquifers.

The vagaries of rainfall, inherent heterogeneity & unsustainable nature of hard rock aquifers, over exploitation of once copious alluvial aquifers, lack of regulation mechanism has a detrimental effect on ground water scenario of the Country in last decade or so. Thus, prompting the paradigm shift from "**traditional groundwater development concept**" to "**modern groundwater management concept**".

Varied and diverse hydrogeological settings demand precise and comprehensive mapping of aquifers down to the optimum possible depth at appropriate scale to arrive at the robust and implementable ground water management plans. The proposed management plans will provide the **"Road Map"** for ensuring sustainable management and equitable distribution of ground water resources, thereby primarily improving drinking water security and irrigation coverage. Thus the crux of NAQUIM is not merely mapping, but reaching the goal-that of ground water management through community participation. The aquifer maps and management plans will be shared with the Administration of UT of Dadra & Nagar Haveli (UT of DNH) for its effective implementation.

1.1 Objective and Scope

Aquifer mapping itself is an improved form of groundwater management – recharge, conservation, harvesting and protocols of managing groundwater. These protocols will be the real derivatives of the aquifer mapping exercise and will find a place in the output i.e, the aquifer map and management plan. The activities under NAQUIM are aimed at:

- identifying the aquifer geometry,
- aquifer characteristics and their yield potential
- quality of water occurring at various depths,
- aquifer wise assessment of ground water resources
- preparation of aquifer maps and
- Formulate ground water management plan.

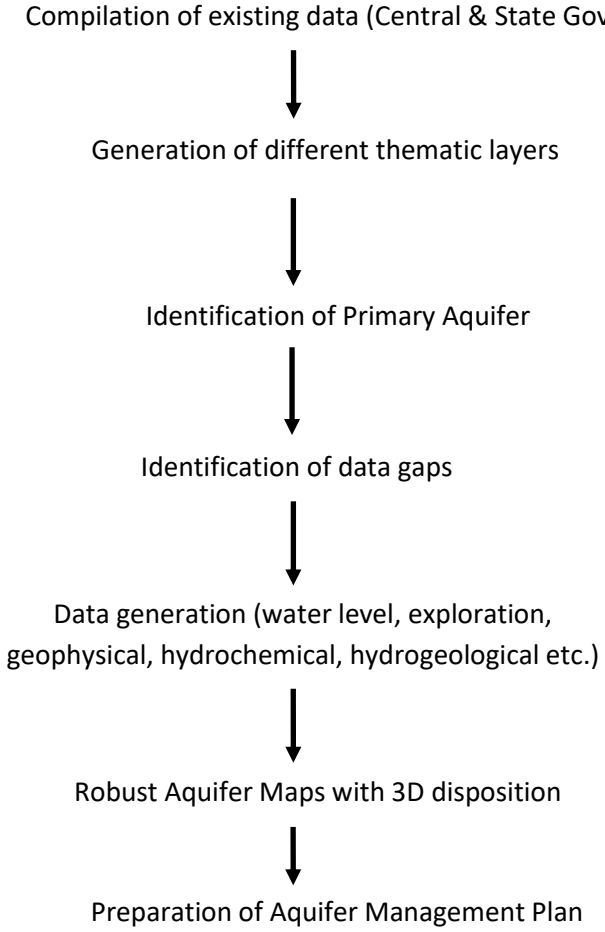
This clear demarcation of aquifers and their potential will help the agencies involved in water supply in ascertaining, how much volume of water is under their control. The robust and implementable ground water management plan will provide a **"Road Map"** to systematically manage the ground water resources for equitable distribution across the spectrum.

Thus, Katol and Narkhed taluka, Nagpur district, Maharashtra covering an area of 1532.83 sq.km. have been entirely covered during the Annual Action Plan of 2015-16.

1.2 Approach and Methodology

The ongoing activities of NAQUIM include toposheet wise micro-level hydrogeological data acquisition supported by geophysical and hydro-chemical investigations supplemented with ground water exploration down to the depths of 200 / 300 meters.

Considering the objectives of the NAQUIM, the data on various components was segregated, collected and brought on GIS platform by geo-referencing the available information for its utilisation for preparation of various thematic maps. The approach and methodology followed for Aquifer mapping is as given below:



1.3 Study area

Keeping in view the current demand and supply and futuristic requirement of water, Central Ground Water Board has initiated the National Aquifer Mapping Programme (NAQUIM) in India during XII five year plan, with a priority to study Over-exploited, Critical and Semi-Critical talukas. However, Groundwater Surveys and Development agency, Govt. of Maharashtra, Pune stress and priority areas of Nagpur district has been taken up to carry out detailed hydrogeological investigation in Narkhed and Katol taluka, by covering an area of 1532.83 sq.km. in the year 2015-16. The index map of the study area is presented in Fig. 1.1a while an administrative map is presented as Fig. 1.1b. These talukas are categorized as safe, as per Ground Water Resources Estimation carried out by CGWB and GSDA as on March 2013.

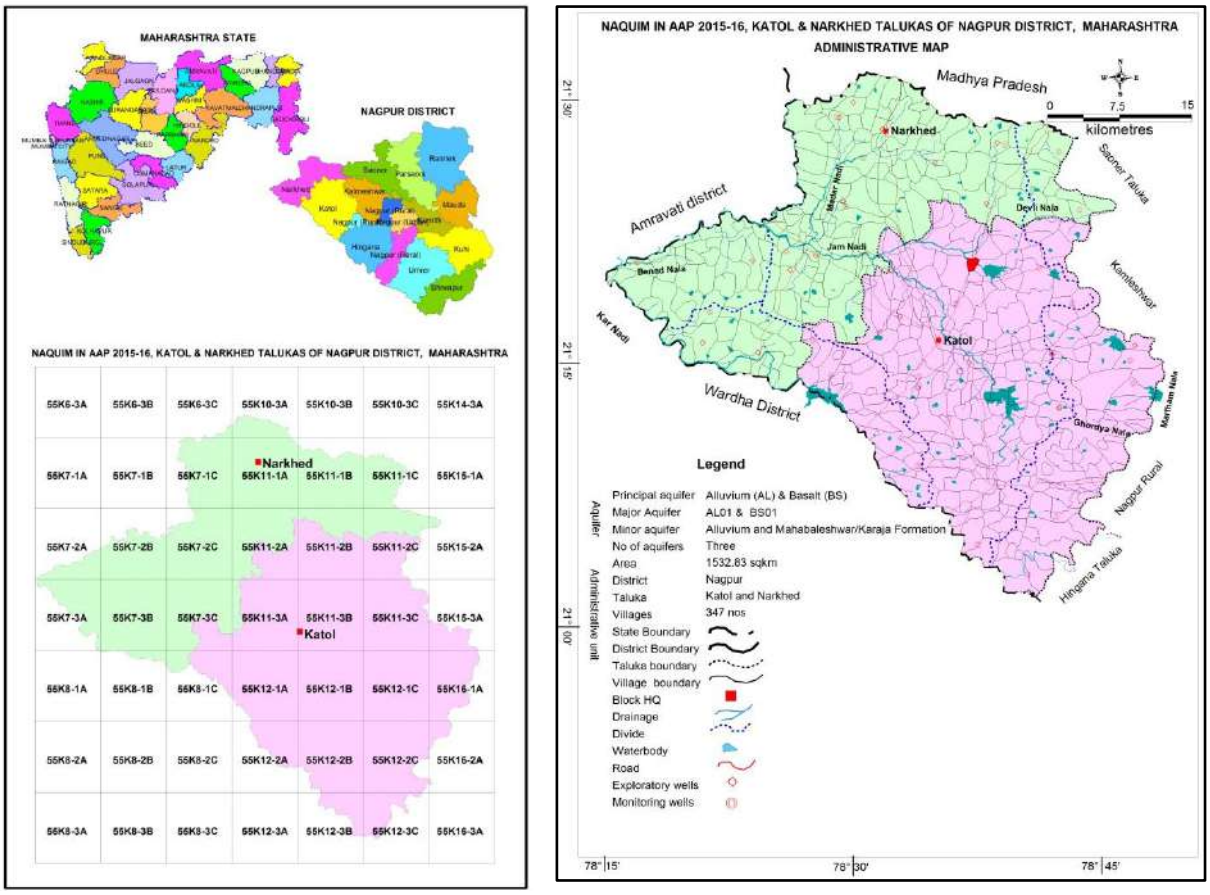


Fig. 1.1a & b: Index & Administrative map, Katol and Narkhed Taluka, Nagpur District

1.4 Data Adequacy and Data Gap Analysis:

The available data of the Exploratory wells drilled by Central Ground Water Board, Central Region, Nagpur, Geophysical Survey carried out in the area, Ground water monitoring stations and ground water quality stations monitored by Central Ground Water Board were compiled and analysed for adequacy of the same for the aquifer mapping studies. In addition to these, the data on ground water monitoring stations and ground water quality stations of the State Govt. (GSDA) was also utilised for data adequacy and data gap analysis. The data adequacy and data gap analysis was carried out for each of the quadrant of falling in the study area mainly in respect of following primary and essential data requirements:

Exploratory Wells
Geophysical Surveys
Ground Water Monitoring and
Ground Water Quality

The locations of existing exploratory wells and ground water monitoring wells which are also used as ground water quality sampling locations are shown in **Fig. 1.2.**

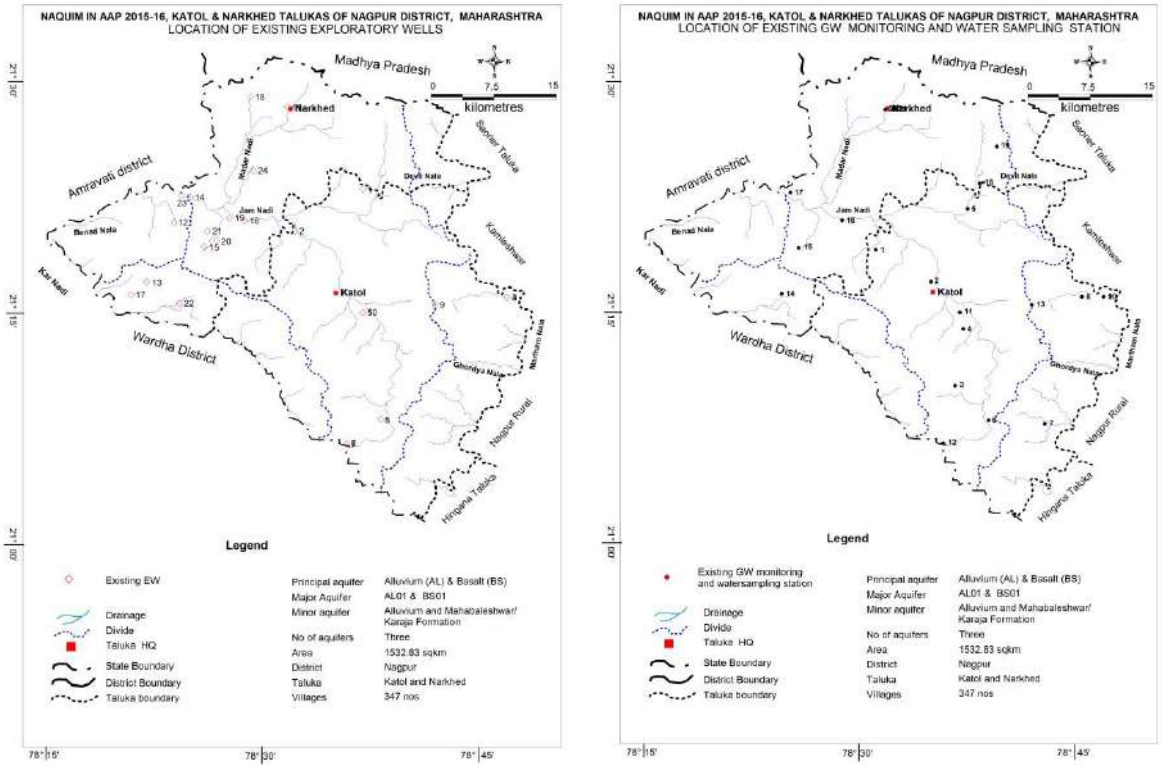


Fig 1.2: Locations of Existing Exploratory Wells and Ground Water Monitoring Wells.

After taking into consideration, the available data of Ground Water Exploration, Geophysical survey, Ground Water Monitoring and Ground Water Quality, the data adequacy is compiled and the summarised details of required, existing and data gap of Exploratory wells, Ground Water monitoring and Ground water quality stations is given below and discussed in detail.

Table 1.1: Data Adequacy and Data Gap Analysis

EXPLORATORY DATA			GEOPHYSICAL DATA			GW MONITORING DATA (AQI)			GW MONITORING DATA (AQII)			GW QUALITY DATA (AQI)			GW QUALITY DATA (AQII)		
Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap	Req.	Exist.	Gap
15	26	7	58	58	36	29	22	16	15	9	7	29	22	16	15	9	7

1.5 Data Gap Identification

The data adequacy as discussed above indicates that the existing data is not sufficient for preparation of aquifer maps; hence data gap has been identified for Exploratory Wells, Geophysical Survey (VES), Ground Water Monitoring Wells and Ground Water Quality. Based on the data gap identification, the data generation activity was planned and completed in 2015-16.

1.6 Rainfall And Climate

The area experiences the sub-tropical to tropical temperate monsoon climate and characterised by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. In Winter average minimum temperature is about 9-15 °C. In summer average maximum temperature is about 38-45 °C. As per Agro-climatic Zones of

the Agriculture Department, both the talukas are categorised under 'Moderate Rainfall Climatic Zone-08'.

Rainfall data of rain gauge stations located at taluka headquarters of Katol and Narkhed have been collected from available sources and are subjected to various types of statistical analysis to understand the characteristic of the rainfall.

The long term rainfall analysis (**Table 1.2**) for the period 1901 to 2015 for Katol taluka and 1998 to 2015 for Narkhed taluka indicates that there is insignificant fall (-0.83 mm/year) in the rainfall at Katol while significant rise (+16.315 mm/year) in rainfall at Narkhed taluka. The probability of normal rainfall is about 75 % in Katol and 69 % in Narkhed taluka while the chances of droughts is about 13 % in Katol and 6 % in Narkhed taluka.

Table 1.2: Long term rainfall analysis, Katol and Narkhed taluka, Nagpur district.

CATEGORY	**KATOL TALUKA**		**NARKHED TALUKA**	
PERIOD	1901 to 2015		1998 to 2015	
NO OF YEARS	112		16	
NORMAL RAINFALL	975.8 mm		837.1 mm	
STANDARD DEVIATION	228 mm		252 mm	
COEFF OF VARIATION	23 %		30 %	
RAINFALL TREND / SLOPE	-0.83 mm/year		+16.315 mm/year	
	Number of years	**% of total years**	**Number of years**	**% of total years**
DEPARTURES				
POSITIVE	55	49	7	44
NEGATIVE	57	51	9	56
DROUGHTS				
MODERATE	15	13	1	6
SEVERE	0	0	0	0
ACUTE	0	0	1	6
NORMAL & EXCESS R/F				
NORMAL	83	75	11	69
EXCESS	14	12	3	19

NOTE: Rainfall departure: EXCESS: > +25; NORMAL: +25 TO -25; MODERATE: -25 TO -50; SEVERE: -50 TO -75; ACUTE: < -74

The average rainfall for the last ten years ranges from 647.5 mm to 1271.8 mm in Katol taluka while 671 mm to 1281 mm in Narkhed taluka. Thus, it has been observed that there is about 50 % variation in the minimum to maximum rainfall in both the talukas. The average annual rainy days ranges from 39 to 57 in Katol taluka while 38 to 57 in Narkhed taluka. The decadal average rainy days are 48.8 days and 47.10 day in Katol and Narkhed talukas respectively. The annual rainfall data of last ten years is given in **Table 1.2 and 1.3.**

Table 1.3: Annual Rainfall Data of 10 years, Taluka Katol (in mm)

Month	**RF details**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Avg Rainfall & Avg Rainy days**
January	Normal Rain	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.70
	Actual Rain	-	-	-	0	-	-	-	-	-	13.5	6.75
	Rainy Days	-	-	-	0	-	-	-	-	-	1	0.50
February	Normal Rain	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.60

Month	RF details	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Avg Rainfall & Avg Rainy days
	Actual Rain	-	-	-	0	0	-	-	-	1.2	9.2	2.60
	Rainy Days	-	-	-	0	0	-	-	-	0	1	0.25
March	Normal Rain	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.90
	Actual Rain	56.3	0	2	0	8.6	-	-	-	-	84	25.15
	Rainy Days	5	0	0	0	1	-	-	-	-	5	1.83
April	Normal Rain	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.90
	Actual Rain	-	-	0	0	-	-	-	-	-	38.2	12.73
	Rainy Days	-	-	0	0	-	-	-	-	-	6	2.00
May	Normal Rain	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.40
	Actual Rain	25.5	-	21	18.8	-	0	-	-	0	8.3	12.27
	Rainy Days	3	-	1	2	-	0	-	-	0	2	1.33
June	Normal Rain	155.1	155.1	155.1	155.1	155.1	155.1	155.1	155.1	155.1	155.1	155.10
	Actual Rain	63	313.2	126	52.4	157.8	86.7	171	279.5	38.9	263.6	155.21
	Rainy Days	5	11	6	5	6	4	5	12	3	11	6.80
July	Normal Rain	271.3	271.3	271.3	271.3	271.3	271.3	271.3	271.3	271.3	271.3	271.30
	Actual Rain	280.2	395	276	481.2	305.6	234.1	307.5	371.2	372.4	111.8	313.50
	Rainy Days	15	8	13	20	18	14	18	17	12	9	14.40
August	Normal Rain	244.5	244.5	244.5	244.5	244.5	244.5	244.5	244.5	244.5	244.5	244.50
	Actual Rain	269.4	294	138.4	105.4	321.8	362	218.9	234	85.8	326.9	235.66
	Rainy Days	14	13	9	9	20	16	15	10	8	11	12.50
September	Normal Rain	158.1	158.1	158.1	158.1	158.1	158.1	158.1	158.1	158.1	158.1	158.10
	Actual Rain	210.4	269.6	155	137.8	143.1	119	340.5	46.1	106.1	165.8	169.34
	Rainy Days	11	13	9	8	7	11	9	5	9	9	9.10
October	Normal Rain	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.70
	Actual Rain	10	0	29.4	54.8	19.4	0	12.2	134.4	27.6	13.9	30.17
	Rainy Days	1	0	3	4	2	0	1	5	5	2	2.30
November	Normal Rain	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.40
	Actual Rain	22.6	-	25.4	37	70.4	-	0	-	15.5	0	24.41
	Rainy Days	2	-	1	2	3	-	0	-	2	0	1.43
December	Normal Rain	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.40
	Actual Rain	-	-	-	1	1.2	-	-	-	0	-	0.73
	Rainy Days	-	-	-	0	0	-	-	-	0	-	0.00
Total Rainfall	**Normal Rain**	973	973	973	973	973	973	973	973	973	973	973.00
	Actual Rain	937.4	1271.8	773.2	888.4	1027.9	801.8	1050.1	1065.2	647.5	1035.2	949.85
	Rainy Days	56	45	42	50	57	45	48	49	39	57	48.80

Table 2.2- Annual Rainfall Data of 10 years, Taluka Narkhed (in mm)

Month	RF details	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Avg Rainfall & Avg Rainy days
January	Normal Rain	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.70
	Actual Rain	-	-	-	0	-	-	-	-	-	14	7.00
	Rainy Days	-	-	-	0	-	-	-	-	-	2	1.00
February	Normal Rain	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.60
	Actual Rain	-	-	-	0	30.5	-	-	-	17	11	14.63
	Rainy Days	-	-	-	0	1	-	-	-	1	1	0.75
March	Normal Rain	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.90
	Actual Rain	98.4	0	0	0	12.6	-	-	-	-	66.1	29.52
	Rainy Days	6	0	0	0	2	-	-	-	-	4	2.00
April	Normal Rain	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.90
	Actual Rain	-	-	34.2	3	-	-	-	-	-	32.1	23.10
	Rainy Days	-	-	1	1	-	-	-	-	-	3	1.67
May	Normal Rain	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.40
	Actual Rain	16.2	-	19	19	-	0	-	-	0.4	3.5	9.68
	Rainy Days	2	-	1	1	-	0	-	-	0	0	0.67
June	Normal Rain	170.4	170.4	170.4	170.4	170.4	170.4	170.4	170.4	170.4	170.4	170.40
	Actual Rain	21	272.4	67.8	38.6	154.6	120.9	45.4	226.2	55.2	268.6	127.07
	Rainy Days	3	10	6	3	10	9	2	10	6	12	7.10
July	Normal Rain	310.8	310.8	310.8	310.8	310.8	310.8	310.8	310.8	310.8	310.8	310.80
	Actual Rain	269	332	175	478.6	294.4	188.6	192.6	386.6	405.7	118.6	284.11
	Rainy Days	14	12	12	20	15	11	13	19	13	11	14.00
August	Normal Rain	225.5	225.5	225.5	225.5	225.5	225.5	225.5	225.5	225.5	225.5	225.50

Month	RF details	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Avg Rainfall & Avg Rainy days
	Actual Rain	241.4	409.9	210.9	99.3	423.8	324.6	264.2	409.5	99.7	261.2	274.45
	Rainy Days	12	13	13	6	15	20	11	13	7	8	11.80
September	Normal Rain	178.6	178.6	178.6	178.6	178.6	178.6	178.6	178.6	178.6	178.6	178.60
	Actual Rain	85.2	267	90.1	151.2	107.8	129	275.4	54.6	83.2	96.7	134.02
	Rainy Days	8	12	8	9	8	11	9	5	5	8	8.30
October	Normal Rain	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.70
	Actual Rain	18	0	26	29.2	55	1.8	29.8	112.8	22.8	4.3	29.97
	Rainy Days	1	0	3	3	4	0	2	4	4	1	2.20
November	Normal Rain	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.40
	Actual Rain	19.4	-	48	129.6	58.2	-	0	-	23.5	0	39.81
	Rainy Days	2	-	1	3	2	-	0	-	2	0	1.43
December	Normal Rain	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.40
	Actual Rain	-	-	-	5.6	0	-	-	-	0	-	1.87
	Rainy Days	-	-	-	1	0	-	-	-	0	-	0.33
Total Rainfall	Normal Rain	1029.3	1029.3	1029.3	1029.3	1029.3	1029.3	1029.3	1029.3	1029.3	1029.3	1029.30
	Actual Rain	768.6	1281.3	671	954.1	1136.9	764.9	807.4	1189.7	707.5	876.1	915.75
	Rainy Days	48	47	45	47	57	51	37	51	38	50	47.10

1.7 Physiography

The area can be broadly divided into two physiographic units i.e., the Satpuda Hill range, and plateaus. The elevation in the area ranges between 279 to 526 mamsl. In the southwest, the upland ranges are an extension of the Satpuda ranges; these are narrow in the west but widen towards the east. The Pilkapar hill runs northwards through the Katol taluka from Kondhali to Kelod, separating the Wardha and Wainganga valleys and are a smaller counterpart of Satpuda hill range. They present a characteristic appearance of flat or slightly rounded tops, covered with thin forests or brushwood and in some cases completely bare and stony. The highest part of it is at Pilkapar. The hills are generally clear of trees, while upland plateaus covered with stones and with soil of varying depth. The physiography of the area is shown in **Fig. 1.3.**

1.8 Geomorphology

The analysis of geomorphological data and thematic map collected from MRSAC, Nagpur reveals that almost entire area forms the Moderately Dissected Plateau (MDP) to Slightly Dissected Plateau (SDP) depending on extent of weathering and thickness of soil cover. In Narkhed taluka, Sligjtly dissected plateau with weathering 0 to 1 m is widely spresd followed by MDP. At places UDP observed in south west of Narkhed town. In Katol taluka UDP is prominently observed in eastern side of Katol town as 'Pilkapar hill' ranges and towards western side in and around Pandhardhakni forest range. Most of the area in Katol taluka is MDP followed by SDP. At places Messa and Butte are also observed. The geomorphology of the area is shown in **Fig. 1.4.**

1.9 Land Use, Soil, Land Use, Agriculture, Irrigation and Cropping Pattern

The landuse details and the thematic map available with the MRSAC, Nagpur has been collected and analysed with reference to the present agricultural practices, various land use etc. It has been observed that the major parts of the area are covered by agricultural land. The major area covers 'Kharif' while the orange orchards are categorized under 'Horticulture' category. Forest covers major area in the western, southwestern, southern and eastern part of Katol taluka. The built up area is reflected wherever settlements have come up. The thematic map on land use is shown in **Fig. 1.5**

The agricultural distribution of crops does follows traditional pattern as oil seeds is the most dominant single crop in the Katol and Narkhed taluka followed by pulses, cotton and oranges. The ground water based irrigation caters to the major area i.e., 151 sq.km. (16.4% of net sown area), while surface water irrigated areas is about 126.38 sq.km (13.38 % of net sown area).

Table 1.2a: Land Use, Agriculture and Irrigation (fig. in sq.km)

Geographical Area	Cultivable/ Agricultural	Forest	Agricultural Land Break up area			Area under irrigation		Total irrigation	Area under Drip & Sprinkler
			Cultivable	Net Sown	Double cropped	GW	SW		
1532	1209	131	1209	926	191	151 (16.4 %)	126.38 (13.6 %)	278.38	61

Table 1.2b: Taluk wise area under different crops (fig. in sq.km)

Taluka	Oil seeds	Pulses	Oranges	Cereals	Cotton
Katol	305.63	81.39	54.88	50.85	47.99
Narkhed	220.41	100.21	58.70	65.70	117.51

The soil data and the thematic map of the area available with the MRSAC, Nagpur has been collected and analysed. It has been observed that the major part of the area is occupied by clayey soil followed by gravelly clay to Silty loam. The southern part of the Narkhed taluka gravelly sandy loam to Sandy clay loam soil is observed. Along the Wardha and Jam river clay loam soil is observed, while northeastern part Silty clay laom is observed. The thematic map on the soil distribution in the study area is shown in **Fig. 1.6.**

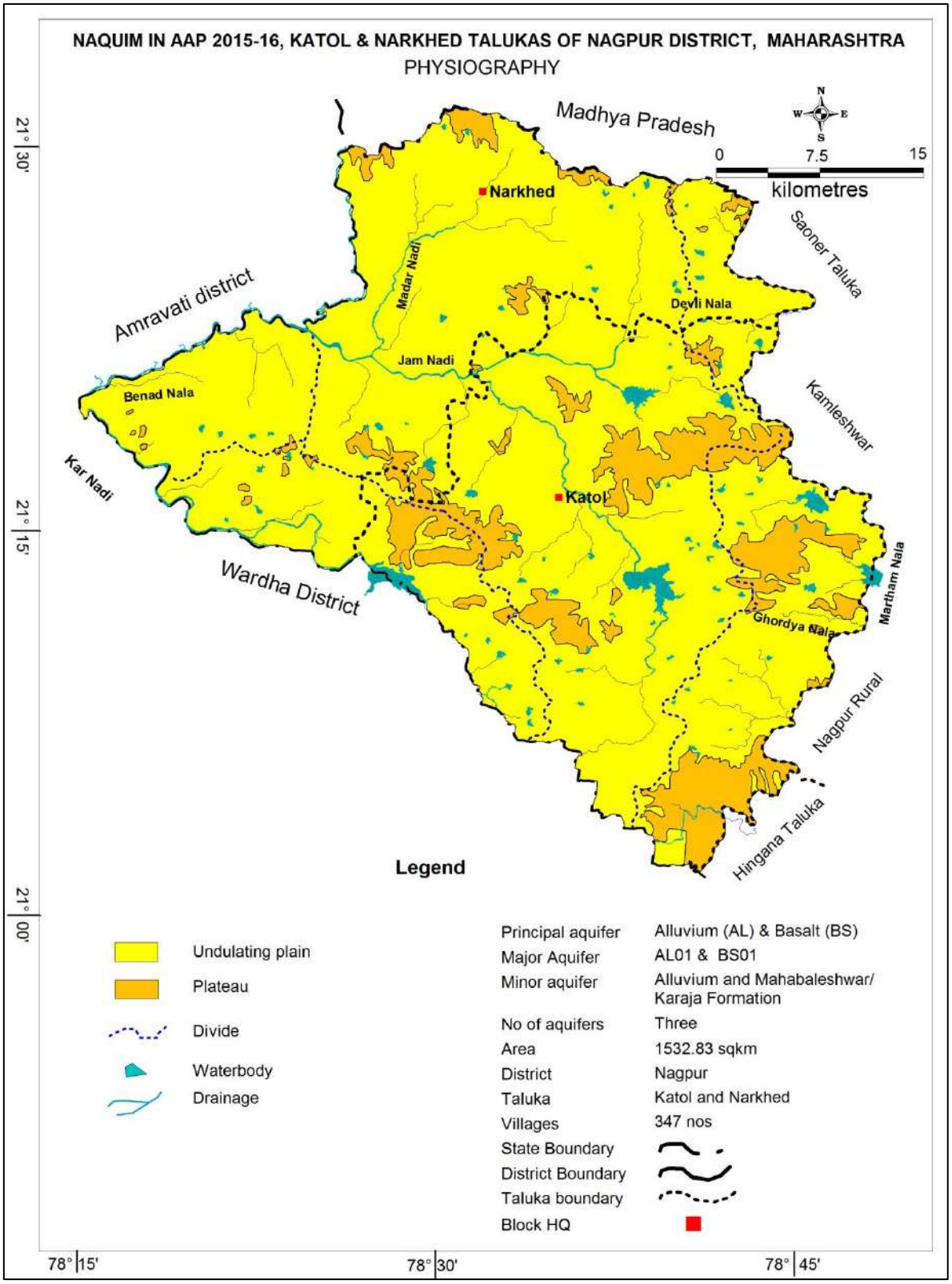


Fig. 1.3: Physiography, Katol and Narkhed taluka, Nagpur district

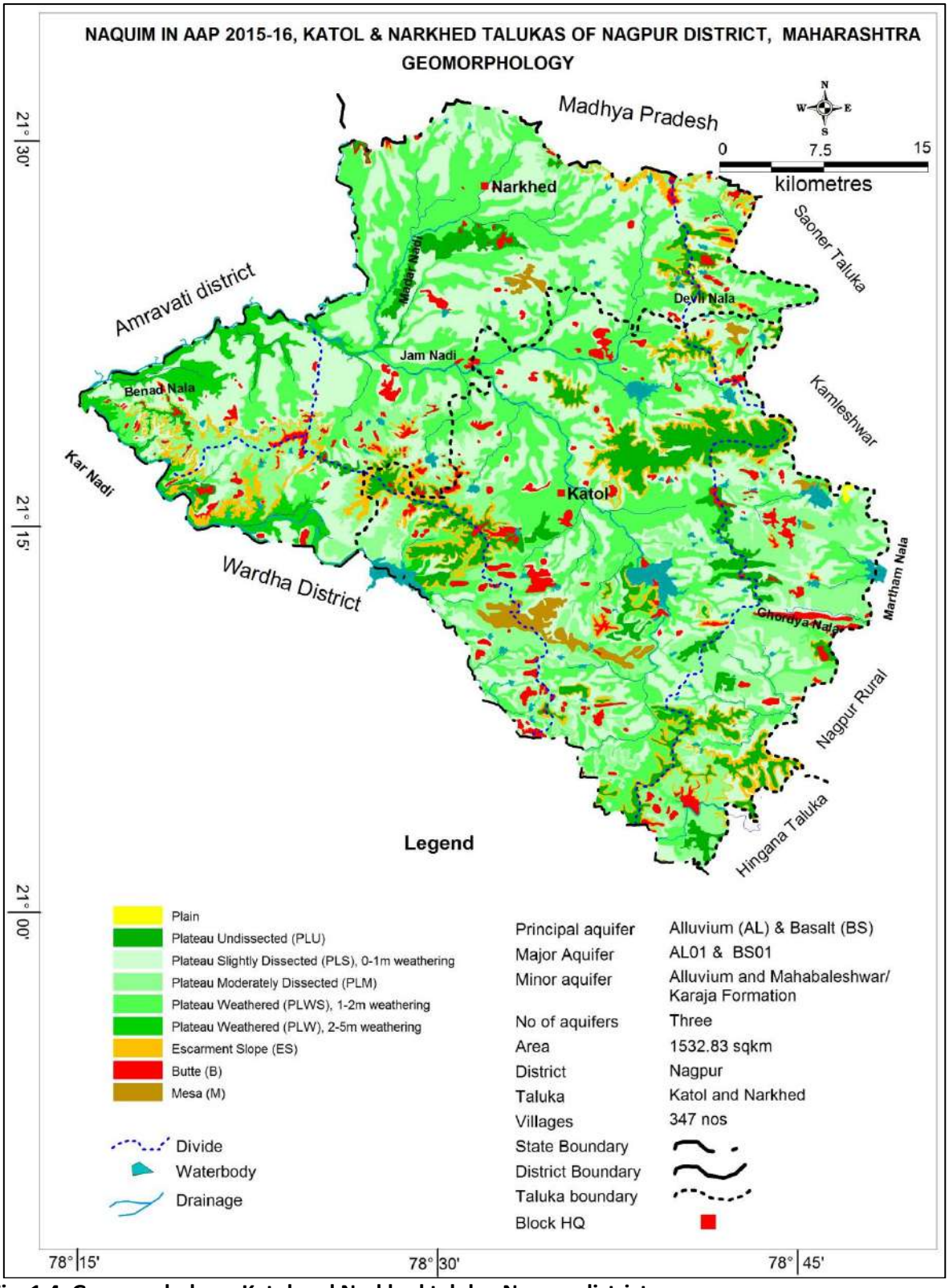


Fig. 1.4: Geomorphology, Katol and Narkhed taluka, Nagpur district

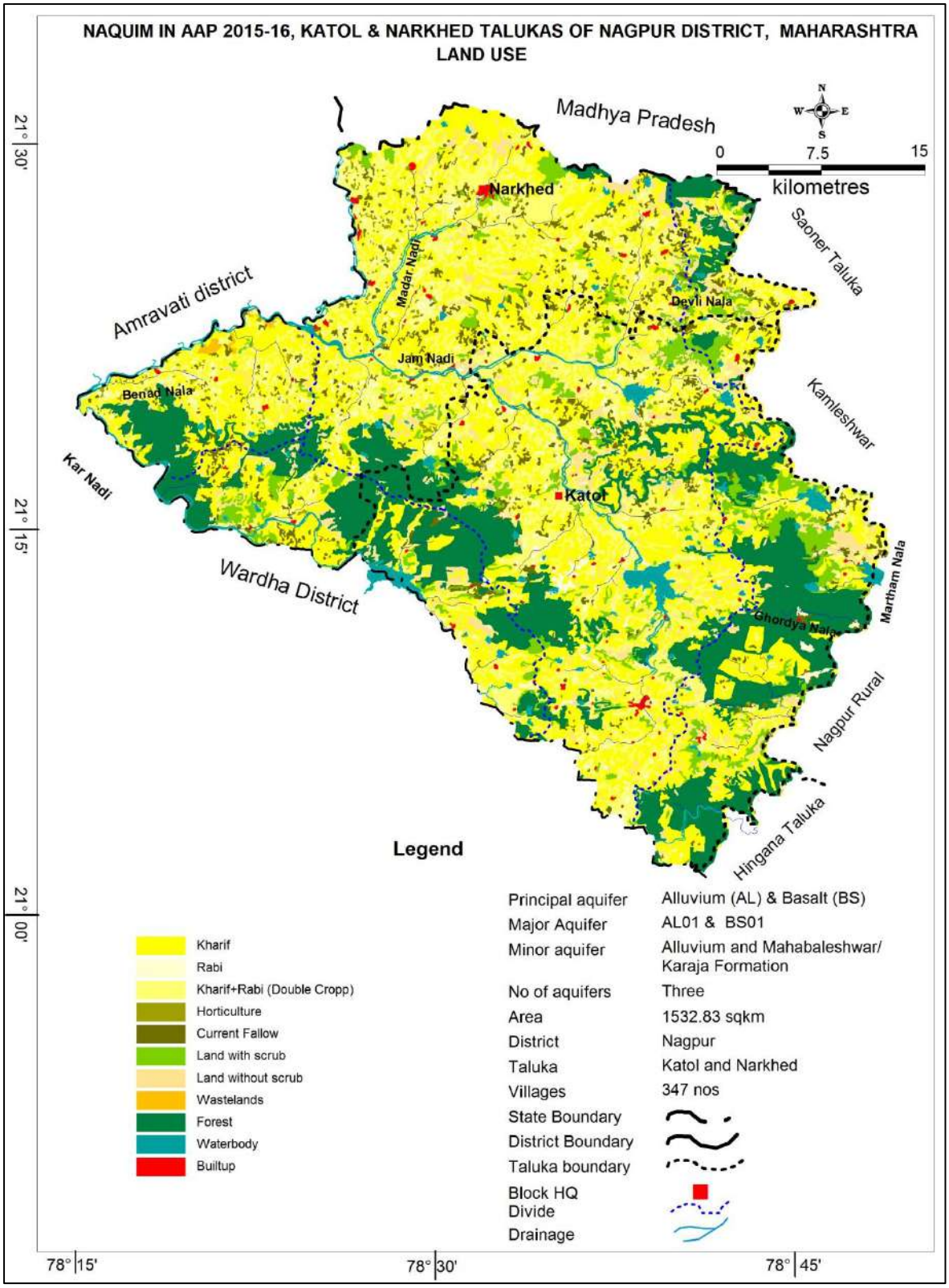


Fig. 1.5: Landuse, Katol and Narkhed taluka, Nagpur district

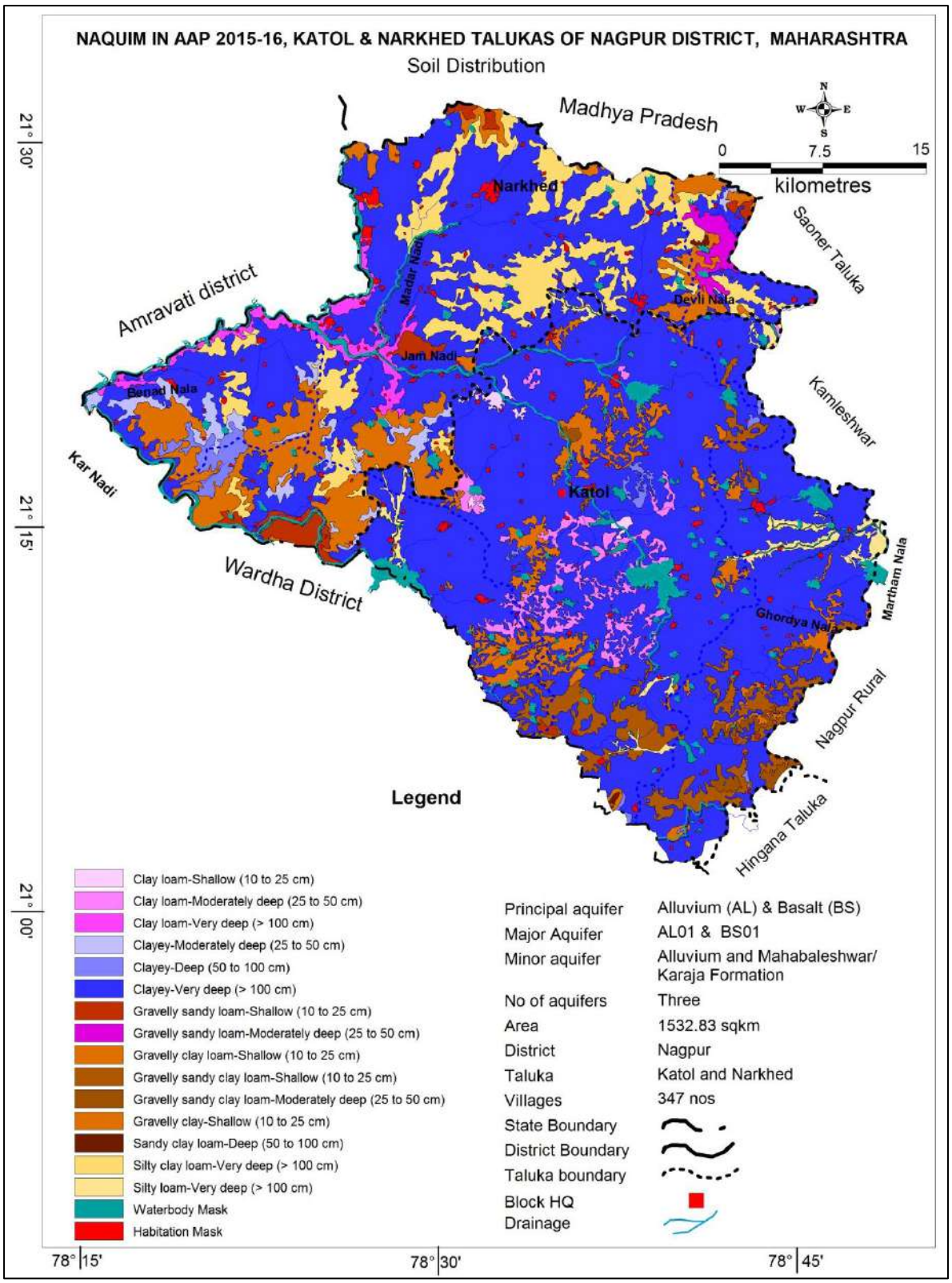


Fig. 1.6: Soil, Katol and Narkhed taluka, Nagpur district

1.10 Hydrology and Drainage:

1.10.1 Hydrology

There is no major irrigation project in the study area. However, the State Govt. constructed a number of medium, bigger minor and minor irrigation structures. As per the Water Resources Department, Govt. of Maharashtra, 7984 ha and 4654 ha land was irrigated in Katol and Narkhed talukas due to these irrigation structures respectively. While, it is expected to that 8020 ha and 1333 ha of land in Katol and Narkhed taluka respectively would be under irrigation due to ongoing irrigation projects. The Abstract of irrigation projects are presented as **Table 3.1a** and **3.1b** while details of area presented as **Annexure-IA** and **IB.**

Table 3.1a: Abstract of Major, Medium and Bigger Minor irrigation projects (>100 Ha) Katol and Narkhed taluka, Nagpur district

Taluka	Medium ptoject	MI Tank	KT	Total	Storage Capacity (MCM)		Gross irrigation potential generated	Quantity of water utilized for (MCM)			Project Status
					Gross	Live		Irrigation	Domestic	Industrial	
Katol	1	9	6	16	17.99	14.27	3841	16.52	0.035	0	Completed
	1	2	0	3	7192.74	34.32	8020	26.84	13.99	0	Ongoing
	2	**11**	**6**	**19**	**7210.73**	**48.59**	**11862**	**43.36**	**14.02**	**0**	**Subtotal**
Narkhed	0	5	6	11	6.97	6.25	3046	6.221	0	0	Completed
	0	4	1	5	8.56	7.27	1333	5.90	0	0	Ongoing
	0	**9**	**7**	**16**	**15.54**	**13.53**	**4379**	**12.13**	**0**	**0**	**Subtotal**

(Source: Water Resources Department, Govt. of Maharashtra, June 2014)

Table 3.1b: Abstract of Minor irrigation projects (<100 Ha) Katol and Narkhed taluka, Nagpur district.

Taluka	LIS	VT	MI Tank	PT	KT	ST	Total	Total irrigation capacity Area under crop (Ha)	Gross storage (MCM)	Project Status
Katol	01	04	20	17	152	151	345	4143	22.49	Completed
			01		02		03	--	1.07	Ongoing
						Sub total	**348**	**4143**	**23.56**	
Narkhed	0	0	10	15	51	128	204	1608	14.50	Completed
			01		03		04	--	0.79	Ongoing
						Sub total	**208**	**1608**	**15.29**	
						Grand total	**556**	5751	38.85	

(Source: Water Resources Department, Govt. of Maharashtra, June 2014)

1.10.2 Drainage

Wardha river and its tributaries (Madar nadi, Jam nala, Kar Nadi, Benad nala and Devli nala) and Wainanga river and its tributaries (Chandrabhaga nadi, Ghordya nala) constitute the principal drainage system in the area. Wardha river and its tributaries forming WR-29, WRJ-1,2,3 & 4, WRK-1 watersheds drains about 1195 sq km area while Wainanga river and its tributaries forming parts of WRWB-2, WGKK-1 & 2, WGKKC-1 & 2, WRW-5 & 6 watersheds drains about 337 sq km area.

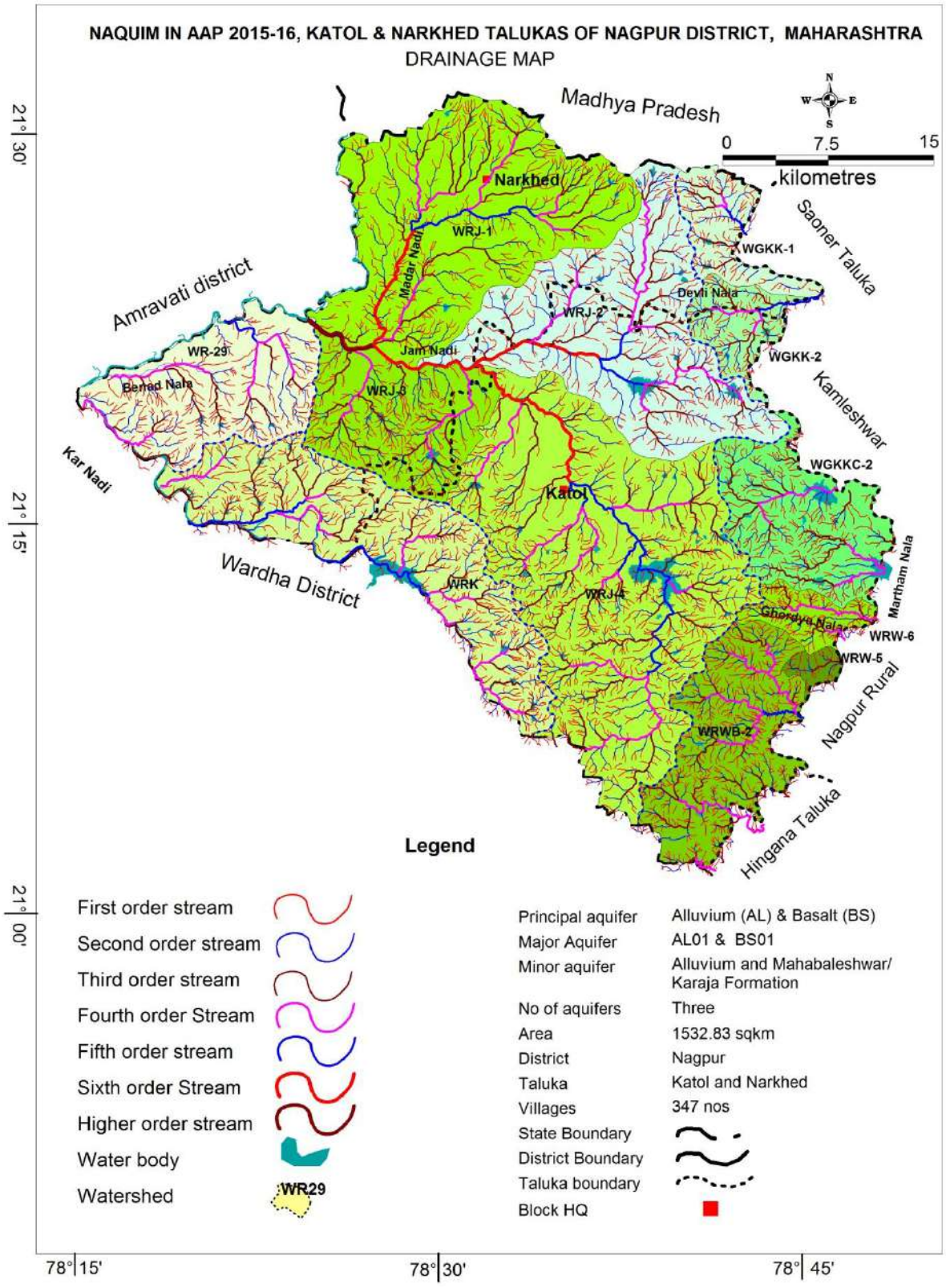


Fig. 1.7: Drainage, Katol and Narkhed taluka, Nagpur district

The other nalas are seasonal emanating from the hilly terrain and form the main nalas and rivers. The drainage pattern is mainly dendritic, sub dendritic to sub parallel. The ordering of the stream is upto 7th order. Overall direction of drain is from southeast to northwest. The meandering

of Wardha river indicates their mature stage of development. Initially, Wardha river flows from north to southward, until Jam Nadi meets near Jalalkheda. From this point Wardha river flows south westerly. This is due to presence of structural discontinuity and shows its structural control. Wardha river and Kar nadi bounds the Narkhed taluka in southwestern portion. The drainage map of study area is shown in **Fig. 3.5.**

1.11 Prevailing Water Conservation and Recharge Practices

The State water conservation department, Agricultural department, Social forestry along with Zilla parishad has constructed various water conservation structures, like percolation tanks, check dams, KT wiers, mati nala bandh, nala bunding, gully plugs, gabion structures, farm ponds, vanrai bandhara etc. These structures are constructed by the various Govt and NGO as suitable sites. However as per the data available, check dams are the most preferred water conservation structures in study area. At present, under *Jal yukt shivar* scheme of Agriculture Department which is a flagship programme of Chief Minister, check dams and farm ponds are being constructed in the Katol and Narkhed taluka.

2 DATA COLLECTION AND GENERATION

The primary data such as water levels, quality and lithological inputs were available with CGWB as well as GSDA, Govt. of Maharashtra has been collected and utilised as baseline data. However, the ancillary data such as numbers of ground water abstraction structures, irrigation facilities, rainfall etc., have been collected from the various State govt. departments and compiled.

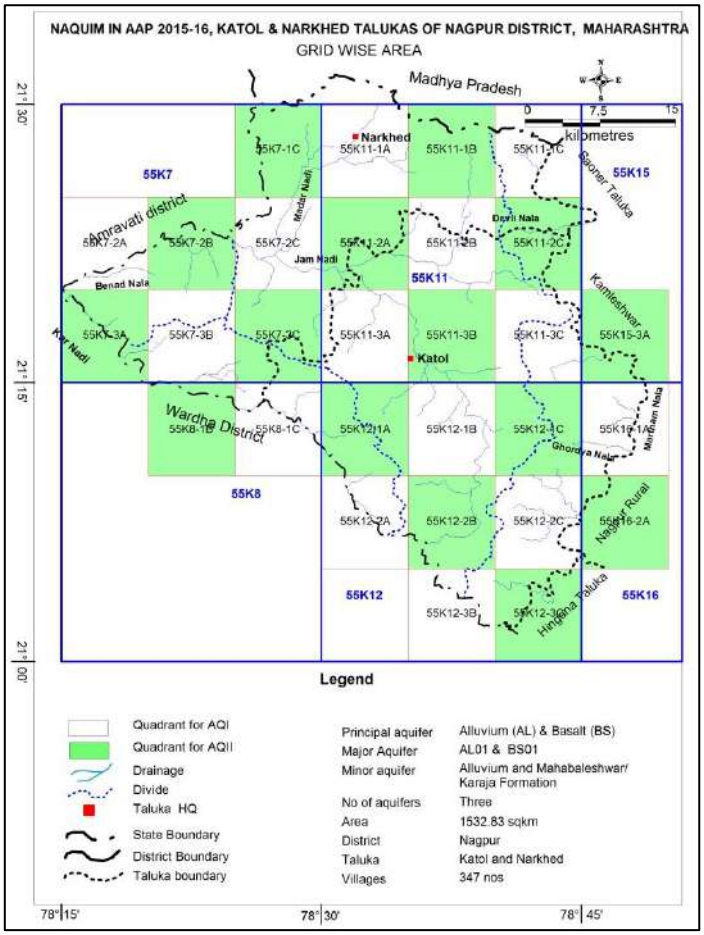
2.1 Data Collection and Compilation

The data collection and compilation for various components was carried out as given below.

i. Hydrogeological Data – Current and historical water levels along with water level trend data of 13 & 8 monitoring wells in Katol & Narkhed taluka respectively representing Aquifer-I. The water levels of 10 & 14 exploratory wells in Katol & Narkhed taluka respectively representing Aquifer-II were also collected and compiled.
ii. Hydrochemical Data - Ground water quality data of 13 & 8 monitoring wells in Katol & Narkhed taluka respectively representing Aquifer-I of CGWB and data of 10 & 14 exploratory wells in Katol & Narkhed taluka respectively representing Aquifer-II were also collected and compiled.
iii. Exploratory Drilling – Ground water exploration data of 10 & 14 exploratory wells in Katol & Narkhed taluka respectively of CGWB.
iv. Geophysical Data – The weathered zone resistivity and weathered zone thickness data from CGWB were complied.
v. Hydrology Data – Data on various irrigation projects, their utilisation status, number of ground water abstraction structures and area irrigated from Irrigation department were compiled.
vi. Hydrometeorological Data - Long term rainfall data for each of the taluka from IMD and Dept. of Agriculture were complied.
vii. Water Conservation Structures – Numbers, type and storage potential of water conservation structures prevailing in the area from Dept. of Agriculture, ZP, Social forestry etc. were complied.

viii. Cropping Pattern Data – Data on prevailing cropping pattern from Agriculture Dept. were complied.

2.2 Data Generation



After taking into consideration, the data available with CGWB on Ground Water Exploration, Geophysical survey, Ground Water Monitoring Wells (GWMW) and Ground Water Quality, the data adequacy was compiled. The requirement, availability and gap of major data inputs i.e., exploratory wells, geophysical data, GWMW and ground water quality data are detailed in the Table 1.1. Based on Data Gap Analysis, all the necessary data was generated as discussed below.

2.2.1 Ground Water Exploration

As seen from Table-1.1, exploratory drilling was required at 15 locations. The drilling at these sites was done down to targeted depth by deploying DTH-REL-06/119 to assess the lithological disposition of shallow aquifer (Aquifer-I) and deeper aquifer [Aquifer-II (Basalt) and Aquifer-III Sandstone (TCG)]. Ground water exploration down to the depth of 200 m bgl in Katol and Narkhed has been taken up where the data gap exists and accordingly 7 exploratory wells and 2 observation wells have been constructed. The details of aquifers encountered are discussed in successive chapter. The locations of exploratory wells are shown in **Fig. 2.1**. The details of existing and newly constructed exploratory and observation wells is given in **Annexure-II**.

2.2.2 Ground Water Monitoring Wells

As observed from Table-1.1, GWMW's were required at 16 locations for Aquifer-I and 7 for Aquifer-II correspondingly 26 key observation wells (KOW) were established and 9 EW were monitored in addition to the existing GWMW to assess the ground water scenario of shallow & deeper aquifer (Aquifer-I, II & III) of the area. The locations of KOW's are shown in **Fig. 2.2**. The details of existing and newly established GWMW/KOW's are given in **Annexure-III**.

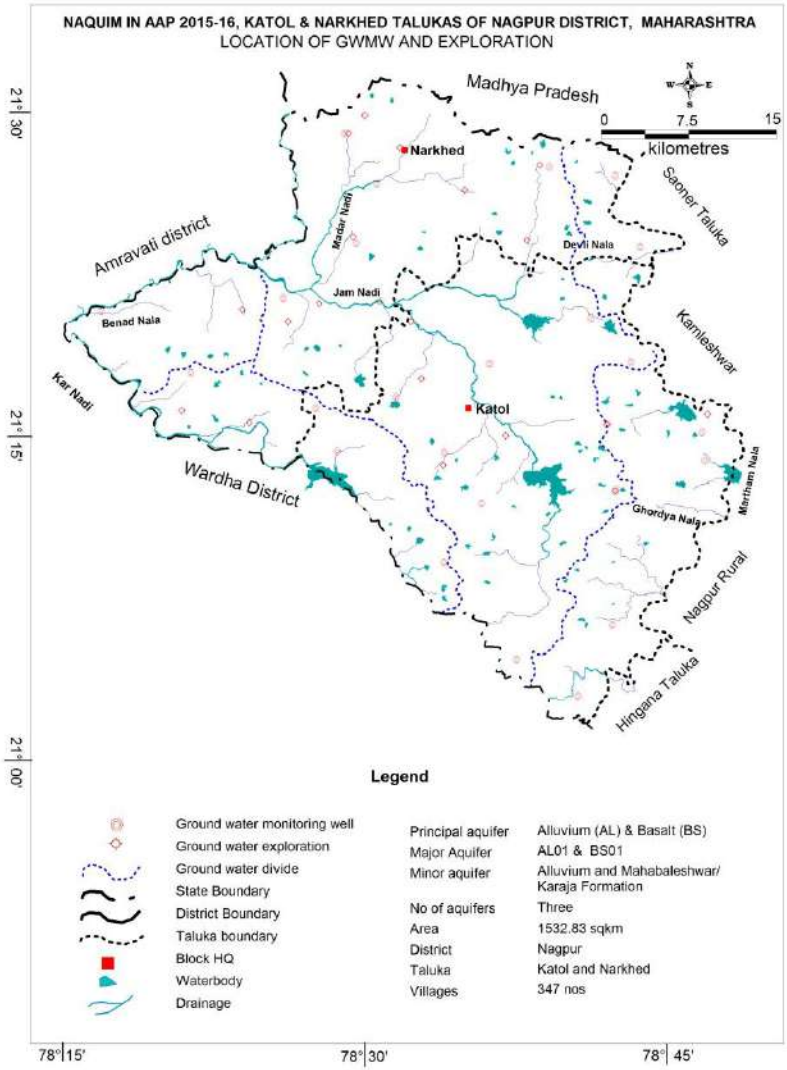


Fig.2.1: Locations of Exploratory Wells Ground Water Monitoring Wells

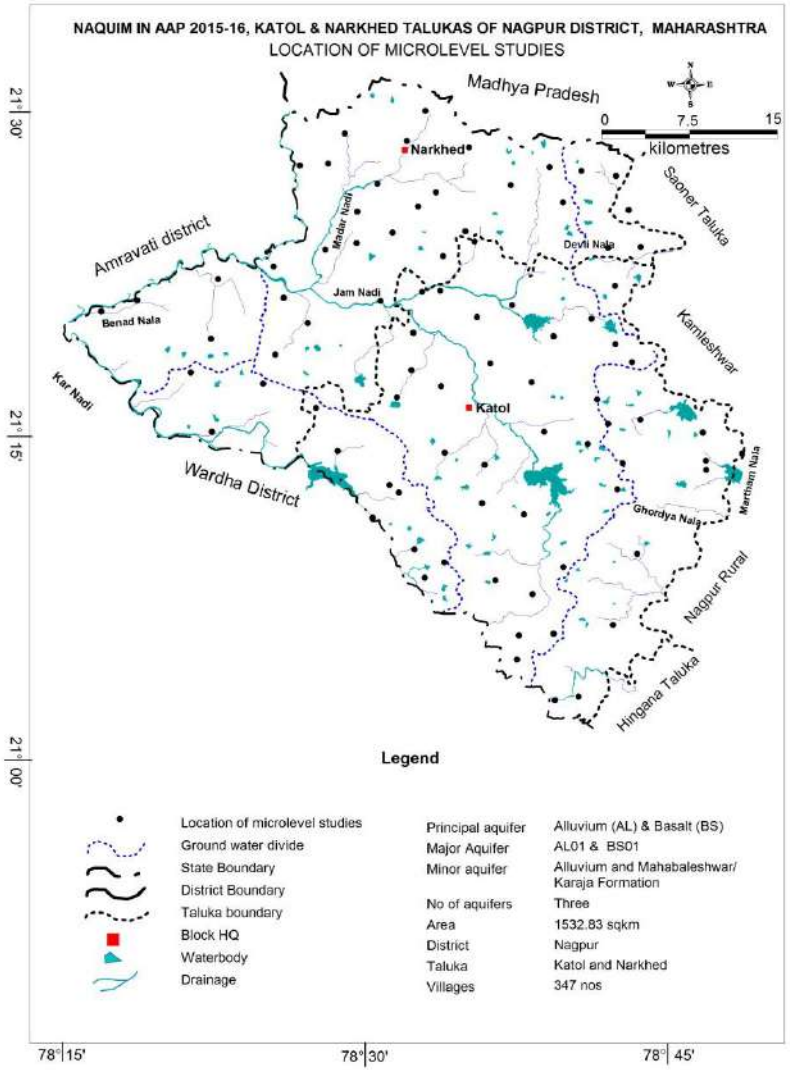


Fig.2.2: Locations of Micro Level Hydrogeological Data Acquisition Wells

2.2.3 Ground Water Quality

As observed from Table-1.1, GWMW's were required at 16 locations for Aquifer-I and 7 for Aquifer-II correspondingly 26 key observation wells (KOW) were established and 9 EW were monitored in addition to the existing GWMW to assess the ground water quality of shallow & deeper aquifer (Aquifer-I, II & III) of the area. The details of chemical analysis of existing and newly established GWMW/KOW's are given in **Annexure-IVA, B, C, D, and E.**

2.2.4 Micro Level Hydrogeological Data Acquisition

In addition to the KOW's, micro level hydrogeological data was also required as per data gap analysis for deciphering the sub-surface lithological disposition, water level scenario and other hydrogeological inputs such as weathered thickness etc., of shallow aquifer (Aquifer-I). Thus 84 well, 50 in Katol and 34 in Narkhed talukas respectively, were inventoried for micro level data acquisition. The details of dugwells inventoried for micro-level data acquisition are given in **Annexure-V**. The locations of micro level hydrogeological data acquisition wells are shown in **Fig. 2.2**.

2.2.5 Thematic Layers

The following five thematic layers were also generated on GIS platform, which supported the primary database and provided precise information to assess the present ground water scenario and also to propose the future management plan.

I. Drainage
II. physiography
III. Geomorphology
IV. Soil
V. Land Use – Land Cover
VI. Geology and Structure

3 Data Interpretation, Integration and Aquifer Mapping

The data collected and generated on various parameters viz., water levels, water quality, exploration, aquifer parameters, geophysical, hydrology, hydrometeorology, irrigation, thematic layers was interpreted and integrated. Based on this the various aquifer characteristic maps on hydrogeology, aquifer wise water level scenario both current and long term scenarios, aquifer wise ground water quality, 2-D and 3-D sub surface disposition of aquifers by drawing fence and lithological sections, aquifer wise yield potential, aquifer wise resources, aquifer maps were generated and as discussed in details.

3.1 Geology

Geologically, the area is divided into following three parts i.e., Deccan Trap Basalt, Trap covered Gondwana Sandstone and Alluvium formation. The generalized geological sequence occurring in the area is given in **Table 3.1** and the geological map with basaltic flows is shown in **Fig. 3.1.**

Table 3.1: Generalized Geological sequence, Katol and Narkhed taluka, Nagpur district

Geologic Period	Age in million years	Stratigraphic unit	Lithology
Recent to Sub-Recent	-	Alluvium	Sand, silt and clay. (Restricted only along the Wardha river)

Geologic Period	Age in million years	Stratigraphic unit	Lithology
Lower Eocene to upper Cretaceous	30-60	Deccan traps	Basalt hard, massive, vesicular, amygdaloidal varieties with inter- trappean.
Permo-carboniferous to	350-250	Gondwana Sandstone (Trap covered/ TCG)	medium to coarse-grained friable Sandstone of Kamthi Stage/Barakar Stage

3.2 Hydrogeology

Hydrogeologically, the area occupied is mainly comprised of Basaltic Deccan traps with inter-trappean beds of Chikhli Formation, Sahyadri Group of Upper Cretaceous- Lower Eocene age (**Fig. 4.2**). The lava pile exposed within the altitude of 380 to 510 m amsl, consists of 8 basalt flows of 'undifferentiated type' occupying major part of the area. Each flow comprise of 3 units namely top vesicular basalt followed by fractured/massive basalt followed by massive basalt.

Although the Gondwana sandstone is not exposed in the area, however, it plays a vital role in hydrogeological aspect. It is mostly occurred in eastern part of the Narkhed taluka and north eastern part of the Katol taluka. The Recent Alluvium is occupied along the Wardha river, Jam river and its major tributaries.

The yields of wells are functions of the permeability and transmissivity of aquifer encountered and vary with location, diameter and depth etc. There are three types of ground water structures in the area i.e. dugwells, borewells and dug cum borewells (DCB). Their yield characteristics are described below.

Dugwells are generally used for both domestic water supply and irrigation purposes in this area. As per State Govt. statistical data there are 11,769 dug wells Katol taluka and 13,021 dug wells in Narkhed taluka which includes 1366 and 1121 irrigation dug wells constructed under 'Jawahar Vihir Yojna' respectively in Katol and Narkhed taluka. It is observed that the dugwells varying from 6.00 m to around 23.20 m in depth in basaltic lava flows can sustain assured water supply for domestic needs of about 500 people throughout the year. The yield of dugwells in basalt for irrigation purposes varies from 12 to 186 m^3/day. Ground water is predominantly used for irrigation, as it is the major ground water utilising sector in these intense orange growing talukas.

State government has drilled large number of borewells fitted with hand pumps and electric motors for rural drinking water purposes in the area. Till 2012, about 368 and 426 hand pump fitted with power pump respectively in Katol and Narkhed taluka has been drilled by the State Govt. Yields of borewells range from 500 to 7,200 lph. The ground water development in these talukas is mostly through dugwells.

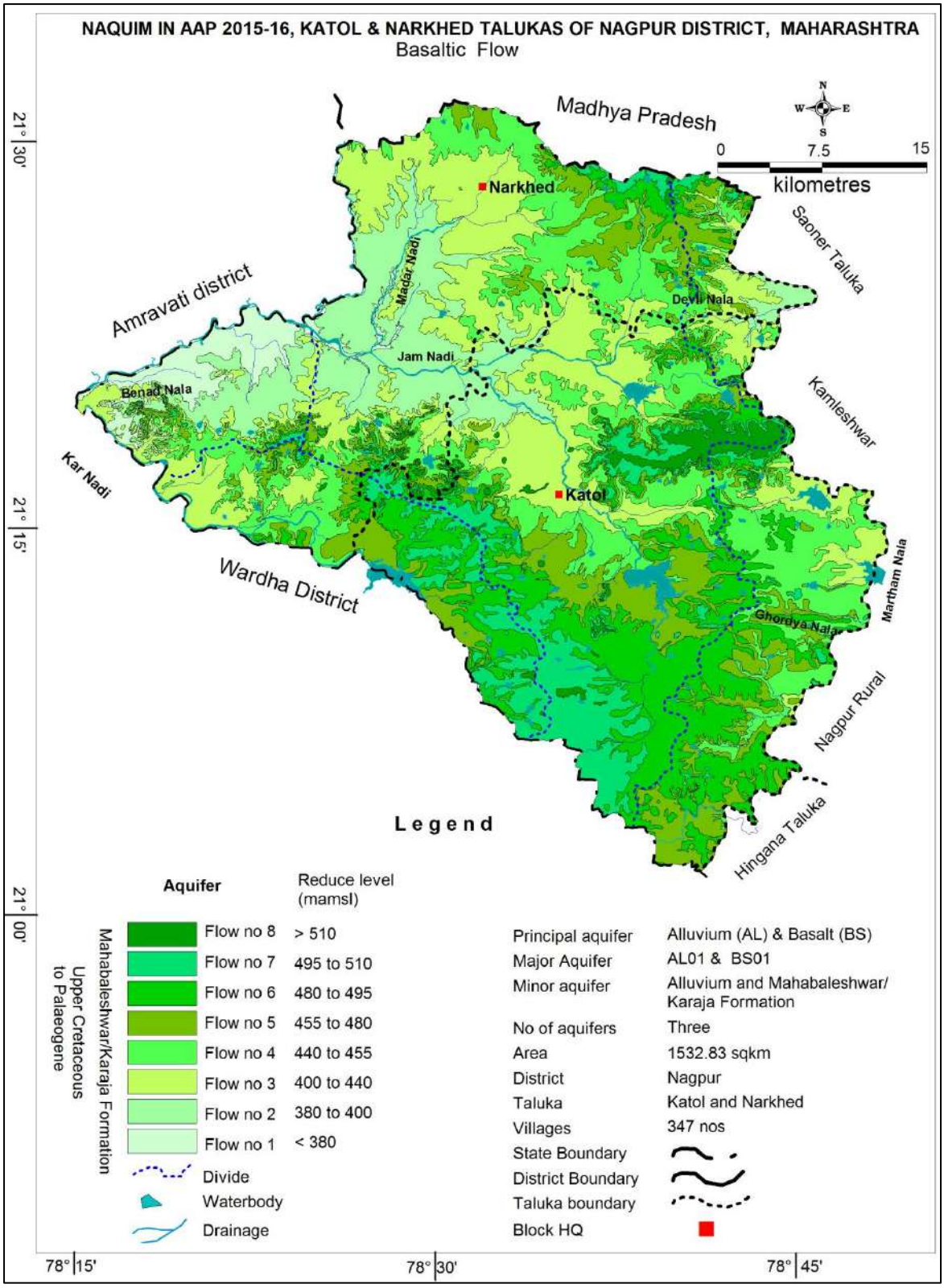


Fig. 3.1: Geology with basaltic flows, Katol and Narkhed taluka, Nagpur district

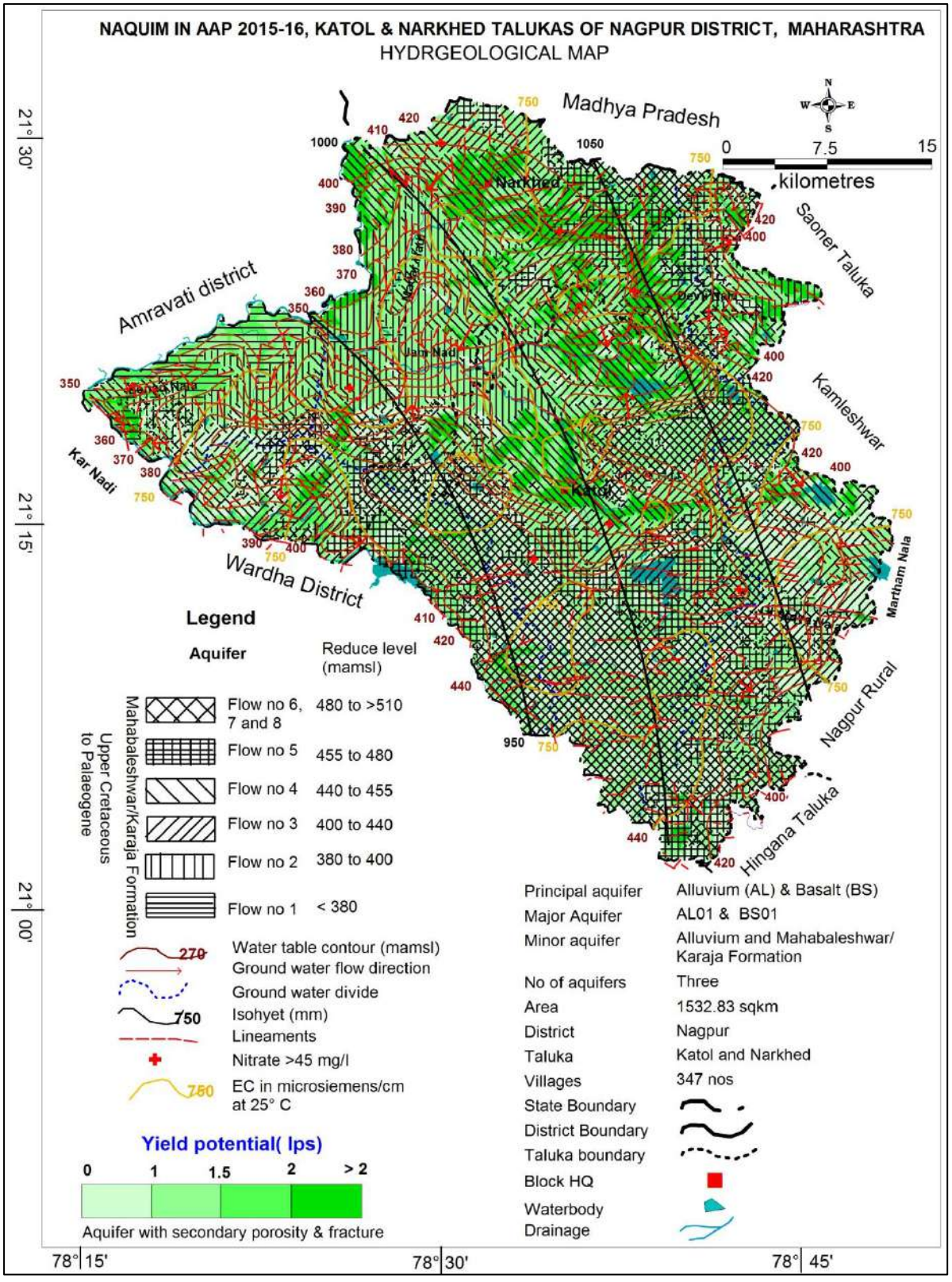


Fig. 3.2: Hydrogeology, Katol and Narkhed taluka, Nagpur district

3.2.1 Occurrence of Ground Water in Basalt (Shallow Aquifer-I & Deeper Aquifer-II)

Ground water occurs under phreatic/ unconfined to semi-confined conditions in basalts. Ground water occurs in unconfined state in shallow Aquifer-I tapped by dugwells of 6 to 32 m depth,

water levels are ranging from 2.76 to 18.11 m bgl and yield varies from 1 to 3 lps. The deeper Aquifer-II is also present which is being tapped by borewells and it ranges from 18 to 1265 m bgl, whereas the water level ranges from 45 to 60 m bgl.

3.2.2 Occurrence of Ground Water in Sandstone (Deeper Aquifer-III, TCG)

The peculiar formation i.e., trap covered Gondwana sandstone is forming the deeper Aquifer-III in the area. The local people rarely tap it, as it is difficult to pierce sandstone through basalt by rotary drilling rig. The ground water occurs mostly in semi-confined to confined condition, tapped by the bore wells. It covers about 139.71 sq km and 41.56 sq km area in Katol and Narkhed taluka respectively. The ground water exploration reveals that it has huge ground water potential. It is one of the high yielding aquifer of the area and yields are mainly observed in the range of 5 to more than 10 lps with continues pumping.

3.3 Geophysical Survey (VES)

Electrical resistivity surveys were carried out in these areas in addition to exploratory drilling to understand the precise aquifer disposition and identify the ground water potential zones, for better ground water management planning. In all 61 (22 and 39 VES during 2006-07 in Narkhed taluka and during 2011-12 and 2012-13 in Katol taluka respectively) Vertical Electrical Soundings (VES) were conducted in a nearly grid pattern, by deploying the ABEM SAS 300C Terrameter and using the Schlumberger electrode configuration. The VES location map is shown in **Fig 4.3** and the details of VES results is presented in **Annexure VI**.

The data was processed and interpreted by using appropriate software after marginally modifying the manually interpreted results keeping in view the local geology and hydrogeology. Contour maps for different geo-electric layer parameters were generated to infer the nature of the topsoil and to demarcate the ground water potential zones in order to achieve the objectives. From the Longitudinal conductivity (S) and Transverse Resistance (T) values ground water potential zones are demarcated. Different resistivity ranges were assigned to have associated with different geological formations/litho units.

The resistivities ranging from 6.6 Ohm to 32 Ohm m with thicknesses ranging from 4.3m to 31.2m may correspond to the basaltic formation with fractures which forms principle aquifer in the Aquifer-I (above 30m depth) zone. It is expected the fractured basaltic formation and the Gondwana Sandstones as principal aquifers in the Aquifer-II zone (below 30m depth). The resistivities ranging from 6.0 Ohm to 33 Ohm m with thicknesses ranging from 24.8m to 144.0m may correspond to the basaltic formation with fractures which forms principle aquifer in the Aquifer-II zone. At and around Kohli and Raulgaon in Katol taluka, the Gondwana Sandstones with resistivities ranging from 11 to 28 Ohm m and thickness from 54m to 166m form principal Aquifers in Aquifer-II zone.

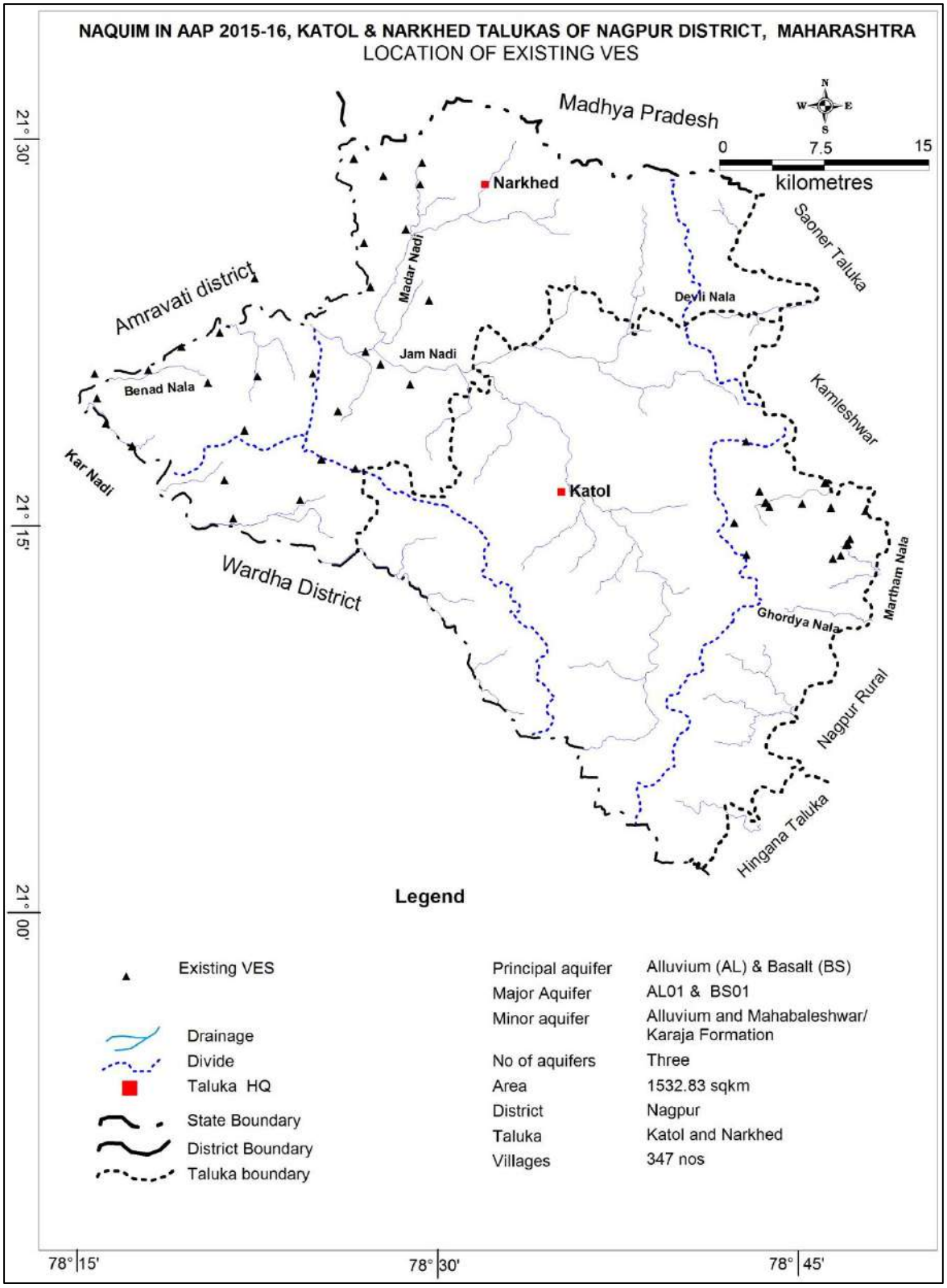


Fig. 3.3: Locations of geophysical surveys (VES) conducted, Katol and Narkhed taluka, Nagpur district

Based on the VES results, Longitidinal conductivity (S) and Transverse resistance (T) were estimated to find out the ground water potential locations in Aquifer 1 and Aquifer 2 zones. The S value in Aquifer-I ranges from 0.21 to 3.9, while the average value is 0.96. The T value in Aquifer-I

ranges from 28.38 to 673 while the average value is 291. The locations at, Khargaon and Thugaondev where S > average S and T < average T were considered as potential ground water locations for Aquifer-I. At Narsingi, Sinjar, Mowad in Narkhed taluka, the groundwater potentiality is moderate while at other places it is low to very low.

The S value in Aquifer-II ranges from 2.21 to 12.46, while the average value is 5.26. The T value in Aquifer-II ranges from 211 to 7920 while the average value is 1804. The locations at Narsingi in Narkhed taluka, Dahegaon, Dorli andf Kohli in katol taluka where S > average S and T < average T were considered as more potential locations for ground water in Aquifer-II. At Malegaon, Dorli and Rawalgaon in Katol taluka, the groundwater potentiality is moderate while at other places it is low to very low.

3.4 Ground Water Dynamics

To decipher the ground water dynamics of shallow Aquifer-I, 26 KoW and 84 micro-water level wells were established. For deeper Aquifer-II & III, 7 exploratory wells (4 in Katol and 3 in Narkhed taluka) have been drilled and studied. The water level data from Nov. 2015 were collected and analysed. The ground water levels in Deeper Aquifer-III (TCG) could not be analysed as it has limited extends and tapped by the 3-4 exploratory wells. Hence, the ground water level scenarios for Shallow Aquifer-I and Deeper Aquifer-II are analysed.

3.4.1 Depth to water level (Shallow Aquifer-I)

To understand the depth to water level scenario in Katol and Narkhed Talukas, water level measurement from all the key observation wells (KOW) were carried out in the month of May and November. The pre and post monsoon data collected from these KOWs along with data collected by CGWB and GSDA, GoM from there network monitoring stations have been used to ascertain the water level scenario and preparation of depth to water level maps of the area.

3.4.1.1 Depth to Water Level (pre-monsoon May 2016)

The depth to water levels in Katol-Narkhed Talukas during May 2016 ranges between 5.90 (Mannath) and 18.80 (Kharsoli) m bgl. Depth to water levels during premonsoon shows water levels within 10 to 15 m bgl in almost entire Katol and Narkhed taluka. However, water levels <10 mbgl is mostly observed along the local river/nala. The Deeper water level i.e., 15 to 20 m bgl is restricted mostly in northern and southern part of Narkhed. The premonsoon depth to water level map is given in **Fig. 3.4** and the water level data is presented as **Annexure-VII.**

3.4.1.2 Depth to Water Level (Post-monsoon 2015)

The depth to water levels in Katol-Narkhed Talukas during Nov 2015 ranges between 3.00 (Pandhardhakni) and 17.10 (Kharsoli) m bgl. Except small isolated stretch in southwestern, Eastern and northern part, where water level is 10 to 15 mbgl, rest of the area shows Depth to water levels during postmonsoon within 10 m bgl. A small isolated patch of water level 15 to 20 m is observed south of Narkhed. The postmonsoon depth to water level map is given in **Fig. 3.5**.

3.4.2 Depth to water level (Deeper Aquifer-II)

In Aquifer-II, the pre monsoon depth to water levels in Katol-Narkhed Talukas during pre-monsoon May 2016 ranges between 9 m bgl (Maragsur) and 80 m bgl (Lohari Sawanga).

The deeper DTWL (>30 m bgl) has been observed in southern part of the Narkhed taluka and western part of Katol taluka. The Shallow DTWL (upto 10 m bgl) has been observed in southern

part of the Katol taluka. In rest of the area water level ranges between 10 to 30 m bgl. The premonsoon depth to water level for Aquifer –II is given in **Fig. 3.6** and the details are presented in **Annexure VIII**.

The post-monsoon DTWL ranges from 2 m bgl (Maragsur) and 55 m bgl (Lohari Sawanga) in Aquifer-II and presented in **Fig. 3.7**. The area representing post monsoon DTWL in Aquifer is more or less same except shallow water level (< 10 m bgl) is observed in entire Narkhed taluka.

3.4.3 Water Level Fluctuation, Shallow Aquifer-I

The water level measured during pre and post monsoon period was used to calculate the fluctuation. The seasonal fluctuation (May 16-Nov 15) in water level was obtained from difference in water level during pre and post monsoon water level. In the area, number of wells and their percentage falling in each fluctuation range is presented in **Table 3.2**.

Table 3.2: Seasonal fluctuation (May-16 vs Nov-15) in water level with percentage

No. of key wells	Seasonal fluctuation in water level m with %			
	0 to 2	2 to 4	4 to 6	6 to 8
26	16 (61.53%)	3 (11.53 %)	2 (7.69%)	5 (19.23%)

It is observed that minimum water level fluctuation was measured at Bhorgadh (0.0 m) & Junapani (0.30) while maximum water level fluctuation was measured at Dorli (7.40m). The water level fluctuations are grouped under three categories and are discussed under.

0-2 m and 2-4 m - Less water level fluctuation
4-6 m and - Moderate water level fluctuation
6-8 m - High water level fluctuation

Area with less water level fluctuation, about 61.53% wells (16 wells) were showing the water level fluctuation less than 4m. The area with less water level fluctuation is observed in almost entire Katol and Narkhed taluka. The area with moderate to high water level fluctuation is observed in and around Malegaon-Dorli-Raulgaon-Dongargaon in Katol taluka while Semda, Bhishnur-Tinkheda in Narkhed taluka.

3.4.4 Depth to Water Level Trend (2006-15)

Based on the CGWB's GWMW and Observation wells of GSDA, Nagpur, the long-term trend of water levels for pre-monsoon and post-monsoon periods for the last ten years (2006-15) have been computed. The long term water level data of 9 GWMW of CGWB and 13 OB Wells of GSDA has been utilised. The maps depicting the special variation in long-term water level trend is presented as (**Fig 3.8 and 3.9**). The data is presented in **Annexure IX**.

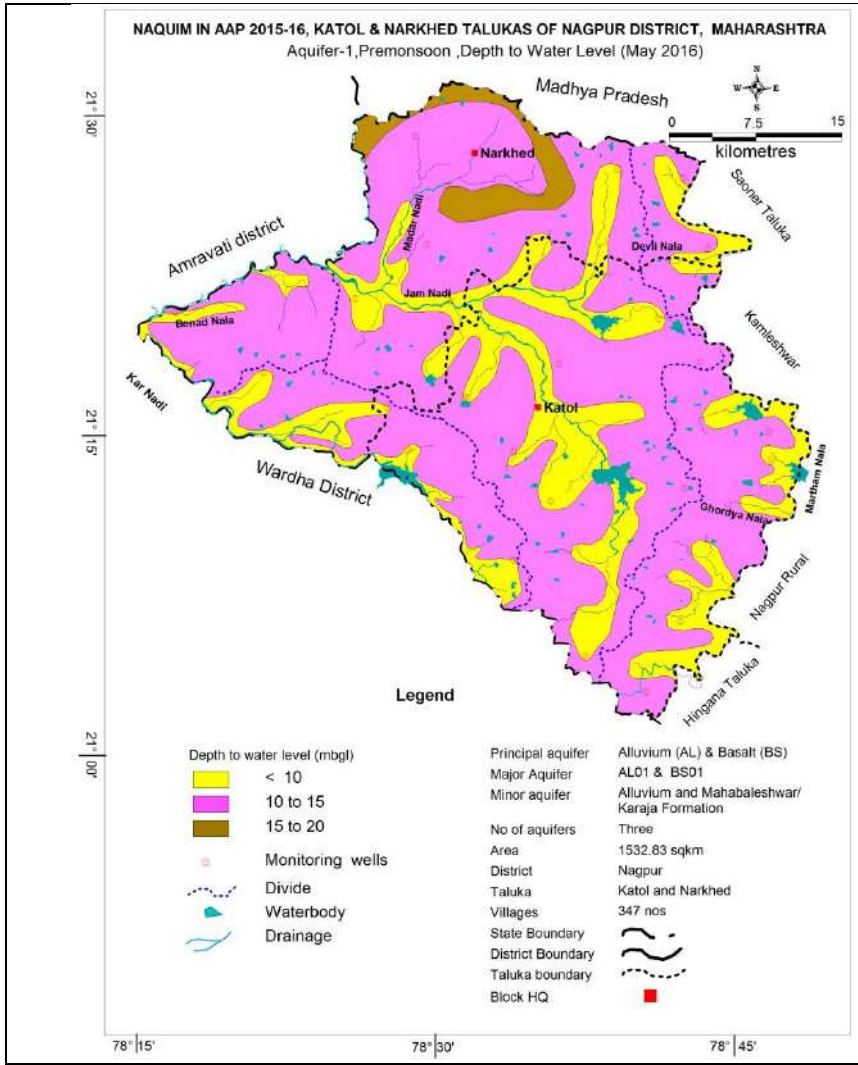


Fig. 3.4: Shallow Aquifer-I, Depth to Water Level (pre-monsoon May-2016)

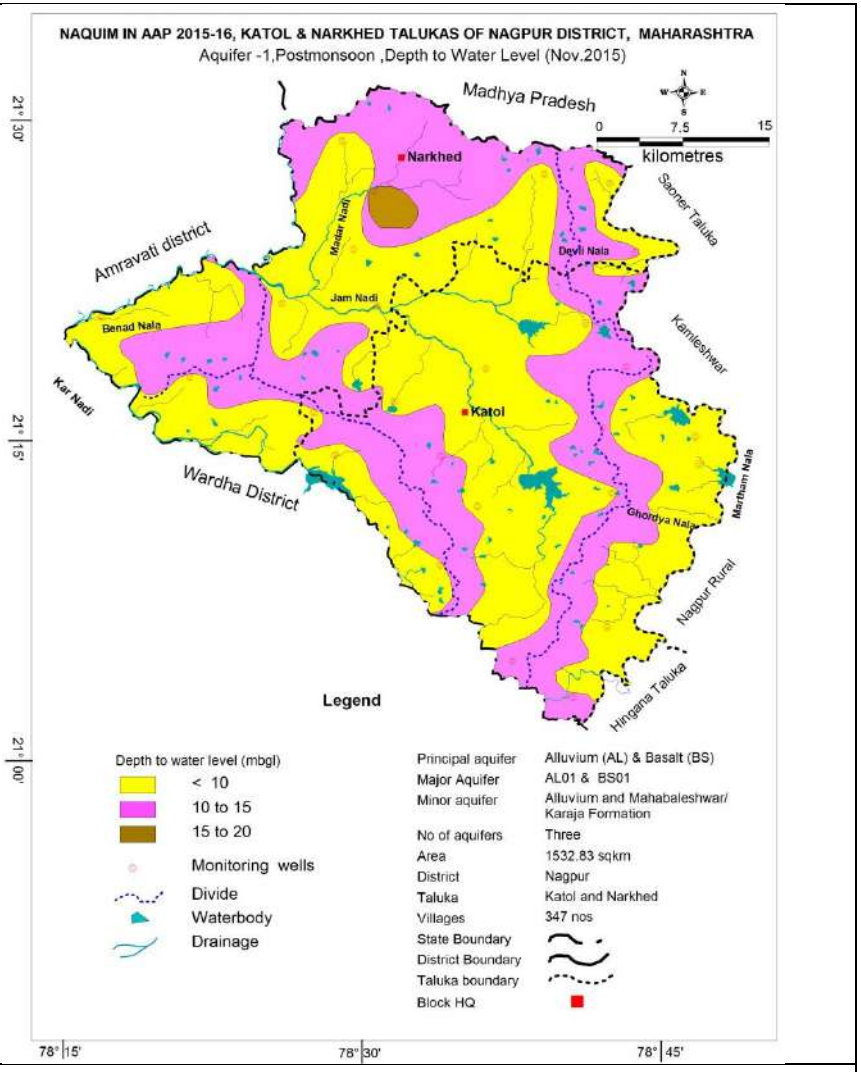


Fig. 3.5: Shallow Aquifer-I, Depth to Water Level (Post-monsoon Nov.-2015)

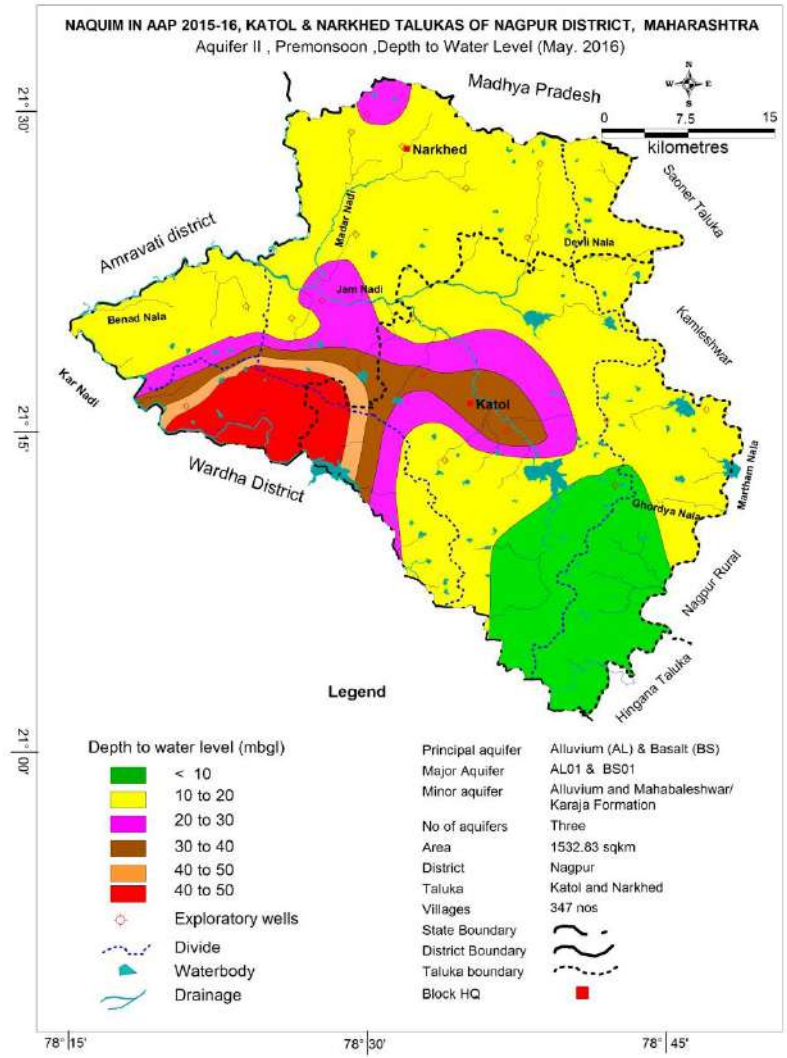


Fig. 3.6: Deeper Aquifer-II, Depth to Water Level (Pre-monsoon May-2016)

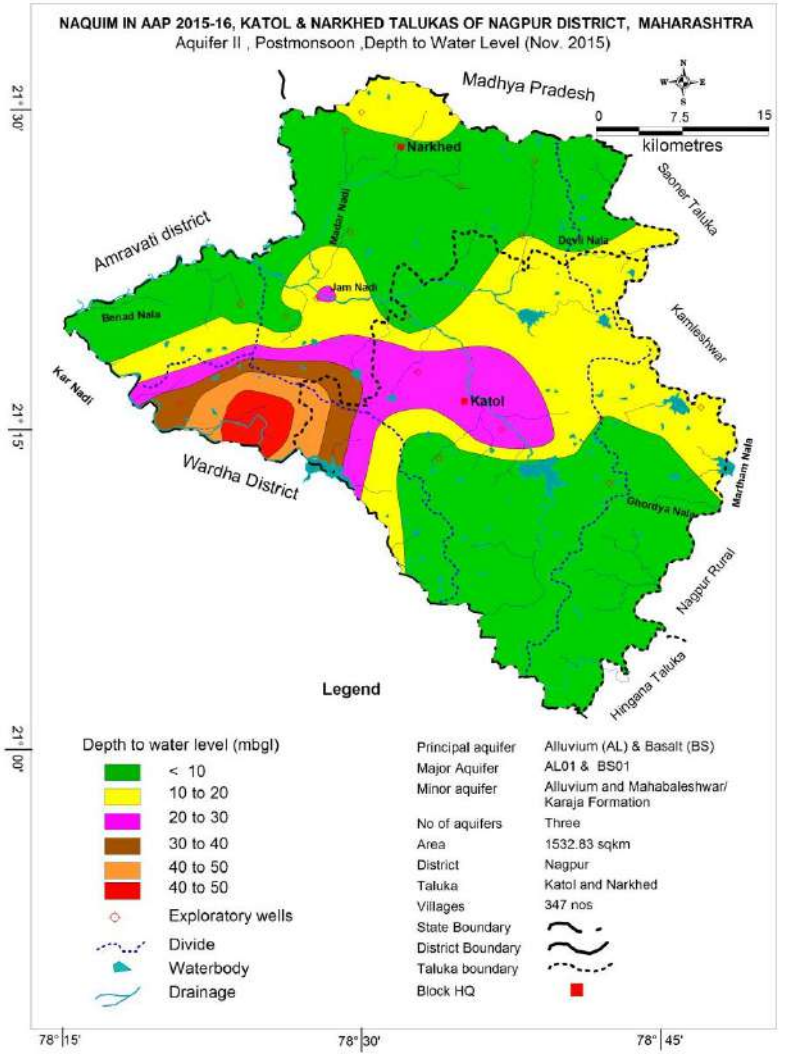


Fig. 3.7: Deeper Aquifer-II, Depth to Water Level (Post-monsoon Nov-2015)

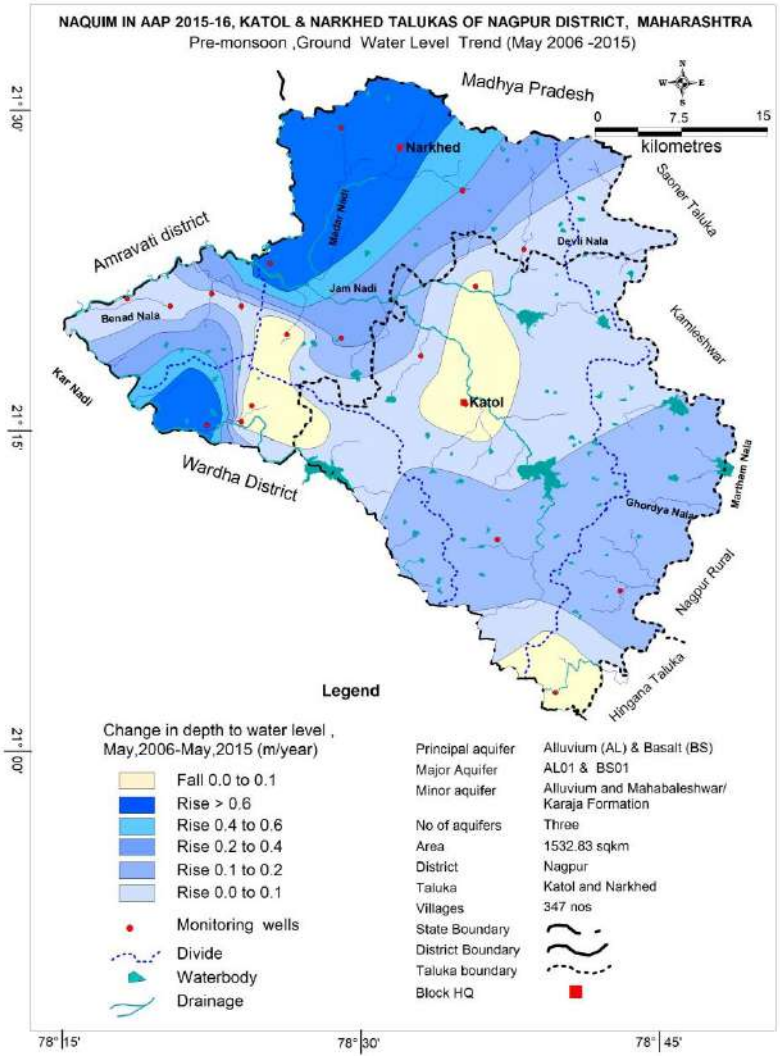


Fig 3.8: Pre -monsoon decadal water level trend (2006-15)

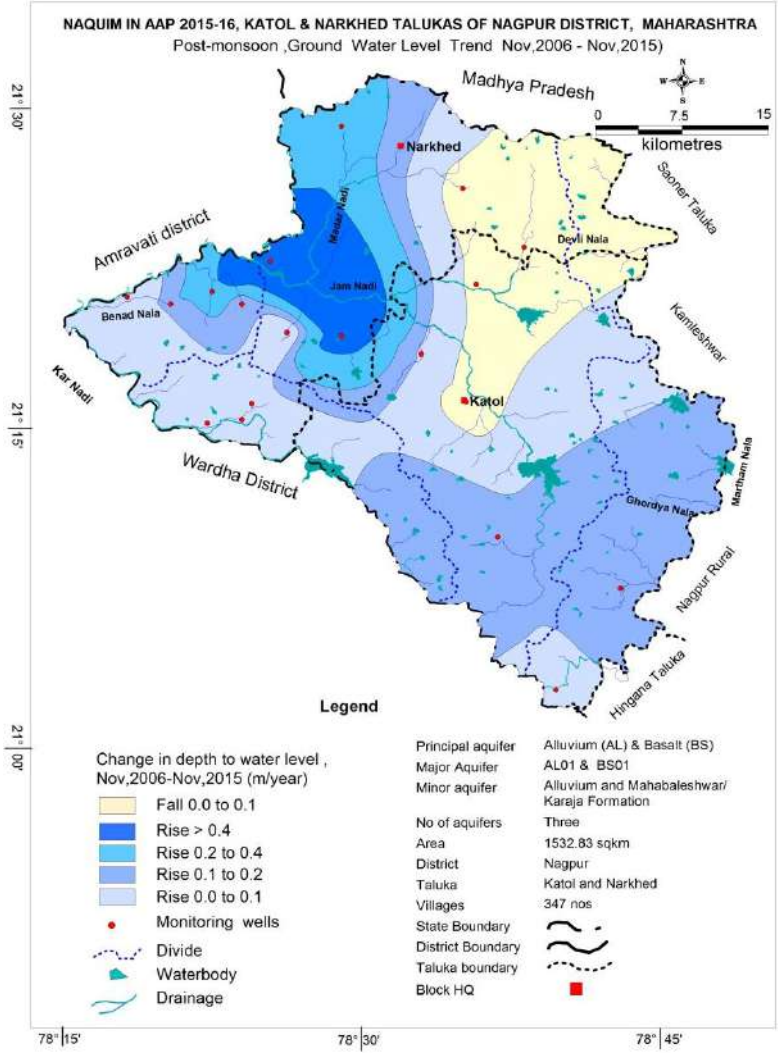


Fig 3.9 : Post-monsoon decadal water level trend (2006-15)

In the study area, pre monsoon rise in water levels trend has been recorded at 14 stations and it ranges between 0.0175 m/year (Sawargaon) to 0.94 m/year (Belona) while falling trend was observed in 07 stations varing from -0.0175 (Gondidigras) to -0.1414 m/year (Jamgaon Bk). In pre monsoon the falling water level trend has been observed in almost entire area of Katol and Narkhed while small patches of falling trend has been observed in and around Katol toen which treaches upto Sawargaon in north. Also, area around lohara and jamgaon in Narkhed taluka shows insignificant fall in ground water level trend.

In the study area, post monsoon rise in water levels trend has been recorded at 18 stations and it ranges between 0.0077 m/year (Jamgaon Bk) to 0.630 m/year (Jalalkheda) while falling trend was observed in four (04) stations varing from -0.006 m/year (Gondidigras) to -0.023 (Katol). In post monsoon the falling water level trend has been observed only in and around Katol town which extends towards north. Rest of the area in Katol and Narkhed is showing rise in water levels trend. Significant rise of 0.6 m/year was observed in Madar river catchment.

3.4.5 Hydrograph Analysis

The hydrographs of fourteen (10) GWMW, 4 in Katol taluka and 6 in Narkhed taluka, were analysed for the period from 2006 to 2015. It is observed that the long-term water level trends during pre and post-monsoon seasons are rising in shallow aquifer-I represented by dug wells. However, the deeper aquifer-II is showing declining short term trend as in the case of Jamgaon Bk Pz, Paradsinga Pz and Raulgaon EW. The variation in short term and long-term water level trends may be due to variation in natural recharge due to rainfall and withdrawal of groundwater for various agricultural activity, domestic requirement and industrial needs. The analysis of hydrographs show that the annual rising limbs in hydrographs indicate the natural recharge of groundwater regime due to monsoon rainfall, as the monsoon rainfall is the only source of water (**Fig. 3.10a to 3.10j**). However, the groundwater draft continuously increases as indicated by the recessionary limb. The groundwater resources are not replenished / recharged fully and the groundwater levels are under continuous stress and depleting. It has also been observed that there were few years when the recharge exceeded draft for a particular period or year but in the next successive year, the draft again exceeded recharge.

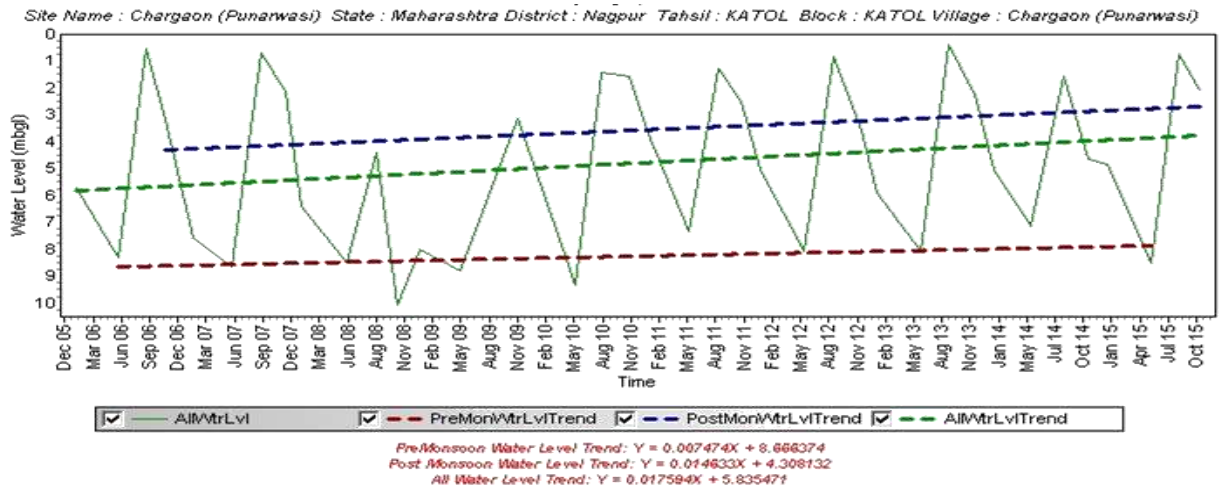


Fig 3.10a: Hydrograph (2006-15), Chargaon, Katol taluka, Nagpur district

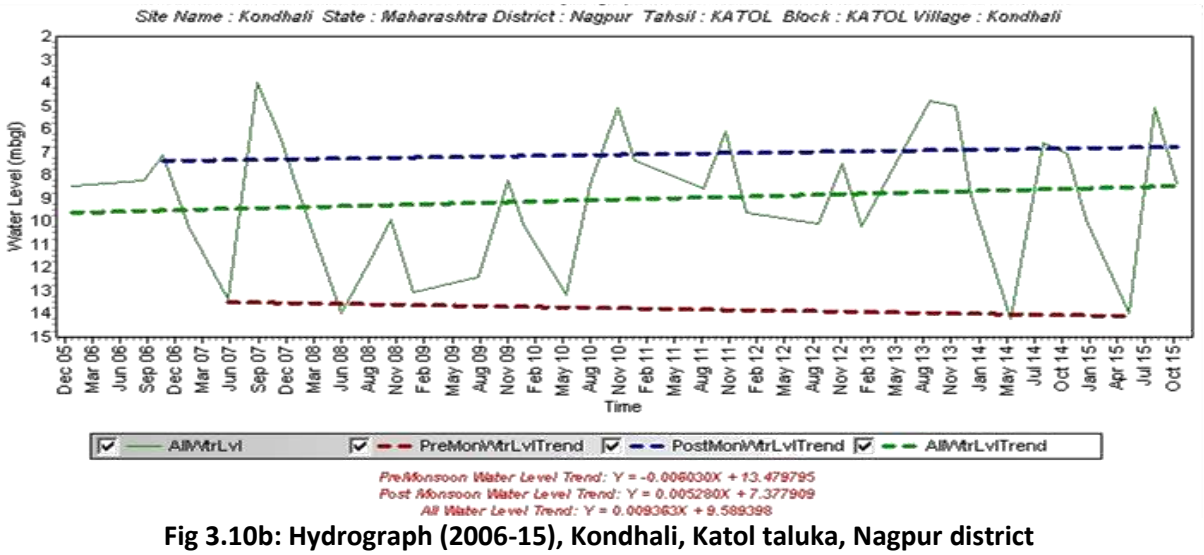


Fig 3.10b: Hydrograph (2006-15), Kondhali, Katol taluka, Nagpur district

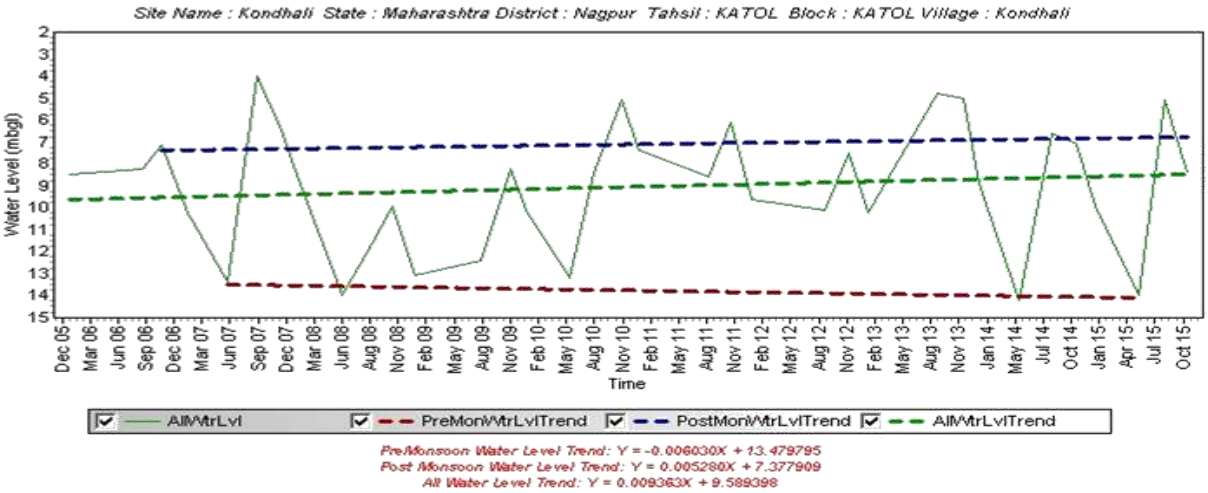


Fig 3.10c: Hydrograph (2006-15), Kondhali, Katol taluka, Nagpur district

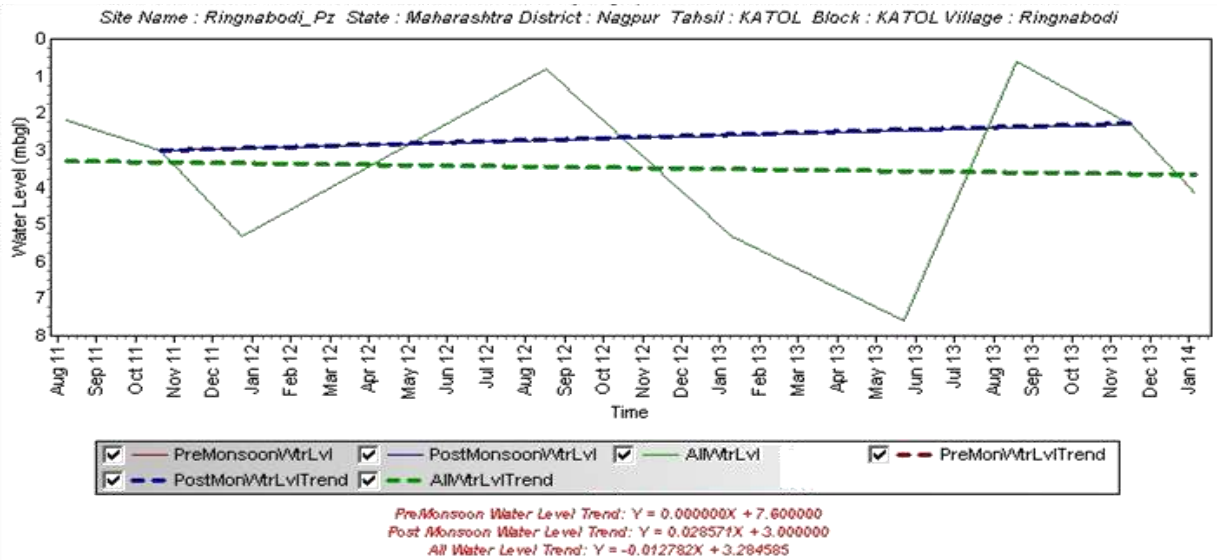


Fig 3.10d: Hydrograph (2011-15), Ringnabodi, Katol taluka, Nagpur district

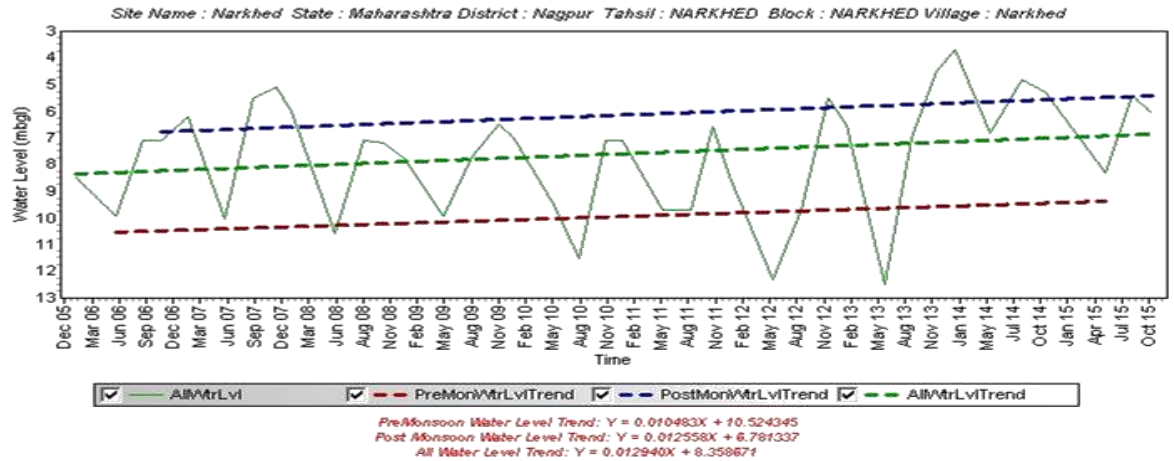


Fig 3.10e: Hydrograph (2006-15), Narkhed, Narkhed taluka, Nagpur district

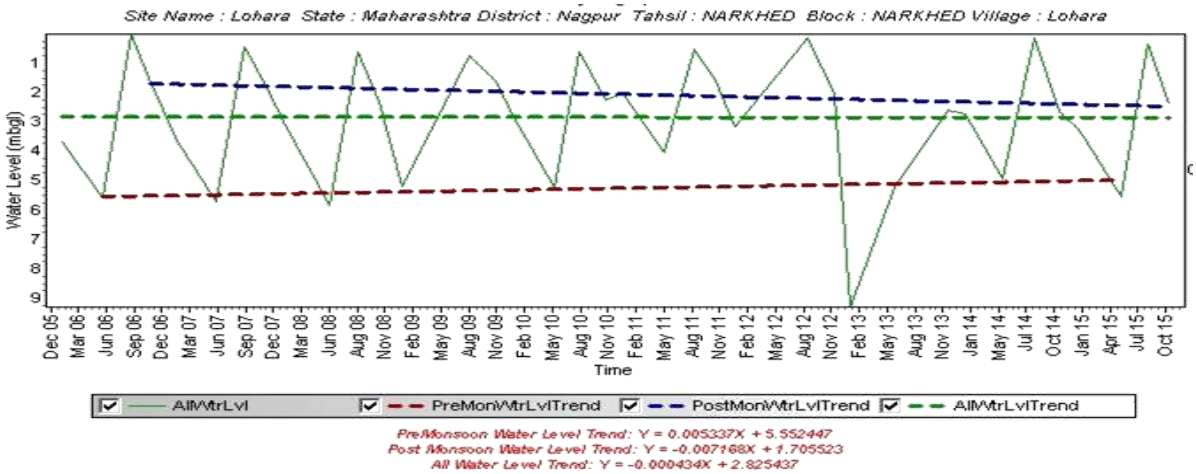


Fig 3.10f: Hydrograph (2006-15), Lohara, Narkhed taluka, Nagpur district

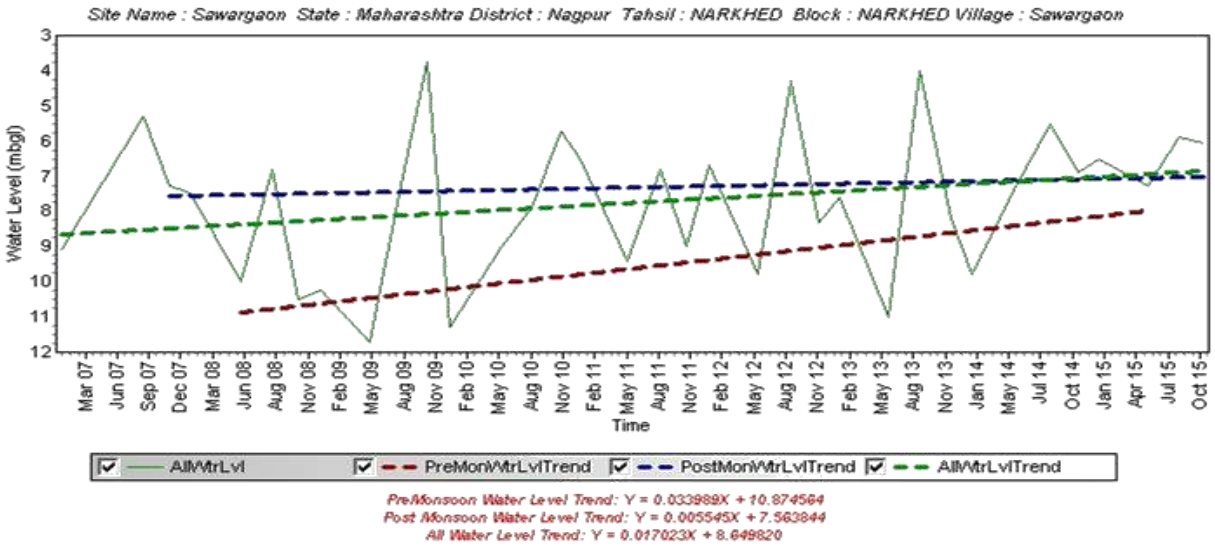


Fig 3.10g: Hydrograph (2007-15), Sawargaon, Narkhed taluka, Nagpur district

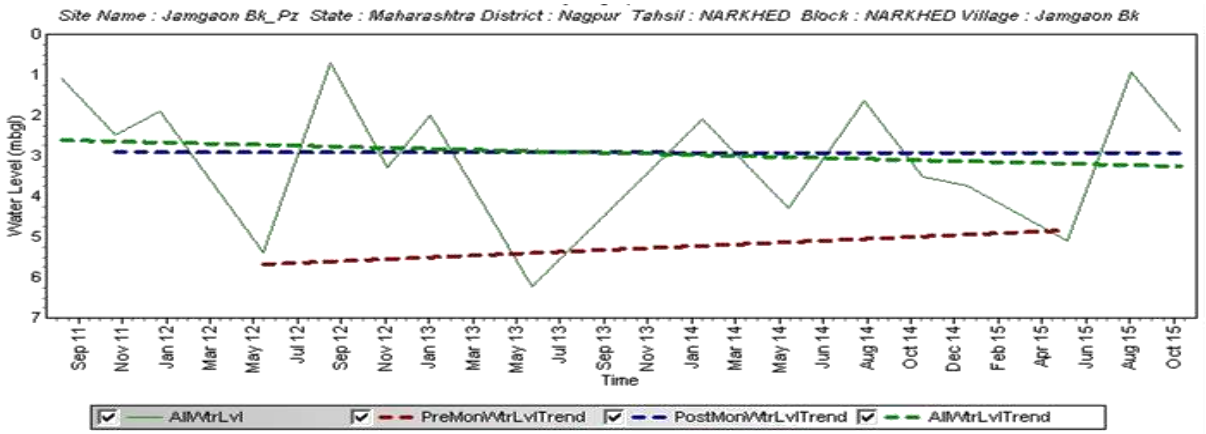


Fig 3.10h: Hydrograph (2006-15), Jamgaon (Bk) Pz, Narkhed taluka, Nagpur district

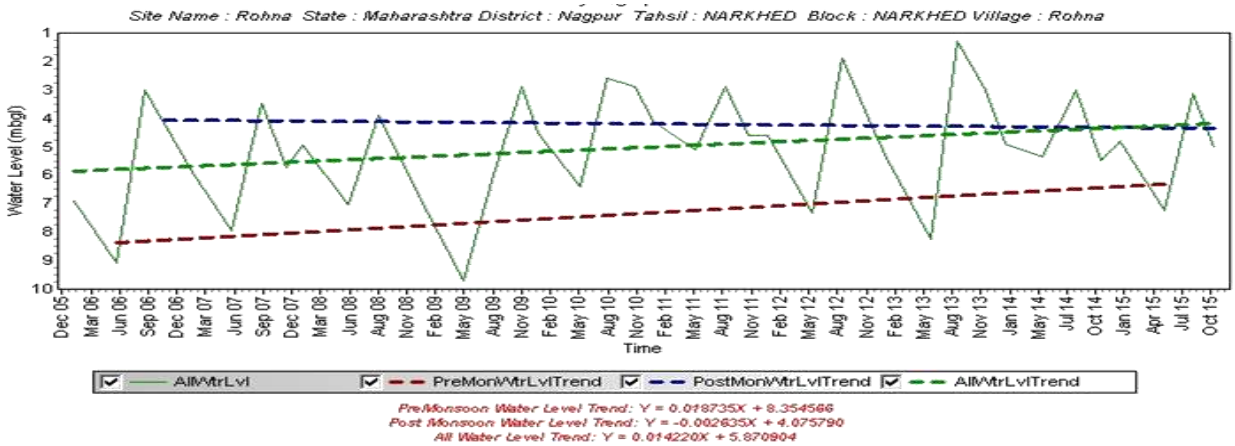


Fig 3.10i: Hydrograph (2006-15), Rohna, Narkhed taluka, Nagpur district

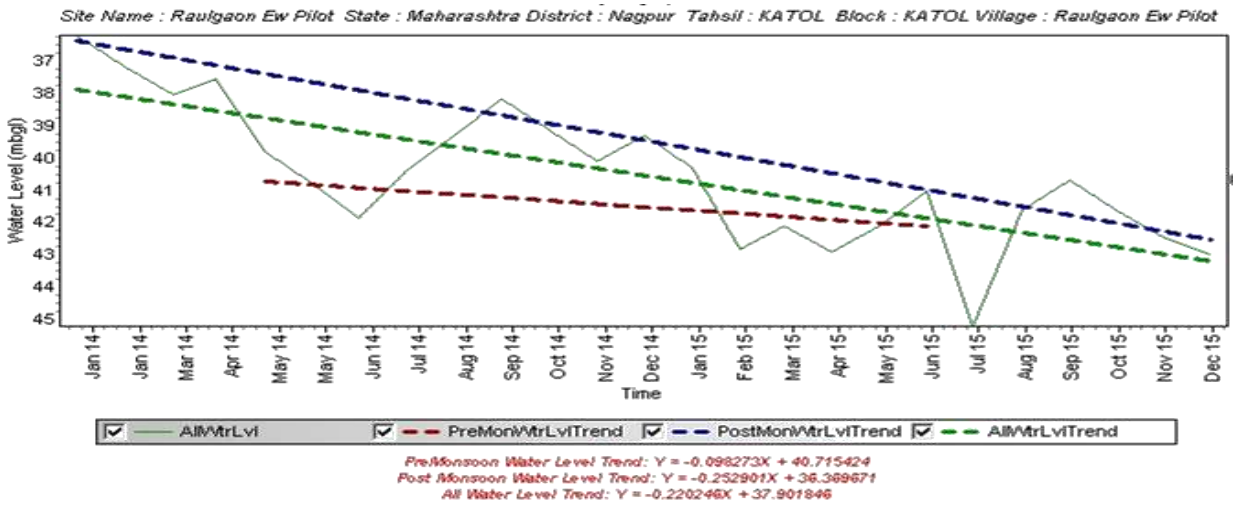


Fig 3.10j: Hydrograph (2006-15), Raulgaon EW, Narkhed taluka, Nagpur district

3.4.6 Ground Water Flow

In a groundwater regime, equipotential lines, the line joining points of equal head on the potentiometric surface, were drawn based on the area of variation of the head of an aquifer. Based on the Water table elevation, ground water flow directions are demarcated (**Fig. 3.11**). It has been observed that

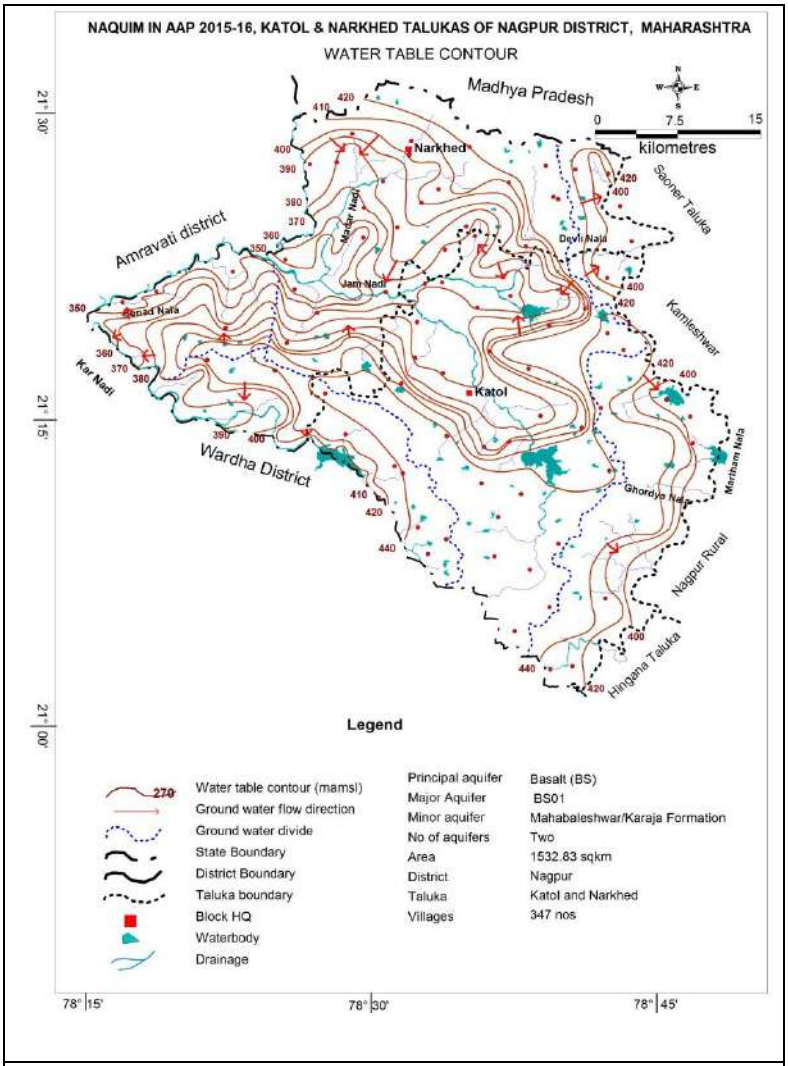


Fig. 3.11: Ground water flow, Katol and Narkhed taluka, Nagpur district

1 The area under study Wardha river and its tributaries (Madar nadi, Jam nala, Kar Nadi, Benad nala and Devli nala) and Wainganga river and its tributaries (Chandrabhaga nadi, Ghordya nala) constitute the principal drainage system in the area. The drainage pattern is mainly dendritic, sub dendritic to sub parallel. The ordering of the stream is upto 7th order. Overall direction of surface water drain is from southeast to northwest. Other nalas are seasonal emanating from the hilly terrain and form the main nalas and rivers.

2 The water table varies from 350 m amsl near Wardha river in southwestern part of Narkhed taluka to about 460 m amsl eastern part of Katol taluka.

3 The overall ground water movement in Katol taluka is from southeast to northwest in Wardha river basin while it is northwest to southeast in Wainganga river basin. It almost follow the surface water divide.

4 The ground water movement in Narkhed taluka is mainly controlled by the Wardha and Jam river. In northern part of the Narkhed taluka the ground water movement is from NE to SW towards Jam river while in southern part it is from south to north towards Jam rive; and towards south which is governed by Kar river.

It has been observed that the ground water flow directions follow the major drainage of Wardha river, Jam river and topography of the area. This indicates the topographic control for the ground water movement. However, in western part of the study area, the ground water movement is control by Wardha river and structural discontinuity.

3.5 Ground Water Quality

The suitability of ground water for drinking/irrigation/industrial purposes is determined keeping in view the effects of various chemical constituents present in water on the growth of human being, animals, various plants and also on industrial requirement. Though many ions are very essential for the growth of plants and human body but when present in excess, have an adverse effect on health and growth. For estimation of the quality of ground water, ground water samples from 26 KOW's (shallow dug wells representing Aquifer - I) have been collected during pre-monsoon. Similarly, for Aquifer – II, the ground water samples were collected during the drilling and pumping test activities of seven exploratory and two observation wells constructed in Katol and Narkhed. The ground water samples were analysed for major chemical constituents. The aquifer wise ranges of different chemical constituents present in ground water are given in **Table 3.3.** The details of water quality analysis of **Aquifer I, II and III** is given in **Annexure IVA, B and C**.

Table 3.3: Aquifer wise ranges of chemical constituents in Katol and Narkhed

Constituents	Shallow aquifer-I		Deeper aquifer-II	
	Min	Max	Min	Max
pH	7.6	8	7.1	8
EC	385	2000	350	1183
TDS	243	898	228	769
TH	185	470	40	410
Calcium	38	64	10	96
Magnesium	22	75	4	47
Potassium	0.05	0.32	0.92	47.47
Sodium	3	17	25	192
Carbonate	0	0	0	0
Bi-carbonate	92	226	43	299
Chloride	21	213	25	216
Sulphate	34	103	24	323
Nitrate	3	57	10	51
Fluoride	0.09	0.54	0.17	1.90

According to above table, nitrate contamination in Aquifer-I is observed only at Malapur, while in Aquifer-II, it is observed in Sawargaon, Koni, Manikwada and Ladgaon. Aquifer-II at Maragsur is contaminated with fluoride (1.9 mg/l) at 114.30-117.40 m bgl zone depth. Rest of the parameters is within permissible limit.

The iso-conductivity map of Aquifer I and II has been prepared and presented as **Fig 3.12** and **Fig 3.13** respectively. On perusal of the **Fig 3.12** it is observed that the electrical conductivity for shallow aquifer - I in Katol and Narkhed taluka is within Permissible Limit (750-2250 μMhos/cm @ 25°C) except at one or two places may be due to localised point contamination. Nitrate concentration of >45 mg/l is observed in isolated scattered points. Whereas, perusal of **Fig 3.13** for Aquifer-II shows that, the electrical conductivity in Katol and Narkhed taluka is within Permissible Limit (750-2250 μMhos/cm @ 25°C). Except fluoride (1.9 mg/l) at 114.30-117.40 m bgl zone depth in Katol taluka. It is due to the fringe area of Basalt and Sandstone.

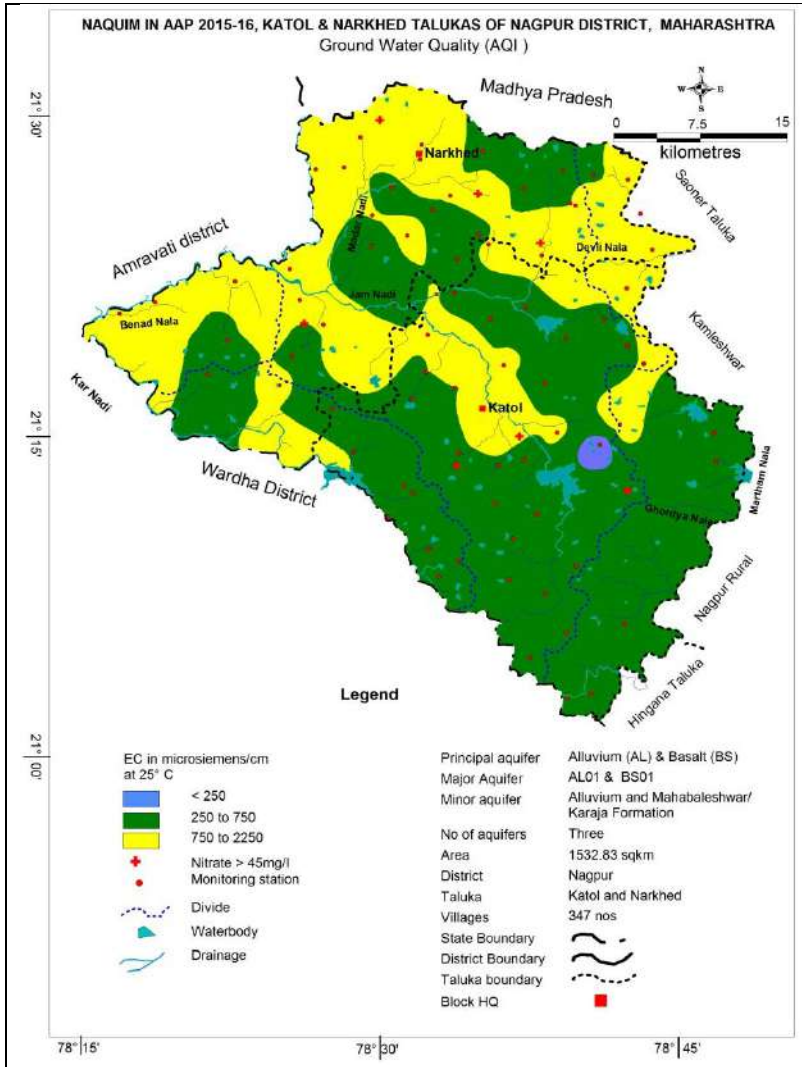


Fig. 3.12: Ground water quality, Aquifer-I, Katol and Narkhed taluka, Nagpur district

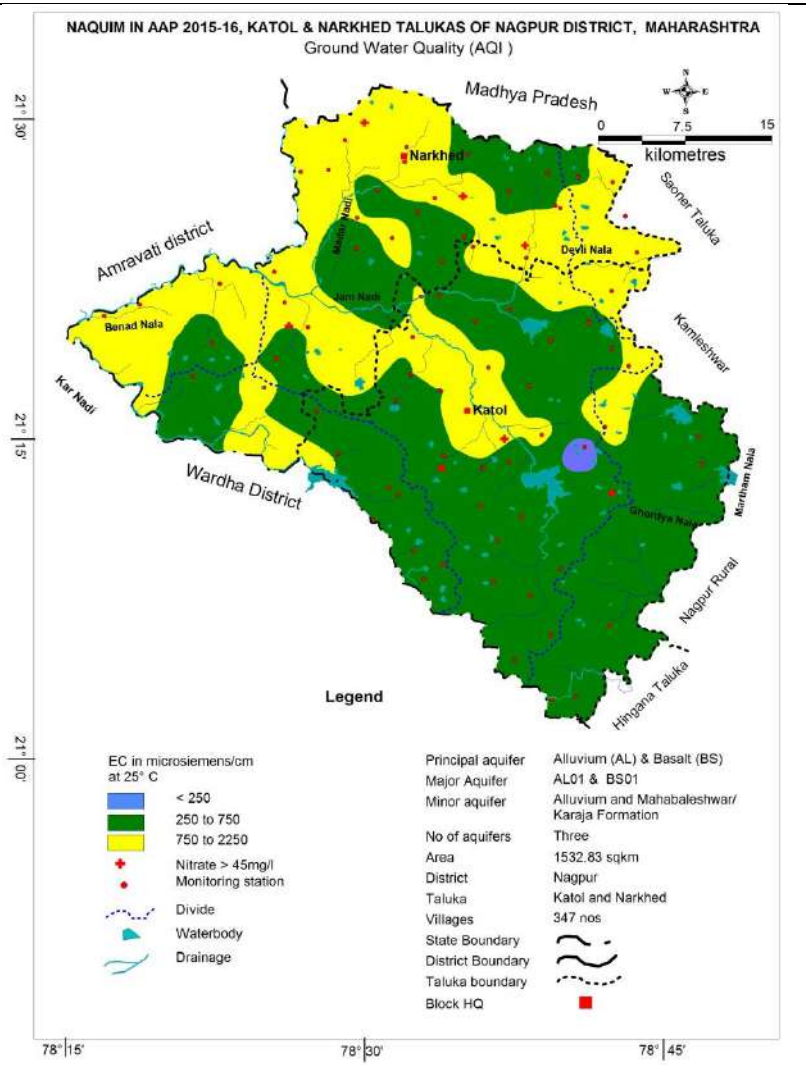


Fig. 3.13: Aquifer-II, Iso conductivity, Katol and Narkhed taluka, Nagpur district

3.6 3-D and 2-D Aquifer Disposition

Based on extensive analysis of historical data, micro level hydrogeological survey data generated and ground water exploration carried out Narkhed and Katol, the following three types of aquifers has been demarcated and the details of ground water exploration is given in **Annexure-II**. A generalised sub-surface aquifer disposition maps of Aquifer I, II & III, has been prepared and shown in **Fig 3.14 a.** The ground water exploration data has been used to generate the 3D disposition of deeper basaltic aquifers. It comprises of all existing litho-units and the zones tapped during the ground water exploration, forming an aquifer. Based on the ground water exploration and micro-level hydrogeological survey, lithological Fence diagram has been generated and shown in **Fig. 3.14 b**. The aquifer units in each of the formation are listed below:

- **Basalt** –
  - Aquifer - I (Shallow Aquifer) from 5 to 32m bgl (weathered / fractured Basalt)
  - Aquifer - II (Deeper Aquifer) from 32 to 160 m bgl (Jointed / fractured Basalt)
- **Sandstone** – (Trap cover Gondwana)
  - Aquifer – III (Deeper Aquifer) from 59 to 300 m bgl (Sandstone)

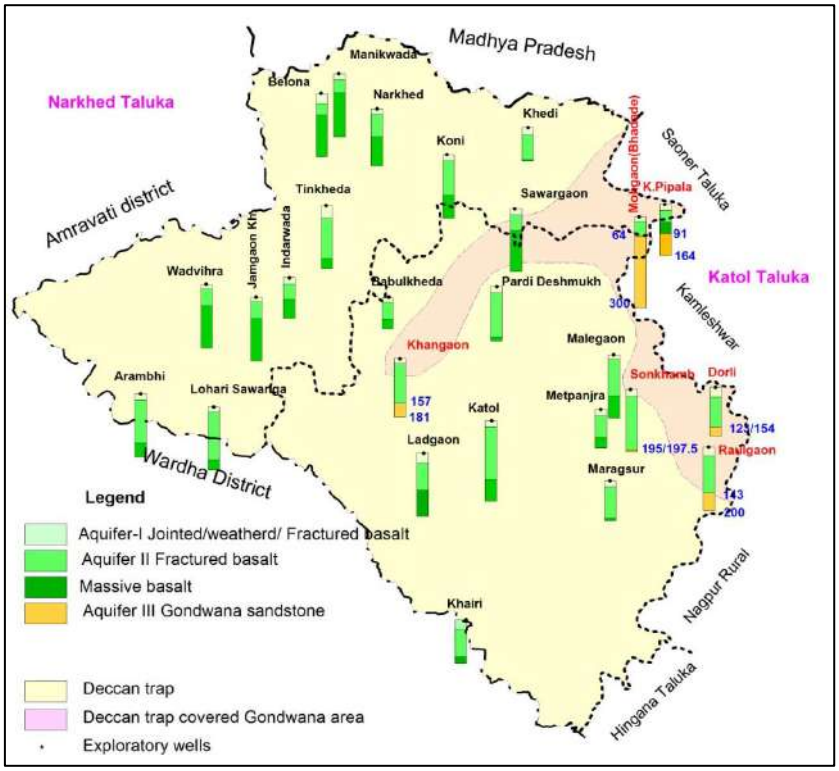


Fig. 3.14 a: Sub surface Aquifer disposition based on litholog, Katol and Narkhed taluka, Nagpur district

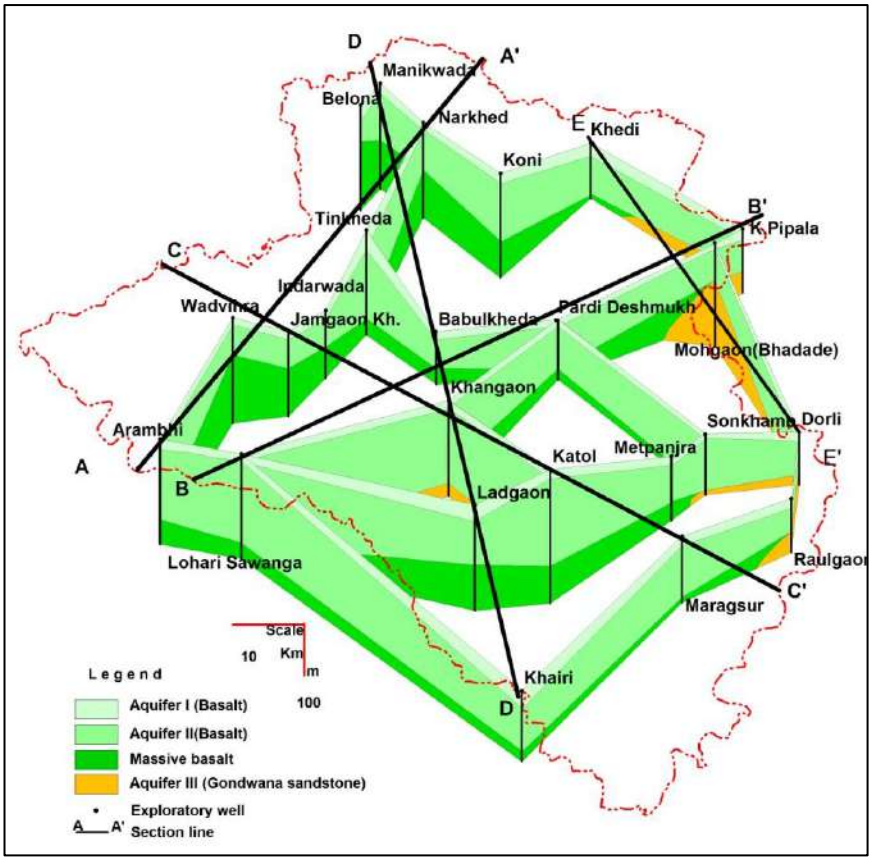


Fig. 3.14 b: 3-D Fence diagram, Katol and Narkhed taluka, Nagpur district

To visualize the Aquifer-I, Aquifer-II and Aquifer-III, a schematic 3-D aquifer disposition has been prepared and shown in **Fig. 3.15.**

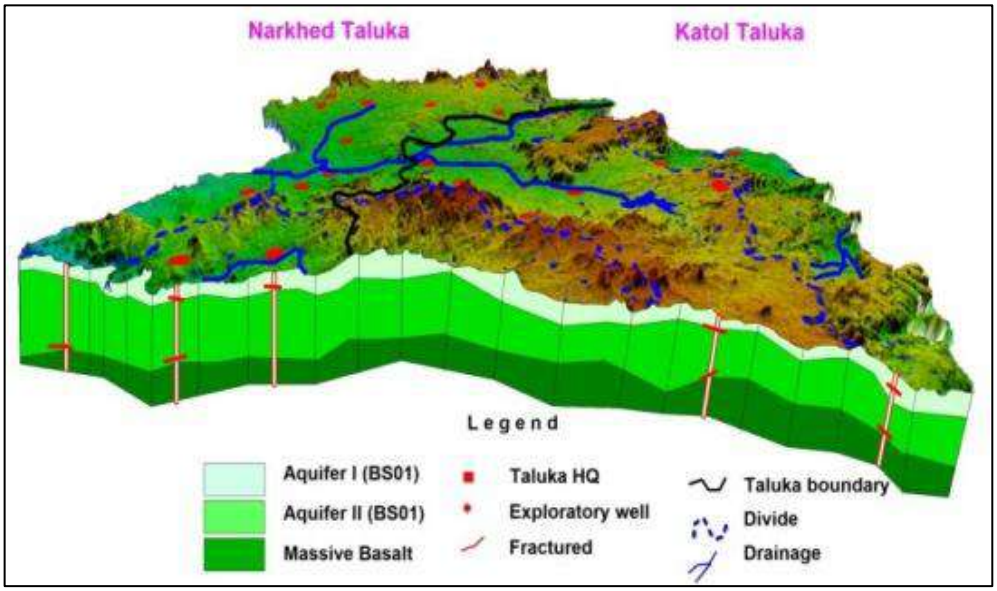


Fig. 3.15: Schematic 3-D Aquifer Disposition, Katol and Narkhed taluka, Nagpur district

3.6.1 Hydrogeological Cross Sections

Based on ground water exploration a sub-surface lithological section has been prepared to know the lithological continuity and its extent. The aquifer disposition in detail, various

hydrogeological cross section indicating aquifer geometry has been prepared viz. A-A' representing southwest– northeast direction (western part), B-B' representing southwest–northeast direction, C-C' representing northwest-southeast direction, D-D' representing north-south direction and E-E' representing north-east direction (in eastern part) as marked in **Fig. 3.14 b.** The sections are shown in **Fig 3.16 a** to **3.16 e.**

3.6.1.1 Hydrogeological Cross Section A-A'

Section A-A' represents the entire basaltic terrain sub-surface hydrogeology & aquifer disposition along Arambhi to Narkhed area, down to 200m bgl. The data of 4 exploratory wells i.e., Arambhi, Wadvihira, Tinkheda and Narkhed has been utilised. The Basalt has been encountered down to depth of 200 m bgl. The thickness of massive basalt/basement is observed more in Wadvihira and Narkhed. The water levels have also been depicted in the section and a close observation of water level indicates that the water levels of both shallow and deeper aquifer-I and II are almost coinside except around Arambhi area.

3.6.1.2 Hydrogeological Cross Section B-B'

Section B-B' represents the major part consisting of basaltic terrain with partial Sandstone aquifer sub-surface hydrogeology & aquifer disposition along Lohari Sawanga to K. Pipala, down to 200m bgl. The data of 3 exploratory wells i.e., Lohari Sawanga, Khangaon and K. Pipala has been utilised. The Sandstone (Deeper Aquifer-III, TCG) has been encountered down to depth of 157 m bgl in Khangaon while in K. Pipala it is encountered at 83.50 m bgl. The thickness of of Sandstone aquifer is increased from Khangaon to K. Pipla. The water levels have also been depicted in the section and it indicates that the water levels of both shallow and deeper aquifer-I and II are entirely distinct. The Aquifer-I (Shallow) has water levels residing within the aquifer zone. In Aquifer-II (deeper) it is observed that water level is deeper in entire basaltic terrain while it is shallow wherever the Sandstine aquifer encounters, due to to its confined/semi-confined nature in Aquifer-III.

3.6.1.3 Hydrogeological Cross Section C-C'

Section C-C' represents the major part consisting basaltic terrain sub-surface hydrogeology & aquifer disposition except at central part where Sandstone encountered, along Wadvihira to Maragsur, with depth ranging from 126m to 200m bgl. The data of 5 exploratory wells i.e., Wadvihira, Jamgaon Kh, Khangaon, Katol and Maragsur has been utilised. The Sandstone (Deeper Aquifer-III, TCG) has been encountered down to depth of 157 m bgl only in Khangaon. The thickness of Aquifer-II (Deeper aquifer) is found relatively more in & around Katol. The water levels have also been depicted in the section and it indicates that the water levels of both shallow and deeper aquifer-I and II are almost coinside.

3.6.1.4 Hydrogeological Cross Section D-D'

Section D-D' represents the major part consisting of basaltic terrain sub-surface hydrogeology & aquifer disposition except at central part where Sandstone encountered, along Manikwada to Khairi, with depth ranging from 116m to 200m bgl. The data of 5 exploratory wells i.e., Manikwada, Belona, Khangaon, Ladgaon and Khairi has been utilised. The Sandstone (Deeper Aquifer-III, TCG) has been encountered down to depth of 157 m bgl only in Khangaon. The thickness of Aquifer-II (Deeper aquifer) is found relatively less in & around Belona. The water levels have also been depicted in the section and it indicates that the water levels of both shallow and deeper aquifer-I and II are almost coinside.

3.6.1.5 Hydrogeological Cross Section E-E'

Section E-E' represents the major part consisting of Sandstone terrain sub-surface hydrogeology & aquifer disposition except around Khedi where Basalt encountered, along Khedi to Raulgaon, with depth ranging from 105 m to 300 m bgl. The data of 4 exploratory wells i.e., Khedi, Mohgaon Bhadade, Dorli, and Raulgaon has been utilised. The Sandstone (Deeper Aquifer-III, TCG) has been encountered at different depths of 59 m bgl (at Mohgaon Bhadade) , 123 m bgl (at Dorli), and 143 m bgl at (Raulgaon). The thickness of Aquifer-III (Deeper aquifer, TCG, Sandstone) is found 93 m in & around Mohgaon Bhadade in 300 m bgl drilled EW. The water levels have also been depicted in the section and it indicates that the water levels of both shallow and deeper aquifer-I and II are almost coinside.The discharge is very high in TCG formation may be due to confined/semi-confined nature of Aquifer-III.

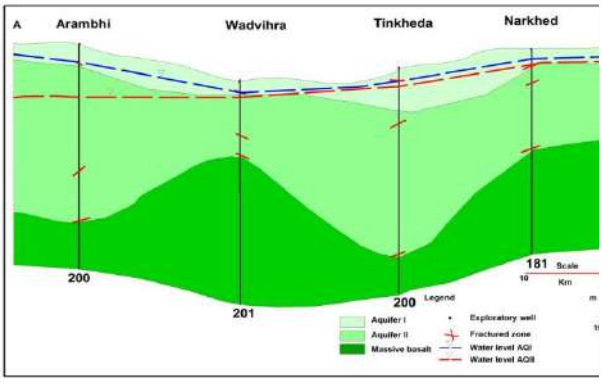


Fig. 3.16 (a): Lithological section A-A', Katol and Narkhed taluka, Nagpur district

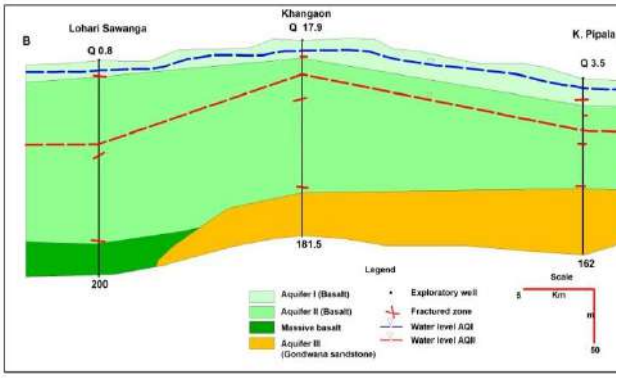


Fig. 3.16 (b): Lithological section B-B', Katol and Narkhed taluka, Nagpur district

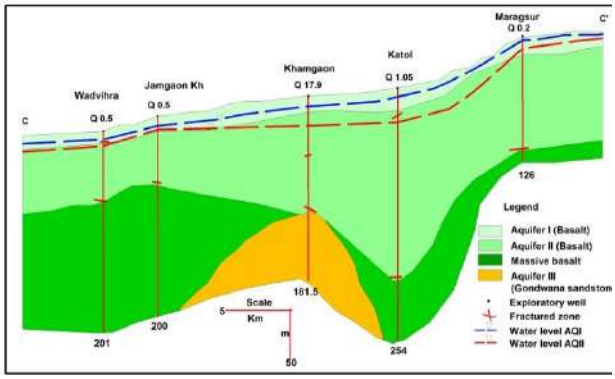


Fig. 3.16 (c): Lithological section C-C', Katol and Narkhed taluka, Nagpur district

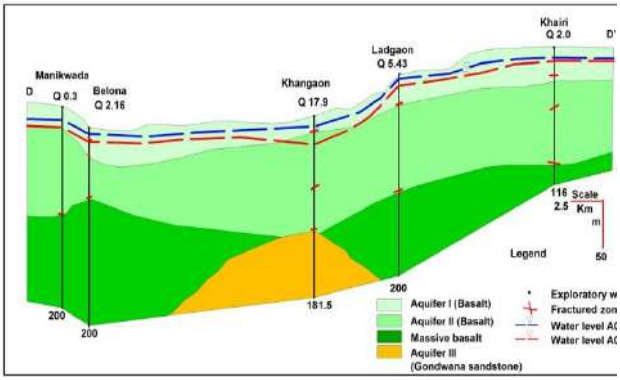


Fig. 3.16 (d): Lithological section D-D', Katol and Narkhed taluka, Nagpur district

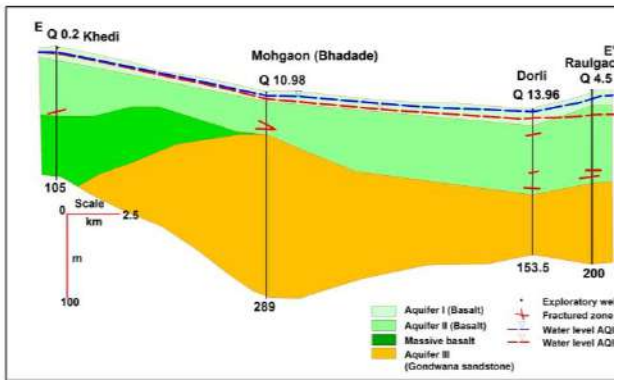


Fig. 3.16 (e): Lithological section E-E', Katol and Narkhed taluka, Nagpur district

3.7 Aquifer Characteristics

Although, basalt is the only formation exposed in the area and forms the major aquifer but sandstone (Gondwana Formation) is also plays a vital role in aquifer-III i.e., Trap covered Gondwana (TCG). At some places, alluvium occurs in along the Wardha, Madar and Jam river in Narkhed taluka, however, it does not form as potential aquifer. The summarised aquifer charachteristics are presented in **Table 3.2**.

Table 3.2 Aquifer Characteristic of Katol and Narkhed Taluka, Nagpur district

Type of Aquifer	Formation	Depth range of the aquifers (mbgl)	SWL (mbgl)	Thickness (m)	Fractured encountered (mbgl)	Yield	Sustainability	Aquifer parameter (Transmissivity – m^2/day)	Sy/S	Suitability for drinking/ irrigation
Aquifer-I	Weathered / Fractured Basalt	5-32	4.60 to 23.15	5 to 27	Upto 32	35-110 (m^3/day)	0.5 to 2 hours	3.5 to 45	0.02	Suitable for both (except Nitrate affected villages for drinking)
Aquifer-II	Jointed / Fractured Basalt	32-160	6 to 30	0.5 to 9	Upto 160	50-150 (lps)	2 to 5 hours	10 to 300	1.0×10^{-4} to 5.5×10^{-5}	Suitable for both except at Maragsur (Fluoride contamination)
Aquifer-III (TCG)	Sandstone	59-300	26.50 to 40.70	2.5 to 24.4	--	1.37 to 17.90 (lps)	12 to 16 hours	9.32	9.8×10^{-3} to 1.14×10^{-4}	Suitable for both.

Basalt is the main rock type of the area and comprises two distinct units viz, upper vesicular unit and lower massive unit. The massive basalt is hard, compact and does not have primary porosity and hence impermeable. Weathering, jointing and fracturing induces secondary porosity in massive unit of basalt. In vesicular basalt, when vesicles are interconnected constitutes good primary porosity and when the vesicles are filled/ partly filled the porosity is limited. Ground water occurs under phreatic/ unconfined to semi-confined conditions in basalts. A total of 8 lava flows were demarcated based on GSI maps and ground water exploration. The Basaltic flow map is shown in **Fig 3.1.** The occurrence of red bole beds are plays major role in local hydrogeological conditions. It is observed that in Katol taluka red bole encountered at 25 m bgl having thickness > 3m at Sonoli

village. While on surface it is observed at 435 to 445 m aMSL elevation near Ghubadmet village; about 445 to 452 m aMSL near Pathar village. In Narkhed taluka, during ground water exploration, red bole encountered at 10m , 14 to 18 m and 25 m bgl at Sonoli village; at about 27 m bgl in Rohna village. While at surface it is exposed at an elevation of 440 to 450 m aMSL in and around village Pipla. The 3-D disposition of Basalt aquifer is shown in **Fig. 3.14b & 3.15** and the aquifer characteristics are presented in **Table- 3.2**.

Aquifer-I in the area predominantly consists of weathered fractured and jointed basalt and exposed almost covering entire area. It is 'Unconfined Shallow Aquifer', occurs in Deccan trap basalt. Ground water is present in pore spaces in the vesicular unit of each flow and in the weathered fractured and jointed portions of massive unit. However, secondary porosity and permeability that has been developed due to weathering and fracturing play a very important role in the storage and movement of ground water. Weathering not only produces granular materials but also widens the fractures, joint and shear zones and constitute ground water potential aquifers in the area.

The Aquifer-I is observed in the depth range of 5 to 32 m bgl with water levels of 4.60 to 23.15 m bgl and thickness of 5.00 to 27.00 m. The fractures are encountered upto 32 m bgl. The yield of the dugwells tapping this aquifer generally ranges from 35 to 110 m^3/day which susitains from 0.5 to 2 hs. The transmissivity ranges from 3.5 to 45 m^2/day. The overall groundwater quality is suitable for both drinking/domestic and irrigation purposes except at few villages where nitrate contamination is observed. Based on Ground Water Exploration, map of Aquifer –I depicting depth of occurrence and fractured rock thickness is generated and shown in **Fig 3.17.**

Dugwells tapping Basalt in western part and along Wardha river of Narkhed Taluka is high and ranges between 50 to 100 m3/day. Around 60% area of Narkhed taluka covering basaltic formation is having moderate yield in the range of 25 to 50 m^3/day. Rest of the taluka is having low yield in the range of 15 to 25 m^3/day. Whereas, In Katol taluka, around 60% area covering basaltic formation of is having moderate yield of dugwells in the range of 25 to 50 m^3/day. About 40% areas is having low yield in the range of 15 to 25 m^3/day. Rest of the area excluding hilly part is having poor yield upto 15m^3/day. The yield potential map of Aquifer-I for Katol and Narkhed taluka is shown in **Fig. 3.18**.

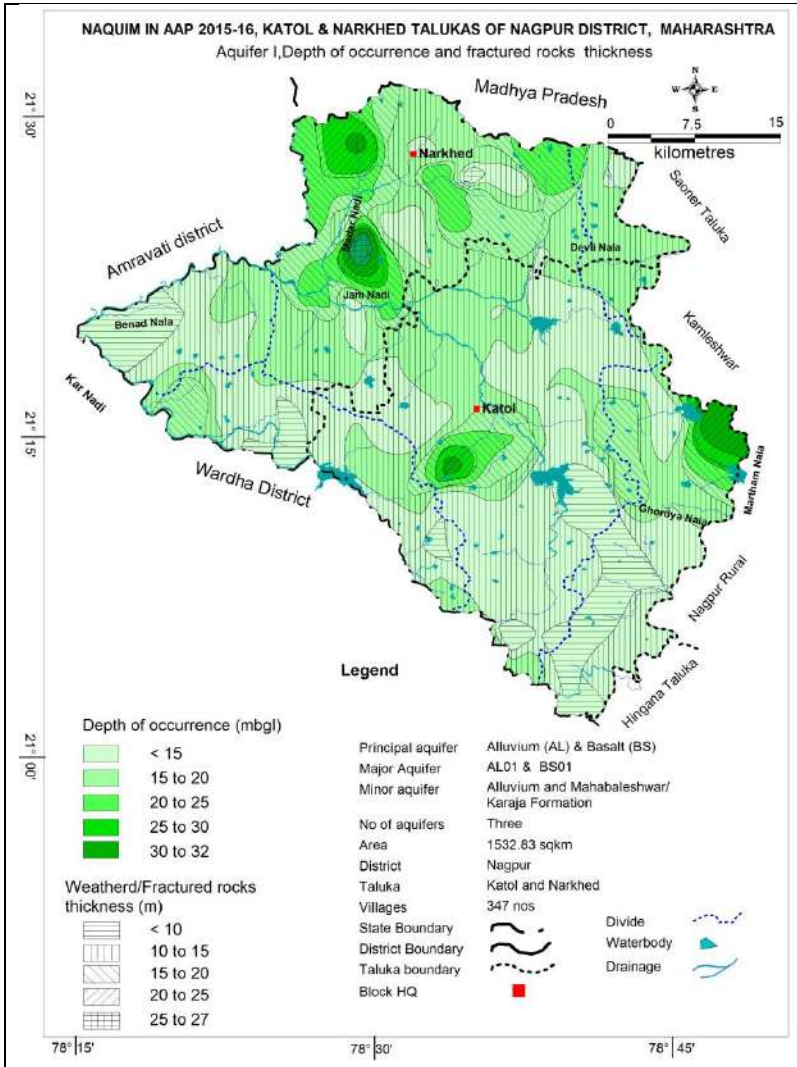


Fig. 3.17: Depth of occurrence & fractured rock thickness of Aquifer-I (shallow), Katol and Narkhed taluka, Nagpur district

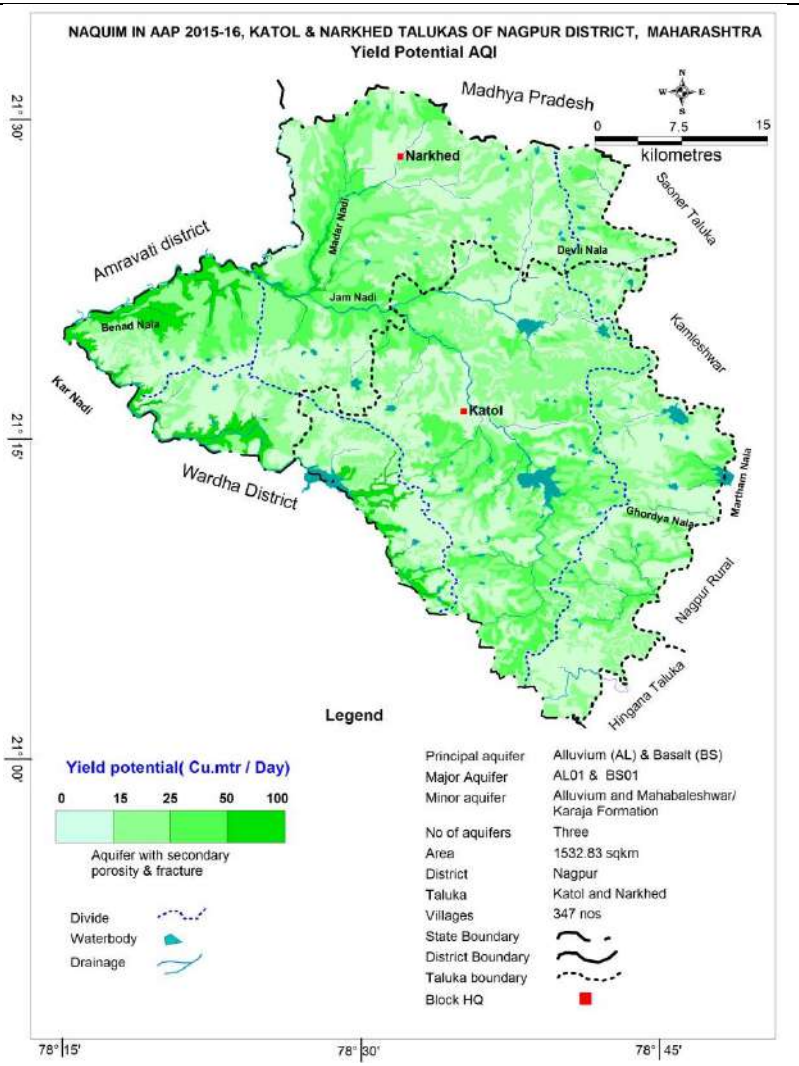


Fig. 3.18: Aquifer-I (shallow), Yield potential, Katol and Narkhed taluka, Nagpur district

Aquifer II – Semi-confined to Confined Deeper Aquifer. Generally occurs in Deccan trap basalt which is exposed in major parts. The Aquifer-II is observed in the depth range of 32 to 200 m bgl with water levels of 6.00 to 30.00 m bgl and thickness of 0.50 to 9.00 m. The fractures are encountered upto 160 m bgl. The yield of the dugwells tapping this aquifer generally ranges from 50 to 150 lps which susitains from 02 to 5 hs. The transmissivity ranges from 10 to 300 m^2/day. The overall groundwater quality is suitable for both drinking/domestic and irrigation purposes except at Maragsur where fluoride contamination is observed. Based on Ground Water Exploration, map of Aquifer –I depicting depth of occurrence and fractured rock thickness is generated and shown in **Fig 3.19**. A perusal of Fig. 3.19 shows that the depth of occurrence of fractures is limited upto 160 mbgl with a thickness of fractures range between 0.5 to 9 m.

The data of exploratory wells reveals that, in Narkhed Taluka high yielding area is restrict to northeastern part of the Narkhed taluka and ranges between 1 to >2 lps in terms of sustainability. Rest of the area is having moderate to low yield in upto 1 lps. Whereas, In Katol taluka, northern part is having moderate to high yield of bore wells in the range of 0.5 to >2 lps. While southern part is having low to moderate upto 1 lps. The yield potential map of Aquifer-II for Katol and Narkhed taluka is shown in **Fig. 3.20.**

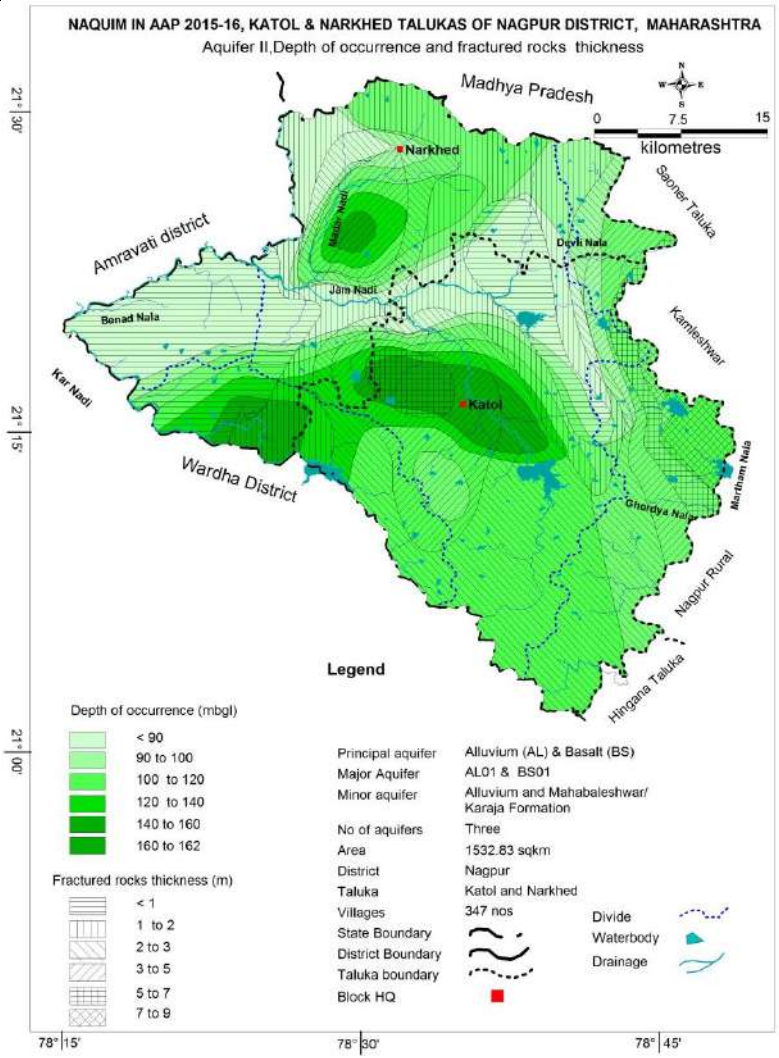


Fig. 3.19: Depth of occurrence & fractured rock thickness of Aquifer-II (deeper), Katol and Narkhed taluka, Nagpur district

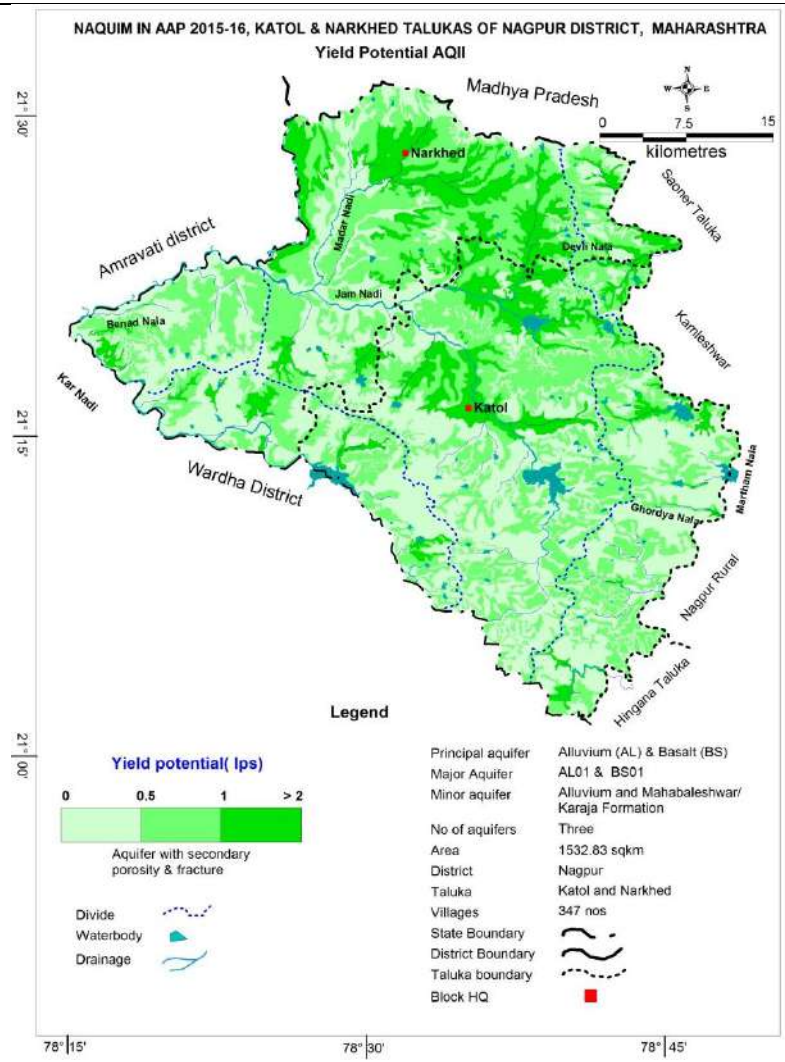


Fig. 3.20: Aquifer-II (deeper), Yield potential, Katol and Narkhed taluka, Nagpur district

The cumulative aquifer group thickness map consisting of Aquifer-I and II as been prepared and presented as **Fig. 3.21**.

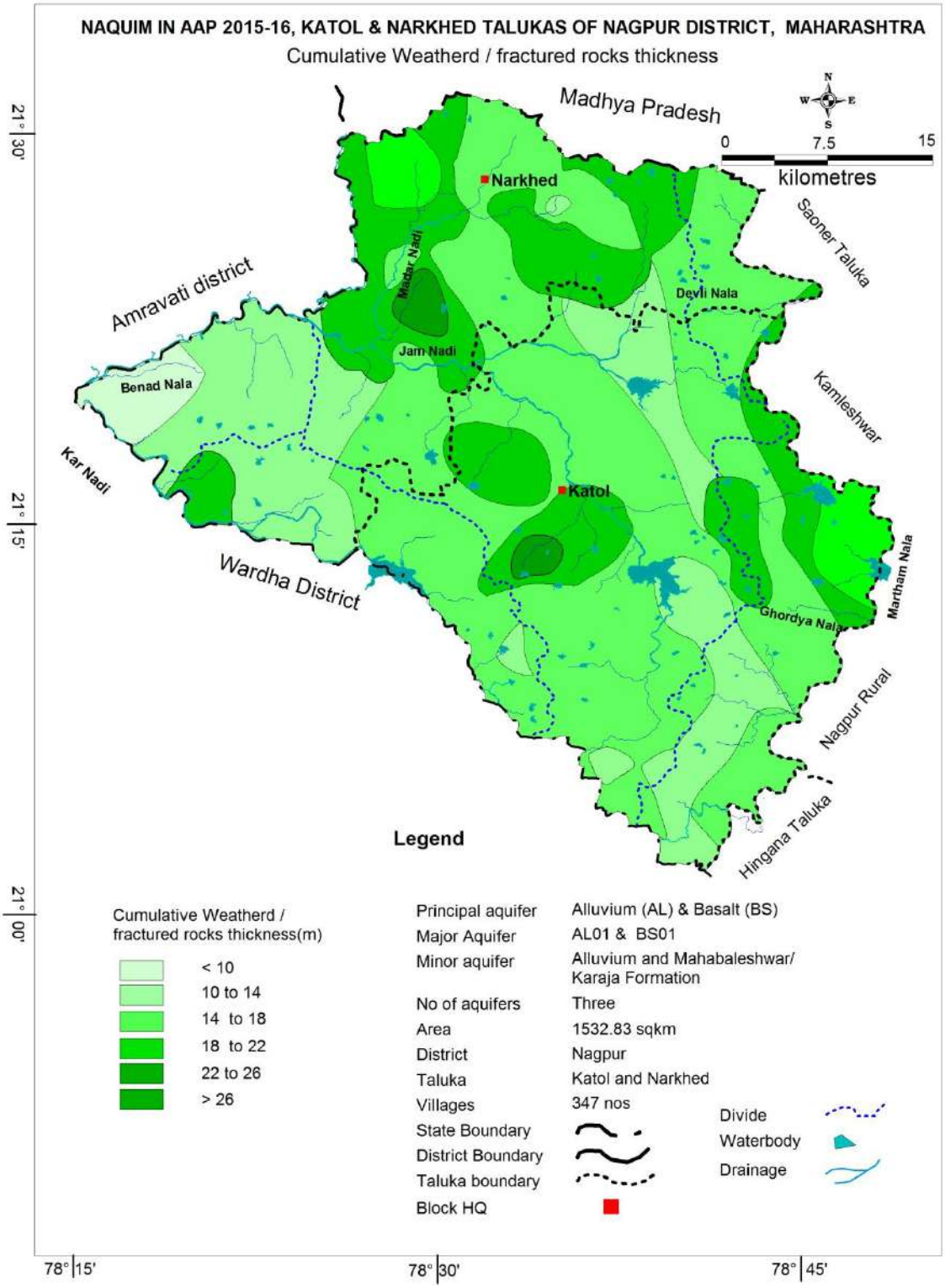


Fig. 3.21: Aquifer group thickness of I and II (fractured rock thickness), Katol and Narkhed taluka, Nagpur district

Aquifer III - Semi-confined to confined Deeper Sandstone Aquifer. Generally occurs as semi-confined to confined conditions. The upper hard formation (Basalt) is followed by the soft formation (Sandstone), which is a reversal of the formation in terms of ground water well construction. Due to

which most of the people in the area have difficulties to tap the potential of Sandstone aquifer occupying below Basalt as it is very costly to construct tube well penetrating huge pile of hard rock. During the ground water exploration, it has been observed that the thickness of hard basalt encountered from 59 m bgl (Mohgaon Bhadade), 83.50 m (Pipala K.), 123 m bgl (Dorli), 143 m bgl (Raulgaon), 157 m bgl (Khangaon) to 195.1 m bgl (Sonkhamb). The thickness of potential sandstone aquifer is varying from 2.5 to 24.4 mbgl. The water level in these tube wells is observed from 11.27 mbgl (Sonkhamb) to 40.70 mbgl (Pipla K.). The thickness of granular zone is limited upto 160 mbgl (**Fig 3.22)**. The yield of the Aquifer-III is recorded moderate to high and the discharge recorded ranges from 5.94 lps (Mohgaon) to 17.90 lps (Khangaon) **(Fig 3.23)**.

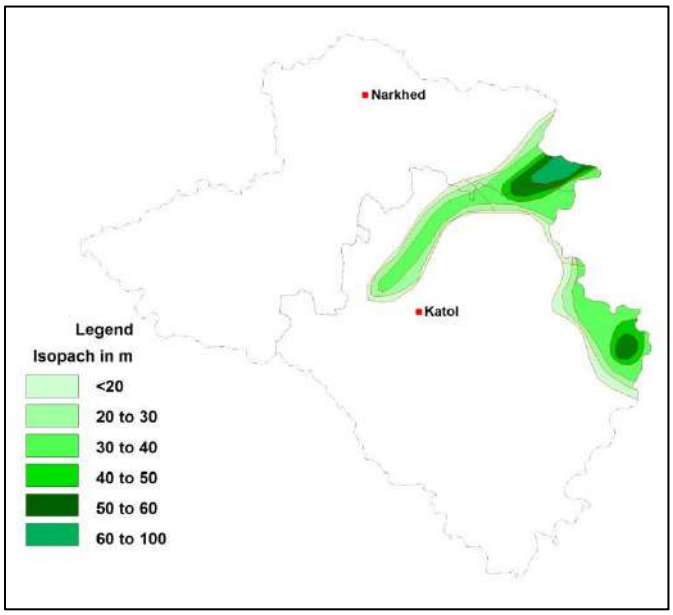


Fig. 3.22: Thickness of granular zones, Aquifer-III (deeper, TCG), Katol and Narkhed taluka, Nagpur district

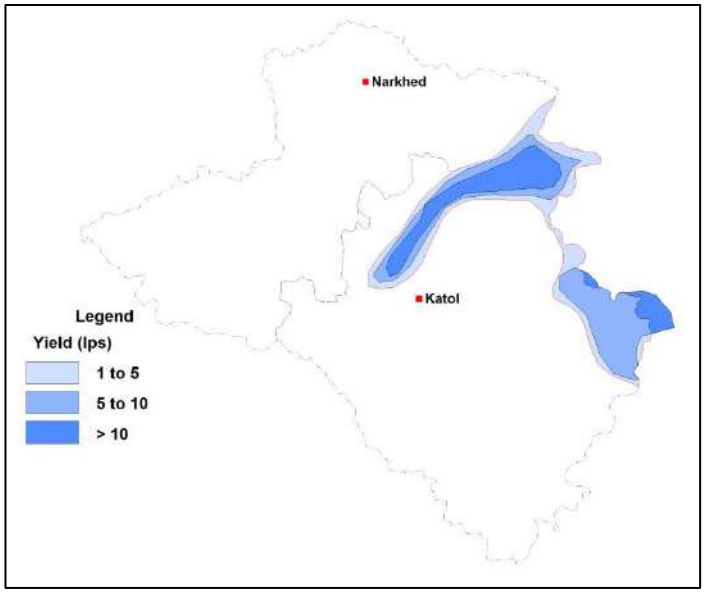


Fig. 3.23: Yield potential,l Aquifer-III (deeper, TCG), Katol and Narkhed taluka, Nagpur district

4 Ground Water Resources

The ground water resources have been assessed for three types of aquifer existing in the area i.e., Aquifer-I, Aquifer-II and Aquifer-III. The details of the assessment are discussed below.

4.1 Ground Water Resources – Aquifer-I

The ground water resource assessment as on March 2013 has been carried out and the salient features of the resources are given in **Table 4.1, 4.2** and **4.3** and the map depicting the taluka wise distribution of ground water resources and categorisation of the talukas is presented in **Fig 4.1.**

As per **Table-4.1**, out of the total 1,53,283 ha area, recharge worthy areas are 8,615 ha in command areas and 1,11,001 ha in non-command areas.

Table 4.1: Ground Water Recharge Worthy Areas for Resource Estimation

Taluka	Predominant Formation	Total Geographical Area (ha)	Hilly Area (ha)	Ground Water Recharge Worthy Area	
				Command area (ha)	Non-command area (ha)
Katol	Basalt	73463.00	18170.00	3832.00	51461.00
Narkhed	Basalt	79820.00	15497.00	4783.00	59540.00
Total		**153283**	**33667**	**8615**	**111001**

4.1.1 Recharge Parameters

During monsoon season, the rainfall recharge is the main recharge parameter, which is estimated as the sum total of the change in storage and gross draft. The change in storage is computed by multiplying groundwater level fluctuation between pre and post monsoon periods with the area of assessment and specific yield. Monsoon recharge can be expressed as:-

$R = h \times Sy \times A + DG$

where,

h = rise in water level in the monsoon season, S_y = specific yield

A = area for computation of recharge, D_G = gross ground water draft

The specific yield value as estimated from dry season balance method or field studies was taken, wherever available. In absence of field values of specific yield values through above methods recommended values as per GEC-1997 norms has been taken. The specific yield value for Deccan Traps - 0.002 to 0.03. Here, the value for Specific yield is taken as 0.02.

The monsoon ground water recharge has two components- rainfall recharge and recharge from other sources. The other sources of groundwater recharge during monsoon season include recharge from rainfall, seepage from canals, surface water irrigation, tanks and ponds, ground water irrigation, and water conservation structures.

During the non-monsoon season, rainfall recharge is computed by using Rainfall Infiltration Factor (RIF) method. Recharge from other sources is then added to get total non-monsoon recharge. As the area is occupied by Deccan traps, the factor is taken as 0.07 to 0.14 depending on the formation, which is weathered basalt and vesicular jointed basalt. The details of Recharge parameters are given in **Table 4.2.** It is estimated that the *recharge from rainfall during monsoon season* is 12432.77 while it is 2204.13 during non-monsoon. Considering the *natural discharges* of 1034.72 ham, *net ground water availability* estimated as 19659.61 ham.

Table 4.2: Recharge components evaluated Ground Water Resources Estimation

Taluka	Command / Non-Command / Total	Recharge from rainfall during monsoon season (ham)	Recharge from other sources during monsoon season (ham)	Recharge from rainfall during non-monsoon season (ham)	Recharge from other sources during non-monsoon season (ham)	Total Annual Ground Water Recharge (ham)	Provision for Natural Discharges (ham)	Net Annual Ground Water Availability (ham)
Katol	Command	439.54	30.76	73.77	1562.55	2106.61	105.33	2001.28
	Non Command	5537.12	48.98	961.12	1398.30	7945.53	397.28	7548.25
	Total	5976.66	79.74	1034.89	2960.85	10052.14	502.61	9549.53
Narkhed	Command	537.20	69.90	89.54	1134.03	1830.67	91.53	1739.14
	Non Command	5918.91	52.12	1079.70	1760.80	8811.53	440.58	8370.95
	Total	6456.11	122.02	1169.24	2894.83	10642.20	532.11	10110.09
Area Total		**12432.77**	**201.76**	**2204.13**	**5855.68**	**20694.34**	**1034.72**	**19659.62**

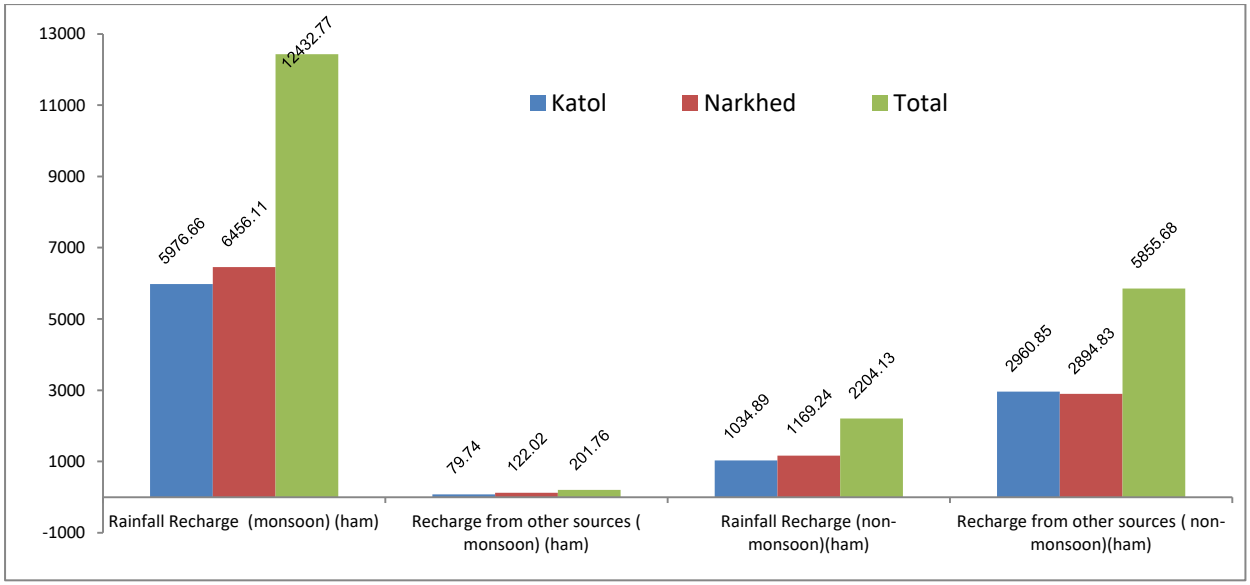


Fig.4.1: Season wise recharge from various sources, Katol and Narkhed taluka, Nagpur district

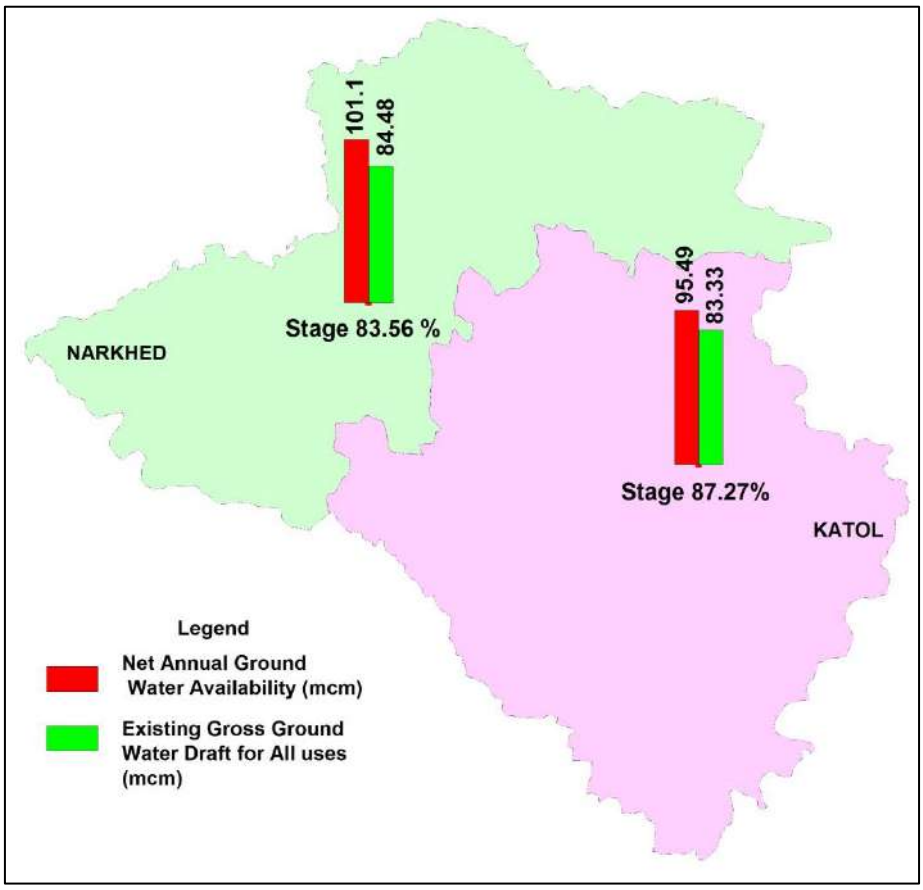
4.1.2 Other Parameters

The discharge parameters include natural discharge in the form of springs and base flow and discharge for ground water irrigation, domestic and industrial draft. The net annual ground water availability comes to be 19659.62 ham. The annual gross draft for all uses is estimated at 16782.34 ham with irrigation sector being the major consumer having a draft of 15735.28 ham. The annual draft for domestic and industrial uses was 1047.06 ham. The allocation for domestic & industrial requirement supply up to next 25 years is about 1933.08 ham (Table 4.3). The stage of ground water development of Katol and Narkhed taluka is 87.27 % and 83.56 % respectively (Fig.4.2). Although the stage of ground water development is more than 80 % there is no significant

fall in ground water level trend noticed and hence, both the talukas are categorised as 'Safe'. The details of ground water resources are given in **Table 4.3.**

Table 4.3 Ground water resources,Aquifer-I(Shallow, weathered/jointed Basalt), Katol and Narkhed taluka (2013)

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
Katol	Command	2001.28	2439.17	174.68	2613.85			
	Non Command	7548.25	5405.63	314.44	5720.07			
	Total	9549.53	7844.80	489.12	8333.92	875.26	1477.75	87.27/SAFE
Narkhed	Command	1739.14	1031.62	53.24	1084.86			
	Non Command	8370.95	6858.86	504.70	7363.56			
	Total	10110.09	7890.48	557.94	8448.42	1057.82	1201.01	83.56/SAFE
Area total		19659.62	15735.28	1047.06	16782.34	1933.08	2678.76	



4.2 Ground Water Resources – Aquifer-II and Aquifer-III

The ground water resource of the aquifer – II (Basalt) and III (TCG) were also estimated to have the corret quantification of resources so that proper management strategy can be framed.

To assess these resources of Auqifer-II (Basalt), the area was divided into 19 polygons (9 in Katol & 10 in Narkhed) based on fractured rock thickness occurring below water level and the thickness of aquifer –II in that particular polygon (if present). Like-wise, to assess these resources of Auqifer-III (TCG), the area was divided into 30 polygons (19 in Katol & 11 in Narkhed) based on the granular zones occurring below water level and the thickness of aquifer –III in that particular polygon. Then the storativity value for the nearest exploratory well was taken into consideration. By applying the formula of deeper ground water resource estimation as given by CGWB, CHQ during the static ground water resources was utilised i.e.,

GWR = Area x Thickness of aquifer x Storativity

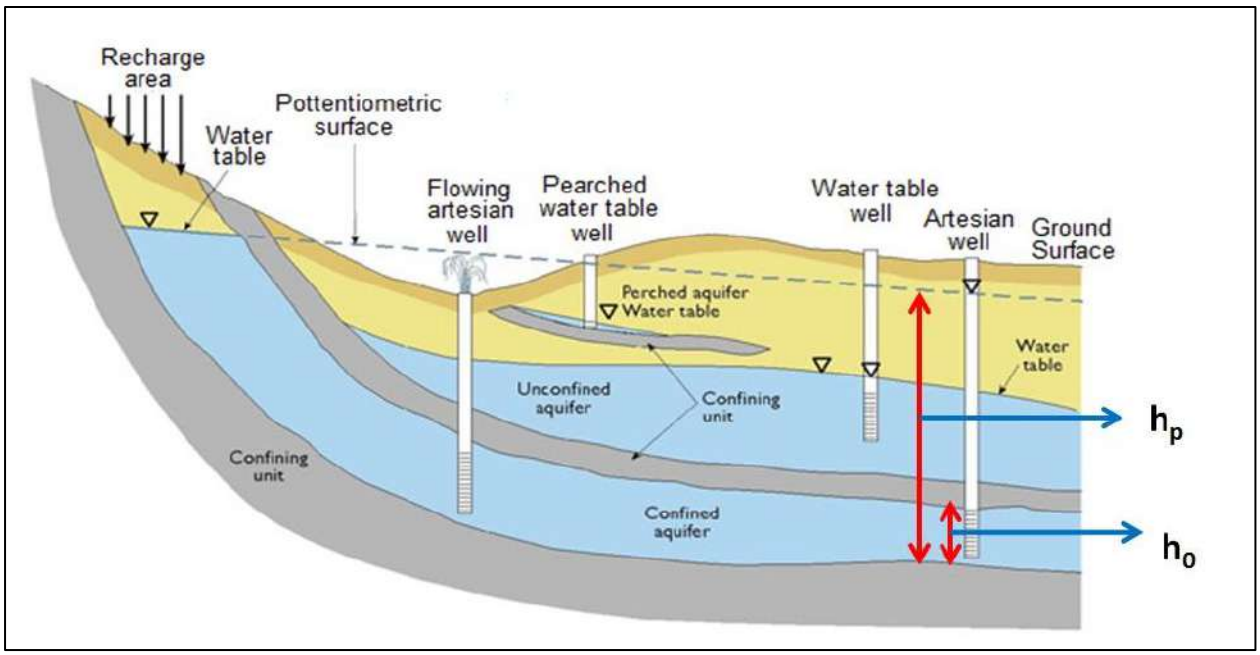
However, for Trap covered Gondwana Sandtone Aquifer-III, following formulae were used to estimate the resources,

$$\boldsymbol{Qp = S * A * (hp - ho)} \text{ and } \boldsymbol{Q = Sy * A * ho}$$

Where,

S- Storativity, Sy- Specific yield, A- Area,

ho- Saturated thickness of aquifer, hp- piezometric head



By applying above formula the ground water resources of aquifer-II and III were estimated and are presented below in **Table- 4.4 & 4.5**. Thus the total resources of aquifer-II and III have been estimated as 11.36 and 111.10 MCM respectively. It is observed that the Stanstone Aquifer-III (TCG) has huge ground water potential.

Table 4.4: Ground Water Resources of Aquifer-II (Deep, fractured basalt)

Taluka	Fractured Rock Thickness (m)	X	Y	Area (Sqkm)	Storativity	Resource (MCM)
Katol	0.75	78.5857	21.3913	49.7262	0.000125	0.004661831
Katol	1.5	78.5542	21.3661	82.651	0.00347	0.430198455
Katol	2.5	78.4469	21.3767	3.47485	0.000125	0.001085891
Katol	2.5	78.4599	21.2952	321.586	0.00347	2.78975855
Katol	4	78.4755	21.2993	109.631	0.00347	1.52167828
Katol	4	78.6863	21.3589	59.8536	0.00245	0.58656528
Katol	6	78.5038	21.2993	33.9067	0.00245	0.49842849
Katol	6	78.708	21.3349	32.8331	0.000125	0.024624825
Katol	8	78.7323	21.3129	40.9544	0.00245	0.80270624
Katol	3.916667			734.61685	0.000125	6.659707842
Narkhed	0.75	78.5857	21.3913	24.9735	0.00347	0.064993534
Narkhed	0.75	78.3594	21.3185	230.12	0.00245	0.4228455
Narkhed	1.5	78.5542	21.3661	249.545	0.00245	0.917077875
Narkhed	2.5	78.4469	21.3767	69.1815	0.00245	0.423736688
Narkhed	2.5	78.4599	21.2952	30.0988	0.00245	0.18435515
Narkhed	4	78.4755	21.2993	67.6046	0.00347	0.938351848
Narkhed	4	78.6863	21.3589	54.4107	0.00347	0.755220516
Narkhed	4	78.4577	21.385	68.9179	0.00347	0.956580452
Narkhed	6	78.5038	21.2993	1.75278	0.00347	0.03649288
Narkhed	6	78.708	21.3349	1.60251	0.000125	0.001201883
Narkhed	3.2			798.20729	0.00245	4.700856324

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

Taluka	Fractured Rock Thickness (m)	Area (Sq km)	Storativity	Resource (MCM)
Katol	3.92	734.62	0.000125	6.66
Narkhed	3.2	798.21	0.00245	4.70
Total	--	--	--	11.36

Table 4.5: Ground Water Resources of Aquifer-III (Trap Covered Gondwana)

SN	Taluka	Area	Longitude	Latitude	Mean thickness of gondwana fm	Depth of piezometric head (mbgl)	Depth of top of Gondwana fm	Head of Pz above top of Gondwana fm	Sy	S	Resource above top of Gondwana fm	Resource within Gondwana fm	Resource of AQIII
1	Katol	0.000806	78.7157	21.3852	45	41	100	59	0.015	0.000114	5.42376E-06	0.000544311	0.000549735
2	Katol	0.061192	78.6416	21.3849	25	26.5	140	113.5	0.015	0.000114	0.000791762	0.022946963	0.023738724
3	Katol	0.093868	78.7187	21.3871	55	41	100	59	0.015	0.000114	0.000631353	0.077440688	0.07807204
4	Katol	0.258415	78.7386	21.3189	25	41	100	59	0.015	0.000114	0.001738099	0.096905625	0.098643724
5	Katol	0.330564	78.7441	21.3183	35	41	100	59	0.015	0.000114	0.002223373	0.1735461	0.175769473
6	Katol	0.360981	78.6458	21.3879	25	41	100	59	0.015	0.000114	0.002427958	0.135367875	0.137795833
7	Katol	2.84861	78.7061	21.3802	45	41	100	59	0.015	0.000114	0.019159751	1.92281175	1.941971501
8	Katol	3.21374	78.6957	21.3833	55	41	100	59	0.015	0.000114	0.021615615	2.6513355	2.672951115
9	Katol	3.23625	78.7024	21.3616	25	41	100	59	0.015	0.000114	0.021767018	1.21359375	1.235360768
10	Katol	4.42041	78.7132	21.3409	10	41	100	59	0.015	0.000114	0.029731678	0.6630615	0.692793178
11	Katol	4.62091	78.7897	21.2404	55	36.52	143	106.48	0.015	0.000114	0.056091933	3.81225075	3.868342683
12	Katol	7.79566	78.804	21.2445	45	36.52	143	106.48	0.015	0.000114	0.094629334	5.2620705	5.356699834
13	Katol	9.37314	78.602	21.335	10	26.5	140	113.5	0.015	0.000114	0.121279058	1.405971	1.527250058
14	Katol	9.9372	78.747	21.2582	25	37	123	86	0.015	0.000114	0.097424309	3.72645	3.823874309
15	Katol	12.3802	78.7457	21.2543	10	12	195	183	0.015	0.000114	0.258275732	1.85703	2.115305732
16	Katol	13.0063	78.6915	21.3714	35	41	100	59	0.015	0.000114	0.087480374	6.8283075	6.915787874
17	Katol	19.6261	78.5888	21.3375	35	26.5	140	113.5	0.015	0.000114	0.253942108	10.3037025	10.55764461
18	Katol	20.5113	78.5988	21.3353	25	26.5	140	113.5	0.015	0.000114	0.265395711	7.6917375	7.957133211
19	Katol	27.6325	78.7754	21.2618	35	37	123	86	0.015	0.000114	0.27090903	14.5070625	14.77797153
20	Narkhed	0.366918	78.6376	21.3785	35	26.5	140	113.5	0.015	0.000114	0.004747552	0.19263195	0.197379502
21	Narkhed	0.7794	78.627	21.3889	10	26.5	140	113.5	0.015	0.000114	0.010084657	0.11691	0.126994657
22	Narkhed	0.915774	78.633	21.3857	25	26.5	140	113.5	0.015	0.000114	0.0118492	0.34341525	0.35526445
23	Narkhed	1.04613	78.7409	21.3954	45	41	100	59	0.015	0.0098	0.604872366	0.70613775	1.311010116
24	Narkhed	2.81177	78.7436	21.3934	35	41	100	59	0.015	0.0098	1.625765414	1.47617925	3.101944664
25	Narkhed	3.0449	78.6835	21.3986	45	41	100	59	0.015	0.0098	1.76056118	2.0553075	3.81586868
26	Narkhed	5.24555	78.6859	21.4238	10	41	100	59	0.015	0.0098	3.03297701	0.7868325	3.81980951
27	Narkhed	5.66377	78.6904	21.4197	25	41	100	59	0.015	0.0098	3.274791814	2.12391375	5.398705564
28	Narkhed	6.43867	78.679	21.4044	35	41	100	59	0.015	0.0098	3.722838994	3.38030175	7.103140744
29	Narkhed	6.91949	78.7416	21.3997	55	41	100	59	0.015	0.0098	4.000849118	5.70857925	9.709428368
30	Narkhed	8.33215	78.7215	21.4026	80	35	62	27	0.015	0.0098	2.20468689	9.99858	12.20326689

Summerised Ground Water Resources of Aquifer-II

Taluka	Area (sq km)	Mean thickness of Gondwana fm	Sy	S	Utilizable Resource under pressure head (MCM)	Resource in granular zone (MCM)	Total Resource of AQ-III (MCM)
Katol	139.71	32.63	0.015	0.000114	1.61	62.35	63.96
Narkhed	41.56	36.36	0.015	0.0098	20.25	26.89	47.14
Total	--	--	--	--	21.86	89.24	111.10

5 GROUND WATER RELATED ISSUES

The Katol and Narkhed talukas are part of famous 'Orange belt' of Vidarbha region of Maharashtra. It is famous for orange/sweet lime cultivation. Over the period of years the ground water is being exploited for cultivation of oranges/sweet lime. Due to which, the ground water development has been drastically raised. On the contrary, the area shows rise in water levels due to many reasons like assured rainfall region, construction of water conservation structures by various government agencies & NGOs, micro irrigation practices adopted by the farmers etc. Hence, although the stage of ground water development is high i.e., upto 87 %, the talukas are categorized as safe, because of rise in water levels. Though the farmers of the area have adapted large scale micro irrigation techniques, however limited ground water availability has stunted the increase in irrigation potential. The major issues afflicting the areas are discussed below

5.1 Orange/Sweet lime Cultivation as a Cash Crop

The cultivation of cash crop orange/sweet lime is wide spread and covers an area of about 113.58 sq.km.'s and entire cultivation is ground water based irrigation. Depending upon the water availability, farmers used to change the crops from orange to sweet lime and visa-vies.

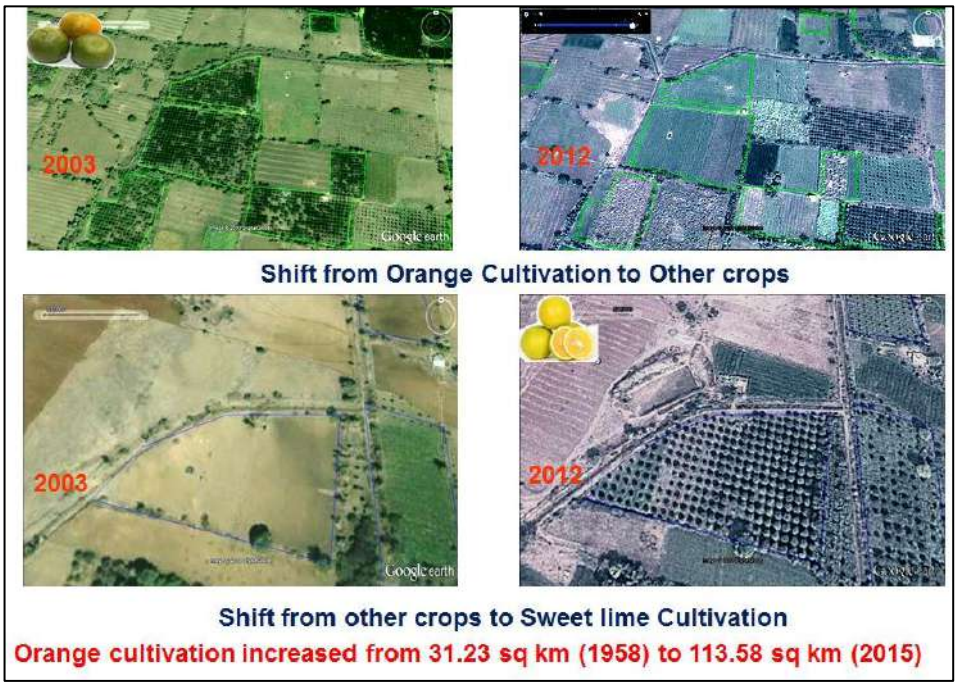


Fig. 5.2: Change in Orange/Sweet lime cultivation, Katol and Narkhed taluka, Nagpur district

Irrigation is provided at an interval of 10-15 days during winter months whereas during summer months it is provided at an interval of 5-7 days. Water requirement of citrus trees is generally higher than most of the other sub-tropical fruits due to recurrent growth and development. The water requirement varies from 900 to 1100 mm per year depending upon the location. Water requirement of young (1-4 years old), middle (5-8 years old) and mature (9 and more) Nagpur orange/sweet lime trees varies from 5 to 15 litres/day, 35 to 105 litres/day and 60 to 170 litres/day respectively. *Mrig* crop (monsoon blossom) which matures in February-March has great potential for export since arrivals of orange/sweet lime fruit in international market are very less during this period. It is observed that, to meet the demand of ground water of orange/sweet

lime cultivation, farmers were stared drilling more and more irrigation wells over the period. It has been observed that the orange/sweet lime cultivation has been increased from 31.23 sq km in 1958 to 113.58 sq km in 2015. The irrigation wells was 22,621 during the year 2000 has risen to 28,332 (**Fig. 5.2**).

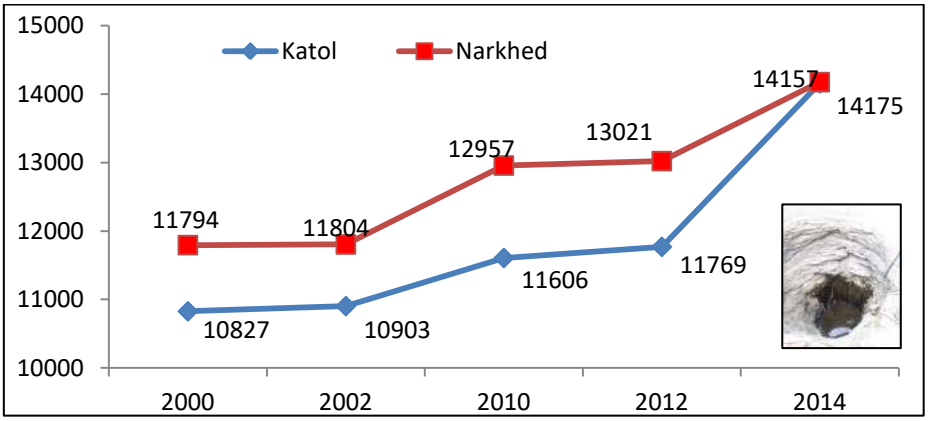


Fig. 5.2: Increase in irrigation wells, Katol and Narkhed taluka, Nagpur district

5.2 Over Exploitation of Ground Water

The stage of ground water development has increased over the period of time from 2008 to 2013 from 72.44% to 87.27% in Katol taluka and from 75.03% to 83.56% in Narkhed taluka (**Fig. 5.3**). Although the stage of ground water development is more than 80 % there is no significant fall in ground water level trend noticed and hence, both the talukas are categorised as 'Safe'. However, even though being categorised as Safe, it can again migrate towards semi-critical if necessary precautions are not put in place. The main reason for ground water excessive draft is for irrigation purpose (**Fig. 5.4**). The draft has increased from 138.26 MCM in 2008 to 166.96 MCM in 2013. Also, the gap between the availability of ground water and draft is reducing over the period from 2008 to 2013 (**Fig. 5.5**)

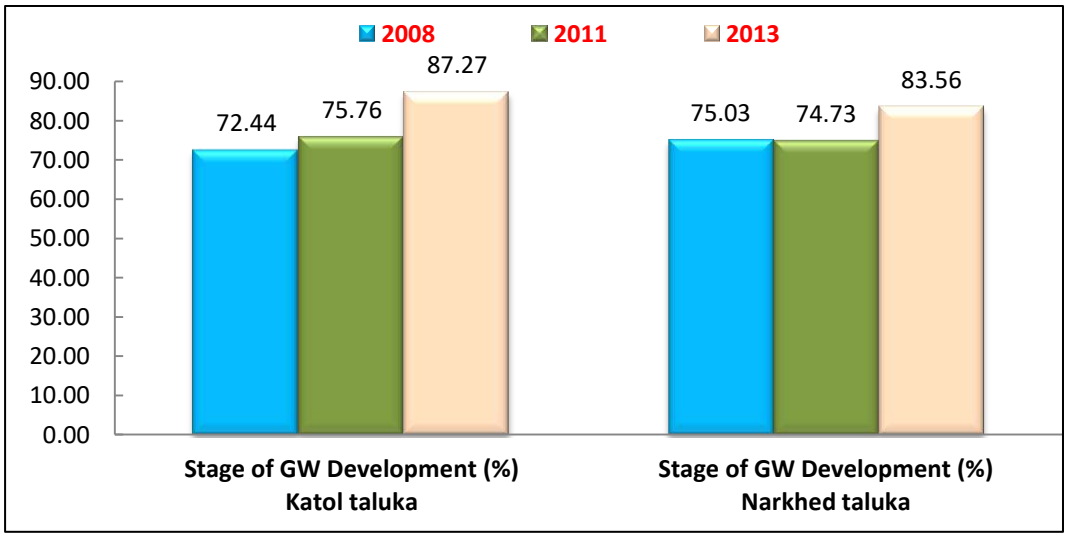


Fig. 5.3: Increase in stage of ground water development, Katol and Narkhed taluka, Nagpur district

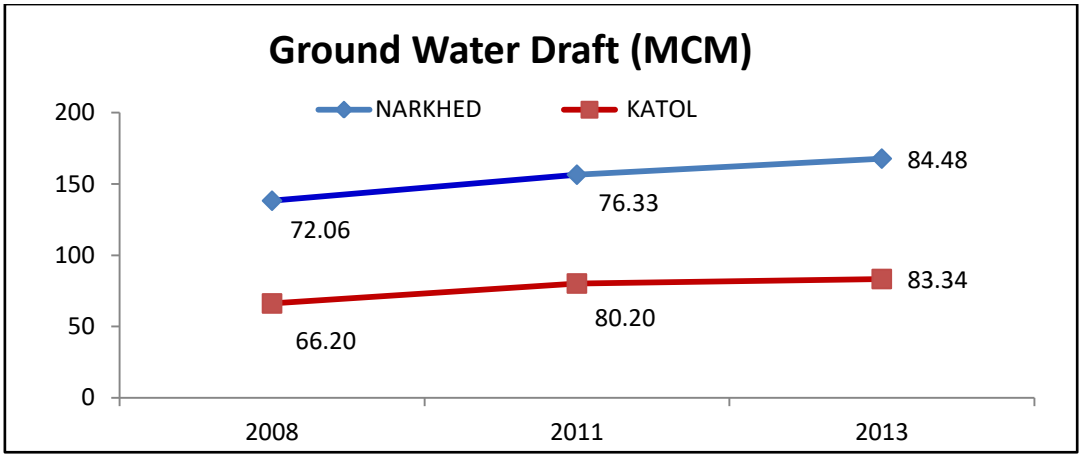


Fig. 5.4: Increase in ground water draft, Katol and Narkhed taluka, Nagpur district

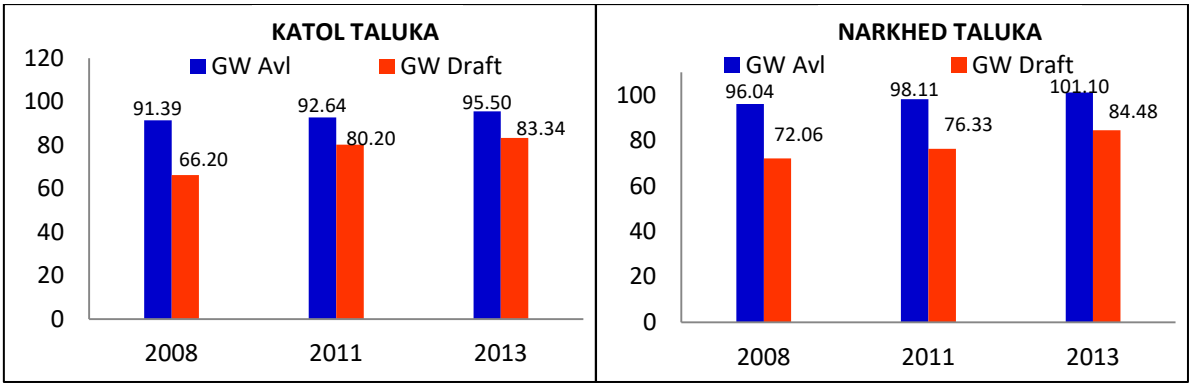


Fig. 5.5: Ground water availability and draft, Katol and Narkhed taluka, Nagpur district

5.3 Traditional and Micro Irrigation Techniques

Micro Irrigation practices, like drip and sprinkler irrigation, are being practiced in the area since last decade or so. The ground water based drip irrigation system is preferred in the area to obtain maximum yield of the cash crop like orange/sweet lime. The ground water is the most dependable source of water supply at the time of crop requirement. Although, the facilities for drip irrigation are exists but the farmers are still prefer to irrigate the orange orchards by traditional flood irrigation method which causes undue feeding of ground water. This is because of irregular electricity supply, high maintenance cost of drip/sprinkler system, etc.

The year wise daily water requirement for an orange tree (in lit per day per tree) upto 10 years by applying drip technology is presented in the **Table 5.1**. It has been observed that using drip irrigation, the average rate of water utilization for irrigation is about 87 litre/day/tree showing

progressive rise with maximum utilization during the months of March, April, May and June (PKV, 2009).

Table 5.1: Daily month wise water requirement (lit per day per tree) for an orange tree upto 10 years by drip irrigation (after PKV, 2009)

Year	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec	Total
1	--	--	--	--	--	37	19	14	17	18	19	17	141
2	22	31	41	57	71	50	26	20	24	25	25	22	414
3	27	37	50	69	85	59	30	24	28	32	29	26	496
4	38	51	71	98	120	72	37	29	34	39	35	32	656
5	40	54	75	103	127	76	39	30	36	41	37	33	691
6	43	59	82	113	139	83	42	33	39	45	41	37	756
7	46	62	86	118	145	86	44	35	41	47	42	38	790
8	49	67	93	128	157	94	48	37	44	50	46	41	854
9	55	77	103	142	175	105	53	42	49	56	51	46	954
10	61	84	116	159	196	117	60	47	55	63	57	52	1067

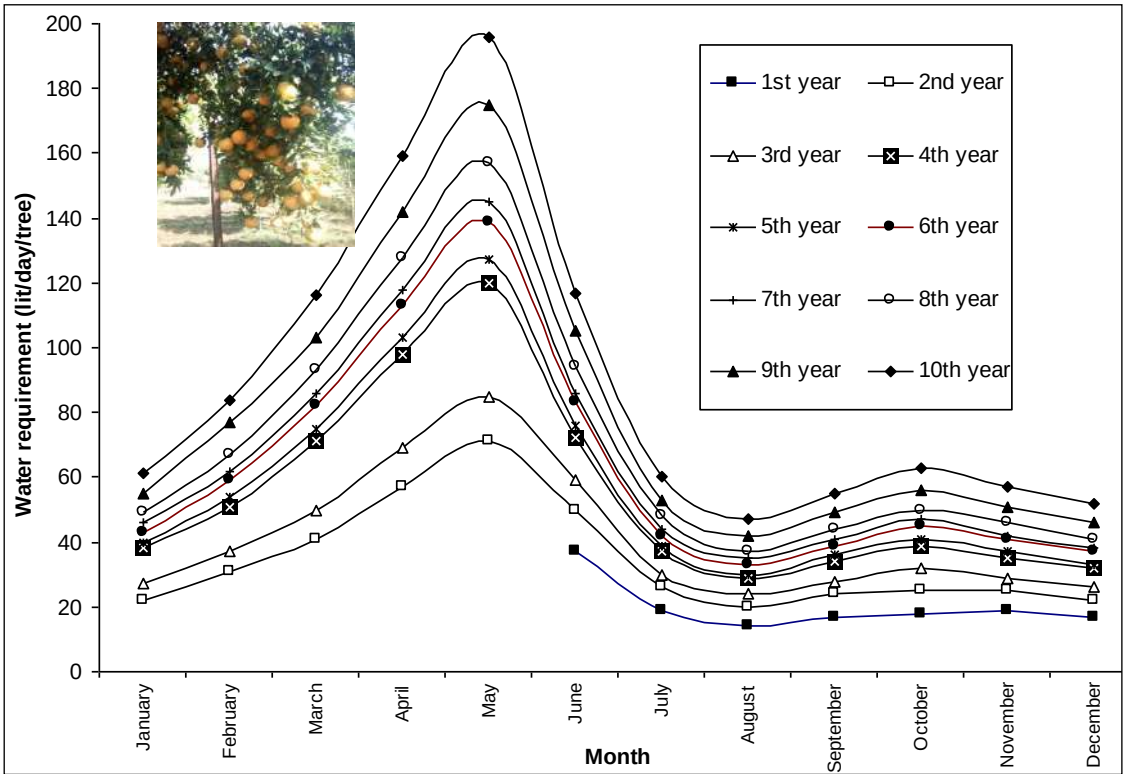


Fig. 5.1: Daily month wise water requirement for an orange tree (after PKV, 2009)

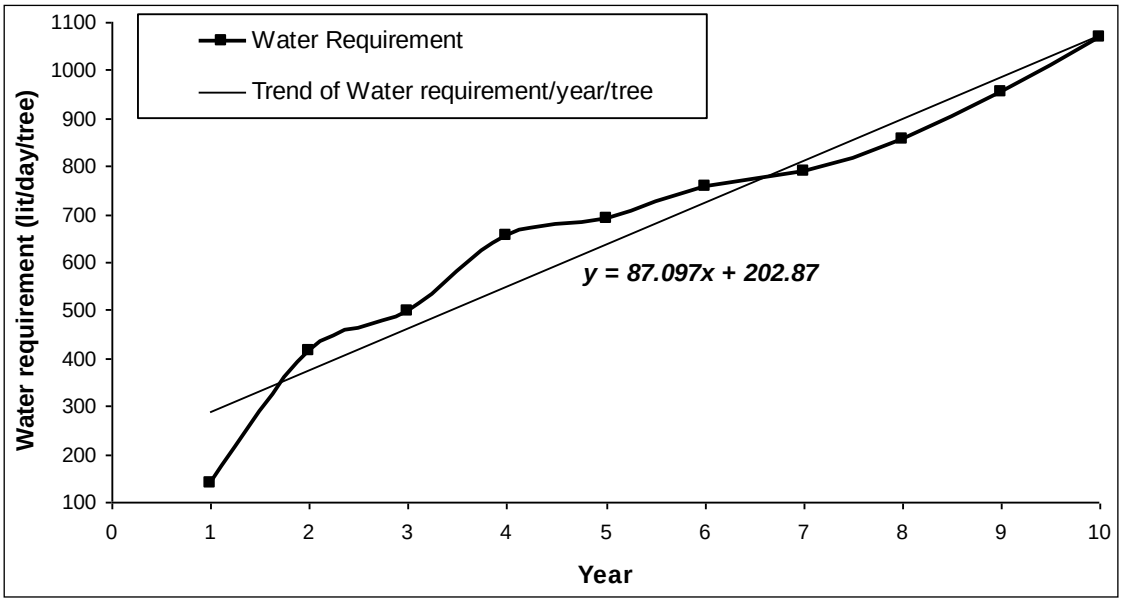


Fig. 5.2: Year wise water requirement for an orange tree (after PKV, 2009)

Total area irrigated by ground water based drip irrigation is 61.42 sq km (17.08 in Katol and 44.34 sq km in Narkhed taluka), out of the total irrigated area 155.22 sq.km., as per the data provided by Agriculture Dept. Thus, there is further scope of implementing the water use efficiency measures by drip/sprinkler to save or manage the ground water resources in the area.

6 MANAGEMENT STRATEGIES

The Katol and Narkhed taluka has ample of ground water potential apart from the small surface water resources for irrigation. It is observed that the farmers are facing problem due to non-availability of required quantum of ground water during the lean/scarcity period. To tackle these issues, a management plan has been formulated considering the availability of non-committed surface runoff, scope for artificial recharge to ground water, desilting of water bodies etc. Thus, ground water management strategy has been prepared with the objective of bringing the current stage of ground water development down to 70% so that the taluka/block comes under Safe category by adopting both supply side and demand side interventions. The taluka/block wise sustainable management plan have been suggested for these 2 talukas 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 Katol and Narkhed talukas of Nagpur district and is presented in **Table 8.1**.

6.1 Aquifer Management Plan for Katol Taluka

The geographical area of Katol Taluka is 734.63 sq. km., as per ground water resources estimation 2013, the stage of ground water development is **87.27 %** and categorised as safe. The annual ground water resource available is 95.50 MCM and the gross ground water draft for all uses is 83.34 MCM including 78.45 MCM for irrigation and 4.89 MCM for domestic sector. The major issues identified in Katol Taluka are high stage of ground water development, exploitation of ground water, limited aquifer potential, and water scarcity during lean period.

The Agricultural **demand** in rainfed area is worked out as 161.06 MCM. The agricultural demand from ground water and surface water is 78.45 and 44.58 MCM respectively. Whereas, the domestic demand for ground water and surface water is 4.89 and 1.22 MCM. The Agricultural **supply** in rainfed area is 161.06 MCM due to monsoon. The agricultural supply from ground water and

surface water is 78.45 and 44.58 MCM respectively. Whereas, the domestic supply for ground water and surface water is 4.89 and 1.22 MCM. Hence, there is no Demand-Supply gap. To bring the stage of ground water development upto 70 % it is estimated that about 23.56 MCM of water is required to recharge.

Supply side interventions proposed to tackle above said major issues through rainwater harvesting and artificial recharge. The volume of unsaturated granular zone available in Katol taluka is worked out as 813.06 MCM. The volume of water required for recharge the area is 16.26 MCM. The surface surplus non-committed runoff availability is 21.63 MCM. Therefore, the surface runoff of 9.09 MCM is considered for planning. For this, a total of 32 percolation tank and 91 Check dams are required as recharge measures. The volume of water expected to be conserved/recharged @75% efficiency is 4.80 MCM through Percolation tank and 2.05 MCM through Check dams. The cost estimate for 32 percolation tank and 91 check dams are Rs. 48 and Rs. 27.30 crore respectively. The location of artificial recharge structures proposed are given in **Annexure XI and XII** and shown in **Fig 6.1.**

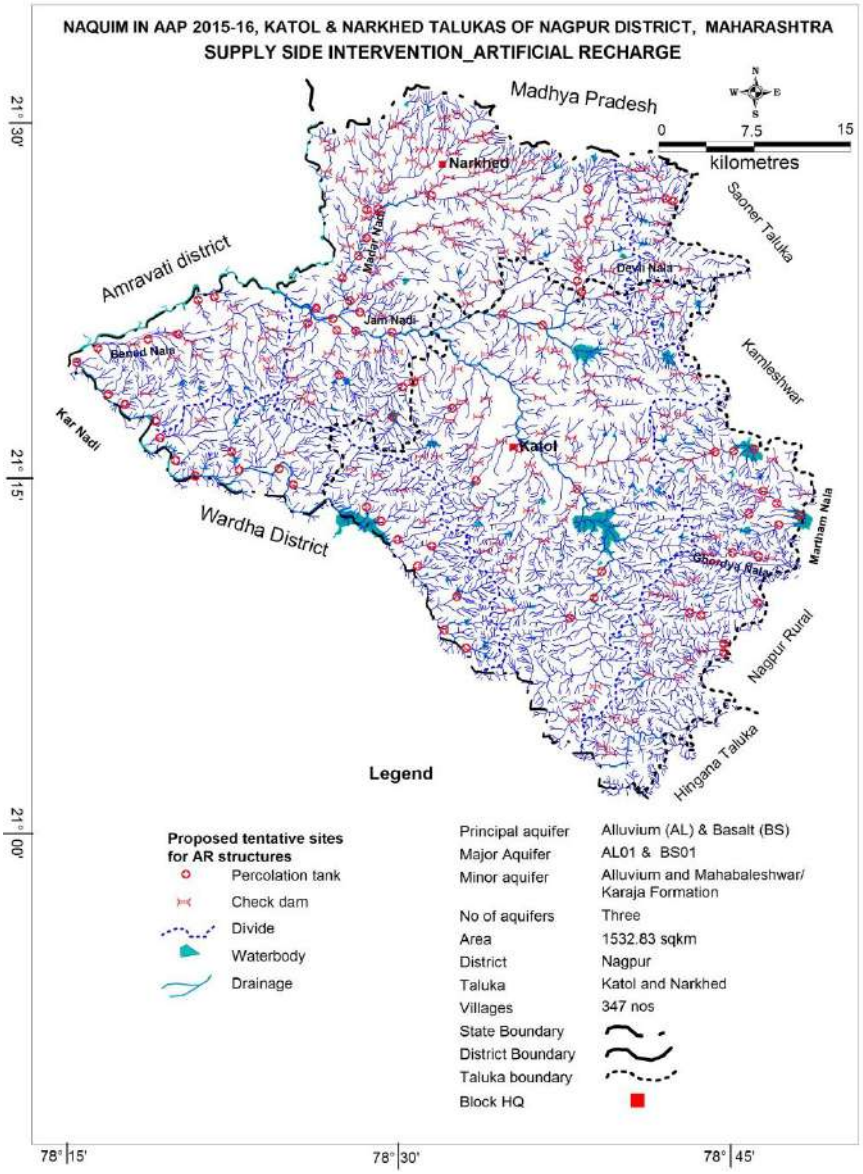


Fig. 6.1- Supply side intervention -proposed Artificial Recharge Structures, Katol and Narkhed taluka, Nagpur district

The rainwater harvesting in urban areas can be adopted in 25% of the household with 50 Sq. m roof area. A total of 0.27 MCM potential can be generated by taking 80% runoff coefficient. The estimated cost for rainwater harvesting through rooftop is calculated as Rs.14.14 crore. Hence, this technique is not economically viable and therefore it is not recommended.

Also, rejuvenation of existing water body is proposed. There are 18 waterbodies / percolation tanks/ irrigation tanks exist in the Katol taluka, covering about 6.03 sq km area. The area considered for desilting and deepening upto 0.6 m bgl is 1.21 sq km. The volume of water expected to be recharged or conserved by rejuvenation of existing water body is 0.73 MCM. The estimated expenditure is Rs. 15.20 crore. This activity could be linked under MNREGA scheme. The location of waterbodies/tanks for rejuvenation, in Narkhed taluka is presented in **Annexure-XIII** and shown in **Fig 6.2.**

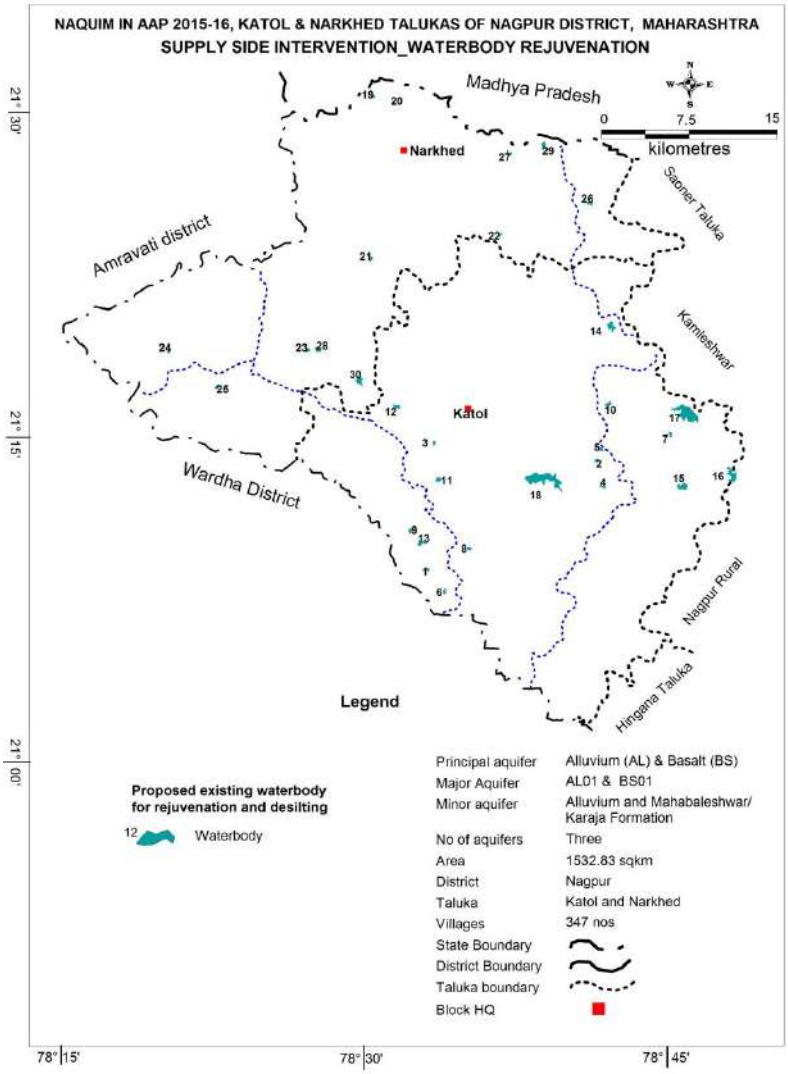


Fig. 6.2- Supply side intervention -proposed waterbodies/tanks for rejuvenation, Katol and Narkhed taluka, Nagpur district

Overall total volume of water expected to be recharged or conserved by artificial recharge is 7.58 MCM with a cost estimate of Rs. 90.50 crore, excluding roof top rain water harvesting which is not economically viable.

Demand side interventions such as change in cropping pattern has not been proposed in the area as orange/sweet lime cultivation drives the economy of the region. However, as discussed

earlier, there is a scope for increasing areas under micro-irrigation techniques like drip irrigation. About 40% of Double crop area (i.e. 38.0 Sq km) is proposed to be covered under Drip i.e., about 38 sq km. Due to which about 15.20 MCM water is expected to be saved (water req for Surface Flooding 0.90 m., Drip 0.50 = saving 0.4 m). The expenditure of Rs. 23.47 Crore is expected considering Rs. 25,000/- per acre, towards the implementation of micro-irrigation in Katol Taluka.

Thus, following benefits are expected after implementation of above said Aquifer Management Plan in Katol taluka.

1. Additional ground water resources available after implementing above measures is 22.77 MCM which would bring the stage of ground water development from 87.27 % to 70.46% i.e. about 16.81 % reduction in the stage of ground water development with estimated expenditure of Rs. 113.97 crore.
2. About 800 ha (8 sq km) additional area will be covered under assured irrigation after implementation of artificial recharge to ground water.
3. About 2533 ha (25.33 sq km) additional area will be covered under assured irrigation after implementation of micro irrigational techniques.
4. About 268 h (2.68 sq km) additional area will be covered under assured irrigation after using utilizable potential of AQ-III (TCG) (21.86 MCM).

Apart from this, it is proposed to impose ground water regulatory measures like banning the bore well drilling down to 60 m bgl for irrigation purpose.

Table 8.1: Aquifer management plan of Katol and Narkhed Taluka, Nagpur district

Block	Katol	Narkhed	Total
District	Nagpur	Nagpur	
State	Maharashtra	Maharashtra	
Area	734.63	798.2	1523.83
Major Issues Identified	Over exploitation of ground water, Sustainability of ground water, Decreasing GW Resources, Water Scarcity - lean period.		
Stage of GW Development	87.27%	83.56%	
Annual Available Resource (MCM)	95.50	101.10	196.60
Gross Annual Draft (MCM)	83.34	84.48	167.82
Domestic Requirement (MCM)	4.89	5.58	10.47
DEMAND (MCM)			
Agricultural demand -Rainfed	161.06	153.15	314.21
Agricultural demand -GW	78.45	78.9	157.35
Agricultural demand -SW	44.58	31.21	75.79
Domestic demand - GW	4.89	5.58	10.47
Domestic demand - SW	1.22	1.4	2.62
Total Demand(mcm)	**290.20**	**270.24**	560.44
SUPPLY (MCM)			
Agricultural Supply -Rainfed	161.06	153.15	314.21
Agricultural Supply -GW	78.45	78.9	157.35
Agricultural Supply -SW	44.58	31.21	75.79
Domestic Supply - GW	4.89	5.58	10.47
Domestic Supply - SW	1.22	1.4	2.62
Total supply(mcm)	**290.20**	**270.24**	560.44
Total gap to bring stage of GWD Upto 70%	**23.56**	**19.59**	43.14

Block	Katol		Narkhed		Total
Interventions proposed to deal with overexploitation					
SUPPLY SIDE INTERVENTIONS					
Rainwater Harvesting and Artificial Recharge					
Volume of unsaturated granular zone (MCM)	813.06		1044.64		1857.70
volume of water required for recharge (Recharge Potential) (MCM)	16.26		20.89		37.15
Surface water requirement @ 75% efficiency (MCM)	21.63		27.78		49.41
Availability of Surplus surface runoff (MCM)	9.09		11.68		20.77
Surplus runoff considered for planning (MCM)	9.09		11.68		20.77
Proposed Structures	***Percolation Tank*** (@ Rs.150 lakh, Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	***Check Dam*** (@ Rs.30 lakh, Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	***Percolation Tank*** (@ Rs.150 lakh, Av. Gross Capacity-100 TCM*2 fillings = 200 TCM)	***Check Dam*** (@ Rs.30 lakh, Av. Gross Capacity-10 TCM * 3 fillings = 30 TCM)	***PT & CD***
Number of Structures	32	91	41	117	**281**
Volume of Water expected to be conserved / recharged @ 75% efficiency (MCM)	4.80	2.05	6.15	2.63	**15.63**
Estimated Expenditure (Rs. in Cr.)	48.00	27.30	61.50	35.10	**171.90**
RTRWH - Urban Areas					
Households to be covered (25% with 50 m2 area)	9427		8600		18027
Total RWH potential (MCM)	0.27		0.22		0.49
Rainwater harvested / recharged @ 80% runoff co-efficient	0.21		0.18		0.39
Estimated Expenditure (Rs. in Cr.) @ Rs. 15000/- per HH	14.14 **Economically not viable & Not Recommended**		12.90 **Economically not viable & Not Recommended**		27.04
Total volume of water expected to be recharged/conserved by AR	6.85		8.78		15.63
Total Estimated Expn. For AR	75.30		96.60		171.90
Existing Water body desilting					
Number of water body	18		12		30.00
Area(Sq km)	6.03		1.21		7.24
Area considered	1.21		0.28		1.49
Volume of Water expected to be conserved (MCM)	0.73		0.28		1.01
Estimated Expenditure (Rs. in Cr.)	15.20		0.35		15.55

Block	Katol	Narkhed	Total
DEMAND SIDE INTERVENTIONS			
Proposed Cropping Pattern change	None	None	
Area proposed to be covered (sq.km.)	-	-	
Volume of Water expected to be conserved (MCM)	-	-	
Estimated Expenditure	-	-	
Micro irrigation techniques			
Double crop area proposed to be covered under Drip	38 [40% of Double crop area (i.e. 38.0 Sqkm) proposed]	24.00 [25% of Double crop area (24 Sqkm) proposed]	62.00
Volume of Water expected to be saved (MCM). (water req for Surface Flooding 0.90 m., Drip 0.50 = saving 0.4 m)	15.20	9.60	24.80
Estimated Expenditure (Rs. in Cr.) @ Rs. 25,000/- per acre	23.47	14.83	38.30
Alternate Sources	No alternate source available		
GW resources available after implementing above measures (MCM)	22.77	18.67	41.44
Probable Benefits			
1. Additional area under assured irrigation after implementation of artificial recharge to ground water	800 ha (8 sq km)	1025 ha (10.25 sq km)	1825 ha (18.25 sq km)
2. Additional area under assured irrigation after implementation of micro irrigational techniques	2533 ha (25.33 sq km)	1600 ha (16 sq km)	4133 ha (41.33 sq km)
3. Utilizable potential of AQ-III (TCG) (21.86 MCM) causes Additional area under assured irrigation	268 ha (2.68 sq km)	3375 ha (33.75 sq km)	3643 ha (36.43 sq km)
Stage of GW Development after intervention	70.46	70.54	
Regulatory Measures	**Regulation of wells below 60 m**	**Regulation of wells below 60 m**	

6.2 Aquifer Management Plan for Narkhed Taluka

The geographical area of Narkhed Taluka is 798.20 sq. km., as per ground water resources estimation 2013, the stage of ground water development is **83.56 %** and categorised as safe. The annual ground water resource available is 101.10 MCM and the gross ground water draft for all uses is 84.48 MCM including 78.90 MCM for irrigation and 5.58 MCM for domestic sector. The major issues identified in Narkhed Taluka are high stage of ground water development, exploitation of ground water, limited aquifer potential, and water scarcity during lean period.

The Agricultural **demand** in rainfed area is worked out as 153.15 MCM. The agricultural demand from ground water and surface water is 78.90 and 31.21 MCM respectively. Whereas, the domestic demand for ground water and surface water is 5.58 and 1.40 MCM. The Agricultural **supply** in rainfed area is 153.15 MCM due to monsoon. The agricultural supply from ground water and surface water is 78.90 and 31.21 MCM respectively. Whereas, the domestic supply for ground water and surface water is 5.58 and 1.40 MCM. Hence, there is no Demand-Supply gap. To bring the stage of ground water development upto 70 % it is estimated that about 19.59 MCM of water is required to recharge.

Supply side interventions proposed to tackle above said major issues through rainwater harvesting and artificial recharge. The volume of unsaturated granular zone available in Narkhed taluka is worked out as 2044.64 MCM. The volume of water required for recharge the area is 20.89 MCM. The surface surplus non-committed runoff availability is 27.78 MCM. Therefore, the surface runoff of 11.68 MCM is considered for planning. For this, a total of 41 percolation tank and 117 Check dams are required as recharge measures. The volume of water expected to be conserved/recharged @75% efficiency is 6.15 MCM through Percolation tank and 2.63 MCM through Check dams. The cost estimate for 41 percolation tank and 117 check dams are Rs. 61.50 and Rs. 35.10 crore respectively. The location of artificial recharge structures proposed are given in **Annexure IX and X** and shown in **Fig 6.1.**

The rainwater harvesting in urban areas can be adopted in 25% of the household with 50 Sq. m roof area. A total of 0.22 MCM potential can be generated by taking 80% runoff coefficient. The estimated cost for rainwater harvesting through rooftop is calculated as Rs. 12.90 crore. Hence, this technique is not economically viable and therefore it is not recommended.

Also, rejuvenation of existing water body is proposed. There are 12 waterbodies / percolation tanks/ irrigation tanks exist in the Narkhed taluka, covering about 1.21 sq. km area. The area considered for desilting and deepening upto 0.6 m bgl is 0.28 sq. km. The volume of water expected to be recharged or conserved by rejuvenation of existing water body is 0.28 MCM. The estimated expenditure is Rs. 0.35 crore. This activity could be linked under MNREGA scheme. The location of waterbodies/tanks for rejuvenation, in Narkhed taluka is presented in **Annexure-XI** and shown in **Fig 6.2.**

Overall total volume of water expected to be recharged or conserved by artificial recharge is 9.06 MCM with a cost estimate of Rs. 96.95 crore, excluding roof top rain water harvesting which is not economically viable.

Demand side interventions such as change in cropping pattern has not been proposed in the area as orange/sweet lime cultivation drives the economy of the region. However, as discussed earlier, there is a scope for increasing areas under micro-irrigation techniques like drip irrigation. About 25% of Double crop area is proposed to be covered under Drip i.e., about 24 sq. km. Due to which about 9.60 MCM water is expected to be saved (water req for Surface Flooding 0.90 m., Drip 0.50 = saving 0.4 m). The expenditure of Rs. 14.83 Crore is expected considering Rs. 25,000/- per acre, towards the implementation of micro-irrigation in Narkhed Taluka.

Thus, following benefits are expected after implementation of above said Aquifer management plan in Narkhed taluka.

1. Additional ground water resources available after implementing above measures is 18.67 MCM which would bring the stage of ground water development from 83.56 % to 70.54% i.e. about 13.02 % reduction in the stage of ground water development with estimated expenditure of Rs. 111.78 crore.

2. About 1025 ha (10.25 sq km) additional area will be covered under assured irrigation after implementation of artificial recharge to ground water.
3. About 1600 ha (16 sq km) additional area will be covered under assured irrigation after implementation of micro irrigational techniques.
4. About 3375 h (33.75 sq km) additional area will be covered under assured irrigation after using utilizable potential of AQ-III (TCG) (21.86 MCM).

Apart from this, it is proposed to impose ground water regulatory measures like banning the bore well drilling down to 60 m bgl for irrigation purpose.

6.3 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 Katol and Narkhed taluka of Nagpur district.

The study area is spanning over 1532.83 sq.km., out of which 734.63 sq.km. falling in Katol and 798.20 sq. km. in Narkhed taluka. Geologically, the area is occupied entirely by Basalt, however, trap covered Gondwana Sandstone is observed in and around Mohagaon Bhadade, to Sonkhamb villages. Over exploitation of ground water, Sustainability of ground water, Decreasing ground water resources, water scarcity during lean period and limited aquifer potential are the major issues in the area. The stage of ground water development is 87.27 % in Katol and 83.56 % in Narkhed 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 further, there is scope for introducing the drip irrigation in ground water irrigated area.

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. It is observed that in Katol taluka red bole encountered at 25 m bgl having thickness > 3m at Sonoli village. While on surface it is observed at 435 to 445 m aMSL elevation near Ghubadmet village; about 445 to 452 m aMSL near Pathar village. In Narkhed taluka, during ground water exploration, red bole encountered at 10m , 14 to 18 m and 25 m bgl at Sonoli village; at about 27 m bgl in Rohna village. While at surface it is exposed at an elevation of 440 to 450 m aMSL in and around village Pipla. Also, Aquifer-III, (Trap Cover Gondwana Sandstone) has huge groundwater potential of 21.86 MCM. It should be properly tapped for irrigation.

The overall quality of ground water is found suitable for drinking, domestic, and irrigation purposes, except at few places. Nitrate contamination in Aquifer-I is observed only at Malapur, while in Aquifer-II, it is observed at Manikwada. Aquifer-II at Maragsur is found contaminated with fluoride (1.9 mg/l) at 114.30-117.40 m bgl zone depth. Rest of the parameters is within permissible limit.

Ground water management plan has been prepared for Aquifer I (Weathered and jointed fracture), Aquifer II (Jointed and Fractured Basalt) and Aquifer III (Trap Covered Gondwana Sandstone), with the objective of bringing the current stage of ground water development down to 70% by adopting supply side and demand interventions. There is no gap between demand and supply in Katol and Narkhed taluka. As a part of supply side interventions, feasible artificial recharge, water conservation measures like, percolation tank, check dam, water body desilting/rejuvenation, depending on the source water availability in the taluka, are recommended. Also, as demand side interventions, 38 sq km area has been identified for micro irrigation techniques like drip irrigation.

1. Additional ground water resources available after implementing above measures is 41.44 MCM which would bring the stage of ground water development from 87.27 % to 70.46% of

Katol taluka and 83.56 % to 70.54% of Narkhed taluka with estimated expenditure of Rs. 113.97 crore and 111.78 crore respectively.

2. About 5958 (59.58 sq km) additional area will be covered under assured irrigation after implementation of artificial recharge, water conservation measures and micro irrigational techniques.
3. About 3643 ha (36.43 sq km) additional area will be covered under assured irrigation after using utilizable potential of AQ-III (TCG) (21.86 MCM).

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

Annexure-IA Details of Medium, Bigger Minor and Minor irrigation projects (>100 ha), Katol and Narkhed taluka, Nagpur district

Name of Project	Topo-sheet No.	Lat	Long	Taluka	Storage Capacity		Command area (Ha)		Quantity of water utilized for			Type of strucutre	Status of project	Irrigation capcity
					Gross (MCM)	Live (MCM)	Gross irrigation potential generated	By Latest Date	Irrigation (MCM)	Domestic (MCM)	Industrial (MCM)			
Ridhora	55 K/12	21.2209	78.6312	Katol	0.054				0.054			KTW	Completed project	101-250 Ha
Khapa Pratapgadh	55 K/12	21.1578	78.6327	Katol	0.071				0.071			KTW	Completed project	101-250 Ha
Ringnabodi	55 K/16	21.1286	78.716	Katol	0.065				0.065			KTW	Completed project	101-250 Ha
Chandanpardi	55 K/12	21.1687	78.5361	Katol	0.07				0.07			KTW	Completed project	101-250 Ha
Masli	55 K/12	21.3604	78.5449	Katol	0.07				0.07			KTW	Completed project	101-250 Ha
Raulgaon	55 K/16	21.2269	78.7862	Katol	0.081				0.081			KTW	Completed project	101-250 Ha
Khadki	55 K/11	21.362	78.4371	Narkhed	0.598	0.598	435	Jun-14	0.598			KTW	Completed project	> 250 Ha
Inderwada	55 K/7	21.3423	78.4731	Narkhed	0.469	0.469	266	Jun-14	0.469			KTW	Completed project	> 250 Ha
Khairgaon	55 K/7	21.4533	78.4575	Narkhed	0.946	0.946	460	Jun-14	0.946			KTW	Completed project	> 250 Ha
Tara Utara	55 K/7	21.3183	78.2847	Narkhed	0.754	0.754	206	Jun-14	0.754			KTW	Completed project	> 250 Ha
Bhishnur	55 K/11	21.35443	78.51268	Narkhed	0.571	0.571	301	Jun-14	0.571			KTW	Completed project	> 250 Ha
Wadhona	55 K/11	21.3192	78.3721	Narkhed	0.6	0.6	340	Jun-14	0.6			KTW	Completed project	> 250 Ha
Chandrabhaga	54 K/15	21.26972	78.76416	Katol	8.886	8.262	2226	Jun-14	8.227	0.035		Medium	Completed project	> 250 Ha
Junewani	55 K/11	21.27983	78.52628	Katol	1.573	1.507	315	Jun-14	1.507			MI tank	Completed project	> 250 Ha
Zilpa	55 K/11	21.34092	78.68694	Katol	1.8	1.781	356	Jun-14	1.781			MI tank	Completed project	> 250 Ha
Kotwalbardi	55 K/16	21.2239	78.7818	Katol	1.717	1.32	360	Jun-14	1.32			MI tank	Completed project	> 250 Ha
Dhotewada	55 K/12	21.04625	78.65674	Katol	1.724	1.4	262	Jun-14	1.4			MI tank	Completed project	> 250 Ha
Khutamba	55 K/12	21.2079	78.5942	Katol	1.199		125	Jun-14	1.199			MI tank	Completed project	101-250 Ha
Digras	55 K/11	21.3199	78.5509	Katol	0.271		198	Jun-14	0.271			MI tank	Completed project	101-250 Ha
Pethbudhwar	55 K/11	21.24603	78.67531	Katol	0.297				0.297			MI tank	Completed project	101-250 Ha
Tarabodi	55 K/11	21.2401	78.7118	Katol	0.052				0.052			MI tank	Completed project	101-250 Ha
Raulgaon	55 K/16	21.2269	78.7862	Katol	0.064				0.064			MI tank	Completed project	101-250 Ha
Arambhi	55 K/12	21.2664	78.3476	Narkhed	0.598	0.598	322	Jun-14				MI tank	Completed project	> 250 Ha
Paradsinga	55 K/11	21.30069	78.53825	Narkhed	1.88	1.721	400	Jun-14	1.721			MI tank	Completed project	> 250 Ha
Lohari sawang	55 K/8	21.2623	78.3966	Narkhed	0.215		106	Jun-14	0.215			MI tank	Completed project	101-250 Ha
Rampuri	55 K/8	21.2734	78.3142	Narkhed	0.287		210	Jun-14	0.287			MI tank	Completed project	101-250 Ha
Nawewgaon-1	55 K/8	21.5039	78.5424	Narkhed	0.06				0.06			MI tank	Completed project	101-250 Ha
Kharala	55 K/7	21.2575	78.368	Narkhed	0.075				0.075			KTW	Ongoing Projects	101-250 Ha
Jam	55 K/12	21.21902	78.76416	Katol	7184	29	7184	Jun-14	24.3	12.25	3.691	Medium	Ongoing Projects	> 250 Ha
Chikhli Nala	55 K/12	21.3258	78.6243	Katol	7.202	5.328	836	Jun-14	1	1.74		MI tank	Ongoing Projects	> 250 Ha
Sabkund	55 K/12	21.1844	78.6012	Katol	1.54				1.54			MI tank	Ongoing Projects	101-250 Ha
Pimpalgaon	55 K/11	21.4507	78.55834	Narkhed	7.22	6.498	915	Jun-14	4.563			MI tank	Ongoing Projects	> 250 Ha
Kharwadi	55 K/11	21.3199	78.5509	Narkhed	0.776	0.776	418	Jun-14	0.776			MI tank	Ongoing Projects	> 250 Ha
Mowad	55 K/7	21.4785	78.4565	Narkhed	0.43				0.43			MI tank	Ongoing Projects	101-250 Ha
Nawegaon-2	55 K/8	21.5039	78.5424	Narkhed	0.065				0.065			MI tank	Ongoing Projects	101-250 Ha

(Source: Water Resources Department, Govt. of Maharashtra, June 2014)

Annexure-IB Details of Minor irrigation projects (<100 ha), Katol and Narkhed taluka, Nagpur district

Sl. No.	Location/village name	Taluka	lat	long	Live Storage capacity (MCM)	Irrigation Potential (Ha)	Type of strucutre
1	Ajangaon	katol	21.2525	78.68389	0.02	10	KT wier
2	ajangaon(Khu.)	katol	21.01027778	78.68667	0.05	19	KT wier
3	Ajangaon-2	katol	21.25277778	78.70083	0.03	11	KT wier
4	Ajangaon-3	katol	21.2525	78.70056	0.02	6	KT wier
5	Akewada	katol	21.16666667	78.73389	0.04	11	KT wier
6	Alagondi	katol	21.19333333	78.66361	0.03	8	KT wier
7	Amnergondi	katol	21.27444444	78.63167	0.04	10	KT wier
8	Bahiramdev	katol	#N/A	#N/A	0.04	10	KT wier
9	Bihalgondi	katol	21.1475	78.67472	0.03	10	KT wier
10	Bordoh-1	katol	21.285	78.63528	0.03	5	KT wier
11	Bordoh-2	katol	21.28472222	78.635	0.03	5	KT wier
12	Borgaon	katol	21.1143	78.6208	0.04	11	KT wier
13	Borgondi	katol	21.26472222	78.57889	0.05	14	KT wier
14	Bori	katol	21.35111111	78.66722	0.04	12	KT wier
15	Borkhedi	katol	21.39416667	78.73139	0.04	12	KT wier
16	Borkhedi (Ridhora)	katol	21.2012	78.6311	0.04	23	KT wier
17	Chakdoh-2	katol	21.28361111	78.75	0.06	16	KT wier
18	Chameli	katol	#N/A	#N/A	0.04	10	KT wier
19	ChandanPardi	katol	21.16583333	78.53861	0.05	16	KT wier
20	Chikhlagarh	katol	21.20694444	78.49611	0.03	10	KT wier
21	Chikhli malode	katol	21.21666667	78.13222	0.03	7	KT wier
22	Chorkhairi	katol	21.4651	78.6795	0.04	12	KT wier
23	Chorkhairi	katol	21.4651	78.6795	0.03	8	KT wier
24	Datewadi	katol	21.35333333	78.3925	0.03	5	KT wier
25	Dhankundav	katol	21.1475	78.7567	0.04	10	KT wier
26	Dhankundav	katol	21.1475	78.7567	0.05	10	KT wier
27	Dhiivarwadi	katol	21.28444444	78.55139	0.04	6	KT wier
28	Dhotiwada-1	katol	21.26611111	78.68583	0.03	5	KT wier
29	Dhotiwada-2	katol	21.04722222	78.64833	0.06	5	KT wier
30	Dhukheda	katol	21.11333333	78.62667	0.05	15	KT wier
31	Dhurkheda -2	katol	21.11555556	78.62361	0.06	31	KT wier
32	Digras(bk)	katol	21.33138889	78.54694	0.02	9	KT wier
33	Dondki	katol	21.10555556	78.65111	0.05	14	KT wier
34	Dongargaon-1	katol	21.2924	78.6104	0.03	5	KT wier
35	Dongargaon-2	katol	21.2924	78.6104	0.03	5	KT wier
36	Dorli (Bha)-2	katol	21.26916667	78.78139	0.02	12	KT wier
37	Dorli (Bhandwalkar)	katol	21.37361111	78.6	0.03	10	KT wier
38	Dorli Bhingare	katol	21.31833333	78.61861	0.03	5	KT wier
39	Ganeshpur	katol	21.17055556	78.66833	0.04	15	KT wier
40	gangaldoh	katol	21.47527778	78.4875	0.03	8	KT wier
41	Gangaldoh Khapa	katol	21.47472222	78.49167	0.03	8	KT wier
42	Gondi Digras	katol	21.35972222	78.5975	0.2	24	KT wier
43	Gondi Mohgaon	katol	21.365	78.71583	0.03	8	KT wier
44	Gondi Mohgaon -2	katol	21.36611111	78.7025	0.03	5	KT wier
45	Gondi Mohgaon -3	katol	21.36111111	78.71	0.03	5	KT wier
46	Gondi Mohgaon-1	katol	21.35916667	78.70556	0.03	5	KT wier
47	Gondidigras-1	katol	21.36638889	78.595	0.03	5	KT wier
48	Gondidigras-2	katol	21.36333333	78.59611	0.03	5	KT wier
49	Gondikahapa	katol	21.36666667	78.58556	0.03	5	KT wier
50	Gondikahapa-1	katol	21.35805556	78.71083	0.03	5	KT wier
51	Gondikhapa-2	katol	21.32861111	78.71	0.03	5	KT wier
52	Hardoli	katol	21.131	78.6894	0	0	KT wier
53	Hatla	katol	21.26222222	79.00028	0.05	12	KT wier
54	Isapur	katol	21.31833333	78.61861	0.02	7	KT wier
55	Isapur	katol	21.31916667	78.61861	0.05	12	KT wier
56	Isapur-2	katol	21.32166667	78.64944	0.04	5	KT wier
57	Issapur-1	katol	21.31833333	78.61861	0.03	5	KT wier
58	Jamgad	katol	21.1382	78.5871	0.03	9	KT wier
59	Jatamazri	katol	21.38305556	78.69806	0.03	5	KT wier
60	Jatamazri	katol	21.38138889	78.68583	0.03	5	KT wier
61	Jatlapur	katol	21.11555556	78.64194	0.04	10	KT wier
62	Jatlapur-1	katol	21.10388889	78.63694	0.05	5	KT wier
63	Jatlapur-2	katol	21.09666667	78.63417	0.03	5	KT wier

Sl. No.	Location/village name	Taluka	lat	long	Live Storage capacity (MCM)	Irrigation Potential (Ha)	Type of strucutre
64	Jod Ajan	katol	#N/A	#N/A	0.04	11	KT wier
65	Kachari Sawangi	katol	21.19916667	78.65472	0.04	20	KT wier
66	Kalambha	katol	21.33194444	78.63472	0.16	79	KT wier
67	Kalkudi Khapri	katol	21.05333333	78.55306	0.02	8	KT wier
68	Kalmunda-1	katol	21.17555556	78.72222	0.03	9	KT wier
69	Karla Vadhona	katol	21.3073	78.5883	0.06	16	KT wier
70	Kathlabodi	katol	21.35305556	78.35778	0.03	5	KT wier
71	Katol Khadaknala	katol	21.3073	78.5883	0.06	16	KT wier
72	Kedarpur	katol	21.20472222	78.54222	0.02	8	KT wier
73	Khadki	katol	21.362	78.4371	0.06	18	KT wier
74	Khairi	katol	21.11388889	78.59944	0.03	5	KT wier
75	Khairi Navghare	katol	21.33444444	78.6525	0.04	10	KT wier
76	Khairi Navghare-1	katol	21.33972222	78.66639	0.03	5	KT wier
77	Khamli	katol	21.37666667	78.60333	0.03	5	KT wier
78	Khandala	katol	21.25916667	78.55639	0.03	8	KT wier
79	Khangaon	katol	21.28555556	78.53583	0.06	29	KT wier
80	Khorinala	katol	#N/A	#N/A	0.03	5	KT wier
81	Khursapar	katol	21.16027778	78.58083	0.03	8	KT wier
82	Khutamba	katol	21.22083333	78.59167	0.01	3	KT wier
83	Kodhasawli-2	katol	21.45083333	78.73361	0.04	12	KT wier
84	Kondhali Dudhala	katol	21.13944444	78.64278	0.25	65	KT wier
85	Kondhali(jam Nadi)	katol	21.13527778	78.63639	0.07	19	KT wier
86	Kondhasawli	katol	21.45027778	78.13417	0.03	5	KT wier
87	Kukdi Panjra	katol	21.2985	78.4473	0.02	4	KT wier
88	Ladgaon	katol	21.23027778	78.56083	0.04	12	KT wier
89	Lakholi-1	katol	21.28305556	78.68639	0.05	22	KT wier
90	Lakholi-2	katol	21.27722222	78.69111	0.06	26	KT wier
91	Linga	katol	21.25777778	78.63028	0.04	11	KT wier
92	Mahurkhera	katol	21.16666667	78.73389	0.04	12	KT wier
93	Malegaon	katol	21.295	78.7133	0.03	10	KT wier
94	Maragsur	katol	21.20361111	78.71556	0.04	12	KT wier
95	Maragsur	katol	21.20305556	78.71639	0.03	5	KT wier
96	Masali	katol	21.3604	78.5449	0.04	12	KT wier
97	Mendhepathar (BA)	katol	21.17555556	78.62667	0.03	7	KT wier
98	Mendhepathar (BA)-2	katol	21.17416667	78.61944	0.04	12	KT wier
99	Mendhepathar (jangli)	katol	21.1801	78.6234	0.07	14	KT wier
100	Mendhepathar(Ba)	katol	21.23944444	78.70417	0.03	5	KT wier
101	Mendki-1	katol	21.16944444	78.63694	0.03	8	KT wier
102	Mendki-1	katol	21.35166667	78.62778	0.03	5	KT wier
103	Mendki-2	katol	21.35305556	78.57667	0.21	15	KT wier
104	Mendki-3	katol	21.35055556	78.64694	0.03	5	KT wier
105	Mhasala	katol	21.10194444	78.68417	0.04	12	KT wier
106	Minivada-2	katol	21.10083333	78.7	0.04	10	KT wier
107	Miniwada-1	katol	78.7129	78.7129	0.05	13	KT wier
108	Miniwada-1	katol	78.7129	78.7129	0.03	5	KT wier
109	Mohgaon Dhole	katol	21.63444444	78.73361	0.04	10	KT wier
110	Murli	katol	21.195	78.74556	0.04	11	KT wier
111	Murti	katol	21.18555556	78.50972	0.04	5	KT wier
112	Naygaon (Chi.)	katol	21.2839	78.5743	0.03	8	KT wier
113	Paradsinga-2	katol	21.31972222	78.51222	0.07	55	KT wier
114	pardi gotmare	katol	21.25166667	78.63417	0.04	11	KT wier
115	pardsinga -1	katol	21.35638889	78.51583	0.04	13	KT wier
116	Rajni -2	katol	21.395	78.58806	0.04	8	KT wier
117	Rajni-1	katol	21.39944444	78.59028	0.03	12	KT wier
118	Raulgaon	katol	21.23111111	78.78417	0.04	11	KT wier
119	Raulgaon	katol	21.23166667	78.78417	0.04	10	KT wier
120	Ridhora-1	katol	21.21916667	78.68472	0.04	11	KT wier
121	Ridhora-2	katol	21.22694444	78.57694	0.04	19	KT wier
122	Ringnabodi	katol	21.11888889	78.70222	0.04	10	KT wier
123	Ringnabodi	katol	21.13083333	78.71694	0.03	5	KT wier
124	Saali kelapur	katol	21.16222222	78.66222	0.03	8	KT wier
125	Sawli Anant	katol	21.2161	78.4907	0.03	12	KT wier
126	Shekapur	katol	21.1551	78.7106	0.03	9	KT wier
127	Singarwadi	katol	21.37861111	78.59917	0.03	5	KT wier
128	Sonkhamb-1	katol	21.26916667	78.73917	0.05	15	KT wier

Sl. No.	Location/village name	Taluka	lat	long	Live Storage capacity (MCM)	Irrigation Potential (Ha)	Type of strucutre
129	Sonkhamb-1	katol	21.28222222	78.72194	0.04	12	KT wier
130	Sonkhamb-1	katol	21.26388889	78.72	0.04	5	KT wier
131	Sonkhamb-2	katol	21.2675	78.71694	0.03	5	KT wier
132	Sonoli	katol	21.3552	78.6369	0.04	12	KT wier
133	Sonpur	katol	21.18166667	78.68056	0.03	7	KT wier
134	Tandulwani	katol	21.205	78.36472	0.03	10	KT wier
135	Tapani-1	katol	21.37944444	78.65361	0.03	5	KT wier
136	Tapni -1	katol	21.37805556	78.64972	0.04	12	KT wier
137	Tapni-2	katol	21.3825	78.64278	0.04	14	KT wier
138	Tapni-3	katol	21.38222222	78.6525	0.03	5	KT wier
139	Tapni-3	katol	21.37611111	78.645	0.05	5	KT wier
140	Tarabodi	katol	21.25638889	78.70972	0.04	12	KT wier
141	Taroda	katol	21.1333	78.6093	0.03	5	KT wier
142	Vadvihira	katol	21.32805556	78.32111	0.06	16	KT wier
143	Wandli wagh	katol	21.24583333	78.60639	0.04	10	KT wier
144	Yenva-1	katol	21.34416667	78.59361	0.07	20	KT wier
145	Yenva-2	katol	21.34138889	78.59389	0.06	14	KT wier
146	Yerla	katol	21.45083333	78.49056	0.03	8	KT wier
147	Zilpa	katol	21.34277778	78.65472	0.02	6	KT wier
148	Zilpa	katol	21.3352	78.6855	0.04	5	KT wier
149	Zilpa-1	katol	21.04277778	78.68889	0.03	5	KT wier
150	Zilpa-2	katol	21.34472222	78.6825	0.03	5	KT wier
151	Zilpa-3	katol	21.34	78.65556	0.03	5	KT wier
152	Zilpa-4	katol	21.34444444	78.68278	0.03	5	KT wier
153	mahurkhora	katol	21.15919444	78.72481	-	60	LIS
154	Bihalgondi-1	Katol	21.1471	78.6769	0.27	59	MI Tank
155	BihalGondi-2	Katol	21.14944444	78.67361	0.2	48	MI Tank
156	Chandanpardi-1	Katol	21.16277778	78.53472	0.47	100	MI Tank
157	Chandanpardi-2	Katol	21.15888889	78.53722	0.33	48	MI Tank
158	Chikhli Malode	Katol	21.2112	78.6913	0.47	94	MI Tank
159	Dhamangaon	Katol	21.12	78.56722	0.29	53	MI Tank
160	Garamsur	Katol	21.16305556	78.73778	0.29	53	MI Tank
161	Gondimohgaon	Katol	21.365	78.70472	0.29	58	MI Tank
162	Khandala	Katol	21.25083333	78.55528	0.49	100	MI Tank
163	Khapri barokar	Katol	21.1527	78.5435	0.44	100	MI Tank
164	Khursapar	Katol	21.15777778	78.58667	0.25	74	MI Tank
165	Maragsur	Katol	21.1991	78.7039	0.33	63	MI Tank
166	Masala-1	Katol	21.10194444	78.68417	0.43	1000	MI Tank
167	Masala-2	Katol	21.10222222	78.68444	0.49	96	MI Tank
168	Mendhepathar-1	Katol	21.21833333	78.70139	0.17	46	MI Tank
169	Mendhepathar-2	Katol	21.21833333	78.70139	0.47	100	MI Tank
170	nandora	Katol	21.16194444	78.61444	0.37	99	MI Tank
171	Salai kelapur	Katol	21.94305556	78.64556	0.32	77	MI Tank
172	Sonmoh	Katol	21.2177	78.6879	0.25	67	MI Tank
173	Taroda	Katol	21.20666667	78.71028	0.44	100	MI Tank
174	Ambada Sonak	Katol	21.26833333	78.54944	0.35	-	PT
175	Bori	Katol	21.3421	78.6643	0.18	-	PT
176	Chargaon	Katol	21.2549	78.7551	0.26	-	PT
177	dorli	Katol	21.18138889	78.16389	0.12	-	PT
178	Gollarkhapa	Katol	21.3576	78.6546	0.31	-	PT
179	Heti-1	Katol	#N/A	#N/A	0.26	-	PT
180	Heti-2	Katol	#N/A	#N/A	0.27	-	PT
181	Jatamazari	Katol	21.14666667	78.81417	0.15	-	PT
182	Kedarpur	Katol	21.29861111	78.59833	0.19	-	PT
183	Kedarpur	Katol	21.203	78.5572	0.32	-	PT
184	Khursapar	Katol	21.1575	78.58028	0.18	-	PT
185	Kundi	Katol	21.1448	78.6971	0.15	-	PT
186	Masali	Katol	21.3604	78.5449	0.17	-	PT
187	Masod	Katol	21.07305556	78.62944	0.23	-	PT
188	Panjra rithi-2	Katol	21.2378	78.6485	0.27	-	PT
189	Ridhora	Katol	21.22861111	78.46	0.15	-	PT
190	Ringnabodi	Katol	21.13111111	78.71444	0.18	-	PT
191	Alagondi	Katol	21.20166667	78.69667	0.03		Storage Bund
192	Alagondi	Katol	21.1895	78.5848	0.05	-	Storage Bund
193	Ambada Sonak	Katol	21.26805556	78.4325	0.03	-	Storage Bund

Sl. No.	Location/village name	Taluka	lat	long	Live Storage capacity (MCM)	Irrigation Potential (Ha)	Type of strucutre
194	Ambada sonak	Katol	21.26638889	78.54889	0.04	-	Storage Bund
195	Amnergondi	Katol	21.2643	78.5848	0.04	-	Storage Bund
196	Bhajipani	Katol	21.30444444	78.63472	0.03	-	Storage Bund
197	Bhorgad	Katol	21.24361111	78.81194	0.02	-	Storage Bund
198	Bhorgarh-1	Katol	21.23777778	78.47833	0.04	-	Storage Bund
199	Bhorgarh-1	Katol	21.07111111	78.47861	0.04	-	Storage Bund
200	Bhorgarh-1	Katol	21.24166667	78.47806	0.04	-	Storage Bund
201	Bihalgondi	Katol	21.1471	78.6769	0.04	-	Storage Bund
202	Bihalgondi	Katol	21.1471	78.6769	0.04	-	Storage Bund
203	Bilavargondi	Katol	21.1722	78.5918	0.03	-	Storage Bund
204	Bopapur	Katol	21.3925	78.45861	0.04	-	Storage Bund
205	Borgaon	Katol	21.1143	78.6208	0.04	-	Storage Bund
206	Borgondi	Katol	21.26916667	78.61778	0.04	-	Storage Bund
207	Bori	Katol	21.3421	78.6643	0.03	-	Storage Bund
208	Chankapur	Katol	21.32361111	78.72889	0.04	-	Storage Bund
209	chankapur	Katol	21.13194444	78.62583	0.04	-	Storage Bund
210	Chaurepathar	Katol	21.2536	78.5046	0.04	-	Storage Bund
211	Chaurepathar	Katol	21.2536	78.5046	0.04	-	Storage Bund
212	Chendkapur	Katol	21.3001	78.7315	0.04	-	Storage Bund
213	Chichala	Katol	21.2864	78.5656	0.05	-	Storage Bund
214	Chikhali (bk.)	Katol	21.3258	78.6243	0.02	-	Storage Bund
215	Chikhali (bk.)	Katol	21.3258	78.6243	0.03	-	Storage Bund
216	Chikhali (bk.)	Katol	21.3258	78.6243	0.04	-	Storage Bund
217	Chikhali (malode)	Katol	21.2112	78.6913	0.04	-	Storage Bund
218	Chikhali(Ma)	Katol	21.21444444	78.68639	0.03	-	Storage Bund
219	Chikhlagad	Katol	21.207	78.5001	0.03	-	Storage Bund
220	Chikhlagad	Katol	21.207	78.5001	0.04	-	Storage Bund
221	Chikhlagad	Katol	21.207	78.5001	0.04	-	Storage Bund
222	Chincholi	Katol	21.16972222	78.54611	0.03	-	Storage Bund
223	Dhamangaon	Katol	21.1299	78.5611	0.03	-	Storage Bund
224	Dhiwarwadi	Katol	21.29083333	78.56	0.02	-	Storage Bund
225	Dhotiwada	Katol	21.04694444	78.66194	0.03	-	Storage Bund
226	Dhurkheda	Katol	21.1141	78.64	0.05	-	Storage Bund
227	Dhurkheda-1	Katol	21.11944444	78.62194	0.04	-	Storage Bund
228	Digras(Bu)	Katol	21.32277778	78.54861	0.02	-	Storage Bund
229	Digras(Bu)	Katol	21.32416667	78.54528	0.04	-	Storage Bund
230	Dongargaon	Katol	21.2924	78.6104	0.04	-	Storage Bund
231	Dongargaon-1	Katol	21.2924	78.6104	0.04	-	Storage Bund
232	Dorli (bhandwalkar)	Katol	21.3643	78.5872	0.03	-	Storage Bund
233	Dorli(Bhi)	Katol	21.28111111	78.16139	0.03	-	Storage Bund
234	Fetari-1	Katol	21.28111111	78.54972	0.02	-	Storage Bund
235	Fetari-2	Katol	21.27861111	78.54667	0.02	-	Storage Bund
236	Ganeshpur	Katol	21.17638889	78.66722	0.04	-	Storage Bund
237	Gangaldoh-2	Katol	21.30055556	78.65139	0.04	-	Storage Bund
238	Garamsur	Katol	21.16805556	78.81583	0.03	-	Storage Bund
239	Garamsur	Katol	21.16805556	78.73278	0.05	-	Storage Bund
240	Garamusr	Katol	21.16888889	78.7375	0.03	-	Storage Bund
241	Ghubdi	Katol	21.08861111	78.70278	0.02	-	Storage Bund
242	Gollarkhapa	Katol	21.3576	78.6546	0.05	-	Storage Bund
243	Gondikhapa	Katol	21.32361111	78.71333	0.04	-	Storage Bund
244	Gondikhapa	Katol	21.32861111	78.71	0.03	-	Storage Bund
245	Gondikhapa	Katol	21.3184	78.7131	0.04	-	Storage Bund
246	Gonhi	Katol	21.3083	78.6229	0.04	-	Storage Bund
247	Harankhuri	Katol	21.31694444	78.56306	0.03	-	Storage Bund
248	Hardoli	Katol	21.131	78.6894	0.04	-	Storage Bund
249	Hatla-1	Katol	21.26111111	78.66056	0.04	-	Storage Bund
250	Jamgad	Katol	21.1382	78.5871	0.04	-	Storage Bund
251	Jamgaeh	Katol	21.17	78.52028	0.04	-	Storage Bund
252	Jatamkhor	Katol	21.475	78.81639	0.03	-	Storage Bund
253	Junapani	Katol	21.1518	78.568	0.05	-	Storage Bund
254	Junewani	Katol	21.2757	78.4454	0.02	-	Storage Bund
255	Junewani	Katol	21.28194444	78.52583	0.04	-	Storage Bund
256	Junewani	Katol	21.2757	78.4454	0.04	-	Storage Bund
257	Kedarpur	Katol	21.21694444	78.55972	0.04	-	Storage Bund
258	Kedarpur	Katol	21.20944444	78.55861	0.04	-	Storage Bund

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259	Khadaki	Katol	21.2454	78.5125	0.05	-	Storage Bund
260	Khadki	Katol	21.24555556	78.50972	0.04	-	Storage Bund
261	Khadki	Katol	21.362	78.4371	0.04	-	Storage Bund
262	Khadki	Katol	21.362	78.4371	0.04	-	Storage Bund
263	Khairi	Katol	21.114	78.598	0.03	-	Storage Bund
264	Khandala-1	Katol	21.2468	78.5597	0.03	-	Storage Bund
265	Khandala-2	Katol	21.3854	78.5682	0.03	-	Storage Bund
266	Khangaon	Katol	21.2947	78.5543	0.02	-	Storage Bund
267	Khangaon	Katol	21.29777778	78.54417	0.04	-	Storage Bund
268	Khapri	Katol	21.4356	78.6886	0.04	-	Storage Bund
269	Khapri	Katol	21.4356	78.6886	0.03	-	Storage Bund
270	Khursapar	Katol	21.15777778	78.58639	0.03	-	Storage Bund
271	Khutamba	Katol	21.22138889	78.5925	0.02	-	Storage Bund
272	Khutamba	Katol	21.22222222	78.54361	0.05	-	Storage Bund
273	Kolambi	Katol	21.29666667	78.53361	0.03	-	Storage Bund
274	Kolhu	Katol	21.22361111	78.47444	0.04	-	Storage Bund
275	Kondhali	Katol	21.13472222	78.48556	0.01	-	Storage Bund
276	Kondhali	Katol	21.14166667	78.64333	0.04	-	Storage Bund
277	Kondhali	Katol	21.13416667	78.6425	0.03	-	Storage Bund
278	Kondhali	Katol	21.13	78.6497	0.03	-	Storage Bund
279	Kondhasaoli	Katol	21.2174	78.6691	0.01	-	Storage Bund
280	Kukdi panjra	Katol	21.2985	78.4473	0.04	-	Storage Bund
281	Kukdipanjara	Katol	21.2985	78.4473	0	-	Storage Bund
282	Kukdipanjra	Katol	21.2985	78.4473	0.03	-	Storage Bund
283	Kundi	Katol	21.1448	78.6971	0.03	-	Storage Bund
284	Kundi	Katol	21.1448	78.6971	0.04	-	Storage Bund
285	Ladgaon	Katol	21.23	78.56111	0.03	-	Storage Bund
286	Ladgaon	Katol	21.23083333	78.56444	0.03	-	Storage Bund
287	Ladgaon-2	Katol	21.22944444	78.56028	0.02	-	Storage Bund
288	Lakho;li	Katol	21.28138889	78.69056	0.04	-	Storage Bund
289	Linga	Katol	21.2433	78.6375	0.04	-	Storage Bund
290	Malegaon	Katol	21.295	78.7133	0.04	-	Storage Bund
291	Maragsur	Katol	21.20222222	78.71639	0.02	-	Storage Bund
292	Masali-1	Katol	21.3604	78.5449	0.04	-	Storage Bund
293	Masali-2	Katol	21.3604	78.5449	0.03	-	Storage Bund
294	Masod	Katol	21.0819	78.6199	0.03	-	Storage Bund
295	Mendhepathar	Katol	21.2362	78.6881	0.04	-	Storage Bund
296	Mendhepathar(Ba)	Katol	21.17388889	78.62833	0.03	-	Storage Bund
297	Mhaskahapa	Katol	21.3525	78.07361	0.04	-	Storage Bund
298	Miniwada	Katol	21.1057	78.7129	0.02	-	Storage Bund
299	Mohgaon (dhole)	Katol	21.2353	78.4556	0.04	-	Storage Bund
300	Mohgaon Jangali	Katol	21.23222222	78.44778	0.04	-	Storage Bund
301	Murti	Katol	21.18444444	78.505	0.04	-	Storage Bund
302	Murti	Katol	21.18777778	78.34639	0.03	-	Storage Bund
303	Murti-1	Katol	21.18777778	78.57833	0.03	-	Storage Bund
304	Murti-2	Katol	21.18666667	78.51028	0.03	-	Storage Bund
305	Nandora	Katol	21.16694444	78.60167	0.03	-	Storage Bund
306	Naygaon Chinchala	Katol	21.2839	78.5743	0.04	-	Storage Bund
307	Pandhardhakani	Katol	21.2626	78.4772	0.04	-	Storage Bund
308	Panjara kate	Katol	21.12444444	78.65111	0.04	-	Storage Bund
309	Panjra (kate)	Katol	21.1229	78.6666	0.03	-	Storage Bund
310	Panjrarithi	Katol	21.2378	78.6485	0.05	-	Storage Bund
311	Panwadi	Katol	21.31777778	78.72833	0.03	-	Storage Bund
312	Paradsinga	Katol	21.31722222	78.5175	0.03	-	Storage Bund
313	Paradsinga	Katol	21.42194444	78.35167	0.03	-	Storage Bund
314	Raulgaon	Katol	21.2269	78.7862	0.01	-	Storage Bund
315	Ridhora	Katol	21.23555556	78.63028	0.03	-	Storage Bund
316	Ridhora(Bo)	Katol	21.23166667	78.62972	0.03	-	Storage Bund
317	Ringnabodi	Katol	21.13083333	78.71306	0.03	-	Storage Bund
318	Sabkund-1	Katol	21.19861111	78.59472	0.04	-	Storage Bund
319	Sabkunda	Katol	21.2025	78.59417	0.03	-	Storage Bund
320	Sabkunda	Katol	21.20194444	78.59306	0.04	-	Storage Bund
321	Salai Kelpur	Katol	21.2369	78.4382	0.03	-	Storage Bund
322	Salai khursapar	Katol	21.1575	78.57972	0.03	-	Storage Bund
323	Sawali-1	Katol	21.21972222	78.48694	0.04	-	Storage Bund

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324	Shekapur	Katol	21.15722222	78.7125	0.02	-	Storage Bund
325	Shekapur	Katol	21.15722222	78.71278	0.05	-	Storage Bund
326	Sirmi Sab.	Katol	21.14027778	78.58083	0.04	-	Storage Bund
327	Sonegaon	Katol	21.14861111	78.12583	0.03	-	Storage Bund
328	Sonegaon	Katol	21.2623	78.4274	0.03	-	Storage Bund
329	Sonmoh	Katol	21.23277778	78.68722	0.02	-	Storage Bund
330	Sonmoh-2	Katol	21.06361111	78.68611	0.05	-	Storage Bund
331	Tandulwani	Katol	21.20777778	78.52389	0.05	-	Storage Bund
332	Taroda	Katol	21.13972222	78.60722	0.04	-	Storage Bund
333	Wai	Katol	21.21166667	78.67444	0.04	-	Storage Bund
334	Wai	Katol	21.21277778	78.67806	0.03	-	Storage Bund
335	Wajbodi	Katol	21.2164	78.7146	0.04	-	Storage Bund
336	Wandli	Katol	21.24694444	78.60972	0.02	-	Storage Bund
337	Wandli (Wagh)	Katol	21.2425	78.60694	0.02	-	Storage Bund
338	Wandli Wagh-2	Katol	21.2375	78.6094	0.04	-	Storage Bund
339	Yenva	Katol	21.34416667	78.58472	0.02	-	Storage Bund
340	Zilpa	Katol	21.34305556	78.68833	0.03	-	Storage Bund
341	Zilpa	Katol	21.36138889	78.06694	0.03	-	Storage Bund
342	Ahmednagar	katol	21.17305556	78.56472	0.05	-	VT
343	Metpanjara	katol	21.27055556	78.67806	0.1	-	VT
344	Paradsinga	katol	21.31805556	78.52222	0.04	-	VT
345	Vajbodi	katol	21.22888889	78.71111	0.06	-	VT
346	Ambada (Sa)-2	Narkhed	21.33722222	78.28722	0.03	5	KT wier
347	Ambada Deshmukh	Narkhed	21.45444444	78.60444	0.02	6	KT wier
348	Ambada Saywada-1	Narkhed	21.33388889	78.26722	0.01	2	KT wier
349	Arambhi-1	Narkhed	21.24972222	78.34972	0.03	5	KT wier
350	Arambhi-2	Narkhed	21.26722222	78.36722	0.03	5	KT wier
351	Belona	Narkhed	21.48388889	78.46917	0.04	11	KT wier
352	Bhaywadi	Narkhed	21.46777778	78.50111	0.04	11	KT wier
353	Chandani bardi-1	Narkhed	21.37116667	78.37869	0.04	10	KT wier
354	Chandani bardi-2	Narkhed	21.37116667	78.37869	0.11	66	KT wier
355	Chorkhairi	Narkhed	21.4525	78.66917	0.01	2	KT wier
356	Hiwarmath-1	Narkhed	#N/A	#N/A	0.03	5	KT wier
357	Hiwarmath-2	Narkhed	#N/A	#N/A	0.03	5	KT wier
358	Jamgaon (Bu)-3	Narkhed	21.31861111	78.43528	0.01	4	KT wier
359	Jamgaon (Bu.)-2	Narkhed	21.31861111	78.43333	0.04	2	KT wier
360	Khairi (Khurd)	Narkhed	21.114	78.598	0.06	15	KT wier
361	Khalangondri	Narkhed	21.41888889	78.71889	0.03	5	KT wier
362	Kharala	Narkhed	21.25638889	78.37306	0.03	5	KT wier
363	Kharasi	Narkhed	21.2476	78.4216	0.14	99	KT wier
364	Kharsoli	Narkhed	21.39555556	78.72889	0.12	46	KT wier
365	Khedi Mannath	Narkhed	21.45416667	78.65417	0.03	8	KT wier
366	Loharisawanga	Narkhed	21.26055556	78.41056	0.04	40	KT wier
367	Mahendri	Narkhed	21.55555556	78.40556	0.1	60	KT wier
368	masora	Narkhed	21.43055556	78.63944	0.01	2	KT wier
369	Mendhla	Narkhed	21.32777778	78.37778	0.03	5	KT wier
370	Mogra	Narkhed	21.44638889	78.56306	0.05	10	KT wier
371	Mohdi Dalwi	Narkhed	21.5033	78.5617	0.25	71	KT wier
372	Mohdi Dhotra	Narkhed	21.4168	78.5465	0.03	9	KT wier
373	Mohgaon (Bhadade)	Narkhed	21.3891	78.7318	0.04	10	KT wier
374	Mohgaon(Bhadade)	Narkhed	21.39694444	78.73028	0.03	6	KT wier
375	Narkhed Madar	Narkhed	21.47944444	78.54611	0.11	31	KT wier
376	Pandhri (Gaimukh)	Narkhed	21.485	78.46833	0.06	12	KT wier
377	Parsodi(Raut)	Narkhed	21.38444444	78.50111	0.02	12	KT wier
378	Peth Muktapur	Narkhed	21.114	78.598	0.13	50	KT wier
379	Pimpalgaon raut	Narkhed	21.38833333	78.47167	0.04	12	KT wier
380	Pipaldhara-1	Narkhed	21.3239	78.3543	0.04	5	KT wier
381	Pipaldhara-2	Narkhed	21.3239	78.3543	0.03	5	KT wier
382	Ramthi	Narkhed	21.2977	78.3592	0.03	5	KT wier
383	Ranwadi	Narkhed	21.32444444	78.45778	0.03	8	KT wier
384	Sawargaon	Narkhed	21.38583333	78.61917	0.01	3	KT wier
385	Sawargaon (Kukdoba)	Narkhed	21.40027778	78.61694	0.05	5	KT wier
386	Sawargaon Hawale)	Narkhed	21.39333333	78.64333	0.03	5	KT wier
387	Sawargaon Landgi	Narkhed	21.40472222	78.55472	0.05	15	KT wier
388	Sawargaon-2	Narkhed	21.38583333	78.61917	0.04	16	KT wier

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389	Singarkheda	Narkhed	21.03972222	78.58972	0.03	8	KT wier
390	Sinjar	Narkhed	21.3576	78.385	0.1	35	KT wier
391	Talegaon Rithi-1	Narkhed	21.2995	78.3978	0.02	6	KT wier
392	Talegaon rithi-2	Narkhed	21.2995	78.3978	0.02	8	KT wier
393	Thaturwada-1	Narkhed	21.35	78.5	0.03	10	KT wier
394	Thaturwada-2	Narkhed	21.35	78.5	0.06	10	KT wier
395	wadhona	Narkhed	21.31805556	78.36806	0.04	5	KT wier
396	Yenikoni	Narkhed	21.44944444	78.56611	0.03	10	KT wier
397	Banorchandra	Narkhed	21.455	78.5793	0.48	79	MI Tank
398	hiwarmath	Narkhed	21.28	78.36917	0.44	91	MI Tank
399	Khapri Gosawi	Narkhed	21.4356	78.6886	0.41	91	MI Tank
400	Khedigowargodi	Narkhed	21.35527778	78.64	0.52	100	MI Tank
401	Khutkhairi	Narkhed	21.403	78.7206	0.4	100	MI Tank
402	Malapur-1	Narkhed	21.3946	78.6663	0.28	78	MI Tank
403	Mendhla	Narkhed	21.32972222	78.37583	0.41	66	MI Tank
404	Navegaon	Narkhed	21.49972222	78.53722	0.46	77	MI Tank
405	Pithori	Narkhed	21.47472222	78.60889	0.36	67	MI Tank
406	Rohana	Narkhed	21.3274	78.4885	0.25	53	MI Tank
407	Ambada deshmukh	Narkhed	21.45555556	78.58472	0.14	-	PT
408	Chorkhairi	Narkhed	21.465	78.12333	0.14	-	PT
409	Ghogra-1	Narkhed	21.28333333	78.41361	0.31	-	PT
410	Jamgaon(khori)	Narkhed	21.39888889	78.66444	0.19	-	PT
411	Kharala-1	Narkhed	21.25416667	78.37	0.19	-	PT
412	Kharala-2	Narkhed	21.25416667	78.37	0.44	-	PT
413	Malapur-2	Narkhed	21.3946	78.6663	0.29	-	PT
414	Manikwada	Narkhed	21.49722222	78.49306	0.19	-	PT
415	Pimpalgaon raut	Narkhed	21.45333333	78.06278	0.29	-	PT
416	Pipaldhara	Narkhed	21.33055556	78.34556	0.31	-	PT
417	Singarkheda	Narkhed	21.46277778	78.54889	0.21	-	PT
418	Sippikhapa-1	Narkhed	21.4029	78.5996	0.33	-	PT
419	Sippikhapa-2	Narkhed	21.4029	78.5996	0.21	-	PT
420	Talegaon rithi	Narkhed	21.2995	78.3978	0.16	-	PT
421	Wadhona	Narkhed	21.32361111	78.36639	0.3	-	PT
422	Agra	Narkhed	21.42436111	78.71778	0.04	-	Storage Bund
423	Ambada (Deshmukh)	Narkhed	21.45277778	78.61667	0.01	-	Storage Bund
424	Ambada(Saywada)	Narkhed	21.45388889	78.61778	0.05	-	Storage Bund
425	Banor	Narkhed	21.455	78.5793	0.03	-	Storage Bund
426	Banor(Pithori)	Narkhed	21.46861111	78.57528	0.03	-	Storage Bund
427	Banora 2	Narkhed	21.32388889	78.33278	0.03	-	Storage Bund
428	Banora(Chandrahas)	Narkhed	21.455	78.5793	0.04	-	Storage Bund
429	Banorchandra -1	Narkhed	21.455	78.5793	0.04	-	Storage Bund
430	baorchandra-3	Narkhed	21.455	78.5793	0.04	-	Storage Bund
431	Baradpauni	Narkhed	21.34694444	78.18861	0.03	-	Storage Bund
432	Belona1	Narkhed	21.48861111	78.47944	0.03	-	Storage Bund
433	Belona2	Narkhed	21.03833333	78.47639	0.04	-	Storage Bund
434	Belona3	Narkhed	21.03722222	78.485	0.03	-	Storage Bund
435	Belona-4	Narkhed	21.4919	78.4924	0.05	-	Storage Bund
436	Bhaywadi	Narkhed	21.47416667	78.50889	0.03	-	Storage Bund
437	Bhaywadi	Narkhed	21.4773	78.518	0.04	-	Storage Bund
438	Chichkumbh	Narkhed	21.28555556	78.28889	0.03	-	Storage Bund
439	Chorkhairi	Narkhed	21.45972222	78.64111	0.03	-	Storage Bund
440	Datewadi	Narkhed	21.37666667	78.34139	0.03	-	Storage Bund
441	Datewadi-1	Narkhed	21.34944444	78.39889	0.03	-	Storage Bund
442	Dawasa-2	Narkhed	21.51388889	78.33889	0.03	-	Storage Bund
443	Dawsa	Narkhed	21.04388889	78.33361	0.04	-	Storage Bund
444	dawsa	Narkhed	21.34777778	78.33694	0.04	-	Storage Bund
445	Dawsa-1	Narkhed	21.34722222	78.33806	0.04	-	Storage Bund
446	Dawsa-2	Narkhed	21.34694444	78.34083	0.04	-	Storage Bund
447	Dawsa-2	Narkhed	21.34833333	78.17194	0.04	-	Storage Bund
448	Dhotra	Narkhed	21.43138889	78.54972	0.03	-	Storage Bund
449	Dindargaon	Narkhed	21.4078	78.4872	0.05	-	Storage Bund
450	Gangaldoh	Narkhed	21.30472222	78.64778	0.03	-	Storage Bund
451	Godhani	Narkhed	21.4862	78.4619	0.05	-	Storage Bund
452	Godhni	Narkhed	21.47861111	78.44972	0.03	-	Storage Bund
453	Godhni	Narkhed	21.8025	78.2725	0.04	-	Storage Bund

Sl. No.	Location/village name	Taluka	lat	long	Live Storage capacity (MCM)	Irrigation Potential (Ha)	Type of strucutre
454	Gondegaon	Narkhed	21.5042	78.5301	0.03	-	Storage Bund
455	Gondikhapa	Narkhed	21.3184	78.7131	0.05	-	Storage Bund
456	Gonhi	Narkhed	21.3083	78.6229	0.05	-	Storage Bund
457	Gowargondi	Narkhed	21.463	78.637	0.03	-	Storage Bund
458	Gowargondi	Narkhed	21.45583333	78.64111	0.03	-	Storage Bund
459	Gumgaon	Narkhed	21.2362	78.4175	0.04	-	Storage Bund
460	Gumgaon	Narkhed	21.2362	78.4175	0.06	-	Storage Bund
461	Hiwarmath-1	Narkhed	#N/A	#N/A	0.04	-	Storage Bund
462	Jamgaon (Bu)	Narkhed	21.32888889	78.43861	0.04	-	Storage Bund
463	Junewani	Narkhed	21.2757	78.4454	0.03	-	Storage Bund
464	Junona Fuke	Narkhed	21.41944444	78.64083	0.05	-	Storage Bund
465	Junona Fuke-1	Narkhed	21.41694444	78.63861	0.01	-	Storage Bund
466	Junona Fuke-2	Narkhed	21.33472222	78.64472	0.01	-	Storage Bund
467	Kakaddara	Narkhed	21.2941	78.463	0.03	-	Storage Bund
468	Karanjoli	Narkhed	21.3492	78.4409	0.03	-	Storage Bund
469	Karanjoli	Narkhed	21.36361111	78.44944	0.05	-	Storage Bund
470	Khalangondri	Narkhed	21.30333333	78.28444	0.04	-	Storage Bund
471	Khalangondri	Narkhed	21.3	78.295	0.04	-	Storage Bund
472	Khalangondri-4	Narkhed	21.13472222	78.28417	0.04	-	Storage Bund
473	Khalangondri-5	Narkhed	21.30333333	78.29639	0.05	-	Storage Bund
474	Khandala	Narkhed	21.38897222	78.56442	0.03	-	Storage Bund
475	Khandala	Narkhed	21.38897222	78.56442	0.03	-	Storage Bund
476	Khapa	Narkhed	21.3008	78.4339	0.03	-	Storage Bund
477	Khapa	Narkhed	21.3008	78.4339	0.03	-	Storage Bund
478	Khapa	Narkhed	21.3008	78.4339	0.04	-	Storage Bund
479	Khapri (go)	Narkhed	21.52666667	78.96333	0.03	-	Storage Bund
480	Khapri(Gosavi)(	Narkhed	21.4325	78.68972	0.03	-	Storage Bund
481	Kharashi	Narkhed	21.9175	78.87111	0.04	-	Storage Bund
482	Kharashi	Narkhed	21.2476	78.4216	0.06	-	Storage Bund
483	Kharbadi	Narkhed	21.37888889	78.34028	0.03	-	Storage Bund
484	Khedi(Khurd)	Narkhed	21.3653	78.3308	0.04	-	Storage Bund
485	Lohara	Narkhed	21.81666667	78.22611	0.01	-	Storage Bund
486	Lohara	Narkhed	21.82611111	78.25	0.04	-	Storage Bund
487	Masora	Narkhed	21.0819	78.6199	0.04	-	Storage Bund
488	Maywadi	Narkhed	21.33611111	78.44861	0.03	-	Storage Bund
489	Mehandi(D)-2	Narkhed	21.5033	78.5617	0.03	-	Storage Bund
490	Mendhla	Narkhed	21.32416667	78.38222	0.03	-	Storage Bund
491	Mendhla-1	Narkhed	21.32527778	78.37694	0.05	-	Storage Bund
492	Mohdi(Dalwi)	Narkhed	21.5033	78.5617	0.03	-	Storage Bund
493	Mohdi(Dhotra)	Narkhed	21.4225	78.53333	0.03	-	Storage Bund
494	Mohgaon Bhadade	Narkhed	21.39527778	78.7175	0.05	-	Storage Bund
495	nanda Shinde	Narkhed	21.435	78.6043	0.03	-	Storage Bund
496	nandani	Narkhed	21.375	78.37111	0.05	-	Storage Bund
497	Pandhri	Narkhed	#N/A	#N/A	0.03	-	Storage Bund
498	Panwadi	Narkhed	21.33194444	78.46444	0.03	-	Storage Bund
499	parsodi	Narkhed	21.461	78.5119	0.05	-	Storage Bund
500	Pimpalgaon(B)	Narkhed	21.4548	78.5608	0.03	-	Storage Bund
501	Pimpalgaon(Ra)	Narkhed	21.38888889	78.35806	0.03	-	Storage Bund
502	Pipla (khurd)	Narkhed	21.4587	78.6941	0.03	-	Storage Bund
503	Pipla (Shemda)	Narkhed	21.4587	78.6941	0.03	-	Storage Bund
504	Pipla(Shemda)	Narkhed	21.4587	78.6941	0.03	-	Storage Bund
505	Rampuri (rayyatwari)	Narkhed	21.2734	78.3142	0.04	-	Storage Bund
506	Rampuri (rayyatwari)	Narkhed	21.2734	78.3142	0.03	-	Storage Bund
507	Rampuri(mal)	Narkhed	21.2851	78.3111	0.04	-	Storage Bund
508	Rampuri-4	Narkhed	21.35972222	78.44306	0.04	-	Storage Bund
509	Ramthi	Narkhed	21.29444444	78.35083	0.03	-	Storage Bund
510	Ramthi-1	Narkhed	21.29166667	78.28861	0.03	-	Storage Bund
511	Ramthi-2	Narkhed	21.29027778	78.34778	0.03	-	Storage Bund
512	Ranwadi	Narkhed	21.32916667	78.44833	0.05	-	Storage Bund
513	Saiwada	Narkhed	21.35	78.27611	0.03	-	Storage Bund
514	Sakharkheda	Narkhed	21.34972222	78.34667	0.03	-	Storage Bund
515	Sakharkheda	Narkhed	21.35194444	78.34278	0.03	-	Storage Bund
516	Sardi	Narkhed	21.47722222	78.58806	0.03	-	Storage Bund
517	Sawargaon	Narkhed	21.39916667	78.6325	0.03	-	Storage Bund
518	Sawargaon-1	Narkhed	21.40583333	78.63389	0.01	-	Storage Bund

Sl. No.	Location/village name	Taluka	lat	long	Live Storage capacity (MCM)	Irrigation Potential (Ha)	Type of strucutre
519	Sawargaon-2	Narkhed	21.38416667	78.63361	0.01	-	Storage Bund
520	Shegda(Pipla)	Narkhed	#N/A	#N/A	0.03	-	Storage Bund
521	Shemda2	Narkhed	21.47111111	78.71611	0.03	-	Storage Bund
522	Singarkheda	Narkhed	21.37055556	78.54639	0.05	-	Storage Bund
523	Sinjar	Narkhed	21.35916667	78.37361	0.03	-	Storage Bund
524	Sinjar	Narkhed	21.3575	78.37333	0.03	-	Storage Bund
525	Sinjar-2	Narkhed	21.35694444	78.37278	0.04	-	Storage Bund
526	Sukhya Nala Belona	Narkhed	21.4919	78.4924	0.04	-	Storage Bund
527	Talegaon (Rithi)	Narkhed	21.2995	78.3978	0.03	-	Storage Bund
528	Tara	Narkhed	21.31083333	78.27833	0.03	-	Storage Bund
529	Thadipauni	Narkhed	21.3544	78.3026	0.03	-	Storage Bund
530	Thaturwada	Narkhed	21.3398	78.5326	0.03	-	Storage Bund
531	Thugaon (Nipani)	Narkhed	21.41777778	78.48917	0.03	-	Storage Bund
532	Thugaon Dev	Narkhed	21.41222222	78.45194	0.03	-	Storage Bund
533	Thugaon Nipani	Narkhed	21.415	78.48889	0.03	-	Storage Bund
534	Thugaon(Nipani)	Narkhed	21.4251	78.4976	0.03	-	Storage Bund
535	Tinkheda	Narkhed	21.4075	78.48833	0.03	-	Storage Bund
536	Udapur	Narkhed	21.30861111	78.33583	0.03	-	Storage Bund
537	Umari Sindi-2	Narkhed	21.442	78.6587	0.01	-	Storage Bund
538	Umri Sindhi	Narkhed	21.43694444	78.65472	0.01	-	Storage Bund
539	Umtha	Narkhed	21.33972222	78.40833	0.03	-	Storage Bund
540	Umtha-1	Narkhed	21.33638889	78.40472	0.03	-	Storage Bund
541	Umtha-2	Narkhed	21.33694444	78.40472	0.04	-	Storage Bund
542	Vivra	Narkhed	21.35333333	78.47333	0.05	-	Storage Bund
543	Wadegaon Umri	Narkhed	21.4093	78.5339	0.03	-	Storage Bund
544	Wadvihira-1	Narkhed	21.3475	78.39944	0.03	-	Storage Bund
545	Yenikoni	Narkhed	21.43944444	78.585	0.03	-	Storage Bund
546	Yerla (Pawde)	Narkhed	21.4507	78.4922	0.01	-	Storage Bund
547	Yerla (Pawde)	Narkhed	21.44916667	78.43667	0.03	-	Storage Bund
548	Zolwadi	Narkhed	#N/A	#N/A	0.03	-	Storage Bund
549	Zolwadi	Narkhed	#N/A	#N/A	0.03	-	Storage Bund

#N/A = Not available

(Source: Water Resources Department, Govt. of Maharashtra, June 2014)

Annexure-II Salient Features of Ground water exploration in Narkhed and Katol taluka, Nagpur district.

SN	Toposheet	Taluka	Village	Longitude	Latitude	Type	Altitude	Drilling_depth	Casing	AQ_Zones	Aq1	Aq2	T	S	K
1	55K/11-2B	Katol	Sonali	78.6167	21.3833	Pz		25.3					-	-	-
2	55K/11-2A	Katol	Narkhed	78.5381	21.3381	Pz		40					-	-	-
3	55K/15-3A	Katol	Dorli	78.7833	21.2667	EW		125	2	36.6 -39.6 ,88.4 -100.6	36.6 -39.6	88.4 -100.6	7.11	5.50 E-05	5.50E -05
4	55K/15-3A	Katol	Dorli	78.7833	21.2667	OW		153.5	1.5	30.5 -33.5 ,115.5 -125	30.5 -33.5	115.5 -125	-	-	-
5	55K/11-3B	Katol	Katol	78.6167	21.25	EW		254	10	12.2 -18.3 ,183 -186	12.2 -18.3	183 -186	-	-	-
6	55K/12-2B	Katol	Khairi	78.5972	21.1083	OW		170.8	9				-	-	-
7	55K/12-2B	Katol	Khairi	78.5972	21.1083	EW		115.9	6.33	21 -24 ,27.4 -33.4 ,76 -79 ,52 -55 ,101 -104 ,113 -115.9	21 -24 ,27.4 -33.4 ,76 -79 ,52 -55 ,	101 -104 ,113 -115.9	-	-	-
8	55K/12-2B	Katol	Kondhali	78.6375	21.135	EW		6.5	-				-	-	-
9	55K/11-3C	Katol	Metpanjra	78.7	21.2583	EW		122	19.2		19		-	-	-
10	55K/11	Katol	Katol	78.6167	21.25	EW	421	254	10	12.2 -18.3 ,183 -186	18				
11	55K/11	Narkhed	Narkhed	78.5292	21.4722	OW	410.1	181	10.3						
12	55K/7	Narkhed	Wadvihra	78.3986	21.3472	EW	382.7	201.3	9						
13	55K/7	Narkhed	Paradsinga	78.3667	21.2833	Pz	418.9	40	4.4						
14	55K/7	Narkhed	Jalalkheda	78.4167	21.375	Pz	364	32.2	27.4						
15	55K/7	Narkhed	Jamgaon (Bk)	78.4333	21.3208	Pz	398	40	5.4						
16	55K/7	Narkhed	Rohna	78.48	21.3492	Pz	386.8	27.6	5.4						
17	55K/7	Narkhed	Arambhi	78.3486	21.2694	EW	415.6	200	5.6	40-43 & 153-156					
18	55K/7	Narkhed	Belona	78.4864	21.4833	EW	405.5	200	5.6	9-12 & 28-31					
19	55K/7	Narkhed	Indarwada	78.4622	21.3519	EW	389	128.6	5.6	16-19					
20	55K/7	Narkhed	Jamgaon Bk.	78.4478	21.3278	EW	393.7	31	5.6	24-27					
21	55K/7	Narkhed	Jamgaon Kh.	78.4367	21.3381	EW	394.3	200	5.6						
22	55K/7	Narkhed	Lohari Sawanga	78.4044	21.26	EW	399.7	200	5.6	165-168					

SN	Toposheet	Taluka	Village	Longitude	Latitude	Type	Altitude	Drilling_depth	Casing	AQ_Zones	Aq1	Aq2	T	S	K
23	55K/7	Narkhed	Muktapur	78.4069	21.3764	EW	376.2	25	0	Drilling abandoned					
24	55K/7	Narkhed	Tinkheda	78.4903	21.4033	EW	393.3	200	5.6	9-12, 37-40, 140-143 & 165-168					
25	55K/12-1C	Katol	Maragsur	78.7071111	21.20731	EW	512	126.5	20	114.30-117.40		114.30-117.40			
26	55K/12-1A	Katol	Ladgaon	78.5646944	21.22706	EW	538	200	20	28.90-32 114.30-117.40	28.90-32	114.30-117.40			
27	55K/12-1A	Katol	Ladgaon	78.5646944	21.22706	OW	538	200	20	28.90-32 114.30-117.40	28.90-32	114.30-117.40			
28	55K/11-3C	Katol	KHANGAON	78.5466944	21.29417	EW	418	181.5	20	16-17 157 (Basalt-Gondwana contact) 181	16-17	157 (Basalt-Gondwana contact) 181			
29	55K/11-3C	Katol	KHANGAON	78.5468056	21.29417	OW	418	181.5	20	16-17 157 (Basalt-Gondwana contact) 181	16-17	157 (Basalt-Gondwana contact) 181			
30	55K/11-B2	Katol	SAWARGAON	78.6342222	21.40108	EW	420	200	20	10.3-13.70	10.3-13.70				
31	55K/11-A1	Narkhed	KONI	78.5824722	21.43964	EW	421	200	25	16.70-19.80, 126.50-129.60	16.70-19.80,	126.50-129.60			
32	55K/11-B2	Narkhed	KHEDI	78.6445556	21.45894	EW	421	105.2	25	53.30-56.40		53.30-56.40			
33	55K/7-1C	Narkhed	MANIKWADA	78.4998889	21.49717	EW	417	200	25	19.80, 41.10, 108.2	19.80,	41.10, 108.2			
34	55K/15-1C	Katol	SONKHAMB	21.27225000	78.72252778	EW	411	197.75	11.20	11.10 - 11.20, 22.60 - 23.00, 76.45 - 79.10	11.10 - 11.20, 22.60 - 23.00,	76.45 - 79.10	30.00	_	
35	55K/16-1A	Katol	RAULGAON	21.23755556	78.78313889	EW	394	200	59.37	150.34 - 162.45, 174.55 - 198.80	--	150.34 - 162.45, 174.55 - 198.80	42.83	_	
36	55K/11-2C	Narkhed	PIPLA	21.40000000	78.73333333	EW	348	162	100	100-114, 116-132		100-114, 116-132	9.32	9.8x10-3	

SN	Toposheet	Taluka	Village	Longitude	Latitude	Type	Altitude	Drilling_depth	Casing	AQ_Zones	Aq1	Aq2	T	S	K
37	55K/11-2C	Narkhed	MOHGAON BHADADE	21.391666 67	78.7222 2222	EW	400	300	68	68-72, 89-97, 107-113, 118-123, 143-147, 148-154, 165-172, 176-178, 184-204, 218-225, 232-238, 244-257, 266-271		68-72, 89-97, 107-113, 118-123, 143-147, 148-154, 165-172, 176-178, 184-204, 218-225, 232-238, 244-257, 266-271	-	-	

Annexure-III Details of GW monitoring wells and KOWs in Narkhed and Katol taluka, Nagpur district.

Sl. No.	Toposheet well no.	Taluka	Site name	agency	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Soil thickness	Lining (mbgl)	Total Thickness weathered portion (m)	Dia (m)	Total Thickness weathered portion (m)	Depth to Fractures (mbgl)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Annual Draft m3/year (X0.7) 0.7=Efficency)	Well command area (acre)
1	2	3	4	5	6	7	8	9	10	11	12	12	14	15	16	17	18	19	20	21	22	23	24
1	55 K/11 1B	Narkhed	Mannat	CGWB	DW	21.45756	78.65247	462.10	6.10	DT Basalt	FMB	1	2.2	3	6.80			3		20 min to 2	20 min		1.5
2	55 K/7 3C	Narkhed	Pandhardhakni	CGWB	DW	21.27153	78.45967	482.20	6.60	DT Basalt	WMB	1.5	3.2	5	6.00				1	2 to 8	2		4
3	55 K/12 1C	Katol	Miniwada	CGWB	DW	21.10421	78.70477	429.40	6.70	DT Basalt	JFMB	1.5	4.2	2.7	4.65			5		2	2		4.5
4	55 K/12 3B	Katol	Masod	CGWB	DW	21.07761	78.62553	497.90	15.00	DT Basalt	WFVB	0.6	3.2	3.5	5.40			3		2	0		27.6
5	55 K/11 3A	Katol	Junewani	CGWB	DW	21.27983	78.52628	437.20	9.60	DT Basalt	FMB	0.1	2.2	4	4.80			3	0	8	2		6
6	55 K/11 2B	Katol	Zilpa	CGWB	DW	21.34092	78.68694	442.10	9.20	DT Basalt	WMB	1.1	2.4	8.1	4.20			3		2	0		88 r
7	55 K/7 1B	Narkhed	Ramthi	CGWB	DW	21.29894	78.35611	418.20	9.10	DT Basalt	FMB	0.5	2.3	1	6.00				1	1 to 2	1 to 30 min	1983.089	
8	55 K/8 1C	Narkhed	Bhorgadh	CGWB	DW	21.23831	78.47739	447.00	10.20	DT Basalt	WMB	0.8	6	8	3.80				0	1 to 8	0		6
9	55 K/7 2C	Narkhed	Karanjoli	CGWB	DW	21.35664	78.43283	341.00	10.60	DT Basalt	WVB	6	6.7	4	3.50			5	1	2 to 4	1		6
10	55 K/12 1A	Katol	Junapani	CGWB	DW	21.1525	78.56561	520.50	10.80	DT Basalt	JFMB	0.5	3.15	3.15	5.30			3		2 to 4	1		3
11	55 K/12 1B	Katol	Sabkund	CGWB	DW	21.19817	78.5965	469.30	15.20	DT Basalt	JFMB	0.8	4	9.2	4.00			3		3	0		3
12	55 K/11 2B	Katol	Mohgaon bhadade	CGWB	DW	21.39586	78.72772	397.30	13.40	DT Basalt	FMB		4.8		1.00								
13	56 K/11 1C	Narkhed	Semda	CGWB	DW	21.45081	78.70715	424.10	9.00	DT Basalt	WMB	1	2.5	6	4.45			3	1	2 to 4	0		2
14	55K/7 1C	Narkhed	Belona	CGWB	DW	21.48358	78.48333	405.00	11.00	DT Basalt	FMB	0.8	5.5	8	1.70			3	0	2 to 2.5	1		6 to 7
15	55 K/12 1A	Katol	Ladgaon	CGWB	DW	21.23711	78.56581	441.60	11.10	DT Basalt	JFMB	1.5	2.5	3.8	4.40			3		2	1		2.5
16	55 K/12 1C	Katol	Maragsur	CGWB	DW	21.20858	78.70844	429.00	13.10	DT Basalt	JFMB	0.1	4.5	3.5	3.30			3		2			2
17	55 K/12 3C	Katol	khapa (Dhotiwada)	CGWB	DW	21.04917	78.67611	442.30	11.75	DT Basalt	JFMB	0.5	2.8	7.5	5.00			3	0	1	0		3
18	55 K/11 3C	Katol	Dongargaon	CGWB	DW	21.30603	78.60347	424.50	13.80	DT Basalt	FMB	1.5	3.5	4.5	2.80				3		4		2.5
19	55 K/11 1A	Narkhed	Bhishnur	CGWB	DW	21.35443	78.51268	384.60	14.70	Local river Alluvium	Alluvium		14.7		5.20			3					
20	55 K/7 2A	Narkhed	Ambada	CGWB	DW	21.34619	78.28203	354.80	14.00	DT Basalt	WVB	1.5	14	10	3.60			3	1	2 to 3	1 to 2		4
21	55 K/11 1A	Narkhed	Kharsoli	CGWB	DW	21.44468	78.51008	398.10	17.90	DT Basalt	FMB & WVB	1	5.8	1	4.50			3	0	2 to 3	2 to 3		6
22	55 K/7 2B	Narkhed	Tinkheda	CGWB	DW	21.39889	78.493	393.50	8.85	DT Basalt	JMB	1.5	4.3	7.2	4.90								
23	55 K/12 1B	Katol	Mendhepathar	CGWB	DW	21.24381	78.68408	407	10.4	DT Basalt	JFMB				4.4	6.7		3		0.5 to 4			

Sl. No.	Toposheet well no.	Taluka	Site name	agency	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Soil thickness	Lining (mbgl)	Total Thickness weathered portion (m)	Dia (m)	Total Thickness weathered portion (m)	Depth to Fractures (mbgl)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Annual Draft m3/year (X0.7) 0.7=Efficiency)	Well command area (acre)
24	55 K/7 2B	Katol	Mendki	CGWB	DW	21.35111	78.62158	368	21.6	DT Basalt	JMB				3.7			5					
25	55 K/11 2A	Narkhed	Ambola	CGWB	DW	21.40792	78.58278	389	15.5	DT Basalt	JFMB				4.3	7		3		0.5 to 3	0	2	
26	55 K/11 1A	Narkhed	Bhishnur	CGWB	DW	21.35443	78.51268	384.6	14.7	Local river Alluvium	Alluvium				5.2			3					
27	55 K/7 2B	Narkhed	Tinkheda	GSDA	DW	21.39889	78.493	393.5	8.85	DT Basalt	JMB				4.9	7.2							
28	55 K/11 2C	Katol	Gondikhapa	GSDA	DW	21.32089	78.70667	450	8.8	DT Basalt	JFMB				5	2.2		3		0.5 to 5		2	
29	55 K/7 2B	Katol	Yenwa	GSDA	DW	21.34189	78.59258	371	10.3	DT Basalt	WMB				3.4	10		3		1 to 6		8	
30	55 K/7 3C	Narkhed	Pandhardhakni	GSDA	DW	21.27153	78.45967	482.2	6.6	DT Basalt	WMB				6	5			1	2 to 8	2	4	
31	55 K/11 3B	Katol	Bordoh	GSDA	DW	21.29172	78.63764	477	9	DT Basalt	WB				3.8	3		2		1		4	
32	55 K/12 1C	Katol	Walni	GSDA	DW	21.21217	78.52033	448	10.7	DT Basalt	JFMB				3.4	7.3		3		1		0.5	
33	55 K/11 1B	Narkhed	Sardi	GSDA	DW	21.47272	78.58597	428	10.2	DT Basalt	JMB				3.5	3.5		2		1		2	
34	55 K/12 1C	Katol	Miniwada	GSDA	DW	21.10421	78.70477	429.4	6.7	DT Basalt	JFMB				4.65	2.7	2.5	5		2	2	4.5	
35	55 K/12 2A	Katol	Khapri	GSDA	DW	21.14075	78.54939	475	8.1	DT Basalt	WMB				6	3		3		2	2	7	
36	55 K/12 1B	Katol	Kacheri Sawanga	GSDA	DW	21.18961	78.63111	439	12.9	DT Basalt	JMB				6.8	8		3		2 to 4	1	4	
37	55 K/11 3A	Katol	Paradsinga	GSDA	DW	21.30069	78.53825	380	9.3	DT Basalt	JFMB				3.5	2		3		2 to 3	0.5	2	
38	55 K/7 2A	Katol	Khandala	GSDA	DW	21.38897	78.56442	373	14	DT Basalt	JMB				3.8	6		3	0	45 min to 4 hr	15 min	3	
39	55 K/12 1A	Katol	Ladgaon	GSDA	DW	21.23711	78.56581	441.6	11.1	DT Basalt	JFMB				4.4	3.8		3		2	1	2.5	
40	55 K/11 2A	Katol	Kalambha	GSDA	DW	21.36214	78.56214	349	13	DT Basalt	JFMB				3.7			3		0.5 to 3	0	3	
41	55 K/7 1B	Narkhed	Ramthi	GSDA	DW	21.29894	78.35611	418.2	9.1	DT Basalt	FMB				6	1			1	1 to 2	1 to 30 min		
42	55 K/12 1C	Katol	Tandulwani	GSDA	DW	21.20644	78.52772	445	10.7	DT Basalt	FMB				5.2	2.75		5			1 to 3	6	
43	55 K/12 2C	Katol	Kondhali	GSDA	DW	21.128	78.6385	475.2	21.1	DT Basalt	JFMB				7.9	9.7		3		7 to 8	2	7 to 8	
44	55 K/15 1C	Katol	Dorli	GSDA	DW	21.2528	78.7790	382.12	12.70	DT Basalt			12.7		3.60								
45	55 K/11 2B	Katol	Zilpa	GSDA	DW	21.34092	78.68694	442.1	9.2	DT Basalt	WMB				4.2	8.1	0	3		2	0	88 r	
46	55 K/11 1B	Narkhed	Mannat	GSDA	DW	21.45756	78.65247	462.1	6.1	DT Basalt	FMB				6.8	3		3		20 min to 2	20 min	1.5	
47	55 K/12 1C	Katol	Maragsur	GSDA	DW	21.20858	78.70844	429	13.1	DT Basalt	JFMB				3.3	3.5		3		2		2	

Sl. No.	Toposheet well no.	Taluka	Site name	agency	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Soil thickness	Lining (mbgl)	Total Thickness weathered portion (m)	Dia (m)	Total Thickness weathered portion (m)	Depth to Fractures (mbgl)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Annual Draft m3/year (X0.7) 0.7=Efficiency)	Well command area (acre)
48	55 K/11 1A	Narkhed	Kharsoli	GSDA	DW	21.44468	78.51008	398.1	17.9	DT Basalt	FMB & WVB				4.5	1		3	0	2 to 3	2 to 3	6	
49	55 K/11 1B	Narkhed	Ambada Deshmukh	GSDA	DW	21.44375	78.62033	426	16.5	DT Basalt	JFMB				5	9		3		2 to 4		2	
50	55 K/12 3C	Katol	khapa (Dhotiwada)	GSDA	DW	21.04917	78.67611	442.3	11.75	DT Basalt	JFMB				5	7.5		3	0	1	0	3	
51	55 K/12 2B	Katol	Taroda	GSDA	DW	21.13862	78.60777	504	23.2	DT Basalt	FMB				4.6	5.5		5		3 to 8			
52	55 K/7 2B	Narkhed	Wadhona	GSDA	DW	21.32531	78.37256	385	10.33	DT Basalt	JFMB				2.75	8		5		1 to 3	30 min	3	
53	55 K/12 1B	Katol	Khutamba	GSDA	DW	21.22778	78.59881	408	12.8	DT Basalt	WVB				4.6	6		3	0.5 to 6			3	
54	55 K/7 3C	Narkhed	Khapa	GSDA	DW	21.31294	78.42589	413	19.6	DT Basalt	JFMB				3.7	10		3		3 to 8	0.25	7	
55	55 K/12 3B	Katol	Dhotiwada	GSDA	DW	21.04625	78.65674	437.9	9.7	DT Basalt	JFMB				5.5	8.2		3		8	1 to 2	7	
56	55 K/12 1C	Katol	Murti	GSDA	DW	21.18703	78.50631	429	13	DT Basalt	WVB				5	3.3		3		0.5 to 2		1.5	
57	55 K/11 1A	Narkhed	Mohdi-dhotra	GSDA	DW	21.42722	78.54375	409	11.6	DT Basalt	JMB				2.3	5		3		1 to 3		3	
58	55 K/11 1C	Narkhed	Chorkhairi	GSDA	DW	21.4545	78.67864	409	10	DT Basalt	FMB				7	15		5		4 to 5		7	
59	55 K/11 1C	Narkhed	Agra	GSDA	DW	21.42436	78.71778	372	12.2	DT Basalt	JFMB				4	1		5		0.5 to 4		3	
60	55 K/11 3C	Katol	Isapur	GSDA	DW	21.32697	78.65564	419	9.2	DT Basalt	JMB				4.4	5		3		1 to 2		2	
61	55 K/12 2A	Katol	Chandanpardi	GSDA	DW	21.16236	78.54067	462	10.5	DT Basalt	FMB				3.7	5.8		3		1 to 2 hrs		1	
62	55 K/11 3A	Katol	Dhivarwadi	GSDA	DW	21.28836	78.56278	381	10.2	DT Basalt	JFMB				3			5		2 to 6	1	5	
63	55 K/8 1C	Narkhed	Bhorgadh	GSDA	DW	21.23831	78.47739	447	10.2	DT Basalt	WMB				3.8	8			0	1 to 8	0	6	
64	55 K/7 1C	Narkhed	Tugaonnipani	GSDA	DW	21.42303	78.49347	382	10.7	DT Basalt	JFMB				4.6	6		3		1 to 3	0.5	4	
65	55 K/11 2A	Katol	Wandli	GSDA	DW	21.36125	78.54717	345	16	DT Basalt	JFMB				6.2	5.8		5		1 to 4		3	
66	55 K/12 1B	Katol	Sabkund	GSDA	DW	21.19817	78.5965	469.3	15.2	DT Basalt	JFMB				4	9.2		3		3	0	3	
67	55 K/11 1A	Narkhed	Toyapar	GSDA	DW	21.43822	78.55867	417	15.8	DT Basalt	JMB				3.5	6		3		1 to 6		4	
68	55 K/7 3B	Narkhed	Ghogra	GSDA	DW	21.29036	78.41571	417	6.3	DT Basalt	JMB				4	4		3		0.5 to 3	0.25	2	
69	55 K/11 2A	Narkhed	Wadegaon	GSDA	DW	21.40708	78.52267	398	11.8	DT Basalt	JFMB & VB				4	3		3		0.5 to 3	0.5	3	
70	55 K/11 2B	Katol	Ranjani	GSDA	DW	21.40011	78.59056	325	11.7	DT Basalt	JFMB				4.5	5		3		0.5 to 5	0.5	3	
71	55 K/11 2C	Katol	Kukdipanjra	GSDA	DW	21.25331	78.64794	388	14.8	DT Basalt	JMB				3.5	9		3		0.5 to 3		4	
72	55 K/11 3C	Katol	Malegaon	GSDA	DW	21.3071	78.7206	517.11	7.35	DT Basalt			3.25		3.00								

Sl. No.	Toposheet well no.	Taluka	Site name	agency	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Soil thickness	Lining (mbgl)	Total Thickness weathered portion (m)	Dia (m)	Total Thickness weathered portion (m)	Depth to Fractures (mbgl)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Annual Draft m3/year (X0.7) 0.7=Efficiency)	Well command area (acre)
73	55 K/11 3C	Katol	Dongargaon	GSDA	DW	21.30603	78.60347	424.5	13.8	DT Basalt	FMB				2.8	4.5			3		4	2.5	
74	55 K/7 2B	Narkhed	Nadani chandani	GSDA	DW	21.37117	78.37869	362	14.5	Local river Alluvium	Alluvium				5			3		30 min to 3 hr	0	4	
75	55 K/11 3C	Katol	Metpanjra	GSDA	DW	21.2596	78.7008	426.16	12.17	DT Basalt			6.42		4.15								
76	55 K/11 3A	Katol	Junewani	GSDA	DW	21.27983	78.52628	437.2	9.6	DT Basalt	FMB				4.8	4		3	0	8	2	6	
77	56 K/11 1C	Narkhed	Semda	GSDA	DW	21.45081	78.70715	424.1	9	DT Basalt	WMB				4.45	6		3	1	2 to 4	0	2	
78	55 K/7 2C	Narkhed	Maywadi	GSDA	DW	21.33736	78.45247	389	11	DT Basalt	JFMB				2	10		3		0.5 to 4	0.5	4	
79	55 K/7 1C	Narkhed	Yerla	GSDA	DW	21.46025	78.46964	389	11	DT Basalt	JFMB				2.6	4		3		0.5 to 4	0.5	2	
80	55 K/11 1A	Narkhed	Narkhed	GSDA	DW	21.478	78.53467	405	10	DT Basalt	JMB				2	5		1		1 to 6		4	
81	55 K/7 2A	Narkhed	Ambada	GSDA	DW	21.34619	78.28203	354.8	14	DT Basalt	WVB				3.6	10		3	1	2 to 3	1 to 2	4	
82	55 K/12 2C	Katol	Bihalgondi	GSDA	DW	21.14875	78.66372	418	14	DT Basalt	WJMB				4.8	4.8		3		2 to 4		6	
83	55 K/11 3A	Katol	Digras	GSDA	DW	21.32972	78.53994	366	19.9	DT Basalt	WMB				2.75	5		3		2 to 8	2	9	
84	55 K/11 2C	Katol	Gondimohgaon	GSDA	DW	21.36603	78.70644	404	12.5	DT Basalt	JFMB				7	6		3		0.5 to 3		4	
85	55 K/11 1B	Narkhed	Sindhi Umri	GSDA	DW	21.43028	78.66361	423	15.2	DT Basalt	FMB				2.6			3		2 to 12		2	
86	55 K/12 2B	Katol	Pusagondi	GSDA	DW	21.09736	78.65583	459	10.4	DT Basalt	JFMB				6.2	2		5				4	
87	55 K/7 2A	Narkhed	Thadi Pavni	GSDA	DW	21.35492	78.31167	363	17	DT Basalt	FMB				3.8	8		3		30 min to 2 hrs	0	2	
88	55 K/12 3B	Katol	Masod	GSDA	DW	21.07761	78.62553	497.9	15	DT Basalt	WFVB				5.4	3.5		3		2	0	27.6	
89	55 K/16 1A	Katol	Raulgaon	GSDA	DW	21.2311	78.7814	396.11	9.25	DT Basalt			2.6		3.60								
90	55 K/11 2B	Katol	Mohgaon bhadade	GSDA	DW	21.39586	78.72772	397.3	13.4	DT Basalt	FMB				1								
91	55 K/7 2C	Narkhed	Jalalkheda	GSDA	DW	21.38092	78.42444	365	20	Local river Alluvium	Alluvium				5			3		5 to 6	3 to 4	10	
92	55 K/12 1A	Katol	Junapani	GSDA	DW	21.1525	78.56561	520.5	10.8	DT Basalt	JFMB				5.3	3.15		3		2 to 4	1	3	
93	55 K/7 1C	Narkhed	Mowad	GSDA	DW	21.4587	78.44612	400	19	DT Basalt	WJVB				2.7	5		3		0.25 to 8	0.25 to 1	1.8	
94	55 K/7 2C	Narkhed	Karanjoli	GSDA	DW	21.35664	78.43283	341	10.6	DT Basalt	WVB				3.5	4		5	1	2 to 4	1	6	
95	55K/7 1C	Narkhed	Belona	GSDA	DW	21.48358	78.48333	405	11	DT Basalt	FMB				1.7	8		3	0	2 to 2.5	1	6 to 7	

Annexure-IV A Aquifer-I, Ground water quality of Narkhed and Katol taluka, Nagpur district (based on spot/field EC of KoW)

Sl. no.	Village/ Location	Depth (mbgl)	Aquifer Type	EC (µS/cm)
1	Mannat	6.10	FMB	626
2	Pandhardhakni	6.60	WMB	510
3	Miniwada	6.70	JFMB	583
4	Masod	15.00	WFVB	1015
5	Junewani	9.60	FMB	848
6	Zilpa	9.20	WMB	624
7	Ramthi	9.10	FMB	610
8	Bhorgadh	10.20	WMB	740
9	Karanjoli	10.60	WVB	1120
10	Junapani	10.80	JFMB	1053
11	Sabkund	15.20	JFMB	780
12	Mohgaon bhadade	13.40	FMB	2000
13	Semda	9.00	WMB	868
14	Belona	11.00	FMB	1192
15	Ladgaon	11.10	JFMB	606
16	Maragsur	13.10	JFMB	631
17	khapa (Dhotiwada)	11.75	JFMB	653
18	Dongargaon	13.80	FMB	827
19	Bhishnur	14.70	Alluvium	433
20	Ambada	14.00	WVB	2000
21	Kharsoli	17.90	FMB & WVB	634
22	Tinkheda	8.85	JMB	460
23	Mendhepathar	10.4	JFMB	1.5
24	Mendki	21.6	JMB	396
25	Ambola	15.5	JFMB	410
26	Bhishnur	14.7	Alluvium	433

Annexure-IV B Aquifer-I, Ground water quality of Narkhed and Katol taluka, Nagpur district (based on GWMW)

Sl. no.	Taluka	Site name	Type of structures	Latitude	Longitude	Depth (m bgl)	pH	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F	SAR	RSC	SSP
1	KATOL	Nandora	DW	21.1706	78.6111	10.7	7.9	243	185	38	22	3	0.16	0	177	21	34	3	0.13	0.03	-0.8	3.2
2	KATOL	Ridhora	DW	21.2322	78.6206	13.5	7.6	336	200	38	26	4	0.11	0	104	50	56	13	0.11	0.04	-2.3	3.8
3	KATOL	Chargaon (Punarwasi)	DW	21.2667	78.7583	11	8	319	250	38	38	3	0.05	0	92	50	103	27	0.54	0.03	-3.5	2.7
4	NARKHED	Sawargaon	DW	21.3917	78.635	12.9	7.7	491	325	64	40	4	0.32	0	153	82	42	31	0.13	0.03	-4	2.3
5	NARKHED	Malapur	DW	21.4322	78.6594	16.8	7.6	461	300	58	38	4	0.05	0	128	64	54	57	0.09	0.03	-3.9	2.7
6	NARKHED	Narkhed	DW	21.4667	78.5333	12.5	7.9	898	470	64	75	17	0.11	0	226	213	42	44	0.33	0.12	-5.7	7.3

Annexure-IV C Aquifer-I, Ground water quality of Narkhed and Katol taluka, Nagpur district (based on KOW)

Sl. no.	Taluka	Location/village name	Latitude	Longitude	Accreditated parameters (Method: APHA, 22nd Edition) ppm (mg/l)										Non-Accreditated Parameters		
					pH	EC µS/cm @25°C	Na	K	TH	Ca	Mg	CO_3	HCO_3	Cl	SO_4	NO_3	F
1	Katol	Junewani	21.27983	78.52628	7.6	836	99	8.9	184	95	22	0	244	36	125	28	1.05
2	Katol	Dongargaon	21.30603	78.60347	7.7	492	51	1.1	129	75	13	0	181	10	61	26	0.36
3	Katol	Zilpa	21.34092	78.68694	7.5	533	30	0.4	194	100	23	0	171	10	80	31	0.26
4	Katol	Mohgaon babhdade	21.39586	78.72772	7.5	1102	117	1.0	284	179	25	0	142	136	170	45	0.21
5	Katol	Junapani	21.1525	78.56561	7.4	1031	91	0.5	294	194	24	0	156	64	227	47	0.27
6	Katol	Ladgaon	21.23711	78.56581	7.9	637	82	0.8	139	100	10	0	156	46	99	13	0.74
7	Katol	Sabkund	21.19817	78.5965	8.0	789	64	1.3	224	149	18	0	229	33	111	41	0.35
8	Katol	Masod	21.07761	78.62553	7.7	1154	65	4.8	364	174	46	0	190	123	131	45	0.40
9	Katol	Khapa	21.04917	78.67611	7.9	898	81	2.6	259	139	29	0	156	62	184	45	0.35

Sl. no.	Taluka	Location/village name	Latitude	Longitude	Accreditated parameters (Method: APHA, 22nd Edition) ppm (mg/l)										Non-Accreditated Parameters		
					pH	EC µS/cm @25°C	Na	K	TH	Ca	Mg	CO_3	HCO_3	Cl	SO_4	NO_3	F
10	Katol	Miniwada	21.10421	78.70477	8.0	615	70	0.9	154	90	16	0	224	13	90	22	0.35
11	Katol	Maragsur	21.20858	78.70844	7.5	497	48	1.1	134	85	12	0	151	18	58	39	0.32
12	Narkhed	Kharsoli	21.44468	78.51008	7.5	545	59	1.0	144	85	15	0	210	13	59	18	0.38
13	Narkhed	Bhishnur	21.35443	78.51268	7.7	606	71	1.0	144	80	16	0	200	23	104	7	0.27
14	Narkhed	Mannat	21.45756	78.65247	7.9	715	79	0.6	169	90	19	0	190	46	90	24	0.39
15	Narkhed	Semda	21.45081	78.70715	7.6	774	89	0.8	189	115	18	0	190	39	104	46	0.32
16	Narkhed	Ambada	21.34619	78.28203	7.9	925	129	1.8	184	80	25	0	322	46	118	7	0.34
17	Narkhed	Karanjoli	21.35664	78.43283	7.8	1234	185	7.0	209	95	28	0	293	87	196	45	0.53
18	Narkhed	Pandhardakhni	21.27153	78.45967	7.7	494	23	5.0	184	90	23	0	190	18	41	8	0.27
19	Narkhed	Belona	21.48358	78.48333	7.7	1820	183	24.9	453	134	77	0	361	182	279	46	0.32
20	Narkhed	Bhorgadh	21.23831	78.47739	7.9	702	28	4.7	284	129	38	0	210	28	87	39	0.28

Annexure-IV D Aquifer-II, Ground water quality of Narkhed and Katol taluka, Nagpur district.

S. No	Taluka	Location/ID	Lat	Long	pH	EC µS/cm @ 25°C	TDS	TH	Ca	Mg	Na	K	CO3	HCO 3	Cl	NO3	SO4	F	Fe
1	Katol	Katol-EW	21.2500	78.6167	8.26	600	365	245	40	35	28	1	0	356	18	62	0		0
2	Katol	Ladgaon Ow-I	21.2269	78.5644	7.8	885	575	410	86	47	41	3.31	0	244	89	51	104	0.24	
3	Katol	Ladgaon Ew-II	21.2269	78.5644	7.9	497	323	220	52	22	27	1.41	0	122	57	48	47	0.66	
4	Katol	Maragsur-EW	21.2073	78.7071	7.9	772	502	220	38	30	63	47.47	0	79	121	48	173	0.2	
5	Katol	Ladgaon Ew-I	21.2269	78.5644	7.5	621	404	90	26	6	109	1.66	0	207	71	33	62	1.87	
6	Katol	Ladgaon Ow-II	21.2269	78.5644	8.2	601	391	60	16	5	116	2.25	6	183	71	24	54	1.59	
7	Katol	Khangaon Z-I Ow	21.2942	78.5467	7.6	523	340	220	62	16	44	8.44	0	275	43	24	45	0.66	
8	Katol	Metpanjra-EW	21.2583	78.7000	7.9	979	636	100	34	4	188	0.92	0	43	216	16	203	0.39	
9	Katol	Narkhed PZ	21.3381	78.5381	7.8	697	439	255	32	43	8	0.41	0	159	46	12	78	1.04	
10	Katol	Khangaon Ew	21.2942	78.5467	7.1	1183	769	235	86	5	192	5.46	0	165	163	11	323	0.94	
11	Katol	Khangaon Z-I Ew	21.2942	78.5467	7.8	708	460	40	10	4	183	4.07	0	299	89	10	111	1.39	
12	Katol	Khangaon Ow	21.2942	78.5467	7.9	709	461	40	10	4	184	4.24	0	299	85	10	120	1.39	
13	Katol	Dorli-OW	21.2667	78.7833	8.3	1160	725	70	26	1.2	235	2	0	128	170	1.4	225		3
14	Narkhed	Lohari Sawanga-	21.2600	78.4044	8.1	700	NA	60	12	7	NA	NA	0	214	99	BDL	NA	1.00	

S. No	Taluka	Location/ID	Lat	Long	pH	EC µS/cm @ 25°C	TDS	TH	Ca	Mg	Na	K	CO3	HCO 3	Cl	NO3	SO4	F	Fe
		PYT																	
15	Narkhed	Sawargaon Ew	21.4008	78.6342	7.5	829	539	335	96	23	71	2.23	0	207	89	51	192	0.17	
16	Narkhed	Koni Ew	21.4394	78.5822	7.9	772	502	220	38	30	63	47.47	0	79	121	48	173	0.2	
17	Narkhed	Manikwada Z-III Ew	21.4969	78.4997	8	450	293	155	48	9	46	2.14	0	183	32	48	51	0.2	
18	Narkhed	Manikwada Z-II Ew	21.4969	78.4997	7.8	400	260	150	52	5	37	1.16	0	153	32	47	43	0.17	
19	Narkhed	Jamgaon Kh.-EW	21.3381	78.4367	7.3	980	NA	365	68	47	NA	NA	0	275	67	46	NA	0.55	
20	Narkhed	Manikwada Ew PYT	21.4969	78.4997	8	402	261	180	40	19	25	0.96	0	201	25	45	24	0.24	
21	Narkhed	Narkhed-OW	21.4722	78.5292	7.9	1426	898	470	64	75	17	0.11	0	226	213	44	42	0.33	
22	Narkhed	Manikwada Z-I Ew	21.4969	78.4997	8	350	228	130	32	12	36	1.72	0	92	32	38	42	0.21	
23	Narkhed	Arambhi-EW	21.2694	78.3486	7.5	700	NA	75	20	6.1	110	25	0	104	128	32	55.0	0.45	
24	Narkhed	Arambhi	21.2694	78.3486	8.1	670	NA	90	14	13	NA	NA	0	244	82	24	NA	1.00	
25	Narkhed	Jamgaon Kh.-EW PYT	21.3381	78.4367	8.7	1160	NA	160	38	16	NA	NA	36	171	110	21	NA	0.55	
26	Narkhed	Arambhi	21.2694	78.3486	7.8	640	NA	75	10	12	NA	NA	0	238	82	20	NA	0.99	
27	Narkhed	Khedi Ew	21.4589	78.6444	7.9	979	636	100	34	4	188	0.92	0	43	216	16	203	0.39	
28	Narkhed	Arambhi-EW	21.2694	78.3486	6.9	1830	NA	545	106	68	150	32.0	0	275	206	8	374	0.13	
29	Narkhed	Tinkheda-EW PYT	21.4033	78.4903	7.2	961	NA	215	46	24	117	2.43	0	201	124	3	122	0.30	
30	Narkhed	Belona-EW PYT	21.4833	78.4864	7.3	630	NA	140	38	11	89	0.72	0	287	43	1	36	0.93	
31	Narkhed	Wadvihra-EW	21.3472	78.3986	7.5	750	0	135	24	9	0	0	0	140	136	0	0		2.5

Annexure-IV E Ground water quality under Ground water exploration in Narkhed and Katol taluka, Nagpur district.

Location	Zone /Depth (m bgl)	pH	EC µS/cm @ 25°C	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	NO3	SO4	F	SAR	RSC	SSP
				……ppm……														
Khangaon Z-I Ew	Zone 16.50 m bgl	7.8	708	460	40	10	4	183	4.07	0	299	89	10	111	1.39	12.6	4.1	90
Khangaon Ew	Cumulative	7.1	1183	769	235	86	5	192	5.46	0	165	163	11	323	0.94	5.5	-2	63
Khangaon Z-I Ow	Zone 16.50 m bgl	7.6	523	340	220	62	16	44	8.44	0	275	43	24	45	0.66	1.3	0.1	29
Khangaon Ow	Cumulative	7.9	709	461	40	10	4	184	4.24	0	299	85	10	120	1.39	12.7	4.1	90
Sawargaon Ew	Zone 10.3- to 13.70 m bgl	7.5	829	539	335	96	23	71	2.23	0	207	89	51	192	0.17	1.7	-3.3	31
Koni Ew	200 m bgl depth	7.9	772	502	220	38	30	63	47.47	0	79	121	48	173	0.2	1.8	-3.1	33

Location	Zone /Depth (m bgl)	pH	EC µS/cm @ 25°C	TDS	TH	Ca	Mg	Na	K	CO3	HCO3	Cl	NO3	SO4	F	SAR	RSC	SSP
				……ppm……														
Khedi Ew	Cumulative	7.9	979	636	100	34	4	188	0.92	0	43	216	16	203	0.39	8.2	-1.3	80
Manikwada Z-I Ew	Zone I- 19.80	8	350	228	130	32	12	36	1.72	0	92	32	38	42	0.21	1.4	-1.1	37
Manikwada Z-II Ew	Zone II- 41.10 m bgl	7.8	400	260	150	52	5	37	1.16	0	153	32	47	43	0.17	1.3	-0.5	34
Manikwada Z-III Ew	Zone III- 108.20 m bgl	8	450	293	155	48	9	46	2.14	0	183	32	48	51	0.2	1.6	-0.1	39
Manikwada Ew PYT	PYT sample	8	402	261	180	40	19	25	0.96	0	201	25	45	24	0.24	0.8	-0.3	23
Maragsur EW	114.30-117.40	7.5	612	404	90	26	6	109	1.66	0	207	71	33	62	1.9			
Ladgaon EW	28.90-32 & 114.30-117.40	7.8	885	575	410	86	47	41	3.31	0	244	89	51	104	0.2			

Annexure-V Details of micro-level wells in Narkhed and Katol taluka, Nagpur district.

Sl. No.	Toposheet	well no.	Agency	Taluka	Site name	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Dia (m)	Soil thickness	Lining (mbgl)	Total Thickness weatherd portion (m)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Rate of discharge (lps)
1	55 K/11	55 K/11 3C	CGWB	Katol	Lakholi	DW	21.2783	78.6916	433.01	8.80	DT Basalt	FMB	3.5	0.6	12.7	10	3		2	1	0.78
2	55 K/11	55 K/11 3C	CGWB	Katol	Metpanjra	DW	21.2596	78.7008	426.16	12.17	DT Basalt	FMB	4.15	0.4	6.42	4	3		3	1	0.78
3	55 K/11	55 K/11 3C	CGWB	Katol	Malegaon	DW	21.3071	78.7206	517.11	7.35	DT Basalt	FMB	3	0.5	3.25	2.6	3		3	1	0.78
4	55 k/11	55 K/11 3C	CGWB	Katol	Sonkhamb	DW	21.2627	78.7275	403.08	11.80	DT Basalt	FMB	4.3	0.3	1.5	0.8	3		2	1	0.78
5	55 K/12	55 K/12 1C	CGWB	Katol	Vasboli	DW	21.2292	78.7129	483.16	13.55	DT Basalt	FMB	3	0.7	3.4	2.6	3		4	1	0.78
6	55 k/15	55 K/15 1C	CGWB	Katol	Dorli	DW	21.2528	78.7790	382.12	12.70	DT Basalt	FMB	3.6	0.2	12.7	8	3		2	2	0.78
7	55 K/16	55 K/16 1A	CGWB	Katol	Raulgaon	DW	21.2311	78.7814	396.11	9.25	DT Basalt	FMB	3.6	0,3	2.6	1.8	3		4	0.5	0.78
8	55 K/16	55 K/16 1A	CGWB	Katol	Kotwali Bardi	DW	21.2239	78.7818	389.21	6.25	DT Basalt	FMB	4	0,5	2.2	2	3		3		0.78
9	55 K/16	55 K/16 1A	CGWB	Katol	Pohi	DW	21.2365	78.8116	396.10	10.50	DT Basalt	FMB	3.65	0.4	2.8	2.7			2	1	
10	55 K/11	55 K/11 3A	CGWB	Katol	Junewani	DW	21.27983333	78.52627778	437.20	9.60	DT Basalt	FMB	4.80	0.1	2.2	4	3	0	8	2	2.156
11	55 K/11	55 K/11 3C	CGWB	Katol	Dongargaon	DW	21.30602778	78.60347222	424.50	13.80	DT Basalt	FMB	2.80	1.5	3.5	4.5		3		4	0.78
12	55 K/11	55 K/11 2B	CGWB	Katol	Zilpa	DW	21.34091667	78.68694444	442.10	9.20	DT Basalt	WMB	4.20	1.1	2.4	8.1	3		2	0	0.78
13	55 K/11	55 K/11 2B	CGWB	Katol	Mohgaon bhadade	DW	21.39586111	78.72772222	397.30	13.40	DT Basalt	FMB	1.00		4.8						
14	55 K/12	55 K/12 1A	CGWB	Katol	Junapani	DW	21.1525	78.56561111	520.50	10.80	DT Basalt	JFMB	5.30	0.5	3.15	3.15	3		2 to 4	1	2.156
15	55 K/12	55 K/12 1A	CGWB	Katol	Ladgaon	DW	21.23711111	78.56580556	441.60	11.10	DT Basalt	JFMB	4.40	1.5	2.5	3.8	3		2	1	2.156
16	55 K/12	55 K/12 1B	CGWB	Katol	Sabkund	DW	21.19816667	78.5965	469.30	15.20	DT Basalt	JFMB	4.00	0.8	4	9.2	3		3	0	2.156

Sl. No.	Toposheet	well no.	Agency	Taluka	Site name	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Dia (m)	Soil thickness	Lining (mbgl)	Total Thickness weatherd portion (m)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Rate of discharge (lps)
17	55 K/12	55 K/12 3B	CGWB	Katol	Masod	DW	21.07761111	78.62552778	497.90	15.00	DT Basalt	WFVB	5.40	0.6	3.2	3.5	3		2	0	2.156
18	55 K/12	55 K/12 3C	CGWB	Katol	khapa (Dhotiwada)	DW	21.04916667	78.67611111	442.30	11.75	DT Basalt	JFMB	5.00	0.5	2.8	7.5	3	0	1	0	2.156
19	55 K/12	55 K/12 1C	CGWB	Katol	Miniwada	DW	21.10420833	78.70476667	429.40	6.70	DT Basalt	JFMB	4.65	1.5	4.2	2.7	5		2	2	2.156
20	55 K/12	55 K/12 2C	CGWB	Katol	Kondhali	DW	21.128	78.6385	475.20	21.10	DT Basalt	JFMB	7.90	0.1	9.7	9.7	3		7 to 8	2	2.156
21	55 K/12	55 K/12 3B	CGWB	Katol	Dhotiwada	DW	21.04625278	78.65673889	437.90	9.70	DT Basalt	JFMB	5.50	0.5	2.4	8.2	3		8	1 to 2	2.156
22	55 K/8	55 K/12 1B	CGWB	Katol	Kacheri Sawanga	DW	21.18961111	78.63111111	439.00	12.90	DT Basalt	JMB	6.80	0.5	9.7	8	3		2 to 4	1	2.156
23	55 K/12	55 K/12 1C	CGWB	Katol	Murti	DW	21.18702778	78.50630556	429.00	13.00	DT Basalt	WVB	5.00	0.2	3.3	3.3	3		0.5 to 2		0.78
24	55 K/12	55 K/12 1C	CGWB	Katol	Walni	DW	21.21216667	78.52033333	448.00	10.70	DT Basalt	JFMB	3.40	0.1	4.2	7.3	3		1		0.78
25	55 K/12	55 K/12 1C	CGWB	Katol	Tandulwani	DW	21.20644444	78.52772222	445.00	10.70	DT Basalt	FMB	5.20	0.2	2.6	2.75	5			1 to 3	2.156
26	55 K/12	55 K/12 2A	CGWB	Katol	Chandanpardi	DW	21.16236111	78.54066667	462.00	10.50	DT Basalt	FMB	3.70	0.2	6	5.8	3		1 to 2 hrs		0.78
27	55 K/12	55 K/12 2A	CGWB	Katol	Khapri	DW	21.14075	78.54938889	475.00	8.10	DT Basalt	WMB	6.00	0.2	3	3	3		2	2	2.156
28	55 K/12	55 K/12 2B	CGWB	Katol	Taroda	DW	21.13861944	78.60776944	504.00	23.20	DT Basalt	FMB	4.60	0.8	5.5	5.5	5		3 to 8		2.156
29	55 K/12	55 K/12 2B	CGWB	Katol	Chikhali	DW	21.09630556	78.62722222	466.00	22.10	DT Basalt	JFMB & WVB	6.00	0.5	10	2.2	5		2 to 8		
30	55 K/12	55 K/12 2B	CGWB	Katol	Pusagondi	DW	21.09736111	78.65583333	459.00	10.40	DT Basalt	JFMB	6.20	1.9	2	2	5				2.156
31	55 K/12	55 K/12 2C	CGWB	Katol	Bihalgondi	DW	21.14875	78.66372222	418.00	14.00	DT Basalt	WJMB	4.80	0.5	5	4.8	3		2 to 4		0.78
32	55 K/12	55 K/12 2C	CGWB	Katol	Mahorkhora	DW	21.15919444	78.72480556	426.00	14.00	DT Basalt	JFMB	7.20	0.1	14	4	3				
33	55 K/11	55 K/11 3C	CGWB	Katol	Isapur	DW	21.32697222	78.65563889	419.00	9.20	DT Basalt	JMB	4.40	0.2	5.2	5	3		1 to 2		0.78
34	55 K/11	55 K/11 2C	CGWB	Katol	Gondimohgaon	DW	21.36602778	78.70644444	404.00	12.50	DT Basalt	JFMB	7.00	0.3	5.4	6	3		0.5 to 3		0.78
35	55 K/11	55 K/11 2C	CGWB	Katol	Gondikhapa	DW	21.32088889	78.70666667	450.00	8.80	DT Basalt	JFMB	5.00	0.2	1.9	2.2	3		0.5 to 5		2.156
36	55 K/11	55 K/11 3B	CGWB	Katol	Bordoh	DW	21.29172222	78.63763889	477.00	9.00	DT Basalt	WB	3.80	0.1	4.5	3	2		1		0.78
37	55 K/11	55 K/11 2C	CGWB	Katol	Kukdipanjra	DW	21.25330556	78.64794444	388.00	14.80	DT Basalt	JMB	3.50	1	4.1	9	3		0.5 to 3		0.78
38	55 K/12	55 K/12 1B	CGWB	Katol	Mendhepathar	DW	21.24380556	78.68408333	407.00	10.40	DT Basalt	JFMB	4.40	0.3	1.8	6.7	3		0.5 to 4		0.78
39	55 K/12	55 K/12 1B	CGWB	Katol	Khutamba	DW	21.22777778	78.59880556	408.00	12.80	DT Basalt	WVB	4.60	0.5	6.7	6	3	0.5 to 6			0.78
40	55 K/12	55 K/12 1C	CGWB	Katol	Maragsur	DW	21.20858333	78.70844444	429.00	13.10	DT Basalt	JFMB	3.30	0.1	4.5	3.5	3		2		0.78
41	55 K/11	55 K/11 2C	CGWB	Katol	Borkhedi	DW	21.39527778	78.70091667	371.00	6.00	DT Basalt	JFMB	3.00	0.5	1.5	1.5	3		1 to 3		0.78
42	55 K/7	55 K/7 2B	CGWB	Katol	Mendki	DW	21.35111111	78.62158333	368.00	21.60	DT Basalt	JMB	3.70	0.5	21.6		5				

Sl. No.	Toposheet	well no.	Agency	Taluka	Site name	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Dia (m)	Soil thickness	Lining (mbgl)	Total Thickness weatherd portion (m)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Rate of discharge (lps)
43	55 K/7	55 K/7 2B	CGWB	Katol	Yenwa	DW	21.34188889	78.59258333	371.00	10.30	DT Basalt	WMB	3.40	0.3	3	10	3		1 to 6		2.156
44	55 K/11	55 K/11 3A	CGWB	Katol	Dhivarwadi	DW	21.28836111	78.56277778	381.00	10.20	DT Basalt	JFMB	3.00	1.5			5		2 to 6	1	2.156
45	55 K/11	55 K/11 3A	CGWB	Katol	Paradsinga	DW	21.30069444	78.53825	380.00	9.30	DT Basalt	JFMB	3.50	1.5	3.8	2	3		2 to 3	0.5	0.78
46	55 K/11	55 K/11 3A	CGWB	Katol	Digras	DW	21.32972222	78.53994444	366.00	19.90	DT Basalt	WMB	2.75	2	6	5	3		2 to 8	2	2.156
47	55 K/11	55 K/11 2B	CGWB	Katol	Ranjani	DW	21.40011111	78.59055556	325.00	11.70	DT Basalt	JFMB	4.50	1	5	5	3		0.5 to 5	0.5	0.78
48	55 K/11	55 K/7 2A	CGWB	Katol	Khandala	DW	21.38897222	78.56441667	373.00	14.00	DT Basalt	JMB	3.80	1	6	6	3	0	45 min to 4 hr	15 min	2.156
49	55 K/11	55 K/11 2A	CGWB	Katol	Wandli	DW	21.36125	78.54716667	345.00	16.00	DT Basalt	JFMB	6.20	1	6.2	5.8	5		1 to 4		2.156
50	55 K/11	55 K/11 2A	CGWB	Katol	Kalambha	DW	21.36213889	78.56213889	349.00	13.00	DT Basalt	JFMB	3.70	1	13		3		0.5 to 3	0	0.78
51	55 K/11	55 K/11 1A	CGWB	Narkhed	Kharsoli	DW	21.44468056	78.51008333	398.10	17.90	DT Basalt	FMB & WVB	4.50	1	5.8	1	3	0	2 to 3	2 to 3	0.78
52	55 K/11	55 K/11 1A	CGWB	Narkhed	Bhishnur	DW	21.35443056	78.51268056	384.60	14.70	Local river Alluvium	Alluvium	5.20		14.7		3				
53	55 K/11	55 K/11 1B	CGWB	Narkhed	Mannat	DW	21.45755556	78.65247222	462.10	6.10	DT Basalt	FMB	6.80	1	2.2	3	3		20 min to 2	20 min	0.78
54	55 K/11	56 K/11 1C	CGWB	Narkhed	Semda	DW	21.45081111	78.70715	424.10	9.00	DT Basalt	WMB	4.45	1	2.5	6	3	1	2 to 4	0	0.78
55	55 K/7	55 K/7 2A	CGWB	Narkhed	Ambada	DW	21.34619444	78.28202778	354.80	14.00	DT Basalt	WVB	3.60	1.5	14	10	3	1	2 to 3	1 to 2	0.14 to 0.78
56	55 K/7	55 K/7 1B	CGWB	Narkhed	Ramthi	DW	21.29894444	78.35611111	418.20	9.10	DT Basalt	FMB	6.00	0.5	2.3	1		1	1 to 2	1 to 30 min	2.156
57	55 K/7	55 K/7 2C	CGWB	Narkhed	Karanjoli	DW	21.35663889	78.43283333	341.00	10.60	DT Basalt	WVB	3.50	6	6.7	4	5	1	2 to 4	1	0.14 to 2.156
58	55 K/7	55 K/7 3C	CGWB	Narkhed	Pandhardhakni	DW	21.27152778	78.45966667	482.20	6.60	DT Basalt	WMB	6.00	1.5	3.2	5		1	2 to 8	2	0.78
59	55 K/7	55K/7 1C	CGWB	Narkhed	Belona	DW	21.48358333	78.48333333	405.00	11.00	DT Basalt	FMB	1.70	0.8	5.5	8	3	0	2 to 2.5	1	0.78
60	55 K/7	55 K/7 2B	CGWB	Narkhed	Tinkheda	DW	21.39888889	78.493	393.50	8.85	DT Basalt	JMB	4.90	1.5	4.3	7.2					
61	55 K/8	55 K/8 1C	CGWB	Narkhed	Bhorgadh	DW	21.23830556	78.47738889	447.00	10.20	DT Basalt	WMB	3.80	0.8	6	8		0	1 to 8	0	
62	55 K/11	55 K/11 1A	CGWB	Narkhed	Mohdi-dhotra	DW	21.42722222	78.54375	409.00	11.60	DT Basalt	JMB	2.30	0.5	5	5	3		1 to 3		0.78
63	55 K/11	55 K/11 1A	CGWB	Narkhed	Toyapar	DW	21.43822222	78.55866667	417.00	15.80	DT Basalt	JMB	3.50	1	1	6	3		1 to 6		0.14 to 0.78
64	55 K/11	55 K/11 1A	CGWB	Narkhed	Narkhed	DW	21.478	78.53466667	405.00	10.00	DT Basalt	JMB	2.00	1	5.2	5	1		1 to 6		0.14
65	55 K/10	55 K/10 3A	CGWB	Narkhed	Mohdi (MP)	DW	21.50094444	78.55	418.00	14.80	DT Basalt	JMB	3.00	0.1	2.5	2.5	3		1 to 4		0.78
66	55 K/11	55 K/11 1B	CGWB	Narkhed	Sardi	DW	21.47272222	78.58597222	428.00	10.20	DT Basalt	JMB	3.50	0.2	2.8	3.5	2		1		0.14 to 0.78

Sl. No.	Toposheet	well no.	Agency	Taluka	Site name	Type of structures	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Dia (m)	Soil thickness	Lining (mbgl)	Total Thickness weatherd portion (m)	Pump (hp)	No. of hours pump runs in Kharif	No. of hours pump runs in Rabi	No. of hours pump runs in Summer	Rate of discharge (lps)
67	55 K/11	55 K/11 1B	CGWB	Narkhed	Ambada Deshmukh	DW	21.44375	78.62033333	426.00	16.50	DT Basalt	JFMB	5.00	0.5	4.2	9	3		2 to 4		2.156
68	55 K/11	55 K/11 1B	CGWB	Narkhed	Sindhi Umri	DW	21.43027778	78.66361111	423.00	15.20	DT Basalt	FMB	2.60	1	2.2		3		2 to 12		2.156
69	55 K/11	55 K/11 1C	CGWB	Narkhed	Chorkhairi	DW	21.4545	78.67863889	409.00	10.00	DT Basalt	FMB	7.00	5	5	15	5		4 to 5		2.156
70	55 K/11	55 K/11 1C	CGWB	Narkhed	Agra	DW	21.42436111	78.71777778	372.00	12.20	DT Basalt	JFMB	4.00	0.1	1	1	5		0.5 to 4		2.156
71	55 K/7	55 K/7 2C	CGWB	Narkhed	Jalalkheda	DW	21.38091667	78.42444444	365.00	20.00	Local river Alluvium	Alluvium	5.00	20			3		5 to 6	3 to 4	2.156
72	55 K/7	55 K/7 2B	CGWB	Narkhed	Nadani chandani	DW	21.37116667	78.37869444	362.00	14.50	Local river Alluvium	Alluvium	5.00				3		30 min to 3 hr	0	0.78
73	55 K/7	55 K/7 2A	CGWB	Narkhed	Thadi Pavni	DW	21.35491667	78.31166667	363.00	17.00	DT Basalt	FMB	3.80	1	8.5	8	3		30 min to 2 hrs	0	0.78
74	55 K/7	55 K/7 2B	CGWB	Narkhed	Wadhona	DW	21.32530556	78.37255556	385.00	10.33	DT Basalt	JFMB	2.75	2	2.5	8	5		1 to 3	30 min	2.156
75	55 K/7	55 K/7 2C	CGWB	Narkhed	Maywadi	DW	21.33736111	78.45247222	389.00	11.00	DT Basalt	JFMB	2.00	2	7.5	10	3		0.5 to 4	0.5	0.78
76	55 K/7	55 K/7 3C	CGWB	Narkhed	Khapa	DW	21.31294444	78.42588889	413.00	19.60	DT Basalt	JFMB	3.70	0.5	4	10	3		3 to 8	0.25	0.78
77	55 K/7	55 K/7 3B	CGWB	Narkhed	Ghogra	DW	21.29036111	78.41570556	417.00	6.30	DT Basalt	JMB	4.00	0.2	4	4	3		0.5 to 3	0.25	0.78
78	55 K/7	55 K/7 3B	CGWB	Narkhed	Kharala	DW	21.25330556	78.37338889	398.00	14.00	DT Basalt										
79	55 K/7	55 K/7 2C	CGWB	Narkhed	Pimpalgaon	DW	21.394	78.467	384.00	16.60	Local river Alluvium	Alluvium	4.60	2	16		3		0.5 to 3	0	0.14 to 0.78
80	55 K/7	55 K/7 1C	CGWB	Narkhed	Mowad	DW	21.45870278	78.44611944	400.00	19.00	DT Basalt	WJVB	2.70	2	5	5	3		0.25 to 8	0.25 to 1	0.78
81	55 K/7	55 K/7 1C	CGWB	Narkhed	Yerla	DW	21.46025	78.46963889	389.00	11.00	DT Basalt	JFMB	2.60	2	6	4	3		0.5 to 4	0.5	0.78
82	55 K/7	55 K/7 1C	CGWB	Narkhed	Tugaon nipani	DW	21.42302778	78.49347222	382.00	10.70	DT Basalt	JFMB	4.60	0.5	3.7	6	3		1 to 3	0.5	0.78
83	55 K/11	55 K/11 2A	CGWB	Narkhed	Wadegaon	DW	21.40708333	78.52266667	398.00	11.80	DT Basalt	JFMB & VB	4.00	0.3	3	3	3		0.5 to 3	0.5	0.78
84	55 K/11	55 K/11 2A	CGWB	Narkhed	Ambola	DW	21.40791667	78.58277778	389.00	15.50	DT Basalt	JFMB	4.30	0.1	7.6	7	3		0.5 to 3	0	0.78

Annexure-VI VES Results, Narkhed and Katol taluka, Nagpur District

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
1	AMT	Godhni	Narked	21−29'15.0"	78−26'30.0"	I	21	0.4	0.4	Top Soil			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
	NAMP 2012018					II	10	5.7	6.1	W.Basalt			
						III	15	27.1	33.2	Fr. Basalt	Aq1	1.806667	406.5
						IV	82			Basalt			
2	AMT NAMP 2012019	Belona	Narked	21−28'15.0"	78−29'15.0"	I	23	3.2	3.2	Top Soil			
						II	81	13.8	17	Basalt			
						III	149	133	150	Basalt			
						IV	11			Fr. Basalt	Aq2	4.545455	550
3	AMT NAMP 2012020	Khargaon	Narked	21−26'30.0"	78−28'40.0"	I	12	0.9	0.9	Top Soil			
						II	8	3.4	4.3	W.Basalt			
						III	15	16.6	20.9	Fr. Basalt	Aq1	1.106667	249
						IV	8.5	24.8	45.7	Fr. Basalt	Aq2	2.917647	210.8
						V	111						
4	AMT NAMP 2012021	Narsingi	Narked	21−21'46.2"	78−27'00.0"	I	21	0.8	0.8	Top Soil			
						II	5.4	9.1	9.9	Clay			
						III	25	25	34.9	Fr. Basalt	Aq1	1	625
						IV	7.4	44.9	79.8	Fr. Basalt	Aq2	6.067568	332.26
						V	271			Basalt			
12	AMT NAMP 2012022	Rohna	Narked	21−20'29.4"	78−28'51.0"	I	26	0.7	0.7	Top Soil			
						II	4.8	3	3.7	Clay			
						III	6.3	18.4	22.1	W.Basalt			
						IV	315	55.1	77.2	Basalt			
						V	6.5			Weathered Basalt / Bole bed			
13	AMT NAMP 2012023	Jamgaonkalan	Narked	21−19'27.2"	78−25'50.8"	I	10	1.97	1.97	Top Soil			
						II	25	2.4	4.37	W.Basalt			
						III	455	24	28.37	Basalt			
						IV	100			Basalt			
14	AMT NAMP 2012024	Ghogra	Narked	21−17'35.1"	78−25'09.2"	I	14	1.7	1.7	Top Soil			
						II	416	2.4	4.1	Basalt			
						III	4.4	18.2	22.3	Clay / Bole bed			
						IV	181			Basalt			
15	AMT NAMP 2012025	Lohara	Narked	21−16'01.0"	78−24'16.0"	I	6.4	1.98	1.98	Top Soil			
						II	20	2.35	4.33	W.Basalt			
						III	175	17.8	22.13	Basalt			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						IV	6	24.8	46.93	Clay / Bole bed			
						V	2455			Basalt			
16	AMT NAMP 2012026	Datewadi	Narked	21−20'54.2"	78−24'47.5"	I	41	1.4	1.4	Top Soil			
						II	21	2.5	3.9	W.Basalt			
						III	16	15	18.9	Fr. Basalt	Aq1	0.9375	240
						IV	185	73.9	92.8	Basalt			
						V	11			Fr. Basalt	Aq2	5.181818	627
17	AMT NAMP 2012027	Wadhona	Narked	21−18'42.6"	78−21'57.3"	I	70	0.6	0.6	Top Soil			
						II	175	7.4	8	Basalt			
						III	421	4.5	12.5	Basalt			
						IV	90	180.6	193.1	Basalt			
						V	8.2			Clay / Bole bed			
18	AMT NAMP 2012028	Ramthi	Narked	21−16'46.5"	78−21'07.2"	I	156	1.25	1.25	Top Soil			
						II	83	11.9	13.15	Basalt			
						III	1347	28.3	41.45	Basalt			
						IV	5.5			Clay / Bole bed			
19	AMT NAMP 2012029	Kharala	Narked	21−15'17.8"	78−21'28.4"	I	68	1.1	1.1	Top Soil			
						II	192	5.3	6.4	Basalt			
						III	65	39.9	46.3	Basalt			
						IV	145			Basalt			
20	AMT NAMP 2012030	Pandhardhakni	Narked	21−17'13.5"	78−26'33.6"	I	23	0.6	0.6	Top Soil			
						II	14000	1.3	1.9	Basalt			
						III	117			Basalt			
21	AMT NAMP 2012031	Sinjar	Narked	21−20'48.5"	78−22'29.7"	I	17	0.9	0.9	Top Soil			
						II	7.4	3.5	4.4	W.Basalt			
						III	20	5.2	9.6	Fr. Basalt	Aq1	0.26	104
						IV	102	11.3	20.9	Basalt			
						V	24	24.8	45.7	Fr. Basalt	Aq1	1.033333	595.2
						VI	65			Basalt			
22	AMT NAMP 2012032	Dawsa	Narked	21−20'33.4"	78−20'26.2"	I	12	0.9	0.9	Top Soil			
						II	6.5	3	3.9	W.Basalt			
						III	45	4.3	8.2	Basalt			
						IV	10	9	17.2	Fr. Basalt	Aq1	0.9	90

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						V	61	58.2	75.4	Basalt			
						VI	1.7			Clay / Bole bed			
27	AMT NAMP 2012037	Mowad	Narked	21−28'34.1"	78−27'43.7"	I	23	0.75	0.75	Top Soil			
						II	4	6.9	7.65	Clay			
						III	24	26.1	33.75	Weathered / Fr. Basalt	Aq1	1.0875	626.4
						IV	184	23.5	57.25	Basalt			
						V	5.7	44.5	101.75	Clay / Bole bed			
						VI	17	40	141.75	Fr. Basalt	Aq2	2.352941	680
						VII	178			Basalt			
28	AMT NAMP 2012038	Belona	Narked	21−29'05.8"	78−29'19.9"	I	34	1	1	Top Soil			
						II	146	2.1	3.1	Basalt			
						III	8	2.9	6	W.Basalt			
						IV	107			Basalt			
29	AMT NAMP 2012039	Tinkheda	Narked	21−23'44.8"	78−29'37.9"	I	5.4	2.1	2.1	Top Soil			
						II	323	5.9	8	Basalt			
						III	17	3.6	11.6	Fr. Basalt	Aq1	0.211765	61.2
						IV	106			Basalt			
30	AMT NAMP 2012040	Inderwada	Narked	21−21'16.1"	78−27'37.5"	I	52	0.7	0.7	Top Soil			
						II	2.8	0.9	1.6	Clay			
						III	1420	3.6	5.2	Basalt			
						IV	3.6	38.4	43.6	Clay / Bole bed			
						V	1206			Basalt			
32	AMT NAMP 2012042	Khargaon	Narked	21−25'59.6"	78−26'56.1"	I	12	0.7	0.7	Top Soil			
						II	3.8	4.6	5.3	Clay			
						III	14	35.6	40.9	Weathered / Fr. Basalt			
						IV	445			Basalt			
33	AMT NAMP 2012043	Thugaondev	Narked	21−24'16.7"	78−27'11.8"	I	13	0.9	0.9	Top Soil			
						II	6.7	3	3.9	Alluvium			
						III	9.5	4.2	8.1	Alluvium			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						IV	6.9	26.9	35	Alluvium	Aq1	3.898551	185.61
						V	72	123.8	158.8	Basalt			
						VI	4380			Basalt			
	NGP 138	In between Rawalgaon & Kotwalbardi	Katol	21°13'32"	78°46'47"	I	157	1.3	1.3	Top Soil			
						II	366	4.4	5.7	Basalt			
						III	54	78.4	84.1	Basalt			
						IV	11	53.9	137.9	SST (Gondwana)	Aq2	4.978743	582.8734
						V	554			Gneiss			
	NGP 304	Chargaon	Katol	21°15'51.4"	78°45'08.9"	I	23	0.2	0.2	Top Soil			
						II	52	3.7	3.9	Basalt			
						III	7.3	6	9.9	W.Basalt			
						IV	96	17.6	27.5	Basalt			
						V	6.7			Fr. Basalt	Aq2	10.8209	485.75
	NGP 305	Dorli, SW of the Lake	Katol	21°15'42.4"	78°46'20.9"	I	10	1.7	1.7	Top Soil			
						II	15	2.1	3.8	W.Basalt			
						III	7	4.8	8.6	W.Basalt			
						IV	102			Basalt			
	NGP 331	Kohli	Katol	21°15'35.2"	78°47'47.1"	I	113	3.2	3.2	Top Soil			
						II	37	19.2	22.4	W.Basalt			
						III	13	52.2	74.6	Fr. Basalt	Aq2	4.015385	678.6
						IV	495	55.1	129.7	Basalt			
						V	13			SST (Gondwana)	Aq2	5.384615	910
	NGP 333	Sonkhamb	Katol	21°15'44.0"	78°43'47.2"	I	31	1.4	1.4	Top Soil			
						II	64	34.7	36.1	Basalt			
						III	271	98.8	134.9	Basalt			
						IV	2.8			Clay (Gndwana)			
	NGP 334	Metpanjra	Katol	21°15'07.6"	78°42'19.7"	I	107	0.9	0.9	Top Soil			
						II	31	0.9	1.8	W.Basalt			
						III	496	5.6	7.4	Basalt			
						IV	20	7.6	15.0	Fr. Basalt	Aq1	0.38	152

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						V	322	56.6	71.6	Basalt			
						VI	1.3			Bole bed			
	NGP 336	Malegaon	Katol	21°18'17.0"	78°42'49.8"	I	13	0.8	0.8	Top Soil			
						II	119	4	4.8	Basalt			
						III	775	5.3	10.1	Basalt			
						IV	27	144	154.1	Fr. Basalt	Aq2	5.333333	3888
						V	2411			Gneiss ?			
	NGP 337	Wasbodi	Katol	21°13'52.9"	78°42'50.3"	I	88	1	1	Top Soil			
						II	779	0.7	1.7	Basalt			
						III	48	1.7	3.4	Basalt			
						IV	930	5	8.4	Basalt			
						V	6.4	4.6	13	Clay			
						VI	393	18.1	31.1	Basalt			
						VII	21	62.2	93.3	Fr. Basalt	Aq2	2.961905	1306.2
						VIII	1424			Gneiss ?			
	NGP 338	Dorli	Katol	21°14'30.2"	78°47'08.1"	I	92	2.9	2.9	Top Soil			
						II	1412	6.1	9	Basalt			
						III	33			Fr. Basalt	Aq2	7.272727	7920
	NGP 339	Kotyalbordi	Katol	21°13'43.9"	78°46'25.5"	I	39	2.9	2.9	Top Soil			
						II	154	21.3	24.2	Basalt			
						III	27	79.5	103.7	SST (Gondwana)	Aq2	2.944444	2146.5
						IV	8.6	82.9	186.6	SST+Shale (Gondwana)			
						V	366			Gneiss			
	NGP 380	Rawalgaon	Katol	21°13'51.4"	78°46'46.2"	I	29	1.5	1.5	Top Soil			
						II	50	6.5	8	Basalt			
						III	2.2	18.5	26.5	Bole bed			
						IV	640			Basalt			
	NGP 381	Rawalgaon	Katol	21°13'51.5"	78°46'45.4"	I	30	1.9	1.9	Top Soil			
						II	54	6.9	8.8	Basalt			
						III	1.3	10	18.8	Bole bed			
						IV	468			Basalt			
	NGP 383	Rawalgaon	Katol	21°13'51.3"	78°46'46.3"	I	47	0.9	0.9	Top Soil			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						II	17	3.5	4.4	W.Basalt			
						III	32	16.3	20.7	Fr. Basalt	Aq1	0.509375	521.6
						IV	3.9	24.4	45.1	Clay			
						V	848			SST_Compact (Gondqana)			
	NGP 384	Rawalgaon	Katol	21°14'17.7"	78°47'00.5"	I	47	1.9	1.9	Top Soil			
						II	846	2.6	4.5	Basalt			
						III	40	40	44.5	Basalt			
						IV	20			SST (Gondwana)	Aq2	8.15	3260
	NGP 385	Rawalgaon	Katol	21°14'17.4"	78°47'04.0"	I	63	1.1	1.1	Top Soil			
						II	494	3.3	4.4	Basalt			
						III	124	29.2	33.6	Basalt			
						IV	28			SST (Gondwana)	Aq2	5.928571	4648
	NGP 386	Rawalgaon	Katol	21°14'17.0"	78°47'00.3"	I	46	0.8	0.8	Top Soil			
						II	1071	1.6	2.4	Basalt			
						III	92	41.4	43.8	Basalt			
						IV	23			SST (Gondwana)	Aq2	7.217391	3818
	NGP 387	Rawalgaon	Katol	21°14'16.5"	78°47'00.0"	I	97	0.8	0.8	Top Soil			
						II	61	0.8	1.6	Basalt			
						III	1046	2.4	4	Basalt			
						IV	13	4.9	8.9	Fr. Basalt	Aq1	0.376923	63.7
						V	138	13.7	22.6	Basalt			
						VI	47	15.2	37.8	Basalt			
						VII	13			SST (Gondwana)	Aq2	12.46154	2106
	NGP 392	Ubgi	Katol			**I**	10	1.5	14.5	Top Soil			
						II	45	2.1	16.6	Basalt			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						III	3	4.4	21	W.Basalt			
						IV	80			Basalt			
	NGP 393	Pari Deshmukh	Katol			**I**	63	0.9	0.9	Top Soil			
						II	85	7.3	8.2	Basalt			
						III	41	28.2	36.4	Basalt			
						IV	93			Basalt			
	NGP 394	Pari Deshmukh	Katol			**I**	65	0.9	0.9	Top Soil			
						II	105	10.4	11.3	Basalt			
						III	22	14.7	26	Fr. Basalt	Aq1	0.668182	323.4
						IV	87			Basalt			
	NGP 395	Pari Deshmukh	Katol			**I**	82	2.1	2.1	Top Soil			
						II	319	2.7	4.8	Basalt			
						III	29	23.2	28	Fr. Basalt	Aq1	0.8	672.8
						IV	76			Basalt			
	NGP 396	Pari Deshmukh	Katol			**I**	48	0.8	0.8	Top Soil			
						II	121	7.6	8.4	Basalt			
						III	11	8.7	17.1	Fr. Basalt	Aq1	0.790909	95.7
						IV	124			Basalt			
	NGP 402	Ramgiri	Katol			I	47	0.9	0.9	Top Soil			
						II	54	1	1.9	Basalt			
						III	78	2.1	4	Basalt			
						IV	237	4.3	8.3	Basalt			
						V	926	9	17.3	Basalt			
						VI	25	59.8	77.1	Fr. Basalt	Aq2	2.392	1495
						VII	2321			Basalt			
	NGP 403	Sonkhamb	Katol			I	84	2.1	2.1	Top Soil			
						II	1834	2.7	4.8	Basalt			
						III	92	22.3	27.1	Basalt			
						IV	192			Basalt			
	NGP 404	Sonkhamb	Katol			I	49	1.2	1.2	Top Soil			
						II	2075	1.1	2.3	Basalt			
						III	36	3.3	5.6	W.Basalt			
						IV	1243	4.7	10.3	Basalt			
						V	93			Basalt			
	NGP 405	Sonkhamb	Katol			I	20	1.3	1.3	Top Soil			
						II	1330	3.5	4.8	Basalt			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						III	13	5.7	10.5	W.Basalt			
						IV	114			Basalt			
	NGP 406	Sonkhamb	Katol			I	52	2.5	2.5	Top Soil			
						II	155	9.8	12.3	Basalt			
						III	15	39.2	51.5	Fr. Basalt	Aq2	2.613333	588
						IV	109			Basalt			
	NGP 407	Sonkhamb	Katol			I	51	1.9	1.9	Top Soil			
						II	132	11.5	13.4	Basalt			
						III	5.8	15.2	28.6	W.Basalt			
						IV	83			Basalt			
	NGP 409	Ghoard	Katol			I	70	0.9	83.9	Top Soil			
						II	24	1	84.9	W.Basalt			
						III	13	2.2	87.1	W.Basalt			
						IV	6.4	4.7	91.8	W.Basalt			
						V	46	31.3	123.1	Basalt			
						VI	216			Basalt			
	NGP 410	Dahegaon	Katol	21°12'47.0"	78°56'48.2"	I	11	1.5	1.5	Top Soil			
						II	33	6.1	7.6	W.Basalt			
						III	504	9	16.6	Basalt			
						IV	6	44.7	61.3	Weathered / Fr. Basalt	Aq2	7.45	268.2
						V	2665			Gneiss			
	NGP 411	Dahegaon	Katol	21°12'57.0"	78°56'43.6"	I	10	0.9	0.9	Top Soil			
						II	2	0.85	1.8	Clay			
						III	4816	3.1	4.9	Basalt			
						IV	27	59.8	64.7	Fr. Basalt	AQ2	2.214815	1614.6
						V	4388			Gneiss			
	NGP 412	Dahegaon	Katol	21°12'36.1"	78°56'52.4"	I	9.5	0.7	0.7	Top Soil			
						II	1.4	1	1.7	Clay			
						III	591	4.9	6.6	Basalt			
						IV	25			Fra.Basalt/ Fr. Gneiss	Aq2	2.52	1575
	NGP 413	Khairi Deshmukh	Katol	21°17'32.7"	78°47'25.2"	I	18	0.9	0.9	Top Soil			
						II	9	3.2	4.1	W.Basalt			
						III	181	14.6	18.7	Basalt			

Sl. No.	VES No.	Village	Taluka	Latitude	Longitude	Layer No.	Resistivity (Ohm m)	Thickness (m)	Depth to the bottom of the Layer (m)	Probable Lithology	Aquifer	S (Aquifer)	T (Aquifer)
						IV	2.5			Bole bed			
	NGP 414	Khairi Deshmukh	Katol	21°17'32.8"	78°47'28.4"	I	14	0.9	0.9	Top Soil			
						II	8.9	3.2	4.1	W.Basalt			
						III	26	4.7	8.8	Fr. Basalt			
						IV	80	31.2	40.0	Basalt			
						V	41			Basalt			
	NGP 416	Mohgaon	Katol	21°18'07.0"	78°51'11.5"	I	9.4	0.9	0.9	Top Soil			
						II	3.7	1	1.9	Clay			
						III	40	2.1	4.0	Basalt			
						IV	6.6	4.3	8.3	Fr. Basalt	Aq1	0.651515	28.38
						V	46			Basalt			
	NGP 417	Mohgaon	Katol	21°18'05.4"	78°51'10.9"	I	13	1.0	1.0	Top Soil			
						II	9	9.5	10.5	W.Basalt			
						III	49			Basalt			
	NGP 418	Mohgaon	Katol	21°18'04.7"	78°51'12.8"	I	15	0.4	0.4	Top Soil			
						II	8	5.8	6.2	W.Basalt			
						III	15	12.8	19.0	Fr. Basalt	Aq1	0.853333	192
						IV	223	35.2	54.2	Basalt			
						V	5			Clay / Bole bed			
	NGP 419	Mohgaon	Katol	21°18'06.2"	78°51'13.3"	I	11	1.0	1.0	Top Soil			
						II	5	0.8	1.8	Clay			
						III	9.4	10.7	12.5	W.Basalt			
						IV	45			Basalt			

Annexure-VII Aquifer-I, Depth to water level data Katol and Narkhed taluka, Nagpur district

Sl. No.	Toposheet	Taluka	Site name	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Dia (m)	D.T.W. (Post - 2015) (m bgl)	D.T.W. (Pre - 2016) (m bgl)	Fluctuation (m)
1	55 K/11	Katol	Metpanjra	21.2596	78.7008	426.16	12.17	DT Basalt	FMB	4.15	7.6	9.2	1.6
2	55 K/11	Katol	Malegaon	21.3071	78.7206	517.11	7.35	DT Basalt	FMB	3.00	2.76	dry	--
3	55 k/15	Katol	Dorli	21.2528	78.7790	382.12	12.70	DT Basalt	FMB	3.60	4.7	12.1	7.4
4	55 K/16	Katol	Raulgaon	21.2311	78.7814	396.11	9.25	DT Basalt	FMB	3.60	3.9	dry	--
5	55 K/11	Katol	Junewani	21.27983333	78.52627778	437.20	9.60	DT Basalt	FMB	4.80	5.2	7.6	2.4
6	55 K/11	Katol	Dongargaon	21.30602778	78.60347222	424.50	13.80	DT Basalt	FMB	2.80	5.6	12.7	7.1

Sl. No.	Toposheet	Taluka	Site name	Latitude	Longitude	Altitude (m a msl)	Depth (m bgl)	Geology	Aquifer	Dia (m)	D.T.W. (Post - 2015) (m bgl)	D.T.W. (Pre - 2016) (m bgl)	Fluctuation (m)
7	55 K/11	Katol	Zilpa	21.34091667	78.68694444	442.10	9.20	DT Basalt	WMB	4.20	6.5	7.8	1.3
8	55 K/11	Katol	Mohgaon bhadade	21.39586111	78.72772222	397.30	13.40	DT Basalt	FMB	1.00	10.3	10.1	-0.2
9	55 K/12	Katol	Junapani	21.1525	78.56561111	520.50	10.80	DT Basalt	JFMB	5.30	9.1	9.4	0.3
10	55 K/12	Katol	Ladgaon	21.23711111	78.56580556	441.60	11.10	DT Basalt	JFMB	4.40	10	11.1	1.1
11	55 K/12	Katol	Sabkund	21.19816667	78.5965	469.30	15.20	DT Basalt	JFMB	4.00	9.1	10	0.9
12	55 K/12	Katol	Masod	21.07761111	78.62552778	497.90	15.00	DT Basalt	WFVB	5.40	13.5	7.4	-6.1
13	55 K/12	Katol	khapa (Dhotiwada)	21.04916667	78.67611111	442.30	11.75	DT Basalt	JFMB	5.00	11	12	1
14	55 K/12	Katol	Miniwada	21.10420833	78.70476667	429.40	6.70	DT Basalt	JFMB	4.65	4.9	6.3	1.4
15	55 K/12	Katol	Maragsur	21.20858333	78.70844444	429.00	13.10	DT Basalt	JFMB	3.30	9.9	11.7	1.8
16	55 K/11	Narkhed	Kharsoli	21.44468056	78.51008333	398.10	17.90	DT Basalt	FMB & WVB	4.50	17.1	18.8	1.7
17	55 K/11	Narkhed	Bhishnur	21.35443056	78.51268056	384.60	14.70	Local river Alluvium	Alluvium	5.20	7.7	13.2	5.5
18	55 K/11	Narkhed	Mannat	21.45755556	78.65247222	462.10	6.10	DT Basalt	FMB	6.80	5	5.9	0.9
19	55 K/11	Narkhed	Semda	21.45081111	78.70715	424.10	9.00	DT Basalt	WMB	4.45	5.45	10.6	5.15
20	55 K/7	Narkhed	Ambada	21.34619444	78.28202778	354.80	14.00	DT Basalt	WVB	3.60	9.6	13.3	3.7
21	55 K/7	Narkhed	Ramthi	21.29894444	78.35611111	418.20	9.10	DT Basalt	FMB	6.00	8	9	1
22	55 K/7	Narkhed	Karanjoli	21.35663889	78.43283333	341.00	10.60	DT Basalt	WVB	3.50	7.2	9.1	1.9
23	55 K/7	Narkhed	Pandhardhakni	21.27152778	78.45966667	482.20	6.60	DT Basalt	WMB	6.00	3	6.1	3.1
24	55 K/7	Narkhed	Belona	21.48358333	78.48333333	405.00	11.00	DT Basalt	FMB	1.70	8.9	10.8	1.9
25	55 K/7	Narkhed	Tinkheda	21.39888889	78.493	393.50	8.85	DT Basalt	JMB	4.90	8.7	dry	--
26	55 K/8	Narkhed	Bhorgadh	21.23830556	78.47738889	447.00	10.20	DT Basalt	WMB	3.80	9.1	9.1	0

Annexure-VIII Aquifer-II, Depth to water level Narkhed and Katol taluka, Nagpur district

SN	Taluka	Village	Toposheet	Long_deci	Latitude	altitude_m__	Type	Aquifer	Drilling_depth	Postmonsoon Nov 2015	Premonsoon May 2016
1	Katol	Narkhed	55K/11	78.5381	21.3381	393	Pz		40	5	12
2	Katol	Katol	55K/11	78.6167	21.25	421	EW		254	28.3	35
3	Katol	Metpanjra	55K/11	78.7	21.2583	439.8	EW		122	10	15
4	Narkhed	Narkhed	55K/11	78.5292	21.4722	410.1	OW	F Basalt	181	8	15
5	Katol	Dorli	55K/15	78.7833	21.2667	375.9	OW	F Basalt	153.5	13.88	18
6	Narkhed	Arambhi	55K/7	78.3486	21.2694	415.6	EW	FB	200	33.37	45
7	Narkhed	Belona	55K/7	78.4864	21.4833	405.5	EW	FVB	200	6.55	15
8	Narkhed	Indarwada	55K/7	78.4622	21.3519	389	EW	FMB	128.6	20	28
9	Narkhed	Jamgaon Kh.	55K/7	78.4367	21.3381	394.3	EW		200	6	10
10	Narkhed	Lohari Sawanga	55K/7	78.4044	21.26	399.7	EW	FMB	200	55	80

11	Narkhed	Tinkheda	55K/7	78.4903	21.4033	393.3	EW	FMB	200	8.55	15
12	Narkhed	Wadvihra	55K/7	78.3986	21.3472	382.7	EW		201.3	8.55	15
13	Katol	Maragsur	55 K/12 1C	78.70711111	21.20731	477.2	EW	FMB	126.5	2	9
14	Katol	Ladgaon	55 K/12 1A	78.56469444	21.22706	461.9	EW	FMB	200	4.43	10
15	Katol	Ladgaon	55 K/12 1A	78.56469444	21.22706	461.9	OW	FMB	200	5.43	11
16	Katol	KHANGAON	55 K/11 3A	78.54669444	21.29417	418.9	EW	FMB Basalt-Gondwana contact sandstone (Gondwana)	181.5	26.5	30
17	Katol	KHANGAON	55 K/11 3A	78.54680556	21.29417	418.5	OW	FMB Basalt-Gondwana contact sandstone (Gondwana)	181.5	28.4	32
18	Katol	SAWARGAON	55 K/11 1B	78.63422222	21.40108	420.3	EW	FMB	200	10	13
19	Narkhed	KONI	55 K/11 1A	78.58247222	21.43964	423.4	EW	FMB	200	9	13
20	Narkhed	KHEDI	55 K/11 1B	78.64455556	21.45894	458.6	EW	VB	105.2	8	12
21	Narkhed	MANIKWADA	55 K/7 1C	78.49988889	21.49717	427.4	EW	FMB	200	14.2	21

Annexure-IX Aquifer-I, Pre and Post Monsoon water level trend (2006-15), Narkhed and Katol taluka, Nagpur district.

SN	Taluka	Village	Y	X	Depth of Well (m bgl)	Premonsoon trend (m /year)	Postmonsoon trend (m /year)
1	KATOL	Dhotiwada	21.04583	78.6625	24.4	0.091464	-0.05868
2	KATOL	Gondidigras	21.3625	78.59583	15.7	0.017576	0.006
3	KATOL	Katol	21.27083	78.5875	11.1	0.035964	0.023
4	KATOL	Khangaon	21.30833	78.55	16.1	--	-0.09354
5	KATOL	Mendhla	21.32917	78.37778	15	-0.23515	-0.16588
6	KATOL	Nandora	21.16528	78.61389	15.55	-0.18865	-0.16177
7	NARKHED	Belona	21.48611	78.48333	10.4	-0.94105	-0.24576
8	NARKHED	Dawsa	21.34722	78.34028	12	-0.05417	-0.12237
9	NARKHED	Jalalkheda	21.38056	78.42361	15.3	-0.77091	-0.63606
10	NARKHED	Jamgaon Bk.	21.325	78.4375	45.75	0.050278	-0.06732
11	NARKHED	Jamgaon Bk.	21.325	78.4375	45.75	0.141485	-0.0077
12	NARKHED	Kharala	21.25417	78.37083	42.7	-0.79424	--
13	NARKHED	Lohara	21.26944	78.40833	8.3	0.049091	-0.0741
14	NARKHED	Ringanabodi	21.125	78.71667	10.5	-0.19345	-0.18996
15	NARKHED	Rohana	21.32222	78.48333	13.3	-0.2143	-0.49226
16	NARKHED	Sawanga (lohari)	21.25694	78.4	12.8	0.043333	-0.05491
17	NARKHED	Sawargaon	21.39167	78.63611	9.9	-0.08121	0.013001
18	NARKHED	Sawargaon	21.39167	78.63611	102	-0.01735	0.019
19	NARKHED	Sinjar	21.35694	78.375	9.65	-0.08718	-0.33963
20	NARKHED	Thadipavni	21.35278	78.30417	19.4	-0.05512	-0.04464
21	NARKHED	Wadvihara	21.34722	78.4	13.3	-0.07789	-0.14688
22	NARKHED	Yeni Koni	21.4375	78.58472	15.5	-0.39685	0.019

-ve value indicates rising while +ve value indicates falling trend.

Annexure X Location of proposed Percolation tanks in Narkhed and Katol taluka, Nagpur district

S.N.	Taluka	Village	Longitude	Latitude	Artificial recharge structures
1	KATOL	Chakdoh	78.7452	21.1333	Percolation tank
2	KATOL	Chandanpardi	78.544	21.1666	Percolation tank
3	KATOL	Chargaon	78.7681	21.2702	Percolation tank
4	KATOL	Chargaon	78.7524	21.2689	Percolation tank
5	KATOL	Chargaon	78.7384	21.2682	Percolation tank
6	KATOL	Chikhlagad	78.4995	21.2065	Percolation tank
7	KATOL	Dhamangaon	78.5346	21.1432	Percolation tank
8	KATOL	Dhamangaon	78.5508	21.1303	Percolation tank
9	KATOL	Dorli (bhandwalkar)	78.5786	21.3654	Percolation tank
10	KATOL	Elkapar	78.7452	21.1272	Percolation tank
11	KATOL	Forest	78.7706	21.1622	Percolation tank
12	KATOL	Forest	78.7711	21.1949	Percolation tank
13	KATOL	Garamsur	78.7277	21.1534	Percolation tank
14	KATOL	Gondidigras	78.6084	21.3573	Percolation tank
15	KATOL	Kachari Savanga	78.6529	21.1842	Percolation tank
16	KATOL	Katol (rural)	78.5912	21.2711	Percolation tank
17	KATOL	Khandala (kh)	78.5583	21.2481	Percolation tank
18	KATOL	Kolhu	78.476	21.2295	Percolation tank
19	KATOL	Kotwalbardi	78.7863	21.217	Percolation tank
20	KATOL	Lamdham	78.5404	21.2991	Percolation tank
21	KATOL	Murli	78.7517	21.1974	Percolation tank
22	KATOL	Murti	78.5251	21.202	Percolation tank
23	KATOL	Raulgaon	78.802	21.2238	Percolation tank
24	KATOL	Raulgaon	78.7851	21.2321	Percolation tank
25	KATOL	Raulgaon	78.7638	21.2247	Percolation tank
26	KATOL	Salai (bk)	78.6471	21.1656	Percolation tank
27	KATOL	Saoli	78.4869	21.2196	Percolation tank
28	KATOL	Saoli (bk)	78.6343	21.2423	Percolation tank
29	KATOL	Shekapur	78.7195	21.155	Percolation tank
30	KATOL	Shivkamath	78.5145	21.1879	Percolation tank
31	KATOL	Sonegaon (bk)	78.629	21.1516	Percolation tank
32	KATOL	Yenvihira	78.7747	21.2407	Percolation tank
33	NARKHED	Ambada	78.2734	21.3413	Percolation tank
34	NARKHED	Ambada	78.5111	21.3174	Percolation tank
35	NARKHED	Ambada	78.5029	21.3142	Percolation tank
36	NARKHED	Arambhi	78.347	21.2515	Percolation tank
37	NARKHED	Baradpavni	78.3111	21.3476	Percolation tank
38	NARKHED	Bharsingi	78.4503	21.3619	Percolation tank
39	NARKHED	Dawasa	78.3341	21.3511	Percolation tank
40	NARKHED	Forest	78.332	21.2624	Percolation tank
41	NARKHED	Forest	78.3203	21.2782	Percolation tank
42	NARKHED	Forest	78.3167	21.2902	Percolation tank
43	NARKHED	Indarwada	78.468	21.3535	Percolation tank
44	NARKHED	Jamgaon Bk	78.4554	21.3224	Percolation tank
45	NARKHED	Jamgaon Kh	78.4535	21.3539	Percolation tank
46	NARKHED	Jatlapur	78.3799	21.2556	Percolation tank
47	NARKHED	Junona (gharad)	78.4849	21.4391	Percolation tank
48	NARKHED	Junona (gharad)	78.4762	21.4387	Percolation tank
49	NARKHED	Khadki	78.4317	21.3589	Percolation tank
50	NARKHED	Khadki	78.438	21.3695	Percolation tank
51	NARKHED	Khalangondri	78.2937	21.3016	Percolation tank
52	NARKHED	Khaprikene	78.4956	21.2931	Percolation tank
53	NARKHED	Kharala	78.3741	21.2682	Percolation tank
54	NARKHED	Kharashi	78.4206	21.2452	Percolation tank
55	NARKHED	Kharbadi	78.361	21.3774	Percolation tank
56	NARKHED	Kharbadi	78.3489	21.3751	Percolation tank
57	NARKHED	Khargad	78.2574	21.3314	Percolation tank
58	NARKHED	Kharsoli	78.5244	21.449	Percolation tank

S.N.	Taluka	Village	Longitude	Latitude	Artificial recharge structures
59	NARKHED	Mannath	78.6428	21.4535	Percolation tank
60	NARKHED	Mohgaon	78.4757	21.4188	Percolation tank
61	NARKHED	Narsingi	78.4578	21.3905	Percolation tank
62	NARKHED	Narsingi	78.4634	21.3744	Percolation tank
63	NARKHED	Sahajapur	78.4709	21.3666	Percolation tank
64	NARKHED	Sawanga (lohari)	78.4099	21.2565	Percolation tank
65	NARKHED	Sawargaon	78.6345	21.3887	Percolation tank
66	NARKHED	Sawargaon	78.6353	21.3997	Percolation tank
67	NARKHED	Sawargaon	78.6379	21.381	Percolation tank
68	NARKHED	Shemda	78.7067	21.4445	Percolation tank
69	NARKHED	Shemda	78.7011	21.4466	Percolation tank
70	NARKHED	Shindi (umari)	78.6432	21.4319	Percolation tank
71	NARKHED	Tara	78.2811	21.3088	Percolation tank
72	NARKHED	Thugaon (deo)	78.4699	21.4063	Percolation tank
73	NARKHED	Wiwara	78.4951	21.3526	Percolation tank

Annexure XI Location of proposed check dam in Narkhed and Katol taluka, Nagpur district

S.N.	Taluka	Village	Longitude	Latitude	Structures
1	KATOL	Khadki	78.5024	21.2412	Check dam
2	KATOL	Forest	78.4833	21.2515	Check dam
3	KATOL	Pandhardhakani	78.4647	21.2562	Check dam
4	KATOL	Gondimohgaon	78.7086	21.3659	Check dam
5	KATOL	Zilpa	78.678	21.3193	Check dam
6	KATOL	Isapur (kh)	78.6441	21.3105	Check dam
7	KATOL	Ambada (sonak)	78.5551	21.2716	Check dam
8	KATOL	Tapani	78.6586	21.3787	Check dam
9	KATOL	Jatamzari	78.6846	21.3819	Check dam
10	KATOL	Jatamzari	78.6956	21.3858	Check dam
11	KATOL	Kamthi	78.632	21.0795	Check dam
12	KATOL	Bopapur	78.6348	21.0881	Check dam
13	KATOL	Pusagondi	78.6441	21.093	Check dam
14	KATOL	Jatlapur	78.6483	21.1031	Check dam
15	KATOL	Kinki Dhoda	78.6629	21.0806	Check dam
16	KATOL	Forest	78.6762	21.0788	Check dam
17	KATOL	Hardoli	78.687	21.1394	Check dam
18	KATOL	Dhotiwada	78.6596	21.0563	Check dam
19	KATOL	Ahmednagar	78.5815	21.1849	Check dam
20	KATOL	Forest	78.5852	21.1941	Check dam
21	KATOL	Forest	78.5727	21.2041	Check dam
22	KATOL	Forest	78.5649	21.1984	Check dam
23	KATOL	Jamgad	78.5833	21.157	Check dam
24	KATOL	Forest	78.688	21.1469	Check dam
25	KATOL	Shekapur	78.7028	21.1668	Check dam
26	KATOL	Forest	78.6923	21.1678	Check dam
27	KATOL	Forest	78.7224	21.1781	Check dam
28	KATOL	Kalmunda	78.7109	21.1748	Check dam
29	KATOL	Yenvihira	78.7385	21.2085	Check dam
30	KATOL	Forest	78.7327	21.1963	Check dam
31	KATOL	Forest	78.737	21.1907	Check dam
32	KATOL	Walni	78.5197	21.2191	Check dam
33	KATOL	Parsodi	78.5604	21.2287	Check dam
34	KATOL	Khandala (kh)	78.5597	21.2607	Check dam
35	KATOL	Junewani	78.5167	21.2647	Check dam
36	KATOL	Junewani	78.5288	21.265	Check dam
37	KATOL	Ajangaon	78.6855	21.2626	Check dam
38	KATOL	Lakholi	78.7026	21.2858	Check dam
39	KATOL	Malegaon	78.7131	21.2942	Check dam
40	KATOL	Zilpa	78.6827	21.3519	Check dam
41	KATOL	Jatamzari	78.6956	21.3764	Check dam
42	KATOL	Gondikhapa	78.7242	21.3205	Check dam
43	KATOL	Gondikhapa	78.7086	21.3228	Check dam
44	KATOL	Gangaldoh	78.6529	21.3006	Check dam
45	KATOL	Lakholi	78.683	21.2764	Check dam
46	KATOL	Malegaon	78.7008	21.2938	Check dam
47	KATOL	Yenvihira	78.7724	21.2348	Check dam
48	KATOL	Yenvihira	78.7619	21.2433	Check dam
49	KATOL	Sonkhamb	78.7337	21.2671	Check dam
50	KATOL	Forest	78.7629	21.1974	Check dam
51	KATOL	Ghorpad	78.7805	21.1936	Check dam
52	KATOL	Dhawalapur	78.6534	21.2606	Check dam
53	KATOL	Pardi (gotmare)	78.6378	21.2578	Check dam
54	KATOL	Dongargaon	78.6066	21.306	Check dam
55	KATOL	Isapur(bk)	78.6443	21.3223	Check dam
56	KATOL	Sonoli	78.6363	21.3551	Check dam
57	KATOL	Khamli	78.5971	21.372	Check dam
58	KATOL	Yerla (dhote)	78.5664	21.3369	Check dam

S.N.	Taluka	Village	Longitude	Latitude	Structures
59	KATOL	Khangaon	78.5479	21.3036	Check dam
60	KATOL	Panwadi	78.5659	21.3055	Check dam
61	KATOL	KATOL	78.5991	21.2592	Check dam
62	KATOL	Salai (bk)	78.5991	21.3205	Check dam
63	KATOL	Yenwa	78.5956	21.3486	Check dam
64	KATOL	Pardi	78.6197	21.3392	Check dam
65	KATOL	Borgondi	78.6302	21.2638	Check dam
66	KATOL	Kolambi	78.5388	21.2901	Check dam
67	KATOL	Digras (bk)	78.5438	21.3266	Check dam
68	KATOL	Ubagi	78.7277	21.2489	Check dam
69	KATOL	Sonkhamb	78.7182	21.2624	Check dam
70	KATOL	Dorli (bk)	78.7815	21.2629	Check dam
71	KATOL	Ridhora	78.6232	21.2203	Check dam
72	KATOL	Ridhora	78.6302	21.2297	Check dam
73	KATOL	Kokarda	78.6091	21.2058	Check dam
74	KATOL	Gujarkhedi	78.5981	21.2269	Check dam
75	KATOL	Borgondi	78.6036	21.2526	Check dam
76	KATOL	Pathar	78.6297	21.2779	Check dam
77	KATOL	Dongargaon	78.6076	21.2812	Check dam
78	KATOL	Chichala	78.5604	21.2929	Check dam
79	KATOL	KATOL	78.5775	21.2755	Check dam
80	KATOL	Chikhali (bk.)	78.6257	21.3284	Check dam
81	KATOL	Yenwa	78.6091	21.3406	Check dam
82	KATOL	Khairi (navghare)	78.6659	21.3366	Check dam
83	KATOL	Bori	78.6635	21.3454	Check dam
84	KATOL	Raulgaon	78.8051	21.2386	Check dam
85	KATOL	Mhasala	78.6888	21.112	Check dam
86	KATOL	Hardoli	78.6868	21.1331	Check dam
87	KATOL	Dhotiwada	78.6534	21.061	Check dam
88	KATOL	Miniwada	78.7114	21.1095	Check dam
89	KATOL	Akewada	78.7182	21.1214	Check dam
90	KATOL	Elkapar	78.7287	21.1277	Check dam
91	KATOL	Ambola	78.5785	21.4091	Check dam
92	NARKHED	Wadvihara	78.3984	21.3479	Check dam
93	NARKHED	Datewadi	78.4054	21.3657	Check dam
94	NARKHED	Wadvihara	78.3991	21.3334	Check dam
95	NARKHED	Mendhala	78.3703	21.3357	Check dam
96	NARKHED	Banor	78.3311	21.3348	Check dam
97	NARKHED	Forest	78.3095	21.309	Check dam
98	NARKHED	Ramthi	78.3507	21.2903	Check dam
99	NARKHED	Pimpaldhara	78.3482	21.3362	Check dam
100	NARKHED	Sinjar	78.3748	21.3694	Check dam
101	NARKHED	Mamdapur	78.3286	21.3507	Check dam
102	NARKHED	Baradpavni	78.3009	21.3437	Check dam
103	NARKHED	Sinjar	78.3743	21.3567	Check dam
104	NARKHED	Parsodi [dixit]	78.4732	21.3773	Check dam
105	NARKHED	Rohana	78.4858	21.3394	Check dam
106	NARKHED	Khapa	78.4321	21.31	Check dam
107	NARKHED	Umatha	78.42	21.3203	Check dam
108	NARKHED	Umatha	78.4175	21.3399	Check dam
109	NARKHED	Rohana	78.4989	21.3385	Check dam
110	NARKHED	Rohana	78.4738	21.3366	Check dam
111	NARKHED	Jamgaon Kh	78.4476	21.3376	Check dam
112	NARKHED	Khaprikene	78.4808	21.2945	Check dam
113	NARKHED	Sonegaon	78.4175	21.2674	Check dam
114	NARKHED	Wiwara	78.4868	21.3642	Check dam
115	NARKHED	Pimpalgaon Raut	78.4918	21.3862	Check dam
116	NARKHED	Belona	78.4964	21.4966	Check dam
117	NARKHED	Belona	78.4994	21.4997	Check dam

S.N.	Taluka	Village	Longitude	Latitude	Structures
118	NARKHED	Gangaldoh	78.4793	21.4903	Check dam
119	NARKHED	MOWAD	78.4481	21.4805	Check dam
120	NARKHED	MOWAD	78.4449	21.4866	Check dam
121	NARKHED	Khairgaon	78.4451	21.4653	Check dam
122	NARKHED	Khairgaon	78.4567	21.4594	Check dam
123	NARKHED	MOWAD	78.4632	21.4866	Check dam
124	NARKHED	Yerla	78.4856	21.4656	Check dam
125	NARKHED	MOWAD	78.4722	21.4654	Check dam
126	NARKHED	Gangaldoh	78.4861	21.4769	Check dam
127	NARKHED	Dindargaon	78.4901	21.414	Check dam
128	NARKHED	Dindargaon	78.4863	21.4049	Check dam
129	NARKHED	Tinkheda	78.5067	21.4115	Check dam
130	NARKHED	Junona (gharad)	78.4828	21.4363	Check dam
131	NARKHED	Yerla	78.4883	21.4527	Check dam
132	NARKHED	Dewali	78.471	21.4451	Check dam
133	NARKHED	Junona (gharad)	78.4758	21.4327	Check dam
134	NARKHED	Yerla	78.4926	21.4561	Check dam
135	NARKHED	Mohgaon	78.4637	21.4259	Check dam
136	NARKHED	Thugaon (deo)	78.4622	21.4128	Check dam
137	NARKHED	Pardi	78.5378	21.4615	Check dam
138	NARKHED	Pardi	78.528	21.4557	Check dam
139	NARKHED	Kharsoli	78.517	21.4505	Check dam
140	NARKHED	Tinkheda	78.5099	21.4227	Check dam
141	NARKHED	Khedikaryat	78.518	21.4274	Check dam
142	NARKHED	Khedikaryat	78.53	21.4262	Check dam
143	NARKHED	Dhotra	78.5456	21.429	Check dam
144	NARKHED	Pimpalgaon (wakhaji)	78.5484	21.4494	Check dam
145	NARKHED	Wadgaon (umari)	78.5386	21.4176	Check dam
146	NARKHED	Wadgaon (umari)	78.5338	21.4227	Check dam
147	NARKHED	Wadgaon (umari)	78.5443	21.4138	Check dam
148	NARKHED	Toyapur	78.5556	21.4308	Check dam
149	NARKHED	Nawegaon	78.5348	21.5032	Check dam
150	NARKHED	Nawegaon	78.5345	21.495	Check dam
151	NARKHED	NARKHED	78.529	21.4802	Check dam
152	NARKHED	NARKHED	78.5202	21.4688	Check dam
153	NARKHED	Bhaiwadi	78.5172	21.4812	Check dam
154	NARKHED	Belona	78.5092	21.4896	Check dam
155	NARKHED	Parsodi	78.5094	21.4732	Check dam
156	NARKHED	Pimpalgaon (wakhaji)	78.5566	21.4646	Check dam
157	NARKHED	Pimpalgaon (wakhaji)	78.5682	21.4664	Check dam
158	NARKHED	NARKHED	78.5604	21.4905	Check dam
159	NARKHED	Bamhani	78.5669	21.4922	Check dam
160	NARKHED	NARKHED	78.5637	21.4875	Check dam
161	NARKHED	Sardi	78.5855	21.4737	Check dam
162	NARKHED	Pithori	78.5983	21.4718	Check dam
163	NARKHED	NARKHED	78.5486	21.4869	Check dam
164	NARKHED	NARKHED	78.5416	21.4783	Check dam
165	NARKHED	NARKHED	78.5592	21.471	Check dam
166	NARKHED	Sardi	78.5737	21.4731	Check dam
167	NARKHED	Nawegaon	78.5451	21.5059	Check dam
168	NARKHED	Yeni	78.573	21.4491	Check dam
169	NARKHED	Pimpalgaon (wakhaji)	78.5609	21.4524	Check dam
170	NARKHED	Koni	78.5782	21.441	Check dam
171	NARKHED	Koni	78.5901	21.4377	Check dam
172	NARKHED	Nanda (shinde)	78.6034	21.4477	Check dam
173	NARKHED	Khedi Gowargondi	78.6184	21.4526	Check dam
174	NARKHED	Ambada (deshmukh)	78.6049	21.4606	Check dam
175	NARKHED	Banor	78.585	21.4618	Check dam
176	NARKHED	Mogra	78.5619	21.4438	Check dam

S.N.	Taluka	Village	Longitude	Latitude	Structures
177	NARKHED	Singarkheda	78.5521	21.3722	Check dam
178	NARKHED	Khandala[bk]	78.5717	21.3876	Check dam
179	NARKHED	Singarkheda	78.5499	21.3794	Check dam
180	NARKHED	Sawargaon	78.6325	21.4142	Check dam
181	NARKHED	Shindi (umari)	78.6395	21.4265	Check dam
182	NARKHED	Pithori	78.6114	21.4744	Check dam
183	NARKHED	Malapur	78.6586	21.3954	Check dam
184	NARKHED	Umari	78.6481	21.4428	Check dam
185	NARKHED	Junona (fuke)	78.6481	21.4162	Check dam
186	NARKHED	Shindi (umari)	78.6566	21.4321	Check dam
187	NARKHED	Sawargaon	78.6375	21.3961	Check dam
188	NARKHED	Sawargaon	78.6345	21.4045	Check dam
189	NARKHED	Lohgad (theke)	78.6988	21.4288	Check dam
190	NARKHED	Chorkhairi	78.6755	21.4664	Check dam
191	NARKHED	Pipla (kh)	78.6853	21.4676	Check dam
192	NARKHED	Shemda	78.6953	21.4615	Check dam
193	NARKHED	Khapri	78.6865	21.4454	Check dam
194	NARKHED	Pipla (kh)	78.6835	21.4526	Check dam
195	NARKHED	Lohgad(mal]	78.6958	21.4166	Check dam
196	NARKHED	Borkhedi(mal)	78.6961	21.4005	Check dam
197	NARKHED	Borkhedi(mal)	78.7154	21.3972	Check dam
198	NARKHED	Sipikhapa	78.5951	21.4098	Check dam
199	NARKHED	Sawargaon	78.5908	21.4198	Check dam
200	NARKHED	Sawargaon	78.5976	21.4154	Check dam
201	NARKHED	Toyapur	78.5604	21.4269	Check dam
202	NARKHED	Pimpalgaon Raut	78.482	21.3948	Check dam
203	NARKHED	Wadvihara	78.4052	21.3544	Check dam
204	NARKHED	Wadvihara	78.4022	21.3275	Check dam
205	NARKHED	Khapa	78.4326	21.3032	Check dam
206	NARKHED	Khapa	78.426	21.3055	Check dam
207	NARKHED	Dawasa	78.3426	21.3457	Check dam
208	NARKHED	Ambada	78.5162	21.3195	Check dam

Annexure XII Location of waterbodies/tanks for desilting, Narkhed and Katol taluka, Nagpur district

SN	Taluka	Type of water body	Area (Sqkm	Permeter (km)	Area considered for intervention (sqkm)	Average depth (m)	Aditional volume avilable for storage (mcm)	Expenditure (Rs.)
1	Katol	Tanks	0.0529987	0.94644	0.00529987	0.6	0.00318	66587.57
2	Katol	Tanks	0.054803	1.04629	0.0054803	0.6	0.003288	68854.49
3	Katol	Tanks	0.0620606	1.11852	0.00620606	0.6	0.003724	77972.94
4	Katol	Tanks	0.0711847	1.38734	0.00711847	0.6	0.004271	89436.46
5	Katol	Tanks	0.0722727	1.08983	0.00722727	0.6	0.004336	90803.42
6	Katol	Tanks	0.074746	1.31912	0.0074746	0.6	0.004485	93910.87
7	Katol	Tanks	0.0773636	1.20735	0.00773636	0.6	0.004642	97199.63
8	Katol	Tanks	0.0831364	1.18992	0.00831364	0.6	0.004988	104452.6
9	Katol	Tanks	0.088795	1.34984	0.0088795	0.6	0.005328	111562
10	Katol	Tanks	0.109808	1.96117	0.0109808	0.6	0.006588	137962.8
11	Katol	Tanks	0.130251	1.56251	0.0130251	0.6	0.007815	163647.4
12	Katol	Tanks	0.159227	1.88041	0.0159227	0.6	0.009554	200052.8
13	Katol	Tanks	0.177552	2.39475	0.0177552	0.6	0.010653	223076.3
14	Katol	Tanks	0.309263	3.0114	0.0309263	0.6	0.018556	388558
15	Katol	Tanks	0.374567	2.91541	0.0374567	0.6	0.022474	470606
16	Katol	Tanks	0.496461	5.31681	0.12	0.6	0.072	1507680
17	Katol	Tanks	1.61272	7.87879	0.4	0.6	0.24	5025600
18	Katol	Reservoirs	2.02554	10.5901	0.5	0.6	0.3	6282000
Katol			**6.0327497**	**48.166**	**1.20980287**	**10.8**	**0.725882**	**15199963**
19	Narkhed	Tanks	0.0510319	1.03552	0.00510319	0.6	0.003062	64116.48
20	Narkhed	Tanks	0.052232	0.936749	0.0052232	0.6	0.003134	65624.28
21	Narkhed	Tanks	0.0558886	1.03469	0.01117772	0.6	0.006707	140436.9
22	Narkhed	Tanks	0.0595141	1.24421	0.01190282	0.6	0.007142	149547
23	Narkhed	Tanks	0.075443	1.1351	0.0150886	0.6	0.009053	189573.2
24	Narkhed	Tanks	0.0731588	1.0924	0.01463176	0.6	0.008779	183833.4
25	Narkhed	Tanks	0.0883645	1.397	0.0176729	0.6	0.010604	222042.3
26	Narkhed	Tanks	0.102832	1.53998	0.0205664	0.6	0.01234	258396.2
27	Narkhed	Tanks	0.10763	1.73906	0.021526	0.6	0.012916	270452.7
28	Narkhed	Tanks	0.135576	1.77804	0.0271152	0.6	0.016269	340675.4
29	Narkhed	Tanks	0.155192	1.96968	0.0310384	0.6	0.018623	389966.5
30	Narkhed	Tanks	0.252304	2.89084	0.1009216	0.6	0.060553	1267979
Narkhed			**1.2091669**	**17.79327**	**0.28196779**	**7.2**	**0.169181**	**3542643**