



Aquifer Map and Management Plans For Latur, Nilanga, & Renapur Talukas of Latur District Maharashtra

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DOI- 10.5281/zenodo.7544577

Abstract

The document includes an accurate assessment of rainfall's amount, duration, and severity. It is a crucial component of the planning and design of different hydraulic structures. The major goal of this study is to gather data and forecast potential solutions to address the situation in that area.

Introduction

National Aquifer Mapping (NAQUIM), a project that CGWB took up for the XII five-year plan, aims to conduct in-depth hydrogeological research at a toposheet size of 1:50,000. The State Government's proposed stress zones as well as the overexploited, critical, and semi-critical talukas have been given top priority by the NAQUIM. Aquifer mapping is a procedure used to characterise the quantity, quality, and sustainability of ground water in aquifers. It combines geology, geophysical, hydrologic, and chemical analyses.

The unpredictable nature of rainfall, the inherent heterogeneity and unsustainable nature of hard rock aquifers, the excessive exploitation of once-abundant alluvial aquifers, and a lack of regulation mechanisms have all had a negative impact on the country's ground water situation over the past ten or so years. Consequently, "traditional groundwater development concept" gave way to "contemporary groundwater management concept," causing a paradigm shift.

Aquifers must be precisely and completely mapped to the best depth and scale feasible in order to create robust and implementable ground water management strategies in a variety of hydrogeological situations. The proposed management plans will offer a "Road Map" for making sure that ground water resources are managed sustainably and fairly, primarily enhancing irrigation

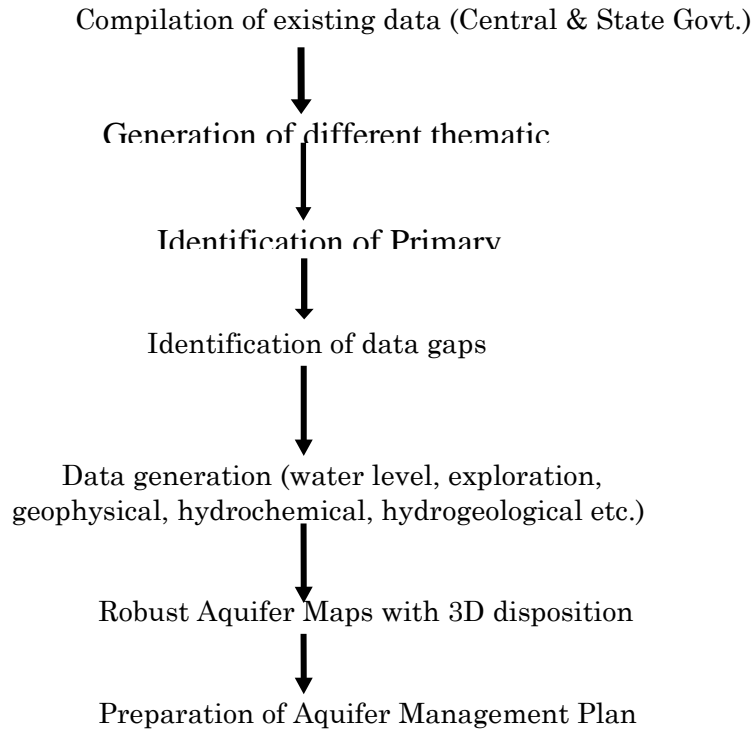
coverage and drinking water security. Consequently, the core of NAQUIM is not just mapping but

Objective and Scope

Groundwater recharge, conservation, harvesting, and methods for managing groundwater are all improved through aquifer mapping. These protocols will be the true byproducts of the exercise in aquifer mapping and will be included in the output, which is the aquifer map and management plan. NAQUIM's initiatives are intended to:

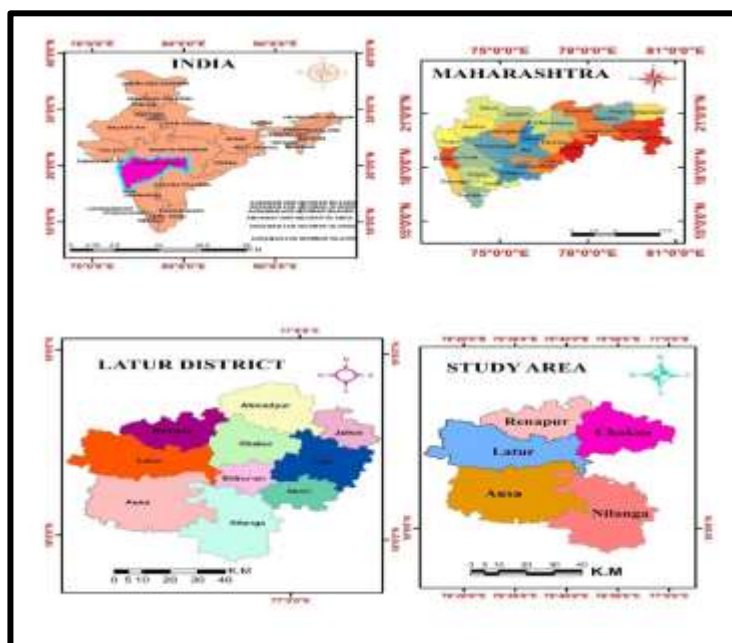
- Determining the aquifer's shape;
- Aquifer traits and their potential output;
- Water quality at various depths;
- Aquifer-wise evaluation of available groundwater resources;
- Creation of aquifer maps; and
- Development of a ground water management strategy.

The water supply authorities will be able to determine how much water is under their control thanks to this clear separation of aquifers and its potential. The sturdy a workable ground water management strategy will offer a "Road Map" for methodically managing the ground water resources for fair distribution across the board. Originally intended to be covered under the XII plan, an area of 43,058 sq. km has been enlarged to 49,000 sq. km to include the gap areas as well as recent drought-affected areas of the Latur district.

Approach and procedure**Study area**

The Central Ground Water Board started the National Aquifer Mapping Programme (NAQUIM) in India during the XII five-year plan, with a priority to investigate Over-Exploited, Critical, and Semi-Critical talukas, keeping in mind the current demand and supply of water as well as future water requirements. Since Ausa, Chakur, Nilanga, and Renapur taluka are classified as safe, the Latur taluka, a semi-critical taluka of the

Latur district, has been chosen to conduct extensive hydrogeological survey; In 2016, Latur was 970.71, Ausa was 1213.67, Chakur was 520.21, Nilanga was 1255.5, and Renapur was 516.22 square kilometres. According to a Ground Water Resources Estimation conducted by CGWB and GSDA as of March 2013, Latur Taluka is classified as semi critical, and the remaining four are safe. The list

Index Map



Administrative map

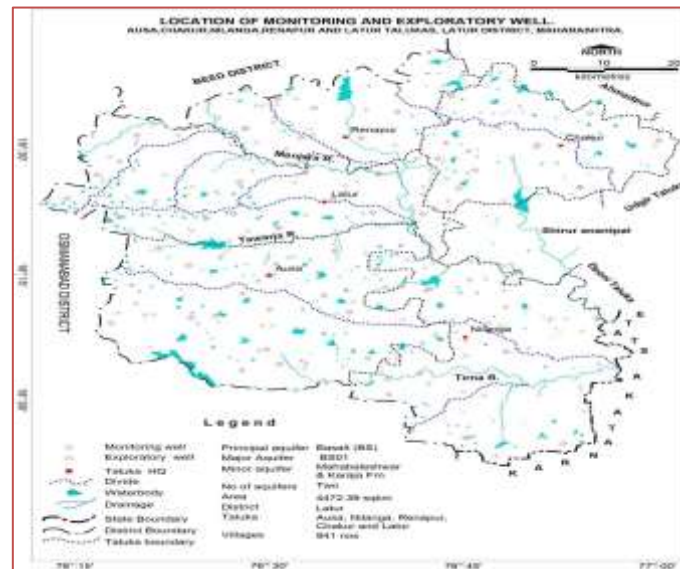
Analysis of data gaps and data adequacy

The Central Ground Water Board's accessible data from exploration wells, geophysical surveys, ground water monitoring stations, and ground water quality monitoring stations were collated and examined to see whether they were adequate for aquifer mapping studies. Additionally, the State Government's (GSDA) data on ground water monitoring stations and ground water quality stations were used for data adequacy and data gap analysis. The following key and critical data needs were the main focus of the data

data gaps are identified

adequacy and data gap analyses for each quadrant falling within the study area: Surveys of exploratory wells' geophysical data. Monitoring of ground water levels and water quality The information below summarises the necessary, existing, and data-gap information for exploratory wells, ground water monitoring, and ground water quality stations after taking into account the data from ground water exploration, geophysical survey, ground water level monitoring, and ground water quality.

Taluk a	Exploratory Data			Geophysical Data			Gw Monitoring Data			Gw Quality Data		
	Re q.	Exi st.	G ap	Re q	Exi st.	Ga p	Re q.	Exi st.	G ap	Re q.	Exi st.	G ap
Latur	9	6	8	32	25	15	16	12	4	16	12	4
Ausa	8	5	2	50	0	50	25	13	12	25	13	12
Nilang a	8	3	5	28	12	28	14	6	8	14	6	8
Chaku r	5	4	4	16	0	16	8	8	0	8	8	0
Renap ur	5	3	4	18	5	15	9	5	4	9	5	4
	35	21	23	144	42	124	72	44	28	72	44	28

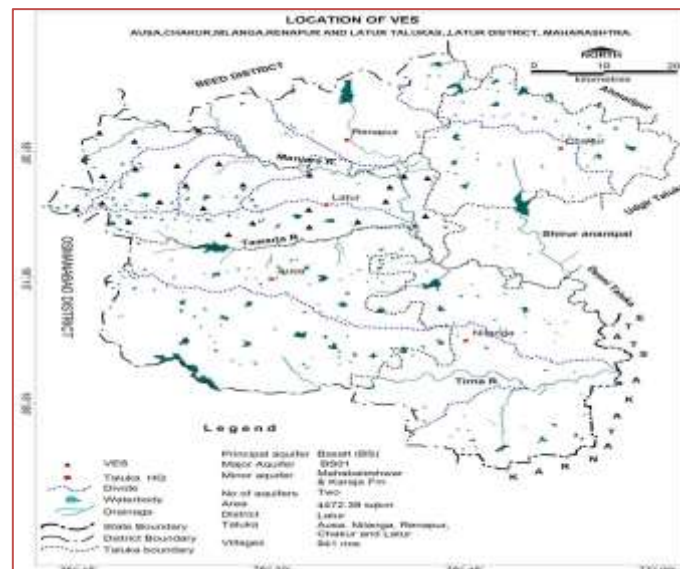


Identification of Data Gaps

Water level and quality have been attained throughout data generation, and only the Geophysical Survey has insufficient data as indicated in the aforementioned data gap (VES). There is no information void on

exploratory wells, ground water level monitoring, or ground water quality. The locations of the currently operational exploratory wells, GW level monitoring stations, quality sampling stations, and VES are shown

Location of monitoring wells and exploratory well



Climate and Rainfall

The environment there has a subtropical to tropical monsoon climate. For the purpose of understanding the characteristics of the rainfall, rainfall data from all the rain gauge stations at the taluka headquarters in AUSA, Chakur, Latur, Nilanga, and Renapur have been gathered from the accessible sources.

The zone of low rainfall, which extends from 650 to 800 mm and rises from the southwest to the northeast, covers a significant portion

of the territory. The second week of June is often when the rainy season begins, and it lasts until the end of September. In July, the amount of rain is at its heaviest. Thunderstorms are occasionally recorded in March and April. The short-term rainfall analysis for the years 2006 to 2015 shows that Chakur taluka receives an average annual rainfall of 759.44 mm, Renapur receives an average annual rainfall of 721 mm, AUSA receives an average annual

rainfall of 648.45 mm, Latur receives an average annual rainfall of 718 mm, and Nilanga taluka receives an average annual rainfall of 790 mm. However, the long-term rainfall data for these talukas (18 year) Renapur

12.3°C is the mean lowest temperature, and 39.1°C is the mean maximum temperature. Due to its location in the Western Ghats' "Rain Shadow" zone, the area frequently experiences drought conditions.

The Key Characteristics of Rainfall

CATEGORY	Chakur		Ausa		Latur		Nilanga		Renapur	
	No of years	% of total years	No of years	% of total years	No of years	% of total years	No of years	% of total years	No of years	% of total years
Departures										
Positive	8	44	8	44	5	46	7	39	8	44
Negative	10	56	10	56	6	54	11	61	10	56
Droughts										
Moderate	3	17	6	33	2	20	3	17	3	17
Severe	0	0	0	0	3	3	0	0	0	0
Acute	0	0	0	0	0	0	0	0	0	0
Normal & Excess R/F										
Normal	11	61	7	39	6	56	10	55	13	72
Excess	4	22	5	28	2	21	5	28	2	11

Static evaluation

	Chakur	Ausa	Latur	Nilanga	Renapur
Period	1998 to 2015	1998 to 2015	1901 to 2015	1998 to 2015	1998 to 2015
No of year	18	18	114	18	18
Normal rain fall in mm	858.5	742.8	730.4	823.3	782.1
Standard deviation in mm	203	265	227	217	177
Coeff of variation	24%	36%	31%	26%	23%
Slope	24.132 mm/year	30.274 mm/year	1.738 mm/year	13.266 mm/year	14.805 mm/year
Intercept	1087.8 mm	1030.4 mm	628.7 mm	949.3	922.7
Trend line equation	Y= - 24.132 X +1087.8	Y= - 30.274 X +1030.4	Y= 1.738 X +628.7	Y= -13.266 X +949.3	Y= -14.805 X +922.7

Physiography

The Denudational hills range, plateaus, and plain can be considered three physiographic units that roughly correspond to the area. The region's elevation ranges from 560 to 701

mamsl. East-west upland ranges extend from the Balaghat Plateau in the Latur taluka. Roughly 45% of the region is covered by denudational hills, nearly 28% by middle-level plateaus, and around 27% by flood plains. Manjra and its tributaries drain the

area. The Manjra River springs above Gaurwadi in the Bhir district, close to the northern edge of the Balaghat plateau, and flows southeast. For the majority of its easterly journey, it serves as the district boundary. The primary right bank tributaries of the Manjra are the Terna River and Tawarja.

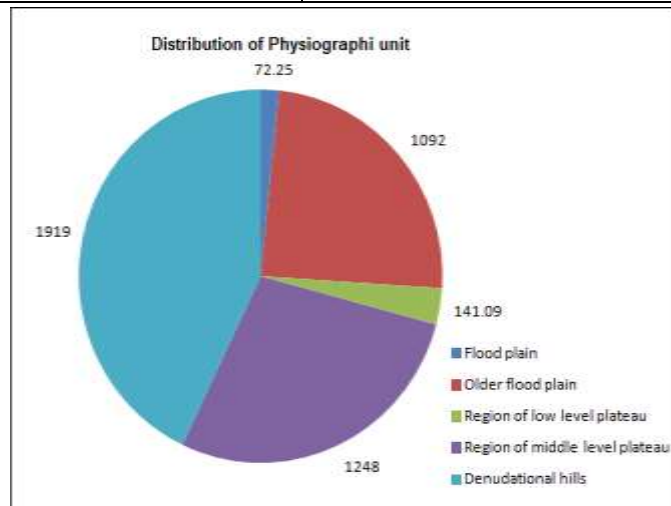
Geomorphology

Based on the degree of weathering and the thickness of the soil cover, the analysis of

geomorphological data and thematic maps gathered from MRSAC, Nagpur, shows that almost the entire area is a weathered plateau, ranging from a Moderately Dissected Plateau (MDP) to a Slightly Dissected Plateau (SDP). Along the Manjra River, there are remnants of a palio plentiful channel (younger and lower); along the Tirna River, there are isolated deep alluvial plains (younger, lower). Messa and Butte are also observed at such locations.

Geographic features

SN	Geomorphic units	Ground waterprospects
1	Paleao/abandoned channel (Alluvial Plain Younger/Lower)	Form productive aquifer.Good Recharge zone.
2	Deep alluvial plain (Younger/Lower)	Form productive aquifer.Good Recharge zone.
3	Plateau-, With exposed rock and thin soil cover	Suitable for seasonal source only.Groundwater prospect are good along Lineaments.
4	Plateau- With moderate soil cover	suitable for seasonal source only.Groundwater Prospect are good along Lineaments.
5	Plateau- With thick soil cover and thick weathered zone	Suitable for seasonal source only.Groundwater Prospect are good along Lineaments.
6	Plateau- With exposed rock, negligible soil cover	Suitable for seasonal source only.Groundwater prospect are good along Lineaments.
7	Plateau- With thin soil cover and Weathering	Suitable for seasonal source only.Groundwater prospect are good along Lineaments.
8	Plateau-Moderately thick soil cover and moderate weathering	suitable for seasonal source only.Groundwater prospect are good along Lineaments.
9	Plateau Top	suitable for seasonal source only.Groundwater prospect are good along Lineaments.
10	Denudational Slopes	Form runoff zone.Not suitable for groundwater development.
11	Dissected Lateritic Cappings	Limited ground water storage
12	Denudational Hill	Form runoff zone.Not suitable for groundwater development.
13	Structural Hills	Form runoff zone.Not suitable for groundwater development.
14	Water Body Mask	Water Body Mask
15	Habitation Mask	Suitable for domesticwater supply due to less open area for ground water recharge



Distribution of physiographic unit



Physiography

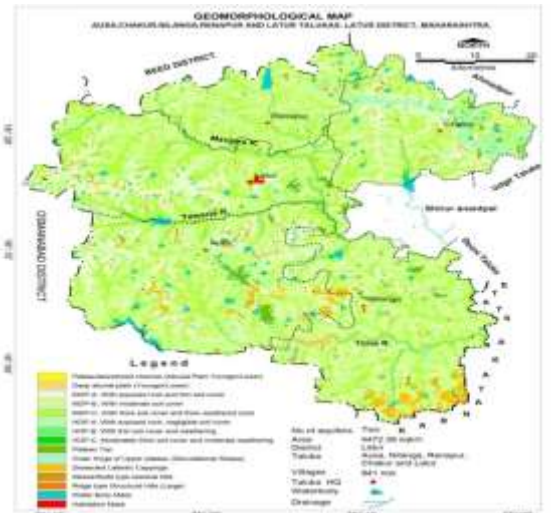
Use of Land

With the exception of fallow fields, the research area can be divided into cultivated and uncultivated land. The research region's entire geographic area in 2012-13 was 4472.39 Sqkm. 0.5% of the total area was classified as land not suitable for agriculture, which included territory covered by forests used for non-agricultural purposes, barren and uncultivated land, permanent pastures and other grazing lands, fields under various trees, crops, groves, and cultivable waste. 91% of the total area was made up of cultivable land, and the remaining 9% was

Detail on Taluka Land Use (Area in ha)

S N	Taluka	Total Geographical area	Forest area	Land under non-agricultural Uses	Permanent pastures	Cultivable waste	Current fallow	Other fallow	Net sown area	Gross cropped area	Cropping intensity
1	Chakur	52021	155	979	2174	1513	258	207	47267	57882	115
2	Renapur	51222	1033	310	259	361	1608	1401	47511	50285	104
3	Ausa	121367	235	5177	1032	2395	13833	3455	114295	126074	109
4	Nilanga	125558	350	2216	1653	1615	12412	5264	108313	117030	110
5	Latur	97071	88	3481	1199	2439	1810	589	91975	101725	111
		447239	1861	12163	6317	8323	29921	10916	409361	452996	

The MRSAC, Nagpur has collected and analysed the land use information and thematic map with reference to current agricultural techniques, different land uses, etc. The majority of the area, it has been



Geomorphology

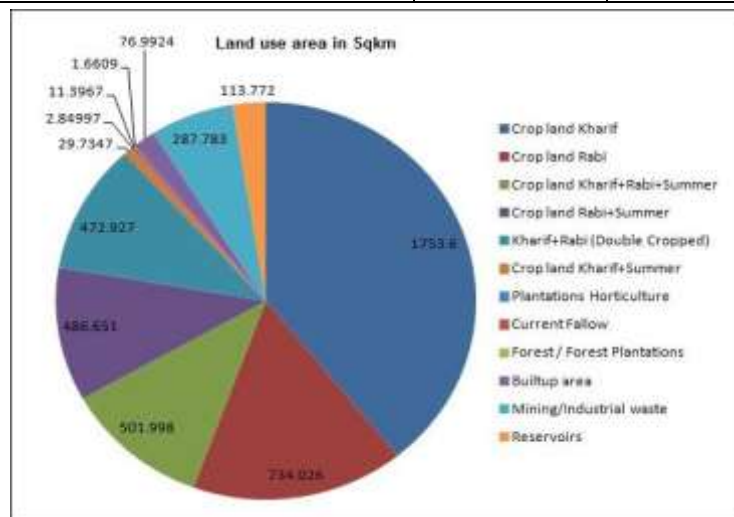
made up of fallow lands, which often include both current and other fallows.

Despite the fact that the district's share of cultivable land is higher than the State's overall, the percentage of net land under cultivation is lower. This demonstrates the widespread practise of leaving land fallow for a year or longer and rotating it in order to produce superior harvests. As a result, the local farmers still need to get used to the norm of farming the same land throughout both kharif and rabi. This is demonstrated by the fact that 9.7% of the land was sown more than once.

noted, is made up of agricultural land. In the northern and northwest, there is virtually little forest. Wherever a community has emerged, it reflects the surrounding built-up region.

Summerised Land use detail

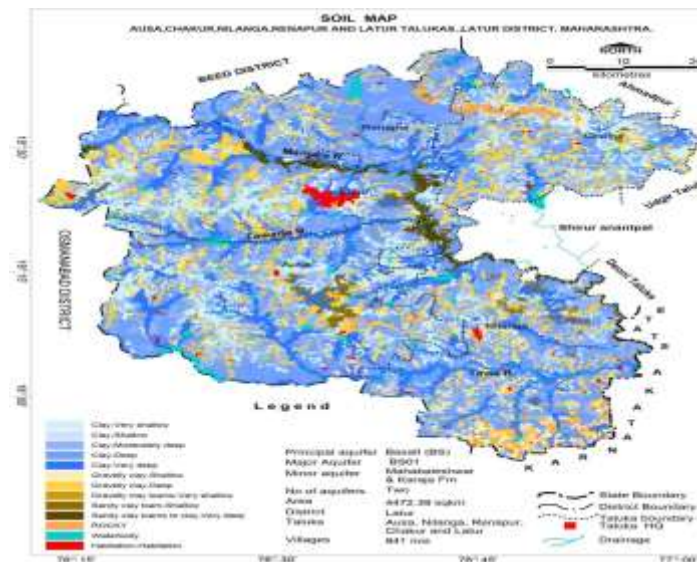
SN	Landuse	Area (Sqkm)	% to total area
1	Crop land Kharif	1753.6	39.20
2	Crop land Rabi	734.026	16.41
3	Crop land Kharif+Rabi+Summer	501.998	11.22
4	Crop land Rabi+Summer	486.651	10.88
5	Kharif+Rabi (Double Cropped)	472.927	10.57
6	Crop land Kharif+Summer	29.7347	0.66
7	Plantations Horticulture	2.84997	0.06
8	Current Fallow	11.3967	0.25
9	Forest / Forest Plantations	1.6609	0.04
10	Builtup area	76.9924	1.72
11	Mining/Industrial waste	287.783	6.43
12	Reservoirs	113.772	2.54
Total		4473.392	100.00



Landuse distribution



S N	Soil type	Area cove red (Sqkm)	Characteristics
1	Clay- Very shallow	597.98	Very shallow, dark brown, clay, on weathered basalt substrata, non-calcareous, pH 7.6, well drained, severe to very severe erosion, plateaus, 3-5% slopes
2	Clay-Shallow	20.2917	Shallow, strong brown, clay over paralithic strata, calcareous, pH 7.6, well drained, severely to very severely eroded, valley sides, 2-4% slopes
3	Clay- Moderately deep	1006.57	Moderately deep, dark to very dark gray brown, clay, slightly calcareous, pH 7.5, moderately well drained moderately eroded, lower plateaus, 0-2% slopes
4	Clay-Deep	1218.24	Deep, dark gray, clay, calcareous, pH 9.5, poorly drained, slightly eroded, lower pediplains, 1-2% slopes, sub-soils slightly sodic
5	Clay- Very deep	562.206	Very deep, dark grayish brown, clay, calcareous, pH 8.4, moderately well drained, slightly eroded, low lands on banks of streams and rivers, 0-2% slopes
6	Gravelly clay-Shallow	222.718	Shallow, dark grayish brown, gravelly clay, gravel >35%, calcareous, pH 8.3, well drained, very severely eroded, valley fringes 3-5% slopes
7	Gravelly clay loams- Very shallow	5.17195	Very shallow, grayish brown, gravelly clay loams, gravel over 40%, resting on murum followed by basalt rock, non-calcareous, pH 8.1, well drained severe to very severe erosion, eroded mesa/butte, 3-5% slope
8	Gravelly clay- Deep	592.341	Deep, dark brown to very dark grayish brown, gravelly clay, gravel < 20%, strongly calcareous, pH 8.3, moderately to poorly drained, slightly eroded, narrow valleys, 0-1% slopes, subsoil slightly sodi
9	Sandy clay loam- Shallow	61.5841	Shallow, dark brown, sandy clay loam, gravel < 25%, basalt rock as substrata, calcareous, pH 8.5, well drained, severely to very severely eroded, escarpment slopes, 8-10% slopes
1 0	Sandy clay loams to clay-Very deep	85.6587	Very deep, grayish brown, sandy clay loams to clay, over clay, strongly calcareous, pH 8.2, moderately well drained, slightly to moderately eroded, low lands, on river banks, 3-5% slopes
1 1	Rocky	76.0908	Rocky
1 2	Waterbody	113.778	Waterbody
1 3	Habitation	39.4022	Habitation



Soil

Hydrology

A number of minor irrigation structures were built by the state government. According to the Maharashtra Government's Irrigation Department, these irrigation structures irrigate 128.74 square kilometres of land in Latur, 77.58 square kilometres in Renapur, 80.77 square kilometres in Chakur, 133.45

square kilometres in AUSA, and 134.09 square kilometres in Nilanga taluka.

Two significant irrigation projects—two large, five bandharas of the Kolhapur variety, and five barrages—are situated on the borders of the Beed and Osmanabad districts, but the irrigation command is headquartered in the Latur district.

Information about major, medium-sized, and larger small irrigation projects.

Name	Lat	Lon g	Taluk a	Distri ct	Storage Capacity (MCM)		Command area (Ha)		Quantity of water utilized for (MCM)		
					Gross	Live	Gr oss	By Latest Date	Irrigati on	Dome stic	Ind ust rial
Major Project s											
Manjar a	18° 35' 15.03"	76° 06' 00.8 4"	Kaij	Beed	224.09	176.96					
Lower Terna	18° 19' 44.47"	76° 07' 23.8 6"	Lohara	Osma na Bad	121.188	91.221					
Mediu m Project s											
Tawarja	18° 18' 34.12"	76° 20' 10.7 8"	Latur	Latur	27.727	20.345					
Minor Project s											
Gondeg aon	18° 25' 54.97"	76° 06' 59.3 2"	Latur	Latur	2.366	2.063					

Wasang aon			Latur	Latur	2.000	1.800					
Chikurd a	18° 25' 01.07"	76° 25' 38.1 1"	Latur	Latur	1.599	1.438					
Niwli	18° 22' 03.15"	76° 18' 21.0 0"	Latur	Latur	3.140	2.900					
Katpur	18° 21' 54.10"	76° 36' 09.5 0"	Latur	Latur	3.708	3.205					
Saarola -Son	18° 15' 15.29"	76° 35' 23.2 9"	Latur	Latur	2.201	1.942					
Barrag es											
Nagjhar i	18° 49' 16.49"	76° 54' 55.1 8"	Latur	Latur	2.075						
Sai	18° 29' 02.88"	76° 33' 16.7 3"	Latur	Latur	0.280						
Mahapu r	18° 28' 10.26"	76° 35' 08.4 8"	Latur	Latur	0.980						
Kasarkhe da	18° 27' 01.07"	76° 38' 31.2 9"	Latur	Latur	0.421						
Bhatkh eda	18° 25' 49.20"	76° 40' 04.7 0"	Latur	Latur	0.493						

(Source: Irrigation Department, Govt. of Maharashtra, 2010)

Area Irrigated by various sources

S N	Taluka	Area under irrigation (ha)		Total area irrigation ed (ha)	Area under cultivatio n (ha)	% area under irrigation wrt cultivation
		Surface	Ground water			
1	Latur	12874	12537	25411	163818	16
2	Renapu	7588	6033	13621	69257	20
3	Chakur	8077	2889	10966	62623	18
4	Ausa	13345	5318	18663	150663	12
5	Nilang a	13409	6704	20113	134656	15

Common Techniques for Water Conservation and Recharge

Additionally, the State Government built numerous water-conservation structures, including Kolhapuri Type (KT) weirs (86),

percolation tanks (225), and village ponds (320), among others.

Information on the water conservation structures built by the state government

S. No.	Talu ka	KT Weir		Village Ponds		Percolation Tank		Other Structures	
		No.'s	Capa city (TCM)	No.'s	Capac ity (TCM)	No.'s	Capac ity (TCM)	No.'s	Capac ity (TCM)
1	Ausa	22	9.10	98	7657.5	86	2580	1	0.56
2	Chakur	13	5.38	59	4340	5	150	0	0
3	Latur	21	8.69	83	4500	73	2190	1	0.56
4	Renapur	3	1.24	21	2820	5	150	2	1
5	Nilanga	27	11.17	59	2750	56	1680	1	0.6
	Total	86	35.57	320	22067.5	225	6750	5	2.72

Drainage

The Manjra and its tributaries, which are part of the Godavari drainage system, drain the area. The Tirna River begins near Chakur on the eastern border of the plateau and flows roughly eastward for about 56 kilometres until joining the Lendi at Kharka in Nanded district. The Manjra River springs above Gaurwadi in the Bhir district, close to the northern edge of the Balaghat plateau, and flows southeast. With the exception of a few deviations of the boundary to the north and south of the river, it forms the district boundary for the most of its easterly course. Where the Tirna River joins the Manjra River, the latter turns south, following the flow of this tributary, and after passing through Halki, flows in a south-easterly

direction up to Chichaundi within the district, where it then serves as the State's border till Aurad Shajahani. It then takes an eastward direction to enter the Mysore State. The Tawarja and the Tirna are the two primary right bank tributaries of the Manjra. The 50-kilometer-long Tawarja River begins near Murud Railway Station and flows primarily east till it joins the Manjra River close to Seoni Village.

Every river has a drainage pattern that ranges from sub-dendritic to sub-parallel, and the drainage density is relatively high. Deep black soils, medium deep black soils, and shallow grey soils are the three types of soil present in the area.

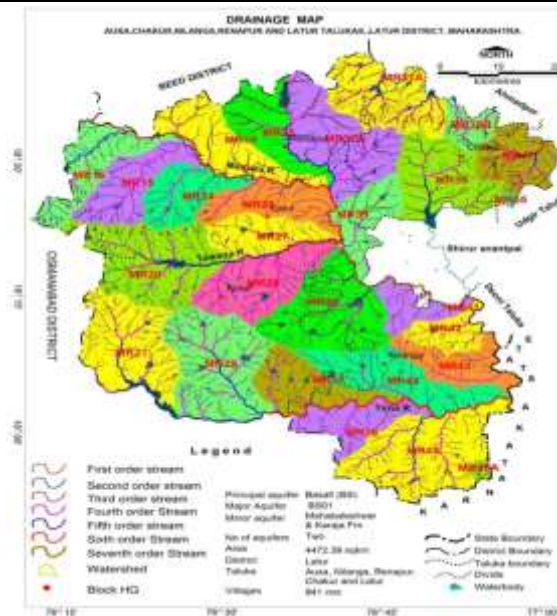
Chakur, Ausa, Nilanga, Renapur, and Latur taluka watersheds

Region	Basin	Catchment	Sub catchment	Watershed	Subwatershed	Area (Sqkm)
			Tirna	Tirna	MR45A	13.0798
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR15	163.528
			Tirna	LB Tirna	MR21	267.946
			Upper Manjra beyond confl. With Karanja (both RB and	Tawarhja	MR27	129.639
			Tirna	Tirna	MR35	156.379
			Manjra LB	Manar	MR38B	55.1469

			Upper Manjra beyond confl. With Karanja (both RB and	Tawarhja	MR20	303.892
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR33	124.42
			Tirna	Tirna	MR36	128.306
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR42	78.329
			Manjra LB	Tiru	MR47	138.674
			Upper Manjra beyond confl. With Karanja (both RB and	LB Manjra	MR18	188.206
			Upper Manjra beyond confl. With Karanja (both RB and	Tawarhja	MR28	213.505
			Upper Manjra beyond confl. With Karanja (both RB and	Ghirni	MR39	215.433
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR41	82.3563
			Tirna	Tirna	MR44	210.8
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR16	162.213
			Upper Manjra beyond	LB Manjra	MR25	147.531

Region	Bas in	Catch ment	Sub catchment	Watershe d	Subwatersh ed	Area (Sqkm)
			confl. With Karanja (both RB and			
			Tirna	LB Tirna	MR29	316.693
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR43	124.094
			Manjra LB from Karanja confl. To Nizamsagar	Hibalman di	MR55	4.28274
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR24	136.875
			Manjra LB	Manar	MR31A	218.898
			Upper Manjra beyond confl.	RB Manjra	MR34	276.636

			With Karanja (both RB and			
			Tirna	Tirna	MR45	326.938
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR26	148.288
			Upper Manjra beyond confl. With Karanja (both RB and	RB Manjra	MR32A	269.393



Drainage

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