



**GOVERNMENT OF KARNATAKA
DEPARTMENT OF AGRICULTURE**

**Pradhan Mantri Krishi Sinchayee Yojana
(PMKSY)**

**DISTRICT IRRIGATION PLAN
BENGALURU URBAN DISTRICT**



2016

FOREWORD

The sustainability of the water resource is a sensitive issue which impacts a lot of aspects that has a major impact on many inter-related components. Basically, the project focuses on the water resources that is currently available in the district and being used for multi purposes. We are mainly focusing on doing a qualitative as well as quantitative analysis of the data collected through various resources in order to implement "PradhanMantriKrishiSinchayaYojanaya (PMKSY)" With the motto of "harkethkopani" and "Per drop more Crop" which enhances the water usage to expand the cultivable area as per the projection to 2020.

In order to get the facts and figures for analysing, we are closely co-ordinating and monitoring with various departments that has the available data that is necessary for projection of the project. The departments involved are :- Minor irrigation, Water source, Ground water Resources, Panchayat Raj Institutions who have immensely helped to get our data in place for analysis. Also adding various departments who have helped us in providing the statistical data which was also a part of core subject : Horticulture , Animal Husbandry, Industries and commerce, KEB (Power Generation) ,BWSSB (Sewage treatment).

We have considered the water availability and assessing requirement of water for the present year and 2020 respectively. Some of the aspects are : Domestic purpose, crops, animals, industries, Power generation. We are having more concentration on preparing district irrigation plan which is one of the components of PMKSY which has the motto "Per drop-more crop", where micro-irrigation is popularized. Implementation of water application devices like drip, sprinkler, rain guns, pivots, rain water harvesting structures to effectively use the physically available sources of water.

As mentioned above, We have a committee formed to successfully implement the changes chaired by District commissioner Followed by vice chairman, CEO (Z.P), Dist.head, Department of agriculture (Member secretary), Horticulture , District head of the dept. (Agriculture marketing, Forest Dept., Water resources Dept., Minor Irrigation Dept., Rural Development & Panchayat Raj Dept., Ground water Dept., Surface & ground water resources Dept., Representative from zonal research station., Programme Co-ordinator (KVK), Lead bank officer of the district., Two representative farmers., Leading NGO, Representative from input supplying association.

I hereby declare that all the information is carefully reviewed and will provided an assistance to plan and execute the water implementation programme successfully to reap benefits.


Deputy Commissioner

Bangalore Urban District

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PRADHAN MANTRI KRISHI SINCHAYEE YOJANA (PMKSY)

I. Introduction:

The major objective of PMKSY is to achieve convergence of investments in irrigation at the field level, expand cultivable area under assured irrigation, improve on-farm water use efficiency to reduce wastage of water, enhance the adoption of precision-irrigation and other water saving technologies (More crop per drop), enhance recharge of aquifers and introduce sustainable water conservation practices by exploring the feasibility of reusing treated municipal waste water for peri-urban agriculture and attract greater private investment in precision irrigation system.

PMKSY has been conceived amalgamating ongoing schemes *viz.*, Accelerated Irrigation Benefit Programme (AIBP) of the Ministry of Water Resources, River Development & Ganga Rejuvenation (MoWR, RD & GR), Integrated Watershed Management Programme (IWMP) of Department of Land Resources (DoLR) and the On Farm Water Management (OFWM) of Department of Agriculture and Cooperation (DAC). The scheme will be implemented by Ministry of Agriculture, Water Resources and Rural Development. Ministry of Rural Development is to mainly undertake rain water conservation, construction of farm pond, water harvesting structures, small check dams and contour bunding etc., MoWR, RD &GR, is to undertake various measures for creation of assured irrigation source, construction of diversion canals, field channels, water diversion/lift irrigation, including development of water distribution systems. Ministry of Agriculture will promote efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm “(Jal Sinchan)”, construction of micro-irrigation structures to supplement source creation activities, extension activities for promotion of scientific moisture conservation and agronomic measures.

Programme architecture of PMKSY will be to adopt a ‘decentralized State level planning and projectised execution’ structure that will allow States to draw up their own irrigation development plans based on District Irrigation Plan (DIP) and State Irrigation Plan (SIP). It will be operative as convergence platform for all water sector activities including drinking water & sanitation, MGNREGA, application of science & technology etc., through comprehensive plan. State Level Sanctioning Committee (SLSC) chaired by the Chief Secretary of the State with the authority to oversee its implementation and sanction of projects.

The programme will be supervised and monitored by an Inter-Ministerial National Steering Committee (NSC) will be constituted under the Chairmanship of Prime Minister with Union Ministers from concerned Ministries. A National Executive Committee (NEC) constituted under the Chairmanship of Vice Chairman, NITI Aayog to oversee programme implementation, allocation of resources, inter-ministerial coordination, monitoring & performance assessment, addressing administrative issues etc.,

Components and responsible Ministries/ Departments are as follows:

1. AIBP by MoWR, RD & GR: To focus on faster completion of on-going Major and Medium Irrigation including National Projects.
2. PMKSY (Har Khet Ko Pani) by MoWR, RD & GR: Creation of new water sources through Minor Irrigation (both surface and ground water), Repair, restoration and renovation of water bodies; strengthening carrying capacity of traditional water sources, construction rain water harvesting structures (Jal Sanchan); Command area development, strengthening and creation of distribution network from source to the farm. Improvement in water management and distribution system for water bodies to take advantage of available source, which is not utilised to its fullest capacity (deriving benefits from low hanging fruits).

3. PMKSY (Watershed) by Dept. of Land Resources, MoRD Water harvesting structures such as check dams, nala bund, farm ponds, tanks etc. Capacity building, entry point activities, ridge area treatment, drainage line treatment, soil and moisture conservation, nursery raising, afforestation, horticulture, fodder development, livelihood activities for the asset-less persons and production system & microenterprises for small and marginal farmers etc., Effective rainfall management like field bunding, contour bunding/trenching, staggered trenching, land levelling, mulching etc.,

4. PMKSY (Per drop more crop) by Dept. of Agriculture & Cooperation, MoA Programme management, preparation of State/District Irrigation Plan, approval of annual action plan, Monitoring etc., Promoting efficient water conveyance and precision water application devices like drips, sprinklers, pivots, rain-guns in the farm (Jal Sinchay). Topping up of input cost particularly under civil construction beyond permissible limit (40%), under MGNREGA for activities like lining inlet, outlet, silt traps distribution systematic.

Construction of micro irrigation structures to supplement source creation activities including tube wells and dug wells (in areas where ground water is available and not under semi critical /critical /over exploited category of development) which are not supported under PMKSY (WR), PMKSY (Watershed) and MGNREGA.

Secondary storage structures at tail end of canal system to store water when available in abundance (rainy season) or from perennial sources like streams for use during dry periods through effective on-farm water management Water lifting devices like diesel/ electric/ solar pumpsets including water carrying pipes.

Extension activities for promotion of scientific moisture conservation and agronomic measures including cropping alignment to maximize use of available water including rainfall and minimise irrigation requirement (Jal samrankshan)

Capacity building, training for encouraging potential use water source through technological, agronomic and management practices including community irrigation awareness campaign on water saving technologies, practices, programmes etc., organisation of workshops, conferences, publication of booklets, pamphlets, success stories, documentary, advertisements etc. Improved/innovative distribution system like pipe and box outlet system with controlled outlet and other activities of enhancing water use efficiency.

District Irrigation Plans (DIPs):

District Irrigation Plan (DIP) shall be the cornerstone for planning and implementation of PMKSY. DIP will identify the gaps in irrigation infrastructure after taking into consideration the District Agriculture Plans (DAPs) already prepared for Rashtriya Krishi Vikas Yojana (RKVY) vis-à-vis irrigation infrastructure currently available and resources that would be added during XII Plan from other ongoing schemes (both State and Central), like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA), Rashtriya Krishi Vikash Yojana (RKVY), Rural Infrastructure Development Fund (RIDF), Member of Parliament Local Area Development (MPLAD) Scheme, Member of Legislative Assembly Local Area Development (MLALAD) Scheme, Local body funds etc. The gaps identified under Strategic Research & Extension Plan (SREP) be used in preparation of DIP. DIPs will present holistic irrigation development perspective of the district outlining medium to long term development plans integrating three components viz., water sources, distribution network and water use applications incorporating all

usage of water like drinking & domestic use, irrigation and industry. Preparation of DIP will be taken up as joint exercise of all participating departments. DIP will form the compendium of all existing and proposed water resource network system in the district.

The DIPs may be prepared at two levels, the block and the district. Keeping in view the convenience of map preparation and data collection, the work would be primarily done at block level. Block wise irrigation plan is to be prepared depending on the available and potential water resources and water requirement for agriculture sector prioritising the activities based on socio-economic and location specific requirement. In case of planning is made based on basin/sub basin level, the comprehensive irrigation plan may cover more than one district. The activities identified in the basin/sub-basin plan can be further segregated into district/block level action plans.

i. Background

Hon'ble President in his address to the joint Session of the Parliament of 16th Lok Sabha indicated that "Each drop of water is precious. Government is committed to giving high priority to water security. It will complete the long pending irrigation projects on priority and launch the 'Pradhan Mantri Krishi Sinchayee Yojana' with the motto of 'Har Khet Ko Paani'.

There is a need for seriously considering all options including linking of rivers, where feasible; for ensuring optimal use of our water resources to prevent the recurrence of floods and drought. By harnessing rain water through 'Jal Sanchay' and 'Jal Sinchan', we will nurture water conservation and ground water recharge. Micro irrigation will be to ensure 'Per drop-More crop'. Out of about 141 ml ha of net area sown in the country, about 65 million hectare (or 45%) is presently covered under irrigation. Substantial dependency on rainfall makes cultivation in unirrigated areas a high risk, less productive

profession. Empirical evidences suggest that assured or protective irrigation encourages farmers to invest more in farming technology and inputs leading to productivity enhancement and increased farm income. The overreaching vision of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) will be to ensure access to some means of protective irrigation to all agricultural farms in the country, to produce ‘per drop more crop’, thus bringing much desired rural prosperity.

ii. Vision

To utilize the available water resources in the district to the maximum extent in an efficient way to meet the basic needs of every living being and enhancing the livelihoods of rural population to the maximum extent thus alleviating poverty in a sustainable way without compromising the interests of future generations.

iii. Objective

Following are the objectives:

- A. Enhance the physical access of water on the farm and expand cultivable area under assured irrigation (Har Khet ko pani).
- B. Integration of water source, distribution and its efficient use, to make best use of water through appropriate technologies and practices.
- C. Improve on-farm water use efficiency to reduce wastage and increase availability both in duration and extent.
- D. Enhance the adoption of precision-irrigation and other water saving technologies (More crop per drop).

- Enhance the physical access of water on the farm and expand cultivable area under assured irrigation (Har Khet ko pani).
- Integration of water source, distribution and its efficient use, to make best use of water through appropriate technologies and practices.
- Improve on-farm water use efficiency to reduce wastage and increase availability both in duration and extent.

- ❑ Enhance the adoption of precision-irrigation and other water saving technologies (More crop per drop).
- ❑ Enhance recharge of aquifers and introduce sustainable water conservation practices.
- ❑ Ensure the integrated development of rain fed areas using the watershed approach towards soil and water conservation, regeneration of ground water and arresting runoff.
- ❑ Promote extension activities relating to water harvesting, water management and crop alignment for farmers and grass root level field functionaries.
- ❑ Explore the feasibility of reusing treated municipal wastewater for peri-urban agriculture.

iii. Strategy /approach

- ❑ Creation of new water sources; repair, restoration and renovation of defunct water sources; construction of water harvesting structures, secondary & micro storage, ground water development
- ❑ Developing/augmenting distribution network where irrigation sources (both assured and protective) are available or created;
- ❑ Promotion of scientific moisture conservation and run off control measures to improve ground water recharge so as to create opportunities for farmer to access recharged water through shallow tube/dug wells;
- ❑ Promoting efficient water conveyance and field application devices within the farm *viz.*, underground piping system, Drip & Sprinklers
- ❑ Encouraging community irrigation through registered user groups.

Farmer oriented activities like capacity building, training and exposure visits, demonstrations, farm schools, skill development in efficient water and crop management practices (crop alignment) including large scale awareness on more crop per drop of water through mass media campaign, exhibitions, field days, and extension activities through short animation films etc.

CHAPTER I

GENERAL INFORMATION OF THE DISTRICT

District profile:

Bengaluru, the capital city of Karnataka, is a bustling metropolis and one of the world's fastest growing cities. Bengaluru is draped over the Deccan Plateau at an altitude of 949 meters (3113 ft.) above mean sea level, which gives it possibly the best climate among all the cities in India. Legend has it that Bengaluru got its name from the words "Benda Kaalu" (which means boiled beans in the local language Kannada). King Veera Ballala of the Vijayanagara kingdom was once lost in a forest and happened to stumble upon a lonely cottage. An old woman who lived there could offer the starving king only boiled beans "Benda kaalu" and the place came to be known as "Bendakaaluooru" (ooru in Kannada means a city). Bendakaalooru later came to be known as Bengalooru in Kannada and Bangalore in English.

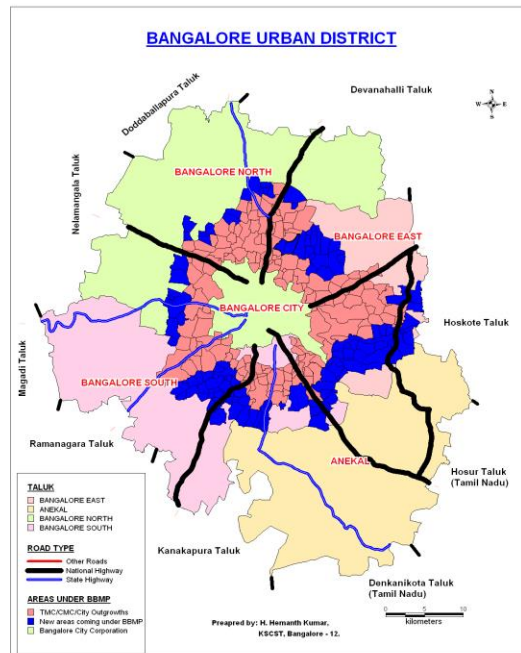
Bengaluru Urban district came into being in 1986 with the partition of the erstwhile Bengaluru district into Bengaluru Urban and Bengaluru Rural. It has four taluks namely Anekal, Bengaluru North, Bengaluru South and Bengaluru East. It is surrounded by Bengaluru Rural district on the west, east and north and the Krishnagiri district of Tamil Nadu on the south. It is located at 12° 57' 26.4" North latitude and 77° 36' 1" East longitude. The district has 17 Hoblies, 86 Grama Panchayaths and 613 villages. The geographical area of the district is 2.17 lakh ha and has a population of 96.2 lakh as per 2011 census. Out of the total population of 96.2 lakhs, 50.2 lakhs are male and 46.0 lakhs are female, while the SC population is 11.98 lakhs and the ST population is 1.9 lakhs (As per 2011 Census). The SC & ST population works out to 14.4 % of the total population. The literacy rate is 88 per cent and the sex ratio is 944 females for 1000 males. The mean maximum temperature ranges from 29 to 35° C and

mean minimum temperature ranges from 15 to 20⁰ C. however, in the recent years the maximum temperatures have reached up to 38⁰ C in summer months and reached below 12⁰ C in winter months. The humidity ranges from 64 to 77 %.

No major river run through the district, though the Arakavathi and South Pennar cross paths at the Nandi Hills, 60 km to the North. The river Vrishabhavathi, a minor tributary of Arkavathi arises within the city at Basavanagudi and flows through the city. Bangalore has a handful of freshwater lakes and water tanks, the largest of them are Madivala tank, Hebbal lake, Halasur lake and Sankey Tank. Many historical tank beds have been converted for human habitation. Bangalore receives rainfall from the northeast monsoon as well as the south west monsoon. The normal rainfall of this district is 875 mm. Vegetation in the city is primarily in the form of large deciduous trees and interspersed coconut trees. Bangalore enjoys a pleasant and equitable climate throughout the year and it is called the **“Garden City of India”**.

Of the total geographical area of the district 2.17 lakh ha, the net sown area is only 45246 ha and the gross cropped area is 46433 ha. It works out to the cropping intensity of 103 %. The district has 5055 ha under forest area.

Fig 1.1



All the four taluks of Bengaluru Urban district are located in eastern dry zone (Zone V) of Karnataka. The zone has the characteristic of low rainfall pattern with more uniform and bi-modal distribution. The distribution of different soil types of Alfisols, red sandy loam in major areas and clay lateritic soils are also noticed in patches. The soils of the district are mainly red sandy loam soils which cover an area of 2.16 lakh ha. In Anekal, Bengaluru East and Bengaluru South taluks have 100 % red sandy loam soils, while Bengaluru North taluk has 95 % of red sandy loam soils and only 5 % clayey lateritic soils.

The pH of the soils in major parts of the district is neutral (6.5 -8.5) and is acidic (<6.5) in parts of Bengaluru North, Anekal, and Bengaluru South. The EC status of the soils in the district is normal (<0.8 d/Sm.). The soils are deficient in OC (<0.5 %) in Bengaluru North, major area of Anekal, minor area in Bengaluru South and Sufficient (>0.5 %) in major area in Bengaluru South and minor area in Bengaluru East and Anekal taluks. The soils of all the taluks

of the district are sufficient in available phosphorous (>5 ppm), available potassium (>50 ppm), Bengaluru Urban district is primarily focused on industries and tertiary sector such as IT & BT. Agriculture sector has the last priority in the district. However, horticulture, animal husbandry (dairying and poultry) and fisheries sectors are the major activities supplementing the agriculture component.

Traditionally the agriculture system in the district is dependent on rainfall. The district has about 35058 ha (75.5%) under agriculture crops, of which cereals occupy a major area 29791 ha, followed by pulses (4100 ha), oilseeds (1167 ha). Horticulture is another important sector of the district covering an area of 10,345 ha (22.3%). The district has 1,030 ha (2.2%) under mulberry cultivation and recorded a cocoon production of 1,033 tons.

Live-stock farming is one of the important occupations in this district. The district has a total live-stock population of 3.2 lakhs, of which 1.4 lakhs cows, 8453 buffaloes, 77302 sheep, 44725 goats and 18114 pigs,

Table 1.1 : District Profile

1.	Latitude and Longitude	12 ^o 57'26.4" North latitude and 77 ^o 36'1" East longitude
2.	Total Number of block	4
3.	Total Number of Grama Panchayat	86
4.	Total No. of Hoblies	17
5.	Total Number of Villages	613
6.	Total Population	9621551
7.	Total Male Population	5022661
8.	Total Female Population	4598890
9.	Total Child population	1052837
10.	Total SC Population	1198385
11.	Total ST Population	190239
12.	Geographical Area	217410 ha
13.	Net Sown Area	45246 ha
14.	Gross Cropped Area	46433 ha
15.	Net Irrigated	11280 ha
16.	Area under Forest	5055 ha
17.	Total livestock	324682
18.	Total poultry	2421151

1.2. Demography:

1.2.1: Population:

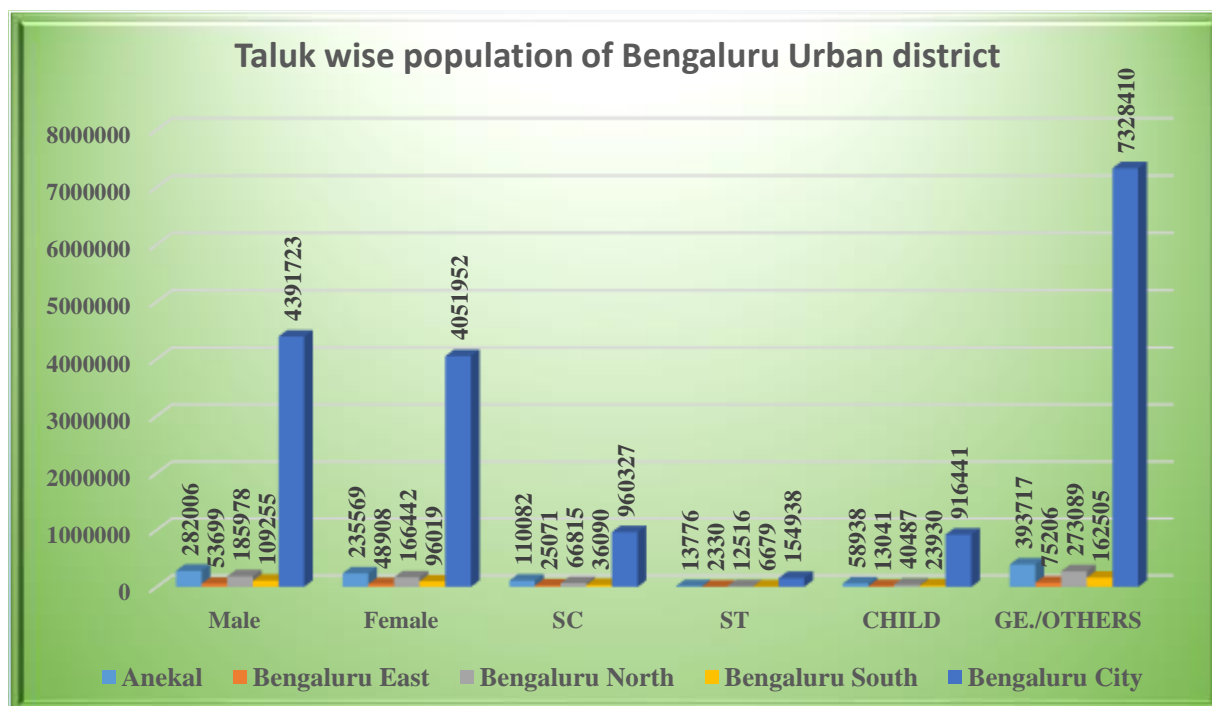
The total population of the district is 9621551. Of this, 5022661 are male and 4598890 are females. Lion's share of district population belongs to Bengaluru City 8443675 (87.8%). SC population is 1198385 (12.5%) the ST population is 190239 (2.0 %). Further, among the taluks, Anekal has the highest population of 517575, followed by Bengaluru North with 352420 and Bengaluru South with 205274. Bengaluru East taluk has the lowest population of 102607. The percentage of SC population is highest in Bengaluru East taluk (24.4%), followed by Anekal Taluk (21.3%) and Bengaluru North (19.0%). SC population is the lowest in Bengaluru South taluk and Bengaluru City (11.4%), where as the percentage of ST population is highest in Bengaluru North taluk (3.6%) followed by Bengaluru South (3.3%) and Anekal (2.7 %). In Bengaluru East taluk (2.3%) and Bengaluru City (1.8%) the percentage of ST population is lowest. Details are furnished at Table 1.2.

Table 1.2 : Taluk wise population of Bengaluru Urban district.

Sl. No	Name of the Block	Population			SC	ST	Child	General/ Others	Total
		Male	Female	Total					
1.	Anekal	282006	235569	517575	110082	13776	58938	393717	517575
2.	Bengaluru East	53699	48908	102607	25071	2330	13041	75206	102607
3.	Bengaluru North	185978	166442	352420	66815	12516	40487	273089	352420
4.	Bengaluru South	109255	96019	205274	36090	6679	23930	162505	205274
5.	Bengaluru City	4391723	4051952	8443675	960327	154938	916441	7328410	8443675
	Total	5022661	4598890	9621551	1198385	190239	1052837	8232927	9621551

NOTE:As per 2011 Census.

Fig. 1.2



1.2.2. Rural and Urban Population:

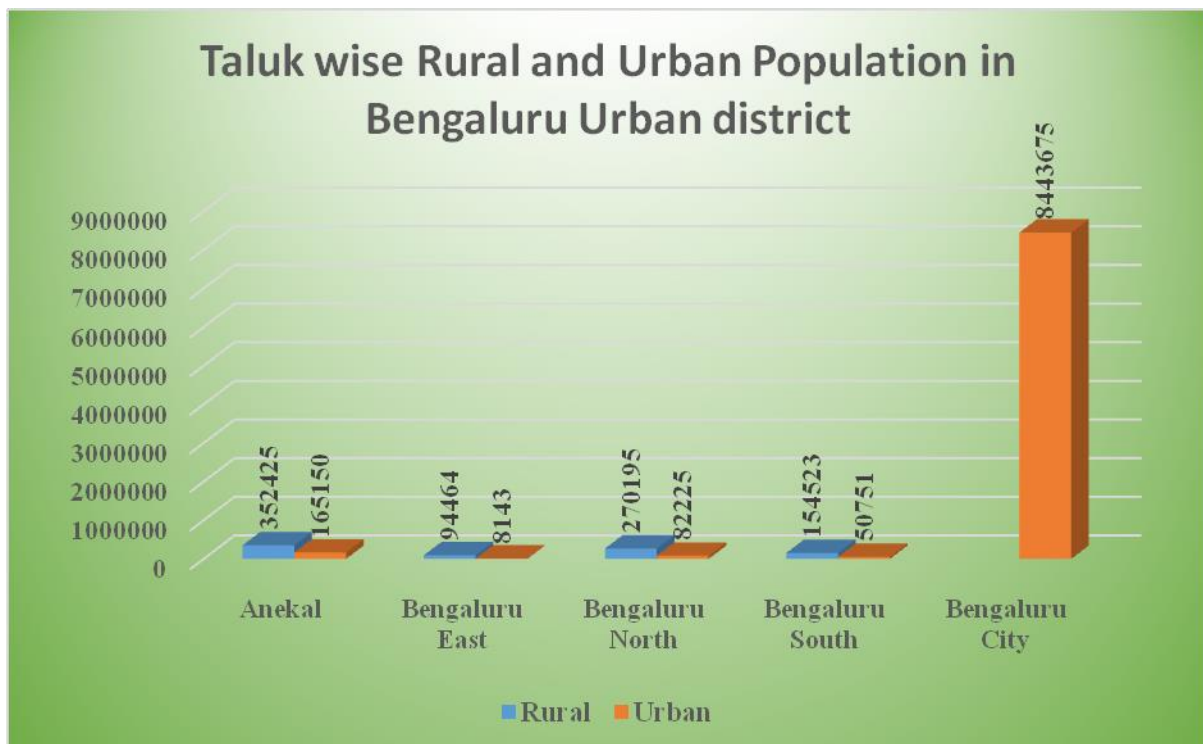
The Rural population of the district is 871607 (74.0%), while the Urban population is 306269 (26%)-(Excluding Bengaluru City). Bengaluru East taluk has the highest percentage (92.1%) of Rural population in the district, followed by Bengaluru North taluk (76.7%) and Bengaluru South (75.3%). The lowest percentage of rural population is in Anekal taluk (68.1%). Among the taluks Anekal taluk has the highest percentage of (31.9%) urban population, followed Bengaluru South (24.7%) and Bengaluru North taluk (23.3%). Bengaluru East taluk has the lowest percentage of urban population (7.9%) in the district. Bengaluru City has urban population of 8443675. Taluka wise Rural and Urban population in the district is furnished in Table 1.3

Table.1.3. Taluk wise Rural and Urban Population in Bengaluru Urban district

Sl.No.	Taluk	Rural	Urban	Total
1.	Anekal	352425	165150	517575
2.	Bengaluru East	94464	8143	102607
3.	Bengaluru North	270195	82225	352420
4.	Bengaluru South	154523	50751	205274
5.	Bengaluru City		8443675	8443675
	Total	871607	8749944	9621551

NOTE:As per 2011 Census.

Fig. 1.3



1.2.3. House holds:

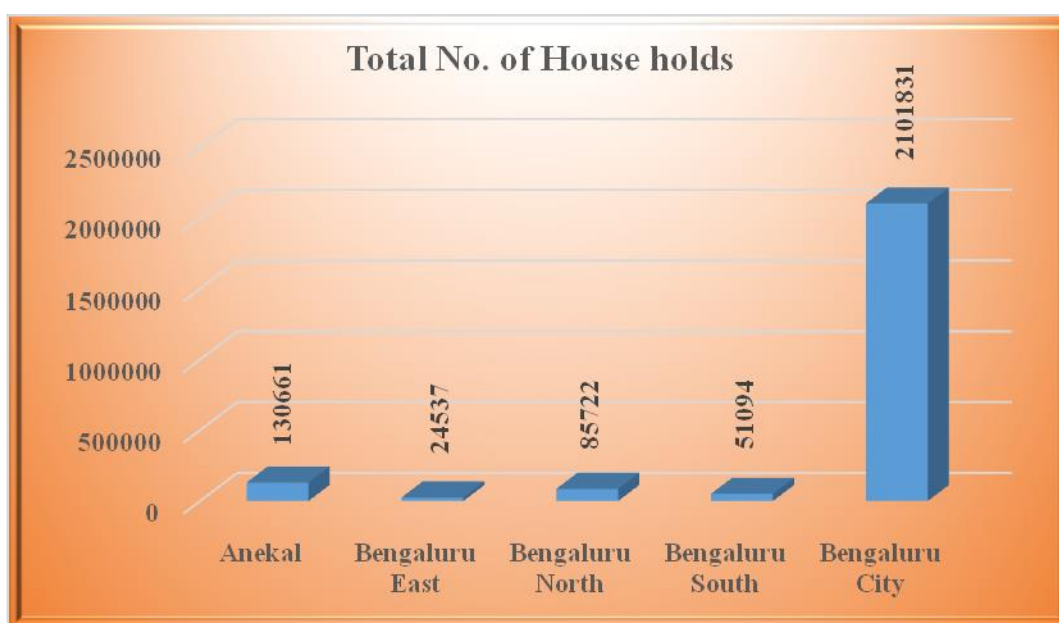
The total number of households in Bengaluru district is 2393845. Excluding Bengaluru City, households of the district is 292014. Anekal taluk has the highest percentage of households, 44.7% (130661), followed by Bengaluru North 29.4% (85722) and Bengaluru South 17.5% (51094). Bengaluru East taluk has the lowest percentage of households 8.4% (24537). Details are furnished at Table 1.4

Table.1.4 Taluk-wise households in Bengaluru Urban district

Sl. No.	Taluk	Total No. of House holds
1.	Anekal	130661
2.	Bengaluru East	24537
3.	Bengaluru North	85722
4.	Bengaluru South	51094
5.	Bengaluru City	2101831
	Total	2393845

NOTE:As per 2011 Census.

Fig 1.4



1.3. Biomass and livestock

Animal Husbandry is an important subsidiary occupation in the district. Due to proximity to Bengaluru City, it provides additional employment opportunity and also additional income to the farming community.

Large animals:

Animal Husbandry is an important subsidiary occupation in the district. Due to proximity to Bengaluru development of this sector is considered important in the interest of farming community as it provides additional employment opportunity and also additional income to the farming community.

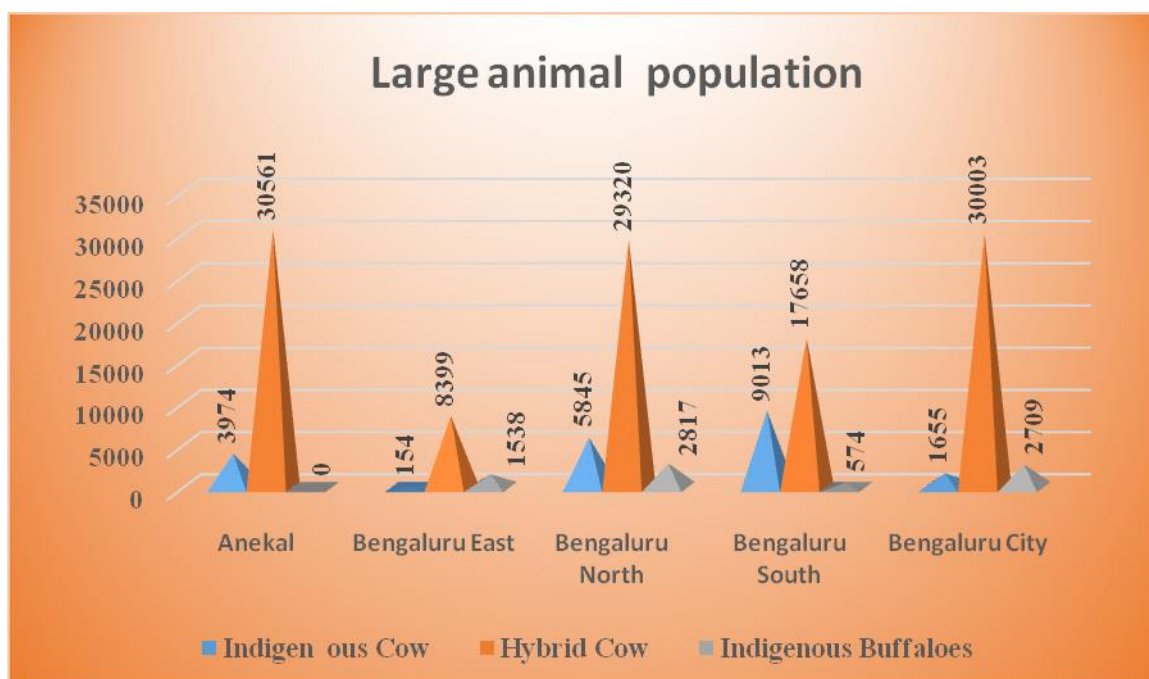
The District has totally 148541 large animals comprising, 136582 Cows (91.2%) and 8453 (5.7%) buffaloes. Of the Cow population 20641 (15.1%) is indigenous breed and 115941 (85.9%) is crossbreeds. Bengaluru City alone has a large animal population of 36447 (24.5%). Among the taluks, Bengaluru North taluk has the highest large animal population 38996 (34.8%), followed by Anekal 35642(31.8%) and Bengaluru South with 27366 (24.4%). Lowest cattle population is in Bengaluru East 10108 (9.0%). The total milk production in the district is 1155059.72 thousand tonnes.

Table. 1.5 : Large animal population

Sl. No.	Taluk	Large Animals				Any Other Milch or Meat Animal	Total Large animals
		Indigenous Cow	Hybrid Cow	Total Cow	Indigenous Buffaloes		
1	Anekal	3974	30561	34535	815	274	35624
2	Bengaluru East	154	8399	8553	1538	17	10108
3	Bengaluru North	5845	29320	35165	2817	1014	38996
4	Bengaluru South	9013	17658	26671	574	121	27366
5	Bengaluru City	1655	30003	31658	2709	2080	36447
Total		20641	115941	136582	8453	3506	184541

Source: District at a glance 2014-15

Fig 1.5



Sheep, goat and pig rearing are also popular allied activities in the district. These allied activities are supplementing the income of the farmers, additional employment and they also contribute to the fertility of the soil through organic manure. Poultry, egg and meat are important sources of quality proteins, minerals and vitamins to balance the human diet. The total small animals in the district are 140141. Among small animals, Sheep population is highest 77302 (55.2%), followed by Goats 44725 (31.9%) and Pigs 18114 (12.9%). Bengaluru City alone has a small animal population of 27636 (19.7%). Among the taluks, Bengaluru North taluk has the highest Small animal population 41700 (37.1%), followed by Anekal with 37687 (33.5%) and Bengaluru South with 23482 (20.9%). Bengaluru East has the lowest 9636 (8.6 %) small animal population.

The total poultry population in the district is 2421151. Among taluks of the district, Anekal taluk has the highest poultry population of 1588057 (65.6%) followed by Bengaluru North with 522989 (21.6%) and Bengaluru South

200481 (8.3 %). Lowest poultry is in Bengaluru East 52207 (2.2%). Apart from the taluks of the district, Bengaluru City has a poultry population of 57417 (2.4%).

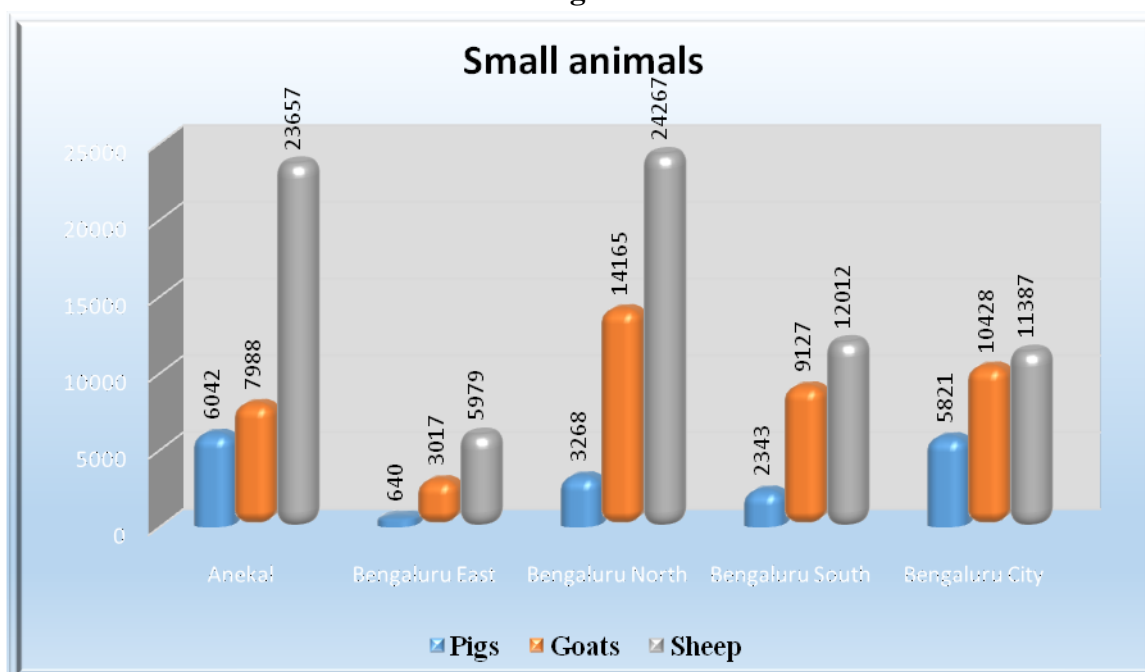
The total Egg production in the district is 85412.38 lakhs, with maximum production of 1186.38 lakhs in Anekal taluk and the lowest egg production of 10.0 lakhs in Bengaluru South. The total meat production in the district is 2.07 lakh tonnes. Taluk wise details are furnished in Table 1.6.

Table : 1.6 Small animals

Sl. No.	Taluk	Poultry	Small Animals			
			Pigs	Goats	Sheep	Total
1	Anekal	1588057	6042	7988	23657	37687
2	Bengaluru East	52207	640	3017	5979	9636
3	Bengaluru North	522989	3268	14165	24267	41700
4	Bengaluru South	200481	2343	9127	12012	23482
5	BengaluruCity	57417	5821	10428	11387	27636
Total		2421151	18114	44725	77302	140141

Source: District at a glance 2014-15

Fig1.6



1.4 Agro-Ecology, Climate, Hydrology and Topography:

1.4.1 Agro-ecology

All the five taluks of Bengaluru Urban district are located in eastern dry zone (Zone V) of Karnataka. The zone has the characteristic of low rainfall pattern with more uniform and bi-modal distribution. The distribution of different soil types of Alfisols, red sandy loam in major areas and clay lateritic soils are also noticed in patches.

1.4.2 : Climate

The mean maximum temperature ranges from 29 to 35⁰ C and mean minimum temperature ranges from 19 to 20⁰ C. However, in the recent years the maximum temperatures have reached up to 38⁰ C in summer months and reached below 12⁰ C in winter months. The humidity ranges from 64 to 77 %. Most common crops grown in the district are finger millet, maize, field bean, red-gram and groundnut. Important horticulture crops grown are mango, papaya, sapota, vegetable crops such tomato, capsicum, cucumber and floriculture (cut flowers).

The average annual rainfall received in the district is 875 mm with 55 rainy days in a bi-modal pattern from April to June and again September to November. This pattern helps the farmers to grow two crops in a year in both Kharif and rabi season due to good distribution of rainfall. However, occurrence of drought and dry spells are observed during the cropping season. Maximum rain fall in almost all the taluks in the district is in the months of May, July, August, September and October.

Table 1.7 Taluk-wise average normal climate parameters of Bengaluru Urban

Sl. No.	Taluk	Rainfall		Temperature		Humidity (%)	
		No. of rainy days	Average rainfall (mm)	Min. °C	Max. °C	Min	Max
1	Anekal	54	867	19	35	71	66
2	Bengaluru North	58	933	20	29	72	64
3	Bengaluru South	54	851	20	31	77	70
4	Bengaluru East	52	851	20	31	77	70
Total		55	875	20	32	74	67

Source: KSNDMC

1.4.3 Hydrology

The major rivers of the district are Shimsa, Kanva, Arkavathi, South Pennar and Vrishabharathi. There are two major river basins in the district namely Cauvery and South Pennar. Shimsha and Kanva river of the Cauvery basin is draining majority of the district and Anekal taluk is drained by South Pennar river of Ponnaiyar basin, which takes its birth from Nandi hills and flows towards south.

Ground water occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations. The occurrence of Ground water movement and recharge to aquifers are controlled by various factors like fracture pattern, degree of weathering, geomorphological setup and amount of rainfall received. Generally the depth of weathering varies, being more in the valley, and often extending up to 30 m in the dug wells. However, the yield in the bore well is dependent upon factors like degree of weathering, presence of joints and fractures and its connectivity and the presence of intrusive bodies. Granites and

Gneisses of peninsular gneissic group constitute major aquifers in the urban district of Bangalore. Laterites of Tertiary age occur as isolated patches capping crystalline rocks in Bangalore north taluk and ground water occur in phreatic condition. Alluvium of limited thickness and aerial extent of 20 to 25m thick occur along the river courses possessing substantial ground water potential.

The depth of water level in the core area of Bangalore city has the shallowest water level in the range of (1-5) m bgl. Majority of the stations located in the periphery has deeper water level in the range of 10- 20 m bgl. In general, pre monsoon depth to water levels of the peizometer ranges from 5 to 30 m bgl. In dug wells, it ranges from 2 to 11 m. The post monsoon depth to water level ranges of the peizometer varies from 2 to 40 m bgl. In dug wells, it ranges from 0.5 to 11 m.

Shallow aquifers in granites and gneisses ranges from 2 to 25m depth. Depth of semi confined to confined aquifers varies. General fractures are encountered in the depth range of 35-80m, 100-125m and deeper fractures up to 213 & 250m depth were also encountered in the district during ground water exploration programme. In general, discharge of the exploratory wells ranged from < 1.0 lps at Hesaraghatta to 8.4 lps at Bengaluru university. The aquifer in Bengaluru urban district can be divided and generalized into three zones namely shallow zone, moderately deep zone and deep zone. Shallow zone: Aquifer occurring within depth of 25m below ground level comprises of weathered and shallow fractured granites and gneisses and ground water occur in phreatic condition. Ground water development is mainly through dug wells, dug cum bore wells and shallow bore wells. Weathered thickness generally ranges from 5 to 10m in 60% of the area in Bengaluru south taluk and part of Bengaluru north taluk. In Anekal taluk weathered zone thickness is deeper generally up to 25m depth. About 90% of ground water structures tapping shallow aquifers are yielding less than 1 lps and yield of more than 2 lps is recorded in Bengaluru south taluk.

Moderately deep zone (up to 60mbgl), aquifer category consists of weathered and fractured granites and gneisses. Yield of the wells ranged from 2 to 6 lps. Transmissivity ranged from 10 to 65m²/day. In Deeper aquifers, (Beyond 60 m) yield ranged from 2 to 8 lps in parts of Bangalore north and Anekal taluks. Transmissivity ranged from 15 to 280m²/day and storability varies from 2.8*10⁻³ to 8.4*10⁻⁴.

1.4.4 : Topography:

The lands of Bengaluru Urban district are mainly nearly level (0-1 %), very gently sloping (1-3 %), gently sloping (3-5%) and in certain areas moderately steep (15-25%) and very steeply sloping (25-50%). The land in all the taluks are mainly very gently sloping to gently sloping and in the valleys they nearly level. In parts of Bengaluru North, the lands are moderately sloping. Moderately steep to very steeply sloping land are observed in the western part of Anekal and norther western part of Bengaluru South (Fig 1.7 to 1.10).

Fig 1.7

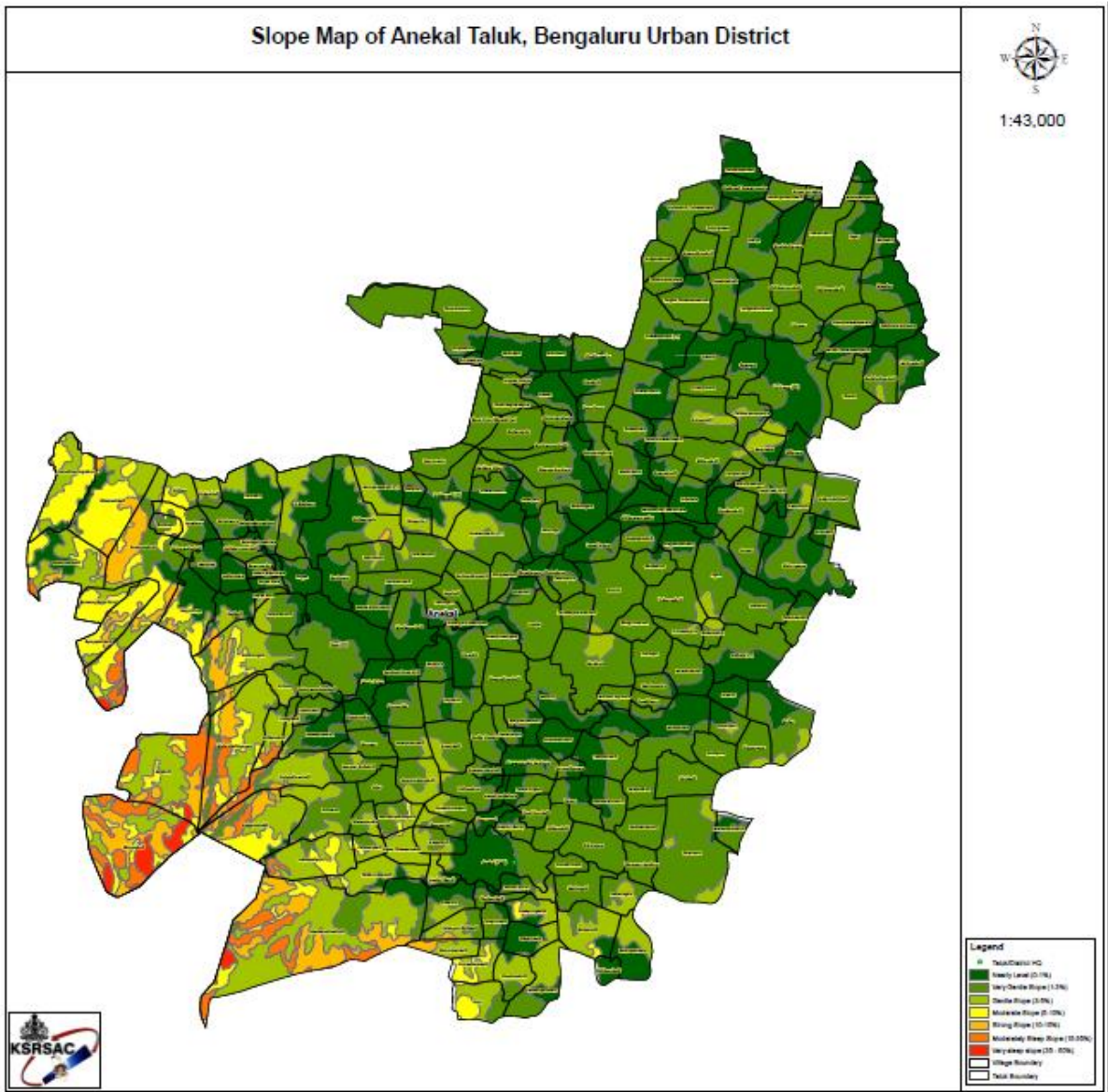


Fig 1.8

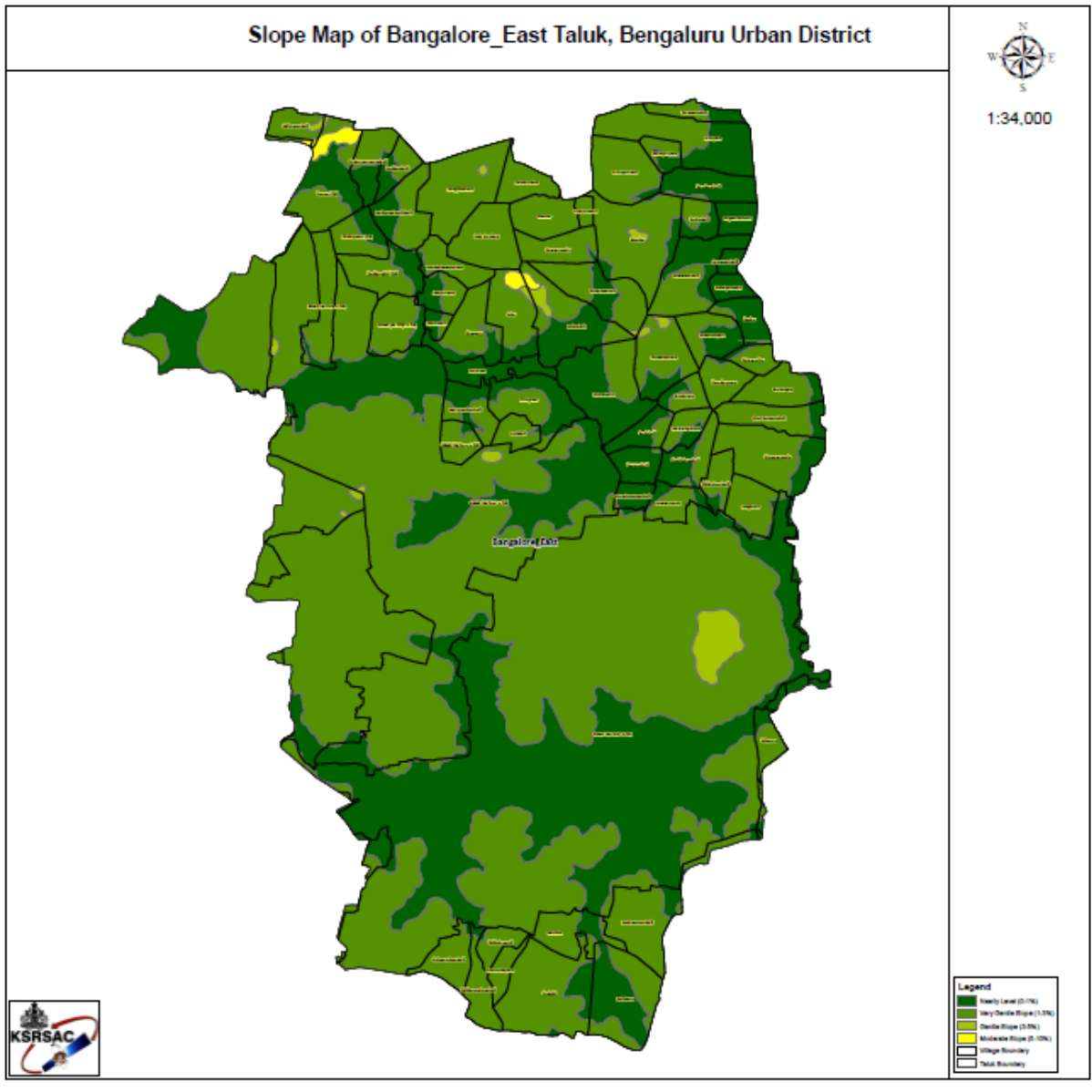


Fig 1.9

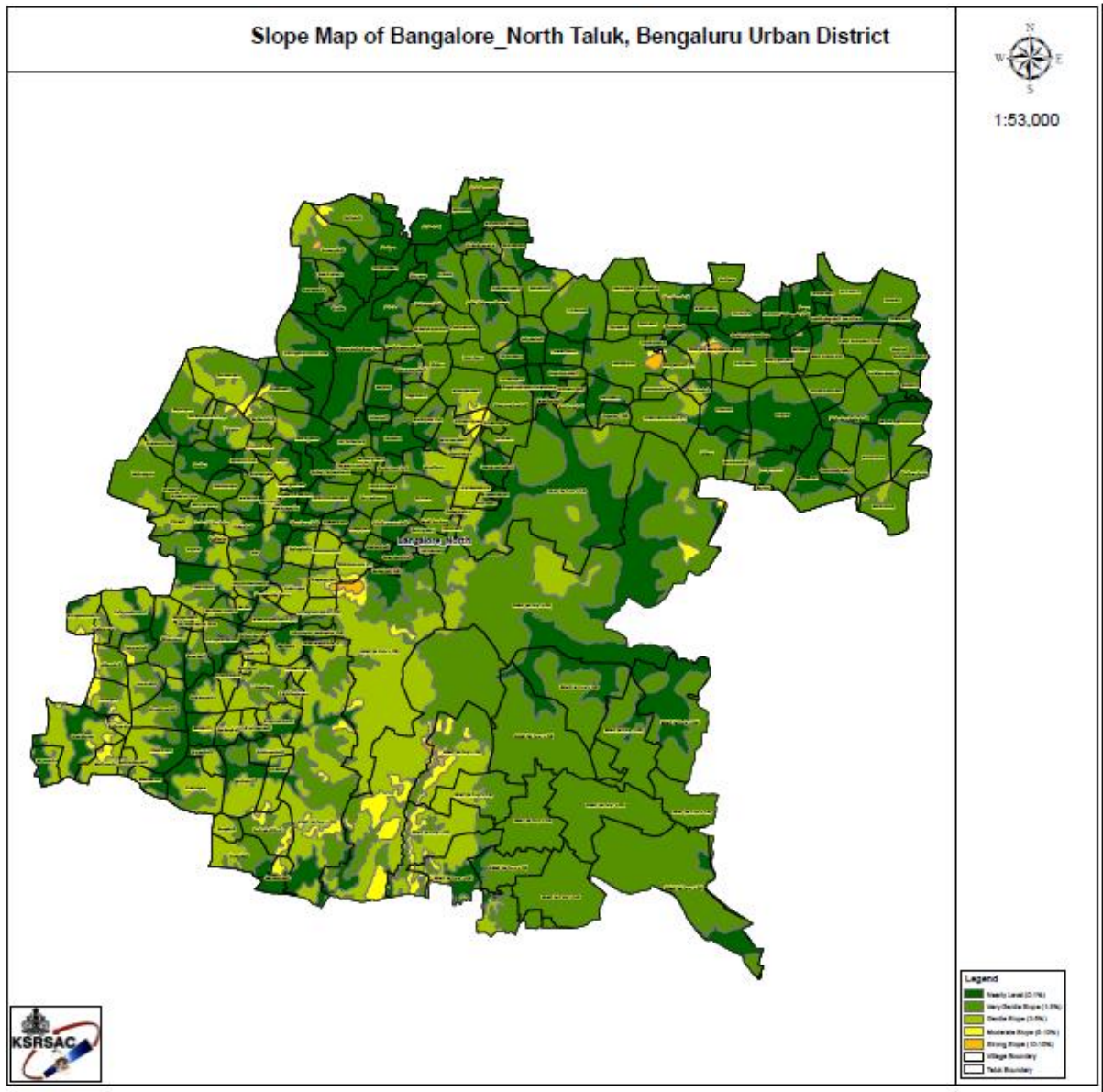
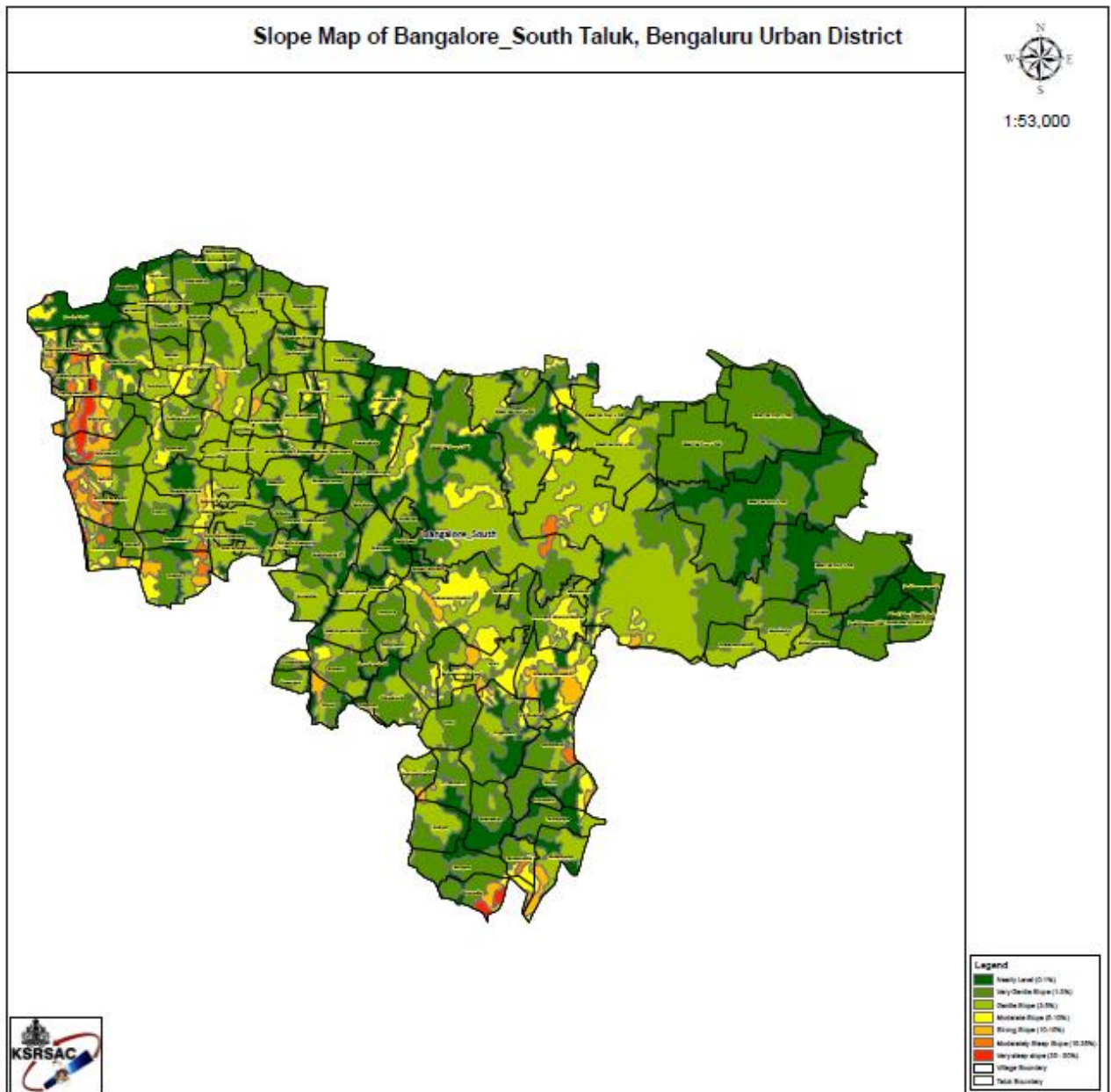


Fig 1.10

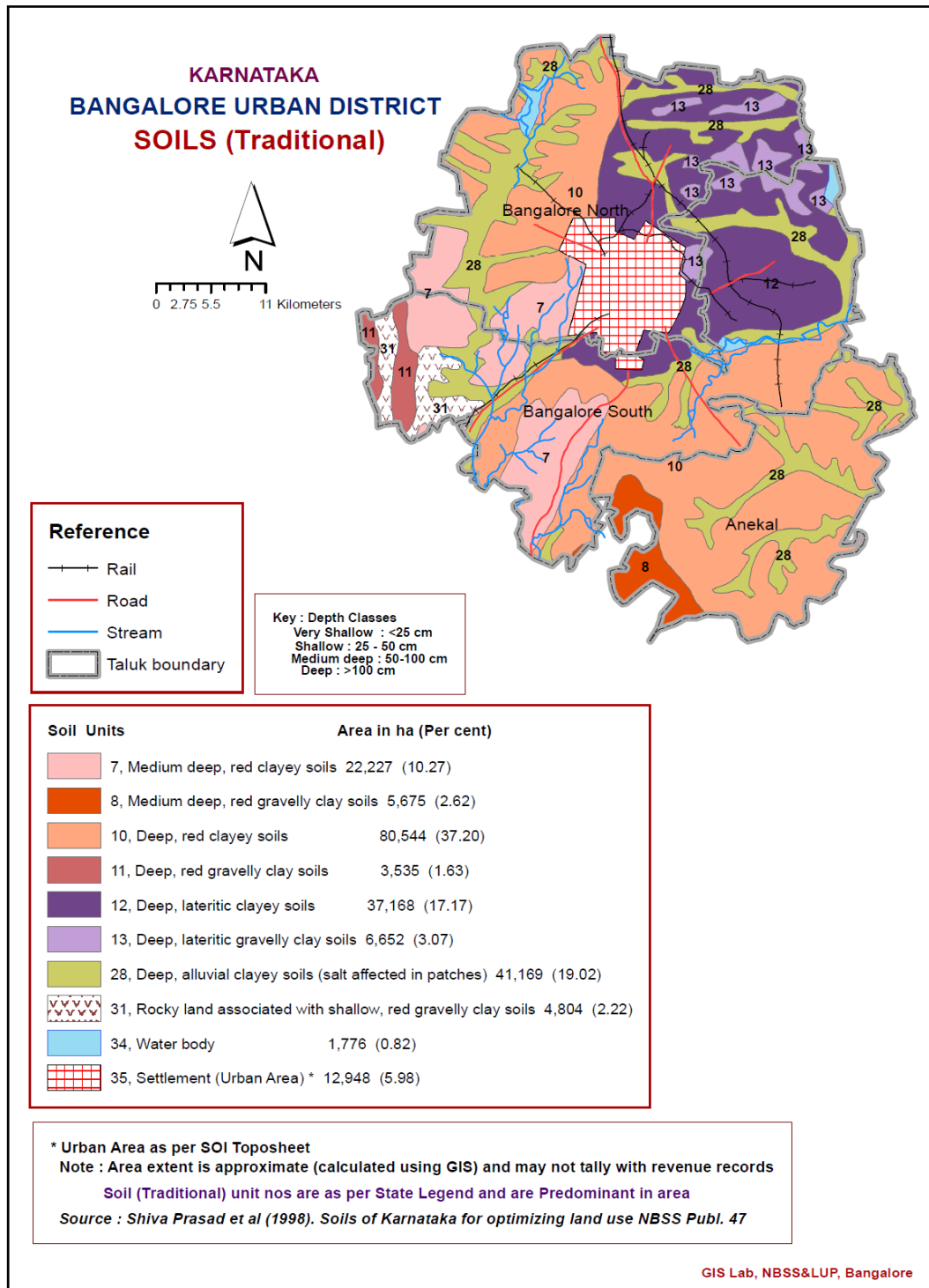


1.5 : Soil Profile

The soils of the district are mainly deep red clayey soils in an area of 80544 ha (37.20%), deep lateritic clayey soils - 37168 ha (17.17%) and medium deep red clayey soil (22227 ha, 10.27%) and in certain parts deep lateritic gravelly clay soil 6652 (3.07%), medium deep red gravelly clay soil 5675 ha (2.82%) and deep red gravelly clay soils 3635 ha (1.63%). The soils in Anekal, Bengaluru South and Bengaluru North are medium deep to deep red gravelly

clay to clayey soils and deep alluvial clayey soil with salt affected in patches in the valleys (Fig. 1.11). Whereas, in Bengaluru East the soils are deep lateritic gravelly clay to clay and deep alluvial clayey soil with salt affected in patches in the valleys.

Fig 1.11



1.6 Soil erosion

Soil erosion which occurs at varying rates is a widespread threat to sustainable resource management. Major causes of soil erosion are cultivation without proper soil and water conservation measures in area not suitable for crops, denuded areas without vegetation, cultivated fallow on moderate slopes, degraded forests/pastures on steep slopes and poorly managed forest cover. Appropriate soil conservation and land management techniques for the different soil erosion classes were suggested. It is generally associated with agricultural practices, leading to decline in soil fertility, bringing in a series of negative environmental impacts and has become a threat to sustainable agricultural production and water quality.

Soil erosion is one form of soil degradation: Soil erosion is a naturally occurring process on all land. The agents of soil erosion are water and wind, each contributing a significant amount of soil loss each year. Soil erosion may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing serious loss of topsoil. The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damaged drainage networks.

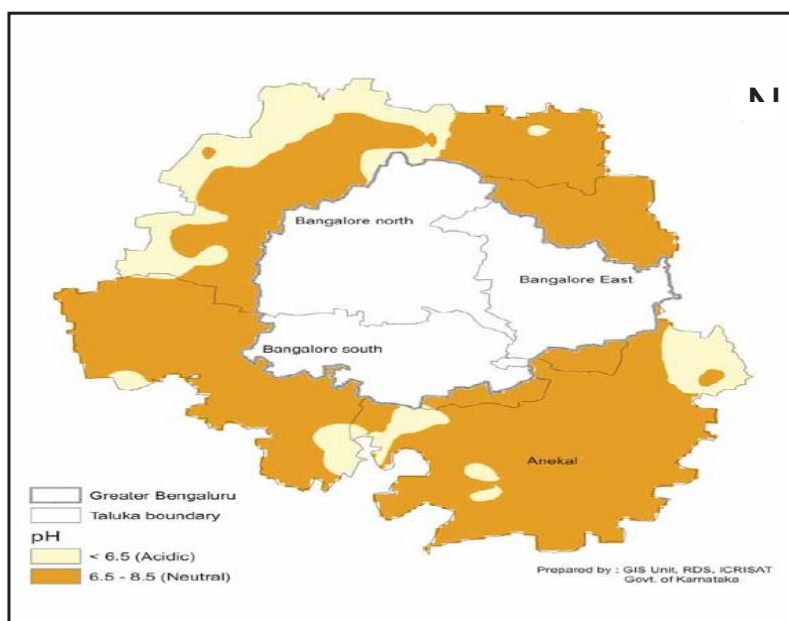
The soils of Bengaluru Urban district are classified mainly under non or slight erosion, moderately eroded and severely eroded classes. The soils of the district are mainly moderate in erosion occurring all the taluks. Soils with non or slight erosion in the valleys of all the taluks. While soils that are severe in erosion are observed in western part of Anekal and norther western part of Bengaluru South. Surface runoff is high in major parts of the district that is moderately eroded to severely eroded, resulting in loss of water, soil fertility and top soil. Necessary water conservation measures are needed to be taken up to conserve water and soil in the district.

Soils and their fertility status:

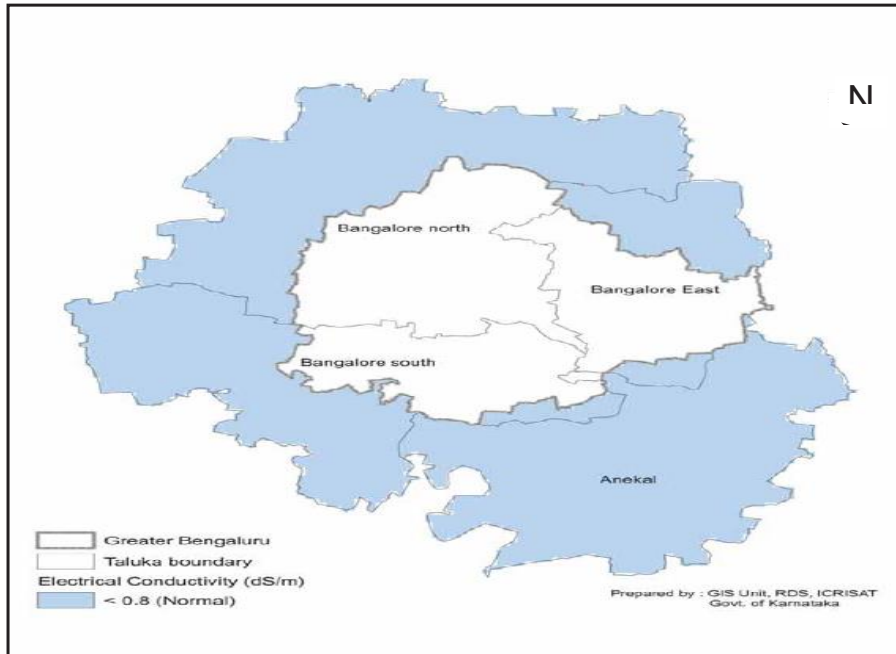
The soils of the district are mainly red sandy loam soils which cover an area of 2.17 lakh ha. In Anekal, Bengaluru East and Bengaluru South taluks have 100% red sandy loam soils, while Bengaluru North taluk has 95% of red sandy loam soils and only 5% clayey lateritic soils.

The pH of the soils in major parts of the district is neutral (6.5 -8.5) and is acidic (<6.5) in parts of Bengaluru North, Anekal, and Bengaluru South. The EC status of the soils in the district is normal (<0.8 d/Sm.). The soils are deficient in OC (<0.5 %) in Bengaluru North, major area of Anekal, minor area in Bengaluru South and Sufficient (>0.5 %) in major area in Bengaluru South and minor area in Bengaluru East and Anekal taluks. The soils of all the taluks of the district are sufficient in available phosphorous (>5 ppm), available potassium (>50 ppm), available sulphur (>10 ppm) and available zinc (>0.75 ppm). The status of available boron is sufficient (>0.58 ppm) in major parts of Anekal and Bengaluru North and deficient (<0.58 ppm) in Bengaluru South and Bengaluru East.

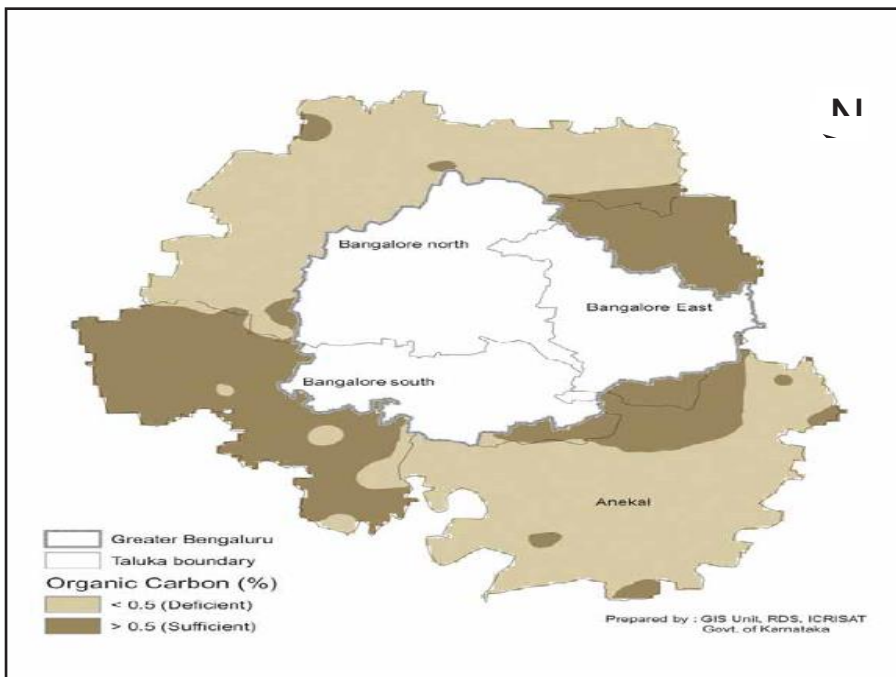
Fig.1.12 Soil Fertility maps



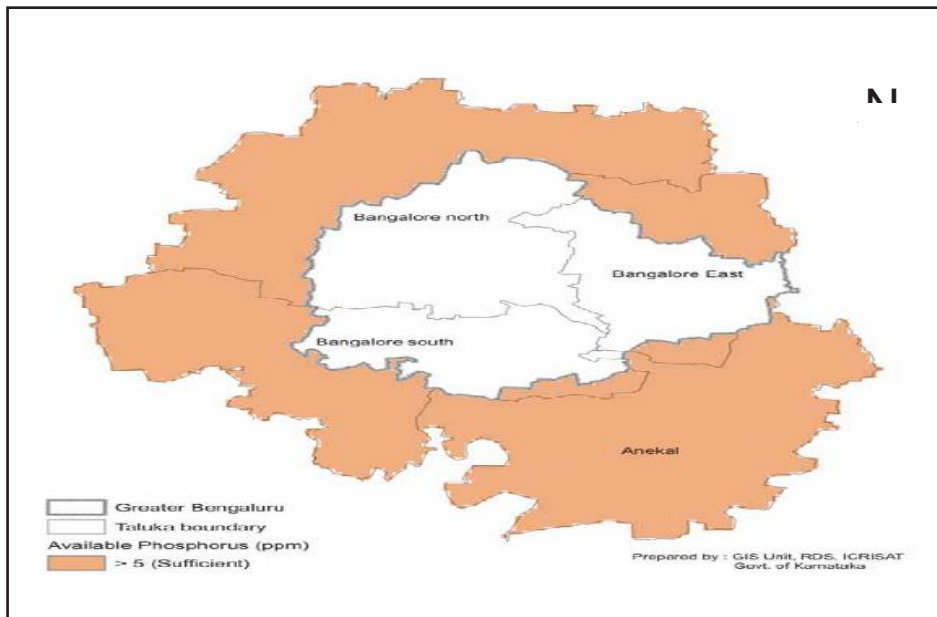
pH status in Bengaluru Urban district



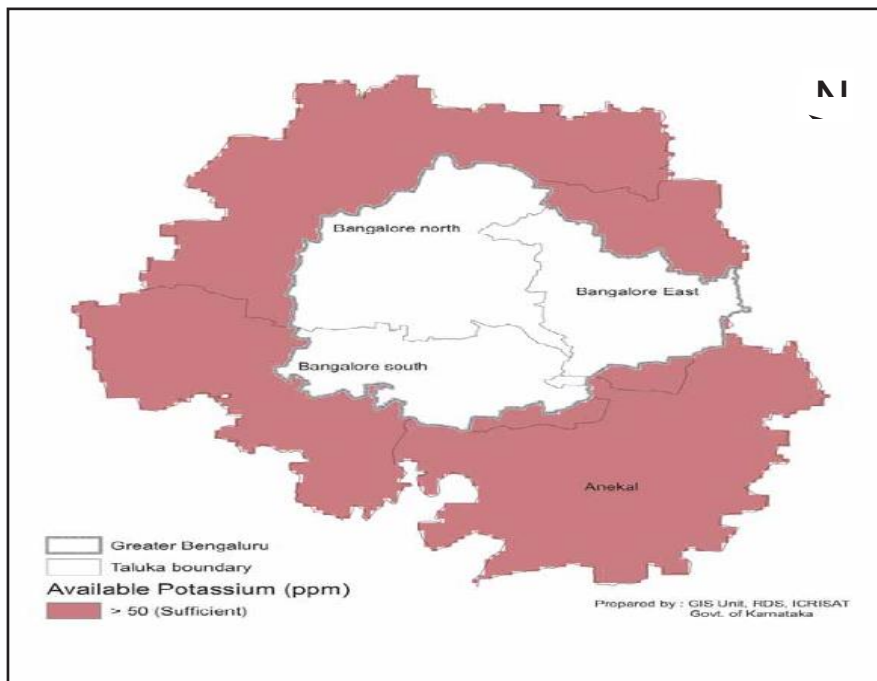
EC status in Bengaluru Urban district



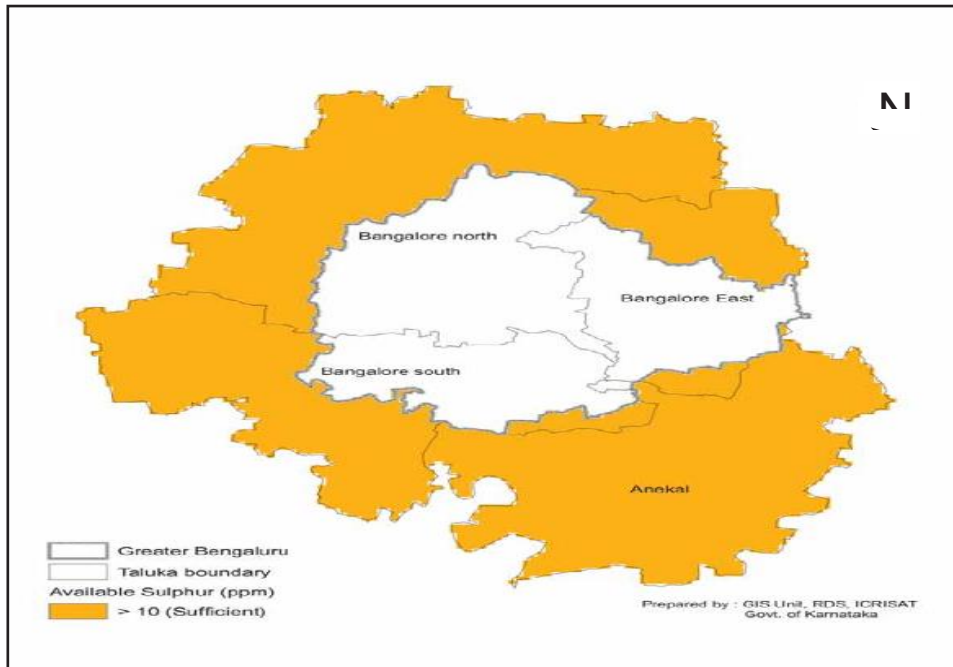
OC status in Bengaluru Urban district



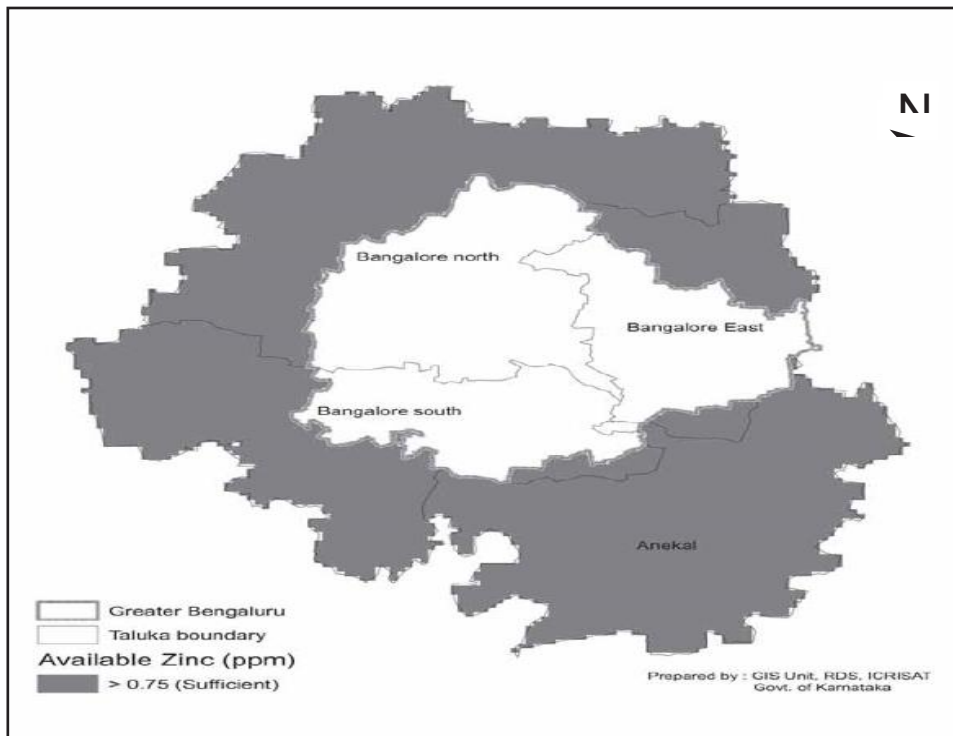
Av phosphorus status in Bengaluru Urban district



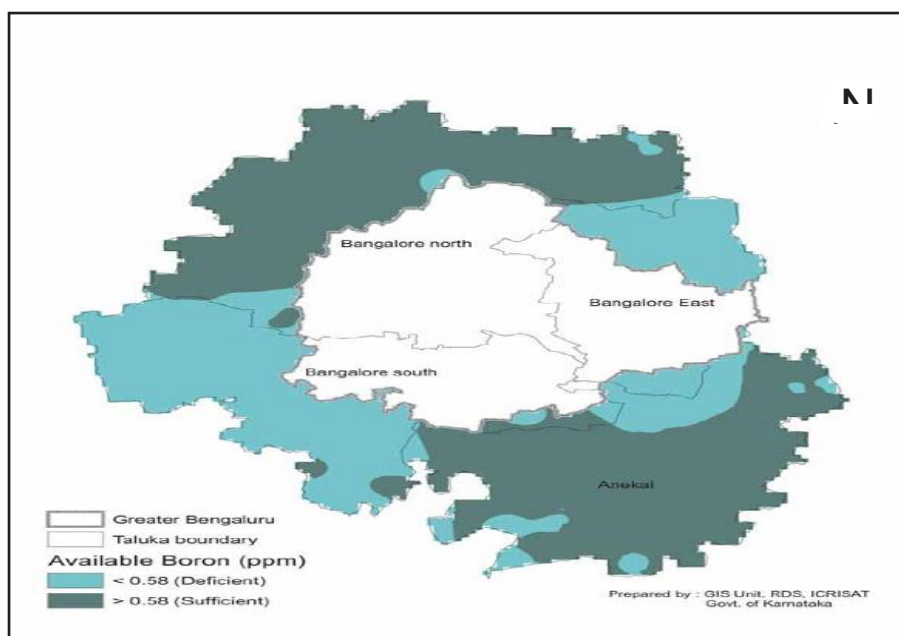
Av. Potassium status in Bengaluru Urban district



Av. Sulphur status in Bengaluru Urban district



Av. zinc status in Bengaluru Urban district



Av. Boron status in Bengaluru Urban district

1.7 Land Use pattern:

The total geographical area of the district is 217410 ha. Out of the geographical area, only 45246 ha (20.8%) is the net sown area and the forest area accounts for 5055 ha (2.3%). Area sown more than once is 1187 ha and the cropping intensity works out to 103. The district has the highest area 129056 ha (59.4%) under other uses.

Geographical area is the highest in Bengaluru North taluk 78411 ha (36.1%), followed by Bengaluru South 55609 ha (25.6%) and Anekal 53518 ha (24.6%). The lowest geographical area is in Bengaluru East taluk 29872 ha (13.7%).

Percentage of net sown area is the highest in Bengaluru East taluk (41.3%), followed by Anekal taluk (29.2%) and Bengaluru South (21.65%). Lowest net area sown (14.7%) is in Bengaluru East taluk. Whereas, percentage of area under forest is highest in Anekal taluk (4.1%), followed by Bengaluru South (2.4%) and Bengaluru North (1.5%). Lowest forest area is in Bengaluru East taluk (1.2%).

Out of gross cultivated area of 46433 ha, about 1187 ha area is cropped more than once in the district and the cropping intensity works out to 103 %. Bengaluru North taluk has the highest cropping intensity 107 % and Anekal taluk has the least cropping intensity of 101 %.

Percentage of area under other uses is the highest (71.4%) in Bengaluru South taluk followed by Bengaluru East taluk (65.5%) and Bengaluru North taluk (55.7%). Lowest percentage of area (48.8%) under other uses is in Anekal taluk.

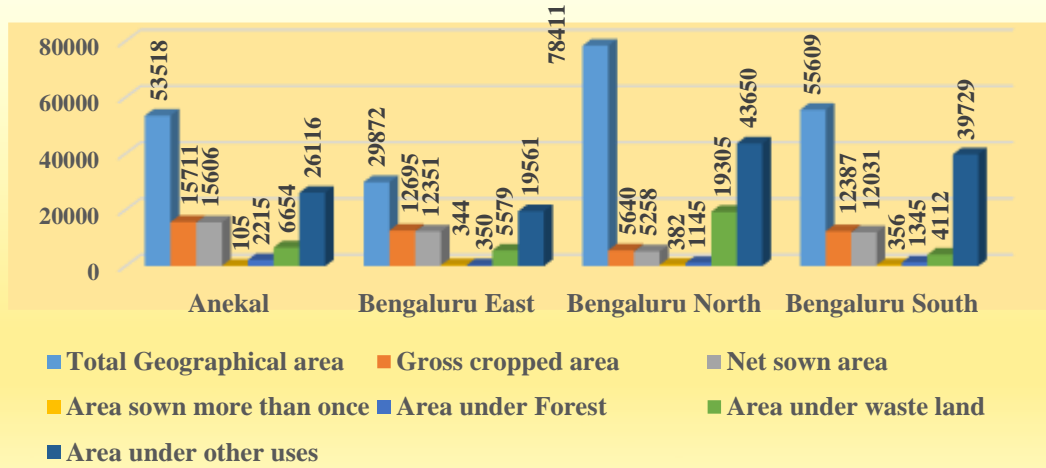
Taluk wise details are furnished in Table 1.8 and Fig. 1.13.

Table 1.8 Taluk wise Land Use pattern in Bangalore Urban district.

Sl. No	Taluk	Total Geographical area	Gross cropped area	Net sown area	Area sown more than once	Cropping intensity (%)	Area under Forest	Area under waste land	Area under other uses
1	Anekal	53518	15711	15606	105	101	2215	6654	26116
2	Bengaluru East	29872	12695	12351	344	103	350	5579	19561
3	Bengaluru North	78411	5640	5258	382	107	1145	19305	43650
4	Bengaluru South	55609	12387	12031	356	103	1345	4112	39729
Total		217410	46433	45246	1187	103	5055	35650	129056

Source: District at a glance

Fig 1.13 Taluk wise Land Use pattern in Bangalore Urban district



CHAPTER II

DISTRICT WATER PROFILE

2.1. Area Wise, Crop Wise irrigation status:

Taluk wise, Season wise, Category wise Irrigated and Rainfed area details in Bengaluru Urban district is furnished at Appendix 2.1. Totally agriculture, horticulture crops and mulberry are cultivated in an area of 46433 ha. Under irrigated condition crops are cultivated in an area of 12467 ha (26.8%) and 33966 ha (73.2 %) area under rainfed condition. Agriculture crops are cultivated in an area of 35058 ha (75.5 %), Horticulture crops in an area of 10345 ha (22.3%) and Mulberry in an area of 1030 ha (2.2%). Gross cropped area is the highest in Anekal taluk with 15711 ha (33.8%) followed by Bengaluru East taluk with 12695 ha (27.3%) and Bengaluru South taluk with 12387 ha (26.7%). Gross cropped area is the lowest in Bengaluru North taluk -5640 ha (12.1%).

During Kharif season agricultural crops are cultivated in an area of 29065 ha (97.6%), during Rabi season in an area of 330 ha (1.1 %) and during Summer season in an area of 396 ha (1.3 %). During Kharif season, agricultural crops are cultivated under irrigation in an area of 2208 ha (7.6%) and under rainfed condition in an area of 26857 ha (92.4%), during Rabi season agricultural crops are cultivated under irrigated condition in an area of 180 ha (54.5 %) and under rainfed condition in an area of 150 ha (45.5 %) and during summer season all the crops are grown only under irrigated condition in an area of 396 ha. Major area of 29791 ha (85.0%) under agricultural crops is covered with Cereal crops, Pulse crops are sown in an area of 4100 ha (11.7 %) and Oilseeds in an area of 2489 ha (3.5%).

In the district, Anekal taluk has the highest agricultural gross cropped area of 11385 ha (32.5%), followed by Bengaluru South with 10847 ha (30.9%)

and Bengaluru North with 9993 ha (28.5%). Bengaluru East taluk has the lowest agricultural crops gross cropped area, 2833 ha (8.1%).

Further, in the district horticultural crops are cultivated during Kharif season in an area of 6980 ha (67.4%), during Rabi season in an area of 2654 ha (25.7%) and during Summer in an area of 711 ha (6.9%). Horticultural crops are cultivated under irrigated condition in an area of 7927 ha (76.6%) and under rainfed condition in an area of 2417 ha (23.6%).

2.2. Production and productivity of major crops:

Production and productivity of major crops during Kharif, Rabi and Summer Taluk wise are furnished in Appendix 2.2.

During Kharif season, total agriculture crops production in the district is 46350.8 MT and the productivity is 1620 Kg/ha. Average productivity in case of cereals is the highest (1770 Kg/ha), followed by Pulses (519 Kg/ha). Average productivity is the lowest in case of Oilseeds (457 Kg/ha). Further, average yields are highest in Bengaluru East taluk (1958 kg/ha), followed by Bengaluru North (1885 Kg/ha), Bengaluru South (1476 Kg/ha) and Anekal taluk (1406 Kg/ha). In case of Cereals average highest productivity is recorded in Paddy (5800 Kg/ha) under irrigated condition, and in case of pulses the highest productivity is recorded in Cowpea (1130 Kg/ha) and in case of Oilseeds, highest productivity is recorded in Groundnut (795Kg/ha)

During Rabi season, total agriculture crops production in the district is 420.2 MT with an average productivity of 567 Kg/ha. Average productivity is the highest in Bengaluru East taluk (1018 Kg/ha), followed by Bengaluru North (898 Kg/ha), Bengaluru South (324 Kg/ha) and Anekal (248 Kg/ha). In case of Cereals average productivity is highest in Maize (2703 Kg/ha) under irrigated condition and in Pulses highest productivity is recorded in Field bean (800 Kg/ha).

During Summer season, total agricultural crops production in the district is 1047.3 MT with an average productivity of 3456 Kg/ha. Productivity is highest in Bengaluru East taluk (4500 kg/ha), followed by Anekal taluk (4057 Kg/ha), Bengaluru South (3064Kg/ha), and Bengaluru North (2760 Kg/ha). Among various crops, productivity is the highest in Paddy (5012Kg/ha) and lowest in Field bean (833 Kg/ha)

2.3. Irrigation based classification:

Main source of irrigation in the district is bore wells. Entire area under irrigation in the district is through 15844 bore wells only. Even though there are 652 tanks and 24753 open wells, there is no water in these tanks and wells, hence, no area is irrigated from these sources. There is no canal irrigation in the district. In view of frequent droughts and over exploitation of underground water, depth of water in the bore wells has gone below 1000 feet.

Of the net irrigated area of 11280 ha in the district, the highest area 4862 ha (43.1%) is in Anekal taluk, followed by Bengaluru South, 2249 ha (19.9 %) and Bengaluru East taluk, 2230 ha (19.8 %). Lowest area under irrigation is in Bengaluru North taluk 1939 ha (17.2%). The total rainfed area of the district is 33966 ha. Details are furnished in Table 2. 1.

Table 2.1. Net irrigated area in Bengaluru Urban district.

(Area in ha)

Taluk	Net Irrigated	Rainfed
Anekal	4862	10744
Bengaluru North	1939	3009
Bengaluru South	2249	9801
Bengaluru East	2230	10412
Total	11280	33966

Source : KSDA

CHAPTER III

WATER AVAILABILITY

3.1. Status of Water availability:

Bengaluru Urban district came into being in 1986 with the partition of the erstwhile Bengaluru district into Bengaluru Urban and Bengaluru Rural. It has five taluks namely Anekal, Bengaluru North, Bengaluru South, Bengaluru East and Bengaluru City. It is situated in the agro-climatic Zone-V (Eastern Dry Zone). The geographical area of the district is 2.17 lakh ha and has a population of 96.2 lakh as per 2011 census. Bengaluru Urban district has very good soil and rainfall distribution, the agriculture sector does not provide any importance due to the growth of IT – BT sector, which provides employment to large number of people. No major rivers run through the district, though the Arakavathi and South Pennar cross paths at the Nandi Hills, 60 km to the North. The river Vrishabhavathi, a minor tributary of Arkavathi arises within the city at Basavanagudi and flows through the city. Bengaluru has a handful of freshwater lakes and water tanks, the largest of them are Madivala tank, Hebbal lake, Halasur lake and Sankey Tank. Many historical tank beds have been converted for human habitation. Bengaluru receives rainfall from the north east monsoon as well as the south west monsoon. The normal rainfall of this district is 831.3 mm.

The general situation of water availability in Bengaluru Urban district is dominated by the limited rainfall and variations in the rainfall have caused the failures of agriculture frequently. The district is dependent on the tube wells and tanks for the purpose of irrigation. The district mainly depends on tanks and bore wells for irrigation. There are 467 tanks, under minor irrigation and Zilla Panchayat. However, there is no irrigation due to these tanks- mainly due to no cultivation in these areas or due to use of tank

water for drinking purposes. Irrigation is restricted to borewells/ tube wells only. There are 13563 tube wells providing irrigation to crops over an area of 11,684 ha spread in all taluqs. No other source provides irrigation.

Table 3.1. Status of Water Availability

Sl. No	Sources	Water bodies	Area in ha.	Live capacity (BCM)	Total (BCM)
1	Surface Irrigation				
i)	Canal (Major & Medium Irrigation)				
ii)	Minor Irrigation tanks				
	Anekal	26		0.0068	0.0068
	Bengaluru East	6		0.0006	0.0006
	Bengaluru North	9		0.0018	0.0018
	Bengaluru South	5		0.0030	0.0030
	Total no.of tanks	46		0.0122	0.0122
ii)	Minor Irrigation tanks(ZP)				
	Anekal	217		0.0111	0.0111
	Bengaluru East	19		0.0072	0.0072
	Bengaluru North	93		0.0053	0.0053
	Bengaluru South	92		0.0010	0.0010
	Total No.of tanks	421		0.0246	0.0246
iii)	Lift Irrigation/Diversion				
	Anekal	1			
	Bengaluru East				
	Bengaluru North				
	Bengaluru South	3			
		4		0	
	Total surface water details	471		0.0368	0.0368
IV)	Various Water Bodies Including Rain Water Harvesting				
V)	Treated Effluent Received from STP(860 MLD)				
VI)	Untreated Effluent(420 MLD)				
VII)	Perennial sources of water				
2	Ground Water				
i)	Tube Well				
	Anekal	4129	4564		
	Bengaluru East	2942	987		
	Bengaluru North	3761	4415		
	Bengaluru South	2731	1718		
	Total no.	13563	11684		
ii)	Dug well				
	Anekal	9		0.03377	0.03377
	Bengaluru East	3		0.02400	0.02400
	Bengaluru North	2		0.02975	0.02975
	Bengaluru South	6		0.02971	0.02971
	Total no.	20		0.11723	0.11723
	Total Ground water details	13583	11684	0.11723	0.11723
	Total surface & ground water	14054	11684	0.19065	0.19065

Source : CGWB (2014), District Irrigation and Agriculture office records.

The district has totally 0.19065 BCM of water.

3.2 Status of Ground water availability:

The ground water estimation is worked out based on the methodology recommended by Ground Water Estimation Committee. The ground water resource of the entire State has been computed by Central Ground Water Board (CGWB, 2013). The salient features of the ground water resources are given below. The data has been computed Block-wise. The areas having slopes of > 20 % have been excluded from the recharge computation. Further, the ground water recharge and draft has been computed separately for command and non-command areas. The information has been calculated separately for each taluk.

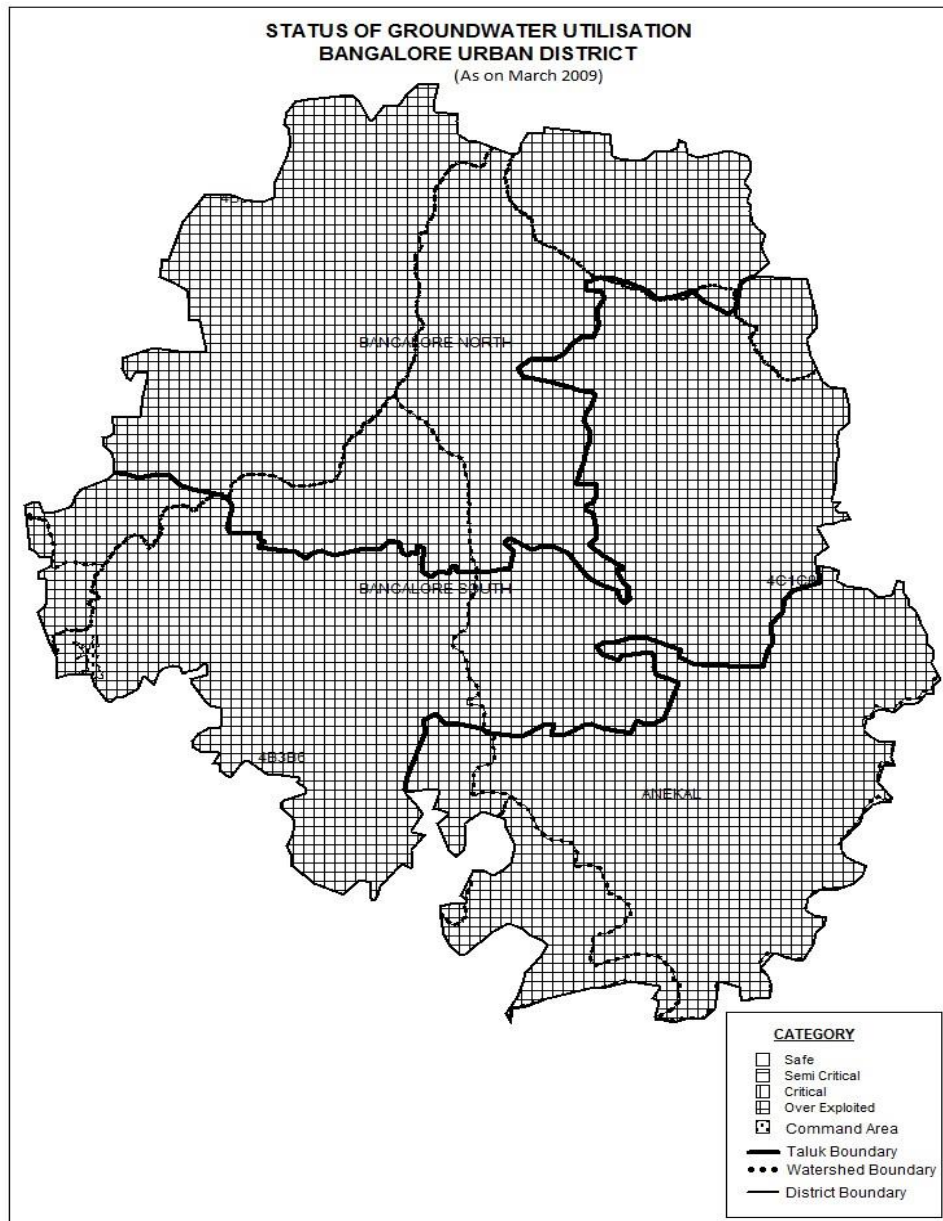
Net annual groundwater availability of the district is 11723 ha m, total ground water draft for irrigation and for all uses (drinking water) is 16703 ha m. Thus, draft exceeds the total available ground water resources leaving absolutely no ground water resources for future use. The stage of ground water development in all the four taluks of the district ranges from 128-176 % and thereby categorized as over exploited. Therefore, Central Ground Water Authority has notified these taluks to completely obstruct further use of ground water in all taluks of Bengaluru (urban) district.

Table 3.2 Status of ground water in Bengaluru Urban district

Taluk	Status of ground water exploitation- taluk wise (% area in each taluk)				Status of ground water draft, recharge (HAM.)	
	Safe	Semi critical	Critical	Over exploited	Net ground water availability	Total draft
Anekal	--	--	--	100	3377	4324
Bengaluru East	--	--	--	100	2400	3112
Bengaluru North	--	--	--	100	2975	4028
Bengaluru South	--	--	--	100	2971	5329
Total	--	--	--		11723	16703

(Adapted from CGWB Brochure of Bengaluru Urban District-2013)

Fig 3.1



3.3. Status of Command area:

There is no command area in the district as there are no major rivers or reservoirs in Bengaluru Urban district.

3.4. Existing type of irrigation:

The only source of irrigation in Bengaluru Urban district is through tube wells as there are no other sources like canal irrigation, tank/reservoirs available in the district. The net area under irrigation in the district is 11280 ha. Anekal taluk has the maximum area irrigated under tube wells with 4862 ha, followed by Bengaluru North with 2249 ha, Bengaluru South with 2230 ha and Bengaluru East with 1939 ha.

Table 3.3. Status of Existing type of irrigation (Net area irrigated)

Area in hectares

Sl. No	Taluk	Canal	Tanks	Open wells	Tube wells	Lift irrigation	Others	Total
1	Anekal	-	-	-	4862	-	-	4862
2	Bengaluru East	-	-	-	1939	-	-	1939
3	Bengaluru North	-	-	-	2249	-	-	2249
4	Bengaluru South	-	-	-	2230	-	-	2230
Total		-	-	-	11280		-	11280

Source : KSDA

3.5. Water availability from various sources:

Water is available from underground water (as per Central underground Board Booklet, 2013) and tanks maintained by Zilla Panchayats and Minor Irrigation. Water that would become available as function of rainfall runoff over territory is 0.67460 BCM, which needs to be harnessed properly by various conservation measures. Water available from this source is more in Bengaluru North and Bengaluru City, while it is lower in Bengaluru East taluk. Total water available for the district from underground tube wells is 0.14505 BCM and these wells are over exploited. There is less scope for further improvement unless proper recharge structures are created. Water from irrigation tanks (maintained by Zilla Panchayats and Minor Irrigation Departments) is 0.0460

BCM (excluding Bengaluru City), which is live capacity. Here also, efforts are to be made to recharge these tanks for utilization – mostly for drinking, industrial or other purposes (Table 3.4). Further, BWSSB is providing drinking water facility from Cauvery River to Bengaluru City to the tune of 0.49275 BCM.

The total water available from various sources for Bengaluru Urban district is 0.6746 BCM. Bengaluru City possesses higher water available, followed by Anekal, Bengaluru North, and Bengaluru South, while it lower in Bengaluru East taluk (Table 3.4, Fig. 3.2, 3.3).

Table 3.4. Water availability from various sources Bengaluru Urban district

Taluks	Underground Water#	Water from tanks##	Total
	Water available, BCM		
Anekal	0.03377	0.0179	0.05167
Bengaluru North	0.02975	0.0071	0.03685
Bengaluru South	0.02971	0.0040	0.03371
Bengaluru East	0.024	0.0078	0.0318
Bengaluru City	0.02782 λ	0.49275 λ	0.52057
Total	0.14505	0.52955	0.67460

#- Central Groundwater Board Brochure, Bengaluru Urban district, 2013;

- CGWB (2014), District Irrigation and Agriculture office records (for details refer Table 3.1);

λ - Data obtained from BWSSB - <http://bwssb.gov.in/bwssbuat/content/about-bwssb-2>.

Fig. 3.2. Water available from various sources taluk wise in Bengaluru Urban district

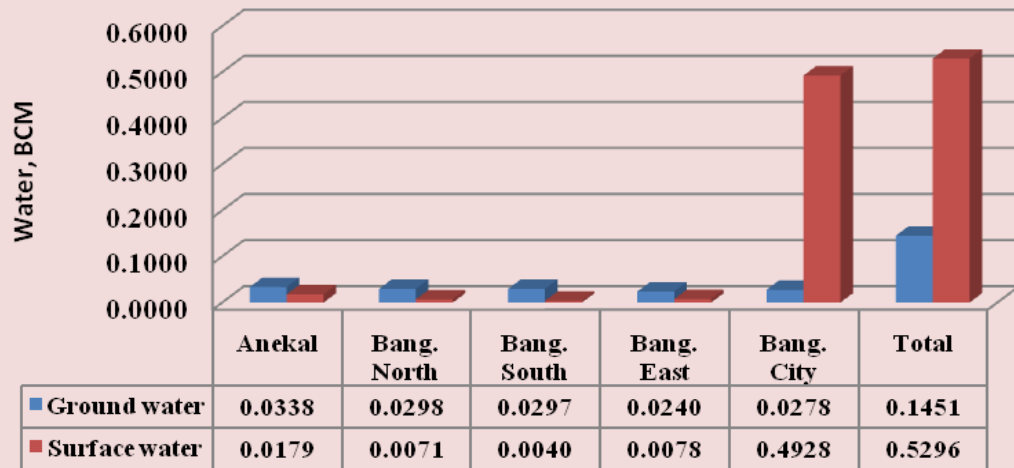
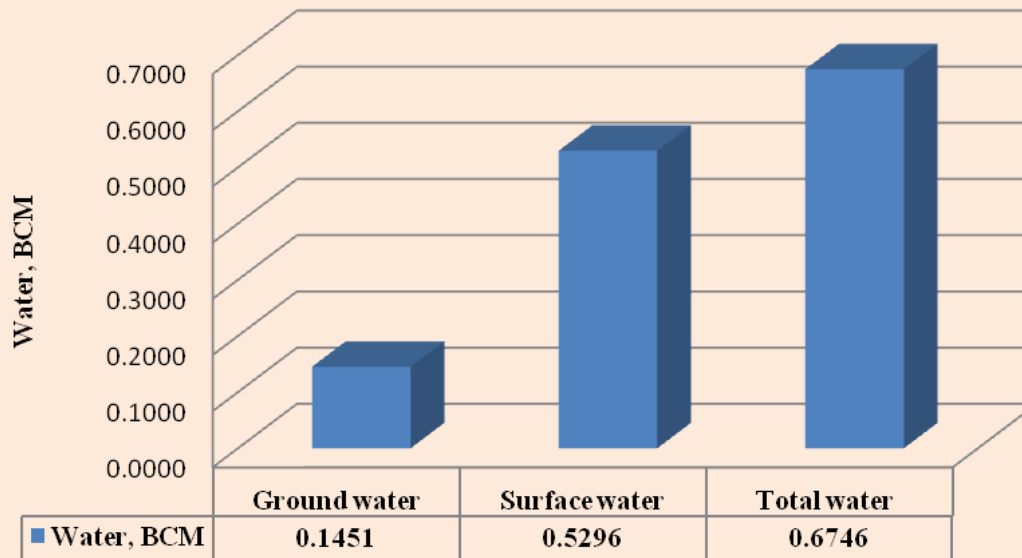


Fig. 3.3. Water available from various sources in Bengaluru Urban district



CHAPTER IV
WATER REQUIREMENT/ DEMAND - BENGALURU URBAN
DISTRICT

Water is a precious natural resource provided by nature to mankind for usage in various activities. Life does not exist without water. All living organisms depend on water for performing various vital functions for survival. Major portion of water is used for agriculture all over India and that too in Karnataka. Although water is renewable resource, it is quite dynamic and becoming scarce due to spatial and temporal variation in rainfall. Water is needed to ensure food security, feed livestock, maintain organic life (sustain lifestyle of human beings, living creatures, conserve biodiversity and environment), industrial use, etc. However with reckless abuse and increasing demand due to growing population and undesirable lifestyle, many states are facing severe water crisis. It is not only due to rapid population growth alone, but also on account of many other factors such as rise in per capita water demand arising out of continuous upward movement of living standards, increased reliance on irrigated agriculture, massive urbanization and industrialization etc. The available utilizable water resource of the country is considered insufficient to meet all future needs. Under such a situation, in order to face the challenge of water deficit, apart from accelerating pace of development of available utilizable water resources, all out efforts, on the part of people from every walk of life, would need to be made to conserve every drop of water and improve efficiency in all areas of water use.

The National Commission on Agriculture in 1976 estimated water resources in the country for 1974 and projected for 2000 and 2025 based on certain empirical formulae and assumptions related to runoff characteristics of soil, rainfall events and vegetation cover. India is a vast country with a geographical area of 328 Mha and receiving annual precipitation of 1194 mm.

This amounts to availability of 400 Mha-m (million hectare meter) of water to India. Out of this, 17.5% goes as immediate evaporation (70 Mha-m), 53.8% as precipitation into soil (215 Mha-m) and 28.7% as surface runoff (115 Mha-m, which includes 10 Mha-m as snowfall). Further total precipitation received on the soil is further divided into 41.3% (165 Mha-m) as soil moisture available for crops and 12.5% as ground water (50 Mha-m). Water is lost through evaporation to an extent of 20% in medium and major reservoirs and 40% in tanks. This assumption is followed for Karnataka (Bhaskar *et al.*, 2016).

Karnataka has total geographical area of 19.20 million ha receiving an annual precipitation of 1133.3 mm (average of 55 years from 1960 to 2014). About 71% of rainfall is received during south west monsoon (June to September), while north monsoon contributes 17% (October to December) and early showers by 12%. The south west monsoon sustains agricultural activity in most parts of the state, as large proportion of agriculture is rainfed farming. Taking geographical area and rainfall into consideration, available water due to precipitation is 21.76 Mha-m to Karnataka (215.2864 Billion cubic m or 7688.8 TMC). Following NCA 1976 recommendation, out of 215.2864 BCM (7688.8 TMC) of water, 53.8% percolates into soil (115.822 BCM or 4136.57 TMC), 17.5% as immediate evaporation loss (37.674 BCM or 1345.54 TMC), and 28.7% as surface water runoff (61.7876 BCM or 2206.69 TMC).

The average annual rainfall in Karnataka is 1248 mm. The state is divided into four meteorological zones viz. North Interior Karnataka, South Interior Karnataka, Malnad and Coastal Karnataka. Coastal Karnataka with an average annual rainfall of 3456 mm is one of the rainiest regions in the country. Contrasting this, the region of South Interior Karnataka and North Interior Karnataka receive only 1286 and 731 mm of average annual rainfall.

(https://en.wikipedia.org/wiki/Rainfall_in_Karnataka).

With a surface water potential of about 102 kilometers, Karnataka accounts for about six percent of the country's surface water resources. Around 60% of this is provided by the west flowing rivers, while the remaining comes from the east flowing rivers. There are seven river basins in all formed by the Godavari, Cauvery, Krishna, the west-flowing rivers, North Pennar River, South Pennar, and Palar

(http://waterresources.kar.nic.in/river_systems.htm);

https://en.wikipedia.org/wiki/Geography_of_Karnataka).

Bengaluru Urban district has a total geographical area of 217,410 ha receiving an annual precipitation of 87.5 cm. Bengaluru North taluk receives higher rainfall of 93.3 cm, followed by Anekal taluk (86.7 cm), while it is lower in Bengaluru South and Bengaluru East (85.1 cm each). Most of rain (53.6%) is received during south west monsoon (June to September). The south west monsoon sustains agricultural activity in most parts of the state, as large proportion of agriculture is rainfed farming. Taking geographical area and rainfall into consideration, available total water due to precipitation is 1.98996 BCM to Bengaluru Urban. Following NCA 1976 recommendation, out of 2.70996 BCM of water, 53.8% percolates into soil (1.45796 BCM), 17.5% as immediate evaporation loss (0.474243 BCM), 28.7% as surface water runoff (0.777759 BCM) and 12.5% as underground water (0.338745 BCM). Water availability is relatively more in Bengaluru North taluk (0.7676437 BCM), followed by Bengaluru City (0.72 BCM), Bengaluru South (0.4843544 BCM), Anekal (0.481662 BCM), while it is relatively lower in Bengaluru East taluk (0.2563018 BCM).

4.1. Water Demand for domestic need:

Bengaluru, the capital city of Karnataka, is the third largest city and the fifth largest metropolitan area in India. It is one of the fastest growing metropolitan cities. It is a centre for education, Information Technology & Bio-

Technology industries, sophisticated high tech health care and many MNC industries which are attracting people to the city. As per Census 2011, the population of Bengaluru city was about 8.5 million and now it is 9.9 million.

Bruhat Bengaluru Mahanagara Palike (BBMP) covers an area of 800 sq.km. Of this, Bengaluru core area is 245 sq. km. In addition, 8 Urban Local Bodies with 330 sq.km covering 7 City Municipal Corporation and 1 Town Municipal Corporation and 110 Villages with 225 sq. km have been added to BBMP. Thus, BBMP covers an area of 800 sq. km.

Bengaluru Water Supply and Sewerage Board is an autonomous body formed by the State legislature under Bengaluru Water supply and Sewerage Board Act on 10-09-1964 for Water Supply & Sewage disposal. It is one of the first Water supply & Sanitation Utilities in India with jurisdiction of entire Bruhat Bengaluru Mahanagara Palike area of 800 sq.km. Government of Karnataka allocated 19 TMC of water from Cauvery River for the water supply requirements of Bengaluru City. In the year 2012, with the commissioning of the CWSS Stage IV, Phase II, the allocated water from Cauvery River has been exhausted. At present BWSSB is supplying treated Cauvery Water to Bengaluru City under the Cauvery Water Supply Scheme (CWSS) Stage I, II, III & Stage IV Phase I & II with total installed capacity of 1310 MLD. This quantity of water provided to the core areas of BBMP including the erstwhile 7 CMC's and 1 TMC area covering total area of 575 sq.km, but excluding 110 village areas of BBMP covering 225 sq.km. In order to provide water supply to the newly added 110 villages which are part of BBMP, BWSSB is finding it difficult to meet the water requirements even after implementation of CWSS Stage IV, Phase II scheme. Subsequently, the Urban Development Department, Govt. of Karnataka (GoK) allocated an additional 10 TMC (775 MLD) of Cauvery Water for Bengaluru city. Considering the technical aspects and water demand, it is proposed to take up the Stage V Scheme in two Phases i.e., Phase I of 500 MLD

(6.45 TMC) capacity and Phase II of 275 MLD (3.55 TMC) capacity. This additional demand is to be met after completion of the project. Thus, BWSSB is providing now 1350 MLD to meet the domestic water demand of BBMP area of 575 sq. km (<http://bwssb.gov.in/bwssbuat/content/about-bwssb-2>).

A number of factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology determine the requirement of water. The per capita water requirement in urban areas is more than that in the rural areas. As per the Bureau of Indian Standards, IS:1172-1993, a minimum water supply of 200 liters per capita per day (lpcd) should be provided for domestic consumption in cities with full flushing systems. IS:1172-1993 also mentions that the amount of water supply may be reduced to 135 lpcd for the LIG and the economically weaker sections (EWS) of the society and in small towns [Modi, 1998]. However, in the Tenth Plan (2002-07), the cities with planned sewerage systems are classified into two groups based on population, i e, metropolitan or megacities (minimum water supply level is 150 lpcd) and non-metropolitan cities (135 lpcd) [Government of India 1997, 2002]. Over and above the aforesaid demand, 15% losses may be allowed for determining the quantity of raw water required.

During 2015, water demand for domestic use is more in Bengaluru City covering BBMP area (0.491811903 BCM), followed by taluks of Anekal (0.027804848 BCM), Bengaluru North (0.018727555 BCM), Bengaluru South (0.0011145069 BCM), while it is lower in taluk of Bengaluru East (0.005347471 BCM). The water requirements in these taluks corresponded to the prevalent population. For district as whole, water demand is 0.554836845 BCM in 2015 (Table 4.3). Bengaluru City alone requires almost 89% of total water demand of the district, which is met by Bengaluru Water Supply and Sewerage Board, Bengaluru from Cauvery River. With projected growth of population of 42.5% during 2011 to 2020, the domestic water requirements in

the taluks of Bengaluru Urban district followed the same trend (Table 4.3, Fig. 4.1, 4.1a, 4.1b). Thus, domestic water demand is projected at 0.675801451 BCM in 2020 from the present consumption level of 0.554836845 BCM during 2015 (Table 4.1, Fig. 4.1).

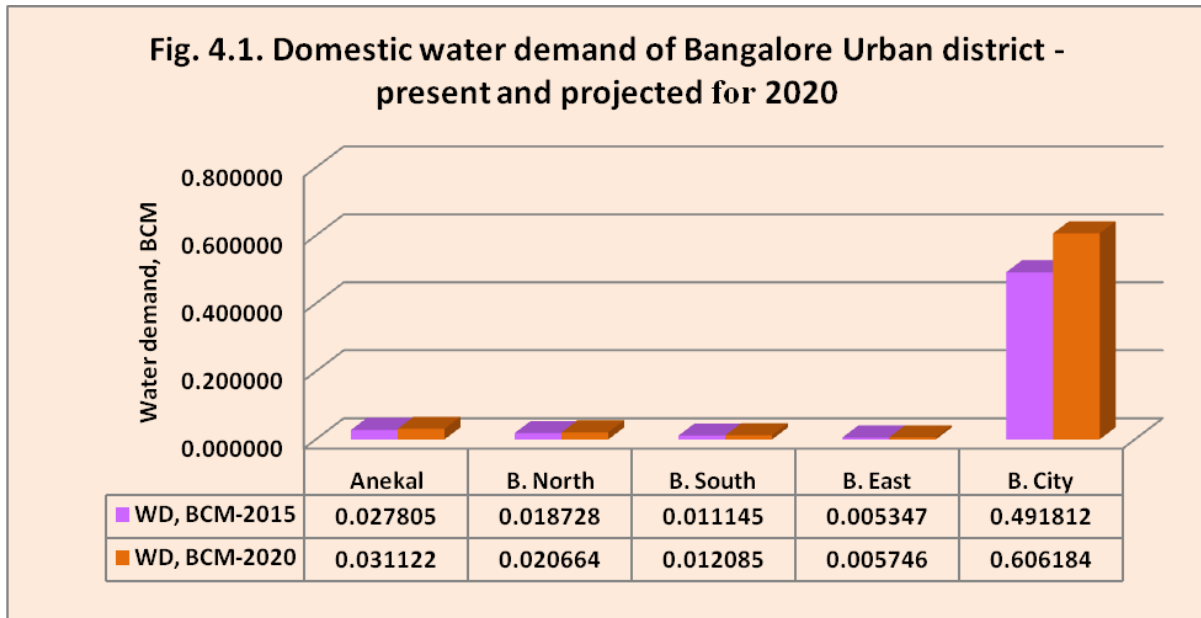


Table 4.1. Domestic water demand (BCM) of Bengaluru Urban district - present and projected 2020

Blocks/ Taluks	Population in 2011	Water demand in 2011, BCM	Population in 2015	Water demand in 2015, BCM	Projected population, 2020	Projected water demand by 2020, BCM
Anekal	515575	0.025404958	564279	0.027804848	631607	0.031122435
Bengaluru North	352420	0.017365496	380062	0.018727555	419367	0.020664309
Bengaluru South	209220	0.010309316	226181	0.011145069	245248	0.012084595
Bengaluru North	102607	0.00505596	108523	0.005347471	116606	0.005745761
Bengaluru City	8443675	0.416062086	9980962	0.491811903	12302067	0.606184351
Total	9623497	0.474197815	11260007	0.554836845	13714895	0.675801451

Water requirement for human being - 135 liters/head/day, lphd;

Domestic Water requirement/Demand in Billion cubic meter, BCM

= (Population X Water requirement, 135 lphd X 365 days)/ (1000 liters X 1,000,000,000)

Assumption: Increase in population during 2011 - 2021 is 16.4% similar to as that of decadal growth rate of population of 12.3% observed between 2001-2011.

{Source: Bengaluru Urban district at a glance 2014-15, Zilla Panchayat, Bengaluru Urban}

Excluding Bengaluru City, total water demand for other taluks is 0.063024942 BCM during 2015, which constitute about 11% of the total water demand of the Bengaluru Urban district. While for 2020, total water demand for taluks excluding Bengaluru City would be 0.0696171 BCM, which would be 10% of the total demand of the district (Table 4.1, Fig. 4.1).

4.2. Water requirement for crops: Field/horticultural/plantation crops grown in Bengaluru Urban district are paddy, maize, ragi, groundnut (both in Kharif & summer), Tur, avare, horse gram, castor, niger (in Kharif only) (under agriculture), fruit crops, vegetables, spices, flowers and plantation crops. For calculation of water requirement of irrigated crops, following methodology and some assumptions have been used based on the recommendations of the NCA, 1976 and methodology suggested by Bhaskar et al. (2016).

Irrigation water requirement considered for calculation purpose for various crops are paddy (150 cm in summer, 100 cm in Kharif), maize - 60 cm, bajra/jowar - 45 cm, red gram - 70 cm, groundnut - 45 cm, other oilseeds - 40 cm, pulses - 40 cm, vegetable crops - 50 cm, spices - 60 cm, plantation crops - 70 cm and fruit crops - 60 cm. From this water requirement of various crops and the area of the crops grown under irrigation, irrigation water requirement for crops has been worked out.

Assumption - Rain water accounted for crop use is 30% of total rainfall occurring during the cropping season in Bengaluru rural district, considering the soil type (sandy soil, sandy loam soils) and the intensity of rain. Rain water used for crops' growth is used for calculating the water demand of rainfed crops.

Total water requirement of all crops (both field and horticulture) is relatively higher in Anekal (0.03733 BCM), followed by Bengaluru North and Bengaluru South (0.027959 to 0.026807 BCM), and Bengaluru East (0.017583

BCM) in view of large area of crops (maize, Jowar, ragi, tur, horse gram, avare, groundnut, niger, vegetables, fruit crops, spices and plantation crops- both irrigated and rainfed areas). Total water requirement of irrigated field crops of the district is 0.01674 BCM, whereas total water requirement of rainfed crops is 0.04396 BCM, due to more area under rainfed conditions in the district. Whereas under horticulture crops, water demand of irrigated horticulture crops is 0.03965 BCM, which is more than the rainfed crops - 0.00933 BCM. Water demand for total horticultural crops is 0.048986 BCM for Bengaluru Urban district, of which major share goes to vegetables (0.0218 BCM), followed by fruit crops, plantation crops, spices and flowers. Total water demand of field crops is more (0.06070 BCM) as compared to horticulture crops (0.048986 BCM).

Water demand of cereals is more (0.051726 BCM), followed by pulses (0.0070374 BCM), while it is lower for oilseed crops (0.001932 BCM). The projected water demand for total crops is also worked out for 2020, keeping 10% increase in irrigated area due to efficient rain water use, more under area and other means. For Bengaluru Urban district, the projected total water demand for crops is 0.1206544 BCM by 2020 as compared to the present demand of 0.109686 BCM), which amounts to 10% increase (Table 4.2, Fig. 4.2, 4.2a).

Fig. 4.2. Water demand of total crops taluk wise in Bengaluru Urban district - 2015 and 2020

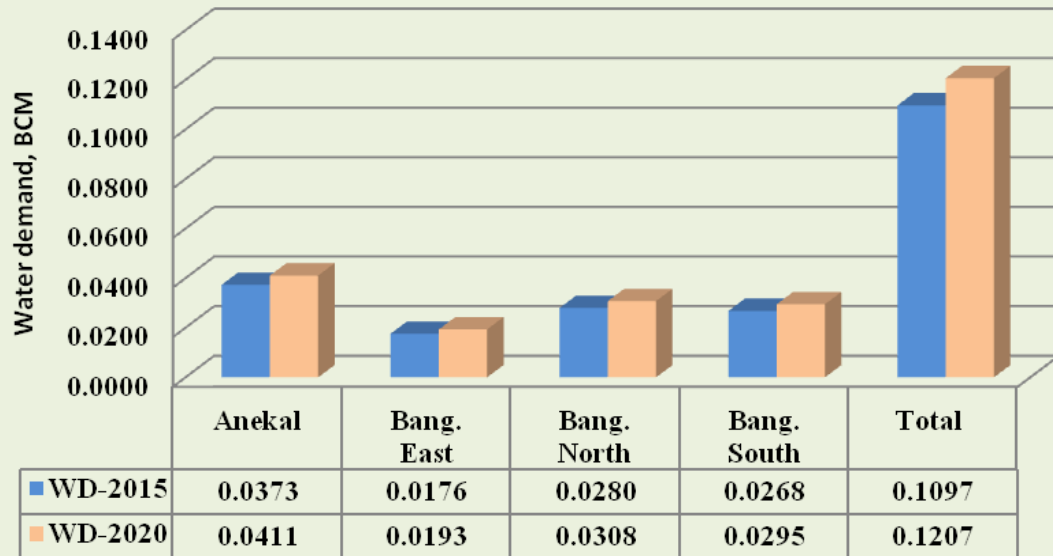
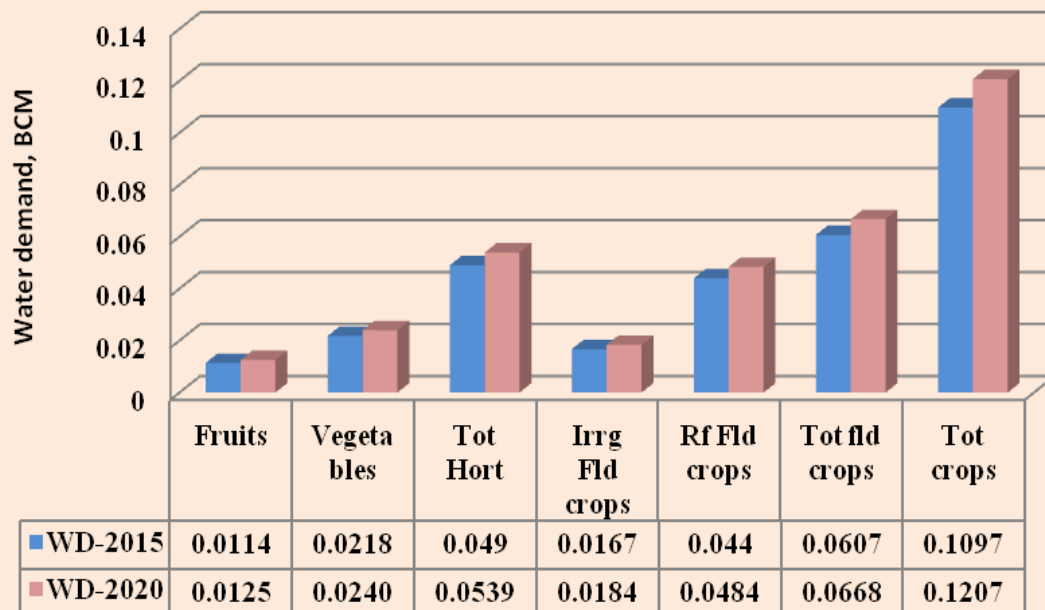


Fig. 4.2a. Water demand of crops in Bengaluru Urban district - 2015 and 2020



**Table 4.2. Water requirement of horticulture and agricultural crops
(BCM) in Bengaluru Urban district - 2014-15**

Taluks	Vegetables	Fruits	Spices	Flowers	Plantation	Total Horticulture
	Net Water requirement, BCM - 2015					
Anekal	0.010605	0.002441	0.000732	0.00342	0.002249	0.0194471
Bengaluru North	0.003555	0.004825	0.000066	0.000378	0.003689	0.0125134
Bengaluru South	0.004355	0.002030	0.000471	0.000666	0.002397	0.0099188
Bengaluru East	0.003285	0.002070	0.000267	0.001056	0.000428	0.0071065
Total	0.0218	0.011365	0.001537	0.00552	0.008764	0.0489859
	Field crops					
	Irrigated	Rainfed	Total		Total crops - 2015	Total crops - 2020
Anekal	0.00483	0.01306	0.01788		0.0373271	0.0410598
Bengaluru North	0.00247	0.00261	0.00507		0.0175834	0.0193417
Bengaluru South	0.0042	0.01384	0.01804		0.0279588	0.0307547
Bengaluru East	0.00525	0.01445	0.01970		0.0268065	0.0294872
Total	0.01674	0.04396	0.06070		0.1096859	0.1206544

Water requirement for crops: Fruit crops - 60 cm, Vegetable crops - 50 cm, Plantation crops - 70 cm, Spices - Maize - 60 cm, Pulses - 40 cm, Oilseeds - 40 cm, Groundnut - 45 cm, Tur - 70 cm, Jowar - 55 cm, Ragi - 45 cm; Rice - 150 cm during rabi/summer, 100 cm in Kharif;

The crops include both irrigated and rainfed crops

Irrigation water requirement, ha - cm = Area of the crop, ha X Water requirement of the crop, cm; One ha-cm = 1,00,000 liters or 100 cubic meters;

Source: Bengaluru Urban district at a glance 2013-14, 2014-15;

Irrigation water requirement in BCM = {(Irrigation water requirement, ha-cm X 100)/100,000}

4.3. Water requirement of Livestock:

Livestock sector plays a significant role in rural economy of India. It contributes to 5% of total domestic gross product (DGP) and one fourth of total agricultural GDP (AgGDP). Livestock sector is unique in terms of providing employment opportunity particularly to two third of women workforce in India towards animal rearing. Livestock is an integral part of mixed farming of Indian agriculture. Both indigenous cattle and buffalo population registered an annual decline of 4.5 per cent and 4.3 per cent respectively between 2007 and 2012 census periods, while that of crossbred cattle increased by 5.8 per cent (<https://www.Uttara%20Kannada/Livestock%20census%20Karnataka.pdf>).

Besides, contributing food and inputs (draught energy and manure) for crop production, livestock are important as savings or investments for the poor household and provide food security or insurance through various ways in different production systems. Rainfed regions support the highest number of livestock units. Except buffalo and pigs, more than half of all livestock species (52.3 to 60.1%) are concentrated in the rainfed region. Even 43.1% of the total buffalo and 44.7% of pigs are reared in rainfed region. Irrigated region accounts for higher proportion of buffalo (43.1%) and except sheep it accounts for second highest population of all major livestock species. although the resource degradation in rainfed areas has been observed, various support programmes of the government are encouraging mixed farming to stabilize the income of the resource poor farmers of arid and semi-arid regions of the state. Considering these facts, increase in total population of the livestock has been maintained at 5% in 2020 as compared to earlier census of 2012 (Anjani Kumar and Singh, 2008).

Water requirement for livestock and other animals namely - indigenous cattle, cross bred cattle, draft animals/bulls/others, sheep, goats, pigs, duck, and poultry, have been calculated separately with the corresponding population for

2012. The projected water requirement for livestock population at 2020 has also been calculated separately for all live stock. The total water requirement for live stocks for 2012 and projected for 2020 is provided taluk wise in Table 4.3.

Total population of livestock and other animals in Bengaluru Urban district is 2838,657 during 2012 and their water requirement is 0.003307325 BCM. Considering the increase in the population of livestock at 5% from 2012 to 2020, their water demand would be 0.003708382 BCM with corresponding population of 2980,590 (Table 4.3, Fig. 4.3). Water demand of livestock is more in Anekal, followed by Bengaluru North, Bengaluru City, Bengaluru South and Bengaluru East taluks, as reflection of corresponding livestock population in these taluks. Excluding Bengaluru City, the water demand of livestock and other animals of the district is 0.002518033 BCM for 2015 with population of 2610,501 and 0.002816913 BCM for 2020 with population of 2741,027 (Table 4.3, Fig. 3a).

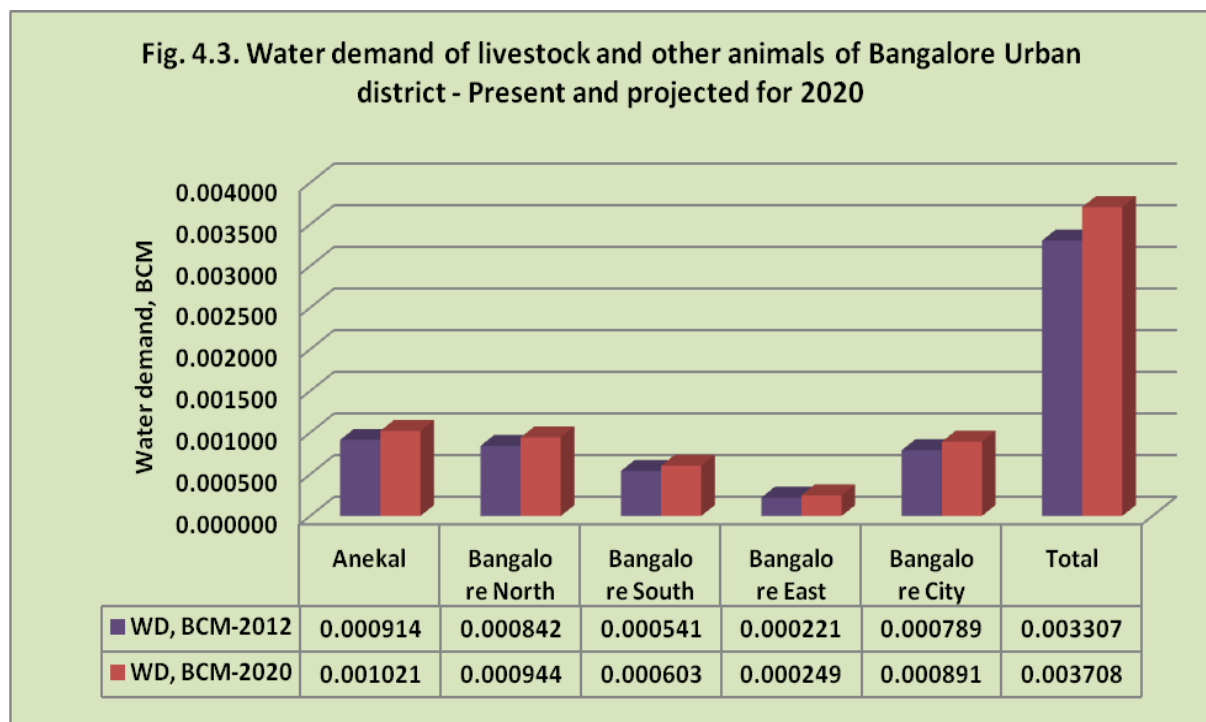


Fig. 4.3a. Water demand of livestock and other animals of Bangalore Urban district - excluding Bangalore city - present and projected for 2020

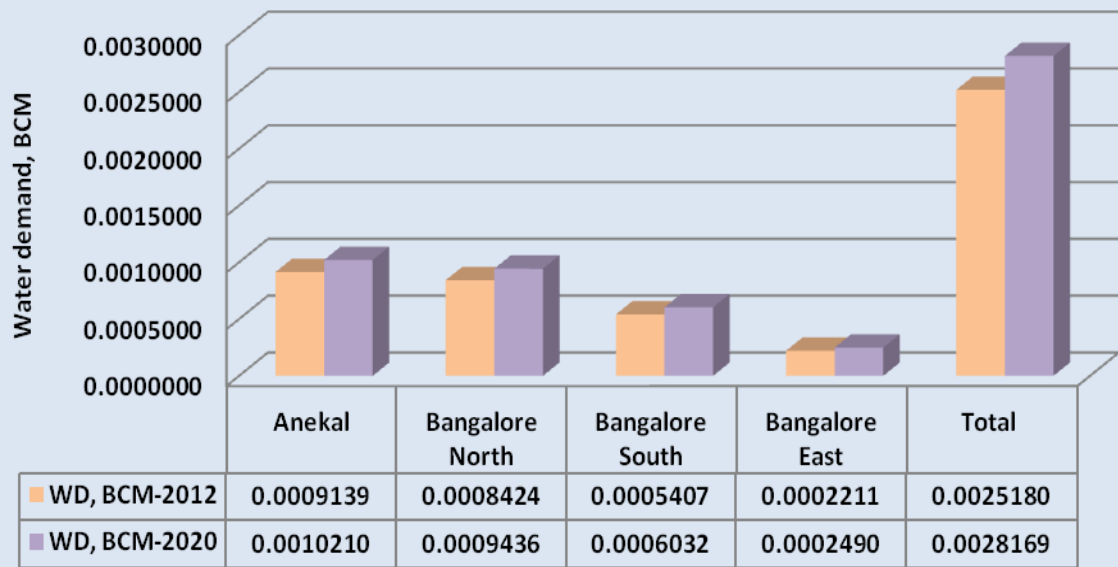


Table 4.3. Water requirement of livestock and other animals in Bengaluru Urban district in 2012 and projected for 2020

Taluks	Water requirement of livestock, Billion cubic meters (BCM)			
	Population, 2012	Present Water requirement for 2012, BCM	Projected Population, 2020	Water requirement for 2020, BCM
Anekal	1668,452	0.0009139	1751,875	0.0010211
Bengaluru North	612,771	0.0008424	643,410	0.0009436
Bengaluru South	254,943	0.0005407	267,690	0.0006032
Bengaluru East	74,335	0.0002211	78,052	0.0002490
Bengaluru City	228,156	0.0007893	239,564	0.0008915
Total	2838,657	0.0033073	2980,590	0.0037084
Total excl. B. City	2610,501	0.0025180	2741,027	0.0028169

Water requirement for various livestock: liters/head/day, lphd: Indigenous cattle - 36 lit; Cross bred cattle/Buffalo - 55 lit; Sheep/Goat - 3.5 lit; Pigs - 6.3 lit; Poultry - 0.3 lit; Dog - 1.8 lit; Duck - 1.0 lit; Others (Bull/He Buffalo/Others) - 55 lit

Water requirement is calculated based on water requirement for various livestock(s), BCM = {(Population of livestock * Water requirement for various livestock, lphd X 365 days)/1000*1000,000,000}

Livestock population is projected to be increased by 5% between 2012 to 2020 census, due to encouragement in the government policies and more support for integrated farming systems. Though cattle population has decreased particularly in favour of indigenous cattle, this reduction is compensated with increase in the density of cross bred animals and other animals due to economic considerations.

(Anjani Kumar and Singh, D.K. 2008. Livestock production systems in India: An appraisal across agro-ecological regions. Indian Journal of Agricultural Economics, 63(4): 577-597)

Source: Deputy Director, Department of Animal Husbandry and Veterinary Services, Bengaluru, Bengaluru Urban District at a glance - 2014-15

4.4. Water demand for Industry

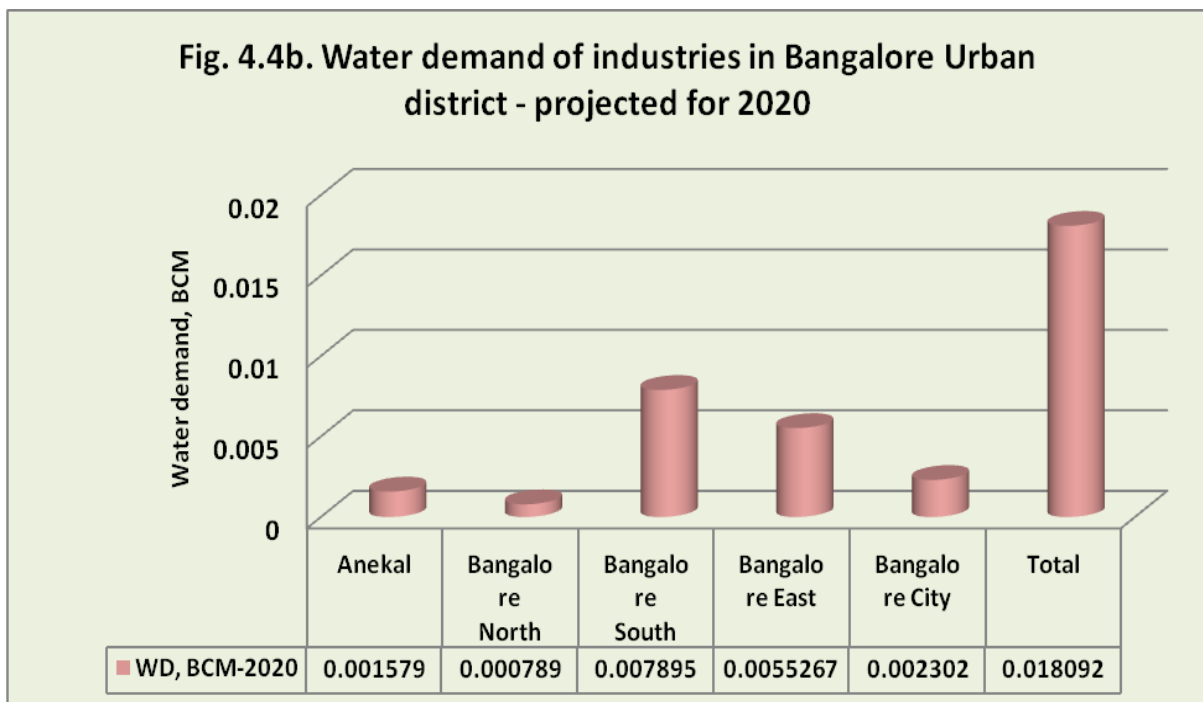
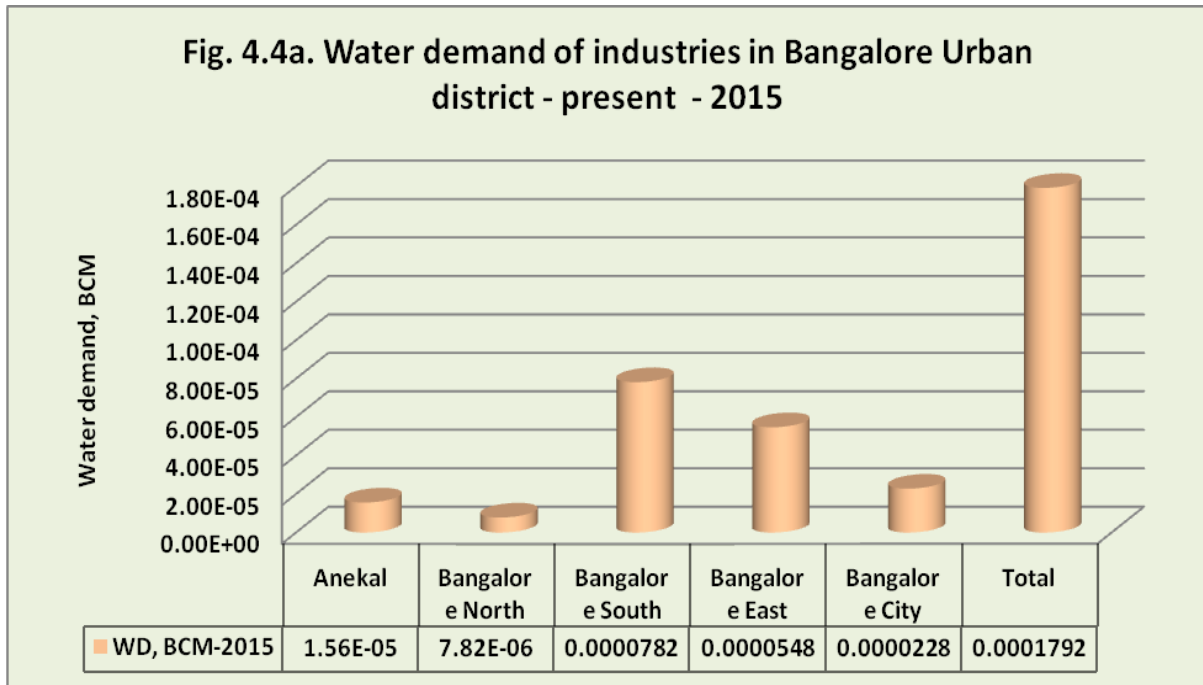
Surface water is the major source of water for the industries in India (41%) followed by groundwater (35%) and municipal water (24%). With greater demand for water, water availability to Industries is becoming scarce and have to invest more for getting water. In addition, industries have to adopt conservation measures and reuse of water after treatment. The water available from waste water treatment is being used for gardening.

While inadequate availability of water is the major risk facing the industries (37%), others agree that poor water quality is another major risk in the running of business (14%). Sectors like pharmaceuticals, power, food processing and agriculture feel the brunt of poor water quality. High costs for obtaining water are hindering the business interest of smaller industries and the ones which are located in the drier regions of the country. Around 14 per cent of the respondents also feel that environmental changes over the past few decades have had an impact on freshwater availability. A realization is gradually emerging that rectifying measures needs to be taken by industries to augment freshwater through rainwater harvesting and wastewater treatment and reuse.

Indian industry is becoming responsive to the fact that it should be the role of every user to undertake measures for water conservation. It is desirable that the shared responsibility of companies across sectors is to join hands with communities and governments to work on programmes for water conservation, recharge and wastewater treatment (FICCI, 2011).

In Bengaluru Urban district, total water demand of 99,396 factories/industries at present (2015) is put at 0.000179218 BCM, whereas the projected water demand for 2020 is 0.0180917 BCM. The water requirement of industries is more in Bengaluru South, followed by Bengaluru East and

Bengaluru City, while it is lower in Bengaluru North and Anekal taluks (0.176 to 0.208 BCM) (Table 4.4, Fig. 4.4a, 4.4b). The water demand for 2020 is also very huge as compared to the present demand, 2015 (Fig. 4.4a, 4.4b).



It is necessary to augment the requirement of fresh water by undertaking wastewater treatment and using it for horticulture, gardening, ash handling,

washing of ore, flushing toilets, cleaning, fire-fighting and dust suppression activities. The industries must see a merit and an economically value in reusing wastewater for purposes where water quality is not an important criterion. There is need to take up water auditing to understand the complete water use pattern in their operations and look for water saving measures.

Table 4.4 Water demand of Industries (category wise) in Bengaluru urban district - Present and future demand by 2020

Sl. No.	Taluk	Water demand, BCM		
		No of Industries/ factories	2015	2020
1	Anekal	9504	0.0000156	0.001579
2	Bengaluru North	4752	0.00000782	0.000789
3	Bengaluru South	47521	0.0000782	0.007895
4	Bengaluru East	33265 ψ	0.00005475	0.0055267
5	Bengaluru City	13,858	0.000022808	0.002302
Total		99,396	0.000179218 (0.006329 TMC)	0.0180917 (0.63890 TMC)

Here rain water harvesting measures are to be created in the premises of the industries to augment the water demand and also to recharge the bore well. 1 BCM = 35.3147 TMC; One TMC = One thousand million cubic feet of water or 28.3168 billion liters of water

ψ - Water demand of industries (33265 Nos.) located in Bengaluru East is 1.5 lakh liters/day for 2015 and 4.0 MGD for 2020, as per the information provided by the Development Officer & Executive Engineer - 2, Karnataka Industrial Development Board, Bengaluru. Taking this as base, water demand for other taluks has been worked out accordingly.

4.5. Water demand for power generation: No proposal for power generation in the district. There is no new proposal for power generation (Table 4.5).

Table 4.5 Water demand for power generation in Bengaluru Urban district

Block	Name of the power generating unit/ Power requirement	Present Water demand, BCM	Proposed for new power generating unit	Water demand at 2020, BCM
	None		No new proposal	

4.6. Water demand for other public purposes:

Water is also required to be provided in public places like schools, colleges, offices, public toilets, bus station, railway stations, theaters, hostels, hotels, restaurants, hospitals, nursing homes and medical quarters, community hall and all other public places. Here, it is very difficult to work out the water demand for all these places, which require many parameters - number of persons involved in each activity, type facility available, etc. It is assumed that 10% of domestic requirement is considered as water demand for these public places. The water demand for these public places amounted to 0.055484 BCM in 2015, where as the water demand would be 0.067580 BCM by 2020 (Table 4.6, Fig. 4.6).

4.7. Total water demand of the district for various sectors:

At present, water demand for all purposes in Bengaluru Urban district is 0.723493 BCM, of which major share goes to domestic need, amounting to 0.55483685 BCM (76.7%), followed by crops, 0.109686 BCM (15.2%). The next share of water demand is for other purposes' requirements (0.055484 BCM – 7.7%). The water demand of livestock and industrial purposes is around 0.4% of the total (Table 4.6, Fig. 4.5, 4.6).

Water demand for various sectors put together for 2015 is more in Bengaluru city (in view of very high population), followed by Anekal (high population, more area under crops and higher livestock and other animal population), Bengaluru South, Bengaluru North, while, it is relatively less in Bengaluru East taluk. The projected water demand of various sectors for 2020 followed the same trend of 2015 and would be to the tune of 0.885835 BCM (Table 4.6, Fig. 4.5, 4.6).

Fig. 4.5. Total water demand of various sectors -taluk wise in Bengaluru Urban district - 2015 and 2020

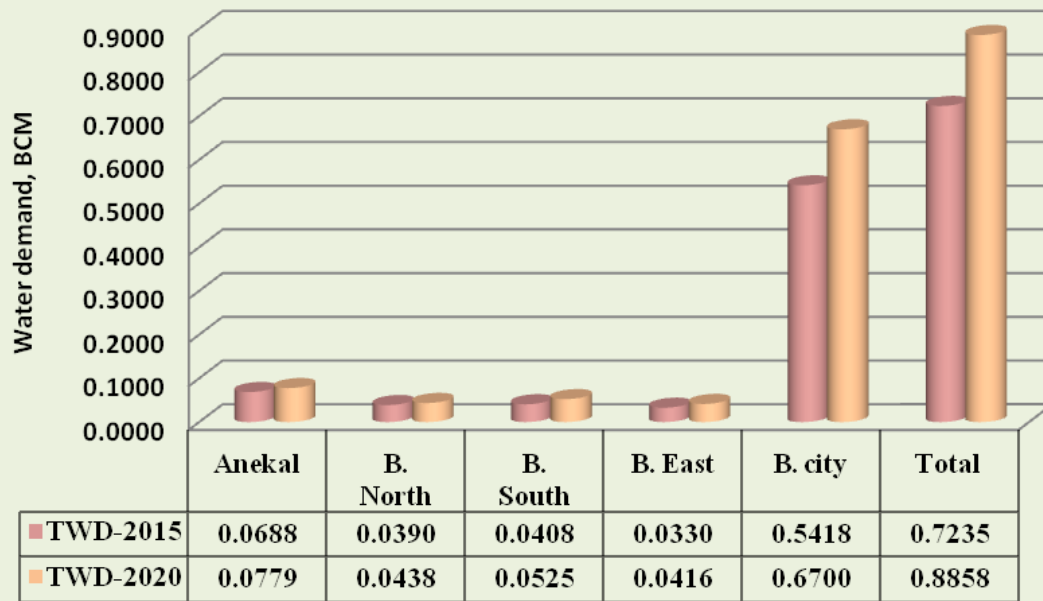


Fig. 4.6. Total water demand sector wise in Bengaluru Urban district - 2015 and 2020

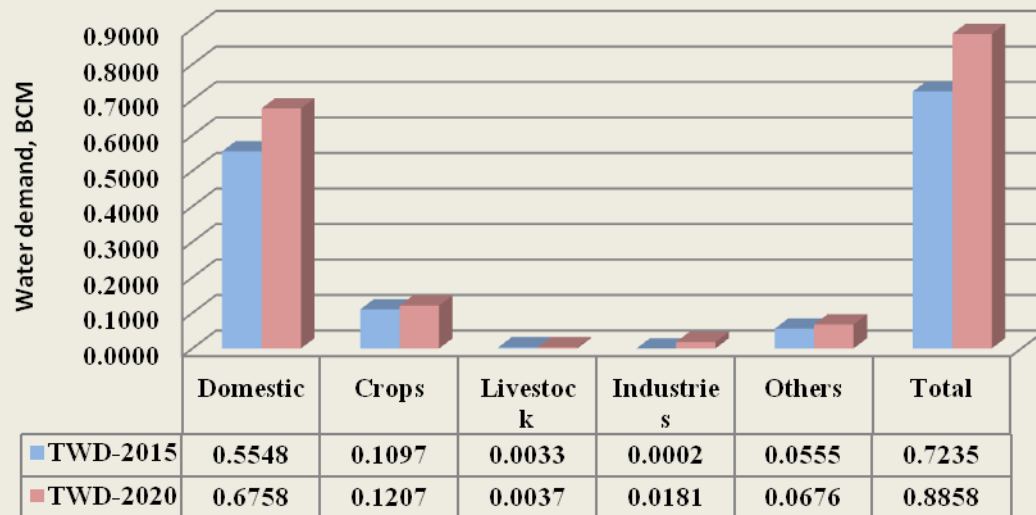


Table 4.6. Total water demand for various sectors in Bengaluru Urban district - present and projected demand for 2020

Taluks	Water demand at present (2015), BCM						
	Domestic	Crops (Hort. + Field)	Livestock	Indus-tries	Power generation	Other public places	Total water demand, BCM
Anekal	0.027805	0.037327	0.000914	0.0000156	0	0.0027805	0.06884
B. North	0.018728	0.017583	0.000842	0.0000078	0	0.0018728	0.03903
B. South	0.011145	0.027959	0.000541	0.0000782	0	0.0011145	0.04084
B. North	0.005347	0.026807	0.000221	0.0000548	0	0.0005348	0.03296
B. city	0.491812	0	0.000789	0.0000228	0	0.0491812	0.54181
Total	0.554837	0.109686	0.003307	0.000179	0	0.0554837	0.72349
Taluks	Water demand for 2020, BCM						
Anekal	0.031122	0.041060	0.001021	0.001579	0	0.0031122	0.07789
B. North	0.020664	0.019342	0.000944	0.000789	0	0.0020664	0.04381
B. South	0.012085	0.030755	0.00060	0.007895	0	0.0012085	0.05254
B. North	0.005746	0.029487	0.000249	0.0055267	0	0.0005746	0.04158
B. city	0.606184	0	0.000891	0.002302	0	0.0606184	0.67000
Total	0.675802	0.120654	0.003708	0.0180912	0	0.0675801	0.88584

Assumption - Increase in population is 42.5%, crops by 10% between 2011 to 2020, livestock by 5% between 2012 to 2020, Industrial use - 100 times higher between 2015 to 2020, Power generation - Not proposed;

4.8. Water budgeting: Total water available in the form of surface water and ground water occurring over the territory of Bengaluru Urban district is 0.67460 BCM, of which, water accounted for surface water is 78.5%, while underground water available annually is 21.5% (0.14505 BCM). The surface water in Bengaluru district is available through minor irrigation and drinking water through BWSSB from Cauvery river, amounting to 0.52955 BCM (78.5% of total, of which 0.49275 BCM comes from Cauvery river for drinking purpose

only - 93% of total surface water) (Table 4.7). Thus, total water availability for the district from all sources at present is 0.67460 BCM, which is less than the present requirement (2015) of 0.72349 BCM (Table 4.7, Fig. 4.7). There is negative balance of water required, amounting to -0.04889 BCM, suggesting to harness rainwater properly- conveying excess runoff to minor irrigation tanks. This negative balance has been observed in all taluks and more from Anekal and Bengaluru City during 2015 as well as for 2020. Here, negative balance indicates the necessity of harnessing the rain water properly (Fig. 4.7, 4.8, Table 4.7).

Thus, all efforts should be made to encourage more water conservation structures to enhance the underground recharge and rejuvenating tanks/lakes by desilting and other means to hold more surface water in tanks/lakes, etc.

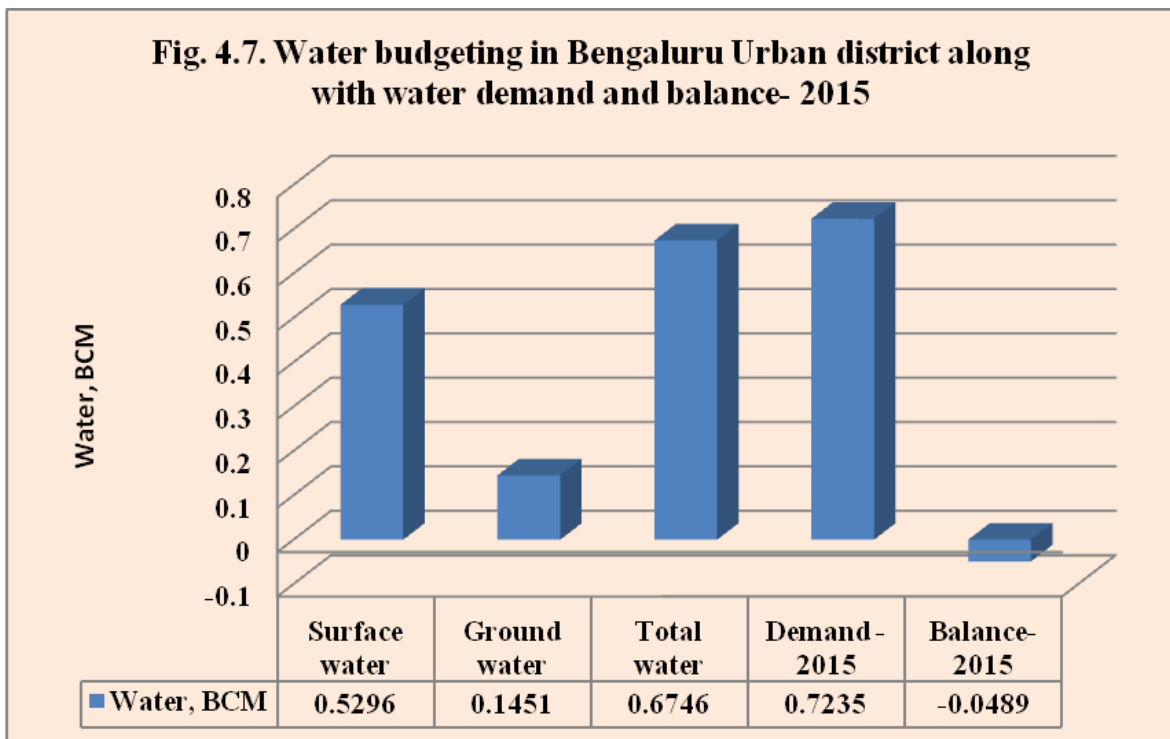
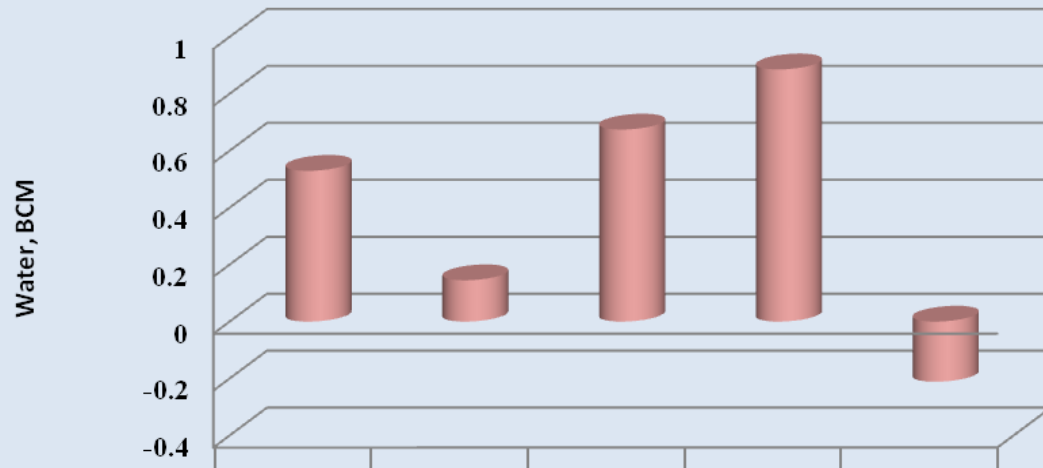


Fig. 4.8. Water budgeting in Bengaluru Urban district along with demand and balance -2020



	Surface water	Ground water	Total water	Demand-2020	Balance-2020
Water, BCM	0.5296	0.1451	0.6746	0.8858	-0.2112

Table 4.7. Water budgeting for Bengaluru Urban district - available, demand and water balance available – 2015 and 2020

Taluks	Net underground water available, BCM (CGWB)	Surface water available from various sources		Total water available, BCM - 2015 (Col. 1+2)
	1	2		3
Anekal	0.03377	0.0179		0.05167
Bengaluru North	0.02975	0.0071		0.03685
Bengaluru South	0.02971	0.004		0.03371
Bengaluru East	0.024	0.0078		0.0318
Bengaluru City	0.02782	0.49275 ψ		0.52057
Total	0.14505	0.52955		0.67460
Taluks	Total water demand for various sectors, BCM - 2015	Water balance available after meeting all demands, 2015, BCM	Projected total demand, BCM - 2020	Water balance after meeting all demands, 2020, BCM
	3	4	5	6
Anekal	0.06884	-0.01717	0.07789	-0.02622
Bengaluru North	0.03903	-0.00218	0.04381	-0.00696
Bengaluru South	0.04084	-0.00713	0.05254	-0.01883
Bengaluru East	0.03296	-0.00116	0.04158	-0.00978
Bengaluru City	0.54181	-0.02124	0.67000	-0.14943
Total	0.72349	-0.04889	0.88584	-0.21124

CGWB - Central Ground Water Board, 2013 for Bengaluru Urban district - Net underground water available; water available from other sources includes water available from minor irrigation - tanks and ψ - water supplied by BWSSB for drinking purpose (1350 MLD = 0.49275 BCM/year)

CHAPTER V

STRATEGIC ACTION PLAN

Bengaluru Urban district came into being in 1986 with the partition of the erstwhile Bengaluru district into Bengaluru Urban and Bengaluru Rural. It has five taluks namely Anekal, Bengaluru North, Bengaluru South, Bengaluru East and Bengaluru City. It is situated in the agro-climatic Zone-V (Eastern Dry Zone). It is located in the heart of the Mysore plateau at an average elevation of 920M. It is positioned at 12^o 39' to 13^o18' North latitude and 77^o 22' to 77^o52' East longitude.

No major rivers run through the district. Bangalore has a handful of freshwater lakes and water tanks, the largest of them are Madivala tank, Hebbal lake, Halasur lake and Sankey Tank. Many historical tank beds have been converted for human habitation. Bangalore receives rainfall from the northeast monsoon as well as the south west monsoon. The normal rainfall of this district is 851.2 mm. Vegetation in the city is primarily in the form of large deciduous trees and interspersed coconut trees.

The total geographical area of the district is 2.17 lakh ha, of which the net sown area is only 45246 ha and the gross cropped area is 46433 ha. It works out to the cropping intensity of 103 %. The district has 5,055 ha area under forests, 115,852 ha under non-agriculture use, cultivable waste and barren land adds up to 8,774 ha. The permanent pastures cover an area of 5,674 ha and the land under tree crops is 7,530 ha. The river Vrishabhavathi, a minor tributary of Arkavathi arises within the city at Basavanagudi flows through the city. All the five taluks of Bengaluru Urban district are located in eastern dry zone (Zone V) of Karnataka. The zone has the characteristic of low rainfall pattern with more uniform and bi-modal distribution. The distribution of different soil types of Alfisols, red sandy loam in major areas and clay lateritic soils are also noticed in patches.

Bengaluru Urban district is primarily focused on industries and tertiary sector such as IT & BT. Agriculture sector has the last priority in the district. However, horticulture, animal husbandry (dairying and poultry) and fisheries sectors are the major activities supplementing the agriculture component.

The Bengaluru Urban district has got less than 10 % of population residing in rural areas and hence, agriculture sector has taken a back seat in the district. Whole economy of the district revolves around industries and IT – BT sectors. The Bengaluru Urban district has very less area under irrigation, since there are no canals although there are many tanks (650) and open wells (24753) none of them provide water for irrigation. However, the district has 15844 bore wells through which 11280 ha of net area and 12467 ha under gross irrigated area. Further, there are no lift irrigation projects operating in this district. Bengaluru North has highest number of bore wells (6392) followed by Bengaluru South (5427), Bengaluru East (2829) and Anekal has the lowest number of bore wells (1196). In view of frequent droughts and over exploitation of underground water, depth of water in the bore wells has gone below 1000 feet and in most of the areas fluoride content in the water is very high and not fit for domestic use as well as irrigation.

Since last two to three decades, the ground water exploitation has reached its peak due to very fast growth of the city and reduction in the drinking water supply from Kaveri reservoir. Bore-wells have become the major source of water supply for the domestic use, industries and other public utility establishments. The report from mines and geology department indicate that the ground availability has gone from 300 to 400 feet a decade back to 800 to 1000 feet and the quality of water is deteriorated since it contains very high quantity of fluorides and dissolved salts.

Traditionally the agriculture system in the district is dependent on rainfall. The district has 35058 ha under agriculture crops, of which cereals occupy a major area 29791 ha, followed by pulses (4100 ha), oilseeds (2489 ha) and there is no area under commercial crops. Among cereals, highest area of 22,457 ha is covered under finger-millet followed by paddy (974 ha), maize (808 ha) and Jowar (750 ha). In respect of pulses, highest area is under redgram (636 ha) followed by others, especially horsegram, field bean etc., by 3160 ha.

Bengaluru Urban district has very good soil and rainfall distribution, the agriculture sector does not provide any importance due to the growth of IT - BT sector, which provides employment to large number of people. Agriculture sector mainly serves as supporting system for the live-stock in providing required green fodder so that the milk production should increase and fetch higher income to the farmers. Further, the farmers do not get good income from land based activities, since the labour availability is very scarce and at the same time it is very expensive. Hence, Integrated Farming System Approach with agri.-horti-livestock-fisheries-sericulture-forestry to be adopted in a holistic manner to get employment throughout the year, better income and livelihood security. The district accounts for nearly 77 % of the area under fruits and vegetable crops. The area under spices is very less (320 ha), however, the area under plantation crops is 1,814 ha which works to 20 % of the total area.

In this background, drawing up of district irrigation plan on holistic basis derives great importance for considering all water resources of the district. Since many decades, more importance was given to construct reservoirs and provide canal irrigation to improve the performance of agriculture in the country. But, importance was not given to rationalise and regulate the use of ground water, even though ground water is more than 50% of national water resource. Similarly, desirable focus was not given in harvesting the surface

flow- rain water efficiently. Adoption of micro irrigation is known to save substantial water, which can help increasing the irrigated area. Adoption of micro irrigation is still not very popular and needs encouragement in all respects.

The district level action plan is prepared as a part of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) for Bengaluru Urban district duly considering the available surface as well as ground water resources in the district for sustainable water management. PMKSY-DIP irrigation plan envisages a total of 25725 ha of area to be brought under irrigation through surface and ground water sources by creating new water harvesting structures and using water saving irrigation system like micro irrigation. The total estimated cost for DIP under PMKSY is Rs. 107123 lakh.

5.2: Taluk Plans

Taluk-wise strategic action plans suggested for district irrigation plans under PMKSY are presented in Tables 5.1 through 5.13 and Fig. 5.1 to 5.13.

Table 5.1: STRATEGIC ACTION PLAN FOR ANEKAL TALUK

Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise budget requirement (in Lakh Rs)					
					I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11
MoWR -MI	AIBP	Construction of Check dam near muthuru village near muthyala madavu right bank Anekal taluk, Bengaluru urban District	1	30.00	30	30	30	30	30	150
DoLR-MoRD –Agric. Dept	Convergence with MGNREGA	Desilting of MI tanks		2381.53	477	477	476	476	476	2382
DoLR-MoRD-PRED	Har khetkopani	Over-all development of ZP tanks	217	0	3000	3000	3000	3000	3000	15000
DoLR-MoRD-PRED	Harkhetkopani	Over-all development of UGD	14	0	481	481	480	480	480	2402
MoWR- MI	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	26	2381.53	1667	1667	1667	1667	1667	8335
MoWR-MI	HarKhetKo Panni	Construction of lift irrigation scheme from Madappanahalli to Jathagodanahalli and other tank in Anekal taluk,	3.00	2945	5000	5000	5000	5000	5000	25000

1	2	3	4	5	4	7	8	9	10	11
MOA &FW- DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip		913.8	147	147	146	146	146	732
MOA &FW- DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler		1500	54	54	54	54	54	270
MOA &FW- DAC&FW - Agriculture Dept	Per drop more crop*	Farm pond	586	1172	102	102	102	102	102	510
MOA &FW- DAC&FW - Agriculture Dept	Per drop more crop*	Check Dam	20	80	18	18	18	18	18	90
MOA &FW- DAC&FW - Agriculture Dept	Per drop more crop *	Nallah bund	10	40	10	10	10	10	10	50
TOTAL			877	11443.86	10986	10986	10983	10983	10983	54921

Note 1: Numbers of water harvesting structures (farm ponds, check dams and Nallah bunds) and their costs proposed in the plan are according to the information provided by the JDA, Bengaluru Urban

- Bengaluru Urban district does not have contiguous area for watershed development. Hence, the water harvesting structures like farm ponds, Check dams and Nallah bunds are suggested under Per Drop more crop and the activities would be implanted based on individual farmer basis depending on the suitability of the location.

Fig 5.1: Irrigation Potential Created under different Components Anekal Taluk

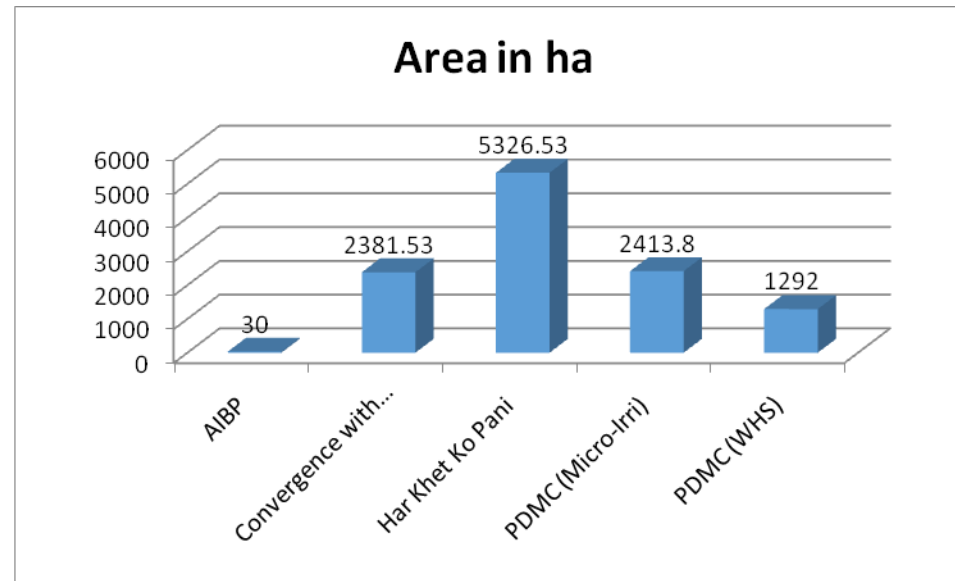


Fig. 5.2: Estimated cost of interventions under different Components Anekal Taluk

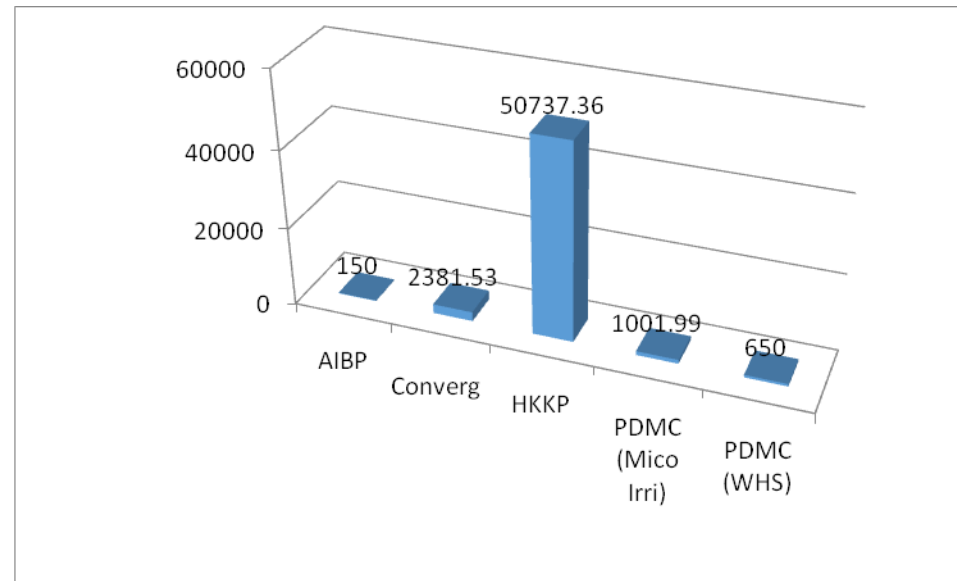


Table 5.2: STRATEGIC ACTION PLAN FOR BENGALURU-EAST TALUK

Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise budget requirement in Lakhs					
					I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11
DoLR-MoRD – Agric. Dept	Convergence with MGNREGA	Desilting of MI tanks		212	43	43	42	42	42	212
DoLR-MoRD-PRED	Har khet ko pani	Overall development of ZP tanks	19	0	110	110	109	109	109	547
DoLR-MoRD-PRED	Har khet ko pani	Overall development of UGD	20	0	1113	1113	1113	1113	1113	5565
MoWR-MI	Har Khet Ko Panni	Providing & laying pipe line for lift irrigation scheme Near Nimbeyakepura	1.00	939.27	40	40	40	40	40	200.00
MoWR-MI	Har Khet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	6	531.64	373	372	372	372	372	1861

1	2	3	4	5	6	7	8	9	10	11
MOA &FW- DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip		112.4	18	18	18	18	17	89
MOA &FW- DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler		1250	45	45	45	45	45	225
MOA &FW- DAC&FW - Agriculture Dept	Per drop more crop (WHS)*	Farm pond	197	394	35	35	34	34	33	171.00
TOTAL				3439.31	1777	1776	1773	1773	1771	8870

Note 1: Numbers of water harvesting structures (farm ponds, check dams and Nallah bunds) and their costs proposed in the plan are according to the information provided by the JDA, Bengaluru Urban

- Bengaluru Urban district does not have contiguous area for watershed development. Hence, the water harvesting structures like farm ponds, Check dams and Nallah bunds are suggested under Per Drop more crop and the activities would be implanted based on individual farmer basis depending on the suitability of the location.

Fig 5.3: Potential Irrigated Area by Component - Bengaluru East Taluk

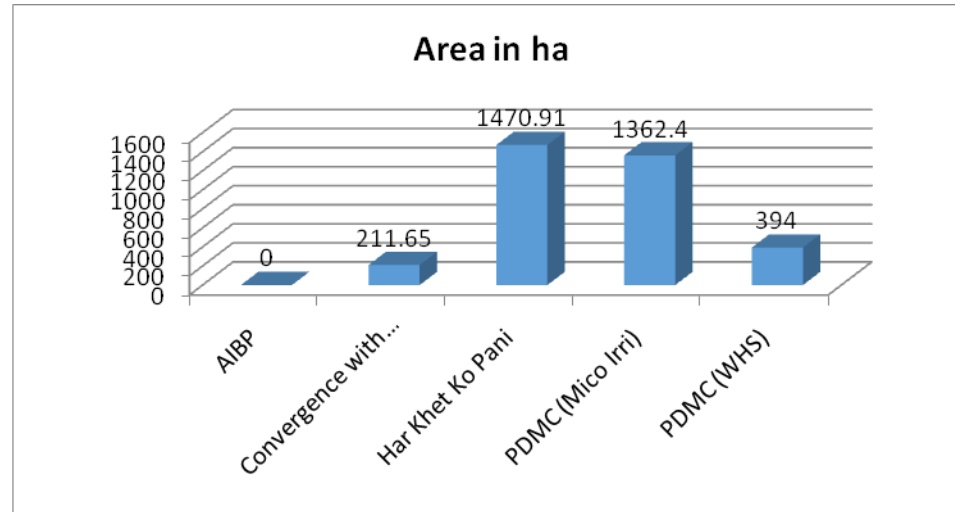


Fig. 5.4: Estimated cost of interventions under different Components Bengaluru East Taluk

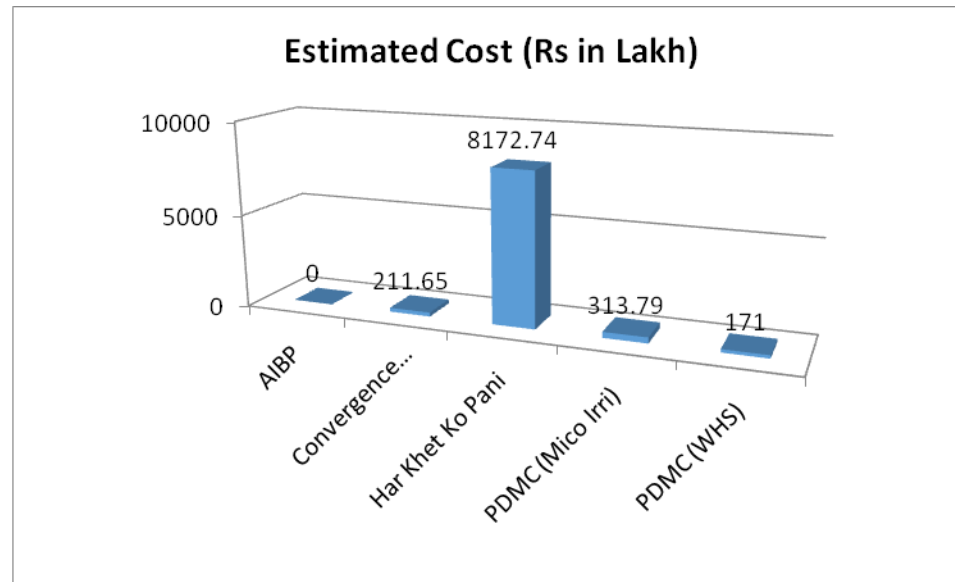


Table 5.3: STRATEGIC ACTION PLAN FOR BENGALURU NORTH TALUK

Concerned Ministry or Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise funds required (in Lakh Rs)					
					I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11
DoLR-MoRD - Agriculture Dept	Convergence with MGNREGA	Desilting of MI tanks	0	624	125	125	125	125	124	624
DoLR-MoRD- PRED- Bengaluru Division	Har khet ko pani	Over-all development of ZP tanks	93	0	1259	1259	1259	1259	1259	6295
DoLR-MoRD- PRED- Bengaluru Division	Har khet ko pani	Over-all development of UGD	15	0	883	883	882	882	882	4412
MoWR - MI	Har Khet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	8	623.43	437	437	436	436	436	2182.
MOA &FW- DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip	0	583.4	94	94	94	92	92	466
MOA &FW- DAC&FW -Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler	0	2000	72	72	72	72	72	360

1	2	3	4	5	6	7	8	9	10	11
MOA &FW- DAC&FW -Agriculture Dept	Per drop more crop (WHS)*	Farm pond	784	1568	137	137	136	136	136	682
MOA &FW- DAC&FW -Agriculture Dept	Per drop more crop (WHS)*	Check Dam	10	40	9	9	9	9	9	45
MOA &FW- DAC&FW -Agriculture Dept	Per drop more crop (WHS)*	Nallah bund	10	40	10	10	10	10	10	50
Total			920	5478.83	3026	3026	3023	3021	3020	15116

Note 1: Numbers of water harvesting structures (farm ponds, check dams and Nallah bunds) and their costs proposed in the plan are according to the information provided by the JDA, Bengaluru Urban

- Bangalore Urban district does not have contiguous area for watershed development. Hence, the water harvesting structures like farm ponds, Check dams and Nallah bunds are suggested under Per Drop more crop and the activities would be implanted based on individual farmer basis depending on the suitability of the location.

Fig 5.5: Potential Irrigated Area by Component –Bengaluru North Taluk

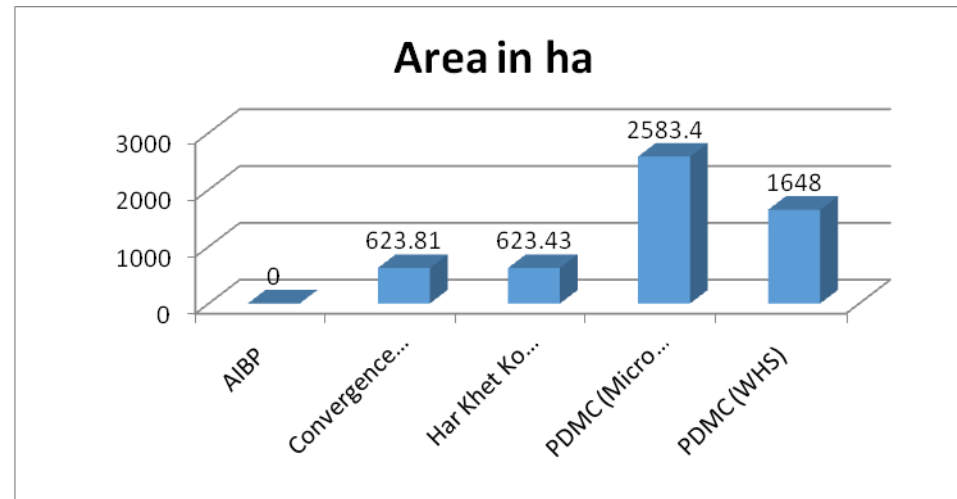


Fig. 5.6: Estimated cost of interventions under different Components Bengaluru North Taluk

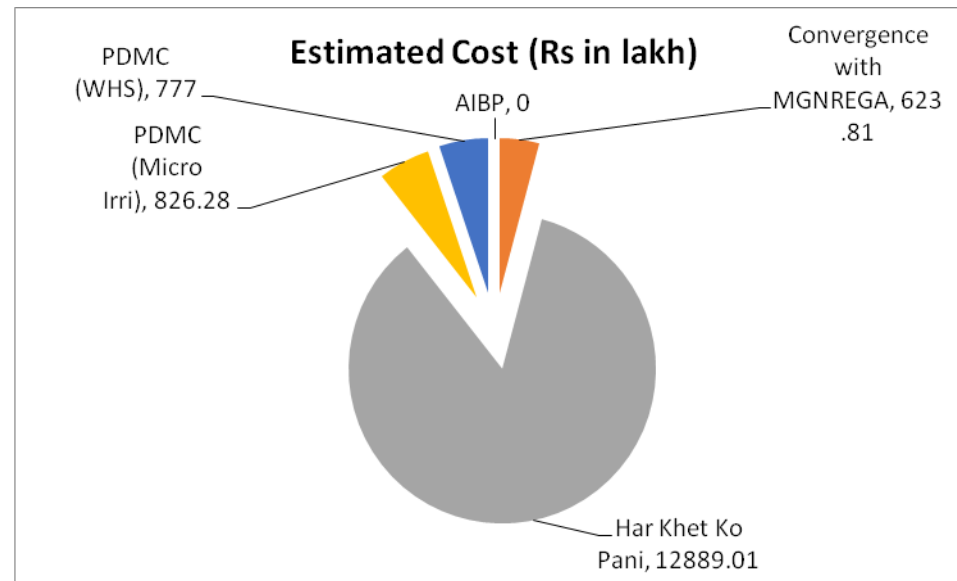


Table 5.4: STRATEGIC ACTION PLAN FOR BENGALURU SOUTH TALUK

Concerned Ministry or Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise requirement of funds (in Lakh Rupees)					
					I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11
MoWR -MI	AIBP	Construction of Check dam near muthuru village near muthyala madavu right bank Anekal taluk, , Bengaluru urban District	6	187.00	134	134	134	134	134	670
DoLR-MoRD –Agric. Dept	Convergence with MGNREGA	Desilting of MI tanks	0	990.2	198	198	198	198	198	990
DoLR-MoRD- PRED	Har khet ko pani	Overall development of ZP tanks	92	0	1429	1429	1429	1428	1428	7143
DoLR-MoRD-PRED-	Har khet ko pani	Overall development of UGD	55	0	2941	2941	2941	2941	2940	14704
MoWR - MI	Har Khet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	5	990.2	694	693	693	693	693	3466
MOA &FW-DAC&FW – Hort. Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip	0	403.4	65	65	65	64	64	323

1	2	3	4	5	6	7	8	9	10	11
MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler	0	1500	54	54	54	54	54	270
MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (WHS)*	Farm pond	586	1172	102	102	102	102	102	510
MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (WHS)*	Check Dam	20	80	18	18	18	18	18	90
MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (WHS)*	Nallah bund	10	40	10	10	10	10	10	50
TOTAL			774	5362.8	5645	5644	5644	5642	5641	28216

Note 1: Numbers of water harvesting structures (farm ponds, check dams and Nallah bunds) and their costs proposed in the plan are according to the information provided by the JDA, Bengaluru Urban

- Bangalore Urban district does not have contiguous area for watershed development. Hence, the water harvesting structures like farm ponds, Check dams and Nallah bunds are suggested under Per Drop more crop and the activities would be implanted based on individual farmer basis depending on the suitability of the location.

Fig 5.7: Potential Irrigated Area by Component -Bengaluru South Taluk

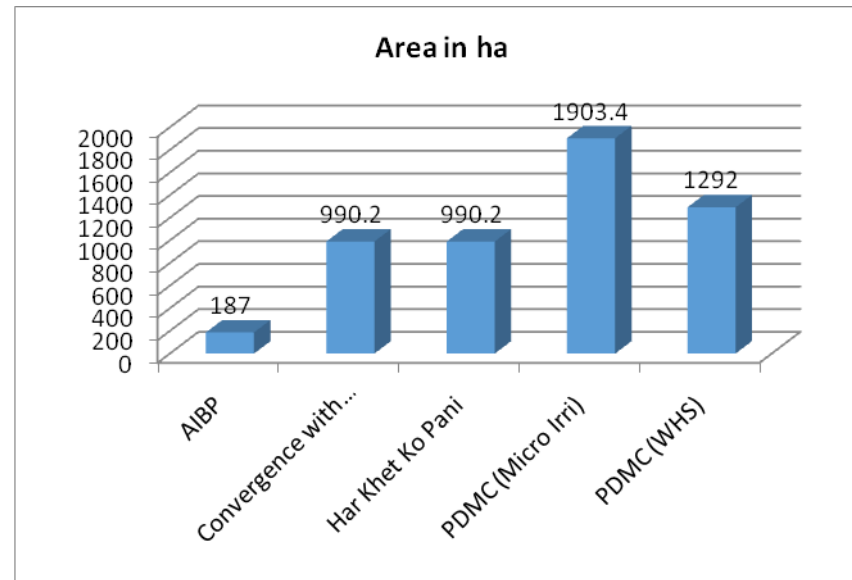
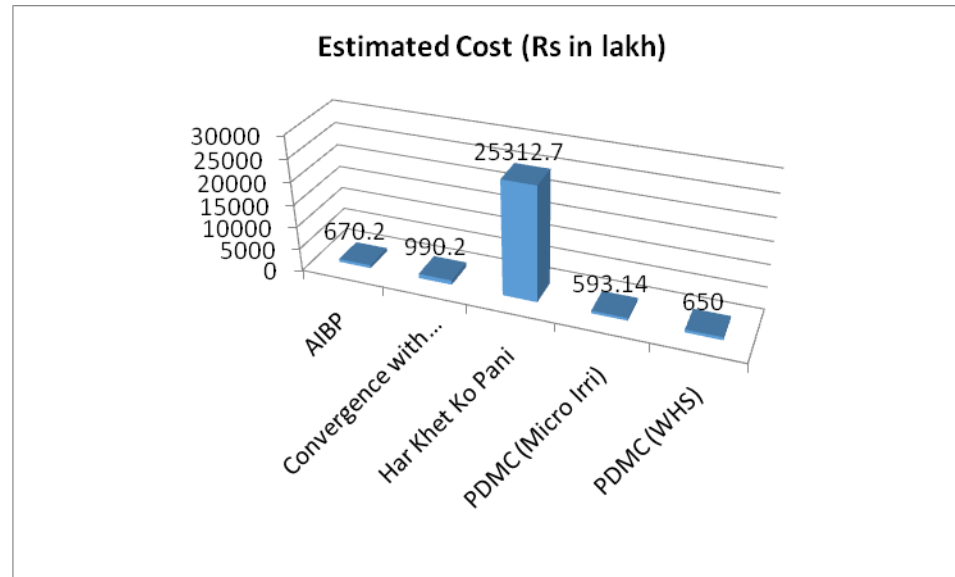


Fig. 5.8: Estimated cost of interventions under different Components Bengaluru South Taluk



District Plans

Table 5.5: District Irrigation Plan by Components-AIBP

SL. NO	Name of the block or Sub District	Concerned Ministry or Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise funds proposed (in Lakh Rs)					
							I	II	III	IV	V	Total
1	Anekal	MoWR - MI	AIBP	Construction of Check dam near muthuru village near muthyalamadavu right bank Anekal taluk, , Bengaluru urban District	1	30.00	30	30	30	30	30	150
2	Bengaluru South	MoWR - MI	AIBP	Construction of Check dam near muthuru village near muthyala madavu right bank Anekal taluk, , Bengaluru urban District	6	187.00	134	134	134	134	134	670
				TOTAL	7	217	164	164	164	164	164	820

Table 5.6. Component: Convergence with MGNREGA

SL. NO	Name of the block or Sub District	Concerned Ministry/ Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise funds proposed (in Lakh Rs)					
							I	II	III	IV	V	Total
1	Anekal	DoLR-MoRD - Agriculture Dept	Convergence with MGNREGA	Desilting of MI tanks		2381.53	477	477	476	476	476	2382
2	Bengaluru East	DoLR-MoRD Agriculture Dept	Convergence with MGNREGA	Desilting of MI tanks		211.65	43	43	42	42	42	212
3	Bengaluru North	DoLR-MoRD Agriculture Dept	Convergence with MGNREGA	Desilting of MI tanks		623.81	125	125	125	125	124	624
4	Bengaluru South	DoLR-MoRD - Agriculture Dept	Convergence with MGNREGA	Desilting of MI tanks		990.2	198	198	198	198	198	990
			Total			4207.19	843	843	841	841	840	4208

Table. 5.7 Component: Har Khet Ko Pani

Sl. NO	Name of the block or Sub District	Concerned Ministry/ Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise funds proposed (in Lakh Rs)					
							I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Anekal	DoLR-MoRD-PRED-Bengaluru Div.	Har khet ko pani	Over-all development of ZP tanks	217	0	3000	3000	3000	3000	3000	15000
2	Anekal	DoLR-MoRD-PRED-Bengaluru Div.	Har khet ko pani	Over-all development of UGD	14	0	481	481	480	480	480	2402
3	Bengaluru East	DoLR-MoRD-PRED-Bengaluru Division	Har khet ko pani	Overall development of ZP tanks	19	0	110	110	109	109	109	547
4	Bangalore East	DoLR-MoRD-PRED-Bengaluru Division	Har khet ko pani	Overall development of UGD	20	0	1113	1113	1113	1113	1113	5565
5	Bengaluru North	DoLR-MoRD-PRED-Bengaluru Div.	Har khet ko pani	Over-all development of ZP tanks	93	0	1259	1259	1259	1259	1259	6295
6	Bengaluru North	DoLR-MoRD-PRED-Bengaluru Division	Har khet ko pani	Over-all development of UGD	15	0	883	883	882	882	882	4412

1	2	3	4	5	6	7	8	9	10	11	12	13
7	Bengaluru South	DoLR-MoRD-PRED-Bengaluru Division	Har khet ko pani	Overall development of ZP tanks	92	0	1429	1429	1429	1428	1428	7143
8	Bengaluru South	DoLR-MoRD-PRED-Bengaluru Division	Har khet ko pani	Overall development of UGD	55	0	2941	2941	2941	2941	2940	14704
9	Anekal	MoWR- MI	Har khet ko pani	Renovation and improvements to tanks including desilting of water bodies	26	2381.53	1667	1667	1667	1667	1667	8335
10	Anekal	MoWR-MI	Har khet ko pani	Construction of lift irrigation scheme from Madappanahalli to Jathagodanahalli and other tank in Anekataluk, Bangalor e urban Dist	3.00	2945.00	5000	5000	5000	5000	5000	25000
11	Bengaluru East	MoWR-MI	Har khet ko pani	Providing & laying pipe line for lift irrigation scheme Near Nimbeyakepura	1.00	939.27	40	40	40	40	40	200.00
12	Bengaluru East	MoWR-MI	Har khet ko pani	Renovation and improvements to tanks including desilting of water bodies	6	531.64	373	372	372	372	372	1861

1	2	3	4	5	6	7	8	9	10	11	12	13
13	Bengaluru North	MoWR - MI	Har khet ko pani	Renovation and improvements to tanks including desilting of water bodies	8	623.43	437	437	436	436	436	2182
14	Bengaluru South	MoWR - MI	Har khet ko pani	Renovation and improvements to tanks including desilting of water bodies	5	990.2	694	693	693	693	693	3466
			TOTAL		574	8411.07	19427	19425	19421	19420	19419	97112

Table 5.8. Component: Per Drop More Crop –Micro Irrigation

SL. NO	Name of the block or Sub District	Concerned Ministry/ Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise funds proposed (in Lakh Rs)					
							I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Anekal	MOA &FW-DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip		913.80	147	147	146	146	146	732
2	Anekal	MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler		1500	54	54	54	54	54	270
3	Bengaluru East	MOA &FW-DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip		112.40	18	18	18	18	17	89
4	Bengaluru East	MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler		1250	45	45	45	45	45	225
5	Bengaluru North	MOA &FW-DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip		583.40	94	93	93	93	93	466
6	Bengaluru North	MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler		2000	72	72	72	72	72	360

1	2	3	4	5	6	7	8	9	10	11	12	13
7	Bengaluru South	MOA &FW-DAC&FW - Horticulture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Drip		403.40	65	65	65	64	64	323
8	Bengaluru South	MOA &FW-DAC&FW - Agriculture Dept	Per drop more crop (Micro Irrigation)	Non-DPAP Sprinkler		1500	54	54	54	54	54	270
			Total			8263	549	548	547	546	545	2735

Table 5.9.Component: Per Drop More Crop – Water Harvesting Structures

SL. NO	Name of the block or Sub District	Concerned Ministry or Department	Component	Activity	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Estimated Cost/Year wise funds proposed (in Lakh Rs)					
							I	II	III	IV	V	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Anekal	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Farm pond	586	1172	102	102	102	102	102	510
2	Anekal	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Check Dam	20	80	18	18	18	18	18	90
3	Anekal	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Nallah bund	10	40	10	10	10	10	10	50
4	Bengaluru East	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Farm pond	197	394	35	34	34	34	34	171
5	Bengaluru North	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Farm pond	784	1568	137	137	136	136	136	682
6	Bengaluru North	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Check Dam	10	40	9	9	9	9	9	45
7	Bengaluru North	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Nallah bund	10	40	10	10	10	10	10	50

1	2	3	4	5	6	7	8	9	10	11	12	13
8	Bengaluru South	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Farm pond	586	1172	102	102	102	102	102	510
9	Bengaluru South	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Check Dam	20	80	18	18	18	18	18	90
10	Bengaluru South	MOA &FW-DAC&FW Agriculture Dept	Per drop more crop (WHS)	Nallah bund	10	40	10	10	10	10	10	50
			TOTAL		2233	4626	451	450	449	449	449	2248

Bengaluru Urban district does not have contiguous area for watershed development. Hence, the water harvesting structures like farm ponds, Check dams and Nallah bunds are suggested under Per Drop more crop and the activities would be implemented based on individual farmer basis depending on the suitability of the location.

Table 5.10: PMKSY-DIP Strategic Action Plan - Area by Component in Bengaluru Urban District

Area in ha

Sl. No.	Component	Anekal	Bengaluru East	Bengaluru North	Bengaluru South	Total
1	AIBP	30			187	217
2	HKKP	5327	1471	624	990	8412
3	PDMC	2414	1362	2583	1903	8262
4	PDMC-WS	1292	394	1648	1292	4626
5	MGNREGA	2382	212	624	990	4208
Total		11445	3439	5479	5362	25725

The irrigation potential created under Har Khet Ko Pani is the highest i.e., 8412 ha followed by micro irrigation component with 8262 ha. Most of the activities suggested under AIBP component relates to renovation of minor irrigation system in the district. Similarly, Some of the activities related to the construction of water harvesting structures like farm ponds, check dams and Nallah bunds would be taken up on the individual farm basis due to lack of contiguous area for watershed development.

Fig 5.9: Irrigation Potential proposed to be created under different components

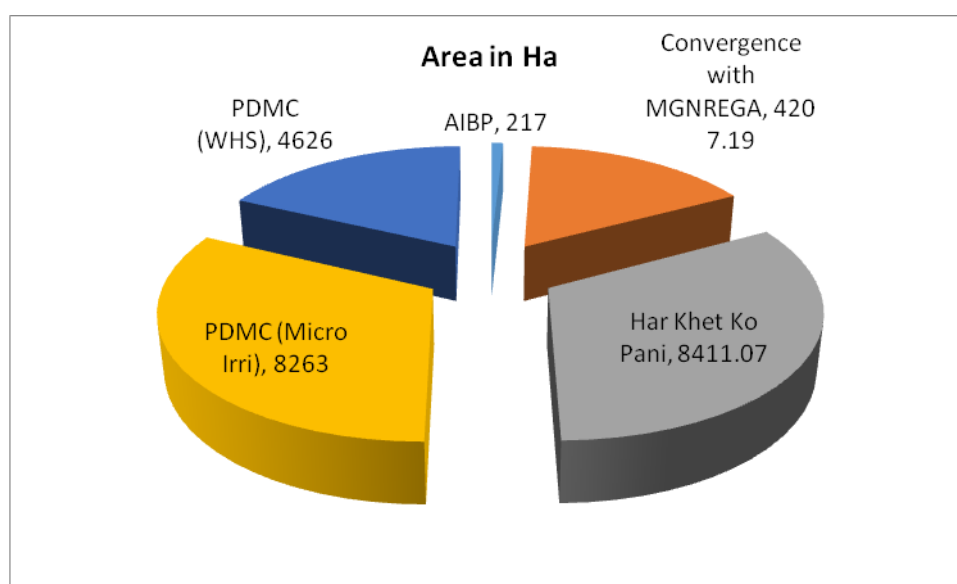


Table 5.11: PMKSY-DIP Strategic Action Plan - Estimated Cost by Component - Bengaluru Urban District

Rs in Lakh

Sl. No.	Component	Anekal	Bengaluru East	Bengaluru North	Bengaluru South	Total
1	AIBP	150			670	820
2	HKKP	50737	8173	12889	25313	97112
3	PDMC	1002	314	826	593	2735
4	PMKSY-WS	650	171	777	650	2248
5	MGNREGA	2382	212	624	990	4208
Total		54921	8870	15116	28216	107123

It can be seen from Table 5.11 that Component Har Khet ko Pani shares the maximum budget of Rs. 971 .12 crore followed by Works to be carried out under MGNREGA with Rs. 42.08 crore, micro irrigation (Rs. 27.35 crore) and WS (Rs. 22.48 crore). Activities like renovations and modernization of minor / medium irrigation system under AIBP adds up to Rs. 8.20 crore.

Fig. 5.10: Estimated Cost (Budget) for different components in the PMKSY-Dip

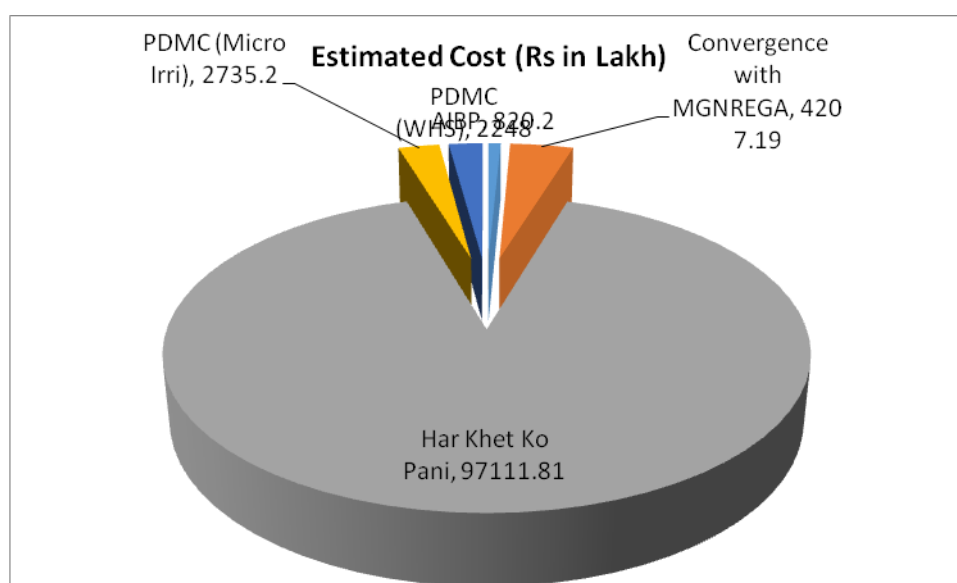


Table 5.12 : DISTRICT ABSTRACT-BUDGET-TALUK & YEAR WISE
in Lakh Rupees

Sl. No.	Year	Anekal	Bengaluru East	Bengaluru North	Bengaluru South	Total
1	I	10986	1777	3026	5645	21434
2	II	10986	1776	3026	5644	21432
3	III	10983	1773	3023	5644	21423
4	IV	10983	1773	3021	5642	21419
5	V	10983	1771	3020	5641	21415
Total		54921	8870	15116	28216	107123

Anekal taluk requires highest amount of Rs. 549.21 crore followed by Bengaluru South Rs. 282.16 crore, Bengaluru North Rs. 151.16 crore and Bengaluru East Rs.88.70 crore.

Fig. 5.11

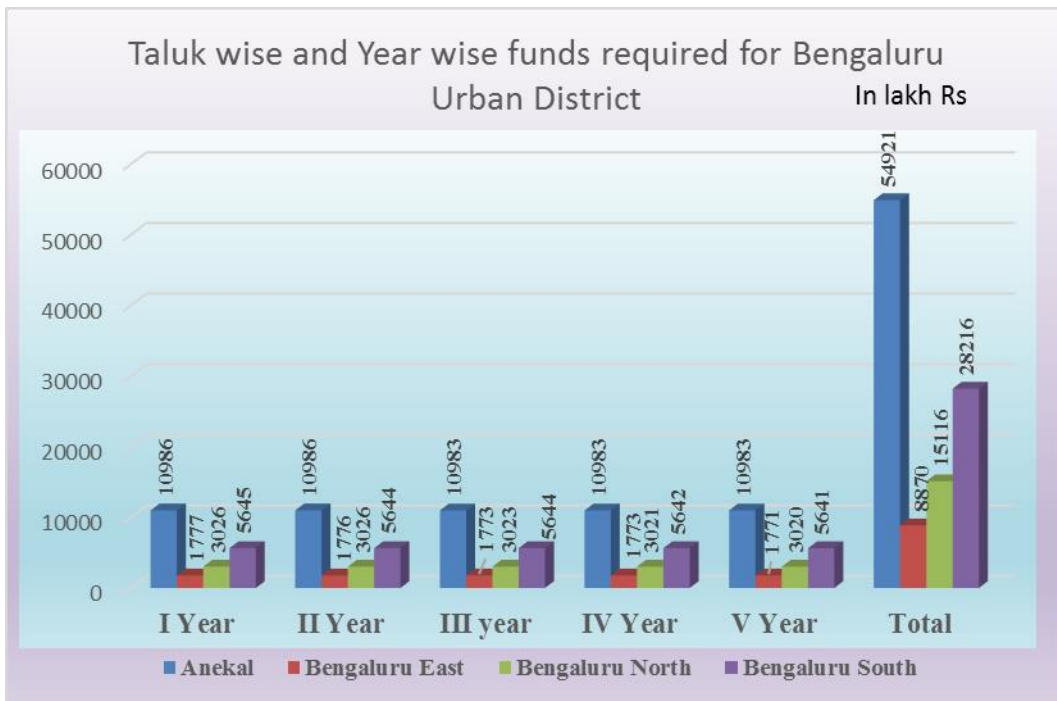


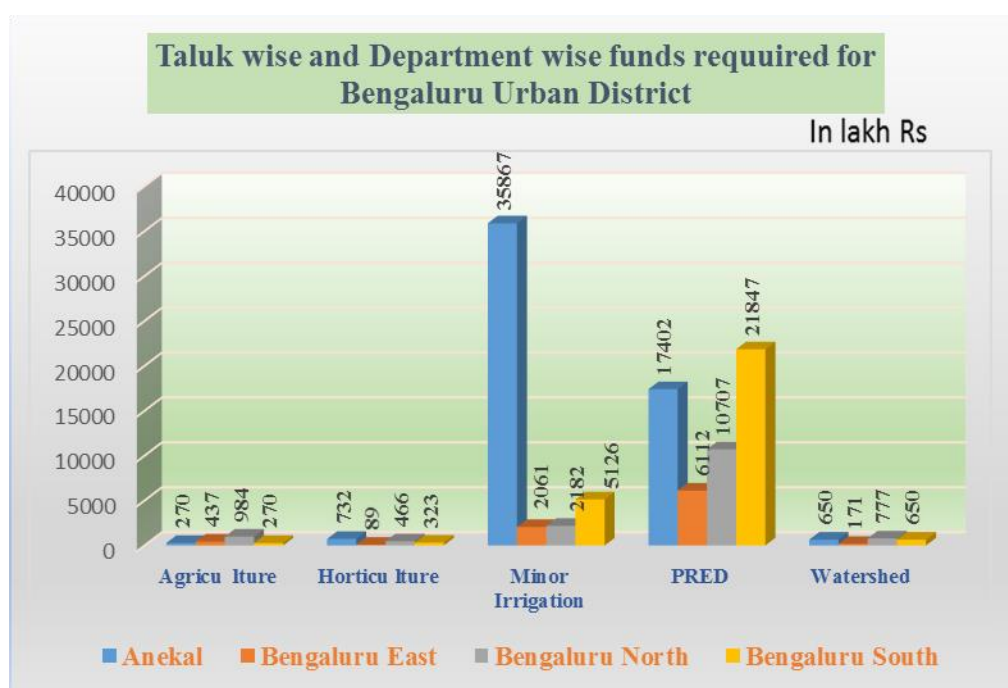
Table 13. DISTRICT ABSTRACT-BUDGET-TALUK WISE & DEPARTMENT WISE

In lakh Rupees

Sl. No.	Taluk	Agricu Iture	Horticu Iture	Minor Irrigation	PRED	Watershed	Total
1	Anekal	270	732	35867	17402	650	54921
2	Bengaluru East	437	89	2061	6112	171	8870
3	Bengaluru North	984	466	2182	10707	777	15116
4	Bengaluru South	270	323	5126	21847	650	28216
Total		1961	1610	45236	56068	2248	107123

Out of the total funds required under DIP for Bengaluru Urban district, PRED requires the highest amount of Rs.560.68 crore, followed by Minor Irrigation Rs.452.36 crore, Watershed Rs.22.48 crore, Agriculture Rs. 19.61 crore and Horticulture Rs. 16.10 crore.

Fig 5.12



CONCLUSIONS

- Bangalore (Urban) district comes under Eastern Dry Zone. No major rivers run through the district. Bangalore has a handful of freshwater lakes and water tanks, the largest of them are Madivala tank, Hebbal lake, Halasur lake and Sankey Tank. Many historical tank beds have been converted for human habitation. Bangalore receives rainfall from the northeast monsoon as well as the south west monsoon. The normal rainfall of this district is 875 mm.
- The Bengaluru Urban district has very less area under irrigation, since there are no canals. Although there are many tanks (650) and open wells (24753), none of them provide water for irrigation. However, the district has 15844 bore wells through which 11280 ha of net area and 12467 ha under gross irrigated area. Further, there are no lift irrigation projects operating in this district.
- Bengaluru North has the highest number of bore wells (6392) followed by Bengaluru South (5427), Bengaluru East (2829) and Anekal has the lowest no. of bore wells (1196). In view of frequent droughts and over exploitation of underground water, depth of water in the bore wells has gone below 1000 feet and in most of the areas fluoride content in the water is very high and not fit for domestic use as well as irrigation.
- Since last two to three decades, the ground water exploitation has reached its peak due to very fast growth of the city and reduction in the drinking water supply from Kaveri reservoir. Bore-wells have become the major source of water supply for the domestic use, industries and other public utility establishments. The report from mines and geology department indicate that the ground water availability has gone from 300 to 400 feet a decade back to 800 to 1000 feet and the quality of water is deteriorated since it contains very high quantity of fluorides and dissolved salts.

- Agriculture sector mainly serves as supporting system for the live-stock in providing required green fodder so that the milk production should increase and fetch higher income to the farmers.
- The district accounts for nearly 77 % of the area under fruits and vegetable crops. The area under spices is very less (320 ha.), however, the area under plantation crops is 1,814 ha which works to 20% of the total area.
- Harvesting rain water structures like farm ponds, check dams, tanks, barrages, bandharas etc., is an essential features of planning for these areas. Similarly, for exploited regions in respect of ground water, recharging of ground water through bore well recharging and other water bodies is also equally essential.
- The plan envisages creation of new irrigation potential of 25725 ha in the next five years, which is distributed in all taluks.
- A budgetary provision of Rs 107,123 lakhs is necessary to achieve this development,
- Activities under Her Khet KoPani shared a major portion of the budget i.e., Rs. 97112 lakh and accounts for 91 per cent of the total budget of Rs. 107123 lakh.
- The activities under the convergence with MGNREGA need Rs. 4208 lakh (3.44 per cent). The interventions under Per Drop more Crop for micro irrigation and for creating new water harvesting structure under PMKSY shared little more than 4 per cent of the total budget.
- Activities under AIBP component needs Rs. 820 lakh which are basically used for renovation of minor irrigation works.
- Sewage treatment plants along with establishment of UGD pipe laying is proposed in the district.

- In nut shell, implementation of PMKSY is going to change the agrarian scenario in Bangalore Urban district by improving the irrigation status to a sizable cultivated area. The implementation of DIP will also facilitate the repairs/ maintenance of existing net work, so that wastage of water is avoided. Due care is also taken to include the reuse of treated sewage water by establishment of STPs and strengthening underground drainage network.

APPENDICES

1.2 Demography

District : Bangalore Urban

Sl. No	Name of the Block	Population			SC	ST	Child	General/ Others	Total
		Male	Female	Total					
1.	Anekal	282006	235569	517575	110082	13776	58938	393717	517575
2.	Bengaluru East	53699	48908	102607	25071	2330	13041	75206	102607
3.	Bengaluru North	185978	166442	352420	66815	12516	40487	273089	352420
4.	Bengaluru South	109255	96019	205274	36090	6679	23930	162505	205274
5.	Bengaluru City	4391723	4051952	8443675	960327	154938	916441	7328410	8443675
	Total	5022661	4598890	9621551	1198385	190239	1052837	8232927	9621551

Source : Census of India

1.4 Agro Ecology, Climate, Hydrology & Topography :

Sl. No.		Agro Ecological Zone Type	Type of Terrain	Taluk Name	Block Area (ha)	Normal Annual Rainfall (mm)	Average Monthly Rainfall (mm)	No. of Rainy Days (No.)	Maximum Rainfall Intensity (mm)			Average Weekly Temperature (C)						Potential Evapo-Transpiration (PET)				Elevation					
									Upto 15 min	Beyond 15 but upto 30 min	Beyond 30 but upto 60 min	Period						Period				Min	Max	Mean			
												Summer (April-May)			Winter (Oct-March)			Rainy (June-Sept.)			Summer				Winter	Rainy Season	Cumulative Total
												Min	Max	Mean	Min	Max	Mean	Min	Max	Mean							
1	Karnataka plateau hot moist semi-arid with 150-180 days of LGP	Rocky upland Plateau and Flat topped hills	ANEKAL	53518	867	72.2	54	96		20.4	38.9	30	14.7	40	27	19.1	37	28.05	471.0	373.8	664.3	1509	690	902	796		
2	Karnataka plateau hot moist semi-arid with 150-180 days of LGP		Bengaluru North	78411	933	77.8	58	124		19.9	32	26	17.4	31.7	25	19.5	30.4	24.95	612.1	399.4	872.1	1884	710	890	800		

District Water Profile

2.1 Area-wise, Crop-wise Irrigation Status :

Source : Department of Agriculture, Agriculture Statistics of State, Agristat

District : Bangalore Urban

Crop Type	Kharif (Area in ha)			Rabi (Area in ha)			Summer (Area in ha)			Total (Area in ha)		
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
A) Cereals												
Anekal	700	9155	9855	50	0	50	35		35	785	9155	9940
B. East	270	1660	1930	20	150	170	135		135	425	1810	2235
B. North	518	7732	8250	55	0	55	120		120	693	7732	8425
B. South	720	8310	9030	55	0	55	106		106	881	8310	9191
	2208	26857	29065	180	150	330	396	0	396	2784	27007	29791
B) Pulses												
Anekal	175	960	1135	20	0	20	0		0	195	960	1155
B. East	50	325	375	10	52	62	15		15	75	377	452
B. North	110	994	1104	20	125	145	28		28	158	1119	1277
B. South	133	905	1038	15	125	140	38		38	186	1030	1216
	468	3184	3652	65	302	367	81	0	81	614	3486	4100
C) Oil Seeds												
Anekal	50	240	290	0	0	0	0		0	50	240	290
B. East	10	136	146	0	0	0	0		0	10	136	146
B. North	18	265	283	0	0	0	8		8	26	265	291
B. South	20	415	435	0	0	0	5		5	25	415	440
	98	1056	1154	0	0	0	13	0	13	111	1056	1167
D) Total Agriculture crops..												
Anekal	925	10355	11280	70	0	70	35	0	35	1030	10355	11385
B. East	330	2121	2451	30	202	232	150	0	150	510	2323	2833
B. North	646	8991	9637	75	125	200	156	0	156	877	9116	9993
B. South	873	9630	10503	70	125	195	149	0	149	1092	9755	10847
Total	2774	31097	33871	245	452	697	490	0	490	3509	31549	35058
Abstract - Horticulture												

aneal	1634	389	2023	1429	0	1429	466	0	466	3529	389	3918
Bangalore North	1450	686	2136	279	0	279	105	0	105	1834	686	2520
Bangalore south	830	685	1515	577	0	577	55	0	55	1462	685	2147
Bangalore east	649	657	1306	369	0	369	85	0	85	1103	657	1760
Total	4563	2417	6980	2654	0	2654	711	0	711	7927	2417	10345
Sericulture												
aneal										408		408
Bangalore North										287		287
Bangalore south										247		247
Bangalore east										88		88
Total										1030	0	1030
GRAND TOTAL												
aneal										4967	10744	15711
Bangalore North										2631	3009	5640
Bangalore South										2586	9801	12387
Bangalore East										2283	10412	12695
										12467	33966	46433

Source: JDA, Bengaluru Urban District

2.2. Production and productivity of various crops during Kharif 2015-16

Bangalore Urban District

Production in MT, productivity in Kgs/ha

Sl. No.	Crop		Anekal		Bengaluru South		Bengaluru North		Bengaluru East		Total	
			Average Productivity	Production	Average Productivity	Production	Average Productivity	Production	Average Productivity	Production	Average Productivity	Production
1	Paddy	Irri		0.0	0	0.0	5800	626.4	5800	870.0	5800	1496.4
		RF	4000	268.0	4000	612.0	0	0.0	0	0.0	4000	880.0
2	Ragi	Irri	0	0.0	0	0.0	3035	364.2	3035	75.9	3035	440.1
		RF	1500	10948.5	1500	11046.0	1792	11816.4	1792	2759.7	1604	36570.6
3	Maize	Irri	0	0.0	0	0.0	5598	1270.7	0	0.0	5598	1270.7
		RF	3500	420.0	3500	871.5	3200	2604.8	3200	64.0	3292	3960.3
4	Minor Millets	Irri		0.0		0.0		0.0		0.0	0	0.0
		RF		0.0		0.0	350	8.8		0.0	350	8.8
Total Cereals			1554	11636.5	1613	12529.5	2043	16691.3	2112	3769.6	1770	44626.9
5	Redgram	Irri		0.0		0.0	0	0.0		0.0		0.0
		RF	300	44.7	300	55.2	550	138.6	550	19.3	416	257.8
6	Horsegram	RF	350	24.5	350	24.5	480	19.2	480	19.2	397	87.4
7	Blackgram	RF	250	1.0	250	1.0	567	2.3		0.0	356	4.3
8	Greengram	RF	250	1.9	250	1.0	550	1.1	550	19.3	479	23.2
9	Cowpea	Irri		0.0		0.0	1130	33.9		0.0	1130	33.9
		RF	600	78.6	600	105.0	750	150.8	750	22.5	665	356.9
10	Field bean	Irri		0.0		0.0	1062	73.3		0.0	1062	73.3
		RF	350	174.3	350	112.4	750	273.8	750	49.5	488	609.9
Total Pulses			378	325.0	395	299.1	719	692.8	630	129.7	519	1446.6
Total Food grains			1433	11961.5	1505	12828.6	1903	17384.2	1958	3899.3	1646	46073.5

11	Groundnut	Irrig		0.0		0.0	795	6.0		0.0	795	6.0
		RF	700	63.7	700	16.8	600	7.8	600	0.6	689	88.9
12	Sesamum	RF	400	11.6	400	6.4	350	0.4		0.0	399	18.4
14	Castor	RF	800	20.0	800	58.4	750	26.3		0.0	787	104.7
15	Niger	RF	300	12.6	300	16.5	350	2.8		0.0	304	31.9
16	Mustard	RF	250	7.5	250	20.0		0.0		0.0	175	27.5
	Total Oilseeds		469	115.4	476	118.1	386	43.2	600	0.6	457	277.3
	Grand Total		1406	12076.9	1476	12946.7	1885	17427.4	1958	3899.9	1620	46350.8

Source: JDA, Bengaluru Urban District

Production and productivity of various crops during Rabi 2015-16

Bangalore Urban District

Production in MT, productivity in Kgs/ha

Sl. No.	Crop		Anekal		Bengaluru South		Bengaluru North		Bengaluru East		Total	
			Average Productivity	Production	Average Productivity	Production	Average Productivity	Production	Average Productivity	Production	Average Productivity	Production
1	Ragi	Irri					1800	25.2	2100	16.8	1500	42.0
		RF										0.0
2	Maize	Irri			5000	15.0	2756	110.3	3150	31.5	2703	156.8
		RF									0	0.0
Cereals Total			0	0	1250	15.0	1908	135.5	2683	48.3	1930	198.8
3	Bengalgram	Irri					750	7.5	750	2.3	750	9.8
		RF										0.0
4	Horsegram	Irri										0.0
		RF	250	51.3	275	52.8	450	68.4	450	21.6	325	194.1
5	Field bean	Irri					800	2.4	800	4.0	800	6.4
		RF									0	0.0
6	Cowpea\	Irri					750	9.0	750	2.3	662	11.3
		RF										0.0
Total pulses			250	51.3	268	52.8	493	87.3	510	30.1	347	221.5
Grand total			248	51.3	324	67.8	898	222.8	1018	78.4	567	420.2

Source: JDA, Bengaluru Urban District

Production and productivity of various crops during Summer 2015-16

Bangalore Urban District

Production in MT, productivity in Kgs/ha

Sl.No.	Crop		Anekal		Bengaluru South		Bengaluru North		Bengaluru East		Total	
			Average Productivity	Production	Average Productivity	Production	Average Productivity	Production	Average Productivity	Production	Average Productivity	Production
1	Ragi	Irri	1700	17.0	1700	10.2	1670	41.8			1682	69.0
2	Paddy	Irri	5000	125.0	5000	135.0	5100	76.5	5000	300.0	5012	636.5
3	Maize	Irri			2500	112.5	3000	150.0	3000	60.0	2804	322.5
Total Cereals		Irri	4057	142.0	3304	257.7	2981	268.3	4500	360.0	3632	1028.0
4	Field bean	Irri			813	3.3	850	4.3			833	7.5
5	Cowpea	Irri			1120	5.6	1042	6.3			1077	11.9
Total Pulses		Irri	0	0.0	983	8.9	955	10.5	0	0.0	968	19.4
6	Groundnut	Irri			1850	1.9	2050	2.1			1950	3.9
Grand Total		Irri	4057	142.0	3064	268.4	2760	280.8	4500	360.0	3456	1051.2

Source: JDA, Bengaluru Urban District

2.3 Irrigation based classification :					
District : Bangalore Urban					
Sl. No.	Taluk	Irrigated (Area in ha)		Rainfed (Area in ha)	
		Gross Irrigated Area	Net Irrigated Area	Partially Irrigated/Protective Irrigation	Un-Irrigated or Totally Rainfed
1	Anekal	4967	4862		10744
2	Bengaluru North	2631	2249		3009
3	Bengaluru South	2586	2230		9801
4	Bengaluru East	2283	1939		10412
	Total	12467	11280		33966

Source : Agriculture Statistic, Irrigation Statistic of CWC, Indian Statistic, Open Government Data Platform

Appendix 5.1: Strategic action plan for irrigation in Bangalore Urban district under PMKSY- Minor Irrigation

SL. NO	Name of the block or Sub District	Concerned Ministry or Department	Component	Activity	Name of work	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Period of Implementation	Estimated Cost in Lakhs
1	Anekal	MoWR	AIBP	Surface Minor irrigation / Ground water development	Construction of Check dam near muthuru village near muthyalamadavu right bank Anekal taluk, Bangalore urban District	1	20.00	2 years	100.00
						1	20.00		100.00
1	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	AnekalDoddaKere	40.17	113.20	5years	226.40
2	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	AnekalRajanakere	14.85	48.80	5years	97.60
3	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Karpura Tank	25.25	60.80	5years	121.60

4	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	MarasurDoddaKere	13.69	112.80	5years	225.60
5	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Bidarakere	10.65	40.80	5years	81.60
6	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	BagganadoddiKere	10.12	44.00	5years	88.00
7	Anekal	MoWR	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	HaragaddeDoddakere	18.56	61.60	5years	123.20
8	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	JiganiDoddaKere	76.68	141.60	5years	283.20

9	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Biderei Amani Kere	30.12	51.60	5years	103.20
10	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	SakalavaraBhujangaDasanaKere	10.75	48.80	5years	97.60
11	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	HulimangalaKere	14.30	76.40	5years	152.80
12	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	ByatarayanadoddiKere	4.93	54.70	5years	109.40
13	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	HennagaraKere	100.48	280.00	5years	560.00

14	Anekal	MoWR	HarKhetK o Panni	Renovation and improvements to tanks including desilting of water bodies	BommandahallyKere	19.67	177.00	5years	354.00
15	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	SarjapuraChikkaKere	18.56	60.60	5years	121.20
16	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Muthanallur Amani Kere	125.37	260.00	5years	520.00
17	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	SingenaAgraharaKere	20.30	67.20	5years	134.40
18	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	HuskurKere	20.69	52.80	5years	105.60

19	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	GattahallyBommanakere	19.47	40.40	5years	80.80
20	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	PandithanaAgraharaKere	10.04	43.20	5years	86.40
21	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	MugalurKodiKere	20.69	52.80	5years	105.60
22	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	SarjapuraDoddaKere	51.73	177.20	5years	354.40
23	Anekal	MoWR	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	MayasandraDoddaKere	16.43	76.40	5years	152.80

24	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	BhidaraguppeKere	36.51	98.83	5years	197.66
25	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	BommansandraKere	9.80	48.80	5years	97.60
26	Anekal	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	ArehallyDoddaKere	54.47	91.20	5years	182.40
						794.28	2381.53	0.00	4763.06
27	Bangalore South	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	VaderahalliKere	116.00	525.28	5years	1050.56
28	Bangalore South	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of	GulakamaleKere	70.00	268.51	5years	537.02

				water bodies					
29	Bangalore South	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Chikkalingasastrikere	17.00	74.92	5years	149.84
30	Bangalore South	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	UdipalyaKere	9.88	42.52	5years	85.04
31	Bangalore South	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	AgaraKere	20.00	78.97	5years	157.94
						232.88	990.20	0.00	1980.40
32	Bangalore East	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Kodathi Tank	2.69	50.89	5years	101.78
33	Bangalore East	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including	Chikkenahally Tank	2.40	47.16	5years	94.32

				desilting of water bodies					
34	Bangalore East	MoWR	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	Rampur Tank	27.00	145.80	5years	291.60
35	Bangalore East	MoWR	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	Yelamallappa Shetty Tank	110.00	176.98	5years	353.96
36	Bangalore East	MoWR	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	Bidarahally Tank	11.00	50.06	5years	100.12
37	Bangalore East	MoWR	HarKhetKo Panni	Renovation and improvements to tanks including desilting of water bodies	Doddagubbi Tank	13.00	60.75	5years	121.50
							531.64	0.00	1063.28
38	Bangalore North	MoWR	HarKhetKo Panni	Renovation and improvements to tanks	Bandekodigehally	8.90	121.40	5years	242.80

				including desilting of water bodies					
39	Bangalore North	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Doddajala Tank	12.64	107.60	5years	215.20
40	Bangalore North	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Bagalur Tank	7.94	83.00	5years	166.00
41	Bangalore North	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Singanayakanahally Tank	4.98	74.12	5years	148.24
42	Bangalore North	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	AddeViswanathapura Tank	4.48	45.73	5years	91.46
43	Bangalore North	MoWR	HarKhet Ko Panni	Renovation and improvements to tanks including	Mahadevakodigehally tank	8.79	52.60	5years	105.20

				desilting of water bodies					
44	Bangalore North	MoWR	Harkhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Alur tank	7.45	62.48	5years	124.96
45	Bangalore North	MoWR	Harkhet Ko Panni	Renovation and improvements to tanks including desilting of water bodies	Sondekoppa Tank	7.98	76.50	5years	153.00
						2283.57	8430.17		16860.34
1	Anekal	MoWR	PMKSY	Providing Lift Irrigation schemes	Construction of lift irrigation scheme from Madappanahalli to Jathagodanahalli and other tank in Anekaltaluk, Bangalore urban Dist	1.00	121.00	5years	150.00
						1.00	121.00		150.00


Abstract

SL. NO	Name of the block or Sub District	Concerned Ministry or Department	Component	Activity	Name of work	Total No./Capacity (Mcft)	Command Area/Irrigation Potential (Ha.)	Period of Implementation	Estimated Cost in Lakhs
1	Bangalore Urban	MoWR	PMKSY	Surface Minor irrigation / Ground water development	Surface Minor irrigation / Ground water development	1	20.00	2-5years	100.00
3	Bangalore Urban	MoWR	PMKSY	Renovation and improvements to tanks including desilting of water bodies	Renovation and improvements to tanks including desilting of water bodies	2283.57	8430.17	2-5years	16860.34
4	Bangalore Urban	MoWR	PMKSY	Providing Lift Irrigation schemes	Providing Lift Irrigation schemes	1.00	121.00	3-5years	150.00
Grand Total									17110.34

BANGALORE URBAN ZILLA PANCHAYATH
PANCHAYATH RAJ ENGINEERING DIVISION, BANGALORE URBAN DISTRICT
PROPOSAL FOR OVERALL DEVELOPMENT OF ZP TANKS

ABSTRACT

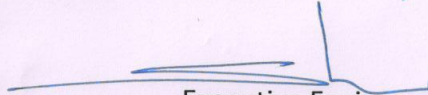
SI No	Name of Taluk	Number of Tanks	Amount Required for Development (Rs. In Lakhs)					Total	Remarks
			1st Year	2nd Year	3rd Year	4th Year	5th Year		
1	Anekal Taluk	217	4500.00	4500.00	2250.00	2250.00	1500.00	15000.00	
2	Bangalore North Taluk	93	1889.00	1889.00	945.00	945.00	627.00	6295.00	
3	Bangalore South Taluk	92	2143.00	2143.00	1071.00	1071.00	715.00	7143.00	
4	Bangalore East Taluk	19	164.00	164.00	82.00	82.00	55.00	547.00	
	Total	421	8696.00	8696.00	4348.00	4348.00	2897.00	28985.00	


 Executive Engineer
 Panchayath Raj Engineering Division
 Bangalore Urban District

BANGALORE URBAN ZILLA PANCHAYATH
PANCHAYATH RAJ ENGINEERING DIVISION, BANGALORE URBAN DISTRICT, BANGALORE
PROPOSED FOR OVERALL DEVELOPMENT OF ZP TANKS

ABSTRACT

SL.NO	Name of Taluk	Number of UGD	Amount Required for Development of UGD (Rs In Lakhs)						Remarks
			1st Year	2nd Year	3rd Year	4th Year	5th Year	Total	
1	2	3	4	5	6	7	8	9	10
1	Anekal Taluk	14	360	601	601	600	240	2402	
2	Bangalore North Taluk	15	662	1103	1103	1103	441	4412	
3	Bangalore South Taluk	55	2523	4205	4205	4205	1682	16818	
4	Bangalore East Taluk	20	835	1391	1391	1391	557	5565	
	Total	104	4379	7300	7300	7299	2920	29197	


Executive Engineer
Panchayath Raj Engineering Division
Bangalore Urban, Bangalore.

4: Strategic Action Plan for Micro Irrigation – Sprinkler –Agriculture Department

Name of the Blocks / sub Districts	Concerned Ministry / Department	Component	Activity	Total Number / Capacity (cum)	Command Area / Irrigation Potential (ha)	Period of Implementation (5 / 7 yrs)	Estimated Cost (in lakhs.)
Bangalore Urban		Per drop more crop (Supplementary water Management activities)				1809	904.910
	MOA & FW-DAC & FW		DPAP Sprinkler(Agri.dept)		2016-17		
			Anekal		300	1 Year	54.0
			B.North		400	1 Year	72.0
			B.East		250	1 Year	45.0
			B.South		300	1 Year	54.0
					1250		225
					2017-18		
			Anekal		300	1 Year	54.0
			B.North		400	1 Year	72.0
			B.East		250	1 Year	45.0
			B.South		300	1 Year	54.0
					1250	1 Year	225
					2018-19		
			Anekal		300	1 Year	54.0
			B.North		400	1 Year	72.0
			B.East		250	1 Year	45.0
			B.South		300	1 Year	54.0
					1250	1 Year	225

				2019-2020		
			Anekal	300	1 Year	54.0
			B.North	400	1 Year	72.0
			B.East	250	1 Year	45.0
			B.South	300	1 Year	54.0
				1250	1 Year	225
				2020-21		
			Anekal	300	1 Year	54.0
			B.North	400	1 Year	72.0
			B.East	250	1 Year	45.0
			B.South	300	1 Year	54.0
				1250	1 Year	225
						1125
			Anekal	1500		270
			B.North	2000		360
			B.East	1250		225
			B.South	1500		270
			District Tot	6250		1125

Annexure 5.5: Strategic Action Plan for Watershed Activities

Name of the Blocks / sub Districts	Concerned Ministry / Department	Component	Activity	Total Number / Capacity (cum)	Command Area / Irrigation Potential (ha)	Period of Implementation (5 / 7 yrs)	Estimated Cost (Rs.in Lakhs)
	DoLR-MoRD	PMKSY Watershed	Newly created WHS				
	DoLR-MoRD		Farm Ponds				
			Anekal	586	1,172	5Years	510
	DoLR-MoRD		Bangalore South	586	1,172	5Years	510
	DoLR-MoRD		Bangalore east	197	394	5Years	171
	DoLR-MoRD		Bangalore North	784	1,568	5Years	682
			TOTAL	2,153	4,306		1,873
	DoLR-MoRD		Check Dams				
			Anekal	20	80	5Years	90
			Bangalore South	20	80	5Years	90
			Bangalore east	0	0	5Years	0
			Bangalore North	10	40	5Years	45
			TOTAL	50	200		225
			Nala Bund				
			Anekal	10	40	5Years	50
			Bangalore South	10	40	5Years	50
			Bangalore east	0	0	5Years	0
			Bangalore North	10	40	5Years	50
			TOTAL	30	120		150
	TOTAL			2,233	4,634		2,248

Annexure 5.6: Strategic Action Plan for Micro Irrigation- Drip – Horticulture Department

Sl. No.	Name of the Blocks / sub Districts	Concerned Ministry / Department	Component	Activity	Total Number / Capacity (cum)	Command Area / Irrigation Potential (ha)	Period of Implementation (5 / 7 yrs)	Estimated Cost (in Rs.)
11		MOA & FW-DAC & FW		anekal		134.2	2016-17	108.31
				Bangalore North		81.6		64.84
				Bangalore south		59.4		47.94
				Bangalore east		17.8		13.11
				Total		293.00		234.20
				anekal		165.60	2017-18	132.48
				Bangalore North		100.80		80.64
				Bangalore south		72.00		57.60
				Bangalore east		21.60		17.28
				Total		360.00		288.00
				anekal		189.00	2018-19	151.20
				Bangalore North		118.00		94.40
				Bangalore south		83.00		66.40
				Bangalore east		20.00		16.00
				Total		410.00		328.00
				anekal		205.00	2019-20	164.00
				Bangalore North		128.00		102.40

				Bangalore south		94.00		75.20
				Bangalore east		23		18.40
				Total		450.00		360.00
				anekal		220	2020-21	176
				Bangalore North		155		124
				Bangalore south		95		76
				Bangalore east		30		24
				Total		500.000		400.00
				anekal		913.80	For 5 years	731.99
				Bangalore North		583.40		466.28
				Bangalore south		403.40		323.14
				Bangalore east		112.40		88.79
				Total		2013.00		1610.20