CHAPTER 2: STUDY AREA

' A river is more than an amenity – it is a treasure that offers a necessity of life that must be rationed among those who have the power over it'.

-Oliver Wendell Holmes, Jr.

India is the seventh largest country in terms of its geographical area and the second most populous country in the world. Politically, the country is divided into 29 States and 7 Union Territories. The Gujarat state, land of opportunities is one of the most developing states located at the extreme west of the country. Gujarat state, shares its international boundary with Pakistan and inter-state boundaries with Rajasthan in the North, Madhya Pradesh in the East and Maharashtra in the South. The state is rich in both, the industrial as well as agricultural resources.

Physiographically, Gujarat is divided into three major divisions- The Kutch, the Saurashtra and the Mainland. Gujarat has 1600 km long coastal belt, which is about one third of the country's coast line. The state has 185, small and

large river basins, out of which only 17 fall in the mainland region that comprises the North, South and Central Gujarat regions. The rivers of North Gujarat have their origin in the Aravalli hills in Rajasthan. The south Gujarat fluvial systems originate from the Satpura Mountain Ranges in Madhya Pradesh and the Sahayadri Range and flow westerly and ultimately debouches into the Arabian Sea. Narmada, Kim, Tapi, Purna, Ambika and Damanganga are the major fluvial systems of South Gujarat. (Fig 2.1)

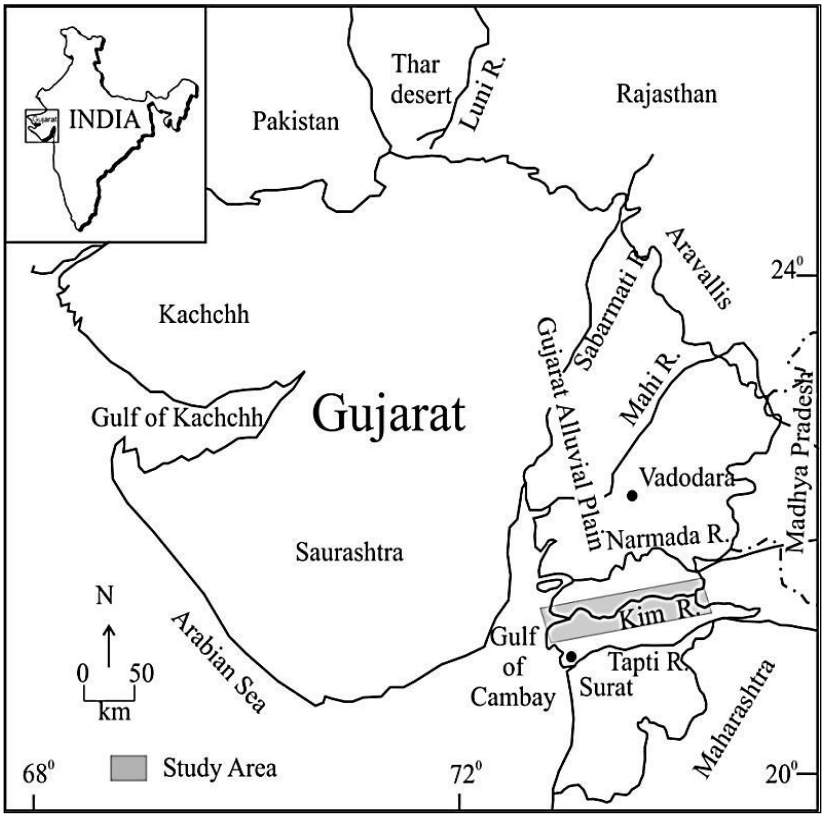

Figure 2. 1 Location of the Study Area

THE KIM RIVER WATERSHED

The Kim River originates from Jharnavadi located in the hill ranges of Narmada (Rajpipla) District in the east. It flows in the western direction covering a total length of 107 km and drains in the Gulf of Khambhat, near the village Kantiajal of Hansot taluka, Bharuch District. The Kim River watershed is geographically bounded between the co-ordinates N - 21^0 19': 21^0 38' and E – 72^0 40': 73^0 27', covering a total area of 1330 km^2 of Bharuch and Surat Districts.

The Kim River shares its watershed boundaries with two major fluvial systems of Gujarat, viz., the Narmada in its North and the Tapi in its South. It has two tributary streams, namely Ghanta and Tokri. Kim River in its initial course flows through the basaltic hilly terrain of Rajpipla hills is dominantly fracture controlled. Further downstream it shows meandering nature as it passes through the narrow sedimentary and vast alluvial plains. Finally the river flows through the coastal plains cutting across the mudflats and debouches in the Gulf of Cambay near Kantiajal. The Kim River has two minor irrigation schemes on its tributary Tokri, viz Baldeva and Pingut Projects.

Physiographically, the Kim River basin can be divided into three distinct regions viz. Eastern (Upper) Hilly Region; Central (Middle) Alluvial Plain and Western (Lower) Coastal Plains. The Eastern Hilly Region is mostly covered with reserved forests with intermittent sporadic tribal hamlets. The highest point in the eastern hilly region attains 225m AMSL and the lowest one attains 05m AMSL in the western coastal plain.

Communication Network:

The Kim River basin is located in the Gujarat State's foremost important industrial belt- The Golden Corridor. Major towns within the Kim watershed are Kosamba, Kim, Tadkeshwar, Nani Naroli, Mota Miya Mangrol and Wankal. Netrang and Zankhvav towns are located just outside the watershed boundary of Kim. Surat and Bharuch are major cities located in the vicinity of the study area. The basin area and its neighbourhood is characterized by a good network of metalled and non-metalled roads connecting major towns and villages. The National Highway-8 and the Delhi-Mumbai Western Railway line also pass through the watershed, giving connectivity to other parts of the state and country. The nearest airport is Surat (40kms) and Vadodara (80kms). Several major state highways like Kim-Mandvi, Kosamba-Mangrol, Olpad-Mandroi, Kim-Vadoli,Wankal-Zhankhvav, Netrang-Mandvi form a strong metalled road grid in the Basin.(Fig 2)

Climatic Conditions:

The Kim watershed falls within the tropical climate zone and therefore, experiences hot summers and dryness in non-rainy seasons. The year is divided into four distinct seasons, viz.

December to February	-	Winter
March to May	-	Summer
June to September	-	Monsoon
October and November	-	Post Monsoon (Hot)

During summer season the study area witness continuous rise in temperature. May is the hottest month with highest mean daily maximum temperature 42^{o}C. From November onwards, till January, temperatures of both, day and night drop and minimum temperature is as low as 10^{o}C during January. The winds are light to moderate from south-West and North-West in summers while strong westerlies prevail during the monsoon season. In winters, the winds are from North and East. The basin area receives rainfall during the south-west monsoon season from June to September with July being the month with highest rainfall. The average annual rainfall of the region in the past decade stands at 1000mm.

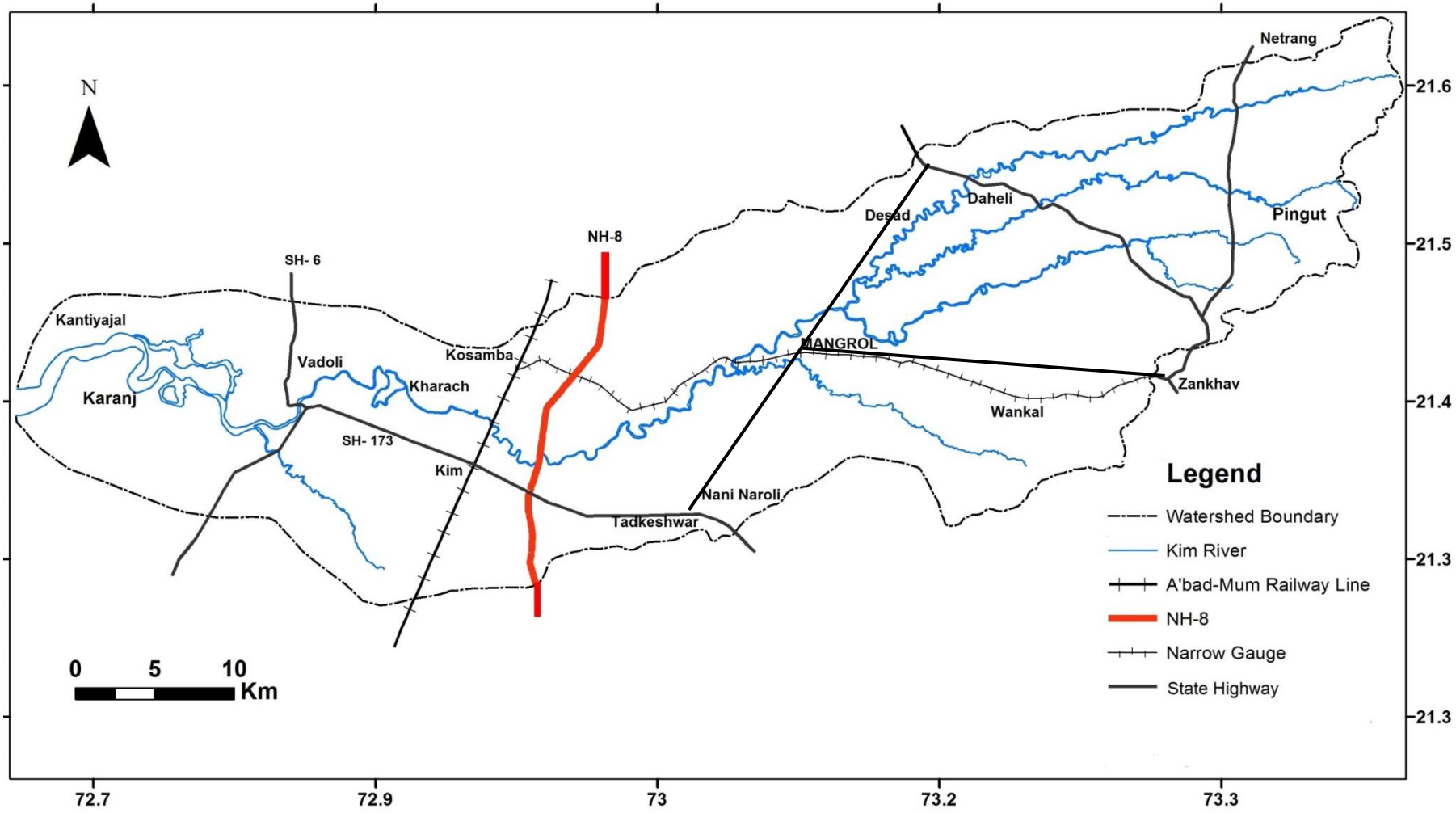

Figure 2. 2 Kim River Watershed and its Communication Network

Water Resources:

The Kim River basin in terms of its water resource potential enjoys comfortable position. In the study area, surface water resource is harnessed through a variety of man-made structures and irrigation schemes. The study area is benefitted through Pingut and Baldeva irrigation schemes and large number of village ponds. In addition, the basin area receives major irrigation water input from neighbouring Tapi watershed region through the Ukai-Kakrapar canal Distribution network that covers almost 60% of the Kim basin Area.

The groundwater potential in the basin area is also adequate except the upper parts of the basin. The upper-middle part is characterized by rocky (basaltic) aquifer which displays large scale fluctuations in groundwater levels seasonally. This invariable fluctuation creates water scarcity especially during lean monsoon period.

There exist patchy outcrops of Tertiary Limestone in the middle parts of the basin. The groundwater potential and quality, both are poor in nature. The middle lower parts being alluvium laden has ample groundwater potential. However, due to excess irrigation and proximity of sea, the water quality is of major concern.

Soils:

The Kim River Basin is characterized by diverse soil conditions and their occurrence and distribution pattern is governed by the processes relevant to geo-climatic conditions of the area and its surroundings. The soil types available in the study area are: the Red (Lateritic) soils comprising partially weathered rock fragments, silt and clay enriched in iron oxide. These red soils are commonly seen in the elevated regions of Mangrol and Valia talukas characterized by moderate slopes. The black cotton soil known for its high fertility occur in the middle and lower parts of the basin described as the Mangrol and Olpad plains. The yellowish soils are common in the talukas of Hansot and Valia and the Gorat soils are found all along the banks of the Kim River. The saline soils are only available near the mouth of the river (Kolay 2007).

Demographic Attributes:

The Kim Watershed is spread over two districts of Bharuch and Surat covering 6 talukas and 213 villages. None of class I or II town is located in the basin area.

District Name		Taluka
Bharuch	-	Hansot, Rajpipla,Valia
Surat	-	Mandvi, Mangrol,Olpad

According to the Census, the total population of the study area stands at 3,44,059 (Census ,2011). There are 925 females per 1000 males. The overall literacy rate of the region is around 80%. The population comprises both, the tribal as well as non-tribal communities. The Scheduled Castes (SC) contributes to 3% while the Scheduled Tribes (ST) almost forms 54% of the total population in the study area.

The upper part of the basin has less population density due to hilly terrain, and limited natural resources. The central and lower parts of the basin have flourishing agricultural and industrial activities along with adequate availability of resources, leading to greater population density. Towns of Kosamba, Kim, Mota Miya Mangrol and Tadkeshwar show urban developments characterised by pucca houses, metalled roads, primary and secondary schools, drinking water supplies and access to basic amenities. Major religions followed by the people inhabiting the basin region are Hindus, Muslims, Christians, Jains and Sikhs (District Census Handbook 2011).

Human Resources:

The Kim watershed being located in the Industrial Golden Corridor of the state and situated between 2 mega basins viz. the Narmada and Tapi basins is actively engaged in both, the agricultural as well as industrial sectors. Occupation wise, the study area has a large chunk of skilled and non-skilled workers, with a small population of marginal and migrational workers. The workers are either engaged as skilled labourers in industries on full time basis or carry out farming as their principal occupation. Non-skilled labours are engaged in construction activities and brick making industries. The marginal workers are only active during the harvest season and consist of almost equal numbers of males and females. Livestock rearing and aquaculture form the minor occupations in this region. On account of on-going industrialisation in this region, a common trend of rural to urban migration is observed. A large population of male marginal workers, along with

their families migrate from Maharashtra to the Kim region during the harvesting seasons of Rabi and Kharif corps.

Agriculture:

In the Kim River basin region, agriculture is a major occupation followed by industrial sector. The basin has total cultivable area of 87281 hectares where the irrigation is either rain fed or done by available water sources (Census,2011). The food and the non-food crops, both are grown in the region. Majority of the cultivation is done in the Kharif and Rabi seasons. The kharif (rainfed) crops are sown in June-July at the onset of the south-west monsoon and are harvested in the months of October-November. The rabi (winter) crops are sown in the post monsoon season (September-October) and are harvested during February-March. Once the summer season starts, depending on the availability of water hot season crops are sown, which are harvested just before the beginning of the monsoon season. The major crops that are cultivated in the basin area are paddy, cotton, sugarcane, groundnut, wheat, chillies, jowar, bajri and various vegetables. Certain fruits like papaya, mangoes, and bananas, are also cultivated in the region along with the local seasonal fruits. A well-established network of canals belonging to various irrigation schemes covers the basin area which serves as a major source of irrigation.

The region being rich in agriculture also inheritates rich livestock population, a cattle wealth which plays a significant role in the rural economy.

Industries:

As it has already been elucidated that one of the major industrial corridors of the Country passes through the study area that includes textiles, food processing, wood and wood products, paper and paper products, rubber and plastics, mining, glass making, mining and alloy units. In all, around, 300 small and large industrial units are present in the study area. Kharach, Karanj, Valia, Warethi, Pipodra, Kosamba, and Mangrol are places where major industrial clusters are located in the Kim Basin. Birla Cellulosic, Piramal Glass, Amrut Cement, Surat Lignite Thermal Power Plant, Geotex textiles are few of the chief industrial units located in the Kim Watershed.

In a very recent past from Surat city, a very large number of small scale textile & dyeing and diamond cutting & polishing industries have been relocated around the Kim town. Gujarat Mineral Development Corporation carries out mining activities in the Tadkeshwar region which has adequate deposits of limestone and lignite, while the Gujarat Industrial Power Corporation Limited has excavated many zones of Mangrol and Valia talukas having rich deposits of lignite and it runs a Smokeless Thermal Power Plant near the Nani Naroli Village of the Mangrol Taluka.

Quarrying of basalt is common in the upper reaches of Mangrol Taluka. Aquaculture and fishing activities of both marine and freshwater habitat are developing in the extreme downstream and estuarine areas of the Kim River. Study area also inhibits several small scale industries like brick kilning and fly-ash brick making.