Annexure-C

CONCEPT NOTE

1. General Data/ Introduction

Basins in Maharashtra-

Maharashtra mainly has 6 river basins namely Godavari, Krishna, Narmada, Tapi, Mahanadi and West flowing rivers. And these 6 basins are divided into 25 sub-basins.

Godavari Basin- Godavari basin is the largest basin in Maharashtra and the area of this basin is 1,52,588 square kilometers. And the basin covers 49.66% of the total area of Maharashtra. A total of 16 rivers flow in the Godavari basin and this basin is spread over 17 districts in Maharashtra.

Krishna Basin - Krishna basin is the second largest basin in Maharashtra and covers an area of 69,425 square kilometers. And 26.81% of the total area of Maharashtra is occupied by this basin. Total 13 rivers flow in Krishna basin. And this basin is spread over 9 districts in Maharashtra.

Tapi Basin - The area of Tapi Basin is 51,304 square kilometers. And the basin covers 16.67% of the total area of Maharashtra. A total of 14 rivers flow in Tapi basin and this basin is spread over 6 districts in Maharashtra.

Western Flowing Rivers - The basin area of Western flowing Rivers is 33,228 square kilometers. And the basin covers 10.79% of the total area of Maharashtra. A total of 16 rivers flow in this basin and this basin is spread over 7 districts in Maharashtra.

Narmada Basin and Mahanadi Basin – Narmada basin has an area of 1338 square kilometers in Maharashtra. And the Mahanadi basin has a very small area in Maharashtra. Mahanadi basin in Maharashtra east of Vidarbha. Tal. Deori Dist. Gondia, Tal. Korachi Dist. Gadchiroli has a total area of 322.38 square kilometers.

Among the above basins, detailed information about Krishna basin is as follows.

Krishna Basin-

Krishna basin is the second largest basin in Maharashtra covering 26.81% of its geographical area. Krishna and Bhima are the main tributaries of this valley. The Bhima River originates at an altitude of 945 meters in the Western Ghats at Bhimashankar in the Pune district of Maharashtra. The total length of the Bhima river is 861 km and it flows through the states of Maharashtra, Karnataka and Andhra Pradesh.

There are a total of 315 watersheds in the Krishna basin in Maharashtra. Cultivable area is 56.98 lakh km. Krishna basin covers 9 districts and 7503 villages in Konkan, Pune, Nashik and Marathwada regions. In Konkan region- Sindhudurg (old Ratnagiri) – 2.25%, Pune in Pune region -98.97%, Solapur -100%, Satara 100%, Sangli -100% and Kolhapur - 98.71% Ahmednagar in Nashik region – 36.25% and Osmanabad in Marathwada region – 60.19% And Beed - 14.65 % of the district wise geographical area of the basin in Maharashtra.

The Krishna basin receives a maximum rainfall of 400 mm to 5000 mm from the southwest monsoon. Krishna Basin Water Disputes Arbitration: K-1 Upper Krishna (Maharashtra Karnataka), K-2 Middle Krishna (Maharashtra Karnataka), K-3 Ghataprabha (Maharashtra Karnataka), K-4 Malaprabha (Karnataka), K-5 Upper Bhima (Maharashtra) Karnataka), K-6 Lower Bhima (Maharashtra Karnataka), K-7 Lower Krishna (Karnataka Andhra Pradesh), K-8 Tungabhadra (Karnataka Andhra Pradesh), K-9 Vedavati (Karnataka Andhra Pradesh), K-10 Musi (Andhra Pradesh), K The entire Krishna basin is divided into 12 sub-basins namely -11 Palleru (Andhra Pradesh), K-12 Muneru (Andhra Pradesh).

Krishna, Koyna, Urmodi, Bhima, Mula, Mutha, Panchganga, Dudhganga, Ghataprabha, Nira, Kukdi, Ghod, Sina rivers mainly flow in Maharashtra.

Koyana, Dhom, Kanher, Tarali, Urmodi, Warana, Radhanagari, Dudhganga, Panshet, Kukadi, Khadkavasala, Warasgaon, Chaskaman, Nira deoghar, Bhalgher, Mulshi, Ghod, Ujjani etc are major dams constructed in Krishna Basin.

Krishna River Information: -

Krishna River is the second longest river in the Indian subcontinent. The originates in the Mahadev Ranges near Mahabaleshwar in the Western Ghats at an altitude of 1337 meters above sea level ($13^0$7'/S to 19^0 20'/S and 73^0 22"N to 81^0 10'/E) and flows through the states of Maharashtra, Karnataka and Telangana to the Bay of Bengal in the state of Andhra Pradesh. The total area of Krishna basin is 2,58,948 square kilometers which is 8% of the total area of the country. The total length of the river is 1,400 kilometers and the length in Maharashtra is 301 kilometers. The basin is roughly triangular in shape and bounded by the Balaghat Ranges on the north, the Eastern Ghats on the south and the Western Ghats on the west. The maximum length and width of the Krishna basin is 701 millimeters and 672 kilometers and lies between 73^0 22'N to 81^0 10'/E latitude and $13^0$7'/N to 19^0 20'/N longitude. The Krishna River basin in Maharashtra drains an area of 69,425 square kilometers (i.e.,26.81% of the total Krishna basin).

Information about tributaries and dams on Krishna River: -

Rivers Krishna, Koyna, Venna, Savitri originate in Satara district. Krishna river has its origin in Mahabaleshwar and after it flows in the first Dhom-Balakwadi dam is constructed and capacity dam is 4.08 TMC. Then Dhom dam of capacity 13.50 TMC is constucted near Dhom village on Krishna river. After the river flows through the town of Wai, Kudali river at Chandwadi, Venna river at Srikshetra Mahuli, Urmodi river at Kashil, Tarli and Mand river at Umbraj all joins to the Krishna river. out of the above tributaries, capacity of Kanher dam on Venna River is 10.10 TMC, capacity of Urmodi dam on Urmodi River is 9.96 TMC, capacity of Tarali dam on Tarali River is 5.85 TMC, capacity of Uttarmand dam on Mand River is 0.88 TMC.

Koyna River originates in Mahabaleshwar. Koyna Dam is located on this river near Deshmukhwadi village in Patan taluka. In the catchment area of the dam, the rivers Solshi and Kandati meet the Koyna river. The capacity of the said dam is 105.25 TMC. After that Koyna river meets Wang, Morna (Patan), Kera rivers. At Karad, Krishna river and Koyna river meet and from here onwards it flows as Krishna river. Also on this river there are K.T. Weirs in Bahe, Borgaon, Nagthane, Digraj, Sangli, Mhaisal and Rajapur.

Yeralwadi Dam of capacity 1.15 TMC is constructed on Yerla river in Satara district. This river meets to the Krishna River at Brahmanal, Tal. Palus in Sangli district

Warana river originate at Chandoli in Shirala Taluka. Capacity of Warna Damis 32.40 TMC. At Haripur, Tal- Miraj, Krishna river and Warana river meet. Also, Panchganga river and Krishna river meet at Nrusinhwadi in Shirol taluka and River flows from K.T. Weir Rajapur, Tal. Shirol to Karnataka State which is located on the border of Maharashtra and Karnataka.

Out of 6 river basin systems of Maharashtra, only 55% of the dependable yield is available in the four river basins (Godavari, Krishna, Tapi and Narmada) east of the Western ghats. The rest drains out in the westward flowing river basins into the Arabian Sea. Over dependency on ground water in a state where its recharge capacity is low, escalates vulnerability of systems dependent on the same such as irrigated agriculture, industries and drinking water.

Maharashtra is prone to drought and floods. Out of the total geographical area of Maharashtra, 40% of the area is drought prone and 7% is flood prone. Rainfall trends indicate that Maharashtra could face an increase in rainfall variability, including droughts and dry spells, as well as increased likelihood of flooding in the future. This has direct

bearing on ground water as heavy intensity rainfall gets lost as runoff while low intensity rainfall which contributes to recharge decreases in frequency.

Climate change vulnerability assessments are necessary for designing targeted adaptation actions. The vulnerability analysis was carried out for different sectors at various levels of governance, on the basis of Macro level Vulnerability Indices, estimated using the Indices of Exposure, Sensitivity and adoptive capacities to climate changes. This was done by the Department of Environment, Government of Maharashtra while preparing the Maharashtra State Action Plan on Climate Change in 2014. The Action Plan has also presented climate projections for future at 25km x 25 km resolution using the Hadley Centre regional climate model.

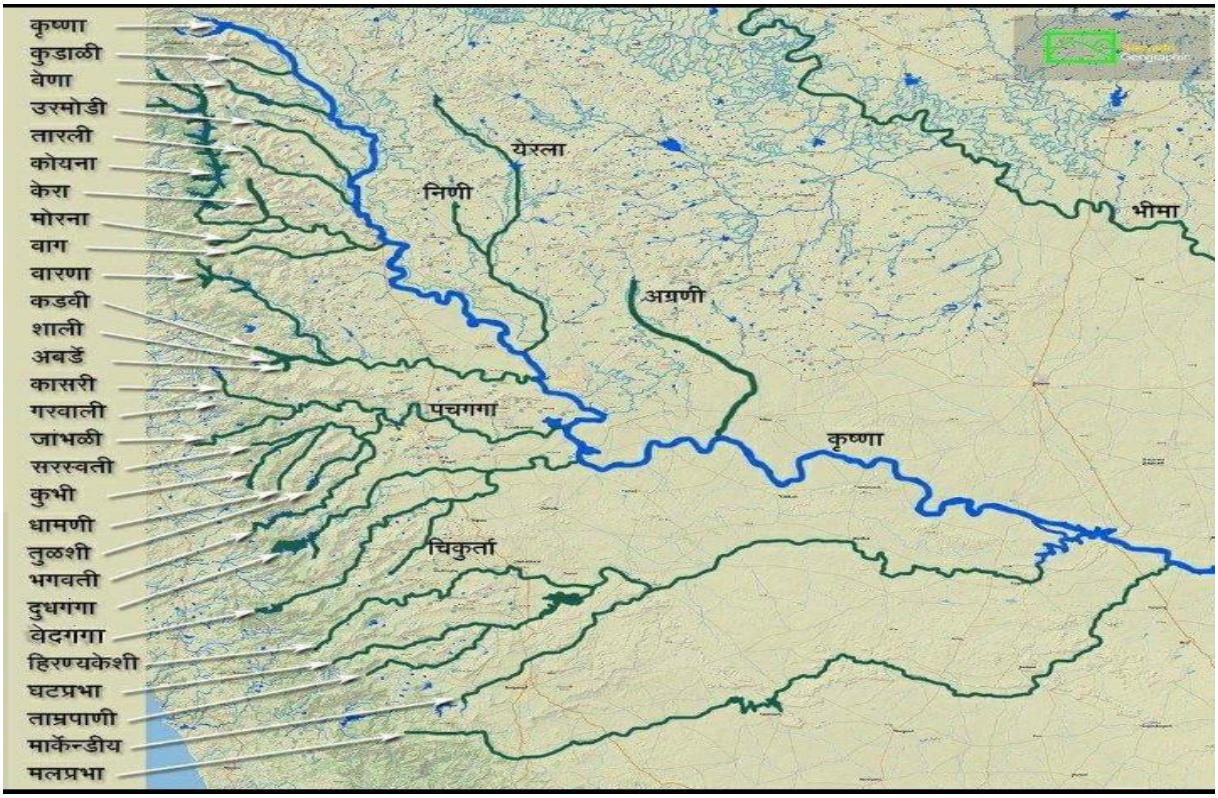
Some of the projected changes in climate over Maharashtra are:

- Increase in mean temperature from 1.2 to 1.6 degree centigrade in 2030s.
- Rainfall is also projected to increase during the same period, with more rainfall projected as we progress from 2030 to 2050 to 2070 but it will be highly variable spatially.
- Annual rainfall shows highest increasing trend for Satara, Mumbai, Kolhapur and Sindhudurg and highest decreasing trend for Bhandara and Latur in 2030s.
- Extreme rainfall events with longer dry spells are projected to increase in all districts of Maharashtra.
- Numbers of dry days are likely to increase by minimum 3 to maximum 9 days in the state by 2030s.
- The sea level is expected to increase by 24 cm to 66 cm along the coastline in sync with the projections for global sea level rise, accompanied by an increase in wave heights, wind speeds, greater storminess and storm surges.

Krishna is an inter-state river that flows through Maharashtra, Karnataka and Andhra Pradesh. This river originates near Mahabaleshwar in Maharashtra and has a length of about 1400 km. Crossing the distance, it meets the Bay of Bengal at Rajamahendri in Andhra Pradesh.

The Krishna River receives its tributaries Koyna, Panchganga, Dudhganga, and Warna. Koyna, Dhom, Kanher, Urmodi and Tarli are the big dams on Krishna River upstream of Sangli city. Also, about 3 km from Sangli city there is a confluence of Krishna-Warna River at Haripur.

Training the tributaries of Krishna River- The Krishna River system is shown in the figure below.



The system broadly shows that most of the rivers joins Krishna river in right-angle or obtuse angle. Also, it is significant to note that, the bed gradients of tributaries are quite steep as compared to that of River Krishna. (Ref MSIWP Report)

The velocity as well as energy level of the tributary is quiet more than that of River Krishna. When the flow of tributary incidents upon Flow of River Krishna, it obviously causes loss of energy viz Velocity and reduction in discharging capacity causing afflux. This cumulative reduction in velocity and cumulative increase in afflux is also responsible for the situation.

Flood Situation Sangli District:

Koyna, Dhom, Kanher, Urmodi and Tarli are the big dams on Krishna river upstream of Sangli town. Also about 3 km from Sangli city, there is a confluence of Krishna-Warna river at Haripur and there is a major dam at Warna on this river. Due to the heavy rainfall in catchment of all these dams as well as in the free catchment area downstream of these dams, there is a large amount of runoff in the Krishna river at Sangli during the monsoon season. In 2005, 2019 and 2021, due to heavy rains, a large-scale flood situation was created in Sangli city and its surroundings. The details of this are as follows.

In the year 2005, heavy rainfall occurred from 25/07/2005 to 15/08/2005 with 2349 mm at Koyna, 3074 mm at Navja. 3565 mm at Mahabaleshwar and 1937 mm at Warna. Due to heavy rainfall on 04/08/2005 the highest flood level observed at Irwine Bridge, Sangli was 53 feet 6 inches. The flood water (53 ft 6 in) remained constant for 13 hours and then receded slowly. Flood waters were above the danger level for the period of 181 hours above 50 feet level for a period of 91 hours. At this time, Irwine Bridge in Sangli had the highest discharge of 1,94,700 Cusecs. Where in the discharge from Koyna, Dhom and Kanher dams was 1,35,885 cusecs in the Krishna river.

In the year 2019, heavy rainfall occurred from 27/07/2019 to 13/08/2019 with 3193 mm at Koyna, 3286 mm at Navja, 3158 mm at Mahabaleshwar and 2989 mm at Warna. Due to heavy rainfall, the Maximum flood level at Irwin Bridge, Sangli was 57 feet 6 inches on 08/08/2019. The flood water level (57 ft 6 in) remained constant for 1 hour and receded. However, the flood water was above the danger level for 8 days from 05/08/2019 to 13/08/2019, and above 50 feet for 6 days. At this time the maximum discharge at Irwin Bridge in Sangli was 2,23,446 cusecs. Out of this, the discharge from Koyna, Dhom and Kanher dams was 1,40,170 cusecs; while the discharge from open catchment area was about 83296 cusecs.

Flood Situation Kolhapur District:

Kolhapur district is situated on the Western Ghats of Maharashtra. Shirol, Hatkanangle, Kagal talukas in the eastern part of this district are located in the plains. While Radhanagari, Bhudargad, Gaganbawda, Panhala, Shahuwadi, Ajra, Chandgad and Gadhinglaj are in the hilly areas i.e. on the Western Ghats. The district is mainly divided into 4 major river basins. The major rivers Warna, Panchganga, Dudhganga and Ghataprabha and their tributaries are originate about 650 to 700 m MSL on the Western Ghats. And it meets the Krishna River flowing towards the east. Studying the rainfall in the district, the maximum annual rainfall is 7000 to 10000 mm in Ghat area & Dam area and 800 mm annually in the Krishna River basin east of the National Highway. In terms of rainfall, the Western Ghats have very heavy rainfall while the Eastern Ghats have less rainfall.

Warna, Dudhganga, Radhanagari and Tulsi are major dams in Kolhapur district. Also Kumbi, Kasari, Kadvi, Patgaon, Chitri, Chikotra, Ghataprabha, Ambeohol, Jambare are medium dams. Among these, Tulsi, Kumbi, Kasari, Varana, Dudhganga, Chikotra, Chitri are gated dams. In addition, there are 55 minor irrigation tanks. All these dams fill up to their full capacity between 10th July to 15th August and water release through spillways.

Major floods occurred in 1989, 2005, 2019 and 2021 mainly in Panchaganga basin. While studying the Panchaganga basin, it has been observed that Kolhapur city, Ichalkaranji city, Shirol, Kurundwad, are densely populated villages on the bank of Panchaganga river and during the flood period these villages suffer huge financial losses due to inundation of water.

The catchment area of Panchaganga river upto Kolhapur city is about 1900 Sqkm. Radhanagari and Tulsi are the two major dams in this catchment area. Among these, Radhanagari dam has automatic gates. Tulsi Dam is a gated dam. Also Kumbi and Kasari are medium dams with gates. Additionally, there are 16 minor irrigation tanks in the Panchaganga basin. Out of all these dams, the catchment area of four dams namely Radhanagari, Tulshi, Kumbhi and Kasari is 198 sq. km. Which is about 10% of total catchment area upto Kolhapur. However, a large amount of rainfall has been recorded in the dam & free catchment area, in the years 1989, 2005, 2019 and 2021, due to heavy rainfall in the Panchaganga basin, Kolhapur city and the villages on the banks of the Panchganga river have suffered huge financial losses.

While studying the flood of 2019, Kolhapur city and Panchaganga river basin, it is observed that in Panchaganga basin, in the dam area of Radhanagari, Tulshi, Kumbhi and Kasari dams and in open catchment area the rainfall intensity was 150 mm to 350 mm for the same of 30/07/2019 to 09/08/ 2019. As a result of this heavy rainfall, the Panchaganga River reached flood water level of 55'7" on 07/08/2019. On this date the highest flood level in the history of Kolhapur, a large part of the district was inundated by the flood water. Karveer, Hatkanangle and Shirol talukas were mainly affected by the flood. At the same time the Koyna dam was filled to its capacity and water was released in the river at a rate of about 1 lakh Cusecs. All this situation lead to the flood and affected the Kolhapur city along with Sangli City.

Flood Disaster Events –

In the years 2005, 2019 and 2021, Krishna, Panchganga and Warna rivers experienced major floods. Due to this flood, the maximum flood level recorded at Irwin Bridge near Sangli city was 57 ft 6 inches in 2019 and 54 ft 6 inches in 2021, while at Rajaram Bandhara near Kolhapur city it was 55 ft 7 inches in 2019 and 56 ft 3 in 2021.

Both these floods received heavy rainfall in a short period of time. Sangli city and most of the villages on the banks of the Krishna were affected by this flood and caused great damage. Also, most of the villages in Kolhapur city, Shirol and Hatkanangle talukas on the bank of Panchganga were hit by floods and suffered heavy losses.

Formation of committee & GR etc. -

After occurrence of heavy flood in Kolhapur & Sangli district Maharashtra Govt. decided to form a committee named Expert Study Committee for the evaluation of floods 2019 event, in analysis and finding results thereof, and to suggest flood mitigation measures for Krishna sub basin on date 23.08.2019. The Chairman of this committee was retired Secretary of Water Resource Department, Maharashtra Govt. Mr. Nandkumar Vadnere and their was 10 expert members in various departments of Govt. of Maharashtra & Govt. of India.

Report of committee -

According to the flood study committee report/ presentation of other measures to be taken to reduce the intensity of this flood and keep the flood situation under control was prepared and submitted to the Corporation/ Govt. Accordingly, Sangli Irrigation Circle, Sangli and Kolhapur Irrigation Circle, Kolhapur were directed to prepare and submit the cost proposal for preparation of concept, budgets and maps for the preparation of the project report of the flood relief works.

Accordingly, Preliminary Project Report (PPR) of flood remedial works has been received from both these Circles. In this, the Circles have submitted preliminary details of the flood control works and the cost proposal for preparing the concept, estimates and maps for preparing the project report of these works. The details of this proposal are as follows.

1 a) Aim (s) of the project and description of works.

1 a) 1. Strengthen the institutional capacities for adaptive planning and mainstreaming flood and multi-hazard mitigation and management, to reduce the impacts of Climate change (CC) & build resilience to futures disasters.

1 a) 2. Establish knowledge base & systems for informed decision-making based on scientific evidence for planning and investments for management of drought and flood management in Krishna and Bhima river basins.

Phase – 1

- Institutional reforms & strengthening MSDMA
- Disaster Risk Assessments & other studies
- Preparation of DPRs with CCP of long-term investments for improved WRM
- flood & drought management

- Critical investments for flood management in hotspots of Krishna and Bhima basins
- Capacity building of human resources, Equipment, software & system for operationalizing flood forecasting
- EWS, DSS platform to strengthen planning & mitigation
- Emergency Operation Centers, State level control room, & related systems.

Phase – 2

- Implementation of long-term investments for flood mitigation
- Updation of DRR system.

This measure will obviate the occurrence of flood optimally however the proper planning is necessary. If we control the floods, it mean that the consequences of flood are obviously avoided. This measure can be classified as SMART management as the infrastructure created/hired for the purpose can be utilized for the arid zones in rest of Maharashtra and the rain gaps affecting the specifically Kharif can be bridged at negligible costs.

1 b) Location of project:-

The project is located in the state of Maharashtra, District Sangli & Kolhapur. The project work will be in Radhanagari, Karveer, Hatkanagale and Shirol Tahsil areas of Kolhapur District and Miraj taluka of Sangli District. The extent of work is from Radhanagari dam (Long.$16^0$24'27" N and Lat. $73^0$57'40 E), upto the boundary of Maharashtra i.e. at Rajapur K.T.Weir on Krishna river (Long.$16^0$37'45" N and Lat. $74^0$39'54 E). The extent of work is around 158 Km.

1 c) Access :-

The project area is accessible by all weather roads. Railway facility and Air facility is available at Kolhapur.

Airport is available at Kolhapur.

Railway station is available at Sangli, Miraj Jn., Jaysingpur and Kolhapur.

National Highway, Pune-Benguluru goes through Kolhapur. Also State highway Ratnagiri-Kolhapur-Miraj-Nagpur passes through this area.

1 d) General topography and physiography and geology of the area :-

Sangli District :

Topography

Sangli City situated on both banks of Krishna river bank between altitude 535.0 m to 550.0m. Krishna and Warana are main rivers flowing in Sangli district. Confluence of Krishna and Warana river is near Sangli City. River Bed level at Irwin bridge is 527.06 m. The length of Krishna river in the district is 105 kms. The bed gradient of river is 1in 4577 from Karad to Irwin bridge, Sangli. Since there is flatter slope and existence of number of meanders, velocity get reduced around Sangli. In addition, due to confluence of Krishna and Warna and also of Krishna and Yerala river, inundation effect around Sangli town is experienced during heavy floods.

Dams

There are 7 major reservoirs upstream of Sangli City namely Dhom, Kanher, Urmodi, Tarali, Koyna, Dhom Balkawadi, and Warana dam is responsible for flood around Sangli. In addition, there are 10 medium dams.

Catchment Area

Free catchment area up to Sangli city is 6646 Sq.km... Free catchment area including Warana river is 8252 Sq Km. and total catchment area up to the Sangli city is 9357 Sq. Km.

Flood Prone Area

Two major rivers flowing in Sangli district are Krishna and Warna. Both catchments normally receive high rainfall in July and August in comparison to free catchment downstream. Inspite of proper reservoir operations, many times, heavy discharges are required to be let out from major dams namely Koyna, Warana, dhom, and many medium dams during heavy floods. Sometimes heavy down pour is also experienced in free catchment. This situation collectively results in huge inflow in the river and area get flooded around Sangli town and few talukas near river mainly Shirala, Walwa, Miraj, Palus & Tasgaon tahsil.

Kolhapur District :

Topography:

Krishna is an inter-state river that flows through Maharashtra, Karnataka and Andhra Pradesh. This river originates near Mahabaleshwar in Maharashtra and has a length

of about 1400 km. Crossing the distance, it meets the Bay of Bengal at Rajamahendri in Andhra Pradesh.

The Krishna River receives its tributaries Koyna, Panchganga, Dudhganga, and Warna. Koyna, Dhom, Kanher, Urmodi and Tarli are the big dams on Krishna River upstream of Sangli city. Also, about 3 km from Sangli city there is a confluence of Krishna-Warna River at Haripur.

Bhogavati River originates in the western ghats near Asane (Dajipur) in the Kolhapur district of Maharashtra state. At Radhanagari dam elevation is 553.90 m. Bhogavati river flows in south-north direction approximate 40 Km where river Tulashi meets at Bid (Tal. Karveer). Then, at Bahireshwar (Tal. Karveer) Kumbhi & Dhamani river meets and Kasari river meets at PrayagChikhali. Then, after it runs as Panchganga river till confluence to Krishna river.

Average bed gradient of Bhogavati River from Radhanagari to Prayag Chikhali is 1: 2529. Then, Prayag Chikhali to Rajaram K.T.weir average bed gradient is 1:4641. Similarly, from Rajaram K.T.weir to shirol K.T.weir it is 1:7700. L-section of Bhogavati and Panchganga River.

Kolhapur City situated on the bank of Panchganga river which is a major tributary of Krishna river. Average altitude of Kolhapur city is 540.00m at the river bank and 560.00 m on the hilly portion.

Dams :

There are 2 major dams namely, Radhanagari (automatic gates) and Tulshi and 2 medium dams viz. Kasari, Kumbhi are constructed in Panchganga sub basin, 1 medium dam named Dhamani dam is under construction.

Catchment Area :

The Free catchment area of Panchganga river up to national highway is 1938 Sq.km and entrapped catchment by the 4 constructed dam is 198 Sq.km.

Flood Prone Area :

In Kolhapur district Panchaganga river receive very high rainfall in upper catchment which is the Western Ghat area of Maharashtra State. Also all dams namely Radhanagari, Tulshi, Kumbhi and Kasari are almost at FRL at the time of flood. But the releases from these upstream side dams during heavy floods not much affect flooding situations. Abnormal heavy precipitation in free catchment of Panchaganga river basin mostly creates the flooding situations. The areas of Kolhapur city as well as parts of tahsils namely Radhanagari, Karveer, Hatkanagale, Shirol are affected by flood.

Radhanagari Dam :

This old dam is having fully automatic gates. Hence it couldn't play role in ROS for flood regulation, it absorbs initial heavy flood to the extent of its FRL capacity of 236 Mm3(8.36 TMC). It has 109 Sq Km catchment areas. Spillway capacity of 7 Automatic gates is 283 cumecs (10000 cusecs). In addition, through 3 old service gates, around 678 cumecs (24,000 cusecs) maximum discharge can be passed. Powerhouse release is 40 cumecs (1400 cusecs).

Remaining three dams in Panchaganga basin namely Kasari, Kumbhi & Tulshi are gated dams. So we can regulate the flow of flood by gates following reservior opeation schedule.

Rajaram K. T. Weir :

The flood level in Panchganga river Observation point is at Rajaram K.T. weir Kolhapur had exceeded danger level i.e. 543.30 m on 03/08/2019. The Maximum level reached on 07/08/2019 at 11.00 am was 546.97 m. The level started to recede below danger level from 14/8/2019. Kolhapur city area from 03 August to 14 Aug (11 days) inundated. Maximum Flood discharge observed was 2111 Cumecs on 08/08/2019 and out of this discharge released from above dams is 728 Cumecs.

Total runoff water received from rainfall was 2656 Mm3 (93.80TMC) out of which 424 Mm3 (15 TMC) (16%) was received from dam catchment area while 2231 Mm3 (78.80 TMC) (84%) was received in free catchment. Free catchment received 4.25 times more runoff outflow than dam catchment. 16% runoff water is flown from 12.28 % of dam catchment. The flood mitigation in Panchaganga basin is difficult since free catchment contribute large area nearing to 88% of total catchment up to Rajaram weir (Kolhapur) where there is no control over the free runoff. In remaining 12% area above dams, out of 4 dams Radhanagari is major dam where also practically no flood mitigation is possible except initial filling upto crest level of automatic gates.

The general topography of the terrain is hilly as it falls in Sahyadri ranges. The physiography is the highly eco sensitivity zone as the western ghats are the second largest Bio-Diversity zone in the world. The geology is Deccan trap.

1 e) Natural resources :-

The project is of flood mitigation. Flood is the natural phenomenon and it is occurring in Kolhapur and Sangli District repeatedly.

This area is the main source of surface water for the state of Maharashtra. Also,

thick and quality forests with rich bio-diversity exist in this zone. No any mineral is seen so far. This zone contains very high fertile and irrigated land having perinial crops like sugarcane, banana and other cash crops. As this area is having Sugarcane as a prominent crop, also this known as sugar belt, Sugar factories are prominently seen here in this zone.

1 f) Overall development of water resources of basin, the present level of utilization of land & water resources and system efficiency: -

Almost all the allocation of water is utilized by the state and the allocation for the D/s states is planned for utilization. There is some scope for the state to make good according to the storages of water. The storages reduced on the count of silting.

Krishna basin upto Maharashtra boundary has total catchment area around 21457 Sq.km. out of which irrigable command area is 1,27,815 Ha. and created irrigation area is 1,29,952 Ha. Cropped area is about 1,21,340 Ha, which has many perennial crops such as sugarcane, banana, like wise cash crops. Almost 80% of the crops is sugarcane, which plays major role economy of this basin. Many efficiently working sugar factories are the denoters of this rich economy.

There are 7 K.T.Weirs, 2 Barrages and 3 Major LIS Schems in flood prone area of Krishna river in Sangli District. Koyana, Urmodi, Kanher, Dhom are major dams on upstream side of Sangli.

Panchaganga basin has total catchment area around 2700 Sq.km. out of which irrigable command area is 65,000 Ha. and created irrigation area is 63,000 Ha. Cropped area is about 72000 Ha, which has many perennial crops such as sugarcane, banana, like wise cash crops. Almost 80% of the crops is sugarcane, which plays major role economy of this basin. Many efficiently working sugar factories are the denoters of this rich economy.

Radhanagari & Tulshi are two major dams and Kasari & Kumbhi are two medium dams along with 11 minor projects feed this main Panchaganga basin.

1 g) Land use and socio-economic (including tribal, backward & drought areas etc and population benefitted / affected: -

During the floods of 2019 and 2021, major part of Kolhapur & Sangli District was affected. The affected city & villages from Kolhapur district are 345 Nos. and houses are 31492 Nos. and in Sangli district affected city & villages are 84 Nos. and affected families are 87228 Nos. Also many Govt. properties are affected by these floods and there is wet drought in the Kolhapur District. After completion of flood mitigation works, occurrence of hazardous situation will be minimized.

1 h) History (earlier proposals)

The project of flood mitigation works is not proposed previously.

2. General Planning / Choice of project :

2 a) Alternative studies carried out for various major components of the project and including water resources planning. Their merits & demerits and reason for final choice of project.

Flood Disaster Events -

In the years 2005, 2019 and 2021, Krishna, Panchganga and Warna rivers experienced major floods. Due to this flood, the maximum flood level recorded at Irwin Bridge near Sangli city was 57 ft 6 inches in 2019 and 54 ft 6 inches in 2021, while at Rajaram Bandhara near Kolhapur city it was 55 ft 7 inches in 2019 and 56 ft 3 in 2021.

Both these floods received heavy rainfall in a short period of time. Sangli city and most of the villages on the banks of the Krishna were affected by this flood and caused great damage. Also, most of the villages in Kolhapur city, Shirol and Hatkanangle talukas on the bank of Panchganga were hit by floods and suffered heavy losses.

Formation of committee & GR etc. -

After occurrence of heavy flood in Kolhapur & Sangli district Maharashtra Govt. decided to form a committee named Expert Study Committee for the evaluation of floods 2019 event, in analysis and finding results thereof, and to suggest flood mitigation measures for Krishna sub basin on date 23.08.2019. The Chairman of this committee was retired Secretary of Water Resource Department, Maharashtra Govt. Mr. Nandkumar Vadnere and their was 10 expert members in various departments of Govt. of Maharashtra & Govt. of India.

Report of Committee -

According to the flood study committee report/ presentation of other measures to be taken to reduce the intensity of this flood and keep the flood situation under control was prepared and submitted to the Corporation/ Govt. Accordingly, Sangli Irrigation Circle, Sangli and Kolhapur Irrigation Circle, Kolhapur were directed to prepare and submit the cost proposal for preparation of concept, budgets and maps for the preparation of the project report of the flood relief works.

Accordingly, Preliminary Project Report (PPR) of flood remedial works has been received from both these Circles. In this, the Circles have submitted preliminary details of the flood control works and the cost proposal for preparing the concept, estimates and maps for preparing the project report of these works. The details of this proposal are as follows.

Flood Study Committee Report & Recommendations:

Major cities and many villages in the two districts of Sangli and Kolhapur have been heavily damaged due to the floods of 2005, 2006, 2019 and 2021. A committee was appointed by the government to find out the causes of the flood situation in the Bhima and Krishna valleys in the year 2019 and to study the future remedial plan in order to take permanent measures in view of the continuous floods in the Krishna River. Krishna sub basin study report by this flood study committee has been submitted to the government on 27 May 2020. State Government's Water Resources Department Government Decision No. Purani 2021/ 275/2021 Simvya (M) Out of 18 recommendations in the report submitted by the Krishna Flood Study Committee (Vadneres Committee) on 12/10/2021, 10 are accepted, 5 partially accepted, 1 accepted with modifications and 2 rejected.

1. Implementation of advanced technology Real Time Data Acquisition System (RTDAS) in the entire basin to enable early warning of emerging floods - **Accepted**
2. Reservoir operation system plans should be revised and should be done for the whole year instead of being limited to the monsoon period – **Partially accepted**
3. Reservoir operation in Krishna basin in an integrated manner – **Partially accepted**
4. Service of expert hydrologist should be engaged in flood monitoring room- **Accepted**
5. Establishment of Basin Level Flood Control Board- **Approved with amendment**
6. Capacity strengthening of India Meteorological Department (IMD) – **Approved**
7. Restoration of natural river channels draining water in urban area-**Accepted**
8. Widening, deepening and desilting of rivers and major drains, flood protection works on river banks, river straightening works etc.- **Partly accepted**
9. Rehabilitating lakes and reservoirs in urban areas and connecting natural drains-**Approved**
10. Plotting of flood line in all areas along the length of main river – **Partially accepted**
11. Control of construction in flood prone areas and removal of encroachments- **Approved**
12. Hydrological inspection and embankment of bridges, causeways, small dams to prevent obstruction of river flow- **Accepted**

Revising reservoir operational system plans to include floods, as well as creation of new reservoirs wherever possible, raising the height of existing dams, increasing storage capacity – **Accepted**

13. River Krishna meanders downstream of Sangli town. For that, this river should be straightened- **partially approved**

14. Diversion of flood water from Krishna basin to Bhima basin for flood control– **Rejected**

15. Keeping disaster management system operational. Preparation of Disaster Management Plan and Standard Operating Procedure – **Accepted**

16. Maps of flood prone areas, flood levels should be prepared and made available in public form – **Approved**

17. Latest and advanced equipment for monitoring dams should be installed in basins of large dams – **Rejected**

2 (b) The project design :-

To find out the causes of flood situation in Bhima and Krishna valleys in 2005, 2019 and 2021 and to prepare future solutions and planning report committee has been formed. This committee has submitted detailed remedial report for flood mitigation. Thus this project is designed and proposed on recommendations of appointed study committee. The following is a proposal of possible cost for preparation of concept, estimates and maps for preparation of project report of flood relief works

Remedial plan for flood situation in Krishna sub basin of Sangli & Kolhapur District, based on Flood Committee Recommendations:

2 b) (a) Sangli District :

Total cost of Rs. 880.00 Crores is expected for implementation of project in Kolhapur District as follows.

2 b) (a) 1. Deepening the river by removing silt from the river bed :-

Floods of 2005, 2006, 2019 and 2021 caused large-scale collapse of river banks; degraded soil, silt deposited in riverbeds which was carried with flood water. Therefore, the river level has increased by about 2 to 3 meters. Therefore, the carrying capacity of the river has decreased. It is necessary to remove the silt from the river and deepen the river bed. It is also necessary to dump the accumulated silt 10 km away from the river. Between Tembhu (Karad) and K.T.Weir Rajapur (Kolhapur) the length of the Krishna River is about 150 km

with an estimated silt volume of 510 lakh cubic meters. Probable cost of this component is Rs. 150.00 crores.

2 b) (a) 2. Removal of K. T. Weir Sangli and Construction of Barrage at Mhaishal on Krishna River:-

For Sangli city being down stream of Irwin Bridge; Water is being supplied through K.T.Weir Sangli. Therefore, if the existing K.T. Weir Sangli is dismantled, the obstruction in the river flow will be removed.

Water is supplied to the drought-prone areas of Miraj, Jat, Kavthe Mahankal taluka through Lift Irrigation Scheme at Mhaisal Barrage by releasing water from Warna Dam. The storage capacity and height of the Mhaishal K.T. weir project is limited. Since there is unavailability of high capacity of K.T. Weir on downstream of Mhaishal K T weir, if the pumps of Mhaishal LIS stops working due to some technical reasons all water flows toward Karnataka because of low capacity of K. T. weir Mhaishal. Hence to control water from river this new work of Barrage is proposed.

Due to the proposed barrage, K. T. Weir Sangli and K. T. Weir Mhaishal will be removed. Hence removal of obstruction in river will help in controlling flood more effectively. Mhaishal Barrage has 16 gates of size 12.00 x 7.80 M. 5 gates of size 12.00 x 7.00 M. and 2 gates of size 04.75 x 7.00 M. and design discharge is 9327.00 cum/sec. capacity of barrage is 1004.96 Mcft. Probable cost of this component is Rs. 199.20 crores.

2 b) (a) 3. Permanent resettlement of flood affected families between Tembhu (Karad) to K.T.Weir Rajapur (Kolhapur) :-

From Tembhu Barrage (Karad), to Sangli city on banks of Krishna river within flood zone. There are a total of 2500 such families in flood zone area. This information regarding the number of families migrating has been made available from Sangli, Miraj, Kupwad Municipal Corporation, Kolhapur Municipal Corporation and Karad Municipality. Probable cost of this component is Rs. 200.00 crores.

2 b) (a) 4. Land acquisition required for Re-sectioning:-

Re-sectioning is proposed within 150 km stretch of the river. Approximately 500 hectares of land has to be acquired on both banks. Probable cost of this component is Rs. 70.00 crores.

2 b) (a) 5. Re-sectioning of River banks & its strengthening:-

Due to the floods of 2005, 2006, 2019 and 2021, a large portion of river banks have collapsed in the river. A large portion of cultivable land of the farmers on the banks of the river has been eroded, washed away. These existing river banks need protection and strengthening. This will increase water carrying capacity of the river.

It is necessary to provide measures like planting grass (Turfing) on the slope, gabbion type stone pitching in certain areas.This will stop further erosion and damages of the river banks between Tembhu Barrage (Karad) to K. T. Weir at Rajapur on Krishna river. Probable cost of this component is Rs. 250.00 crores.

2 b) (a) 6. Obtaining the approval of Environment Department:-

Removal of silt from the river bed, sectioning of the bank and taking measures to stop the pollution of the river bank. To carry out the works of, it is necessary to take the environmental approval of the Central Government. Probable cost of this component is Rs. 5.80 crores.

2 b) (b) Kolhapur District :

Total cost of Rs. 800.00 Crores is expected for implementation of project in Kolhapur District as follows.

2 b) (b) 1. Remodeling of spillway gates of Radhanagari dam:-

This old dam is having fully automatic gates. Hence it couldn't play role in ROS for flood regulation, it absorbs initial heavy flood to the extent of its FRL capacity of 236 Mm3 (8.36 TMC). It has 109 Sq Km catchment area. Spillway capacity of 7 Automatic gates is 283 cumecs (10,000 cusecs). In addition, through 3 old service gates, around 678 cumecs (24,000 cusecs) maximum discharge can be passed. But these 3 service gates need to repair. Powerhouse release is 40 cumecs (1400 cusecs). It is proposed to remodel the spillway of Radhanagari dam for this work automatic gates are proposed to replace by 4 radial gates. Also 3 service gates are to be repaired for their operation in floods. Probable cost of this component is Rs. 85.00 crores.

2 b) (b) 2. Bringing the cross section of the river in a good condition, removing the bottom silt from the river bed and giving proper slope to the stream :-

During flood of 2005, 2006, 2019 & 2021 there is major damage occurred to the Panchaganga river banks. It is considered to remove debris and re-sectioning of the river near Kolhapur city.

Altering the confluences- The data pertaining to topography, geology and hydrology will be procured through surveying and/or records.

The confluence will be designed to make it maximum tangential duly studying the situation prevailing, local obstacles etc. the section will be designed suiting the worst combination of floods possible in the tributary Panchaganga and Krishna. Confluence of Panchaganga & Krishna is at Nrusihwadi, Confluence of Bhogawati and Kasari is at Prayag Chikhali which is origin of Panchaganga river. Confluence of Kumbhi, Bhogawati at Bahireshwar and Confluence of Tulshi & Bhogawati at Beedshed.

The topographic situation may attract a river guiding structure, such structure if required will be designed duly studying the geology for foundation availability, hydrology and other factors such as availability of material etc. Probable cost of this component is Rs. 80.00 crores.

2 b) (b) 3. Rajaram Bandhara and Surve Bandhara near Kolhapur city :-

There are 9 K.T.weir's constructed along the 81 Km length of Panchaganga river. They are at Shinganapur (KMC, Kolhapur), Rajaram, Surve, Rukadi, Rui, Ichalkaranji (KMC), Terwad, Shirol and Kurundwad. In floods these barrages become obstacles for the flow of water in the river. Hence it is proposed to construct balloon type Bandhara at Rajaram Bandhara and Surve Bandhara. Probable cost of this component is Rs. 200.00 crores.

2 b) (b) 4. Bhogavati Dudhganga Tunnel :-

Discharging capacity of automatic spillway gates of Radhanagari dam is 10,000 cusecs. This discharge passes through Bhogavati – Panchaganga river. Which is the major part of flood. Study regarding diversion of this discharge from Bhogavati river to Dudhganga river is carried out. This study is carried out on the basis of Google earth data. It is observed that if 4 Km length of tunnel is prepared along with 2.3 Km of tail channel this diversion tunnel is possible. It is proposed that on the downstream of Radhanagari dam near village Karanjfen, Tal. Radhanagari. R.L. of Bhogavati river is 557.00 m. and on Dudhganga near village Nartawade, Tal. Radhanagari. R.L. is 547.00 m. which shows that there is 10 m. drop in 6.3 Km. length. It is observed that 15 m. diameter tunnel can divert 10,000 cusecs of water from Bhogavati to Dudhganga river during flood situation. It will reduce flood water level in Kolhapur and adjoining area. Probable cost of this component is Rs. 260.00 crores.

2 b) (b) 5. Removal of obstructions to flow in the river channel :-

It is observed that there are too many obstructions for the flow in Panchaganga river reach. There are many bridges constructed across the river, and approach roads for this bridges are prepared by earthwork. Because of this there are formation of bottlenecks. which reduces carrying capacity as well as velocity of flood discharge. These design of bridges are to be checked hydraulically and modified as necessary. Probable cost of this component is Rs. 115.00 crores.

2 b) (b) 6. Land acquisition:-

For the above measures there will be need of land acquisition. Such land acquisition will be decided after model study and detailed design. Probable cost of this component is Rs. 50.00 crores.

2 b) (b) 7. Obtain environmental approval:-

As this project is regarding river flood mitigation, while taking inconsideration the aspects of the river it is need to take permissions for removing debris and resectioning or river from Envoirmental Department. Probable cost of this component is Rs. 5.00 crores.

3. Inter-project/inter-state/international aspects :-

As the project is flood mitigation project and only flood water is transferred from Panchaganga river basin to Dudhganga river basin which are within K-1 Upper Krishna basin. Hence there is no Interstate or International aspect of water sharing. There is no violation of KWDT award.

There are no other project in this district regarding flood mitigation works.

No such case of operation and regulation of the project confirm the stipulation made in the tribunal award/agreement.

4. Survey & Investigation :-

As the project is in initial phase till detailed survey and investigation work is not done. The provision of survey works for designing and planning of the project is incorporated in the project cost. There is need of detailed survey / investigation / sub surface explorations, model studies and designing this project. Presently the estimates are prepared on available flood discharge data and block estimates of each component is prepared.

There is need of geological investigation as well as hydraulic/hydrological studies for the tunnel work proposed in this project.

Ample quantity of construction material is available in vicinity of the site.

5. Hydrology :-

While planning the project the available hydrological data like, discharges from dam and discharges over Rajaram K.T.Weir are taken into consideration. Also flood discharge level, warning level and danger level at Rajaram K.T.Weir is taken in consideration. Also the levels at Irwin bridge and discharges are taken into consideration. Legacy data of flood levels are attached herewith. (Page No. 55)

5.1 Rainfall Pattern in the Krishna Basin

Like most other parts of India, the Krishna basin receives its maximum rainfall during the south-west monsoon. The monsoon winds strike the west coast of the Indian peninsula from the west and south-west and strike the Western Ghats or the Sahyadri Range, which present an almost uninterrupted barrier ranging from 610 m to 2,134 m in height above MSL.

According to the India-WRIS database the average annual rainfall in the Krishna basin is 859 mm. The south-west monsoon sets in the middle of June and withdraws by the middle of October. About 90% of annual rainfall is received during the Monsoon period, of which more than 70% occurs during July August and September. Western parts of the basin receive maximum rainfall However, around 203 blocks of 30 districts (16-Karnataka, 8-Andhra Pradesh & 6 Maharashtra) falling in the basin are drought prone.

There is a large variation in rainfall in Krishna basin in Maharashtra. The maximum of 6,000 mm at Mahabaleshwar and minimum up to 350 mm in Man river sub basin. The ridges of Sahyadri receive annual rainfall of 4,000 mm to 6,000 mm while a 50 km away NH4 (Pune - Bangalore Highway) receives 500 to 600 mm rains. Towards east from this highway rainfall still goes on reducing. Krishna Basin is having 65% of its area in drought prone zone.

While planning the project the available hydrological data like, discharges from dam and discharges over various structures are taken into consideration. Also flood discharge level, warning level and danger level taken in consideration.

6. Irrigation planning

Basically, the project is designed for flood mitigation work. So there is no question arise about command area and cropping pattern.

7. Environmental, ecology & forest aspects of the project :-

Projects needs clearance from :

1. Environmental clearance will be required as de-siltation and re-sectioning of Panchaganga river is proposed. The proposal for environment clearance will be initiated after getting preliminary approval for the project.
2. For the work of re-modelling of spillway gates of Radhangari dam. It is needed to get approval from National Board of Wild Life. The procedure for getting this approval is already initialed by department.
3. No forest land required for project.

8. Cost & Financing :-

8 a) Estimated cost of proposal including Soft components

Maharashtra Resilience Development Programme (MRDP)-World Bank

Component-1	**Institutional and Capacity Development**	
	Component 1.1 : Institutional policies/capacity enhancement (US$ 2 million)	Rs. 16 Cr
	Component 1.2 : Capacity Development (US$ 5 million)	Rs. 40 Cr
	Component 1.3 : Technical Assistance to Strengthen Climate Adaptation measures (US$ 13 million)	Rs. 104 Cr
	Total Component -1 (US$ 20 million)	**Rs. 160 Cr**
Component-2	**Flood Management and Disaster Mitigation**	
	Component 2.1 : Flood control and Remedial Measures in Sangli District (US$ 110 million)	Rs. 880 Cr
	Component 2.2 : Flood control and Remedial Measures in Kolhapur District (US$ 100 million)	Rs. 800 Cr
	Component 2.3 : Other Risk, Flood Management works in other area (US$ 75 million)	Rs. 600 Cr
	Component 2.4 : Landslides, Earthquake, lightening mitigation measures (US$ 50 million)	Rs. 400 Cr
	Component 2.5 : Improving resilience of Cultural Heritage sites (US$ 5 million)	Rs. 40 Cr
	Total Component -2 (US$ 340 million)	**Rs. 2720 Cr**
Component-3	**Improving emergency response capacity**	
	Component 3.1 : Early Warning Dissemination Systems (US$ 15 million)	Rs. 120 Cr
	Component 3.2 : Instrumentation System for Disaster Management (US$ 20 million)	Rs. 160 Cr
	Total Component -3 (US$ 35 million)	**Rs. 280 Cr**
Component-4	**Project Management (US$ 5 million)**	Rs. 40 Cr
	Total Component -4 (US$ 5 million)	**Rs. 40 Cr**
	Total MRDP (US$ 400 million)	**Rs. 3200 Cr**

District wise cost details of components 2.1

Sangli District :

Sr. No.	Remedial Measures	Estimated Cost (In Cr.)
A.	**Approximate cost incurred in preparation of concept, estimates and maps for preparation of project report of flood control works**	
1	To carry out a detailed survey of the river Krishna From Karad To K.T. Weir Rajapur (158 km).	3.30
2	Preparation of design by doing hydraulic study (by external agency).	1.06
3	Preparation of project reports, detailed concepts, estimates, and maps of flood mitigation works and providing necessary information in public domain	0.64
	Total A (Survey & model studies)	**5.00**
B	**Probable cost of taking measures for straightening / deepening and bank protection of river Krishna from Tembhu Barrage to K. T. Weir Rajapur (Kolhapur)**	
1	Deepening the river by removing silt from the river bed.	150.00
2	Removal of K. T. Weir Sangli and Construction of Barrage at Mhaishal on Krishna River.	199.20
3	Permanent resettlement of flood affected families between Tembhu (Karad) to K.T.Weir Rajapur (Kolhapur)	200.00
4	Land acquisition required for Re-sectioning	70.00
5	Re-sectioning of River banks & its strengthening.	250.00
6	Obtaining the approval of Environment Department	5.80
	Total	**875.00**
	Total of Sangli District	**880.00**

District wise cost details of components 2.2

Kolhapur District :

Sr. No.	Remedial Measures	Estimated Cost (In Cr.)
A	**Probable cost incurred for preparation of concept**	
1	The work of surveying, designing and planning for river cross section, restoration, desilting of river.	2.00
2	Construction of barrage instead of Rajaram and Surve K.T.Weir in two places. Survey works only.	1.00
3	Surveying, conceptualization and planning of Bhogavati Dudhganga tunnel work	0.50
4	Removal of obstructions to flow in the riverbed	1.50
	Total A**(Survey & Model studies)**	**5.00**
B	**Probable cost of taking flood control measures in Kolhapur District.**	
1	Remodelling of spillway gates of Radhanagari dam	85.00
2	Bringing the cross section of the river in a good condition, removing the bottom silt from the river bed and giving proper slope to the stream	80.00
3	Rajaram and Surve K.T.Weirs modification.	200.00
4	Bhogavati Dudhganga Tunnel	260.00
5	Removal of obstructions to flow in the riverbed	115.00
6	Land acquisition	50.00
7	Obtain environmental approval	5.00
	Total	**795.00**
	Total of Kolhapur District	**800.00**
	Total Kolhapur & Sangli District	**1680.00**

8 b) Financing pattern of the proposal

Counterpart funding by the Centre or State or both (specify %)	Central Sector (min 50%)	70% (Technical Assistance)
	State Sector (min 30%) for General Category	30-%
	State Sector (min 20%) for Special Category	--
	Other	--

8 c) Foreign exchange element and soft components

Financial arrangement (in crores and USD Million)

Tranche	Total external assistance sought	Implementing Agency	State Govt.	Central Govt.	Other, If any	Total cost
In INR Cr.						
Tranche-1	2240	0	960	0	0	3200
Total	2240	0	960	0	0	3200
Percentage	70	0	30	0	0	100
In USD Million						
One USD = 80.0000 INR						
Tranche-1	280	0	120	0	0	400
Total	280	0	120	0	0	400
Percentage	70	0	30	0	0	100

8 d) Benefit Cost Ratio of the project

As the project is of flood mitigation works there is no any question arises of Benefit cost Ratio.

Annexure –D

Details of Projects

Sl No.	*Name of project*	*Category*	*District (s) River/Basin*	*Estimated cost*	*Culturable Command Area in ha*	*Water Availablity*	*Area u nder irrigation (in ha)*	
							At present	*Proposed after the project*
1	Maharashtra Climate & Floods, Draught & Resilience Improvement project	New Scheme	Sangli & Kolhapur / Krishna & Panchaganga river / Krishna Basin	3200.00 Cr.	N.A.	N.A.	N.A.	N.A.

Panchganga River

Maximum Water Levels at Rajaram K.T. Weir

Date	Water Level		Discharge	
	feet	meter	cusecs	cumecs
20/07/1988	43'6"	543.45	63136	1790
27/07/1989	50'6"	545.61	69184	1961
19/08/1990	43'2"	543.34	62870	1782
29/07/1991	44'10"	543.85	64201	1820
21/07/1992	37'6"	541.62	44591	1264
13/07/1993	42"2"	543.04	61888	1754
15/07/1994	46'8"	544.41	65675	1862
21/07/1995	37'8"	541.67	45360	1286
29/07/1996	39'0"	542.07	53467	1516
02/08/1997	44'2"	543.65	63668	1805
10/07/1998	37'4"	541.57	43822	1242
23/07/1999	44'4"	543.70	63802	1808
14/07/2000	39'7"	542.25	57092	1618
11/07/2001	37'5"	541.59	44206	1253
14/08/2002	40'9"	542.61	60443	1713
23/06/2003	30'6"	539.48	31386	890
14/08/2004	40'3"	542.45	59937	1699
27/07/2005	49'6"	545.27	68030	1928
12/08/2006	45'10"	544.16	65001	1842
02/07/2007	43'4"	543.39	63003	1786
13/08/2008	46'7"	544.39	65605	1860
18/07/2009	40'5"	542.51	60107	1704
29/07/2010	42'2"	543.04	61888	1754
09-05-2011	41'6"	542.84	61209	1735
02/08/2012	33'4"	540.35	34010	964
27/07/2013	41'6"	542.84	61209	1735
25/07/2014	39'2"	542.12	54503	1545
25/06/2015	32'2"	540.29	33809	958
13/07/2016	46'2"	544.26	65267	1850
27/07/2017	41'11'	542.96	61634	1747
19/07/2018	44'5"	543.72	63868	1810
7/08/2019	55'7"	547.13	75352	2136
7/08/2020	44'10"	543.85	64201	1820
24/07/2021 (3.00 वा)	56'3"	547.33	76383	2165
13/08/2022	41'8"	542.89	61379	1740