VISVESVARAYA JALA NIGAM LIMITED
(A Government of Karnataka Enterprise)

FINAL DETAILED PROJECT REPORT

OF

UPPER BHADRA PROJECT

(G.O. No: WRD166 vbye-2020(part I) Bengaluru dated 16/12/2020)

COST OF THE PROJECT
Rs.21,473.67 Crores

VOLUME - I / III

MAY 2022

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DOCUMENT RELEASE SHEET					
11	13.05.2022	Incorporating Client Observations	RL	UP	MSP
10	08.03.2022	Incorporating Client Observations	RL	UP	MSP
09	08.02.2022	Incorporating the Approved CWC Final Cost	RL	UP	MSP
08	03.04.2019	Incorporating Updated Cost of CBC and TBC	VS	KSL	KSL
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Client:

CHIEF ENGINEER
Karnataka Neeravari Nigam Limited
(A Government of Karnataka Enterprise)
UPPER BHADRA PROJECT ZONE CHITRADURGA

Document:

Final Detailed Project Report

VOL- I / III

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Project:

Upper Bhadra Project (Comprehensive)
(Combined Tarikere Lift and Flow, CBC, JBC and TBC with Drip Irrigation System)

File Name: DPR: 05-22: UBP

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UPPER BHADRA PROJECT
(Comprehensive)

PROJECT AT A GLANCE

UPPER BHADRA PROJECT AT A GLANCE

1.	Estimated Cost of Project	:	Rs.21473.67 Crores (As per price level WRD SR 2018-19)
2.	Proposed ICA	:	225515 Ha
3.	Cropping Pattern	:	Khariff Semidry - 225515 Ha, by Drip Irrigation
4.	Utilisation	:	29.90 TMC
5.	District and Taluk Wise Area & Tank Fillings	:	

District	Taluk	Total Area for Irrigation (Ha)	Tank Filling (Nos.)
Chikamagalur	Tarikere	22189	81
	Kadur	22366	32
Chitradurga	Hosadurga	44608	27
	Holalkere	371	21
	Hiriyur	67034	32
	Chitradurga	28966	08
	Challakere	13266	51
	Molkalmuru		20
Tumkur	C.N.Halli	4657	19
	Sira	14558	41
	Pavagada		30
Davangere	Jagallur	7500	5
Total		**225515**	**367**

6 (a)	No. of MI Tanks for Stabilization	:	367 Tanks in Chikkamagalur , Chitradurga, Tumkur and Davanagere District
6 (b)	No, of MI Tanks proposed for Filling	:	(i) 236 Tanks under Chitradurga, Tarikere lift & Jagalur Branch Canal. (ii) 131 Tanks under Tumkur Branch Canal
7.	Utilisation	:	
(a)	Irrigation facility to Chikkamagalur, Chitradurga, Davangere and Tumkur Districts	:	21.90TMC
(b)	Stabilization of existing MI Tanks in Command Area of Chitradurga, Tumkur, Jagalur Branch Canal and additional tanks filling in Chitradurga Districts	:	6.00 TMC
(c)	Augmenting VV Sagar Reservoir	:	2.00 TMC
	Total	:	29.90 TMC

Upper Bhadra Project Brief

Upper Bhadra Project create an Irrigation Potential of 2,25,515 Ha in central plateau and drought prone land of Karnataka and covers four districts of Chikkamagalur, Chitradurga, Davangere and Tumkur and to fill 367 tanks in the command area.

The taluk wise detail of irrigation and tank filling is given below.

Sl. No.	District	Taluk	Area for Irrigation (Ha)				Total Area for Irrigation (Ha)	Tank Filling (Nos.)	Remarks
			Tarikere Lift	Chitradurga Branch Canal	Tumkur Branch Canal	Jagalur Branch Canal			
1	Chikamagalur	Tarikere	20150	411	1628	-	22189	81	
		Kadur	-	1864	20502	-	22366	32	
2	Chitradurga	Hosadurga	-	31035	13573	-	44608	27	
		Holalkere	-	371	-	-	371	21	
		Hiriyur	-	37052	29982	-	67034	32	
		Chitradurga	-	23266	-	5700	28966	08	
		Challakere	-	13266	-	-	13266	51	
		Molkalmuru						20	
3	Tumkur	C.N.Halli	-	-	4657	-	4657	19	
		Sira	-	-	14558	-	14558	41	
		Pavagada						30	
4	Davangere	Jagallur	-	-	-	7500	7500	5	
	Total		**20150**	**107265**	**84900**	**13200**	**225515**	**367**	

***Note**: TBC - Tumkur Branch Canal, CBC - Chitradurga Branch Canal, JBC - Jagalur Branch Canal*

17.40 TMC of water is proposed to be lifted from river Tunga at upstream of Upper Tunga Project in 2 stages and is led into existing Bhadra Reservoir. 29.90 TMC of water is lifted from Bhadra Reservoir again in 2 stages and carried through a tunnel (6.90 Km). Tarikere Gravity and Lift canals will take off from delivery chamber to be constructed before tunnel near Ajjampura and provides irrigation facility of 20150 Ha of land and filling 79 tanks in the Command Area. Chitradurga and Tumkur Branch Canals takes off at the exit of Tunnel and distribute water for irrigation and tank filling. Tank filling is considered necessary to recharge ground water which in turn provides drinking water diluting the fluoride contents in specific areas.

The amount of water proposed to be used for irrigation is 21.90 TMC as finalized by CWC for Semi dry crop in Khariff (June to October) only and for the tank filling 8.00 TMC (6.00+2.00), which includes 2.00 TMC for augmentation of Vanivilasa Sagara dam. It has been possible to cover an area of 2,25,515 Ha utilizing 21.90 TMC of water by adopting drip irrigation.

The estimated cost of the project is `.21473.67 crores.

The Environmental Impact Analysis is carried out by M/s Environmental Health and Safety Consultants for UBP Scheme A and necessary clearances from MoEF, New Delhi are obtained. Provision is made for amelioration, monitoring and management as per EIA report.

The project is scheduled to be completed over during 2023-24.

UPPER BHADRA PROJECT

INDEX MAP

UPPER BHADRA PROJECT

CHECK LIST & SALIENT FEATURES

DETAILED PROJECT REPORT

SECTION - I

Check List

I	**GENERAL DATA**	
1.	Name of the Project	Upper Bhadra Project
2.	Location (a) State(s) (b) District(s) (c) Taluka(s)/Tehsil(s) (d) Longitude/Latitude (e) Survey of India Topographical Map reference No.(s) (f) Earthquake Zone number (g) Complete address for correspondence along with pin code/e-mail	 Karnataka Chikkamagalur, Chitradurga, Davangere & Tumkur N.R.Pura, Tarikere, Kadur, Hosadurga, Chitradurga , Challakere, Jagalur, Hiriyur, Chiknayakanahalli & Sira Latitude : 13^0 18' N Longitude : 75^0 28' E 48-O, 57-B, 57-C and 57-F Zone - II Chief Engineer, Visvesvaraya Jala Nigam Limited, Upper Bhadra Project Zone, Chitradurga-577501 ubpchief@gmail.com
3.	Category of the Project (a) Irrigation/Multipurpose (b) Storage/diversion	 Multipurpose Diversion
II	**PLANNING**	
4.	Has the Master plan for overall development of the river basin been prepared and stages of basin development discussed?	Yes. (The Project comes under 734 TMC master plan of Revised KWDT-I)
5.	Have the alternative proposals (including set of smaller developments vis-a-vis a single large development) been studied and their merits and demerits discussed.	Yes. (Alternatives have been studied and the present proposal is found to be feasible.)
6.	Does the scheme fit in the overall development of the river basin and has its priority in the overall development of the basin been discussed?	Yes.
7.	Have the other Departments concerned with the development been informed?	Yes.
8.	Is the present scheme proposed to be executed in stages? If so, are its various stages of execution and development discussed in the report?	Yes.
9.	Are the effects of the scheme on the riparian rights & existing upstream and downstream projects etc. discussed?	Yes.
10.	Has the provision for municipal and industrial water supply been made?	No.

III	**INTERSTATE AND INTERNATIONAL ASPECTS**	
11.	Are there any International/Interstate issues involved'? If so have these issues been identified and present status of agreement or **tribunal decision** indicated specially in respect of (a) Sharing of water (b) Sharing of cost (c) Sharing of benefits (irrigation, flood control. power etc.) (d) Acceptance of the submergence by the upstream state(s) (e) Acceptance by the upstream state(s) of compensation of land coming under submergence (f) Settlement of oustees (g) Any other NOTE: - If there is no agreement, state the present position against each of the above item.	Yes – Interstate issues. The project is being implemented by Government of Karnataka in its water share. The rivers Tunga and Bhadra originate in Karnataka State and no upstream state is involved. (There is no additional submergence in the existing reservoirs.)
IV	**SURVEYS**	
12.	Have the detailed topographical surveys been carried out for the following items and maps prepared as per prescribed scales	
	(a) River surveys	Does not arise. The water will be utilized from Upper Tunga reservoir and Bhadra Reservoirs.
	(b) Reservoir surveys	Existing Bhadra reservoir will be used as a transit storage reservoir.
	(c) Headwork surveys dam(s), dyke(s), barrage (s). weir(s) etc and auxiliary components)	Not applicable
	(d) Plant and Colonies' sites	Yes
	(e) Canal(s), branch canal(s) and water distribution system	Yes
	(f) Major canal structures	Yes
	(g) Power house. switch -yard. surge shafts. Tailrace	Not applicable
	(h) Tunnel(s), adit (s), penstocks etc.	No hydropower generation is envisaged. However, a tunnel is proposed near Ajjampura for conveyance of water for irrigation.
	(i) Surveys (detailed and sample) of areas of the command for OFD and drainage works.	Yes
	(j) Soil surveys	Yes
	(k) Surveys for soil conservation	Yes
	(l) Any other surveys i.e. archaeological. right of way communication etc.	Not applicable
V	**GEOLOGICAL INVESTIGATIONS**	
13.	Have the geological surveys for the following items been carried out and report on geology of the following appended?	
	(a) Region as a whole	Yes.
	(b) Reservoir	Not applicable
	(c) Headwork and energy dissipation area	Not applicable
	(d) Powerhouse and appurtenances	Not applicable
	(e) Intakes and regulators	Yes.
	(f) Major canal structures	Yes.
	(g) Tunnel(s), Penstock(s), hill(s) etc.	Not applicable
	(h) Communication routes	Yes.

	(i) Any other	Detailed geological investigations are carried out for pump houses and tunnel.
VI	**SEISMIC INVESTIGATIONS**	
14.	Has the seismicity of the region been studied and coefficient of vertical horizontal acceleration for the various structures discussed?	Yes.
15.	Has the approval of the Standing Committee for recommending design of seismic coefficients for River Valley Project been obtained?	Not applicable as existing reservoirs are utilized in the Scheme.
16.	Is there possibility of liquefaction of foundations? If so whether liquefaction studies been carried out?	Not applicable as existing reservoirs are utilized.
VII	**FOUNDATION INVESTIGATIONS**	
17.	Have the detailed foundation investigations (including in-situ tests and laboratory tests) for the following structures been carried out and detailed report(s) appended? (a) Earth and rock. fill dam(s) (b) Masonry/concrete dam(s) (c) Barrage(s)/Weir(s)/head regulatorts) etc (d) Canal(s) & Canal Structures (e) Power house(s), tunnel(s), transformer cavern(s), desilting chamber(s), surge tank(s)/ shaft(s), intake(s). (f) Pump House(s) (g) Any other: Tunnel and Aqueduct Under Canal System.	 Not applicable Not applicable Not applicable Yes. Carried out for Tunnel(s), surge tank(s) Yes. Yes.
18.	Are there any special features affecting the designs?	No
VIII	**CONSTRUCTION MATERIAL SURVEYS**	
19.	Have the surveys and laboratory tests for the· following construction materials been carried out and report(s) appended?	
	(a) Soils for impervious, semi-pervious and pervious zones of earth and rock-fill dam(s) (b) Sand (c) Rock and coarse aggregates (d) Bricks and tiles (e) Pozzolona (f) Cement and lime stone (g) Steel (h) Any other	Not applicable (No new earthen dam is proposed) Yes. Yes. Not applicable. Not applicable as it is not used. Yes. Yes. ----
20.	Have the sources for each of the above material been identified and need etc. indicated?	Yes. Rock - Rock obtained during execution will be utilized. Sand - Tunga river is the source and quarry is identified. Cement & Steel - Materials will be purchased from open market from reputed manufacturers.
21.	Have the proposals for procurement of scarce materials been indicated?	Not applicable.
IX	**HYDROLOGICAL AND METEOROLOGICAL INVESTIGATIONS**	
22.	(a) Have the hydrological and meteorological investigations been carried out and status of following data discussed in report? (i) Rainfall (ii) Temperature (iii) Sunshine (iv) Gauge & Discharge	 Yes. The meteorological data have been obtained from I.M.D. Station Yes.

	(v) Sediment (vi) Water quality (vii) Evaporation (b) Has the above data been collected & appended?	Not applicable. Yes. Yes.
X	**HYDROLOGY**	
23.	Is the hydrology dealt with in detail in a separate volume? Have its brief details been included in this Report?	Yes.
24.	Have an index map and bar chart showing locations. of various hydro-metric, climatic and rainfall stations existing/ ongoing/ planned water resources projects and .the data availability at those stations been attached?	Yes.
25.	Have required detailed note .about project specific hydro-meteorological data observatories been attached.	Yes.
26.	Have required detail in case of Himalayan rivers. If project being planned in upper reaches. The satellite imageries of project catchment especially one during snowmelt period (March-May) and one during monsoon (June-September) period been attached?	Not applicable.
27.	Are detailed notes about quality, consistency, processing and gap filling of the data included.	Yes.
28.	Have hydrological studies been carried out for the following: (a) To establish the availability of water for the benefits envisaged? (b) To determine design flood for the various structures (spillway. weir. barrage etc.) (c) Sediments storage (d) Design flood for diversion during construction (e) Tail water rating curve (f) Evaporation rates from reservoirs / concerned area (g) Command area rainfall	 Yes. Not applicable. Not applicable. Not applicable. Not applicable. Yes. Yes.
29.	Has the Ground Water Potential (existing use and additional availability) been indicated?	Yes.
30.	Have the studies regarding reservoir sedimentation been carried out and revised elevation-area capacity curves been used in the simulation studies (Working Table)?	Yes.
31.	Have the ecological requirements of water such as low flow augmentation and water quality control etc. and water requirement for domestic, industrial use and power generation (thermal, hydel, nuclear) been considered and included in the Project Report and incorporated in the simulation studies?	Environmental monitoring is being made during execution. The project caters to irrigation and groundwater recharge by filling up tanks.
32.	Have the details of the simulation studies. (Working Tables) and conclusions arrived from the various alternatives explaining the factors and assumptions been included and discussed?	Yes.
33.	Has the number of failures for different aspects been indicated?	Yes.

34.	Have the likely desirable and, undesirable changes in the hydrologic regime due to the project been brought .out in the report.	Yes.
35.	Is the criteria adopted for selection of the construction diversion flood discussed?	Not applicable.
36.	.Has the basis for determining the stage capacity been discussed?	Not applicable.
37.	Have integrated working tables (for more than one reservoir in the system) been prepared?	Yes.
38.	Has carry over storage been provided? If so, whether studies for most economic carry over storage been done?	Not applicable
39.	Have the flood routing studies, been carried out?	Not applicable
40.	Have the back water studies been carried out?	Not applicable
XI	**LAND ACQUISITION AND RESETTLEMENT OF OUSTEES**	
41.	Have the type and quantum of 'land proposed to be acquired in the submerged area, project area, area coming under canals and distribution system, area required for rehabilitation of the outers been detailed?	Yes.
42.	Is the basis for provision for land compensation indicated?	Yes.
43.	Have the rehabilitation measures, amenities and facilities to be provided to the Project Affected Persons been discussed and whether their provisions included in the report? Are these in accordance with State's policy/project, specific policy/draft national policy for rehabilitation and resettlement '	Yes.
44.	Are the basis of land acquisition of the submerged area upto FRL/MWL etc. discussed?	Not applicable.
XII	**DESIGNS**	
45.	Does the state have established a Central Design Organization and State level multidisciplinary Advisory Committee and whether its composition has been indicated in the report?	No. Not envisaged.
46.	Has the selection of final location of the 'head works and appurtenances, in preference to the other sites investigated been discussed?	Yes
47.	Have the layout of the project viz location of head works, workshop sheds, offices, Colonies etc, been finalized" and discussed?	Yes
48.	Has the layout of the various major components of the head works been discussed in the light of site features, geology, foundation characteristics etc.?	Yes
49.	Have the detailed designs been prepared for the following components & got vetted by CDO? (a) Earth or rockfill dam, masonry or concrete dam, spillway, barrage, weir etc. and appurtenances. (b) Energy dissipation arrangements, training walls etc. (c) Openings through dams-galleries head regulators, penstocks other outlets, sluices etc.. (d) Regulators	 Not applicable. Not applicable. Not applicable. Yes

	(e) Canal and water conductor system (f) Canal structures & Tunnel (g) Pump house, intake structures (h) Power house, tunnels, surge shaft (i) Instrumentation (j) Power evacuation arrangement (k) Design of Hydro Mechanical equipments	Yes Yes Yes Yes (for Tunnel) Yes Not applicable. Yes
50.	Have the salient features of the above components ·and the assumptions made in the design of above components of the project been indicated and their basis discussed?	Yes.
51.	Have any model studies been carried out for location of the dam, spillway 'and other appurtenances & checking the design profile, of the spillway, energy dissipation arrangements location of outlets/ regulators etc?	Not applicable.
52.	Has the final alignment of canal(s) and branch canals(s) been. Discussed in the light of various alignments studied?	Yes.
	(a) Does the canal design provide for meeting requirements of rush irrigation? (b) Have any intermediate storages and tail tanks been considered to reduce the canal capacities?	Is not applicable to Drip Irrigation System No.
53.	Are the canals and distribution system being lined and if so what is the minimum capacity of the channel proposed to be lined?	For water distribution micro irrigation system is being used. Lining is provided for Main Canal upto Tail end.
54.	Is the location of canal structures on main and branch canals fixed after detailed surveys of the final alignments?	Yes.
55.	Are the regulation arrangements of the off-taking channel both near and away from the cross regulators discussed?	Yes.
56.	Are sufficient escapes including terminal escapes provided on the main/branch canal distributaries / minors?	Yes.
57.	Have the basis for adopting water way for the cross drainage works been discussed?	Yes.
58.	Have the proposals for rating the canal section by providing standing wave flumes. rating of the falls, broad crested weirs V: notches etc. been discussed for the canal and distribution system?	Yes.
59.	Have any model studies for major canal structure(s) been carried out and if so are the results discussed and incorporated in the design?	Yes. Model study of pump house and delivery arrangement are carried out and results incorporated in the design.
XIII	**IRRIGATION AND COMMAND AREA DEVELOPMENT**	
60.	Have the conveyance and field irrigation efficiencies for paddy and upland crops during kharif, rabi etc. been indicated, discussed and justified?	There is no paddy in the cropping pattern. The conveyance and field efficiencies for semi-dry crops for Khariff are considered.
61.	Have the 10-daily/monthly crop water requirements at the canal head been worked out?	Fortnightly crop water requirements are considered.
62.	Are there any proposals for introducing warabandi and if so have these proposals been discussed in the report and sample calculations for a typical distributary / minor / sub-minor furnished?	No. The distribution to the fields is by LPS drip irrigation by rotation through network of pipe lines. A sample calculation is enclosed.

63.	Has the present position of irrigation in the command through existing canals, tanks, lift schemes. wells etc. been brought out ·in the report? .	Yes.
64.	Are the particulars of all irrigation projects (including minor schemes) existing / proposed in the command been indicated?	Yes.
65.	Are there any potential areas, where ground water is available? If so, has the quantity & quality of the ground water been indicated?	Yes.
66.	Has the quantum of available ground water been assessed and plan for its conjunctive use with surface water been prepared and incorporated in the report?	Yes.
67.	Have the semi-detailed soil surveys been carried out for the entire command? If not the extent of area surveyed may be indicated.	Yes.
68.	Have soil and land irritability classifications brought out in the report?	Yes.
69.	Is the method used for determining the crop water requirements discussed?	Yes.
70.	Has the pre-project cropping pattern and the proposed cropping pattern along with justification been furnished?	Yes.
71.	Has the proposed cropping pattern been certified by Centre/State Agricultural Authorities giving the statement of having considered the soil characteristics and land irrigability characteristics of the command area in-deciding the percentage of the command area falling under respective crops as suggested in DPR.	Yes.
72.	Whether drinking water needs of the population projected for the 25-30 years after construction of the project on enroute and that in the command of the project considered.	Yes.
73.	Whether the proposed G.W utilisation is certified by CGWB and a statement furnished.	Groundwater utilization is certified by Dept of Mines & Geology.
74.	Are the areas and percentages of the CA that will be irrigated during kharif, rabi, two seasonal, summer and perennial been indicated?	Yes.
75.	Is justification furnished' for irrigating perennials and summer crops from the reservoir?	Not applicable.
76.	Have the monthly reservoir operation studies been carried out at least for.20 years and summary on annual basis attached?	Yes.
77.	Have the number of blocks selected for detailed surveys for On Farm Development (OFD) works including drainage and total area covered by such blocks been indicated?	Provision is made.
78.	Have the existing locations of the Trial cum Demonstration Farm, input centres (seeds, fertiliser and insecticides) in the command been indicated and proposal to strengthen the same discussed?	Provision is made.

79.	Have the arrangements for financing the OFD works and proposals, if any, for strengthening, the same been discussed?	Provision is made.
80.	Have the agencies responsible for execution of OFD Works been identified and simultaneous planning of execution of OFD works along with engineering works discussed?	Yes.
81.	Has-the year-wise phasing of irrigation development as a result of the project been discussed?	Yes.
82.	Is the existing communication system telephone wireless and roads within command area sufficient to meet the requirement after full development of irrigation? If not, have the new proposals been planned and discussed?	No. Provision for new roads is made.
83.	Is the adequacy of the marketing centres in the Command Area and new proposals to meet the requirements after full development of irrigation been discussed?	Yes.
84.	Is there any stabilization of existing irrigation proposed?	Not applicable.
XIV	**FLOOD CONTROL AND DRAINAGE**	
85.	Have the various flood control components of the multipurpose project been indicated?	Not applicable.
86.	Have the damage areas in pre-project & post project situations been identified and flood intensities worked out at each of the damage centre(s) which gets affected?	Not applicable.
87.	Have the following flood aspects been discussed? (a) Flood cushion in the reservoir. (b) Maximum moderated flood out flows over the spillway etc and its frequency.	Not applicable.
	(c) Existing and proposed safe carrying capacities of the channel below the dam after construction of flood embankment channel improvement, river diversion etc. (d) Synchronized moderated peak floods due to releasers) from the dam' upstream and un intercepted catchment upto the damage centres. (e) Average annual expenditure incurred' on flood relief works. (f) Area and population affected/likely to be affected before/after the project. (g) Estimated saving in annual loss of life, property, cattle, crops etc. (evaluated in terms of money) due to flood control.	Not applicable.
88.	Have the following drainage aspects of command area. been discussed? (a) Existing Surface and. sub-surface drainage network and problems of the drainage congestion, water logging, alkalinity/salinity If any. (b) Studies on sub soil water table (pre -monsoon, post-monsoon etc.)	Not Applicable. Drip Irrigation

	(c) Maximum intensity of 1, 2, and 3 day rainfall. (d) Deficiencies in farm drains. (e) Deficiencies in existing natural drains. (f) Proposal for improvement of drainage water logging /alkalinity/salinity of the area along with justification thereof. (g) Identification of the area in Command which will get benefited due to execution of drainage net-work and benefits thereof in terms of relief from crop damage, increased yields etc.	
XV	**NAVIGATION**	
89.	Is the present scheme for remodeling of the existing facilities and/or extension of the navigable reach or establishing new navigable reach?	Not applicable.
90.	Is the existing inland transport system being fully utilized? If not, have the bottlenecks in its full utilization been identified and discussed?	Not applicable.
91.	Have the surveys for goods and passenger traffic been carried out and discussed?	Not applicable.
92.	Is the extent of modification required in the existing system discussed and justified?	Not applicable.
93.	Do design for the canal section and structures take into account the navigation requirements?	Not applicable.
94.	Have the proposals to develop the new scheme and phases of development in the different reaches been discussed?	Not applicable.
95.	If the area is being served by inland water transport, have the following been discussed: (a) The existing toll rates and registration fees for the crafts (size wise) (b) Proposals for revision of tollage rates and fees, if any. (c) Concurrence of the competent authorities for revision of rates and fees. (d) Proposal to subsidies the tariff, tollage, craft registration fee, passenger fare etc. to attract traffic.	Not applicable.
96.	Has the State Inland Water Authority been consulted while finalizing the scheme and its view point discussed?	Not applicable.
97.	Has economic justification and viability of the navigation component of the multipurpose project. been discussed?	Not applicable.
XVI	**POWER**	
98.	Have the following points been discussed? (a) Availability of the' power generating capacity' in the state as well as in the region from different sources. (b) Total energy available and' peaking capacity of the system in the state as well as in the region 'from different sources. (c) Integrated operation of the system and present status of utilisation in the state as well as in the region.	Approval for providing power supply to the scheme is obtained from state electricity board.

	(d) Surpluses and shortfalls in the system in the state as well as in the region. (e) Future plans of power development from different sources in the State / region. (f).Fitment of the scheme in planning of power 'development of the State / region. (g) Energy generated from the project firm .power, seasonal power and total power (h) Proposal for transmission lines connecting to. The existing system/grid. (i) Project cost per kwh installed' and per kwh generated at bus bar as compared to the different hydro-electric thermal generation and gas projects a different sources .in the State as well as in the region to justify the power component of the project.	
	(j) Whether the proposed addition to the transmission system 'has been shown-on a geographical map. Whether options considered for the proposed addition have been discussed with statement of justification for the selected option after carrying out supporting studies covering. load flow studies, short-circuit studies (three phase and single phase and stability studies (k)*Whether .sufficient 'Surplus off Peak power is available for pumping of water from lower to upper reservoir. (l) Actual off peak" energy requirement of proposed, scheme (m)*Cost of peak-and off peak energy* *for pumped storage schemes only.*	(Not applicable).
XVII	**CONSTRUCTION PROGRAMME AND PLANT AND MANPOWER PLANNING**	
99.	Are the .major components of work proposed to be done departmentally or through contractor?	Contractor.
100.	Have the various alternative construction programme been studied and proper justification furnished for the final programine adopted?	- Yes -
101.	Has the proposed. construction programme' been prepared and synchronized for timely completion of each of the major component of work including' Command Area-Development?	- Yes -
102.	Have the year wise quantities of .the following materials of construction been worked out for various components of the project: (a) Excavation separately in -soft and hard strata	Yes.
	(b) Earthwork in filling-impervious, semi-pervious and pervious (c) Rockfill- for dam, toe, riprapetc: (d) Stone for masonry (e) Coarse aggregate for concrete (f) Sand- for filter, masonry/concrete (g) Gravel- for. Filter (h) Steel of various sizes and type	Yes.

	(i) Cement-normal, quick/slow setting with or without pozzolona, special types (j) Lime-surkhi-pozzolona (k) Scarce material-special steel (l) Other material-fuel, electricity, explosive etc.	
103.	Have the year wise quantities to be executed by machine/labour for each of the major component been worked out for each of the above material?	Yes.
104.	Have the labour intensive items- of the various major components of the project been identified and the quantities of such items .worked out?	Yes.
105.	Have PERT chart or CPM diagrams for construction programme of various components "been made and included 'in report? Has organisational set up and frequency for project monitoring been indicated in the Report?	Yes.
XVIII	**FOREIGN EXCHANGE**	
106.	Have the details of the plant and machinery, spares, instruments and scarce materials to be imported worked out?	Yes.
107.	Has the phasing of imports and source(s) of imports been discussed item wise?	Yes.
108.	Are the imports to be affected under foreign grants/credits or internal resources of the country?	Yes.
109.	Is the scheme covered under State sector or Central sector?	State Sector. Proposed to be included under Central Sector.
XIX	**FINANCIAL RESOURCES**	
110.	Has the Concurrence of the State Finance department been obtained?	Yes.
111.	Is the scheme included in the Five Year/Annual Plan? If not what is the present position regarding its inclusion in the plan?	Yes. Included in 12th Five Year plan
112.	Whether the scheme has already been started? If so, is the present stage of construction indicated?	Yes. Present stage is indicated.
113.	Have the year wise requirement of funds been indicated?	Yes.
114.	Is the scheme covered or proposed to be covered under any foreign assistance/aid agreement?	No.
XX	**ESTIMATE**	
115.	Is the separate volume of estimate attached as appendix?	Yes.
116.	Is the year to which the rates adopted in the estimate relate to indicated?	Yes. 2018-19 DSR of Water Resources Department is considered.
117.	Have the analysis of rates for various major items of work for the major components of the project been furnished and with basis of analysis described?	Yes.
118.	Are the provision for the following items made on the basis of sample survey and sub- estimates: (a) Distributaries, minor and sub-minors (b) Water courses (c) Drainage (d) CAD Works	Yes.

XXI	**REVENUE**	
119.	Are the basis for the following sources of revenues furnished?	
	(a) Betterment levy and proposal for its recovery	Not applicable.
	(b) Irrigation cess (c) Flood protection cess (d).Crop wise water rates (e) Sale of water for village / city / industrial / power / water supply (f) .Miscellaneous	Yes. Not applicable. Yes. Not applicable. ---
120.	Have these rates been compared with the existing rates at the other projects in the State/region?	The rates are as per rates fixed by the Government which is uniform in all the projects of the State.
121.	In case the rates are being enhanced, has the concurrence of the concerned department (s) been obtained?	Enhancement of rates is not envisaged.
122.	Have the organisational set up for the collection of revenue been indicated?	Yes.
XXII	**B.C.RATIO**	
123.	Are the allocated cost for the following components of the multipurpose project worked out and basis therein furnished? (a) Irrigation (b) Power (c) Flood Control (d) Navigation (e) Water supply (f) Any other	 Yes. Yes. Not applicable. Not applicable. Not applicable. ---
124.	Have the various departments of the State/Centre agreed to the sharing of the above allocated cost?	Not applicable.
125.	Have the crop wise benefits been worked out for irrigated and un irrigated crops being grown before project in consultation with the agriculture department and statement furnished?	Yes.
126.	Have the crop wise benefits been worked out for proposed cropping pattern after. the introduction of irrigation in consultation with the agriculture department and statement furnished?	Yes.
127.	Is the B.C. ratio of Irrigation Projects acceptable or otherwise justified?	Yes. Acceptable as it is more than 1.0.
128.	Is the B.C. Ratio for Flood Control Projects acceptable or .otherwise justified?	Not applicable.
129.	Is the B.C. ratio for power component of the project acceptable or otherwise justified?	Not applicable.
130.	Have- the financial and economic return statements been furnished keeping in view the phasing of development?	Yes.
131.	Are the benefits other than those considered in the B.C. Ratio and financial return statement been identified?	Yes.
132.	Is the benefit from Gallper land, if proposed, based on lease rates admissible and statement from concerned Central / State authorities furnished?	Not applicable.
133.	Are the benefits front fisheries, horticulture, if proposed, based on lease rates admissible and	Not applicable.

	statement from concerned Central/ State authorities furnished	
XXIII	**ECOLOGICAL ASPECTS**	
134.	(a) Is the area likely to have any of the following environmental and ecological problems due to the altered surface water pattern? If yes, whether preventive measures have been discussed? (i) Excessive sedimentation of the reservoir and the upper reaches of the river and its tributaries tailing into reservoir (ii) Water logging, salinity/alkalinity (iii) Quality of surface and ground water (iv) Ground water recharge (v) Health hazards-water borne diseases, industrial pollution etc. (vi) Submergence of important minerals deposits (vii) Submergence of monuments / archeological sites (viii) Fish culture and aquatic life (ix) Plant life (flora) (x) Wild Life (xi) Migratory birds (xii) National parks and sanctuaries (xiii) Seismicity due to filling of reservoir (xiv) Likely change in the regime of the river (xv) Any other (b) Have the environmental and forest clearances from MOE&F been obtained? If not what is status thereof?	Environmental clearance for the project as per original proposal is obtained on 10-05-2010 & 10-07-2017 from MoEF, New Delhi. (a)Forest clearance is obtained on 17-06-2020 for diversion of 96.95 Ha. in Muttinakoppa minor forest and Aramballi reserved forest in Koppa division of package 1. (b)110.10 Ha of forest land in Bhadravathi division on 22-12-2017 (c) 111.57 Ha of forest land in Janakal reserve forest and Lakkihalli reserve of Hosadurga range and Chitradurga forest on 20-12-2017
XXIV	**COLONIES AND BUILDINGS**	
135.	Has the planning of the colony/building been done keeping in view the ultimate use for optimum utilization of investment?	Yes.
136.	Has an estimate of the extent of higher cost involved been made and details discussed?	Yes.
137.	Are the permanent buildings being constructed required for maintenance of the project only?	Yes.
138.	Can the buildings Other than required for maintenance of the project being constructed be put to some other use after the completion of the project by the department or any other agencies?	Yes.
139.	Have the interested agencies been consulted in planning of the buildings to suit their requirements later on?	Yes.
140.	Have the proposals for disposal of temporary buildings been discussed?	Yes.

XXV	**PUBLIC PARTICIPATION AND COOPERATION**	
141.	Are the possibilities of these been discussed in:	
	(a) Planning (b) Construction (c) Improved agricultural practices (d) Any other	Yes. Yes. Yes. ---
142.	Have public debates about utility of projects been: held and the response thereof outlined in the Report?	Yes.
XXVI	**SOIL CONSERVATION**	
143.	Is the need for soil conservation measures in the 'catchment of the project discussed?	Not applicable.

SECTION-II
SALIENT FEATURES

	The following salient features (and any others) as applicable to the project, shall be furnished:	
1	Name of the Project,	Upper Bhadra Project
2	Type of Project (Irrigation or Multipurpose)	Multipurpose
3	Location	
3.1	River Basin (a) Name (b) Located in (i) State(s) (ii) Countries (if international river)	River Basin Krishna basin, Tunga Bhadra Sub-Basin Located in Karnataka/ Andhra Pradesh / Maharashtra ---
3.2	River / Tributary	Tunga river and Bhadra river
3.3	State(s) / District(s) / Taluka(s) or Tehsils in which following are located: (a) Reservoir (b) Headwork (c) Command Area (d) Power- house	 Karnataka / Chikkamagalur / Tarikere Karnataka / Chikkamagalur / Tarikere Karnataka / Chikkamagalur, Chitradurga, Tumkur, Davangere / Tarikere, Kadur, Hosdurga, Hiriyur, Chitradurga, Holalkere, Chikka Nayakanhalli, Sira, Jagalur Not applicable.
3.4	Name of village near the Head-works	Lakkavalli
3.5	Location of Head-works (a) Longitude (b) Latitude (c) Lies in Earthquake Zone-No.	 75^0 28' E 13^0 18' N Zone-II
3.6	Project area reference to: (a) Degree Sheets (b) Index Plan	 48-O, 57B, 57C,57F 48-O, 57B, 57C,57F
3.7	Access to the project distance from project site (a) Airport (b) Rail head (c) Road head (d) River port (e) Sea port	275 Kms from Bangalore & 35 Kms from Shimoga Bangalore 300 Km Tarikere 20 Km Lakkavalli 3 Km Not available Mangalore 300 Km
3.8	Rail / Road transportation limit of (a) Weights (T) (b) Dimensions (Lx B x H)	 As per prevailing norms As per prevailing norms

4	**International Interstate Aspects of the Project** (a) Catchments area of the basin	The water from existing Tunga & Bhadra Reservoir will be utilized. The Catchment area of existing reservoirs. (i) Tunga (up to dam site) = 2440 Sq. Km. (ii) Bhadra (up to dam site) = 1968 Sq. Km
	(b) State-wise / country-wise details of catchments area	Lies within Karnataka state
	(c) Submergence due to projects (i) In the state (ii) In other states (iii) In other countries	No submergence is involved
	(d) Water allocation for the state (if any)/country (e) Water allocation for other states / countries	
	(f) Committed utilization	(i) 21.50 TMC under KWDT-I award for Krishna basin
4		(ii) 2.40 TMC additional allocation to Karnataka State by virtue of Indirasagar - Pollavaram Diversion Scheme in Andhra Pradesh (iii) 6.00 TMC of water from MI allocation under KWTD - I for Krishna basin (K-8 & K-9 Sub Basins) i.e, 21.50+2.40+6.00 = 29.90 TMC
	Upstream Projects	There are no upstream projects.
	Irrigation Water Thermal Industrial Hydel Supply (evaporation losses)	
	(i) Projects completed	(i) Bhadra Project (ii) Gondi Anicut (iii) Tunga Anicut
	(ii) Projects under construction	(i) Upper Tunga (ii) Ubrani-Amrutapura LIS
	(iii) Future Projects	No.
	(iv) Any other	---
	Downstream Projects	
	Irrigation, Water Thermal Industrial Hydel, Supply (evaporation losses)	Singatalur Project & Tungabhadra Project
	(i) Projects completed	Tunga Bhadra Project
	(ii) Projects under construction	Singatalur Project
	(iii) Future Projects	No
	(iv) Any other	---
	Sub Total (f) :	Sub Total : 7
	(g) Proposed Annual utilisation by the project (i) Irrigation	
	- Kharif	**Irrigation** 620.406 MCM (21.90 TMC) — **Tank Filling** 226.63 MCM (8.00 TMC)
	- Rabi	--
	- Hot weather	--
	Total:	**29.90**
	(ii) Water Supply	--
	(iii) Hydel (evaporation losses)	--
	(iv) Thermal power	--

	(v) Industrial Gross annual utilization {sum of (i) to(v)} (h) Minimum agreed/proposed flow in the river for maintaining ecology	-- 29.90 TMC Not applicable.
5	**Estimated life of the project (years)**	25 years
6	Irrigation (ha.) By flow By drip (a) Gross command area (GCA) (b) Area under Irrigation (break up): (i) Kharif (ii) Rabi (iii) Hot weather (iv) Two seasonal (v) Perennial (vi) Gross irrigated area (GIA)** (vii) Intensity of irrigation $\frac{(GIA \times 100\%)}{CCA}$ (viii) Districts (s) Benefited (if the district benefited is predominantly tribal or drought prone, it may be so indicated against each district) ** Irrigated area under Kharif, two seasonal, perennial, rabi and hot weather shall be indicated. (c) Cost per hectare of gross area irrigated (d) Cost-per 1000 cum of gross/live storage (e) Cost per 1000 cum of water delivered at the (Canal head/outlet) (f) Water utilization	By drip 355748.76 Ha 225515 Ha --- --- --- 225515 Ha 100 % Chikkamagalur - Drought Prone Chitradurga - Drought Prone Tumkur - Drought Prone Davangere - Drought Prone 9.52 Lakhs / Ha NA NA 29.90 TMC
7	Flood control	Not applicable.
8	Navigation	Not applicable.
9	Water supply	Not applicable.
9.1	Domestic	Not applicable.
9.2	Industrial	Not applicable.
10	Project Performance	
	(a) Irrigation Period or Simulation No. of failure, (b) Power (c) Flood Control (d) Water Supply (e) Navigation	 43 years 16 years Not applicable Not applicable Not applicable Not applicable
11	**Hydrology**	
11.1	Catchments	
11.1.1	Catchments area at headwork site (Sq. Km) (a) Gross (b) Intercepted: (i) By existing projects (ii) By ongoing projects (iii)By contemplated projects (c) Un intercepted	 Upper Tunga 2240 Sq. Km (865 Sq. miles) Bhadra 1968 Sq. Km (760 Sq. miles) At Tunga Dam Nil Sq. Kms AT Bhadra Dam Nil Sq. Kms --- --- --- At Upper Tunga Dam 2240 Sq.Kms. AT Bhadra Dam1968 Sq Kms.

	Note: - In case of a downstream weir /barrage regulating the supply to the canal(s) similar details shall he furnished for the catchments between head works and the weir/barrage.	
11.1.2	Catchments area classification according to mode of precipitation (sq. km.) (a) Rain fed (b) Snow fed	 At Tunga Dam 2240 Sq.Kms. AT Bhadra Dam 1968 Sq Kms. ----
11.2	Precipitation	
11.2.1	Catchments	

	Rainfall (Weighted mm)
	Annual
(a) Average	202" to 43"
(b) Maximum	202"
(c) Minimum	43"
(d) Co-efficient of variation	

11.2.2	Command

	Cropping Season			
	Annual	**Kharif (June-October)**	**Rabi (November-February)**	**Hot (March -May)**
(a) Annual	---		---	---
(b) 80% dependable	---		---	---
(c) ETO (mm)	1847.33	648.97	584.73	613.63

11.3	Annual yield calculated at the proposed site (TMC)

		Tunga		Bhadra	
		Gross	**Net**	**Gross**	**Net**
(a)	Maximum	267.481	-	151.415	-
(b)	Minimum	72.877	-	44.449	-
(c)	Average	167.52	-	92.102	-
(d)	Dependable (Percent)	**Annual**	**Monsoon (June - October)**	**Annual**	**Monsoon (June - October)**
(i)	50	159.397	153.785	88.475	81.817
(ii)	75	133.4	126.077	77.630	70.656
(iii)	90	115.719	109.294	66.363	58.569
(iv)	98	97.26	86.03	46.503	41.713

11.4	Climatic Data (Command)	
11.4.1	Name of Station(s) and period of record	

Sl. No.	Names	Period of Record	
		from	**to**
1.	Chitradurga	1951	1980

Source : Hydrometeorological Data IMD

11.4.2	Data (average of Chitradurga station in command area)	

	Normal	Maximum	Minimum
(a) Air temp (^{0}C)	25.28	30.33	20.23
(b) Humidity (per cent)	61.71	74.83	48.58
(c) Wind (km/hr)	9.43	14.30	6.50
(d) Water-temperature (^{0}C)	22.75	27.30	18.21

11.5	Seismic coefficients (a) Horizontal (b) Vertical	
11.6	Utilisation within the State (Mm^3)	29.90 TMC (846.55 Mm^3)
11.6.1	Water availability (State's share in case of interstate river)	133.40 TMC @ 75% dependability in Tunga river 159.40 TMC @ 50% dependability in Tunga river
11.6.2	Committed Utilisation	

		Major	Medium	Minor
(a)	Upstream Projects	Nil	Nil	Nil
	(i) Projects Completed			
	(ii) Projects under Construction			
	(iii) Future Projects			
	(iv) Any Other			

		Major	Medium	Minor
(a)	Downstream Projects	Details enclosed in Hydrology Chapter		
	(i) Projects Completed			
	(ii) Projects under Construction			
	(iii) Future Projects			
	(iv) Any Other			

11.6.3	Proposed Utilization by the Project (a) Irrigation (i) Kharif (ii) Rabi (iii)' Hot Weather (iv) Perennials Total:- (b) Water Supply	 29.90 TMC --- --- --- 29.90 TMC ---	
11.7	Floods near the headwork site	Not applicable.	
12	**Reservoir**		
12.1	**Reservoir**	**Tunga Dam**	**Bhadra Dam**
	(a) Maximum Water Level.(MWL)	589.20 m	657.75 m
	(b) Full Reservoir Level (FRL)	588.24 m	657.75 m
	(c) Minimum Draw Down Level (MDDL)		636.40 m
	(d) Crest Level	583.50 m	
	(e) Outlet levels		
	(i) Irrigation	582.168 for LBC 582.778 m for RBC	612 m for LBC 631.5 m for RBC
	(ii) Power		
	(iii)Others (Please specify)		
	(f) Dead Storage Level		631.50 m
12.2	Free board (m)	Not applicable.	
12.3	Wave height (m)	Not applicable.	
12.4	Live storage (Mm^3)	63 TMC	

12.5	Capacity (Mm^3) at : (a) Maximum water level (b) Full reservoir level (c) Minimum draw down level (d) Dead storage level	 - - - -
12.6	Flood absorption capacity (Mm^3) (a) Below FRL (b) Between FRL & MWL	Not applicable.
12.7	Sedimentation (Mm^3) and levels after	Not applicable.
	Years **50** **100** (a) Above MDDL (b) Below MDDL (c) Encroachment of live storage (percent) (d) New zero elevation	
12.8	Average monthly evaporation losses from the reservoir (Mm^3)	

[

Month	Average Evaporation loss (Mm^3)
January	348
February	318
March	347
April	345
May	223
June	117
July	156
August	257
September	282
October	341
November	343
December	359

12.9	Seepage in the reservoir	Not applicable.
13	**Submergence**	Not applicable.
14	**Headworks**	
14.1	**Head Regulator(s)**	Not applicable.
15	**Canal System**	
15.1	Main Canal (Name)	Tarikere Flow & Lift, Chitradurga Branch Canal (CBC) & Tumkur Branch Canal (TBC), Jagalur Branch Canal (JBC)
15.1.1	Purpose of canal (Irrigation/Power/Navigation/Diversion/Water Supply/ Multipurpose)	Multipurpose
15.1.2	Type (a) Flow/lift (b) Lined-unlined (c) Discharging capacity of the channel above which lining is proposed (d) Type of lining	 Lift Lined Tarikere Lift 5.04 Cumecs for Pipe Line Network CBC 53.493 Cumecs, TBC 37.477 Cumecs, JBC 6.015 Cumecs Concrete
15.1.3	Design data	

	Design Data	Tarikere Lift	Chitradurga Branch Canal	Tumkur Branch Canal	Jagalur Branch Canal
(a)	Length (Km)	Tarikere Flow 72.00	134.597	159.684	43.65
(b)	Full supply level at head / tail (m)	739.702	734.800 / 694.308	733.700 / 676.918	708.620 / 697.850
(c)	Full supply depth at head / tail (m)	-	4.80 / 3.00	3.70 / 0.30	1.65 / 1.55
(d)	Bed width at head / tail (m)	-	6.00 / 3.80	6.00 / 0.30	2.60 / 2.00
(e)	Side slope at head / tail	-	1 :1 / 1 :1	1 :1 / 1 :1	1 :1 / 1 :1
(f)	Bed slope (range)	-	1:10000 / 1:4000	1:8000 / 1:1500	1:4000 / 1:3000
(g)	Maximum discharging capacity at head / tail (m^3 / sec)	5.04 (Pipe Line Network)	55.125 / 25.128	37.477 / 0.075	6.015 / 5.055

	Design Data	Tarikere Lift	Chitradurga Branch Canal	Tumkur Branch Canal	Jagalur Branch Canal
(h)	Total number of canal structures (No's)	Nil	424	437	84
(i)	Total assumed head losses across the structure (m)	-	17.87	5.30	3.05
(j)	Gross Command Area (Ha)	25188	187895.13	121285.71	21379.92
(k)	Irrigable Command Area (Ha)	20150	107265	84900	13200

15.2	Efficiencies (percent) (a) Conveyance	75%	
	(b) Field application	90%	
16	**Cropping Pattern**	**Percentage Area (CCA)** **Existing**	**Proposed**
16.1	Name of crop (season-wise)		
	(a) Groundnut	53221.540	101481.750
	(b) Maize	35225.443	22551.500
	(c) Ragi	21175.859	-
	(d) Sunflower	4713.264	45103.000
	(e) Jowar	4713.264	33827.250
	(f) Pulses	83914.132	22551.500
	(g) Vegetables & Misc Crops	22551.50	-
	Note: - If there are different cropping patterns in different reaches of the canal, information for each reach shall be given separately.		
17	**Power**		
17.1	Type - Conventional/Pumped storage	-	
17.2	Installed capacity (MW)	-	
17.3	Load factor	-	
17.4	Annual energy (kwh) (a) Firm (b) Seasonal (c) Total	-	

17.5	Off peak requirement for pumping*	-
17.6	Cost per kW installed	-
17.7	Cost per kWh at the bus bar	-
17.8	Head Race Channel/Tunnel (a) Length (m) (b) Shape (c) Size (m) (d) Rock type reach-wise-RMR/Q values (e) Rock cover reach-wise (f) Free/Pressure flow (g) Lining type-PCC/RCC/Steel (h)Reach-wise Design Internal & external pressures (i) Thickness of lining(m) (j) Designed discharge (m^3/s.) (k) Invert level at (EI-I11) (l) Gates-No., type & size .. *For pumped storage projects only.	-
17.9	Balancing Reservoir (a) Capacity (Mm^3) (b) Full reservoir level (El-m) (c) Maximum reservoir level (El-m) (d) Minimum Drawdown Level (EL-m) (e) Live Storage (Mm^3) (f) Balancing period (hrs.)	-
17.10	Forebay (a)Size of forebay (m) (b)Sill level of forebay (El-m) (c)Full reservoir level (El-m) (d)Maximum reservoir level (El-m) (e)Minimum drawdown level (El-m) (f)Duration of storage (g)Number of off-takes (h) Size of off-takes (i) Invert level at off-take (El-m) (j)Capacity of each off-take (m^3/s.) (k)Escape arrangement Location Length Discharging capacity (m^3/s.)	-
17.11	Intakes (a) Upper Intake (i) Type & size of intake (ii) Entry profile with details of transition (iii) Stability of the slope/cuts around intake (iv) Design velocity through trash rack' and bell mouth (v) Submergence of the entry below water level (vi) Intake gates-number ,type, size (vii) Details of anti-vortex arrangements	-
	(viii) Type of hoisting arrangement and its capacity (b) Lower Intake (for pumped storage scheme) (i) Type & size of intake (ii) Entry profile with details of transition (iii) Stability of the slope/cuts around intake (iv) Design velocity through trash rack and bell mouth	

	(v) Submergence of the entry below water level (vi) Intake gates-number. type size (vii) Details of anti-vortex arrangements	
17.12	Surge tank/shaft (a) Nos. & location (HRT/TRT or both) (b) Type. height & size (c) Orifice -size & position (or any other relevant detail) (d) Top level (El-m) (e) Bottom Level (El-m) (f) Steady state level (El-m) (g) Capacity (Mm^3) (h) Lower expansion chamber -size & location (i) Upper expansion chamber -size & location (j) Maximum surge level (El-m) (k) Minimum surge level (El-m) (l) Size of gates and capacity of hoists	-
17.13	Penstocks/pressure shafts:	Not applicable.
17.14	Power House:	Not applicable.
17.15	Switch yard	Not applicable.
17.16	Transformer Cavern (a) Rock types encountered -RMR/Q Values (b) Major wedge formations, if any (c) Rock ledge -dimension between cavities	Not applicable. Not applicable.
17.17	Tail Race Channel	-
17.18	Tail Race Tunnel	-
18	**Construction facilities**	-
19	**Cost**	`.21473.67 Crores
19.1	Cost of the project (`. Lakh) Unit wise (Refer Part II Section-3 para 18)	` 2147367.00 Lakhs
19.2	Allocated cost (`. lakh) (a) Irrigation (b) Power (c) Flood control (d) Navigation (e) Water Supply (f) Any other	 `2147367.00 Lakhs - - - - -
20	**Benefits/Revenue**	
20.1	Benefits	

Item	**Benefits**		
	Quantity	**Unit Price**	**Value `. lakh**
(a) Food Production (tonne)	7566036	380.567	287938.17
(b) Power (kwh)			
(c) Flood Protection(ha)			
(d) Navigation (tonnage)			
(e) Water supply (MCM)			
(f) Any other (fisheries)			

20.2	**Revenue**

Item	Benefits		
	Quantity	**Unit Price**	**Value `. lakh**
1. Betterment levy	-	-	-
2. Water Rates			
3. Irrigation Cess			
4. Pisciculture rights /auction			
5. Power Rates			
6. Navigation (i) Cargo Rates (ii) Regd. Charges (iii)Passenger Tax			
Others.			
Total :			

21	**Benefit Cost Ratio**	
	(a) B.C. Ratio	1.024
	(i) Irrigation	
	- With cost of CAD- works	
	- Without cost of CAD works	
	(ii) Flood control	
	(iii) Power	
	(b) Internal Rate of Return (IRR)	-
	- With cost of CAD works	
	- Without cost of CAD works	
	(c) BC Ratio with discounted cash flow method 'Irrigation	-
	- With cost of CAD works	
	- Without cost of CAD works	
	(d) Financial Rate of Return (FRR)	-
	- With cost of CAD works	
	- Without cost of CAD works	

UPPER BHADRA PROJECT

INTRODUCTION

GENERAL REPORT

1.0 Introduction

Upper Bhadra Project is a major lift irrigation Scheme under implementation in the central region of Karnataka State. It envisages lifting upto 17.40 TMC of water in first stage from Tunga to Bhadra and lifting 29.90 TMC of water in second stage from Bhadra to Tunnel near Ajjampura, in Tungabhadra sub-basin of Krishna basin. It is planned to irrigate an extent of 2,25,515 hectares by micro irrigation in drought-prone districts of Chikmagalur, Chitradurga, Tumkur and Davangere. The primary objective of the project is providing sustainable irrigation facility in khariff season and the other objective of the project is to recharge the ground water table and provide drinking water by filling 367 tanks in drought-prone taluks of the above said districts.

1.1 Aim of the Project and Description of Works

The comprehensive project envisages providing irrigation and drinking water to the parched lands of Central Karnataka plateau and in specific:

(i) Providing irrigation facility for an area of 2,25,515 Ha of land in Tarikere, Kadur taluks of Chikkamagalur district, Hosadurga, Hiriyur, Chitradurga and Challakere taluks of Chitradurga district, Jagalur taluk of Davangere district and Sira, Chikkanayakanahalli taluks of Tumkur district. The total requirement of water for irrigation in the command area is 620.40 MCM (21.90 TMC) as finalized by CWC.

(ii) Filling up of 367 Nos. of Tanks would require 226.63 MCM (8TMC) including augmentation of 2.00 TMC for Vani Vilas Sagar Reservoir. The filling up of tanks will facilitate recharging of ground water besides diluting the fluoride content.

The Project Component Comprises of:

(i) Lifting up to 17.40 TMC (492.78 MCM) of water from the foreshore of Upper Tunga reservoir to Bhadra reservoir. from June to October

(ii) Lifting of 29.90 TMC (846.55 MCM) of water from Bhadra reservoir to delivery chamber near proposed tunnel near Ajjampura from June to October

(iii) Construction of 7.00KM (approximate) length of tunnel near Ajjampura to supply water to Chitradurga Branch Canal(CBC) and Tumkur Branch Canals(TBC) by gravity.

(iv) Providing infrastructure for drip irrigation to an area of 20,150 Ha above & surrounding tunnel in Tarikere taluk during Kharif season.

(v) Construction of Chitradurga Branch canal and providing necessary infrastructure for drip irrigation of 1,07,265 Ha in Kharif season only.

(vi) Construction of Tumkur Branch Canal and providing necessary infrastructure for drip irrigation to 84,900 Ha in Kharif season.

(vii) Construction of Jagalur Branch Canal and providing infrastructure for drip irrigation of 13,200 Ha in Kharif season.

(viii) Filling of tanks 36 Nos. coming under the command of Chitradurga Branch Canal,131 Nos. coming under the command of Tumkur Branch Canal, 09 Nos coming under command of Jagalur Branch Canal and 33 Nos. coming under the command of Tarikere gravity & lift canal.

(ix) Filling of 21 Nos. of tanks in Holalkere taluk, 20 Nos. of tanks in Molakalmuru taluk and 41 Nos. of tanks in Challakere taluk and 46 Nos of tanks in Tarikere taluk.

(x) Filling of 30 Nos. of tanks in Pavagada taluk for drinking water supply.

Estimates for the above said project components have been prepared. The Cost of the Project works-out to Rs.**21473.67 Crores** based on WRD SR for 2018-19**.**

An Index Map Showing detail of the project, in Map VJNL/UBP/Index Map/01, is enclosed.

1.2 Location of the Project Area

1.2.1 The lifting point of Tunga water is located at the foreshore of Upper Tunga Dam near Muthinakoppa village of Narasimharajapura Taluk and the water is delivered to Bhadra reservoir.

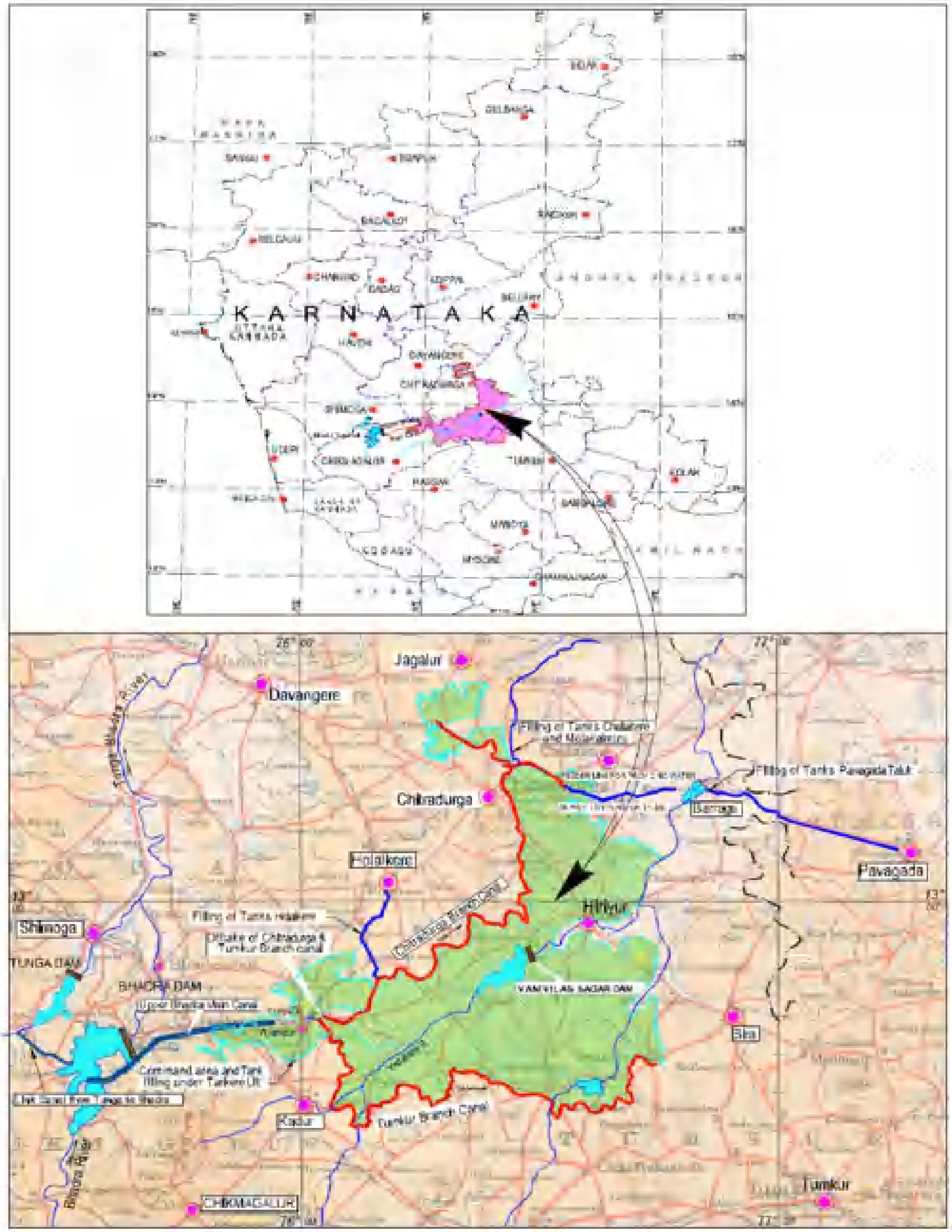
1.2.2 Upper Bhadra main canal takes off from Bhadra reservoir. The open canal runs for a length 40.535 Km and crosses Tarikere - Birur railway line. Water is proposed to be lifted in 2 stages up to RL.733.702. The alignment passes through Kundur, Siddarahalli, Duggalapur, Yellugere, Chikkattur, Samatala, Hunsagatta Villages of Tarikere Taluk. The alignment is proposed to cross the bridge between Bhadra valley and Vedavathi valley through a tunnel of about 7.00 Kms. The Tunnel ends near Ajjampura town of Tarikere Taluk.

Tarikere Lift scheme is planned to provide drip irrigation to an area of 20150 Ha in Tarikere taluku covering the area above the ajjampura tunnel and filling up of 79 tanks for groundwater recharge.

Alignment of Chitradurga Branch Canal off-takes after tunnel and passes through Tarikere, Kadur Taluks of Chikkamagalur District, Hosadurga, Hiriyur, Holalkere, Chitradurga and Challakere taluks of Chitradurga district.

Tumkur Branch Canal also off-takes after Ajjampura tunnel from the Y-Junction and passes through Tarikere and Kadur taluks of Chikkamagalur District, Hosadurga and Hiriyur Taluks of Chitradurga District and Sira, Chikkanayakanhalli Taluks of Tumkur District.

Jagalur Branch Canal off-takes from Chitradurga Branch Canal at 125.167 Km of CBC and passes through Chitradurga taluk of Chitradurga District, Jagalur Taluk of Davangere District


KARNATAKA
ANDHRA PRADESH
BIDAR
GULBARGA
BIJAPUR
BELGAUM
RAICHUR
DHARWAD
GADAG
KOPPAL
BELLARY
UTTARA KANNADA
HAVERI
DAVANGERE
CHITRADURGA
SHIMOGA
UDUPI
TUMKUR
HASSAN
KOLAR
MANDYA
MYSORE
CHAMARAJANAGAR
KODAGU
Jagalur
Davangere
Filling of Tanks Challakere and Molakalmuru
Filling of Tanks Pavagada Taluk
Chitradurga
Hosadurga
Pavagada
Shimoga
TUNGA DAM
BHADRA DAM
Upper Bhadra Main Canal
Filling of Tanks Holalkere
Offtake of Chitradurga & Tumkur Branch canal
Chitradurga Branch Canal
Hiriyur
VANIVILAS SAGAR DAM
Sira
Command area and Tank filling under Tarikere Lift
Link Canal from Tunga to Bhadra
Kadur
Tumkur Branch Canal
Tumkur
CHIKMAGALUR
Tunga Bhadra River
Bhadra River
Vedavathi

1.3 Accessibility

The headwork at Tunga River near Muttinakoppa is accessible through State Highway (SH) from Shivamogga to Mangalore.

Bhadra reservoir is accessible through Tarikere - Mangalore road (SH) from Tarikere. Upper Bhadra main canal from Bhadra reservoir is approachable by T-M Road (SH) and South Central railway. Nearest railway station is Tarikere. Tunnel reach is approachable through Tarikere - Hosadurga Road and from Ajjampura Railway station by rail. Command area of Chitradurga Branch canal is approachable by NH - 4 and NH - 206.

Tumkur Branch Canal is approachable by various major district roads. Nearest airports to project site are Bangalore and Mangalore.

1.4 General Climatic Conditions

1.4.1 The climate of the major command area which lies in Chitradurga and Tumkur districts is characterized by dryness in major part of year and hot summer. The period from December to February is the dry and comparatively cool season. The summer season from March to May is followed by South-West monsoon season, from June to September. October and November form the retreating monsoon or post monsoon season.

1.4.2 Rainfall

The Average Annual Rainfall is about 575 mm and the rainfall is confined to period from May to November. 60% of the annual rainfall will be during the period June to September and about 24% of the annual normal rainfall occurs during October and November. September is the month with highest rainfall. The variation in the annual rainfall in the region from year to year is large. On an average, the region has about 40 rainy days (days with rainfall 2.5 mm or more).

1.4.3 Temperature

The period from the later half of November to the end of February is the coolest part of the year. In December, when the temperature is the lowest, the mean daily maximum temperature is 28.5^{0}C and the daily minimum temperature is 16.5^{0}C. The period from March to May is the period of increasing temperature. April is the hottest month with mean daily maximum temperature of 37^{0}C and the mean daily minimum temperature of 26^{0}C. During this season the maximum temperature may sometimes reach 42^{0}C. With the onset of Southwest monsoon early in June, the weather becomes slightly cooler and continues to be so throughout the Southwest monsoon. Both day and night temperatures decrease progressively from the beginning of October.

1.4.4 Humidity

The region has, on the whole, a dry climate, the summer and cold seasons being the driest part of the year when relative humidity's are 45% to 60% in the mornings and 20% to 30% in the afternoons. Relative humidity's are higher in the South-West monsoon and monsoon retreating season, when they are generally 50% to 70%.

1.4.5 Cloudiness

During the period May to November, skies are moderately to heavily clouded. In the rest of the year skies are clear or lightly clouded generally.

1.4.6 Winds

Winds are generally light to moderate with some strengthening in the Southwest monsoon season. In the Southwest monsoon months, they blow mainly from a South-westerly or Westerly direction. In the rest of the year, they are predominantly from directions between Northeast and Southeast. Winds blow from directions between Southwest and Northwest in the period May to September.

1.4.7 Special Weather Phenomena

In October and November, storms originating in the Bay of Bengal, sometimes cross the East coast of India and moving in the Westerly to North-Westerly direction across the Peninsula affect the area causing wide spread rain and high winds. Thunderstorms occur during the periods April to May and September to October. Dust raising winds occur in April and May.

Table 6.1 gives the Meteorological data (vide page 188) of Chitradurga. **Table 6.3** gives the Annual Average depth of rainfall (vide page 190) considered at different locations of Command Area.

1.4.8 Population

The population of the benefited districts is furnished below.

Sl. No.	Name of District	Population			SC	ST
		Total	Males	Females		
1.	Chikkamagalur	1137753	567483	570270	233134	41019
2.	Chitradurga	1660378	843411	816967	336127	266235
3.	Tumkur	2681449	1354770	1326679	474044	193819
4.	Davangere	1946905	989602	957303	333227	209701

(Source: 2011 Census)

The average population growth rate is 2.12% and the density of population is 180 per sq km. In general, 70 percent of population is rural and agriculture is their main occupation.

1.5 Irrigation Scenario in the Four Districts

Irrigation scenario in the four districts of Chikkamagalur, Chitradurga, Tumkur and Davangere is as follows: (As per Directorate of Statistics 2010-11).

Sl. No.	Name of the Districts	Geographical Area (Ha)	Cultivable Area (Ha)	Land Utilization (ha) area sown	Cultivable area in terms of % age of Geographical Area	Area sown in terms of % age of Cultivable Area	Net Area Irrigated in terms of % age of Cultivable Area
1.	Chikkamagalur	722075	320897	299054	44.44	93.19	14.60
2.	Chitradurga	770702	531597	433392	68.98	81.53	-
3.	Tumkur	1064755	786497	558953	73.87	71.07	-
4.	Davangere	597597	-	395679	-	-	-

The net irrigated area in terms of cultivable area is low in the above four districts.

Summary and Recommendations of HPCFRRI connected with Hydrological and Agricultural Drought related issues are as below.

(a) Out of 114 taluks, 70 taluks (41 taluks in South Karnataka and 29 taluks in North Karnataka) belong to the category of backward taluks

Taluks identified as drought affected by the Irrigation Commission (1972) and as Backward by HPCFRRI are,

Chitradurga District

1. Challakere
2. Hiriyur
3. Molakalmur
4. Holalkere
5. Hosadurga

Tumkur District

1. Turuvekere
2. Kunigal
3. Madhugiri
4. Gubbi
5. Sira
6. Pavagada
7. Korategere
8. C. N. Halli

Davangere District

1. Jagalur

Backwards taluks identified by HPCFRRI for drought relief measures by the Government of Karnataka are.

Chitradurga District

1. Challakere
2. Hosadurga
3. Jagalur
4. Molakalmur
5. Hiriyur
6. Holalkere

Tumkur District

1. Korategere
2. Pavagada
3. Turuvekere
4. Kunigal
5. Sira

Chikkamagalur District

1. Tarikere
2. Kadur

(b) The ratio of net area irrigated to net area sown (%) in case of Chikkamagalur, Chitradurga, Tumkur and Davangere districts are as under:

Sl. No.	Name of the Districts	Ratio of Net Area Irrigated to Net Area Sown (%)	
		1997-98	2000-01
1.	Chikkamagalur	-	14.60
2.	Chitradurga	12.71	15.53
3.	Tumkur	18.27	19.2
4.	Davangere	-	-

1.6 History / Background of Upper Bhadra Project

1.6.1 Upper Bhadra Project was proposed across the river Bhadra in (K-8) Tungabhadra sub-basin, upstream of existing Bhadra Reservoir Project. The Project was under contemplation to provide irrigation facilities to chronic drought-prone areas of Chitradurga & Tumkur districts. Upper Bhadra Project was first mooted in the year 1969 envisaging the construction of storage dams across Bhadra river near Magundi village in Chikkamagalur district to provide irrigation facilities to drought prone districts; Chikkamagalur, Chitradurga, Tumkur and Bellary. This project was filed before KWDT for an allocation of 36.00 TMC. KWDT report mentioned that *"it cannot be said that the demand for this project is not worth consideration. But, unless a further study is made of the water available in the river Tungabhadra, the project may be deferred."*

1.6.2 Since then several alternatives have been studied to provide irrigation facility mainly to Chitradurga and Tumkur districts. However, in the year 2001, 23 TMC of water was allocated to UBP under Scheme A in the 734 TMC revised master plan, with 10 TMC being direct allocation and 13 TMC being savings from modernization of Tunga Anicut (6.25 TMC), Bhadra Anicut (0.50 TMC) and Vijayanagar Channels (6.25 TMC). Further, it was proposed to utilize additional 19 TMC of water under Scheme B. With this, a total allocation of 42 TMC was proposed for utilization under UBP.

Considering allocation of 23 TMC under Scheme A, Government in the year 2003 accorded administrative approval to Upper Bhadra Project Stage-I (including Ubrani Amrutapur LIS) for Rs 2813 Cr, vide GO No. WRD/ 63/VEEVYATA/ 2000, Bangalore dated 23.08.2003. The project envisaged, construction of a dam across Bhadra river on the upstream of Bhadra reservoir near Magundi village, a pick up dam near Tegargudda and a main canal running for a length of 114.65 Km including tunnel near Ajjampura, thereafter bifurcating into Chitradurga Brach Canal (CBC) and Tumkur Branch Canal (TBC) each of the length 210 Kms and 441 Kms respectively. The proposed area of irrigation under these canals are:

Chitradurga Branch Canal (Scheme "A")	Kharif Semidry	2,54,023 Acres	102803.11 Ha
	Rabi Semidry	1,01,185 Acres	40949.57 Ha
	Total	3,55,208 Acres	143752.68 Ha
Tumkur Branch Canal (Scheme "B")	Kharif Semidry	2,09,703 Acres	84900.00 Ha
	Rabi Semidry	83,417 Acres	33772.06 Ha
	Total	2,93,120 Acres	118625.66Ha
(Scheme "A" + "B")	**Grand Total**	6,48,328 Acres	262378.34Ha

1.6.3 The project also envisaged lifting 19 TMC water from Tunga river to Bhadra reservoir under Scheme B of UBP. There were representations against this proposal by the land owners likely to be affected by the submergence in

Chikkamagalur district and also by environmentalists who apprehended damage to the environment as the canal was running in wildlife area.

In order to address the above issues including the aspects of water availability and conveyance and also to examine possible alternatives for implementing the UBP, the Government constituted a committee under the Chairmanship of Sri K.C. Reddy, a Technical Expert in Irrigation.

After a detailed study which included hydrological aspects for availability of water, technical feasibility for storage and conveyance, environmental impact and interaction with the project affected people, the committee recommended to modify the earlier Scheme as under;

(i) Lifting 15.00 TMC of water from Tunga river to Bhadra reservoir (Package - I).

(ii) Lifting of 21.50 TMC of water from Bhadra Reservoir to delivery chamber near Ajjampura (Package - II).

(iii) Construction of 7.00 Km tunnel near Ajjampura to deliver water to Chitradurga Branch Canal (Package - III).

(iv) Construction of Chitradurga Branch Canal to irrigate 1,02,843 Ha.

(v) Filling up of 156 Minor irrigation tanks coming under drought prone areas of Chikkamagalur, Chitradurga, Kolar & Tumkur districts for drinking water purposes.

1.6.4 The availability of 21.50 TMC of water for the UBP - Scheme A was thus confirmed by the Expert Committee. Further, as regards Scheme B, the committee was of the view and mentioned in its report that *"as the issues of determination of flows available in Krishna basin and distribution of the flows beyond the presently allocated quantum are before the Krishna Water Dispute Tribunal recently constituted and therefore the availability of water beyond the allocated quantity will be known only after the tribunal gives the award, depending upon the total availability in the state and in the sub-basin, further utilization could be planned keeping in view the forest and environmental constraints".* The committee finally recommended that for Scheme B of the Project, investigations regarding availability of water and planning other alternative schemes should be continued. The Government accepted the recommendations of the K.C. Reddy committee and transferred the work to KNNL for implementation in November 2006.

1.6.5 DPR for UBP - Scheme A with the above provisions was prepared amounting to Rs.5985 crores and submitted for approval of government. Upper Bhadra Project Scheme 'A' has been accorded in-principle approval by the Government of Karnataka for Rs.5985 crores comprising of Rs.3388 crores towards irrigation component and Rs.2597 crores towards drinking water component at SR 2007-08, vide GO No. WRD 152 VIBHYAE 2004 (Part - I) Bangalore dated 15.09.2008.

Brief details of the Project Components are as follows:

(i) **Irrigation Component**

The cost of the irrigation component of the project is Rs. 3388 crores. Irrigation facility is proposed to be provided to drought prone areas of Tarikere and Kadur taluks in Chikkamagalur district and Hosadurga, Hiriyur, Chitradurga and Chalkere taluks of Chitradurga district to an extent of 1,07,265 ha. A provision of 11.44 TMC is made for providing irrigation facilities and 2.78 TMC for filling 36 Tanks coming in the atchkut area under CBC.

(ii) **Drinking Water Component**

The drinking water component is estimated to cost Rs.2597 crores. An allocation of 5.60 TMC (158.6 Mcum) of water is made for filling up of 119 MI tanks coming under Tumkur and Kolar districts for drinking water purpose. The filling up of tanks will facilitate recharging of ground water besides diluting the fluoride content particularly in Kolar district and certain taluks of Tumkur district.

Further, as a part of UBP scheme A (Stage -1), a scheme to irrigate 5471 ha and fill up 52 Nos. of tanks for area above tunnel and area before tunnel in Tarikere taluk at a cost of Rs.75 crores. Utilizing 0.8 TMC of water within the allocation of 21.5 TMC for UBP, is administratively approved by the Government, vide GO No. WRD 150 VIBHYAEE 2009 dated 13.04.2011.

In the meantime, an additional allocation of 2.40 TMC is allocated by the Government, vide GO No WRD 49 KBN 2009 dt:19-03-2012 for irrigation in Jaglur taluk of Davanagere district and for providing drinking water supply for Pavagada taluk in Tumkur district. This is out of 21TMC as per revised G. W. D. T allocated to Karnataka due to Indirasagar-Pollarvam diversion scheme in Godavari basin by Andra Pradesh vide GO No. WRD 20 KBN 2016 dated 31/8/2017

There was agitation from the people of Hiriyur taluk & public representatives to meet the shortfall in Vani Vilas Sagar dam from Upper Bhadra Project. They represented to Govt. to augment water to Vani Vilas Sagar Reservoir from Upper Bhadra Project. Govt. has approved utilization of 5.00 TMC water for Vani Vilas Sagar Project out of UBP as an interim arrangement and temporary measure, vide Govt. Letter No. WRD 22 vibhyaee 2009 dated: 27.02.2009.

1.6.6 UBP Scheme B

A proposal for providing irrigation facility and filling up of tanks of Chikkamagalur, Chitradurga and Tumkur districts under Upper Bhadra Project Scheme-B has been approved by the Board of KNNL in its 36th meeting held on 08.08.2007. This involves lifting 19 TMC of water from Tunga river to Bhadra reservoir simultaneously lifting 19 TMC of water from Bhadra reservoir for utilizing 11.005 TMC of water to irrigate 1.3 lakhs hectares in Tarikere and Kadur Taluks of Chikkamagalur district, Hosadurga and Hiriyur Taluks of Chitradurga district and Sira, Chikkanayakanahalli Taluks of Tumkur district. The balance 8.00 TMC was proposed to be used for filling the tanks coming within the command area and tanks in Pavagada, Sira, Koratagere and Madhugiri taluks. The components of the proposed scheme were as follows:

(i) Offtake of open canal at Bhadra reservoir is EL 642.00 m.

(ii) Open channel of capacity 58.74+10% extra cumecs, for a length of 30 Km (Approx).

(iii) Jackwell / pump house construction at Km 30.00.

(iv) Static head at lift point (i.e. Km No. 30) is 98 m (Approx).

(v) Approach channel for a length of 300 m (Approx) from delivery chamber to tunnel.

(vi) Tunnel for a length of 7 Km (Approx).

(vii) Exit canal from tunnel for a length of 2.70 Km (Approx) upto off take of Tumkur Branch Canal.

(viii) Tumkur Branch Canal for a length of 190 Kms (Approx) to irrigate 130000 Ha of command area in Khariff season.

(ix) It also augments the tanks within the command and tanks in Sira, Madhugiri, Kortatagere, Pavagada taluks of Tumkur district.

Now, the KWDT-II award to utilize surplus waters was given during 2010.But, no allocation is made in the award, for UBP-Scheme B of 19 TMC as required under Tumkur Branch Canal. As there is no additional allocation of 19 TMC in the KWDT - II award for UBP Scheme - B, it has become imperative to explore possibilities to irrigate areas in Tumkur district which was originally proposed under UBP Scheme - B.

1.7 Additions in the approved DPR

The implementation of the UBP was taken up in the year 2008. The key components of the infrastructure viz. the lifting arrangements in 2 stages and tunnel that delivers water to Chitradurga Branch Canal and Tumkur Branch Canal are taken up and are in progress.

The work of 7.00 km long tunnel near Ajjampura village in Tarikere taluk is a critical work that would convey water from Bhadra reservoir to CBC. The project had to face opposition for construction of tunnel with apprehension that the ground water in the region would deplete if the tunnel is constructed. Detailed hydro-geological study along tunnel alignment was conducted.

After detailed study, by the High level Technical Committee under the Chairmanship of Sri. D.N. Desai, it became clear that it would be possible to conserve and sustain groundwater in the tunnel region during and after construction by appropriate strategies which broadly include precautions to be taken during tunneling operations and augment limited groundwater reserves by providing additional surface water and by rainwater harvesting techniques/structures.

An important initiative is to extend irrigation above and surrounding tunnel region to support agriculture. In order to mitigate the opposition for the construction of tunnel, the Hon'ble Minister of Water Resources, during a meeting held on 17-6-2013, directed to provide **additional irrigation facility to a total extent of 20150 Ha and filling up of total 79 tanks surround tunnel area in Tarikere taluk with a utilization of 1.47 TMC of water.**

Another recommendation of the committee is to prepare and **implement watershed development schemes on the lines of integrated mission for sustainable development (IMSD) guidelines in the region of tunnel**. A provision of Rs. 45.36 crores have been made under the sub-head 'X' of this DPR.

Schematic Diagram Showing Details of Upper Bhadra Project is enclosed.

1.7.1 Land Acquisition (as per Present Proposal)

An extent of 7899.177 acres of land is proposed to be acquired under UBP. A provision of Rs.75867.00 Lakhs is made under the head B-lands

Compensation for acquisition of private land is fixed by Govt. vide G.O. dated: 21.03.2012 @ Rs.3.50 Lakhs/ Acres for dry lands, @ Rs.5.50 Lakhs/ Acres for wet lands & @ Rs.12.00 Lakhs/ Acres for garden lands. Further, with the enactment of right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, the land rates are revised and included in the estimate.

1.7.2 Forest Clearance (as per present proposal)

An extent of 378.72 Ha of land is required to be diverted. Land for an area of 378.72 Ha has been identified for compensatory land by Revenue Dept. in Nayakanahatti Varav Kaval in Challakere taluk. The Deputy Commissioner, Chitradurga recommended proposed compensatory land vide letter dated: 17.01.2012 to Govt. to hand over the area required. The Govt. has accepted the proposal & directed to hand over compensatory land to Forest Dept. on 26.02.2013, in Nayakanahatti Varav Kaval in Challakere taluk, Chitradurga district.

Joint inspection with District/ Zonal Forest Officers is made & recommended that the proposed compensatory land is suitable for afforestation to Chief Conservator of Forest, Bangalore vide letter dated: 19.10.2013.

1.8 Modification Contemplated in the Present Proposal

Further, with the changing trends in the methods of application of water from the conventional open canal system to sprinkler/drip, water use efficiency has become a prime area of concern. With the surface irrigation system where the entire canal system is open canal system, the overall efficiency was arrived at as 50 % in the project planning. Due to the long pending demand of farmers of Tumkur district which is adjacent to Chitradurga district, it became imperative to consider alternative to surface irrigation where the loss of water in the conveyance system is high. In order to improve the water use efficiency significantly to meet the demands for irrigation to additional area, it is now planned to adopt drip irrigation in the entire command area of UBP. Adoption of drip irrigation in UBP was also one of the major recommendations of Sri. K.C. Reddy's Committee Report regarding implementation of project Extract (Page 60 of KS Reddy Report) of the report is as follows:

Since this project is being recommended by considering prevailing drought situation in Chitradurga district, the committee suggests for adopting the following two new approaches:

(a) *To recharge ground water, irrigation under the tank command should be discouraged for a period of three years so that there would be adequate drinking water in this area.*

(b) *To conserve and economies usage of water for irrigation purpose sprinkler and drip irrigation should be made mandatory after the three years period.*

A proposal to provide water for irrigation to areas in Chikkamagalur, Chitradurga, Tumkur and Davangere districts has been prepared by adopting drip irrigation so that it would be possible to irrigate area under CBC and TBC by virtue of higher water use efficiency of 67.50%.

The salient features of the proposal are;

- The main canal will be constructed as open lined canal. The distribution of water below the main canal will be through a network of pipelines.
- It is proposed to install Main Pipelines and Pressurized Irrigation Network and then connect the same to the Drip Irrigation System, thereby increasing the water use efficiency to 67.50% in the project area.
- The pipe network carries water to individual Head Unit(s) (One Head Unit for 50 Ha drip modules) located at different places in the command area. The pipe network will have control valves near to the Head Unit to control the discharge rate of water and to ON / OFF the system as per requirement.
- It is proposed to create a network of pipelines (GRP/PVC) instead of constructing distributaries laterals, minors and field channels. The topography of the command area permits distribution of water through drip irrigation system by gravity where more than 2 bar of pressure is available.

Due to the increased efficiency of the system under drip irrigation over flood irrigation, it would be possible to provide irrigation under CBC, JBC and TBC for an area to an extent of 2,25,515 Ha by utilizing 21.90 TMC of water.

In this regard, a proposal was placed in the 140th TSC meeting held on 25.08.2012 and the TSC desired that a detailed note be prepared and sent to the Board of KNNL and Government for according in-principal approval for ADOPTION OF DRIP IRRIGATION system in UBP. The proposal was also placed in the 59th Board meeting of KNNL held on 12.12.2012 and further proposal was also submitted to Government Vide Managing Director, KNNL, Bangalore vide letter no.4821 dated 04.02.2013 with a request to accord Administrative approval and also to accord approval for utilization of saved water under Scheme-A with modification for implementation of Scheme-B of UBP.

Further draft DPZR was placed before, Estimate Review Committee-**ERC** & Tender Scrutiny Committee-TSC formed vide G.O.no.: jasae/253/kbn/2013, Bangalore dated: 28.10.2013 with guidelines issued therein. Expert Certificate on adoption of Drip Irrigation has been obtained from Dr. Yella Reddy on 26.12.2013 & enclosed in the report along with comments of Dr. V. Praveen Rao as per delibration issued during 2nd ERC meeting held on 5-12-2013. Compliance was submitted for the observations & placed before 3rd ERC meeting held on dated: 10.01.2014 for deliberation & further, the committee recommended to place before Board of KNNL for approval & onward submission to Govt. for seeking Revised Administrative Approval.

The revised proposal was placed in the 62nd Board meeting of KNNL held on 24.01.2014 for recommendation and further proposal was submitted to Government Vide Managing Director, KNNL, Bangalore vide letter no.4994 dated 07.02.2014 with a request to accord revised Administrative approval, for utilization 29.90 TMC of water with modification for adoption of Drip Irrigation to an extent of 2,25,515 ha. & filling up of 367 tanks. Government of Karnataka has accorded administrative approval for this project vide G.O. No: WRD 53 VIBYAE 2014, Bengaluru, dated: 06.03.2015 for Rs.12,340.00 cr. G.O is enclosed in Annexure-1.1.

1.8.1 Crop Water Requirements

The crop water requirement is based on potential evapotranspiration and the crop coefficient. The potential evapotranspiration corresponds to central zone of Karnataka provided by IMD and Meteorological data for Chitradurga is given in Table 6.1. The crop coefficients are given in Table 6.2. Water requirement for each group of area is calculated separately considering the average rainfall of that area is given in Tables 6.3 to 6.7. The effective precipitation is based on the USDA Table given in FAO - 24 and also reproduced by CWC in their publication of crop water requirements. The chance of occurrence of rainfall considered corresponds to 50% dependability. Abstract of Discharge calculation and water requirement for each group of area & Schedule of Releases for Upper Bhadra project is shown in Table 6.8 & 6.9.

1.8.2 Allocation of Water

The allocation of water to Upper Bhadra Project - Scheme A is 21.5 TMC. An additional allocation of 2.40 TMC is made by the Government in its order dated 31.08.2017 for meeting needs of Jagalur and other taluks.

Details are as follows:

1.	As per revised master plan 2002, with direct allocation of 10TMC and the balance is met out of modernisiation of Tunga anicut system (6.25 TMC) Bhadra Anicut System (0.5 TMC) and Vijayanagar canal system(6.25 TMC)	21.50 TMC
2.	As per additional allocation to Upper Bhadra Project, vide GO No WRD 20 KBN 2016 dated 31.08.2017 out of 21 TMC **Revised** as per GWDT allocated to Karnataka due to Indirasagar- Pollarvam diversion scheme in Godavari basin by Andra Pradesh.	2.40 TMC
3.	Additional allocation of water from out of the MI allocation in K-8 and K-9 sub-basin.	6.00 TMC
	Total Allocation	29.90TMC

**The modernization works of Tunga Anicut System Bhadra Anicut System and Vijayanagar Canal System are taken up separately*

** An allocation 1.5 TMC out of allocation is allocated Ubrani Amrathapura LIS out of the 23 TMC (10+13.0 = 23.0 TMC) and balance 21.5 TMC is allocated Upper Bhadra Project.*

1.8.3 Conjunctive Use of Water

The command of UBP also contain bore wells and certain pockets in these regions are irrigated by bore wells. In the present scheme 367 no of tanks are proposed to be filled. This also helps to recharge the ground water as such, there is groundwater potential the farmers will be encouraged to go in for conjunctive use using both groundwater and canal water to maximize benefits of the scheme.

1.8.4 Filling up of Tanks in Holalkere, Molakalmuru, Challakere & Pavagada Taluks

The farmers & local representatives of Holalkere, Molakalmuru & Challakere taluks have represented to extend irrigation facility & tank filling from UBP to these taluks, as there was a provision in the 1969 UBP Report.

This issue has been examined considering additional discharge required for irrigation purpose which cannot be accommodated within the designed pumping system. Hence it is not possible to provide irrigation facility to said Taluks. However, filling up of tanks, by gravity flow through natural nala & pipes, can be made during non-peak crop water requirements period. Accordingly, provision for filling of 21 Nos. of tanks under Holalkere taluk, 20 Nos. tanks in Molakalmuru, 41 Nos. tanks in Challakere taluk and 30 Nos. of tanks in Pavagada taluks by gravity flow has been made within the allocation of UBP.

1.8.5 Proposed 29.90 TMC of Water Utilization

The requirement of water for irrigation using drip system and for tank filling in the districts of Chikkamagalur, Chitradurga, Davangere and Tumkur that can be met out of the above allocation is worked out keeping the following points in view

(i) The area under Chitradurga Branch Canal (CBC) is considered as 107265 Ha as per administratively approved UBP Scheme - A (Year 2008).

(ii) The area under Tumkur Branch Canal (TBC) is considered as 84900 Ha as per the original proposal of UBP Scheme - B.

(iii) The area of Jagalur Branch Canal (JBC) is considered as 13200 Ha as per the Expert Committee report on tunnel.

(iv) The area under gravity and lift canals as per approved project report in Tarikere taluk i.e 5471 Ha area proposed, is to be increased to 20150 Ha with drip irrigation, keeping the utilization of 1.2 TMC for Irrigation and 0.27 TMC for 79 Nos. of Tanks filling.

(v) Supplying drinking water to Pavagada taluk by filling 30 Nos. of tanks is proposed utilizing 0.54 TMC of water.

(vi) The allocation of 5.6 TMC for drinking water supply to Tumkur and Kolar districts by filling up of 119 tanks is proposed to be diverted to Tumkur Branch Canal as there is a proposal to fill up tanks in Kolar district by a separate scheme - Yettinahole Lift which envisages diversion of flood water from Sakaleshpura (West) to Kolar & Chikballapur districts (East) which has been administratively approved by the Government for Rs.8323.50 crores, vide G.O. No. WRD 203 WBE 2012, Bangalore, dated 13.07.2012.

(vii) Government has approved utilization of 5.00 TMC water for Vanivilas Sagar Project out of UBP as an interim arrangement and temporary measure, vide Govt. Letter No. WRD 22 vibhyaee 2009 dated: 27.02.2009. However, provision of 2.00 TMC for augmenting Vanivilas Sagar is made from Tumkur Branch Canal under this scheme.

(ix) The project is under implementation. The three package works (2 lifts and a tunnel) are entrusted on EPC turnkey contract basis on 15.10.2008 amounting to Rs. 1580 crores. The Package - I which is in progress involves lifting 17.40 TMC water from Tunga river to Bhadra reservoir from June to October. The Package - II work is completed involves lifting 29.90 TMC of water from Bhadra reservoir to delivery chamber near Ajjampura. The Package - III, work involves construction of 7.0 Kms long tunnel with discharge capacity of 79.365 cumecs is also completed.

(x) In case of pumping from Bhadra reservoir to Ajjampura tunnel, the design discharge is 81.85 Cumecs. The total quantity of water that can be pumped from June to October (121 days) is 29.90 TMC.

(xi) Filling of 21 Nos. of tanks in Holalkere taluk, 20 Nos. of tanks in Molakalmuru taluk and 41 Nos. of tanks in Challakere taluk and 79 Nos. of tanks in Tarikere taluk.

(xii) Filling of 30 Nos. of tanks in Pavagada taluk for drinking water supply

Keeping the above in view, the utilization of water for irrigation and tank filling is proposed as follows: -

The total water allocation as per the approved DPR of UBP for an amount of Rs 12340/- crores the total water utilization for the project is as follows: -

- Chitradurga branch canal for an area of 107265 Ha including filling of 37 tanks is 12.45 TMC
- Tumkur branch Canal for an area of 84900 Ha including filling of 130 tanks is 9.69 TMC
- Jagalur Branch canal for an area of 13200 Ha including tank filling 08 tanks filling 1.96 TMC.
- Tarikere lift for an area of 20150 Ha including filling of 79 tanks is 2.00 TMC.
- Supplying drinking water to Pavagada taluk by filling 30 Nos. of tanks is utilizes 0.39 TMC of water.
- Filling of 21 Nos. of tanks in Holalkere taluk utilizes of 0.37 TMC of water, 20 Nos. of tanks in Molakalmuru taluk utilizes of 0.67 TMC of water and 42 Nos. of tanks in Challakere taluk utilizes of 0.92 TMC of water.

As the DPR of the Upper Bhadra project for an amount of Rs 12340 Crores has been submitted to Central Water Commission for considering it as a National Project. While Scrutinizing the DPR of Upper Bhadra project the CWC authorities instructed that the conveyance efficiency of the main canal has been taken as 90% which is applicable only there is a continuous flow in the lied canal as per the existing guidelines. Since the main canal will be operated only during the rainy season there will not be flow in the main canal during non monsoon period, hence the conveyance efficiency of 75%(on the higher side) can be applied for main canal only. As the project is considered as the Drip irrigation the conveyance efficiency of the Drip is considered as 90%. Hence the overall efficiency of the Upper Bhadra project is 67.50%. Accordingly, as per the instructions issued by the CWC, Modified Penman method was adopted for the calculation of CWR and the Peak discharge is increased, so the crop water requirement is also increased and tank filling capacity has been reduced. After the detailed calculation the utilization of water is as follows:

Sl. No.	Canal	Drawal Point (Offtake) (Km)	ICA (Ha)	Utilization for Irrigation (Drip System) (TMC)	No of Tanks (Nos)	Utilization for Tank Filling (TMC)	Total Utilization (TMC)
1.	Chitradurga Branch Canal (CBC)	Exit Canal of tunnel	107265	11.44	36	0.81	12.25
2.	Tumkur Branch Canal (TBC)	Exit Canal of tunnel	84900	7.28	131	2.20	9.48
3.	Jagalur Branch Canal (JBC)	125.167 Km of CBC	13200	1.39	09	0.75	2.14
4.	Tarikere Lift	Ajjampura Tunnel approach and exit canals	20150	1.79	79	0.27	2.06
5.	Allocation to Pavgada Taluk for Drinking Water	From tail-end of CBC	-	-	30	0.54	0.54
6.	Allocation to V V Sagar to meet the shortfall	34.00 Km of TBC by distributary of length of 10 Km	-	-	-	2.00*	2.00*
7.	Tank Filling in Chalkere Taluk	125.832 Km of CBC	-	-	41	0.78	0.78
8.	Tank Filling in Molakalmur Taluk		-	-	20	0.45	0.45
9.	Tank Filling in Holalkere Taluk	25.710 Km from CBC	-	-	21	0.20	0.20
	Total		225515	21.90	367	8.00	29.9**

(*) *Water will be released to V V Sagar from TBC of UBP to meet the shortfall in its requirement.*

(**) The utilization of 29.90 TMC water has to be met from Tunga / Bhadra rivers. The availability of water has been worked out in the working table 5.5 & 5.6 for 40 years 1972-73 to 2011-12 and It is observed that success rate is 62.5 % for UBP and 80% for Bhadra Reservoir Project.

1.8.6 Accommodating the needs of TBC and JBC in the Approved UBP

Presently, three packages forming part of UBP for lifting water from Tunga and Bhadra rivers and for conveying to Chitradurga Branch Canal have been awarded to agencies on EPC basis. These are as under:

(i) Package-I: Pumping of 17.40 TMC of water from Tunga river to Bhadra river subject to certain restrictions.

(ii) Package-II: Pumping of 29.90 TMC of water from Bhadra reservoir to Chitradurga Branch Canal including construction of canal upto intake channel of the tunnel.

(iii) Package-III: Construction of 7.00 KM length of tunnel including approach and exit canals.

The adequacy of pumping and canal capacity as provided in the agreements of Package-I and II to meet the requirement under all the canals is examined. Accordingly crop water requirement as per Modified Penmen's method is worked out duly considering the requirement of all canals and it is observed that the peak requirement of present proposal is 81.85 Cumecs.

Further, working tables for 40 years i.e., from 1972-73 to 2011-12 have been worked out with the existing canal and pumping capacity considering the requirement of Tarikere lift and flow canal, Chitradurga Branch Canal, Tumkur Branch Canal, Jaglur Branch Canal and filling up of 367 tanks and the success rate is confirmed as 62.50 % for UBP and 80% for Bhadra Reservoir Project.

It is also proposed to extend irrigation benefits to area under Tumkur Branch Canal within the allocation by enhancing the water use efficiency by adopting drip irrigation within the provisions of Package I, II & III. In order to effect the planned utilization of 29.90 TMC of water in UBP, it is essential to lift 81.85 Cumecs of water from 16th June to 15th October i.e., for 121 days. It is observed from the working tables that the quantum of water to be lifted in Package - 1 is more than 15 TMC in 11 years out of 40 years and the highest quantum lifted is 19.30 TMC in the year 2001-02 & 2010-11. This quantum of water can be lifted by operating all the 4 pumps.

Further, the requirement for irrigation varies as per crop water requirement and the peak discharge of 81.85 Cumecs occurs during the 1st & 2nd quarter of August. Hence, during the other months when the requirement is below the peak discharge the water in the canal will be drawn up to the peak discharge and the balance discharge available between peak discharge and actual requirement will be utilized for filling up of tanks.

1.8.7 Proposed Irrigable Command Area (ICA) under UBP

In the present DPR it is proposed to irrigate the entire extent by drip irrigation considering drip system. The extent of irrigation for Chitradurga Branch Canal is proposed as 1,07,265 Ha which is in accordance with the earlier administratively approved (year 2008) proposal, Further to this the Taluka wise achcut is also maintained same as per the earlier administratively approved (year 2008) proposal and the details are as shown below.

Sl. No.	District	Taluk	Area in Ha
1.	Chickamaglur	Tarikere	411
2.		Kadur	1864
3.	Chitradurga	Hosadurga	31035
4.		Hiriyur	37052
5.		Holalkere	371
6.		Chitradurga	23266
7.		Challikere	13266
Total			**1,07,265**

It is also proposed to provide irrigation facility to 84,900 Ha under Tumkur Branch Canal as per the original administratively approved proposal of UBP (year 2003) by adopting flow irrigation. Further to this the Taluka wise atchkut is also maintained same as per the administratively approved (year 2003) proposal and the details are as shown below.

Sl. No.	District	Taluk	Area in Ha
1.	Chickamaglur	Tarikere	1628
2.		Kadur	20502
3.	Chitradurga	Hosadurga	13573
4.		Hiriyur	29982
5.	Tumkur	Chikkanayakana halli	4657
6.		Sira	14558
Total			**84,900**

1.8.8 Increase in Discharge on Package - I & II

The EPC works of Packages - I for lifting 17.4 TMC of water from Tunga River to Bhadra Reservoir and Package - II for lifting of 29.90 TMC of water from Bhadra Reservoir to tunnel near Ajjampura, comprises of construction period of 3 years and maintenance period for 5 years.

The DPR of Upper Bhadra Project was modified by adopting drip irrigation system for irrigating 2,25,515 Ha of land and filling of 367 Tanks of Chikkamagalur, Chitradurga, Davangere and Tumkur Districts utilizing 29.90 TMC.

Sri. Prof. Ramaprasad has carried out study of working tables, for the additional water to be lifted by increasing schedule of operation of 4 pumps in different combinations to their designed capacity in each of the four pump houses & opined that the required quantum of water can be lifted in full capacity during peak demand and partially in other months.

The requirement of power is already sanctioned for Package - I and II, for the operation of all the pumps to their full capacity and the electrical infrastructure is also provided in the package work accordingly. In the EPC tenders there is separate provision for payment towards maintenance. Hence, all the electricity charges are borne by the VJNL.

Power requirement for lifting water from Tunga to Bhadra Reservoir (Package - I) is about 63 MW and lifting water from Bhadra to Tunnel near Ajjampura (Package - II) is about 122 MW Further, Power requirement for total drip irrigation to an extent of ICA of 2,25,515 Ha, considering 39% of the area by pressurized system, is about 10.43 MW. Thus total requirement of power under UBP including Tarikere lift scheme is about 200 MW.

1.8.9 Project Components

The Project Comprises following components:

(a) Lifting water from Tunga to Bhadra Reservoir (Up to 17.40 TMC)

Lifting of water from river Tunga and feeding it into a diversion canal 11.263 Km long so as to drop into Bhadra Reservoir. It is proposed to lift 98.554 MCM (3.480 TMC) of water each month from June to October for five months. Total static head of lift is 89.0 m in two stages.

(b) Lifting water from Bhadra (29.90 TMC)

Second part of the scheme is to draw 29.90 TMC of water from Bhadra Reservoir at a regulator on its right flank. The canal from Bhadra Reservoir runs for a length of 47.50 Km and terminate at distribution chamber near Ajjampura. This consists of 2 parts - i.e., open cut canal of 40.535 Km and a tunnel of 6.90 Km in length. There are two lifts in the open cut canal.

(c) Tarikere Lift irrigation system

(i) It is proposed to irrigate 20150 Ha around Ajjampura tunnel area by lifting water from the main canal before and after the Tunnel. The utilization is 1.20 TMC of water.

(ii) Chitradurga Branch Canal runs for a length of 134.597 Km feeding the lands by gravity in Kadur and Tarikere taluks of Chikkamagalur district, Hosadurga, Hiriyur, Chitradurga, Holalakere and Challakere taluks of Chitradurga district. The total area proposed under Chitrardurga Branch Canal is 107265 Ha utilizing 11.44 TMC of water.

(iii) Tumkur Branch Canal runs for a length of 159.684 Km feeding lands by gravity in Chikkanayakanahalli and Sira taluk of Tumkur district, Tarikere, Kadur taluks in Chikkamagalur district, Hosadurga, Hiriyur in Chitradurga district. The area proposed for irrigation under Tumkur Branch Canal is 84900 Ha utilizing 7.28 TMC of water.

(iv) Jagalur Branch Canal taking off from Chitradurga Branch Canal for a length of 26.172 Km feeding the lands by gravity in Chitradurga taluk of Chitradurga district and Jagalur taluk in Davangere district. The total irrigated area proposed under Jagalur Branch canal is 13200 Ha utilizing 1.39 TMC of water.

(d) Filling up of Tanks

In addition, 8.00 TMC of water is proposed to be utilized for 367 Nos. of tank filling in the following manner:

(1)	Chitradurga Branch Canal Command (36 Nos.)	=	0.81 TMC
(2)	Tumkur Branch Canal Command (131 Nos.)	=	2.20 TMC
(3)	Jagalur Branch Canal Command (9 Nos.)	=	0.75 TMC
(4)	Tarikere Lift and Flow Area (79 Nos.)	=	0.27 TMC
(5)	Challakere Taluk (41 Nos.)	=	0.78 TMC
(6)	Holalkere Taluk (21 Nos.)	=	0.20 TMC
(7)	Molkalmuru Taluk (20 Nos.)	=	0.45 TMC
(8)	Pavagada (30 Nos.)	=	0.54 TMC
(9)	Vanivilas Sagar (augmentation)	=	2.00 TMC
	Grand Total	**=**	**8.00 TMC**

(e) Adoption of Drip Irrigation

Cost for implementation of drip irrigation system based on market rates amounting to Rs.534818.75 Lakhs is made in the estimate. The percentage of drip component works out to 24.91 % of total cost of the estimate.

1.9 A Note on Programme for Completion and Operation and maintenance

(i) Programme of Completion

Stage 1

Upper Bhadra Project works commenced in the year 2008 by taking up the following critical works under stage-1 of the project costing Rs 1580 Cr.

(a)	Lifting 17.4 TMC water from Tunga river to Bhadra reservoir (Package-1)	=	Cost Rs 324 Cr.
(b)	Lifting 29.9 TMC water from Bhadra reservoir to Ajjampura tunnel (Package-2)	=	Cost Rs 1032 Cr
(c)	Construction of 7 kms long Ajjampura tunnel (Package-3)	=	Cost Rs 224 Cr

The works (package-2 &3) are completed. The work of lifting water from Tunga river to Bhadra reservoir (package-1) is delayed due to forest and wild life clearance issues. The alignment of this work passes through eco-sensitive zone of Bhadra Wild Life Reserve for a length of 1.91 Kms for which necessary clearance is obtained from National Board for Wild Life (NBWL) in the 50th meeting of NBWL held on 07-09-2018. It is programmed to complete this work during 2022-23.

Stage-2

Under stage-2, the works of Chitradurga Branch Canal (CBC), Tumakuru Branch Canal (TBC), Tarikere LIS are taken up and are in progress since 2016-17. The work of tank filling in Holalkere taluk is taken up during 2018-19 and is in progress. The works of tank filling in Pawgada, Challakere, Molakalmuru, Jagaluru, Sira, Chiknayakanahalli & Jagaluru talukas were under progress from 2019-20 for which necessary surveys, investigation etc are in progress. The component-wise programme of completion of the project is given below.

Programme of Completion

Sl. No.	Component	Programme of Completion
1	**Stage-1** Lifting 17.4 TMC water from Tunga river to Bhadra Reservoir (Package-1)	2022-23
2	Lifting 29.9 TMC water from Bhadra Reservoir to Ajjampura tunnel (Package-2)	July 2019
3	Construction of 7 Kms long Ajjampura Tunnel (Package-3)	July 2019
4	**Stage-2** Tarikere LIS to provide drip irrigation to an area of 20,150 Ha and fill up 79 Nos. of tanks in Tarikere Taluk	June 2022
5	Chitradurga Branch Canal (CBC) 134.6 Km length	Dec 2022
5	Tumakuru Branch Canal (TBC) 159.684 Km length	March 2023
6	Holalkere Tank Filling Scheme	June 2022
7	Tank filling schemes in Pawgada, Challakere, Molakalmuru, Jagaluru, Sira, Chiknayakanahalli Talukas	March 2024
8	Drip Irrigation System to cover an area of 2,05,365 Ha	March 2024
9	Overall Completion of the Project	March 2024

2. Operation and Maintenance (O & M)

Stage - 1

The operation and maintenance of the three critical works of lifts and tunnel (Package1, 2 & 3) are included in the scope of the Contractors of the three package works for five years after completion of the works.

Stage - 2

The operation and maintenance (O & M) of the Tarikere LIS which covers an area of 20150 a by drip irrigation and fill up 79 Nos of tanks is included in the scope of the Contractor for five years. During the period of construction, the Water Users' Cooperative Societies (WUCs) will be formed, each for an area of about 500 Ha and O & M will be handed over to the WUCs after five years of O & M by the Contractor. Necessary trainings and capacity building of the farmers in drip irrigation, agronomic practices, bringing in best practices in land and water management are a part of the Contract which will be carried out by the Contractor. The WUCs will collect the water rates from the farmers as per the tariff fixed by the Government on volumetric basis, carry out O & M and remit to the Nigam as per prevailing rules. This will be followed for the drip irrigation area of 2,25,515 Ha in the project.

The O & M of the CBC, TBC and tank filling schemes after construction and commissioning the schemes will be carried out by the respective Contractors as per the terms and conditions of their Contract. Post construction and O & M by the Contractors, the O & M will be carried out by Nigam duly following the procedures by calling for tenders for O & M as per the grants provided by Nigam.

1.10 Stage of Work as per Present Proposal

Sl. No.	Description of the Work	Present Stage of Work
1.	Lifting of water from Tunga river to Bhadra Reservoir in two stages - Package I. 17.50 TMC Awarded as per EPC Tender cost Rs.324.00 Crores.	➢ It involves two stages of lifting (8450 Hp 5 Nos. in each stage) ➢ 60 Cumecs of water is lifted with static lift of 45 mts. ➢ 60% of the work has been completed.
2.	Construction of canal from Bhadra Reservoir to Delivery Chamber including two lifts but excluding the tunnel - Package II. (29.90 TMC) Awarded as per EPC Tender cost Rs.1032.00 Crores.	➢ It involves two stages of lifting (18500 Hp (4+1) No.s.in each stage) ➢ 81 Cumecs of water is lifted from about 45 Mtr ➢ Total length of canal is 40.290 Km. ➢ Total No. of Structure 96. ➢ Work is completed
3.	Construction of tunnel 7.00 Km long. Tunnel in the above canal including approach and exit - Package III. Awarded as per EPC Tender cost Rs.224.00 Crores.	➢ The work is completed
4.	Tarikere lift irrigation scheme ➢ It is proposed to irrigate 20150 Ha. By Drip Irrigation and fill up 79 Nos. of Tanks work taken up in 2 packages at the cost of Rs.812.02 Crores	➢ Work is under progress.
5.	Chitradurga Branch Canal length 134.538 Km is taken up in 12 packages Tender cost Rs.1639.52 Crores	➢ Work is under progress.
6.	Tumkur Branch Canal is 159.684 Km in length. Works are taken up to 159.684 Km in 8 packages at a cost of Rs.1091.58 Crores	➢ Work is under progress.
7	Jagalur Branch Canal and Tank Filling for a length of 74.14 Km are taken up in 2 Packages at a cost of 1833.45 Crores.	➢ Survey work is completed.

Sl. No.	Description of the Work	Present Stage of Work
8	Holalkere Branch Canal under CBC Total Tender Cost Rs.196.75 Crores	➢ Open Canal upto 4.53 Km work is under progress. ➢ Further tank filling network is work is under progress.
9	Challakere, Molakalmuru,Pavagada Tank filling works under CBC taken in 4 Packages at the cost of Rs.1338.32 Crore	➢ Work is under progress.
10	Chikkanayakanahalli 18 Tanks filling work as taken up in Rs. 69.7 Crores	➢ Work is under progress.
11	Sira 62 Tanks after tail end of TBC work as taken up in Rs. 1165.29 Crores	➢ Work is under progress.
12	Drip Irrigation for CBC for an area of 40749 Ha were taken in 03 packages at the cost of Rs.2389.87 Crores	➢ Work is under progress.
13	Drip Irrigation for TBC for an area of 27590 Ha were taken in 02 packages at the cost of Rs.1286.79 Crores	➢ Work is under progress.
14	Drip Irrigation for CBC & TBC area of 123826 Ha	➢ Survey work is under progress.

1.11 Revised Cost of the Project

The comprehensive detailed project report for Upper Bhadra Project utilizing 29.90TMC of water with modification for adoption of drip irrigation system to an extent of 225515 Ha and filling of 367 tanks has been administratively approved by the government of Karnataka vide G.O. No: WRD166 vbye-2020(part I) Bengaluru dated 16/12/2020 for **Rs. 21473.67 Cr.**

The works are taken up in phased manner.

Phase(I): -

The lift components comprising lifting of water from Tunga river to Bhadra reservoir and Bhadra reservoir to UBP canal up to tunnel was taken up in two stages.

These details are as follows;

- **Package1: -**Consists pumping of 17.40TMC of water from Tunga River to Bhadra Reservoir including construction of intake channel and gravity canal for a length of 11.26KM.
- **Package2: -**Consists pumping of 29.90TMC of water from Bhadra Reservoir and construction of canal up to intake channel of the tunnel near Ajjampura to a length of 40.535KM.
- **Package3: -**Construction of 7.00KM length of Tunnel including approach and exit canal near Ajjampura of Tarikere Tq.

Phase(II): - Works Consists of;

I. Construction of Tarikere Lift Irrigation system for providing drip irrigation to an area of 20150Ha above the surrounding area of the Tunnel and filling up of 79 tanks in tarikere taluk.

II. Construction of Chitradurga Branch Canal for a length of 135KM and extending irrigation facility to an extent of 107265.00Ha through drip irrigation system including filling up of 36 numbers of tanks.

III. Construction of Tumkur Branch Canal for a length of 160KM and extending irrigation facility to an extent of 84900.00Ha through drip irrigation system including filling up of 131 number of tanks.

IV. Construction of Jagalur Branch Canal for a length of 43.65KM and extending irrigation facility to an extent of 13200.00Ha through drip irrigation system including filling up of 9 number of tanks.

The works are taken up on package based on the actual site condition and considering the prevailing rates at the time of preparation of estimates. Project cost is arrived based on the actual cost of the works entrusted on packages for the works already tendered and for the works yet to be taken up, Current Schedule of Rates for the year 2018-19 are considered. The cost of the land acquisition/forest clearance, the prevailing rates as per the Revenue and Forest department are considered.

The total Revised Cost of the Upper Bhadra Project cost works out to Rs.21473.67 Crores.

The component wise Excess/Savings against the approved DPR is as follows;

Sl. No.	Sub-Head of Classification	As per Previous DPR 2014	As per Revised DPR 2019	Excess	Savings
	I - Works				
1	A - Preliminaries	7159.50	6701.26	-	458.24
2	B - Land	22586.84	75867.00	53280.16	-
3	C – Works	110634.00	348206.32	237572.32	-
4	D - Regulator and Measuring device	43469.55	220503.44	177033.89	-
5	E – Falls				
6	F - Cross Drainage Works				
7	G – Bridges				
8	H – Escapes				
9	I - Navigation works	-	-	-	-
10	J - Power plants and Civil Works	-	-	-	-
11	K – Buildings	2712.00	6748.74	4036.74	-
12	**L - Earthwork**				
13	L1 - Earthworks	156563.00	181863.00	25300.00	-
14	L2 - Lining				
15	L3 - Tunnel	16900.00	48189.75	31289.75	-
16	M - Plantation	238.35	1159.12	920.77	-
17	N - Tank and Reservoirs	-	11366.45	11366.45	-
18	O - Miscellaneous	4960.00	325.77	-	4634.23
19	P - Maintenance (1% of cost of I - works except A,B,M,O,Q and X)	10489.15	11280.69	791.54	-
20	Q - Special Tools and plants	185.00	243.07	58.07	-
21	R - Communication	4132.65	3367.08	-	765.57
22	S - Power plant and Electrical systems	-	46075.56	46075.56	-
23	T - Water supply works	-	-	-	-
24	U - Distributaries and Minors	563787.50	489789.76	-	73997.74
25	V - Drip irrigation	-	534818.75	534818.75	-
26	W - Drainage and Protective works	676.55	0.00	-	676.55
27	X - Environment and Ecology	6036.00	18105.56	12069.56	-
28	Y - Loss of stocks and unforeseen (0.25% of cost of I - works except A,B,M,O,Q and X)	2622.29	-	2622.29	-
29	Z - Provision for power generation	150040.00	-	-	150040.00
30	**Total of I - Works**	**1103192.38**	**2004611.32**	**-**	**-**
31	**II - Establishment:**				
32	Establishment charges @ 10% of I-Works (except B-Lands)	**108060.55**	**115811.90**		
33	**III - Tools and Plants :**				
34	Small T & P 1% of I -Works	**11031.92**	**12132.59**		
35	**IV - Suspense :**		-		
36	**V - Receipt & Recoveries on capital account**				
37	a) Recoveries on account of K-Building 15% salvage value of building cost.	406.80	-		
38	b) Recoveries towards resale transfer of	-	-	-	-

Sl. No.	Sub-Head of Classification	As per Previous DPR 2014	As per Revised DPR 2019	Excess	Savings
	special T & P 75% of provision in I-Works on Q-Special T & P excluding cost of inspection of vehicle				
39	c) Recoveries towards resale/transfer of inspection vehicle (20% of inspection vehicle)	37.00	48.61		
40	**Total Direct Charges**	**1221841.05**	**2132507.20**		
41	**Indirect Charges**				
42	a) Audit and Accounts charges (1% of I - Works)	11031.92	12132.59		
43	b) Capitalized value of abatement of land Revenue (5% of the cost of B-lands)	1129.34	2726.89		
	Grand Total	**1234002.35 Lakhs**	**2147366.70 Lakhs**		
	Say	**12340.00 Crores**	**21473.67 Crores**		

Executive Engineer
VJNL UBP Division No.1
Kaadur

Executive Engineer
VJNL UBP Division No.2
B R Project

Executive Engineer
VJNL UBP Division No.3
Ajjampura

Executive Engineer
VJNL UBP Division No.4
Hosadurga

Executive Engineer
VJNL UBP Division No.5
Chitradurga

Executive Engineer
VJNL UBP Division No.6
Challakere

Executive Engineer
VJNL, UBP Division No.7 Hiriyur Camp
Chitraduga

Executive Engineer
VJNL, UBP Division No.9
Sira

Superintending Engineer
VJNL, UBP Circle No.1
B R Project

Superintending Engineer
VJNL, UBP Circle No.2
Chitradurga

Chief Engineer
VJNL, UBP Zone
Chitradurga

1.11.1 The main reasons for variation observed under different components are listed below when compared to approved DPR;

Item involves	As per previous DPR amount (2014)	As per revised amount (2019)	Reasons
A - Preliminary: Provision is made for consultancy charges for Package I, II and III and also for detailed survey, investigation of canal network of Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal, Tarikere Lift, Restoration and filling of MI tanks and other component which is essential.	7159.50	6701.26	Instead of lumsum provision, the actual amount is considered. Hence the reduction. .
B - Lands:			
Provision of towards Land acquisition required for both canals and Residential and Non-Residential Colonies is made.	22586.85	75867.00	1. Due to change in the alignment of the CBC & TBC. 2. Due to increase in the land for pump houses residential and nonresidential colony's.
C - Works:			
Provision is made towards the head works such as offtake structure, intake channel, jackwell, pump houses, delivery chamber along with pumps and rising main.	110634.00	348206.32	1. Increased due to actual amount in UBP Package-I & II. 2. Due to increase in rates 3. Due to additional works which is not contemplated in the approved DPR.

D - Regulator & Measuring device, E - Falls, F - CD works, G - Bridges, H - Escapes - works (Construction of Structures):

Provision is made towards different types of structures coming under the Main canal of Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal, Tarikere Lift & flow canals, Restoration and filling of MI tanks.	43469.55	220503.44	1. Change in the alignment. 2. Increased due to No. of structures. 3. Due to increase in rates. 4. Increase in No. of measuring devices.

K – Building:

Provision is made for construction of Zonal Office, Circle Office, Division Office and Sub Division Office buildings. Necessary provision is also made towards camps inspection bunglow and residential quarters.	2712.00	6748.74	Increased due to considering the actual cost.

L-Earthwork:

Provision is made towards earthwork L1- Canal, Service road and Boundry. L2- Lining. L3- Tunnel	156563.000 16900.00	181863.00 48189.75	Due to increase in length of canal, lining quantity is increased. Due to change in the alignment, tunnel length is increased.

M - Plantation:

Provision is made for plantation all along the main canal for providing irrigation facility.	238.35	1159.12	Due to increase in the length and escalation in cost.

N- Tanks & Reservoirs:

Provision is made for Tank and Reservoirs.	-	11366.45	1.For Augmentation of V.V. Sagar additional works were to be taken up 2. provision Made towards restoration (Desilting) of tanks of Chitradurga Branch Canal under C-works in the approved DPR is shifted to component "N"

O - Miscellaneous:

Provision is made towards Deposits required for Electrical and other works is made towards training and Capacity building for adoption of Drip Irrigation.	4960.00	325.77	Due to increase in cost under C-works.

P - Maintenance:

Provision is made towards maintenance of all works at 1 % cost of I-works except (A, B, M, O, Q and X).	10489.15	11280.69	Due to increase in cost under the components A,B,M,O,Q and X

Q - Special Tools and Plants:

Provision is made towards purchase of new Vehicles required for officers.	185.00	243.07	Due to additional requirement of vehicles, the amount is increased.

R - Communication:

Provision is made towards approach roads to various works.	4132.00	3367.08	Due to additional works, the amount is increased.

S - Power Plant and Electrical System:

Provision is made for Power plant and Electrical system coming under Chitradurg Branch Canal, Tumkur Branch Cana and Jagalur Branch Canal and Tariker Lift and flow canals.	Nil	46075.56	Provision is not made in the approved DPR as the project consists of lift & drip irrigation system.

U - Distributories and Minors:

Distributories and minors	563787.50	489789.76	Provision for Bulk water supply and feeder line network for filling of tanks

V - Drip Irrigation System:

A provision is made for Drip irrigation system coming under Chitradurga Branch Canal, Tumkur Branch Canal,	Nil	534818.75	Provision of drip irrigation to cater irrigation facility covering an area of 2,25,515 ha is made in the Revised

Jagalur Branch Canal and Tarikere Lift & flow canals			DPR against the provision of construction of Distributaries and Minors.

W- Drainage and Protective works:

Drainage and Protective works	676.55	Nil	Provision made under component "W" is shifted to "X-environment & Ecology sub-heads" i.e. IMSD works. as per Guidelines.

X - Environment and Ecology

A provision is made towards consultation charges for study on Environment impact assessment.	6036.00	18105.56	1. Due to change in the alignment. 2. Due to change in the NPA value and deposited for forest clearance. 3. Due to provision of water shed development works above the Ajjampura Tunnel.

Y - Loss of Stock and Unforeseen Items of Work

A lumsum provision is made under this head at 0.25% cost of I-works except (A, B, M, O, Q and X).	2622.29	Nil	Increase in the item of work A,B,M,O,Q and X.

Z - Provision for Power Generation

Provision is made towards power generation from solar energy farm development.	150040.00	Nil	Installation of Solar power system instead of wind farm generation.

Establishment Charges

A lumsum provision is made towards establishment charges at 10% of the total cost of project except B-Land.	108060.92	115811.90	Due to increase in the cost of project

Small T & P

A lumsum provision is made towards small T & P at 1% of I - Works.	11031.92	12132.59	Increase in the total cost under component of I-Works.

Receipts & Recoveries

a) Recoveries on account of K-Buildings of the salvage value of building cost.	406.80	Nil	-
b) Recoveries towards resale transfer of special T & P 75% of provision in I-works on Q-special, T & P excluding cost of inspection vehicle.	-	-	-
c) Recoveries towards resale-transfer inspection of vehicle (20% of inspection vehicle)	37.00	48.61	-

Indirect Charges

a) Capitalized value of abatement of land revenue (5% of the cost of B-land)	1129.34	2726.89	Increase in the cost under the component, B-land and I-Works
b) Audit and account chargers (1% cost of I-Works)	11031.32	12132.59	

1.12 B C Ratio

The data received for calculation of B.C. Ratio is collected. The yield per hectare under rain-fed and irrigation condition are as below.

Sl. No.	Crop (Khariff and Rabi)	Maximum Yield in Quintal/ Ha	
		Rainfed	Irrigated
1.	Maize	18	70
2.	Jowar	10	50
3.	Groundnut	7	25
4.	Sunflower	5	30
5.	Pulses	7	18
6.	Ragi	8	-

The rates for various crops grown in the command area is considered from Karnataka Agriculture price commission cost of cultivation report 2019 (for crops grown during 2018-19)

Sl. No	Crop	Rates / Quintal
		Minimum
1.	Jowar	2430
2.	Maize	1700
3.	Groundnut	4890
4.	Sunflower	5388
5.	Pulses	5675

The Benefit cost ratio works out to be 1.024.

1.13 Conclusion

Considering all the above mentioned aspects, the estimated cost of the project is **Rs.21473.67 Crores** (at price level of WRD SR for 2018-2019) and the cost per hectare works out to **Rs.9.52** lakhs per Ha. The project serves the districts of Chikmagalur, Chitradurga, Tumkur and Davangere, brings 2,22,515 Ha of drought prone lands under irrigation(drip) by utilizing **21.90 TMC** of water and filling of **367 Nos.** of tanks to recharge the ground water and thereby supply drinking water facility in these region which face severe shortage of water by utilizing **8.00 TMC** of water. This tank filling also includes augmentation to Vani Vilas Sagar by **2.00 TMC**. The expenditure incurred up to end of March 2019 is 2565.05 Crores.

TALUKA-WISE AREA BENIFIED UNDER PROJECT A & B

Sl. No.	District	Taluk	Area for Irrigation(Ha)				Total Area for Irrigation (Ha)	Tank Filling (Nos.)
			Tarikere Lift	Chitradurga Branch Canal	Tumkur Branch Canal	Jagalur Branch Canal		
1.	Chikamagalur	Tarikere	20150	411	1628	-	22189	80
		Kadur	-	1864	20502	-	22366	32
2.	Chitradurga	Hosadurga	-	31035	13573	-	44608	27
		Holalkere	-	371	-	-	371	21
		Hiriyur	-	37052	29982	-	67034	32
		Chitradurga	-	23266	-	5700	28966	09
		Challakere	-	13266	-	-	13266	51
		Molkalmuru						20
3.	Tumkur	C.N.Halli	-	-	4657	-	4657	19
		Sira	-	-	14558	-	14558	41
		Pavagada						30
4.	Davangere	Jagalur	-	-	-	7500	7500	5
	Total		**20150**	**107265**	**84900**	**13200**	**225515**	**367**

Talukwise & District Wise Tank Filling Details

Sl. No	District	Taluk	Tarikere Lift & Gravity Canal	Chitradurga Branch Canal		Tumkur Branch Canal	Jagalur Branch Canal	Drinking water Supply & Filling of Tanks under Pavagada Taluk	Total
				Tank Filling coming under Command Area	Tank Filling through Gravity Feeder Lines	Tank Filling coming under Command Area			
1.	Chikamagalur	Tarikere	79			1			**80**
		Kadur		3		29			32
2.	Chitradurga	Hosadurga		3		24			27
		Holalkere		**-**	21				21
		Hiriyur		15		17			32
		Chitradurga		6			4		9
		Challakere		**9**	41				**51**
		Molkalmuru			20				20
3.	Tumkur	C.N.Halli				19			19
		Sira				**41**			**41**
		Pavagada						30	30
4.	Davangere	Jagalur					5		5
TOTAL			**79**	**36**	**82**	**131**	**9**	**30**	**367**

Summary of the Project

1. The Estimated Cost of the Project is ***Rs.21473.67 Crores*** (at price level of WRD SR for 2018-2019).
2. The Project serves the drought prone districts of Chikmagalur, Chitradurga, Tumkur and Davangere, bringing in 2,25,515 Ha of land under irrigation land by micro irrigation utilizing ***21.90 TMC*** and ***8.00 TMC*** of water is towards filling of ***367 Nos***. of tanks which also includes augmentation of Vani Vilas Sagar Project.
3. The Peak discharge for irrigation is 88.36 m^3 / sec.
4. The approved cropping pattern is adopted in post irrigation during Khariff season comprising of semidry crops as shown below with 100 % intensity of irrigation.

Ground Nut	45%
Jowar	15%
Maize	10%
Pulses	10%
Sunflower	20%

Thus, the proposed intensity of irrigation is 100%.

5. The combined efficiency with drip irrigation works out to 67.50%.
6. The Lengths of Chitradurga Branch canal is 134.597Km, Tumkur Branch canal is 159.684Km and Jagalur Branch canal is 43.5Km.
7. The total villages benefited by the proposed project is 787 Nos.
8. The total length of canal network in reserved forest is 33.524Km.
9. The total extent of forest area required for diversion is 351.97 ha and Stage -1 have been obtained from forest authorities. The Compensatory land of 364.50 Ha is also identified in Varavukaval in Nayakanahatti village in Challakere taluk of chitradurga district is already handed over to Forest authorities.
10. The Total power requirement for operating the drip system for CBC, JBC and TBC is ***10.43 MW***.
11. The Power requirement of 198 MVA for Package works is already sanctioned by KPTCL.
12. Hydrology clearance is received from CWC vide letter no. CWC UO NO. 11/135/09-PA/553 dated 06.07.2010.
13. The Cost per hectare works out to ***Rs.9.52 Lakhs per ha***.
14. The BC ratio of the project will be calculated after finalization of the irrigation planning & the cost estimate.
15. The Project is proposed to be taken up as National Project.

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ: ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ರೂ.12,340.00 ಕೋಟಿಗಳ ಕಾಮಗಾರಿಯ ಪರಿಷ್ಕೃತ ಅಂದಾಜಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆ ನೀಡುವ ಕುರಿತು.

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ಓದಲಾಗಿದೆ :-

1. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ :ಜಸಂಇ 63 ವಿಬ್ಯಾತ 2000, ದಿನಾಂಕ:23.08.2003.
2. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ: ಜಸಂಇ:152:ವಿಬ್ಯಾಇ:2004 ಭಾ–I, ದಿನಾಂಕ: 15.09.2008.
3. ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು ರವರ ಪತ್ರ ಸಂಖ್ಯೆ:ಕನೀನಿ:ಭ.ಮೇ.ಯೋ:ಸ್ಕೀಂಎ&ಬಿ:2013–14:4994:ದಿನಾಂಕ:07.02.2014.

ಪ್ರಸ್ತಾವನೆ :-

ಮೇಲೆ ಓದಲಾದ(1) ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ–1 (ಉಬ್ರಾಣಿ ಏತ ನೀರಾವರಿ ಯೋಜನೆ ಸೇರಿದಂತೆ) ಯೋಜನೆಯನ್ನು ಸ್ಕೀಂ–ಎ ಅಡಿಯಲ್ಲಿ 23 ಟಿ.ಎಂ.ಸಿ ನೀರಿನ ಬಳಕೆಯೊಂದಿಗೆ (ಭದ್ರಾ ನದಿಯಿಂದ 10 ಟಿ.ಎಂ.ಸಿ ನೀರು ಮತ್ತು ತುಂಗಾ ಅಣೆಕಟ್ಟು ನಾಲೆಗಳು, ಭದ್ರಾ ಅಣೆಕಟ್ಟು ನಾಲೆಗಳು ಮತ್ತು ವಿಜಯನಗರ ನಾಲೆಗಳ ಆಧುನೀಕರಣದಿಂದ ಉಳಿತಾಯವಾಗುವ 13.00 ಟಿ.ಎಂ.ಸಿ ನೀರು) ರೂ.2813.00 ಕೋಟಿಗಳ ಅಂದಾಜಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಿ ಅನುಷ್ಠಾನಕ್ಕಾಗಿ ಯೋಜನೆಯನ್ನು ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತಕ್ಕೆ ಹಸ್ತಾಂತರಿಸಲಾಗಿರುತ್ತದೆ.

ಮೇಲೆ ಓದಲಾದ(2) ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ–Iರ ಮಾರ್ಪಾಡಿತ ಅಂದಾಜು ಮೊತ್ತವಾದ ರೂ.5985.00 ಕೋಟಿಗಳಿಗೆ ತಾತ್ವಿಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿದೆ. ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ–Iರ ಮೊದಲನೆ ಹಂತದಲ್ಲಿ, ನೀರಾವರಿ ಭಾಗದ ಕಾಮಗಾರಿಗಳನ್ನು ತುರ್ತಾಗಿ ಕೈಗೊಂಡು ಪೂರ್ಣಗೊಳಿಸುವ ಹಿತದೃಷ್ಟಿಯಿಂದ, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತದ ನಿರ್ದೇಶಕರ ಮಂಡಳಿ ಮತ್ತು ತಾಂತ್ರಿಕ ಉಪ ಸಮಿತಿಯಿಂದ ವಿಧಿಸಲಾಗಿರುವ ಷರತ್ತುಗಳಿಗೆ ಮತ್ತು ಮುಂದೆಯೂ ಸಹ ವಿಧಿಸಬಹುದಾದ ಷರತ್ತುಗಳಿಗೆ ಮತ್ತು ಕಾಲ ಕಾಲಕ್ಕೆ ಸಕ್ಷಮ ಪ್ರಾಧಿಕಾರದ ಅನುಮತಿಯನ್ನು ಪಡೆದು ಅದರಂತೆ ಮುಂದುವರೆಯುವ ಷರತ್ತಿಗೆ ಒಳಪಟ್ಟು ಸರ್ಕಾರದ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿತ್ತು.

ಮೇಲೆ ಓದಲಾದ (3)ರ ಪತ್ರದಲ್ಲಿ, ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ರವರು, ಒಂದೇ ಹಂತದಲ್ಲಿ ಅನುಷ್ಠಾನಗೊಳಿಸಲು ರೂ.12340.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಪರಿಷ್ಕೃತ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಯನ್ನು ತಯಾರಿಸಿದ್ದು, ಇದಕ್ಕೆ ದಿನಾಂಕ 5/12/2013 ಮತ್ತು 8/1/2014ರಂದು ಜರುಗಿದ ನಿಗಮದ 2ನೇ ಮತ್ತು 3ನೇ ಅಂದಾಜು ಪರಿಶೀಲನಾ ಸಮಿತಿ ಸಭೆಯಲ್ಲಿ ಮಂಡಿಸಿ ತೀರುವಳಿ ಪಡೆದಿದ್ದು, ಸಮಿತಿಯು ಪರಿಷ್ಕೃತ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಗಾಗಿ ಸರ್ಕಾರಕ್ಕೆ ಸಲ್ಲಿಸಲು ಶಿಫಾರಸ್ಸು ಕೋರಿ ನಿಗಮದ ನಿರ್ದೇಶಕರ ಮಂಡಳಿಯ ಮುಂದೆ ಮಂಡಿಸಲು ಸೂಚಿಸಿದೆ ಎಂದು ತಿಳಿಸಿರುತ್ತಾರೆ. ಇದರನ್ವಯ, ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಯನ್ನು ದಿನಾಂಕ.24.01.2014 ರಂದು ಜರುಗಿದ ನಿಗಮದ 62ನೇ ನಿರ್ದೇಶಕರ ಮಂಡಳಿಯ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆಗಾಗಿ ಮಂಡಿಸಲಾಗಿದ್ದು ಚರ್ಚೆಯ ನಂತರ, ನಿಗಮದ ಅಂದಾಜು ಪರಿಶೀಲನಾ ಸಮಿತಿಯ ಶಿಫಾರಸ್ಸಿನಂತೆ ರೂ.12340.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಪರಿಷ್ಕೃತ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಯನ್ನು ಮಂಡಳಿಯು ಅನುಮೋದಿಸಿ, ಸರ್ಕಾರದ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಗೆ ಸಲ್ಲಿಸಲು ಶಿಫಾರಸ್ಸು ಮಾಡಿದೆ ಎಂದು ವರದಿ ಮಾಡಿರುತ್ತಾರೆ.

ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಇವರು ಚಿಕ್ಕಮಗಳೂರು, ಚಿತ್ರದುರ್ಗ, ದಾವಣಗೆರೆ ಮತ್ತು ತುಮಕೂರು ಜಿಲ್ಲೆಗಳ 2,25,515 ಹೆ. ಭೂಪ್ರದೇಶಕ್ಕೆ ಸೂಕ್ಷ್ಮ ನೀರಾವರಿ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡು 19.04 ಟಿ.ಎಂ.ಸಿ. ನೀರಿನ ಬಳಕೆಯೊಂದಿಗೆ ಚಿತ್ರದುರ್ಗ ಶಾಖಾ ಕಾಲುವೆ, ಜಗಳೂರು ಶಾಖಾ ಕಾಲುವೆ, ತರೀಕೆರೆ ಏತ ಹಾಗೂ ಗುರುತ್ವ ಕಾಲುವೆ ಮತ್ತು ತುಮಕೂರು ಶಾಖಾ ಕಾಲುವೆಗಳನ್ನು ನಿರ್ಮಿಸಿ, ಇದರಡಿಯಲ್ಲಿ ನೀರಾವರಿ ಸೌಲಭ್ಯ ಕಲ್ಪಿಸಲು ಮತ್ತು ಈ ಜಿಲ್ಲೆಗಳಲ್ಲಿನ 367 ಸಣ್ಣ ನೀರಾವರಿ ಕೆರೆಗಳನ್ನು 8.86 ಟಿ.ಎಂ.ಸಿ. ನೀರನ್ನು ಬಳಸಿಕೊಂಡು ತುಂಬಿಸಲು ಮತ್ತು ವಾಣಿವಿಲಾಸ ಸಾಗರಕ್ಕೆ 2.00 ಟಿ.ಎಂ.ಸಿ. ನೀರು ತುಂಬಿಸುವ ಒಟ್ಟಾರೆ 29.90 ಟಿ.ಎಂ.ಸಿ. ನೀರಿನ ಬಳಕೆಯ ರೂ.12340.00 ಕೋಟಿಗಳ ಮೊತ್ತಕ್ಕೆ (2012-13ರ ದರಪಟ್ಟಿಯಂತೆ) ತಯಾರಿಸಲಾಗಿರುವ ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಪರಿಷ್ಕೃತ ಯೋಜನಾ ವರದಿಯನ್ನು ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಗಾಗಿ ಸರ್ಕಾರಕ್ಕೆ ಸಲ್ಲಿಸಿರುತ್ತಾರೆ.

ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು ರವರು ಸಲ್ಲಿಸಿರುವ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಪರಿಶೀಲಿಸಲಾಗಿದ್ದು, ಈ ಕೆಳಗಿನಂತೆ ಆದೇಶವನ್ನು ಹೊರಡಿಸಲಾಗಿದೆ.

ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ: ಜಸಂಇ 53 ವಿಬ್ಯಾಇ 2014, ಬೆಂಗಳೂರು, ದಿನಾಂಕ: 06.03.2015

ಸೂಕ್ಷ್ಮ ನೀರಾವರಿ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡು 2,25,515ಹೆ ಭೂಪ್ರದೇಶಕ್ಕೆ ನೀರಾವರಿ ಕಲ್ಪಿಸಲು ಮತ್ತು 367 ಸಣ್ಣ ನೀರಾವರಿ ಕೆರೆಗಳನ್ನು ಅವುಗಳ ಸಾಮರ್ಥ್ಯದ ಶೇ.50 ರಷ್ಟು ತುಂಬಿಸಲು ಮತ್ತು ತುಮಕೂರು ಶಾಖಾ ಕಾಲುವೆ ಮುಖಾಂತರ 2 ಟಿಎಂಸಿ ನೀರನ್ನು ವಾಣಿವಿಲಾಸ ಸಾಗರಕ್ಕೆ ಪೂರೈಸುವ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ರೂ.12,340.00 ಕೋಟಿ ಮೊತ್ತದ ಪರಿಷ್ಕೃತ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಗೆ ಸರ್ಕಾರದ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿದೆ.

ಮುಂದುವರೆದು, ಸದರಿ ಯೋಜನೆಯನ್ನು ರಾಷ್ಟ್ರೀಯ ಯೋಜನೆಯನ್ನಾಗಿ ಪರಿಗಣಿಸಲು ಕೇಂದ್ರ ಸರ್ಕಾರಕ್ಕೆ ಪ್ರಸ್ತಾವನೆ ಸಲ್ಲಿಸುವುದು ಹಾಗೂ ಪರಿಷ್ಕೃತ ಯೋಜನಾ ವರದಿಯಲ್ಲಿನ ಅವಶ್ಯವಿರುವ ತುರ್ತು ಕಾಮಗಾರಿಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವ ಬಗ್ಗೆ ಕ್ರಮವಹಿಸುವುದು ಎಂದು ಆದೇಶಿಸಲಾಗಿದೆ.

ಈ ಆದೇಶವನ್ನು ಆರ್ಥಿಕ ಇಲಾಖೆಯ ಟಿಪ್ಪಣಿ:ಸಂಖ್ಯೆ: FD 596 FC-1/2014 ದಿನಾಂಕ 22.11.2014 ಹಾಗೂ ಅ.ಟಿ. ಸಂಖ್ಯೆ: FD/PS/1974/2015, ದಿನಾಂಕ 24.01.2015 ರಲ್ಲಿ ನೀಡಿರುವ ಸಹಮತಿಯೊಂದಿಗೆ ಹೊರಡಿಸಲಾಗಿದೆ.

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆಜ್ಞಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,

6/3/2015

(ಕೆ.ಎಸ್. ನಾಗರಾಜ)
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ (ತಾಂತ್ರಿಕ-4),
ಜಲ ಸಂಪನ್ಮೂಲ ಇಲಾಖೆ.

ಇವರಿಗೆ

1) ಪ್ರಧಾನ ಮಹಾಲೇಖಪಾಲರು (ಜಿ & ಎಸ್ ಎಸ್ ಎ), ಕರ್ನಾಟಕ, ಹೊಸ ಕಟ್ಟಡ, ಆಡಿಟ್ ಭವನ, ಅಂಚೆ ಪೆಟ್ಟಿಗೆ ಸಂಖ್ಯೆ:5398, ಬೆಂಗಳೂರು-560001.

..3...

2) ಮಹಾಲೇಖಪಾಲರು (ಲೆಕ್ಕ ಪತ್ರ/ಲೆಕ್ಕ ಪರಿಶೋಧನೆ), ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು.

3) ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

4) ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ (ಸಚಿವ ಸಂಪುಟ ಶಾಖೆ), ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು (ಸಚಿವ ಸಂಪುಟ ವಿಷಯ ಸಂಖ್ಯೆ:ಸಿ:04:2015, ದಿನಾಂಕ:08.01.2015ರ ಕುರಿತಂತೆ ಹಾಗೂ ದಿನಾಂಕ 21.01.2015 ರಂದು ನಡೆದ ಸಚಿವ ಸಂಪುಟ ಸಭೆಯಲ್ಲಿಯ ಸ್ಥಿರೀಕರಣದನ್ವಯ).

5) ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

6) ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿ ಹಾಗೂ ಅಭಿವೃದ್ಧಿ ಆಯುಕ್ತರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

7) ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ ಇವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಕಾಸ ಸೌಧ, ಬೆಂಗಳೂರು.

8) ಸರ್ಕಾರದ ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಪರಿಸರ, ಅರಣ್ಯ ಮತ್ತು ಜೀವಿಶಾಸ್ತ್ರ ಇಲಾಖೆ, ಬಹುಮಹಡಿಗಳ ಕಟ್ಟಡ, ಬೆಂಗಳೂರು.

9) ಸರ್ಕಾರದ ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿಗಳು, ಆರ್ಥಿಕ ಇಲಾಖೆ ಇವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

10) ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ ಇವರ ಆಪ್ತ ಸಹಾಯಕರು, ವಿಕಾಸ ಸೌಧ, ಬೆಂಗಳೂರು.

11) ಮಾನ್ಯ ಜಲಸಂಪನ್ಮೂಲ ಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಯವರು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

12) ವಿಶೇಷಾಧಿಕಾರಿ ಮತ್ತು ಪದನಿಮಿತ್ತ ಸರ್ಕಾರದ ಉಪ ಕಾರ್ಯದರ್ಶಿಗಳು, ಲೋಕೋಪಯೋಗಿ ಇಲಾಖೆ (ಆರ್ಥಿಕ ಕೋಶ), ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.

13) ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆಯ ಎಲ್ಲಾ ಉಪ ಕಾರ್ಯದರ್ಶಿಗಳು/ ವಿಶೇಷ ಕರ್ತವ್ಯಾಧಿಕಾರಿಗಳು/ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು , ವಿಕಾಸ ಸೌಧ, ಬೆಂಗಳೂರು.

14) ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಜಲಸಂಪನ್ಮೂಲ ಅಭಿವೃದ್ಧಿ ಸಂಸ್ಥೆ / ಅಂತರರಾಜ್ಯ ಜಲ ವಿವಾದ, ಆನಂದ್ ರಾವ್ ವೃತ್ತ, ಬೆಂಗಳೂರು-9.

15) ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಕಾಫಿ ಬೋರ್ಡ್ ಕಟ್ಟಡ, ಬೆಂಗಳೂರು.

16) ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಕನೀನಿನಿ, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ, ಚಿತ್ರದುರ್ಗ.

17) ನಿರ್ದೇಶಕರು, ರಾಜ್ಯ ಪತ್ರಾಗಾರ ಇಲಾಖೆ, ವಿಕಾಸಸೌಧ ಬೆಂಗಳೂರು, 10 ಪ್ರತಿಗಳು.

18) ನಿರ್ದೇಶಕರು, ಜಿಯೋಮೆಟ್ರಿಕ್ ಕೇಂದ್ರ, ಆನಂದರಾವ್ ವೃತ್ತ, ಬೆಂಗಳೂರು.

19) ಶಾಖಾ ರಕ್ಷಾ ಕಡತ/ಹೆಚ್ಚಿನ ಪ್ರತಿ.

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ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ: ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ರೂ.12,340.00 ಕೋಟಿಗಳ ಕಾಮಗಾರಿಯ ಪರಿಷ್ಕೃತ ಅಂದಾಜಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆ ನೀಡುವ ಕುರಿತು.

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ಓದಲಾಗಿದೆ :-

1. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ :ಜಸಂಇ 63 ವಿಬ್ಯಾಕ 2000, ದಿನಾಂಕ:23.08.2003.
2. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ: ಜಸಂಇ:152:ವಿಬ್ಯಾಇ:2004 ಭಾ-1, ದಿನಾಂಕ: 15.09.2008.
3. ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು ರವರ ಪತ್ರ ಸಂಖ್ಯೆ:ಕನೀನಿ:ಭ.ಮೇ.ಯೋ:ಸ್ಕೀಂಎ&ಬಿ:2013-14:4994:ದಿನಾಂಕ:07.02.2014.

ಪ್ರಸ್ತಾವನೆ :-

ಮೇಲೆ ಓದಲಾದ(1) ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ-1 (ಉಬ್ರಾಣಿ ಏತ ನೀರಾವರಿ ಯೋಜನೆ ಸೇರಿದಂತೆ) ಯೋಜನೆಯನ್ನು ಸ್ಕೀಂ-ಎ ಅಡಿಯಲ್ಲಿ 23 ಟಿ.ಎಂ.ಸಿ ನೀರಿನ ಬಳಕೆಯೊಂದಿಗೆ (ಭದ್ರಾ ನದಿಯಿಂದ 10 ಟಿ.ಎಂ.ಸಿ ನೀರು ಮತ್ತು ತುಂಗಾ ಅಣೆಕಟ್ಟು ನಾಲೆಗಳು, ಭದ್ರಾ ಅಣೆಕಟ್ಟು ನಾಲೆಗಳು ಮತ್ತು ವಿಜಯನಗರ ನಾಲೆಗಳ ಆಧುನೀಕರಣದಿಂದ ಉಳಿತಾಯವಾಗುವ 13.00 ಟಿ.ಎಂ.ಸಿ ನೀರು) ರೂ.2813.00 ಕೋಟಿಗಳ ಅಂದಾಜಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಿ ಅನುಷ್ಠಾನಕ್ಕಾಗಿ ಯೋಜನೆಯನ್ನು ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತಕ್ಕೆ ಹಸ್ತಾಂತರಿಸಲಾಗಿರುತ್ತದೆ.

ಮೇಲೆ ಓದಲಾದ(2) ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ-1ರ ಮಾರ್ಪಾಡಿತ ಅಂದಾಜು ಮೊತ್ತವಾದ ರೂ.5985.00 ಕೋಟಿಗಳಿಗೆ ತಾತ್ವಿಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿದೆ. ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ-1ರ ಮೊದಲನೆ ಹಂತದಲ್ಲಿ, ನೀರಾವರಿ ಭಾಗದ ಕಾಮಗಾರಿಗಳನ್ನು ತುರ್ತಾಗಿ ಕೈಗೊಂಡು ಪೂರ್ಣಗೊಳಿಸುವ ಹಿತದೃಷ್ಟಿಯಿಂದ, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತದ ನಿರ್ದೇಶಕರ ಮಂಡಳಿ ಮತ್ತು ತಾಂತ್ರಿಕ ಉಪ ಸಮಿತಿಯಿಂದ ವಿಧಿಸಲಾಗಿರುವ ಷರತ್ತುಗಳಿಗೆ ಮತ್ತು ಮುಂದೆಯೂ ಸಹ ವಿಧಿಸಬಹುದಾದ ಷರತ್ತುಗಳಿಗೆ ಮತ್ತು ಕಾಲ ಕಾಲಕ್ಕೆ ಸಕ್ಷಮ ಪ್ರಾಧಿಕಾರದ ಅನುಮತಿಯನ್ನು ಪಡೆದು ಅದರಂತೆ ಮುಂದುವರೆಯುವ ಷರತ್ತಿಗೆ ಒಳಪಟ್ಟು ಸರ್ಕಾರದ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿತ್ತು.

ಮೇಲೆ ಓದಲಾದ (3)ರ ಪತ್ರದಲ್ಲಿ, ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ರವರು, ಒಂದೇ ಹಂತದಲ್ಲಿ ಅನುಷ್ಠಾನಗೊಳಿಸಲು ರೂ.12340.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಪರಿಷ್ಕೃತ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಯನ್ನು ತಯಾರಿಸಿದ್ದು, ಇದಕ್ಕೆ ದಿನಾಂಕ 5/12/2013 ಮತ್ತು 8/1/2014ರಂದು ಜರುಗಿದ ನಿಗಮದ 2ನೇ ಮತ್ತು 3ನೇ ಅಂದಾಜು ಪರಿಶೀಲನಾ ಸಮಿತಿ ಸಭೆಯಲ್ಲಿ ಮಂಡಿಸಿ ತೀರುವಳಿ ಪಡೆದಿದ್ದು, ಸಮಿತಿಯು ಪರಿಷ್ಕೃತ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಗಾಗಿ ಸರ್ಕಾರಕ್ಕೆ ಸಲ್ಲಿಸಲು ಶಿಫಾರಸ್ಸು ಕೋರಿ ನಿಗಮದ ನಿರ್ದೇಶಕರ ಮಂಡಳಿಯ ಮುಂದೆ ಮಂಡಿಸಲು ಸೂಚಿಸಿದೆ ಎಂದು ತಿಳಿಸಿರುತ್ತಾರೆ. ಇದರನ್ವಯ, ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಯನ್ನು ದಿನಾಂಕ.24.01.2014 ರಂದು ಜರುಗಿದ ನಿಗಮದ 62ನೇ ನಿರ್ದೇಶಕರ ಮಂಡಳಿಯ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆಗಾಗಿ ಮಂಡಿಸಲಾಗಿದ್ದು, ಚರ್ಚೆಯ ನಂತರ, ನಿಗಮದ ಅಂದಾಜು ಪರಿಶೀಲನಾ ಸಮಿತಿಯ ಶಿಫಾರಸ್ಸಿನಂತೆ ರೂ.12340.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಪರಿಷ್ಕೃತ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಯನ್ನು ಮಂಡಳಿಯು ಅನುಮೋದಿಸಿ, ಸರ್ಕಾರದ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಗೆ ಸಲ್ಲಿಸಲು ಶಿಫಾರಸ್ಸು ಮಾಡಿದೆ ಎಂದು ವರದಿ ಮಾಡಿರುತ್ತಾರೆ.

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ಈ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಇವರು ಚಿತ್ರದುರ್ಗ, ದಾವಣಗೆರೆ ಮತ್ತು ತುಮಕೂರು ಜಿಲ್ಲೆಗಳ 2,25,515 ಹೆ. ಭೂಪ್ರದೇಶಕ್ಕೆ ಸೂಕ್ಷ್ಮ ನೀರಾವರಿ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡು 19.04 ಟಿ.ಎಂ.ಸಿ. ನೀರಿನ ಬಳಕೆಯೊಂದಿಗೆ ಚಿತ್ರದುರ್ಗ ಶಾಖಾ ಕಾಲುವೆ, ಜಗಳೂರು ಶಾಖಾ ಕಾಲುವೆ, ತರೀಕೆರೆ ಏತ ಹಾಗೂ ಗುರುತ್ವ ಕಾಲುವೆ ಮತ್ತು ತುಮಕೂರು ಶಾಖಾ ಕಾಲುವೆಗಳನ್ನು ನಿರ್ಮಿಸಿ, ಇದರಡಿಯಲ್ಲಿ ನೀರಾವರಿ ಸೌಲಭ್ಯ ಕಲ್ಪಿಸಲು ಮತ್ತು ಈ ಜಿಲ್ಲೆಗಳಲ್ಲಿನ 367 ಸಣ್ಣ ನೀರಾವರಿ ಕೆರೆಗಳನ್ನು 6.86 ಟಿ.ಎಂ.ಸಿ. ನೀರನ್ನು ಬಳಸಿಕೊಂಡು ತುಂಬಿಸಲು ಮತ್ತು ಕುಡಿಯುವ ನೀರಿಗೆ 2.00 ಟಿ.ಎಂ.ಸಿ. ನೀರು ಒದಗಿಸುವ ಒಟ್ಟಾರೆ 29.90 ಟಿ.ಎಂ.ಸಿ. ನೀರಿನ ಬಳಕೆಯ ರೂ.12340.00 ಕೋಟಿಗಳ ಮೊತ್ತಕ್ಕೆ (2012-13ರ ದರಪಟ್ಟಿಯಂತೆ) ತಯಾರಿಸಲಾಗಿರುವ ಸಮಗ್ರ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಪರಿಷ್ಕೃತ ಯೋಜನಾ ವರದಿಯನ್ನು ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಗಾಗಿ ಸರ್ಕಾರಕ್ಕೆ ಸಲ್ಲಿಸಿರುತ್ತಾರೆ.

ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು ಇವರು ಸಲ್ಲಿಸಿರುವ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಪರಿಶೀಲಿಸಲಾಗಿದ್ದು, ಈ ಕೆಳಕಂಡ ಆದೇಶವನ್ನು ಹೊರಡಿಸಲಾಗಿದೆ.

ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ: ಜಸಂಇ 53 ವಿಸಭಾಕ 2014, ಬೆಂಗಳೂರು, ದಿನಾಂಕ: 06.03.2015

ಸೂಕ್ಷ್ಮ ನೀರಾವರಿ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡು 2,25,515ಹೆ ಭೂಪ್ರದೇಶಕ್ಕೆ ನೀರಾವರಿ ಕಲ್ಪಿಸಲು ಮತ್ತು 367 ಸಣ್ಣ ನೀರಾವರಿ ಕೆರೆಗಳನ್ನು ಅವುಗಳ ಸಾಮರ್ಥ್ಯದ ಶೇ.50 ರಷ್ಟು ತುಂಬಿಸಲು ಮತ್ತು ತುಮಕೂರು ಶಾಖಾ ಕಾಲುವೆ ಮುಖಾಂತರ 2 ಟಿಎಂಸಿ ನೀರನ್ನು ಕುಡಿಯುವ ನೀರಿಗೆ ಒದಗಿಸುವ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ರೂ.12,340.00 ಕೋಟಿ ಮೊತ್ತದ ಪರಿಷ್ಕೃತ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಗೆ ಸರ್ಕಾರದ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿದೆ.

ಮುಂದುವರೆದು, ಸದರಿ ಯೋಜನೆಯನ್ನು ರಾಷ್ಟ್ರೀಯ ಯೋಜನೆಯನ್ನಾಗಿ ಪರಿಗಣಿಸಲು ಕೇಂದ್ರ ಸರ್ಕಾರಕ್ಕೆ ಪ್ರಸ್ತಾವನೆ ಸಲ್ಲಿಸುವ ಹಾಗೂ ಪರಿಷ್ಕೃತ ಯೋಜನಾ ವರದಿಯಲ್ಲಿನ ಅವಶ್ಯವಿರುವ ತುರ್ತು ಕಾಮಗಾರಿಗಳನ್ನು ಕೈಗೊಳ್ಳುವ ಬಗ್ಗೆ ಕ್ರಮವಹಿಸುವುದು ಎಂದು ಆದೇಶಿಸಲಾಗಿದೆ.

ಈ ಆದೇಶವನ್ನು ಆರ್ಥಿಕ ಇಲಾಖೆಯ ಟಿಪ್ಪಣಿಸಂಖ್ಯೆ: FD 596 FC-1/2014 ದಿನಾಂಕ 22.11.2014 ಹಾಗೂ ಅ.ಟಿ. ಸಂಖ್ಯೆ: FD/PS/1974/2015, ದಿನಾಂಕ 24.01.2015 ರಲ್ಲಿ ನೀಡಿರುವ ಸಹಮತಿಯೊಂದಿಗೆ ಹೊರಡಿಸಲಾಗಿದೆ.

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆಜ್ಞಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,

[illegible] 6/3/2015

(ಕೆ.ಎಸ್. [illegible])
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ (ತಾಂತ್ರಿಕ-4),
ಜಲ ಸಂಪನ್ಮೂಲ ಇಲಾಖೆ.

ಇವರಿಗೆ:

1) ಪ್ರಧಾನ ಮಹಾಲೇಖಪಾಲರು (ಜಿ & ಎಸ್ ಎಸ್ ಎ), ಕರ್ನಾಟಕ, ಹೊಸ ಕಟ್ಟಡ, ಆಡಿಟ್ ಭವನ, ಅಂಚೆ ಪೆಟ್ಟಿಗೆ ಸಂಖ್ಯೆ:5398, ಬೆಂಗಳೂರು-560001.

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2) ಮಹಾಲೇಖಪಾಲರು (ಲೆಕ್ಕ ಪತ್ರ/ಲೆಕ್ಕ ಪರಿಶೋಧನೆ), ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು.

3) ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

4) ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ (ಸಚಿವ ಸಂಪುಟ ಶಾಖೆ), ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು (ಸಚಿವ ಸಂಪುಟ ವಿಷಯ ಸಂಖ್ಯೆ:ಸಿ:04:2015, ದಿನಾಂಕ:08.01.2015ರ ಟಿಪ್ಪಣಿ ಹಾಗೂ ದಿನಾಂಕ 21.01.2015 ರಂದು ನಡೆದ ಸಚಿವ ಸಂಪುಟ ಸಭೆಯಲ್ಲಿನ ನಿರ್ಣಯದನ್ವಯ).

5) ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

6) ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿ ಹಾಗೂ ಅಭಿವೃದ್ಧಿ ಆಯುಕ್ತರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

7) ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ ಇವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಕಾಸ ಸೌಧ, ಬೆಂಗಳೂರು.

8) ಸರ್ಕಾರದ ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಪರಿಸರ, ಅರಣ್ಯ ಮತ್ತು ಜೀವಿಶಾಸ್ತ್ರ ಇಲಾಖೆ, ಬಹುಮಹಡಿಗಳ ಕಟ್ಟಡ, ಬೆಂಗಳೂರು.

9) ಸರ್ಕಾರದ ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿಗಳು, ಆರ್ಥಿಕ ಇಲಾಖೆ ಇವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

10) ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ ಇವರ ಆಪ್ತ ಸಹಾಯಕರು, ವಿಕಾಸ ಸೌಧ, ಬೆಂಗಳೂರು.

11) ಮಾನ್ಯ ಜಲಸಂಪನ್ಮೂಲ ಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಯವರು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.

12) ವಿಶೇಷಾಧಿಕಾರಿ ಮತ್ತು ಪದನಿಮಿತ್ತ ಸರ್ಕಾರದ ಉಪ ಕಾರ್ಯದರ್ಶಿಗಳು, ಲೋಕೋಪಯೋಗಿ ಇಲಾಖೆ (ಆರ್ಥಿಕ ಕೋಶ), ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.

13) ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆಯ ಎಲ್ಲಾ ಉಪ ಕಾರ್ಯದರ್ಶಿಗಳು/ ವಿಶೇಷ ಕರ್ತವ್ಯಾಧಿಕಾರಿಗಳು/ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು , ವಿಕಾಸ ಸೌಧ, ಬೆಂಗಳೂರು.

14) ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಜಲಸಂಪನ್ಮೂಲ ಅಭಿವೃದ್ಧಿ ಸಂಸ್ಥೆ / ಅಂತರರಾಜ್ಯ ಜಲ ವಿವಾದ, ಆನಂದ್ ರಾವ್ ವೃತ್ತ, ಬೆಂಗಳೂರು-9.

15) ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಕಾಫಿ ಬೋರ್ಡ್ ಕಟ್ಟಡ, ಬೆಂಗಳೂರು.

16) ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಕೆಎನ್‌ಎನ್, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ, ಚಿತ್ರದುರ್ಗ.

17) ನಿರ್ದೇಶಕರು, ರಾಜ್ಯ ಪತ್ರಾಗಾರ ಇಲಾಖೆ, ವಿಕಾಸಸೌಧ ಬೆಂಗಳೂರು, 10 ಪ್ರತಿಗಳು.

18) ನಿರ್ದೇಶಕರು, ಬಯೋಮೆಟ್ರಿಕ್ ಕೇಂದ್ರ, ಆನಂದರಾವ್ ವೃತ್ತ, ಬೆಂಗಳೂರು.

19) ಶಾಖಾ ರಕ್ಷಾ ಕಡತ/ಹೆಚ್ಚುವರಿ ಪ್ರತಿ.

AE-4

Annexure-3

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ:- ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ-1 ರ ಮಾರ್ಪಾಡಿತ ಅಂದಾಜು ಮೊತ್ತ ರೂ.5985.00 ಕೋಟಿಗಳಿಗೆ ತಾತ್ವಿಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲು ಮತ್ತು ಇದರಡಿಯ ನೀರಾವರಿ ಭಾಗದ ರೂ.3388.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಕಾಮಗಾರಿಗಳನ್ನು ತುರ್ತಾಗಿ ಕೈಗೊಳ್ಳುವ ಬಗ್ಗೆ.

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ಓದಲಾಗಿದೆ: ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ ಇವರ ಪತ್ರ ಸಂಖ್ಯೆ:KNN/MD/2007-08/676, ದಿನಾಂಕ:02-06-2008.

ಪ್ರಸ್ತಾವನೆ:

ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ ಇವರು ದಿನಾಂಕ:20-5-2008 ರಂದು ಜರುಗಿಸಿದ ಸಭೆಯಲ್ಲಿ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯನ್ನು ಪೂರ್ಣಗೊಳಿಸುವ ಸಲುವಾಗಿ ಮುಂದಿನ 5 ವರ್ಷಗಳ ಅವಧಿಯ ಒಂದು ಕಾರ್ಯಯೋಜನೆಯನ್ನು ತಯಾರಿಸಲು, ಮುಖ್ಯ ಇಂಜಿನಿಯರ್ ರವರಿಗೆ ಸೂಚನೆಯನ್ನು ನೀಡಿದ್ದು, ಅದರ ಮೇರೆಗೆ ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಲಯ, ಚಿತ್ರದುರ್ಗ ಇವರು ಮಾರ್ಪಾಡಿತ ಅಂದಾಜನ್ನು ತಯಾರಿಸಿರುತ್ತಾರೆ.

ಮೇಲೆ ಓದಲಾದ ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರ ದಿನಾಂಕ:2-6-2008ರ ಪತ್ರದಲ್ಲಿನ ವರದಿಯಲ್ಲಿ ತಿಳಿಸಿರುವಂತೆ, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಮುಖ್ಯಾಂಶಗಳು ಈ ಕೆಳಕಂಡಂತಿವೆ.

1) ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಮಾರ್ಪಾಡಿತ ಅಂದಾಜು ಮೊತ್ತ ರೂ 5,985-00 ಕೋಟಿಗಳು

2) ಯೋಜನೆಯನ್ನು 2008-09 ರಿಂದ 2012-13 ರ ಅವಧಿಯಲ್ಲಿ ಈ ಕೆಳಕಂಡ ಅನುದಾನಗಳ ನೆರವಿನೊಂದಿಗೆ ಅನುಷ್ಠಾನಗೊಳಿಸುವ ಉದ್ದೇಶ ಹೊಂದಲಾಗಿದೆ.

1) 2008-09 ರ ಸಾಲಿಗೆ	ರೂ. 314.00 ಕೋಟಿಗಳು
2) 2009-10 ರ ಸಾಲಿಗೆ	ರೂ. 1199.00 ಕೋಟಿಗಳು
3) 2010-11 ರ ಸಾಲಿಗೆ	ರೂ. 1716.00 ಕೋಟಿಗಳು
4) 2011-12 ರ ಸಾಲಿಗೆ	ರೂ. 1717.00 ಕೋಟಿಗಳು
5) 2012-13 ರ ಸಾಲಿಗೆ	ರೂ. 1039.00 ಕೋಟಿಗಳು
ಒಟ್ಟು	ರೂ. 5985.00 ಕೋಟಿಗಳು

3) ಈ ಕೆಳಕಂಡ ಕಾಮಗಾರಿಗಳಿಗೆ ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತದಿಂದ 3 ಟೆಂಡರ್‌ಗಳನ್ನು ಕರೆಯಲಾಗಿರುತ್ತದೆ:

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ಅ) ತುಂಗಾ ನದಿಯಿಂದ 15 ಟಿ.ಎಂ.ಸಿ ನೀರನ್ನು ಎತ್ತಿ ಭದ್ರಾ ಜಲಾಶಯಕ್ಕೆ ಹರಿಸುವುದು.

ಆ) ಭದ್ರಾ ಜಲಾಶಯದಿಂದ 21.50 ಟಿ.ಎಂ.ಸಿ ನೀರನ್ನು ಎತ್ತಿ ಅಜ್ಜಂಪುರದ ಬಳಿ ಇರುವ ಸುರಂಗದ ಹತ್ತಿರದ ಡೆಲಿವರಿ ಛೇಂಬರ್‌ವರೆಗೆ ಹರಿಸುವುದು.

ಇ) ಅಜ್ಜಂಪುರದ ಬಳಿ 6.9 ಕಿ.ಮೀ ಉದ್ದದ ಸುರಂಗದ ನಿರ್ಮಾಣ.

4) ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ರೂ.5985.00 ಕೋಟಿಗಳ ಮೊತ್ತದಲ್ಲಿನ ಅಂಗಗಳು ಈ ರೀತಿ ಇವೆ.

1) ನೀರಾವರಿಗಾಗಿ (2007-08 ರ ಸಾಲಿನ ದರಪಟ್ಟಿಯಂತೆ) -ರೂ. 3388.00 ಕೋಟಿಗಳು
2) ಕುಡಿಯುವ ನೀರಿಗಾಗಿ (2007-08 ರ ಸಾಲಿನ ದರಪಟ್ಟಿಯಂತೆ)-ರೂ. 2597.00 ಕೋಟಿಗಳು

ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯ ಮಾರ್ಪಡಿತ ಅಂದಾಜು ಮೊತ್ತ ರೂ.5985.00 ಕೋಟಿಗಳಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆಯನ್ನು ಮತ್ತು ನೀರಾವರಿ ಭಾಗದ ರೂ.3388.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಕಾಮಗಾರಿಗಳನ್ನು ತುರ್ತಾಗಿ ಕೈಗೆತ್ತಿಕೊಳ್ಳಲು ಸರ್ಕಾರದ ಅನುಮೋದನೆ ನೀಡುವಂತೆ ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು ಕೋರಿರುತ್ತಾರೆ.

ಸದರಿ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಸರ್ಕಾರದ ಮಟ್ಟದಲ್ಲಿ ಪರಿಶೀಲಿಸಲಾಗಿದೆ. ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯು ಪೂರ್ಣ ಪ್ರಯೋಜನವನ್ನು ನೀರಾವರಿ ಭಾಗದಿಂದಲ್ಲೇ ಹೊಂದಲು ಮತ್ತು ಯೋಜನೆಯ ಮಾರ್ಪಡಿತ ಅಂದಾಜು ಮೊತ್ತ ರೂ.5985.00 ಕೋಟಿಗಳಿಗೆ ಕೇಂದ್ರದ ಎ.ಐ.ಬಿ.ಪಿ. ಸಾಲದ ಸಹಯೋಗ ಅಥವಾ ವಿಶ್ವ ಅಭಿವೃದ್ಧಿ ಬ್ಯಾಂಕಿನ ಆರ್ಥಿಕ ನೆರವು ಅಥವಾ ಇನ್ನಿತರ ಜಾಗತಿಕ ಧನಸಹಾಯ ಸಂಸ್ಥೆಗಳು ಆರ್ಥಿಕ ನೆರವನ್ನು ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತದ ಮೂಲಕ ಪಡೆಯಲು ಈ ಕೆಳಗಿನಂತೆ ಆದೇಶವನ್ನು ಹೊರಡಿಸಲಾಗಿದೆ.

ಆದೇಶ ಸಂಖ್ಯೆ: ಜಸಂಇ 152 ವಿಭಯೋ 2004(ಭಾ-1)
ಬೆಂಗಳೂರು, ದಿನಾಂಕ:15-09-2008.

ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ-1 ರ ಮಾರ್ಪಾಡಿತ ಅಂದಾಜು ಮೊತ್ತವಾದ ರೂ.5985.00 ಕೋಟಿಗಳಿಗೆ ತಾತ್ವಿಕ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿದೆ.

ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ-1ರ ಮೊದಲನೆ ಹಂತದಲ್ಲಿ, ಈ ಕೆಳಕಂಡ ನೀರಾವರಿ ಭಾಗದ ಕಾಮಗಾರಿಗಳನ್ನು ತುರ್ತಾಗಿ ಕೈಗೊಂಡು ಪೂರ್ಣಗೊಳಿಸುವ ದೃಷ್ಟಿಯಿಂದ, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತದ ನಿರ್ದೇಶಕರ ಮಂಡಳಿ ಮತ್ತು ತಾಂತ್ರಿಕ ಉಪ ಸಮಿತಿಯಿಂದ ವಿಧಿಸಲಾಗಿರುವ ಷರತ್ತುಗಳಿಗೆ ಮತ್ತು ಮುಂದೆಯೂ ಸಹ ವಿಧಿಸಬಹುದಾದ ಷರತ್ತುಗಳಿಗೆ ಮತ್ತು ಕಾಲ ಕಾಲಕ್ಕೆ ಸಕ್ಷಮ ಪ್ರಾಧಿಕಾರದ ಅನುಮತಿಯನ್ನು ಪಡೆದು ಅದರಂತೆ ಮುಂದುವರೆಯುವ ಷರತ್ತಿಗೆ ಒಳಪಟ್ಟು ಸರ್ಕಾರದ ಅನುಮೋದನೆಯನ್ನು ನೀಡಲಾಗಿದೆ.

1. ತುಂಗಾ ನದಿಯಿಂದ 15 ಟಿ.ಎಂ.ಸಿ ನೀರನ್ನು ಎತ್ತಿ ಭದ್ರಾ ಜಲಾಶಯಕ್ಕೆ ಹರಿಸುವುದು. – ರೂ. 324.00 ಕೋಟಿಗಳು.
2. ಭದ್ರಾ ಜಲಾಶಯದಿಂದ 21.50 ಟಿ.ಎಂ.ಸಿ ನೀರನ್ನು ಎತ್ತಿ ಅಜ್ಜಂಪುರದ ಬಳಿ ಇರುವ ಸುರಂಗದ ಹತ್ತಿರದ ಡೆಲಿವರಿ ಛೇಂಬರ್‌ವರೆಗೆ ಹರಿಸುವುದು. – ರೂ.1025.00 ಕೋಟಿಗಳು.

3. ಅಜ್ಜಂಪುರದ ಬಳಿ 6.9 ಕಿ.ಮೀ ಉದ್ದದ ಸುರಂಗದ ನಿರ್ಮಾಣ (ಪ್ಯಾಕೇಜ್-3) — ರೂ.223.96 ಕೋಟಿಗಳು.
4. ಚಿತ್ರದುರ್ಗ ಶಾಖಾ ಕಾಲುವೆಯಿಂದ ಚಿತ್ರದುರ್ಗ ಜಿಲ್ಲೆಯ ಮಧ್ಯ ಭಾಗದ ಕೆರೆಗಳನ್ನು ಪುನರುಜ್ಜೀವನಗೊಳಿಸುವುದು ಮತ್ತು ನೀರು ತುಂಬಿಸುವುದು — ರೂ.265.62 ಕೋಟಿಗಳು.
5. ಚಿತ್ರದುರ್ಗ ಶಾಖಾ ಕಾಲುವೆಯ ನಿರ್ಮಾಣ — ರೂ.869.79 ಕೋಟಿಗಳು.
6. ಭೂಸ್ವಾಧೀನ, ಟಿ ಅಂಡ್ ಪಿ, ಕಟ್ಟಡಗಳು, ಸಿಬ್ಬಂದಿ ವೆಚ್ಚ, ಇತ್ಯಾದಿಗಳು — ರೂ.679.63 ಕೋಟಿಗಳು.

ಒಟ್ಟು ರೂ.3388.00 ಕೋಟಿಗಳು.

ಆರ್ಥಿಕ ಇಲಾಖೆಯ ಟಿಪ್ಪಣಿ ಸಂಖ್ಯೆ:PWD 457 EC-1/2008 dated:26-08-2008 ರಲ್ಲಿ ನೀಡಿರುವ ಸಹಮತಿಯ ಮೇರೆಗೆ ಈ ಆದೇಶವನ್ನು ಹೊರಡಿಸಲಾಗಿದೆ.

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆಜ್ಞಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,
15/9/08
(ಎಸ್.ಶ್ರೀಧರ್)
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ,
ಜಲ ಸಂಪನ್ಮೂಲ ಇಲಾಖೆ (ವಿ.ಬ್ಯಾ.ಯೋ).

ಗೆ:

1) ಮಹಾಲೇಖಪಾಲರು(ಲೆಕ್ಕ ಪತ್ರ/ಲೆಕ್ಕ ಪರಿಶೋಧನೆ), ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು.
2) ಮಾನ್ಯ ಜಲ ಸಂಪನ್ಮೂಲ ಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನ ಸೌಧ, ಬೆಂಗಳೂರು.
3) ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ/ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ, ಸಚಿವ ಸಂಪುಟ ಶಾಖೆ, ವಿಧಾನ ಸೌಧ. (ಸಚಿವ ಸಂಪುಟ ವಿಷಯ ಸಂಖ್ಯೆ:127/08, ದಿನಾಂಕ:27-08-2008.
4) ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲ ಸಂಪನ್ಮೂಲ ಇಲಾಖೆ ರವರ ಆಪ್ತ ಸಹಾಯಕರು.
5) ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು.
6) ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಜಲ ಸಂಪನ್ಮೂಲ ಅಭಿವೃದ್ಧಿ ಸಂಸ್ಥೆ, ಬೆಂಗಳೂರು.
7) ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಲಯ, ಚಿತ್ರದುರ್ಗ.
8) ಉಪ ಕಾರ್ಯದರ್ಶಿ, ಕೆಬಿಜೆಎನ್/ಎಂಎಂಎ, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ.
9) ವಿಶೇಷಾಧಿಕಾರಿಗಳು ಮತ್ತು ಪದನಿಮಿತ್ತ ಉಪ ಕಾರ್ಯದರ್ಶಿ, ಲೋಕೋಪಯೋಗಿ ಇಲಾಖೆ (ಆರ್ಥಿಕ ಕೋಶ) ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.
10) ಎಲ್ಲಾ ವಿಶೇಷ ಕರ್ತವ್ಯಾಧಿಕಾರಿಗಳು/ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ.
11) ಶಾಖಾ ರಕ್ಷಾ ಕಡತ/ಹೆಚ್ಚಿನ ಪ್ರತಿ.

*****

Annexure-I

(1)

<u>PROCEEDINGS OF THE GOVERNMENT OF KARNATAKA</u>

Sub: According Administrative Approval to the Upper Bhadra Stage-1 (including Ubrani LIS) Project – Reg.

++ ++ ++

<u>Read</u> :-

Letter No.WRD/P&I/TA-4/AE-2/Estimate/2001, Dated:04-08-2003, from the Engineer-in-Chief, Water Resources Development Organisation, Bangalore.

<u>Preamble</u> :-

Upper Bhadra Project was first conceived about 20 years ago and several alternatives to lift water from Tunga Bhadra, Bhadra and Tunga rivers to feed waters to the water starved districts of Karnataka were got up and studied.

2. Water Resources Development Organisation, Bangalore, have conducted various Survey and Investigations to feed water to the drought affected districts of Chitradurga and Chikkamagalur which are in the rain shadow area. After examining several alternatives, in the Upper Bhadra Project, it is now proposed to construct a reservoir at Tegurgudda across Bhadra River near Bellangi village, N.R.Pura taluk of Chikamagalur district. With two stage lifts and canal running to a length of 265 Km. with tunnel for a length of 4.85 Kms. has been envisaged in this scheme. The cost of the estimate is Rs.2813.00 crores and this has been submitted to the Government vide reference above with utilisation of 23 TMC of water (including Ubrani LIS) from Bhadra river. 10 TMC of water has been allocated to Upper Bhadra Stage-1 and the additional 13 TMC of water is proposed to be met out of savings after modernisation of Tunga Anicut system 6.25 TMC, Bhadra Anicut System 0.5 TMC and Vijayanagar channel systems 6.25 TMC which has been communicated to the Central Water Commission in the revised Master Plan submitted on 15-01-2002.

3. This proposal has been examined at Government level and hence the following orders.

GOVERNMENT ORDER NO.WRD 63 VEBYATA 2000, BANGALORE, DATED:23.06.2003

Administrative Approval to the Upper Bhadra Stage-I (including Ubrani) Project is hereby accorded for Rs.2813.00 crores. This project is handed over to Karnat Neeravari Nigam Ltd. for execution with immediate effect.

By order and in the name of
Governor of Karnataka

(S.SRIDHAR)
Under Secretary to Government (WBP),
Water Resources Department.

To :

1. The Accountant General (Audit / Accounts), Karnataka, Bangalore.
2. The Principal Secretary to the Hon'ble Chief Minister, Government of Karnat Bangalore.
3. The Managing Director, Karnataka Neeravari Nigam Ltd., Bangalore.
4. The Engineer-in-Chief, Water Resources Development Organisation, Bangalore
5. The Chief Engineer, KNNL., Irrigation (North), Belgaum.
6. The Deputy Secretary to Government, Cabinet Affairs, Vidhana Soudha, Bangalore
7. The Special Officer & Ex-officio Deputy Secretary to Government (PWD & Irrig Department), Vidhana Soudha, Bangalore.
8. Guard File / Spare Copies.

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು
(ಜಲ ಸಂಪನ್ಮೂಲ ಇಲಾಖೆ)

ವಿಷಯ:- [illegible] ತಾಲ್ಲೂಕು [illegible] ಏತ ನೀರಾವರಿ ಯೋಜನೆ ಮತ್ತು [illegible] ತಾಲ್ಲೂಕು [illegible] ಗ್ರಾಮದ [illegible] ಏತ ನೀರಾವರಿ ಯೋಜನೆಗೆ [illegible] ನೀಡುವ ಕುರಿತು.

ಓದಲಾಗಿದೆ- 1) ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ: [illegible] ದಿನಾಂಕ: 13-06-2003.

2) ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ: [illegible] 96 [illegible] ದಿನಾಂಕ: 14-01-2004.

3) [illegible] ನೀರಾವರಿ [illegible] ಬೆಂಗಳೂರು ಇವರ ಪತ್ರ ಸಂಖ್ಯೆ [illegible] ದಿನಾಂಕ: 18-3-2005.

***

ಮೇಲೆ ಓದಲಾದ (1) ರ ಸರ್ಕಾರ ಆದೇಶದಲ್ಲಿ [illegible] ಯೋಜನೆ [illegible] ರೂ 688.00 [illegible] ನೀರಾವರಿ ಯೋಜನೆ [illegible] ಈ ಯೋಜನೆಯನ್ನು [illegible] ನೀರಾವರಿ [illegible] ಅನುಮೋದನೆ ನೀಡಲಾಗಿದೆ.

ಮೇಲೆ ಓದಲಾದ (2) ರ ಆದೇಶದಲ್ಲಿ [illegible] ತಾಲ್ಲೂಕು [illegible] ನೀರಾವರಿ [illegible] ಯೋಜನೆ ಮತ್ತು [illegible] ತಾಲ್ಲೂಕು [illegible] ಗ್ರಾಮ [illegible] ರೂ 96.41 [illegible] ನೀರಾವರಿ ಯೋಜನೆಯನ್ನು [illegible] ಯೋಜನೆ [illegible] ನೀರಾವರಿ [illegible] ಆದೇಶಿಸಲಾಗಿದೆ.

ಮೇಲೆ ಓದಲಾದ (3) ರ [illegible] ನೀರಾವರಿ [illegible] ಬೆಂಗಳೂರು [illegible] ಯೋಜನೆ [illegible]

[illegible]

ಪ್ರಸ್ತಾವನೆಯನ್ನು ಪರಿಶೀಲಿಸಲಾಗಿದೆ.

ಸರ್ಕಾರಿ ಆದೇಶ ಸಂಖ್ಯೆ: [illegible] 04, ದಿನಾಂಕ: [illegible]-5-2006.

[illegible] 1.00 [illegible] 25.00 [illegible]

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆದೇಶಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,

(ಡಾ. [illegible])
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ(ತಾಂತ್ರಿಕ-1)
ಲೋಕೋಪಯೋಗಿ ಇಲಾಖೆ.

ಪ್ರತಿ:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

UPPER BHADRA PROJECT

PHYSICAL FEATURES

2 PHYSICAL FEATURES

2.1 Geographical Disposition

2.1.1 Command Area

The command area of upper Bhadra project lies between latitudes 13º30'0" N to 15º00'0" N and between longitudes 76º00'0" E to 77º30'0" E. The proposed area for irrigation is 2,25,515 Ha in Tarikere and Kadur taluks of Chikkamagalur district, Hosadurga, Hiriyur, Holalkere, Chitradurga, and Challakere taluks of Chitradurga district, Sira, Chikkanayakanahalli taluk of Tumkur district and Jagalur Taluk of Davangere District. The proposed irrigation is only in Khariff, minimizing water requirement duly taking advantage of monsoon rains.

Sl. No.	Name of District / Taluk	Area in Ha
		Khariff
1.	**Chikkamagalur District**	
	TarikereTaluk	22189
	Kadur	22366
2.	**Chitradurga District**	
	Hosadurga Taluk	44608
	Hiriyur Taluk	67034
	Chitradurga Taluk	28966
	Challakere Taluk	13266
	Holalkere Taluk	371
3.	**Tumkur District**	
	Sira Taluk	14558
	Chikkanayakanahalli	4657
4.	**Davangere**	
	Jagalur	7500
	Total	**2,25,515**

2.2 Topographical Details

The terrain at the dam site is hilly and steeply sloping with good network of streams and drainages. The elevation at the dam site at the flanks is 728 m.

The terrain along the link canal is steep sloping, being in hilly region.

The terrain in the tunnel area is hilly and steep sloping. The elevation varies from 765 m to 750 m respectively at the beginning and at the end of the tunnel.

The command area of Chitradurga Branch Canal has rolling landscape having alternate ridges and valleys. Land slope varies from a little less than 1% to 2% and over. Elevation of the command area ranges from EL 732 m to EL 575 m.

The command area of Tumkur Branch Canal has rolling landscape having alternate ridges and valleys. The landscape consists mainly of, undulating plains interspersed with a sprinkling of hills. Elevation of the command area ranges from EL 732 m to EL 610 m.

2.3 Location of the Project Area

2.3.1 The lifting point of Tunga water is located at the fore shore of Upper Tunga Dam near Muthina Koppa village of Narasimharajapura Taluk.

2.3.2 Upper Bhadra main canal takes off from Bhadra reservoir. The open canal runs for a length 47.535 Km including 6.90 Kms of tunnel near Ajjampura and crosses Tarikere - Birur railway line. Water is proposed to be lifted in 2 stages up to RL.733.702. The alignment passes through Kundur, Siddarahalli, Duggalapur, Yellugere, Chikkattur, Samatala, Hunsagatta, Villages of Tarikere Taluk. After delivery chamber, alignment is proposed to cross ridge between Bhadra valley and Vedavathi valley through a tunnel and tunnel ends near Ajjampur town of Kadur Taluk.

The Tarikere LIS takes off from the approach and exit canal of tunnel intake at Ajjampura and runs in pipeline to provide irrigation facility to 20150 Ha land and filling up of 79 tanks coming under atchkut.

The water being lifted from the approach and exit canal of tunnel at Ajjampura to provide irrigation facilities to 20150 Ha in Shivani & Ajjampura hobli of Tarikere taluk and to fill 79 tanks coming under the command.

Alignment of Chitradurga branch canal passes through Tarikere, Kadur taluks of Chikkamagalur District, Hosadurga, Hiriyur, Holalkere, Chitradurga and Challakere taluks of Chitradurga district and Jagalur branch canal passes through Chitradurga taluk of Chitradurga District and Jagalur taluk of Davangere district.

Alignment of Tumkur Branch Canal passes through Tarikere, Kadur taluks of Chikkamagalur district, Hosdurga & Hiriyur taluk of Chitradurga district and Chikkanayakanahalli & Sira taluks of Tumkur district.

2.4 Physiographic

2.4.1 Central Karnataka Plateau

Central Karnataka Plateau covers the districts of Bellary, Chikkamagalur, Chitradurga, Dharwad, Raichur and Shimoga. The region represents the transitional surface between the Northern Karnataka Plateau of Deccan Trap and southern Karnataka Plateau with relatively higher surface.

By and large, this region represents the area of Tungabhadra basin. The general elevation varies between 450 and 700 m. The general slope of this region is towards the east.

Tumkur district is generally, an open tract except in the south of Kunigal taluk, where the area is covered with intensive thick forests with hills. The other parts consist of mainly undulating plains interspersed with clumps of tall and well grown trees and to the east of Tumkur and north of Devarayana Durga, the region presents beautiful scenery of hill ranges intersected by cultivated valleys.

Long ranges of hills running roughly south-east direction occupy the western part of the district. A narrow range of granitic hills grouped under closepet granites occupies the eastern part. These hills passes through the taluks of Pavagada, Madhugiri, Koratagere and northern parts of Tumkur. In the eastern part, the hills comprising of schistose rocks passes through Chikkanayakanahalli, Sira, and Gubbi taluks.

2.4.2 Land and Soil

2.4.2.1Land Capability Classification

Based on the slope characteristics of the land, the depth of soil, degree of erosion and other properties of the soils have been grouped into the following land capability classes and sub classes.

Chitradurga District

Class II: Comprise level to gently sloping land along with stream banks having deep soil with moderate erosion. The soils are deep and generally fall under Chitradurga series 3, characterized by a redy sandy loam surface soil and the soils is general being derived mainly from coarse granites.

Class II: Under this group soils are classified lands which are level to gently sloping and having deep soils with slight erosion and comparatively fertile as they come under Chitradurga series 6.

Class III: Moderately sloping well drained lands having shallow to moderately deep soils which are subject to moderate sheet erosion.

Class IV: under this class, soils are classified badly eroded and gullied lands lying on moderate to steeply sloping lands having shallow soils.

(Source: Soil and Land Use Survey of India.)

2.4.2.2Soils- Classification

Brief description of the major soil groups along with their modern nomenclature are given below.

The ancient crystalline and metamorphic rocks on meteoric weathering have given rise to the red soils. The color of the soil is due to wide diffusion of iron rather than to a high proportion of it. The soils grade from poor thin gravelly and light colored varieties of the plains and valleys. They are generally poor in nitrogen, phosphorus and humus. These soils are poorer in lime, potash, iron oxide and phosphorus than regular soils. The red soils are overlying the granite from which it is derived.

The Major types of soils occurring in Tumkur district are (i) Red loamy soil, (ii) Red sandy soil and (iii) Mixed red and black soils. Red loamy soil occurs in eastern central part of the district covering Koratgere, Tumkur and eastern parts of Madhugiri and Kunigal Taluks. Red Sandy soil covers rest of the area except very small area in the northwestern part of C.N. Halli Taluk where Mixed Red and Black soil occur. Red soils have good drainage but poor in lime and bases.

The Major soil type in the Chikkamagalur District comprises of red loamy & Sandy soil. However, hilly area soil and mixed red & black soil are also found to occur in small areas in the central and northeastern part respectively.

The major part of Davangere district is covered by red sandy soil and followed by black soil. Red sandy soil is spread through out the district except in a small area in northeastern part of the district where the area is covered by black soil. The red sandy soil comprises of red loams, red sandy, sandy loams and medium black soils.

2.4.3 Geology

The rock types occurring in Chikkamagalur district in which part of the command area lies could be classified into (i) the ancient supracrustals (ii) the Peninsular Gneiss Complex (PGC) and (iii) the sequence of Dharwar super group. The ancient supracrustals are represented by Sargur Group comprising amphobolite, quartzite and ultramafites. Hey occur as enclaves within the PGC. The amphibolites outcrops are seen around Kesave, south of Koppa taluk, west of Ajjampura- Tarikere road junction close to railway line, east of Betta tattakere, north of Madihalli in Tarikere taluk.

The ultramafic complex at Lakkavalli extends 8 Km in strike length and 200m in width. Grey biotite gneiss forms the basement to the granitoids exposed around Chikkamagalur and Kadur taluks.

The peninsular region (Dharwar, Aravali, Gneiss and granite) India's oldest rock- the precambian crystalline group - gneiss, migmalites with granite bodies and the associated regionally metamorphed rock group are exposed in the region. The Precambrian rocks of the area and the adjoining areas locally known as Dharwar, which represents regionally metamorphosed sedimentary rock group associated with gneiss- granitic and basic intrusive suits. The granite bodies are massive, hard and tough with varying degree of weathering, where as the other metamorphic rocks- phyllites and schist's, quartzite's etc are foliated, layered and granular showing intense deformation, jointing and weathering. The Precambrian rocks of the region are characterized by metamorphosed intense pressure, temperature effects, igneous intrusion (granite) bodies and hence the influence of deformations features.

Overlaying the ancient precambrian rocks are a set of sedimentary rocks (seen in patches) - shales, san stones and lime stones (largely metamorphosed)

The geological details of the region are shown in Map VJNL/UBP/Geo/Map/02.

2.4.4 Seismotectonics of the Region

Geologically, the terrain comprises the western and eastern blocks of Dharwarcraton with intrusive close pet granite occupying the central parts. Deccan badalts and the self faces covers intra cratonic sagas which is exposed in the north western part. A small segment of the cuddapah basin occupies the central - eastern part of the area.

The terrain is traversed by several major and intermediate lineaments, having two dominant trends viz, NE - SW to ENE - WSW and NNW - SSE to NW - SE, ENE - WSW trending Krishna river fault, Dharma - Tungabhadra fault, Kumadvati - Narihalla fault, Bukkapatnam fault and Gani - Kalva fault are traverse to the tectonic grain of the Terrain. The most important linear feature of the region is the NNW - SSE trending Chitradurga Boundary shear.

Bouger gravity anomaly picture is fairly flat with a few discernable highs and lows, while the gravity anomaly is constantly low over the granite gneiss terrain, the sediment dominated supracrustal belts such as Chitradurga and Shimoga belts are characterized by low amplitude concentric contours of the order of -100 to -110 m Gal. Deduced crustal thickness contours are consistently flat ranging from 35 Km in the far north eastern corner to 38 Km in the southern half seismicity in the region is only sporadic both in space and time. Local network data have brought out two major clusters - west of Bellary between Dharma - Tungabhadra Kumadvati - Narihalla fault and west of Bhadra lineament. Most significant event in the area is the Bellary earthquake of 1st April 1843 and

Shimoga earthquake of 12th May 1975 is interesting as there are no records of any earthquake activity from this area. The shock had a magnitude of 4.7 and maximum intensity V. The focal depth and felt radius were 35 Km and 140 Km respectively. The seismotechonic details are shown in Map VJNL/UBP/Seis/03.

2.4.5 Geohydrology

The region is dominated by hard granite sand stone region of shallow soil cover. The ground water exists only in crevices and the yield of well is poor.

The hydrological conditions of the district exist under two regimes (i) Basement crystallines, where in groundwater is restricted to 60m depth in weathered mantle and fractured zones with an yield of 1 to 5 litres per second and (ii) deformed metasediments / metavolcanics, having identical conditions as that of (i) the depth of water table ranges between 900m and 700m above MSL. The Bhadra reservoir is an important Hydel power generating project.

The water quality data of Chitradurga district has reflected the presence of excess turbidity, total dissolved solids, total hardness, calcium hardness, fluoride, alkalinity, Iron and Bacteria.

Bringing fresh water to this area should rejuvenate the geohydrological environ, which provides sustainable drinking water source and agro horticulture.

Tumkur district is underlain by meta sediments (limestone) and meta volcanic (quartzite and schists) of Dharwar Group, Peninsular gneisses and Clospet granites of Pre Cambrian age, which are intruded by pegmatite and dolerite dykes. Laterite occurs on the top of the hills south of Bukkapatna as small patch. Joints are observed in general in N. E - S.W to N.N.E - S.S.W and NW - SE to NNW - SSE directions. The alluvial patches are generally seen along the major streams as narrow discontinuous patches particularly in granite country. It comprises medium to coarse grained sand with silt and clay at many places and is largely controlled by topography of the basement crystalline in the area.

Most of the area of Chikkmagalur district is covered by schist followed by gneissic rock formation.

The ground water level has depleted substantially when compared to level in 1990.

The ground water levels in the project area during pre-monsoon ranges from 2.18 to 37.48 mbgl (most frequent range: 9.0 to 30.00 mbgl) and 1.38 to 20.85 mbgl (most frequent range: 4.5 to 21.00 mbgl) during post-monsoon period.

2.4.6 Cropping Pattern

Groundnut is the most important crop covering 45% of area followed by Sunflower (20%), Jowar (15%), Pulses (10%) and the remaining 10% is Maize. High yielding crops are confined to 12% of the area where supplementary sources of irrigation like tanks, wells / tube wells are available. There are no major irrigation facilities as of now.

2.4.7 Yield

Under rainfall conditions the yield in tonnes per hectare for major crops are as indicated below.

Sl. No.	Type of Crop	Yield in Tons/Ha
1.	Maize	1.8
2.	Jowar	1.8
3.	Groundnut	1.0
4.	Sunflower	0.5
5.	Pulses	0.7

There may be slight variation in yield depending on timing and adequacy of rainfall.

2.4.8 Land Use

Nearly 60% of the total land is cultivable and majority of this area is in rainfed agriculture. The major crops grown are Jowar, Groundnut, Maize, Pulses and Sunflower. There are no major mines or industries in the area. Details of land use are covered under Socio economic aspects of the region.

2.5 Ground Water Development

In Chitradurga district there is only one major irrigation project - Vanivilas Sagar project. There are a number of minor irrigation tanks which are silted up and are at the verge of extinction, due to the above reason ground water has been exploited much beyond replenishable rate and the underground water has excessive fluoride, heavy metals and nitrate contamination in some localities. Fossil water has also been exhausted to substantial level. Majority of Chitradurga district is declared as over exploited, critical and semi critical with respect to ground water utilization.

2.5.1 Ground Water Table Observations

As per the report furnished by Director, Mines and Geology, the ground water level has depleted substantially when compared to the level in 1990. The statistics of this depletion in Chikkamagalur, Chitradurga, Tumkur and Davangere Districts are as follows.

Sl. No.	District / Taluk	Water Level Below Ground Level in Mtrs	
		1990	2011
1.	**Chikkamagalur**		
(i)	Tarikere	14.30	14.25
2.	**Chitradurga**		
(i)	Chitradurga	11.75	13.13
(ii)	Hiriyur	8.15	13.52
(iii)	Hosadurga	7.13	16.1
3.	**Tumkur**		
(i)	Chikanayakanahalli	10.9	18.70
(ii)	Sira	10.05	12.0
4.	**Davangere**		
(i)	Jagalur	14.84	23.00

The water depletion in most districts/taluks are progressively going down due to unregulated pumping of ground water through bore wells. Preliminary results of study done by Rural Development Engineering Department (1999-2001) show that drinking water sources in large areas of districts of Kolar, Tumkur, Chitradurga, Bellary, Gadag, Koppal and Gulbarga have a high fluoride level. The High power committee suggests that in taluks where recurrence of fluoride is as high as to affect more than 30% of the source of drinking water, it is necessary to consider designing special water supply scheme based on safe surface source.

2.5.2 Ground Water Quality

The interpretation of the water quality data of Chitradurga district has restricted the presence of excess turbidity, total dissolved solids (680 samples from 340 villages), total hardness, calcium hardness, fluoride, alkalinity (788 samples from 420 villages) iron and Bacteria.

Water samples were collected from selected dug wells in Tumkur district annually for chemical analysis. The analysis results indicate that in general the quality of ground water is potable for drinking and suitable for Irrigation. However high concentration of fluoride is observed in Northern parts of Pavagada and Madhigiri taluks and as small patches in Sira taluk. High concentration of nitrates and Chloride are also observed.

2.6 Ground Water Resources in the Command Area

The taluk wise ground water resources in the command area of Upper Bhadra project is given below.

GROUND WATER RESOURCES OF UPPER BHADRA IRRIGATION COMMAND AREA AS ON MARCH 2004								
Figures in Hactare Metres								
Taluk	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for			Allocation for Domestic and Industrial use for next 25 years	Net GW Availability for Future Irrigation Development	Existing stage of GW Development (%)	Categorization
		Irrigation	Domestic and Industrial Water Supply	All Uses				
Challakere	10879.45	11250.12	720.86	11970.98	1017.17	531.50	110	Semi-Critical
Chitradurga	7857.30	9438.87	506.34	9945.21	713.08	318.88	127	OE
Hiriyur	13363.79	12731.94	1109.18	13841.12	1559.87	395.39	104	Semi-Critical
Holalkere	11052.88	13184.56	591.71	13776.28	873.88	1536.42	125	OE
Hosadurga	9876.88	6899.13	496.12	7395.25	733.63	1873.63	75	Critical
Kadur	9564	7983	476	8465	665	879	88	Semi-Critical
Tarikere	14816	6508	806	7315	1129	7169	49	Critical
C.N Halli	10940.97	12122.92	419.46	12542.39	589.04	295.75	115	OE
Sira	11269.81	12247.8	594.89	12842.69	868.48	421.33	114	Semi-Critical
Jagalur	8221	8258	483	8741	518	443	106	OE
Total	**36200.37**	**38182.84**	**1980.94**	**40163.82**	**2657.54**	**692.5**	**107**	**-**
The estimates have been done on Macrolevel data for watershed with due appropriation for command area, Microlevel data is required for having accurate estimation - neg figures indicate over draft.								

Note: *Details of Ground Water Resources of Jagalur Taluk command area as on March 2009*

Source: *Central Ground Water Board*

2.6.1 Conjunctive Use of Surface and Ground Water

The conjunctive use of surface and ground water conceived herein is not of conventional type wherein the surface irrigation with low irrigation efficiency recharge large quantities of water to ground which is proposed to be lifted for irrigation avoiding ground water rise, water logging and salinization. The emphasis here is the integrated water management in the command area of Upper Bhadra Canal.

The total gross command area under the proposed Upper Bhadra Canal is 367376 Ha of which 225515 Ha is proposed to be irrigated by drip irrigation which has an overall irrigation efficiency of 67.5%. Thus, large quantity of water recharge is not anticipated. The area experience an Annual Rainfall varying from 594 mm to 775 mm and the ground water recharge is expected. Also there are number of tanks irrigating areas which are being integrated into the command. The recharge and D and I requirements are given below.

	Area	Rainfall mm	Rainfall Recharge MCM	D & I Requirements MCM	Available Ground Water MCM
1.	Chikkamagalur	739	243.80	17.94	102.11
2.	Chitradurga	639	530.303	46.56	399.20
3.	Tumkur	775	222.10	14.58	207.52
4.	Davangere	594	82.21	5.18	77.03
			1078.413	**84.26**	**785.86**

The small tanks in the area irrigate an estimated area of about 30000 Ha in both Khariff and Rabi seasons. The recharge from these need not be considered separately as most of it is accounted for in the rainfall recharge.

In addition about 6.49TMC of water is being fed into the tanks after losses. Thus, additional ground water and added surface water available for irrigation is about 34.49 TMC. This quantity of water ultimately can irrigate the proposed area for a second season and summer crops. Thus, it must be possible to realize 200% intensity of irrigation.

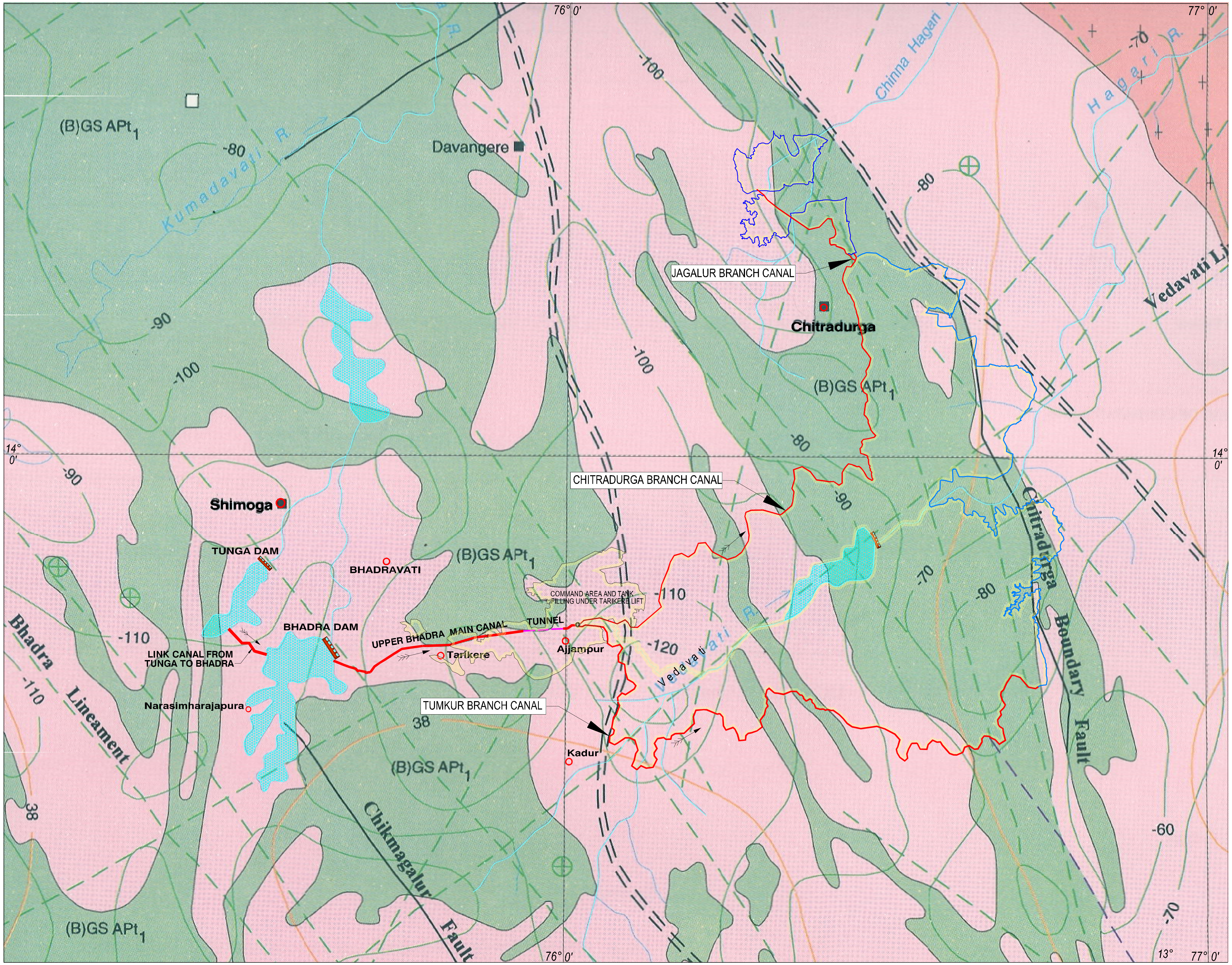
The command of UBP also contains borewells and certain pockets in these regions are irrigated by borewells. In the present scheme 367 tanks are proposed to be filled in using 6.49 TMC. This also helps to recharge the ground water. As such, wherever, there is ground water potential the farmers will be encouraged to go in for conjunctive use using both ground water and canal water to maximize benefits of the scheme.

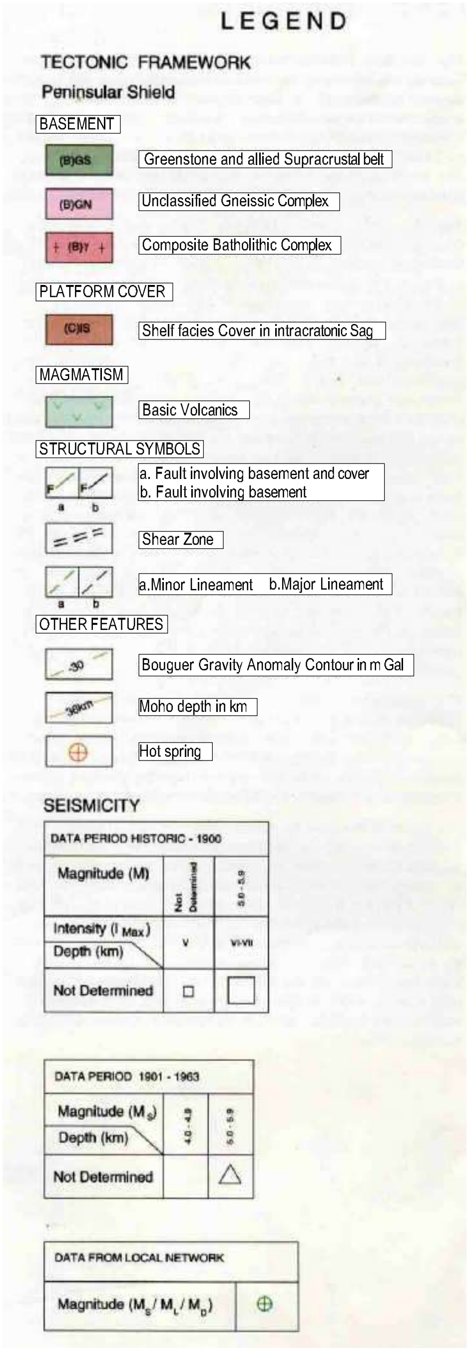
CLIENT	KARNATAKA NEERAVARI NIGAM LIMITED (A GOVT. OF KARNATAKA UNDERTAKING) BANGALORE - 560 001
PROJECT	UPPER BHADRA PROJECT
TITLE	GEOLOGICAL DETAILS OF UPPER BHADRA PROJECT AREA
CONSULTANT	SECON PRIVATE LIMITED PLOT NO.147, 7B ROAD, EXPORT PROMOTION INDUSTRIAL PARK, WHITEFIELD, BANGALORE-560 066 PHONE-41197778, FAX:91-080-41194277

K.S. [signature]

ASST.EXECUTIVE ENGINEER KNNL,UBP SUB-DIV NO.12 CHITRADURGA	EXECUTIVE ENGINEER KNNL,UBP DIVISION NO.5 CHITRADURGA

SCALE	1: 2,50,000	DRAWING NO.	KNNL/UBP/GEO/MAP/02	REV 00





MAP SHOWING SEISMOTECTONIC DETAILS OF ALIGNMENT

CLIENT	KARNATAKA NEERAVARI NIGAM LIMITED (A GOVT. OF KARNATAKA UNDERTAKING) BANGALORE - 560 001
PROJECT	UPPER BHADRA PROJECT
TITLE	SEISMOTECTONIC DETAILS OF UPPER BHADRA PROJECT AREA
CONSULTANT	SECON PRIVATE LIMITED PLOT NO.147, 7B ROAD, EXPORT PROMOTION INDUSTRIAL PARK, WHITEFIELD, BANGALORE-560 066 PHONE-41197778, FAX:91-080-41194277 SECON
ASST.EXECUTIVE ENGINEER KNNL,UBP SUB-DIV NO.12 CHITRADURGA	EXECUTIVE ENGINEER KNNL,UBP DIVISION NO.5 CHITRADURGA

SCALE 1:5,00,000 DRAWING NO. KNNL/UBP/SEIS/MAP/03 REV 00

Phone Nos.
25723791
25723792

No. T25(Command)/CGWB/SWR – 07-08
Bhujal Bhawan
Central Ground Water Board
Southwestern Region,
Sector-I, HSR Layout
Bangalore - 560102
Dated: 15.07.08

To,
The Executive Engineer
KNNL UPB Division-2.
BR Project

Subject: Groundwater resources in Command of Upper Bhadra Project

Ref: 1. Your letter no EE/UPB Dn-2/KNNL/CUPGW/UPB/2008-09 dated 25.05.08

Sir,

With reference to above Please find enclosed herewith taluk wise Groundwater resources in Command of Upper Bhadra Project. The receipt may please be acknowledged.

Yours faithfully,

Enclosed as above

(T. M. Hunse)
Regional Director

Copy to: File Assistance to State Government

APPENDIX 3A-1

GOVERNMENT OF KARNATAKA

No.WRD 11 MTP 2002.

Karnataka Government Secretariat,
M.S.Buildings,
Bangalore, dated 15th January 2002.

From:

The Secretary,
Water Resources Department.

To,

The Chairman,
Central Water Commission,
NEW DELHI.

Sir,

Sub: Revised Master Plan of Krishna Waters for 734 TMC under Scheme 'A' allocation - Reg....

Ref: 1) Government Letter No. PWD 1 MMM 87 dated 08.01.1987

2) Government Letter No. I D 23 MMS 93 dated 24.09.1993.

++++++

In the Government letter cited at reference (1) above, (copy enclosed) project wise allocation in respect of different projects was communicated corresponding to the quantum of 757 TMC of water available to Karnataka in Krishna basin as detailed below.

a) 734 TMC comprising 700 TMC of surface flows and 34 TMC by way of regeneration flows, based on the Award of Krishna Water Disputes Tribunal.

b) 23 TMC by way of the Award of the Godavari Water Disputes Tribunal regarding diversion of Godavari Water to Krishna river including re-generation.

Subsequently, in the light of the allocation of 173 TMC to U.K.P. from out of 734 TMC itself and other connected issues, the projectwise allocations corresponding to the Krishna Tribunal's Award was modified and the same was communicated to Central Water Commission in the Government letter cited at reference (2) above.(copy enclosed)

contd.........2.

Now the Government of Karnataka after judgement of the Supreme Court dated 25.4.2000 in O.S-2 of 1997 that the allocations made by the K.W.D.T are bulk allocations and not projectwise, have again reviewed the allocation of the projects along with utilisation. Further, estimation of Municipal and domestic uses as well as Power and Industry requirements have been worked out as the recommendations of " the National Commission for integrated water Resources Development Plan – Volume-I."

In view of the above, the modifed allocation as per the statement enclosed is got up and sent herewith for kind information

Yours faithfully,

Sd/-
(S.J.CHANNABASAPPA),
Secretary to Government,
Water Resources Department.

1) Copy to the Member (P&P), Central Water Commission, Seva Bhavan, R.K. Puram, New Delhi.
2) Copy to the Engineer-in-Chief, Water Resources Development Organisation, Ananda Rao Circle, Bangalore, for information and needful.
3) Copy to:-
   i) The Joint Secretary (CADA) Water Resources Department.
   ii) The Deputy Secretary (MMI)
   iii) The Officer on Special Duty (Technical)
   iv) The Under Secretary, Technical –1 / World Bank Project, / Krishna Bhagya Jala Nigam Ltd., / CADA.

(S.J.CHANNABASAPPA),
Secretary to Government,
Water Resources Department.

B.R.1512?

REVISED MASTER PLAN UNDER SCHEME - A

SL. NO.	NAME OF PROJECT		SUB BASIN	Revised allocation in tmc
1	2		3	4
1	DUDHGANGA		K-1	4.00
	MINOR IRRIGATION		K-1	0.50
		TOTAL	K-1	4.50
2	UPPER KRISHNA PROJECT		K-2	173.00
3	HIPPARGI		K-2	12.10
	MINOR IRRIGATION		K-2	7.70
		TOTAL	K-2	192.80
4	GOKAK CANAL		K-3	1.40
5	GHATAPRABHA(L.B, RB)		K-3	87.70
6	MARKANDEYA		K-3	4.00
7	SRI RAMESHWARA LIS		K-3	[illegible]
8	BELLARYNALA FLOW CUM LIFT		K-3	3.91
	MINOR IRRIGATION		K-3	4.34
		TOTAL	K-3	101.75
9	KOLCHI WEIR		K-4	0.70
10	MALAPRABHA		K-4	27.00
11	HARINALA		K-4	0.64
12	HANCHINAL LIFT		K-4	4.50
13	BENNIHALLA		K-4	1.80
14	KONNUR LIS		K-4	0.39
	MINOR IRRIGATION		K-4	4.54
		TOTAL	K-4	39.07
	MINOR IRRIGATION	TOTAL	K-5	0.54
15	HATHIKUNI		K-6	0.40
16	UPPER MULLAMARI		K-6	1.08
17	CHANDRAMPALLI		K-6	1.90
18	AMARJA		K-6	1.92
19	BENNITHORA		K-6	5.73
20	LOWER MULLAMARI		K-6	2.61
21	BHIMA LIFT		K-6	6.00
22	GANDHORINALA		K-6	2.16
23	BHIMA BARRAGES		K-6	5.00
24	KAGNA		K-6	2.00
25	SONTHI a barage		K-6	4.00
	MINOR IRRIGATION			9.10
		TOTAL	K-6	41.93
	MINOR IRRIGATION	TOTAL	K-7	3.47
26	JAMBADAHALLA including diversion of Hebbayyanahalla to Jambadahalla		K-8	0.30
27	AMBLIGOLA		K-8	1.30
28	ANJANAPUR		K-8	2.50
29	DHARMA		K-8	1.10
30	BAGARIBOMMANAHALLI		K-8	2.00
31	RAJOLIBANDA		K-8	1.20
32	TUNGA ANICUT		K-8	11.50
33	BHADRA RESERVOIR		K-8	61.70

1	2		3	4
34	BHADRA ANICUT		K-8	3.10
35	TUNGABHADRA		K-8	132.00
36	VIJAYANAGAR CHANNEL		K-8	12.05
37	HIREHALLA		K-8	2.27
38	MASKINALA		K-8	0.78
39	SINGATALUR LIS		K-8	18.55
40	UPPER TUNGA		K-8	12.24
41	GUDDADA MALLAPUR LIS		K-8	1.00
42	UPPER BHADRA STAGE-I *		K-8	10.00
43	BASAPUR LIS		K-8	0.60
	MINOR IRRIGATION		K-8	37.51
		TOTAL	K-8	331.90
44	GAYATHRI		K-9	0.45
45	VANIVILAS SAGAR		K-9	5.25
	MINOR IRRIGATION		K-9	26.80
		TOTAL	K-9	32.50
	CHENNAI WATER SUPPLY			5.00
	DOMESTIC & MUNCIPAL WATER SUPPLY			1.50
	INDUSTRIAL WATER SUPPLY			0.50
		* TOTAL:		734.00

Note: (1) * Upper Bhadra Stage I is planned for 23 tmc. Additional 13 tmc can be met out of savings after modernisation of Tunga anicut system 6.25 tmc, Bhadra anicut system 0.5 tmc and Vijayanagar channels system 6.25 tmc.

(2) Details under Minor Irrigation allocations enclosed.

ANNEXURE-4.5

REVISED MASTER PLAN UNDER SCHEME –A

Sl.No.	NAME OF PROJECT		SUB BASIN	Revised allocation in tmc
1	2	3	4	5
1	DUDHGANGA		K-1	4.00
	MINOR IRROGATION		K-1	0.50
		TOTAL	K-1	4.50
2	UPPER KRISHNA PROJECT		K-2	173.00
3	HIPPARGI		K-2	12.10
	MINOR IRRIGATION		K-2	7.70
		TOTAL	K-2	192.80
4	GOKAK CANAL		K-3	1.40
5	GHATAPRABHA (I, II & III)		K-3	87.70
6	MARKANDEYA		K-3	4.00
7	SRI RAMESHWARA Lift Irrigation Scheme		K-3	2.20
8	BELLARYNALA FLOW CUM LIFT		K-3	1.91
	MINOR IRRIGATION		K-3	4.54
		TOTAL	K-3	101.75
9	KOLCHI WEIR		K-4	0.70
10	MALAPRABHA		K-4	27.00
11	HARINALA		K-4	0.64
12	RAMTHAL LIFT		K-4	4.50
13	BENNIHALLA		K-4	1.80
14	KONNUR Lift Irrigation Scheme		K-4	0.39
	MINOR IRRIGATION		K-4	4.59
		TOTAL	K-4	39.62
	MINOR IRRIGATION		K-5	0.54
15	HATHIKONI		K-6	0.40
16	UPPER MULLAMARI		K-6	1.08
17	CHANDRAMPALLI		K-6	1.90
18	AMARJA		K-6	1.92
19	BENNITHORA		K-6	5.75
20	LOWER MULLAMARI		K-6	2.61
21	BHIMA LIFT		K-6	6.00
22	GANDHORINALA		K-6	2.16
23	BHIMA BARRAGES		K-6	5.00
24	KAGNA		K-6	2.00
25	SONTHI STAGE-I		K-6	4.00
	MINOR IRRIGATION		K-6	9.10
		TOTAL	K-6	41.92
	MINOR IRRIGATION	TOTAL	K-7	1.47

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26	JAMBADAHALLA including diversion of Hodirayenahalla to jambadahalla		K-8	0.70
27	AMBLIGOLA		K-8	1.10
28	ANJANAPUR		K-8	2.50
29	DHARMA		K-8	1.10
30	HAGARIBOMMANAHALLI		K-8	2.00
31	RAJOLIBANDA		K-8	1.20
32	TUNGA ANICUT		K-8	11.50
33	BHADRA RESERVOIR		K-8	61.70
34	BHADRA ANICUT		K-8	3.10
35	TUNGABHADRA		K-8	132.00
36	VIJAYANAGAR CHANNEL		K-8	12.05
37	HIREHALLA		K-8	2.27
38	MASKINALA		K-8	0.78
39	SINGATALUR L.I.S.		K-8	18.55
40	UPPER TUNGA		K-8	12.24
41	GUDDDADA MALLAPUR L.I.S		K-8	1.00
42	UPPER BHADRA STAGE-1*		K-8	10.00
43	BASAPUR L.I.S.		K-8	0.60
	MINOR IRRIGATION		K-8	37.51
		TOTAL	K-8	311.90
44	GAYATHRI		K-9	0.45
45	VANIVILAS SAGAR		K-9	5.25
	MINOR IRRIGATION		K-9	26.80
		TOTAL	K-9	32.50
	CHENNAI WATER SUPPLY			5.00
	DOMESTIC & MUNICIPAL WATER SUPPLY			1.50
	INDUSTRIAL WATER SUPPLY			0.50
		TOTAL		734.00

Note: (1) * Upper Bhadra Stage 1 is planned for 23 tmc. Additional 13 tmc can be met out of saving after modernization of Tunga anicut system 6.25 tmc, Bhadra anicut system 0.5 tmc and Vijayanagar channels system 6.25 tmc.

(2) Details under Minor Irrigation allocation enclosed.

ANNEXURE 4.5

REVISED MASTER PLAN UNDER SCHEME –A

Sl.No.	NAME OF PROJECT		SUB BASIN	Revised allocation in tmc
1	2	3	4	5
1	MINOR IRRIGATION		K-1	0.50
		TOTAL	K-1	0.50
2	ARESHANKAR		K-2	0.20
3	CHITWADGI		K-2	0.10
4	TEGGI-SIDDAPURA LIS		K-2	0.90
5	MINOR IRRIGATION		K-2	6.50
		TOTAL	K-2	7.70
6	KALASKOP		K-3	0.14
7	MINOR IRRIGATION		K-3	4.40
		TOTAL	K-3	4.54
8	JAVALAHALLA LIS		K-4	0.29
9	LIS near 36th KM OF KRBC		K-4	0.30
10	MINOR IRRIGATION		K-4	4.00
		TOTAL	K-4	4.59
11	MINOR IRRIGATION		K-5	0.54
		TOTAL	K-5	0.54
12	NAGATHANA		K-6	0.12
12	RAMANAHALLI		K-6	0.32
14	SOUDAGAR		K-6	0.26
15	MINOR IRRIGATION		K-6	8.40
		TOTAL	K-6	9.10
16	MINOR IRRIGATION		K-7	1.47
		TOTAL	K-7	1.47
17	NARIHALLA		K-8	0.90
18	BAKRIHALLA LIS		K-8	0.21
19	KANAKANALA		K-8	0.27
20	ITAGI-SASALWAD-STAGE-I		K-8	0.55
21	MINOR IRRIGATION		K-8	35.58
		TOTAL	K-8	37.51
22	F.C. TO RANIKERE		K-9	0.30
23	NARAYANAPUR		K-9	0.74
24	MINOR IRRIGATION		K-9	25.76
		TOTAL	K-9	26.80
	MINOR IRRIGATION	TOTAL		92.75

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Master Plan - Tungabhadra Sub Basin (K-8) - Scheme A (Excluding Vedavathi)

No.	Project	Original Allocation (TMC)	Revised Allocation (TMC)	Savings (TMC)	Remarks
	Jambada Halla	0.70	0.70	NIL	
2	Nari Halla	0.90	0.90	NIL	
3	Karakanala	0.40	0.40	NIL	
4	Ambligola	1.40	1.40	NIL	
5	Anjanapura	2.50	2.60	NIL	
6	Dharma	2.20	2.20	NIL	
7	Hagari Bommana Halli	2.00	2.00	NIL	
8	Rajolibunda	1.20	1.20	NIL	
9	Tunga Anicut	11.60	5.25	+ 6.26	Proposed modernisation
10	Bhadra Anicut	3.10	2.60	+ 0.5	Proposed modernisation
11	Bhadra reservoir	61.70	61.70	NIL	
12	Tungabhadra	132.10	121.00	+ 11.00	Less utilisation due to siltation of reservoir.
13	Vijayanagara Canals	12.05	5.80	+ 6.25	Proposed modernisation
14	Hire halla	2.27	2.27	NIL	
15	Maskinala	0.78	0.78	NIL	
16	F.C. to Rasthore	1.60	1.60	NIL	
17	Singatalur LIS	7.64	18.55	-10.91	Additional out of savings in Tungabhadra.
18	Upper Tunga	12.24	12.24	NIL	
19	Basapur LIS	0.60	0.60	NIL	
20	Itagi-Sasalwad LIS	0.55	1.55	-1.00	Additional Allocation due to siltation of Tungabhadra Reservoir
21	Upper Bhadra	-	23.00	-23.00	Addition for providing water to Chitradurga
22	Minor Irrigation	54.77	57.77	NIL	
	Total	312.10	325.01	-10.91	
	Total Avg.	64.06	14.81	-41.64	

Tungabhadra Reservoir evaporation 15.00 TMC

Utilisation in AP (Rajolibunda - KC canal, LLC, HLC) 65.00 TMC (After 5 TMC. Savings due to modernisation)

63.00 TMC

Proceedings of Government of Karnataka.

Sub: Revised water allocation of 21 TMC of water available to Karnataka due to Godavari water diversion to Krishna Basin under Indira Sagar Pollavaram project in the State of Andhra Pradesh.

Ref:
1. Government Order No.WRD 49 KBN 2009, dated: 19-03-2012.
2. Government Order No.WRD 308 KBN 2013, dated: 01-03-2014.
3. Chief Engineer, Malaprabha Project Zone, Dharwad LtrNo.KNNL/MPZ/AE-6/CWC/2015-16, dated: 11-01-2016.
4. Government Order No.WRD 312 KBN 2015, dated: 21-05-2016.
5. Chief Engineer, IMO, CWC, Seva Bhavan, New Delhi Ltr No. CWC.U.O.No.21/53/2014-PA(S)/523-24, dated: 23-06-2016.
6. Government Order No.WRD 293 KBN 2015, dated: 20-07-2016.
7. Government Order No.WRD 20 KBN 2016, dated: 09-06-2016.

Principal Secretary, WRD, MaharastraLtrNo.Misc-2016/422/C.R 106/WRP, dated: 15-03-2017.

Preamble

1. In the Government Order cited at reference(1) above, allocation in respect of different projects was made for 23 TMC of water against 21 TMC additional allocation under scheme-A made available from Indira Sagar Pollavaram Project of Andhra Pradesh duly accounting additional quantity of 2 TMC of water by considering 10% regeneration water.
2. In the Government Order cited at reference(2) above, (23 TMC of water made available to State under Pollavaram Diversion Scheme of Andhra Pradesh) the administrative approval was accorded for Rs 1530.00 Crores estimate to irrigate with micro irrigation system around 36,100 Ha area utilizing 3.75 TMC of water for Nandevadagi Lift Irrigation Scheme.
3. In the letter under reference (3) above,Chief Engineer, Malaprabha Project Zone has requested to reallocate water due to Pollavaram diversion made available in the Order dated 19-03-2012 limiting to 21.00 TMC.
4. In the Government Order cited at ref (4)above, 6.00 TMC of water to Nandavadagi Lift Irrigation scheme and 3.78 TMC of water to Budihal – Peerapur lift irrigation schemewere allocated from the savings in water due to adoption of uniform 100% intensity of irrigation in Upper Krishna Project stage-1 & 2.
5. In the CWC letter cited at reference (5) above, it is objected for accounting additional 2 TMC of water by considering 10% of regeneration water for the available 21 TMC to Karnataka in Krishna basin.
6. In the Government Order cited at reference (6) above, the administrative approval was accorded for Rs. 840.00 Crores estimate to irrigation deprived 20,243 Ha area of Muddebihal and Sindhagi taluk with drip irrigation system

by utilizing 3.78 TMC for Budhihal-Peerapura lift irrigation scheme under Upper Krishna Project.

7. In the Government letter cited at reference (7) above,the State of Maharashtra was requested to furnishtheir opinionfor accounting 2.00 TMC regeneration water by Karnataka for the allocation of 21 TMC water to Karnataka and 14 TMC to Maharastra in Krishna Basin due to implementation of Indira Sagar Pollavaram Project of Andhra Pradesh.
8. In the letter cited at reference (8) above, Government of Maharashtra has clarified that Maharashtra State is utilizing only 14 TMC of water allocated to the state and regeneration water is not considered.
9. In view of the above,the subject of limiting 23.00 TMC allocated under Government Order cited at reference (1) above to 21.00 TMC is examined. Hence, the following Order is issued.

GovernmentOrder No: WRD 20 KBN 2016, Bangalore, dated: 31-08-2017.

As explained in the above preamble, the allocation of water made vide Government Order No.WRD 49 KBN 2009, dated: 19-03-2012 for 23.00 TMC which is 21 TMC made available in addition to Scheme A allocation to Karnataka State due to Pollavaram diversion by Andhra Pradesh and 2 TMC regeneration water is reexamined and limited to 21.00 TMC and revised allocation is made as per Annexure enclosed to this Order. As per the Order,the Nigamsconcerned with Water Resources Department and Zonal Chief Engineers are directed to prepare Detailed Project Report with designs and to take further necessary action.

By Order and in the name of
the Governor of Karnataka.
Sd/-
(B.Harinarayana)
Under Secretary to Government
Water Resource Department
(KBJN)

Copy to,

1. Accountant General (Accounts & Audit) Karnataka, Bangalore.
2. Managing Director, KBJNL, Bangalore.
3. Managing Director, KNNL, Bangalore.
4. Chief Engineer, WRDO, Bangalore.
5. Chief Engineer, (ISW) WRDO, Bangalore.
6. Chief Engineer, ICZ, Munirabad.
7. Chief Engineer, UTP, Shimoga.
8. Section file/Additional copies.

Annexure

Revised allocation details of 21 TMC water available to the State of Karnataka from Pollavaram Diversion Project of Andhra Pradesh.

(In TMC)

Sl No	Name of Project	Revised Godhavari water allocation	Remarks
1	Googal Barrage	0.50	To overcome drinking water shortage 0.10 TMC and irrigation requirement 0.40 TMC in Devedurga Taluk.
2.	Tubachi-Babaleshwara Lift Irrigation Scheme	6.273	To resolve the shortage of drinking water and to provide irrigation to about 52,700 Ha in drought-prone area of Athani and Jamakhadi Taluk.
3	Mahalakshmi Lift Irrigation Scheme	0.52	To resolve the problem of drinking water and to provide irrigation to about 4,861 Ha in drought-prone 17 villages of Chikkodi Taluk in Belgam District
4	Shiggaon Lift Irrigation Scheme	1.50	For providing drinking water facility in Shiggaon and Hanagal taluk In Haveri district and to provide Irrigation to 13,500 Ha of area inShiggaon, Hangal and Savanor taluks
5	Across Malaprabha river a) S.K.Aaloor - 0.009 b) Kalasa- 0.023 c) Nandikeshwara- 0.028 Construction of Bridge cum barrage under Malaprabha project near Nandikeshwara of Badami Taluk in Bagalkot District	0.06	Construction ofvented dams to resolve the drinking water problem in Badami taluk, Bagalkot district

6	TupparíHalla Irrigation Scheme	1.00	To provide irrigation facility in Kharif and Rabi season for about 14,000 Ha area of backward villages coming under Hubli-Dharwad and Navalgund taluk.
7	Construction of 5 Lift irrigation Schemes across Benne Halla a) Moognur Lift Irrigation - 0.069 b) Madagunaki Lift Irrigation - 0.069 c) Hadli-Gangapura Lift Irrigation - 0.069 d) Amargol Lift Irrigation - 0.069 e) Gobberagumpi - 0.091	0.447	Construction of vented dams across Benne halla to provide irrigation facility.
8	Dandavathi Irrigation Scheme	1.85	Construction of reservoir near Marur village in Soraba taluk, Shivamogga district to provide irrigation facility to about 5,287 Ha from Right Bank Canal and 1,646 Ha from Left Bank Canal.
9	Upper Bhadra Project (Additional)	2.40	To provide irrigation facility to Jagalur Taluk from Chitradurga Branch Canal under Upper Bhadra Project from Tunga river and Bhadra Reservoir and to provide drinking water to Pavagadataluk from Upper Bhadra Project.
10	Habbe Falls	1.45	To divert water from HabbeHalli to Magadakere.
11	Alvandi-Betagera Lift Irrigation	0.50	Providing irrigation to

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			about 5,990 Acers or 2,425 Ha of area in Koppal Taluk from Tungabhadra river
12	Small Weirs, tank filling and SCP/TSP works	1.00	Construction of small vented dams to facilitate drinking water supply to people/livestock and providing irrigation facility to SC and ST farmers with small and mini lift irrigation scheme under SCP/TSP
13	Drinking Water Project (PRED and KUWS and DB)	1.75	For providing water to many drinking water Schemes under implementation by the Centre and the State as per the top priority given to drinking water by the National and the State Water Policies
14	Industrial use	1.75	Allocation is for many industries approved by the State Government and with whom Government has entered into MoU under the Global Financial Investments.
	Total	21.00	

Translated Kannada to English Copy

Sd/- (31-08-2017)
B. Harinarayana
Under Secretary to Government,
Water Resources
Department(KBJN)

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ: ಆಂಧ್ರಪ್ರದೇಶ ರಾಜ್ಯದ ಇಂದಿರಾ ಸಾಗರ ಪೋಲಾವರಂ ಯೋಜನೆಯಿಂದ [illegible] ನೀರನ್ನು [illegible] ಕರ್ನಾಟಕಕ್ಕೆ ಲಭ್ಯವಾಗುವ 21 [illegible] ಕುರಿತು.

ಓದಲಾಗಿದೆ:
1. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ ಜಸಂಇ 69 ಕೆಬಿಎನ್ 2009, ದಿನಾಂಕ:19.03.2012
2. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ ಜಸಂಇ 30[illegible] ಕೆಬಿಎನ್ 2013, ದಿನಾಂಕ:01.03.2014.
3. ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಮಲಪ್ರಭಾ ಯೋಜನಾ ವಲಯ, ಧಾರವಾಡ ಇವರ ಪತ್ರ ಸಂಖ್ಯೆ ಕನೀನಿನಿ/ಮುಇಯೋವ/ಎ.ಇಂ-6/CWC/2015-16, ದಿನಾಂಕ:11.01.2016.
4. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ ಜಸಂಇ 312 ಕೆಬಿಎನ್ 2015, ದಿನಾಂಕ:21.05.2016.
5. ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಐಎಂಓ, ಕೇಂದ್ರ ಜಲ ಆಯೋಗ, ಸೇವಾ ಭವನ ನವದೆಹಲಿ ಇವರ ಪತ್ರ ಸಂಖ್ಯೆ: CWC.U.O.No.21/53/2014-PA(S)/523-24, ದಿನಾಂಕ:23.06.2016.
6. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ ಜಸಂಇ 293 ಕೆಬಿಎನ್ 2015, ದಿನಾಂಕ:20.07.2016.
7. ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ ಜಸಂಇ 20 ಕೆಬಿಎನ್ 2016, ದಿನಾಂಕ:09.06.2016.
8. ಪ್ರಧಾನ ಕಾರ್ಯದರ್ಶಿಗಳು, ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ, ಮಹಾರಾಷ್ಟ್ರ ಇವರ ಪತ್ರ ಸಂಖ್ಯೆ Misc-2016/422/C.R. 108/2016/WRP, dated:15.03.2017.

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ಪ್ರಸ್ತಾವನೆ:

ಮೇಲೆ ಓದಲಾದ (1)ರ ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ ಆಂಧ್ರಪ್ರದೇಶ ರಾಜ್ಯದ ಇಂದಿರಾ ಸಾಗರ ಪೋಲಾವರಂ ಯೋಜನೆಯನ್ವಯ ಸ್ಕೀಂ-ಎ ಅಡಿಯ ಹಂಚಿಕೆ ಹಸ್ತಾಂತರದಿಂದಾಗಿ ಕರ್ನಾಟಕಕ್ಕೆ ಕೃಷ್ಣಾ ಕೊಳ್ಳದಲ್ಲಿ ಲಭ್ಯವಾಗುವ 21 ಟಿಎಂಸಿ ಹಾಗೂ ಪುನರುತ್ಪನ್ನ ಶೇ.10 ಅಂದರೆ 2 ಟಿಎಂಸಿ ಸೇರಿಸಿಕೊಂಡು ಒಟ್ಟು 23 ಟಿಎಂಸಿ ನೀರನ್ನು ವಿವಿಧ ಯೋಜನೆಗಳಿಗೆ ಹಂಚಿಕೆ ಮಾಡಿ ಆದೇಶವನ್ನು ಹೊರಡಿಸಲಾಗಿತ್ತು.

2. ಮೇಲೆ ಓದಲಾದ (2)ರ ಸರ್ಕಾರಿ ಆದೇಶದಲ್ಲಿ ನಂದವಾಡಗಿ ಏತ ನೀರಾವರಿ ಯೋಜನೆಯಡಿ ಸುಮಾರು ನೀರಾವರಿ ಪ್ರದೇಶ ಅಂದಾಜು ಸುಮಾರು 36,100ಹೆ. ಪ್ರದೇಶಕ್ಕೆ 3.75ಟಿಎಂಸಿ (ಆಂಧ್ರಪ್ರದೇಶ ರಾಜ್ಯದ ಪೋಲಾವರಂ ತಿರುವು ಯೋಜನೆಯಡಿ ರಾಜ್ಯಕ್ಕೆ ಲಭ್ಯವಾಗಿರುವ 23 ಟಿಎಂಸಿ ನೀರಿನಲ್ಲಿ) ನೀರಿನ ಹಂಚಿಕೆಯೊಂದಿಗೆ ರೂ.1530.00ಕೋಟಿಗಳ ಮೊತ್ತದ ಅಂದಾಜಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆ ನೀಡಲಾಗಿದೆ.

3. ಮೇಲೆ ಓದಲಾದ (3)ರ ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಮಲಪ್ರಭಾ ಯೋಜನಾ ವಲಯ ಇವರು ದಿನಾಂಕ:19.03.2012ರ ಆದೇಶದಲ್ಲಿ ಪೋಲಾವರಂ ತಿರುವಿನಿಂದ ಲಭ್ಯವಿರುವ ನೀರನ್ನು 21.00ಟಿಎಂಸಿ.ಗೆ ಮಿತಿಗೊಳಿಸಿ ಮರು ಹಂಚಿಕೆ ಮಾಡುವಂತೆ ಕೋರಿರುತ್ತಾರೆ.

4. ಮೇಲೆ ಓದಲಾದ(4)ರ ಸರ್ಕಾರಿ ಆದೇಶದಲ್ಲಿ ಕೃಷ್ಣ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಹಂತ 1 ಮತ್ತು 2ರಡಿಯಲ್ಲಿ ಶೇ.100ರ ಅವಲಂಬಿತ ನೀರಾವರಿ ಹಿಡುವಳಿಯನ್ನು ಅಳವಡಿಸುವುದರಿಂದ ಉಳಿತಾಯವಾಗುವ ನೀರಿನ ಪ್ರಮಾಣದಲ್ಲಿ ನಂದವಾಡಗಿ ಏತ ನೀರಾವರಿ ಯೋಜನೆಗೆ 6.00ಟಿಎಂಸಿ ಮತ್ತು ಬೂದಿಹಾಳ್-ಪೀರಾಪೂರ ಏತ ನೀರಾವರಿ ಯೋಜನೆಗೆ 1.78ಟಿಎಂಸಿ ನೀರಿನ ಹಂಚಿಕೆಯನ್ನು ಮಾಡಿ ಆದೇಶಿಸಿದೆ.

5. ಮೇಲೆ ಓದಲಾದ (5)ರ ಕೇಂದ್ರ ಜಲ ಆಯೋಗದ ಪತ್ರದಲ್ಲಿ ಕರ್ನಾಟಕಕ್ಕೆ ಕೃಷ್ಣ ಕೊಳ್ಳದಲ್ಲಿ ಲಭ್ಯವಾಗುವ 21 ಟಿಎಂಸಿ ನೀರಿನ ಪ್ರಮಾಣಕ್ಕೆ ಶೇ.10ರ ಮಿತಿಯಲ್ಲಿ ನೀರು ಅಂದರೆ 2.00 ಟಿಎಂಸಿ ನೀರು ಹಂಚಿಕೊಂಡಿರುವುದಕ್ಕೆ ಆಕ್ಷೇಪಣೆ ವ್ಯಕ್ತಪಡಿಸಲಾಗಿದೆ.

6. ಮೇಲೆ ಓದಲಾದ(6)ರ ಸರ್ಕಾರಿ ಆದೇಶದಲ್ಲಿ ಬೂದಿಹಾಳ್-ಪೀರಾಪೂರ ಏತ ನೀರಾವರಿ ಯೋಜನೆಯಡಿ ಮುದ್ದೇಬಿಹಾಳ್ ಹಾಗೂ ಹುಣಸಗಿ ತಾಲ್ಲೂಕುಗಳ ನೀರಾವರಿ ಹಂತಕ್ಕೆ 20,243ಹೆ. ಪ್ರದೇಶಕ್ಕೆ 3.78ಟಿಎಂಸಿ ನೀರನ್ನು ಕೃಷ್ಣ ಮೇಲ್ದಂಡೆ ಯೋಜನೆಯಡಿ ಈ ನೀರಾವರಿ ಸೌಲಭ್ಯ ಒದಗಿಸಲು ರೂ.840.00 ಕೋಟಿಗಳ ಮೊತ್ತದ ಅಂದಾಜಿಗೆ ಆಡಳಿತಾತ್ಮಕ ಅನುಮೋದನೆ ನೀಡಲಾಗಿದೆ.

7. ಆಂಧ್ರಪ್ರದೇಶ ರಾಜ್ಯದ ಇಂದಿರಾ ಸಾಗರ ಪೋಲಾವರಂ ಯೋಜನೆಯ ಅನುಷ್ಠಾನದಿಂದ ಕರ್ನಾಟಕ ರಾಜ್ಯಕ್ಕೆ ಕೃಷ್ಣ ಕಣಿವೆಯಲ್ಲಿ 21.00 ಟಿಎಂಸಿ ಮತ್ತು ಮಹಾರಾಷ್ಟ್ರ ರಾಜ್ಯಕ್ಕೆ 14.00 ಟಿಎಂಸಿ ಹಂಚಿಕೆಯಾಗಿರುವುದರಿಂದ, ಕರ್ನಾಟಕ ರಾಜ್ಯವು 2.00 ಟಿಎಂಸಿ ಮಿತಿಯನ್ನು, ನೀರಿನ ಪ್ರಮಾಣವನ್ನು, ಹಂಚಿಕೆ ಮಾಡುವ ಕುರಿತು ಮಹಾರಾಷ್ಟ್ರ ರಾಜ್ಯದ ಸಮ್ಮತಿಯನ್ನು ಪಡೆಯಲು ಮೇಲೆ ಓದಲಾದ ಕ್ರಮ ಸಂಖ್ಯೆ(7)ರ ಪತ್ರದಲ್ಲಿ ಕೋರಲಾಗಿತ್ತು.

8. ಮೇಲೆ ಓದಲಾದ (8)ರ ಮಹಾರಾಷ್ಟ್ರ ರಾಜ್ಯ ಸರ್ಕಾರದ ಪತ್ರದಲ್ಲಿ ಆಂಧ್ರಪ್ರದೇಶ ರಾಜ್ಯದ ಇಂದಿರಾ ಸಾಗರ ಪೋಲಾವರಂ ಯೋಜನೆಯ ಅನುಷ್ಠಾನದಿಂದ ಮಹಾರಾಷ್ಟ್ರ ರಾಜ್ಯಕ್ಕೆ ಹಂಚಿಕೆಯಾಗಿರುವ 14.00 ಟಿಎಂಸಿ ನೀರನ್ನು ಮತ್ತು ಬಳಕೆ ಮಾಡುವುದರಿಂದ ಹಾಗೂ ಮಿತಿಯಲ್ಲಿ ನೀರನ್ನು ಪರಿಗಣಿಸಬಹುದೆಂದು ತಿಳಿಸಲಾಗಿದೆ.

9. ಮೇಲ್ಕಂಡ ಅಂಶಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಮೇಲೆ ಓದಲಾದ ಕ್ರಮ ಸಂಖ್ಯೆ(1)ರ ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ ಮಾಡಲಾಗಿರುವ 23 ಟಿಎಂಸಿ ನೀರಿನ ಹಂಚಿಕೆಯನ್ನು, 21 ಟಿಎಂಸಿಗೆ ಮಿತಿಗೊಳಿಸಿ ಪರಿಷ್ಕೃತ ಹಂಚಿಕೆ ವಿವರವನ್ನು ಪರಿಶೀಲಿಸಲಾಗಿದೆ. ಅದರಂತೆ, ಈ ಕೆಳಕಂಡ ಆದೇಶವನ್ನು ಹೊರಡಿಸಲಾಗಿದೆ.

-3-

ಸರ್ಕಾರಿ ಆದೇಶ ಸಂಖ್ಯೆ: ಜಸಂಇ 20 ಕೆಬಿಎನ್ 2016, ಬೆಂಗಳೂರು, ದಿನಾಂಕ: 31.08.2017

ಮೇಲಿನ ಪ್ರಸ್ತಾವನೆಯಲ್ಲಿ ವಿವರಿಸಿರುವಂತೆ, ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ: ಜಸಂಇ 49 ಕೆಬಿಎನ್ 2009, ದಿನಾಂಕ:19.03.2012ರಲ್ಲಿ ಆಂಧ್ರಪ್ರದೇಶ ರಾಜ್ಯದ ಇಂದಿರಾ ಸಾಗರ ಪೋಲಾವರಂ ಯೋಜನೆಯಿಂದಾಗಿ ಸ್ಕೀಂ-ಎ ಅಡಿಯ ಹಂಚಿಕೆಗೆ ಹೆಚ್ಚುವರಿಯಾಗಿ ಕರ್ನಾಟಕಕ್ಕೆ ಕೃಷ್ಣಾ ಕೊಳ್ಳದಲ್ಲಿ ಲಭ್ಯವಾಗುವ 21.00 ಟಿಎಂಸಿ ಹಾಗೂ 2 ಟಿಎಂಸಿ ಮರುಬಳಕೆ ನೀರನ್ನು ಪರಿಗಣಿಸಿ ಒಟ್ಟು 23 ಟಿಎಂಸಿಗೆ ಮಾಡಲಾಗಿದ್ದ ನೀರಿನ ಹಂಚಿಕೆಯನ್ನು ಪುನರ್ ಪರಿಶೀಲಿಸಿ ಒಟ್ಟು 21 ಟಿಎಂಸಿಗೆ ಸೀಮಿತಗೊಳಿಸಿ, ಈ ಆದೇಶದೊಂದಿಗೆ ಲಗತ್ತಿಸಿರುವ ಅನುಬಂಧದಲ್ಲಿರುವಂತೆ ಪರಿಷ್ಕೃತ ಹಂಚಿಕೆ ಮಾಡಲಾಗಿದೆ. ಸದರಿ ಆದೇಶದನ್ವಯ ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆಗೆ ಸಂಬಂಧಿಸಿದ ನಿಗಮಗಳು ಹಾಗೂ ವಲಯಗಳ ಮುಖ್ಯ ಇಂಜಿನಿಯರ್‌ಗಳು ವಿಸ್ತಾರಗೊಳಿಸಿಕೊಂಡ ವಿವರವಾದ ಯೋಜನಾ ವರದಿಗಳನ್ನು ತಯಾರಿಸಿ ಮುಂದಿನ ಅಗತ್ಯ ಕ್ರಮ ಕೈಗೊಳ್ಳುವಂತೆ ಆದೇಶಿಸಿದೆ.

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆದೇಶಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ

(ಬಿ. [illegible])
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ
ಜಲಸಂಪನ್ಮೂಲ ಇಲಾಖೆ(ಕೃಭಾಜನಿ)

ಇವರಿಗೆ,
1. ಮಹಾಲೇಖಪಾಲರು (ಲೆಕ್ಕಪತ್ರ ಮತ್ತು ಆಡಿಟ್), ಕರ್ನಾಟಕ, ಬೆಂಗಳೂರು.
2. ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕೃಷ್ಣಾ ಭಾಗ್ಯ ಜಲ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು.
3. ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ, ಬೆಂಗಳೂರು.
4. ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ಜಲಸಂಪನ್ಮೂಲ ಅಭಿವೃದ್ಧಿ ಸಂಸ್ಥೆ, ಬೆಂಗಳೂರು.
5. ಮುಖ್ಯ ಇಂಜಿನಿಯರ್ (ಅಂತರಾಜ್ಯ), ಜಲಸಂಪನ್ಮೂಲ ಅಭಿವೃದ್ಧಿ ಸಂಸ್ಥೆ, ಬೆಂಗಳೂರು.
6. ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ನೀರಾವರಿ ಕೇಂದ್ರ ವಲಯ, ಮುನಿರಾಬಾದ್.
7. ಮುಖ್ಯ ಇಂಜಿನಿಯರ್, ತುಂಗಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಶಿವಮೊಗ್ಗ.
8. ಶಾಖಾ ರಕ್ಷಾ ಕಡತ / ಹೆಚ್ಚುವರಿ ಪ್ರತಿಗಳು.

<u>ಅನುಬಂಧ</u>

ಬ್ರಿಜೇಶ್‌ಕುಮಾರ್ ನ್ಯಾಯಾಧಿಕರಣದ ತೀರ್ಪಿನಿಂದ ಕರ್ನಾಟಕ ರಾಜ್ಯಕ್ಕೆ ಲಭ್ಯವಾಗಿರುವ 21 ಟಿಎಂಸಿ ನೀರಿನ ಪರಿಷ್ಕೃತ ಹಂಚಿಕೆಯ ವಿವರಗಳು

(ಟಿಎಂಸಿಗಳಲ್ಲಿ)

ಕ್ರಮ ಸಂಖ್ಯೆ	ಯೋಜನೆಯ ಹೆಸರು	ಪರಿಷ್ಕೃತ ಹಂಚಿಕೆ ನೀರಿನ ಪ್ರಮಾಣ	ಷರಾ
1	ಗೂಗಲ್ ಬ್ಯಾರೇಜ್	0.30	ದೇವದುರ್ಗ ತಾ.ನಲ್ಲಿ ಕುಡಿಯುವ ನೀರಿನ ಬೇಡಿಕೆ ನೀಗಿಸಲು 0.30 ಟಿಎಂಸಿ ಹಾಗೂ ನೀರಾವರಿ ಬೇಡಿಕೆಗಾಗಿ 0.40 ಟಿಎಂಸಿ
2	ತುಬಚಿ-ಬಬಲೇಶ್ವರ ಏತ ನೀರಾವರಿ ಯೋಜನೆ	6.273	ಅಥಣಿ ಮತ್ತು ಜಮಖಂಡಿ ತಾಲ್ಲೂಕುಗಳ ಬರಪೀಡಿತ ಪ್ರದೇಶಗಳಿಗೆ ಕುಡಿಯುವ ನೀರಿನ ಸೌಲಭ್ಯ ಒದಗಿಸಲು ಹಾಗೂ ಸುಮಾರು 52,700ಹೆ. ನೀರಾವರಿಗಾಗಿ
3	ಮಹಾಲಕ್ಷ್ಮೀ ಏತ ನೀರಾವರಿ ಯೋಜನೆ	0.52	ಬೆಳಗಾಂ ಜಿಲ್ಲೆ ಚಿಕ್ಕೋಡಿ ತಾ.ನ ಬರಪೀಡಿತ 17 ಗ್ರಾಮಗಳಲ್ಲಿ ಕುಡಿಯುವ ನೀರಿಗಾಗಿ ಹಾಗೂ ಸುಮಾರು 4,800ಹೆ. ನೀರಾವರಿಗಾಗಿ
4	ಶಿಗ್ಗಾಂವ್ ಏತ ನೀರಾವರಿ ಯೋಜನೆ	1.50	ಹಾವೇರಿ ಜಿಲ್ಲೆ ಶಿಗ್ಗಾಂವ್ ಮತ್ತು ಹಾನಗಲ್ ತಾ.ನಲ್ಲಿ ಕುಡಿಯುವ ನೀರಿನ ಬೇಡಿಕೆ ಹಾಗೂ 13,500ಹೆ. ಶಿಗ್ಗಾಂವ್, ಹಾನಗಲ್ ಮತ್ತು ಸವಣೂರು ತಾಲ್ಲೂಕುಗಳಲ್ಲಿ ನೀರಾವರಿಗಾಗಿ
5	ಮಲಪ್ರಭಾ ನದಿಗೆ ಅಡ್ಡಲಾಗಿ (ಎ) ಎಮ್.ಕೆ. [illegible] – 0.009 (ಬಿ) [illegible] – 0.023 (ಸಿ) [illegible] – 0.028 ಬಳಿ ಬಾದಾಮಿ ತಾ. ಬಾಗಲಕೋಟೆ ಜಿಲ್ಲೆ ಇಲ್ಲಿ ಮಲಪ್ರಭಾ ನದಿಗೆ [illegible] ಬ್ಯಾರೇಜ್ ನಿರ್ಮಾಣ	0.06	ಬಾಗಲಕೋಟೆ ಜಿಲ್ಲೆಯ ಬಾದಾಮಿ ತಾ.ನ ಕುಡಿಯುವ ನೀರಿನ ಸೌಲಭ್ಯ ಒದಗಿಸಲು ಈ ಬ್ಯಾರೇಜುಗಳನ್ನು ನಿರ್ಮಿಸಲಾಗುತ್ತಿದೆ
6	ತುಪರಿಹಳ್ಳ ನೀರಾವರಿ ಯೋಜನೆ	1.00	ಹುಬ್ಬಳ್ಳಿ-ಧಾರವಾಡ ಹಾಗೂ ನವಲಗುಂದ ತಾ.ಗಳಲ್ಲಿ [illegible] ಗ್ರಾಮಾಂತರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಕುಡಿಯುವ ಮತ್ತು [illegible] ಸುಮಾರು 14,000ಹೆ. ನೀರಾವರಿಗಾಗಿ.
7	ಬೆಣ್ಣೆಹಳ್ಳಕ್ಕೆ ಅಡ್ಡಲಾಗಿ 5 ಏತ ನೀರಾವರಿ ಯೋಜನೆಗಳ ನಿರ್ಮಾಣ (ಎ) [illegible] ಏತ ನೀರಾವರಿ – 0.089 (ಬಿ) [illegible] ಏತ ನೀರಾವರಿ – 0.089 (ಸಿ) [illegible] ಏತ ನೀರಾವರಿ – 0.089 (ಡಿ) [illegible] ಏತ ನೀರಾವರಿ – 0.089 (ಇ) [illegible] – 0.091	0.447	ಬೆಣ್ಣೆಹಳ್ಳಕ್ಕೆ ಅಡ್ಡಲಾಗಿ ಏತ ಯೋಜನೆಗಳನ್ನು [illegible] ನೀರಾವರಿ ಸೌಲಭ್ಯ ಒದಗಿಸುವುದು

8	[illegible]	1.85	[illegible] 5,287 [illegible] 1.64 [illegible]
9	[illegible]	2.40	[illegible]
10	[illegible]	1.45	[illegible]
11	[illegible]	0.50	[illegible] 5,990 [illegible] 2.425 [illegible]
12	[illegible]	1.00	[illegible]
13	[illegible]	1.75	[illegible]
14	[illegible]	1.75	[illegible]
	[illegible]	[illegible]	

[illegible]

Government of India
भारत सरकार
Central Water Commission
केन्द्रीय जल आयोग
Inter State Matters
अंतरराज्यीय मामले निदेशालय

411 A(S), Sewa Bhawan
४११ ए (द.), सेवा भवन
R.K.Puram, New Delhi-66
रामा कृष्ण पुरम, नई दिल्ली -६६

विषय: Upper Bhadra Project Scheme-A, Karnataka - regarding.

Please refer to letter no. 11/135/2009- PA(S)/845-46 dated 09.09.2016 on the above subject enclosing therewith letter no.WRD 96 Vibyae 2016 dated 30.08.2016 from Secretary to Govt., Water Resources Department, Govt. of Karnataka, Bangalore on the project mentioned above. In the letter it has been stated that Govt. of Karnataka has revised the Master Plan and has restricted the quantity available from Pollavaram diversion to 21 TMC and an allocation of 2.40 TMC of water for the Upper Bhadra Project is included in the above Master Plan.

In this context, it is to mention that comments on original DPR and Updated DPR have already been sent to you after examination of the project from inter- state angle. in details vide this Dte. letter no. 7/2/8(KN)/2013-ISM/604 dated 16.10.2015 and 7/2/8(KN)/2013-ISM/161 dated 10.03.2016 respectively. As per these letters, DPR was found acceptable from inter- state angle for planned utilisation of 21.5 TMC.

In view of letter dated 30.08.2016, received from Govt. of Karnataka, the project can be considered acceptable from inter-state angle for planned utilization of 23.9 TMC i.e.21.5TMC as per Master Plan2002 (KWDT-1) & 2.4TMC as per GWDT. However, Copy of the Revised Master Plan by Govt. of Karnataka as mentioned in the letter dated 30.08.2016, may please be sent to this Dte. for reference and record please.

This issues with the approval of Chief Engineer (IMO), CWC.

(वी. पी. पांडेय)
निदेशक

Director, PA(S) Dte, CWC, Sewa Bhawan, R.K.Puram, New Delhi.
CWC No 7/2/8(KN)/2013/ ISM/602 Dated: 07.10.2016

No: C.E/K.N.N.L/U.B.P.Z/CTA/T.A-4/T.S-5/2016-17/ 8354

Dt: 15 DEC 2016

"MOST URGENT"

1. Copy forwarded to Superintending Engineer, KNNL, Upper Bhadra Project, Circle No-1, B.R.P,for information and submit the compliance to the observations of CWC at the earliest for taking necessary action.

2. Copy forwarded to Superintending Engineer, KNNL, Upper Bhadra Project, Circle No-2, Chitradurga for information and submit the compliance to the observations of CWC at the earliest for taking necessary action.

For Chief Engineer, KNNL,
Upper Bhadra Project Zone,
Chitradurga.

UPPER BHADRA PROJECT

INTERSTATE ASPECTS

3. INTERSTATE ASPECTS

3.1 Upper Bhadra Scheme is proposed to utilize 29.9 TMC of water available in river Tunga and savings of existing projects in Tunga & Bhadra sub-basin. It is proposed to pump 17.40 TMC (492.78 MCM) of water for 121 days during monsoon period (i.e. June to October) from Tunga River to Bhadra Reservoir and simultaneously withdrawing the water from Bhadra Reservoir and leading to a canal for conservation and utilization. Tunga being one of the major tributary of Tungabhadra which in turn a major tributary of river Krishna. Hence, this project comes under the purview of allocation of Krishna Waters among the riparian states and is under Tungabhadra Sub basin (K-8) of Krishna basin.

3.2 Riparian States of Krishna Basin

3.2.1 Krishna River is an Inter-State river in Southern India. It is the second largest river in Peninsular India. Krishna flows across the whole width of the peninsula, from west to east, for a length of about 1392 Km (870 miles) through Maharashtra, Karnataka and Andhra Pradesh and joins Bay of Bengal. The river Krishna enters Karnataka at its 304th Km and passes through the state for 480 Km length.

3.2.2 The total catchment area of Krishna basin is 2,58,948 Sq. Km and the distribution of the same in the three states is as indicated below.

Sl. No.	Name of the Basin State	Catchment Area in Sq. Km
1.	Maharastra	69425
2.	Karnataka	113271
3.	Andhra Pradesh	76252
Total		**258948**

Source: Water Atlas of India

3.3 Krishna River Basin Characteristics

3.3.1 Krishna rises in the Western Ghats at an altitude of 1338m (4385ft) near Mahabaleshwar in Maharashtra State and joins Bay of Bengal near Bapatla in Andhra Pradesh. Krishna river basin is 2.59 Lakh Sq.Kms of which drainage area in Karnataka is 1,13,271 Sq Km, which is 43.74 % of the basin area.

3.3.2 Main tributaries of river Krishna in Karnataka are Bhima and Don from the north, Ghataprabha, Malaprabha, Tungabhadra and Vedavathi from the south. Description of these tributaries of Krishna River in brief is furnished below in a tabular form.

Sl. No.	Name of the Tributary	Catchment Area in Sq. miles	Origin, Altitude and Length	Sub-Tributaries	Name of the State
1.	Ghataprabha	3,409	Westren Ghats, 2900 feet, 176 miles	Hiranyakeshi, Markandeya	Maharshatra, Karnataka
2.	Malaprabha	4,459	Westren Ghats, 2600 feet, 190 miles	Bennihalla, Hirehalla, Tas nadi	Karnataka
3.	Bhima	27,264	Westren Ghats, 3100 feet, 535 miles	Combined waters of Mula and Mutha Ghod, Nira, Sina	Maharastra, Karnataka
4.	Tungabhadra	27,574	Western Ghats at Gangamula, 3930 feet, 330 miles	Combined waters of Tunga and Bhadra, Varada, Vedavathy	Karnataka, Andhra Pradesh

3.3.3 The river basin is in arid zone and is largely sustained by rainfall in Western Ghats through Southwest monsoon. The head reaches of the catchment area lie in Western Ghats where the average rainfall is heavy and is nearly 635 Cm (250 inches) per annum. The rainfall gradually decreases to 51 Cm (20 inches) as it approaches Almatti dam site. i.e, in the area of Bijapur, Gulbarga and Raichur districts. The river is completely rain-fed. River gradually begins to rise in June, picks up in July, overflows in August and September, the flood rise reaching as high as 30 m and again gradually declines through October and by February it would be almost dry.

3.4 Interlinking of the Scheme with Neighboring Scheme

3.4.1 The projects that are linked to Upper Bhadra Project by being in the same sub-basin as Tungabhadra sub-basin (K-8) and by virtue of contributing the water savings to Upper Bhadra Project are (1) Bhadra Project, (2) Gondi Anicut, (3) Tunga Anicut, (4) Vijayanagar Channels. The savings of 13 TMC water has to come by modernizing these schemes. The utilization for Bhadra Project, the modernization of which is cleared by CWC, vide Lr. No.2(66)/2008/WR/GOI/Planning Commission/ Water Resources Department/ dated 31.03.2008 is given below:

Irrigation	57.949	TMC
Drinking	1.560	TMC
Reservoir Ev. Losses	3.436	TMC
Total	**62.945**	**TMC**

3.4.2 The savings envisaged by modernizing Gondi Anicut, Tunga Anicut and Vijayanagara Channels is 13.00 TMC. The details are given below:

Gondi Anicut system	0.50	TMC
Tunga Anicut system	6.25	TMC
Vijayanagar Canal system	6.25	TMC
Total	**13.00**	**TMC**

3.4.3 Out of the above, it is the Bhadra Reservoir project which is directly linked to Upper Bhadra project physically as the reservoir is used as a transit buffer storage for transferring waters of Tunga River to Bhadra reserviour and then on to system of canals for irrigation mainly in Vedavathi sub-basin (i.e. CBC, TBC & JBC) and partly in Tungabhadra sub-basin (i.e. Tarikere flow and lift canal). The modernization works of Bhadra project are nearing completion which will ensure savings of 6.50 TMC. The integrated operation of Bhadra and Upper Bhadra Project has been studied by preparing combined working tables and success of both the projects is ascertained to be more than CWC norms.

3.5 Allocation to Scheme

3.5.1 The Master plan committee, (Government of Karnataka - Water Resources Development Organization) has examined the possibilities of utilizing the water under Krishna basin and drawn up a list of projects to be taken up under Scheme A. The list of projects in the Master plan in all the sub basins of Krishna is given in **Appendix 3A.1**.

3.5.2 There is a direct allocation of 10.00 TMC to Upper Bhadra Project. In order to implement the project as proposed by the state government it is proposed to utilize 13.00 TMC from the savings of water by modernization of (1) Gondi Anicut, (2) Tunga Anicut, (3) Vijayanagar Channels which are the existing projects in Tungabhadra sub-basin.

3.5.3 In the Govt. Order No. WRD 20 KBN 2016 Bangalore dated: 31.8.2017 21.00 TMC revised as per GWDT allocated to Karnataka State by virtue of agreement between riparian states of the basin by implemention of Diversion of Indirasagar - Pollavaram Scheme in Andhra Pradesh which envisages transfer of 80.00 TMC of water from Godavari basin to Krishna basin.

Out of this additional 21.00 TMC of water allocated to Karnataka State, additional 2.40 TMC has been re-allocated to Upper Bhadra Project for providing irrigation facility to Jagalur taluk and providing drinking water to Pavagada taluk by fillingup of tanks.

3.5.4 An allocation of 734 TMC has been made to Karnataka State in *KWDT-I of 2002 award.*

3.6 PLANNING

3.6.1 Upper Bhadra Project is planned for 29.90 TMC which would be accounted as follows.

(a)	Direct allocation as per revised master plan 2003	:	10.00 TMC
(b)	From savings after modernization of		
	Tunga Anicut System	:	6.25 TMC
	Bhadra Anicut System	:	0.50 TMC
	Vijaynagar Canal System	:	6.25 TMC
	Total		**23.00 TMC**
	Deducting allocation made for Ubrani LIS	:	1.50 TMC
	Sub-Total		**21.50 TMC**
(c)	Additional allocation to UBP by GoK by virtue of agreement between riparian states of the basin by implemention of Indirasagar- Pollavaram Diversion Scheme in Andhra Pradesh	:	2.40 TMC
(d)	Water is utilized under Minor Irrigation allocation already made under 734 MC		6.00 TMC
	Total Allocation for UBP	**:**	**29.90 TMC**

3.6.2 Out of 29.90 TMC proposed allocation, 21.90 TMC will be utilized for irrigation and the balance 8.00 TMC will be utilized for filling 367 nos of tanks which includes 2.00 TMC for augmentation of VV Sagar Reservoir.

The proposed utilization of 29.90 TMC considered in Upper Bhadra Scheme is within the overall water allocation of Krishna Water Tribunal Dispute-I

UPPER BHADRA PROJECT

SURVEY AND INVESTIGATIONS

4.0 SURVEY, INVESTIGATION AND PLANNING

4.1 General Approach

In order to execute the project as per the scope and specifications, the following methodology is adopted. For better understanding, the activities have been sub-divided and each of them is explained below in detail.

4.2 Data Collection and Compilation

4.2.1 Data Collection from Survey of India

The details of GTS Bench marks already established with in the area of project area are collected.

A copy of list of GTS Bench Marks located in the command area is enclosed for ready reference in **Annexure 4.1**.

The Topo Sheets in which command Area lies have been procured from Survey of India, Bangalore. Details of Topo Sheets are as below.

Sl. No.	Topo Sheet No.	Scale
1.	48O,57 B, 57 C	1:2,50,000
2.	48 O/5,6,9,10,14	1:50,000
3.	57B/4,7,8,9,10,11,12,13,14,15,16	1:50,000
4.	57C/1,2,5,6,9,10,13,14	1:50,000
5.	57F/4	1:50,000

Lay out of toposheet Maps covering Upper Bhadra Project is in **Figure 4.1**.

4.2.2 Data Collection from Revenue Authorities

All Taluk Maps and District Maps, within command area are collected and are combined to identify the list of villages benefited.

4.3 Command Area Map

All toposheets collected are scanned, digitized and combined to form Command area map for the area of interest. Compendium planning of Link canal from Tunga to Bhadra, UpperBhadraMainCanal from Bhadra Dam, ChitradurgaBranch Canal, Tumkur BranchCanal, JagalurBranchCanal, Tarikere flow and lift canal etc are prepared on the 1:50,000 scale topomaps to identify the command area. The entire command area under each canal is divided into suitable blocks of area 8000 to 10000 Ha.

4.4 Methodology

4.4.1 Reconnaissance survey

The survey consultant's team shall undertake a Reconnaissance Survey of the proposed alignment study by following:

- General topography of the location including accessibility.
- Identify locations for establishing DGPS Control Points.
- Differential global positioning system of high end model shall be used to set up DGPS Control Points on permanent structures.
- Establishment of Control Points.
- Differential global positioning system of high end model shall be used to set up DGPS Control Points on permanent structures.

4.4.2 Establishment of Control Points

Dual frequency Global Positioning System (DGPS) of high-end model shall be setup on permanent structures/sheet rock at two places which are inter-visible. Satellite observations shall be carried out for a minimum duration of 3 hours and the data shall be downloadable to computer to get rectangular (UTM) co-ordinates.

4.4.3 Establishment of temporary bench marks (TBMs)

Tertiary levels shall be carried out from the existing GTS BM and TBMs at regular interval shall be established using auto level.

4.4.4 DGPS Control Points

Number of control points were established at permanent structures/rock covering the entire alignment by using DGPS of high end model. Satellite observations were made for about 60to 120 minutes and the data was processed using proprietary software to get the co-ordinates in UTM.

DGPS control points (Single points) were established at regular interval of 1 km along the proposed alignment. Pair points of DGPS control points were established at 5 km interval.

4.4.5 Survey of Alignment

Double auto levels have been made used for carraring out the survey of canal alignment. The leveling done by two people going in opposite directions controlling all BMs on the way. The agreement of level differences obtained by the two levelers between adjacent BMs will ensure the correctness of leveling. It is seen that the disclosure of leveling at the closing BM is less than 12mm $\sqrt{K}$ where K is the length of the leveling line in Km and the leveling line is adjusted fixing values of the DT BMs.

Leveling is done in the early morning hours with which the work will be faster and could get better results. Necessary precautions have been taken so as to get good results in leveling.

4.5 Fixing Alignment and Detailed Survey of Canal Alignment and Detailed Survey of Command area.

4.5.1 LinkCanal from Tunga to Bhadra

The lifting point of Tunga water is located at Muthina Koppa village near Mandagadde of Narasimharajapura Taluk. The alignment is fixed as per the planning map, L-section along the proposed alignment at every 100m interval along with details of crossings are taken using Total station. Total length of Link canal from Tunga to Bhadra works out to 11.267 Km.

4.5.2 Upper Bhadra Main Canal

Upper Bhadra Main canal takes off from right bank flank of Bhadra Reservoir near the chute. The canal runs for a length of 47.50 Km upto off take of ChitradurgaBranchCanal and TumkurBranchCanal.

The alignment passes through Dodda Kundur, Harapanahalli, Bagenahalli, Duggalapur, Hunsaghatta, Kallashettihalli and Hebbur villages.

The UpperBhadraMainCanal runs for a length of 47.50 Km in gravity. Further water will be lifted in 2 stages upto delivery chamber at Ch: 40.535 Km. Further the canal crosses the ridge point where Tunnel for a length of 7.00 Km is proposed. Thereafter ChitradurgaBranchCanal and TumkurBranchCanal will take off.

4.5.3 Command Area Survey

As per CWC guidelines, micro planning has been carried out for an area of 20800 Ha under Tarikere lift by carrying out detailed command area survey. Accordingly, a realistic cost required for micro irrigation has been arrived.

4.5.4 Watershed Development Scheme

A watershed development scheme on the lines of Integrated Mission for Sustainable Development for the watershed of Ajjampura Tunnel area is prepared. In the scheme, it is proposed to construct rainwater harvesting structures like invert wells, form ponds and check dams.

A provision is also made in the DPR for desilting of MI tanks to promote ground water recharge. Under the same provision it is now proposed to construct recharge shaft in addition to desilting.

4.5.5 Canal Losses

In working out the longitudinal section, the provision of regulators, falls, escapes, cross drainage works, etc. shall be considered. The losses shall be fully accounted for.

4.6 Compendium Planning of MainCanal

Under Upper Bhadra Project 29.90 TMC of water is lifted from Bhadra Reservoir from diverting 17.40 TMC from TungaRiver to Bhadra reservoir by lifting. The Canal from Bhadra Reservoir runs for a length of 47.50 Kms. This consists of two parts i.e. open cut canal of 40.535 Kms and a tunnel of 6.9 Km in length. There are two lifts in the open cut canal.

Tarikere lift irrigation scheme is planned to irrigate 20150 Ha and filling up of 79 tanks. The command area is divided into 3 blocks each of approximate 7000 ha. Each of these blocks is further divided into 500 ha zone and 50 Ha sub blocks. It is proposed to construct two separate pump station (decentralized) for three block. For block A jack well cum pump house is proposed to be constructed at the point of beginning of tunnel at an RL 744.00 m. From the pump house 1 rows of BWS mainlines is proposed to connect 500 Ha blocks. A distribution feeder pipe network is provided up to 50 Ha Chaks and drip irrigation system. For block B and C. a jack well cum pump house is proposed to be constructed at the end of the tunnel at an RL 739.246 m.

In this scheme, it is proposed to provide a network of pipe lines (GRP/HDPE/PVD) instead of constructing distributaries, minors, sub-minors and field channels.

Thereafter Chitradurga and Tumkur branch canal take off from exit canal of Tunnel, feeding the lands by gravity of an area of 1,07,265 by ChitradurgaBranchCanal, 84900 Ha by Tumkur Branch canal and 13200 ha by Jagalur Branch canal. The entire command area will be provided with irrigation water only during Kharif season.

Compendium planning of Chitradurga Branch Canal (0.00 Km to 134.527 Km), Tumkur Branch Canal (0.00 Km to 159.684 Km) and Jagalur Branch Canal (0.00 Km to 43.65 Km) is shown in drawings VJNL/UBP/CAM/02 to 04. Command area of Tarikere Lift and Gravity Flow and tank filling within the command area is shown in drawing VJNL/UBP/CAM/10.

4.6.1 Planning and Investigation

While carrying out survey for alignment of canals location of structures are important. Care has been taken to fix the alignment in such a way that at the location of structures and particularly at CD works sufficient head way is available. As far as possible nala discharge is passed below the canal. If due to topography, it is not possible Super passage has been proposed subject to nala discharge being equal or less than the canal discharge. In case nala discharge is more than canal discharge it is passed below the canal. While finalizing the alignment apxes at 90^0 or less are avoided duly investigating various alternatives.

Along the alignment trail pits or trail bores are taken up to CBL or hard rock whichever is higher. Geological strata classification has been done same is used for the preparation of the estimate.

The Geological investigation of tunnel has been carried out using electrical resistivity Survey Schlumberger configuration of Electrode Separation method. Electrical resistivity soundings and interpretations of LANDSAT imagery brought out the existence of weak zone, weathered and saturated zones along the tunnel.

For sub strata investigations of pumping stations field bore log has been taken up to hard rock formation below FGL. All such structures are founded on hard rock. SBC at founding level well below hard rock level is considered as 100 t/m^2.

Detailed planning of Chitradurga Branch Canal,Tumkur and Jagalur Branch Canal (Main Canal), blocks and their distribution network by Micro Irrigation (Drip Irrigation) is done on 1:50,000 scale command area maps (Extract of 1:50,000 SOI toposheets).

The following points are considered while planning the alignment.

(a) Alignment is planned generally in FSD + FB cutting.
(b) Heavy embankments are generally avoided.
(c) Alignment is planned in such a way that C-D works like canal Syphon and Drop Culverts are generally avoided.
(d) Alternate alignments are studied before finalizing the route.
(e) Distributary blocks have been planned between two nalas to reduce the number of C-D works.
(f) Actual irrigable area of each block is computed after deducting Government land, waste land and uncommand area from the total area of the block to assess the exact water requirement for each block.

The canal is proposed to supply water to the tanks during off-peak period of irrigation. The canal section is designed to accommodate water supply to the tanks also.

The following are the hydraulic particulars of Tarikere, Chitradurga, Tumkur and JagalurBranchCanal (MainCanal) at off take.

Sl. No.	Hydraulic Particulars	Tarikere Lift Scheme	ChitradurgaBranchCanal	TumkurBranchCanal	JagalurBranchCanal
1.	Drawal Point(Km)	Approach & ExitCanal before & after Tunnel	49.95Km from Bhadra Reservoir	49.95Km from Bhadra Reservoir	125.167Km from CBC
2.	Length(Km)	72 Kms by Pipe line	134.527	159.684	43.65
3.	Peak Discharge (Cumecs)	2.20	48.63	33.83	5.329
4.	Required Discharge (Qr) with 10% extra for design consideration in Cumecs	2.22	*53.493	37.213	5.862
5.	Designed Discharge (Qd) in Cumecs	4.99	55.125	37.477	6.015
6.	Bed width (m)	1.60	6.00	6.00	2.60
7.	Full supply depth (m)	0.90	4.80	3.70	1.65
8.	Free Board. (m)	0.45	1.00	0.75	0.60
9.	Side slope	1:0.5	1:1	1:1	1:1
10.	Bed gradient (1 in n)	1:500	1:10,000	1:8000	1:4000
11.	Velocity (M/Sec)	0.753	1.063	1.044	0.858
12.	Irrigable command area (Ha)	Area by Pipe line through drip 20150 Ha	1,07,265	84,900	13,200

Sl. No.	Hydraulic Particulars	Tarikere Lift Scheme	ChitradurgaBranchCanal	TumkurBranchCanal	JagalurBranchCanal
13.	Total No of blocks divided in command area	3	11	08	03
14.	Type of Canal	-	Contour	Contour	Contour

Q_r of CBC & JBC - (44.15 + 4.48 = 48.63). Canal is designed for slightly higher discharge of 53.49 Cumecs.
The Boundaries of the Command Area are as follows:

(a) The command area of ChitradurgaBranchCanal (MainCanal) is bound by the Chitradurga branch Canal itself on the north and west, River Vedavathi on south and east.

(b) The Command area of Tumkur Branch canal (Main canal) is bound by the Tumkur Branch canal itself on the south and west, River Vedavathi and Suvamamukhi on East.

4.6.2 **Command Area Details**

(a) Irrigable area under each block is worked out based on detailed planning done on 1:50,000 scale command area maps. Blockwise Gross command area is measured in AutoCAD. Culturable Area (CCA) is calculated deducting uncultivable area such as high lands (area above full supply level within the command area), villages sites, developments, Roads and cart tracks, natural drainages, grazing grounds, cremation and burial grounds, MI tanks, Govt.lands, barren lands etc.,as per irrigation norms.80% of CCA is considered as irrigable command area block wise area abstract showing details such as block no's, offtaking chainages, gross command area, culturable area and irrigable command area and also taluk wise area benefited is enclosed in **Table 4.1(a) & (b).**

(b) Hydraulic canal sections are designed as per Manning's formula and same is enclosed in **Table 4.2**. Reach wise and cut off statement is prepared for ChitradurgaBranchCanal, TumkurBranchCanal, JagalurBranchCanal and the same is enclosed in **Table 4.3**.

(c) The alignment of Chitradurga, Tumkur and JaglurBranchCanals crosses number of nalas and valleys. Suitable type of cross drainage works are proposed to pass the flood water.

(d) Alignment passes through number of cart tracks, metalled roads, Major District Roads and National Highway No. 4 at Ch:109.570 Km in Chitradurga Branch Canal.

(e) Cross canal works are proposed with suitable carriage width as per MOST are proposed across the canal. Wherever there are no existing road crossing within 1 Km of Main Canal one village road bridge is proposed for local formers for crossing the canal.

(f) Cross regulator combined with escape and Road bridge, are proposed at every 15 Km. CR cum escapes are located before aqueducts or box culverts to tail off the escape channel nearby.

(g) Measuring Devices are proposed at every 30 Km intervals.

Following are the list of structures proposed along the Branch Canals.

Sl. No.	Type of Structures	TarikereGravity & LiftCanal	ChitradurgaBranchCanal (Nos.)	TumkurBranchCanal (Nos.)	Jagalur Branch Canal (Nos.)
1.	Village Road	Yet to be assessed		170	33
2.	RoadBridge			61	16
3.	NH-4 Crossing				-
4.	Foot bridge				
5.	NH-13 Crossing			-	01

Sl. No.	Type of Structures	TarikereGravity & LiftCanal	ChitradurgaBranchCanal (Nos.)	TumkurBranchCanal (Nos.)	Jagalur Branch Canal (Nos.)
6.	Box crossing		01	03	
7.	Cut and cover				
8.	VRB with side drain				
9.	Inlet			01	
9.	Head Regulator		05	14	05
10.	Y-junction or Tailend structure		01		1
11.	Super passage, SP/VRB		76	50	04
12.	Box Culvert		06	45	-
13.	Valley Diversions		13	05	-
14.	Drop Culvert		31	29	19
15.	Aqueduct		13	12	01
16.	Sopanum and ramp		38	27	
17.	Existing canal crossing		01	02	
18.	CR Cum Escape Cum RoadBridge		01	08	-
19.	Canal Drop		29	01	-
20.	Tunnel		03	01	-
21.	Measuring Device		01	04	-
22.	Outlet		04	03	
23.	Cattle Ramp		07	10	
24.	Cause way		08	12	
25.	Nala Training		06	01	
26.	Portal frame		01		
27.	Escape drop		-	04	
28.	Syphon		-	01	
29.	Road Crossing		-	02	
	Total	**120**	**245**	**463**	**80**

4.6.3 In addition to the above, it is proposed to provide irrigation facilities in Tarikere taluk to an extent of 20,150 Ha in Khariff Season.

(a) Lifting 0.27 TMC of water from the Delivery Chamber near Ajjampura and feeding the 79 tanks coming above and below the tunnel.

(b) By taking contour canal and feeding the atchkut by gravity on either side of the Upper Bhadra project canal from Delivery Chamber.

The utilization for feeding 20,150 Ha of land works out 1.20 TMC will be met out of29.90 TMC of water allocated for Upper Bhadra project.

4.6.4 **Drip Irrigation (Distributary Network)**

In view of economizing on water use and thereby increasing the area irrigated per unit of water the whole command under Upper Bhadra Project is proposed to be under low pressure drip irrigation.

The proposed Command Area of Chitradurga Branch Canal and Tumkur Branch Canal is divided into 11 & 08 Nos. of blocks respectively of area approximate 10000 to 11000 Ha. These blocks are later divided into two areas to be irrigated partly by pumping and partly by gravity by studying the terrain.

Area of 10000 Ha blocks is further divided into zones of 500 Ha which is again divided into50 Ha blocks. Bulk water supply mains runs from the MainCanal into the 10000 Ha blocks.

Feeder lines, mains, sub mains and drippers are further designed as per the required discharge of the block.

Arrangement for sump cum pump house, control panel, filters etc are made for each individual block. Provision for SCADA and telemetry is also done.

The command area maps of Chitradurga Branch Canal, Tumkur Branch Canal is shown is shown in drawings VJNL/UBP/D1/CBC & TBC/11-15.

4.6.5 Details of Taluk Wise Command Area Benefitted

The length, command area in each taluk and No of Villages benefited covered under different canals is as follows.

Sl. No.	Name of Taluk	Name of District	Length of the MainCanal in (Km)	Command Area in (Ha).	No. of Villages Benefited
Tarikere Flow and Lift					
1.	Tarikere	Chikkamagalur	72.00	3650 -By flow	98
			-	16500 -By lift	
		TOTAL	**72.00**	**20150**	**98**
ChitradurgaBranchCanal					
1.	Tarikere	Chikkamagalur	3.63	411.00	3
2.	Kadur	Chikkamagalur	11.81	1864.00	17
3.	Hosadurga	Chitradurga	51.979	31035.00	104
4.	Holalakere	Chitradurga	15.037	371.00	-
5.	Hiriyur	Chitradurga	20.049	37052.00	62
6.	Chitradurga	Chitradurga	32.092	23266.00	18
7.	Challakere	Chitradurga	-	13266.00	40
		TOTAL	**134.597**	**107265.00**	**244**
TumkurBranchCanal					
1.	Tarikere	Chikkamagalur	10.514	1628.00	9
2.	Kadur	Chikkamagalur	74.207	20502.00	72
3.	Hosadurga	Chitradurga	21.86	13573.00	110
4.	Hiriyur	Chitradurga	-	29982.00	74
5.	Chikkanayakanahalli	Tumkur	48.224	4657.00	71
6.	Sira	Tumkur	4.879	14558.00	39
		TOTAL	**159.684**	**84900.00**	**375**
JagalurBranchCanal					
1.	Chitradurga	Chitradurga	25.772	5700.00	34
2.	Jagalur	Davangere	17.788	7500.00	36
		TOTAL	**43.56**	**13200.00**	**70**

List of villages benefited in each taluk is enclosed in **Table 4.4**

4.7 Alignment of Canal through Reserved Forest

Some length of the Chitradurga Branch canal (MainCanal) and Tumkur Branch canal (MainCanal) passes through reserved forest which is unavoidable. The details are as below.

Sl. No.	Name of Forest	Taluk	Chainage	Length
Chitradurga Branch Canal				
1.	Devaragudda	Hosadurga	Km 37.498 to Km 41.094	3.596
2.	Devaragudda	Hosadurga	Km 42.390 to Km 43.582	1.192
3.	Janakal	Hosadurga	Km 53.40 to Km 56.741	3.341
4.	Lakkihalli	Holalkere	Km 73.469 to Km 82.456	8.987

Tumkur Branch Canal				
1.	Udugere	Kadur	Km 65.261 to Km 66.423	1.162
2.	Bukkapatna	Chikkanayakanhalli	Km 150.735 to Km 158.282	7.547

Hence total length of canal network in reserved forest = 25.825 Km

4.7 After conducting the Details survey in the Tarikere lift irrigation system and Challakere, Molakalmuru & Pavagada tank filling scheme the public representatives and farmers are demanded to consider the enrouting tanks which can be filled by the gravity only. Accordingly, the No. of tanks have been increased and the filling up of tanks capacity has been reduced.The increase in the tanks are listed below.

Additional(Enrouting) Tank List

Sl. No.	Taluk	Name of Enrouting Tanks Considered in the Command Area of UBP	Tank Capacity in (MCFT)	50% of the Tank Capacity Proposed for Filling up of Tanks in (MCft)
1.	Holalkere	Kalkere	7.60	3.80
2.	Holalkere	Hanumalli	13.56	6.78
3.	Holalkere	Talya	57.98	28.99
4.	Holalkere	T.Yammeganuru	18.05	9.03
5.	Holalkere	Shivaganga	256.65	128.33
6.	Holalkere	Gundikere	9.07	4.54
7.	Holalkere	Horakeredevapura	4.44	2.22
8.	Holalkere	Halehalli	10.50	5.25
9.	Holalkere	Sangrahagara T.Yammeganuru	3.53	1.77
10.	Holalkere	Kereyagalahalli	39.30	19.65
11.	Challakere	Doddaghatta Kere	15.00	7.50
12.	Challakere	Bommakkanahalli kere	7.00	3.50
13.	Challakere	Kyadigunte	22.16	11.08
14.	Challakere	Siddeshwaranadurga	87.55	43.78
15.	Challakere	Pillahalli	2.50	1.25
16.	Challakere	Parashurampura - 1	150.80	75.40
17.	Challakere	Chouluru	22.47	11.24
18.	Challakere	Parashurampura - 2	71.69	35.85
19.	Challakere	P.Gowripura	3.04	1.52
20.	Challakere	Koralukunte	28.75	14.38
21.	Challakere	Bommanakunte	40.50	20.25
22.	Challakere	Vrudavanahalli	10.10	5.05
23.	Challakere	Haravigodanahalli	10.65	5.33
24.	Challakere	Jajuru	4.96	2.48
25.	Challakere	Kamasamundra	3.20	1.60
26.	Challakere	P.Mahadevapura - Chikkakere	55.14	27.57
27.	Challakere	Kadehude	25.87	12.94
28.	Challakere	P.Obanahalli	21.04	10.52
29.	Challakere	Doddachelluru	38.15	19.08
30.	Challakere	Chikka Chellur	42.30	21.15
31.	Challakere	Gosikere	40.47	20.24
32.	Challakere	T.N Kote	41.03	20.52
33.	Challakere	Mirasabihalli	10.14	5.07
34.	Challakere	Junjurgunte	7.12	3.56
35.	Challakere	P.Mahadevapura - Doddakere	52.53	26.27
36.	Challakere	Obannanahallikere	21.04	10.52
37.	Molkalmuru	Nayakanahatti Hirekere	248.00	124.00

Sl. No.	Taluk	Name of Enrouting Tanks Considered in the Command Area of UBP	Tank Capacity in (MCFT)	50% of the Tank Capacity Proposed for Filling up of Tanks in (MCft)
38.	Molkalmuru	Nayakanahatti Chikkakere	92.00	46.00
39.	Molkalmuru	Guntakollammanahalli kere - 2	33.87	16.94
40.	Molkalmuru	Rekhalagere kere	38.00	19.00
41.	Molkalmuru	Myasarahatti - 01	2.00	1.00
42.	Molkalmuru	Ramasagara kere	165.00	82.50
43.	Molkalmuru	Thippayyanakote kere	105.00	52.50
44.	Molkalmuru	Manmainahatti kere	6.00	3.00
45.	Molkalmuru	Ramadurga kere	2.00	1.00
46.	Molkalmuru	Kudapura kere	36.00	18.00
47.	Molkalmuru	N. Gowripura kere	11.00	5.50
48.	Molkalmuru	Neralagunte kere	20.00	10.00
49.	Molkalmuru	Bheemanakere kere	50.00	25.00
50.	Molkalmuru	Varavu kere	24.00	12.00
51.	Molkalmuru	Battayyanahatti kere	5.00	2.50
52.	Molkalmuru	Mallurahalli kere	2.00	1.00
53.	Molkalmuru	Kodihalli kere	108.85	54.43
54.	Molkalmuru	Banjigere kere	57.00	28.50
55.	Molkalmuru	Hirehalli kere	60.00	30.00
56.	Molkalmuru	Palayyanakote kere	52.00	26.00
57.	Molkalmuru	Bukkambudi kere	48.00	24.00
58.	Molkalmuru	Boganahalli kere	16.00	8.00
59.	Molkalmuru	Ghataparti kere	51.00	25.50
60.	Molkalmuru	Gowrasamudra kere	96.00	48.00
61.	Molkalmuru	Obanahalli kere	11.00	5.50
62.	Molkalmuru	Talaku kere	50.00	25.00
63.	Molkalmuru	Thimmanahalli kere	1.00	0.50
64.	Molkalmuru	Valase kere	15.00	7.50
65.	Molkalmuru	Ullarthi kere	48.00	24.00
66.	Molkalmuru	Yadalagatte kere	57.00	28.50
67.	Molkalmuru	Mailanahalli kere	30.00	15.00
68.	Molkalmuru	Gudihalli kere	14.00	7.00
69.	Molkalmuru	Chowlakere kere (Mushtalagummi)	22.00	11.00
70.	Molkalmuru	Bomalinganahalli kere	8.00	4.00
71.	Pavagada	Ponnasamudra	46.78	23.39
72.	Pavagada	Kothur	15.16	7.58
73.	Pavagada	Tippayyanadurga	29.92	14.96
74.	Pavagada	Meghalapalya	121.44	60.72
75.	Pavagada	Kothuganahallikere	244.64	122.32
76.	Pavagada	Bimanakunte	48.40	24.20
77.	Pavagada	Nagalapura	35.28	17.64
78.	Pavagada	Dodda Jalodu	105.00	52.50
79.	Pavagada	Gollarahatti	20.03	10.02
80.	Pavagada	Hariharapura	13.59	6.80
81.	Pavagada	C.K Pura	48.09	24.05
82.	Pavagada	Yadanuru	88.60	44.30
			3657.53	1828.86

After conducting thedetailed survey for the components likely Drip including tank filling within the command area and other tank filling schemes of the Upper Bhadra project, there may be a increase in No. of tankswhich can be filled by the gravity by considering the enrouting tanks by which there may bestill reduction in the tank filling capacity.

FIGURE 4.1 MOSAIC OF TOPOSHEETS COVERING UPPER BHADRA PROJECT

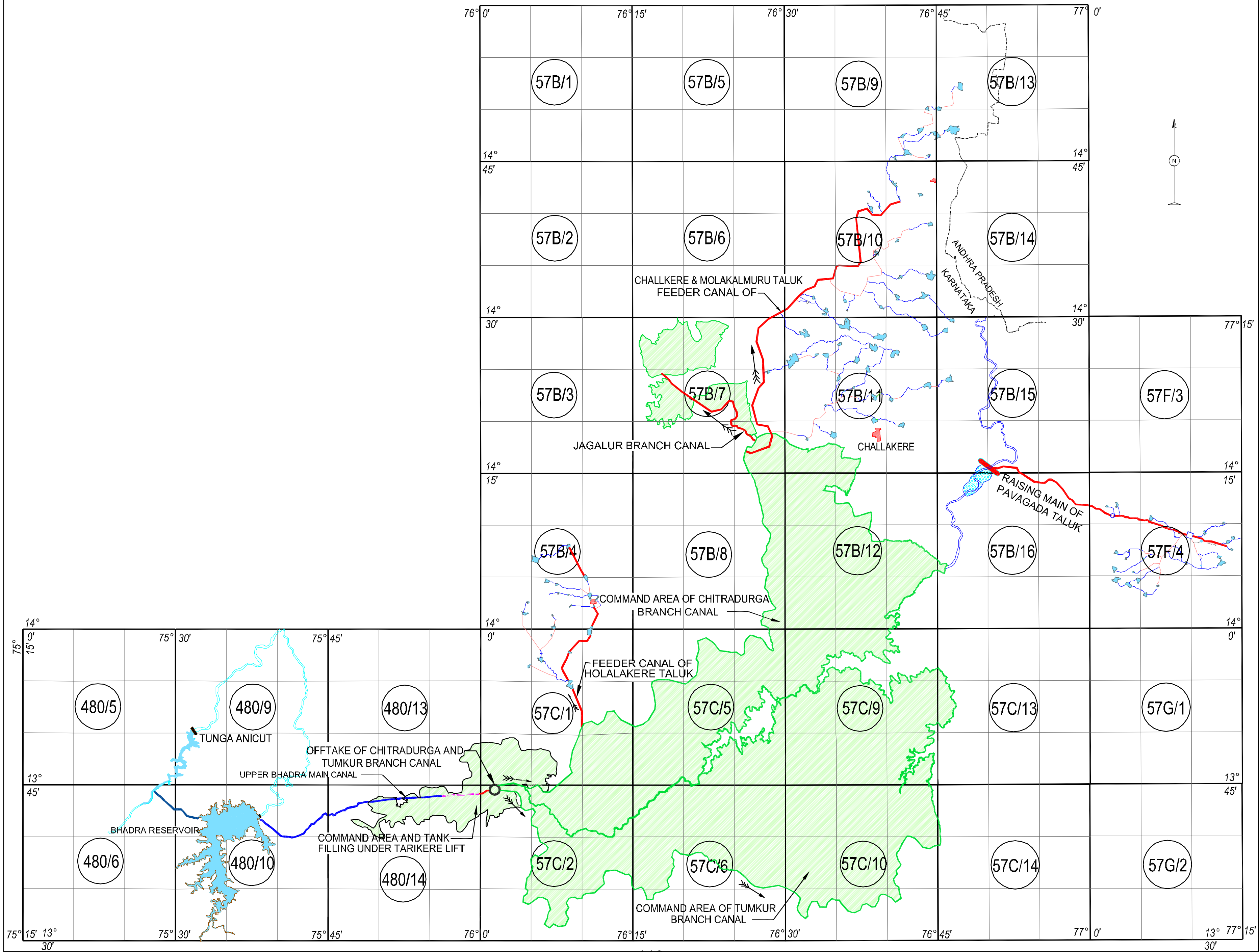


Table 4.1 (a) : BLOCK WISE AREA STATEMENT

CHITRADURGA BRANCH CANAL

SL. NO.	BLOCK NO	OFFTAKE CH IN KM	GCA (Ha)	ICA (Ha)	REMARKS
1	BL-1	6890	12886.53	5275.71	
2	BL-2	29256	12761.37	10908.16	
3	BL-3	41880	11933.51	7175.62	
4	BL-4	52910	20866.84	11296.04	
5	BL-5	84515	11987.20	8391.04	
6	BL-6	91730	38050.54	23120.70	
7	BL-7	97935	10293.28	6550.17	
8	BL-8	106558	11571.24	9675.56	
9	BL-9	117741	18208.95	11900.80	
11	BL-10	120638	21379.92	13200	JAGLURU BC
10	BL-11	123979	17955.75	12971.19	
	TAIL END	134597	-	-	
		TOTAL	**187895.1**	**120465.0**	

TUMKUR BRANCH CANAL

SL.NO.	BLOCK NO	OFFTAKE CH IN KM	GCA (Ha)	ICA (Ha)	REMARKS
1	BL-1	16560	9311.50	6518.05	
2	BL-2	38480	9042.70	6329.89	
3	BL-3	76744	22645.17	15851.62	
4	BL-4	92254	18419.40	12893.58	
5	BL-5	113329	19312.94	13519.06	
6	BL-6	119636	20529.63	14370.74	
7	BL-7	136008	5728.37	4009.86	
8	BL-8	158228	16296.00	11407.2	
	TE	159.684			
		TOTAL	**121285.71**	**84900.0**	

JAGALUR BRANCH CANAL

SL.NO.	BLOCK NO	OFFTAKE CH IN KM	GCA (Ha)	ICA (Ha)	REMARKS
1	BL-1	13250	4571.67	2838.45	
2	BL-2	23725	4203.16	2861.55	
3	BL-3	24685	12605.10	7500.00	
	TAIL END	43.56	-	-	
		TOTAL	**21379.92**	**13200.00**	

SL.NO.	BLOCK NO	OFFTAKE CH IN KM	GCA (Ha)	ICA (Ha)	REMARKS
1	Tariker Lift		25188.00	20150.00	

TABLE 4.1 (b) : TALUKWISE AREA BENIFITED

SL. NO.	NAME OF DISTRICT/TALUK	AREA AS PER DETAILED PLANNING (ICA in Ha)-				TOTAL AREA (ICA in Ha)
		TARIKERE LIFT	CHITRADURGA BRANCH CANAL	TUMKUR BRANCH CANAL	JAGALUR BRANCH CANAL	
A	**CHIKKAMAGALUR**					
1	TARIKERE	20150.00	411.00	1628.00	-	22189.00
2	KADUR	-	1864.00	20502.00	-	22366.00
B	**CHITRADURGA**					
1	HOSADURGA	-	31035.00	13573.00	-	44608.00
2	HOLALAKERE	-	371.00	-	-	371.00
3	HIRIYUR	-	37052.00	29982.00	-	67034.00
4	CHITRADURGA	-	23266.00	-	5700.00	28966.00
5	CHALLAKERE	-	13266.00	-	-	13266.00
C	**TUMKUR**					
1	CHIKKANAYAKANHALLI	-	-	4657.00	-	4657.00
2	SIRA	-	-	14558.00	-	14558.00
D	**DAVANGERE**					
1	JAGALUR	-	-	-	7500.00	7500.00
	TOTAL	**20150**	**107265**	**84900**	**13200**	**225515**
	GRAND TOTAL	**225515Ha**				

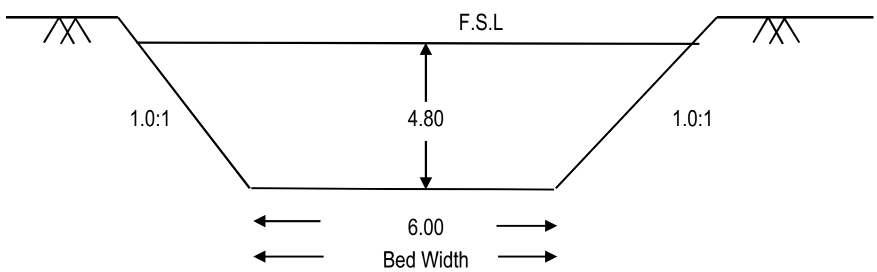
TYPICAL CANAL SECTION DESIGN OF

CHITRADURGA BRANCH CANAL

AS ADOPTED FROM CH:0.00 m TO CH:29256.00 m

Required Discharge	=	48.630 cumec
10% extra for design consideration	=	53.49 cumec
Design Discharge	=	55.125 cumec

CANAL DETAILS			**CANAL SECTION ASSUMED**		
Bed Gradient (s)	=	1:10000	Bed Width (B)	=	6.00 m
Side Slope (n)	=	1.0:1	Full Supply Depth (D)	=	4.80 m
Rugosity Co-efficient (N)	=	0.018	Free Board (FB)	=	1.00 m
Lined Section					



1. Area (A)	= $(B + n \times D)D$	= (6.00 + 1.0 x 4.80) 4.80	=	51.840 m²
2. Perimeter (p)	= $B + 2d\sqrt{n^2 + 1}$	= $6.00 + 2(4.80) \times \sqrt{(1.0)^2 + 1}$	=	19.576 m
3. Hydraulic Mean Depth (R) = A/P		= 51.840 / 19.576	=	2.648 m
4. Velocity (Va)	= $1/N \times (R)^{2/3} \times S^{1/2}$	= $1/0.018 \times (2.648)^{2/3} \times (1/10000)^{1/2}$	=	1.063 m/sec
5. Discharge Qd	= A × Va	= 51.840 x 1.063	=	55.125 cumecs
6. Bed Width / F.S.D Ratio		6.00 / 4.80	=	1.25

Which is more than 48.630 cumecs

Hence OK

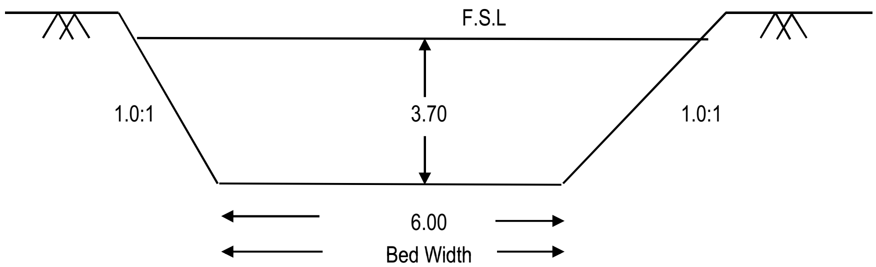
TYPICAL CANAL SECTION DESIGN OF

TUMKUR BRANCH CANAL

AS ADOPTED FROM CH:0.00 m TO CH:4660.00 m

Required Discharge	=	33.818 cumec
10% extra for design consideration		37.200 cumec
Design Discharge	=	37.477 cumec

CANAL DETAILS			**CANAL SECTION ASSUMED**		
Bed Gradient (s)	=	1:8000	Bed Width (B)	=	6.00 m
Side Slope (n)	=	1.0:1	Full Supply Depth (D)	=	3.70 m
Rugosity Co-efficient (N)	=	0.018	Free Board (FB)	=	1.00 m
Lined Section					



1. Area (A)	= $(B + n \times D)D$	= (6.00 + 1.0 x 3.70) 3.70	=	35.890 m²
2. Perimeter (p)	= $B + 2d\sqrt{n^2 + 1}$	= $6.00 + 2(3.70) \times \sqrt{(1.0)^2 + 1}$	=	16.465 m
3. Hydraulic Mean Depth (R)	= A/P	= 35.890 / 16.465	=	2.180 m
4. Velocity (Va)	= $1/N \times (R)^{2/3} \times S^{1/2}$	= $1/0.018 \times (2.180)^{2/3} \times (1/8000)^{1/2}$	=	1.044 m/sec
5. Discharge Qd	= A × Va	= 35.890 x 1.044	=	37.477 cumecs
6. Bed Width / F.S.D Ratio		= 6.00 / 3.70	=	1.62

Which is more than 33.818 cumecs

Hence OK

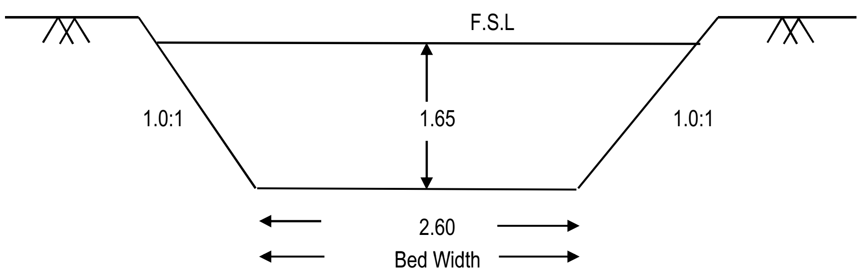
TYPICAL CANAL SECTION DESIGN OF

JAGALUR BRANCH CANAL

AS ADOPTED FROM CH:0.00 m TO CH:13250.00 m

Required Discharge	=	5.329 cumec
10% extra for design consideration	=	5.862 cumec
Design Discharge	=	6.015 cumec

CANAL DETAILS			**CANAL SECTION ASSUMED**		
Bed Gradient (s)	=	1:4000	Bed Width (B)	=	2.60 m
Side Slope (n)	=	1.0:1	Full Supply Depth (D)	=	1.65 m
Rugosity Co-efficient (N)	=	0.018	Free Board (FB)	=	0.60 m
Lined Section					



1. Area (A)	= $(B + n \times D)D$	= (2.60 + 1.0 x 1.65) 1.65	=	7.013 m²
2. Perimeter (p)	= $B + 2d\sqrt{n^2 + 1}$	= $2.60 + 2(1.65) \times \sqrt{(1.0)^2 + 1}$	=	7.267 m
3. Hydraulic Mean Depth (R)	= A/P	= 7.013 / 7.267	=	0.965 m
4. Velocity (Va)	= $1/N \times (R)^{2/3} \times S^{1/2}$	= $1/0.018 \times (0.965)^{2/3} \times (1/4000)^{1/2}$	=	0.858 m/sec
5. Discharge Qd	= A × Va	= 7.013 x 0.858	=	6.015 cumecs
6. Bed Width / F.S.D Ratio		2.60 / 1.65	=	1.58

Which is more than 5.329 cumecs

Hence OK

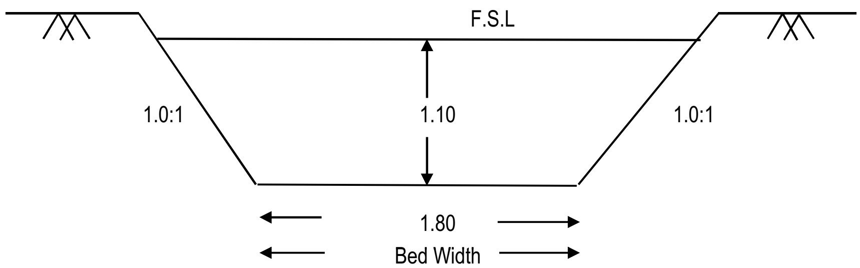
TYPICAL CANAL SECTION DESIGN OF

TARIKERE GRAVITY AND LIFT CANAL

AS ADOPTED FROM CH:0.00 m TO CH:13250.00 m

Required Discharge	=	2.200 cumec
10% extra for design consideration	=	2.420 cumec
Design Discharge	=	2.427 cumec

CANAL DETAILS			**CANAL SECTION ASSUMED**		
Bed Gradient (s)	=	1:3000	Bed Width (B)	=	1.80 m
Side Slope (n)	=	1.0:1	Full Supply Depth (D)	=	1.10 m
Rugosity Co-efficient (N)	=	0.018	Free Board (FB)	=	0.45 m
Lined Section					



1. Area (A)	= $(B + n \times D)D$	= (1.80 + 1.0 x 1.10) 1.10	=	3.190 m^2
2. Perimeter (p)	= $B + 2d\sqrt{n^2 + 1}$	= $1.80 + 2(1.10) \times \sqrt{(1.0)^2 + 1}$	=	4.911 m
3. Hydraulic Mean Depth (R)	= A/P	= 3.190 / 4.911	=	0.650 m
4. Velocity (Va)	= $1/N \times (R)^{2/3} \times S^{1/2}$	= $1/0.018 \times (0.650)^{2/3} \times (1/3000)^{1/2}$	=	0.761 m/sec
5. Discharge Qd	= A × Va	= 3.190 x 0.761	=	2.427 cumecs
6. Bed Width / F.S.D Ratio		1.80 / 1.10	=	1.64

Which is more than 2.200 cumecs

Hence OK

CUTOFF STATEMENT FOR TUMKUR BRANCH CANAL (TBC) FROM KM 0.00 TO KM 159.684

BDC : 0.0003983

Sl. No.	Reach in m		Length in m	Block No	Balance I.C.A (in Ha)	ICA of the Block (in Ha)	Discharge in Cumecs			Canal Particulars				F.B in m	Non Silting Vel	Vel ratio	Side Slope	Bed Fall	Head loss due to		Total Head Loss	CBL		Remarks
	From	To					Qr	Qr with 10% Extra for design consideration	Qd	B.W in m	FSD in m	Vel in m/sec	B/D Ratio						Bed Fall	Str		Start of the reach	End of the reach	
1	0	16560	16560	BL-1	84900.00	6518.05	33.818	37.200	37.477	6.00	3.70	1.044	1.622	0.75	1.271	0.822	1.0:1	1:8000	2.070	1.16	3.230	730.000	726.770	Block-1 offtake
2	16560	38480	21920	BL-2	78381.95	6329.89	32.680	35.948	36.004	5.70	3.70	1.035	1.541	0.75	1.271	0.815	1.0:1	1:8000	2.740	0.74	3.477	726.770	723.293	-
3	38480	76744	38264	BL-3	72052.06	15851.62	32.546	35.801	36.004	5.70	3.70	1.035	1.541	0.75	1.271	0.815	1.0:1	1:8000	4.783	2.64	7.427	723.293	715.866	-
4	76744	92254	15510	BL-4	56200.44	12893.58	25.558	28.114	28.150	5.10	3.40	0.974	1.50	0.75	1.204	0.809	1.0:1	1:8000	1.939	1.263	3.202	715.866	712.664	-
5	92254	113329	21075	BL-5	43306.86	13519.06	24.363	26.799	27.386	4.50	3.40	1.020	1.32	0.75	1.204	0.847	1.0:1	1:7000	3.011	1.287	4.298	712.664	708.367	-
5	113329	119636	6307	BL-5	29787.80	14370.74	20.049	22.054	22.486	4.30	3.00	1.027	1.43	0.75	1.111	0.924	1.0:1	1:6000	1.051	0.30	1.350	708.367	707.016	-
6	119636	136008	16372	BL-6	15417.06	4009.86	17.933	19.726	19.957	4.00	2.90	0.997	1.38	0.75	1.087	0.917	1.0:1	1:6000	2.729	0.90	3.629	707.016	703.387	-
7	136008	158228	22220	BL-7	11407.20	11407.20	9.318	10.250	10.409	4.00	2.05	0.839	1.95	0.75	0.871	0.964	1.0:1	1:6000	3.703	1.80	5.506	703.387	697.881	-
8	158228	159684	1456	BL-8	0.00		7.639	8.403	8.486	3.10	2.05	0.804	1.51	0.75	0.871	0.923	1.0:1	1:6000	0.243	0.06	0.303	697.881	697.578	-

NOTE:

i) Required discharge at offtake of Branch Canal is 48.63 Cumecs. Hence BDC =0.000403686 Cumecs/Ha,for deisgn consideration 10% additional is assumed to take care of design consideration,ets and filling up of tanks

ii) Total command area under Chitradurga Branch Canal is 107265.00Ha & Jagalur BC is 13200 Ha

iii) Canal is designed as trapezoidal section

iv) Value of Rugosity Coefficient n=0.018 is adopted

v) Starting CBL of Chitradurga Branch Canal is 730.00m

vi) From reach 96 km Tank filling required discharge is higher compared to Peak Irrigation requirement during august and hence canal is designed for irrigation requirement along with tank filling during september forthnight

CUTOFF STATEMENT FOR JAGALUR BRANCH CANAL (FROM KM 0.00 TO KM 43.560)

BDC : 0.000403686

Sl. No.	Reach in m		Length in m	Block No	Balance I.C.A (in Ha)	ICA of the Block (in Ha)	Discharge in Cumecs			Canal Particulars				F.B in m	Non Silting Vel	Vel ratio	Side Slope	Bed Fall	Head loss due to		Total Head Loss	CBL		Remarks
	From	To					Qr	Qr with 10% Extra for design consideration	Qd	B.W in m	FSD in m	Vel in m/sec	B/D Ratio						Bed Fall	Str		Start of the reach	End of the reach	
1	2	3	4	5	6	7	8	11	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0	13250	13250	BL-1	13200.00	2838.45	5.329	5.862	6.015	2.60	1.65	0.858	1.58	0.60	0.758	1.132	1.0:1	1:4000	3.313		3.313	706.965	703.653	-
2	13250	23725	10475	BL-2	10361.55	2861.55	4.183	4.601	6.946	2.60	1.65	0.990	1.58	0.60	0.758	1.307	1.0:1	1:3000	3.492	3.05	6.542	703.653	697.111	-
3	23725	24685	960	BL-3	7500.00	7500	4.520	4.972	5.055	2.00	1.55	0.919	1.29	0.60	0.728	1.262	1.0:1	1:3000	0.320		0.320	697.111	696.791	-
4	24685	43560	18875	te	0.00	0.00	0.000	0.000	5.055	2.00	1.55	0.919	1.29	0.30	0.728	1.262	1.0:1	1:3000	6.292		6.292	696.791	690.499	-

NOTE:

i) Required discharge at offtake of Branch Canal is 48.63 Cumecs. Hence BDC =0.000403686 Cumecs/Ha,for deisgn consideration 10% additional is assumed to take care of design consideration,ets and filling up of tanks

ii) Total command area under Chitradurga Branch Canal is 107265.00Ha & Jagalur BC is 13200 Ha

iii) Canal is designed as trapezoidal section

iv) Value of Rugosity Coefficient n=0.018 is adopted

v) Starting CBL of Chitradurga Branch Canal is 730.00m

vi) From reach 13 km Tank filling required discharge is higher compared to Peak Irrigation requirement during august and hence canal is designed for irrigation requirement along with tank filling

Table 4.4 (a): VILLAGES BENEFITED UNDER THE COMMAND AREA OF TARIKERE LIFT AND GRAVITY FLOW

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
TARIKERE TALUK, CHIKKMAGALUR DISTRICT			
1	Basavapura	53	Kallashettihalli
2	Bhutanahalli	54	Rangapura
3	Arahalli	55	Gondedahal
4	Heggadehalli	56	Baguvalli
5	Guddadahalli	57	Baguvalli Kaval
6	Garagadahalli	58	Shanuboganahalli
7	Nandipura	59	Basavanahalli
8	Annapura	60	Makanahalli
9	Kallapura	61	Chatnahalli
10	Mailenehalli	62	Timmapura
11	Begur	63	Karanaghatta
12	Gadihalli	64	Narasipura
13	Asundi	65	Hunasagatta
14	Bankanakatte	66	Mudagundi
15	Anuvanahalli	67	Medihalli
16	Hariyanahalli	68	Gollarahalli
17	Narayanapura	69	Savemaradikaval
18	Gajjagondanahalli	70	Belibasavanahalli
19	Gavarapura	71	Koranahalli
20	Katanagere	72	Brahmanahalli
21	Malenahalli	73	Doddabokikere
22	Sollapura	74	Siddarahalli
23	Tamatanahalli	75	Bettadatavarekere
24	Siriganahalli	76	Bommanahalli
25	Tadaga	77	Santedibbad Kaval
26	Virapura	78	Samatala
27	Banur	79	Chakkonahalli
28	Shiavani Kaval	80	Hosur
29	Bandre	81	Germaradi
30	Biranahalli	82	Bettadahalli
31	Hariyanahalli	83	Kerehosahalli
32	Kanabakatte	84	Rangapur Kaval
33	Danaikapura	85	Rangapura
34	Mugali	86	Basavanahalli
35	Abbanaholalu	87	Haliyuru
36	Hebburu	88	Dwaranahalu
37	Javuru	89	Channapura
38	Hosahalli	90	Bhiravapura
39	Timmapura	91	Marulenahalli
40	Hirekannamangala	92	Dyampura
41	Siddapura	93	Shivani
42	Chikkakannamangala	94	Shivani Kaval
43	Gundasamudra	95	Sokki
44	Jaladihalli	96	Bukkambudi
45	Kopadahalli	97	Makanahalli
46	Hanni	98	Thyarajanahalli
47	Tippagondanahalli		
48	Attimogge		
49	Mallanahalli		
50	Channapura		
51	Ajjampura		
52	Parvatarayanakaval		

Table 4.4 (b): VILLAGES BENEFITED UNDER THE COMMAND AREA OF CHITRADURGA BRANCH CANAL

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
TARIKERE TALUK, CHIKKMAGALUR DISTRICT		**HOSADURGA TALUK, CHITRADURGA DISTRICT**	
1	Guddadahalli	35	Kappagere
2	Maitanahalli	36	Sodaranal
3	Begur	37	Hanuvinadu
KADUR TALUK, CHIKKMAGALUR DISTRICT		38	Srirangapura
1	Chikkaballekere	39	Hosahalli
2	Hanumanahalli	40	Gulubenahalli
3	Kurubarahalli	41	Kanivesanganahalli
4	Hiriyur	42	Honnenahalli
5	H.Thimmapura	43	Masanihalli
6	Jammapura	44	Kodihalli
7	Kallahalli	45	Devapura
8	Gummanahalli	46	Benakanahalli
9	Kalkere	47	Devapuracolony
10	Thimmapura	48	Narasipura
11	Hadagalu	49	Karadikatte
12	K.Chomanahalli	50	Bylahalli
13	Siddapura	51	Janakal
14	Antharagatta	52	Tenigekal
15	C.Dasarahalli	53	Banasihalli
16	Sanklapura	54	Doddagatta
17	Hullahalli	55	Devigere
HOSADURGA TALUK, CHITRADURGA DISTRICT		56	Krishnapura
1	Madhure	57	Kondapura
2	Goravinakal	58	Guthikatte
3	Shivanakatte	59	Mantenahalli
4	Bandihalli	60	Janthikolalu
5	Kenchihalli	61	Kadivanakatte
6	Jogihatti	62	Chikkayagati
7	Doddakittadahalli	63	Anivala
8	Sannakittadahalli	64	Chinnapura
9	Hanumanahalli	65	Lakkenahalli
10	Lakkihalli	66	Lyalapura
11	Kenkere	67	Kundur
12	Veervvanathihalli	68	Nagenahalli
13	Hullukatte	69	Baguru
14	Seeranakatte	70	Srirangapura
15	Mallapura	71	Channapura
16	Ramajjanahalli	72	Palyadahalli
17	Rangavinahalli	73	Neeragundakaval
18	Atimage	74	Honnekere
19	Jammapura	75	Rangapura
20	Iyyanahalli	76	Kumaranakanive
21	Bevinahalli	77	Bokikere
22	Hosdurga	78	Aralihalli
23	Madadakere	79	Kodihalli
24	Menasinadu	80	Settihalli
25	Jogammanahalli	81	Melali
26	Lingadahalli	82	Peelapura
27	Bommenahalli	83	Neeragunda
28	Byrapura	84	Sanihalli
29	Kurabarahalli	85	Huralihalli
30	Marabagatta	86	Aldahalli
31	Adrikatte	87	Kangavalli
32	Kondajji	88	Manchenahalli
33	Thippajjanahalli	89	Adavisangenahalli
34	Virapura	90	Channasamudra

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
HOSADURGA TALUK, CHITRADURGA DISTRICT		**HIRIYUR TALUK, CHITRADURGA DISTRICT**	
91	Kyadigerakaval	46	Bharamapura
92	Goravigondanahalli	47	Tadapinachinnammanahalli
93	Attigatta	48	Talavatti
94	Kellodu	49	Salabommanahalli
95	Muthagondi	50	Kalavibagi
96	Bagasettihalli	51	Yaraballi
97	Koratikere	52	Khandikere
98	Bullalasamudrakaval	53	Gollahalli
99	Kadadanakere	54	Vaddekere
100	Kyadigere	55	Aimangala
101	Kannagondi	56	Burujinaroppa
102	Mettinahole	57	Maradihalli
103	Karalamavinahalli	58	Maddanakunte
104	Handanakere	59	Madakarinaikana Kote
HIRIYUR TALUK, CHITRADURGA DISTRICT		60	Ramajogihalli
1	Kariobenahalli	61	Sondekere
2	Myakenahalli	62	Pura
3	Harthikote	**CHALLAKHERE TALUK, CHITRADURGA DISTRICT**	
4	Hullthotlu	1	Hosahalli
5	Suragondanahalli	2	Sangenahalli
6	Kunikere	3	Ramajogihalli
7	Hemadala	4	Pura
8	Balenshslli	5	Kyathanamale
9	Gannaikanahalli	6	Kalamarahalli
10	Myakalurahalli	7	Kannenahalli
11	Aluru	8	Somaguddu
12	Bochapura	9	Kurudihalli
13	Maskal	10	Belegere Kaval
14	Yelanadu	11	Sanikere kaval
15	Krishnambudi	12	Heggere
16	Bobbur	13	Kaparahalli
17	Goguddu	14	Jadekunte
18	Gownahalli	15	Hulikunte
19	Tavandi	16	Hiremadhure
20	Metikurke	17	Chikkamadhure
21	Yaradakatte	18	Govinahal
22	Huchavvanahalli	19	Balenahalli
23	Mayasandra	20	Ramajogihalli
24	Beerenahalli	21	Sullu Pappananhatti
25	Gudihalli	22	Nakkalurahatti
26	Bharamagiri	23	Lamabadihatti
27	Kambadahalli	24	Nannjvala
28	Vanivilasapura	25	Karikattelahalli
29	Kurubarahalli	26	Bandihatti
30	Yerekenagenahalli	27	Jennenahalli
31	Giddaobanahalli	28	Machchukunte
32	Thoreobenahalli	29	Gollarhatti
33	Ambalagere	30	Himampura
34	Biddarakere	31	Hosa Begarahatti
35	Upparahalli	32	Bnpraharinagar
36	Sangenahalli	33	Challakere Taluk
37	Bhagavathikere	34	Chitranahatti
38	Sidlaiahnakote	35	Kottappanahatti
39	Rangenahalli	36	Dodderi
40	Gudunurhalli	37	Upparahatti
41	Gulagondanahalli	38	Nagaramgere
42	Mallappanahalli	39	Viratimmanahalli
43	Kurudugerenahalli	40	Goriakatte
44	Guilai		
45	Adiralu		

SL.No.	VILLAGES BENEFITED
CHITRADURGA TALUK, CHITRADURGA DISTRICT	
1	Begatta
2	Chikka- jagalur
3	Hayyakalu
4	Dyamavannahalli
5	Doddasiddavvanahalli
6	Chikkenahalli
7	Pallavagere
8	Sajjenakere
9	Haruvanahalli
10	Belagatta
11	Boggulurangavvanahalli
12	Chinna Tippayanahatti
13	Kottehatti
14	Hoyakallu
15	Gollarahatti
16	Hosa chauripappanahatti
17	Halle Chauripappanahatti
18	Pelurahatti
Total-244 Villages	

Table 4.4 (c): VILLAGES BENEFITED UNDER THE COMMAND AREA OF TUMKUR BRANCH CANAL

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
TARIKERE TALUK, CHIKKMAGALUR DISTRICT		**KADUR TALUK, CHIKKMAGALUR DISTRICT**	
1	Karihalli	33	Kodihalli
2	Hebbur	34	Pura
3	Gavarapura	35	Hireballekere
4	Mugali	36	Gedlehalli
5	Abbanaholalu	37	Chikkaballekere
6	Katanagere	38	Hurukanahalli
7	Tamatanahalli	39	Hanumanahalli
8	Savatanahalli	40	Hosahalli
9	Channapura	41	Tarikere
KADUR TALUK, CHIKKMAGALUR DISTRICT		42	Ganganahalli
1	Vaddarahatti	43	Taggihallikaval
2	Myasarahatti	44	Garudahalli
3	Sanehali	45	Udugere
4	Lambanihatti	46	Muglikatte
5	Kshmipura	47	Bukkanagundi
6	Garje	48	Guddenahalli
7	Parvatanahalli	49	Hanumanahalli
8	Hosuru	50	Keremelinahalli
9	Alagatta	51	Harisamudra
10	Vaddarahatti	52	Y.Basavanahalli
11	Yarodakere	53	Mallapura
12	Mallapura	54	Donnekorenahalli
13	Sananahalli	55	Byragondanahalli
14	Bukkamalanahalli	56	Honabagihalli
15	Chiknaikanahalli	57	Hochihalli
16	Yallambalase	58	Asandi
17	Vitthalapura	59	Thammihalli
18	Bilavala	60	Jammapura
19	Madapura	61	Kunkanadu
20	Nagondanahalli	62	Maravanji
21	Jakkanahalli	63	Yaradakere
22	Kallihosahalli	64	M.Jakkanahalli
23	Mudigere	65	Vakkalarere
24	Arehalli	66	M.Kodihalli
25	Hariyanahalli	67	Chinakarahalli
26	Yagati	68	Somanahalli
27	Channenahalli	69	Bannihatti
28	Gidaganahalli	70	Kukkasamudra
29	Siddegowdanahalli	71	Ganganahalli
30	Rampura	72	Kallahalli
31	Hiregarje		
32	Mavinahalli		

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
HOSADURGA TALUK, CHITRADURGA DISTRICT		HOSADURGA TALUK, CHITRADURGA DISTRICT	
1	Gulihalli	45	Mengasandra
2	Myasarahatti	46	Kainadumanikere
3	Hanumadasaiyanapalya	47	Kainaduhorakaval
4	Jaisuvamapura	48	Niralakere
5	Gallarahatti	49	Agrahar
6	Ammanahatti	50	Kudurekanive Forest
7	Dodda Byaladakera	51	Mugilodu
8	Sirollapur	52	Kanchipura
9	Chikka Byaladakere	53	Kittadal
10	Sadarhalli	54	Kanubenahalli
11	Obalapura	55	Doddakarapuradakatte
12	Gollarahalli	56	Kaggalakatte
13	Naganaikanakatte	57	Balenahalli
14	Harenahalli	58	Kappanaikanahalli
15	Hullenahalli	59	Tarikere
16	Kadayugere	60	Siddagondanahalli
17	Sadarahalli	61	Arehalli
18	Vengalapura	62	Tippenahalli
19	Kachapura	63	Dalavalhalli
20	Sriramapura	64	Ajjikamasagara
21	Dalavaikatte	65	Karehalli
22	Girimallayanapalya	66	Nirvagal
23	Heggere	67	Hotragondanahalli
24	Tatadamane	68	Bukkasagara
25	Barmainapalya	69	Chikka Tekalavatti
26	Garginabailu	70	Kadlekamasagara
27	Nagaragere	71	Chikkatekkalavatti Kaval
28	Haragondanahalli	72	Injigere
29	Syednapalya	73	Menasinadu
30	Sujikallu	74	Muthagondi
31	Sudagadanapalya	75	Hegalakere
32	Milarapura	76	Sirigondanahalli
33	Mathodu	77	Doddalhekalavatti
34	Chikkakarapuradakatte	78	Kainaduvalkaval
35	Lakshmidevarahalli	79	Somiandra
36	Giriyapura	80	Naigere
37	Rangenahalli	81	Kaladu
38	Kasappanahalli	82	Thonachenahalli
39	Guddadaneralakere	83	Nagargere
40	Ittigehalli	84	Algatta
41	Nagathihalli	85	Kalakere
42	Agasarahalli	86	Thimmalapura
43	Gollarahalli	87	Ballalasamudra
44	Barhavara	88	Kannagondi

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
HOSADURGA TALUK, CHITRADURGA DISTRICT		HIRIYUR TALUK, CHITRADURGA DISTRICT	
89	Karalamavinahalli	22	Gollarahatti
90	Handanakere	23	Mavinamadu
91	Hosurahalli	24	Lakkanahalli
92	Kalehosahalli	25	Yiravanagattihalli
93	Ulavigondi	26	Dugganigallarahatti
94	Aralahalli	27	Layaradasanahalli
95	Mallapura	28	Madenahalli
96	Tumbinakere	29	Madenahalli
97	Yadagatta	30	Lakkavanahalli
98	Guruvapura	31	Hangapura
99	Kabbala	32	Gollarahatti
100	Mathur	33	Gaudanahalli
101	Mallenahalli	34	Pillajanahalli
102	Bommenahalli	35	Badadasanahatti
103	Ballalasamudrakerekaval	36	Handiganadu
104	Sirigapura	37	Chigalikatte
105	Belaguru	38	Byaharmodu
106	Kodihalli	39	Kenchaianahatti
107	Kerehosahalli	40	Talavaranahatti
108	Singenahalli	41	Badagollorahatti
109	Hariyanahalli	42	Badagollorahatti
110	Taggihallikaval	43	Kottugerahatti
HIRIYUR TALUK, CHITRADURGA DISTRICT		44	Gollarahatti
1	Kariyala	45	Gollarahatti
2	Onigallarahatti	46	Gollarahatti
3	Uluvinahalu	47	Seshappanahalli
4	Lambadi Tanda	48	Halumadenahalli
5	Hurulidibbadahatti	49	Arsingundi
6	Julnahatti	50	Kundalaguru
7	Javanagondanahalli	51	Malagondanahalli
8	Anesidri	52	Dindavara
9	Gollorahatti	53	Pilali
10	Gollorahatti	54	Elladakere
11	Boranakunte	55	Myakenahalli
12	Gollorahatti	56	Chellamadu
13	Gorladaku	57	Paramenahalli
14	Kasturirangappanahalli	58	Lokkavvanahalli
15	Gollorahatti	59	Somerahalli
16	Vaddanahalli	60	Hulggalkunte
17	Golla Chikkanahalli	61	Nandlhalli
18	Gollorahatti	62	Kurubarahalli
19	Lambadihatti	63	Katrikenahall
20	Lambadihatti	64	Doddaghata
21	Obalapura	65	Uduvalli

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
HIRIYUR TALUK, CHITRADURGA DISTRICT		CHIKKANAYAKANHALLI TALUK, TUMKUR DISTRICT	
66	Haladyamavvanahalli	35	Lingappanapalya
67	Lakkanahalli	36	Kemponahalli
68	Kattehole	37	Kurihatti
69	Gonjalagunte	38	Hanumadasaiyanapalya
70	Hindasakatte	39	Gollarahatti
71	Uttare	40	Baradalepalya
72	Yelladakere	41	Yakubsabarepalye
73	Iddalanagenahalli	42	Huliyar
74	Gowdanahalli	43	Tore Surugondanahalli
CHIKKANAYAKANHALLI TALUK, TUMKUR DISTRICT		44	Timmalapura
1	Lekkenahalli	45	Toremane
2	Badikeulidi	46	Kete Suragondanahalli
3	Belavaddi	47	Valagerehalli
4	Gemanaikanahatti	48	Tammadhalli
5	Balasivajahatti	49	Gollarahatti
6	Sialakatte	50	Kenker
7	Dasanahatti	51	Yegachihalli
8	Pachakotte	52	Ganadalu
9	Kaslmtdhibpalya	53	Guruvapura
10	Morenddu	54	Melanahalli
11	Ambarapura	55	Dasundi
12	Ambarapalya	56	Dabbakunte
13	Honnapanapalya	57	Hoysalkatte
14	Bellara	58	Vaddarahatti
15	Gollanahatti	59	Marathipalya
16	Mailakabbe	60	Bhattarahalli
17	Barankanave	61	Elenadu
18	Banjarahatti	62	Singapura
19	Kaladevarahatti	63	Hosur
20	Banjehatti	64	Gallarahatti
21	Nulenur	65	Marenadupalya
22	Timmoppanahatti	66	Gollarahatti
23	Oddankalluhalli	67	Gollarahatti
24	Handigunadu	68	Umlanayakkanhatti
25	Barakanahalli	69	Gollarahatti
26	Marohole	70	Hosahatti
27	Somanahalli	71	Kallenahalli
28	Ranganakanave		
29	Gollarahatti		
30	Erehalli		
31	Banjarahatti		
32	Ballekatte		
33	Samajjanapalya		
34	Kupparachikkanapalya		

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
SIRA TALUK, TUMKUR DISTRICT		SIRA TALUK, TUMKUR DISTRICT	
1	Jogayyanapalya	21	Gungarapente
2	Hunasekatte	22	Ganadahunse
3	Eradakakkte	23	Tavarekere
4	Herur	24	Gollarhatti
5	Yaravarahalli	25	Ranganahalli
6	Narayanapura	26	Gandhinagara
7	Dandikere	27	Giddanahalli
8	Hunasenhalli	28	Shyagadadu
9	Ajjenahalli	29	Ganadahunse
10	Ramanahalli	30	Eradakutte
11	Gollorahatti	31	Ginnanpanahatti
12	Dyagerahalli	32	Doddaladamadu Tanda
13	Bukkapatna	33	Manganahalli
14	Pura	34	Kambadahalli
15	Kombarahatti	35	Sadarakarenahalli
16	Kurubarahalli	36	Jogayannapalya
17	Oddarahatti	37	Hunasekatte
18	Ginnanpanahatti	38	Kilaradahalli Tanda
19	Neralagudda	39	Balapura
20	Udupukalluhatti		
Total- 375Villages			

Table 4.4 (d): VILLAGES BENEFITED UNDER THE COMMAND AREA OF JAGALUR BRANCH CANAL

SL.No.	VILLAGES BENEFITED	SL.No.	VILLAGES BENEFITED
CHITRADURGA TALUK, CHITRADURGA DISTRICT		JAGALUR TALUK, DAVANGERE DISTRICT	
1	Kenchavanagatihalli	1	Kamagetanahalli
2	Adavigollarahalli	2	Malammanahalli
3	Yelgod	3	Bennaehalli
4	Hullehal	4	Donehalli
5	Bastihalli	5	Sangenahalli
6	Chippinakeri	6	Basappanahatti
7	Gollarahalli	7	Kalledevarapura
8	Nellikatti	8	Honnamaradi
9	Ajjapanahalli	9	Akkanuru
10	Hirekabbigere	10	Gaurammanahalli
11	Basavana - shivanakeri	11	Toranagatti
12	Byalhalu	12	Jammapura
13	Kalkunte	13	Arasinagundi
14	Begatta	14	Jammapura
15	Chikkennanahalli	15	Lingannanahalli
16	Muddapura	16	Bommakkanahalli
17	Surenahalli	17	Marenahalli
18	Biravara	18	Nibgur Gollarahatti
19	Belligatta	19	Nibgur
20	Chikka - abbigere	20	Kattigehalli
21	Mallenahalli	21	Gopagondanahalli
22	Karriyamanahalli	22	Mathada Dyamavvanahalli
23	Siddavanadurga	23	Bidarkere Gollarahatti
24	Hunasekatte	24	Bidarkere
25	Bagenahalu	25	Raste Makunte
26	Rayannanahalli	26	Gollarahatti
27	Papenahalli	27	Kasturipura
28	Vaddinahalli	28	Bullanahalli
29	Rimmagatte	29	Dibbadahatti
30	Sultanpura	30	Somanahalli
31	Chikkappanahalli	31	Sante Muddapura
32	Maddalakanahalli	32	Somanahalli
33	Kunabevu	33	Lambanihatti
34	Baggularangappanahalli	34	Koratikere
		35	Jagalur
		36	Gonarahatti
Total- 70 Villages			

ABSTRACT

Statement showing the details of tank filling under Upper Bhadra Project

SL.No.	Particulars	No. of Tanks	Proposed Allocation for tank filling (TMC)
1	Chitradurga Branch Canal	36	0.81
2	Tumkur Branch Canal	131	2.20
3	Jagalur Branch Canal	9	0.75
4	Tarikere Flow and Lift Canal	79	0.27
5	Allocation to Pavagada Taluk for Drinking water porpose	30	0.54
6	Allocation to V.V Sagar to meet the shortfall	-	2.00
7	Tank filling in Challakere Taluk	41	0.78
8	Tank filling in Molkalmuru Taluk	20	0.45
9	Tank filling in Holakere Taluk	21	0.20
		367	**8**

TANK FILLING UNDER TARIKERE LIFT

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER TARIKERE LIFT					
1	Agasana Katte (Hirekatur)	Tarikere	0.008	75.77311172680	13.73787673260
2	Agasana Kere (Siddapura)	Tarikere	0.000	75.97439029670	13.79237662140
3	AgasanaKatte (Koranahalli)	Tarikere	0.006	75.89534732630	13.70093026140
4	Ammanakere (Makanahalli)	Tarikere	0.066	75.97806524040	13.81334025460
5	Aregundihalli	Tarikere	21.18	75.94721235700	13.66144046330
6	Ariyanna Katte	Tarikere	0.006	75.82212318200	13.67225895190
7	Bala Konda	Tarikere	0.014	75.82864328550	13.68183139310
8	Balasuva Katte(Tippagondanahalli)	Tarikere	0.014	75.98185041560	13.74302769340
9	Balasuva Kere	Tarikere	0.008	75.85710257010	13.66061303120
10	Balasuvakatte (Belenahalli)	Tarikere	0.008	75.77025646740	13.74301339500
11	Basavalingakatte	Tarikere	0.008	75.76369196050	13.74123715860
12	Basavanahally	Tarikere	14.4	75.88288466080	13.67558054660
13	Basayyakere(Thippagondanahalli)	Tarikere	0.02	75.97477216470	13.74364702500
14	Basayyanakere (Hanni)	Tarikere	0.016	75.97313021490	13.75604806820
15	Basuva Katte	Tarikere	0.022	75.83605014400	13.67878107050
16	Bhumi Katte	Tarikere	0.026	75.78158673310	13.73447400410
17	Bidara Kere	Tarikere	0.086	75.84277547820	13.70736195400
18	Biggerahalla Kere	Tarikere	52.74	75.90486742220	13.67186624980
19	Budiguppe Anekattu	Tarikere	0.0144	75.95801582080	13.79961902440
20	Bullana Kere	Tarikere	0.1632	75.97799162900	13.80234864180
21	Channammanakere	Tarikere	0.006	75.76069573040	13.71077951510
22	Channapura Katte	Tarikere	0.016	75.94623053070	13.69906498280
23	Chickannakatte	Tarikere	0.032	75.93990137940	13.71585418690
24	Chickthimmana Kere	Tarikere	0.14	75.97456051960	13.68443476960
25	Chikkana Kere (Narsipura)	Tarikere	0.032	75.93845830010	13.72602371750
26	Chikkanakatte	Tarikere	0.014	75.82649658330	13.67644869270
27	Chowdanakatte	Tarikere	0.014	75.97709198510	13.69189460390
28	Devi kere	Tarikere	0.012	75.93779127250	13.74541557620
29	Dodda kere (Channapura)	Tarikere	0.11	76.00275250900	13.68692496830
30	Doddakere & Chikkakere	Tarikere	20.28	75.76543645220	13.73160134260
31	Doddakere (Sokki)	Tarikere	0.146	75.96135970900	13.72129796190
32	Doddathimmanakere	Tarikere	0.044	75.97922561940	13.67421147630
33	Dyammanakatte	Tarikere	0.008	75.75560161170	13.74067823400
34	Gaani katte	Tarikere	0.014	75.83523472830	13.71020002400
35	Gijikatte	Tarikere	0.069	76.06576616990	13.85307526820
36	Gopalarayana Kere	Tarikere	2.08	75.96436833990	13.76561821480
37	Guddadakere	Tarikere	0.016	75.94016102430	13.73335895980
38	Hebbur Katte	Tarikere	0.002	76.01097864010	13.75052565740
39	Hegganakatte	Tarikere	0.014	75.93355272520	13.73973398060
40	Hire Yattinakere	Tarikere	87.2	75.90922156570	13.70155528830
41	Hosa kere	Tarikere	0.034	75.96362098790	13.78544523790
42	Hosakatte	Tarikere	0.016	75.91396979950	13.68235074640
43	Huli katte	Tarikere	0.026	75.86669139010	13.70239571680
44	IyyanaKere	Tarikere	0.0264	75.94479963860	13.80007991110
45	Javuru Hosahalli Pickup	Tarikere	0.168	75.99003554260	13.78651222420
46	Jodi bokikere katte	Tarikere	0.006	75.94063459570	13.67898703290
47	Kadapaal Katte	Tarikere	0.336	75.75880983040	13.74477792010
48	Kanivehalli Pickup	Tarikere	0.1016	76.03664342980	13.82483963380
49	Karki Katte	Tarikere	0.008	75.76521031840	13.74397724720
50	Kechagowdana Katte	Tarikere	0.072	75.97126349490	13.80235242220
51	Kengalakatte	Tarikere	0.006	75.95653451550	13.73200100970
52	Kodlao katte	Tarikere	0.008	75.86609931210	13.70725617390
53	Kudiniru Katte	Tarikere	0.026	75.77876444950	13.73537962620
54	Kuduthala Katte	Tarikere	0.0264	75.96543675900	13.80360405710

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
55	Kumbar Katte	Tarikere	0.008	75.77306216570	13.74319155120
56	Makanahalli	Tarikere	1.632	75.97834110830	13.80929999610
57	Matanakatte	Tarikere	0.014	75.98311478160	13.75845273510
58	Mugali kere	Tarikere	0.116	76.07172623320	13.75131381520
59	Muthana Katte	Tarikere	0.092	75.96684030420	13.73316547480
60	Narasipura Katte	Tarikere	0.002	75.93328386130	13.72775026220
61	Nayakana Kere	Tarikere	0.008	75.94178962310	13.66597743180
62	Parvatharayana Kere	Tarikere	245.374	75.99404541820	13.72592688560
63	Prasannakatte	Tarikere	0.03	75.84534024850	13.70930331260
64	Ramaiahna kere	Tarikere	0.008	75.93183333950	13.67017668150
65	Rudrayyanakatte	Tarikere	0.09	75.96629073740	13.73124564490
66	Shankarshetty Kere	Tarikere	0.048	75.92407731940	13.73213288050
67	Shanuboganahalli Katte	Tarikere	0.002	75.95642856210	13.69841870940
68	Siva Kere	Tarikere	0.026	75.77373428190	13.73485154270
69	Sunnadhahallikere	Tarikere	48.8	75.84703507430	13.66372940790
70	Thimmanakatte	Tarikere	2.6	75.92289484510	13.73762614620
71	Thimmapura Katte	Tarikere	0.002	75.94962247160	13.72436946720
72	Thotadhamundinakere	Tarikere	0.002	75.85566588330	13.65558705660
73	Thyrana Katte	Tarikere	0.03	75.98006381320	13.73796264990
74	Uramundina kere (Chattanahalli)	Tarikere	0.006	75.91300611530	13.68525892800
75	Uramundina Kere (Geramaradi)	Tarikere	0.022	75.85536783970	13.69191272980
76	Uramundinakere (Javoor)	Tarikere	41	75.99953970670	13.79422193750
77	Urumundina Balasuva Kere	Tarikere	0.068	75.95252227190	13.65953587300
78	Urumundinakere (Galihalli)	Tarikere	0.006	75.82593532740	13.69814992820
79	VeerammanaKere	Tarikere	0.098	75.85377713990	13.65884653850

FILLING UP OF TANKS UNDER CHITRADURGA BRANCH CANAL

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER CHITRADURGA BRANCH CANAL					
80	Sankalapura	Kadur	100.00	76.12631572700	13.73487696790
81	Uramundinakere	Kadur	12.20	76.20923798650	13.68999736900
82	Kukkesamudra Kere	Kadur	9.85	76.15686901850	13.67756304420
83	Nayakanakere	Hosadurga	70.68	76.18681511900	13.81604023220
84	Mudalagerekere	Hosadurga	126.40	76.20175598540	13.81566108260
85	Niragunda Kere	Hosadurga	69.00	76.19817529860	13.78209361050
86	Gudihalli kere	Hiriyur	18.50	76.48193412610	13.96144471940
87	Beeranahally	Hiriyur	14.63	76.53277389540	13.95980078380
88	Brahmagiri kere	Hiriyur	18.30	76.49772984880	13.92254210220
89	Tavandi kere	Hiriyur	14.00	76.54744768190	13.99737926650
90	Aymangalakere	Hiriyur	18.80	76.52575560590	14.09349691090
91	Bharamapura	Hiriyur	24.30	76.48915949020	14.05962532740
92	M.D.Kote kere	Hiriyur	13.00	76.59633100000	14.13991000000
93	Metikurkekere	Hiriyur	12.75	76.57329800290	14.01214239290
94	Kandikere	Hiriyur	11.00	76.66391965300	14.10036004610
95	Harhikote kere	Hiriyur	15.60	76.65565943100	14.07193131180
96	Ambalagerekere	Hiriyur	12.28	76.68610727310	14.03614101100
97	Hemadalakere	Hiriyur	8.50	76.66518254930	14.02562398040
98	Rangenahalli kere	Hiriyur	8.50	76.71044567810	14.07832706800
99	Kunnikere	Hiriyur	15.95	76.55602160100	13.94197837680
100	Gownahally kere	Hiriyur	11.50	76.48354606740	14.00602221330
101	Mallapura Kere	Chitradurga	40.30	76.40591222970	14.24808277560
102	Dyamavvanahalli kere	Chitradurga	50.00	76.47305782290	14.26138651830
103	Gonurukere	Chitradurga	64.00	76.43035881440	14.25707778130
104	Jampannanaikanakotekere	Chitradurga	39.00	76.53694069320	14.17099153790
105	Kallahallykere	Chitradurga	97.00	76.50971590390	14.25100908930

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
106	Doddagattakere	Chitradurga	77.60	76.47663068470	14.41386716290
107	Belagere Kere	Challakere	68.35	76.75846300020	14.15859616650
108	Chanamanagatihalli kere	Challakere	55.67	76.80530021660	14.30660961330
109	Sanikere	Challakere	45.21	76.65703010950	14.18876030470
110	Chikkamadure kere	Challakere	160.74	76.59853556940	14.21841359970
111	Karakalkere	Challakere	116.30	76.67312296690	14.29804192110
112	Nagaramgere kere	Challakere	47.00	76.69060294390	14.27606450380
113	Duggammankere	Challakere	51.48	76.62462020210	14.31586973650
114	Dodderi Doddakere	Challakere	45.00	76.70297347150	14.29139260900
115	Ranikere	Challakere	84.40	76.73242209970	14.32295310320

FILLING UP OF TANKS UNDER HOLALKERE TALUK

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER HOLALKERE TALUK					
116	Gangasamudra Tank	Holalkere	503.60	76.14570135600	13.91170990040
117	Gunderi	Holalkere	88.59	76.17535838510	13.99468479900
118	Holakere Hire Kere	Holalkere	53.06	76.17811345270	14.05033713200
119	Adanuru Tank	Holalkere	35.01	76.17088921550	14.08509876360
120	Chikkayamiganuru	Holalkere	35.01	76.08552686010	14.11228401620
121	Devarahosahalli	Holalkere	5.50	76.08058929030	13.94161800240
122	Talikatte	Holalkere	48.70	76.09868944960	13.95271899340
123	Ramagiri	Holalkere	5.00	76.14498099730	13.96243288140
124	Lambanihatti Tank	Holalkere	10.00	76.18558681090	14.03611049490
125	Jayapura Tank	Holalkere	7.30	76.14774208780	14.03604095230
126	Holkere Chikka Kere	Holalkere	5.00	76.19166949550	14.04834533160
127	Punajuru Tank	Holalkere	5.80	76.14410702660	14.05407069040
128	Gundemadu Tank	Holalkere	5.20	76.12797781540	14.05698914000
129	Kunigali Tank	Holalkere	6.00	76.12411580200	14.07095268340
130	Shivapur	Holalkere	5.00	76.10705760020	14.07647134360
131	Chikajajur Tank	Holalkere	5.00	76.14269968540	14.13171632510
132	Rangapura Tank	Holalkere	4.40	76.11668555460	13.98952158480
133	R Nulenuru	Holalkere	5.60	76.12084804590	14.00365072590
134	Basavapura Tank	Holalkere	4.90	76.11782082850	14.02165283110
135	Dummi	Holalkere	4.22	76.07286375500	14.02568420590
136	Kengunte	Holalkere	11.10	76.07814518640	14.04276328740

FILLING UP OF TANKS UNDER JAGALUR BRANCH CANAL - DISTRICT DAVANAGERE

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER JAGALUR BRANCH CANAL - DISTRICT DAVANAGERE					
137	Sangenahalli Kere	Jagalur	389.55	76.38512291080	14.42068466090
138	Nibaguru Kere	Jagalur	82.45	76.30837081790	14.44422621730
139	Jammapura kere	Jagalur	83.29	76.36634320020	14.45844632480
140	Bharmasamdra	Jagalur	123.00	76.38455341570	14.51179790850
141	Bidrakere	Jagalur	42.00	76.30036104430	14.42368142860
142	Katarahalukere	Chitradurga	196.00	76.32275926390	14.28399845310
143	Muddapura Kere	Chitradurga	56.55	76.31357503850	14.35525658530
144	Yalagodu	Chitradurga	41.00	76.29823429750	14.38262788220
152	Sulthanipurakere	Chitradurga	9.00	76.34082270470	14.33627042360

FILLING UP OF TANKS UNDER CHALLAKERE TALUCK - DISTRICT CHITRADURGA

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER CHALLAKERE TALUCK - DISTRICT CHITRADURGA					
145	Bheemanakere	Challakere	53.05	76.62027715020	14.43523335430
146	Tippayyanakote Kere	Challakere	134.08	76.65234942600	14.45312250000
147	Talaku Tank	Challakere	33.87	76.68791406190	14.44552498870
148	VaravuKere	Challakere	22.64	76.64026685560	14.41639854080
149	Ullarti kere	Challakere	37.89	76.74061814860	14.39059385450
150	Yadalagatte Kere	Challakere	97.03	76.77538908860	14.39940989250
151	MylanahalliKere	Challakere	31.36	76.81400498690	14.44674260310
153	Nayakanahatti Hirekere	Challakere	272.00	76.52172107260	14.43700255350
154	Nayakanahatti Chikkere	Challakere	179.40	76.53735338380	14.46841380640
155	Rekalgere Tank	Challakere	37.37	76.57054931410	14.50670959710
156	RamasagaraKere	Challakere	123.25	76.60850414800	14.48592770970
157	Hirehalli Kere	Challakere	72.47	76.66209771460	14.51573119780
158	Banjigere Kere	Challakere	43.38	76.73292656760	14.47850302540
159	Ghataparti Kere	Challakere	40.51	76.76980668830	14.47713210840
160	Palanayakankote kere	Challakere	32.00	76.68972539490	14.52953129060
161	Bukkambudi Tank	Challakere	39.20	76.73350884650	14.53123264030
162	Gourasamudra Kere	Challakere	10.00	76.74650474060	14.56196170300
163	Mysarahatti Tank-1	Challakere	35.00	76.60380057920	14.50967096540
164	Mysarahatti Tank -2	Challakere	8.00	76.61163001960	14.51924129100
165	Chowlkere Kere	Challakere	22.47	76.59625888010	14.60360925740
166	MuchchukunteKere	Challakere	12.00	76.53828628180	14.30431650560
167	Nanniala Kere	Challakere	37.53	76.58407624910	14.31154741660
168	Manumayanahatti Kere	Challakere	40.00	76.55333166530	14.44120783840
169	Kudapura Kere	Challakere	25.00	76.56832724200	14.44211103970
170	Gauripura Kere	Challakere	51.00	76.59460045120	14.45799240990
171	Nerlagunte Kere	Challakere	7.40	76.59119859260	14.40359920620
172	Viratimmanahalli Tank	Challakere	45.00	76.64978183330	14.33009676750
173	Bharmasagara Kere	Challakere	38.00	76.69632898020	14.32537104740
174	Bettayyanahatti Kere	Challakere	4.00	76.61927343380	14.40067154820
175	Budnahatti Kere	Challakere	35.00	76.65129834890	14.36915824180
176	Gengavarahatti Kere	Challakere	5.00	76.67822936360	14.36553180340
177	Valase Tank	Challakere	10.00	76.73831125190	14.44382002630
178	GudihalliTank	Challakere	20.00	76.82253026350	14.42824023830
179	Kadamanekatte tank	Chitradurga	2.00	76.44338492710	14.43105223750
180	Guntukolammanahalli-1 tank	Challakere	7.00	76.54062115750	14.52311167350
181	Guntukolammanahalli-2 tank	Challakere	33.87	76.54929381830	14.52853564680
182	Kodihallikere	Challakere	98.00	76.66476664640	14.46484827980
183	Mallurahallikere	Challakere	35.00	76.60126964290	14.52266573350
184	Bhoganahalli Tank	Challakere	5.00	76.77995670730	14.49377632720
185	Obannanahalli Tank	Challakere	21.04	76.69441009420	14.56500249900
186	Ramdurga Kere	Challakere	7.00	76.55587172310	14.40813574160

FILLING UP OF TANKS UNDER MOLAKALMUR TALUCK - DISTRICT CHITRADURGA

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER MOLAKALMUR TALUCK - DISTRICT CHITRADURGA					
187	Muttigarahalli Tank	Molakalmur	10.35	76.65695128560	14.60120422000
188	Duppihalli Tank	Molakalmur	7.00	76.69029933950	14.62193284720
189	Kona Sagara Tank	Molakalmur	18.35	76.74241956090	14.64492073510
190	Bommalinganahalli(Tuppadakkanahalli tank	Molakalmur	49.10	76.68332971890	14.75627084580
191	Hirekerehalli kere	Molakalmur	58.48	76.70010207270	14.76627913360
192	Nagasmudra Kere	Molakalmur	21.45	76.74937711920	14.79560150920
193	Siddapura Kere	Molakalmur	231.40	76.77566699110	14.80473369110
194	Bhatrahalli Tank	Molakalmur	11.25	76.69984536420	14.78933985710
195	Amakundi Tank	Molakalmur	10.70	76.72941202680	14.79684647630
196	Chikkanahalli Kere	Molakalmur	6.40	76.74066618300	14.83458653620
197	Gaurasamudra	Molakalmur	8.65	76.76093968410	14.83216140410
198	Devasamudra Kere	Molakalmur	17.00	76.79594665730	14.86829043190
199	Rangaiahnadurgakere	Molakalmur	463.38	76.66292578460	14.75724482350
200	Tumkurlahalli Tank-1	Molakalmur	14.00	76.64507275450	14.67709399950
201	Tumkurlahalli Tank-2	Molakalmur	12.00	76.64039681870	14.68239563790
202	Tumkurlahalli Tank-3	Molakalmur	0.00	76.65852369850	14.67768176170
203	Yerpota Jogihalli	Molakalmur	40.00	76.64095021850	14.70200966710
204	Yerrenahalli-1	Molakalmur	30.00	76.69007553960	14.69168677710
205	Yerrenahalli-2	Molakalmur	42.00	76.67915416840	14.71703670720
206	Katanaikanahalli Tank	Molakalmur	100.00	76.73954603910	14.75899225140

FILLING UP OF TANKS UNDER PAVAGADA TALUK - DISTRICT TUMKUR

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER PAVAGADA TALUK - DISTRICT TUMKUR					
207	Jadonahalli kere	Pavagada	15.30	77.04338587160	14.19903068710
208	Rangasamudra kere	Pavagada	28.23	77.09912400950	14.17771552280
209	Gollanakunte kere	Pavagada	18.82	77.04169512810	14.12311339250
210	Arasikere Gujjarappana Kere	Pavagada	48.61	77.03795013900	14.09506864830
211	Mangalavada Kere	Pavagada	19.61	77.07761712030	14.07631261550
212	Madde kere	Pavagada	12.85	77.08990295580	14.05624966100
213	Tumakunte kere	Pavagada	17.25	77.06243045400	14.06891611140
214	Arasikere Hampina Kere	Pavagada	42.60	77.04028170820	14.07934509170
215	Pennabanahalli kere	Pavagada	10.59	77.02695514470	14.19643295370
216	Shailapura kere-1	Pavagada	22.66	77.14560410130	14.15341031450
217	Shailapura kere-2	Pavagada	2.70	77.14010198100	14.14759230030
218	Devarakere	Pavagada	4.54	77.14968513770	14.11937904450
219	Chittaganahalli	Pavagada	34.50	77.15969611670	14.10429672440
220	Bodasanahalli kere	Pavagada	2.88	77.08790935880	14.11118310240
221	Gukkarahalli Kere	Pavagada	4.83	77.05833566230	14.11207513220
222	Virupakshapura	Pavagada	65.63	77.06178695120	14.11098516660
223	Marur Kere	Pavagada	2.83	77.07089875670	14.09064828050
224	Sitharampura kere	Pavagada	3.83	77.06373289440	14.12327381740
225	Karekyatanahalli Kere	Pavagada	10.50	77.11035611410	14.06735612800
226	Kotagudda kere-2	Pavagada	24.00	77.18419365980	14.14162672380
227	Devarabetta	Pavagada	2.55	77.18289221320	14.09965291720
228	Dondorapallya kere	Pavagada	68.53	77.22086386110	14.10635245660
229	Gundalahalli kere	Pavagada	77.62	77.21542894900	14.11360602820
230	Kotagudda kere	Pavagada	16.52	77.19032535830	14.15433184630
231	Komaralahalli Kere	Pavagada	71.09	77.22104834680	14.16822280730
232	Achchammanahalli Kere	Pavagada	15.88	77.22915616740	14.13819560680
233	Kadapalakere	Pavagada	9.15	77.23796939460	14.14376264840
234	Kanikalabande Kere	Pavagada	19.79	77.25495473220	14.14309844510
235	Palluvalli Tank	Pavagada	387.33	77.27835230890	14.16153701090
236	Errampalli kere	Pavagada	18.91	77.23440047930	14.12638958770

FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL CHIKKAMAGALUR DISTRICT

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL					
237	Mudigere	Tarikere	35.36	76.10670719350	13.69747908970
238	Biluvala	Kadur	2.08	76.08135993510	13.58750483570
239	Garje	Kadur	19.36	76.12171675330	13.59846679710
240	Yagati	Kadur	52.25	76.15714470630	13.61256116270
241	Yallambalase	Kadur	67.20	76.11856096150	13.57121528620
242	Macheri	Kadur	46.02	76.05960700430	13.55216993570
243	Vakkalagere	Kadur	4.68	76.24350700750	13.65024661460
244	Sanenahalli	Kadur	6.34	76.22695052980	13.63801387400
245	Hachihalli	Kadur	5.98	76.23979244720	13.61865149710
246	Kunkanadu	Kadur	6.26	76.25519145390	13.59053027210
247	P.Kodihalli	Kadur	81.20	76.11920975070	13.62970497450
248	Dodda Annegere	Kadur	63.18	76.28704038400	13.54014611030
249	Bidare	Kadur	34.52	76.21844258600	13.54187119220
250	Kisinipur	Kadur	17.08	76.14770645810	13.63150348910
251	Mallapura	Kadur	32.06	76.12691040450	13.54901884390
252	Mugallikatte	Kadur	27.44	76.16335528490	13.57555544600
253	Udugere	Kadur	10.92	76.19409250290	13.59301455060
254	Ganganahalli	Kadur	39.68	76.30661087180	13.57434529030
255	Yaradakere	Kadur	8.32	76.20898056010	13.64533447670
256	Garagadahalli	Kadur	2.86	76.27960336270	13.56359551270
257	Harisamudra	Kadur	2.40	76.17614425170	13.61633221970
258	Annegere	Kadur	63.18	76.16058923570	13.55368003940
259	Naganandanahalli	Kadur	7.34	76.08124447850	13.59723915570
260	Byragondanahalli	Kadur	4.90	76.19406856070	13.62512610530
261	Honnenahalli	Kadur	6.40	76.23503744120	13.60699742950
262	Koratagere/Huligere	Kadur	7.54	76.19616330010	13.56564501960
263	Sadarahalli	Kadur	2.86	76.10311635820	13.51808154000
264	Aladahalli	Kadur	5.98	76.25610510750	13.57510300350
265	Bislere	Kadur	6.16	76.08923013210	13.62648725980
266	Hanumanahallii	Kadur	6.24	76.16033402190	13.60061105360

FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL HOSADURGA, CHITRADURGA DISTRICT

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL HOSADURGA, CHITRADURGA DISTRICT					
267	Belaguru	Hosadurga	27.00	76.29676076080	13.62838441140
268	Sriramapura	Hosadurga	42.00	76.41382499200	13.62387268650
269	Sukalarahatti	Hosadurga	46.26	76.27635836540	13.68912089960
270	Kabbala	Hosadurga	5.655	76.31119154560	13.66639673780
271	Bommenahalli	Hosadurga	1.41	76.32247165930	13.65496298260
272	Tonachenahalli	Hosadurga	11.295	76.34089422890	13.65879377440
273	Kainodu	Hosadurga	23.655	76.38911325390	13.67980796790
274	Ganjigere	Hosadurga	31.785	76.37620477660	13.72580961770
275	Dalavaikatte	Hosadurga	8.00	76.42604623910	13.62843136540
276	Kachapura	Hosadurga	101.40	76.43320157990	13.63849346750
277	Vengalapura	Hosadurga	2.82	76.43924334420	13.64615645370
278	Heggere1	Hosadurga	24.96	76.43328553770	13.61131476010
279	Heggere2	Hosadurga	8.00	76.42262215920	13.60708034900
280	Kurubarahalli	Hosadurga	19.065	76.39475981080	13.61067464520
281	Gaudanapalya	Hosadurga	20.60	76.40994854160	13.77077662180
282	Lakshmedevanahalli	Hosadurga	15.70	76.47698444280	13.77377312090
283	Tairkere	Hosadurga	17.30	76.44445556060	13.78740357320
284	Kavalaramane	Hosadurga	14.50	76.39600673210	13.69590883810
285	Nagaragere - 2	Hosadurga	1.42	76.36902069550	13.64322434080
286	Nagaragere - 1	Hosadurga	1.42	76.37220381030	13.64498275740
287	Haglakere	Hosadurga	1.77	76.33807387090	13.73716878910
288	Gollarahalli	Hosadurga	4.59	76.41814309550	13.69243603670
289	Kadayugere	Hosadurga	1.05	76.45441334860	13.64788160160
290	Doddiyanapalya	Hosadurga	11.90	76.40577287390	13.76165992620

FILLING UP OF TANKS UNDER TUMKUR BRANCH CANALCHIKKANAYAKANAHALLI, TUMKUR DISTRICT

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER TUMKUR BRANCH CANALCHIKKANAYAKANAHALLI, TUMKUR DISTRICT					
291	Huliyar	Chikkanayakanahalli	99.79	76.53948667210	13.59013568920
292	Timmalapura	Chikkanayakanahalli	105.40	76.52969666240	13.55280551900
293	Boranakanivi Reservor	Chikkanayakanahalli	2423.60	76.63608312720	13.60102664980
294	Chikka Bidare	Chikkanayakanahalli	13.38	76.57256294890	13.53603147310
295	Kete Suragondanahalli	Chikkanayakanahalli	8.00	76.50344371610	13.58778988630
296	Morenddu	Chikkanayakanahalli	9.42	76.66102486340	13.69402736270
297	Marathipalya	Chikkanayakanahalli	1.88	76.48673344820	13.58524138370
298	Singapura	Chikkanayakanahalli	20.15	76.45212213370	13.60604968020
299	Elenadu	Chikkanayakanahalli	4.70	76.48074621010	13.59383693270
300	Kurihatti	Chikkanayakanahalli	10.30	76.54571647840	13.61077424530
301	Kenker	Chikkanayakanahalli	6.12	76.53123408710	13.62395248520
302	Tore Surugondanahalli	Chikkanayakanahalli	9.20	76.56320651370	13.56535349690
303	Upparahalli	Chikkanayakanahalli	3.01	76.48135408750	13.56480391430
304	Oddankalluhalli	Chikkanayakanahalli	7.30	76.60641504320	13.55743571630
305	Sigebag	Chikkanayakanahalli	9.01	76.51251530710	13.54910490830
306	Dasundi State Forest	Chikkanayakanahalli	9.42	76.61677950810	13.69451279900
307	Kodihalli	Chikkanayakanahalli	0.94	76.56494723930	13.55016799490
308	Guruvapura	Chikkanayakanahalli	14.01	76.59097582210	13.63682980630
309	Motihalli	Chikkanayakanahalli	9.42	76.44399319020	13.57439193840

FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL HIRIYUR TALUK, CHITRADURGA DISTRICT

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL HIRIYUR TALUK, CHITRADURGA DISTRICT					
310	Elladakere	Hiriyur	10.00	76.57669061020	13.79142375820
311	Gaudanahalli	Hiriyur	17.50	76.64298338450	13.85636652180
312	Uduvalli	Hiriyur	300.00	76.58679643850	13.87623608560
313	Gandhinagar	Hiriyur	9.30	76.63480022460	13.87789675860
314	Gollarahatti	Hiriyur	18.50	76.74589023200	13.89275529240
315	Talavaranahatti	Hiriyur	7.30	76.58060807550	13.77254399450
316	Yiravanagattehalli	Hiriyur	4.50	76.63782618860	13.76681526620
317	Boranakunte	Hiriyur	4.50	76.71407878560	13.89468505190
318	Marikanave State Forest	Hiriyur	13.20	76.52556406940	13.85049979740
319	Hangapura	Hiriyur	28.26	76.63885098300	13.84276281370
320	Mavinamadu	Hiriyur	9.30	76.67748437480	13.75682464630
321	Malagondanahalli	Hiriyur	4.70	76.64629754460	13.82838866230
322	Obalapura	Hiriyur	1.42	76.69163315570	13.78757326360
323	Lambadihatti	Hiriyur	4.70	76.69546000330	13.84178650150
324	Golla Chikkanahalli	Hiriyur	46.20	76.69006768440	13.86007546400
325	Vaddanahalli	Hiriyur	9.42	76.67819946780	13.87391732480
326	Dindavara	Hiriyur	4.70	76.65431714930	13.80480198660

FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL SIRA TALUK, TUMKUR DISTRICT

SL NO.	NAME OF THE TANK	TALUK	TANK CAPACITY IN Mcft	LONGITUDE	LATITUDE
FILLING UP OF TANKS UNDER TUMKUR BRANCH CANAL SIRA TALUK, TUMKUR DISTRICT					
327	HOSUR DODDAKERE(Gollarahatti)	SIRA	120.72	76.78604731150	13.88772330730
328	HOSALUR(Bevinahalli)	SIRA	7.83	76.82887231030	13.90341401750
329	MADULUR DODDAKERE	SIRA	286.12	76.96768330610	13.81355309780
330	KOTTA DODDAKERE	SIRA	55.49	76.92945026910	13.79261249520
331	MADULUR CHIKKAKERE	SIRA	36.12	76.95974039380	13.80200100510
332	MELKUNTE KERE	SIRA	14.39	76.93264961090	13.81692596550
333	HONNAGONDANAHALLI KERE	SIRA	16.75	76.98441957340	13.76538448690
334	CHENGAVARA KERE	SIRA	41.28	76.85453966360	13.92901339190
335	NADUR DODDAKERE	SIRA	41.28	76.93537984780	13.88035217940
336	KAGGALADU KERE	SIRA	31.35	76.86288149250	13.80706141500
337	KAMAGONDANAHALLI DODDAKERE	SIRA	12.20	76.91323431530	13.89400544780
338	HEMMADORE DODDAKERE	SIRA	23.51	76.88941808890	13.88876708320
339	ENJALAGERE	SIRA	16.30	76.89664817400	13.96093024240
340	BARGUR KERE	SIRA	79.04	76.98849663460	13.93596096750
341	BADAMARANAHALLI KERE	SIRA	26.20	77.02135212490	13.91625922520
342	HAROGERE KERE	SIRA	13.00	77.00948284750	13.93703369710
343	HANDIKUNTE KERE	SIRA	28.34	76.99162543760	13.89524358230
344	AGRAHARA KERE	SIRA	22.10	76.97863707240	13.89661165310
345	DODDABANAGERE KERE	SIRA	178.10	76.96933551920	13.99500882630
346	CHIKKABANAGERE	SIRA	73.58	76.96620962060	13.98445009480
347	TADAKALURU KERE	SIRA	23.66	76.91068476530	14.02069151840
348	NIDAGHATTA KERE	SIRA	23.66	76.92619323860	14.00379375830
349	DODDA HULIKUNTE KERE	SIRA	80.86	76.92786640970	13.97833133690
350	NEJANTI KERE	SIRA	28.86	76.88616179240	14.00303179250
351	KOTTI KERE	SIRA	18.57	76.90373267770	13.96119247340
352	BIDIRUKERE	SIRA	13.44	76.86803991540	13.78971032270
353	BUVANAHALLI KERE	SIRA	28.50	76.85569703110	13.74492853590
354	LAKSHMISAGARA KERE	SIRA	215.44	76.81474120810	13.76922625000
355	DEVARAHALLI KERE	SIRA	4.70	76.91874891360	13.65989227260
356	KALLAMBELLA TANK	SIRA	248.42	76.93249241300	13.63006778360
357	GULIGENAHALLI KERE	SIRA	12.09	76.99663074830	13.71493501220
358	MAGODU KERE	SIRA	103.43	76.97422203830	13.71943525670
359	DODDAGULA KERE	SIRA	53.92	76.95038614710	13.69012088650
360	HALKUR KERE	SIRA	28.79	76.93454080840	13.72704508510
361	YALIYURU KERE	SIRA	25.92	76.92410055240	13.69896497040
362	CHANNANAKUNTE KERE	SIRA	20.68	76.94172481380	13.74877295190
363	BORASANDRA KERE	SIRA	13.08	77.01293728330	13.70753432680
364	GIRINATHANAHALLI KERE	SIRA	6.80	76.96207309610	13.74163038580
365	BHUPASANDRA KERE	SIRA	43.07	76.96419396380	13.64259812020
366	AJJENAHALLI KERE	SIRA	36.38	76.94894318730	13.64405578760
367	BRAHMASANDRA KERE	SIRA	28.48	76.98999584950	13.58982216970

Annexure 4.1

By Speed Post

भारतीय सर्वेक्षण विभाग / SURVEY OF INDIA
[illegible]
KARNATAKA GEO SPATIAL DATA CENTRE,
KORAMANGALA II BLOCK,SARJAPUR ROAD, BANGALORE-560 223.
Phone No.080-25533595 ; Fax No.080-25533595 ; E-mail : [illegible]@yahoo.com

No. T- 1066 / E 42-C-7 Dated 25-06-2008.

To
The Executive Engineer,
KNNL, No.2, Upper Bhadra Project Division,
B.R. Project – 577 115.

Sub:- Issue of Bench Mark Data

Ref :- Your Lr.No.EE/UBP Dn 2/GTS Bench mark/2008-09, dtd. 31-05-2008.

Sir,

The Description and Heights of the points required by you is enclosed in the Annexure.

Our receipt No A-728/29-J(Tech) dtd 20.05.2007 for Rs.5,000/-(Rupees Five thousand only) towards service charges is also enclosed herewith.

The data may be kept under safe custody and handled by authorised officials of your department only.

Annual safe custody certificate may be submitted by 31st of December every year to this office in the following address:-

" The Director, Karnataka Geo-Spatial Data Centre, Survey of India, Koramangala II Block, Sarjapur Road, Bangalore - 560 034."

Yours faithfully,

(K.R.M.K. BABAJI RAO) BRIG.
DIRECTOR, KARNATAKA GEO SPATIAL DATA CENTRE.

Encl.:- as above.

E.E.	
T.A.	
A.O.	
M.	
COM	

ANNEXURE

SL. NO.	B.M. NO.	DESCRIPTION OF BENCH-MARKS	HEIGHT ABOVE MSL (IN METRES)	SHEET NO.
1	40	G.T.S O B.M on rock in situ on W side of road, and about 120 yards from 99th mile-stone on Hiriyur bridge, opposite first gate.	594.675	57 C/9
2	107	B.G.M on stone basement of 1st pier from E of main or front verandah of I.B. in front of I.B.-I of P.W.D at chitradurga	733.542	57 B/8
3.	290	G.T.S (Type B) at Shimoga. Interred 0.6 m below ground Level in the compound of Circuit house. A masonry reference pillar bearing the inscription G.T.S B.M 2 m on its N face stands 2.0 m S. of the bench mark. B.M A.D. 1962	597.591	48 [illegible]
4.	315	G.T.S (Type B) at Dhadravati. Interred 0.6 m below ground level in SE side of compound of office of Asst. Executive Engineer P.W.D. A masonry reference pillar bearing the inscription G.T.S B.M 2 m on its W face stands 2.0 m E. of the bench mark. B.M A.D. 1962	584.940	48 [illegible]
5	89	G.T.S (Type B) at Hiredurga. Interred 0.6 m below ground level in SE corner of compound of PWD office Hiredurga. A reference slab with the inscription G.T.S B.M 1 m on its N face fixed in S. boundary wall B.M A.D. 1962	727.639	[illegible]

1	290	G.T.S B☐M. A.D. 1961 (Type B)	at Shimoga. Interred 0.6 m below ground level in the compound of Circuit house.	597.991	48 O/9
2	315	G.T.S B☐M. A.D. 1961 (Type B)	at Bhadravati. Interred 0.6 m below ground level in SE side of compound of Office of Assistant Executive Engineer, P.W.D.	581.940	48 O/9
3.	323	O B M	On rock in situ, 6.0 m SE. of road centre, 61m SSW. of Km. stone No.6 from Bhadravati, about 60 m SW. of a bridge over canal near Virapur village on Bhadravati – Chitradurga Road.	594.824	48 O/9

Copy Attested

(N. SHIVAKUMAR)
OFFICER SURVEYOR
KARNATAKA GEO-SPATIAL DATA CENTRE
SURVEY OF INDIA
BANGALORE

Annexure - XIA

Construction Materials With Test Reports

ANNEXURE-IX A

4 CONSTRUCTION MATERIALS

Construction material investigation:

The detailed investigation for construction material has been done. And it is proposed to utilize the available material during execution after conducting necessary quality control tests wherever possible.

The construction materials such as Cement, Steel, Stone, Sand and Water etc, are abundantly available in the nearest vicinity of the project area.

Cement and Steel are proposed to be transported from nearby Railheads/Taluk Headquarters in Chikmagalur, Chitradurga, Davangere and Tumkur Districts, which are about 3-50 kms from site of work.

Rubble required for concreting and slope protection works is obtained from Canal excavation. The metal obtained by crushing rubble will be used for construction work. If no rock is obtained from excavation, both Rubble and metal will be obtained from the adjoining canal reaches. They are being used after obtaining necessary suitability tests.

Sand is obtained from the sources/ collection points in each district are also being used after obtaining necessary suitability tests. Manufactured sand conforming to IS 383-1970 will be used for canal lining and other concrete works.

Further materials like structural steel gate materials etc., can be transported by means of nearest railway station at Tarikere, Kadur, Hosadurga Road, Arsikere, Chitradurga which are about 50-60 Kms from site of work linked with asphalt roads and state and National highways.

KNNL has a quality control unit headed by an Executive Engineer having a well equipped laboratory in Bhadravathi and Chitradurga to carry out required tests on materials of construction.

Apart from this, site laboratories are also established. Comprehensive tests for suitability of these materials reveals that they are fit for construction. The test report of the construction materials are enclosed as **Annexure-2.** Quarry map showing the approximate location of quarries is appended at **Annexure-3**

The following IS codes are referred for testing of materials:

Soil:

1. IS 2720-1983 (Part1 to X and XIV) – Method of tests for soils
2. IS 1888-1971 – Method of load tests on soils
3. IS 2131-1963- Method of standard penetration test for soils
4. IS 4332-1967 (Part-1 reaffirmed 1978)- Method of sampling and preparation of stabilized soils for testing
5. IS 5529-1969 Method of tests for In-situ permeability test

Cement:

1. IS 8112-1989 ordinary Portland cement
2. IS 1489-1976 Portland Puzzolona cement
3. IS 8041-1978 Rapid hardening Portland cement
4. IS 8043-1970 Hydrophobic Portland cement
5. IS 4031-1968 Method of physical tests for hydraulic cement
6. IS 4032-1968 (Reaffirmed 1980) Method of chemical analysis of hydraulic cement
7. IS 5513-1983 Vicat apparatus

Aggregates:

1. IS 2386-1963 (Part-I to VII) Method of tests for aggregates for concrete
2. IS-383 – 1970 (2002) coarse and fine aggregates from natural sources
3. IS 460-1978 Test sieves
4. American Society testing of materials C 494-80 and C 491-80 water reducing agents

These IS codes will be adhered to while using the materials for the project works.

UPPER BHADRA PROJECT
PACKAGE- 2
FIELD DENSITY TEST - (SAND REPLACEMENT METHOD)
IS: 2720 (Part 28) - 1974

Client: Karnataka Neeravari Nigam Ltd Contractor : RNSIL(JV)

Representative Area From 37615 to ch 37750 R/S Date of Testing : 20/04/16
Description of Layer : Hearting 4th Layer Tested By :
Unit Weight of sand, Ys: 1.290 g/cm3 Date of Calibration : 02/03/16

TEST HOLE	1	2	3	4		
Location of Test	L/S 37680	L/S 37740	R/S 37640	R/S 37710		
Depth of Hole, (mm)	150	150	150	150		
Offset from C/L (m)						
DETERMINATION OF WET UNIT WEIGHT						
Wt. of Wet Sample from Hole, (g) W1	1977	2043	2059	1986		
Wt. of Cylinder filled with Sand before Pouring, (g) W2	6400	6400	6400	6400		
Wt. of Cylinder filled with Sand after Pouring, (g) W3	4819	4779	4758	4817		
Wt of Sand in cone (g) W4	310	310	310	310		
Wt. of Sand in Hole, (g) W5=W2-W3-W4 W5	1271	1311	1332	1273		
Volume of Hole V=W5/γs (cm³) V	985.27	1016.27	1032.55	986.82		
Wet Density of Sample γ_{wet} = W1/V g/cm³	2.006	2.010	1.994	2.012		
IN-SITU MOISTURE CONTENT (SPEEDY MOISTURE METER METHOD)						
Dial Gauge Reading, (Div)	13.00	13.00	12.50	13.50		
Calibrated In-Situ Moisture Content (%)	15.80	15.80	15.18	16.42		
DEGREE OF COMPACTION						
Lab. Optimum Moisture Content, (%)	15.20	15.20	15.20	15.20		
Lab Max. Dry Density, (g/cm³) γ_{max}	1.76	1.76	1.76	1.76		
In-situ Dry Density, γd=100xγ_{wet}/(100+w)(g/cm3)	1.732	1.735	1.731	1.728		
Degree of Compaction, (%) 100x$\gamma d/\gamma max$	98.40	98.57	98.35	98.18		
Compaction Required, (%)	98	98	98	98		

Remarks :

"Extract"

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.2,
B.R. Project-577 115.

Contractor

Assistant Executive Engineer
KNNL, UBP Sub-Division, No. 5
Tarikere

R. Sunil

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-577 301

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UPPER BHADRA PROJECT
PACKAGE-2
FIELD DENSITY TEST - (SAND REPLACEMENT METHOD)
IS: 2720 (Part 28) - 1974

Client: Karnataka Neeravari Nigam Ltd | Contractor : RNSIL(JV)

Representative Area : From 37650 to ch. 37785 | Date of Testing : 26/05/16
Description of Layer : Bed filling 1st layer (casing) | Tested By ....
Unit Weight of sand, Ys: 1.290 g/cm3 | Date of Calibration : 09/03/16

TEST HOLE	1	2	3	4	5	6
Location of Test	37670	37680	37700	37705	37710	37720
Depth of Hole, (mm)	150	150	150	150	150	150
Offset from C/L (m)						
DETERMINATION OF WET UNIT WEIGHT						
Wt. of Wet Sample from Hole, (g) W1	1978	2041	2006	1985	1999	2043
Wt. of Cylinder filled with Sand before Pouring, (g) W2	6400	6400	6400	6400	6400	6400
Wt. of Cylinder filled with Sand after Pouring, (g) W3	4860	4808	4873	4855	4874	4831
Wt of Sand in cone (g) W4	310	310	310	310	310	310
Wt. of Sand in Hole, (g) W5=W2-W3-W4 W5	1230	1282	1257	1235	1216	1259
Volume of Hole V=W5/γs (cm³) V	953.48	993.79	974.41	957.36	942.63	975.96
Wet Density of Sample γ_{wet} = W1/V g/cm³	2.074	2.053	2.058	2.073	2.120	2.093
IN-SITU MOISTURE CONTENT (SPEEDY MOISTURE METER METHOD)						
Dial Gauge Reading, (Div)	8.50	7.50	8.00	8.50	10.50	9.00
Calibrated In-Situ Moisture Content (%)	10.21	8.96	9.59	10.21	12.69	10.83
DEGREE OF COMPACTION						
Lab. Optimum Moisture Content, (%)	10.43	10.43	10.43	10.43	10.43	10.43
Lab Max. Dry Density, (g/cm³) γ_{max}	1.91	1.91	1.91	1.91	1.91	1.91
In-situ Dry Density, $\gamma d = 100 \times \gamma_{wet} / (100+w)$ g/cm3)	1.881	1.884	1.877	1.880	1.881	1.888
Degree of Compaction, (%) 100×γd/γmax	98.48	98.63	98.27	98.42	98.48	98.84
Compaction Required, (%)	98	98	98	98	98	98

Remarks :

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ಕ.ನೀ.ನಿ.ನಿ., ಗುಣನಿಯಂತ್ರಣ ಉಪ-ವಿಭಾಗ
ಬಿಆರ್‌ಪಿ ಕ್ಯಾಂಪ್, ಭದ್ರಾವತಿ-577 30

"Extract"

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division,
B.R. Project-577 115.

Contractor

Assistant Executive Engineer
KNNL, UBP Sub-Division, No. 5
Tarikere

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ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ
ತುಂ.ಮೇ.ದಂ. ಶಿವಮೊಗ್ಗ

2

PACKAGE-2

COMPRESSIVE STRENGTH OF CONCRETE CUBE

IS : 516 - 1991

Client : KARNATAKA NEERAVARI NIGAM LTD

Contractor : RNSIL (JV)

Structure Location : Box culvert - 30740

Part of Structure : wall

Concrete Grade : M-30

Water / Cement Ratio : 0.40

Agg's / Cement Ratio : 4.65

Cement Content : 400kg/m3

Date of Casting : 18-7-16

Date of Testing : 25-7-16

Age of Cube : 7days

Nos of Crushed Cubes : 3

Pouring No : 5125

Test No	Cube Ref. No	Weight (kg)	Density (kg/m³)	Test Area (mm²)	Max Load (KN)	Compressive Strength	Avg. Compressive Strength
1	1/5125	8.358	2476	22500	510	22.66	23.99
2	3/5125	8.403	2489	22500	560	24.88	
3	5/5125	8.451	2504	22500	550	24.44	

Avg Compressive Strength (N/mm²) 23.99

Remarks :

extract

Executive Engineer
KNNL, UBP, Sub-Division, No. 2,
B.R. Project

Contractor

Assistant Executive Engineer
KNNL, UBP, Sub-Division, No. 5,
Tarikere.

... - 577 ...

Client

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UPPER BHADRA PROJECT
PACKAGE-2
COMPRESSIVE STRENGTH OF CONCRETE CUBE
IS : 516 - 1991

Client : KARNATAKA NEERAVARI NIGAM LTD
Contractor : RNSIL (JV)
Structure Location : National Highway-22927
Part of Structure : Tiebeam & column 44711 (Ltrack side)

Concrete Grade : M-25
Water / Cement Ratio : 0.50
Agg's / Cement Ratio : 5.32
Cement Content : 350 kg/m3

Date of Casting : 18-8-16
Date of Testing : 25-8-16
Age of Cube : 7 days
Nos of Crushed Cubes : 3

Pouring No. 5212

Test No	Cube Ref. No	Weight (kg)	Density (kg/m³)	Test Area (mm²)	Max Load (KN)	Compressive Strength	Avg. Compressive Strength
1	115212	8.486	2517	22500	480	21.33	21.33
2	515212	8.356	2475	22500	500	22.22	
3	715212	8.410	2491	22500	460	20.44	

Avg Compressive Strength (N/mm²) 21.33

Remarks

"Extract"

Executive Engineer
KNNL, UBP, Sub-Division, No. 2,
B.R. Project

Contractor

Assistant Executive Engineer
KNNL, UBP, Sub-Division, No. 5,
Tarikere.

PACKAGE-2
COMPRESSIVE STRENGTH OF CONCRETE CUBE
IS : 516 - 1991

Client : KARNATAKA NEERAVARI NIGAM LTD
Contractor : RNSIL (JV)
Structure Location : Box culvert - 30792
Part of Structure : Bottom Raft

Concrete Grade : M-20
Water / Cement Ratio : 0.53
Agg's / Cement Ratio : 5.94
Cement Content : 320 kg/m3

Date of Casting : 14-8-16
Date of Testing : 11-9-16
Age of Cube : 28 days
Nos of Crushed Cubes : 9

Pouring No 5205

Test No	Cube Ref. No	Weight (kg)	Density (kg/m³)	Test Area (mm²)	Max Load (KN)	Compressive Strength	Avg. Compressive Strength
1	2/5205	8.380	2482	22500	510	22.66	22.66
2	3/5205	8.326	2466	22500	500	22.22	
3	4/5205	8.409	2491	22500	520	23.11	
4	6/5205	8.426	2496	22500	520	23.11	23.55
5	8/5205	8.281	2453	22500	540	24.00	
6	9/5205	8.502	2519	22500	530	23.55	
7	10/5205	8.403	2489	22500	540	24.00	24.44
8	11/5205	8.387	2485	22500	560	24.88	
9	12/5205	8.461	2506	22500	550	24.44	

Avg Compressive Strength (N/mm²) 23.55

Remarks

"Extract"

Executive Engineer
KNNL, UBP, Sub-Division, No. 2.
B.R. Project

"ಮೇಲುರುಜು"

Contractor

Assistant Executive Engineer
KNNL, UBP, Sub-Division, No. 5.
Tarikere.

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[illegible]
[illegible] -577 301.

Client
[illegible]
[illegible]
[illegible] - 577 301.

UPPER BHADRA PROJECT
PACKAGE-2
COMPRESSIVE STRENGTH OF CONCRETE CUBE
IS : 516 - 1991

Client : KARNATAKA NEERAVARI NIGAM LTD
Contractor : RNSIL (JV)
Structure Location : Box culvert - 39050
Part of Structure : D/s wing wall P.C.C

Pouring No : 5213

Concrete Grade : M-15
Water / Cement Ratio : 0.60
Agg's / Cement Ratio : 8.64
Cement Content : 240kg/m³

Date of Casting : 19-8-16
Date of Testing : 26-8-16
Age of Cube : 7days
Nos of Crushed Cubes : 3

Test No	Cube Ref. No	Weight (kg)	Density (kg/m³)	Test Area (mm²)	Max Load (KN)	Compressive Strength	Avg. Compressive Strength
1	15213	8.396	2487	22500	300	13.33	13.18
2	315213	8.352	2474	22500	310	13.77	
3	515213	8.370	2480	22500	280	12.44	

Remarks -

Avg Compressive Strength (N/mm²) 13.18

Extract

Executive Engineer
KNNL, UBP, Sub-Division, No. 2,
B.R. Project

Contractor

Assistant Executive Engineer
KNNL, UBP, Sub-Division, No. 5,
Tarikere.

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ

(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

[illegible]

[illegible]

[illegible]

[illegible] 2013-14 [illegible] - 7 FEB 2014

[illegible]

[illegible]

ನಂ.2, [illegible]

[illegible]

[illegible]

[illegible]

[illegible] 423 [illegible] 4-2-2014

[illegible]

1, ನಂ.3 [illegible]

1) Upper Bhadra Project (Package-2)

[illegible]

ಸಹಿ/-

[illegible]

1. [illegible] ನಂ.3 [illegible]

2. [illegible]

[illegible]

3

[illegible]
([illegible])

FREE SWELLING INDEX TEST
IS: 2720 (Part 40) -1977

Name of work:- Upper Bhadra Project (Package-2)

[illegible] : AEE,NO5,UBP, AJJAMPURA

Date of sampling : 2.27,03.2015

Description	Sample 1	Sample 1	Sample 2	[illegible]
	Below Free board Ch.33075		Below Free board Ch.33075 Centre	
Chainage				
Date of Testing	06.04.2015	06.04.2015	08.04.2015	
Volume of soil in kerosene (ml)	9.41	9.41	10.60	[illegible]
Volume of soil in water (ml)	11.12	11.12	14.13	
Difference Volume of soil in water and Kerosene (ml)	1.71	1.71	3.53	
Percentage of Swelling (%)	18.18	18.18	33.30	

See the table enclosed.

[illegible]
[illegible]

[illegible]
[illegible]

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work : Upper Bhadra project (Package-2)
Name of Contractor : RNSIL
Name of Sub-Division : U.B.P Sub-Division No.3, B.R.Project
Collected date:13.01.2014

Final testing date:16.01.2014 to 24.01.2014

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4)1985			Attarburg limits in % IS 2720 (Part-5)1985			Procter density tests IS 2720 (Part-8)1985		Soil classification	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)		
1	Trail pit Ch 3175.00 m	2.80	65.74	31.46	28.90	NP	NP	1.92	11.00	SM	Fairly stable: not particularly suited to shells but may be used for impervious cores of dikes
2	Trail pit Ch 3275.00 m	2.14	51.20	46.66	35.10	18.39	16.71	1.97	9.60	SC	Fairly stable: use of impervious core for flood control structures
3	Trail pit Ch 3425.00 m	1.07	54.37	44.56	35.10	17.51	17.59	1.91	14.80	SC	Fairly stable: use of impervious core for flood control structures
4	Stock pile at Ch 4200.00 m	2.96	52.79	44.25	39.49	30.95	8.54	1.88	14.00	SM	Fairly stable: not particularly suited to shells but may be used for impervious cores of dikes
5	Stock pile at Ch 8300.00 m	0.25	10.14	89.61	38.85	22.92	15.93	1.59	21.50	CI	Stable, impervious cores and blankets

Assistant Engineer

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
Quality Control Division,
Shimoga

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ
(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

ಕಾರ್ಯನಿರ್ವಾಹಕ ಅಭಿಯಂತರರವರ ಕಛೇರಿ,
ಕ.ನೀ.ನಿ.ನಿ., ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂಗಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ, ಶಿವಮೊಗ್ಗ.

ನಂ. [illegible] 2013-14 ದಿನಾಂಕ: 15 MAR 2014

1643

ಗೆ,

ಕಾರ್ಯನಿರ್ವಾಹಕ ಅಭಿಯಂತರರು,
ನಂ.2, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಿಭಾಗ,
[illegible]

ಮಾನ್ಯರೇ,

ವಿಷಯ:- [illegible]
[illegible]
ಉಲ್ಲೇಖ:- [illegible] ದಿ. 11-2-2014

[illegible]

[illegible]

1. ನಂ.5 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ [illegible]

1) Upper Bhadra Project (Package-2) [illegible]
   1) Pump House-2 [illegible] (Casing Soil)
   2) B.C. Soil (from canal and from near M.I. Tank)

17-3-14

ಲಗತ್ತು: 10 [illegible] (Casing Soil)
2 [illegible] (B.C. Soil)

ತಮ್ಮ ವಿಶ್ವಾಸಿ,
ಸಹಿ/-
ಕಾರ್ಯನಿರ್ವಾಹಕ ಅಭಿಯಂತರರು,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

1. [illegible] ಕಾರ್ಯನಿರ್ವಾಹಕ ಅಭಿಯಂತರರು, ನಂ.5 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ [illegible]
2. [illegible] ಕಾರ್ಯನಿರ್ವಾಹಕ ಅಭಿಯಂತರರು, ಗುಣ ನಿಯಂತ್ರಣ [illegible]

ಕಾರ್ಯನಿರ್ವಾಹಕ ಅಭಿಯಂತರರು,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work:- Construction of canal embankment km 38 Upper Bhadra Project (Package-2) Excavated soil From Pump House-2 (Casing)

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4)1985			Atterburg limits in % IS 2720 (Part-5)1985			Proctor density tests IS 2720 (Part-8)1985		Soil classification	Cohesion (Kg/Sqcm)	Angle of repose (degrees)	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)				
1	Sample-A (Excavated soil sample collected near PH-2)	19.30	49.47	31.23	26.10	NP	-	1.97	8.30	SM	0.60	21	Not suitable for pervious casing (As per IS-8826-1978)
2	Sample-B (Excavated soil sample collected near PH-2)	45.33	23.97	30.70	22.53	NP	-	2.02	10.40	GM	0.35	29	Suitable for pervious casing (As per IS-8826-1978)
3	Sample-C (Excavated soil sample collected near PH-2)	43.74	40.58	15.68	29.00	19.09	9.51	1.89	14.60	GC	0.38	20	Not suitable for pervious casing (As per IS-8826-1978)
4	Sample-D (Excavated soil sample collected near PH-2)	18.26	63.24	18.48	60.00	NP	-	1.77	13.87	SM	0.05	14	Not suitable for pervious casing (As per IS-8826-1978)

5	Sample-E (Excavated soil sample collected near PH-2)	6.87	63.59	29.54	31.00	NP	-	1.96	14.60	SM	0.025	23.50	Not suitable for pervious casing (As per IS-8826-197
6	Sample-F (Excavated soil sample collected near PH-2)	14.41	44.27	41.32	23.75	16.25	7.50	1.88	18.50	SC	-	-	Not suitable for pervious casing (As per IS-8826-1978)
7	Sample-G (Excavated soil sample collected near PH-2)	48.63	38.21	13.16	28.00	NP	-	1.86	12.57	GM	0.07	32	Suitable for pervious casing (As per IS-8826-1978)
8	Sample-H (Excavated soil sample collected near PH-2)	6.06	51.18	42.46	40.00	NP	-	2.00	13.00	SM	0.255	18.50	Not suitable for pervious casing (As per IS-8826-1978)
9	Sample-I (Excavated soil sample collected near PH-2)	37.00	41.10	21.60	35.50	25.84	9.66	1.88	16.40	SM	0.33	30	Not suitable for pervious casing (As per IS-8826-1978)
10	Sample-J (Excavated soil sample collected near PH-2)	48.71	24.13	27.26	27.00	18.00	9.00	1.69	18.87	GC	0.49	20	Not suitable for pervious casing (As per IS-8826-1978)

Assistant Engineer
Bhadravathi

Assistant Executive Engineer,
KNNL, Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
KNNL, Quality Control Division,
Shimoga

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work:- Construction of canal embankment km 36 Upper Bhadra Project (Package-2) Excavated soil From Canal & near MI tank (Hearting)

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4)1985			Attarburg limits in % IS 2720 (Part-5)1985			Procter density tests IS 2720 (Part-8)1985		Soil classification	Cohesion (Kg/Sqcm)	Angle of repose (degrees)	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)				
1	BC Soil MI tank	0.00	47.46	52.54	43.00	20.00	23.00	1.75	18.80	CI	0.345	20	Suitable for impervious cores (As per IS 8826-1978)
2	BC Soil Near PH-2 Bettadatavarekere	0.00	37.88	62.12	23.75	16.25	11.50	1.83	12.80	CL	0.44	23	Suitable for impervious cores (As per IS 8826-1978)

Assistant Engineer
Bhadravathi

Assistant Executive Engineer,
KNNL, Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
KNNL, Quality Control Division,
Shimoga

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ

(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್‌ರವರ ಕಛೇರಿ,
[illegible]
[illegible] ಶಿವಮೊಗ್ಗ.

[illegible] 2013-14: 1460 ದಿನಾಂಕ: 7 FEB 2014

ಗೆ,

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್,
ನಂ.2, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಿಭಾಗ,
[illegible]

ಮಾನ್ಯರೇ,

ವಿಷಯ:- [illegible]
[illegible]
ಉಲ್ಲೇಖ:-1. [illegible] 426 ದಿ. 4-2-2014

[illegible]

1\. ನಂ.5 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ಉಪವಿಭಾಗ, [illegible]

1\) Upper Bhadra Project (Package-2) [illegible] 1) (Pump House-2 [illegible]) 1) Casing Soil 2) B.C. Soil (from canal and from near M.J. Tank)

[illegible]
ಸಹಿ/-
ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್,
[illegible]
[illegible] ಶಿವಮೊಗ್ಗ.

[illegible] 10 [illegible] Casing Soil
2 [illegible] (B.C. Soil)

1\. [illegible] ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್, ನಂ.4 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ಉಪವಿಭಾಗ, [illegible]
2\. [illegible] ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್, [illegible]
[illegible]

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್,
[illegible]
[illegible] ಶಿವಮೊಗ್ಗ.

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work:- Construction of canal embankment km 36 Upper Bhadra Project (Package-2) Excavated soil From Pump House-2 (Casing)

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4)1985			Atterburg limits in % IS 2720 (Part-5)1985			Procter density tests IS 2720 (Part-8)1985		Soil classification	Cohesion (Kg/Sqcm)	Angle of repose (degrees)	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)				
1	Sample-A (Excavated soil sample collected near PH-2)	19.30	49.47	31.23	26.10	NP	-	1.97	8.30	SM	0.06	21	Fairly stable, not particularly suited to shells, but may be used for impervious cores of dikes
2	Sample-B (Excavated soil sample collected near PH-2)	45.33	23.97	30.70	22.55	NP	-	2.02	10.40	GM	0.35	29	Reasonably stable; not particularly suited to shells, but may be used for impervious cores or blankets
3	Sample-C (Excavated soil sample collected near PH-2)	43.74	40.58	15.68	29.00	19.09	9.91	1.89	14.60	GC	0.18	20	Fairly stable, may be used for impervious core

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

SBC OF SOIL

Name of work: - CTC @ CH:26.080 KM

Ref: Assistant Executive Engineer, No5, UBP Sub-Division
Sample date: 22/04/2014

Date of testing :22.04.2014

SL. No	Particulars of sample	Cohesion Kg/cm^2	Angle of repose (degrees)	SBL		Remakes
				Final (T/m2)	Standard (T/m2)	
1	C.T.C at Ch.26.080 Returning wall (L/s)	0.07	16.00	203	67	
2	C.T.C at Ch.26.080 Abutment (L/s)	0.17	15.71	241	80	
3	C.T.C at Ch.26.080 Returning wall (R/s)	0.09	16.00	204	68	
4	C.T.C at Ch.26.080 Abutment (R/s)	0.13	16.30	252	84	

Assistant Engineer
Quality Control Sub-Division,
Bhadravathi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
Quality Control Division,
Shimoga

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ
(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರವರ ಕಛೇರಿ,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂಗಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ, ಶಿವಮೊಗ್ಗ.

ಸಂ.[illegible]:2013-14/1454 ದಿನಾಂಕ: 7 FEB 2014

ಗೆ,

ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು,
ನಂ.2, ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಿಭಾಗ,
ಬಿ.ಆರ್.ಪ್ರಾಜೆಕ್ಟ್.

ಮಾನ್ಯರೇ,

ವಿಷಯ:- ಕಾಮಗಾರಿಗೆ ಬಳಸುವ ಮಣ್ಣಿನ (SBC) ಗುಣನಿಯಂತ್ರಣ ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳ ಮೇಲು ರುಜು ಮಾಡುವ ಬಗ್ಗೆ. (CTC @ ch: 24.299km)
ಉಲ್ಲೇಖ:-1. ಸ.ಕಾ.ಇಂ, ಗು.ನಿ. ಉ.ವಿ. ಭದ್ರಾವತಿ ಇವರ ಪತ್ರ ಸಂಖ್ಯೆ: 430 ದಿ. 6-2-2014

ಮೇಲಿನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಉಲ್ಲೇಖಿತ ಪತ್ರದ ಆಧಾರದ, ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ, ಭದ್ರಾವತಿ ಇವರು ಸಲ್ಲಿಸಿರುವ ಈ ಕೆಳಕಂಡ ಕಾಮಗಾರಿಯ ಮಣ್ಣಿನ ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳ ಮೇಲು ರುಜು ಮಾಡಿ ತಮಗೆ ಕಳುಹಿಸಲಾಗಿದೆ.

1. ನಂ.4 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ಉಪವಿಭಾಗ, ಅಜ್ಜಂಪುರ

1) Upper Bhadra Project (Package-2) Construction of CTC @ ch: 24.299km of UBP Canal.

ತಮ್ಮ ವಿಶ್ವಾಸಿ,

ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

1. ಪ್ರತಿಯನ್ನು ಅಡಕಗಳೊಂದಿಗೆ ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು, ನಂ.4 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ಉಪವಿಭಾಗ, ಅಜ್ಜಂಪುರ ಇವರಿಗೆ ರವಾನಿಸಲಾಗಿದೆ.
2. ಪ್ರತಿಯನ್ನು ಅಡಕಗಳೊಂದಿಗೆ ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ, ಭದ್ರಾವತಿ ಇವರಿಗೆ ಮಾಹಿತಿಗಾಗಿ ರವಾನಿಸಲಾಗಿದೆ.

ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work:- Upper Bhadra Project (Package-2) CTC @ Ch:24.299

Ref: Assistant Executive Engineer, UBP.No.4, Tarikere vide letter –No- dated:.........

Collected date:28.12.2013 testing date:31.12.2013 & 07.12.2014

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4)1985			Attarburg limits in % IS 2720 (Part-5)1985			Procter density tests IS 2720 (Part-8)1985		Soil classification	Cohesion (Kg/Sq cm)	Angle of repose (degrees)	SBC		Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)				Final	Standard	
1	C.T.C at Ch:24.299 Returning wall (L/S) Excavated soil	10.53	42.09	47.38	37.16	30.00	7.16	1.84	15.80	MI or OI	0.35	11.00	75.00	25.00	
2	C.T.C at Ch:24.299 Returning wall (R/S) Excavated soil	5.02	39.19	55.79	43.95	30.56	13.39	1.80	18.20	MI or OI	0.40	13.00	77.00	25.00	

Assistant Engineer

Assistant Executive Engineer,
KNNL, Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
KNNL, Quality Control Division,
UTP, Shimoga

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

SBC OF SOIL

Name of work: - SP/CTC @ CH:0.760 KM

Ref: Assistant Executive Engineer, No.3, UBP Sub-Division BRP
Sample date: 22/04/2014

Date of testing :26.04.2014

SL. No	Particulars of sample	Cohesion Kg/cm^2	Angle of repose (degrees)	SBL		Remakes
				Final (T/m2)	Standard (T/m2)	
1	SP/CTC at Ch0.760 km Drop wall (L/s)	0.05	7.63	63	21	

Joiner Engineer
Quality Control Sub-Division,
Bhadravathi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
Quality Control Division,
Shimoga

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ

(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್‌ರವರ ಕಛೇರಿ,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂಗಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ,ಶಿವಮೊಗ್ಗ.

ನಂ.ಕಾಇಂ:ಗುನಿವಿ:ತುಂಮೇಯೋ:ಕ.ನೀ.ನಿ.ನಿ.: ಸ.ಸಂ-1:ಪ.ಫ:2014-15: 143 ದಿನಾಂಕ: -5 MAY 2014

ಗೆ,

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್,
ನಂ.2 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಿಭಾಗ,
ಬಿ.ಆರ್. ಪ್ರಾಜೆಕ್ಟ್.

ಮಾನ್ಯರೇ,

ವಿಷಯ:- ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಕಾಮಗಾರಿಗೆ ಗುಣನಿಯಂತ್ರಣಾ ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳನ್ನು ಮೇಲು ರುಜು ಮಾಡುವ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ:- 1. ಸ.ಕಾ.ಇಂ. ಗು.ನಿ. ಉ.ವಿ. ಭದ್ರಾವತಿ ಇವರ ಪತ್ರ ಸಂ. 44 ದಿ. 28-04-2014

ಮೇಲಿನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಉಲ್ಲೇಖಿತ ಪತ್ರದ ಅನುಸಾರ, ಸಹಾಯಕ ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ, ಭದ್ರಾವತಿ ಇವರು ಸಲ್ಲಿಸಿರುವ ಈ ಕೆಳಕಂಡ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಕಾಮಗಾರಿಗೆ ಸಂಬಂಧಿಸಿದ 0.760ಕಿ.ಮೀ.ನಲ್ಲಿ ಬರುವ SP/CTC ಯ ತಳಪಾಯದ ಮಣ್ಣಿಗೆ ಎಸ್.ಬಿ.ಸಿ. ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳನ್ನು ಮೇಲು ರುಜು ಮಾಡಿ ತಮಗೆ ಕಳುಹಿಸಲಾಗಿದೆ.

ತಮ್ಮ ವಿಶ್ವಾಸಿ,
ಸಹಿ/-
ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

12/5/14

1. ಪ್ರತಿಯನ್ನು ಅಡಕಗಳೊಂದಿಗೆ ಸಹಾಯಕ ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್, ನಂ.3 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ಉಪವಿಭಾಗ, ಬಿ.ಆರ್.ಪ್ರಾಜೆಕ್ಟ್ ಇವರಿಗೆ ರವಾನಿಸಲಾಗಿದೆ.
2. ಪ್ರತಿಯನ್ನು ಅಡಕಗಳೊಂದಿಗೆ ಸಹಾಯಕ ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ, ಭದ್ರಾವತಿ ಇವರಿಗೆ ಮಾಹಿತಿಗಾಗಿ ರವಾನಿಸಲಾಗಿದೆ.

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜನಿಯರ್,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

68
12/5/14

NATIONAL EDUCATION SOCIETY (R)

Jawaharlal Nehru National College of Engineering

(Affiliated to Visvesvaraya Technological University & Recognised by AICTE & Accredited by NBA)

DEPARTMENT OF CIVIL ENGINEERING

SHIMOGA

Ref. No. : JNNCE/CE

16/2013-14

To,

M/s R N S Infrastructure Limited,
Naveen Complex, M G Road
Bangalore

Sir

Sub: - Testing of permeability of Soils Samples

Ref: Y/Letter/No /AS/RNSIL/UBP/2008/7/04 dated 21-10-2013

Project: EPC contract for lifting of 21.5 TMC of water from Bhadra Reservoir to delivery chamber near proposed tunnel at Ajjampura for Upper Bhadra Project Package -II

Sl.No	Density kN/m ^{3}	Permeability m/s
1	18.20	2.23×10^{-7}

Note: Sample supplied by the client, Density furnished by client

Lab Instructor   Staff-in-charge   Coordinator   Principal

E-mail : jnnce@sancharnet.in   Website: www.jnnce.ac.in

NATIONAL EDUCATION SOCIETY (R)

Jawaharlal Nehru National College of Engineering

Ref. No. : JNNCE/CE 1559 /13-14

To,

M/s R N S Infrastructure Limited,
Naveen Complex, M G Road
Bangalore

Sir

Sub; - Testing of Shear Parameters and permeability of Soils Samples

Ref: Y/Letter/No /AS/RNSIL/UBP/2006/7/05 dated 21-10-2013

Project: EPC contract for lifting of 21.5 TMC of water from Bhadra Reservoir to delivery chamber near proposed tunnel at Ajjampura for Upper Bhadra Project Package -II

Sl. No	Location	Density kN/m^3	Cohesion kN/m^3	Angle of Internal friction	Permeability m/s
1	35710 3m-6m	19.00	135	26	$1.05x10^{-4}$
2	34725 (S-3) 2m	19.00	103	34	$8.71x10^{-4}$
3	34980 (0GL) 2m	19.00	128	27	$1.55x10^{-5}$
4	34850 (0GL) 1.5m	19.00	105	35	[illegible]
5	34725 (0G2) 2m	19.00	138	26	[illegible]
6	34725 (S-2) 2m	19.00	106	34	$5.36x10^{-4}$
7	34650 1.5m	19,00	110	32	$2.14x10^{-4}$
8		19.00	135	28	$6.41x10^{-5}$
9	35170 (S-2) 3-6m	19.00	100	36	$2.52x10^{-4}$
10	35110 1.5m	19.00	136	30	[illegible]

Note: Sample supplied by the client, Density furnished by client

Lab instructor Staff-in-charge Coordinator Principal

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ
(ಕರ್ನಾಟಕ ಸರಕಾರದ ಉದ್ಯಮ)

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ,
ನೋಂದಾಯಿತ ಕಛೇರಿ, 4ನೇ ಮಹಡಿ, ಕಾಫಿ ಮಂಡಳಿ ಕಟ್ಟಡ, ನಂ.1
ಡಾ: ಬಿ.ಆರ್. ಅಂಬೇಡ್ಕರ್ ವೀಧಿ, ಬೆಂಗಳೂರು-560 001
CIN No. U85110KA1998SGC024503
Ph: 080-22283074-78 Fax: 080-22386015
e-mail: knnl@knnlindia.com
Website: www.knnlindia.com

ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್‌ರವರ ಕಛೇರಿ,
ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ,
ತುಂಗಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ,
ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ಸಾಗರ ರಸ್ತೆ, ಶಿವಮೊಗ್ಗ-577 201.
e-mail: eeqcdnsmg@gmail.com
Ph: 08182-255434

ನಂ.ಕಾಇಂ:ಗುನಿವಿಶಿ:ತುಂಮೇಯೋ:ಕ.ನೀ.ನಿ.ನಿ.: ಸ.ಇಂ-1:ಪ.ಪ್ರ:2014-15: 254 ದಿನಾಂಕ: 15 OCT 2014

ಗೆ,
ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್,
ನಂ.2 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ವಿಭಾಗ,
ಬಿ.ಆರ್. ಪ್ರಾಜೆಕ್ಟ್

ಮಾನ್ಯರೇ,

ವಿಷಯ:-ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ ಪ್ಯಾಕೇಜ್-2 ಕಾಮಗಾರಿಯ ಗುಣನಿಯಂತ್ರಣ ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳಿಗೆ ಮೇಲು ರುಜು ಮಾಡುವ ಬಗ್ಗೆ.
ಉಲ್ಲೇಖ:-1. ಸ.ಕಾ.ಇಂ, ಗು.ನಿ. ಉ.ವಿ. ಭದ್ರಾವತಿ ಇವರ ಪತ್ರ ಸಂ. 236 ದಿ. 17-9-2014

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ಮೇಲಿನ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, ಉಲ್ಲೇಖ ಪತ್ರದ ಅನುಸಾರ, ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ, ಭದ್ರಾವತಿ ಇವರು ಸಲ್ಲಿಸಿರುವ ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ, ಪ್ಯಾಕೇಜ್-2 ಕಾಮಗಾರಿಗೆ ಸಂಬಂಧಿಸಿದ ಮಣ್ಣಿನ ಮಾದರಿಗಳ ಈ ಕೆಳಗೆ ನಮೂದಿಸಿರುವ ಪರೀಕ್ಷಾ ಫಲಿತಾಂಶಗಳನ್ನು ಮೇಲು ರುಜು ಮಾಡಿ ತಮಗೆ ಕಳುಹಿಸಲಾಗಿದೆ.

1) ಯಾಂತ್ರಿಕ ವಿಶ್ಲೇಷಣೆ.
2) ಅಟ್ಟರ್ ಬರ್ಗ್ಸ್ ಲಿಮಿಟ್ಸ್
3) ಎಂ.ಡಿ.ಡಿ. & ಓ.ಎಮ್.ಸಿ.
4) ಮಣ್ಣಿನ ವರ್ಗೀಕರಣ
5) cohesion & angle of internal friction.

ತಮ್ಮ ವಿಶ್ವಾಸಿ,
ಸಹಿ/-
ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

1. ಪ್ರತಿಯನ್ನು ಅಡಕಗಳೊಂದಿಗೆ ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್, ನಂ.4 ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನಾ ಉಪವಿಭಾಗ, ತರೀಕೆರೆ ಇವರಿಗೆ ರವಾನಿಸಲಾಗಿದೆ.
2. ಪ್ರತಿಯನ್ನು ಅಡಕಗಳೊಂದಿಗೆ ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ, ಭದ್ರಾವತಿ ಇವರಿಗೆ ಮಾಹಿತಿಗಾಗಿ ರವಾನಿಸಲಾಗಿದೆ.

ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್,
ಕ.ನೀ.ನಿ.ನಿ. ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ,
ತುಂ.ಮೇ.ಯೋ. ಶಿವಮೊಗ್ಗ.

23

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work:- Upper Bhadra Project (Package-2) Pump House-2 (Excavated soil)

Ref: Assistant Executive Engineer, UBP.No.4, Sub-Division, Tarikere

Collected date:28.08.2014

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4)1985			Attarburg limits in % IS 2720 (Part-5)1985			Procter density tests IS 2720 (Part-8)1985		Soil classification	Cohesion (Kg/Sq cm)	Angle of repose (degrees)	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)				
1	Sample-A @ Ch:35.850 KM	40.87	35.83	23.80	...	NP	....	2.19	6.50	SM	0.580	35	Not suitable for pervious casing as per IS 8826-1978
2	Sample-B @ Ch:35.880 KM	34.83	45.24	19.93	...	NP	....	2.20	7.00	SM	0.635	32	
3	Sample-C@ Ch:35.940 KM	39.42	40.10	20.48	...	NP	....	2.14	8.90	SM	0.613	32	
4	Sample-D @ Ch:36.000 KM	49.40	32.31	18.39	...	NP	....	2.11	8.30	SM	0.604	36	
5	Sample-E @ Ch:36.025KM	27.28	43.90	28.82	...	NP	....	2.16	7.60	SM	0.536	35	
6	Sample-F @ Ch:36.075 KM	35.82	36.61	27.57	...	NP	....	2.22	6.90	SM	0.550	33	
7	Sample-G @ Ch:36.110 KM	46.90	33.41	19.69	...	NP	....	2.20	6.60	SM	0.606	35	
8	Sample-H @ Ch:36.150 KM	38.69	37.50	23.81	...	NP	....	2.18	7.30	SM	0.552	35	

Assistant Engineer
Bhadravathi

Assistant Executive Engineer,
KNNL, Quality Control Sub-Division,
Bhadravathi

Executive Engineer,
KNNL, Quality Control Division,
Shimoga

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ
(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್ ರವರ ಕಛೇರಿ
ಕ.ನೀ.ನಿ.ನಿ ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ
[illegible] ಕ್ಯಾಂಪ್, ಭದ್ರಾವತಿ

ಸಂ/ಸ.ಕಾ.ಇ/ಕ.ನೀ.ನಿ.ನಿ/ಗು.ನಿ.ಉ.ವಿ/[illegible]/2014-15/ 32 ದಿನಾಂಕ-24/04/2014

26-04-14

ಇವರಿಗೆ,
ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು
ಗುಣನಿಯಂತ್ರಣ ವಿಭಾಗ, ಕ.ನೀ.ನಿ.ನಿ
ಶಿವಮೊಗ್ಗ.

ಮಾನ್ಯರೆ,

ವಿಷಯ : [illegible] ಕಿ.ಮೀ ನಲ್ಲಿ ಬರುವ [illegible] ಎಸ್.ಬಿ.ಸಿ ಪರೀಕ್ಷೆ ಬಗ್ಗೆ :-
ಉಲ್ಲೇಖ : [illegible] ರವರ ಪತ್ರ ಸಂಖ್ಯೆ [illegible]

ಮೇಲ್ಕಂಡ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಉಲ್ಲೇಖಿತ ಪತ್ರದಲ್ಲಿ ಕೋರಿರುವ [illegible] ಕಿ.ಮೀ ನಲ್ಲಿ ಬರುವ [illegible] ತಳಪಾಯದ ಮಣ್ಣಿಗೆ ಎಸ್.ಬಿ.ಸಿ. ಪರೀಕ್ಷೆಯನ್ನು ಮಾಡಲಾಗಿ ಫಲಿತಾಂಶವನ್ನು ಲಗತ್ತಿಸಿದ ಪ್ರಪತ್ರದಲ್ಲಿ ನಮೂದಿಸಿ ತಮ್ಮ ಅನುಮೋದನೆಗಾಗಿ ಸಲ್ಲಿಸಲಾಗಿದೆ.

ತಮ್ಮ ವಿಶ್ವಾಸಿ,

ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಅಭಿಯಂತರರು
ಕ.ನೀ.ನಿ.ನಿ, ಗುಣ ನಿಯಂತ್ರಣ ಉಪ ವಿಭಾಗ,
[illegible] ಕ್ಯಾಂಪ್, ಭದ್ರಾವತಿ-577 30[illegible]

UBP: CTC @ Ch.26.080 km returning wall R/S

Chamber pressure Kg/cm²	Proving ring reading	Difference	Strain gauge reading	Strain=col.4 *0.002/2.375	corrected area=1.767/(1-col 5)	Load = 0.334* col 4	stress lbs/in²	stress Kg/cm² = Col 8 * 0.0703
1	2	3	4	5.000	6	7	8	9
0.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	16	16	50	0.031	1.823	5.344	2.932	0.206
	23	23	100	0.061	1.882	7.682	4.082	0.287
	33	33	150	0.092	1.945	11.022	5.666	0.398
	55	55	200	0.122	2.013	18.370	9.126	0.642
	59	59	250	0.153	2.085	19.706	9.450	0.664
	64	64	300	0.183	2.163	21.376	9.881	0.695
	68	68	350	0.214	2.247	22.712	10.106	0.710
	67	67	400	0.244	2.338	22.378	9.571	0.673
								0.642

1 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	26	26	50	0.031	1.823	8.684	4.764	0.335
	37	37	100	0.061	1.882	12.358	6.567	0.462
	53	53	150	0.092	1.945	17.702	9.100	0.640
	72	72	200	0.122	2.013	24.048	11.947	0.840
	83	83	250	0.153	2.085	27.722	13.294	0.935
	99	99	300	0.183	2.163	33.066	15.285	1.075
	97	97	350	0.214	2.247	32.398	14.416	1.013
	100	100	400	0.244	2.338	33.400	14.285	1.004
	106	106	450	0.275	2.437	35.404	14.530	1.021
	105	105	500	0.305	2.544	35.070	13.787	0.969
								1.075

1.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	41	41	50	0.031	1.823	13.694	7.513	0.528
	66	66	100	0.061	1.882	22.044	11.714	0.823
	85	85	150	0.092	1.945	28.390	14.596	1.026
	98	98	200	0.122	2.013	32.732	16.262	1.143
	111	111	250	0.153	2.085	37.074	17.778	1.250
	114	114	300	0.183	2.163	38.076	17.601	1.237
	137	137	350	0.214	2.247	45.758	20.361	1.431
	140	140	400	0.244	2.338	46.760	19.999	1.406
	143	143	450	0.275	2.437	47.762	19.602	1.378
	141	141	500	0.305	2.544	47.094	18.514	1.302
								1.431

CALCULATION OF " C " & " ϕ" (ANALYTICAL METHOD)

Specimen	Dev Str $(\sigma_1-\sigma_3)$	Nor Str σ_1	Lab stress σ_3	$(\sigma_3)^2$	$\sigma_1 \times \sigma_3$	$\sigma_1 + \sigma_3$
1	0.642	1.141686	0.5	0.250	0.570793	1.641686
2	1.074	2.074516	1	1.000	2.074516	3.074516
3	1.431	2.931269	1.5	2.250	4.397054	4.431269
Σ		6.147471	3	3.500	7.042363	9.147471
M		2.049	1.000	1.167	2.347	3.049

$\Sigma(\sigma_1 \times \sigma_3)$	7.042363	
$M\sigma_1 \times \Sigma\sigma_3$	6.147471	
Difference	0.894892	
$\Sigma(\sigma_3)^2$	3.5	
$M\sigma_3 \times \Sigma\sigma_3$	3	
Difference	0.5	
r^2	1.789784	
r	1.337828	
$2r$	2.675656	
$2Cr = M\sigma_1 - r^2 M\sigma_3$		0.259373
C	**0.60694**	
Tan ϕ	0.295174	
ϕ	**16.4452**	

UBP CTC @ Ch.26.080 km ABUTMENT R/S

SAFE BEARING CAPACITIES OF SOILS

c	0.13	Kg/CM2
Φ	16.3	Degrees
γ_{wet}	2.10	gm/cc
γ_{sub}	2.10	
L	5700	cm
B	2000	cm
D	5300	cm

local shear failure

0.66tanΦ	0.195
Φ'	11.031
SQ.Root NΦ	1.334
q	11.130

DEPTH FACTOR

d_c	1.707
$d_q=d_\gamma$	1.000

SHAPE FACTOR

S_c	1.0701754	(For Rectangular)
S_q	1.0701754	
S_γ	0.8596491	

N_c	8.80
N_q	2.770
N_γ	1.5[illegible]5

i_c	1
i_q	1
i_γ	1
W	1

q_d = 2/3 (C NcSc dc ic) + q(Nq -1) Sq dq iq + 1/2 B γ_{sub} Nr Sγdγ iγ W

P	1.408	
Q	21.080	
R	2.735	
q'_c	25.225	
UBC	252.252	T/M^2
SBC	84.084	T/M^2

UBP: CTC @ Ch.26.080 km ABUTMENT L/S

Chamber pressure Kg/cm^2	Proving ring reading	Difference	Strain guage reading	Strain=col.4 *0.002/ 3.276	corrected area=1.767/(1-col 5)	Load = 0.334* col 3	stress lbs/in^2	stress Kg/cm^2 =Col 8 * 0.0703
1	2	3	4	5.000	6	7	8	9
0.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	19	19	50	0.031	1.823	6.346	3.482	0.245
	38	38	100	0.061	1.882	12.692	6.744	0.474
	55	55	150	0.092	1.945	18.370	9.444	0.664
	68	68	200	0.122	2.013	22.712	11.284	0.793
	80	80	250	0.153	2.085	26.720	12.813	0.901
	93	93	300	0.183	2.163	31.062	14.358	1.009
	103	103	350	0.214	2.247	34.402	15.308	1.076
	111	111	400	0.244	2.338	37.074	15.856	1.115
	118	118	450	0.275	2.437	39.412	16.175	1.137
	117	117	500	0.305	2.544	39.078	15.363	1.080
								0.793

1 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	26	26	50	0.031	1.823	8.684	4.764	0.335
	39	39	100	0.061	1.882	13.026	6.922	0.487
	54	54	150	0.092	1.945	18.036	9.272	0.652
	75	75	200	0.122	2.013	25.050	12.445	0.875
	88	88	250	0.153	2.085	29.392	14.094	0.991
	105	105	300	0.183	2.163	35.070	16.211	1.140
	118	118	350	0.214	2.247	39.412	17.537	1.233
	129	129	400	0.244	2.338	43.086	18.427	1.295
	134	134	450	0.275	2.437	44.756	18.368	1.291
	145	145	500	0.305	2.544	48.430	19.039	1.338
	143	143	550	0.336	2.661	47.762	17.951	1.262
								1.295

1.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	35	35	50	0.031	1.823	11.690	6.414	0.451
	58	58	100	0.061	1.882	19.372	10.294	0.724
	78	78	150	0.092	1.945	26.052	13.393	0.942
	97	97	200	0.122	2.013	32.398	16.096	1.132
	118	118	250	0.153	2.085	39.412	18.899	1.329
	137	137	300	0.183	2.163	45.758	21.152	1.487
	147	147	350	0.214	2.247	49.098	21.847	1.536
	150	150	400	0.244	2.338	50.100	21.427	1.506
	151	151	450	0.275	2.437	50.434	20.699	1.455
	152	152	500	0.305	2.544	50.768	19.956	1.403
	156	156	550	0.336	2.661	52.104	19.583	1.377
	163	163	600	0.366	2.789	54.442	19.521	1.372
	167	167	650	0.397	2.930	55.778	19.036	1.338
	165	165	700	0.427	3.086	55.110	17.856	1.255
								1.536

CALCULATION OF " C " & " ϕ " (ANALYTICAL METHOD)

Specimen	Deviator	Nor Str	Lat stress			
	$(\sigma_1-\sigma_3)$	σ_1	σ_3	$(\sigma_3)^2$	$\sigma_1 X \sigma_3$	$\sigma_1 + \sigma_3$
1	0.793	1.293233	0.5	0.250	0.646616	1.793233
2	1.286	2.285446	1	1.000	2.285445	3.285446
3	1.535	3.036849	1.5	2.250	4.553773	4.536849
Σ		6.624526	3	3.500	7.496834	9.624526
M		2.208	1.000	1.167	2.499	3.208

$\Sigma(\sigma_1 X \sigma_3)$	7.496834	
$M \sigma_1 X \Sigma \sigma_3$	6.624526	
Difference	0.871308	
$\Sigma(\sigma_3)^2$	3.5	
$M\sigma_3 X \Sigma \sigma_3$	3	
Difference	0.5	
r^2	1.742616	
r	1.320082	
2r	2.640164	
$2Cr = M \sigma_1 - r^2 M\sigma_3$		0.465550
C	**0.17634**	
Tan ϕ	0.281277	
ϕ	**15.71**	

UBP CTC @ Ch.26.080 km ABUTMENT U/S

SAFE BEARING CAPACITIES OF SOILS

c	0.17	Kg/CM2
Φ	15.71	Degrees
γ_{wet}	2.11	gm/cc
γ_{sub}	2.11	
L	5700	cm
B	2000	cm
D	5300	cm

local shear failure

0.66tanΦ	0.188
Φ'	10.621
SQ.Root NΦ	1.320
q	11.163

DEPTH FACTOR

d_c	1.700
$d_q = d_\gamma$	1.000

SHAPE FACTOR

S_c	1.0701754	(For Rectangular)
S_q	1.0701754	
S_γ	0.8596491	

N_c	8.677
N_q	2.653
N_γ	1.398

i_c	1
i_q	1
i_γ	1
w	1

$q_d = 2/3\ (C\ Nc Sc\ dc\ ic) + q(Nq - 1)\ Sq\ dq\ iq + 1/2\ B\ \gamma_{sub}\ N\gamma\ S\gamma d\gamma\ i\gamma\ W$

P	1.789	
Q	19.783	
R	2.535	
q_d	24.107	
UBC	241.072	T/M²
SBC	80.357	T/M²

I/C

577 301

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UBP: CTC @ Ch.26.060 km returning wall L/S

Chamber pressure Kg/cm²	Proving ring reading	Difference	Strain guage reading	Strain=col.4 *0.002/ 3.275	corrected Area=1.767/(1-col 5)	Load = 0.334* col 3	stress lbs/in²	stress Kg/cm² = Col 8 * 0.0703
1	2	3	4	5.000	6	7	8	9
0.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	17	17	50	0.031	1.823	5.678	3.115	0.219
	24	24	100	0.061	1.882	8.016	4.259	0.299
	35	35	150	0.092	1.945	11.690	6.010	0.422
	52	52	200	0.122	2.013	17.368	8.629	0.607
	54	54	250	0.153	2.085	18.036	8.649	0.608
	62	62	300	0.183	2.163	20.708	9.572	0.673
	69	69	350	0.214	2.247	23.046	10.255	0.721
	68	68	400	0.244	2.338	22.712	9.714	0.683
								0.607

1 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	24	24	50	0.031	1.823	8.016	4.398	0.309
	36	36	100	0.061	1.882	12.024	6.389	0.449
	52	52	150	0.092	1.945	17.368	8.929	0.628
	71	71	200	0.122	2.013	23.714	11.781	0.828
	84	84	250	0.153	2.085	28.056	13.454	0.946
	95	95	300	0.183	2.163	31.730	14.667	1.031
	98	98	350	0.214	2.247	32.732	14.565	1.024
	102	102	400	0.244	2.338	34.068	14.570	1.024
	105	105	450	0.275	2.437	35.070	14.393	1.012
	104	104	500	0.305	2.544	34.736	13.656	0.960
								1.031

1.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	44	44	50	0.031	1.823	14.696	8.063	0.567
	64	64	100	0.061	1.882	21.376	11.359	0.799
	87	87	150	0.092	1.945	29.058	14.938	1.050
	99	99	200	0.122	2.013	33.066	16.428	1.155
	110	110	250	0.153	2.085	36.740	17.618	1.239
	113	113	300	0.183	2.163	38.910	[illegible]	1.240
	131	131	350	0.214	2.247	43.754	19.469	1.369
	142	142	400	0.244	2.338	47.428	20.284	1.426
	143	143	450	0.275	2.437	47.762	19.602	1.378
	145	145	500	0.305	2.544	48.430	19.039	1.338
								1.426

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CALCULATION OF " C " & " ϕ" (ANALYTICAL METHOD)

Specimen	DevStr $(\sigma1-\sigma3)$	Nor Str σ_1	Lat stress σ_3	$(\sigma_3)^2$	$\sigma_1 X \sigma_3$	$\sigma_1 + \sigma_3$
1	0.607	1.10659	0.5	0.250	0.553295	1.60659
2	1.031	2.031101	1	1.000	2.031101	3.031101
3	1.426	2.925983	1.5	2.250	4.38899	4.425983
Σ		6.063684	3	3.500	6.973396	9.063684
M		2.021	1.000	1.167	2.324	3.021

$\Sigma(\sigma_1 X \sigma_3)$	6.973388	
$M\sigma_1 X \Sigma \sigma_3$	6.063684	
Difference	0.909702	
$\Sigma(\sigma_3)^2$	3.5	
$M\sigma_3 X \Sigma \sigma_3$	3	
Difference	0.5	
r^2	1.819403	
r	1.348853	
$2r$	2.697705	
$2Cr=M\sigma_1-r^2 M\sigma_3$		0.201625
C	**0.07481**	
Tan ϕ	0.303741	
ϕ	**16.8956**	

UBP: CTC @ Ch.26.080 km ABUTMENT U/S

SAFE BEARING CAPACITIES OF SOILS

c	0.17	Kg/CM2
Φ	15.71	Degrees
γ_{wet}	2.11	gm/cc
γ_{sub}	2.11	
L	5700	cm
B	2000	cm
D	5300	cm

local shear failure

0.66tanΦ	0.186
Φ'	10.621
SQ.Root NΦ	1.320
q	11.183

DEPTH FACTOR

d_c	1.700
$d_q = d_\gamma$	1.000

SHAPE FACTOR

S_c	1.0701754	(For Rectangular)
S_q	1.0701754	
S_γ	0.8596491	

N_c	8.677
N_q	2.653
N_γ	1.398

i_c	1
i_q	1
i_γ	1
w	1

$q_u = 2/3\ (C\ Nc\ Sc\ dc\ ic) + q(Nq - 1)\ Sq\ dq\ Iq + 1/2\ B\ \gamma_{sub}\ N\gamma\ S\gamma\ d\gamma\ i\gamma\ W$

P	1.785	
Q	19.753	
R	2.536	
q_u	24.[illegible]07	
UBC	241.072	T/M²
SBC	80.357	T/M²

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UBP: CTC @ Ch.26.080 km ABUTMENT R/S

Chamber pressure Kg/cm²	Proving ring reading	Difference	Strain guage reading	Strain=col.4*(0.002/3.275)	corrected prus=1.767+col 5	Load=3.324*col 3	stress lb/in²	stress Kg/cm² = Col 8*0.0703
1	2	3	4	5.000	6	7	8	9
0.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	15	15	50	0.031	1.823	5.010	2.740	0.193
	29	29	100	0.061	1.882	9.580	5.147	0.362
	51	51	150	0.092	1.945	17.034	8.757	0.616
	61	61	200	0.122	2.013	20.374	10.122	0.712
	74	74	250	0.153	2.085	24.718	11.852	0.833
	95	95	300	0.183	2.153	31.730	14.657	1.03
	102	102	350	0.214	2.247	34.068	15.159	1.066
	112	112	400	0.244	2.338	37.408	15.990	1.125
	115	115	450	0.275	2.437	38.410	15.764	1.108
	114	114	500	0.305	2.544	38.076	14.969	1.052
								0.712
1 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	32	32	50	0.031	1.823	10.080	5.564	0.412
	40	40	100	0.061	1.882	13.360	7.099	0.499
	58	58	150	0.092	1.945	19.372	9.959	0.700
	72	72	200	0.122	2.013	24.048	11.947	0.840
	85	85	250	0.153	2.086	28.390	13.614	0.957
	101	101	300	0.183	2.163	33.734	15.594	1.098
	115	115	350	0.214	2.247	38.410	17.091	1.202
	122	122	400	0.244	2.338	40.748	17.427	1.225
	130	130	450	0.275	2.437	43.420	17.820	1.253
	139	139	500	0.305	2.544	46.426	18.251	1.283
	138	138	550	0.336	2.681	46.092	17.324	1.218
								1.225
1.5 Kg	0	0	0	0.000	1.767	0.000	0.000	0.000
	42	42	50	0.031	1.823	[illegible]	7.690	[illegible]
	60	60	100	0.061	1.882	20.040	10.549	[illegible]
	79	78	150	0.092	1.945	26.386	[illegible]	[illegible]
	95	95	200	0.122	2.013	31.730	15.764	1.108
	116	116	250	0.153	2.085	38.744	18.579	[illegible]
	129	129	300	0.183	2.163	43.086	19.916	1.400
	139	138	350	0.214	2.247	46.092	20.509	1.442
	149	148	400	0.244	2.338	49.432	21.141	1.486
	155	155	450	0.275	2.437	51.770	21.247	1.494
	156	158	500	0.305	2.544	52.772	20.746	1.458
	162	162	550	0.336	2.681	54.108	20.233	1.430
	163	163	600	0.366	2.789	54.442	19.521	1.372
	162	162	650	0.397	2.930	54.108	18.466	1.298
	162	162	700	0.427	3.086	54.108	17.531	1.252
								1.494

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CALCULATION OF " C " & " φ" (ANALYTICAL METHOD)

Specimen	DevStr	NorStr	Lat-stress			
	$(\sigma_1-\sigma_3)$	σ_1	σ_3	$(\sigma_3)^2$	$\sigma_1 X \sigma_3$	$\sigma_1 + \sigma_3$
1	0.712	1.211677	0.5	0.250	0.605739	1.711677
2	1.225	2.225149	1	1.000	2.225149	3.225149
3	1.494	2.993551	1.5	2.250	4.490477	4.493551
Σ		6.430377	3	3.600	7.321415	9.430377
M		2.143	1.000	1.167	2.440	3.143

$\Sigma(\sigma_1 X \sigma_3)$	7.321415
$M\sigma_1 X \Sigma\sigma_3$	6.430377
Difference	0.891037
$\Sigma(\sigma_3)^2$	3.6
$M\sigma_3 X \Sigma\sigma_3$	3
Difference	0.5
r^2	1.782075
r	1.334944
$2r$	2.669888
$2C = M\sigma_1 - r^2 M\sigma_3$	0.381384
C	**0.13636**
Tan φ	0.292624
φ	**16.3266**

UBP: CTC @ Ch.26.080 km returning wall R/S

SAFE BEARING CAPACITIES OF SOILS

c	0.09	Kg/CM2
Φ	15	Degrees
γ_{wet}	2.09	gm/cc
γ_{sub}	2.09	
L	3500	cm
B	2000	cm
D	4300	cm

local shear failure

0.66tanΦ	0.191
Φ'	10.822
SQ.Root NΦ	1.327
q	8.987

DEPTH FACTOR

d_c	1.571
$d_q=d_\gamma$	1.000

SHAPE FACTOR

S_c	1.1142857	(For Rectangular)
S_q	1.1142857	
S_γ	0.7714286	

N_c	8.782
N_q	2.712
N_γ	1.455

i_c	1
i_q	1
i_γ	1
W	1

q'_d = 2/3 (C NcSc dc ic) + q(Nq -1) Sq dq iq + 1/2 B γ_{sub} Nr Sγdγ Iγ W

P	0.922	
Q	17.144	
R	2.346	
q'_d	20.412	
UBC	204.122	T/M²
SBC	68.041	T/M²

R. Sumaly

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Jawaharlal Nehru National College of Engineering
Affiliated to Visvesvaraya Technological University

Ref No : JNNCE/CE
2013-14

To,

M/s R N S Infrastructure Limited
Naveen Complex, M G Road.
Bangalore

Sir

Sub: - Testing of permeability of Soils Samples

Ref: Y/Letter/No /AS/RNSIL/UBP/2008/7/04 dated 21-10-2013

Project: EPC contract for lifting of 21.5 TMC of water from Bhadra Reservoir to delivery chamber near proposed tunnel at Ajjampura for Upper Bhadra Project Package -II

Sl.No	Density kN/m³	Permeability m/s
1	18.20	2.23x10

Note: Sample supplied by the client, Density furnished by client

Lab Instructor Staff-in-charge Coordinator Principal

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NATIONAL EDUCATION SOCIETY (R)

Jawaharlal Nehru National College of Engineering

(Affiliated to Visvesvaraya Technological University & Recognised by AICTE New Delhi)

Ref. No. : JNNCE/CE 1559 /13-14

To,

M/s R N S Infrastructure Limited,
Naveen Complex, M G Road,
Bangalore

Sir

Sub: - Testing of Shear Parameters and permeability of Soils Samples

Ref: Y/Letter/No /AS/RNSIL/UBP/2008/7/05 dated 21-10-2013

Project: EPC contract for lifting of 21.5 TMC of water from Bhadra Reservoir to delivery chamber near proposed tunnel at Ajjampura for Upper Bhadra Project **Package -II**

Sl. No	Location	Density kN/m³	Cohesion kN/m³	Angle of internal friction	Permeability m/s
1	35710 3m-6m	19.00	135	26	1.05×10^{-5}
2	34725 (S-3) 2m	19.00	103	34	6.71×10^{-4}
3	34980 (0GL) 2m	19.00	128	27	1.85×10^{-5}
4	34650 (0GL) 1.5m	19.00	105	33	3.24×10^{-4}
5	34725 (0G2) 2m	19.00	138	26	7.21×10^{-5}
6	34725 (S-2) 2m	19.00	108	34	5.36×10^{-4}
7	34650 1.5m	19.00	110	32	2.14×10^{-4}
8		19.00	135	28	6.41×10^{-5}
9	35170 (S-2) 3-3m	19.00	100	36	8.52×10^{-3}
10	35110 1.5m	19.00	136	30	5.33×10^{-5}

Note: Sample supplied by the client, Density furnished by client

Lab Instructor Staff-in-charge Coordinator Principal

KARNATAKA NEERAVARI NIGAM LIMITED
(GOVERNMENT OF KARNATAKA ENTERPRISE)

Test Reports of Materials for concrete

Name of Work: Upper Bhadra Project Package- I

Sl.No	Parameter	Observed Values	Limits
	Fine Aggregates		
1	Specific Gravity	2.38 g/cc	
	Coarse Aggregates		
2	Specific Gravity	2.66 g/cc	
3	Water Absorption	1.15%	< 2%
4	Impact value	25.03%	< 30%
5	Flakiness Index	23.03	< 30%
6	Elongation Index	36.02	
7	Combined Flakiness/ Elongation	29.525	< 35%

Section Officer
No.3 QC Sub Division
Gajanur

Assistant Executive Engineer
No.3 QC Sub Division
Gajanur

"ಮೇಲಂರುಜು"

ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್
ಕ.ನೀ.ನಿ.ನಿ., ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ
ಗುಣ ನಿಯಂತ್ರಣ ವಿಭಾಗ
ಶಿವಮೊಗ್ಗ - 577201.

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Cement Test Results

Name of Division : U.B.P Division No.9, Muttinakoppa
Name of Sub-Division : U.B.P Sub-Division No.9, Muttinakoppa
Name of Contractor : M/s SEW Infostructures L-Jothi (JV)
Tender Agreement No :07/2008-09 dated:04.11.2008 Approximate collected quantity Bags

Name of factory & brand: ACC
Grade of Cement: O.P.C 43 grade
Sample testing date:26.09.2016
Final testing date:04.10.2016

SL No	Name of work	Standard Consistency %	Fineness %`	Setting Time in Minutes		Soundness M.M	Compressive strength as per IS 4031 in N/mtr						Remarks
				Starting	Ending		3 days		7 days		28 days		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	IS-269	1	< 10	> 30	< 600	< 10	Breaking load	> 16	Breaking load	> 22	Breaking load	> 33	IS-269
	IS-8112							> 23		> 33		> 43	IS-8112
	IS-12269							> 27		> 37		> 53	OPC-53 grade
1	Upper Bhadra project Package-01	28%	2%	100	370	--	--	--	167	33.40	--	--	Test results are applicable to the samples received in the Laboratory
									173	34.60			
									173	34.60			
									Average	34.20			
		28%	3%	90	365	--	--	--	172	34.40	--	--	
									173	34.60			
									165	33.00			
									Average	34.00			

Assistant Engineer

Assistant Executive Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Executive Engineer,
No.3, Quality Control Division,
UTP, Shimoga

Karnataka Neeravari Nigam Limited

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Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work : Upper Bhadra Project Package-1 (4825 to 4940 m)
Name of Sub-Division : U.B.P Sub-Division No.2, Muttinakoppa vide letter No & date:159/28.11.2016.
Collected date:28.11.2016

Dated :02.12.2016 to 06.12.2016

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4) 1985			Attarburg limis in % IS 2720 (Part-5) 1985			Procter density tests IS 2720 (Part-8) 1985		Soil Classification	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)		
1	Upper Bhadra Project Package-1 4825 to 4940 m @ Gravity canal	52.7	22.77	24.53	29.34	21.85	7.5	1.95	16.73	GC	Soil is suitable for embankment work

Assistant Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Assistant Executive Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Executive Engineer,
Quality Control Division,
UTP, Shimoga

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Mechanical sieve analysis & Atterburg Limit Test of Soil

Name of work : Upper Bhadra Project Package-1 (Intake canal)
Name of Sub-Division : U.B.P Sub-Division No.1, Muttinakoppa vide letter No & date:156/28.11.2016.
Collected date:28.11.2016

Dated :02.12.2016 to 05.12.2016

SL. No	Particulars of samples	MSA in % as per IS 2720 (Part-4) 1985			Attarburg limis in % IS 2720 (Part-5) 1985			Procter density tests IS 2720 (Part-8) 1985		Soil Classification	Remarks
		Gravel	Sand	Silt clay	L.L	P.L	P.I	Max dry density (G/CC)	OMC (%)		
1	Upper Bhadra Project Package-1 (Intake canal)	50.36	26.73	22.91	31.4	22.49	8.91	1.96	14.81	GC	Soil is suitable for embankment work

Assistant Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Assistant Executive Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Executive Engineer,
Quality Control Division,
UTP, Shimoga

Karnataka Neeravari Nigam Limited

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AGGREGATE IMPACT VALUE TEST

Name of Contractor RNSIL (JV)

Name of Division UBP, No.2, BRP

Sample Connected: Package-2 Structures & Lining Stockyard
Date of Sampling: 02.01.2016
Date of testing: 04.01.2016

Test No		1	2	3
Weight of cylindrical metal measure, in gms	W1	672	672	672
Weight of aggregates+cylindrical metal measure, in gms	W2	1045	1035	1050
Weight of aggregates, in gms	W2-W1	373	363	378
Weight of aggregates pasting 2.36 mm sieve after impact test, in gms	W3	90	95	80
Weight of aggregates retained on 2.36 mm sieve after impact test, in gms	W4	283	268	298
Percentage of Impact value, in%	W3/(W2-W1)X100	24.13	26.17	21.16
Average Impact value, in %			23.82	

Remarks: Max limit of Impact value of aggregate for concrete is 45%

Assistant Engineer,
Quality Control Sub-Division,
Bhadravthi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravthi

Executive Engineer,
Quality Control Division,
Shimoga

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

AGGREGATE IMPACT VALUE TEST

Name of Contractor RNSIL (JV)

Name of Division UBP, No.2, BRP

Package-2 Structures & Lining

Sample Connected Stockyard

Date of Sampling 02.01.2016

Date of testing 04.01.2016

Test No		1	2	3
Weight of cylindrical metal measure, in gms	W1	672	672	672
Weight of aggregates+cylindrical metal measure, in gms	W2	1039	1040	1049
Weight of aggregates, in gms	W2-W1	367	368	377
Weight of aggregates pasting 2.36 mm sieve after impact test, in gms	W3	94	90	99
Weight of aggregates retained on 2.36 mm sieve after impact test, in gms	W4	273	278	278
Percentage of Impact value, in%	W3/(W2-W1)X100	25.61	24.46	26.26
Average Impact value, in %			25.44	

Remarks: Max limit of Impact value of aggregate for concrete is 45%

Assistant Engineer,
Quality Control Sub-Division,
Bhadravthi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravthi

Executive Engineer,
Quality Control Division,
Shimoga

Karnataka Neeravari Nigam Limited

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Test results for coarse aggregate used for concrete

Name of Contractor RNSIL (JV) Name of Division UBP, No.2, BRP

Date of Sampling 02.01.2016
Date of testing 04.01.2016

Sample date of serviced 02.01.2016
Place of sample Stockyard near Batching plan

Name of work	Size of aggregate	Sieve size	Weight of aggregate retained on sieve	% of aggregate retained on sieve	Cumulative percentage	% of aggregate passing sieve	As IS 383 % of aggregate passing through the sieve 20 m.m and below aggregate (combined)	Remarks
Upper Bhadra Project-Package-2 Structures & lining	20 m & below	80	-	-	-	-	-	
		40	0.00	0.00	0.00	100.00	100.00	
		20	0.20	2.00	2.00	98.00	95-100	
		10	5.24	52.39	54.39	45.61	25.55	
		4.75	4.26	42.61	97.00	3.00	0-10	
Quantity of aggregate (approximate) Cum			0.30	3.00	100.00	-		
		Pan	10.00	100.00				

Assistant Engineer, Quality Control Sub-Division, Bhadravthi	Assistant Executive Engineer, Quality Control Sub-Division, Bhadravthi	Executive Engineer, Quality Control Division, Shimoga

Karnataka Neeravari Nigam Limited

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Test results for average aggregate used for concrete

Name of Contractor	RNSIL (JV)	Name of Division	UBP, No.2, BRP
		Date of testing	04.01.2016
Sample date of serviced	02.01.2016	Weight of sample	10
Place of sample	Stockyard near Batching plan		

Name of work	Size of aggregate	Sieve size	Weight of aggregate retained on sieve	% of aggregate retained on sieve	Cumulative percentage	% of aggregate passing sieve	As IS 383 % of aggregate passing through the sieve 20 m.m and below aggregate (combined)	Remarks
Upper Bhadra Project-Package-2 Structures & lining	20 m & below	80	-	-	-	-	-	
		40	0.00	0.00	0.00	100.00	100.00	
		20	0.25	2.50	2.50	97.50	95-100	
		10	5.91	59.10	61.60	[illegible]	25.55	
		4.75	3.59	35.90	97.50	3.00	0-10	
Quantity of aggregate (approximate)	Cum		0.25	2.50	100.00	2.50		
		Pan	10.00	100.00				

Assistant Engineer,
Quality Control Sub-Division,
Bhadravthi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravthi

Executive Engineer,
Quality Control Division,
Shimoga

Karnataka Neeravari Nigam Limited

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Sieve Analysis for Fine Aggregate

Name of Contractor RNSIL (JV) Name of Division UBP, No.2, BRP

Date of sample received Date of testing 04.01.2016

Place of sample collected 02.01.2016 Weight of sample 1000 gm

Stockyard near Batching plan

	% of inorganic materials					Sand passing through the IS sieve (%)										Remarks
	75 µ	Micro content	Clay lumps	Other materials	Total	10 mm	4.75 mm	2.36 mm	1.18 mm	600 µ	300 µ	150 µ	75 µ	Silt factor	Materials used for the work	
	Max 3%	Max 1%	Max 1%	Max 1%	Max 1%	-	100	90-100	70-100	40-100	5 to 70	0-15	IS:2116-1965	5% relaxation towards Zone-1 (Coarse) except particles of 600 µ		Sand shall be used only after sieving if pebbles are found.
	Max 3%	Max 1%	Max 1%	Max 1%	Max 5%	100 100 100	90-100 90-100 90-100	60-95 75-100 85.-100	30-100 55-100 75-100	15-34 35-59 60-79	5 to 70 8 to 30 12 to 40	0-10 0-10 0-10	Class-1 Class-2 Class-3			
(approximate quantities in cum)						100	91.80	82.60	60.50	38.20	15.80	2.50	Class-2			
							95.40	90.80	75.10	45.50	16.40	2.00				

Assistant Engineer,
Quality Control Sub-Division,
Bhadravthi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravthi

Executive Engineer,
Quality Control Division,
Shimoga

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprises)

Crushed Stone Sand Report

Name of Contractor RNSIL (JV)
Date of sample received
Place of sample collected 02.01.2016
Stockyard near Batching plan

Name of Division UBP, No.2, BRP

Weight of sample 1000 gm

SL. No	Date of test	Place where sand is used	Quantity of sand used	% of inorganic materials					Sand passing through the IS sieve (%)								Silt factor	Materials used for the work	Remarks
				75 µ	Micro content	Clay lumps	Other materials	Total	10 mm	4.75 mm	2.36 mm	1.18 mm	600 µ	300 µ	150 µ	75 µ			
Explanation		Cement mortar work IS 2116-1970		Max 3%	Max 1%	Max 1%	Max 1%	Max 1%	-	100	90-100	70-100	40-100	5 to 70	0-15	IS 2116-1965	5% relaxation towards Zone-1 (Coarse) except particles of 600 µ		Sand shall be used only after sieving if pebbles are found.
		Cement Concrete work IS 383.1970		Max 3%	Max 1%	Max 1%	Max 1%	Max 5%	100 100 100	90-100 90-100 90-100	60-95 75-100 85.-100	30-100 55-100 75-100	15-34 35-59 60-79	5 to 70 8 to 30 12 to 40	0-10 0-10 0-10	Class-1 Class-2 Class-3			
1	04.01.2016	Place of work execution	- (approximate quantities in cum)	-	-	-	-	-	← 100 →	92.50	82.60	59.80	45.50	18.30	2.00	← Class-2 →			
2	04.01.2016		-	-	-	-	-	-		95.50	80.80	61.20	41.80	15.50	3.00				
3			-	-	-	-	-	-											

Assistant Engineer,
Quality Control Sub-Division,
Bhadravthi

Assistant Executive Engineer,
Quality Control Sub-Division,
Bhadravthi

Executive Engineer,
Quality Control Division,
Shimoga

Karnataka Neeravari Nigam Limited

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Cement Test Results

Name of Contractor : RNSIL (JV) Sample of Cement: OPC Name of factory and Brand ACC43 GRADE

Sample testing date:02.01.2016 Final sample testing date:11.01.2016

SL No	Name of work	Standard Consistency %	Fineness %`	Setting Time in Minutes		Soundness M.M	Compressive strength as per IS 4031 in N/mtr						Remarks
				Starting	Ending		3 days		7 days		28 days		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
		1	< 10	> 30	< 600	< 10	Breaking load	> 160	Breaking load	> 220	Breaking load	> 330	OPC – 33 grade
		2	< 10	> 30	< 600	< 10		> 230		> 330		> 430	OPC – 43 grade
		3	< 10	> 30	< 600	< 10		> 270		> 370		> 530	OPC – 53grade
1	Upper Bhadra project Package-02 Structures & Lining	29%	7%	115	290	--	--	--	17000	340.00	--	--	Test results are applicable to the samples received in the Laboratory
									17500	350.00			
									17000	340.00			
									Average	343.33			
		-	-	-	-	-	-	-	-	-	--	--	

Assistant Engineer

Assistant Executive Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Executive Engineer,
No.3, Quality Control Division,
UTP, Shimoga

Karnataka Neeravari Nigam Limited

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Flakiness & Elongation Index

Name of Contractor	RNSIL (JV) Package-2 Structures & Lining	Sample Connected	Stockyard
		Date of Sampling	02.01.2016
Name of Division	UBP, No.2, BRP	Date of testing	04.01.2016

Sieve size in mm		Wt. of Aggregate taken (W1) gms	Wt. of Aggregate retained on thickness Gauge (W2) gms	Wt. of Aggregate passing through thickness gauge (W3) gms	Wt. of Aggregate on length gauge after retained on thickness gauge (W4) gms
Passing	Retained				
63	50				
50	40				
40	31.5				
31.5	25				
25	20	4461	3660	790	390
20	16	2339	1685	490	320
16	12.5	1300	1200	250	314
12.5	10	500	340	210	100
10	6.3	300	200	90	70
	Total	8900	7085	1830	1194

Remarks:

Flakiness Index (FI) = W3/W1x 100 = 20.56% (max limit is <25%)

Elongation Index (EI) = W4/W2x100 = 16.85% (max limit is <25%)

FI+EI = 37.41%

Assistant Engineer

Assistant Executive Engineer,
No.3, Quality Control Sub-Division,
UTP, Gajananur.

Executive Engineer,
No.3, Quality Control Division,
UTP, Shimoga

UPPER BHADRA PROJECT
PACKAGE - 2
FIELD DENSITY TEST - (CORE CUTTER METHOD)
IS: 2720 (Part 29) - 1975

Client: Karnataka Neeravari Nigam Ltd

Contractor : [illegible]

Representative Area : From ch. 37850 to ch. 39050

Date of Testing : 28/03/16

Description of Layer : Impervious Bed along 3rd Layer

Tested By :

TEST HOLE	1	2	3	4	5	6
Location of Test	38850	37890	37920	38960	37900	39040
Offset from C/L (m)						
DETERMINATION OF WET UNIT WEIGHT						
Wt. of core-cutter + Wet Sample (W₂) g	2944	2969	2953	2927	2994	2947
Wt. of core-cutter (W₁) g	920	920	920	920	920	920
Wt. of Wet soil (W₂ - W₁) (g)	2024	1949	1953	2027	2074	2027
Volume of core-cutter (Vc) cm³	1021	1021	1021	1021	1021	1021
Bulk Density γ_b = (W₂ - W₁)/Vc g/cm³	1.982	1.942	1.934	1.985	1.996	1.985
IN-SITU MOISTURE CONTENT (SPEED MOISTURE METER METHOD)						
Dial Gauge Reading (Dw)	17.00	18.50	18.80	12.50	14.80	15.60
Calibrated In-Situ Moisture Content (%)	15.70	18.49	15.31	15.18	14.62	14.18
DEGREE OF COMPACTION						
Lab. Optimum Moisture Content (%)	17.00	17.00	17.00	17.00	17.00	17.00
Lab Max. Dry Density (g/cm³) γ_{dmax}	1.73	1.73	1.73	1.73	1.73	1.73
In-situ Dry Density, γ_d = γ_b/(1+w/100) g/cm³	1.711	1.723	1.701	1.723	1.74	1.723
Degree of Compaction (%) = γ_d/γ_{dmax} × 100	98.90	99.60	97.18	98.67	98.91	98.67
Compaction Required (%)	98	98	98	98	98	98

Remarks :

Client

Contractor

"Extract"

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.2,
B.R. Project-577 115.

[illegible]
ಕ.ನೀ.ನಿ.ನಿ. [illegible]
[illegible] ಚಿಕ್ಕಮಗಳೂರು-577 301.

"ಉದ್ಧೃತ"

Assistant Executive Engineer
KNNL, UBP Sub-Division No. 5.
Tarikere.

ಸಹಾಯಕ ಕಾರ್ಯಪಾಲಕ ಇಂಜಿನಿಯರ್
ಕ.ನೀ.ನಿ.ನಿ. ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ
ಉಪ ವಿಭಾಗ ನಂ. 5 /
ತರೀಕೆರೆ - 577201.

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UPPER BHADRA PROJECT

PACKAGE- 3

FIELD DENSITY TEST - (SAND REPLACEMENT METHOD)

IS: 2720 (Part 28) - 1974

Client: Karnataka Neeravari Nigam Ltd

Contractor : RNSIL(JV)

Representative Area :From 37650 to ch. 37725

Description of Layer Bed filling 2nd layer (casing)

Unit Weight of sand, Ys: 1.290 g/cm3

Date of Testing : 29/03/16

Tested By :

Date of Calibration : 08/03/16

TEST HOLE	1	2	3	4	5	6
Location of Test	37660	37670	37690	37700	37710	37720
Depth of Hole, (mm)	150	150	150	150	150	150
Offset from C/L (m)						
DETERMINATION OF WET UNIT WEIGHT						
Wt. of Wet Sample from Hole, (g) W2	2031	1975	1965	2043	2165	2088
Wt. of Cylinder filled with Sand before Pouring, (g) W1	6400	6400	6400	6400	6400	6400
Wt. of Cylinder filled with Sand after Pouring, (g) W3	4820	4850	4882	4825	4731	4789
Wt of Sand in cone (g) W4	310	310	310	310	310	310
Wt. of Sand in Hole, (g) W5=(W1-W3)-W4 W5	1270	1240	1208	1265	1359	1301
Volume of Hole V=W5/Ys (cm³) V	984.49	961.24	936.43	980.62	1053.48	1008.52
Wet Density of Sample Ywet = W1/V g/cm³	2.063	2.054	2.098	2.083	2.055	2.070
IN-SITU MOISTURE CONTENT (SPEEDY MOISTURE METER METHOD)						
Dial Gauge Reading, (Div)	8.00	7.50	9.50	9.00	8.00	8.50
Calibrated In-Situ Moisture Content (%)	9.59	8.96	11.45	10.83	9.59	10.21
DEGREE OF COMPACTION						
Lab. Optimum Moisture Content, (%)	10.43	10.43	10.43	10.43	10.43	10.43
Lab Max Dry Density, (g/cm³) Ymax	1.91	1.91	1.91	1.91	1.91	1.91
In-situ Dry Density, Yd=100xYwet/(100+w)(g/cm³)	1.881	1.885	1.882	1.879	1.875	1.878
Degree of Compaction, (%) 100xYd/Ymax	98.48	98.69	98.53	98.37	98.16	98.32
Compaction Required, (%)	98	98	98	98	98	98

Remarks :

ಕಾರ್ಯನಿರ್ವಾಹಕ ಇಂಜಿನಿಯರ್

ಕ.ನೀ.ನಿ.ನಿ., ಭದ್ರಾ ಮೇಲ್ದಂಡೆ ಯೋಜನೆ,

"Extract"

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.4,
B.R. Project-577 115.

Contractor

"ಉದ್ಧೃತ"

Assistant Executive Engineer
KNNL UBP Sub Division, No. 5,

UPPER BHADRA PROJECT
PACKAGE 2

DIRECT SHEAR TEST
IS: 2720 (Part 13) -1986

CLIENT: KARNATAKA NEERAVARI NIGAM LTD
CONTRACTOR: RNSIL (JV)

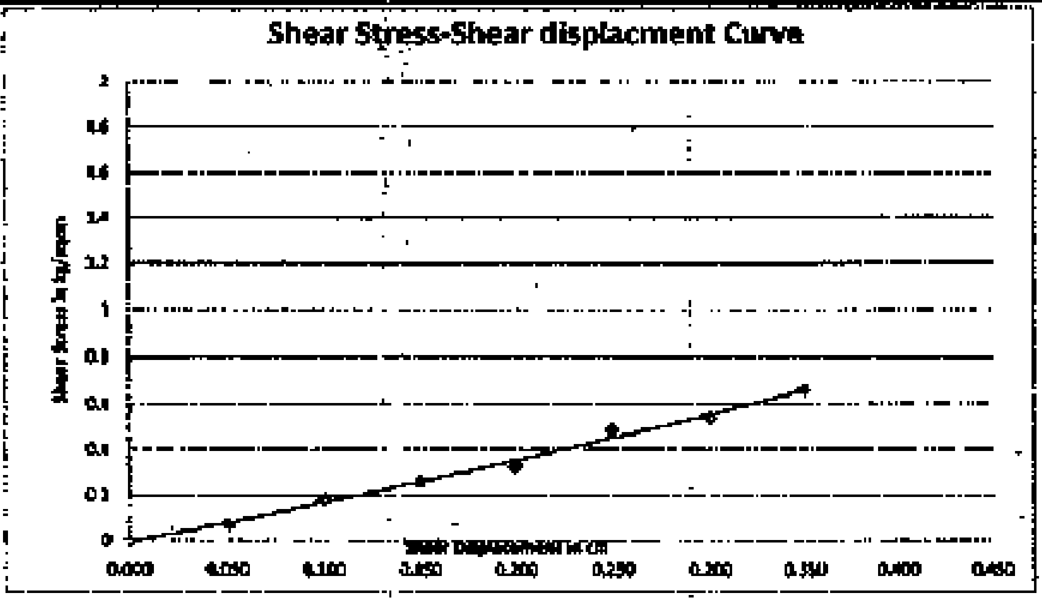
Sample No : 1

Location of Samples: Box culvert @ CH- 30750 Date: 08.03.2016
Proving Ring SL no.: UFJ 919
Rate of Strain in mm/min: 1.25

Soil Specimen Measurements Test :- 1

Length (L) in cm: 6 Breadth (B) in cm: 6 Thickness (T) in cm: 0.25
Area of Specimen A_o in Sq. cm = 36
Moisture Content: 9.80 % Bulk Density in g/cc: 1.802 Normal Stress = 0.5 kg/sqcm

Sl.No	Displacement Dial reading	Displacement δ (cm)	Corrected area ** $A_c = A_o(1-δ/3)$	Stress dial reading	Shear force 0.25 x (5) kg	Shear Stress = (6)/(4) kg/sqcm	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	0	0.000	36.00	0	0	0	
2	50	0.200	35.40	10	2.50	0.07	
3	100	0.200	34.80	25	6.25	0.18	
4	150	0.150	34.20	35	8.75	0.26	
5	200	0.200	31.80	45	11.25	0.35	
6	250	0.250	33.00	65	16.25	0.49	
7	300	0.300	32.40	70	17.50	0.54	
8	350	0.350	31.80	84	21.00	0.66	
9	400	0.400	31.20	88	22.00	0.71	
10	450	0.450	30.00	90	22.50	0.74	
11	300	0.500	30.00	88	22.25	0.74	



Contractor

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.2,
B.R. Project-577 115.

UPPER BHADRA PROJECT
PACKAGE 2

DIRECT SHEAR TEST
IS: 2720 (Part 13) -1986

CLIENT: KA[illegible]AKA NEERAVARI NIGAM LTD
CONTRACTOR: RNSIL (JV)

Location of Sample: Box culvert @ CH -30750
Proving Ring Sl. no.: UFJ 016
Rate of Strain in mm/min: 1.25

Sample No.:
Date 05.03.2016

Soil Specimen Measurements

Test :- 2

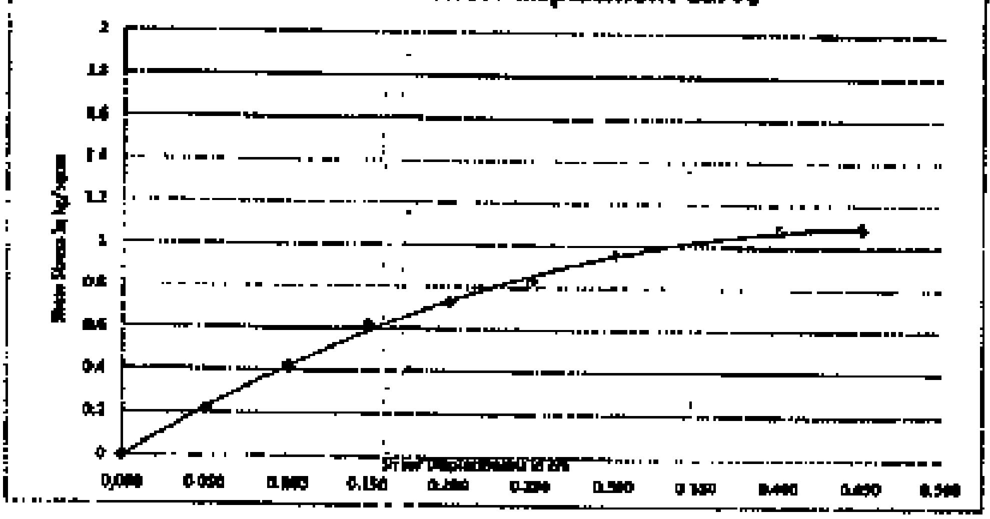
Length (L) in cm. 6 Breadth (B) in cm: 6 Thickness (T) in cm: 0.25

Area of Specimen A_0 in Sq. cm = 36

Moisture Content: [illegible] % Bulk Density in g/cc: 1.802 Normal Stress = 1.0 kg/sqcm

Sl.No	Displacement dial reading	Displacement δ (cm)	Corrected area ** $A_c = A_0(1-\delta/3)$	Shear dial reading	Shear force 0.25 x (5) kg	Shear Stress = (6)/(4) kg/sqcm	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	0	0.000	36.00	0	0	0	
2	50	0.050	35.40	30	7.50	0.21	
3	100	0.100	34.80	59	14.75	0.42	
4	150	0.150	34.20	85	21.25	0.62	
5	200	0.200	33.60	98	24.50	0.73	
6	250	0.250	33.00	110	27.50	0.83	
7	300	0.300	32.40	125	31.25	0.96	
8	350	0.350	31.80	130	32.50	1.02	
9	400	0.400	31.20	135	33.75	1.08	
10	450	0.450	30.60	134	33.50	1.09	

Shear Stress-Shear displacment Curve



Contractor

Client

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.2,
B.R. Project-577 115.

UPPER BHADRA PROJECT
PACKAGE 2

DIRECT SHEAR TEST
IS: 2720 (Part 13) -1986

CLIENT: KARNATAKA NEERAVARI NIGAM LTD
CONTRACTOR: RNSIL (JV)

Location of Samples: Box culvert @ CH -30/100 — Sample No: 1 — Date 05.03.2018
Proving Ring Sl. no.: UEJ 918
Rate of Strain in mm/min: 1.25

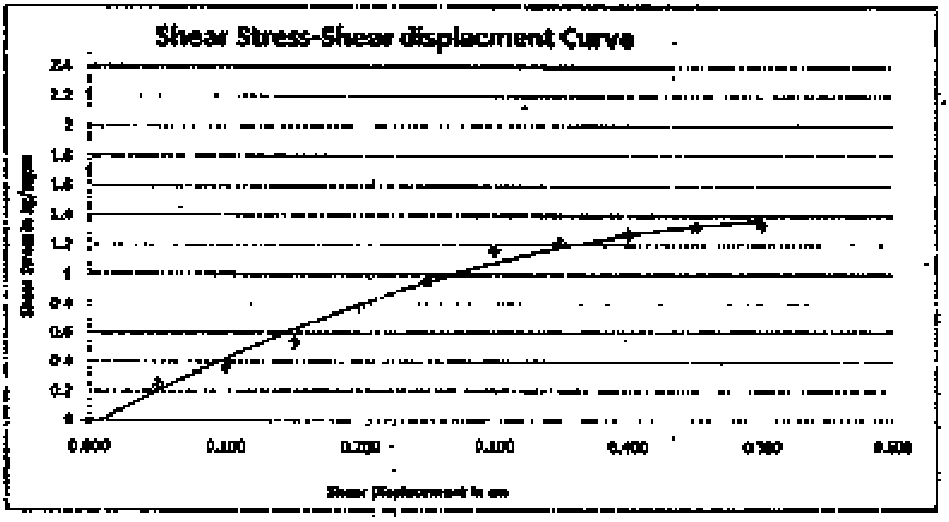
Soil Specimen Measurements — Test :- 3

Length (L) in cm: 6 — Breadth (B) in cm: 6 — Thickness (T) in cm: 0.25

Area of Specimen A_0 in Sq. cm = 36

Moisture Content : 8.59 % — Bulk Density in g/cc: 1.802 — Normal Stress = 1.5 kg/sqcm

Sl. No	Displacement Dial reading	Displacement δ (cm)	Corrected area ** $A_c = A_0(1-δ/3)$	Stress dial reading	Shear force 0.25 x (5) kg	Shear Stress = (6)/(4) kg/sqcm	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	0	0.000	36.00	0	0	0	
2	50	0.050	35.40	35	8.75	0.25	
3	100	0.100	34.80	64	12.80	0.36	
4	150	0.150	34.20	73	18.25	0.53	
5	200	0.200	33.60	105	26.25	0.78	
6	250	0.250	33.00	125	31.25	0.95	
7	300	0.300	32.40	150	37.50	1.16	
8	350	0.350	31.80	155	38.75	1.22	
9	400	0.400	31.20	159	39.75	1.27	
10	450	0.450	30.60	162	40.50	1.32	
11	500	0.500	30.00	160	40.00	1.33	



Contractor

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.2,
B.R. Project-577 115.

- 577 228.

UPPER BHADRA PROJECT
PACKAGE 2

DIRECT SHEAR TEST
IS: 2720 (Part 13) -1986

CLIENT: KARNATAKA NEERAVARI NIGAM LTD
CONTRACTOR: RNSIL (JV)

Sample No : 1

Location of Samples: Box culvert @ CH- 30760 **Date: 05.03.2016**
Proving Ring SL no.: UFJ 918
Rate of Strain in mm/min: 1.25

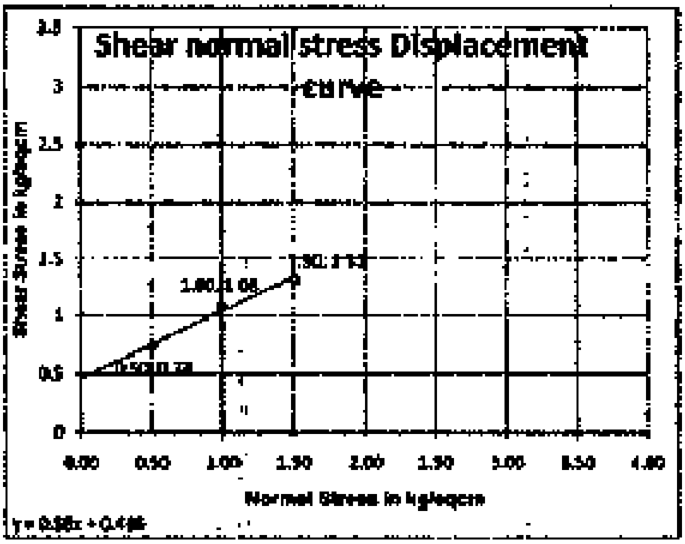
Soil Specimen Measurements

Length (L) in cm: 6 **Breadth (B) in cm: 6** **Thickness (T) in cm: 0.25**

Area of Specimen A_0 in Sq. cm 36

Moisture Content: 9.80 % **Bulk Density in g/cc: 1.602**

Sl. No	Normal Stress applied in kg/sqcm	Stress dial gauge observations at failure	Shear force 0.25 x (3) kg	Displacement δ (cm)	Corrected area ** $A_c = A_0(1-δ/3)$	Shear Stress = (4)/(6) kg/sqcm	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	0.50	90	22.50	0.45	30.60	0.74	
2	1.00	135	33.75	0.45	31.20	1.08	
3	1.50	162	40.50	0.45	30.60	1.32	



Shear Normal Stress displacement curve

$\phi = 30^0$
$C' = 0.466\ Kg/cm^2 = 46.60\ KN/m^2$

Contractor

Executive Engineer,
Karnataka Neeravari Nigam Limited,
Upper Bhadra Project Division No.2,
B.R. Project-577 115.

CALCULATION OF SAFE BEARING CAPACITY WITH "c" AND "φ" VALUE

$$\text{Safe bearing capacity, } q_s = 2/3\left[cN_c + \gamma D(N_q - 1) + 0.5\gamma B N_\gamma w\right]\frac{1}{F} + \gamma D$$

Here,				
	F = Factor of safety (usually 3)	=	3	
	c = cohesion	=	[illegible]	kPa
	φ = Angle of Repose	=	30	deg.
	γ = unit weight of soil	=	16	KN/m²
	D = Depth of foundation	=	4	m
	q = Surcharge at the ground level	=	[illegible]	KN/m²
	B = Width of foundation	=	4.00	m
	N_c = Bearing Capacity factors	=	30.14	
	N_q = Bearing Capacity factors	=	18.4	
	N_γ = Bearing Capacity factors			
	$N_\gamma = 1.5(N_q - 1)\tan\phi$	=	15.07	

SAFE BEARING CAPACITY	=	417.83	kPa
	=	42.75	Tonne/m²

[illegible]

Executive Engineer,
Karnataka Neeravari Nigam Limited
Upper Bhadra Project Division No.
B.R. Project-577 115.

55

UBP - P3, Ajjampura Ajjampura Bhadravathi Shivmoga

M/s. SHANKARANARAYANA CONSTRUCTIONS PRIVATE LIMITED

SIEVE ANALYSIS OF FINE AGGREGATE (M SAND)

(As Per IS 383-1970)

Project :	Upper Bhadra Project, Package - III	Source :	Kadur Quarry
Client :	Karnataka Neeravari Nigam Limited	Weight of Sample :	1 Kg
Sub Division :	No. 7, UBP Sub Division, Ajjampura	Test Date :	15.10.2016
Division :	No. 3, UBP Division, Ajjampura	Materials Collected at :	Shaft Site & Exit Site

S. No.	Testing Date	Location	Quantity of Sand Used	Percentage of Organic Impurities					Percentage of Sand Passing as per IS Sieve								5% relaxation towards Zone - 1 (coarse) except particles of 600 µ	Remarks
				75 µ	Pieces in Layers	Clay Lumps	Other Materials	Total	10 mm	4.75 mm	2.36 mm	1.18 mm	600 µ	300 µ	150 µ	75 µ		
Special Description		Cement Mortor Works As Per IS 2116-1970		Maximum					–	100	90-100	70-100	40-100	5 to 70	0-15	IS:2116-1965		
				3%	1%	1%	1%	1%										
		Cement Concrete Works As Per IS 383-1970		Maximum					100	90-100	60-95	30-100	15-34	5 to 20	0-10	Zone - 1		
				3%	1%	1%	1%	5%	100	90-100	75-100	55-100	35-59	8 to 30	0-10	Zone - 2		
									100	90-100	85-100	75-100	60-79	12 to 40	0-10	Zone - 3		
1	15.10.2016		50 (approximate quantities in "Cum")	–	–	–	–	–	<------ 100 ------>	92.00	84.00	71.00	54.00	14.00	5.00	<-----Zone - 2----->		
2	15.10.2016		50	–	–	–	–	–		92.50	83.00	74.00	51.00	14.00	4.00			

Lab Incharge
For SNC (P) Ltd.
UBP - P3, Ajjampura

Assistant Executive Engineer
Sub Division No.7
Ajjampura

Assistant Executive Engineer
Quality Control Sub Division
Bhadravathi

Executive Engineer
Quality Control Division
Shivmoga

ANNEXURE-IV B

KARNATAKA NEERAVARI NIGAM LIMITED

(A Government of Karnataka Enterprise)

Soil Survey Repert of Upper Bhadra Project

The Chief Engineer

Upper Bhadra Project Zone

KNNL, Chitradurga– 577501

3.2.7 Soil Characteristics

Agro – climatic zones of Upper Bhadra LISincludes

i) Central dry zone (Hosadurga, Chikkanayakanahalli,Pavagada,Holalkere,Molakalmuru,Challakere, Jagalur& Hiriyur) where in predominantly rain fed Kharif crops are grown and the crops are Ragi,sorghum,rice,oil seeds & pulses

ii) Eastern dry zone-(Tumakuru) - where the area is mostly covered by rain fed Ragi, sorghum, rice, mulberry oilseeds & pulses

Agriculture is the major occupation of the country in general and Karnataka in particular. Farming is gambling on Nature and depends on the management of soils, crops, animals; use of package of practices, farm techniques, farm machinery and agricultural implements, marketing, human resources in a systematic way.As a consequence of Burgeoning population, it is planned to increase food production by increasing productivity from average of 4 tons per hectare from the present 1.5 tons per hectare to meet the growing demand in the country. Due to thegreat dependence and pressure on land and water resources, obviously, there will be an effect on soil quality and crop productivity. As per some estimates, the soils have been degrading at the rate of one million hectares per year and 57% of geographical area is affected by various forms of degradation viz., water and wind erosion, physical and chemical deterioration (NBSS & LUP 2014). The state department of Agriculture has estimated that about 10% of irrigated (1.27 lakh ha) command area are affected by problems such as water logging, salinity and alkalinity (Dep. of Agriculture, 1985). Similarly a depletion of ground water levels has also been noticed at an alarming rate in recent times through the rapid depletion of the ground water resources. In this context, it is a great challenge to the scientific community, to evolve and develop appropriate strategies, to increase food production on a sustainable basis.

Among various Natural resources, soil is one of the most vital commodities of earth resources, on which community depends for shelter and food security. During management of soil resources it is important to understand soil distribution, and their characteristics which is a pre-requisite for appropriate land use practices, based on the suitability of soil for various applications.Reclamation of degraded soil also needs to be undertaken during the conservation process.

Irrigation is as much an activity with beneficial impact to begin with and continues to be beneficial if management properly. However, it may also pose problems in terms of change in Physico-chemical properties of soil following application of fertilizers and pesticides to boost agricultural production, water logging, salinity etc., The objective of this chapter is to document and evaluate the current characteristics of the Upper Bhadra irrigation project to enable authorities to plan for appropriate management strategies to ensure sustainability in production.

Physical deterioration of soil by reduction of soil organic matter, making the land more prone to crusting and increased run off, intensive agriculture from specific crops which leads to problem of water logging or condition of short/long term water saturation of top soil, which results in changes in hydrologic regime and landscape.

The processes leading to flooding are being attributed to increased sedimentation and reduced capacity of the river drainage system. The adverse effects of water logging are being reflected severely on overall ecology, reduced agriculture productivity, limited choice of crops and ageing of soil in the longer term *(Woomer and Swift, 1994)*

Nutrients and soil loss is a major problem where excessive leaching of salts occurs, besides in mono cropping, without adequate inputs like fertilizers and organic manure. It is more rampant in areas where agriculture is practiced in poor or moderately fertile soils without application of sufficient fertilizer or manure, which certainly leads to decrease in agricultural productivity. Loss of soil organic matter, following clearing of natural vegetation is also another way of nutrient loss. Plant nutrients are also depleted from soil through crop removal, run off and soil erosion. Middelton et al., (1934) noticed that the eroded material is richer than the original soil in respect of colloidal clay and plant nutrients. The loss of nitrogen by erosion is probably more serious than loss of any other nutrient (Woolley, 1943), since most of the nitrogen being lost is combined with soil organic matter, which is under threat of erosion. Actual nutrient status of tank silt was not found to be much different from that of the soil in the catchment area in studies carried out by the scientists of the Dry land Agriculture project of the University of Agricultural Sciences, Bangalore and also by the Department of Agriculture. (1997)

All such soils need different management and reclamation measures. Their sustained use depends more on the economic concerns and identification of sustainable alternative uses rather than agricultural production (Perspective land use plan for Karnataka 2025.)

Land degradation problems started emerging since the time of man's civilization; as he started cultivating land some 7000 years ago (Lowder milk, 1953) and because of the geometrically increase in population resulted in many environmental problems such as food deficit, environmental pollution, leading to degraded soil.

The tragedy of land degradation is so alarming that the food security of the country is at stake in India, a large portion of land resource is under soil degradation, which in turn, is affecting the country's agricultural productivity.Socio-economic and ecological consequences of land degradation are affecting well over 50 percent of the total geographical area of the country. There is a dire need for soil reclamation measures of degraded lands to increase soil productivity and more food to fulfil the demands of food security and also to protect the original land resource from degradation processes.

Hence, it is important to possess knowledge of various soil degradation processes or displacement of soil material, through different agents such as water, wind and accumulation of chemical substances through physical processes. Soil degradation is a process that lowers the existing and / or future fertility of the soil to producefood, fibre, and fuel required in adequate quantities to sustain day to day human activities. Anthropogenic activities like large-scale irrigation, deforestation, extensive industrial growth etc., have led to over-exploitation of natural resources, without due consideration of resulting ecological imbalance. This has led to problems of salinity, flooding, drought, water logging and enhanced soil erosion processes all of which in turn directly affect agricultural productivity in the area.

3.2.7.1 Study area

The command area covering the districts of Tumakuru,Chitradurga,and Davangere&Chikkamagaluru receives moderate rainfall and even this is poorly distributed. The region is subject to frequent drought and crop failure, affecting the life and economic status of the population, who subsist mainly on agriculture. The soil in this region are of shallow to moderate depth (7.5 to 45 cm), Gravelliness and stoniness accounts for >15% with severe soil erosion and slopes of >3 to >8% and medium to low fertility status overlaid with previous murrum, which enables cultivation of agricultural crops by way of providing micro irrigation facilities.

The area selected for the present study is the commands area of Chitradurga branch canal,Tumakuru branch canal and command area of Jagalur branch canal under Upper Bhadra lift Irrigation Project.The location of proposed 3 lifts are located at Tunga river, Bhadra reservoir and Ajjampura sites.

3.2.7.2 Soil types in the study area

The soil types found in the command area are black, Red, red and black colored. The black cotton soil is rich in bases (alkaline condition) and has a very high water holding capacity. The soils in the Upper Bhadra project area are mostly red and mixed soils, while the black soil constitutes only 30 percent and are 45-90cms and above, heavy in texture, with 45 to 55 per cent clay and contain free calcium carbonate throughout the profile. There is generally a zone of salt concentration in the black soil profile at a depth of 18 to 36 inches, the principal salt being gypsum. Below the gypsum layer occurs 'murrum' which is practically impermeable to water, so that the internal drainage of the soil is lateral rather than vertical within the profile.

3.3.2.3 Soil Erosion classification

The slope varies from nearly level to moderate slope and soil erosion varies from slight to moderate. The soils are classified as Alfisols, Inceptisols and Vertisols and the type varies from Clayey to Clayey skeletal. Soils are classified as residual, transported or organic, depending upon their origin. On the basis of composition and physical characteristics, soil can be designated as clayey, loamy, silty, sandy, gravelly or combinations thereof. Broadly, they are called fine-texture, medium-textured or coarse-textured. Soils have characteristic hydrological properties, namely soil permeability and porosity, which govern the surface run-off vis-à-vis subsurface infiltration. Soils can be grouped as poorly drained, moderately drained, well drained and excessively drained. The coarse-textured soils, owing to their larger grain size, are invariably better drained than the fine-textured soils, in which infiltration of water is inhibited. The soils of the region are dominated by deep black clay soil followed by deep red clay soil & shallow red gravelly loamy soils. Soil map and Soil erosion intensity map is given below.

3.2.7.4 Crops and Cropping pattern

Many parts of the proposed command area particularly the lower reaches repeatedly experience drought and famine conditions which directly affect the life style and economy of the population, dependent mainly on agriculture. However various Kharif crops that can be raised in the region by providing irrigation facilities would not only boost production but improve the socio-economic constituents of the area. The entire population in the command area is depending on agriculture for livelihood and crops like Ragi, Jowar, maize, Sunflower, and Groundnut etc., which are traditionally grown in the area.

3.2.7.5 Soil status

A reconnaissance soil survey was conducted in the study area and soil sampling locations were identified followed by a wide-ranging sampling programme undertaken during the field survey. Depending on the terrain conditions and soil types, 30 Soil samples were collected from different agricultural lands in the command area. A total of 30 sampling sites extended over 30 different villages, were identified during survey, the details of soil sampling locations are given below.

Standard techniques of soil survey were used to obtain qualitative and quantitative data on the soils. Various soil quality parameters viz., pH, electrical conductivity, chlorides, available calcium and magnesium, phosphorus, exchangeable sodium and potassium, available nitrogen etc., were determined employing standard methods of analyses[21]. Details of soil samplings are given below and the results are tabulated in Annexure-12.

[21] Jackson ML (1965) Soil Chemical Analysis - Advanced Course, Department of Soils, University of Wisconsin, Wisconsin, USA.

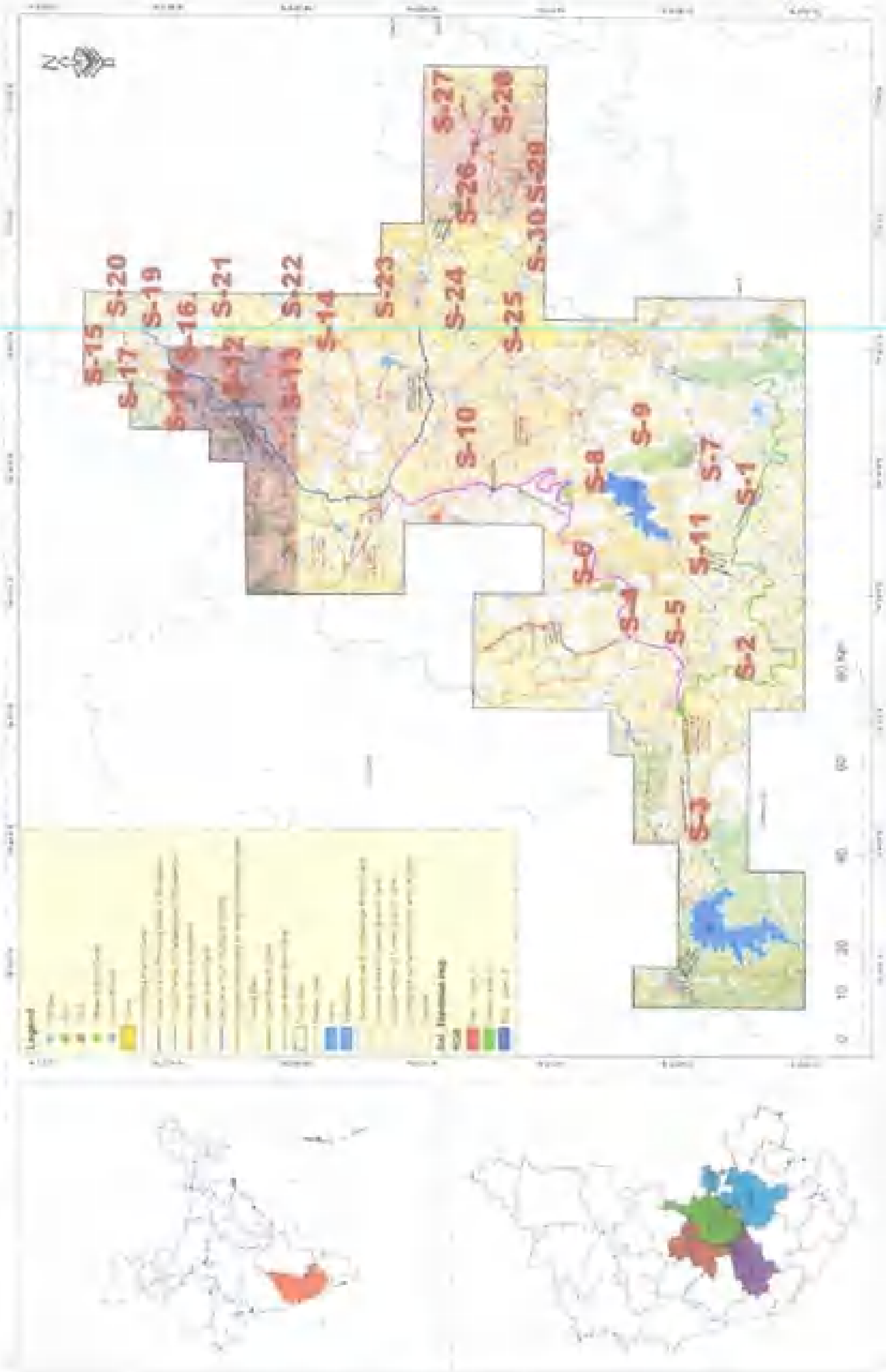


Fig 3.34 Soil sampling locations on study area map

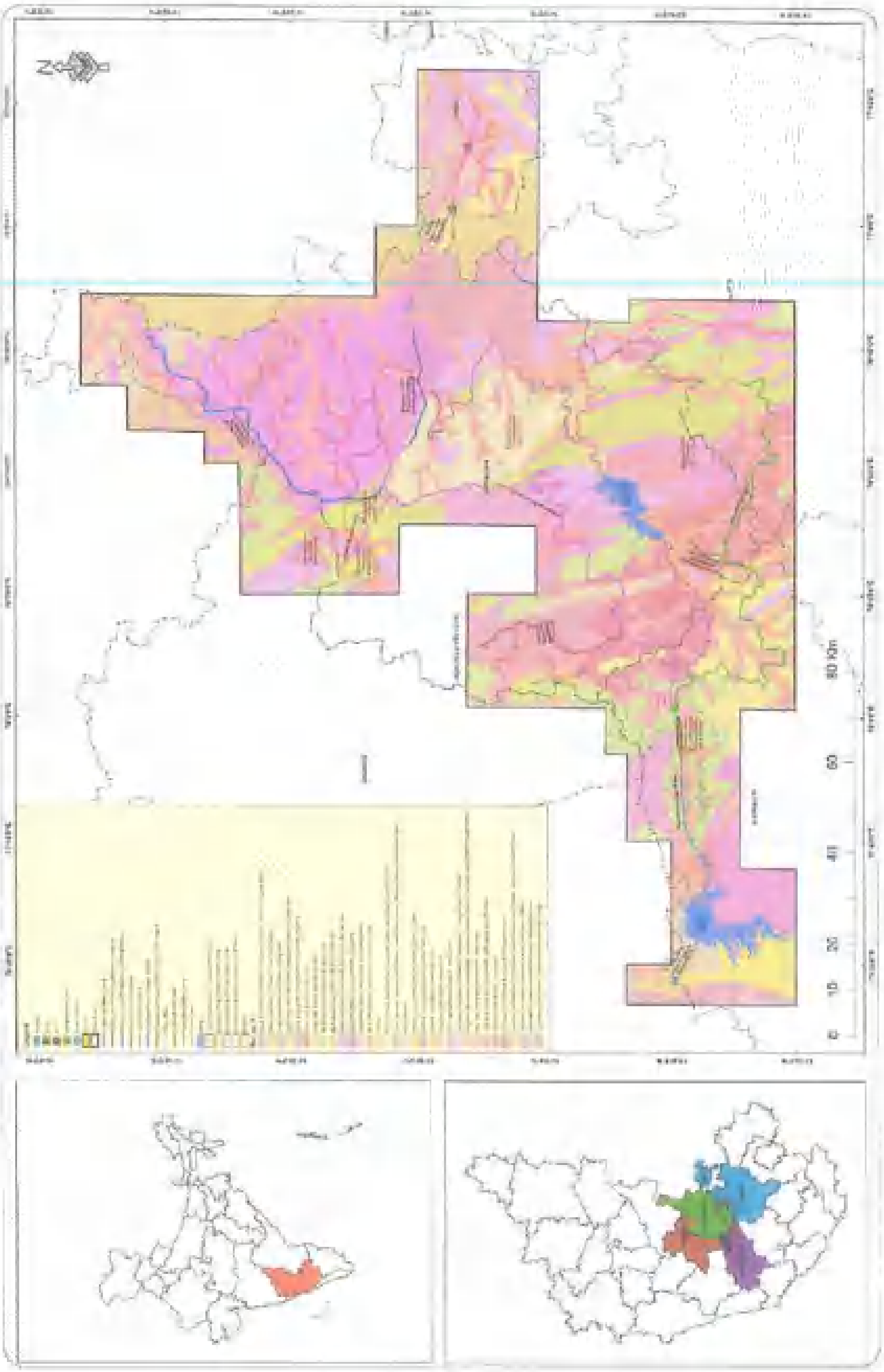


Fig 3.35 Types of soil in the study area

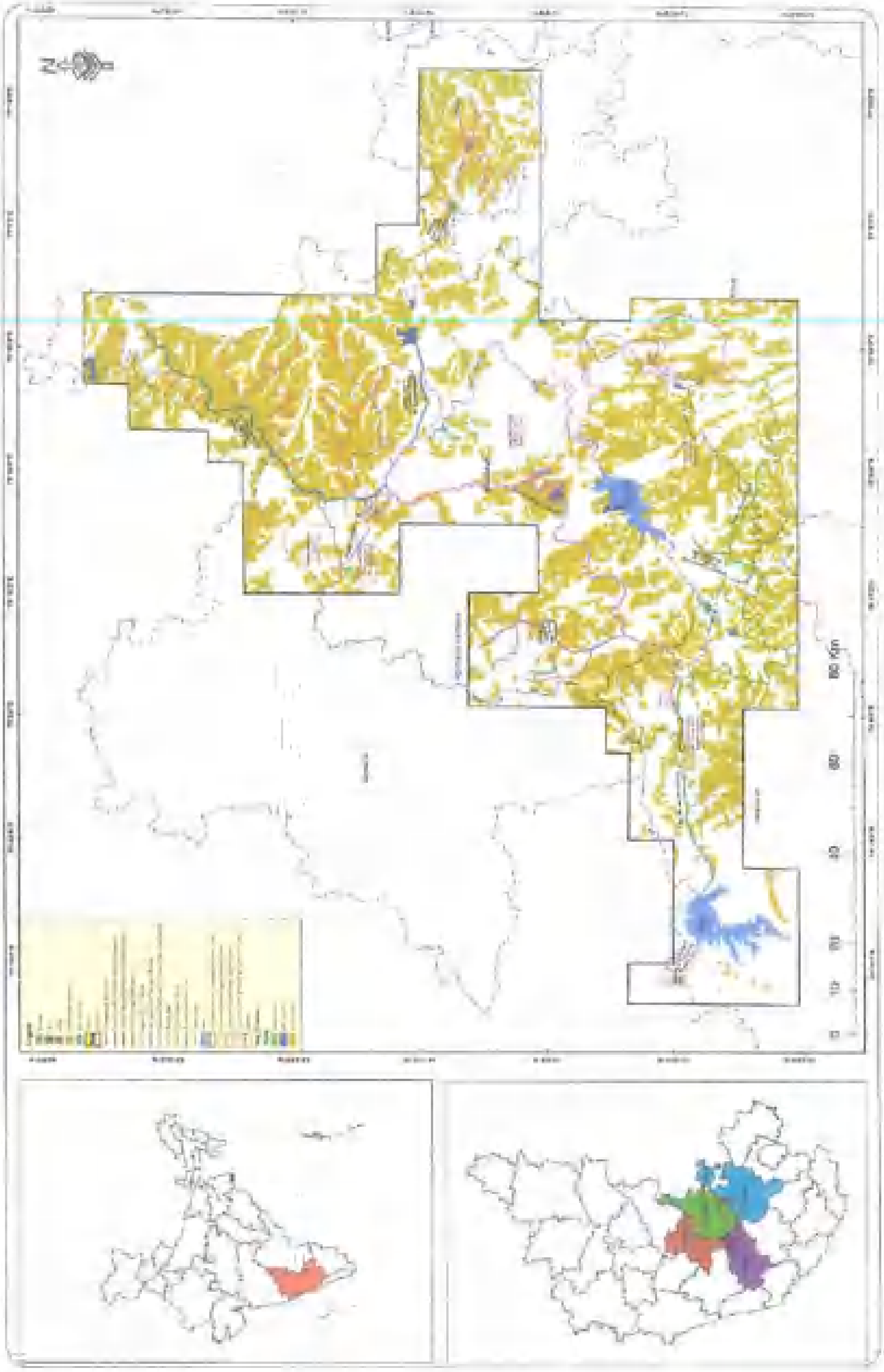


Fig 3.36 Soil erosion intensity in the study area

Table 3.16 Details of soil sampling locations

Location code	Location	Geographical coordinates	Elevation (m)
S1	Huliyar (TBC)	13°34'59.79"N, 76°32'24.55"E	713
S2	Yagati (TBC)	13°36'47.18"N, 76° 8'57.81"E	712
S3	Ajjampura(TFLC)	13°43'38.38"N, 76° 0'20.97"E	757
S4	Hosadurga (CBC)	13°47'54.50"N, 76°17'5.45"E	723
S5	Bagur (CBC)	13°49'10.69"N, 76°11'37.60"E	717
S6	Doddaghatla (CBC)	13°54'46.64"N, 76°15'48.38"E	756
S7	Kenkere (CBC)	13°36'47.44"N, 76°32'0.17"E	718
S8	Vani Vilaspura (CBC)	13°53'31.03"N,76°29'27.28"E	630
S9	Yelladakere (TBC)	13°47'14.86"N, 76°34'2.83"E	679
S10	Aimangala (CBC)	14° 5'40.49"N, 76°31'58.48"E	669
S11	Kyadigere (TBC)	13°44'58.98"N, 76°16'27.88"E	687
S12	Kunabevu (CBC)	14°21'49.41"N, 76°26'20.23"E	670
S13	Turuvanur (JBC)	14°23'23.54"N, 76°26'10.86"E	692
S14	Bidarakere (JBC)	14° 2'54.45"N, 76°41'46.01"E	583
S15	Thoranagatte (CBC)	14°26'48.10"N, 76°21'19.46"E	666
S16	Madanaikanahalli (CBC)	14°20'21.31"N, 76°23'20.99"E	711
S17	Chippinakere (CBC)	14°22'7.01"N, 76°20'10.41"E	674
S18	Kariyamannahalli (CBC)	14°20'13.15"N, 76°17'56.91"E	695
S19	Chikkagondanahalli (CBC)	14°22'38.10"N, 76°22'4.98"E	668
S20	Gollahalli (CBC)	14°22'36.86"N, 76°28'23.50"E	640
S21	Bommakkanahalli (CBC)	14°21'59.71"N, 76°30'29.22"E	631
S22	Gorlakatte (CBC)	14°19'0.45"N, 76°36'44.56"E	596
S23	Dodderi (CBC)	14°17'46.47"N, 76°42'13.70"E	561
S24	Harthikote (CBC)	14° 9'31.08"N, 76°42'2.41"E	595
S25	Gannayakanahalli (CBC)	14° 0'37.41"N, 76°37'26.26"E	638
S26	Rayabommanahalli (CBC)	13°53'36.66"N, 76°41'8.59"E	630
S27	Thimmalapura (CBC)	13°55'44.29"N, 76°46'10.99"E	602
S28	Ganadahunase (CBC)	13°46'1.22"N, 76°44'21.95"E	631
S29	Hunasekatte (CBC)	13°41'7.07"N, 76°44'53.06"E	699
S30	Muthgadahalli (CBC)	13°37'45.23"N, 76°39'41.02"E	685

3.2.7.6 Results of soil quality analysis

- **Soil pH**

pH of soil mainly depends on the soil water ratio. From the results, it is seen that pH of the soil samples in the study area ranged between 6.2(Huliyar) and 10.81(Harthikote) during monsoon and during post monsoon season the same was in the range of 6.56 (Madanaikanahalli) and 9.87(Hosadurga) where as in the pre monsoon season it was between 5.31(Ajjampura) and 8.95(Bommanaiakanahalli). Of all the seasons, the lowest pH value of 5.31 was found in Ajjampuraduring rabi season which belongs to a agricultural land and the maximum pH of 10.81 was observed in Sample No. 3 of pre-monsoon and sample 28 of Kharifwhich belongs to agricultural land at road side of Harthikote village, respectively

- **Electrical conductivity (EC)**

Electrical Conductivity, as the measure of current carrying capacity, gives a clear picture of the amount of soluble salts present in the soil. The EC values of the Kharifsoil samples varied from 10.32 to 365 µmhos/cm in sample 24(Harthikote) and

5(Begur).During the Rabi season the same was 48.7 in sample 29(Hunsekatte) and 1560 in sample19 (Chikkagondanahalli).However,during summer,the same was 63 in sample 26 of Rayabommanahalli and 404 in sample no 2 (Yagati).The highest value of EC was observed in sample No.19 of Chikkagondanahalli in rabi season with1560, which belongs to agricultural land of Chikkagondanahalli village whereas the lowest EC value of 10.32 µmhos/cm was noticed during monsoon in the soil which belongs to the Agricultural land sample no.24(Harthikote) Village.

Salinity: Based on the electrical conductivity of the soil, soil salinity can be classified into four classes:

Water class	Electrical conductivity (micromhos/cm at 25° C	Approximate salt concentration
Class - I - Low salinity	0 to 250	<0.16
Class - II - Medium salinity	250 to 750	0.16 to 0.50
Class - III - High salinity	750 to 2250	0.50 to 1.50
Class - IV - Very High salinity	2250 to 5000	1.5 to 3

- **CI** water is considered as safe with without any salinity problems.
- **CII** When used for irrigation, moderate leaching is required.
- **CIII** and **CIV** cannot be used on soils with inadequate drainage, since salinity develops.

In the study area most of the soil samples sample no 1(Huliyar village), 2(Yagati), 6 (Dodda gollahalli) and 22 (Gorlakatte) of pre-monsoon season andsoil sample no 5 of monsoon season, are of medium saline soils. Post monsoon season soil sample of 19 (Chikkagondanahalli)and 30(Muthugadahalli) which are high salinity, all other sampling areas come under the category of Class-I, which clearly indicates that majority of the soil samples are free from salinity.

- **Colour**

Colour of the soil samples ranged from brown red to black. Some of the soils with greyish red colour were also noticed.

- **Exchangeable Calcium**

During the monsoon season, minimum concentration of Exchangeable Calcium was found to be 3 in the soil sample No. 18which belongs to the agricultural land of Kariyammanahalli village, while the maximum value is 68 (expressed as Ca meq/100g) in the sample No.25 and the agricultural land belongs to the Gannayakanahalli. In the post monsoon, the same is 16 in Hunsakatte (Soil sample no 29) and 48 in soil sample 3 of Hosadurga respectively. However, in the pre-monsoon, the minimum and maximum values are 42 and 277 respectively in soil samples(18) of Kariyammanahalli and Kunabevu (12).There was wide variation (3to 277) in the distribution of Exchangeable Calcium content in the study area.

- **Exchangeable Magnesium**

The minimum concentration of Exchangeable magnesium is found to be 0.8 meq/100g in the sample No.22 which belongs to the agricultural land of Gorlakatte, and similarly the maximum Exchangeable magnesium value of 70.5 meq/100g in the sample No. 25 of agricultural land, which belongs to Gannayakanahalli village from the monsoon season.The same for the post monsoon season vary from0.4(Soil sample 20 of Gollahalli) and 6.4(Soil sample 17 of Chippinakere).During the pre-monsoon season the values are 0.6(Soil sample 25 of Gannayakanahalli) and 35.8(Soil sample 12 of Kunabevu) The

Exchangeable magnesium value found ranged between 0.6 meq/100g and 70.5 meq/100g.

- **Percent Organic Carbon**

In monsoon season, the percent Organic Carbon was found to be in the range of 0.06 to 2.52 and the minimum value was observed in seven villages of Sample No.10, 12, 13,18,22,26 and 27 which belonged to agricultural lands of Aimangala, Kunabevu, Turuvanur, Kariyammanahalli, Gorlakatte, Rayabommanahalli and Thimmalapura respectively. While the maximum percent Organic Carbon value of 2.52 was found in Sample No.2, which belonged to agricultural land of Yagati village.

- **Exchangeable Sodium**

The exchangeable sodium content in the study area in monsoon soil samples ranged between 1.59(soil sample 20 of Gollahalli) to 71.77 Kg/ha(soil sample 10 of Attimangala).During the analysis of post monsoon season soil samples it was observed that the minimum Exchangeable sodium value of 1.19 was observed in Sample No.29 which belonged to agricultural land of Hunsakatte village and the maximum value was found in Sample No. 30, which belonged to agricultural land of Muthugadahalli village. However, in pre-monsoon it was observed that the minimum Exchangeable sodium value of 4.5 was observed in Sample No.3 which belonged to agricultural land of Ajjampura village and the maximum value (211.56) was found in Sample No. 13, which belonged to agricultural land of Turuvnur village.

- **Exchangeable Potassium**

The Exchangeable K values of monsoon season were found to be in a narrow range and ranged between 0.36(soil sample 27 of Thimmalapura) to 8.88 Kg/ha(soil sample 19 of Chikkagondanahalli). The minimum potassium values of 1.4 in post monsoon season soil sample was noticed in Sample No.25,(Gonnayakanahalli village), while the maximum value of 13.28 was found in Sample No.2 (Yagativillage.) which belonged agricultural land of Yagati village. However in the pre monsoon season soil sample analysis,The minimum potassium values of 1.03 was noticed in Sample No.19,(Chikkagondanahalli village) and the maximum value of 18.15 was found in Sample No.7which belonged agricultural land of Kenkere village.

- **Available Nitrogen (%N)**

The available nitrogen ranged between 119.16 (soil sample 4 of Hosadurga) to 533.12 Kg/ha and the minimum value was found in sample No. 4 which belongs to Hosadurga village and the maximum value was observed in sample number 27 which belonged agricultural land of Thimmalapura village.The minimum available nitrogen values of 182.82 in post monsoon season soil sample was noticed in Sample No.20, (Gollahalli village), while the maximum value of 501.25 was found in Sample No.2(Yagativillage.) which belonged agricultural land of Yagati village. However in the pre monsoon season soil sample analysis, The minimum available nitrogen values of 153.66 was noticed in Sample No.22, (Gorlakatte village) and the maximum value of 501.76 was found in Sample No.2 which belonged agricultural land of Yagati village.

- **Percent Chlorides**

The Chloride content of the soil is the measure of salinity of the soil. The Chloride content of the soils of monsoon season ranged between 1.41 to 3.47meq/l . The chloride content was taken as major factor for the estimation of salinity of the soil samples. The maximum chloride content was observed in Sample no.10 of agricultural land, which belongs to the Aimangala, whereas the lowest chloride of 1.41meq/l was observed in Yagachi village. The results for the post monsoon, the maximum chloride content was observed in Sample no.19 of agricultural land, which belongs to the Chikkagondanahalli(5.31meq/l

), whereas the lowest chloride Yalladakere (0.18meq/l), village. However the values for pre monsoon season,the maximum chloride content was observed in Sample no.23 of agricultural land, which belongs to the Dodderi(9.87meq/l). whereas the lowest chloride Gannayakanahalli (0.38meq/l), village.

- **Sodium Absorption Ratio (SAR) and Percent Sodium**

The Sodium Absorption Ratio of Monsoon season ranged between 0.02 to 0.84. A minimum SAR value of 0.02 was found in Sample no.25, which belongs to agricultural land of Hosadurga village, and the maximum SAR value was found in sample No. 4, which belonged Agricultural of Gammayakanahalli village. The high Percent in the post monsoon soil sample was found in the Chikkagondanahalli i.e. 0.78 and lowest value was found to be 0.02 in Gammayakanahalli.The high Percent in the pre-monsoon soil sample was found in the Madanayakanahalli i.e. 1.97 and lowest value was found to be 0.1 in Ajjampura and Kenkere and also in the samples of 18, 25 & 29.

- **Particle Size**

Relative proportions of the soil particles of various sizes are an important physical parameter, which determines the texture of soil. Larger particles help in providing the physical support to the plants, while smaller size particles determine the capacity of soil to hold the water and available nutrients. The soil samples have shown varied composition of coarse sand, fine sand, silt and clay materials and particle sizes ranged between 0.2 to 2 mm, 0.02 to 0.2 mm, 0.002 to 0.02 mm and less than 0.002 mm. In the surface texture of soils in the project ranges from sandy loam to clay loam.

Discussion on analytical results

- **pH**

pH of soil is the measure of hydrogen ion activity and depends largely on the relative amounts of the adsorbed hydrogen and other metallic ions present in the soils. pH of soil mainly depends on the soil water ratio. The pH of the soil samples in the study area ranged between 6.2 (Huliyar) to 10.81(Harthikote) in the Kharif season and in Rabi season it is 6.42(Hunsokote) and 9.87(Hosadurga) and where as in pre-monsoon the same is 6.11(Kariyammanahalli) and 8.95(Bommakkanahalli).The results have shown that all sampling areas come under the category of Class-I, which clearly indicates that majority of the soil samples are free from salinity.In the study area few of the soil samples no 1(Huliyar village), 2(Yagati), 6 (Dodda gollahalli) and 22 (Gorlakatte) of pre-monsoon season andsoil sample no 5 of monsoon season, are of medium saline soils. Post monsoon season soil sample of 19 (nikkagondanahalli)and 30(Muthugadahalli) which are high salinity. All the soil samples shown above pH values of 7.06 are slightly alkaline in nature, and this may be due to high amount of leaching which has led to the leach out of exchangeable anions and are considered as slightly alkaline.

Variation in pH values has an impact on survivability of soil flora and fauna under various slightly saline or highly saline soils. However some species of plants may tolerate the pH fluctuations and it is essential to study the pH of the soil in management practices, through which it gives the overall status of soil minerals to the plants. In the study area most of the soil samples were neutral and few soil samples found to be slightly saline.

- **Electrical conductivity**

Electrical conductivity, as the measure of current carrying capacity, gives a clear picture of the amount of soluble salts present in the soil.

It plays a major rolein the salinity of soils. There is a relation between electrical conductivity and salinity, lesser the EC value lower will be the salinity value of soil and vice-versa. The Electrical Conductivity values of the soil samples vary from 50.4 to 696 µmhos/s, as shown below.

Sl. No.	EC values (µmhos/cm)	No. of samples	Season
1	10 to 500	30	Monsoon & Pre monsoon
2	501 to 1000	0	---
3	1001 to 1500	0	---
4	1501 to 2000 and above	1	Post monsoon

Electrical conductivity values within 800 µmhos/cm are considered as normal nature of soil, and in the present study about 99 percent of the samples were observed to be in the normal range.While EC values between 800 and 1600 are considered critical for tolerant crops, while EC values ranging between 1600 and 2500 are considered critical for salt tolerant crops, and EC values more than 2500 are not considered safe for most of the crops. In the study area one sample no 19 (Chikkagondanahalli)of post monsoon has crossed 1500 and therefore almost all the soil samples are found to be suitable for agriculture.

- **Colour**

Soil colour is one of the visual judgment through which the soil type can be classified. The soil colour may vary from region to region or spatially. Soil derives its colour from the source of the material. However, the colour may also vary due to,

- Soil forming process
- Moisture content and drainage
- Nature and amount of organic matter
- Mineral sources

In the study area, the soil samples have shown a wide range of colour. About 70 percent of the samples were in red colour; whereas about 30 percent of the samples were blackThe colour of samples indicated that majority of the samples belong to red category.

- **Organic Carbon**

Soil resource is a major anchor to the all life beings, such as plants, animals and microorganisms in various stages of decomposition process, which gives the end products in the form of organic matter. The organic one of the major factor contributing to changes in soil structure, moisture content, pH and the soil nutrient status of the topsoil. The importance of organic matter in the soil is can be observed through improved soil structure and fertility status of the soil, which differentiates the soil and other non-fertile soils.

In the study area, the amount organic carbon ranged from 0.06(Soil sample no of monsoon season) to 1.02 %(Soil sample no 4 of pre-monsoon season in Bijargi village) , indicating variable organic matter content and decomposition rate. The percentage of organic matter varied spatially and generally has a higher organic content in the case of thickly vegetated areas. The requirement of optimum level of organic matter required by the plants slightly varies between species, as it is not a single nutrient source required for all the plants and for all the soils. The variation is also dependent on soil type, climate, existing plant and animal species.

Percentage organic carbon	Rating	No of samples
<0.40	Low	21
0.4 to 0.75	Medium	5
>0.75	High	4

In the study area it was noticed that the percent organic carbon was found to be in different ranges in almost all the three season samples i.e., 21 samples contained less than 0.40 percent organic carbon. They are low in organic content. The reason for this might be due to very low level or no application of Back yard manure or compost/green manure and also poor stand of vegetation/green rich trees in the dry land tracts of agricultural lands. Only 4 samples of soils viz. 4, 6, 7 were of medium level and the other soil samples of 16, 11, 9, 7& 2 are of high rate.

Therefore most of the samples in the area appear to possess low content of percent organic carbon, which is the reason for frequent crop loss and the farmer are getting low yield of crops.

- **Available Phosphorus**

Phosphorus is the second most important macronutrient available in the soil of the biological systems, which covers more than 1% of the dry organic weight. It is a major component of nucleic acids, phospholipids and many phosphorylated compounds, Similarly, it is also a second most limiting factor often affecting plant growth. Chemically, phosphorus exists in the soil in the form of both organic and inorganic forms. Generally Plants are dependent on inorganic phosphorus especially in the form of phosphate ions,whereas organic phosphates are also important sources of phosphorus in almost all types of soils. Comparatively however the phosphorus is, required in small quantities; but it may be the most likely limiting element in productivity of the plant. Therefore ecologically it is very much significant.

Sl. No	Grade	Concentration
1	Low phosphorus	Less than 12.4 Kg/ha
2	Medium phosphorus	12.4 to 22.4 Kg/ha
3	Adequate phosphorus	More than 22.4 Kg/ha
4	Abundant phosphorus	Still higher

Soils of the study area showed maximum range of abundant levels of phosphorous i.e., about 96.67 per cent of the samples come under this range and about 3.33 percent of the samples belongs to the adequate range in the monsoon season. In general, the soil samples showed higher levels of available phosphorus content. Only one sample (21) in pre monsoon showed low levels of phosphorous and this may be due to utilization of the element by the crop.

- **Exchangeable Sodium and Potassium**

The exchangeable sodium values in the study area ranged between 4.79 to 90.81mg/100gm. The minimum exchangeable sodium value was observed in Sample No. 5 and the maximum exchangeable sodium value was found in Sample No. 9.

Potassium (K) is the third most essential element required by most of the plants. Simultaneously there is a negative effect at higher levels as it affects cell division, formation of carbohydrates, activation of various enzymatic reactions, cell permeability, while it improves resistance of some plants to some diseases. It also plays an important role in water balancing of plants or regulation of osmosis. Generally it forms a most abundant metal cation in plant cell (about 2 to 3 % by dry weight).

Deficient supply of (K)	Less than 113 Kg/ha
Doubtful supply of (K)	113 to 280 Kg/ha
Adequate supply of (K)	More than 280 Kg/ha

In the study area, the soil samples showed a narrow range of potassium level. About 76.92 percent samples come under the range of deficient level of exchangeable potassium, which can be balanced by applying potassium rich fertilizers, whereas about 23 per cent of the samples have medium range of exchangeable potassium content.

- **Particle size distribution**

The soil particle size is major parameter and a relative proportion of the soil particles of various sizes are an important physical parameter, which emphasizes the texture of soil of a particular region. Larger particle size helps in providing the physical support to the plants, while smaller particles encourage the soil to hold water and availability of nutrients.

As per the International System of Classification, the range of the particle sizes in the soil is as under:

Sl.No.	Category	Particle Size
1	Coarse sand	0.2 to 2.0 mm
2	Fine sand	0.02 to 0.2 mm
3	Silt	0.002 to 0.02 mm
4	Clay	<0.002mm

- **Textural class**

Soil texture refers to the relative proportion of clay, silt and sand in a sample of soil. Based on dominancy of the size fraction the soil texture can be classified as various types, such as clay, sandy clay, silt clay etc. whereas the fine particle fraction of the soil is used to describe as loam. Soil texture is an indicative parameter, through which the other soil properties can be studied, but if used alone, it has limited predictive value; viz., ability of a soil to adsorb cations from solution depends on the mineralogy of the clay fraction as well as on the percentage of clay. It also depends on the amount and nature of the organic matter, the soil holds. The permeability of soil to water depends on shape, mineral particles and organic matter into structural units with pore spaces between them. Texture does however indicate the ease with which the application of the soil can be recommended. Higher content of clay in soils are often described, as 'heavy' and sandy soils are known as 'light'. But clay soils retain more water against gravity and consequently warm up more slowly in spring.

- **Water holding capacity (WHC)**

Water holding capacity is the amount of water that can be retained by the soil when all the pores in the soil have been filled with water; soil is saturated with water, accompanied by very poor drainage. The water retained at zero bar tension, is rarely utilized by plants as it reduces the respiration rate and creates anaerobic conditions for the roots.

In the study area the soil samples exhibited a significant correlation between the clay content and water holding capacity. WHC was more in the surface soil layer where a greater accumulation of organic matter, litter and root mass etc., existed. Thereby it supports rather stronger influence of soil organic matter on water holding capacity of the soil. The water holding capacity of the monsoon soils are 1.48% in Dodderi village and 15.97% in Madanaiakanahalli and the values for post monsoon season varies from 7.9% in Hosadurga to 50.09% in Bommakkanahalli. However, in the pre monsoon season soil samples, the range is from 6.01% in Gamnayakanahalli and 50.79% in Bommakkanahalli

- **Available Nitrogen**

Nitrogen is one among the four primary elements essential for the plant tissues. It is the major component of proteins, nucleic acids and chlorophyll. The atmospheric nitrogen gets trapped in the soil during electro and photo-chemical fixation and also by the action of microorganisms. Soil nitrogen is made available through a process of mineralization. The available nitrogen in soil exists in the form of both organic and inorganic forms. However, relatively most of the nitrogen content in organic form is at the most about 90 per cent.Organic content present in the soil decaying by microbial activity, during process all the organic nitrogen gets converted to ammonium, nitrates and nitriles.Nitrogen is having a major role in maintaining the fertility of the soil and nitrogen content in almost all the soils are observed to be very low and is found as nitrates, nitrite and ammonium.Plants are more dependent upon nitrate nitrogen, during the aerobic conditions and ammonia nitrogen during anaerobic conditions.

Sl. No	Quantity of nitrogen	Rating
1	< 272 Kg/ha	Low
2	272 to 554 Kg/ha	Medium
3	> 554 Kg/ha	High

In the study area, the soil samples are with low to high quantity nitrogen content. Soil moisture content is having a major contribution to vary the process and also one of the important factors affecting nitrification. In water logged areas soil suppresses the process of nitrification because of deficient oxygen. However it is totally different in the case of dry soils. As in the case of present study area in the soils however, there will be enough moisture for the process of bacterial metabolism and such soils posses' higher rate of biosynthesis of nitrogen which also contribute to fertility of the soil.

In the monsoon soils, only the following soil samples were fertile with the ratings shown in the table. Majority of the soil samples are of low nitrogen content because of non application of organic matter to the dry lands due to non availability of FYM, Compost and or green manure to the dry lands by the farmers.Medium and High fertility ratings of Monsoon soils are given below.

Soil sample no	Village	Value Kgs/ha	Rating
5	Begur	338.68	Medium
9	Yelladakere	507.09	
11	Kyadigere	351.23	
15	Thoranagatte	282.86	
17	Chippinakere	289.76	
19	Chikkagondanahalli	1041.77	High
29	Hunasekatte	533.12	Medium

In the monsoon soils, nearly half of the following soil samples were with Medium fertility ratings and the rest are of low nitrogen rating.

Soil sample no	Village	Value Kgs/ha	Rating
2	Yagachi	501.25	Medium
4	Hosadurga	348.66	
8	Vani vilaspura	283.71	
9	Yalladakere	283.74	
10	Aimangala	489.21	
12	Kunabevu	333.1	
13	Turuvanur	294.65	

Soil sample no	Village	Value Kgs/ha	Rating
16	Madanayakanahalli	298.04	
18	Kariyammanahalli	289.57	
22	Gorlakatte	324.73	
23	Dodderi	440.16	
26	Rayabommanahalli	334.98	
27	Thimmalapura	297.19	
29	Hunasekatte	333.88	

Similarly, the soil sample soils of pre-monsoon have the nitrogen rating as below:

Soil sample no	Village	Value Kgs/ha	Rating
2	Yagachi	501.76	Medium
5	Begur	352.32	
8	Vani vilaspura	272.83	
10	Aimangala	492.47	
12	Kunabevu	316.73	
13	Turuvanur	285.37	
16	Madanayakanahalli	304.06	
19	Chikkagondanahalli	277.78	
23	Dodderi	395.13	
26	Rayabommanahalli	301.05	
29	Hunasekatte	297.72	

3.3.1 Approach and Methods

We obtained high resolution satellite imageries from Karnataka State Remote Sensing Centre (KSRSC) Bangalore and then prepared land use maps showing crop land, forest, settlements, water bodies, vegetation etc. Geocoded False Colour Composite scene of IRS-IC LISS III with PAN merged data on 1:10,000 scale coinciding with survey of India (SOI) Toposheet is used to prepare various thematic maps and land use and land cover map to the present study.

For the purpose of study of land use/land cover ARC GIS 9.2 and ERDAS IMAGINE 9.1 are used for extracting the land use, land cover layers, from SOI toposheets and satellite imageries. The land use/land cover classes include agriculture land forest, wetlands, settlements, built-up land etc. This classification and methodology is performed based on the standard methodology. The feature classes were identified based on the visual interpretation of the satellite imagery coupled with filed observations. These datasets were digitized and analysed to obtain land use/land cover statistics for the areas under each of these categories.

The study has made use of various primary and secondary data. These include Survey of India (SOI) topographic sheets of 1:50,000 scale and satellite image IRS P6 LISS III (PAN merged) geocoded data of 1:10,000 scale. The Indian Remote Sensing Satellite (IRS) data was visually and digitally interpreted by using the image interpretation elements (such as tone, texture, shape, pattern, association etc) and Arc GIS software was used for processing, analysis and integration of spatial data to reach the objectives of the study. Adequate field checks were made before finalization of the thematic maps.

All these thematic layers were scanned and vectorized using Geographical Information System (GIS). The coverage created is edited to remove any possible errors. All the features in the GIS coverages are assigned the attributes and GIS data base is created as per the required adjectives and the information needed to meet them. The coverages are projected to polyconic projection. The coverages created using digitizer will have digitizer units for its tics. These values should be projected to real world using latitude and longitude information.

3.3.2 Results and Observations

3.3.2.1 Project location and Extent

The water lifting point is situated at Tarikere Taluk of Chikkamagaluru district of Karnataka. The climate is moderate (tending towards hotter regime). the maximum temperature observed at is 40°C and the minimum is 15°C. The project locations showing the lifting point, canals and command area was shown both on Survey of India (SIO) topomap and satellite imageries. The river Bhadra is one of the tributaries of the Tunga-Bhadra river, which itself is a major tributary of the river Krishna. Bhadra river originates at a place called Gangamula in Kudremukh ranges of Westernghats and is harnessed near the village Lakkavalli in Shimoga District to utilize 61.74 TMC of water under Bhadra reservoir project and 3.10 TMC under Bhadra anicut. From Bhadra anicut water will lifted in three location and is going to irrigate 2,25,515 ha of dry land in Tumkur Chitradurga, Davangere& Chikkamagaluru districts of Karnataka. The region is subject to frequent drought and famine, affecting the life and economic status of the population, which subsists mainly on agriculture. The soil in this region is fertile which enables growth of food crops by providing irrigation facilities.

3.3.2.2 Land Use and Land Cover

The results indicate that the buffer zone is dominated by crop lands followed by scrub forest, plantations and water bodies. It also includes built-up and barren rocky land. The ground truth survey revealed that the crops cultivated in the region are Ragi, Hybrid Maize, Bajra, Hybrid Jowar, Cotton, Pulses, Ground Nut and Sunflower.

Table 3.18Land use and Land cover data of study area

Sl. No	LULC	Area	
		Sq Km	%
1	Acacia Plantation	10.26	0.081
2	Agricultural Plantation	527.85	4.155
3	Areconut Plantation	4.45	0.035
4	Bamboo plantation	4.25	0.033
5	Barren rocky/Stony waste	148.22	1.167
6	Built-up	145.76	1.147
7	Coconut Plantation	69.58	0.548
8	Coffee plantation	0.27	0.002
9	Coffee/Cardamom Plantation	19.31	0.152
10	Crop-Land	8423.93	66.303
11	Dry Deciduous Forest	393.54	3.097
12	Eucalyptus Plantation	248.46	1.956
13	Evergreen Forest	0.23	0.002
14	Forest Blank	99.53	0.783
15	Grass land	46.56	0.366
16	Land with/without scrub	417.4	3.285
17	Mining/Quarrying/Industrial waste	21.11	0.166
18	Mixed Forest Plantation	149.96	1.180
19	Moist Deciduous Forest	387.58	3.051
20	Other Forest Plantation	9.64	0.076
21	River Island	1.14	0.009
22	Rubber Plantation	3.74	0.029
23	Scrub-Forest	901.64	7.097
24	Semi Evergreen Forest	22.55	0.177
25	Teak Plantation	21.96	0.173
26	Wastelands	0.17	0.001
27	Water body	532.03	4.188
28	Waterlogged	94.02	0.740
Total		12705.14	100.000

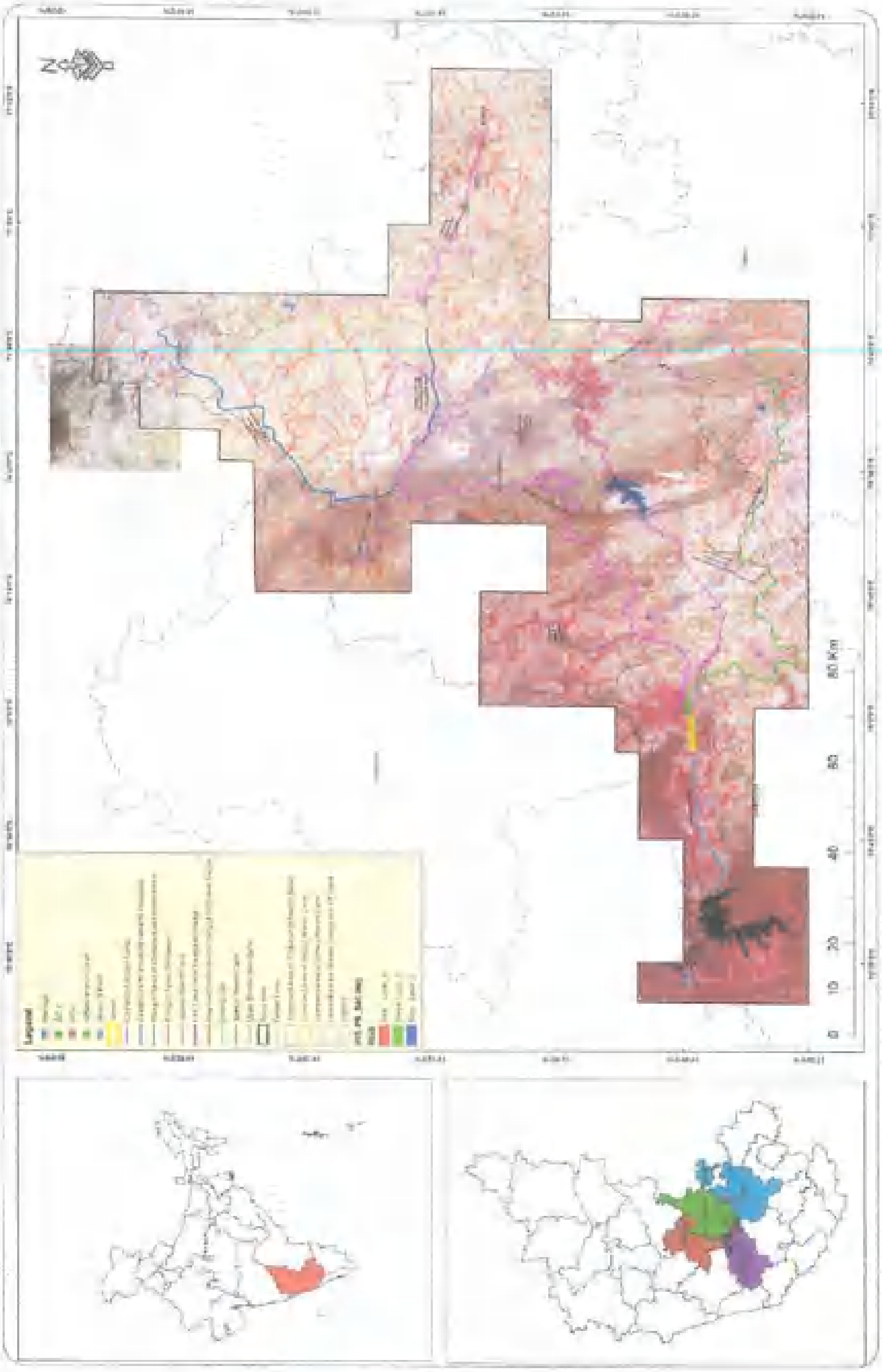


Fig 3.37 Satellite image IRSP6 of study area

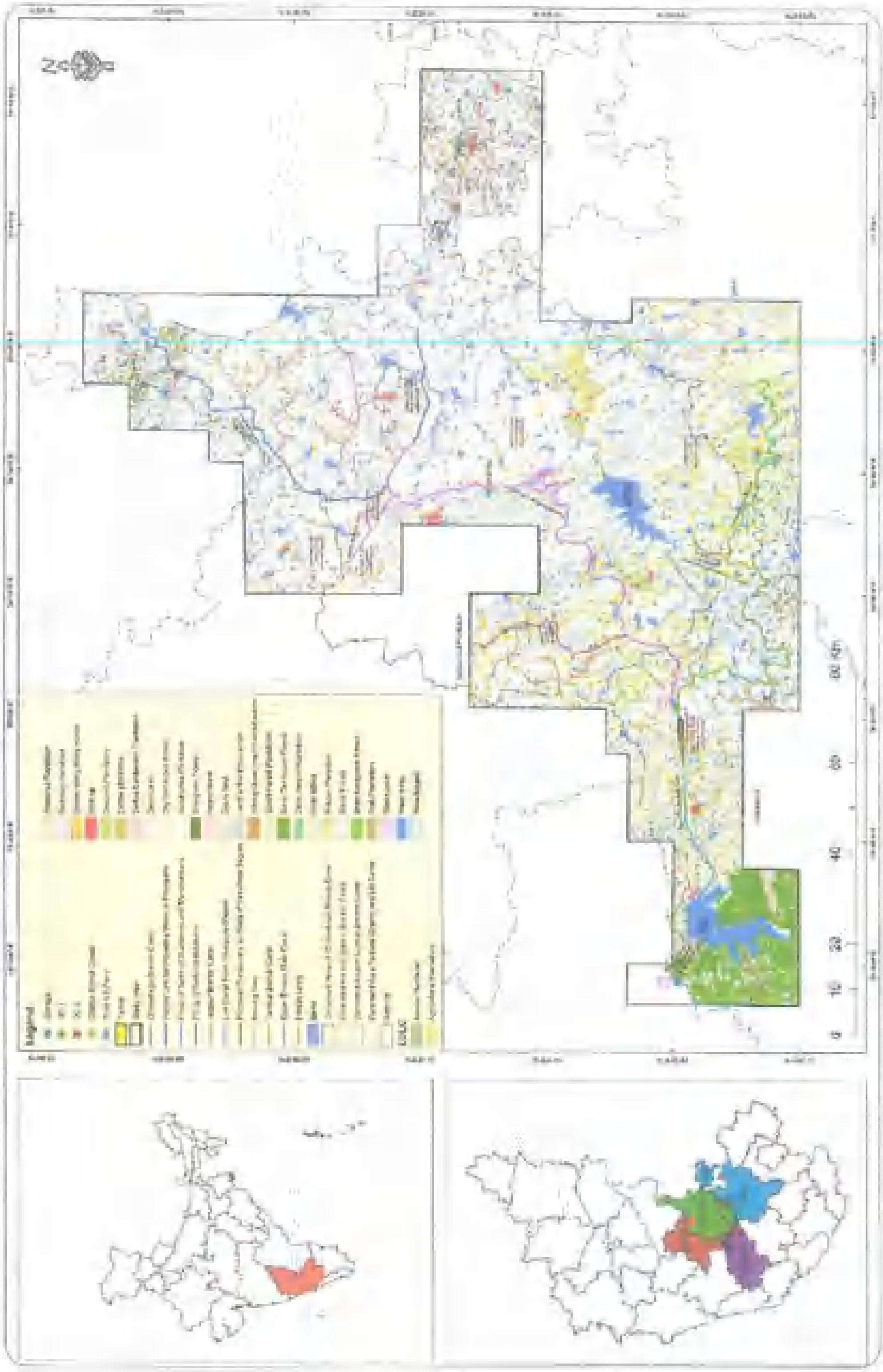


Fig 3.38 Land use/ Land cover map of study area

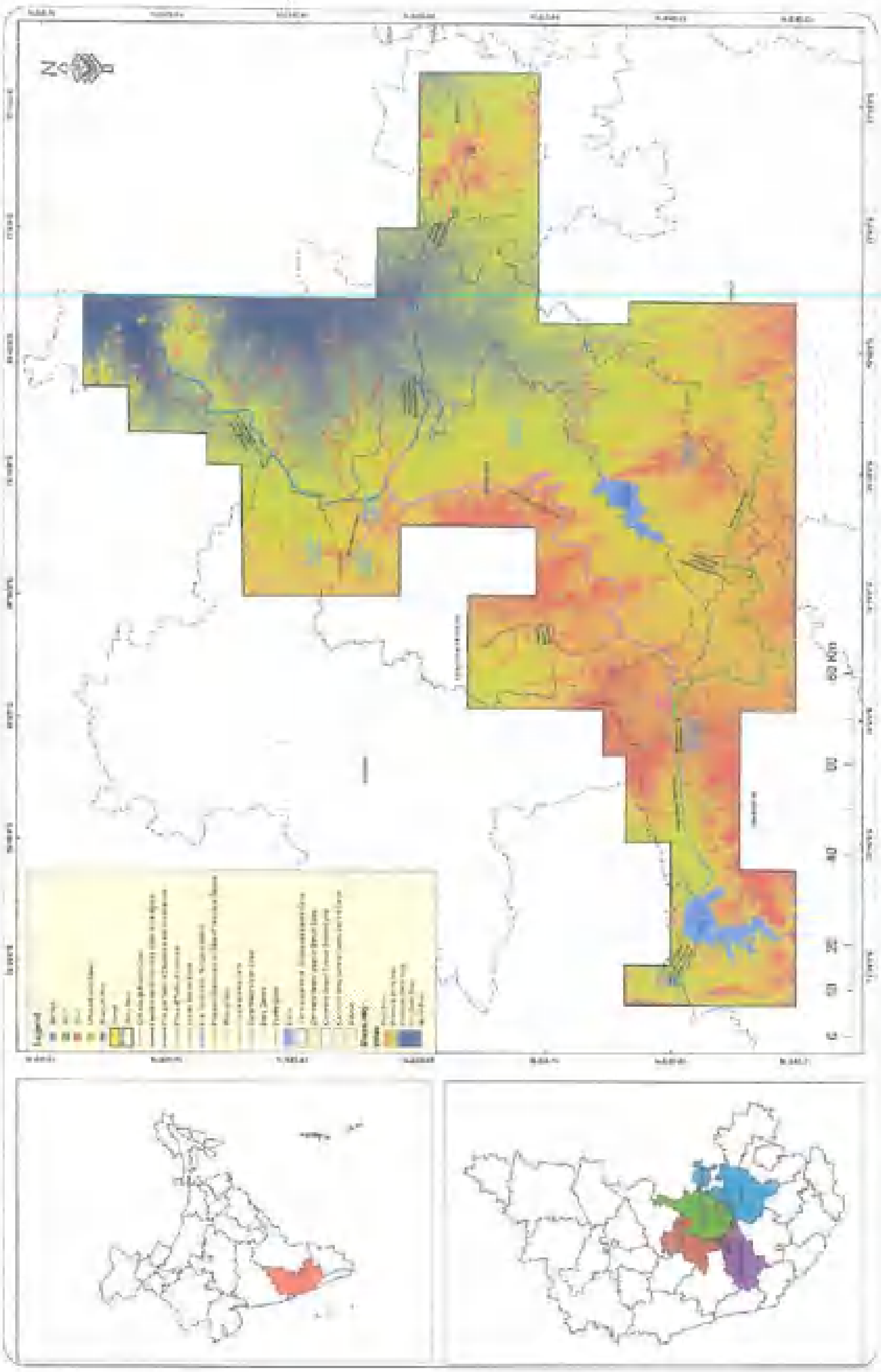


Fig 3.39 Slope map of study area

UPPER BHADRA PROJECT

HYDROLOGY

5. HYDROLOGY

5.1 Introduction

The sources of water for Upper Bhadra Irrigation Scheme are the Tunga and Bhadra rivers. Both the rivers originate in Western Ghats and receive copious supply from highly wooded and hilly catchment of Western Ghats.

5.2 Available Hydrologic Data

River Tunga is being gauged by CWC at about 12 Km downstream of the existing Upper Tunga Project. At this gauging site the catchment area is 2831 Sq. Kms. This discharge data reduced to Upper Tunga project site (Catchment area: 2240.36 Sq. km) is given in **Table 5.1**. The 10 daily flows at Upper Tunga is given in the working tables of Upper Tunga reservoir.

The catchment area of river Bhadra at the Bhadra reservoir site is 1968 Sq. Km. The inflow data at the reservoir site is available from 1972-73. The monthly inflow Figures at Bhadra dam site is shown in **Table 5.2** and the 10 daily flows are in the working Table of Bhadra reservoir.

5.3 The Projects in Tungabhadra Sub-Basin

The rivers Tunga and Bhadra join together at a village called Kudali and below the confluence the river is named Tungabhadra and is further joined by a major tributary Varada. There are a number of projects in Tungabhadra basin. The projects in Karnataka with their water utilization is given in the master plan (**Table 5.3**).

5.4 Area Capacity Table

The area capacity Table of Bhadra reservoir is in **Table 5.4.**

5.5 Working Table

The working Table of Tunga and Bhadra reservoir is in **Table 5.5**.

Historical working tables of the Bhadra Reservoir are available from 1972-73 to 2014-15. But the Upper Bhadra project changes those historical conditions, since water will be pumped from Tunga into (Package I) and also out of Bhadra Reservoir (Package II). The Bhadra Reservoir level pattern will be changed by the quantities pumped into and out of it. In order to define the levels with reasonable sharpness, 10-daily combined working tables (as well as Bhadra Reservoir) were prepared accordingly, the combined 10-daily working tables has been prepared for 43 years from 1972-73 to 2014-15. Each month is divided into three periods, the first two periods being 10 days each and the last period the remaining number of days (e.g., August last period has 11 days). Since then, inflow data at Tunga and Bhadra Reservoir have become available up to and including the year 2014-15 and the working tables are extended accordingly, and revised to take into account the changed 10-daily water requirements. The following data are used in these tables:

(i) Inflow into Tunga Anicut and Bhadra Reservoir as per records.

(ii) Utilization for irrigation and domestic uses, as planned for Bhadra Reservoir, Gondi Anicut, Ubrani LIS, Upper Tunga Project and Tunga Anicut.

(iii) Revised pumping pattern out of Bhadra Reservoir under Package II for 29.9 TMC (**Table 1**).

(iv) Bhadra Reservoir Capacity Tables.

(v) Evaporation rates for Bhadra Reservoir (**Table 1**).

(vi) The FRL of Bhadra Reservoir is 662.92 m. The capacity at FRL is 71535 Mcft.

(vii) MDDL for Bhadra Reservoir project is 641.584 m (capacity = 13832 Mcft).

5.5.1 Package I Pumping

In preparing the working tables, both Package I and Package II pumping are assumed to take place from 16th June to 15th October. For Package I pumping from Tunga, the calculations have been carried out from pumping capacity 48 as well as 60 cumecs (excluding / including the standby pump). When four pumps together are used then the lifting capacity is 1465 Mcft in 10 days and 1611 Mcft in 11 days. When all five pumps are used, the lifting capacities are respectively 1831 and 2014 Mcft. Priority is given to satisfy the requirements of Upper Tunga and Tunga Anicut Projects, and Package I pumping is done only if inflow exceeds these. The upper limit for pumping is the balance flow in Tunga or pumping capacity of 4 pumps as the case may be Ref **Table 5.6**. Pumping is reduced/stopped when Bhadra Reservoir is surplus.

5.5.2 Package II Pumping

Priority is given in each 10 daily period to the irrigation and domestic uses at Bhadra Reservoir, and Package II pumping is done only if water is available after the above requirement and that to the water in the reservoirs above the MDDL of UBP.

5.6 Evaporation Loss

Evaporation loss of Bhadra Reservoir taken from modernization booklet, distributed over the water year is shown in Table 1, and is used for all the years.

5.7 Conclusion

The results show that 29.9 TMC of water can be pumped for the Upper Bhadra project without reducing the Bhadra command success rate below 79.1% with 4 pumps working at Tunga pump house.

Table 1: Data Common for all years used in the Working Tables
(Revised Pumping Pattern and Evaporation Rates of Bhadra Reservoir)

Month	10-daily period	Requirement at UT & TA Mcft	UBP Package II Pumping Requirement Mcft	Evaporation at Bhadra Reservoir Mcft	Bhadra Requirement Mcft
June	**I**	373	0	39	253
	II	373	1158	39	254
	III	905	2316	39	256
July	**I**	1057	2459	50	947
	II	876	2374	50	947
	III	697	2518	56	1042
Aug	**I**	1217	2697	83	2247
	II	1417	2696	83	2247
	III	1618	2665	91	2471
Sep	**I**	2052	2381	94	2017
	II	2035	2382	94	2018
	III	2018	2383	94	2019
Oct	**I**	1589	2381	110	1568
	II	1409	1190	110	1568
	III	1231		121	1727
Nov	**I**			114	1940
	II			114	1941

Month	10-daily period	Requirement at UT & TA Mcft	UBP Package II Pumping Requirement Mcft	Evaporation at Bhadra Reservoir Mcft	Bhadra Requirement Mcft
	III			115	1943
Dec	I			116	545
	II			116	545
	III			127	599
Jan	I			112	1977
	II			112	1977
	III			124	2178
Feb	I			114	2405
	II			114	2405
	III			90	1928
Mar	I			112	3249
	II			112	3249
	III			123	3575
Apr	I			115	2665
	II			115	2666
	III			115	2667
May	I			72	1072
	II			72	1072
	III			79	1179
	Total	**18867**	**29900**	**3436**	**63358**

STATEMENT SHOWING THE YIELD AVAILABLE AT UPPER TUNGA PROJECT SITE BASED ON GAUGED FLOWS AT SHIMOGA C.W.C. G.D.SITE

Catchme 2240.00 Sq.Km (865.00 Sq.Miles)

Sl. No.	YEAR	Yield in Mcft	Yield in Descending order in Mcft	Remarks
1	2	3	4	5
1	1972-73	105443	267481	-
2	1973-74	145696	266459	-
3	1974-75	138639	245405	-
4	1975-76	187231	236784	-
5	1976-77	97260	234663	-
6	1977-78	144393	232987	-
7	1978-79	220706	228819	-
8	1979-80	119515	222764	-
9	1980-81	208168	220706	-
10	1981-82	163866	208168	-
11	1982-83	141479	206544	-
12	1983-84	143972	204258	-
13	1984-85	145661	199735	-
14	1985-86	117909	192707	-
15	1986-87	115746	187595	-
16	1987-88	72877	187231	-
17	1988-89	113049	186925	-
18	1989-90	128302	184180	-
19	1990-91	167426	177450	-
20	1991-92	159397	167426	
21	1992-93	186925	163866	-
22	1993-94	149125	162431	-
23	1994-95	236784	159397	-
24	1995-96	115719	154522	-
25	1996-97	115818	149125	-
26	1997-98	177450	145696	-
27	1998-99	154522	145661	
28	1999-00	228819	144393	
29	2000-01	206544	143972	
30	2001-02	162431	141479	
31	2002-03	139443	139443	
32	**2003-04**	**133376**	138639	
33	2004-05	199735	**133376**	**75% dependable yield137.32**
34	2005-06	267481	128302	
35	2006-07	245405	119515	
36	2007-08	222764	117909	
37	2008-09	232987	115818	
38	2009-10	266459	115746	
39	2010-11	187595	115719	
40	2011-12	234663	113049	
41	2012-13	192707	105443	
42	2013-14	204258	97260	
43	2014-15	184180	72877	-

Table 5.1: INFLOW OF TUNGA RESERVOIR FOR THE YEAR 1972 - 2015

Catchment Area: 2240.00 Sq.Km (865.00 Sq.Miles) **Unit in Mcft**

Sl.No.	Month	Flow at CWC G.D												
		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	TOTAL
1	1972-73	5247	54539	26121	7121	6226	3247	1878	430	170	133	145	186	**105443**
2	1973-74	20428	58683	44247	12766	4360	2151	1780	580	193	171	149	188	**145696**
3	1974-75	1824	53740	54127	14178	9298	2377	1613	652	237	223	174	196	**138639**
4	1975-76	30503	42804	68992	23726	11374	5419	2539	956	342	206	213	157	**187231**
5	1976-77	2568	36799	32992	16380	2382	3451	1398	548	214	183	171	174	**97260**
6	1977-78	12324	64366	24841	23737	10050	4186	2401	837	316	211	172	952	**144393**
7	1978-79	27045	78971	77980	19645	7637	4872	2545	1278	330	143	148	112	**220706**
8	1979-80	9101	31508	56437	9133	5428	4520	2052	577	215	75	139	330	**119515**
9	1980-81	27677	80440	60899	21385	9022	4582	2547	906	161	108	61	380	**208168**
10	1981-82	14184	40038	79967	16070	6781	3449	2059	749	259	119	60	131	**163866**
11	1982-83	2802	36701	81713	10148	4927	2774	1670	529	130	42	10	33	**141479**
12	1983-84	7870	38600	55384	20345	11109	5089	2163	1132	326	1007	737	210	**143972**
13	1984-85	19496	58247	39971	11535	10549	2529	1872	915	205	103	126	113	**145661**
14	1985-86	23213	25482	46665	8662	8319	2337	1915	620	327	178	116	75	**117909**
15	1986-87	11467	32737	54848	6813	3179	4176	1489	610	217	116	70	24	**115746**
16	1987-88	3595	21692	23729	8383	8265	3165	2461	827	290	109	215	146	**72877**
17	1988-89	2364	40608	44005	14286	8031	1403	1426	449	158	84	47	187	**113049**
18	1989-90	12848	48789	45822	11093	5078	2314	1489	655	106	48	15	45	**128302**
19	1990-91	19972	49399	64570	19758	6386	3814	1956	729	175	46	82	539	**167426**
20	1991-92	21036	61947	54931	9567	6304	3079	1559	483	203	53	22	213	**159397**
21	1992-93	19730	45805	66203	24773	9868	13502	4335	1554	480	300	144	231	**186925**
22	1993-94	6841	43899	56912	13588	17957	4450	3557	1083	161	56	501	120	**149125**
23	1994-95	25354	108358	50021	32526	11906	4418	2452	1163	314	99	44	129	**236784**
24	1995-96	1748	44675	25111	33976	5902	2131	1423	485	114	56	26	72	**115719**
25	1996-97	13641	36214	37659	13137	9953	2292	1714	678	250	85	84	111	**115818**
26	1997-98	8380	63454	75419	12997	6273	5664	3744	1038	298	102	42	39	**177450**
27	1998-99	10879	56451	36406	24772	14010	6045	2798	1125	354	102	83	1497	**154522**

Sl.No.	Month	Flow at CWC G.D												
		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	TOTAL
28	1999-00	20621	96443	59713	18280	20610	6969	3390	1303	655	334	250	251	**228819**
29	2000-01	22060	71855	56782	30757	15220	5214	2246	902	397	275	605	231	**206544**
30	2001-02	23173	51639	53556	14097	10533	5235	1942	765	685	289	234	283	**162431**
31	2002-03	11383	28191	62463	14271	12348	5538	2151	1066	567	435	462	568	**139443**
32	2003-04	10485	41917	43548	17189	12938	3129	1524	872	417	341	204	812	**133376**
33	2004-05	28256	46662	91297	15987	9021	4645	1865	983	432	161	192	234	**199735**
34	2005-06	22088	82069	93073	33563	20750	8309	3710	948	370	363	452	1786	**267481**
35	2006-07													**245405**
36	2007-08	22678	95380	46948	29031	12303	8909	3255	538	1096	1292	552	782	**222764**
37	2008-09	19747	51124	111823	28387	10964	5569	3545	1018	112	255	255	188	**232987**
38	2009-10	3819	117166	45660	46124	37965	10936	1825	1171	666	402	217	508	**266459**
39	2010-11	11987	47973	60188	30169	17351	11314	4557	1931	756	512	478	379	**187595**
40	2011-12	39853	74652	46671	47808	12435	6235	3229	1734	908	408	176	554	**234663**
41	2012-13	7933	34677	89839	40965	8469	5587	2742	1442	465	152	120	316	**192707**
42	2013-14	24099	94789	53204	15245	6845	3974	2586	1766	416	156	107	1071	**204258**
43	2014-15	5088	54885	77042	26293	10313	4963	2353	1355	528	206	170	984	**184180**

YEARWISE INLOW DETAILS OF BHADRA RESERVOIR PROJECT (1972-73 TO 2014-15)

Catchment Area: 11655.00 Sq.Km (4500.00 Sq.Miles)

YEAR	INFLOW
1972-73	66363
1973-74	88478
1974-75	82438
1975-76	114736
1976-77	56135
1977-78	84258
1978-79	144924
1979-80	83215
1980-81	135690
1981-82	104209
1982-83	84495
1983-84	82402
1984-85	88745
1985-86	70074
1986-87	81772
1987-88	84449
1988-89	69337
1989-90	84353
1990-91	96701
1991-92	92644
1992-93	125916
1993-94	96904
1994-95	151415
1995-96	77547
1996-97	77625
1997-98	106988
1998-99	97984
1999-00	99695
2000-01	72123
2001-02	69663
2002-03	51955
2003-04	46503
2004-05	72446
2005-06	110648
2006-07	101584
2007-08	133555
2008-09	96924
2009-10	106221
2010-11	86154
2011-12	127903
2012-13	57912
2013-14	129914
2014-15	101598
Average	**92897.57**
	Say92.89TMC

	INFLOW IN DESCENDING ORDER		
	YEAR	**INFLOW**	
1	1994-95	151415	
2	1978-79	144924	
3	1980-81	135690	
4	2007-08	133555	
5	2013-14	129914	
6	2011-12	127903	
7	1992-93	125916	
8	1975-76	114736	
9	2005-06	110648	
10	1997-98	106988	
11	2009-10	106221	
12	1981-82	104209	
13	2014-15	101598	
14	2006-07	101584	
15	1999-00	99695	
16	1998-99	97984	
17	2008-09	96924	
18	1993-94	96904	
19	1990-91	96701	
20	1991-92	92644	
21	1984-85	88745	
22	1973-74	88478	
23	2010-11	86154	
24	1982-83	84495	
25	1987-88	84449	
26	1989-90	84353	
27	1977-78	84258	
28	1979-80	83215	
29	1974-75	82438	
30	1983-84	82402	
31	1986-87	81772	
32	**1996-97**	**77625**	**77606**
33	1995-96	77547	(75% dependability)
34	2004-05	72446	Say 77.60 TMC
35	2000-01	72123	
36	1985-86	70074	
37	2001-02	69663	
38	1988-89	69337	
39	1972-73	66363	
40	2012-13	57912	
41	1976-77	56135	
42	2002-03	51955	
43	2003-04	46503	

Table 5.2: INFLOW OF BHADRA RESIORVOIR FOR THE YEAR 1972 - 2015

Catchment Area: 11655.00 Sq.Km (4500.00 Sq.Miles)

Sl.No.	YEAR	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Total
1	1972-73	6091	29429	12734	5011	5304	2356	1385	873	677	381	896	1226	**66363**
2	1973-74	11403	29812	28071	7805	4227	1943	1593	985	282	636	394	1327	**88478**
3	1974-75	1953	29838	27699	9781	5817	1831	1481	1078	539	729	722	970	**82438**
4	1975-76	18736	21204	37205	16577	8062	4674	2441	2737	780	927	923	470	**114736**
5	1976-77	2159	18931	15676	9195	1929	2823	1580	865	561	510	583	1323	**56135**
6	1977-78	9187	30162	12387	12031	11033	4309	1953	981	396	449	566	804	**84258**
7	1978-79	16516	42914	52725	15927	7127	4883	2137	1250	466	231	496	252	**144924**
8	1979-80	8532	18840	33655	9278	5822	4058	1775	793	288	515	842	817	**85215**
9	1980-81	20395	51835	33531	12685	6991	4130	1870	960	599	951	634	1117	**135698**
10	1981-82	9094	20254	46637	12343	6617	3063	2387	1295	858	330	62	204	**103144**
11	1982-83	7590	19525	40947	6105	4593	1690	1330	968	284	412	332	719	**84495**
12	1983-84	6836	21912	23298	12907	7349	3689	2354	1392	637	1047	486	295	**82202**
13	1984-85	15198	31610	19194	7791	8024	2705	1691	748	215	929	325	315	**88745**
14	1985-86	13918	14164	24739	6034	5846	2088	1064	1022	483	146	334	233	**70071**
15	1986-87	9408	18222	35002	6204	3833	4628	1983	875	600	135	452	430	**81772**
16	1987-88	3925	11393	11002	5455	6888	2124	1577	863	536	379	307	0	**44449**
17	1988-89	1315	25521	22775	9615	4466	1323	2287	457	943	127	196	12	**69037**
18	1989-90	7581	34307	25934	6223	5171	2132	1381	557	403	249	237	1178	**85353**
19	1990-91	11248	22502	36807	10575	6624	3495	1797	1070	597	212	590	1184	**96701**
20	1991-92	11588	34715	23568	6937	6766	3618	1984	1306	1172	479	109	402	**92644**
21	1992-93	15520	28088	35964	15201	8886	12662	3798	1647	1598	762	469	1321	**125916**
22	1993-94	4891	23061	29732	8024	17441	4724	2804	1645	933	386	955	308	**94904**
23	1994-95	17103	62223	27837	16486	11187	4417	2220	7465	552	173	777	965	**151405**
24	1995-96	2608	27581	17212	18728	4902	3092	1033	688	168	461	755	339	**77567**
25	1996-97	11282	20001	20461	10860	8052	2465	1657	984	388	316	381	778	**77625**
26	1997-98	7905	34294	41019	8241	5713	4122	2646	1233	597	340	291	587	**106988**
27	1998-99	7219	27603	21781	17905	12685	5626	2228	993	418	286	336	904	**97984**
28	1999-00	8005	38381	25285	6522	13521	3799	2202	782	401	329	255	213	**99695**

Sl.No.	YEAR	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	Total
29	2000-01	10073	27770	25597	13523	9960	2823	838	363	369	311	230	269	**92126**
30	2001-02	11096	21752	21520	5802	4942	879	693	379	375	408	922	385	**69153**
31	2002-03	5524	9329	22193	3958	5899	2068	890	366	304	300	606	518	**51955**
32	2003-04	5155	13857	13979	4224	5260	811	493	324	268	261	225	1646	**46503**
33	2004-05	12693	13432	33591	5513	3433	1123	573	431	288	321	504	544	**72446**
34	2005-06	6108	35318	37237	12216	10714	3959	1893	699	395	389	227	1493	**110648**
35	2006-07	10153	34346	35074	11014	4395	3597	1716	559	225	135	104	266	**101584**
36	2007-08	12591	39897	40979	22542	10167	4217	1662	545	397	261	115	182	**133555**
37	2008-09	9956	22252	42527	13990	4555	1420	984	544	242	213	134	107	**96924**
38	2009-10	1142	47724	15022	20272	14289	2569	2697	1898	320	95	77	116	**106221**
39	2010-11	4209	17676	21430	15502	11381	10537	3347	1558	174	156	84	100	**86154**
40	2011-12	13120	22893	24852	22072	6513	35557	1752	544	225	153	86	136	**127903**
41	2012-13	1046	12839	26836	11681	1374	2450	476	268	300	229	211	202	**57912**
42	2013-14	12252	58270	33668	14092	6566	1245	759	406	208	137	226	2085	**129914**
43	2014-15	4706	35770	36230	13180	6938	1716	865	584	416	387	370	435	**101598**

Table 5.3: Master Plan - Tungabhadra Sub Basin (K-8) - Scheme A (Excluding Vedavathi)

No.	Project	Original Allocation (TMC)	Revised Allocation (TMC)	Savings (TMC)	Remarks
1	Jambada Halla	0.70	0.70	NIL	
2	Nari Halla	0.90	0.90	NIL	
3	Kanakanala	0.40	0.40	NIL	
4	Ambligola	1.40	1.40	NIL	
5	Anjunapura	2.60	2.50	NIL	
6	Dharma	2.20	2.20	NIL	
7	Hagari Bommana Halli	2.00	2.00	NIL	
8	Rajolibunda	1.20	1.20	NIL	
9	Tunga Anicut	11.50	5.25	+ 6.25	Proposed modernisation
10	Bhadra Anicut	3.10	2.60	+ 0.5	Proposed modernisation
11	Bhadra reservoir	61.70	61.70	NIL	
12	Tungabhadra	132.10	121.00	+ 11.00	Less utilisation due to siltation of reservoir.
13	Vijayanagara Canals	12.00	6.60	+ 5.25	Proposed modernisation
14	Hire halla	2.27	2.27	NIL	
15	Mushkinala	0.75	0.75	NIL	
16	F.C. to Ranibenr	1.50	1.50	NIL	
17	Singatalur LIS	7.64	18.55	-10.91	Additional out of savings in Tungabhadra.
18	Upper Tunga	12.24	12.24	NIL	
19	Basapur LIS	0.80	0.80	NIL	
20	Hagi-Sasalwad LIS	0.55	1.55	-1.00	Additional Allocation due to siltation of Tungabhadra Reservoir
21	Upper Bhadra	-	23.00	-23.00	Addition for providing water to Chitradurga
22	Minor irrigation	54.77	57.77	NIL	
	Total	312.10	325.91	-10.91	
	Total Avg.	14.06	14.81	-11.64	

Tungabhadra Reservoir evaporation	18.00 TMC	
Utilisation in AP (Rajolibunda - KC canal, LC, HLC)	65.00 TMC	(After 8 TMC. Savings due to modernisation)
	83.00 TMC	

Table 5.4 : Capacity Table of Bhadra Reservoir

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	Mtrs.	Sq.Mile.	Sq.Km.	M.Cft.	M.Cum.
1	2	3	4	5	6
32	9.754	1.80	4.662	1200	33.984
33	10.058	1.87	4.843	1232	34.890
34	10.363	1.94	5.025	1264	35.796
35	10.668	2.01	5.206	1296	36.703
36	10.973	2.08	5.388	1328	37.609
37	11.278	2.15	5.569	1360	38.515
38	11.582	2.22	5.750	1392	39.421
39	11.883	2.29	5.931	1424	40.328
40	12.192	2.36	6.112	1456	41.234
41	12.497	2.40	6.216	1488	42.140
42	12.802	2.50	6.475	1522	43.103
43	13.106	2.57	6.656	1554	44.009
44	13.411	2.64	6.837	1588	44.972
45	13.716	2.71	7.019	1622	45.935
46	14.201	2.78	7.200	1656	46.898
47	14.326	2.85	7.382	1690	47.861
48	14.630	2.92	7.563	1724	48.824
49	14.935	2.99	7.744	1758	49.787
50	15.240	3.06	7.926	1792	50.749
51	15.545	3.13	8.107	1826	51.712
52	15.850	3.20	8.288	1860	52.675
53	16.154	3.28	8.495	1894	53.638
54	16.460	3.36	8.702	1928	54.601
55	16.764	3.44	8.910	1962	55.564
56	17.069	3.52	9.117	1996	56.527
57	17.374	3.60	9.324	2030	57.410
58	17.678	3.68	9.531	2064	58.452
59	17.983	3.76	9.738	2098	59.415
60	18.288	3.84	9.946	2132	60.378
61	18.593	3.92	10.153	2166	61.341
62	18.898	4.00	10.360	2200	62.304
63	19.202	4.10	10.619	2280	64.570
64	19.507	4.20	10.878	2360	66.835
65	19.812	4.30	11.137	2440	69.101
66	20.117	4.40	11.396	2520	71.366
67	20.422	4.50	11.655	2600	73.632
68	20.726	4.64	12.018	2720	77.030
69	21.031	4.78	12.380	2840	80.429
70	21.336	4.92	12.743	2960	83.827
71	21.641	5.06	13.105	3080	87.226
72	21.946	5.20	13.468	3200	90.264
73	22.250	5.34	13.831	3340	94.589

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	**Mtrs.**	**Sq.Mile.**	**Sq.Km.**	**M.Cft.**	**M.Cum.**
74	22.555	5.48	14.193	3480	98.554
75	22.860	5.62	14.556	3620	102.518
76	23.165	5.78	14.970	3760	106.483
77	23.470	5.90	15.281	3800	107.616
78	23.774	6.04	15.644	4060	114.980
79	24.079	6.18	16.006	4220	119.510
80	24.384	6.32	16.369	4300	121.776
81	24.689	6.46	16.731	4540	128.573
82	24.994	6.60	17.094	4700	133.104
83	25.298	6.74	17.457	4860	137.635
84	25.603	6.88	17.819	5020	142.166
85	25.908	7.02	18.182	5180	146.698
86	26.213	7.16	18.544	5340	151.229
87	26.518	7.30	18.907	5500	155.760
88	26.822	7.44	19.270	5720	161.990
89	27.127	7.58	19.632	5940	168.221
90	27.432	7.72	19.995	6160	174.451
91	27.737	7.86	20.357	6395	181.106
92	28.042	8.00	20.720	6630	187.762
93	28.364	8.20	21.238	6865	194.417
94	28.651	8.40	21.756	7100	201.072
95	28.956	8.60	22.274	7335	207.727
96	29.261	8.80	22.792	7570	214.382
97	29.566	9.00	23.310	7665	217.073
98	29.870	9.25	23.958	8040	227.693
99	30.175	9.30	24.087	8280	234.490
100	30.480	9.40	24.346	8500	240.720

Capacity Table of Bhadra Reservoir (Contd)

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	Mtrs.	Sq.Mile.	Sq.Km.	M.Cft.	M.Cum.
1	2	3	4	5	6
100	30.48	9.40	24.346	8500.00	240.720
101	30.79	9.60	24.864	8764.00	248.202
102	31.10	9.92	25.693	9031.00	255.763
103	31.40	10.26	26.573	9312.00	263.721
104	31.71	10.60	27.454	9602.00	271.934
105	32.01	10.95	28.361	9902.00	280.430
106	32.32	11.29	29.241	10211.00	289.182
107	32.62	11.63	30.122	10530.00	298.216
108	32.93	11.98	31.028	10859.00	307.533
109	33.23	12.32	31.909	11197.00	317.106
110	33.54	12.66	32.789	11544.00	326.933
111	33.84	13.00	33.670	11901.00	337.043
112	34.15	13.34	34.551	12268.00	347.437
113	34.45	13.70	35.483	12644.00	358.086
114	34.76	14.05	36.390	13030.00	369.017
115	35.06	14.41	37.322	13426.00	380.232
116	35.37	14.76	38.228	13832.00	391.730
117	35.67	15.12	39.161	14248.00	403.512
118	35.98	15.48	40.093	14674.00	415.576
119	36.28	15.83	41.000	15110.00	427.924
120	36.59	16.19	41.932	15556.00	440.555
121	36.89	16.54	42.839	16012.00	453.469
122	37.20	16.90	43.771	16478.00	466.667
123	37.50	17.33	44.885	16955.00	480.176
124	37.80	17.76	45.998	17444.00	494.024
125	38.11	18.19	47.112	17945.00	508.213
126	38.41	18.62	48.226	18458.00	522.741
127	38.72	19.06	49.365	18983.00	537.610
128	39.02	19.49	50.479	19520.00	552.818
129	39.33	19.92	51.593	20069.00	568.366
130	39.63	20.35	52.707	20630.00	584.254
131	39.94	20.78	53.820	21203.00	600.481
132	40.24	21.22	54.960	21788.00	617.049
133	40.55	21.66	56.099	22385.00	633.956
134	40.85	22.04	57.084	22994.00	651.204
135	41.16	22.46	58.171	23614.00	668.762

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	**Mtrs.**	**Sq.Mile.**	**Sq.Km.**	**M.Cft.**	**M.Cum.**
136	41.46	22.87	59.233	24245.00	686.633

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	Mtrs.	Sq.Mile.	Sq.Km.	M.Cft.	M.Cum.
137	41.77	23.29	60.321	24888.00	704.843
138	42.07	23.70	61.383	25543.00	723.393
139	42.38	24.12	62.471	26209.00	742.254
140	42.68	24.53	63.533	26887.00	761.456
141	42.99	24.96	64.646	27576.00	780.969
142	43.29	25.36	65.682	28277.00	800.821
143	43.60	25.79	66.796	28989.00	820.986
144	43.90	26.18	67.806	29713.00	841.490
145	44.21	26.58	68.842	30448.00	862.305
146	44.51	26.99	69.904	31194.00	883.432
147	44.82	27.44	71.070	31952.00	904.899
148	45.12	27.81	72.028	32722.00	926.706
149	45.43	28.21	73.064	33503.00	948.825
150	45.73	28.62	74.126	34295.00	971.255
151	46.04	29.03	75.188	35098.00	993.996
152	46.34	29.44	76.250	35913.00	1017.077
153	46.65	29.93	77.519	36740.00	1040.498
154	46.95	30.42	78.788	37581.00	1064.316
155	47.26	30.91	80.057	38435.00	1088.502
156	47.56	31.40	81.326	39303.00	1113.084
157	47.87	31.89	82.595	40185.00	1138.063
158	48.17	32.37	83.838	41081.00	1163.438
159	48.48	32.86	85.107	41990.00	1189.182
160	48.78	33.35	86.377	42913.00	1215.321
161	49.09	33.84	87.646	43849.00	1241.830
162	49.39	34.33	88.915	44799.00	1268.734
163	49.70	34.82	90.184	45762.00	1296.007
164	50.00	35.31	91.453	46739.00	1323.676
165	50.30	35.80	92.722	47730.00	1351.742
166	50.61	36.29	93.991	48735.00	1380.204
167	50.91	36.78	95.260	49753.00	1409.034
168	51.22	37.26	96.503	50785.00	1438.261
169	51.52	37.75	97.773	51830.00	1467.856
170	51.83	38.24	99.042	52889.00	1497.848
171	52.13	38.73	100.311	53961.00	1528.207
172	52.44	39.22	101.580	55047.00	1558.963
173	52.74	39.66	102.719	56146.00	1590.088
174	53.05	40.10	103.859	57257.00	1621.552

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	Mtrs.	Sq.Mile.	Sq.Km.	M.Cft.	M.Cum.
175	53.35	40.53	104.973	58380.00	1653.356

Reservoir Level in		Water Spread Area in		Capacity in	
Ft.	**Mtrs.**	**Sq.Mile.**	**Sq.Km.**	**M.Cft.**	**M.Cum.**
176	53.66	40.96	106.086	59515.00	1685.500
177	53.96	41.40	107.226	60663.00	1718.012
178	54.27	41.83	108.340	61823.00	1750.864
179	54.57	42.26	109.453	62995.00	1784.056
180	54.88	42.69	110.567	64179.00	1817.587
181	55.18	43.13	111.707	65375.00	1851.459
182	55.49	43.56	112.820	66583.00	1885.670
183	55.79	43.99	113.934	67803.00	1920.221
184	56.10	44.43	115.074	69035.00	1955.112
185	56.40	44.86	116.187	70279.00	1990.343
186	56.71	45.29	117.301	71535.00	2025.913

Table 5.5 : Working Table of Upper Tunga and Bhadra Reservoir

Year : 1972-73		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832 Mcft	641.584 m	FRL =	71535 Mcft		662.920 m			UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Irrig + Domestic		Upper Bhadra		Over Spillway	Total 8+13b+11	Evaporation Mcft	Closing		Unit = Mcft	
										Demand	Met	Demand	Met				R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	115	373	0	0	641.58	13832	121	13953	253	121	0	0	0	121	39	641.55	13793	-132	0
II	Jun	67	373	0	0	641.55	13793	127	13920	254	88	1158	0	0	88	39	641.55	13793	-166	-1158
III	Jun	5065	905	4160	1465	641.55	13793	5843	21101	256	256	2316	0	0	256	39	645.94	20806	0	-2316
I	Jul	28781	1057	27724	1465	645.94	20806	15096	37366	947	947	2459	2459	0	3406	50	651.80	33910	0	0
II	Jul	16960	876	16084	1465	651.80	33910	8781	44156	947	947	2374	2374	0	3321	50	654.28	40785	0	0
III	Jul	8798	697	8101	1611	654.28	40785	5552	47948	1042	1042	2518	2518	0	3560	56	655.45	44332	0	0
I	Aug	9217	1217	8000	1465	655.45	44332	2510	48306	2247	2247	2697	2697	0	4944	83	655.11	43279	0	0
II	Aug	8679	1417	7262	1465	655.11	43279	5151	49895	2247	2247	2696	2696	0	4943	83	655.63	44869	0	0
III	Aug	8225	1618	6607	1611	655.63	44869	5073	51553	2471	2471	2965	2965	0	5436	91	655.99	46026	0	0
I	Sep	2312	2052	260	260	655.99	46026	775	47061	2017	2017	2381	2381	0	4398	94	654.88	42569	0	0
II	Sep	2457	2035	422	422	654.88	42569	1824	44815	2018	2018	2382	2382	0	4400	94	654.13	40321	0	0
III	Sep	2352	2018	334	334	654.13	40321	2412	43067	2019	2019	2383	2383	0	4402	94	653.52	38571	0	0
I	Oct	3149	1589	1560	1465	653.52	38571	1667	41702	1568	1568	2381	2381	0	3949	110	653.19	37643	0	0
II	Oct	1396	1409	0	0	653.19	37643	1412	39055	1568	1568	1190	1190	0	2758	110	652.66	36187	0	0
III	Oct	1681	1231	450	0	652.66	36187	2225	38412	1727	1727	0		0	1727	121	652.80	36564	0	0
I	Nov					652.80	36564	489	37053	1940	1940			0	1940	114	652.21	34999	0	0
II	Nov					652.21	34999	898	35897	1941	1941			0	1941	114	651.77	33842	0	0
III	Nov					651.77	33842	969	34811	1943	1943			0	1943	115	651.35	32753	0	0
I	Dec					651.35	32753	307	33060	545	545			0	545	116	651.21	32399	0	0
II	Dec					651.21	32399	357	32756	545	545			0	545	116	651.09	32095	0	0
III	Dec					651.09	32095	721	32816	599	599			0	599	127	651.09	32090	0	0
I	Jan					651.09	32090	546	32636	1977	1977			0	1977	112	650.46	30547	0	0
II	Jan					650.46	30547	122	30669	1977	1977			0	1977	112	649.65	28580	0	0
III	Jan					649.65	28580	205	28785	2178	2178			0	2178	124	648.72	26483	0	0
I	Feb					648.72	26483	247	26730	2405	2405			0	2405	114	647.66	24211	0	0
II	Feb					647.66	24211	228	24439	2405	2405			0	2405	114	646.53	21920	0	0
III	Feb					646.53	21920	202	22122	1928	1928			0	1928	90	645.57	20104	0	0
I	Mar					645.57	20104	0	20104	3249	3249			0	3249	112	643.58	16743	0	0
II	Mar					643.58	16743	236	16979	3249	3147			0	3147	112	641.50	13720	-102	0
III	Mar					641.50	13720	145	13865	3575	33			0	33	123	641.49	13709	-3542	0
I	Apr					641.49	13709	480	14189	2665	357			0	357	115	641.50	13717	-2308	0
II	Apr					641.50	13717	356	14073	2666	241			0	241	115	641.50	13717	-2425	0
III	Apr					641.50	13717	60	13777	2667	0			0	0	115	641.46	13662	-2667	0
I	May					641.46	13662	272	13934	1072	102			0	102	72	641.53	13760	-970	0
II	May					641.53	13760	397	14157	1072	325			0	325	72	641.53	13760	-747	0
III	May					641.53	13760	557	14317	1179	485			0	485	79	641.52	13753	-694	0
Total, TMC		**99.25**	**18.87**	**80.96**	**13.03**			**66.36**		**63.36**	**49.61**	**29.90**	**26.43**	**0.00**	**76.03**	**3.44**			**-13.75**	**-3.47**

Year : 1973-74		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832 Mcft	641.584 m		FRL =	71535 Mcft		662.92 m		UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Irrig + Domestic		Upper Bhadra		Over Spillway	Total 8+13b+11	Evaporation Mcft	Closing		Unit = Mcft	
										Demand	Met	Demand	Met				R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	309	373	0	0	641.52	13753	779	14532	253	253	0	0	0	253	39	641.88	14240	0	0
II	Jun	16239	373	15866	1465	641.88	14240	8532	24237	254	254	1158	0	0	254	39	647.53	23944	0	-1158
III	Jun	3880	905	2975	1465	647.53	23944	2092	27500	256	256	2316	0	0	256	39	649.04	27205	0	-2316
I	Jul	25803	1057	24746	1465	649.04	27205	15088	43758	947	947	2459	2459	0	3406	50	654.12	40302	0	0
II	Jul	23442	876	22566	1465	654.12	40302	10677	52443	947	947	2374	2374	0	3321	50	656.92	49072	0	0
III	Jul	9438	697	8741	1611	656.92	49072	4047	54730	1042	1042	2518	2518	0	3560	56	657.53	51114	0	0
I	Aug	6815	1217	5598	1465	657.53	51114	6173	58752	2247	2247	2697	2697	0	4944	83	658.28	53725	0	0
II	Aug	18986	1417	17569	1465	658.28	53725	11025	66214	2247	2247	2696	2696	0	4943	83	660.31	61188	0	0
III	Aug	18446	1618	16828	1611	660.31	61188	10873	73672	2471	2471	2965	2965	0	5436	91	662.09	68145	0	0
I	Sep	6817	2052	4765	1465	662.09	68145	3736	73346	2017	2017	2381	2381	0	4398	94	662.27	68854	0	0
II	Sep	3636	2035	1601	1465	662.27	68854	2250	72569	2018	2018	2382	2382	0	4400	94	662.07	68075	0	0
III	Sep	2313	2018	295	295	662.07	68075	1819	70189	2019	2019	2383	2383	0	4402	94	661.48	65693	0	0
I	Oct	1434	1589	0	0	661.48	65693	1277	66970	1568	1568	2381	2381	0	3949	110	660.76	62911	0	0
II	Oct	1325	1409	0	0	660.76	62911	1380	64291	1568	1568	1190	1190	0	2758	110	660.38	61423	0	0
III	Oct	1601	1231	370	0	660.38	61423	1570	62993	1727	1727	0		0	1727	121	660.30	61145	0	0
I	Nov					660.30	61145	1371	62516	1940	1940			0	1940	114	660.12	60462	0	0
II	Nov					660.12	60462	250	60712	1941	1941			0	1941	114	659.64	58657	0	0
III	Nov					659.64	58657	322	58979	1943	1943			0	1943	115	659.17	56921	0	0
I	Dec					659.17	56921	574	57495	545	545			0	545	116	659.15	56834	0	0
II	Dec					659.15	56834	476	57310	545	545			0	545	116	659.10	56649	0	0
III	Dec					659.10	56649	543	57192	599	599			0	599	127	659.05	56466	0	0
I	Jan					659.05	56466	477	56943	1977	1977			0	1977	112	658.60	54854	0	0
II	Jan					658.60	54854	246	55100	1977	1977			0	1977	112	658.08	53011	0	0
III	Jan					658.08	53011	262	53273	2178	2178			0	2178	124	657.49	50971	0	0
I	Feb					657.49	50971	119	51090	2405	2405			0	2405	114	656.77	48571	0	0
II	Feb					656.77	48571	71	48642	2405	2405			0	2405	114	656.02	46123	0	0
III	Feb					656.02	46123	92	46215	1928	1928			0	1928	90	655.41	44197	0	0
I	Mar					655.41	44197	70	44267	3249	3249			0	3249	112	654.33	40906	0	0
II	Mar					654.33	40906	239	41145	3249	3249			0	3249	112	653.24	37784	0	0
III	Mar					653.24	37784	327	38111	3575	3575			0	3575	123	651.99	34413	0	0
I	Apr					651.99	34413	245	34658	2665	2665			0	2665	115	651.00	31878	0	0
II	Apr					651.00	31878	37	31915	2666	2666			0	2666	115	649.87	29134	0	0
III	Apr					649.87	29134	112	29246	2667	2667			0	2667	115	648.71	26464	0	0
I	May					648.71	26464	303	26767	1072	1072			0	1072	72	648.33	25623	0	0
II	May					648.33	25623	570	26193	1072	1072			0	1072	72	648.06	25049	0	0
III	May					648.06	25049	454	25503	1179	1179			0	1179	79	647.68	24245	0	0
Total, TMC		**140.48**	**18.87**	**121.92**	**15.23**			**88.48**		**63.36**	**63.36**	**29.90**	**26.43**	**0.00**	**89.78**	**3.44**			**0.00**	**-3.47**

Year : 1974-75		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
										Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	
10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	251	373	0	0	647.68	24245	228	24473	253	253	0	0	0	253	39	647.65	24181	0	0
II	Jun	195	373	0	0	647.65	24181	298	24479	254	254	1158	0	0	254	39	647.65	24186	0	-1158
III	Jun	1378	905	473	473	647.65	24186	1427	26086	256	256	2316	0	0	256	39	648.40	25791	0	-2316
I	Jul	18671	1057	17614	1465	648.40	25791	11380	38635	947	947	2459	2459	0	3406	50	652.28	35179	0	0
II	Jul	14416	876	13540	1465	652.28	35179	8278	44922	947	947	2374	2374	0	3321	50	654.54	41551	0	0
III	Jul	20653	697	19956	1611	654.54	41551	10180	53342	1042	1042	2518	2518	0	3560	56	657.12	49726	0	0
I	Aug	15835	1217	14618	1465	657.12	49726	8696	59886	2247	2247	2697	2697	0	4944	83	658.60	54859	0	0
II	Aug	27408	1417	25991	1465	658.60	54859	14824	71148	2247	2247	2696	2696	0	4943	83	661.58	66122	0	0
III	Aug	10884	1618	9266	1611	661.58	66122	4179	71912	2471	2471	2965	2965	0	5436	91	661.65	66385	0	0
I	Sep	3848	2052	1796	1465	661.65	66385	2119	69969	2017	2017	2381	2381	0	4398	94	661.42	65477	0	0
II	Sep	3864	2035	1829	1465	661.42	65477	3164	70105	2018	2018	2382	2382	0	4400	94	661.46	65611	0	0
III	Sep	6466	2018	4448	1465	661.46	65611	4498	71574	2019	2019	2383	2383	0	4402	94	661.82	67078	0	0
I	Oct	4356	1589	2767	1465	661.82	67078	2568	71110	1568	1568	2381	2381	0	3949	110	661.82	67051	0	0
II	Oct	2602	1409	1193	1193	661.82	67051	1925	70169	1568	1568	1190	1190	0	2758	110	661.88	67301	0	0
III	Oct	2340	1231	1109	0	661.88	67301	1324	68625	1727	1727	0		0	1727	121	661.75	66777	0	0
I	Nov					661.75	66777	1009	67786	1940	1940			0	1940	114	661.49	65732	0	0
II	Nov					661.49	65732	432	66164	1941	1941			0	1941	114	661.07	64109	0	0
III	Nov					661.07	64109	390	64499	1943	1943			0	1943	115	660.64	62441	0	0
I	Dec					660.64	62441	434	62875	545	545			0	545	116	660.58	62214	0	0
II	Dec					660.58	62214	574	62788	545	545			0	545	116	660.56	62127	0	0
III	Dec					660.56	62127	473	62600	599	599			0	599	127	660.49	61874	0	0
I	Jan					660.49	61874	379	62253	1977	1977			0	1977	112	660.04	60164	0	0
II	Jan					660.04	60164	281	60445	1977	1977			0	1977	112	659.56	58356	0	0
III	Jan					659.56	58356	418	58774	2178	2178			0	2178	124	659.05	56472	0	0
I	Feb					659.05	56472	184	56656	2405	2405			0	2405	114	658.40	54137	0	0
II	Feb					658.40	54137	38	54175	2405	2405			0	2405	114	657.69	51656	0	0
III	Feb					657.69	51656	317	51973	1928	1928			0	1928	90	657.19	49955	0	0
I	Mar					657.19	49955	470	50425	3249	3249			0	3249	112	656.31	47064	0	0
II	Mar					656.31	47064	84	47148	3249	3249			0	3249	112	655.28	43787	0	0
III	Mar					655.28	43787	175	43962	3575	3575			0	3575	123	654.11	40264	0	0
I	Apr					654.11	40264	124	40388	2665	2665			0	2665	115	653.18	37608	0	0
II	Apr					653.18	37608	228	37836	2666	2666			0	2666	115	652.24	35055	0	0
III	Apr					652.24	35055	370	35425	2667	2667			0	2667	115	651.31	32643	0	0
I	May					651.31	32643	278	32921	1072	1072			0	1072	72	650.96	31777	0	0
II	May					650.96	31777	440	32217	1072	1072			0	1072	72	650.68	31073	0	0
III	May					650.68	31073	252	31325	1179	1179			0	1179	79	650.27	30067	0	0
Total, TMC		133.17	18.87	114.60	16.60			82.44		63.36	63.36	29.90	26.43	0.00	89.78	3.44			0.00	-3.47

Year : 1975-76		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
										Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	
10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	218	373	0	0	650.27	30067	531	30598	253	253	0	0	0	253	39	650.36	30306	0	0
II	Jun	2658	373	2285	1465	650.36	30306	1495	33266	254	254	1158	1158	0	1412	39	650.98	31815	0	0
III	Jun	27627	905	26722	1465	650.98	31815	16710	49989	256	256	2316	2316	0	2572	39	656.41	47378	0	0
I	Jul	13248	1057	12191	1465	656.41	47378	6153	54996	947	947	2459	2459	0	3406	50	657.65	51540	0	0
II	Jul	21805	876	20929	1465	657.65	51540	10352	63357	947	947	2374	2374	0	3321	50	660.00	59986	0	0
III	Jul	7751	697	7054	1611	660.00	59986	4699	66296	1042	1042	2518	2518	0	3560	56	660.70	62680	0	0
I	Aug	20599	1217	19382	1465	660.70	62680	11021	75165	2247	2247	2697	2697	0	4944	83	662.58	70138	0	0
II	Aug	36874	1417	35457	0	662.58	70138	19503	89641	2247	2247	2696	2696	13163	18106	83	662.90	71452	0	0
III	Aug	11519	1618	9901	0	662.90	71452	6681	78133	2471	2471	2965	2965	1162	6598	91	662.90	71444	0	0
I	Sep	9588	2052	7536	0	662.90	71444	5879	77323	2017	2017	2381	2381	1390	5788	94	662.90	71441	0	0
II	Sep	7925	2035	5890	0	662.90	71441	5736	77177	2018	2018	2382	2382	1242	5642	94	662.90	71441	0	0
III	Sep	6213	2018	4195	0	662.90	71441	4962	76403	2019	2019	2383	2383	466	4868	94	662.90	71441	0	0
I	Oct	5516	1589	3927	0	662.90	71441	3564	75005	1568	1568	2381	2381	0	3949	110	662.78	70946	0	0
II	Oct	2975	1409	1566	1465	662.78	70946	2226	74637	1568	1568	1190	1190	344	3102	110	662.89	71425	0	0
III	Oct	2883	1231	1652	0	662.89	71425	2272	73697	1727	1727			435	2162	121	662.89	71414	0	0
I	Nov					662.89	71414	2641	74055	1940	1940			580	2520	114	662.89	71421	0	0
II	Nov					662.89	71421	1240	72661	1941	1941			0	1941	114	662.69	70606	0	0
III	Nov					662.69	70606	793	71399	1943	1943			0	1943	115	662.39	69341	0	0
I	Dec					662.39	69341	1005	70346	545	545			0	545	116	662.47	69685	0	0
II	Dec					662.47	69685	913	70598	545	545			0	545	116	662.53	69937	0	0
III	Dec					662.53	69937	523	70460	599	599			0	599	127	662.48	69734	0	0
I	Jan					662.48	69734	1070	70804	1977	1977			0	1977	112	662.23	68715	0	0
II	Jan					662.23	68715	1204	69919	1977	1977			0	1977	112	662.01	67830	0	0
III	Jan					662.01	67830	463	68293	2178	2178			0	2178	124	661.55	65991	0	0
I	Feb					661.55	65991	367	66358	2405	2405			0	2405	114	661.00	63839	0	0
II	Feb					661.00	63839	217	64056	2405	2405			0	2405	114	660.41	61537	0	0
III	Feb					660.41	61537	196	61733	1928	1928			0	1928	90	659.93	59715	0	0
I	Mar					659.93	59715	442	60157	3249	3249			0	3249	112	659.14	56796	0	0
II	Mar					659.14	56796	281	57077	3249	3249			0	3249	112	658.28	53716	0	0
III	Mar					658.28	53716	204	53920	3575	3575			0	3575	123	657.27	50222	0	0
I	Apr					657.27	50222	321	50543	2665	2665			0	2665	115	656.53	47763	0	0
II	Apr					656.53	47763	238	48001	2666	2666			0	2666	115	655.74	45220	0	0
III	Apr					655.74	45220	364	45584	2667	2667			0	2667	115	654.96	42802	0	0
I	May					654.96	42802	200	43002	1072	1072			0	1072	72	654.65	41858	0	0
II	May					654.65	41858	183	42041	1072	1072			0	1072	72	654.32	40897	0	0
III	May					654.32	40897	87	40984	1179	1179			0	1179	79	653.92	39726	0	0
Total, TMC		177.40	18.87	158.69	10.40			114.74		63.36	63.36	29.90	29.90	18.78	112.04	3.44			0.00	0.00

Year : 1976-77		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832 Mcft	641.584 m		FRL =	71535 Mcft		662.92 m		UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
										Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	
10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	586	373	213	0	653.92	39726	710	40436	253	253	0	0	0	253	39	654.07	40144	0	0
II	Jun	642	373	269	269	654.07	40144	349	40762	254	254	1158	1158	0	1412	39	653.78	39311	0	0
III	Jun	1340	905	435	435	653.78	39311	1100	40846	256	256	2316	2316	0	2572	39	653.40	38235	0	0
I	Jul	3323	1057	2266	1465	653.40	38235	2053	41753	947	947	2459	2459	0	3406	50	653.42	38297	0	0
II	Jul	10203	876	9327	1465	653.42	38297	5173	44934	947	947	2374	2374	0	3321	50	654.55	41563	0	0
III	Jul	23273	697	22576	1611	654.55	41563	11705	54879	1042	1042	2518	2518	0	3560	56	657.57	51263	0	0
I	Aug	21002	1217	19785	1465	657.57	51263	10362	63090	2247	2247	2697	2697	0	4944	83	659.48	58063	0	0
II	Aug	6175	1417	4758	1465	659.48	58063	2301	61828	2247	2247	2696	2696	0	4943	83	659.14	56802	0	0
III	Aug	5815	1618	4197	1611	659.14	56802	3013	61426	2471	2471	2965	2965	0	5436	91	658.89	55899	0	0
I	Sep	11540	2052	9488	1465	658.89	55899	6257	63621	2017	2017	2381	2381	0	4398	94	659.77	59129	0	0
II	Sep	3318	2035	1283	1283	659.77	59129	1803	62215	2018	2018	2382	2382	0	4400	94	659.39	57721	0	0
III	Sep	1522	2018	0	0	659.39	57721	1135	58856	2019	2019	2383	2383	0	4402	94	658.46	54360	0	0
I	Oct	1245	1589	0	0	658.46	54360	866	55226	1568	1568	2381	2381	0	3949	110	657.54	51167	0	0
II	Oct	491	1409	0	0	657.54	51167	389	51556	1568	1568	1190	1190	0	2758	110	656.81	48688	0	0
III	Oct	646	1231	0	0	656.81	48688	674	49362	1727	1727			0	1727	121	656.45	47514	0	0
I	Nov					656.45	47514	572	48086	1940	1940			0	1940	114	655.99	46032	0	0
II	Nov					655.99	46032	802	46834	1941	1941			0	1941	114	655.60	44779	0	0
III	Nov					655.60	44779	1449	46228	1943	1943			0	1943	115	655.40	44170	0	0
I	Dec					655.40	44170	597	44767	545	545			0	545	116	655.38	44106	0	0
II	Dec					655.38	44106	522	44628	545	545			0	545	116	655.34	43967	0	0
III	Dec					655.34	43967	461	44428	599	599			0	599	127	655.25	43702	0	0
I	Jan					655.25	43702	259	43961	1977	1977			0	1977	112	654.65	41872	0	0
II	Jan					654.65	41872	423	42295	1977	1977			0	1977	112	654.09	40206	0	0
III	Jan					654.09	40206	183	40389	2178	2178			0	2178	124	653.35	38087	0	0
I	Feb					653.35	38087	284	38371	2405	2405			0	2405	114	652.53	35852	0	0
II	Feb					652.53	35852	274	36126	2405	2405			0	2405	114	651.68	33607	0	0
III	Feb					651.68	33607	3	33610	1928	1928			0	1928	90	650.89	31592	0	0
I	Mar					650.89	31592	247	31839	3249	3249			0	3249	112	649.61	28478	0	0
II	Mar					649.61	28478	98	28576	3249	3249			0	3249	112	648.14	25215	0	0
III	Mar					648.14	25215	165	25380	3575	3575			0	3575	123	646.41	21682	0	0
I	Apr					646.41	21682	35	21717	2665	2665			0	2665	115	644.91	18937	0	0
II	Apr					644.91	18937	344	19281	2666	2666			0	2666	115	643.43	16500	0	0
III	Apr					643.43	16500	204	16704	2667	2667			0	2667	115	641.65	13922	0	0
I	May					641.65	13922	330	14252	1072	420			0	420	72	641.53	13760	-652	0
II	May					641.53	13760	297	14057	1072	225			0	225	72	641.53	13760	-847	0
III	May					641.53	13760	696	14456	1179	624			0	624	79	641.52	13753	-555	0
Total, TMC		91.12	18.87	74.60	12.53			56.14		63.36	61.30	29.90	29.90	0.00	91.20	3.44			-2.05	0.00

Year : 1977-78		Bhadra Reservoir

Year : 1977-78		Tunga Reservoir						MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Irrig + Domestic		Upper Bhadra		Over Spillway	Total 8+13b+11	Evaporation Mcft	Closing		Unit = Mcft	
										Demand	Met	Demand	Met				R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	51	373	0	0	641.52	13753	463	14216	253	253	0	0	0	253	39	641.65	13924	0	0
II	Jun	2382	373	2009	1465	641.65	13924	2431	17820	254	254	1158	0	0	254	39	644.07	17527	0	-1158
III	Jun	9891	905	8986	1465	644.07	17527	6293	25284	256	256	2316	0	0	256	39	648.03	24989	0	-2316
I	Jul	18664	1057	17607	1465	648.03	24989	8912	35366	947	947	2459	2459	0	3406	50	651.02	31910	0	0
II	Jul	10796	876	9920	1465	651.02	31910	4204	37578	947	947	2374	2374	0	3321	50	651.91	34207	0	0
III	Jul	34906	697	34209	1611	651.91	34207	17046	52864	1042	1042	2518	2518	0	3560	56	656.98	49248	0	0
I	Aug	10224	1217	9007	1465	656.98	49248	5147	55860	2247	2247	2697	2697	0	4944	83	657.45	50833	0	0
II	Aug	6233	1417	4816	1465	657.45	50833	3224	55521	2247	2247	2696	2696	0	4943	83	657.35	50495	0	0
III	Aug	8384	1618	6766	1611	657.35	50495	4016	56122	2471	2471	2965	2965	0	5436	91	657.38	50595	0	0
I	Sep	17012	2052	14960	1465	657.38	50595	7906	59966	2017	2017	2381	2381	0	4398	94	658.77	55474	0	0
II	Sep	4124	2035	2089	1465	658.77	55474	2083	59022	2018	2018	2382	2382	0	4400	94	658.51	54528	0	0
III	Sep	2601	2018	583	583	658.51	54528	2042	57153	2019	2019	2383	2383	0	4402	94	657.98	52657	0	0
I	Oct	5269	1589	3680	1465	657.98	52657	6052	60173	1568	1568	2381	2381	0	3949	110	658.95	56114	0	0
II	Oct	3060	1409	1651	1465	658.95	56114	3065	60644	1568	1568	1190	1190	0	2758	110	659.40	57776	0	0
III	Oct	1721	1231	490	0	659.40	57776	1916	59692	1727	1727			0	1727	121	659.42	57844	0	0
I	Nov					659.42	57844	1419	59263	1940	1940			0	1940	114	659.25	57209	0	0
II	Nov					659.25	57209	847	58056	1941	1941			0	1941	114	658.92	56001	0	0
III	Nov					658.92	56001	2043	58044	1943	1943			0	1943	115	658.91	55986	0	0
I	Dec					658.91	55986	943	56929	545	545			0	545	116	658.99	56268	0	0
II	Dec					658.99	56268	363	56631	545	545			0	545	116	658.91	55970	0	0
III	Dec					658.91	55970	647	56617	599	599			0	599	127	658.89	55891	0	0
I	Jan					658.89	55891	554	56445	1977	1977			0	1977	112	658.46	54356	0	0
II	Jan					658.46	54356	310	54666	1977	1977			0	1977	112	657.95	52577	0	0
III	Jan					657.95	52577	117	52694	2178	2178			0	2178	124	657.32	50392	0	0
I	Feb					657.32	50392	282	50674	2405	2405			0	2405	114	656.65	48155	0	0
II	Feb					656.65	48155	114	48269	2405	2405			0	2405	114	655.91	45750	0	0
III	Feb					655.91	45750	0	45750	1928	1928			0	1928	90	655.26	43732	0	0
I	Mar					655.26	43732	201	43933	3249	3249			0	3249	112	654.21	40572	0	0
II	Mar					654.21	40572	0	40572	3249	3249			0	3249	112	653.03	37211	0	0
III	Mar					653.03	37211	248	37459	3575	3575			0	3575	123	651.74	33761	0	0
I	Apr					651.74	33761	226	33987	2665	2665			0	2665	115	650.73	31207	0	0
II	Apr					650.73	31207	180	31387	2666	2666			0	2666	115	649.66	28606	0	0
III	Apr					649.66	28606	160	28766	2667	2667			0	2667	115	648.49	25984	0	0
I	May					648.49	25984	218	26202	1072	1072			0	1072	72	648.06	25058	0	0
II	May					648.06	25058	120	25178	1072	1072			0	1072	72	647.58	24034	0	0
III	May					647.58	24034	466	24500	1179	1179			0	1179	79	647.19	23242	0	0
Total, TMC		135.32	18.87	116.77	18.45			84.26		63.36	63.36	29.90	26.43	0.00	89.78	3.44			0.00	-3.47

Year : 1978-79		Bhadra Reservoir

Year : 1978-79		Tunga Reservoir						MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
										Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	
10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	18	373	0	0	647.19	23242	676	23918	253	253	0	0	0	253	39	647.38	23626	0	0
II	Jun	9330	373	8957	1465	647.38	23626	6773	31863	254	254	1158	1158	0	1412	39	650.41	30412	0	0
III	Jun	17697	905	16792	1465	650.41	30412	9067	40944	256	256	2316	2316	0	2572	39	653.43	38333	0	0
I	Jul	13777	1057	12720	1465	653.43	38333	6607	46404	947	947	2459	2459	0	3406	50	655.01	42948	0	0
II	Jul	27889	876	27013	1465	655.01	42948	15914	60327	947	947	2374	2374	0	3321	50	659.18	56956	0	0
III	Jul	37305	697	36608	0	659.18	56956	20393	77349	1042	1042	2518	2518	2254	5814	56	662.91	71479	0	0
I	Aug	26013	1217	24796	0	662.91	71479	15803	87282	2247	2247	2697	2697	10803	15747	83	662.90	71452	0	0
II	Aug	27162	1417	25745	0	662.90	71452	16963	88415	2247	2247	2696	2696	11937	16880	83	662.90	71452	0	0
III	Aug	24805	1618	23187	0	662.90	71452	19959	91411	2471	2471	2965	2965	14440	19876	91	662.90	71444	0	0
I	Sep	8964	2052	6912	0	662.90	71444	7927	79371	2017	2017	2381	2381	3438	7836	94	662.90	71441	0	0
II	Sep	3850	2035	1815	1465	662.90	71441	2600	75506	2018	2018	2382	2382	0	4400	94	662.79	71012	0	0
III	Sep	6831	2018	4813	0	662.79	71012	5400	76412	2019	2019	2383	2383	475	4877	94	662.90	71441	0	0
I	Oct	2667	1589	1078	1078	662.90	71441	2360	74879	1568	1568	2381	2381	0	3949	110	662.75	70820	0	0
II	Oct	2465	1409	1056	1056	662.75	70820	1866	73742	1568	1568	1190	1190	0	2758	110	662.76	70874	0	0
III	Oct	2505	1231	1274	0	662.76	70874	2901	73775	1727	1727			513	2240	121	662.89	71414	0	0
I	Nov					662.89	71414	2488	73902	1940	1940			427	2367	114	662.89	71421	0	0
II	Nov					662.89	71421	1275	72696	1941	1941			0	1941	114	662.70	70641	0	0
III	Nov					662.70	70641	1120	71761	1943	1943			0	1943	115	662.47	69703	0	0
I	Dec					662.47	69703	727	70430	545	545			0	545	116	662.49	69769	0	0
II	Dec					662.49	69769	578	70347	545	545			0	545	116	662.47	69686	0	0
III	Dec					662.47	69686	832	70518	599	599			0	599	127	662.50	69792	0	0
I	Jan					662.50	69792	514	70306	1977	1977			0	1977	112	662.11	68217	0	0
II	Jan					662.11	68217	518	68735	1977	1977			0	1977	112	661.72	66646	0	0
III	Jan					661.72	66646	218	66864	2178	2178			0	2178	124	661.19	64562	0	0
I	Feb					661.19	64562	177	64739	2405	2405			0	2405	114	660.58	62220	0	0
II	Feb					660.58	62220	217	62437	2405	2405			0	2405	114	659.98	59918	0	0
III	Feb					659.98	59918	72	59990	1928	1928			0	1928	90	659.46	57972	0	0
I	Mar					659.46	57972	97	58069	3249	3249			0	3249	112	658.56	54708	0	0
II	Mar					658.56	54708	134	54842	3249	3249			0	3249	112	657.64	51481	0	0
III	Mar					657.64	51481	0	51481	3575	3575			0	3575	123	656.54	47783	0	0
I	Apr					656.54	47783	118	47901	2665	2665			0	2665	115	655.71	45121	0	0
II	Apr					655.71	45121	206	45327	2666	2666			0	2666	115	654.87	42546	0	0
III	Apr					654.87	42546	172	42718	2667	2667			0	2667	115	653.99	39936	0	0
I	May					653.99	39936	80	40016	1072	1072			0	1072	72	653.62	38872	0	0
II	May					653.62	38872	89	38961	1072	1072			0	1072	72	653.25	37817	0	0
III	May					653.25	37817	83	37900	1179	1179			0	1179	79	652.83	36642	0	0
Total, TMC		211.28	18.87	192.77	9.46			144.92		63.36	63.36	29.90	29.90	44.29	137.54	3.44			0.00	0.00

Year : 1979-80		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	

10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Issues from the Reservoir (in Mcft)						Evaporation Mcft	OR 649.930 m		Unit = Mcft	
										Irrig + Domestic		Upper Bhadra		Over Spillway	Total 8+13b+11		Closing			
										Demand	Met	Demand	Met				R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	26	373	0	0	652.83	36642	198	36840	253	253	0	0	0	253	39	652.79	36548	0	0
II	Jun	21	373	0	0	652.79	36548	673	37221	254	254	1158	1158	0	1412	39	652.50	35770	0	0
III	Jun	9054	905	8149	1465	652.50	35770	7661	44896	256	256	2316	2316	0	2572	39	654.79	42285	0	0
I	Jul	11986	1057	10929	1465	654.79	42285	7907	51656	947	947	2459	2459	0	3406	50	656.66	48200	0	0
II	Jul	8853	876	7977	1465	656.66	48200	5559	55224	947	947	2374	2374	0	3321	50	657.74	51853	0	0
III	Jul	10669	697	9972	1611	657.74	51853	5374	58838	1042	1042	2518	2518	0	3560	56	658.70	55222	0	0
I	Aug	38900	1217	37683	0	658.70	55222	23580	78802	2247	2247	2697	2697	2323	7267	83	662.90	71452	0	0
II	Aug	12980	1417	11563	0	662.90	71452	7336	78788	2247	2247	2696	2696	2310	7253	83	662.90	71452	0	0
III	Aug	4557	1618	2939	1611	662.90	71452	2739	75802	2471	2471	2965	2965	0	5436	91	662.61	70275	0	0
I	Sep	3103	2052	1051	1051	662.61	70275	3284	74610	2017	2017	2381	2381	0	4398	94	662.58	70118	0	0
II	Sep	2690	2035	655	655	662.58	70118	2573	73346	2018	2018	2382	2382	0	4400	94	662.27	68852	0	0
III	Sep	3340	2018	1322	1322	662.27	68852	3421	73595	2019	2019	2383	2383	0	4402	94	662.33	69099	0	0
I	Oct	2330	1589	741	741	662.33	69099	2286	72126	1568	1568	2381	2381	0	3949	110	662.07	68067	0	0
II	Oct	1724	1409	315	315	662.07	68067	1656	70038	1568	1568	1190	1190	0	2758	110	661.85	67170	0	0
III	Oct	1374	1231	143	0	661.85	67170	1880	69050	1727	1727			0	1727	121	661.86	67202	0	0
I	Nov					661.86	67202	909	68111	1940	1940			0	1940	114	661.57	66057	0	0
II	Nov					661.57	66057	1373	67430	1941	1941			0	1941	114	661.40	65375	0	0
III	Nov					661.40	65375	1776	67151	1943	1943			0	1943	115	661.32	65093	0	0
I	Dec					661.32	65093	838	65931	545	545			0	545	116	661.37	65270	0	0
II	Dec					661.37	65270	456	65726	545	545			0	545	116	661.32	65065	0	0
III	Dec					661.32	65065	481	65546	599	599			0	599	127	661.25	64820	0	0
I	Jan					661.25	64820	473	65293	1977	1977			0	1977	112	660.84	63204	0	0
II	Jan					660.84	63204	78	63282	1977	1977			0	1977	112	660.32	61193	0	0
III	Jan					660.32	61193	242	61435	2178	2178			0	2178	124	659.77	59133	0	0
I	Feb					659.77	59133	221	59354	2405	2405			0	2405	114	659.15	56835	0	0
II	Feb					659.15	56835	25	56860	2405	2405			0	2405	114	658.45	54341	0	0
III	Feb					658.45	54341	42	54383	1928	1928			0	1928	90	657.89	52365	0	0
I	Mar					657.89	52365	109	52474	3249	3249			0	3249	112	656.94	49113	0	0
II	Mar					656.94	49113	126	49239	3249	3249			0	3249	112	655.95	45878	0	0
III	Mar					655.95	45878	280	46158	3575	3575			0	3575	123	654.85	42460	0	0
I	Apr					654.85	42460	312	42772	2665	2665			0	2665	115	654.01	39992	0	0
II	Apr					654.01	39992	83	40075	2666	2666			0	2666	115	653.06	37294	0	0
III	Apr					653.06	37294	447	37741	2667	2667			0	2667	115	652.20	34959	0	0
I	May					652.20	34959	397	35356	1072	1072			0	1072	72	651.92	34212	0	0
II	May					651.92	34212	197	34409	1072	1072			0	1072	72	651.55	33265	0	0
III	May					651.55	33265	223	33488	1179	1179			0	1179	79	651.14	32230	0	0
Total, TMC		**111.61**	**18.87**	**93.44**	**11.70**			**85.22**		**63.36**	**63.36**	**29.90**	**29.90**	**4.63**	**97.89**	**3.44**			**0.00**	**0.00**

Year : 1980-81		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	

10-Day Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Pumped to Bhadra (Mcft)	Reservoir level ft	Capacity Mcft	Inflow Mcft	Total Mcft (4+5+6)	Irrig + Domestic		Upper Bhadra		Over Spillway	Total 8+13b+11	Evaporation Mcft	Closing		Unit = Mcft	
										Demand	Met	Demand	Met				R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1529	373	1156	0	651.14	32230	2469	34699	253	253	0	0	0	253	39	651.99	34407	0	0
II	Jun	5055	373	4682	1465	651.99	34407	4082	39954	254	254	1158	1158	0	1412	39	653.49	38503	0	0
III	Jun	21093	905	20188	1465	653.49	38503	13844	53811	256	256	2316	2316	0	2572	39	657.55	51200	0	0
I	Jul	42080	1057	41023	0	657.55	51200	29817	81017	947	947	2459	2459	6076	9482	50	662.91	71485	0	0
II	Jul	14362	876	13486	0	662.91	71485	11001	82486	947	947	2374	2374	7630	10951	50	662.91	71485	0	0
III	Jul	23998	697	23301	0	662.91	71485	11017	82502	1042	1042	2518	2518	7407	10967	56	662.91	71479	0	0
I	Aug	15395	1217	14178	0	662.91	71479	8696	80175	2247	2247	2697	2697	3696	8640	83	662.90	71452	0	0
II	Aug	26326	1417	24909	0	662.90	71452	15064	86516	2247	2247	2696	2696	10038	14981	83	662.90	71452	0	0
III	Aug	19178	1618	17560	0	662.90	71452	9771	81223	2471	2471	2965	2965	4252	9688	91	662.90	71444	0	0
I	Sep	10649	2052	8597	0	662.90	71444	6454	77898	2017	2017	2381	2381	1965	6363	94	662.90	71441	0	0
II	Sep	4003	2035	1968	1465	662.90	71441	2634	75540	2018	2018	2382	2382	0	4400	94	662.80	71046	0	0
III	Sep	6733	2018	4715	1465	662.80	71046	3597	76107	2019	2019	2383	2383	170	4572	94	662.90	71441	0	0
I	Oct	4128	1589	2539	1465	662.90	71441	3224	76130	1568	1568	2381	2381	646	4595	110	662.89	71425	0	0
II	Oct	2491	1409	1082	1082	662.89	71425	1895	74402	1568	1568	1190	1190	109	2867	110	662.89	71425	0	0
III	Oct	2403	1231	1172	0	662.89	71425	1872	73297	1727	1727			35	1762	121	662.89	71414	0	0
I	Nov					662.89	71414	1204	72618	1940	1940			0	1940	114	662.68	70564	0	0
II	Nov					662.68	70564	2228	72792	1941	1941			0	1941	114	662.73	70737	0	0
III	Nov					662.73	70737	698	71435	1943	1943			0	1943	115	662.39	69377	0	0
I	Dec					662.39	69377	900	70277	545	545			0	545	116	662.45	69616	0	0
II	Dec					662.45	69616	604	70220	545	545			0	545	116	662.44	69559	0	0
III	Dec					662.44	69559	366	69925	599	599			0	599	127	662.35	69199	0	0
I	Jan					662.35	69199	372	69571	1977	1977			0	1977	112	661.93	67482	0	0
II	Jan					661.93	67482	494	67976	1977	1977			0	1977	112	661.53	65887	0	0
III	Jan					661.53	65887	94	65981	2178	2178			0	2178	124	660.96	63679	0	0
I	Feb					660.96	63679	370	64049	2405	2405			0	2405	114	660.40	61530	0	0
II	Feb					660.40	61530	124	61654	2405	2405			0	2405	114	659.77	59135	0	0
III	Feb					659.77	59135	105	59240	1928	1928			0	1928	90	659.25	57222	0	0
I	Mar					659.25	57222	153	57375	3249	3249			0	3249	112	658.36	54014	0	0
II	Mar					658.36	54014	332	54346	3249	3249			0	3249	112	657.49	50985	0	0
III	Mar					657.49	50985	466	51451	3575	3575			0	3575	123	656.53	47753	0	0
I	Apr					656.53	47753	172	47925	2665	2665			0	2665	115	655.71	45145	0	0
II	Apr					655.71	45145	289	45434	2666	2666			0	2666	115	654.91	42653	0	0
III	Apr					654.91	42653	173	42826	2667	2667			0	2667	115	654.03	40044	0	0
I	May					654.03	40044	751	40795	1072	1072			0	1072	72	653.90	39651	0	0
II	May					653.90	39651	241	39892	1072	1072			0	1072	72	653.58	38748	0	0
III	May					653.58	38748	125	38873	1179	1179			0	1179	79	653.18	37615	0	0
Total, TMC		199.42	18.87	180.56	8.40			135.70		63.36	63.36	29.90	29.90	42.02	135.28	3.44			0.00	0.00

Year : 1981-82		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day					Pumped to	Reservoir	Capacity		Total Mcft	Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1149	373	776	0	653.18	37615	1774	39389	253	253	0	0	0	253	39	653.70	39097	0	0
II	Jun	3511	373	3138	1465	653.70	39097	2649	43211	254	254	1158	1158	0	1412	39	654.61	41760	0	0
III	Jun	9524	905	8619	1465	654.61	41760	4671	47895	256	256	2316	2316	0	2572	39	655.76	45284	0	0
I	Jul	17652	1057	16595	1465	655.76	45284	8654	55403	947	947	2459	2459	0	3406	50	657.77	51947	0	0
II	Jul	10627	876	9751	1465	657.77	51947	6929	60340	947	947	2374	2374	0	3321	50	659.18	56969	0	0
III	Jul	11759	697	11062	1611	659.18	56969	4671	63251	1042	1042	2518	2518	0	3560	56	659.90	59635	0	0
I	Aug	26582	1217	25365	1465	659.90	59635	14278	75378	2247	2247	2697	2697	0	4944	83	662.63	70351	0	0
II	Aug	36233	1417	34816	0	662.63	70351	22419	92770	2247	2247	2696	2696	16292	21235	83	662.90	71452	0	0
III	Aug	17152	1618	15534	0	662.90	71452	9940	81392	2471	2471	2965	2965	4421	9857	91	662.90	71444	0	0
I	Sep	4628	2052	2576	0	662.90	71444	3838	75282	2017	2017	2381	2381	0	4398	94	662.74	70790	0	0
II	Sep	4168	2035	2133	1465	662.74	70790	3956	76211	2018	2018	2382	2382	276	4676	94	662.90	71441	0	0
III	Sep	7276	2018	5258	0	662.90	71441	4549	75990	2019	2019	2383	2383	53	4455	94	662.90	71441	0	0
I	Oct	2863	1589	1274	1274	662.90	71441	2342	75057	1568	1568	2381	2381	0	3949	110	662.79	70998	0	0
II	Oct	1936	1409	527	527	662.79	70998	2128	73653	1568	1568	1190	1190	0	2758	110	662.74	70785	0	0
III	Oct	1982	1231	751	0	662.74	70785	2147	72932	1727	1727			0	1727	121	662.81	71084	0	0
I	Nov					662.81	71084	1769	72853	1940	1940			0	1940	114	662.74	70799	0	0
II	Nov					662.74	70799	722	71521	1941	1941			0	1941	114	662.42	69466	0	0
III	Nov					662.42	69466	572	70038	1943	1943			0	1943	115	662.05	67980	0	0
I	Dec					662.05	67980	825	68805	545	545			0	545	116	662.09	68144	0	0
II	Dec					662.09	68144	850	68994	545	545			0	545	116	662.14	68333	0	0
III	Dec					662.14	68333	712	69045	599	599			0	599	127	662.13	68319	0	0
I	Jan					662.13	68319	529	68848	1977	1977			0	1977	112	661.74	66759	0	0
II	Jan					661.74	66759	528	67287	1977	1977			0	1977	112	661.35	65198	0	0
III	Jan					661.35	65198	238	65436	2178	2178			0	2178	124	660.82	63134	0	0
I	Feb					660.82	63134	393	63527	2405	2405			0	2405	114	660.27	61008	0	0
II	Feb					660.27	61008	178	61186	2405	2405			0	2405	114	659.64	58667	0	0
III	Feb					659.64	58667	287	58954	1928	1928			0	1928	90	659.17	56936	0	0
I	Mar					659.17	56936	14	56950	3249	3249			0	3249	112	658.24	53589	0	0
II	Mar					658.24	53589	138	53727	3249	3249			0	3249	112	657.31	50366	0	0
III	Mar					657.31	50366	178	50544	3575	3575			0	3575	123	656.25	46846	0	0
I	Apr					656.25	46846	60	46906	2665	2665			0	2665	115	655.39	44126	0	0
II	Apr					655.39	44126	2	44128	2666	2666			0	2666	115	654.47	41347	0	0
III	Apr					654.47	41347	0	41347	2667	2667			0	2667	115	653.52	38565	0	0
I	May					653.52	38565	23	38588	1072	1072			0	1072	72	653.12	37444	0	0
II	May					653.12	37444	0	37444	1072	1072			0	1072	72	652.70	36300	0	0
III	May					652.70	36300	181	36481	1179	1179			0	1179	79	652.30	35223	0	0
Total, TMC		157.04	18.87	138.18	12.20			103.14		63.36	63.36	29.90	29.90	21.04	114.30	3.44			0.00	0.00

Year : 1982-83		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day					Pumped to	Reservoir	Capacity		Total Mcft	Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	263	373	0	0	652.30	35223	1010	36233	253	253	0	0	0	253	39	652.57	35941	0	0
II	Jun	1622	373	1249	1249	652.57	35941	1293	38483	254	254	1158	1158	0	1412	39	652.97	37032	0	0
III	Jun	917	905	12	12	652.97	37032	5287	42331	256	256	2316	2316	0	2572	39	653.92	39720	0	0
I	Jul	1656	1057	599	599	653.92	39720	1091	41410	947	947	2459	2459	0	3406	50	653.30	37954	0	0
II	Jul	11303	876	10427	1465	653.30	37954	6434	45853	947	947	2374	2374	0	3321	50	654.85	42482	0	0
III	Jul	23742	697	23045	1611	654.85	42482	12000	56093	1042	1042	2518	2518	0	3560	56	657.92	52477	0	0
I	Aug	37656	1217	36439	1465	657.92	52477	19203	73144	2247	2247	2697	2697	0	4944	83	662.08	68117	0	0
II	Aug	25746	1417	24329	0	662.08	68117	13104	81221	2247	2247	2696	2696	4743	9686	83	662.90	71452	0	0
III	Aug	18311	1618	16693	0	662.90	71452	8640	80092	2471	2471	2965	2965	3121	8557	91	662.90	71444	0	0
I	Sep	4345	2052	2293	1465	662.90	71444	2283	75192	2017	2017	2381	2381	0	4398	94	662.72	70700	0	0
II	Sep	2914	2035	879	879	662.72	70700	1708	73287	2018	2018	2382	2382	0	4400	94	662.25	68793	0	0
III	Sep	2889	2018	871	871	662.25	68793	2114	71778	2019	2019	2383	2383	0	4402	94	661.88	67282	0	0
I	Oct	1490	1589	0	0	661.88	67282	1505	68787	1568	1568	2381	2381	0	3949	110	661.23	64728	0	0
II	Oct	1290	1409	0	0	661.23	64728	1066	65794	1568	1568	1190	1190	0	2758	110	660.77	62926	0	0
III	Oct	2147	1231	916	0	660.77	62926	2022	64948	1727	1727			0	1727	121	660.81	63100	0	0
I	Nov					660.81	63100	840	63940	1940	1940			0	1940	114	660.50	61886	0	0
II	Nov					660.50	61886	571	62457	1941	1941			0	1941	114	660.11	60402	0	0
III	Nov					660.11	60402	279	60681	1943	1943			0	1943	115	659.63	58623	0	0
I	Dec					659.63	58623	520	59143	545	545			0	545	116	659.59	58482	0	0
II	Dec					659.59	58482	394	58876	545	545			0	545	116	659.52	58215	0	0
III	Dec					659.52	58215	416	58631	599	599			0	599	127	659.44	57905	0	0
I	Jan					659.44	57905	315	58220	1977	1977			0	1977	112	658.95	56131	0	0
II	Jan					658.95	56131	343	56474	1977	1977			0	1977	112	658.47	54385	0	0
III	Jan					658.47	54385	310	54695	2178	2178			0	2178	124	657.90	52393	0	0
I	Feb					657.90	52393	129	52522	2405	2405			0	2405	114	657.20	50003	0	0
II	Feb					657.20	50003	125	50128	2405	2405			0	2405	114	656.48	47609	0	0
III	Feb					656.48	47609	30	47639	1928	1928			0	1928	90	655.86	45621	0	0
I	Mar					655.86	45621	171	45792	3249	3249			0	3249	112	654.84	42431	0	0
II	Mar					654.84	42431	166	42597	3249	3249			0	3249	112	653.75	39236	0	0
III	Mar					653.75	39236	75	39311	3575	3575			0	3575	123	652.44	35613	0	0
I	Apr					652.44	35613	96	35709	2665	2665			0	2665	115	651.42	32929	0	0
II	Apr					651.42	32929	228	33157	2666	2666			0	2666	115	650.39	30376	0	0
III	Apr					650.39	30376	8	30384	2667	2667			0	2667	115	649.22	27602	0	0
I	May					649.22	27602	316	27918	1072	1072			0	1072	72	648.85	26774	0	0
II	May					648.85	26774	211	26985	1072	1072			0	1072	72	648.43	25841	0	0
III	May					648.43	25841	192	26033	1179	1179			0	1179	79	647.93	24775	0	0
Total, TMC		136.29	18.87	117.75	9.61			84.50		63.36	63.36	29.90	29.90	7.86	101.12	3.44			0.00	0.00

Year : 1983-84		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	9	373	0	0	647.93	24775	86	24861	253	253	0	0	0	253	39	647.83	24569	0	0
II	Jun	237	373	0	0	647.83	24569	1453	26022	254	254	1158	0	0	254	39	648.37	25729	0	-1158
III	Jun	7624	905	6719	1465	648.37	25729	5297	32490	256	256	2316	2316	0	2572	39	650.19	29879	0	0
I	Jul	4568	1057	3511	1465	650.19	29879	3990	35334	947	947	2459	2459	0	3406	50	651.00	31878	0	0
II	Jul	7202	876	6326	1465	651.00	31878	3448	36790	947	947	2374	2374	0	3321	50	651.61	33419	0	0
III	Jul	26830	697	26133	1611	651.61	33419	14474	49504	1042	1042	2518	2518	0	3560	56	655.95	45888	0	0
I	Aug	11769	1217	10552	1465	655.95	45888	4447	51800	2247	2247	2697	2697	0	4944	83	656.22	46773	0	0
II	Aug	31040	1417	29623	1465	656.22	46773	12742	60979	2247	2247	2696	2696	0	4943	83	658.90	55953	0	0
III	Aug	12575	1618	10957	1611	658.90	55953	6109	63673	2471	2471	2965	2965	0	5436	91	659.50	58146	0	0
I	Sep	5879	2052	3827	1465	659.50	58146	3488	63099	2017	2017	2381	2381	0	4398	94	659.63	58607	0	0
II	Sep	7875	2035	5840	1465	659.63	58607	5055	65127	2018	2018	2382	2382	0	4400	94	660.17	60633	0	0
III	Sep	6591	2018	4573	1465	660.17	60633	4364	66461	2019	2019	2383	2383	0	4402	94	660.52	61965	0	0
I	Oct	5997	1589	4408	1465	660.52	61965	3559	66989	1568	1568	2381	2381	0	3949	110	660.77	62930	0	0
II	Oct	1950	1409	541	541	660.77	62930	1251	64722	1568	1568	1190	1190	0	2758	110	660.49	61854	0	0
III	Oct	3162	1231	1931	0	660.49	61854	2539	64393	1727	1727			0	1727	121	660.67	62545	0	0
I	Nov					660.67	62545	2240	64785	1940	1940			0	1940	114	660.72	62731	0	0
II	Nov					660.72	62731	1028	63759	1941	1941			0	1941	114	660.45	61704	0	0
III	Nov					660.45	61704	421	62125	1943	1943			0	1943	115	660.02	60067	0	0
I	Dec					660.02	60067	748	60815	545	545			0	545	116	660.04	60154	0	0
II	Dec					660.04	60154	663	60817	545	545			0	545	116	660.04	60156	0	0
III	Dec					660.04	60156	943	61099	599	599			0	599	127	660.10	60373	0	0
I	Jan					660.10	60373	559	60932	1977	1977			0	1977	112	659.69	58843	0	0
II	Jan					659.69	58843	430	59273	1977	1977			0	1977	112	659.24	57184	0	0
III	Jan					659.24	57184	403	57587	2178	2178			0	2178	124	658.72	55285	0	0
I	Feb					658.72	55285	338	55623	2405	2405			0	2405	114	658.10	53104	0	0
II	Feb					658.10	53104	191	53295	2405	2405			0	2405	114	657.43	50776	0	0
III	Feb					657.43	50776	108	50884	1928	1928			0	1928	90	656.86	48866	0	0
I	Mar					656.86	48866	431	49297	3249	3249			0	3249	112	655.96	45936	0	0
II	Mar					655.96	45936	376	46312	3249	3249			0	3249	112	655.01	42951	0	0
III	Mar					655.01	42951	240	43191	3575	3575			0	3575	123	653.84	39493	0	0
I	Apr					653.84	39493	331	39824	2665	2665			0	2665	115	652.97	37044	0	0
II	Apr					652.97	37044	84	37128	2666	2666			0	2666	115	651.97	34347	0	0
III	Apr					651.97	34347	71	34418	2667	2667			0	2667	115	650.91	31636	0	0
I	May					650.91	31636	76	31712	1072	1072			0	1072	72	650.47	30568	0	0
II	May					650.47	30568	99	30667	1072	1072			0	1072	72	650.04	29523	0	0
III	May					650.04	29523	120	29643	1179	1179			0	1179	79	649.57	28385	0	0
Total, TMC		**133.31**	**18.87**	**114.94**	**16.94**			**82.20**		**63.36**	**63.36**	**29.90**	**28.74**	**0.00**	**92.10**	**3.44**			**0.00**	**-1.16**

Year : 1984-85		**Tunga Reservoir**				**Bhadra Reservoir**														
								MDDL =	**13832**	**Mcft**	**641.584 m**	**FRL =**	**71535 Mcft**		**662.92**	**m**	**UBPMDDL**	**29265 Mcft**		
										Issues from the Reservoir (in Mcft)							**OR**	**649.930 m**		
10-Day					**Pumped to**	**Reservoir**	**Capacity**		**Total Mcft**	**Irrig + Domestic**		**Upper Bhadra**					**Closing**		**Unit = Mcft**	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	94	373	0	0	649.57	28385	29	28414	253	253	0	0	0	253	39	649.46	28122	0	0
II	Jun	12688	373	12315	1465	649.46	28122	10291	39877	254	254	1158	1158	0	1412	39	653.47	38426	0	0
III	Jun	6714	905	5809	1465	653.47	38426	4878	44769	256	256	2316	2316	0	2572	39	654.75	42158	0	0
I	Jul	20343	1057	19286	1465	654.75	42158	11678	55300	947	947	2459	2459	0	3406	50	657.74	51844	0	0
II	Jul	24368	876	23492	1465	657.74	51844	13385	66694	947	947	2374	2374	0	3321	50	660.87	63323	0	0
III	Jul	13536	697	12839	1611	660.87	63323	6547	71481	1042	1042	2518	2518	0	3560	56	662.02	67865	0	0
I	Aug	19745	1217	18528	0	662.02	67865	9696	77561	2247	2247	2697	2697	1082	6026	83	662.90	71452	0	0
II	Aug	13003	1417	11586	0	662.90	71452	6212	77664	2247	2247	2696	2696	1186	6129	83	662.90	71452	0	0
III	Aug	7223	1618	5605	1611	662.90	71452	3286	76349	2471	2471	2965	2965	0	5436	91	662.75	70822	0	0
I	Sep	4598	2052	2546	1465	662.75	70822	2008	74295	2017	2017	2381	2381	0	4398	94	662.50	69803	0	0
II	Sep	2935	2035	900	900	662.50	69803	1801	72504	2018	2018	2382	2382	0	4400	94	662.06	68010	0	0
III	Sep	4002	2018	1984	1465	662.06	68010	3982	73456	2019	2019	2383	2383	0	4402	94	662.29	68960	0	0
I	Oct	5242	1589	3653	1465	662.29	68960	4111	74536	1568	1568	2381	2381	0	3949	110	662.66	70477	0	0
II	Oct	3700	1409	2291	1465	662.66	70477	2780	74721	1568	1568	1190	1190	428	3186	110	662.89	71425	0	0
III	Oct	1607	1231	376	0	662.89	71425	1133	72558	1727	1727			0	1727	121	662.72	70710	0	0
I	Nov					662.72	70710	1314	72024	1940	1940			0	1940	114	662.54	69970	0	0
II	Nov					662.54	69970	569	70539	1941	1941			0	1941	114	662.17	68484	0	0
III	Nov					662.17	68484	822	69306	1943	1943			0	1943	115	661.87	67248	0	0
I	Dec					661.87	67248	816	68064	545	545			0	545	116	661.91	67403	0	0
II	Dec					661.91	67403	417	67820	545	545			0	545	116	661.84	67159	0	0
III	Dec					661.84	67159	458	67617	599	599			0	599	127	661.78	66891	0	0
I	Jan					661.78	66891	349	67240	1977	1977			0	1977	112	661.34	65151	0	0
II	Jan					661.34	65151	331	65482	1977	1977			0	1977	112	660.89	63393	0	0
III	Jan					660.89	63393	68	63461	2178	2178			0	2178	124	660.31	61159	0	0
I	Feb					660.31	61159	161	61320	2405	2405			0	2405	114	659.68	58801	0	0
II	Feb					659.68	58801	54	58855	2405	2405			0	2405	114	659.01	56336	0	0
III	Feb					659.01	56336	0	56336	1928	1928			0	1928	90	658.45	54318	0	0
I	Mar					658.45	54318	0	54318	3249	3249			0	3249	112	657.48	50957	0	0
II	Mar					657.48	50957	412	51369	3249	3249			0	3249	112	656.60	48008	0	0
III	Mar					656.60	48008	517	48525	3575	3575			0	3575	123	655.61	44827	0	0
I	Apr					655.61	44827	325	45152	2665	2665			0	2665	115	654.82	42372	0	0
II	Apr					654.82	42372	0	42372	2666	2666			0	2666	115	653.88	39591	0	0
III	Apr					653.88	39591	0	39591	2667	2667			0	2667	115	652.89	36809	0	0
I	May					652.89	36809	0	36809	1072	1072			0	1072	72	652.46	35665	0	0
II	May					652.46	35665	259	35924	1072	1072			0	1072	72	652.13	34780	0	0
III	May					652.13	34780	56	34836	1179	1179			0	1179	79	651.67	33578	0	0
Total, TMC		139.80	18.87	121.21	15.84			88.75		63.36	63.36	29.90	29.90	2.70	95.95	3.44			0.00	0.00

Year : 1985-86		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832 Mcft		641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	39	373	0	0	651.67	33578	260	33838	253	253	0	0	0	253	39	651.66	33546	0	0
II	Jun	5174	373	4801	1465	651.66	33546	3108	38119	254	254	1158	1158	0	1412	39	652.83	36668	0	0
III	Jun	18000	905	17095	1465	652.83	36668	10550	48682	256	256	2316	2316	0	2572	39	656.01	46071	0	0
I	Jul	10161	1057	9104	1465	656.01	46071	5905	53441	947	947	2459	2459	0	3406	50	657.20	49985	0	0
II	Jul	8043	876	7167	1465	657.20	49985	4347	55796	947	947	2374	2374	0	3321	50	657.91	52425	0	0
III	Jul	7278	697	6581	1611	657.91	52425	3912	57948	1042	1042	2518	2518	0	3560	56	658.45	54332	0	0
I	Aug	21889	1217	20672	1465	658.45	54332	11806	67603	2247	2247	2697	2697	0	4944	83	660.68	62576	0	0
II	Aug	17903	1417	16486	1465	660.68	62576	11246	75286	2247	2247	2696	2696	0	4943	83	662.61	70260	0	0
III	Aug	6873	1618	5255	1611	662.61	70260	1687	73558	2471	2471	2965	2965	0	5436	91	662.06	68031	0	0
I	Sep	3286	2052	1234	1234	662.06	68031	2260	71525	2017	2017	2381	2381	0	4398	94	661.81	67033	0	0
II	Sep	2897	2035	862	862	661.81	67033	1643	69538	2018	2018	2382	2382	0	4400	94	661.31	65044	0	0
III	Sep	2479	2018	461	461	661.31	65044	2131	67636	2019	2019	2383	2383	0	4402	94	660.82	63140	0	0
I	Oct	4512	1589	2923	1465	660.82	63140	3719	68324	1568	1568	2381	2381	0	3949	110	661.11	64265	0	0
II	Oct	2380	1409	971	971	661.11	64265	1669	66905	1568	1568	1190	1190	0	2758	110	661.05	64037	0	0
III	Oct	1427	1231	196	0	661.05	64037	458	64495	1727	1727			0	1727	121	660.70	62647	0	0
I	Nov					660.70	62647	1369	64016	1940	1940			0	1940	114	660.52	61962	0	0
II	Nov					660.52	61962	568	62530	1941	1941			0	1941	114	660.13	60475	0	0
III	Nov					660.13	60475	151	60626	1943	1943			0	1943	115	659.62	58568	0	0
I	Dec					659.62	58568	252	58820	545	545			0	545	116	659.51	58159	0	0
II	Dec					659.51	58159	634	58793	545	545			0	545	116	659.50	58132	0	0
III	Dec					659.50	58132	178	58310	599	599			0	599	127	659.35	57584	0	0
I	Jan					659.35	57584	464	58048	1977	1977			0	1977	112	658.91	55959	0	0
II	Jan					658.91	55959	311	56270	1977	1977			0	1977	112	658.41	54181	0	0
III	Jan					658.41	54181	247	54428	2178	2178			0	2178	124	657.82	52126	0	0
I	Feb					657.82	52126	269	52395	2405	2405			0	2405	114	657.17	49876	0	0
II	Feb					657.17	49876	161	50037	2405	2405			0	2405	114	656.45	47518	0	0
III	Feb					656.45	47518	53	47571	1928	1928			0	1928	90	655.84	45553	0	0
I	Mar					655.84	45553	69	45622	3249	3249			0	3249	112	654.78	42261	0	0
II	Mar					654.78	42261	30	42291	3249	3249			0	3249	112	653.65	38930	0	0
III	Mar					653.65	38930	47	38977	3575	3575			0	3575	123	652.32	35279	0	0
I	Apr					652.32	35279	54	35333	2665	2665			0	2665	115	651.27	32553	0	0
II	Apr					651.27	32553	157	32710	2666	2666			0	2666	115	650.21	29929	0	0
III	Apr					650.21	29929	123	30052	2667	2667			0	2667	115	649.07	27270	0	0
I	May					649.07	27270	35	27305	1072	1072			0	1072	72	648.57	26161	0	0
II	May					648.57	26161	82	26243	1072	1072			0	1072	72	648.08	25099	0	0
III	May					648.08	25099	116	25215	1179	1179			0	1179	79	647.54	23957	0	0
Total, TMC		112.34	18.87	93.81	17.00			70.07		63.36	63.36	29.90	29.90	0.00	93.26	3.44			0.00	0.00

Year : 1986-87		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	19	373	0	0	647.54	23957	219	24176	253	253	0	0	0	253	39	647.51	23884	0	0
II	Jun	147	373	0	0	647.51	23884	1520	25404	254	254	1158	0	0	254	39	648.09	25111	0	-1158
III	Jun	11301	905	10396	1465	648.09	25111	7669	34245	256	256	2316	2316	0	2572	39	650.90	31634	0	0
I	Jul	4773	1057	3716	1465	650.90	31634	2794	35892	947	947	2459	2459	0	3406	50	651.22	32436	0	0
II	Jul	13514	876	12638	1465	651.22	32436	6898	40799	947	947	2374	2374	0	3321	50	653.11	37428	0	0
III	Jul	14450	697	13753	1611	653.11	37428	8530	47569	1042	1042	2518	2518	0	3560	56	655.33	43953	0	0
I	Aug	24945	1217	23728	1465	655.33	43953	14239	59656	2247	2247	2697	2697	0	4944	83	658.54	54629	0	0
II	Aug	24860	1417	23443	1465	658.54	54629	17619	73713	2247	2247	2696	2696	0	4943	83	662.22	68687	0	0
III	Aug	5043	1618	3425	1611	662.22	68687	3144	73442	2471	2471	2965	2965	0	5436	91	662.03	67915	0	0
I	Sep	2453	2052	401	401	662.03	67915	1720	70036	2017	2017	2381	2381	0	4398	94	661.44	65544	0	0
II	Sep	1919	2035	0	0	661.44	65544	1622	67166	2018	2018	2382	2382	0	4400	94	660.70	62672	0	0
III	Sep	2441	2018	423	423	660.70	62672	2862	65957	2019	2019	2383	2383	0	4402	94	660.39	61461	0	0
I	Oct	1499	1589	0	0	660.39	61461	1780	63241	1568	1568	2381	2381	0	3949	110	659.78	59182	0	0
II	Oct	811	1409	0	0	659.78	59182	1181	60363	1568	1568	1190	1190	0	2758	110	659.33	57495	0	0
III	Oct	869	1231	0	0	659.33	57495	872	58367	1727	1727			0	1727	121	659.06	56519	0	0
I	Nov					659.06	56519	2373	58892	1940	1940			0	1940	114	659.15	56838	0	0
II	Nov					659.15	56838	1308	58146	1941	1941			0	1941	114	658.94	56091	0	0
III	Nov					658.94	56091	947	57038	1943	1943			0	1943	115	658.63	54980	0	0
I	Dec					658.63	54980	608	55588	545	545			0	545	116	658.62	54927	0	0
II	Dec					658.62	54927	517	55444	545	545			0	545	116	658.58	54783	0	0
III	Dec					658.58	54783	858	55641	599	599			0	599	127	658.62	54915	0	0
I	Jan					658.62	54915	478	55393	1977	1977			0	1977	112	658.16	53304	0	0
II	Jan					658.16	53304	268	53572	1977	1977			0	1977	112	657.64	51483	0	0
III	Jan					657.64	51483	129	51612	2178	2178			0	2178	124	657.00	49310	0	0
I	Feb					657.00	49310	234	49544	2405	2405			0	2405	114	656.30	47025	0	0
II	Feb					656.30	47025	317	47342	2405	2405			0	2405	114	655.61	44823	0	0
III	Feb					655.61	44823	49	44872	1928	1928			0	1928	90	654.98	42854	0	0
I	Mar					654.98	42854	22	42876	3249	3249			0	3249	112	653.85	39515	0	0
II	Mar					653.85	39515	72	39587	3249	3249			0	3249	112	652.67	36226	0	0
III	Mar					652.67	36226	41	36267	3575	3575			0	3575	123	651.28	32569	0	0
I	Apr					651.28	32569	31	32600	2665	2665			0	2665	115	650.16	29820	0	0
II	Apr					650.16	29820	3	29823	2666	2666			0	2666	115	648.97	27042	0	0
III	Apr					648.97	27042	418	27460	2667	2667			0	2667	115	647.89	24678	0	0
I	May					647.89	24678	37	24715	1072	1072			0	1072	72	647.35	23571	0	0
II	May					647.35	23571	52	23623	1072	1072			0	1072	72	646.81	22479	0	0
III	May					646.81	22479	341	22820	1179	1179			0	1179	79	646.34	21562	0	0
Total, TMC		109.04	18.87	91.92	11.37			81.77		63.36	63.36	29.90	28.74	0.00	92.10	3.44			0.00	-1.16

Year : 1987-88		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	40	373	0	0	646.34	21562	848	22410	253	253	0	0	0	253	39	646.63	22118	0	0
II	Jun	2089	373	1716	1465	646.63	22118	2406	25989	254	254	1158	0	0	254	39	648.36	25696	0	-1158
III	Jun	1468	905	563	563	648.36	25696	671	26930	256	256	2316	0	0	256	39	648.79	26635	0	-2316
I	Jul	10332	1057	9275	1465	648.79	26635	5356	33455	947	947	2459	2459	0	3406	50	650.24	29999	0	0
II	Jul	8391	876	7515	1465	650.24	29999	4914	36378	947	947	2374	2374	0	3321	50	651.45	33007	0	0
III	Jul	2969	697	2272	1611	651.45	33007	1123	35741	1042	1042	2518	2518	0	3560	56	651.10	32125	0	0
I	Aug	1251	1217	34	34	651.10	32125	639	32798	2247	2247	2697	1286	0	3533	83	649.89	29182	0	-1411
II	Aug	6364	1417	4947	1465	649.89	29182	2809	33456	2247	2247	2696	1944	0	4191	83	649.89	29182	0	-752
III	Aug	16114	1618	14496	1611	649.89	29182	7554	38347	2471	2471	2965	2965	0	5436	91	651.38	32820	0	0
I	Sep	3204	2052	1152	1152	651.38	32820	1645	35617	2017	2017	2381	2381	0	4398	94	650.70	31125	0	0
II	Sep	1884	2035	0	0	650.70	31125	1289	32414	2018	2018	2382	1131	0	3149	94	649.89	29171	0	-1251
III	Sep	3295	2018	1277	1277	649.89	29171	2521	32969	2019	2019	2383	1685	0	3704	94	649.89	29171	0	-698
I	Oct	2319	1589	730	730	649.89	29171	1798	31699	1568	1568	2381	866	0	2434	110	649.88	29155	0	-1515
II	Oct	3679	1409	2270	1465	649.88	29155	3157	33777	1568	1568	1190	1190	0	2758	110	650.61	30909	0	0
III	Oct	2267	1231	1036	0	650.61	30909	1933	32842	1727	1727			0	1727	121	650.65	30994	0	0
I	Nov					650.65	30994	342	31336	1940	1940			0	1940	114	649.94	29282	0	0
II	Nov					649.94	29282	770	30052	1941	1941			0	1941	114	649.40	27997	0	0
III	Nov					649.40	27997	1012	29009	1943	1943			0	1943	115	648.93	26951	0	0
I	Dec					648.93	26951	618	27569	545	545			0	545	116	648.91	26908	0	0
II	Dec					648.91	26908	565	27473	545	545			0	545	116	648.87	26812	0	0
III	Dec					648.87	26812	394	27206	599	599			0	599	127	648.72	26480	0	0
I	Jan					648.72	26480	236	26716	1977	1977			0	1977	112	647.86	24627	0	0
II	Jan					647.86	24627	410	25037	1977	1977			0	1977	112	647.05	22948	0	0
III	Jan					647.05	22948	217	23165	2178	2178			0	2178	124	645.97	20863	0	0
I	Feb					645.97	20863	175	21038	2405	2405			0	2405	114	644.67	18519	0	0
II	Feb					644.67	18519	239	18758	2405	2405			0	2405	114	643.26	16239	0	0
III	Feb					643.26	16239	122	16361	1928	1928			0	1928	90	641.96	14343	0	0
I	Mar					641.96	14343	94	14437	3249	605			0	605	112	641.50	13720	-2644	0
II	Mar					641.50	13720	144	13864	3249	0			0	0	112	641.52	13752	-3249	0
III	Mar					641.52	13752	141	13893	3575	61			0	61	123	641.49	13709	-3514	0
I	Apr					641.49	13709	229	13938	2665	106			0	106	115	641.50	13717	-2559	0
II	Apr					641.50	13717	51	13768	2666	0			0	0	115	641.45	13653	-2666	0
III	Apr					641.45	13653	27	13680	2667	0			0	0	115	641.38	13565	-2667	0
I	May					641.38	13565	0	13565	1072	0			0	0	72	641.33	13493	-1072	0
II	May					641.33	13493	0	13493	1072	0			0	0	72	641.28	13421	-1072	0
III	May					641.28	13421	0	13421	1179	0			0	0	79	641.22	13342	-1179	0
Total, TMC		65.67	18.87	47.28	14.30			44.45		63.36	42.74	29.90	20.80	0.00	63.53	3.44			-20.62	-9.10

Year : 1988-89		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	15	373	0	0	641.22	13342	66	13408	253	0	0	0	0	0	39	641.24	13369	-253	0
II	Jun	628	373	255	255	641.24	13369	510	14134	254	254	1158	0	0	254	39	641.59	13841	0	-1158
III	Jun	1721	905	816	816	641.59	13841	939	15596	256	256	2316	0	0	256	39	642.63	15301	0	-2316
I	Jul	1211	1057	154	154	642.63	15301	1538	16993	947	947	2459	0	0	947	50	643.10	15996	0	-2459
II	Jul	21415	876	20539	1465	643.10	15996	13147	30608	947	947	2374	396	0	1343	50	649.91	29215	0	-1978
III	Jul	17982	697	17285	1611	649.91	29215	10836	41662	1042	1042	2518	2518	0	3560	56	653.33	38046	0	0
I	Aug	23101	1217	21884	1465	653.33	38046	11181	50692	2247	2247	2697	2697	0	4944	83	655.88	45665	0	0
II	Aug	11692	1417	10275	1465	655.88	45665	6164	53293	2247	2247	2696	2696	0	4943	83	656.68	48267	0	0
III	Aug	9212	1618	7594	1611	656.68	48267	5430	55308	2471	2471	2965	2965	0	5436	91	657.14	49781	0	0
I	Sep	3906	2052	1854	1465	657.14	49781	3110	54356	2017	2017	2381	2381	0	4398	94	657.16	49864	0	0
II	Sep	3213	2035	1178	1178	657.16	49864	2434	53476	2018	2018	2382	2382	0	4400	94	656.90	48982	0	0
III	Sep	7167	2018	5149	1465	656.90	48982	4071	54517	2019	2019	2383	2383	0	4402	94	657.21	50021	0	0
I	Oct	5069	1589	3480	1465	657.21	50021	2693	54179	1568	1568	2381	2381	0	3949	110	657.24	50120	0	0
II	Oct	1776	1409	367	367	657.24	50120	1068	51555	1568	1568	1190	1190	0	2758	110	656.81	48687	0	0
III	Oct	1186	1231	0	0	656.81	48687	705	49392	1727	1727			0	1727	121	656.46	47544	0	0
I	Nov					656.46	47544	565	48109	1940	1940			0	1940	114	656.00	46055	0	0
II	Nov					656.00	46055	360	46415	1941	1941			0	1941	114	655.46	44360	0	0
III	Nov					655.46	44360	398	44758	1943	1943			0	1943	115	654.92	42700	0	0
I	Dec					654.92	42700	723	43423	545	545			0	545	116	654.95	42762	0	0
II	Dec					654.95	42762	1254	44016	545	545			0	545	116	655.14	43355	0	0
III	Dec					655.14	43355	310	43665	599	599			0	599	127	655.00	42939	0	0
I	Jan					655.00	42939	66	43005	1977	1977			0	1977	112	654.33	40916	0	0
II	Jan					654.33	40916	184	41100	1977	1977			0	1977	112	653.67	39011	0	0
III	Jan					653.67	39011	207	39218	2178	2178			0	2178	124	652.93	36916	0	0
I	Feb					652.93	36916	169	37085	2405	2405			0	2405	114	652.05	34566	0	0
II	Feb					652.05	34566	569	35135	2405	2405			0	2405	114	651.30	32616	0	0
III	Feb					651.30	32616	205	32821	1928	1928			0	1928	90	650.57	30803	0	0
I	Mar					650.57	30803	0	30803	3249	3249			0	3249	112	649.14	27442	0	0
II	Mar					649.14	27442	68	27510	3249	3249			0	3249	112	647.63	24149	0	0
III	Mar					647.63	24149	59	24208	3575	3575			0	3575	123	645.79	20510	0	0
I	Apr					645.79	20510	111	20621	2665	2665			0	2665	115	644.26	17841	0	0
II	Apr					644.26	17841	42	17883	2666	2666			0	2666	115	642.49	15102	0	0
III	Apr					642.49	15102	43	15145	2667	1313			0	1313	115	641.50	13717	-1354	0
I	May					641.50	13717	6	13723	1072	0			0	0	72	641.45	13651	-1072	0
II	May					641.45	13651	6	13657	1072	0			0	0	72	641.40	13585	-1072	0
III	May					641.40	13585	0	13585	1179	0			0	0	79	641.34	13506	-1179	0
Total, TMC		109.29	18.87	90.83	14.78			69.24		63.36	58.43	29.90	21.99	0.00	80.42	3.44			-4.93	-7.91

Year : 1989-90		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	24	373	0	0	641.34	13506	609	14115	253	253	0	0	0	253	39	641.58	13823	0	0
II	Jun	7368	373	6995	1465	641.58	13823	4872	20160	254	254	1158	0	0	254	39	645.43	19867	0	-1158
III	Jun	5456	905	4551	1465	645.43	19867	2100	23431	256	256	2316	0	0	256	39	647.14	23136	0	-2316
I	Jul	6349	1057	5292	1465	647.14	23136	3345	27946	947	947	2459	0	0	947	50	648.93	26949	0	-2459
II	Jul	6033	876	5157	1465	648.93	26949	3498	31911	947	947	2374	1699	0	2646	50	649.91	29215	0	-675
III	Jul	36407	697	35710	1611	649.91	29215	27464	58290	1042	1042	2518	2518	0	3560	56	658.55	54674	0	0
I	Aug	12085	1217	10868	1465	658.55	54674	6482	62621	2247	2247	2697	2697	0	4944	83	659.35	57594	0	0
II	Aug	16551	1417	15134	1465	659.35	57594	9880	68938	2247	2247	2696	2696	0	4943	83	661.02	63912	0	0
III	Aug	17186	1618	15568	1611	661.02	63912	9572	75095	2471	2471	2965	2965	0	5436	91	662.44	69568	0	0
I	Sep	4659	2052	2607	1465	662.44	69568	2205	73238	2017	2017	2381	2381	0	4398	94	662.24	68746	0	0
II	Sep	2636	2035	601	601	662.24	68746	1483	70830	2018	2018	2382	2382	0	4400	94	661.64	66336	0	0
III	Sep	3798	2018	1780	1465	661.64	66336	2535	70335	2019	2019	2383	2383	0	4402	94	661.51	65839	0	0
I	Oct	2701	1589	1112	1112	661.51	65839	2245	69196	1568	1568	2381	2381	0	3949	110	661.34	65137	0	0
II	Oct	1340	1409	0	0	661.34	65137	1659	66796	1568	1568	1190	1190	0	2758	110	661.03	63928	0	0
III	Oct	1037	1231	0	0	661.03	63928	1267	65195	1727	1727			0	1727	121	660.88	63347	0	0
I	Nov					660.88	63347	998	64345	1940	1940			0	1940	114	660.60	62291	0	0
II	Nov					660.60	62291	846	63137	1941	1941			0	1941	114	660.29	61082	0	0
III	Nov					660.29	61082	288	61370	1943	1943			0	1943	115	659.82	59312	0	0
I	Dec					659.82	59312	445	59757	545	545			0	545	116	659.76	59096	0	0
II	Dec					659.76	59096	430	59526	545	545			0	545	116	659.70	58865	0	0
III	Dec					659.70	58865	506	59371	599	599			0	599	127	659.64	58645	0	0
I	Jan					659.64	58645	171	58816	1977	1977			0	1977	112	659.12	56727	0	0
II	Jan					659.12	56727	235	56962	1977	1977			0	1977	112	658.60	54873	0	0
III	Jan					658.60	54873	151	55024	2178	2178			0	2178	124	658.00	52722	0	0
I	Feb					658.00	52722	221	52943	2405	2405			0	2405	114	657.33	50424	0	0
II	Feb					657.33	50424	127	50551	2405	2405			0	2405	114	656.61	48032	0	0
III	Feb					656.61	48032	55	48087	1928	1928			0	1928	90	656.01	46069	0	0
I	Mar					656.01	46069	135	46204	3249	3249			0	3249	112	654.97	42843	0	0
II	Mar					654.97	42843	24	42867	3249	3249			0	3249	112	653.85	39506	0	0
III	Mar					653.85	39506	90	39596	3575	3575			0	3575	123	652.55	35898	0	0
I	Apr					652.55	35898	98	35996	2665	2665			0	2665	115	651.53	33216	0	0
II	Apr					651.53	33216	126	33342	2666	2666			0	2666	115	650.47	30561	0	0
III	Apr					650.47	30561	13	30574	2667	2667			0	2667	115	649.31	27792	0	0
I	May					649.31	27792	226	28018	1072	1072			0	1072	72	648.89	26874	0	0
II	May					648.89	26874	393	27267	1072	1072			0	1072	72	648.56	26123	0	0
III	May					648.56	26123	559	26682	1179	1179			0	1179	79	648.23	25424	0	0
Total, TMC		123.63	18.87	105.38	16.65			85.35		63.36	63.36	29.90	23.29	0.00	86.65	3.44			0.00	-6.61

Year : 1990-91		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1136	373	763	0	648.23	25424	636	26060	253	253	0	0	0	253	39	648.39	25768	0	0
II	Jun	8555	373	8182	1465	648.39	25768	4865	32098	254	254	1158	1158	0	1412	39	650.50	30647	0	0
III	Jun	10281	905	9376	1465	650.50	30647	5747	37858	256	256	2316	2316	0	2572	39	652.31	35247	0	0
I	Jul	17468	1057	16411	1465	652.31	35247	8651	45363	947	947	2459	2459	0	3406	50	654.66	41907	0	0
II	Jul	18024	876	17148	1465	654.66	41907	7257	50629	947	947	2374	2374	0	3321	50	656.37	47258	0	0
III	Jul	13907	697	13210	1611	656.37	47258	6594	55463	1042	1042	2518	2518	0	3560	56	657.74	51847	0	0
I	Aug	8768	1217	7551	1465	657.74	51847	4554	57865	2247	2247	2697	2697	0	4944	83	658.03	52838	0	0
II	Aug	32518	1417	31101	1465	658.03	52838	18635	72938	2247	2247	2696	2696	0	4943	83	662.03	67912	0	0
III	Aug	23284	1618	21666	0	662.03	67912	13618	81530	2471	2471	2965	2965	4559	9995	91	662.90	71444	0	0
I	Sep	12734	2052	10682	0	662.90	71444	6222	77666	2017	2017	2381	2381	1733	6131	94	662.90	71441	0	0
II	Sep	4444	2035	2409	1465	662.90	71441	2640	75546	2018	2018	2382	2382	0	4400	94	662.80	71052	0	0
III	Sep	2580	2018	562	562	662.80	71052	1713	73327	2019	2019	2383	2383	0	4402	94	662.26	68831	0	0
I	Oct	2039	1589	450	450	662.26	68831	1533	70814	1568	1568	2381	2381	0	3949	110	661.74	66755	0	0
II	Oct	1609	1409	200	200	661.74	66755	1770	68725	1568	1568	1190	1190	0	2758	110	661.52	65857	0	0
III	Oct	2738	1231	1507	0	661.52	65857	3321	69178	1727	1727			0	1727	121	661.89	67330	0	0
I	Nov					661.89	67330	1461	68791	1940	1940			0	1940	114	661.74	66737	0	0
II	Nov					661.74	66737	1377	68114	1941	1941			0	1941	114	661.57	66059	0	0
III	Nov					661.57	66059	657	66716	1943	1943			0	1943	115	661.21	64658	0	0
I	Dec					661.21	64658	728	65386	545	545			0	545	116	661.23	64725	0	0
II	Dec					661.23	64725	371	65096	545	545			0	545	116	661.16	64435	0	0
III	Dec					661.16	64435	698	65133	599	599			0	599	127	661.15	64407	0	0
I	Jan					661.15	64407	527	64934	1977	1977			0	1977	112	660.75	62845	0	0
II	Jan					660.75	62845	538	63383	1977	1977			0	1977	112	660.34	61294	0	0
III	Jan					660.34	61294	5	61299	2178	2178			0	2178	124	659.73	58997	0	0
I	Feb					659.73	58997	369	59366	2405	2405			0	2405	114	659.15	56847	0	0
II	Feb					659.15	56847	141	56988	2405	2405			0	2405	114	658.49	54469	0	0
III	Feb					658.49	54469	87	54556	1928	1928			0	1928	90	657.94	52538	0	0
I	Mar					657.94	52538	129	52667	3249	3249			0	3249	112	656.99	49306	0	0
II	Mar					656.99	49306	65	49371	3249	3249			0	3249	112	655.99	46010	0	0
III	Mar					655.99	46010	18	46028	3575	3575			0	3575	123	654.80	42330	0	0
I	Apr					654.80	42330	345	42675	2665	2665			0	2665	115	653.98	39895	0	0
II	Apr					653.98	39895	190	40085	2666	2666			0	2666	115	653.07	37304	0	0
III	Apr					653.07	37304	55	37359	2667	2667			0	2667	115	652.05	34577	0	0
I	May					652.05	34577	69	34646	1072	1072			0	1072	72	651.64	33502	0	0
II	May					651.64	33502	449	33951	1072	1072			0	1072	72	651.37	32807	0	0
III	May					651.37	32807	666	33473	1179	1179			0	1179	79	651.14	32215	0	0
Total, TMC		160.09	18.87	141.22	13.08			96.70		63.36	63.36	29.90	29.90	6.29	99.55	3.44			0.00	0.00

Year : 1991-92		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	4997	373	4624	0	651.14	32215	3159	35374	253	253	0	0	0	253	39	652.25	35082	0	0
II	Jun	9939	373	9566	1465	652.25	35082	5285	41831	254	254	1158	1158	0	1412	39	654.15	40380	0	0
III	Jun	6100	905	5195	1465	654.15	40380	3144	44989	256	256	2316	2316	0	2572	39	654.82	42378	0	0
I	Jul	8869	1057	7812	1465	654.82	42378	5143	48985	947	947	2459	2459	0	3406	50	655.84	45529	0	0
II	Jul	20283	876	19407	1465	655.84	45529	11582	58576	947	947	2374	2374	0	3321	50	658.70	55205	0	0
III	Jul	32795	697	32098	1611	658.70	55205	17990	74806	1042	1042	2518	2518	0	3560	56	662.84	71190	0	0
I	Aug	16256	1217	15039	0	662.84	71190	6850	78040	2247	2247	2697	2697	1561	6505	83	662.90	71452	0	0
II	Aug	23810	1417	22393	0	662.90	71452	10777	82229	2247	2247	2696	2696	5751	10694	83	662.90	71452	0	0
III	Aug	14865	1618	13247	0	662.90	71452	5941	77393	2471	2471	2965	2965	422	5858	91	662.90	71444	0	0
I	Sep	4430	2052	2378	1465	662.90	71444	2603	75512	2017	2017	2381	2381	0	4398	94	662.79	71020	0	0
II	Sep	2762	2035	727	727	662.79	71020	2396	74143	2018	2018	2382	2382	0	4400	94	662.46	69649	0	0
III	Sep	2375	2018	357	357	662.46	69649	1938	71944	2019	2019	2383	2383	0	4402	94	661.92	67448	0	0
I	Oct	2972	1589	1383	1383	661.92	67448	2049	70880	1568	1568	2381	2381	0	3949	110	661.76	66821	0	0
II	Oct	2088	1409	679	679	661.76	66821	2917	70417	1568	1568	1190	1190	0	2758	110	661.94	67549	0	0
III	Oct	1244	1231	13	0	661.94	67549	1800	69349	1727	1727			0	1727	121	661.93	67501	0	0
I	Nov					661.93	67501	1576	69077	1940	1940			0	1940	114	661.81	67023	0	0
II	Nov					661.81	67023	1228	68251	1941	1941			0	1941	114	661.60	66196	0	0
III	Nov					661.60	66196	814	67010	1943	1943			0	1943	115	661.29	64952	0	0
I	Dec					661.29	64952	636	65588	545	545			0	545	116	661.28	64927	0	0
II	Dec					661.28	64927	665	65592	545	545			0	545	116	661.28	64931	0	0
III	Dec					661.28	64931	683	65614	599	599			0	599	127	661.27	64888	0	0
I	Jan					661.27	64888	515	65403	1977	1977			0	1977	112	660.87	63314	0	0
II	Jan					660.87	63314	372	63686	1977	1977			0	1977	112	660.42	61597	0	0
III	Jan					660.42	61597	419	62016	2178	2178			0	2178	124	659.92	59714	0	0
I	Feb					659.92	59714	651	60365	2405	2405			0	2405	114	659.42	57846	0	0
II	Feb					659.42	57846	409	58255	2405	2405			0	2405	114	658.84	55736	0	0
III	Feb					658.84	55736	112	55848	1928	1928			0	1928	90	658.31	53830	0	0
I	Mar					658.31	53830	332	54162	3249	3249			0	3249	112	657.44	50801	0	0
II	Mar					657.44	50801	47	50848	3249	3249			0	3249	112	656.44	47487	0	0
III	Mar					656.44	47487	100	47587	3575	3575			0	3575	123	655.31	43889	0	0
I	Apr					655.31	43889	70	43959	2665	2665			0	2665	115	654.42	41179	0	0
II	Apr					654.42	41179	0	41179	2666	2666			0	2666	115	653.46	38398	0	0
III	Apr					653.46	38398	39	38437	2667	2667			0	2667	115	652.46	35655	0	0
I	May					652.46	35655	0	35655	1072	1072			0	1072	72	652.03	34511	0	0
II	May					652.03	34511	166	34677	1072	1072			0	1072	72	651.65	33533	0	0
III	May					651.65	33533	236	33769	1179	1179			0	1179	79	651.25	32511	0	0
Total, TMC		153.79	18.87	134.92	12.08			92.64		63.36	63.36	29.90	29.90	7.73	100.99	3.44			0.00	0.00

Year : 1992-93		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	135	373	0	0	651.25	32511	614	33125	253	253	0	0	0	253	39	651.38	32833	0	0
II	Jun	2390	373	2017	1465	651.38	32833	1956	36253	254	254	1158	1158	0	1412	39	652.14	34802	0	0
III	Jun	17205	905	16300	1465	652.14	34802	12950	49217	256	256	2316	2316	0	2572	39	656.17	46606	0	0
I	Jul	6173	1057	5116	1465	656.17	46606	3681	51751	947	947	2459	2459	0	3406	50	656.69	48295	0	0
II	Jul	7766	876	6890	1465	656.69	48295	4471	54231	947	947	2374	2374	0	3321	50	657.46	50860	0	0
III	Jul	31866	697	31169	1611	657.46	50860	19936	72407	1042	1042	2518	2518	0	3560	56	662.25	68791	0	0
I	Aug	10047	1217	8830	1465	662.25	68791	6168	76423	2247	2247	2697	2697	0	4944	83	662.89	71396	0	0
II	Aug	37804	1417	36387	0	662.89	71396	18954	90350	2247	2247	2696	2696	13872	18815	83	662.90	71452	0	0
III	Aug	18352	1618	16734	0	662.90	71452	10842	82294	2471	2471	2965	2965	5323	10759	91	662.90	71444	0	0
I	Sep	14755	2052	12703	0	662.90	71444	8062	79506	2017	2017	2381	2381	3573	7971	94	662.90	71441	0	0
II	Sep	5740	2035	3705	0	662.90	71441	3785	75226	2018	2018	2382	2382	0	4400	94	662.73	70732	0	0
III	Sep	4278	2018	2260	1465	662.73	70732	3354	75551	2019	2019	2383	2383	0	4402	94	662.80	71055	0	0
I	Oct	5736	1589	4147	0	662.80	71055	4299	75354	1568	1568	2381	2381	0	3949	110	662.86	71295	0	0
II	Oct	2307	1409	898	0	662.86	71295	2587	73882	1568	1568	1190	1190	0	2758	110	662.79	71014	0	0
III	Oct	1825	1231	594	0	662.79	71014	2000	73014	1727	1727			0	1727	121	662.83	71166	0	0
I	Nov					662.83	71166	1310	72476	1940	1940			0	1940	114	662.65	70422	0	0
II	Nov					662.65	70422	7569	77991	1941	1941			4515	6456	114	662.89	71421	0	0
III	Nov					662.89	71421	3783	75204	1943	1943			1726	3669	115	662.89	71420	0	0
I	Dec					662.89	71420	1553	72973	545	545			893	1438	116	662.89	71419	0	0
II	Dec					662.89	71419	1140	72559	545	545			479	1024	116	662.89	71419	0	0
III	Dec					662.89	71419	1105	72524	599	599			390	989	127	662.89	71408	0	0
I	Jan					662.89	71408	679	72087	1977	1977			0	1977	112	662.55	69998	0	0
II	Jan					662.55	69998	391	70389	1977	1977			0	1977	112	662.13	68300	0	0
III	Jan					662.13	68300	577	68877	2178	2178			0	2178	124	661.70	66575	0	0
I	Feb					661.70	66575	760	67335	2405	2405			0	2405	114	661.25	64816	0	0
II	Feb					661.25	64816	502	65318	2405	2405			0	2405	114	660.74	62799	0	0
III	Feb					660.74	62799	336	63135	1928	1928			0	1928	90	660.30	61117	0	0
I	Mar					660.30	61117	182	61299	3249	3249			0	3249	112	659.45	57938	0	0
II	Mar					659.45	57938	220	58158	3249	3249			0	3249	112	658.58	54797	0	0
III	Mar					658.58	54797	360	55157	3575	3575			0	3575	123	657.63	51459	0	0
I	Apr					657.63	51459	113	51572	2665	2665			0	2665	115	656.84	48792	0	0
II	Apr					656.84	48792	87	48879	2666	2666			0	2666	115	656.01	46098	0	0
III	Apr					656.01	46098	269	46367	2667	2667			0	2667	115	655.21	43585	0	0
I	May					655.21	43585	486	44071	1072	1072			0	1072	72	655.00	42927	0	0
II	May					655.00	42927	481	43408	1072	1072			0	1072	72	654.78	42264	0	0
III	May					654.78	42264	354	42618	1179	1179			0	1179	79	654.48	41360	0	0
Total, TMC		**166.38**	**18.87**	**147.75**	**10.40**			**125.92**		**63.36**	**63.36**	**29.90**	**29.90**	**30.77**	**124.03**	**3.44**			**0.00**	**0.00**

Year : 1993-94		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	177	373	0	0	654.48	41360	428	41788	253	253	0	0	0	253	39	654.52	41496	0	0
II	Jun	4814	373	4441	1465	654.52	41496	3263	46224	254	254	1158	1158	0	1412	39	655.60	44773	0	0
III	Jun	1850	905	945	945	655.60	44773	1200	46918	256	256	2316	2316	0	2572	39	655.45	44307	0	0
I	Jul	6202	1057	5145	1465	655.45	44307	4046	49817	947	947	2459	2459	0	3406	50	656.10	46361	0	0
II	Jul	22391	876	21515	1465	656.10	46361	10862	58688	947	947	2374	2374	0	3321	50	658.73	55317	0	0
III	Jul	15306	697	14609	1611	658.73	55317	8153	65081	1042	1042	2518	2518	0	3560	56	660.39	61465	0	0
I	Aug	19525	1217	18308	1465	660.39	61465	10988	73917	2247	2247	2697	2697	0	4944	83	662.27	68890	0	0
II	Aug	25010	1417	23593	0	662.27	68890	11951	80841	2247	2247	2696	2696	4363	9306	83	662.90	71452	0	0
III	Aug	12377	1618	10759	0	662.90	71452	6798	78250	2471	2471	2965	2965	1279	6715	91	662.90	71444	0	0
I	Sep	7479	2052	5427	0	662.90	71444	4157	75601	2017	2017	2381	2381	0	4398	94	662.82	71109	0	0
II	Sep	3616	2035	1581	1465	662.82	71109	2139	74713	2018	2018	2382	2382	0	4400	94	662.60	70219	0	0
III	Sep	2493	2018	475	475	662.60	70219	1728	72422	2019	2019	2383	2383	0	4402	94	662.04	67926	0	0
I	Oct	4271	1589	2682	1465	662.04	67926	2897	72287	1568	1568	2381	2381	0	3949	110	662.11	68228	0	0
II	Oct	8020	1409	6611	0	662.11	68228	7375	75603	1568	1568	1190	1190	1310	4068	110	662.89	71425	0	0
III	Oct	5666	1231	4435	0	662.89	71425	7169	78594	1727	1727			5332	7059	121	662.89	71414	0	0
I	Nov					662.89	71414	2153	73567	1940	1940			92	2032	114	662.89	71421	0	0
II	Nov					662.89	71421	1329	72750	1941	1941			0	1941	114	662.72	70695	0	0
III	Nov					662.72	70695	1242	71937	1943	1943			0	1943	115	662.52	69879	0	0
I	Dec					662.52	69879	1278	71157	545	545			0	545	116	662.67	70496	0	0
II	Dec					662.67	70496	789	71285	545	545			0	545	116	662.70	70624	0	0
III	Dec					662.70	70624	737	71361	599	599			0	599	127	662.70	70635	0	0
I	Jan					662.70	70635	441	71076	1977	1977			0	1977	112	662.30	68987	0	0
II	Jan					662.30	68987	775	69762	1977	1977			0	1977	112	661.97	67673	0	0
III	Jan					661.97	67673	429	68102	2178	2178			0	2178	124	661.50	65800	0	0
I	Feb					661.50	65800	552	66352	2405	2405			0	2405	114	661.00	63833	0	0
II	Feb					661.00	63833	332	64165	2405	2405			0	2405	114	660.44	61646	0	0
III	Feb					660.44	61646	49	61695	1928	1928			0	1928	90	659.92	59677	0	0
I	Mar					659.92	59677	233	59910	3249	3249			0	3249	112	659.07	56549	0	0
II	Mar					659.07	56549	101	56650	3249	3249			0	3249	112	658.16	53289	0	0
III	Mar					658.16	53289	52	53341	3575	3575			0	3575	123	657.10	49643	0	0
I	Apr					657.10	49643	25	49668	2665	2665			0	2665	115	656.26	46888	0	0
II	Apr					656.26	46888	715	47603	2666	2666			0	2666	115	655.61	44822	0	0
III	Apr					655.61	44822	215	45037	2667	2667			0	2667	115	654.78	42255	0	0
I	May					654.78	42255	116	42371	1072	1072			0	1072	72	654.43	41227	0	0
II	May					654.43	41227	123	41350	1072	1072			0	1072	72	654.09	40206	0	0
III	May					654.09	40206	69	40275	1179	1179			0	1179	79	653.68	39017	0	0
Total, TMC		**139.20**	**18.87**	**120.53**	**11.82**			**94.91**		**63.36**	**63.36**	**29.90**	**29.90**	**12.38**	**105.63**	**3.44**			**0.00**	**0.00**

Year : 1994-95		**Tunga Reservoir**				**Bhadra Reservoir**														
								MDDL =	**13832**	**Mcft**	**641.584 m**	**FRL =**	**71535 Mcft**		**662.92**	**m**	**UBPMDDL**	**29265 Mcft**		
										Issues from the Reservoir (in Mcft)							**OR**	**649.930 m**		
10-Day	**Month**	**Inflow at**	**Requiremnt at**	**Balance**	**Pumped to**	**Reservoir**	**Capacity**	**Inflow Mcft**	**Total Mcft**	**Irrig + Domestic**		**Upper Bhadra**		**Over**	**Total**	**Evaporation**	**Closing**		**Unit = Mcft**	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	2808	373	2435	0	653.68	39017	2657	41674	253	253	0	0	0	253	39	654.49	41382	0	0
II	Jun	9207	373	8834	1465	654.49	41382	6378	49225	254	254	1158	1158	0	1412	39	656.53	47774	0	0
III	Jun	13339	905	12434	1465	656.53	47774	8068	57306	256	256	2316	2316	0	2572	39	658.55	54695	0	0
I	Jul	18617	1057	17560	1465	658.55	54695	9055	65215	947	947	2459	2459	0	3406	50	660.46	61759	0	0
II	Jul	50068	876	49192	0	660.46	61759	29944	91703	947	947	2374	2374	16847	20168	50	662.91	71485	0	0
III	Jul	39673	697	38976	0	662.91	71485	23224	94709	1042	1042	2518	2518	19614	23174	56	662.91	71479	0	0
I	Aug	18996	1217	17779	0	662.91	71479	12986	84465	2247	2247	2697	2697	7986	12930	83	662.90	71452	0	0
II	Aug	10509	1417	9092	0	662.90	71452	5267	76719	2247	2247	2696	2696	241	5184	83	662.90	71452	0	0
III	Aug	20516	1618	18898	0	662.90	71452	9584	81036	2471	2471	2965	2965	4065	9501	91	662.90	71444	0	0
I	Sep	23482	2052	21430	0	662.90	71444	11104	82548	2017	2017	2381	2381	6615	11013	94	662.90	71441	0	0
II	Sep	5957	2035	3922	1465	662.90	71441	3160	76066	2018	2018	2382	2382	131	4531	94	662.90	71441	0	0
III	Sep	3087	2018	1069	1069	662.90	71441	2222	74732	2019	2019	2383	2383	0	4402	94	662.60	70236	0	0
I	Oct	3947	1589	2358	1465	662.60	70236	3497	75198	1568	1568	2381	2381	0	3949	110	662.82	71139	0	0
II	Oct	3628	1409	2219	0	662.82	71139	3748	74887	1568	1568	1190	1190	594	3352	110	662.89	71425	0	0
III	Oct	4331	1231	3100	0	662.89	71425	3942	75367	1727	1727			2105	3832	121	662.89	71414	0	0
I	Nov					662.89	71414	2183	73597	1940	1940			122	2062	114	662.89	71421	0	0
II	Nov					662.89	71421	1320	72741	1941	1941			0	1941	114	662.71	70686	0	0
III	Nov					662.71	70686	914	71600	1943	1943			0	1943	115	662.43	69542	0	0
I	Dec					662.43	69542	778	70320	545	545			0	545	116	662.46	69659	0	0
II	Dec					662.46	69659	557	70216	545	545			0	545	116	662.44	69555	0	0
III	Dec					662.44	69555	885	70440	599	599			0	599	127	662.48	69714	0	0
I	Jan					662.48	69714	1575	71289	1977	1977			0	1977	112	662.35	69200	0	0
II	Jan					662.35	69200	3337	72537	1977	1977			0	1977	112	662.66	70448	0	0
III	Jan					662.66	70448	2553	73001	2178	2178			0	2178	124	662.72	70699	0	0
I	Feb					662.72	70699	460	71159	2405	2405			0	2405	114	662.21	68640	0	0
II	Feb					662.21	68640	17	68657	2405	2405			0	2405	114	661.59	66138	0	0
III	Feb					661.59	66138	75	66213	1928	1928			0	1928	90	661.10	64195	0	0
I	Mar					661.10	64195	87	64282	3249	3249			0	3249	112	660.24	60921	0	0
II	Mar					660.24	60921	70	60991	3249	3249			0	3249	112	659.36	57630	0	0
III	Mar					659.36	57630	16	57646	3575	3575			0	3575	123	658.34	53948	0	0
I	Apr					658.34	53948	250	54198	2665	2665			0	2665	115	657.62	51418	0	0
II	Apr					657.62	51418	226	51644	2666	2666			0	2666	115	656.86	48863	0	0
III	Apr					656.86	48863	301	49164	2667	2667			0	2667	115	656.10	46382	0	0
I	May					656.10	46382	394	46776	1072	1072			0	1072	72	655.87	45632	0	0
II	May					655.87	45632	253	45885	1072	1072			0	1072	72	655.59	44741	0	0
III	May					655.59	44741	318	45059	1179	1179			0	1179	79	655.28	43801	0	0
Total, TMC		**228.17**	**18.87**	**209.30**	**8.39**			**151.41**		**63.36**	**63.36**	**29.90**	**29.90**	**58.32**	**151.58**	**3.44**			**-**	**-**

Year : 1995-96		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	26	373	0	0	655.28	43801	291	44092	253	253	0	0	0	253	39	655.28	43800	0	0
II	Jun	701	373	328	328	655.28	43800	1052	45180	254	254	1158	1158	0	1412	39	655.26	43729	0	0
III	Jun	1021	905	116	116	655.26	43729	1265	45110	256	256	2316	2316	0	2572	39	654.86	42499	0	0
I	Jul	7679	1057	6622	1465	654.86	42499	4229	48193	947	947	2459	2459	0	3406	50	655.58	44737	0	0
II	Jul	19709	876	18833	1465	655.58	44737	11605	57806	947	947	2374	2374	0	3321	50	658.48	54435	0	0
III	Jul	17287	697	16590	1611	658.48	54435	11747	67793	1042	1042	2518	2518	0	3560	56	661.09	64177	0	0
I	Aug	10921	1217	9704	1465	661.09	64177	6391	72033	2247	2247	2697	2697	0	4944	83	661.81	67006	0	0
II	Aug	5451	1417	4034	1465	661.81	67006	4344	72814	2247	2247	2696	2696	0	4943	83	662.00	67788	0	0
III	Aug	8739	1618	7121	1611	662.00	67788	6477	75876	2471	2471	2965	2965	0	5436	91	662.63	70349	0	0
I	Sep	26241	2052	24189	0	662.63	70349	14212	84561	2017	2017	2381	2381	8628	13026	94	662.90	71441	0	0
II	Sep	5176	2035	3141	1465	662.90	71441	2941	75847	2018	2018	2382	2382	0	4400	94	662.88	71353	0	0
III	Sep	2559	2018	541	541	662.88	71353	1575	73469	2019	2019	2383	2383	0	4402	94	662.29	68973	0	0
I	Oct	2419	1589	830	830	662.29	68973	2287	72090	1568	1568	2381	2381	0	3949	110	662.06	68031	0	0
II	Oct	1497	1409	88	88	662.06	68031	1370	69489	1568	1568	1190	1190	0	2758	110	661.71	66621	0	0
III	Oct	1986	1231	755	0	661.71	66621	1245	67866	1727	1727			0	1727	121	661.56	66018	0	0
I	Nov					661.56	66018	1538	67556	1940	1940			0	1940	114	661.43	65502	0	0
II	Nov					661.43	65502	532	66034	1941	1941			0	1941	114	661.04	63979	0	0
III	Nov					661.04	63979	1022	65001	1943	1943			0	1943	115	660.77	62943	0	0
I	Dec					660.77	62943	517	63460	545	545			0	545	116	660.74	62799	0	0
II	Dec					660.74	62799	181	62980	545	545			0	545	116	660.61	62319	0	0
III	Dec					660.61	62319	335	62654	599	599			0	599	127	660.51	61928	0	0
I	Jan					660.51	61928	440	62368	1977	1977			0	1977	112	660.07	60279	0	0
II	Jan					660.07	60279	206	60485	1977	1977			0	1977	112	659.57	58396	0	0
III	Jan					659.57	58396	42	58438	2178	2178			0	2178	124	658.95	56136	0	0
I	Feb					658.95	56136	117	56253	2405	2405			0	2405	114	658.28	53734	0	0
II	Feb					658.28	53734	51	53785	2405	2405			0	2405	114	657.57	51266	0	0
III	Feb					657.57	51266	0	51266	1928	1928			0	1928	90	656.98	49248	0	0
I	Mar					656.98	49248	170	49418	3249	3249			0	3249	112	656.00	46057	0	0
II	Mar					656.00	46057	143	46200	3249	3249			0	3249	112	654.97	42839	0	0
III	Mar					654.97	42839	148	42987	3575	3575			0	3575	123	653.77	39289	0	0
I	Apr					653.77	39289	581	39870	2665	2665			0	2665	115	652.99	37090	0	0
II	Apr					652.99	37090	140	37230	2666	2666			0	2666	115	652.01	34449	0	0
III	Apr					652.01	34449	34	34483	2667	2667			0	2667	115	650.93	31701	0	0
I	May					650.93	31701	122	31823	1072	1072			0	1072	72	650.52	30679	0	0
II	May					650.52	30679	39	30718	1072	1072			0	1072	72	650.06	29574	0	0
III	May					650.06	29574	178	29752	1179	1179			0	1179	79	649.62	28494	0	0
Total, TMC		**111.41**	**18.87**	**92.89**	**12.45**			**77.57**		**63.36**	**63.36**	**29.90**	**29.90**	**8.63**	**101.89**	**3.44**			**0.00**	**0.00**

Year : 1996-97		**Tunga Reservoir**				**Bhadra Reservoir**														
								MDDL =	**13832**	**Mcft**	**641.584 m**	**FRL =**	**71535 Mcft**		**662.92**	**m**	**UBPMDDL**	**29265**	**Mcft**	
										Issues from the Reservoir (in Mcft)							**OR**	**649.930**	**m**	
10-Day	**Month**	**Inflow at**	**Requirement at**	**Balance**	**Pumped to**	**Reservoir**	**Capacity**	**Inflow Mcft**	**Total Mcft**	**Irrig + Domestic**		**Upper Bhadra**		**Over**	**Total**	**Evaporation**	**Closing**		**Unit = Mcft**	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	25	373	0	0	649.62	28494	144	28638	253	253	0	0	0	253	39	649.56	28346	0	0
II	Jun	9280	373	8907	1465	649.56	28346	7814	37624	254	254	1158	1158	0	1412	39	652.65	36173	0	0
III	Jun	4336	905	3431	1465	652.65	36173	3324	40962	256	256	2316	2316	0	2572	39	653.44	38351	0	0
I	Jul	780	1057	0	0	653.44	38351	737	39088	947	947	2459	2459	0	3406	50	652.45	35632	0	0
II	Jul	6781	876	5905	1465	652.45	35632	4416	41512	947	947	2374	2374	0	3321	50	653.37	38141	0	0
III	Jul	28653	697	27956	1611	653.37	38141	14848	54600	1042	1042	2518	2518	0	3560	56	657.49	50984	0	0
I	Aug	12959	1217	11742	1465	657.49	50984	6730	59179	2247	2247	2697	2697	0	4944	83	658.40	54152	0	0
II	Aug	14130	1417	12713	1465	658.40	54152	7505	63121	2247	2247	2696	2696	0	4943	83	659.49	58095	0	0
III	Aug	10570	1618	8952	1611	659.49	58095	6226	65932	2471	2471	2965	2965	0	5436	91	660.11	60405	0	0
I	Sep	4992	2052	2940	1465	660.11	60405	3398	65268	2017	2017	2381	2381	0	4398	94	660.21	60776	0	0
II	Sep	3845	2035	1810	1465	660.21	60776	2520	64761	2018	2018	2382	2382	0	4400	94	660.07	60267	0	0
III	Sep	4300	2018	2282	1465	660.07	60267	4942	66673	2019	2019	2383	2383	0	4402	94	660.57	62177	0	0
I	Oct	4321	1589	2732	1465	660.57	62177	3949	67591	1568	1568	2381	2381	0	3949	110	660.92	63532	0	0
II	Oct	3146	1409	1737	1465	660.92	63532	2287	67283	1568	1568	1190	1190	0	2758	110	661.15	64415	0	0
III	Oct	2486	1231	1255	0	661.15	64415	1816	66231	1727	1727			0	1727	121	661.14	64383	0	0
I	Nov					661.14	64383	738	65121	1940	1940			0	1940	114	660.81	63067	0	0
II	Nov					660.81	63067	920	63987	1941	1941			0	1941	114	660.51	61932	0	0
III	Nov					660.51	61932	807	62739	1943	1943			0	1943	115	660.18	60681	0	0
I	Dec					660.18	60681	432	61113	545	545			0	545	116	660.12	60452	0	0
II	Dec					660.12	60452	713	61165	545	545			0	545	116	660.13	60504	0	0
III	Dec					660.13	60504	512	61016	599	599			0	599	127	660.08	60290	0	0
I	Jan					660.08	60290	485	60775	1977	1977			0	1977	112	659.65	58686	0	0
II	Jan					659.65	58686	242	58928	1977	1977			0	1977	112	659.15	56839	0	0
III	Jan					659.15	56839	257	57096	2178	2178			0	2178	124	658.58	54794	0	0
I	Feb					658.58	54794	126	54920	2405	2405			0	2405	114	657.90	52401	0	0
II	Feb					657.90	52401	125	52526	2405	2405			0	2405	114	657.20	50007	0	0
III	Feb					657.20	50007	137	50144	1928	1928			0	1928	90	656.64	48126	0	0
I	Mar					656.64	48126	47	48173	3249	3249			0	3249	112	655.61	44812	0	0
II	Mar					655.61	44812	12	44824	3249	3249			0	3249	112	654.51	41463	0	0
III	Mar					654.51	41463	257	41720	3575	3575			0	3575	123	653.32	38022	0	0
I	Apr					653.32	38022	101	38123	2665	2665			0	2665	115	652.34	35343	0	0
II	Apr					652.34	35343	198	35541	2666	2666			0	2666	115	651.35	32760	0	0
III	Apr					651.35	32760	82	32842	2667	2667			0	2667	115	650.26	30060	0	0
I	May					650.26	30060	162	30222	1072	1072			0	1072	72	649.85	29078	0	0
II	May					649.85	29078	351	29429	1072	1072			0	1072	72	649.53	28285	0	0
III	May					649.53	28285	265	28550	1179	1179			0	1179	79	649.08	27292	0	0
Total, TMC		110.60	18.87	92.36	17.87			77.63		63.36	63.36	29.90	29.90	0.00	93.26	3.44			0.00	0.00

Year : 1997-98		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265	Mcft	
10-Day	Month									Issues from the Reservoir (in Mcft)							OR	649.930	m	
		Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	26	373	0	0	649.08	27292	126	27418	253	253	0	0	0	253	39	649.01	27126	0	0
II	Jun	33	373	0	0	649.01	27126	558	27684	254	254	1158	0	0	254	39	649.12	27391	0	-1158
III	Jun	8321	905	7416	1465	649.12	27391	7221	36077	256	256	2316	2316	0	2572	39	651.63	33466	0	0
I	Jul	20771	1057	19714	1465	651.63	33466	9997	44927	947	947	2459	2459	0	3406	50	654.52	41471	0	0
II	Jul	23088	876	22212	1465	654.52	41471	15034	57970	947	947	2374	2374	0	3321	50	658.53	54599	0	0
III	Jul	19595	697	18898	1611	658.53	54599	9263	65473	1042	1042	2518	2518	0	3560	56	660.49	61857	0	0
I	Aug	37322	1217	36105	0	660.49	61857	19359	81216	2247	2247	2697	2697	4737	9681	83	662.90	71452	0	0
II	Aug	10719	1417	9302	0	662.90	71452	5795	77247	2247	2247	2696	2696	769	5712	83	662.90	71452	0	0
III	Aug	27378	1618	25760	0	662.90	71452	15865	87317	2471	2471	2965	2965	10346	15782	91	662.90	71444	0	0
I	Sep	7102	2052	5050	0	662.90	71444	4343	75787	2017	2017	2381	2381	0	4398	94	662.86	71295	0	0
II	Sep	3225	2035	1190	1190	662.86	71295	2273	74758	2018	2018	2382	2382	0	4400	94	662.61	70264	0	0
III	Sep	2670	2018	652	652	662.61	70264	1625	72541	2019	2019	2383	2383	0	4402	94	662.07	68045	0	0
I	Oct	2733	1589	1144	1144	662.07	68045	2082	71271	1568	1568	2381	2381	0	3949	110	661.86	67212	0	0
II	Oct	1285	1409	0	0	661.86	67212	906	68118	1568	1568	1190	1190	0	2758	110	661.36	65250	0	0
III	Oct	2255	1231	1024	0	661.36	65250	2725	67975	1727	1727			0	1727	121	661.59	66127	0	0
I	Nov					661.59	66127	1541	67668	1940	1940			0	1940	114	661.46	65614	0	0
II	Nov					661.46	65614	990	66604	1941	1941			0	1941	114	661.19	64549	0	0
III	Nov					661.19	64549	1591	66140	1943	1943			0	1943	115	661.07	64082	0	0
I	Dec					661.07	64082	803	64885	545	545			0	545	116	661.10	64224	0	0
II	Dec					661.10	64224	1106	65330	545	545			0	545	116	661.22	64669	0	0
III	Dec					661.22	64669	737	65406	599	599			0	599	127	661.22	64680	0	0
I	Jan					661.22	64680	557	65237	1977	1977			0	1977	112	660.83	63148	0	0
II	Jan					660.83	63148	367	63515	1977	1977			0	1977	112	660.38	61426	0	0
III	Jan					660.38	61426	309	61735	2178	2178			0	2178	124	659.85	59433	0	0
I	Feb					659.85	59433	272	59705	2405	2405			0	2405	114	659.24	57186	0	0
II	Feb					659.24	57186	214	57400	2405	2405			0	2405	114	658.61	54881	0	0
III	Feb					658.61	54881	111	54992	1928	1928			0	1928	90	658.07	52974	0	0
I	Mar					658.07	52974	134	53108	3249	3249			0	3249	112	657.13	49747	0	0
II	Mar					657.13	49747	92	49839	3249	3249			0	3249	112	656.13	46478	0	0
III	Mar					656.13	46478	114	46592	3575	3575			0	3575	123	654.99	42894	0	0
I	Apr					654.99	42894	104	42998	2665	2665			0	2665	115	654.09	40218	0	0
II	Apr					654.09	40218	92	40310	2666	2666			0	2666	115	653.15	37529	0	0
III	Apr					653.15	37529	95	37624	2667	2667			0	2667	115	652.15	34842	0	0
I	May					652.15	34842	69	34911	1072	1072			0	1072	72	651.74	33767	0	0
II	May					651.74	33767	325	34092	1072	1072			0	1072	72	651.43	32948	0	0
III	May					651.43	32948	193	33141	1179	1179			0	1179	79	651.01	31883	0	0
Total, TMC		166.52	18.87	148.47	8.99			106.99		63.36	63.36	29.90	28.74	15.85	107.95	3.44			0.00	-1.16

Year : 1998-99		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day					Pumped to	Reservoir	Capacity		Total Mcft	Irrig + Domestic		Upper Bhadra					Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	31	373	0	0	651.01	31883	133	32016	253	253	0	0	0	253	39	650.94	31724	0	0
II	Jun	467	373	94	94	650.94	31724	489	32307	254	254	1158	1158	0	1412	39	650.59	30856	0	0
III	Jun	10381	905	9476	1465	650.59	30856	6597	38918	256	256	2316	2316	0	2572	39	652.70	36307	0	0
I	Jul	30852	1057	29795	1465	652.70	36307	14017	51788	947	947	2459	2459	0	3406	50	656.70	48332	0	0
II	Jul	13087	876	12211	1465	656.70	48332	6477	56274	947	947	2374	2374	0	3321	50	658.05	52903	0	0
III	Jul	12512	697	11815	1611	658.05	52903	7109	61623	1042	1042	2518	2518	0	3560	56	659.47	58007	0	0
I	Aug	12534	1217	11317	1465	659.47	58007	6730	66201	2247	2247	2697	2697	0	4944	83	660.31	61174	0	0
II	Aug	13640	1417	12223	1465	660.31	61174	8024	70663	2247	2247	2696	2696	0	4943	83	661.46	65637	0	0
III	Aug	10232	1618	8614	1611	661.46	65637	7027	74275	2471	2471	2965	2965	0	5436	91	662.24	68748	0	0
I	Sep	4753	2052	2701	1465	662.24	68748	3872	74084	2017	2017	2381	2381	0	4398	94	662.45	69592	0	0
II	Sep	14735	2035	12700	0	662.45	69592	9496	79088	2018	2018	2382	2382	3153	7553	94	662.90	71441	0	0
III	Sep	5284	2018	3266	0	662.90	71441	4537	75978	2019	2019	2383	2383	41	4443	94	662.90	71441	0	0
I	Oct	5473	1589	3884	0	662.90	71441	5767	77208	1568	1568	2381	2381	1724	5673	110	662.89	71425	0	0
II	Oct	5685	1409	4276	0	662.89	71425	4498	75923	1568	1568	1190	1190	1630	4388	110	662.89	71425	0	0
III	Oct	2852	1231	1621	0	662.89	71425	2420	73845	1727	1727			583	2310	121	662.89	71414	0	0
I	Nov					662.89	71414	2622	74036	1940	1940			561	2501	114	662.89	71421	0	0
II	Nov					662.89	71421	1961	73382	1941	1941			0	1941	114	662.87	71327	0	0
III	Nov					662.87	71327	1043	72370	1943	1943			0	1943	115	662.62	70312	0	0
I	Dec					662.62	70312	923	71235	545	545			0	545	116	662.69	70574	0	0
II	Dec					662.69	70574	886	71460	545	545			0	545	116	662.74	70799	0	0
III	Dec					662.74	70799	419	71218	599	599			0	599	127	662.67	70492	0	0
I	Jan					662.67	70492	451	70943	1977	1977			0	1977	112	662.27	68854	0	0
II	Jan					662.27	68854	383	69237	1977	1977			0	1977	112	661.84	67148	0	0
III	Jan					661.84	67148	159	67307	2178	2178			0	2178	124	661.30	65005	0	0
I	Feb					661.30	65005	168	65173	2405	2405			0	2405	114	660.70	62654	0	0
II	Feb					660.70	62654	103	62757	2405	2405			0	2405	114	660.06	60238	0	0
III	Feb					660.06	60238	147	60385	1928	1928			0	1928	90	659.56	58367	0	0
I	Mar					659.56	58367	83	58450	3249	3249			0	3249	112	658.66	55089	0	0
II	Mar					658.66	55089	79	55168	3249	3249			0	3249	112	657.73	51807	0	0
III	Mar					657.73	51807	124	51931	3575	3575			0	3575	123	656.67	48233	0	0
I	Apr					656.67	48233	133	48366	2665	2665			0	2665	115	655.85	45586	0	0
II	Apr					655.85	45586	112	45698	2666	2666			0	2666	115	655.00	42917	0	0
III	Apr					655.00	42917	91	43008	2667	2667			0	2667	115	654.09	40226	0	0
I	May					654.09	40226	74	40300	1072	1072			0	1072	72	653.72	39156	0	0
II	May					653.72	39156	549	39705	1072	1072			0	1072	72	653.52	38561	0	0
III	May					653.52	38561	281	38842	1179	1179			0	1179	79	653.17	37584	0	0
Total, TMC		142.52	18.87	123.99	12.10			97.98		63.36	63.36	29.90	29.90	7.69	100.95	3.44			0.00	0.00

Year : 1999-00		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1236	373	862.70031	0	653.17	37584	137	37721	253	253	0	0	0	253	39	653.11	37429	0	0
II	Jun	10672	373	10298.771	1465	653.11	37429	4237	43131	254	254	1158	1158	0	1412	39	654.59	41680	0	0
III	Jun	7848	905	6943.1112	1465	654.59	41680	3631	46775	256	256	2316	2316	0	2572	39	655.40	44164	0	0
I	Jul	3699	1057	2641.5881	1465	655.40	44164	1517	47146	947	947	2459	2459	0	3406	50	655.25	43690	0	0
II	Jul	30180	876	29304.147	1465	655.25	43690	13383	58537	947	947	2374	2374	0	3321	50	658.69	55166	0	0
III	Jul	47857	697	47159.742	0	658.69	55166	23481	78647	1042	1042	2518	2518	3552	7112	56	662.91	71479	0	0
I	Aug	31162	1217	29944.989	0	662.91	71479	14260	85739	2247	2247	2697	2697	9260	14204	83	662.90	71452	0	0
II	Aug	14830	1417	13412.536	0	662.90	71452	7234	78686	2247	2247	2696	2696	2208	7151	83	662.90	71452	0	0
III	Aug	9556	1618	7938.0437	1611	662.90	71452	3791	76854	2471	2471	2965	2965	0	5436	91	662.87	71327	0	0
I	Sep	8459	2052	6406.5317	1465	662.87	71327	2955	75747	2017	2017	2381	2381	0	4398	94	662.85	71255	0	0
II	Sep	6339	2035	4303.7499	1465	662.85	71255	2122	74841	2018	2018	2382	2382	0	4400	94	662.63	70347	0	0
III	Sep	3900	2018	1881.7224	1465	662.63	70347	1445	73257	2019	2019	2383	2383	0	4402	94	662.24	68761	0	0
I	Oct	7141	1589	5552.3342	1465	662.24	68761	4237	74462	1568	1568	2381	2381	0	3949	110	662.65	70403	0	0
II	Oct	6354	1409	4945.0058	0	662.65	70403	4701	75104	1568	1568	1190	1190	811	3569	110	662.89	71425	0	0
III	Oct	6462	1231	5231.4145	0	662.89	71425	4583	76008	1727	1727			2746	4473	121	662.89	71414	0	0
I	Nov					662.89	71414	1879	73293	1940	1940			0	1940	114	662.85	71239	0	0
II	Nov					662.85	71239	1086	72325	1941	1941			0	1941	114	662.61	70270	0	0
III	Nov					662.61	70270	834	71104	1943	1943			0	1943	115	662.31	69046	0	0
I	Dec					662.31	69046	682	69728	545	545			0	545	116	662.32	69067	0	0
II	Dec					662.32	69067	756	69823	545	545			0	545	116	662.34	69162	0	0
III	Dec					662.34	69162	764	69926	599	599			0	599	127	662.35	69200	0	0
I	Jan					662.35	69200	331	69531	1977	1977			0	1977	112	661.92	67442	0	0
II	Jan					661.92	67442	343	67785	1977	1977			0	1977	112	661.48	65696	0	0
III	Jan					661.48	65696	108	65804	2178	2178			0	2178	124	660.92	63502	0	0
I	Feb					660.92	63502	122	63624	2405	2405			0	2405	114	660.29	61105	0	0
II	Feb					660.29	61105	123	61228	2405	2405			0	2405	114	659.66	58709	0	0
III	Feb					659.66	58709	156	58865	1928	1928			0	1928	90	659.15	56847	0	0
I	Mar					659.15	56847	82	56929	3249	3249			0	3249	112	658.24	53568	0	0
II	Mar					658.24	53568	153	53721	3249	3249			0	3249	112	657.31	50360	0	0
III	Mar					657.31	50360	94	50454	3575	3575			0	3575	123	656.22	46756	0	0
I	Apr					656.22	46756	84	46840	2665	2665			0	2665	115	655.37	44060	0	0
II	Apr					655.37	44060	77	44137	2666	2666			0	2666	115	654.48	41356	0	0
III	Apr					654.48	41356	94	41450	2667	2667			0	2667	115	653.55	38668	0	0
I	May					653.55	38668	74	38742	1072	1072			0	1072	72	653.17	37598	0	0
II	May					653.17	37598	87	37685	1072	1072			0	1072	72	652.79	36541	0	0
III	May					652.79	36541	52	36593	1179	1179			0	1179	79	652.34	35335	0	0
Total, TMC		195.69	18.87	176.83	13.33			99.70		63.36	63.36	29.90	29.90	18.58	111.84	3.44			0.00	0.00

Year : 2000-01		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	2564	373	2190.6688	0	652.34	35335	1614	36949	253	253	0	0	0	253	39	652.83	36657	0	0
II	Jun	12139	373	11766.18	1465	652.83	36657	4748	42870	254	254	1158	1158	0	1412	39	654.50	41419	0	0
III	Jun	7504	905	6598.5718	1465	654.50	41419	3711	46594	256	256	2316	2316	0	2572	39	655.34	43983	0	0
I	Jul	15209	1057	14151.644	1465	655.34	43983	6866	52314	947	947	2459	2459	0	3406	50	656.86	48858	0	0
II	Jul	37848	876	36972.028	1465	656.86	48858	17914	68236	947	947	2374	2374	0	3321	50	661.27	64865	0	0
III	Jul	8834	697	8136.9811	1611	661.27	64865	2990	69466	1042	1042	2518	2518	0	3560	56	661.52	65850	0	0
I	Aug	5718	1217	4500.6202	1465	661.52	65850	2774	70089	2247	2247	2697	2697	0	4944	83	661.32	65062	0	0
II	Aug	10734	1417	9317.4742	1465	661.32	65062	4740	71266	2247	2247	2696	2696	0	4943	83	661.61	66240	0	0
III	Aug	34623	1618	33005.35	0	661.61	66240	18083	84323	2471	2471	2965	2965	7352	12788	91	662.90	71444	0	0
I	Sep	15712	2052	13659.937	0	662.90	71444	6541	77985	2017	2017	2381	2381	2052	6450	94	662.90	71441	0	0
II	Sep	6051	2035	4015.8709	1465	662.90	71441	2843	75749	2018	2018	2382	2382	0	4400	94	662.85	71255	0	0
III	Sep	6956	2018	4937.8531	0	662.85	71255	4139	75394	2019	2019	2383	2383	0	4402	94	662.77	70898	0	0
I	Oct	6482	1589	4893.0647	0	662.77	70898	4997	75895	1568	1568	2381	2381	411	4360	110	662.89	71425	0	0
II	Oct	4139	1409	2729.6917	0	662.89	71425	2643	74068	1568	1568	1190	1190	0	2758	110	662.84	71200	0	0
III	Oct	3747	1231	2515.8277	0	662.84	71200	2320	73520	1727	1727			258	1985	121	662.89	71414	0	0
I	Nov					662.89	71414	1192	72606	1940	1940			0	1940	114	662.68	70552	0	0
II	Nov					662.68	70552	912	71464	1941	1941			0	1941	114	662.40	69409	0	0
III	Nov					662.40	69409	719	70128	1943	1943			0	1943	115	662.07	68070	0	0
I	Dec					662.07	68070	294	68364	545	545			0	545	116	661.98	67703	0	0
II	Dec					661.98	67703	318	68021	545	545			0	545	116	661.89	67360	0	0
III	Dec					661.89	67360	226	67586	599	599			0	599	127	661.77	66860	0	0
I	Jan					661.77	66860	187	67047	1977	1977			0	1977	112	661.29	64958	0	0
II	Jan					661.29	64958	118	65076	1977	1977			0	1977	112	660.78	62987	0	0
III	Jan					660.78	62987	58	63045	2178	2178			0	2178	124	660.20	60743	0	0
I	Feb					660.20	60743	138	60881	2405	2405			0	2405	114	659.56	58362	0	0
II	Feb					659.56	58362	99	58461	2405	2405			0	2405	114	658.90	55942	0	0
III	Feb					658.90	55942	132	56074	1928	1928			0	1928	90	658.37	54056	0	0
I	Mar					658.37	54056	101	54157	3249	3249			0	3249	112	657.44	50796	0	0
II	Mar					657.44	50796	89	50885	3249	3249			0	3249	112	656.46	47524	0	0
III	Mar					656.46	47524	121	47645	3575	3575			0	3575	123	655.33	43947	0	0
I	Apr					655.33	43947	70	44017	2665	2665			0	2665	115	654.44	41237	0	0
II	Apr					654.44	41237	65	41302	2666	2666			0	2666	115	653.50	38521	0	0
III	Apr					653.50	38521	95	38616	2667	2667			0	2667	115	652.53	35834	0	0
I	May					652.53	35834	69	35903	1072	1072			0	1072	72	652.12	34759	0	0
II	May					652.12	34759	77	34836	1072	1072			0	1072	72	651.72	33692	0	0
III	May					651.72	33692	123	33815	1179	1179			0	1179	79	651.27	32557	0	0
Total, TMC		**178.26**	**18.87**	**159.39**	**11.86**			**92.13**		**63.36**	**63.36**	**29.90**	**29.90**	**10.07**	**103.33**	**3.44**			**0.00**	**0.00**

Year : 2001-02		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Issues from the Reservoir (in Mcft)							OR	649.930	m	
										Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	88	373	0	0	651.27	32557	137	32694	253	253	0	0	0	253	39	651.21	32402	0	0
II	Jun	11004	373	10630.742	1465	651.21	32402	6636	40503	254	254	1158	1158	0	1412	39	653.69	39052	0	0
III	Jun	10596	905	9690.7062	1465	653.69	39052	4323	44839	256	256	2316	2316	0	2572	39	654.77	42228	0	0
I	Jul	22643	1057	21586.137	1465	654.77	42228	9832	53525	947	947	2459	2459	0	3406	50	657.22	50069	0	0
II	Jul	14020	876	13144.268	1465	657.22	50069	7196	58729	947	947	2374	2374	0	3321	50	658.74	55358	0	0
III	Jul	11248	697	10550.806	1611	658.74	55358	4724	61693	1042	1042	2518	2518	0	3560	56	659.49	58077	0	0
I	Aug	13487	1217	12269.706	1465	659.49	58077	6232	65774	2247	2247	2697	2697	0	4944	83	660.20	60747	0	0
II	Aug	17759	1417	16341.949	1465	660.20	60747	7311	69522	2247	2247	2696	2696	0	4943	83	661.17	64496	0	0
III	Aug	17661	1618	16043.372	1611	661.17	64496	7977	74084	2471	2471	2965	2965	0	5436	91	662.19	68557	0	0
I	Sep	6107	2052	4054.9518	1465	662.19	68557	2381	72403	2017	2017	2381	2381	0	4398	94	662.03	67911	0	0
II	Sep	3928	2035	1893.1598	1465	662.03	67911	1418	70794	2018	2018	2382	2382	0	4400	94	661.63	66300	0	0
III	Sep	4222	2018	2204.4773	1465	661.63	66300	2003	69767	2019	2019	2383	2383	0	4402	94	661.37	65271	0	0
I	Oct	4877	1589	3288.1401	1465	661.37	65271	2304	69040	1568	1568	2381	2381	0	3949	110	661.30	64981	0	0
II	Oct	3510	1409	2101.3302	1465	661.30	64981	1536	67981	1568	1568	1190	1190	0	2758	110	661.33	65113	0	0
III	Oct	2961	1231	1729.9639	0	661.33	65113	1102	66215	1727	1727			0	1727	121	661.14	64367	0	0
I	Nov					661.14	64367	263	64630	1940	1940			0	1940	114	660.68	62576	0	0
II	Nov					660.68	62576	287	62863	1941	1941			0	1941	114	660.21	60808	0	0
III	Nov					660.21	60808	329	61137	1943	1943			0	1943	115	659.76	59079	0	0
I	Dec					659.76	59079	242	59321	545	545			0	545	116	659.64	58660	0	0
II	Dec					659.64	58660	203	58863	545	545			0	545	116	659.52	58202	0	0
III	Dec					659.52	58202	248	58450	599	599			0	599	127	659.39	57724	0	0
I	Jan					659.39	57724	154	57878	1977	1977			0	1977	112	658.86	55789	0	0
II	Jan					658.86	55789	105	55894	1977	1977			0	1977	112	658.30	53805	0	0
III	Jan					658.30	53805	120	53925	2178	2178			0	2178	124	657.68	51623	0	0
I	Feb					657.68	51623	141	51764	2405	2405			0	2405	114	656.98	49245	0	0
II	Feb					656.98	49245	117	49362	2405	2405			0	2405	114	656.25	46843	0	0
III	Feb					656.25	46843	117	46960	1928	1928			0	1928	90	655.65	44942	0	0
I	Mar					655.65	44942	127	45069	3249	3249			0	3249	112	654.60	41708	0	0
II	Mar					654.60	41708	122	41830	3249	3249			0	3249	112	653.48	38469	0	0
III	Mar					653.48	38469	159	38628	3575	3575			0	3575	123	652.19	34930	0	0
I	Apr					652.19	34930	141	35071	2665	2665			0	2665	115	651.17	32291	0	0
II	Apr					651.17	32291	289	32580	2666	2666			0	2666	115	650.15	29799	0	0
III	Apr					650.15	29799	492	30291	2667	2667			0	2667	115	649.17	27509	0	0
I	May					649.17	27509	126	27635	1072	1072			0	1072	72	648.72	26491	0	0
II	May					648.72	26491	99	26590	1072	1072			0	1072	72	648.24	25446	0	0
III	May					648.24	25446	160	25606	1179	1179			0	1179	79	647.73	24348	0	0
Total, TMC		**144.11**	**18.87**	**125.53**	**19.33**			**69.15**		**63.36**	**63.36**	**29.90**	**29.90**	**0.00**	**93.26**	**3.44**			**0.00**	**0.00**

Year : 2002-03		**Tunga Reservoir**				**Bhadra Reservoir**														
								MDDL =	**13832**	**Mcft**	**641.584 m**	**FRL =**	**71535 Mcft**		**662.92**	**m**	**UBPMDDL**	**29265**	**Mcft**	
										Issues from the Reservoir (in Mcft)							**OR**	**649.930**	**m**	
10-Day	**Month**	**Inflow at**	**Requirement at**	**Balance**	**Pumped to**	**Reservoir**	**Capacity**	**Inflow Mcft**	**Total Mcft**	**Irrig + Domestic**		**Upper Bhadra**		**Over**	**Total**	**Evaporation**	**Closing**		**Unit = Mcft**	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	78	373	0	0	647.73	24348	563	24911	253	253	0	0	0	253	39	647.86	24619	0	0
II	Jun	1289	373	915.88262	916	647.86	24619	1154	26689	254	254	1158	0	0	254	39	648.68	26396	0	-1158
III	Jun	9358	905	8452.5343	1465	648.68	26396	3807	31668	256	256	2316	2147	0	2403	39	649.91	29226	0	-169
I	Jul	4759	1057	3702.2422	1465	649.91	29226	1466	32157	947	947	2459	1945	0	2892	50	649.91	29215	0	-514
II	Jul	13730	876	12853.703	1465	649.91	29215	4941	35621	947	947	2374	2374	0	3321	50	651.15	32250	0	0
III	Jul	8558	697	7861.0927	1611	651.15	32250	2922	36783	1042	1042	2518	2518	0	3560	56	651.51	33167	0	0
I	Aug	15120	1217	13903.465	1465	651.51	33167	5741	40372	2247	2247	2697	2697	0	4944	83	652.34	35345	0	0
II	Aug	27473	1417	26055.831	1465	652.34	35345	11551	48361	2247	2247	2696	2696	0	4943	83	655.13	43335	0	0
III	Aug	12302	1618	10683.656	1611	655.13	43335	4901	49847	2471	2471	2965	2965	0	5436	91	655.45	44320	0	0
I	Sep	7260	2052	5207.8124	1465	655.45	44320	2124	47908	2017	2017	2381	2381	0	4398	94	655.16	43416	0	0
II	Sep	4259	2035	2224.4882	1465	655.16	43416	1313	46194	2018	2018	2382	2382	0	4400	94	654.59	41700	0	0
III	Sep	2275	2018	256.53822	257	654.59	41700	521	42477	2019	2019	2383	2383	0	4402	94	653.31	37981	0	0
I	Oct	3808	1589	2219.4617	1465	653.31	37981	446	39892	1568	1568	2381	2381	0	3949	110	652.53	35833	0	0
II	Oct	5411	1409	4002.2505	1465	652.53	35833	3851	41149	1568	1568	1190	1190	0	2758	110	653.42	38281	0	0
III	Oct	3452	1231	2220.7169	0	653.42	38281	1602	39883	1727	1727			0	1727	121	653.33	38035	0	0
I	Nov					653.33	38035	1115	39150	1940	1940			0	1940	114	652.99	37096	0	0
II	Nov					652.99	37096	528	37624	1941	1941			0	1941	114	652.43	35569	0	0
III	Nov					652.43	35569	425	35994	1943	1943			0	1943	115	651.81	33936	0	0
I	Dec					651.81	33936	336	34272	545	545			0	545	116	651.68	33611	0	0
II	Dec					651.68	33611	270	33881	545	545			0	545	116	651.53	33220	0	0
III	Dec					651.53	33220	284	33504	599	599			0	599	127	651.36	32778	0	0
I	Jan					651.36	32778	138	32916	1977	1977			0	1977	112	650.58	30827	0	0
II	Jan					650.58	30827	111	30938	1977	1977			0	1977	112	649.76	28849	0	0
III	Jan					649.76	28849	117	28966	2178	2178			0	2178	124	648.80	26664	0	0
I	Feb					648.80	26664	105	26769	2405	2405			0	2405	114	647.68	24250	0	0
II	Feb					647.68	24250	115	24365	2405	2405			0	2405	114	646.49	21846	0	0
III	Feb					646.49	21846	84	21930	1928	1928			0	1928	90	645.46	19912	0	0
I	Mar					645.46	19912	123	20035	3249	3249			0	3249	112	643.54	16674	0	0
II	Mar					643.54	16674	102	16776	3249	2944			0	2944	112	641.50	13720	-305	0
III	Mar					641.50	13720	75	13795	3575	0			0	0	123	641.46	13672	-3575	0
I	Apr					641.46	13672	145	13817	2665	0			0	0	115	641.49	13702	-2665	0
II	Apr					641.49	13702	259	13961	2666	129			0	129	115	641.50	13717	-2537	0
III	Apr					641.50	13717	202	13919	2667	87			0	87	115	641.50	13717	-2580	0
I	May					641.50	13717	195	13912	1072	80			0	80	72	641.53	13760	-992	0
II	May					641.53	13760	206	13966	1072	134			0	134	72	641.53	13760	-938	0
III	May					641.53	13760	117	13877	1179	45			0	45	79	641.52	13753	-1134	0
Total, TMC		119.13	18.87	100.56	17.58			51.96		63.36	48.63	29.90	28.06	0.00	76.69	3.44			-14.73	-1.84

Year : 2003-04		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Issues from the Reservoir (in Mcft)							OR	649.930 m		
										Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	153	373	0	0	641.52	13753	96	13849	253	17	0	0	0	17	39	641.55	13793	-236	0
II	Jun	155	373	0	0	641.55	13793	376	14169	254	254	1158	0	0	254	39	641.62	13876	0	-1158
III	Jun	10140	905	9235.2555	1465	641.62	13876	4683	20024	256	256	2316	0	0	256	39	645.36	19729	0	-2316
I	Jul	9454	1057	8397.3485	1465	645.36	19729	3335	24528	947	947	2459	0	0	947	50	647.33	23531	0	-2459
II	Jul	11542	876	10665.696	1465	647.33	23531	4841	29837	947	947	2374	0	0	947	50	649.75	28840	0	-2374
III	Jul	19219	697	18522.155	1611	649.75	28840	5681	36132	1042	1042	2518	2518	0	3560	56	651.26	32516	0	0
I	Aug	12841	1217	11624.38	1465	651.26	32516	3909	37889	2247	2247	2697	2697	0	4944	83	651.39	32862	0	0
II	Aug	17563	1417	16145.574	1465	651.39	32862	3249	37576	2247	2247	2696	2696	0	4943	83	651.27	32550	0	0
III	Aug	40210	1618	38591.525	1611	651.27	32550	6821	40982	2471	2471	2965	2965	0	5436	91	652.39	35455	0	0
I	Sep	8763	2052	6711.102	1465	652.39	35455	2257	39176	2017	2017	2381	2381	0	4398	94	652.10	34684	0	0
II	Sep	4842	2035	2806.6853	1465	652.10	34684	1489	37638	2018	2018	2382	2382	0	4400	94	651.50	33144	0	0
III	Sep	3337	2018	1319.2668	1319	651.50	33144	478	34941	2019	2019	2383	2383	0	4402	94	650.42	30445	0	0
I	Oct	6464	1589	4875.1543	1465	650.42	30445	3217	35127	1568	1568	2381	2381	0	3949	110	650.68	31068	0	0
II	Oct	3034	1409	1624.7347	1465	650.68	31068	1080	33612	1568	1568	1190	1190	0	2758	110	650.54	30744	0	0
III	Oct	3263	1231	2032.2755	0	650.54	30744	963	31707	1727	1727			0	1727	121	650.18	29859	0	0
I	Nov					650.18	29859	330	30189	1940	1940			0	1940	114	649.47	28135	0	0
II	Nov					649.47	28135	318	28453	1941	1941			0	1941	114	648.68	26398	0	0
III	Nov					648.68	26398	163	26561	1943	1943			0	1943	115	647.80	24503	0	0
I	Dec					647.80	24503	181	24684	545	545			0	545	116	647.57	24023	0	0
II	Dec					647.57	24023	178	24201	545	545			0	545	116	647.34	23540	0	0
III	Dec					647.34	23540	134	23674	599	599			0	599	127	647.05	22948	0	0
I	Jan					647.05	22948	141	23089	1977	1977			0	1977	112	646.05	21000	0	0
II	Jan					646.05	21000	88	21088	1977	1977			0	1977	112	644.95	18999	0	0
III	Jan					644.95	18999	95	19094	2178	2178			0	2178	124	643.61	16792	0	0
I	Feb					643.61	16792	99	16891	2405	2405			0	2405	114	641.98	14372	0	0
II	Feb					641.98	14372	102	14474	2405	642			0	642	114	641.50	13718	-1763	0
III	Feb					641.50	13718	67	13785	1928	0			0	0	90	641.48	13695	-1928	0
I	Mar					641.48	13695	58	13753	3249	0			0	0	112	641.44	13641	-3249	0
II	Mar					641.44	13641	59	13700	3249	0			0	0	112	641.40	13588	-3249	0
III	Mar					641.40	13588	144	13732	3575	0			0	0	123	641.42	13609	-3575	0
I	Apr					641.42	13609	50	13659	2665	0			0	0	115	641.37	13544	-2665	0
II	Apr					641.37	13544	51	13595	2666	0			0	0	115	641.32	13480	-2666	0
III	Apr					641.32	13480	124	13604	2667	0			0	0	115	641.33	13489	-2667	0
I	May					641.33	13489	465	13954	1072	122			0	122	72	641.53	13760	-950	0
II	May					641.53	13760	216	13976	1072	144			0	144	72	641.53	13760	-928	0
III	May					641.53	13760	965	14725	1179	893			0	893	79	641.52	13753	-286	0
Total, TMC		**150.98**	**18.87**	**132.55**	**17.72**			**46.50**		**63.36**	**39.20**	**29.90**	**21.59**	**0.00**	**60.79**	**3.44**			**-24.16**	**-8.31**

Year : 2004-05		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1452	373	1079.4024	0	641.52	13753	1319	15072	253	253	0	0	0	253	39	642.27	14780	0	0
II	Jun	16859	373	16486.226	1465	642.27	14780	8865	25110	254	254	1158	0	0	254	39	647.95	24817	0	-1158
III	Jun	5526	905	4621.15	1465	647.95	24817	2509	28790	256	256	2316	0	0	256	39	649.62	28495	0	-2316
I	Jul	14261	1057	13204.395	1465	649.62	28495	4373	34333	947	947	2459	2459	0	3406	50	650.60	30877	0	0
II	Jul	8047	876	7170.9394	1465	650.60	30877	2930	35271	947	947	2374	2374	0	3321	50	651.01	31900	0	0
III	Jul	17504	697	16807.131	1611	651.01	31900	6129	39640	1042	1042	2518	2518	0	3560	56	652.60	36024	0	0
I	Aug	44237	1217	43020.382	1465	652.60	36024	16934	54423	2247	2247	2697	2697	0	4944	83	657.02	49396	0	0
II	Aug	27642	1417	26224.791	1465	657.02	49396	10935	61795	2247	2247	2696	2696	0	4943	83	659.13	56769	0	0
III	Aug	12913	1618	11294.873	1611	659.13	56769	5722	64102	2471	2471	2965	2965	0	5436	91	659.62	58575	0	0
I	Sep	4917	2052	2865.1115	1465	659.62	58575	1870	61910	2017	2017	2381	2381	0	4398	94	659.31	57418	0	0
II	Sep	4439	2035	2404.4941	1465	659.31	57418	1877	60760	2018	2018	2382	2382	0	4400	94	658.99	56266	0	0
III	Sep	4055	2018	2037.4481	1465	658.99	56266	1766	59496	2019	2019	2383	2383	0	4402	94	658.64	55000	0	0
I	Oct	3348	1589	1758.7142	1465	658.64	55000	1590	58055	1568	1568	2381	2381	0	3949	110	658.36	53996	0	0
II	Oct	2646	1409	1236.8361	1237	658.36	53996	1214	56447	1568	1568	1190	1190	0	2758	110	658.24	53579	0	0
III	Oct	2130	1231	899.46062	0	658.24	53579	629	54208	1727	1727			0	1727	121	657.89	52360	0	0
I	Nov					657.89	52360	536	52896	1940	1940			0	1940	114	657.45	50842	0	0
II	Nov					657.45	50842	344	51186	1941	1941			0	1941	114	656.94	49131	0	0
III	Nov					656.94	49131	243	49374	1943	1943			0	1943	115	656.39	47316	0	0
I	Dec					656.39	47316	216	47532	545	545			0	545	116	656.25	46871	0	0
II	Dec					656.25	46871	174	47045	545	545			0	545	116	656.10	46384	0	0
III	Dec					656.10	46384	183	46567	599	599			0	599	127	655.93	45841	0	0
I	Jan					655.93	45841	195	46036	1977	1977			0	1977	112	655.33	43947	0	0
II	Jan					655.33	43947	83	44030	1977	1977			0	1977	112	654.67	41941	0	0
III	Jan					654.67	41941	153	42094	2178	2178			0	2178	124	653.94	39792	0	0
I	Feb					653.94	39792	101	39893	2405	2405			0	2405	114	653.09	37374	0	0
II	Feb					653.09	37374	96	37470	2405	2405			0	2405	114	652.20	34951	0	0
III	Feb					652.20	34951	91	35042	1928	1928			0	1928	90	651.46	33024	0	0
I	Mar					651.46	33024	107	33131	3249	3249			0	3249	112	650.14	29770	0	0
II	Mar					650.14	29770	88	29858	3249	3249			0	3249	112	648.72	26497	0	0
III	Mar					648.72	26497	126	26623	3575	3575			0	3575	123	647.04	22925	0	0
I	Apr					647.04	22925	95	23020	2665	2665			0	2665	115	645.64	20240	0	0
II	Apr					645.64	20240	136	20376	2666	2666			0	2666	115	644.11	17595	0	0
III	Apr					644.11	17595	273	17868	2667	2667			0	2667	115	642.48	15086	0	0
I	May					642.48	15086	211	15297	1072	1072			0	1072	72	641.82	14153	0	0
II	May					641.82	14153	154	14307	1072	475			0	475	72	641.53	13760	-597	0
III	May					641.53	13760	179	13939	1179	107			0	107	79	641.52	13753	-1072	0
Total, TMC		**169.98**	**18.87**	**151.11**	**19.10**			**72.45**		**63.36**	**61.69**	**29.90**	**26.43**	**0.00**	**88.11**	**3.44**			**-1.67**	**-3.47**

Year : 2005-06		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	68	373	0	0	641.52	13753	162	13915	253	83	0	0	0	83	39	641.55	13793	-170	0
II	Jun	44	373	0	0	641.55	13793	404	14197	254	254	1158	0	0	254	39	641.64	13904	0	-1158
III	Jun	10299	905	9393.5612	1465	641.64	13904	5542	20911	256	256	2316	0	0	256	39	645.84	20616	0	-2316
I	Jul	10410	1057	9353.176	1465	645.84	20616	10748	32828	947	947	2459	2459	0	3406	50	649.97	29372	0	0
II	Jul	22134	876	21257.983	1465	649.97	29372	4826	35663	947	947	2374	2374	0	3321	50	651.17	32292	0	0
III	Jul	8503	697	7806.299	1611	651.17	32292	19744	53647	1042	1042	2518	2518	0	3560	56	657.21	50031	0	0
I	Aug	51520	1217	50303.453	1465	657.21	50031	22335	73830	2247	2247	2697	2697	0	4944	83	662.25	68803	0	0
II	Aug	55561	1417	54143.502	0	662.25	68803	10892	79695	2247	2247	2696	2696	3217	8160	83	662.90	71452	0	0
III	Aug	28197	1618	26578.541	1611	662.90	71452	4010	77073	2471	2471	2965	2965	102	5538	91	662.90	71444	0	0
I	Sep	11246	2052	9194.3665	1465	662.90	71444	3470	76379	2017	2017	2381	2381	446	4844	94	662.90	71441	0	0
II	Sep	8285	2035	6250.3669	0	662.90	71441	5671	77112	2018	2018	2382	2382	1177	5577	94	662.90	71441	0	0
III	Sep	14663	2018	12645.192	1465	662.90	71441	3075	75981	2019	2019	2383	2383	44	4446	94	662.90	71441	0	0
I	Oct	7106	1589	5516.7036	1465	662.90	71441	1715	74621	1568	1568	2381	2381	0	3949	110	662.68	70562	0	0
II	Oct	4650	1409	3240.9385	0	662.68	70562	5963	76525	1568	1568	1190	1190	2232	4990	110	662.89	71425	0	0
III	Oct	11780	1231	10548.767	0	662.89	71425	3036	74461	1727	1727			1199	2926	121	662.89	71414	0	0
I	Nov					662.89	71414	1940	73354	1940	1940			0	1940	114	662.86	71300	0	0
II	Nov					662.86	71300	1096	72396	1941	1941			0	1941	114	662.63	70341	0	0
III	Nov					662.63	70341	923	71264	1943	1943			0	1943	115	662.35	69206	0	0
I	Dec					662.35	69206	633	69839	545	545			0	545	116	662.35	69178	0	0
II	Dec					662.35	69178	683	69861	545	545			0	545	116	662.35	69200	0	0
III	Dec					662.35	69200	577	69777	599	599			0	599	127	662.31	69051	0	0
I	Jan					662.31	69051	356	69407	1977	1977			0	1977	112	661.88	67318	0	0
II	Jan					661.88	67318	185	67503	1977	1977			0	1977	112	661.41	65414	0	0
III	Jan					661.41	65414	158	65572	2178	2178			0	2178	124	660.86	63270	0	0
I	Feb					660.86	63270	150	63420	2405	2405			0	2405	114	660.24	60901	0	0
II	Feb					660.24	60901	108	61009	2405	2405			0	2405	114	659.60	58490	0	0
III	Feb					659.60	58490	137	58627	1928	1928			0	1928	90	659.08	56609	0	0
I	Mar					659.08	56609	151	56760	3249	3249			0	3249	112	658.19	53399	0	0
II	Mar					658.19	53399	151	53550	3249	3249			0	3249	112	657.26	50189	0	0
III	Mar					657.26	50189	87	50276	3575	3575			0	3575	123	656.16	46578	0	0
I	Apr					656.16	46578	51	46629	2665	2665			0	2665	115	655.30	43849	0	0
II	Apr					655.30	43849	88	43937	2666	2666			0	2666	115	654.41	41156	0	0
III	Apr					654.41	41156	88	41244	2667	2667			0	2667	115	653.48	38462	0	0
I	May					653.48	38462	101	38563	1072	1072			0	1072	72	653.11	37419	0	0
II	May					653.11	37419	112	37531	1072	1072			0	1072	72	652.73	36387	0	0
III	May					652.73	36387	1280	37667	1179	1179			0	1179	79	652.74	36409	0	0
Total, TMC		244.47	18.87	226.23	13.47			110.65		63.36	63.19	29.90	26.43	8.42	98.03	3.44			-0.17	-3.47

Year : 2006-07		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	5681	373	5307.598	0	652.74	36409	3345	39754	253	253	0	0	0	253	39	653.83	39462	0	0
II	Jun	1870	373	1497.2719	1465	653.83	39462	1248	42175	254	254	1158	1158	0	1412	39	654.26	40724	0	0
III	Jun	12949	905	12044.32	1465	654.26	40724	5560	47748	256	256	2316	2316	0	2572	39	655.71	45137	0	0
I	Jul	34779	1057	33721.979	1465	655.71	45137	14859	61461	947	947	2459	2459	0	3406	50	659.47	58005	0	0
II	Jul	29051	876	28174.793	1465	659.47	58005	9406	68875	947	947	2374	2374	0	3321	50	661.43	65504	0	0
III	Jul	28794	697	28097.234	0	661.43	65504	10081	75585	1042	1042	2518	2518	490	4050	56	662.91	71479	0	0
I	Aug	24633	1217	23415.74	0	662.91	71479	7003	78482	2247	2247	2697	2697	2003	6947	83	662.90	71452	0	0
II	Aug	67831	1417	66414.288	0	662.90	71452	23068	94520	2247	2247	2696	2696	18042	22985	83	662.90	71452	0	0
III	Aug	11722	1618	10103.758	0	662.90	71452	5003	76455	2471	2471	2965	2965	0	5436	91	662.77	70928	0	0
I	Sep	6678	2052	4625.5558	1465	662.77	70928	2902	75295	2017	2017	2381	2381	0	4398	94	662.74	70803	0	0
II	Sep	10687	2035	8652.4687	0	662.74	70803	4960	75763	2018	2018	2382	2382	0	4400	94	662.86	71269	0	0
III	Sep	6792	2018	4774.0498	1465	662.86	71269	3152	75885	2019	2019	2383	2383	0	4402	94	662.88	71389	0	0
I	Oct	5258	1589	3668.9706	1465	662.88	71389	2042	74896	1568	1568	2381	2381	0	3949	110	662.75	70837	0	0
II	Oct	2971	1409	1562.2931	1465	662.75	70837	1654	73955	1568	1568	1190	1190	0	2758	110	662.81	71087	0	0
III	Oct	2733	1231	1501.5758	0	662.81	71087	699	71786	1727	1727			0	1727	121	662.53	69938	0	0
I	Nov					662.53	69938	1785	71723	1940	1940			0	1940	114	662.47	69669	0	0
II	Nov					662.47	69669	730	70399	1941	1941			0	1941	114	662.14	68344	0	0
III	Nov					662.14	68344	1082	69426	1943	1943			0	1943	115	661.90	67368	0	0
I	Dec					661.90	67368	661	68029	545	545			0	545	116	661.90	67368	0	0
II	Dec					661.90	67368	666	68034	545	545			0	545	116	661.90	67373	0	0
III	Dec					661.90	67373	389	67762	599	599			0	599	127	661.81	67036	0	0
I	Jan					661.81	67036	294	67330	1977	1977			0	1977	112	661.36	65241	0	0
II	Jan					661.36	65241	184	65425	1977	1977			0	1977	112	660.87	63336	0	0
III	Jan					660.87	63336	81	63417	2178	2178			0	2178	124	660.30	61115	0	0
I	Feb					660.30	61115	99	61214	2405	2405			0	2405	114	659.65	58695	0	0
II	Feb					659.65	58695	86	58781	2405	2405			0	2405	114	658.99	56262	0	0
III	Feb					658.99	56262	40	56302	1928	1928			0	1928	90	658.44	54284	0	0
I	Mar					658.44	54284	58	54342	3249	3249			0	3249	112	657.49	50981	0	0
II	Mar					657.49	50981	41	51022	3249	3249			0	3249	112	656.50	47661	0	0
III	Mar					656.50	47661	36	47697	3575	3575			0	3575	123	655.35	43999	0	0
I	Apr					655.35	43999	33	44032	2665	2665			0	2665	115	654.44	41252	0	0
II	Apr					654.44	41252	43	41295	2666	2666			0	2666	115	653.50	38514	0	0
III	Apr					653.50	38514	28	38542	2667	2667			0	2667	115	652.50	35760	0	0
I	May					652.50	35760	37	35797	1072	1072			0	1072	72	652.08	34653	0	0
II	May					652.08	34653	28	34681	1072	1072			0	1072	72	651.66	33537	0	0
III	May					651.66	33537	201	33738	1179	1179			0	1179	79	651.24	32480	0	0
Total, TMC		**252.43**	**18.87**	**233.56**	**11.72**			**101.58**		**63.36**	**63.36**	**29.90**	**29.90**	**20.54**	**113.79**	**3.44**			**0.00**	**0.00**

Year : 2007-08		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	50	373	0	0	651.24	32480	196	32676	253	253	0	0	0	253	39	651.20	32384	0	0
II	Jun	279	373	0	0	651.20	32384	432	32816	254	254	1158	1158	0	1412	39	650.80	31365	0	0
III	Jun	19532	905	18627	1465	650.80	31365	11963	44793	256	256	2316	2316	0	2572	39	654.75	42182	0	0
I	Jul	54111	1057	53054	1465	654.75	42182	21296	64942	947	947	2459	2459	0	3406	50	660.39	61486	0	0
II	Jul	37926	876	37050	0	660.39	61486	13729	75215	947	947	2374	2374	359	3680	50	662.91	71485	0	0
III	Jul	10865	697	10168	0	662.91	71485	4872	76357	1042	1042	2518	2518	1262	4822	56	662.91	71479	0	0
I	Aug	61308	1217	60091	0	662.91	71479	23375	94854	2247	2247	2697	2697	18375	23319	83	662.90	71452	0	0
II	Aug	25442	1417	24025	0	662.90	71452	13269	84721	2247	2247	2696	2696	8243	13186	83	662.90	71452	0	0
III	Aug	11571	1618	9953	1611	662.90	71452	4335	77398	2471	2471	2965	2965	427	5863	91	662.90	71444	0	0
I	Sep	20050	2052	17998	0	662.90	71444	8619	80063	2017	2017	2381	2381	4130	8528	94	662.90	71441	0	0
II	Sep	11217	2035	9182	0	662.90	71441	6626	78067	2018	2018	2382	2382	2132	6532	94	662.90	71441	0	0
III	Sep	17094	2018	15076	0	662.90	71441	7297	78738	2019	2019	2383	2383	2801	7203	94	662.90	71441	0	0
I	Oct	6624	1589	5035	1465	662.90	71441	3145	76051	1568	1568	2381	2381	567	4516	110	662.89	71425	0	0
II	Oct	7030	1409	5621	0	662.89	71425	2381	73806	1568	1568	1190	1190	0	2758	110	662.78	70938	0	0
III	Oct	9924	1231	8693	0	662.78	70938	4641	75579	1727	1727			2317	4044	121	662.89	71414	0	0
I	Nov					662.89	71414	2019	73433	1940	1940			0	1940	114	662.88	71379	0	0
II	Nov					662.88	71379	1161	72540	1941	1941			0	1941	114	662.67	70485	0	0
III	Nov					662.67	70485	1037	71522	1943	1943			0	1943	115	662.42	69464	0	0
I	Dec					662.42	69464	949	70413	545	545			0	545	116	662.49	69752	0	0
II	Dec					662.49	69752	555	70307	545	545			0	545	116	662.46	69646	0	0
III	Dec					662.46	69646	158	69804	599	599			0	599	127	662.32	69078	0	0
I	Jan					662.32	69078	196	69274	1977	1977			0	1977	112	661.85	67185	0	0
II	Jan					661.85	67185	206	67391	1977	1977			0	1977	112	661.38	65302	0	0
III	Jan					661.38	65302	143	65445	2178	2178			0	2178	124	660.82	63143	0	0
I	Feb					660.82	63143	64	63207	2405	2405			0	2405	114	660.18	60688	0	0
II	Feb					660.18	60688	185	60873	2405	2405			0	2405	114	659.56	58354	0	0
III	Feb					659.56	58354	148	58502	1928	1928			0	1928	90	659.05	56484	0	0
I	Mar					659.05	56484	112	56596	3249	3249			0	3249	112	658.14	53235	0	0
II	Mar					658.14	53235	46	53281	3249	3249			0	3249	112	657.18	49920	0	0
III	Mar					657.18	49920	103	50023	3575	3575			0	3575	123	656.09	46325	0	0
I	Apr					656.09	46325	37	46362	2665	2665			0	2665	115	655.21	43582	0	0
II	Apr					655.21	43582	26	43608	2666	2666			0	2666	115	654.30	40827	0	0
III	Apr					654.30	40827	52	40879	2667	2667			0	2667	115	653.35	38097	0	0
I	May					653.35	38097	56	38153	1072	1072			0	1072	72	652.96	37009	0	0
II	May					652.96	37009	48	37057	1072	1072			0	1072	72	652.56	35913	0	0
III	May					652.56	35913	78	35991	1179	1179			0	1179	79	652.11	34733	0	0
Total, TMC		293.02	18.87	274.57	6.00			133.56		63.36	63.36	29.90	29.90	40.61	133.87	3.44			0.00	0.00

Year : 2008-09		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832 Mcft	641.584 m		FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	881	373	508	0	652.11	34733	903	35636	253	253	0	0	0	253	39	652.34	35344	0	0
II	Jun	8850	373	8477	1465	652.34	35344	4609	41418	254	254	1158	1158	0	1412	39	654.01	39967	0	0
III	Jun	10016	905	9111	1465	654.01	39967	4444	45875	256	256	2316	2316	0	2572	39	655.11	43264	0	0
I	Jul	10555	1057	9498	1465	655.11	43264	4622	49351	947	947	2459	2459	0	3406	50	655.95	45895	0	0
II	Jul	5551	876	4675	1465	655.95	45895	2265	49624	947	947	2374	2374	0	3321	50	656.06	46253	0	0
III	Jul	35018	697	34321	1611	656.06	46253	15365	63229	1042	1042	2518	2518	0	3560	56	659.90	59613	0	0
I	Aug	34551	1217	33334	1465	659.90	59613	13900	74978	2247	2247	2697	2697	0	4944	83	662.53	69951	0	0
II	Aug	68608	1417	67191	0	662.53	69951	24637	94588	2247	2247	2696	2696	18110	23053	83	662.90	71452	0	0
III	Aug	8664	1618	7046	1611	662.90	71452	3990	77053	2471	2471	2965	2965	82	5518	91	662.90	71444	0	0
I	Sep	9905	2052	7853	0	662.90	71444	5523	76967	2017	2017	2381	2381	1034	5432	94	662.90	71441	0	0
II	Sep	13122	2035	11087	0	662.90	71441	6301	77742	2018	2018	2382	2382	1807	6207	94	662.90	71441	0	0
III	Sep	5360	2018	3342	1465	662.90	71441	2166	75072	2019	2019	2383	2383	0	4402	94	662.69	70576	0	0
I	Oct	4074	1589	2485	1465	662.69	70576	1865	73905	1568	1568	2381	2381	0	3949	110	662.51	69846	0	0
II	Oct	2742	1409	1333	1333	662.51	69846	1514	72693	1568	1568	1190	1190	0	2758	110	662.50	69825	0	0
III	Oct	4148	1231	2917	0	662.50	69825	1176	71001	1727	1727			0	1727	121	662.34	69153	0	0
I	Nov					662.34	69153	809	69962	1940	1940			0	1940	114	662.03	67908	0	0
II	Nov					662.03	67908	308	68216	1941	1941			0	1941	114	661.59	66161	0	0
III	Nov					661.59	66161	303	66464	1943	1943			0	1943	115	661.15	64406	0	0
I	Dec					661.15	64406	300	64706	545	545			0	545	116	661.06	64045	0	0
II	Dec					661.06	64045	304	64349	545	545			0	545	116	660.96	63688	0	0
III	Dec					660.96	63688	380	64068	599	599			0	599	127	660.88	63342	0	0
I	Jan					660.88	63342	262	63604	1977	1977			0	1977	112	660.40	61515	0	0
II	Jan					660.40	61515	158	61673	1977	1977			0	1977	112	659.89	59584	0	0
III	Jan					659.89	59584	124	59708	2178	2178			0	2178	124	659.30	57406	0	0
I	Feb					659.30	57406	82	57488	2405	2405			0	2405	114	658.63	54969	0	0
II	Feb					658.63	54969	107	55076	2405	2405			0	2405	114	657.95	52557	0	0
III	Feb					657.95	52557	53	52610	1928	1928			0	1928	90	657.38	50592	0	0
I	Mar					657.38	50592	75	50667	3249	3249			0	3249	112	656.39	47306	0	0
II	Mar					656.39	47306	80	47386	3249	3249			0	3249	112	655.36	44025	0	0
III	Mar					655.36	44025	58	44083	3575	3575			0	3575	123	654.15	40385	0	0
I	Apr					654.15	40385	49	40434	2665	2665			0	2665	115	653.19	37654	0	0
II	Apr					653.19	37654	47	37701	2666	2666			0	2666	115	652.18	34920	0	0
III	Apr					652.18	34920	38	34958	2667	2667			0	2667	115	651.12	32176	0	0
I	May					651.12	32176	40	32216	1072	1072			0	1072	72	650.68	31072	0	0
II	May					650.68	31072	27	31099	1072	1072			0	1072	72	650.22	29955	0	0
III	May					650.22	29955	40	29995	1179	1179			0	1179	79	649.71	28737	0	0
Total, TMC		**222.05**	**18.87**	**203.18**	**14.81**			**96.92**		**63.36**	**63.36**	**29.90**	**29.90**	**21.03**	**114.29**	**3.44**			**0.00**	**0.00**

Year : 2009-10		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535	Mcft	662.92	m	UBPMDDL	29265	Mcft	
										Issues from the Reservoir (in Mcft)							OR	649.930	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1540	373	1167	0	649.71	28737	567	29304	253	253	0	0	0	253	39	649.82	29012	0	0
II	Jun	861	373	488	488	649.82	29012	335	29835	254	254	1158	316	0	570	39	649.91	29226	0	-842
III	Jun	1418	905	513	513	649.91	29226	240	29979	256	256	2316	458	0	714	39	649.91	29226	0	-1858
I	Jul	23844	1057	22787	1465	649.91	29226	11783	42474	947	947	2459	2459	0	3406	50	653.68	39018	0	0
II	Jul	65760	876	64884	1465	653.68	39018	26152	66634	947	947	2374	2374	0	3321	50	660.86	63263	0	0
III	Jul	27562	697	26865	1611	660.86	63263	9789	74663	1042	1042	2518	2518	0	3560	56	662.80	71047	0	0
I	Aug	19261	1217	18044	0	662.80	71047	5704	76751	2247	2247	2697	2697	272	5216	83	662.90	71452	0	0
II	Aug	9554	1417	8137	1465	662.90	71452	3186	76103	2247	2247	2696	2696	0	4943	83	662.81	71077	0	0
III	Aug	16845	1618	15227	0	662.81	71077	6132	77209	2471	2471	2965	2965	238	5674	91	662.90	71444	0	0
I	Sep	27274	2052	25222	0	662.90	71444	10460	81904	2017	2017	2381	2381	5971	10369	94	662.90	71441	0	0
II	Sep	10130	2035	8095	0	662.90	71441	5276	76717	2018	2018	2382	2382	782	5182	94	662.90	71441	0	0
III	Sep	8720	2018	6702	0	662.90	71441	4536	75977	2019	2019	2383	2383	40	4442	94	662.90	71441	0	0
I	Oct	18272	1589	16683	0	662.90	71441	9422	80863	1568	1568	2381	2381	5379	9328	110	662.89	71425	0	0
II	Oct	11369	1409	9960	0	662.89	71425	3249	74674	1568	1568	1190	1190	381	3139	110	662.89	71425	0	0
III	Oct	8324	1231	7093	0	662.89	71425	1618	73043	1727	1727			0	1727	121	662.84	71195	0	0
I	Nov					662.84	71195	770	71965	1940	1940			0	1940	114	662.53	69911	0	0
II	Nov					662.53	69911	911	70822	1941	1941			0	1941	114	662.24	68767	0	0
III	Nov					662.24	68767	888	69655	1943	1943			0	1943	115	661.95	67597	0	0
I	Dec					661.95	67597	700	68297	545	545			0	545	116	661.96	67636	0	0
II	Dec					661.96	67636	699	68335	545	545			0	545	116	661.97	67674	0	0
III	Dec					661.97	67674	1298	68972	599	599			0	599	127	662.12	68246	0	0
I	Jan					662.12	68246	1319	69565	1977	1977			0	1977	112	661.92	67476	0	0
II	Jan					661.92	67476	364	67840	1977	1977			0	1977	112	661.49	65751	0	0
III	Jan					661.49	65751	215	65966	2178	2178			0	2178	124	660.96	63664	0	0
I	Feb					660.96	63664	178	63842	2405	2405			0	2405	114	660.35	61323	0	0
II	Feb					660.35	61323	96	61419	2405	2405			0	2405	114	659.71	58900	0	0
III	Feb					659.71	58900	46	58946	1928	1928			0	1928	90	659.17	56928	0	0
I	Mar					659.17	56928	32	56960	3249	3249			0	3249	112	658.25	53599	0	0
II	Mar					658.25	53599	42	53641	3249	3249			0	3249	112	657.28	50280	0	0
III	Mar					657.28	50280	21	50301	3575	3575			0	3575	123	656.17	46603	0	0
I	Apr					656.17	46603	22	46625	2665	2665			0	2665	115	655.30	43845	0	0
II	Apr					655.30	43845	23	43868	2666	2666			0	2666	115	654.39	41087	0	0
III	Apr					654.39	41087	32	41119	2667	2667			0	2667	115	653.44	38337	0	0
I	May					653.44	38337	34	38371	1072	1072			0	1072	72	653.04	37227	0	0
II	May					653.04	37227	36	37263	1072	1072			0	1072	72	652.63	36119	0	0
III	May					652.63	36119	46	36165	1179	1179			0	1179	79	652.18	34907	0	0
Total, TMC		**250.73**	**18.87**	**231.87**	**7.01**			**106.22**		**63.36**	**63.36**	**29.90**	**27.20**	**13.06**	**103.62**	**3.44**			**0.00**	**-2.70**

Year : 2010-11		**Tunga Reservoir**				**Bhadra Reservoir**														
								MDDL =	**13832**	**Mcft**	**641.584 m**	**FRL =**	**71535**	**Mcft**	**662.92**	**m**	**UBPMDDL**	**29265**	**Mcft**	
										Issues from the Reservoir (in Mcft)							**OR**	**649.930**	**m**	
10-Day	**Month**	**Inflow at**	**Requiremnt at**	**Balance**	**Pumped to**	**Reservoir**	**Capacity**	**Inflow Mcft**	**Total Mcft**	**Irrig + Domestic**		**Upper Bhadra**		**Over**	**Total**	**Evaporation**	**Closing**		**Unit = Mcft**	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	90	373	0	0	652.18	34907	154	35061	253	253	0	0	0	253	39	652.13	34769	0	0
II	Jun	3539	373	3166	1465	652.13	34769	1808	38042	254	254	1158	1158	0	1412	39	652.81	36591	0	0
III	Jun	8358	905	7453	1465	652.81	36591	2247	40302	256	256	2316	2316	0	2572	39	653.21	37691	0	0
I	Jul	7944	1057	6887	1465	653.21	37691	3087	42243	947	947	2459	2459	0	3406	50	653.59	38787	0	0
II	Jul	4173	876	3297	1465	653.59	38787	2724	42975	947	947	2374	2374	0	3321	50	653.88	39604	0	0
III	Jul	35856	697	35159	1611	653.88	39604	11865	53080	1042	1042	2518	2518	0	3560	56	657.04	49464	0	0
I	Aug	30367	1217	29150	1465	657.04	49464	7368	58297	2247	2247	2697	2697	0	4944	83	658.15	53270	0	0
II	Aug	12378	1417	10961	1465	658.15	53270	4638	59372	2247	2247	2696	2696	0	4943	83	658.46	54346	0	0
III	Aug	17443	1618	15825	1611	658.46	54346	9424	65381	2471	2471	2965	2965	0	5436	91	659.96	59854	0	0
I	Sep	13529	2052	11477	1465	659.96	59854	6975	68294	2017	2017	2381	2381	0	4398	94	660.99	63802	0	0
II	Sep	8993	2035	6958	1465	660.99	63802	4036	69303	2018	2018	2382	2382	0	4400	94	661.25	64809	0	0
III	Sep	7647	2018	5629	1465	661.25	64809	4491	70764	2019	2019	2383	2383	0	4402	94	661.62	66268	0	0
I	Oct	7736	1589	6147	1465	661.62	66268	6004	73737	1568	1568	2381	2381	0	3949	110	662.47	69678	0	0
II	Oct	5136	1409	3727	1465	662.47	69678	2273	73415	1568	1568	1190	1190	0	2758	110	662.68	70547	0	0
III	Oct	4479	1231	3248	0	662.68	70547	3104	73651	1727	1727			389	2116	121	662.89	71414	0	0
I	Nov					662.89	71414	3623	75037	1940	1940			1562	3502	114	662.89	71421	0	0
II	Nov					662.89	71421	5008	76429	1941	1941			2953	4894	114	662.89	71421	0	0
III	Nov					662.89	71421	1906	73327	1943	1943			0	1943	115	662.86	71269	0	0
I	Dec					662.86	71269	1203	72472	545	545			392	937	116	662.89	71419	0	0
II	Dec					662.89	71419	811	72230	545	545			150	695	116	662.89	71419	0	0
III	Dec					662.89	71419	1333	72752	599	599			618	1217	127	662.89	71408	0	0
I	Jan					662.89	71408	953	72361	1977	1977			0	1977	112	662.61	70272	0	0
II	Jan					662.61	70272	389	70661	1977	1977			0	1977	112	662.20	68572	0	0
III	Jan					662.20	68572	216	68788	2178	2178			0	2178	124	661.68	66486	0	0
I	Feb					661.68	66486	85	66571	2405	2405			0	2405	114	661.06	64052	0	0
II	Feb					661.06	64052	54	64106	2405	2405			0	2405	114	660.42	61587	0	0
III	Feb					660.42	61587	35	61622	1928	1928			0	1928	90	659.90	59604	0	0
I	Mar					659.90	59604	59	59663	3249	3249			0	3249	112	659.00	56302	0	0
II	Mar					659.00	56302	59	56361	3249	3249			0	3249	112	658.07	53000	0	0
III	Mar					658.07	53000	38	53038	3575	3575			0	3575	123	657.01	49340	0	0
I	Apr					657.01	49340	21	49361	2665	2665			0	2665	115	656.17	46581	0	0
II	Apr					656.17	46581	26	46607	2666	2666			0	2666	115	655.29	43826	0	0
III	Apr					655.29	43826	37	43863	2667	2667			0	2667	115	654.39	41081	0	0
I	May					654.39	41081	33	41114	1072	1072			0	1072	72	654.01	39970	0	0
II	May					654.01	39970	35	40005	1072	1072			0	1072	72	653.62	38861	0	0
III	May					653.62	38861	32	38893	1179	1179			0	1179	79	653.19	37635	0	0
Total, TMC		**167.67**	**18.87**	**149.08**	**19.33**			**86.15**		**63.36**	**63.36**	**29.90**	**29.90**	**6.06**	**99.32**	**3.44**			**0.00**	**0.00**

Year : 2011-12		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	13832	Mcft	641.584 m	FRL =	71535 Mcft		662.92	m	UBPMDDL	29265 Mcft		
										Issues from the Reservoir (in Mcft)							OR	649.930 m		
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	2437	373	2064	0	653.19	37635	2175	39810	253	253	0	0	0	253	39	653.85	39518	0	0
II	Jun	13283	373	12910	1465	653.85	39518	4457	45440	254	254	1158	1158	0	1412	39	655.34	43989	0	0
III	Jun	24133	905	23228	1465	655.34	43989	6488	51941	256	256	2316	2316	0	2572	39	657.00	49330	0	0
I	Jul	13154	1057	12097	1465	657.00	49330	2639	53434	947	947	2459	2459	0	3406	50	657.20	49978	0	0
II	Jul	37048	876	36172	1465	657.20	49978	11359	62801	947	947	2374	2374	0	3321	50	659.85	59430	0	0
III	Jul	24450	697	23753	1611	659.85	59430	8895	69936	1042	1042	2518	2518	0	3560	56	661.63	66320	0	0
I	Aug	20173	1217	18956	0	661.63	66320	11600	77920	2247	2247	2697	2697	1441	6385	83	662.90	71452	0	0
II	Aug	12238	1417	10821	0	662.90	71452	5959	77411	2247	2247	2696	2696	933	5876	83	662.90	71452	0	0
III	Aug	14260	1618	12642	0	662.90	71452	7293	78745	2471	2471	2965	2965	1774	7210	91	662.90	71444	0	0
I	Sep	26828	2052	24776	0	662.90	71444	13644	85088	2017	2017	2381	2381	9155	13553	94	662.90	71441	0	0
II	Sep	13752	2035	11717	0	662.90	71441	5832	77273	2018	2018	2382	2382	1338	5738	94	662.90	71441	0	0
III	Sep	7228	2018	5210	1465	662.90	71441	2596	75502	2019	2019	2383	2383	0	4402	94	662.79	71006	0	0
I	Oct	4123	1589	2534	1465	662.79	71006	1709	74179	1568	1568	2381	2381	0	3949	110	662.58	70120	0	0
II	Oct	4632	1409	3223	1465	662.58	70120	2937	74522	1568	1568	1190	1190	229	2987	110	662.89	71425	0	0
III	Oct	3680	1231	2449	0	662.89	71425	1867	73292	1727	1727			30	1757	121	662.89	71414	0	0
I	Nov					662.89	71414	1654	73068	1940	1940			0	1940	114	662.79	71014	0	0
II	Nov					662.79	71014	975	71989	1941	1941			0	1941	114	662.53	69934	0	0
III	Nov					662.53	69934	928	70862	1943	1943			0	1943	115	662.25	68804	0	0
I	Dec					662.25	68804	750	69554	545	545			0	545	116	662.28	68893	0	0
II	Dec					662.28	68893	544	69437	545	545			0	545	116	662.25	68776	0	0
III	Dec					662.25	68776	458	69234	599	599			0	599	127	662.18	68508	0	0
I	Jan					662.18	68508	458	68966	1977	1977			0	1977	112	661.77	66877	0	0
II	Jan					661.77	66877	56	66933	1977	1977			0	1977	112	661.26	64844	0	0
III	Jan					661.26	64844	30	64874	2178	2178			0	2178	124	660.68	62572	0	0
I	Feb					660.68	62572	55	62627	2405	2405			0	2405	114	660.03	60108	0	0
II	Feb					660.03	60108	92	60200	2405	2405			0	2405	114	659.38	57681	0	0
III	Feb					659.38	57681	78	57759	1928	1928			0	1928	90	658.85	55741	0	0
I	Mar					658.85	55741	52	55793	3249	3249			0	3249	112	657.91	52432	0	0
II	Mar					657.91	52432	41	52473	3249	3249			0	3249	112	656.94	49112	0	0
III	Mar					656.94	49112	60	49172	3575	3575			0	3575	123	655.82	45474	0	0
I	Apr					655.82	45474	27	45501	2665	2665			0	2665	115	654.93	42721	0	0
II	Apr					654.93	42721	26	42747	2666	2666			0	2666	115	654.01	39966	0	0
III	Apr					654.01	39966	33	39999	2667	2667			0	2667	115	653.03	37217	0	0
I	May					653.03	37217	31	37248	1072	1072			0	1072	72	652.63	36104	0	0
II	May					652.63	36104	50	36154	1072	1072			0	1072	72	652.22	35010	0	0
III	May					652.22	35010	55	35065	1179	1179			0	1179	79	651.76	33807	0	0
Total, TMC		**221.42**	**18.87**	**202.55**	**11.86**			**95.90**		**63.36**	**63.36**	**29.90**	**29.90**	**14.90**	**108.16**	**3.44**			**0.00**	**0.00**

Year : 2012-13		**Tunga Reservoir**				**Bhadra Reservoir**														
								MDDL =	**0**	**Mcft**	**0.000 m**	**FRL =**	**0**	**Mcft**	**0**	**m**	**UBPMDDL**	**0**	**Mcft**	
10-Day	**Month**	**Inflow at**	**Requirement at**	**Balance**	**Pumped to**	**Reservoir**	**Capacity**	**Inflow Mcft**	**Total Mcft**	**Issues from the Reservoir (in Mcft)**							**OR**	**0.000**	**m**	
										Irrig + Domestic		**Upper Bhadra**		**Over**	**Total**	**Evaporation**	**Closing**		**Unit = Mcft**	

Period	Month	Inflow at UT (MCft)	Requiremnt at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	99	373	2064	0	651.76	33807	112	33919	253	253	0	0	0	253	39	651.69	33627	0	0
II	Jun	3085	373	12910	1465	651.69	33627	233	35325	254	254	1158	1158	0	1412	39	651.79	33874	0	0
III	Jun	4749	905	23228	1465	651.79	33874	704	36043	256	256	2316	2316	0	2572	39	651.61	33432	0	0
I	Jul	7157	1057	12097	1465	651.61	33432	2942	37839	947	947	2459	2459	0	3406	50	651.98	34383	0	0
II	Jul	4495	876	36172	1465	651.98	34383	1334	37182	947	947	2374	2374	0	3321	50	651.76	33811	0	0
III	Jul	23025	697	23753	1611	651.76	33811	8562	43984	1042	1042	2518	2518	0	3560	56	654.14	40368	0	0
I	Aug	54227	1217	18956	0	654.14	40368	14425	54793	2247	2247	2697	2697	0	4944	83	657.13	49766	0	0
II	Aug	21672	1417	10821	0	657.13	49766	6628	56394	2247	2247	2696	2696	0	4943	83	657.60	51368	0	0
III	Aug	13940	1618	12642	0	657.60	51368	5783	57151	2471	2471	2965	2965	0	5436	91	657.68	51624	0	0
I	Sep	22900	2052	24776	0	657.68	51624	7620	59244	2017	2017	2381	2381	0	4398	94	658.57	54752	0	0
II	Sep	13371	2035	11717	0	658.57	54752	2933	57685	2018	2018	2382	2382	0	4400	94	658.13	53191	0	0
III	Sep	4694	2018	5210	1465	658.13	53191	1128	55784	2019	2019	2383	2383	0	4402	94	657.58	51288	0	0
I	Oct	3380	1589	2534	1465	657.58	51288	883	53636	1568	1568	2381	2381	0	3949	110	657.08	49577	0	0
II	Oct	2513	1409	3223	1465	657.08	49577	186	51228	1568	1568	1190	1190	0	2758	110	656.71	48360	0	0
III	Oct	2576	1231	2449	0	656.71	48360	305	48665	1727	1727			0	1727	121	656.24	46817	0	0
I	Nov					656.24	46817	1965	48782	1940	1940			0	1940	114	656.21	46728	0	0
II	Nov					656.21	46728	328	47056	1941	1941			0	1941	114	655.67	45001	0	0
III	Nov					655.67	45001	157	45158	1943	1943			0	1943	115	655.06	43100	0	0
I	Dec					655.06	43100	154	43254	545	545			0	545	116	654.89	42593	0	0
II	Dec					654.89	42593	154	42747	545	545			0	545	116	654.72	42086	0	0
III	Dec					654.72	42086	169	42255	599	599			0	599	127	654.54	41529	0	0
I	Jan					654.54	41529	80	41609	1977	1977			0	1977	112	653.85	39520	0	0
II	Jan					653.85	39520	82	39602	1977	1977			0	1977	112	653.14	37513	0	0
III	Jan					653.14	37513	106	37619	2178	2178			0	2178	124	652.33	35317	0	0
I	Feb					652.33	35317	116	35433	2405	2405			0	2405	114	651.41	32914	0	0
II	Feb					651.41	32914	104	33018	2405	2405			0	2405	114	650.44	30499	0	0
III	Feb					650.44	30499	80	30579	1928	1928			0	1928	90	649.64	28561	0	0
I	Mar					649.64	28561	63	28624	3249	3249			0	3249	112	648.16	25263	0	0
II	Mar					648.16	25263	87	25350	3249	3249			0	3249	112	646.56	21989	0	0
III	Mar					646.56	21989	80	22069	3575	3575			0	3575	123	644.58	18371	0	0
I	Apr					644.58	18371	90	18461	2665	2665			0	2665	115	642.89	15681	0	0
II	Apr					642.89	15681	65	15746	2666	1914			0	1914	115	641.50	13717	-752	0
III	Apr					641.50	13717	56	13773	2667	0			0	0	115	641.45	13658	-2667	0
I	May					641.45	13658	50	13708	1072	0			0	0	72	641.44	13636	-1072	0
II	May					641.44	13636	41	13677	1072	0			0	0	72	641.41	13605	-1072	0
III	May					641.41	13605	110	13715	1179	0			0	0	79	641.44	13636	-1179	0
Total, TMC		181.883	18.867	202.552	11.866			57.92		63.36	56.62	29.90	29.90	0.00	86.52	3.44			-6.74	0.00

2013-14		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	0	Mcft	Met	FRL =	Met Mcft		0	m	UBPMDDL	pacity (in Mc	Mcft	
										Issues from the Reservoir (in Mcft)							OR	18.000	m	
10-Day	Month	Inflow at	Requiremnt at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	1009	373	2064	0	641.44	13636	822	14458	253	253	0	0	0	253	39	641.83	14166	0	0
II	Jun	8260	373	12910	1465	641.83	14166	4145	19776	254	254	1158	0	0	254	39	645.22	19483	0	-1158
III	Jun	14830	905	23228	1465	645.22	19483	7285	28233	256	256	2316	0	0	256	39	649.37	27938	0	-2316
I	Jul	33217	1057	12097	1465	649.37	27938	15600	45003	947	947	2459	2459	0	3406	50	654.54	41547	0	0
II	Jul	24232	876	36172	1465	654.54	41547	15683	58695	947	947	2374	2374	0	3321	50	658.73	55324	0	0
III	Jul	37340	697	23753	1611	658.73	55324	26987	83922	1042	1042	2518	2518	8827	12387	56	662.91	71479	0	0
I	Aug	29218	1217	18956	0	662.91	71479	20459	91938	2247	2247	2697	2697	15459	20403	83	662.90	71452	0	0
II	Aug	13193	1417	10821	0	662.90	71452	6560	78012	2247	2247	2696	2696	1534	6477	83	662.90	71452	0	0
III	Aug	10793	1618	12642	0	662.90	71452	6650	78102	2471	2471	2965	2965	1131	6567	91	662.90	71444	0	0
I	Sep	3846	2052	24776	0	662.90	71444	4267	75711	2017	2017	2381	2381	0	4398	94	662.84	71219	0	0
II	Sep	6473	2035	11717	0	662.84	71219	5951	77170	2018	2018	2382	2382	1235	5635	94	662.90	71441	0	0
III	Sep	4926	2018	5210	1465	662.90	71441	3874	76780	2019	2019	2383	2383	843	5245	94	662.90	71441	0	0
I	Oct	2767	1589	2534	1465	662.90	71441	2632	75538	1568	1568	2381	2381	54	4003	110	662.89	71425	0	0
II	Oct	2082	1409	3223	1465	662.89	71425	1858	74748	1568	1568	1190	1190	455	3213	110	662.89	71425	0	0
III	Oct	1996	1231	2449	0	662.89	71425	2076	73501	1727	1727			239	1966	121	662.89	71414	0	0
I	Nov					662.89	71414	840	72254	1940	1940			0	1940	114	662.60	70200	0	0
II	Nov					662.60	70200	232	70432	1941	1941			0	1941	114	662.15	68377	0	0
III	Nov					662.15	68377	173	68550	1943	1943			0	1943	115	661.68	66492	0	0
I	Dec					661.68	66492	202	66694	545	545			0	545	116	661.56	66033	0	0
II	Dec					661.56	66033	220	66253	545	545			0	545	116	661.45	65592	0	0
III	Dec					661.45	65592	337	65929	599	599			0	599	127	661.35	65203	0	0
I	Jan					661.35	65203	120	65323	1977	1977			0	1977	112	660.85	63234	0	0
II	Jan					660.85	63234	103	63337	1977	1977			0	1977	112	660.33	61248	0	0
III	Jan					660.33	61248	183	61431	2178	2178			0	2178	124	659.77	59129	0	0
I	Feb					659.77	59129	123	59252	2405	2405			0	2405	114	659.12	56733	0	0
II	Feb					659.12	56733	35	56768	2405	2405			0	2405	114	658.43	54249	0	0
III	Feb					658.43	54249	51	54300	1928	1928			0	1928	90	657.87	52282	0	0
I	Mar					657.87	52282	40	52322	3249	3249			0	3249	112	656.89	48961	0	0
II	Mar					656.89	48961	51	49012	3249	3249			0	3249	112	655.87	45651	0	0
III	Mar					655.87	45651	45	45696	3575	3575			0	3575	123	654.69	41998	0	0
I	Apr					654.69	41998	64	42062	2665	2665			0	2665	115	653.77	39282	0	0
II	Apr					653.77	39282	84	39366	2666	2666			0	2666	115	652.80	36585	0	0
III	Apr					652.80	36585	77	36662	2667	2667			0	2667	115	651.79	33880	0	0
I	May					651.79	33880	1602	35482	1072	1072			0	1072	72	651.96	34338	0	0
II	May					651.96	34338	387	34725	1072	1072			0	1072	72	651.67	33581	0	0
III	May					651.67	33581	96	33677	1179	1179			0	1179	79	651.22	32419	0	0
Total, TMC		**194.182**	**18.867**	**202.552**	**11.866**			**129.91**		**63.36**	**63.36**	**29.90**	**26.43**	**29.78**	**119.56**	**3.44**			**0.00**	**-3.47**

2014-15		Tunga Reservoir				Bhadra Reservoir														
								MDDL =	0	Mcft	0.000 m	FRL =	0	Mcft	0	m	UBPMDDL	0	Mcft	
										Issues from the Reservoir (in Mcft)							OR	0.000	m	
10-Day	Month	Inflow at	Requirement at	Balance	Pumped to	Reservoir	Capacity	Inflow Mcft	Total Mcft	Irrig + Domestic		Upper Bhadra		Over	Total	Evaporation	Closing		Unit = Mcft	

Period	Month	Inflow at UT (MCft)	Requirement at UT & TA (Mcft)	Balance (Mcft)	Bhadra (Mcft)	level ft	Mcft	Inflow Mcft	(4+5+6)	Demand	Met	Demand	Met	Over Spillway	Total 8+13b+11	Evaporation Mcft	R L (m)	Capacity (in Mcft)	Bhadra Deficit	UBP Deficit
1	2	3	4	5	6	7	8	9	10	11	12	13 (a)	13 (b)	14	15	16	17	18	19	20
I	Jun	405	373	2064	0	651.22	32419	208	32627	253	253	0	0	0	253	39	651.18	32335	0	0
II	Jun	1129	373	12910	1465	651.18	32335	1878	35678	254	254	1158	1158	0	1412	39	651.92	34227	0	0
III	Jun	3554	905	23228	1465	651.92	34227	2620	38312	256	256	2316	2316	0	2572	39	652.48	35701	0	0
I	Jul	1659	1057	12097	1465	652.48	35701	808	37974	947	947	2459	2459	0	3406	50	652.03	34518	0	0
II	Jul	23020	876	36172	1465	652.03	34518	14928	50911	947	947	2374	2374	0	3321	50	656.46	47540	0	0
III	Jul	30206	697	23753	1611	656.46	47540	20034	69185	1042	1042	2518	2518	0	3560	56	661.44	65569	0	0
I	Aug	56420	1217	18956	0	661.44	65569	24022	89591	2247	2247	2697	2697	13112	18056	83	662.90	71452	0	0
II	Aug	10547	1417	10821	0	662.90	71452	6273	77725	2247	2247	2696	2696	1247	6190	83	662.90	71452	0	0
III	Aug	10075	1618	12642	0	662.90	71452	5935	77387	2471	2471	2965	2965	416	5852	91	662.90	71444	0	0
I	Sep	13932	2052	24776	0	662.90	71444	7161	78605	2017	2017	2381	2381	2672	7070	94	662.90	71441	0	0
II	Sep	5920	2035	11717	0	662.90	71441	3128	74569	2018	2018	2382	2382	0	4400	94	662.57	70075	0	0
III	Sep	6441	2018	5210	1465	662.57	70075	2891	74431	2019	2019	2383	2383	0	4402	94	662.53	69935	0	0
I	Oct	4104	1589	2534	1465	662.53	69935	3385	74785	1568	1568	2381	2381	0	3949	110	662.72	70726	0	0
II	Oct	2929	1409	3223	1465	662.72	70726	2464	74655	1568	1568	1190	1190	362	3120	110	662.89	71425	0	0
III	Oct	3280	1231	2449	0	662.89	71425	1090	72515	1727	1727			0	1727	121	662.71	70667	0	0
I	Nov					662.71	70667	633	71300	1940	1940			0	1940	114	662.36	69246	0	0
II	Nov					662.36	69246	779	70025	1941	1941			0	1941	114	662.05	67970	0	0
III	Nov					662.05	67970	305	68275	1943	1943			0	1943	115	661.61	66217	0	0
I	Dec					661.61	66217	263	66480	545	545			0	545	116	661.51	65819	0	0
II	Dec					661.51	65819	313	66132	545	545			0	545	116	661.42	65471	0	0
III	Dec					661.42	65471	289	65760	599	599			0	599	127	661.31	65034	0	0
I	Jan					661.31	65034	309	65343	1977	1977			0	1977	112	660.85	63254	0	0
II	Jan					660.85	63254	121	63375	1977	1977			0	1977	112	660.34	61286	0	0
III	Jan					660.34	61286	154	61440	2178	2178			0	2178	124	659.77	59138	0	0
I	Feb					659.77	59138	168	59306	2405	2405			0	2405	114	659.13	56787	0	0
II	Feb					659.13	56787	143	56930	2405	2405			0	2405	114	658.47	54411	0	0
III	Feb					658.47	54411	106	54517	1928	1928			0	1928	90	657.93	52499	0	0
I	Mar					657.93	52499	146	52645	3249	3249			0	3249	112	656.99	49284	0	0
II	Mar					656.99	49284	124	49408	3249	3249			0	3249	112	656.00	46047	0	0
III	Mar					656.00	46047	117	46164	3575	3575			0	3575	123	654.85	42466	0	0
I	Apr					654.85	42466	118	42584	2665	2665			0	2665	115	653.95	39804	0	0
II	Apr					653.95	39804	117	39921	2666	2666			0	2666	115	653.01	37140	0	0
III	Apr					653.01	37140	135	37275	2667	2667			0	2667	115	652.02	34493	0	0
I	May					652.02	34493	134	34627	1072	1072			0	1072	72	651.63	33483	0	0
II	May					651.63	33483	151	33634	1072	1072			0	1072	72	651.25	32490	0	0
III	May					651.25	32490	150	32640	1179	1179			0	1179	79	650.80	31382	0	0
Total, TMC		**173.621**	**18.867**	**202.552**	**11.866**			**101.60**		**63.36**	**63.36**	**29.90**	**29.90**	**17.81**	**111.07**	**3.44**			**0.00**	**0.00**

Table 5.6 : Annual Summary of Working Table Results with 4 Pumps Working at Tunga
(Units : Quantities in TMC)

Year	Pumped from Tunga	Pumped to UBP Canal	UBP Deficit	Bhadra Utilisation	Bhadra Deficit	Bhadra Inflow	Bhadra Surplus
1972-73	13.03	26.43	3.47	63.36	13.75	66.36	0.00
1973-74	15.23	26.43	3.47	63.36	0.00	88.48	0.00
1974-75	16.60	26.43	3.47	63.36	0.00	82.44	0.00
1975-76	10.40	29.90	0.00	63.36	0.00	114.74	18.78
1976-77	12.53	29.90	0.00	63.36	2.05	56.14	0.00
1977-78	18.45	26.43	3.47	63.36	0.00	84.26	0.00
1978-79	9.46	29.90	0.00	63.36	0.00	144.92	44.29
1979-80	11.70	29.90	0.00	63.36	0.00	85.22	4.63
1980-81	8.40	29.90	0.00	63.36	0.00	135.70	42.02
1981-82	12.20	29.90	0.00	63.36	0.00	103.14	21.04
1982-83	9.61	29.90	0.00	63.36	0.00	84.50	7.86
1983-84	16.94	28.74	1.16	63.36	0.00	82.20	0.00
1984-85	15.84	29.90	0.00	63.36	0.00	88.75	2.70
1985-86	17.00	29.90	0.00	63.36	0.00	70.07	0.00
1986-87	11.37	28.74	1.16	63.36	0.00	81.77	0.00
1987-88	14.30	20.80	9.10	63.36	20.62	44.45	0.00
1988-89	14.78	21.99	7.91	63.36	4.93	69.24	0.00
1989-90	16.65	23.29	6.61	63.36	0.00	85.35	0.00
1990-91	13.08	29.90	0.00	63.36	0.00	96.70	6.29
1991-92	12.08	29.90	0.00	63.36	0.00	92.64	7.73
1992-93	10.40	29.90	0.00	63.36	0.00	125.92	30.77
1993-94	11.82	29.90	0.00	63.36	0.00	94.91	12.38
1994-95	8.39	29.90	0.00	63.36	0.00	151.41	58.32
1995-96	12.45	29.90	0.00	63.36	0.00	77.57	8.63
1996-97	17.87	29.90	0.00	63.36	0.00	77.63	0.00
1997-98	8.99	28.74	1.16	63.36	0.00	106.99	15.85
1998-99	12.10	29.90	0.00	63.36	0.00	97.98	7.69
1999-00	13.33	29.90	0.00	63.36	0.00	99.70	18.58
2000-01	11.86	29.90	0.00	63.36	0.00	92.13	10.07
2001-02	19.33	29.90	0.00	63.36	0.00	69.15	0.00
2002-03	17.58	28.06	1.84	63.36	14.73	51.96	0.00
2003-04	17.72	21.59	8.31	63.36	24.16	46.50	0.00
2004-05	19.10	26.43	3.47	63.36	1.67	72.45	0.00
2005-06	13.47	26.43	3.47	63.36	0.17	110.65	8.42
2006-07	11.72	29.90	0.00	63.36	0.00	101.58	20.54
2007-08	6.00	29.90	0.00	63.36	0.00	133.56	40.61
2008-09	14.81	29.90	0.00	63.36	0.00	96.92	21.03
2009-10	7.01	27.20	2.70	63.36	0.00	106.22	13.06
2010-11	19.33	29.90	0.00	63.36	0.00	86.15	6.06
2011-12	11.86	29.90	0.00	63.36	0.00	95.90	14.90
2012-13	11.87	29.90	0.00	63.36	-6.74	57.92	0.00
2013-14	11.87	26.43	-3.47	63.36	0.00	129.91	29.78
2014-15	11.87	29.90	0.00	63.36	0.00	101.60	17.81
Success Rate %			**62.8**		**79.1**		

केन्द्रीय जल आयोग
सिंचाई आयोजना ...

205 ...
नई दिल्ली 110066
Ph. No.011-26104250
Email: ...

विषय :Upper Bhadra Irrigation Project , Karnataka .
संदर्भ :C.W.C. I.D. No 11/135/2009-PA(S)/617 Dated 22/07/2016

Vide above referred letter, compliances to our earlier observations dated 31.5.2016 has been forwarded for further examination. The same has been examined and observations are as under:

Observations:

1. Hydrological series have been approved by Hydrological (South) directorate of CWC and copy of the same has been furnished. No comments.

2. It was suggested earlier to rework the effective rainfall considering 80% chance of occurrence of rainfall. In this regard, it has been stated that the semidry crops which are of low value crop have been proposed and as per CWC guidelines, it will be economical to consider effective rainfall computations at 50% chance of occurrence. No comments.

3. The conveyance efficiency through canals has been considered as 80% against our suggestion of 75%. In this regard, it has been stated that as per Guidelines, "In the canals with having continuously supply without substantial change in flow, the conveyance efficiency of 90% is to be considered" and main canal of this project is of this category. But, the hydrological series show that there are flows only during monsoon months and flows during non-monsoon months are negligible; hence the statement of canal running for the full time may not be correct. Therefore, it is suggested that crop water requirements may be revised by taking conveyance efficiency as 75% and overall efficiency as 67.5% as suggested earlier.

4. Regarding cost of installation of solar panels on canal top, it is stated that the power produced through the solar system will be directly fed into the power grid and the power required for the project will be obtained from the local power outlets. Hence cost of solar panels is not considered rather cost of power has been considered in the B.C. ratio. No comments.

yields and yield rates may be got approved from the state agriculture dep. and copy of the letter may be furnished. Instead a copy of the r downloaded from APMC site is furnished. It is again suggested that a letter may be taken from state agriculture department and furnish comments stands.

6. Earlier, the pre-project agricultural benefits were considered for an area CCA, now it is stated that pre-project agriculture benefits are considered existing actual cropped area and same has been authenticated by the Agriculture directorate, but no letter in this regard has been furnished. Th may kindly be furnished.

7. The cost estimate is yet to be approved by Cost Appraisal (I) Dte. of CWC may be expedited. It is stated that earlier comments regarding B. C. rat. been complied but revised B.C. Ratio computations on the prescribed fo not furnished. B.C. ratio and other related parameters shall be examined after finalization of Irrigation planning and cost estimate.

This issues with the approval of Chief Engineer (IMO), CWC.

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[illegible] (PA-S), [illegible]

के. ज. आ. आई. पी.सं.2/963/IP(S)/2010 /9/3 दिनांक : 14/08/2016

No.	Aspect		Status	Remarks/Action
1	Inter-State Aspect	Observation received on 11.05.16	Sent to GRMB for N.A on 13.5.16	
2	Cost Appraisal(I)	Observation received on 19.05.16	Sent to GRMB for N.A on 19.5.16	
3	Hydrology(S)	Observation received on 18.05.16	Sent to GRMB for N.A on 25.5.16	

5. UPPER BHADRA PROJECT, KARNATAKA

Date of receipt of DPR: 15.7,2015

Date of Circulation of DPR: 11.8.2015

Updated DPR received on 16.02.16 and circulated to CA(I), IP(S),ISM, Hy(S), CGWB, MoAg on 29.02.2016

No.	Aspect	Status		Remarks/Action
1.	Hydrology	accepted	29.03.2016	
2.	Inter-State Matter	accepted	21.04.16	
3.	Irrigation Planning	Pending with State Govt..	20.9.16	
4.	Construction Material	N.A		
5.	Ground Water aspect	Compliance under examination	16.03.2016	-- --
6.	Cost Appraisal	Compliance under examination	18.03.16	
7.	Ministry of Agriculture	Compliance under examination	10.06.2016	Compliance received on 8.06.2016 from project authority sent to MoAg for examination.
8.	Barrage & Canal Design	N.A		CDO Certificate submitted
9.	Embankment (NW &S)	N.A		
10.	Statutory Clearance from MoEF & CC			
	Environment Clearance	accepted	05.1.2010	
	Forest Clearance	N.A		

CWC U.O No No.11/135/2009-PA(S)/617-18
Central Water Commission
परियोजना मूल्यांकन (दक्षिण) निदेशालय
Project Appraisal (S) Directorate

ई-मेल/E-mail: pasdte-cwc@nic.in

7th Floor, सेवा भवन/Sewa Bhawan
आर.के. पुरम/R.K. Puram
नई दिल्ली New Delhi-110066
Dated: 26.05.2017

To,
Chief Engineer
Karnataka Neeravari Nigam Ltd.
Upper Bhadra Project Zone
Mutyal Mahal, V.P. Extension
1st Cross, Chitradurga
Fax No. 08194-230018
E-mail: cheluvaraju.r@gmial.com

Sub: Observation of IP(S) Directorate on Upper Bhadra Project, Karnataka-regarding
Ref: CWC Lr.No.2/963/IP(S)/2010/1421 Dated 19.05.2017

Sir,

Kind reference is invited to the above cited letter vide which observation of Irrigation Planning Directorate is submitted. It is requested to comply the observation early and sent reply directly to IP(S) Dte with a copy to this office.

Encl: As above

26/5/17

(N. Mukherjee)
Director

Copy for information to:

Director IP(S) Directorate, CWC New Delhi.

312

भारत सरकार
केन्द्रीय जल आयोग
सिंचाई आयोजन (दक्षिण)

209, सेवा भवन रामकृष्णपुरम,
नई दिल्ली 110066
Ph. No.011-26104280
Email :irpdte@nic.in

विषय :Upper Bhadra Irrigation Project, Karnataka.

संदर्भ :C.W.C. I.D. No 11/135/2009-PA(S)/338 dated: 23/03/2017

May please refer to letter under reference above vide which compliances to this Directorate's earlier observations dated 14.09.2016 have been forwarded for examination. The same has been examined and observations thereon are as under:

Observations:

1. The project authorities have revised the crop water requirement considering the conveyance efficiency as 75% and overall efficiency as 67.5 %. Accordingly, total irrigation water demand has been worked out as 21.9 TMC. In addition to this, the water required for tank filling has been indicated as 1.95 TMC. Thus total water demand for the project now has been estimated by the project authorities as 23.9 TMC. No further comments to offer.

2. While examination of the integrated working tables/ simulation studies, it has been observed that monthly inflow series for Upper Bhadra are not matching with the series approved by the Hydrology (South) Directorate of CWC. The discrepancies in this regard may be rectified, Further, it may be confirmed that the net hydrological series for Tunga reservoir considered in the integrated working tables/simulations studies are approved by the Hydrology (South) Directorate of CWC. A copy of the approved net hydrological series for Tunga reservoir by the Hydrology (South) Directorate of CWC may be furnished for reference & record. The integrated working tables/simulation studies may be revised accordingly after rectifying the discrepancies as mentioned above and with the approved net yield series of Tunga reservoir and the same may be furnished to assess the success rate of the project.

3. The B C Ratio computation has not been furnished. Hence, the earlier observation on BC ratio stands, Further, the yield and rates of crop produces and cost of inputs viz. seed, fertilizers/manures, labour charges etc. for both

pre and post project conditions may be got approved from the State Agriculture Department by the Director level officer and in the format given in the Guidelines for Submission, Appraisal and Acceptance of Irrigation and Multipurpose Projects, 2017 of CWC for the purpose of estimating the agricultural benefits. The revised BC Ratio computation may be submitted with the approved cost of the project from Cost Appraisal (I) Dte. of CWC. The BC Ratio, however, will be firmed up only after finalization of irrigation planning aspects as mentioned under para 2 above.

4. Soft copies of the compliances may also be submitted in order to expedite the process of appraisal.

यह मुख्य अभियन्ता (सिंचाईप्रबन्ध) के अनुमोदन से जारी किया जाता है ।

(भालचन्द्र विश्वकर्मा) 19/05/2017
निदेशक सिंचाई आयोजन (दक्षिण)

निदेशक परियोजना मूल्यांकन (दक्षिण) (PA-S), केन्द्रीय जल आयोग
के. ज. आ. आई. डी.सं.2/963/IP(S)/2010/ 1521. दिनांक: 19 /05/2017

CEC/VJNL/UBPZ/TA-4/TS-5/CWC/2017-18/ 541 Dt: 6 JUN 2017

1. Copy along with enclosure forwarded to Superintending Engineer, VJNL, Upper Bhadra Project, Circle No-1, B.R.Project for information and submit the compliance to the comments of CWC to this office immediately.

2. Copy along with enclosure forwarded to Superintending Engineer, KNNL, Upper Bhadra Project, Circle No-2, Chitradurga for information and submit the compliance to the comments of CWC to this office immediately.

(of) Chief Engineer, VJNL,
Upper Bhadra Project Zone,
Chitradurga.

OIC

(A Government of Karnataka Enterprise)

Regd Office: Managing Director, Visvesvaraya Jala Nigam Limited, No-148, Embassy Square, Infantry Road, Bangalore-560 001,
Ph:22283074-78, Fax:22386015,
Email id:vjnl@vjnlindia.com
Website: www.vjnlindia.com
CIN No: U85110KA1996SGC024503

Office of the Chief Engineer,
VJNL, Upper Bhadra Project Zone,
Chitradurga
Phone:08194-230018,
Fax:08194-230032
E-mail: ubpchief@gmail.com

27 JAN 2018

No:CE/VJNL/UBPZ/TA-1/TS-5/CWC/2017-18/ 3033

Date: 18 JAN 2018

To,
The Director,
Central Water commission,
Irrigation Planning (S) Directorate,
203,Sewa Bhavan, R.K.Puram,
New Dehli-110066.

Sir,

Sub: Observation of IP(S)Directorate on Upper Bhadra Project, Karnataka reg.,

Ref: 1. Director, CWC Project Appraisal(S) Directorate New Dehli. Letter No.11/135/2009-PA(S)/617-18, Dtd: 26.05.2017.

2. Director, CWC Irrigation Planning (S) Directorate New Dehli. Letter No.1421, Dtd: 19.05.2017.

3. SE, VJNL, UBP, Circle No-2 Chitradurga, Letter No.2897, Dtd: 16.01.2018.

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With reference to the above subject compliance for the observations of IP(S) Directorate vide ref (2) letter is prepared and submitted herewith for kind information and needful.

Encl: Compliance.-1set.

EE 23/1

PA/AES 23/1

Yours faithfully
Sd/-
Chief Engineer,
VJNL, UBP Zone,
Chitradurga

20.01.2018

1. Copy submitted to The Director,Central Water Commission,Project Appraisal (S) Directorate, 7th floor Sewa Bhavan, R.K .Puram,New Delhi-110066, For information and necessary action.

2. Copy submitted to Secretary Water Resource Dept. Government of Karnataka, Bangalore.for information and necessary action.

3.Copy submitted to Managing Director, Visvesvaraya Jala Nigam Limited, No-148, Embassy Square, Infantry Road, Bangalore-560 001,for information and necessary action.

4. Copy to SE, VJNL UBP circle-1 B.R Project.. for information.

5. Copy to SE, VJNL UBP circle-2 Chitradurga.. for information

Chief Engineer
VJNL UBP Zone
Chitradurga.

UPPER BHADRA PROJECT

IRRIGATION PLANNING

6. IRRIGATION PLANNING

6.1 Area Available for Irrigation

The proposed area for irrigation is divided into four main parts and they are (i) Area under Tarikere lift and gravity flow (ii) Area under Chitradurga Branch Canal (iii) Area under Tumkur Branch Canal (iv) Area under Jagalur Branch Canal. The gross and ICA under each canal area is given below.

		GCA (Ha)	ICA (Ha)
(a)	Area under Tarikere lift & gravity flow	25188	20150
(b)	Area under Chitradurga Branch Canal	187895	107265
(c)	Area under Tumkur Branch Canal	121286	84900
(d)	Area under Jagalur Branch Canal	19017	13200
	Total	**353386**	**225515**

6.2 Existing Cropping Pattern

The cropping pattern under rainfed condition as prevailing in the proposed command area is as under.

	Crop	Percentage
(i)	Groundnut	23.6
(ii)	Maize	15.62
(iii)	Ragi	9.39
(iv)	Sunflower	2.09
(v)	Jowar	2.09
(vi)	Pulses	37.21
(viii)	Vegetables & Misc Crops	10.00

It is seen that pulses and oilseeds dominate in the command area and cropped area and crops are mostly in Khariff. The Rabi crops are meager and is dependent on soil moisture remained.
Under rainfed conditions crop yields are small and varying from year to year. The crop yields are poor, in the light of recent trends in agricultural production can be increased in the area which is having an assured supply of water for agriculture and having used the new high yielding varieties of seeds and corresponding other inputs.

6.3 Proposed Cropping Pattern

The proposed crops for irrigated agriculture in the area are taken from the recommendations of the State Agricultural Department. The recommended crops for the central zone of Karnataka are Jowar, Gram, Tur and other Pulses, Small Millets, Bajra, Groundnut and other Oilseeds, Cotton, Paddy, Wheat, Ragi, Sugarcane, Maize and Plantain crops (see **Annexure 6.1**). The crops suggested are for Khariff season only and in view of providing irrigation for larger area only dry crops are preferred.
The proposal of cropping pattern was referred to Sri Praveen Rao Director, Water Technology Centre ANGRAU, Hyderabad for furnishing his opinion. The Director, in his comments opined that, the Ragi crop due to narrow spacing (0.20m) is not recommended for drip. Duly considering his opinion, the cropping pattern of Upper Bhadra Project was modified by replacing Ragi crop with Jowar.
Considering the local climatic conditions, soils and aspirations of the people the cropping pattern suggested is:

Groundnut	-	45%
Sunflower	-	20%
Pulses	-	10%
Maize	-	10%
Jowar	-	15%
Total	-	**100%**

Thus, the proposed intensity of irrigation is 100%.

6.4 Crop Water Requirements

The crop water requirement is based on potential evapotranspiration and the crop coefficient. The potential evapotranspiration corresponds to central zone of Karnataka provided by IMD and Meteorological data for Chitradurga is given in **Table 6.1**. The crop coefficients are given in **Table 6.2**. Water requirement for each group of area is calculated separately considering the average rainfall of that area is given in **Tables 6.3 to 6.7**. The effective precipitation is based on the USDA Table given in FAO - 24 and also reproduced by CWC in their publication of crop water requirements. The chance of occurance of rainfall considered corresponds to 50% dependability. Abstract of Discharge and water requirement for each group of area & Schedule of Releases for Upper Bhadra project is shown in **Tables 6.8.**

6.4.1 System Efficiency under Drip Irrigation

The combined efficiency with drip irrigation is 67.50%, as worked out below.

Seepage and Canal losses from Main Canal - 90%
Efficiency of the drip irrigation system below the Main Canal - 75%
Irrigation efficiency = 0.90 x 0.75 = 0.675

The delta of crop for different areas and water requirements worked out are given below.

Area	Delta for Crop (mm)					Delta (mm)	Water Requirements	Peak Discharge (m^3/s)
	Groundnut	Sunflower	Pulses	Maize	Jowar		MCM (TMC)	
Jagalur Branch Canal	228.00	245.78	245.78	259.00	241.23	238.42	39.35 (1.39)	4.48
Tarikere Lift and Flow Canal	159.45	176.39	176.39	185.16	170.54	168.77	50.23 (1.79)	4.47
Tumkur Branch Canal	191.05	217.69	217.69	220.82	205.22	204.14	206.04(7.28)	28.75
Chitradurga Branch Canal	268.41	289.37	289.37	299.37	282.66	279.93	323.95(11.44)	44.15
Crop Percentage	45%	20%	10%	10%	15%			
Total Quantity of Water used							619.57(21.9)	*81.85

* The peak discharge in all the area except Tarikere is in the 1st and 2nd Half of August.

6.5 Peak Discharge

The peak discharge for irrigation is 88.36 m^3/sec. However, the main canal is designed for 81.85 m^3/sec. Thus, for a period of 1 month an excess discharge of 6.51 Cumecs is made good by conjuctive use ie borewells existing in the command area.

6.6 Drip Irrigation

In view of economizing on water use and there by increasing the area irrigated per unit of water the whole command under Upper Bhadra Project is proposed to be under drip irrigation.

The proposed Command Area of Chitradurga Branch Canal and Tumkur Branch Canal is divided into 11 & 08 Nos. of blocks respectively of area approximate 10000 to 11000 Ha. These blocks are later divided into two areas to be irrigated partly by pumping and partly by gravity by studying the terrain.

Area of 10000 Ha blocks is further divided into zones of 500 Ha which is again divided into 50 Ha blocks. Bulk water supply mains runs from the Main Canal into the 10000 Ha blocks.

Feeder lines, mains, submains and drippers are further designed as per the required discharge of the block.

Arrangement for sump cum pumphouse, control panel, filters etc are made for each individual block. Provision for SCADA and telemetry is also done.

The command area maps of Chitradurga Branch Canal, Tumkur Branch Canal is shown in drawings VJNL/UBP/D1/CBC & TBC/11-15

6.7 Tank Fillings

An allocation of 8.0TMC of water is made for filling up of 367 tanks both within the command and outside the command and augmentation of Vanivilas Sagar dam 2.00 TMC. The filling up of tanks will facilitate recharging of ground water besides diluting the fluoride content.

Also MI Tanks within the command area is proposed for filling without exceeding the allocation made for filling of tanks.

6.7.1 Providing Drinking Water Supply to Pavagada Taluk of Tumkur District

Keeping in view of the representations received from the elected bodies, the irrigation minister assured in the floor of the legislative assembly that 0.54 TMC of water will be allocated for supplying drinking water to Pavagada by filling tanks under scheme 'A' vide letter number WRD 64 WLA2007 dated 17/08/2007 out of the savings in 5.60 TMC of water. Part II of UBP scheme 'A' is reviewed again to verify whether there is any saving in 5.60 TMC water allotted for supply of drinking water to Kolar and Tumkur Districts. Mean while 2.40 TMC of water is expected to be allocated to UBP zone from 21.00 TMC of water being transferred to Karnataka from inter basin transfer. Out of this it is proposed to utilize 0.54 TMC to Pavagada by filling 30 Tanks.

6.7.1.1 Proposed Scheme

The proposal consists of

(a) Drawing 0.54 TMC water from Ch: 132.050 Km of CBC under UBP. Gravity Main Pipeline from Chitradurga Branch Canal (CBC) from Ch 132.050 Km is proposed at RL +668.150 that traverses up to a distance of 54.903 km by crossing the Vedavathi river on upstream of Chouluru barrage and ends at RL +599.716 m.

(b) Lifting of 0.54 TMC of water from RL:559.716 m to RL:668.150 m in first stage for a length of 54.903 Km through a 1700 mm diameter M.S pipe of 9 & 8 mm thick to chamber DC1 and from RL: 668.150 m to RL: 729.00 m through 1270 mm diameter M.S pipe of 7 mm thick of length 17.369 Km to chamber DC2.

(c) At RL +599.716 mm where Gravity Main ends, it is proposed to construct Delivery chamber 1, Pumping Station, Sub Station to Lift water to Delivery Chamber-2. At Delivery Chamber 1, it is also proposed to feed 21 tanks of Challakere Taluka through Gravity flow pipelines.

(d) From Delivery Chamber 1 @ RL +599.716 m, rising main for a length of 17.4 Kms up to RL+729.00 m is proposed. Delivery Chamber-2 is proposed at this point and proposed to feed 30 tanks of Pavagda taluka through Gravity flow pipelines.

(e) Necessary provision's such as,
   (i) Gravity Main
   (ii) Delivery Chamber
   (iii) Pumping Machine to lift 0.54 TMC of water
   (iv) Rising Main
   (v) Sub Station
   (vi) Drip Irrigation
   (vii) Land acquisition cost etc.., have been proposed.
   (viii) The estimate is prepared based on WRD SR 2018-19, PWD Circle, North Zone, Dharwad for 2018-19, KUWSSB Bangalore Circle SR for the year 2018-19 and steel and cement rate for the 3rd quarter of 2019-20 issued by Superintending Engineer, UBP Circle-2, Chitradurga.
   (ix) The total estimated cost of the scheme is Rs. 63245.22 lakhs

7.2 Filling Up of MI Tanks in Holalkere Taluk

In Under Upper Bhadra Project, a total capacity of 0.20 TMC of water is allocated for filling up of tanks in Holalkere taluk. It is proposed to draw water from Chitradurga Branch Canal at off take point 28.420km to fill tanks coming in Holalkere taluk. It was proposed to draw 2.777 cumecs for 120 days of flowing water from Chitradurga Branch Canal to fill water to 31 Tanks coming under Holalkere Taluk.

The Holakere tank filling scheme has been taken up in 04 packages to fill 31 tanks.

The approved scheme envisages open canal for a length of 0.00 km to 4.53 km and Delivery Chamber is proposed at chainage 4.530 km. It is designed for Gravity Main System is introduced for distribution of water through pipeline network for a length of about 64.59 Km for the discharge of 2.777 cumecs from Delivery chamber of size 10.00x10.00x4.70m with at RL of 722.435 m for 31 tanks.

Water allocated to Holalkere taluk is 0.200 TMC, with available water it is proposed to fill 08 nos. of tanks in Talya Hobli of Holalkere taluk by Constructing Jackwell Cum Pump House, thereby lifting water from Kesarukatte tank near Holalkere Town to delivery Chamber (Raising main of 6.45 Kms) proposed at T. Emmiganuru Village. Thereafter water is fed to 08 Nos of Tanks through gravity piped network.

The estimates are prepared based on SR of K.U.W.S and D.B for the year 2018-2019, WRD 2018-19, PWD SR 2018-19 and KPTCL SR 2018-19.

The estimated cost for Filling of tanks in Holalkere taluk is Rs. **21,984.54** Lakhs.

6.7.3 Filling Up of MI Tanks in Challakere and Molkalmuru Tanks

Under Upper Bhadra Project 0.78 TMC and 0.45 TMC is allotted for 37% filling up of tanks in Challakere and Molkalmuru taluks respectively. It is proposed to draw water from Chitradurga Branch canal at Ch: 120.820 Km through a combined gravity feeder line of 2000 mm diameter M.S pipe of 5mm thick at offtake reach and further feeder lines of various diameter of MS pipe of length 228.170 Km, DI pipe of length of 151.75 Km and HDPE pipe of length 64.788 Km are proposed to feed 58 No’s and 20 No’s of tanks in Challakere and Molkalmuru taluks respectively.

The entire network of feeder lines are proposed to run by gravity and the diameter and type of pipes are designed based on discharge and head available between intermediate reaches. The diameter of pipes appears to be high, since the system runs on available head only to avoid pumping which ultimately costs more due to maintenance of pumps and other cumulative expenditures.
The estimates are prepared as per the Schedule of Rates of PWD SR of 2018-19 Shivmogga circle, WRDO of 2018-19, KUWSDB of 2018-19.

The total estimated cost of the scheme is **Rs. 74899.00 Lakhs**
General Notes

Since the feeder lines are by gravity, non pressure pipes can be proposed but however to meet the static pressure from station to station, MS pipe is proposed for all feeder lines.

6.8 Water Management

6.8.1 Training and Agriculture Extension Program

It is important to disseminate information about new technologies so that the farmer is able to make use of the latest agricultural developments. There also exists a gap between research findings and the needs of farmers. For technology to be successful, it is important that it should serve a useful purpose to the end user. The institution that bridges the gap between farmers and agricultural research scientists is the Agricultural Extension Service. This service works through an Agricultural Research System in the States. Agriculture is a lot more than mere cultivation. Agriculture today is a science that is based on continuing research and a solid foundation of proven data. The more the growers know, the better they cultivate; the more people they can feed, the healthier populations become. There is need to provide farmers training with advanced Agronomy solutions for raising yields, cutting costs and improving quality. In the Training centers experts share knowledge with the farmers. Hence it is proposed that in the project a training center to be established to train the stake holders and line departments/extension workers. The basic infrastructure like building for training class will be provided by Govt. of Karnataka and the trainers and faculty will be Experts from Drip Industry. A curriculum prepared based on the farmers requirement is given below.

The Training rendered to the farmers is:

- Technical training.
- Engineering training.
- Agronomical training.
- Mechanical training.

(1) Topic of Technical training for the Project Farmers.

Day	Topic
1	Introduction to drip Irrigation
	Basic drip agronomy and advantages of drip irrigation
	Drip irrigation Components
	Fertigation and how to Fertigate
	Crop wise water requirement and irrigation scheduling
2	Maintenance of Drip Irrigation system and chemical treatments (acid ,Chlorination)
3	Field visit and practical demonstration on system maintenance
4	Crop wise drip protocols & crop production technology with drip irrigation

(2) Engineering training are given to the farmers on the following aspects

- Training in Rotation of crops.
- Training in maintenance of Drip system.
- Training in maintenance of Records & Financial aspects.
- Training in Conducting Election of WUA.
- Farmers Interaction with Agricultural department.
- Training in Women's role in Participatory Irrigation management.
- Training on Social behavior.

(3) The Agronomical services are the services rendered to the farmer by the company Agronomists on the following aspects.

- Training and guidance in Selection of proper plant materials.
- Training and guidance in adopting suitable cropping pattern to suit drip irrigation system.
- Training and guidance in Irrigation scheduling through drip Irrigation.
- Training and guidance in Fertigation application and scheduling through drip Irrigation.
- Training and guidance in Selection of proper fertilizers to enhance productivity.
- Training and guidance in Plant protection practices.
- Training and guidance in Best Management Practices.
- Training and guidance in Harvesting.
- Training and guidance in Post Harvest Practices.
- Training and guidance in export packing practices.
- Training and guidance by crop experts in specialized Crops.
- Arranging farmer's field days.
- Arranging farmer's field visits.
- Sharing farmer's experiences.
- Exposure Visits to Progressive Farmers.

(4) Mechanical training are given to the farmers on the following aspects

- Training in maintenance aspects of pumping unit.
- Training in maintenance of Centrifugal pumps, Engines and motors.
- Training in installation and adjustments of pumps.

6.8.2 Integrated Mission for Sustainable Development (IMSD)

The Tunnel of length 7.0KM is proposed to be constructed near Ajjampura under Package-3 of Upper Bhadra Project. The peoples, farmers and Representatives of Peoples of Tarikere Taluk were opposing for construction of tunnel with apprehension that the ground water in the region would deplete if the tunnel is constructed. Hence, to address this issue, the Government constituted an Expert Committee. The committee after detailed study and visit to the work site submitted a report to the Government. Out of many recommendations of the Committee, one is to prepare and implement watershed development schemes on the lines of Integrated Mission for Sustainable Development (IMSD) guidelines in the region of tunnel.

Preparation of water shed development scheme in the tunnel region on IMSD guidelines was entrusted to Dr. Y.Lingaraju, Professor and research head and Dr. C.V.Srinivasa Professor and head of civil Engineering department of Global Academy of Technology Bangalore who have expertise in this field.

Methodology:

The technique adopted in the scheme are satellite Remote Sensing (RS), Geographic Information System and (GIS) and Global Positioning System (GPS) and finally methodology designed as per IMSD guide lines is adopted.

The thematic aspects identified for IMSD study are

- Rainfall and climate.
- Drainage, watershed and surface water body.
- Slope, Aspect and Altitude.
- Soils.
- Hydro-geomorphology and Ground Water Prospects.
- Lithology and Lineaments.
- Land use /Land cover.
- Transportation network, Settlement location and Village locations.

The estimate is prepared based on the Report submitted by them and included in this Report. Following Provisions are made in the Estimate:

1. Construction of farm ponds.
2. Construction of check dams.
3. Construction of invert wells.

With all the provisions the estimate cost of the Scheme works out to **9.29 crores.**

Table 6.1 : Meteorological Data - Station - Chitradurga

CHITRADURGA	Latitude :	14°14' N
Altitude: 733m	Longitude :	76°26' E
Ha-Height of Wind Instrument = 7m		

Sl No	Month	Temperature°c			Relative Humidity(%)			Wind Measured (Kmph)	at 2m (Km / day)	Cloud amount(okta)			n/N
		Max	Min	Mean	Max	MIN	Mean			I -HALF	II -HALF	Mean	
1.	January	28.8	17.1	22.95	67	34	50.5	7.4	148.47	2	2.2	2.1	0.74
2.	february	31.7	19.3	25.50	58	30	44.0	7.4	148.47	1.8	2.1	1.95	0.755
3.	March	34.6	21.6	28.10	58	27	42.5	7.1	142.45	1.4	2.4	1.9	0.76
4.	April	35.7	22.9	29.30	69	33	51.0	7.3	146.46	2.7	4.3	3.5	0.6
5.	May	34.3	22.4	28.35	76	41	58.5	10.5	210.67	4.2	4.6	4.4	0.51
6.	June	30.1	21.5	25.80	82	62	72.0	14.3	286.91	6.1	6.1	6.1	0.285
7.	July	27.7	20.9	24.30	87	72	79.5	14.2	284.9	7	6.9	6.95	0.158
8.	August	27.7	20.7	24.20	87	71	79.0	13.6	272.87	6.8	6.4	6.6	0.21
9.	Sept	28.8	20.5	24.65	85	63	74.0	10.5	210.67	5.8	5.8	5.8	0.33
10.	October	29.1	20.4	24.75	81	57	69.0	6.5	130.41	4.8	5.2	5.0	0.45
11.	November	28.1	18.6	23.35	75	51	63.0	6.7	134.43	3.9	4.1	4.0	0.55
12.	December	27.4	16.8	22.10	73	42	57.5	7.6	152.48	2.9	3.0	2.95	0.655

Cloud cover in Octas to n/N conversion is given by

Cloudiness Octas	0	1	2	3	4	5	6	7	8
n/N Ratio	0.95	0.85	0.75	0.65	0.55	0.45	0.3	0.15	-

Velocity of wind measured at any height Z (U_Z) is converted to velocity at 2m height (U_2) by the equation

$$U_2 = U_Z \left(\frac{2}{Z}\right)^{0.143}$$

Table 6.2 : ET_O (Chitradurga) - Crop Co-efficients (Zone - 4)

No	Month	Jan		Feb		March		April		May		June		July		Aug		Sep		Oct		Nov		Dec		
1	Fort Night	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
2	Daily Evapo Transiparation (mm)	5.04	5.04	6.00	6.00	6.89	6.89	6.73	6.73	6.39	6.39	4.79	4.79	3.64	3.64	4.45	4.45	4.06	4.06	4.28	4.28	4.25	4.25	4.29	4.29	
3	Fortnightly evaporation (mm)	75.60	80.64	90.00	78.00	103.35	110.24	100.95	100.95	95.85	102.29	71.85	71.85	54.60	58.24	66.75	71.20	60.90	60.90	64.20	68.48	63.75	63.75	64.35	68.64	
	KHARIFF:					**CROP CO-EFFICIENT**																				
4	Jowar												0.35	0.57	0.79	1.00	1.00	1.00	0.75	0.50						June-II to Oct-I
5	Maize												0.35	0.58	0.81	1.05	1.05	1.05	0.80	0.55						June-II to Oct-I
6	Pulses												0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30						June-II to Oct-I
7	Sunflower												0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30						June-II to Oct-I
8	Groundnut												0.35	0.55	0.75	0.95	0.95	0.95	0.75	0.55						June-II to Oct-I

Table 6.3: Rainfall in Command Area of Upper Bhadra - Scheme A (Unit - mm)

Month	Ajjampura	Shivani	Tarikere	Average RF		Chitradurga	Challakere	Hiriyur	Hosdurga	Average RF		Chikkanayaka na Halli	Sira	Average RF		Jagalur
Jan	3.61	0.52	3.60	2.58		0.30	3.30	3.30	3.10	2.50		17.63	6.58	12.11		1.13
Feb	12.18	5.52	4.60	7.43		1.50	5.80	5.10	4.80	4.30		19.15	19.90	19.53		4.09
Mar	28.48	18.15	4.60	17.08		6.60	4.10	2.00	4.60	4.33		77.81	23.83	50.82		9.39
Apr	28.40	49.26	38.30	38.65		48.80	19.10	23.40	23.10	28.60		48.36	35.94	42.15		33.62
May	71.10	72.80	76.20	73.37		86.50	58.70	76.70	90.90	78.20		78.90	64.43	71.67		73.38
Jun	64.12	68.73	86.60	73.15		50.40	29.70	40.40	55.60	44.03		77.02	68.97	72.99		66.91
Jul	110.73	111.01	240.50	154.08		79.60	33.30	46.50	70.60	57.50		81.20	72.75	76.97		77.72
Aug	115.35	128.99	142.00	128.78		67.70	62.20	65.30	65.80	65.25		87.90	90.76	89.33		89.21
Sep	122.38	96.05	87.90	102.11		105.70	92.20	97.50	82.80	94.55		150.91	131.01	140.96		96.63
Oct	155.72	152.44	135.40	147.85		138.00	100.10	111.00	125.00	118.53		137.62	127.59	132.61		102.23
Nov	25.92	16.95	64.50	35.79		43.00	38.10	53.30	66.50	50.23		43.71	50.45	47.08		27.31
Dec	3.30	4.03	16.00	7.78		11.30	8.90	9.10	13.50	10.70		18.85	17.76	18.30		0.14
Total	**741.29**	**724.45**	**900.20**	**788.65**		**639.40**	**455.50**	**533.60**	**606.30**	**558.70**		**839.07**	**709.96**	**774.52**		**581.75**

Table 6.4 : Crop Water requirement as per Penman's method - Tarikere Lift

Station -Tarikere and Kadur **Annual total rain fall-639.40 mm**

CCA = 20150 Ha **Chance of occurance -50% for low value crops**

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
1	E.T.O	mm/day	4.79	4.79	3.64	3.64	4.45	4.45	4.06	4.06	4.28	4.28
2	E.T.O(i/2 month)	mm	71.85	71.85	54.6	58.24	66.75	71.2	60.9	60.9	64.2	68.48
3	Monthly rainfall (R)	mm	70.75		161.40		95.90		76.60		137.95	
4	Normal monthly rainfall (cl N-3*0.97)		68.63		156.56		93.02		74.3		133.81	
A	**Sorghum**											
1	Land preparation			**20.00**	**25.00**							
2	Kc			0.35	0.57	0.79	1.00	1.00	1.00	0.75	0.50	
3	E.T.c		25.15	25.15	31.12	46.01	66.75	71.20	60.90	45.68	32.10	32.10
4	Monthly Etc(Cu)		50.30		77.13		137.95		106.58		64.20	
5	Effective rainfall monthly		43.47		76.94		69.29		54.02		64.20	
6	Effective rainfall monthly*1.00		43.47		76.94		69.29		54.02		64.20	
7	Effective rainfall (1/2 month)		21.74	21.74	37.23	39.71	33.53	35.76	27.01	27.01	31.06	33.14
8	N.I.R			23.41	18.89	6.30	33.22	35.44	33.89	18.67	1.04	0.00
9	**G.I.R (Eff=0.675)**			**34.68**	**27.99**	**9.33**	**49.21**	**52.5**	**50.21**	**27.66**	**1.54**	**0**
B	**Maize**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.80	0.55	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	48.72	35.31	35.31
4	montly Etc(Cu)		50.30		78.84		144.85		112.67		70.62	
5	Effective rain fall monthly		**43.47**		**78.50**		**69.84**		**54.50**		**70.62**	
6	Effective rainfall monthly*1.00		43.47		78.50		69.84		54.50		70.62	
7	Effective rain fall (1/2 month)		21.74	21.74	37.98	40.52	33.79	36.05	27.25	27.25	34.17	36.45
8	N.I.R			23.41	18.69	6.65	36.30	38.71	36.70	21.47	1.14	0.00
9	**G.I.R (Eff=0.675)**			**34.68**	**27.69**	**9.85**	**53.78**	**57.35**	**54.37**	**31.81**	**1.69**	**0**
C	**Pulses**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Monthly Etc(Cu)		50.3		78.84		144.85		105.36		38.52	

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
5	Effective rain fall monthly		**43.47**		**78.50**		**69.84**		**53.92**		**64.20**	
6	Effective rainfall monthly*1.00		43.47		78.50		69.84		53.92		64.20	
7	Effective rain fall (1/2 month)		21.74	21.74	37.98	40.52	33.79	36.05	26.96	26.96	31.06	33.14
8	N.I.R			23.41	18.69	6.65	36.30	38.71	36.99	14.45	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**34.68**	**27.69**	**9.85**	**53.78**	**57.35**	**54.8**	**21.41**	**0**	**0**
D	**Sun flower**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Montly Etc(Cu)		50.30		78.84		144.85		105.36		38.52	
5	Effective rain fall monthly		**43.47**		**78.50**		**69.84**		**53.92**		**64.20**	
6	Effective rainfall monthly*1.00		43.47		78.50		69.84		53.92		64.20	
7	Effective rain fall (1/2 month)		21.74	21.74	37.98	40.52	33.79	36.05	26.96	26.96	31.06	33.14
8	N.I.R			23.41	18.69	6.65	36.30	38.71	36.99	14.45	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**34.68**	**27.69**	**9.85**	**53.78**	**57.35**	**54.8**	**21.41**	**0**	**0**
E	**Ground nut**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.55	0.75	0.95	0.95	0.95	0.75	0.55	0
3	E.T.c		25.15	25.15	30.03	43.68	63.41	67.64	57.86	45.68	35.31	0
4	montly Etc(Cu)		50.3		73.71		131.05		103.53		70.62	
5	Effective rain fall montly		**43.47**		**73.71**		**68.74**		**53.77**		**65.28**	
6	Effective rainfall monthly*1.00		43.47		73.71		68.74		53.77		65.28	
7	Effective rain fall (1/2 month)		21.74	21.74	35.67	38.04	33.26	35.48	26.89	26.89	31.59	33.69
8	N.I.R			23.41	19.36	5.64	30.15	32.16	30.97	18.79	3.72	0.00
9	**G.I.R (Eff=0.675)**			**34.68**	**28.68**	**8.36**	**44.67**	**47.64**	**45.88**	**27.84**	**5.51**	**0**
A	**Ground nut (45%)**											
1	Depth(mm)			34.68	28.68	8.36	44.67	47.64	45.88	27.84	5.51	0
2	Area in Ha	45%		450	450	450	450	450	450	450	450	
3	**Discharge In Cumecs**			0.12	0.1	0.027	0.155	0.155	0.159	0.097	0.019	0
4	Volume Consumed in Mcum			0.156	0.129	0.038	0.201	0.214	0.206	0.125	0.025	
B	**Sun flower (20 %)**											
1	Depth(mm)			34.68	27.69	9.85	53.78	57.35	54.80	21.41	0.00	0.00

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
2	Area in Ha	20%		200	200	200	200	200	200	200	0	200
3	Discharge In Cumecs			0.054	0.043	0.014	0.083	0.083	0.085	0.033	0	0
4	Volume Consumed in Mcum			0.069	0.055	0.02	0.108	0.115	0.11	0.043	0	0
C	**Pulses (10 %)**											
1	Depth(mm)			34.68	27.69	9.85	53.78	57.35	54.80	21.41	0.00	0.00
2	Area in Ha	10%		100	100	100	100	100	100	100		
3	Discharge In Cumecs			0.027	0.021	0.007	0.041	0.041	0.042	0.017	0	0
4	Volume Consumed in Mcum			0.035	0.028	0.01	0.054	0.057	0.055	0.021	0	0
D	**Maize (10%)**											
1	Depth(mm)			34.68	27.69	9.85	53.78	57.35	54.37	31.81	1.69	0.00
2	Area in Ha	10%		100	100	100	100	100	100	100	100	
3	Discharge In Cumecs			0.027	0.021	0.007	0.041	0.041	0.042	0.025	0.001	0
4	Volume Consumed in Mcum			0.035	0.028	0.01	0.054	0.057	0.054	0.032	0.002	0
E	**Sorghum (15 %)**											
1	Depth(mm)			34.68	27.99	9.33	49.21	52.50	50.21	27.66	1.54	0.00
2	Area in Ha	15%		150	150	150	150	150	150	150	150	
3	Discharge In Cumecs			0.04	0.032	0.01	0.057	0.057	0.058	0.032	0.002	0
4	Volume Consumed in Mcum			0.052	0.042	0.014	0.074	0.079	0.075	0.041	0.002	0
I	**Total**											
1	Area in Ha	100%		1000	1000	1000	1000	1000	1000	1000	1000	
2	Discharge In Cumecs			0.268	0.217	0.065	0.377	0.377	0.386	0.204	0.022	
3	Volume Consumed in Mcum			0.35	0.28	0.09	0.49	0.52	0.5	0.26	0.03	
II	**Total Area Irrigated(ha)**			20150	20150	20150	20150	20150	20150	20150	20150	
1	Discharge In Cumecs			**5.40**	**4.37**	**1.31**	**7.6**	**7.6**	**7.78**	**4.11**	**0.44**	
2	Volume Consumed in Mcum			**7.05**	**5.64**	**1.81**	**9.87**	**10.48**	**10.08**	**5.24**	**0.6**	
3	Total										**MCft**	**1793**
										Say	**TMC**	**1.79**

Table 6.5 : Crop Water requirement as per Modified Penman's method

Station -Average of Hosadurga ,Hiriyur,Chitradurga and Challikere, taluks **639.40mm** **Annual total rain fall-660.94 mm**

CCA = 107265 Ha **Chance of occurance -50% for low value crops**

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
1	E.T.O	mm/day	4.79	4.79	3.64	3.64	4.45	4.45	4.06	4.06	4.28	4.28
2	E.T.O(i/2 month)	mm	71.85	71.85	54.6	58.24	66.75	71.2	60.9	60.9	64.2	68.48
3	Monthly rainfall (R)	mm	44.03		57.5		65.25		94.55		118.53	
4	Normal monthly rainfall (cl N-3*0.97)		42.71		55.78		63.29		91.71		114.97	
A	**Sorghum**											
1	Land preparation			**21.00**	**20.00**	4.00						
2	Kc			0.35	0.57	0.79	1.00	1.00	1.00	0.75	0.50	0.00
3	E.T.c		25.15	25.15	31.12	46.01	66.75	71.20	60.90	45.68	32.10	32.10
4	Monthly Etc(Cu)		50.30		77.13		137.95		106.58		64.20	
5	Effective rainfall monthly		28.35		38.82		48.38		64.90		64.20	
6	Effective rainfall monthly*1.00		28.35		38.82		48.38		64.90		64.20	
7	Effective rainfall (1/2 month)		14.18	14.18	18.79	20.04	23.41	24.97	32.45	32.45	31.06	33.14
8	N.I.R			31.97	32.33	29.97	43.34	46.23	28.45	13.23	1.04	0.00
9	**G.I.R (Eff=0.675)**			**47.36**	**47.9**	**44.4**	**64.21**	**68.49**	**42.15**	**19.59**	**1.54**	**0**
B	**Maize**											
1	Land preparation			21.00	20.00	4.00						
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.80	0.55	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	48.72	35.31	35.31
4	montly Etc(Cu)		50.30		78.84		144.85		112.67		70.62	
5	Effective rain fall monthly		**28.35**		**38.92**		**49.06**		**65.72**		**67.31**	
6	Effective rainfall monthly*1.00		28.35		38.92		49.06		65.72		67.31	
7	Effective rain fall (1/2 month)		14.18	14.18	18.83	20.09	23.74	25.32	32.86	32.86	32.57	34.74
8	N.I.R			31.97	32.84	31.08	46.35	49.44	31.09	15.86	2.74	0.57
9	**G.I.R (Eff=0.675)**			**47.36**	**48.65**	**46.04**	**68.67**	**73.24**	**46.06**	**23.5**	**4.06**	**0.84**
C	**Pulses**											
1	Land preparation			21.00	20.00	4.00						
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0.00

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Monthly Etc(Cu)		50.3		78.84		144.85		105.36		38.52	
5	Effective rain fall monthly		**28.35**		**38.92**		**49.06**		**64.74**		**64.20**	
6	Effective rainfall monthly*1.00		28.35		38.92		49.06		64.74		64.20	
7	Effective rain fall (1/2 month)		14.18	14.18	18.83	20.09	23.74	25.32	32.37	32.37	31.06	33.14
8	N.I.R			31.97	32.84	31.08	46.35	49.44	31.58	9.04	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**47.36**	**48.65**	**46.04**	**68.67**	**73.24**	**46.79**	**13.39**	**-17.48**	**0**
D	**Sun flower**											
1	Land preparation			21.00	20.00	4.00						
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Montly Etc(Cu)		50.30		78.84		144.85		105.36		38.52	
5	Effective rain fall monthly		**28.35**		**38.92**		**49.06**		**64.74**		**64.20**	
6	Effective rainfall monthly*1.00		28.35		38.92		49.06		64.74		64.20	
7	Effective rain fall (1/2 month)		14.18	14.18	18.83	20.09	23.74	25.32	32.37	32.37	31.06	33.14
8	N.I.R			31.97	32.84	31.08	46.35	49.44	31.58	9.04	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**47.36**	**48.65**	**46.05**	**68.66**	**73.24**	**46.78**	**13.4**	**-17.48**	**0**
E	**Ground nut**											
1	Land preparation			21.00	20.00	4.00						
2	Kc			0.35	0.55	0.75	0.95	0.95	0.95	0.75	0.55	0
3	E.T.c		25.15	25.15	30.03	43.68	63.41	67.64	57.86	45.68	35.31	0
4	montly Etc(Cu)		50.3		73.71		131.05		103.53		70.62	
5	Effective rain fall montly		**28.35**		**38.57**		**47.70**		**64.50**		**67.31**	
6	Effective rainfall monthly*1.00		28.35		38.57		47.70		64.50		67.31	
7	Effective rain fall (1/2 month)		14.18	14.18	18.66	19.91	23.08	24.62	32.25	32.25	32.57	34.74
8	N.I.R			31.97	31.37	27.77	40.33	43.02	25.61	13.43	2.74	0.00
9	**G.I.R (Eff=0.675)**			**47.36**	**46.47**	**41.14**	**59.75**	**63.73**	**37.94**	**19.9**	**4.06**	**0**
A	**Ground nut (45%)**											
1	Depth(mm)			47.36	46.47	41.14	59.75	63.73	37.94	19.9	4.06	0
2	Area in Ha	45%		450	450	450	450	450	450	450	450	
3	**Discharge In Cumecs**			0.164	0.161	0.134	0.207	0.207	0.132	0.069	0.014	0

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
4	Volume Consumed in Mcum			0.213	0.209	0.185	0.269	0.287	0.171	0.09	0.018	
B	**Sun flower (20 %)**											
1	Depth(mm)			47.36	48.65	46.05	68.66	73.24	46.78	13.40	0.00	0.00
2	Area in Ha	20%		200	200	200	200	200	200	200	200	
3	Discharge In Cumecs			0.073	0.075	0.067	0.106	0.106	0.072	0.021	0	0
4	Volume Consumed in Mcum			0.095	0.097	0.092	0.137	0.146	0.094	0.027	0	0
C	**Pulses (10 %)**											
1	Depth(mm)			47.36	48.65	46.04	68.67	73.24	46.79	13.39	0.00	0.00
2	Area in Ha	10%		100	100	100	100	100	100	100	100	
3	Discharge In Cumecs			0.037	0.038	0.033	0.053	0.053	0.036	0.01	0	0
4	Volume Consumed in Mcum			0.047	0.049	0.046	0.069	0.073	0.047	0.013	0	0
D	**Maize (10%)**											
1	Depth(mm)			47.36	48.65	46.04	68.67	73.24	46.06	23.50	4.06	0.84
2	Area in Ha	10%		100	100	100	100	100	100	100	100	100
3	Discharge In Cumecs			0.037	0.038	0.033	0.053	0.053	0.036	0.018	0.003	
4	Volume Consumed in Mcum			0.047	0.049	0.046	0.069	0.073	0.046	0.024	0.004	
E	**Sorghum (15 %)**											
1	Depth(mm)			47.36	47.90	44.40	64.21	68.49	42.15	19.59	1.54	0.00
2	Area in Ha	15%		150	150	150	150	150	150	150	150	
3	Discharge In Cumecs			0.055	0.055	0.048	0.074	0.074	0.049	0.023	0.002	0
4	Volume Consumed in Mcum			0.071	0.072	0.067	0.096	0.103	0.063	0.029	0.002	0
I	**Total**											
1	Area in Ha	100%		1000	1000	1000	1000	1000	1000	1000	1000	1000
2	Discharge In Cumecs			0.366	0.367	0.315	0.378	0.378	0.325	0.141	0.019	
3	Volume Consumed in Mcum			0.47	0.48	0.44	0.49	0.52	0.42	0.18	0.02	
II	**Total Area Irrigated(ha)**			107265	107265	107265	107265	107265	107265	107265	107265	107265
1	Discharge In Cumecs			**39.26**	**39.37**	**33.79**	**40.55**	**40.55**	**34.86**	**15.12**	**2.04**	
2	Volume Consumed in Mcum			**50.41**	**51.49**	**47.2**	**52.56**	**55.78**	**45.05**	**19.31**	**2.15**	
3	Total										**MCft**	**11440.00**
										Say	**TMC**	**11.44**

Table 6.6: Crop Water requirement as per Modified Penman's method

Station -Average of ,Chickkanayakana Halli and Sira taluks **Annual total rain fall-660.94 mm**

84900 Ha **Chance of occurance - 50% for low value crops**

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
1	E.T.O	mm/day	4.79	4.79	3.64	3.64	4.45	4.45	4.06	4.06	4.28	4.28
2	E.T.O(i/2 month)	mm	71.85	71.85	54.6	58.24	66.75	71.2	60.9	60.9	64.2	68.48
3	Monthly rainfall (R)	mm	72.99		76.97		89.33		140.96		132.61	
4	Normal monthly rainfall (cl N-3*0.97)		70.8		74.66		86.65		136.73		128.63	
A	**Sorghum**											
1	Land preparation			**20.00**	**25.00**							
2	Kc			0.35	0.57	0.79	1.00	1.00	1.00	0.75	0.50	0.00
3	E.T.c		25.15	25.15	31.12	46.01	66.75	71.20	60.90	45.68	32.10	32.10
4	Monthly Etc(Cu)		50.30		77.13		137.95		106.58		64.20	
5	Effective rainfall monthly		44.69		51.04		64.96		91.27		64.20	
6	Effective rainfall monthly*1.00		44.69		51.04		64.96		91.27		64.20	
7	Effective rainfall (1/2 month)		22.35	22.35	24.69	26.34	31.43	33.53	45.64	45.64	31.06	33.14
8	N.I.R			22.80	31.43	19.67	35.32	37.67	15.26	0.03	1.04	0.00
9	**G.I.R (Eff=0.675)**			**33.77**	**46.57**	**29.14**	**52.33**	**55.81**	**22.61**	**0.05**	**1.54**	**0**
B	**Maize**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.80	0.55	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	48.72	35.31	35.31
4	montly Etc(Cu)		50.30		78.84		144.85		112.67		70.62	
5	Effective rain fall monthly		**44.69**		**51.24**		**65.51**		**92.85**		**63.57**	
6	Effective rainfall monthly*1.00		44.69		51.24		65.51		92.85		63.57	
7	Effective rain fall (1/2 month)		22.35	22.35	24.79	26.45	31.70	33.81	46.42	46.42	30.76	32.81
8	N.I.R			22.80	31.88	20.72	38.39	40.95	17.53	2.30	4.55	2.50
9	**G.I.R (Eff=0.675)**			**33.78**	**47.23**	**30.7**	**56.87**	**60.67**	**25.97**	**3.41**	**6.74**	**3.7**
C	**Pulses**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Monthly Etc(Cu)		50.3		78.84		144.85		105.36		38.52	

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
5	Effective rain fall monthly		**44.69**		**51.24**		**65.51**		**90.96**		**64.20**	
6	Effective rainfall monthly*1.00		44.69		51.24		65.51		90.96		64.20	
7	Effective rain fall (1/2 month)		22.35	22.35	24.79	26.45	31.70	33.81	45.48	45.48	31.06	33.14
8	N.I.R			22.80	31.88	20.72	38.39	40.95	18.47	-4.07	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**33.78**	**47.23**	**30.7**	**56.87**	**60.67**	**27.36**	**-6.03**	**-17.48**	**0**
D	**Sun flower**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Montly Etc(Cu)		50.30		78.84		144.85		105.36		38.52	
5	Effective rain fall monthly		**44.69**		**51.24**		**65.51**		**90.96**		**64.20**	
6	Effective rainfall monthly*1.00		44.69		51.24		65.51		90.96		64.20	
7	Effective rain fall (1/2 month)		22.35	22.35	24.79	26.45	31.70	33.81	45.48	45.48	31.06	33.14
8	N.I.R			22.80	31.88	20.72	38.39	40.95	18.47	-4.07	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**33.77**	**47.23**	**30.7**	**56.87**	**60.67**	**27.36**	**-6.03**	**-17.48**	**0**
E	**Ground nut**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.55	0.75	0.95	0.95	0.95	0.75	0.55	0
3	E.T.c		25.15	25.15	30.03	43.68	63.41	67.64	57.86	45.68	35.31	0
4	montly Etc(Cu)		50.3		73.71		131.05		103.53		70.62	
5	Effective rain fall montly		**44.69**		**50.58**		**64.41**		**90.48**		**63.57**	
6	Effective rainfall monthly*1.00		44.69		50.58		64.41		90.48		63.57	
7	Effective rain fall (1/2 month)		22.35	22.35	24.47	26.1	31.16	33.24	45.24	45.24	30.76	32.81
8	N.I.R			22.80	30.56	17.58	32.25	34.40	12.62	0.44	4.55	0.00
9	**G.I.R (Eff=0.675)**			**33.78**	**45.27**	**26.04**	**47.78**	**50.96**	**18.7**	**0.65**	**6.74**	**0**
A	**Ground nut (45%)**											
1	Depth(mm)			33.78	45.27	26.04	47.78	50.96	18.7	0.65	6.74	0
2	Area in Ha	45%		450	450	450	450	450	450	450	450	
3	**Discharge In Cumecs**			0.117	0.157	0.085	0.166	0.166	0.065	0.002	0.023	0
4	Volume Consumed in Mcum			0.152	0.204	0.117	0.215	0.229	0.084	0.003	0.03	
B	**Sun flower (20 %)**											
1	Depth(mm)			33.77	47.23	30.70	56.87	60.67	27.36	-6.03	-17.48	0.00

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
2	Area in Ha	20%		200	200	200	200	200	200			200
3	Discharge In Cumecs			0.052	0.073	0.044	0.088	0.088	0.042	0	0	0
4	Volume Consumed in Mcum			0.068	0.094	0.061	0.114	0.121	0.055	0	0	0
C	**Pulses (10 %)**											
1	Depth(mm)			33.78	47.23	30.70	56.87	60.67	27.36	-6.03	-17.48	0.00
2	Area in Ha	10%		100	100	100	100	100	100			
3	Discharge In Cumecs			0.026	0.036	0.022	0.044	0.044	0.021	0	0	0
4	Volume Consumed in Mcum			0.034	0.047	0.031	0.057	0.061	0.027	0	0	0
D	**Maize (10%)**											
1	Depth(mm)			33.78	47.23	30.70	56.87	60.67	25.97	3.41	6.74	3.70
2	Area in Ha	10%		100	100	100	100	100	100	100	100	100
3	Discharge In Cumecs			0.026	0.036	0.022	0.044	0.044	0.02	0.003	0.005	
4	Volume Consumed in Mcum			0.034	0.047	0.031	0.057	0.061	0.026	0.003	0.007	
E	**Sorghum (15 %)**											
1	Depth(mm)			33.77	46.57	29.14	52.33	55.81	22.61	0.05	1.54	0.00
2	Area in Ha	15%		150	150	150	150	150	150	150		
3	Discharge In Cumecs			0.039	0.054	0.032	0.061	0.061	0.026	0	0	0
4	Volume Consumed in Mcum			0.051	0.07	0.044	0.078	0.084	0.034	0	0	0
I	**Total**											
1	Area in Ha	100%		1000	1000	1000	1000	1000	1000	1000	1000	1000
2	Discharge In Cumecs			0.26	0.356	0.205	0.403	0.403	0.174	0.005	0.028	
3	Volume Consumed in Mcum			0.339	0.462	0.28	0.521	0.556	0.226	0.006	0.037	
II	**Total Area Irrigated(ha)**			84900	84900	84900	84900	84900	84900	84900	84900	84900
1	Discharge In Cumecs			**22.07**	**30.22**	**17.4**	**34.21**	**34.21**	**14.77**	**0.42**	**2.38**	
2	Volume Consumed in Mcum			**28.78**	**39.22**	**23.77**	**44.23**	**47.2**	**19.19**	**0.51**	**3.14**	
3	Total										**MCft**	**7276.3**
										Say	**TMC**	**7.28**

Table 6.7: Crop Water requirement as per Modified Penman's method

Station -Average of Jaglur taluk **Annual total rain fall-660.94 mm**

13200 Ha **Chance of occurance -50% for low value crops**

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
1	E.T.O	mm/day	4.79	4.79	3.64	3.64	4.45	4.45	4.06	4.06	4.28	4.28
2	E.T.O(i/2 month)	mm	71.85	71.85	54.6	58.24	66.75	71.2	60.9	60.9	64.2	68.48
3	Monthly rainfall (R)	mm	65.80		65.4		74		103.1		103.7	
4	Normal monthly rainfall (cl N-3*0.97)		63.83		63.44		71.78		100.01		100.59	
A	**Sorghum**											
1	Land preparation			**20.00**	**25.00**							
2	Kc			0.35	0.57	0.79	1.00	1.00	1.00	0.75	0.50	0.00
3	E.T.c		25.15	25.15	31.12	46.01	66.75	71.20	60.90	45.68	32.10	32.10
4	Monthly Etc(Cu)		50.30		77.13		137.95		106.58		64.20	
5	Effective rainfall monthly		40.78		43.78		54.66		70.06		64.20	
6	Effective rainfall monthly*1.00		40.78		43.78		54.66		70.06		64.20	
7	Effective rainfall (1/2 month)		20.39	20.39	21.18	22.6	26.45	28.21	35.03	35.03	31.06	33.14
8	N.I.R			24.76	34.94	23.41	40.30	42.99	25.87	10.65	1.04	0.00
9	**G.I.R (Eff=0.675)**			**36.68**	**51.77**	**34.68**	**59.7**	**63.69**	**38.33**	**15.77**	**1.54**	**0**
B	**Maize**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.80	0.55	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	48.72	35.31	35.31
4	montly Etc(Cu)		50.30		78.84		144.85		112.67		70.62	
5	Effective rain fall monthly		**40.78**		**43.92**		**55.24**		**71.03**		**62.57**	
6	Effective rainfall monthly*1.00		40.78		43.92		55.24		71.03		62.57	
7	Effective rain fall (1/2 month)		20.39	20.39	21.25	22.67	26.73	28.51	35.52	35.52	30.27	32.29
8	N.I.R			24.76	35.42	24.50	43.36	46.25	28.43	13.20	5.04	3.02
9	**G.I.R (Eff=0.675)**			**36.68**	**52.47**	**36.3**	**64.24**	**68.52**	**42.12**	**19.56**	**7.47**	**4.47**
C	**Pulses**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0.00
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
4	Monthly Etc(Cu)		50.3		78.84		144.85		105.36		38.52	
5	Effective rain fall monthly		**40.78**		**43.92**		**55.24**		**69.86**		**64.20**	
6	Effective rainfall monthly*1.00		40.78		43.92		55.24		69.86		64.20	
7	Effective rain fall (1/2 month)		20.39	20.39	21.25	22.67	26.73	28.51	34.93	34.93	31.06	33.14
8	N.I.R			24.76	35.42	24.50	43.36	46.25	29.02	6.48	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**36.68**	**52.47**	**36.3**	**64.24**	**68.52**	**42.99**	**9.6**	**-17.48**	**0**
D	**Sun flower**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.58	0.81	1.05	1.05	1.05	0.68	0.30	0
3	E.T.c		25.15	25.15	31.67	47.17	70.09	74.76	63.95	41.41	19.26	19.26
4	Montly Etc(Cu)		50.30		78.84		144.85		105.36		38.52	
5	Effective rain fall monthly		**40.78**		**43.92**		**55.24**		**69.86**		**64.20**	
6	Effective rainfall monthly*1.00		40.78		43.92		55.24		69.86		64.20	
7	Effective rain fall (1/2 month)		20.39	20.39	21.25	22.67	26.73	28.51	34.93	34.93	31.06	33.14
8	N.I.R			24.76	35.42	24.50	43.36	46.25	29.02	6.48	-11.80	0.00
9	**G.I.R (Eff=0.675)**			**36.68**	**52.47**	**36.3**	**64.23**	**68.52**	**42.99**	**9.6**	**-17.48**	**0**
E	**Ground nut**											
1	Land preparation			20.00	25.00							
2	Kc			0.35	0.55	0.75	0.95	0.95	0.95	0.75	0.55	0
3	E.T.c		25.15	25.15	30.03	43.68	63.41	67.64	57.86	45.68	35.31	0
4	montly Etc(Cu)		50.3		73.71		131.05		103.53		70.62	
5	Effective rain fall montly		**40.78**		**43.44**		**54.07**		**69.57**		**62.57**	
6	Effective rainfall monthly*1.00		40.78		43.44		54.07		69.57		62.57	
7	Effective rain fall (1/2 month)		20.39	20.39	21.02	22.42	26.16	27.91	34.79	34.79	30.27	32.29
8	N.I.R			24.76	34.01	21.26	37.25	39.73	23.07	10.89	5.04	0.00
9	**G.I.R (Eff=0.675)**			**36.68**	**50.39**	**31.5**	**55.19**	**58.86**	**34.18**	**16.13**	**7.47**	**0**
A	**Ground nut (45%)**											
1	Depth(mm)			36.68	50.39	31.5	55.19	58.86	34.18	16.13	7.47	0
2	Area in Ha	45%		450	450	450	450	450	450	450	450	
3	**Discharge In Cumecs**			0.127	0.175	0.103	0.192	0.192	0.119	0.056	0.026	0
4	Volume Consumed in Mcum			0.165	0.227	0.142	0.248	0.265	0.154	0.073	0.034	

Sl. No.	Item	Unit	June(30)		July (31)		August (31)		Sept (30)		Oct (31)	
	No of Days		15	15	15	16	15	16	15	15	15	16
B	**Sun flower (20 %)**											
1	Depth(mm)			36.68	52.47	36.30	64.23	68.52	42.99	9.60	-17.48	0.00
2	Area in Ha	20%		200	200	200	200	200	200	200	0	200
3	Discharge In Cumecs			0.057	0.081	0.053	0.099	0.099	0.066	0.015	0	0
4	Volume Consumed in Mcum			0.073	0.105	0.073	0.128	0.137	0.086	0.019	0	0
C	**Pulses (10 %)**											
1	Depth(mm)			36.68	52.47	36.30	64.24	68.52	42.99	9.60	-17.48	0.00
2	Area in Ha	10%		100	100	100	100	100	100	100		
3	Discharge In Cumecs			0.028	0.04	0.026	0.05	0.05	0.033	0.007	0	0
4	Volume Consumed in Mcum			0.037	0.052	0.036	0.064	0.069	0.043	0.01	0	0
D	**Maize (10%)**											
1	Depth(mm)			36.68	52.47	36.30	64.24	68.52	42.12	19.56	7.47	4.47
2	Area in Ha	10%		100	100	100	100	100	100	100	100	100
3	Discharge In Cumecs			0.028	0.04	0.026	0.05	0.05	0.033	0.015	0.006	0
4	Volume Consumed in Mcum			0.037	0.052	0.036	0.064	0.069	0.042	0.02	0.007	0
E	**Sorghum (15 %)**											
1	Depth(mm)			36.68	51.77	34.68	59.70	63.69	38.33	15.77	1.54	0.00
2	Area in Ha	15%		150	150	150	150	150	150	150	150	
3	Discharge In Cumecs			0.042	0.06	0.038	0.069	0.069	0.044	0.018	0.002	0
4	Volume Consumed in Mcum			0.055	0.078	0.052	0.09	0.096	0.057	0.024	0.002	0
I	**Total**											
1	Area in Ha	100%		1000	1000	1000	1000	1000	1000	1000	1000	1000
2	Discharge In Cumecs			0.282	0.396	0.246	0.46	0.46	0.295	0.111	0.034	
3	Volume Consumed in Mcum			0.360	0.510	0.330	0.590	0.630	0.380	0.140	0.040	
II	**Total Area Irrigated(ha)**			13200	13200	13200	13200	13200	13200	13200	13200	13200
1	Discharge In Cumecs			**3.72**	**5.23**	**3.25**	**6.07**	**6.07**	**3.89**	**1.47**	**0.45**	
2	Volume Consumed in Mcum			**4.75**	**6.73**	**4.36**	**7.79**	**8.32**	**5.02**	**1.85**	**0.53**	
3	Total										**MCft**	**1389.65**
										Say	**TMC**	**1.39**

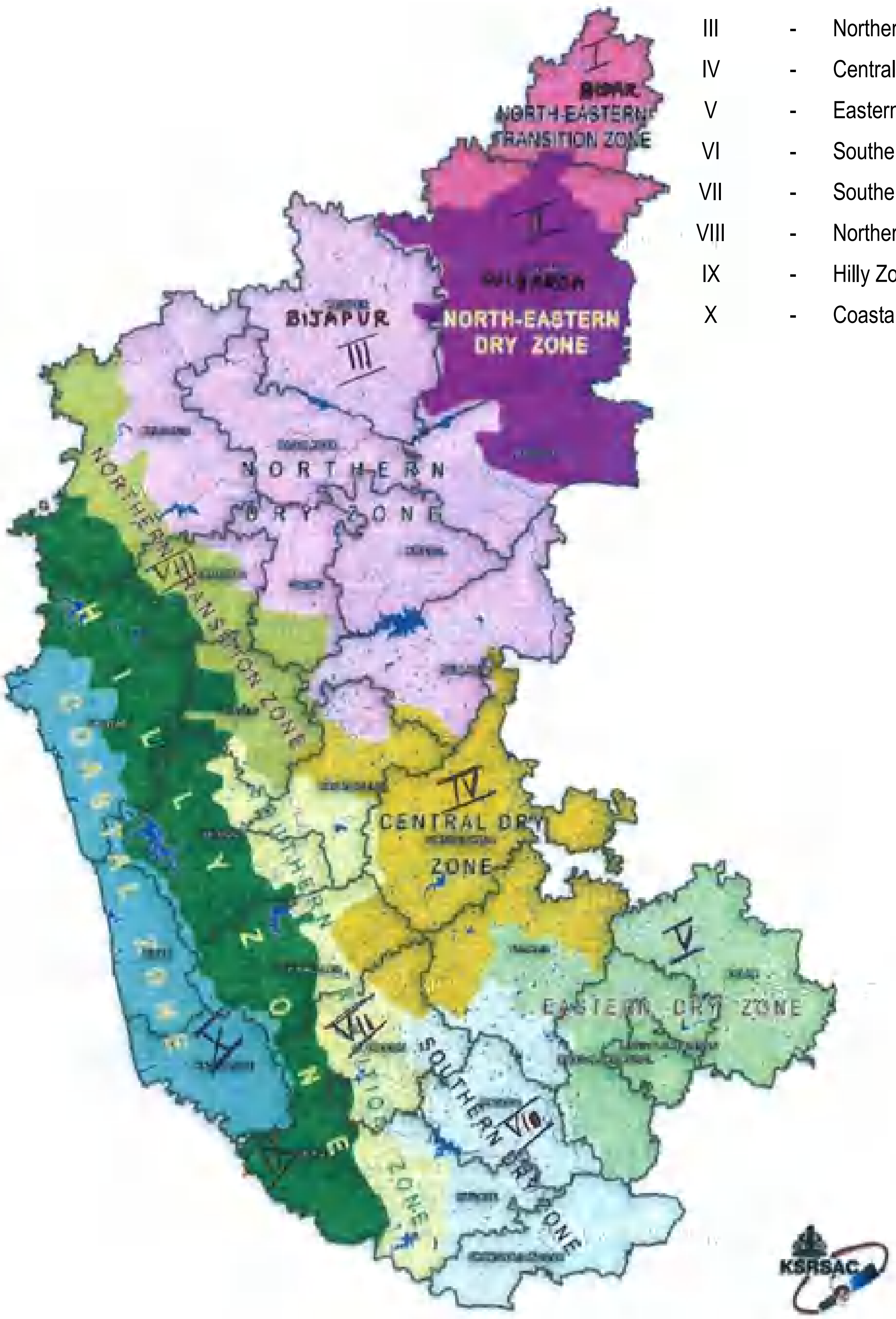
Table 6.8 : Abstract of Discharge and Water Requirement for Command Area of Upper Bhadra Scheme

	Item	**June(30)**		**July(31)**		**August(31)**		**Sep(30)**		**Oct(31)**		**Total**
	No of Days	**15**	**15**	**15**	**15**	**15**	**16**	**15**	**16**	**15**	**16**	
1	**CRW4 Tarikere**											
2	Volume Consumed in Mcum		7.05	5.64	1.81	9.87	10.48	10.08	5.24	0.6		50.77
3	Tank filling								5.4	2.3		7.65
	Total		7.05	5.64	1.81	9.87	10.48	10.08	10.63	2.85		58.42
1	**CRW3-Jaglur**											
2	Volume Consumed in Mcum		4.75	6.73	4.36	7.79	8.32	5.02	1.85	0.53		39.35
3	Tank filling		4.09		4.09				7.50	5.55		21.24
	Total		8.84	6.73	8.45	7.79	8.32	5.02	9.35	6.08		60.59
1	**CRW2-Tumkur**											
2	Volume Consumed in Mcum		28.78	39.22	23.77	44.23	47.2	19.19	0.51	3.14		206.04
3	Tank filling + VV sagar		3.26	1.09	20.55			16.55	34.43	43.05		118.93
	Total		32.04435682	40.308119	44.324567	44.23	47.2	35.740289	34.938083	46.18599		324.9714
1	**CRW-Chitradurga**											
2	Volume Consumed in Mcum		50.41	51.49	47.2	52.56	55.78	45.05	19.31	2.15		323.95
3	Tank filling		0.83	0.58	3.83			5.371	27.22	40.88		78.72
	Total		51.24	52.072874	51.030313	52.56	55.78	50.420765	46.530203	43.03443		402.67126
1	**Total of above**											
2	Volume Consumed in Mcum		99.18	104.75	105.62	114.45	121.78	101.26	101.45	98.15		846.65
3	Discharge In Cumecs		76.53	80.83	81.49	88.31	88.09	78.13	73.39	75.74		
	Total											**29.90**

Annexure 6.1

Agro Climatic Zones of Karnataka

I	-	North Eastern Transition Zone
II	-	North Eastern Dry Zone
III	-	Northern Dry Zone
IV	-	Central Dry Zone
V	-	Eastern Dry Zone
VI	-	Southern Dry Zone
VII	-	Southern Transition Zone
VIII	-	Northern Transition Zone
IX	-	Hilly Zone
X	-	Coastal Zone



Annexure 6.1 (Contd)

STATE : KARNATAKA

AGRO CLIMATIC REGION : SOUTHERN PLATEAU AND HILLS REGION

NARf Zone	Zonal Research Station	Districts	Suitable Crofs	Crof Information
KA -1 North-east Transition Zone	Bidar	Bhalki, Aurad, Basavva-Kalyan, Hummabad Aland, Chincholi (Talukas of District Bidar.	Jowar, Gram, Tur, Other fulses, Small Millets, Bajra, Groundnut & Other Oilseed, Cotton, faddy.	Sorghum, Gram, Arhar, Bajra.
KA - 2 North-east Dry Zone	Raichur	Afzalfur, Chitafur (Talukas of district Gulburga), Sedam, Shorafur, Yadgir, Shahfur, Deodurg, Manvi, Raichur (Talukas of District Jewargi).	Jowar, Gram, Tur, Other fulses, Small Millets, Bajra, Groundnut & Other Oilseed, Cotton, faddy, Chills.	Jowar, Groundnut, Cotton, Small Millets.
KA - 3 Northern Dry Zone	Bijafur	Bagalkot, Bagewadi, Bhijafur Baligi, Bagewadi, Humgund, Indi, Jamkhandi, Mudhol, Mddebihal, Sindgi (Talukas of district Badamil). Hadagali, Hosfet, Kudi, hegaribommanahally, Sandoor, Siruguffa, Harafanahally (Talukas of district Bellary). Lingasugur, Gan.	Jowar, Gram, Tur, Other fulses, Small Millets, Bajra, Groundnut & Other Oilseed, Cotton, faddy, Wheat, Ragi, Sugarcane, Forage Crofs.	Jowar, Groundnut, Cotton, Ragi.
KA - 4 Central Dry Zone	Bidaramaanagudi	Jagalfur, Hardavangere, hiriyur, Challaker, Molakalnur, Hosdurga (Talukas of district Chitradurga Madhugiri, favagada, Sira, Koratagere, Arasikere, Tiftu, Chickaayakanahalli (Talukas of district Tumkur), Kadur (Talukas of district Chikmangalur).	Jowar, Gram, Tur, Other fulses, Small Millets, Bajra, Groundnut & Other Oilseed, Cotton, faddy, Wheat, Ragi, Sugarcane, Maize, flantain Crofs.	Jowar, Groundnut, Cotton, Ragi.
KA - 5 Eastern Dry Zone	Chintamani	Gubbim, Tumkhu (Talukas of district Tumkur), Devanahalli, Doddabadllafur, Magadi, Bangalore North, Bangalore South, Kanakafura, Anekal, Ramanagram, Channafatna, hoskote, Nalamangala (Talukas of district Bangalore), Malur, Bangarfet, Mulabagal, Drinivasfur.	fulses, Small Millets, Bajra, Groundnut ,faddy, Ragi, Maize, Soybean, fotato, Fodder Crofs, Mulberry & Horticultural Crofs.	Bajra, Groundnut, Cashew, Small Millets
KA - 6 Southern Dry Zone	Mandya	K.R. Nagar, T.N.fura, Kollegal, Nanjangud, Chamarajanagar, Gundlufet, Yelandur (Talukas of district Mysore). Turvekere, Kumigal (talukas of district Tumkur), Nagamangala, Srirangafatna, Malavalli, Madhur, Mandya, fandavafura, K.R. fet, Hassan, Chanmareyafa.	Jowar, fulses, Small Millets, Bajra, Groundnut & Other Oilseed, Cotton, faddy, Ragi, Sugarcane,Cottin, Fodder, Mulberry, flantain Crofs.	Jowar, Groundnut, Bajra, Ragi.

NARf Zone	Zonal Research Station	Districts	Suitable Crofs	Crof Information
KA - 7 Southern Transition Zone	Navile / Shimoga	Holemarasifur, Alur Belur, Arkala (Talukas of district Hassan), Bhadravathi, Shimoga, Shikarifur, Honnali, Channagiri (Talukas of district Shimoga), Hunsur, feriyaftna (talukas of district H.D. Kote)	Jowar, fulses, Groundnut, Cotton, faddy, Ragi, Sugarcane, Maize, Fodder, Aromatic flants, Tobacco, flantain Crofs.	Jowar, Groundnut, Cotton, Ragi.
KA - 8 Northern Transition Zone	Hanumanamatti	Hukker, Chikkodi, Balihongali (Talukas of district Belgaun), Dharwad, Haveri, Shiggoan, Shirahatti, Kundgol, Savanur, Hubli, Dharwad, Byadagi, hirekerur, Ranibenur.	Jowar, fulses, Groundnut, Cotton, faddy, Ragi, Sugarcane, Fodder, Small Millets, Wheat, Horticultural Crofs.	Jowar, Groundnut, Cotton, Ragi.
Agro Climatic Features of the Sub Regions				
Sub Region	**Rainfall (mm)**	**Climate**	**Soil**	**Crof**
South Region of Kartnaka and North Region of Taminadu (Sub - Region - 5)	865	Semi-arid	Red Loamy, Red Sandy	Ragi, Jowar, Groundnut, Rice
Northern Dry Region of Karnataka (Sub - Region - 1)	769	Semi-arid & arid	Medium, Black, Red Loamy	Jowar, Cotton, Groundnut, Bajra
South Telangana (Sub - Region - 3)	725	Semi-arid & arid	Red Sandy, Medium to Deef Black	Jowar, Rice, Castor, Groundnut
North telangana (Sub - Regino - 4)	1001	Semi-arid (Wetter half)	Deef Black, Medium Black	Rice, Jowar, Maize, Cotton, Groundnut
Central Region of Karnataka and Rayalseema (Sub - Region - 2)	677	Semi-arid	Red Loamy, Medium Black, Red Sandy, Coastal Alluvi	Groundnut, Ragi, Jowar, Rice
Central flateau of Tamilnadu (Sub - Region - 6)	841	Semi-arid to Dry Sub-humid	Mixed Red and Black, Red Loamy, Deltaic Alluvium	Rice, Jowar, Groundnut, Bajra

STATE : KARNATAKA

AGRO CLIMATIC REGION : SOUTHERN fLATEAU AND HILLS REGION

NARf Zone	Zonal Research Station	Districts	Suitable Crofs	Crof Information
KA - 9 Hill Zone	Mudigere	Sirsi, Siddafur, Yellafur, Sufa, Haliyal, Mundgod (Talukas of district North Kafnada), Koffa, Sringeri, Mudgere, Narasimharajefur Chikmangalur (Talukas of district Chikmangalor), Kalghatgi, Hanagel (Talukas of district Dhrwad), Virajfet, Sonwerfet, Mercara.	Rice, fulses, Ragi, Sorghum	Jowar, Groundnut, Bajra, Ragi.
KA - 10 Coastal Zone	Brahmavar	Kurwar, Kumta, Honnavar, Bhatkal, Ankola (Talukas of district North Kenda), Udufi, Coondafur, Mangalore, Bhantaval, Karkala, Belthangudi, futtur, Sulya (Talukas of district South Kenda)	Rice, fulses,Groundnut	Jowar, Groundnut, Bajra.
Agro Climatic Features of the Sub Regions				
Sub Region	**Rainfall (mm)**	**Climate**	**Soil**	**Crof**

NARf Zone	Zonal Research Station	Districts	Suitable Crofs	Crof Information
Hilly	266	fer humid	Red Loamy, Mixed Red and Black	Rice, Ragi, Jowar, Groundnut
Coastal hilly	3640	fer humid & humid	Laterite, Red Loamy, Coastal Alluvium	Rice, Ragi, Sesame, Niger
Coastal Midland	3127	Dry Sub-humid & fer humid	Red Loamy, Coastal Alluvium, Laterite	Rice, Tafioca, Ragi, Banana
Midland	2727	fer humid	Laterite, Red Loamy, Coastal Alluvium	Rice, Tafioca, Groundnut, Banana

7.0 Methodology and Expert Opinion on Drip Irrigation

With the changing trends in the methods of application of water from the conventional open canal system to sprinkler/drip, water use efficiency has become a prime area of concern. With the surface irrigation system where the entire canal system is open canal system, the overall efficiency was arrived at as 50 % in the project planning. Due to the long pending demand of farmers of Tumkur district which is adjacent to Chitradurga district, it became imperative to consider alternative to surface irrigation where the loss of water in the conveyance system is high. In order to improve the water use efficiency significantly to meet the demands for irrigation to additional area, it is now planned to adopt drip irrigation in the entire command area. This will be the first such attempt of its kind in Karnataka State where such a large area of 2,25,515 hactares in an irrigation project is planned to be brought under drip irrigation. Its success has immense significance not only to the State, but to the entire country.

Adoption of drip irrigation in UBP was also one of the major recommendations of Sri. K. C. Reddy's committee Report regarding implementation of project. Extract of report (Page 60 of K.C. Reddy's) is as follows:

Since this Project is being recommended by considering prevailing drought situation in Chitrdurga district, the committee suggests for adopting the following two new approaches.

(a) To recharge ground water, irrigation under the tank command should be discouraged for a period of three years so that there would be adequate drinking water in this area.

(b) To Conserve and economize usage of water for irrigation purpose sprinkler and drip irrigation should be made mandatory after the three years period.

7.1 System Efficiency under Flood Irrigation

The efficiencies considered with lined canals are;

Seepage and canal losses from Main Canal & Distributaries	-	15%
Operation Losses	-	10%
Total Losses	-	**25%**

With these losses,	Conveyance Efficiency	-	75%
	Field Channel Efficiency	-	85%
	Field Efficiency	-	80%

Irrigation efficiency = 0.75 x 0.85 x 0.80 = 0.50

7.1.2 System Efficiency under Drip Irrigation

The combined efficiency with drip irrigation works out to 67.5%, as worked out below.

Seepage and canal losses from main canal	-	25%
Efficiency of the drip irrigation system below the main canal	-	75%

Irrigation efficiency = 0.90 x 0.75 = 0.675

Due to the increased efficiency of the system (i.e. 67.5%) under drip irrigation over flood irrigation (i.e. 50%), it would be possible to provide irrigation under CBC and TBC for an area of over (107265 & 84900)2, 14,000 Ha utilizing (10.61 & 6.012) 18.75 TMC of water.

The proposed Command area of CBC and TBC is divided into no. of blocks of area approximate 10000 to 11000 Ha. These blocks are later divided into two areas to be irrigated partly by pumping and partly by gravity by studying the terrain.

Area of 10000 Ha blocks is further divided into zones of 500 Ha which is again divided into 50 Ha blocks. Bulk water supply mains runs from the Main Canal into the 10000 Ha blocks.

7.2 Implementation of Drip Irrigation under Upper Bhadra Project

An allocation of 21.50 TMC of water is allocated for Upper Bhadra Project. Further, with the proposed additional allocation of 2.40 TMC, the total allocation available for planning of UBP is 23.90 TMC. As per the present proposal i.e. Scheme A, area under CBC, JBC and Tarikere lift can be irrigated i.e. through conventional flow irrigation.

Whereas to irrigate area under Tumkur Branch canal (TBC) i.e. Scheme-B, additional 19.00 TMC of water would be required for which no allocation is made in KWDT-II. The overall efficiency at present is only 50% which is low due to the open canal system of flow irrigation. But, with adoption of Drip Irrigation System, the overall efficiency can be improved to 67.50%. With improved water use efficiency, it would be possible to irrigate area under TBC also.

In view of the above scenario it is suggested as follows:

- To adopt LPS Drip Irrigation Technology in the Command area and this will enhance water utilization.
- Reduces power consumption.
- Increases in production and crop productivity
- Water savings up to 40% to 70%
- Controls weed growth, savings of fertilizers (30%) and labour cost (10%)
- Fertigation /Chemigation can be made efficiency
- Control diseases
- Use of saline water is possible
- Soil erosion is eliminated
- Faster returns on investment
- Through the LPS drip Irrigation system, the overall efficiency of the project can be improved to 67.50% from the present 50 %

Thus the command areas under the following canals under Upper Bhadra Project (scheme A & B) can be brought under irrigation adopting Drip Irrigation.

(i)	Chitradurga Branch Canal (CBC)	107265 Ha
(ii)	Tumkur Branch Canal (TBC)	84900 Ha
(iii)	Jagalur Branch Canal (JBC)	13200 Ha
(iv)	Tarikere Flow and Lift Canals	20150 Ha
	Total	**225515 Ha**

7.3 LPS System of Drip Irrigation

The drip system is proposed to be run on Low Pressure System (LPS). Here, the main canal will be an open canal and the distribution system below the main canal will be piped system.

The entire command area will be divided in to 50 ha modules which will operated independently which means each module will be connected to the feeder line that draws water from the main canal. Electrical power required to run the pumps on LPS system in a part of the command area where pressure of 1 bar (10.2 m head) is not available and where pressure of more than 1 bar is available, the modules will be run on gravity system of drip not requiring electrical power. It is estimated that about 39 % of area can be irrigated requiring electrical power and the balance 61 % area can be irrigated by gravity flow. This has been possible due to excellent topography of the command area.

The LPS drip design eliminates the need of constructing distributaries, laterals, minors and field channels thereby reducing the cost of land acquisition and the delays associated with land acquisition. The piping network is further connected to the modern micro irrigation system. This will ensure water use efficiency of 90% at the farm level. This also increases the overall efficiency of water use from 50% in the conventional open canal system to 81% in the drip irrigation system. This system will have all the advantages that micro-irrigation system offers over flood/furrow irrigation viz. water saving, labour saving, power saving, fertilizer savings, etc. and lesser operation

UPPER BHADRA PROJECT

METHODOLOGY AND EXPERTS OPINION ON DRIP IRRIGATION

(a) METHODOLOGY

and maintenance costs over open canals. Since the design eliminates the construction of open canals, the project can be completed within shorter span of time.

This system operates like a Pressurized Irrigation Network System (PINS) and therefore adequate pressure is available in the pipelines for operation of low pressure micro-irrigation system at the outlets i.e. at the farm level. Further, this eliminates the need of creating electrical infrastructure for irrigation across the command area like in the case of sprinkler/high pressure drip irrigation. The centralized pumping system for each 50 ha module ensures easy operation of the system as flow of water through the network of pipes can be controlled from one place rather than from various locations. This also reduces O&M costs and cost of valves at various locations.

With the above system of LPS drip irrigation, it is feasible to irrigate an area of 225515 ha and fill up a 367 no's of tanks in the command for groundwater recharge and drinking water supply. The work on the Project is commenced and substantial progress has been achieved in the execution of lifting arrangement and the conveyance system. The project is facing many challenges in its implementation which have been addressed appropriately so as to eventually commence irrigation early. Another important initiative is to extend irrigation by LPS system of drip in and around the region of tunnel so as to support agriculture over a large area of about 20150 ha.

Other than the above, the project had to overcome many impediments in its implementation after entrustment of the three package works; two lifts and tunnel on EPC turn-key contract basis such as delays in land acquisition, power sanction, forest clearance etc. Now, with substantial progress achieved over the last three years, the UBP is poised to become a flagship project of VJNL to benefit the farmers and the State in the years to come.

7.3.1 Pressure Piped Irrigation Systems

A pressure piped irrigation system is a network installation consisting of pipes, fittings and other devices properly designed and installed to supply water under pressure from the source of the water to the irrigable area. The basic differences between traditional surface irrigation and piped irrigation techniques are:

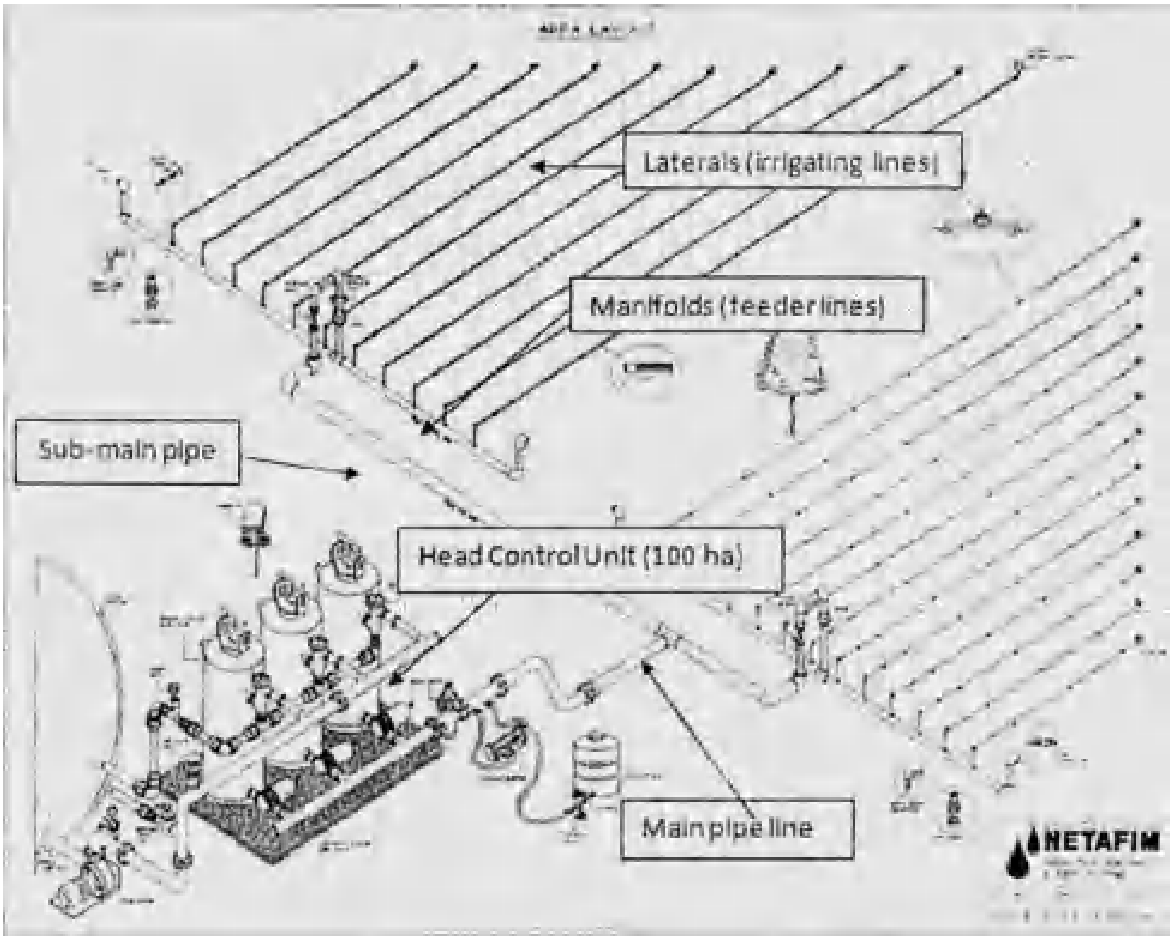
- **The Flow Regime:** With traditional surface methods, the size of the stream/ canal should be large, while in pressure piped irrigation systems very small flows, even 1m^3/h, can be utilized.
- **The Route Direction of the Flow:** With traditional surface methods the water is conveyed from the source and distributed to the fields, through open canals by gravity following the field contours. The piped system conveys and distributes water in closed pipes by pressure following the most convenient (shortest) route, regardless of slope and topography of the area.
- **The Area Irrigated Simultaneously:** With traditional surface methods the water is applied in large volumes per unit of (small) area, while piped irrigation systems distribute the water at small rates over a very large area.
- **The External Energy (Pressure) Required:** Traditional surface gravity methods do not need external energy for operation, while piped irrigation systems require about 1-3 bar depending on site topography and type of emitter used, which is provided from a pumping unit or from a supply tank situated at a high point.

7.3.2 Network Layout

The pipelines that convey and distribute water to the individual plots are buried, so as to protect from farming operations. Off-take hydrants, rising on the surface, are located at various spots according to the planned layout. With surface methods the irrigation water can be delivered directly to the open ditches feeding the furrows or the basins. In drip irrigation, the hydrants are coupled with smaller manifold feeder pipelines placed along the edges of the plots. These feed the lateral irrigating lines which are laid along the plant rows perpendicular to the manifolds. The laterals are equipped with water emitters at designed spaces and distribute uniformly the irrigation water to the plants under certain pressure.

In the piped system, the main component parts are:

- The Control station (head control unit)
- The mains and sub-mains (pipelines)
- The manifolds (feeder pipelines)
- The laterals (irrigating pipelines) with the emitters



Head Control: This consists of a PVC supply line installed horizontally at a minimum height of 60 cm above ground. It is equipped with safety equipments like air release valve, a check valve, a shut-off valve between the two outlets and a filter. There are different types of filters like hydro-cyclone filter, media/grave filter, screen filter; disc filter, etc whose selection is depends on source and quality of water. Where a gravel filter or a hydro cyclone sand separator is needed, it is installed at the beginning of the unit complex.

Main Pipeline: It is the largest diameter pipeline of the network, capable of conveying the flow of the system under favorable hydraulic conditions of flow velocity and friction losses. The pipes used are buried permanent assembly high density polyethylene (HDPE) ranging from 63 to 160 mm (2-6 in) depending on the area of the farm.

Sub Mains: These are small diameter pipelines which extend from the main lines and to which the system flow is diverted for distribution to the various plots. The pipes are the same kind as the mains.

Emitting Manifolds: It consists of pipelines of a smaller diameter than the sub-mains and is connected perpendicular to the sub-mains which supplies water drop by drop to the root zone area of crop. They are of LLDPE pipes in sizes of 12, 16, 20, 25, 32 mm.

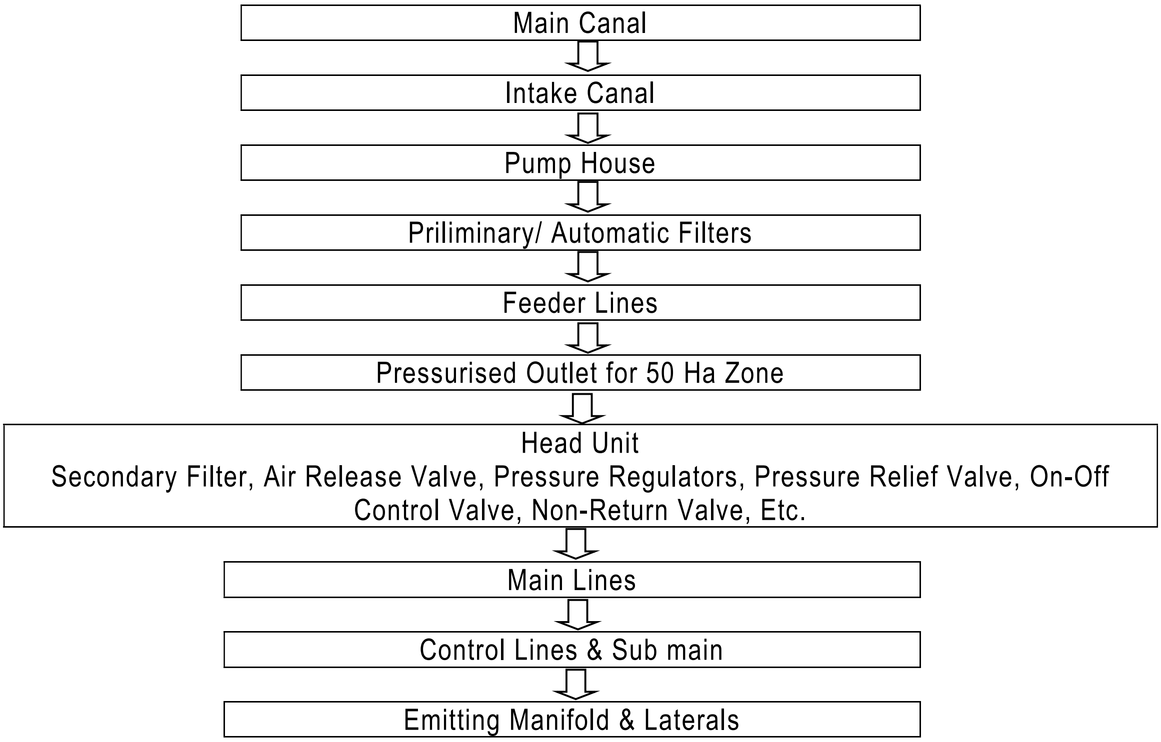
Emitters: Emitter is a device fitted on an emitting pipe, is operated under pressure to discharge water by continuous drops (drippers).

These component parts replace the ones in the traditional surface systems, i.e. the distributaries, laterals, minors, field channels and the furrows in the plot.

Total Head:

Total head is composed of friction head losses in mainline, sub main, primary and secondary filters, control valves, emitting pipe, field fittings, suction lift of pump and the operating pressure of emitter.

Flow Diagram:



7.3.3 Method of Application of Water

7.3.3.1 Drip Irrigation by Drippers/ Emitters

The water is delivered to the plants without being spread over the entire area but by being applied in low rates to a limited soil surface area around the plants. The water delivery method and the kind of the water emitter are the main characteristics of a piped irrigation system. They influence and specify the pressure, flow capacity of the system and duration of application.

The flow capacity of a system is the water flow (in cubic meters per hour or liters per second) designed to meet the irrigation requirements of the area at peak demand. It is inversely proportional to the duration of application. It is generally designed so as to economize on pipe size and other equipments. The duration of application is the time required for the completion of one irrigation cycle.

7.3.4 Design Details of Drip Irrigation for 2.50 Lakhs Ha under CBC & TBC

It is proposed to install Main Pipelines and Pressurized Irrigation Network and then connect the same to the Drip Irrigation System.

7.3.4.1 **Design for Distribution**

(i) The distributaries will be converted in to main Pipelines.

(ii) Water will be distributed through pipelines below the main canal.

(iii) The pipe network carries water to individual Head Unit(s) (One Head Unit for 50 Ha. Drip modules) located at different places in the command Area. The pipe network will have Control Valves near to the Head Unit to control the discharge rate of Water and to ON / OFF the system as per requirement.

7.3.4.2 **Salient Features**

It is proposed to create a network of pipelines (GRP/ PVC) below the level of main canal. Considering the topography at site, the entire project area can be operated by **GRAVITY** as well as through **LOW PRESSURE DRIP IRRIGATION SYSTEM** depending upon the availability of minimum pressure of 1 bar in the irrigation area for operation of LPS system. Where minimum pressure of 1 bar is available (10.2 m head of water), the drip system will be operated under gravity without requiring power and where the required minimum pressure of 1 bar (10.2 m) is not available, the LPS system will be operated with power. The following criteria followed in the drip design are

(i) Drip irrigation System is designed in multiple module of an average area of 50 Ha. For 50 Ha module, one head unit is proposed. There should be continuous flow into the pipe network from the Main Canal to operate the Micro-irrigation System on continuous basis.

(ii) Centralized pumping from the pump house in each 50 Ha module will be operating under LPS.

Advantages

- The centralized pumping ensures easy operation of the system as flow of water through the network of pipes can be controlled from one place rather than other various locations.
- This also reduces O&M costs and cost of valves at various locations.

(iii) The drip irrigation system is a permanent system. The mains and sub-mains are installed underground and the field control valves above surface. Hence, there is no need for shifting of pipes and nozzles every day. The farmers need to only ON / OFF their respective field control valves on their need basis.

(iv) The drip irrigation system can be operated on daily or on alternate day basis. Considering the water requirement, climatic conditions, soil type, water holding capacity and crop growth stage, and the drip irrigation efficiency, provision is made in the design to irrigate the crop on daily or alternative day basis as per the requirement. Peak water requirement on daily basis works out to 3.2 mm per day.

(v) *50 Ha Module:*

Each zone (Average 50 Ha) will have secondary infield filtration with necessary safety equipments and control valves, mainlines, sub-mains and emitting manifolds. The design process is common to all the zones of the command area, as previously mentioned. What will be varying will be the design of main pipe line from the main canal which will feed water to each zone which in turn will either be gravity fed depending upon head available or under LPS system requiring little power. Drip Irrigation System with suitable Filtration units, Mains, Sub-mains, Control Valves, Flush Valves, and Drip Lines with Integral drippers/emitters. Due to variability of crops common Fertigation may not possible, so Fertigation equipments are suggested at field level.

(vi) Irrigation scheduling of a sample block 50 ha is worked out and furnished in map and it is enclosed for reference.

7.3.4.3 Design Details

Drip Irrigation Design Terminologies

Application Rate (AR)

Application rate also called as the irrigation rate is the rate of application of water per unit time expressed in depth. Unit of AR is mm/hr.

Application Rate (mm / hr) = $$\frac{Dripper\ Discharge\ (lph) \times No.\ of\ Laterals / Row}{Dripper\ Spacing\ (m) \times Row\ Spacing\ (m)}$$

$$= \frac{Total\ Flow\ Rate\ of\ all\ the\ Emitter\ Per\ Plant\ (lph)}{Total\ Area\ of\ Individual\ Plant\ (m^2)}$$

$$= \frac{Total\ Flow\ of\ Entire\ Field\ (lph)}{Total\ Area\ (m^2)}$$

Peak Water Requirement (PWR)

Peak water requirement also called as peak evapotranspiration is the one day maximum water requirement of matured crop throughout day expressed in mm/day.

ET_c (mm / day) = Pan evaporation (mm / day) x pan coefficient x crop factor
= Reference Evapotranspiration (ET_0) x crop factor

Shift

Block or several blocks that are irrigated simultaneously by the same water source during an irrigation cycle.

Irrigation Cycle

Period of time (in days or hours) required to complete all the irrigation shifts. Irrigation Interval between irrigations, these are the breaks (in days or in hours) between irrigation cycles.

Shifts / Day

Shifts / Day = $$\frac{Max.\ Operating\ Hours\ Per\ Day}{Shift\ Duration\ (Hr)}$$

$$= \frac{Total\ Flow\ of\ all\ the\ Drippers\ in\ a\ day\ (m^3)}{Available\ Discharge\ (m^3 / Hr)}$$

Shift Duration

It is the irrigation time required to meet the desired water requirement of crop with particular application rate. Unit of shift duration is hour.

Shift Duration (Hr) = $$\frac{PWR\ (mm / day)}{Application\ Rate\ (mm / hr)}$$

A.R. (mm / hr) = $\frac{Dripper\ Discharge(lph) \times No.\ of\ Laterals\ /\ Row}{Dripper\ Spacing\ (m) \times Row\ Spacing\ (m)}$

hift Area

It is the area irrigated at a time under single head unit.

Shift Flow

It is the flow rate per unit time in a shift area. Unit of shift flow is m^3/hr.

Shift flow (m^3/hr) = area per shift x AR (mm/hr)

If the area is in hectare - multiply the result by 10

If the area is in acre - multiply the result by 4

If the area is in m^2 - divide the result by 1000

Emitter Spacing (m)

Dripper Spacing (m) = $\frac{Plant\ Spacing(m)}{No.\ of\ Drippers\ /\ Plant}$

Valve Area

Valve Area = $\frac{Valve\ Flow\ Rate\ (m^3\ /\ hr)}{AR\ (mm\ /\ hr)}$

For the area to be in

Hectare - divide the result by 10

Acre - divide the result by 4

m^2 multiply the result by 1000.

Area that can be irrigated in a Day

Area = $\frac{Discharge\ (m^3\ /\ hr) \times Operating\ Hours\ Per\ Day}{PWR\ (mm\ /\ day)}$

For the area to be in

Hectare - divide the result by 10

Acre - divide the result by 4

m^2- divide the result by 1000

Discharge needed to Irrigate given Area

Discharge (m^3/hr) = $\frac{Area \times PWR\ (mm\ /\ day)}{Operating\ Hours\ Per\ Day}$

If the area is in hectare - multiply the result by 10

If the area is in acre multiply the result by 4

If the area is in m2- divide the result by 1000

The entire area for both low head pump and gravity operation is designed with small units of 50 Ha. The size of each unit is decided by due consideration of operational ease, formation of water user's associations, system economy and topography of land. Each 50 Ha zone is designed with eight shifts.

Pipe size determination

1. The Main pipe head loss is determined by Hazen williams's formula as stated below

$$\frac{\Delta h = 10.67 \times Q^{1.85}}{C^{1.85} \times d^{4.87}}$$

Where:

(h = Head loss (in m of water) per m of pipeline

Q = volumetric flow rate in m3/s

C = Roughness coefficient

d = Inside pipe diameter in m

2. Head Control

The head control unit will have filters and fertigation equipments. The friction losses are calculated by empirical equations.

Total dynamic head of the Pumping unit

$$HP = Q(LPS) \times TDH / (75 \times e1 \times e2)$$

Where:
Q is the flow capacity in LPS
TDH is expressed in metres
e1 is the pump efficiency(fraction)
e2 is the driving efficiency(fraction)
75 is a constant

3. **Design of Main Pipe**

Main lines' design is also same as feeder lines. Selection of both feeder lines as well as mainlines is done with due consideration of land topography, inlet pressure at pipe segment, flow velocity and flow carrying capacity of pipe.

4. **Design of Sub-Main Pipe**

Sub main design is also done considering head losses using Hazen Williams formula except the submain coefficient. Mainline/feeder line is blind pipe i.e. the flow at outlet of pipe segment is same as in inlet. But in submains, laterals are connected to a submain which distribute flow and hence the flow reduces from head end to tail end. The submain head loss can be computed by following formula.

$$\frac{\Delta h = 10.67 \times Q^{1.85}}{C^{1.85} \times d^{4.87}} \times Sub\ Main\ Co - efficient$$

5. **Design of Laterals (Irrigating Lines)**

Lateral or emitting pipe is a LLDPE made tubing with emitters welded inside tubing at specified distance. Selection of lateral diameter depends on the length of plots i.e. maximum run of lateral on each side of sub main. If laterals needs to be run for longer distances or if the emitter discharges is high higher diameter of lateral can be selected.
An abstract of schedule of irrigation and operation schedule is furnished below. The design considerations are explained subsequently.

Irrigation Data	
Area (Ha)	50
Crop	Mixed
System	Drip
Emitter	DNPC
Emitter Discharge (lph)	1.00
Emitter Spacing (m)	0.40
Lateral Spacing (m)	1.22
Application Rate (mm/hr)	2.05
Peak Water Requirement (mm/day)	3.20
Shift Duration (Hr)	1.56
Application Volume (m^3/hr.ha)	12.00
Available Operational hrs/day	24.00
No of Shifts / day	14
Actual Operating hrs/day	21.86
Average Shift Area (Ha)	3.57
Average Shift Flow (m^3/hr)	73.19
Water Source	Canal
Max. Discharge variation (%)	0.00

Daily and Alternate Day Irrigation

Drip irrigation system can be operated on daily or alternate day basis. There is no difference in system design except time of irrigation. Drip irrigation system design for daily irrigation holds good even for alternate day irrigation with change in time of irrigation.

In alternate day irrigation we are supposed to satiate the crop water requirement of two days. So the irrigation time will also be double. E.g. for current design we have suggested 14 shifts with 1.56 Hr shift duration to satiate crop water requirement of 3.2 mm / day for daily irrigation. For same area for alternate day irrigation amount of water to be discharged will be 6.4 mm and so the time of irrigation will be 3.12Hrs and maximum of 07 shifts / day.

The operational schedule for daily irrigation is as below:

Operational Schedule - 50 Ha Module - Daily Irrigation							
Shift No	Valve				Shift		
	No.	Valve Size	Valve Area (Ha)	Valve Flow (m³/hr)	Shift Area (Ha)	Shift Flow (m³/hr)	Shift Duration (Hr)
1	V1-V6	2	0.60	12.20	3.6	73.19	1.6
2	V7-12	2	0.60	12.20	3.6	73.19	1.6
3	V13-V18	2	0.60	12.20	3.6	73.19	1.6
4	V19-V24	2	0.60	12.20	3.6	73.19	1.6
5	V25-V30	2	0.60	12.20	3.6	73.19	1.6
7	V36-V42	2	0.60	12.20	3.6	73.19	1.6
8	V43-V48	2	0.60	12.20	3.6	73.19	1.6
9	V49-V54	2	0.60	12.20	3.6	73.19	1.6
10	V55-V60	2	0.60	12.20	3.6	73.19	1.6
11	V61-V66	2	0.60	12.20	3.6	73.19	1.6
12	V67-V72	2	0.60	12.20	3.6	73.19	1.6
13	V73-V78	2	0.60	12.20	3.6	73.19	1.6
14	V79-V84	2	0.60	12.20	3.6	73.19	1.6
Total				**170.77**	**50.00**	**1024.59**	**21.9**

The operational schedule alternate day irrigation is as below:

Operational Schedule - 50 Ha Module - Alternate Day Irrigation								
		Valve				Shift		
Day	Shift No	No	Valve Size	Valve Area (Ha)	Valve Flow (m³/hr)	Shift Area (Ha)	Shift Flow (m³/hr)	Shift Duration (Hr)
1	1	V1-V6	2	0.60	12.20	3.6	73.19	3.2
	2	V7-V12	2	0.60	12.20	3.6	73.19	3.2
	3	V13-V18	2	0.60	12.20	3.6	73.19	3.2
	4	V19-V24	2	0.60	12.20	3.6	73.19	3.2
	5	V25-V30	2	0.60	12.20	3.6	73.19	3.2
	6	V31-V36	2	0.60	12.20	3.6	73.19	3.2
	7	V37-V42	2	0.60	12.20	3.6	73.19	3.2
Day 01 Total						**25.20**		**22.40**
2	8	V43-V48	2	0.60	12.20	3.6	73.19	3.2
	9	V49-V54	2	0.60	12.20	3.6	73.19	3.2
	10	V55-V60	2	0.60	12.20	3.6	73.19	3.2
	11	V61-V66	2	0.60	12.20	3.6	73.19	3.2
	12	V67-V72	2	0.60	12.20	3.6	73.19	3.2
	13	V73-V78	2	0.60	12.20	3.6	73.19	3.2
	14	V79-V84	2	0.60	12.20	3.6	73.19	3.2
Day 02 Total						**25.20**		**22.40**

7.4 Power Requirement for Operating the Drip System

(a) Power requirement for operating the drip system is worked out for the case of CBC with 1,07,265 ha ICA. The details are given below.

Power Requirement under CBC			
Total Area under CBC	**Total Area 107265 Ha**		
		Gravity Irrigation	**Low Head Pump Irrigation**
Approximate area (%)		61	39
Area (Ha)	a	65028	42237
No of shifts	b	8	8
Average shift area (Ha)	c = a/b	8128.5	5279.6
Application rate (mm/hr)	d	1.2	1.2
Average shift flow (m3/hr)	e = c*d*10	97542	63355.5
Approximate pumping head required to operate Drip system	f	0	0.25
Approximate pump HP (Overall pumping efficiency is considered as 80%)	g =((e/3.6) * f)/ (75*80%)	0	7332.8
Approximate power requirement (MW)	h = (g * 746 / 1000000)	0	5.47

(b) Power requirement for operating the drip system is worked out for the case of TBC with 84,900 Ha ICA. The details are given below.

Power Requirement under TBC			
Total Area under CBC	**Total Area 84,900 Ha**		
		Gravity Irrigation	**Low Head Pump Irrigation**
Approximate area (%)		61	39
Area (Ha)	a	51789	33111
No of shifts	b	8	8
Average shift area (Ha)	c = a/b	6473.625	4138.875
Application rate (mm/hr)	d	1.2	1.2
Average shift flow (m3/hr)	e = c*d*10	77683.5	49666.5
Approximate pumping head required to operate Drip system	f	0	0.25
Approximate pump HP (Overall pumping efficiency is considered as 80%)	g =((e/3.6) * f)/ (75*80%)	0	5748.4
Approximate power requirement (MW)	h = (g * 746 / 1000000)	0	4.29

(c) Power requirement for operating the drip system is worked out for the case of JBC with 13,200 Ha ICA. The details are given below.

Power Requirement under JBC			
Total Area under JBC	**Total Area 13200 Ha**		
		Gravity Irrigation	**Low Head Pump Irrigation**
Approximate area (%)		**61**	**39**
Area (Ha)	a	8052	5148
No of shifts	b	8	8
Average shift area (Ha)	c = a/b	1006.5	643.5
Application rate (mm/hr)	d	1.2	1.2
Average shift flow (m3/hr)	e = c*d*10	12078	7722
Approximate pumping head required to operate Drip system	f	0	0.25
Approximate pump HP (Overall pumping efficiency is considered as 80%)	g =((e/3.6) * f)/ (75*80%)	0	893.75
Approximate power requirement (MW)	h = (g * 746 / 1000000)	0	0.67

Thus total power requirement for operating the drip system for CBC, JBC & TBC is 5.47+4.29+0.67= **10.43 MW**

7.4.1 The other Aspect of Power Generation

Solar panels being laid at top of the canal. When the canal is covered over there is the additional benefit of saving huge quantities of water that would otherwise be lost from the irrigation canals through evaporation. The benefits gained through the installation of solar panels are

- The electricity is generated from renewable solar energy & hence it is clean.
- Since the canals are covered with solar panels, there will be no explicit need to acquire lands to install the solar project.
- The power generated will be supplied to villages along side of the canal, which will lead to lower transmission losses.

The Power requirement of the UBP is 242MW.Karnataka Government encourages Captive generation of power. Any organization or private company or individual can generate power in any part of the state and wheel it to the nearest substation. This generated energy will be recorded and set off against the utilized energy at the point of consumption. The detailed study of Power generation from Wind farm for Captive Consumption is discussed in UBP DPR (Chapter 11).

7.5 Water User's Association

Water user's association will be formed in the entire command area with area of about approximately 400 Ha or larger depending on District wise / villagewise / Distributary. The objects of farmer's organization shall promote & secure distribution of water among its users, adequate maintenance of the irrigation system, efficient & economical utilization of water to optimize agriculture production.

Functions of water user's association.

- Preparation of plan for the maintenance of irrigation system in the area of its operation at the end of each crop season and carry out the maintenance works of both distributary system and minor & field drains in its area of operation with the funds of the association from time to time & provide funds for the maintenance of staff including such persons who are placed by the state Government with the Water User's Association for the purpose of regulation & maintenance of irrigation system.
- To regulate the use of water among the various pipe outlet under its area of operation.
- To promote economy in the use of water allocated.
- To maintain a register of land holders as published by the revenue department.
- To prepare & maintain a register of co-opted members.
- To prepare & maintain an inventory of the irrigation system within the area of operation.
- To monitor flow of water for irrigation.
- To resolve the disputes, if any between the members & water users in its area of operation.
- To raise resources.
- To maintain accounts.
- To cause annual audit of its accounts.
- To assist in the conduct of elections to the managing committee.
- To maintain other records as may be prescribed.
- To abide by the decisions of the distributary & project committee.
- To conduct general body meetings as may be prepared.
- To conduct regular water budgeting and also to conduct periodical social audit, as may be prescribed.
- To encourage modernization of agriculture in its area of operation.

7.6 Experts Opinion Regarding Upper Bhadra Project

An expert opinion on adoption of drip irrigation was obtained, as suggested by TSC, from Dr. V. Praveen Rao, Director Water Technology Centre, ANGRAU wherein it is opined by the Director that -

- Modern Surface drip Irrigation system would be designed, installed and operate to achieve an overall Irrigation efficiency of 67.5% as compared to 51% under Conventional Surface Irrigation System.
- The Ragi crop considered in the cropping pattern is not recommended for irrigation by drip needs to be changed due its narrow spacing and. Hence it was advised to allocate this area by other profitable crop.
- Training and Capacity Building to enlighten the farmers about planting pattern and spacing to be adopted for different crops to improve productivity, etc.
- The Emitter flow rate of 0.6L/hour and 24 hours operational hours per day seem to be unrealistic & it is suggested that an emitter flow rate of at least 1 L/hour may be used in order to reduce the irrigation duration and total operational hours per day from 24 hours.
- A massive Irrigation system network can be practicable and feasible only when automation is integrated into the drip irrigation system. Hence the automation component as considered under Ramtal Drip Irrigation System may be considered for inclusion in the project as well.
- Adoption of Drip system by three methods Viz., Solar, Electric and Gravity and the detailed cost be worked out for 10% of the sample area under each of the canals and can be extrapolated to the entire project area.

Further, as per suggestion of ERC, to address the apprehensions of adopting drip irrigation opinion is also sought from another expert in this field, Sri K. Yella Reddy Director (Agriculture and Research), WALMATRI, Hyderabad vide CE office letter no: 1307 dated: 01/09/2013 to furnish his comments regarding the aspect of design, cost, execution, implementation, operation and Maintenance of this mega lift irrigation project.

Sri K. Yella Reddy, Director (Agriculture & Research) WALMATRI Hyderabad regarding Upper Bhadra Project has mainly opined that -

- It has been remarked that this is very unique project where the water head available due to elevation difference is considered as pressure head for operation of Micro Irrigation System. It is proposed to extend micro irrigation to the presently grown field crops and has followed same crops even after advent of Micro Irrigation which does not justify investment of Rs. 5.47 lakhs per ha, on creation of infrastructure for providing advanced method of irrigation.
- Efforts may be made on Institutional arrangement and Infrastructure requirement for crop selection (considering Soil type, Climatic conditions which suite Micro Irrigation System), storage of produce, processing, value addition and marketing tie-ups required for maximizing the benefits to farmers.
- Select few important crops suited to MI systems based on the soil, climate and workout cost of cultivation and net returns expected.
- Give option to farmer to choose from the recommended cropping systems, also ensure cluster approach with participatory approach. (Ex. In particular area based on suitability large scale promotion of vegetables like tomato, onion etc can be tried).
- Active participation of all agencies and all public representatives along with technical experts is necessary to train and motivate farmers. The participatory approach need to be ensured with the active involvement of Farmers, Government agencies, Universities and Research stations and Private partners, entrepreneurs.
- Monitoring and Evaluation through reputed third party agencies shall be included.

7.6.1 Adoption of Expert's Suggestion in UBP - DPR

Accordingly, as per the advice of the director **Dr. V. Praveen Rao**, provisions have been made for automation as per Ramtal LIS (under KBJNL) in Drip Irrigation. Further the energy required for this project has been proposed to be developed by non-conventional source- Wind for which a provision of Rs.1500 Cr has been made. Solar proposal will be explored as per site conditions duly consulting experts. The Ragi crop as suggested is already replaced by Jowar and the water requirements have been calculated in the present DPR.

In order to enhance the returns and to justify investment, as suggested by the director **Sri K. Yella Reddy**, during implementation of the scheme it is proposed to give option to farmers to select crop of their choice from a list of selected crops which suit the dripper line spacing and crop water requirement will be short listed in consultation with experts of concerned department. Further, active participation of all agencies along with technical experts to train and motivate farmers in adopting drip irrigation will be considered. The actual modalities of implementing will be finalized during execution of work.

Provision has been made towards cost of **Training & Capacity Building**, as suggested by experts for adoption of Drip Irrigation System (Discussed in Chapter Irrigation Planning & Cost of Training & Capacity Building is included in sub head O-miscellaneous of the estimate) and (IMSD) **Integrated Mission for Sustainable Development** (Discussed in Chapter Irrigation Planning & Cost of IMSD is included in sub head X-environment & Ecology of the estimate), as suggested in Expert Committee report under Chapter 7 point(xii).

7.7 Estimate Review Committee (ERC) Comments

- For Operation of drip system, as power is required for 24hrs, it is necessary that dedicated power supply has to be ensured to the pumping units along the main canal. Provision towards power supply arrangement to be made in DPR.
- The BC ratio worked out is 1.11. It is necessary that all the benefit accruing out of the project are properly assessed & Considered in the BC ratio calculations. Here, yield of crops due to drip Irrigation and rates of food grains are important. This requires to be again reviewed & confirmed.
- The maintenance of the drip system during the Khariff season when the network is operational & during the non-monsoon season when the network is not operational are to addressed & a report be included in the DPR.

7.7.1 Adoption of ERC Comments in UBP DPR

- Provision of 10 Lakhs is made towards power supply arrangement for working out Cost / Ha for construction of distributary network using Low Pressure drip irrigation system.
- BC ratio is calculated considering the yield per hectare under rainfed & irrigation conditions & rates for various crops grown in the command are based on the present market rate obtained from the wed site of http://krishimaratavahini.kar.nic.in/department.aspx. The Benefit cost ratio works out to 1.158. As suggested by Dr Yella Reddy, during implementation of the scheme it is proposed to take-up the commercial crops which suit the dripper line spacing and crop water requirement and details of crops suitable will be short listed in consultation with the experts and option will be given to farmers to grow any crops among short listed crops. This will further help in increasing the Benefit Cost ratio of the project.
- Maintenance of Drip Irrigation

  Maintenance is carried out during a period of non-use to prepare the system.

  (a) For the off-season shut-down.

  (b) For use before the next season.

  (a) Maintenance for the off-season period

  - Drain all the water from pump and connecting pipelines.
  - Remove suction lines & store them wherever possible.
  - Cover shaft & any exposed metal & all oil or grease lubricated bearings with protective lubricant.
  - Loosen 'V' belt or flat belt drive & insert piece of greaseproof paper between belts & pulley.
  - Clean debris & any other material from impeller & volute.

- Run the engine to thoroughly warm up oil in the crankcase, stop engine & drain crankcase oil, replace drain plug & refill crankcase with high-grade engine oil, start engine & run slowly for two minutes for complete oil distribution on all surfaces.
- Stop engine, remove all spark plugs, and pour 60ml of engine oil into each spark plug hole, with ignition switch off, crank engine for several revolutions to distribute oil over the cylinder walls & valve mechanism, replace spark plugs.
- Drain oil from crankcase, drain cooling system & close drain cocks, drain all fuel from tank, lines & carburetor bowl, replace all plugs & close drain cock.
- Lubricate all accessories & seal all openings airtight, including air cleaner inlet, exhaust outlet & crankcase breather tube with weatherproof masking tape.
- Check oil filler cap, gas tank & radiant cap.
- Spray all accessories & electrical equipment with suitable insulating compound.
- Insert a strip of greaseproof paper under the ‘v’ belt pulley.
- Remove battery & store fully charged.
- Cover the engine with waterproof material.
- All the bearings are to be well lubricated.
- Cover motor to protect against rodents, insects & dust.
- Lock the control box in ‘off’ position & cover with a canvas where exposed in the open to protect against moisture & dust.

(b) Maintenance for the use before the next period

- Clean & install trash screen properly.
- Ensure foot valve on suction line of horizontal centrifugal pumps operates properly.
- Install suction line of horizontal pumps & or vertical turbine pumps and / or check they are adequately submerged, check impeller adjustment of deep-well vertical turbine pumps.
- Clean all passages for liquid.
- Tighten packing gland to proper setting.
- Replace bearing oil or lubricant bearings with grease.
- Ensure pump shaft turns freely without noticeable dragging.
- Start pump & check for normal operation.
- Remove all tape from sealed openings.
- Open fuel tank valve, shut water drain cocks & add coolant.
- Check oil drain plug, replace oil filter & add correct amount of oil to engine.
- Remove spark plugs & spray cylinder walls with light engine oil.
- Replace spark plugs & crank engine several revolutions by hand to spread oil on cylinder walls.
- Lubricate all engine accessories.
- Where a distributor is used, clean inside & outside of cap, inspect cap & rotor for cracks, lubricate distributor sparingly with suitable lubricant, where a magneto is used, inspect breaker points for wear & gap and lubricate rotor.
- Where oil bath air cleaner is used, clean & fill with correct grade oil.
- Check all terminals & electrical connections.
- Start engine, run slowly for a few minutes, monitor oil pressure, it is fails to come up to correct reading, stop engine & investigate cause.
- Check oil level in crankcase & bring level up to proper mark on dipstick.
- Clean all debris is accumulated during the storage period.
- Change motor bearing oil with special type of lubricant, do not overfill, use grease gun to lubricate bearings.

- Change oil in reduced voltage starters.
- Check whether motor ventilation vents are open, clean dust & dirt from all moving parts of motor & panel.
- Check & tighten all electrical connections, replace overheated connections with new material, test all coils & heaters for continuity & shorts, clean all magnet surfaces, check for spare fuses of proper size, ensure all conduits or shielded cables are in good condition, check all conduct points are correction free.
- Ensure service cabinet interior is moisture free.
- Operate all moving parts by hand before applying power.

(b) EXPERTS OPINION ON DRIP IRRIGATION

Dr K YELLA REDDY, FIE
[illegible]
Director (Agri. & Research)
WALAMTARI, Hyderabad

EXPERT CERTIFICATE

The Detailed Project Reports (DPR) of Upper Bhadra Project of Karnataka Neeravari Nigam Limited [illegible] Visvesvaraya Jala Nigam Limited (VJNL) containing [illegible] Execution/Implementation and O&M was examined thoroughly by me as desired by the Chief Engineer, VJNL, Upper Bhadra Project Zone, Chitradurga vide [illegible] CE/CD/VJNL/UBP/2/TA-3/TS-10/UBP-DPR/ [illegible] dated 18th December 2014. The project envisages bringing [illegible] ha under Drip Irrigation in [illegible] Scheme.

General Observations:

1. It is very unique project where [illegible] difference is considered as pressure head for operation of Micro Irrigation System.
2. Wind [illegible] development of [illegible] MW at the cost of Rs [illegible] crores to meet the energy requirement of the project, [illegible] towards sustainability.
3. The Inline lateral spacing suggested [illegible] suggested/ [illegible] plant spacing.
4. It is mentioned as Low Pressure Drip [illegible] be called as Drip Irrigation System [illegible] available for operation.
5. Abstract statement of [illegible] in page 322 of Vol II. It is better to [illegible] various components [illegible]
6. In the same table under Part [illegible] of Lift scheme, maintenance of drip [illegible] scope of each service [illegible] with agencies.
7. Similarly the scope of [illegible] defined.

Critical Observations:

1. The proposal [illegible] field crops. It was suggested to follow [illegible] does not justify investment of Rs [illegible] for providing advanced method of [illegible] cropping pattern.
2. Table 19.3 (page 324 Vol II) presents [illegible] and Benefit Cost Ratio as 1.11. This [illegible] such MI project. The major [illegible] from the crops suggested. Some of the [illegible] jowar, groundnut are rain fed or ID crops [illegible] too expensive.

3. The project reports vol I and II covers detailed designs and engineering of various components including canal network, structures, MI systems etc. But very little effort was gone on institutional arrangement, infrastructure required for crop selection, storage of produce, processing, value addition and marketing etc. required for maximizing the benefits to farmers.

Suggestions:

Focused approach is required to maximize the net returns from the project area. It is suggested to

1. Select few important crops suited to MI systems based on the soil, climate and workout cost of cultivation and net returns expected.
2. Give option to farmer to choose from the recommended cropping systems, also ensure cluster approach with participatory approach, etc. In particular area based on suitability, [illegible] promotion of vegetables like tomato, onion etc can be tried.
3. With cluster approach, it becomes easy for transport, storage, processing and marketing.
4. Processing, value addition and marketing of farm produce need to be integrated with the project. For selected crops establishment of processing plants with the support of industry need to be established.
5. Participation of Departments of Agriculture, Horticulture, Marketing, Universities, KVKs, NGO with clearly defined roles and responsibilities is necessary. State level, project level, community level and WUA level integration is required.
6. Active participation of all agencies along with qualified experts is necessary to train and motivate farmers.
7. All public representatives need to be sensitized on the positive aspects of the projects and be involved.

General Recommendations:

1. All Micro Irrigation equipment shall be standard one and meet BIS requirements. Standards already established in APMIP and GGRC projects can be taken as Bench Mark.
2. Testing of all equipment for quality parameters need to be carried continuously with reputed agencies like CIPET.
3. Monitoring and Evaluation through reputed third party agencies shall be included.
4. The participatory approach need to be ensured with the active involvement of Farmers, Government agencies, Universities, R&D, Research stations and Private partners.

[illegible]
[illegible]
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Hyderabad-[illegible] A.P.

COMMENTS ON THE UPPER BHADRA PROJECT LPS DRIP IRRIGATION SCHEME IN CHIKAMAGLUR DISTRICT

By V. Praveen Rao, Director
Water Technology Centre, ANGRAU, Hyderabad

Sub: Introduction of LPS Drip Irrigation in Upper Bhadra Project, Chikamaglur district, Karnataka state – Comments furnished – Regarding

1. Nature of the project

Expert Comment: This Upper Bhadra Project Drip Irrigation scheme proposes to replace conventional surface flood irrigation systems characterized by low irrigation efficiency (approximately 50%) under Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal and Tarikere flow and lift canals with pressurized (pump and gravity pressure) surface drip irrigation system. The modern surface drip irrigation system would be designed, installed and operated to achieve an overall irrigation system efficiency of 81% as compared to 51% under conventional surface irrigation systems. A complete turnkey system will be installed, and for the following season, scheduled and monitored.

2. Scope of the project

Expert Comment: The scope of this project is to provide irrigation equipment materials for, install, schedule, and monitor turnkey drip irrigation systems. The specific material and installation requirements would be according to the climate, soil, crop and management requirements. Drip irrigation systems would require pumps (in field blocks where drip systems are installed near to the main canal) or gravity pressure (located away from the main canal, which generate sufficient head due to elevation difference) to operate the irrigation system, below ground pipelines, filtration & fertigation units, water meters, control & safety valves, above ground emitting pipes, fittings and other devices. The drip systems, once installed, will be set and checked at the beginning of irrigations to ensure that the systems are running at the maximum possible uniformity. Checking pressures at critical spots in the field will do this.

All irrigation systems would be scheduled for one season by a professional irrigation scheduler. All irrigation systems will be monitored for one season. All data, including weather conditions, water usage, power usage, problems, and benefits will be recorded and reported.

3. Objectives

Expert comments: The specific objectives of the project should be as follows:

a) To provide the grower with a tool, in the form of a new surface drip irrigation system, that is more efficient in water use and easier to manage than what he currently has, and to provide him with a professional irrigation scheduling and monitoring scheme for the envisaged maintenance period that will show the maximum potential of the system.

b) To spread the available water supplies over a large area through water savings achieved by adoption of efficient surface drip irrigation system for irrigating crops.

c) To enhance water productivity and total agricultural production in the Chikamagalur, Chitradurga and Tumkur Districts of Karnataka.

4. Location of the project

As per the DPR geographically the Upper Bhadra (Sceme A and B) Drip Irrigation Project site includes the command area under Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal and Tarikere flow and lift Canals in Chikamagalur, Chitradurga and Tumkur Districts (Latitude - 13°18' N, Longitude - 76°28' E).

5. Water source – Availability and Area coverage

The details provided and based on the clarifications received from the Engineers indicated that the water allocation is 21.5 TMC for Chitradurga branch canal which includes 15.9 TMC for irrigation and 5.6 TMC for drinking water. An additional allocation of 1.86 TMC is made for Upper Bhadra Project totaling to 23.36 TMC. It is proposed to divert 5.6 TMC to Tumkur Branch Canal because of Yettinhole project which meets the drinking water needs.

Expert comments: As per the report and clarifications from the Engineers it was apparent that the assumed irrigation application efficiency adopting conventional surface flood irrigation was equivalent to 50%. Likewise when the surface flood irrigation is replaced with drip irrigation the assumed irrigation application efficiency was 81%. However, the conveyance efficiency of the main canal was not given in the report, based on which it would have been possible to work out the overall project efficiency. Considering these efficiencies the actual water required to irrigate 213878 ha under Chitradurga Branch Canal (107265ha), Tumkur Branch Canal (84900), Jagalur Branch Canal (13200 ha) and Tarikere few and lift canals (8513 ha) was estimated at 30.3 TMC under surface flood and 18.5 TMC under drip irrigation methods.

Table 1. Water allocation and water demand under conventional flood and drip irrigation system

[illegible]	[illegible]	[illegible]	
		Flood (Ep = 50%)	Drip (Ep = 81%)
Chitradurga Branch canal	107265	15.20	9.38
Tumkur branch canal	84900	12.00	7.40
Jagalur branch canal	13200	1.90	1.17
Tarikere canal	8513	1.20	0.74
Total water required	213878	30.30	18.69
Total water available including drinking purpose		23.36	
Ep = irrigation system efficiency			

Since the water available for irrigation of crops is only 18.50 TMC (total available 23.36 TMC - 4.86 TMC tank filling = 18.50 TMC), it would not be possible to satisfy the crop water requirements of crops raised on 213878 ha by adopting conventional surface method of irrigation. Therefore, the proposal of KNNL to adopt modern irrigation system like drip having higher field application efficiency (of 81%) seems appropriate. Further, when using drip system for irrigation of crops, the water required for irrigating 213878 ha worked out to be 18.69 TMC only. Therefore, it would be the responsibility of the KNNL to ensure 18.69 (≈18.5 TMC) from the available 23.36 TMC for irrigation of crops for successful implementation of the proposed drip irrigation project on 213878 ha.

6. Cropping pattern

As per the DPR it was apparent that the cropping pattern considered was based on the existing crops that are being already grown by the farmers in the project area. Thus the crops proposed under the project mainly included maize, groundnut, ragi, sunflower and pulses viz., greengram, red gram, bengal gram etc.

Expert comments: These are mostly subsistence crops with low monetary returns. Further among these crops – maize has a row spacing between 0.6 to 0.75 m; groundnut, sunflower, green gram and bengal gram between 0.3 to 0.45 m and ragi 0.2 – 0.3 m. Except maize and groundnut for the above crops the empirical evidence concerning use of drip irrigation is very meagre and confined to only experimental plots. Further when drip system is used for irrigating groundnut, green gram & bengal gram the dripperline spacing recommended is ≤ 0.75m, which would significantly enhance the project cost and economic viability becomes questionable. Therefore, in the proposed project the dripperline spacing adopted is 1.2 m. In view of this efforts should be made during training & capacity building to enlighten the farmers about the planting pattern and spacing to be adopted for different crops when using 1.2 m dripperline spacing. The ragi crop due to its very narrow spacing (< 0.2 m) is not recommended for irrigation by drip. Hence, the area allocated for this crop in the proposed drip project may be considered for coverage by other profitable crops. Further, it is suggested that drought tolerant crops such as castor, soybean, sesamum, guar (clusterbean for gum), vegetables etc may be included in the proposed cropping pattern duly considering climatic conditions and their adaptability to improve water productivity, farm profits and make the project economically viable.

7. Climatic data & Crop water requirements

Crop water requirements (ETc) (daily, monthly, total season and peak rates) are one of the most important pieces of information both for the designing of drip irrigation systems and for scheduling irrigations to crops. ETc was shown to have been calculated from climatic data which include – rainfall, ambient temperature, relative humidity, solar radiation and wind velocity. In the present project the rainfall data was sourced from Department of Agriculture, Government of Karnataka (URL: raitamitra.kar.nic.in/agriprofile/rainfall.htm). Whereas, the reference crop evapotranspiration (ETo) was downloaded from the FAO Software viz., New_locClim – an abbreviation for "Local Climate Estimator" (URL: www.fao.org/nr/climpag/pub/en3) for Chitradurga and Tumkur district. The crop coefficients (Kc) values corresponding to different crop developmental phases were sourced from FAO Publication viz., Crop Water Requirements - Guidelines for computing crop water requirements – Irrigation & Drainage Paper No. 56 (Allen et.al., 1998). The crop water requirements were calculated as follows:

a) The crop water requirements (ETc) for each crop including biennial crops was calculated on daily basis, fortnightly, monthly, total season and finally for the design area by following standard procedures as outlined by FAO group of scientists. These calculations included estimation of reference crop evapotranspiration (ETo) and calculation of ETc by using crop coefficients as follows:

$$ETc\ (mm/day) = (ETo \times Kc)$$

b) The effective rainfall was assumed equal to 70% of the total rainfall received as outlined by Dastane (1978) in FAO Irrigation & Drainage Paper No. 25 on fortnightly, monthly and on seasonal basis.

c) The net Irrigation requirements were then arrived at by deducting the effective rainfall from the net crop water requirements as follows:

$$NIR\ (mm/period) = ETc - Effective\ Rainfall$$

Whereas, the groundwater contribution and stored soil moisture was assumed to be nil.

d) The gross irrigation requirements were computed by considering the field overall application efficiency (Ep) of 81% as follows:

$$GIR\ (mm/period) = \frac{NIR}{Ep}$$

e) Based on the above, the total water required to irrigate the given design area of 213878 ha were arrived.

f) Likewise the peak water requirements (i.e., highest daily water use rate during the few days of the highest ETc of the season) of 3.2 mm/day (In some places it is given as 3.8 mm – kindly it may be verified) was arrived at and used for designing the drip irrigation system in the proposed scheme.

Expert comments: The calculation of crop water requirements were appeared to be based on standard procedures suggested by FAO Group of scientists.

8. Designing process

The design of an irrigation system is the process of determining the system elements (source, energy, pipe) and its operation for each of the system components (units and sub-units. In practice, the design is an interactive one and each step in the process affects others. The design process is therefore one of the iteration back and forth between each of the different steps. Notwithstanding the above, the design process can be defined in a logical sequence of successive steps as detailed below followed in the present project:

Expert Comments on design:

8.1 **Selection of an irrigation method:** The selected irrigation method of surface drip irrigation system is appropriate for the project keeping in view the elements such as scarce water resources, unlimited land, row crops grown and method performance under field conditions.

8.2 **Selection of dripline/Emitting pipe:** The emitting pipe/dripline selected for Upper Bhadra Drip Irrigation Project was integral dripline with pressure compensation mechanism having 16 mm OD with a dripline spacing of 1.2 m. The flow-rate of compensating emitters remains uniform provided the pressure in dripper's inlet is kept above a given minimum threshold.

8.3 **System capacity:** Perusal of the irrigation system data in the concept note revealed that the system was designed with due consideration of computed peak irrigation water requirements of 3.2 mm/day.

8.4 **Emitter discharge rate:** The emitter flow rates are mainly determined based on infiltration rates, soil water holding capacity, crop type and peak crop water requirement. The emitter discharge rate selected should not create runoff with in the immediate application area. In the present Upper Bhadra Drip Irrigation Project the emitter discharge rate considered was 0.6 L/hour. The lower emitter flow rate 0.6 L/hour would increase the operational time to 24 per day. Therefore, it is recommended that dripper flow rates between 1.0 to 3.0 L/hour may be recommended with due consideration of soil texture in the project design area.

8.5 **Number and Spacing of emitters:** In the present Upper Bhadra Drip Irrigation Project the emitter spacing adopted in the design process was a fixed 0.4 m. However, keeping the dripline spacing of 1.2 m static an emitter spacing varying from 0.4 m to 0.6 m may be considered with due consideration of crop type and soil and water holding properties prevailing in the project design area.

8.6 **Application rate of proposed drip irrigation model:** As per the DPRs it was observed that the Application Rate (AR) of proposed drip irrigation model was computed considering the dripline spacing (1.2 m), emitter spacing (0.4 m) and emitter flow rate (0.6 L/hour). The emitter flow rate of 0.6 L/hour and 24 hours operational hours per day seem to be a bit unrealistic. Hence, it is suggested that an emitter flow rate of atleast 1.0 L/hour may be used in order to reduce the irrigation duration and total operational hours per day from 24 hours as follows:

$$AR = \frac{Dripper\ Flow\ rate\ (L/hour)}{[(Dripline\ spacing\ (m)) \times Dripper\ Spacing\ (m)]} = \frac{1.0}{(1.2 \times 0.4)} = 2.08\ mm/hr$$

Thus, to satisfy the peak irrigation requirements of 3.2 mm/day the irrigation duration considering an AR = 1.25 mm/day, works out to 1.56 hours and the total operational hours per day of 22.0 hours approximately as shown below:

Emitter specifications and irrigation data

Total area under Chitradurga Branch Canal	107265.0 ha
No of zones	11.0
Average area under each zone	9751.4 ha
No of sub-zones under each zone	20.0
Average area under each sub-zone	487.6 ha
No of blocks under each sub-zone	10.0
Area under each block	48.8 ha

Emitter Discharge	1.0 L/hour
Emitter spacing	0.4 m
Lateral spacing	1.22 m.
Application rate	2.05 mm/hour
Peak CWR	3.2 mm/day
Shift duration	1.56 hours
No of shifts/day	14
Total operational hours/day	21.85
Average shift area under each block	3.57 ha
Average shift flow under each block	73.2 m³/hour

9. **Automation:** Such a massive irrigation system network can be practicable and feasible only when automation is integrated in to the drip irrigation system. Hence, the automation component as considered under Ramthal Drip Irrigation Project may be considered for inclusion in the present project proposal as well.
10. **Training & Capacity building:** Drip irrigation of crops is a modern approach of growing crops. The concept behind Upper Bhadra Drip Irrigation Project is not merely to provide an efficient drip irrigation system but also to add value to this infrastructure by training and capacity building of stake holders/end users as well as agriculture extension personnel before and after grounding the scheme through both theoretical & practical training sessions on agronomic protocols of crops grown in the project area, supply of publication of technical and agronomic manuals, field visits by experts, multimedia presentations etc concerning technical and agronomic aspects of drip technology must be considered in the project implementation programmes so that the breakthrough in both the quantity and quality of agricultural yield is sustainable and can be made widespread across all the command areas under various irrigation projects across Karnataka.
11. **Drip irrigation system:** Keeping in view the canal command, land topography etc three versions of drip are suggested viz., drip system operated with pressure developed by a pump using electric power source and solar panel operated pump and drip system operated by gravity pressure taking in to account the elevation difference away from the canal distributory. The electric pump model is suggested for existing bore well having electricity connection in the command area. Exploiting the groundwater source in command area would promote conjunctive use of water, arrests waterlogging and salinity build up besides facilitating early planting of crops under delayed monsoon conditions. The solar power model is suggested for areas using canal water source

but without any electric power source and that do not provide enough elevation difference to run the gravity based drip system and which are nearer to the canal. The third model is suggested for command area located far away from the canal and provides enough elevation for operating the drip systems with gravity pressure. Further whatever may be the model for arriving at the total system costs the following guidelines are suggested:

a) Surveying of 10% of sample area under chitradurga, Tumkur, Jagalur and Tarikere branch canals
b) Preparation of maps showing the details of surveyed area with clear demarcation of areas allotted to the suggested three models under a given distributory/canal
c) Calculation of costs per ha basis and for the total sample surveyed area for the suggested models. Thereafter it can be extrapolated to the entire project design area.
d) Break of costs per as follows:
    - Block size considered for each model
    - Cost of drip system for each model per ha and per block (not individual components of drip but total system cost).
    - Cost of solar power infrastructure for solar power model. This would be required for tapping the solar power subsidy.
    - Cost of infrastructure to bring the water from canal to the point of application i.e., drip control head-unit for all the all the three models
    - O & M costs for 5-years
    - Details of pumps suggested in case of solar power and electric power model
    - Any other relevant costs

After arriving of all the above costs for the sample surveyed area for the three models suggested (as per their applicability under a given branch canal) the total budget for project design area can be estimated for calculating the BC ratio and other benefits.

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INTRODUCTION OF MODERN LPS DRIP SYSTEM OF IRRIGATION IN UPPER BHADRA IRRIGATION PROJECT, KARNATAKA

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Keywords

Water use efficiency, LPS drip, module, drought prone, Pressurized Irrigation Network System (PINS)

Synopsis

Upper Bhadra Project is a major lift irrigation Scheme under implementation in the central region of Karnataka State by Karnataka Neeravari Nigam Limited, a Government of Karnataka undertaking. It involves lifting of water by about 130 m from June to October from the rivers of Tunga and Bhadra in Tungabhadra sub-basin of Krishna basin and is planned to supply water for irrigation to an area of over 2 lakh hectares in drought-prone districts of Chikmagalur, Chitradurga, Tumkur and Davangere.

The Project was started in the year 2008 with the primary objective of providing irrigation facilities. The other objectives of the project are drinking water supply and groundwater recharge by filling up tanks within the command. With the changing trends in the methods of application of water from the conventional open canal system to sprinkler/drip, water use efficiency has become a prime area of concern. With the surface irrigation system where the entire canal system is open canal system, the overall efficiency was arrived at as 50 % in the project planning. Due to the long pending demand of farmers of Tumkur district which is adjacent to Chitradurga district, it became imperative to consider alternative to surface irrigation where the loss of water in the conveyance system is high. In order to improve the water use efficiency significantly to meet the demands for irrigation to additional area, it is now planned to adopt drip irrigation in the entire command area. This will be the first such attempt of its kind in Karnataka State where such a large area of 2.14 lakh hectares in an irrigation project is planned to be brought under drip irrigation. Its success has immense significance not only to the State, but to the entire country.

The drip system is proposed to be run on Low Pressure System (LPS). Here, the main canal will be an open canal and the distribution system below the main canal will be piped system. The entire command area will be divided in to 50 ha modules which will be operated independently which means each module will be connected to the feeder line that draws water from the main canal. Electrical power required to run the pumps on LPS system in a part of the command area where pressure of 1 bar (10.2 m head) is not available and where pressure of more than 1 bar is available, the modules will be run on gravity system of drip not requiring electrical power. It is estimated that about 39 % of area can be irrigated requiring electrical power and the balance 61 % area can be irrigated by gravity flow. This has been possible due to excellent topography of the command area. The LPS drip design eliminates the need of constructing distributaries, laterals, minors and field channels thereby reducing the cost of land acquisition and the delays associated with land acquisition. The piping network is further connected to the modern micro irrigation system. This will ensure water use efficiency of 90% at the farm level. This also increases the overall efficiency of water use from 50% in the conventional open canal system to 85% in the drip irrigation system. This system will have all the advantages that micro-irrigation system offers over flood/furrow irrigation viz. water saving, labour saving, power saving, fertilizer savings, etc. and lesser operation and maintenance costs over open canals. Since the design eliminates the construction of open canals, the project can be completed within shorter span of time. This system operates like a Pressurized Irrigation Network System (PINS) and therefore adequate pressure is available in the pipelines for operation of low pressure micro-irrigation system at the outlets i.e. at the farm level. Further, this eliminates the need of creating electrical infrastructure for irrigation across the command area like in the case of sprinkler/high pressure drip irrigation. The centralized pumping system for each 50 ha module ensures easy operation of the system as flow of water through the network of pipes can be controlled from one place rather than from various locations. This also reduces O&M costs and cost of valves at various locations.

With the above system of LPS drip irrigation, it is feasible to irrigate an area of 214000 ha and fill up a large number of tanks in the command for groundwater recharge and drinking water supply. The work on the Project is commenced and substantial progress has been achieved in the execution of lifting arrangement and the conveyance system. The project is facing many challenges in its implementation which have been addressed appropriately so as to eventually commence irrigation by the year 2016 and complete the project by the year 2020. There are many challenges the project is facing in dealing with forest clearance, land acquisition and agitation by the farmers losing their lands for canals. Particularly, the farmers of the area where the tunnel passes through in Km 41 from Bhadra reservoir are apprehensive that the groundwater in the region will deplete due to tunnel effecting their agriculture which depended heavily on limited groundwater potential. All the issues related to their apprehensions have been addressed scientifically by conducting hydrogeological study along the tunnel alignment and taking appropriate measures to circumvent the difficulties the farmers are likely to face. Another important initiative is to extend irrigation by LPS system of drip above and in the region of tunnel so as to support agriculture over a large area of about 7500 ha. Other than the above, the project had to overcome many impediments in its implementation after entrustment of the three package works; two lifts and tunnel on EPC turn key contract basis such as delays in land acquisition, power sanction, forest clearance etc. Now, with substantial progress achieved over the last three years, the UBP is poised to become a flagship project of KNNL to benefit the farmers and the State in the years to come.

1. INTRODUCTION

1.1 Upper Bhadra Project (UBP) in the Central region of Karnataka was first mooted in the year 1969 envisaging the construction of storage dams across Bhadra river upstream of Bhadra dam near Magundi village in Chikmagalur district to provide irrigation facilities to drought prone districts; Chikmagalur, Chitradurga, Tumkur and Bellary. There were representations against this proposal by the people affected by the submergence of lands in Chikmagalur district and also by environmentalists who apprehended damage to the environment as the canal was running in Wildlife area.

Taking into consideration the above issues including the aspects of water availability and conveyance, the Scheme was modified with the following provisions;

i) lifting 15 TMC of water from Tunga river to Bhadra reservoir ;
ii) lifting of 21.5 TMC of water from Bhadra Reservoir to delivery chamber near Ajjampura ,
iii) construction of Ajjampur tunnel to deliver water to Chitradurga Branch Canal ,
iv) construction of Chitradurga Branch Canal (CBC) to irrigate 1,07,265 ha &
v) filling up of 156 Minor Irrigation tanks coming under drought prone areas of Chickmagalur, Chitradurga, Kolar & Tumkur districts for drinking water purposes.

1.2 A Detailed Project report with above provisions was prepared amounting to Rs. 5985 crores, comprising of Rs.3388 Crores towards irrigation component and Rs.2597 crores towards drinking water component. The type of irrigation envisaged was surface irrigation with open canal system right up to the field, with project efficiency of 50%.

1.3 Additional demands for irrigation

There were additional demands for increasing area under irrigation from other drought-prone districts, notably from Chikmagalur and Tumkur districts. Conceding the demands, an additional proposal for providing irrigation facility under Tumkur Branch Canal (TBC) under UBP and filling up of tanks was prepared which required additional infrastructure for lifting and conveyance of water. In view of compulsion to manage this additional area under TBC with available waters, it became imperative to explore possibility to irrigate areas in Tumkur district. In this regard, with a view to explore possibility of saving water under CBC with the use of modern technology such as drip irrigation and extend irrigation benefits to area under TBC, a solution suited to the local needs of the region maximizing water use efficiency with minimum use of electric power for operating the micro irrigation system at the farmers' field, using LPS^{TM} (Low Pressure System) has been envisaged.

2. IRRIGATION PLANNING

A proposal to provide water through TBC for irrigation to areas in Chikmagalur, Chitradurga and Tumkur districts has been prepared adopting LPS system of drip irrigation so that it would be possible to irrigate area under CBC and TBC by virtue of higher water use efficiency of 81 %. The salient features of the proposal are ;

- The main Canal will be constructed as open lined canal. The distribution of water below the main canal will be through a network of pipelines.
- It is proposed to install Main Pipelines and Pressurized Irrigation Network and then connect the same to the Drip Irrigation System, thereby increasing the Water Use Efficiency to 90 % in the project area.
- The pipe network carries water to individual Head Unit(s) (One Head Unit for 50 Ha drip modules) located at different places in the command Area. The pipe network will have control

valves near to the Head Unit to control the discharge rate of Water and to ON / OFF the system as per requirement.

- It is proposed to create a network of pipelines (GRP/PVC) instead of constructing distributaries, laterals, minors and field channels. The topography of the command area permits distribution of water by gravity where 1 bar of pressure is available as well as through low pressure drip irrigation system.

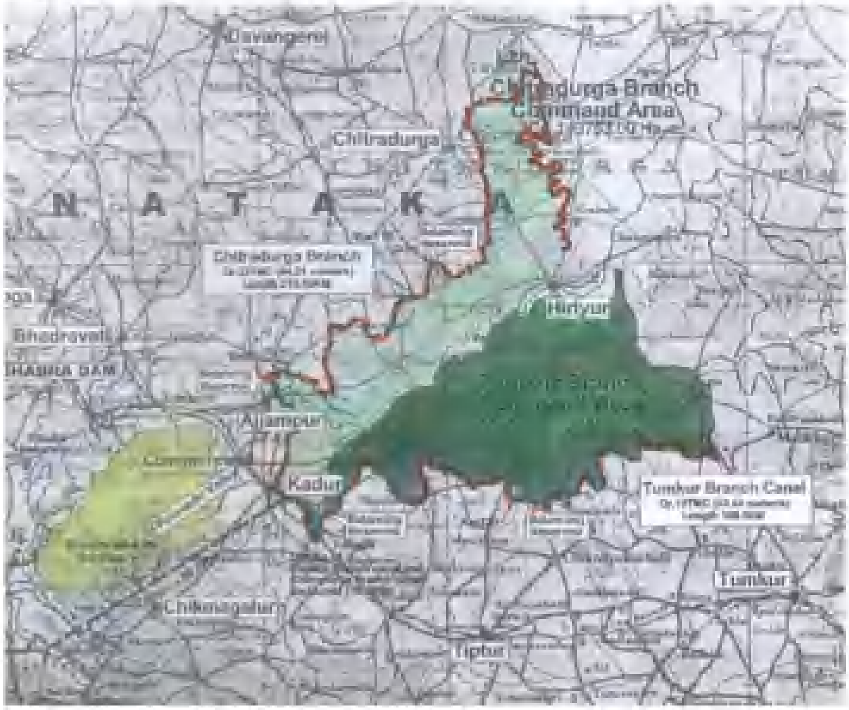

Fig 1 : Index map of project area

2.1 System efficiency under flood irrigation

The efficiencies considered with lined canals are;

Seepage and canal losses from Main Canal & Distributaires	-	15%
Operation losses	-	<u>10%</u>
Total losses		<u>25%</u>
With these losses, conveyance efficiency	–	75%
field channel efficiency	-	85%
field efficiency	-	80%

Irrigation efficiency = 0.75X0.85X0.80 = 0.50

2.2 System efficiency under drip irrigation

The combined efficiency with drip irrigation works out to 81%, as worked out below.

Seepage and canal losses from Main Canal	-	10%
Efficiency of the drip irrigation system below the main canal	-	90%

Irrigation efficiency = 0.90X0.90 = 0.81

Due to the increased efficiency of the system under drip irrigation over flood irrigation, it would be possible to provide irrigation under both CBC and TBC for an area of over 2,14,000 ha.

3. LPS SYSTEM OF DRIP IRRIGATION

3.1 Pressure piped irrigation systems

A pressure piped irrigation system is a network installation consisting of pipes, fittings and other devices properly designed and installed to supply water under pressure from the source of the water to the irrigable area. The basic differences between traditional surface irrigation and piped irrigation techniques are;

The flow regime: With traditional surface methods, the size of the stream/canal should be large, while in pressure piped irrigation systems very small flows, even 1 m^3/h, can be utilized.

- **The route direction of the flow:** With traditional surface methods the water is conveyed from the source and distributed to the field through open canals by gravity following the field contours. The piped system conveys and distributes water in closed pipes by pressure following the most convenient (shortest) route, regardless of slope and topography of the area.
- **The area irrigated simultaneously:** With traditional surface methods the water is applied in large volumes per unit of area, while piped irrigation systems distribute the water at small rates over a very large area.
- **The external energy (pressure) required:** Traditional surface gravity methods do not need external energy for operation, while piped irrigation systems require about 1-3 bar depending on site topography and type of emitter used, which is provided from a pumping unit or from a supply tank situated at a high point.

3.2 Network layout

The pipelines that convey and distribute water to the individual plots are buried, so as to protect from farming operations. Off-take hydrants, rising on the surface, are located at various spots according to the planned layout. With surface methods the irrigation water can be delivered directly to the open ditches feeding the furrows or the basins. In drip irrigation, the hydrants are coupled with smaller manifold feeder pipelines placed along the edges of the plots. These feed the lateral irrigating lines which are laid along the plant rows perpendicular to the manifolds. The laterals are equipped with water emitters at designed spaces and distribute uniformly the irrigation water to the plants under certain pressure.

In the piped system, the main component parts are:

- The control station (head control unit);
- The mains and sub-mains (pipelines);
- The manifolds (feeder pipelines);
- The laterals (irrigating pipelines) with the emitters.

Fig 2 General drip irrigation layout

Head control: This consists of a PVC supply line installed horizontally at a minimum height of 60 cm above ground. It is equipped with safety equipments like air release valve, a check valve, a shut-off valve between the two outlets and a filter. There are different types of filters like hydro cyclone filter, media/grave filter, screen filter; disc filter etc whose selection is depends on source and quality of water. Where a gravel filter or a hydro cyclone sand separator is needed, it is installed at the beginning of the unit complex.

Main pipeline: It is the largest diameter pipeline of the network, capable of conveying the flow of the system under favourable hydraulic conditions of flow velocity and friction losses. The pipes used are buried permanent assembly high density polyethylene (HDPE) ranging from 63 to 160 mm (2-6 in) depending on the area of the farm.

Sub mains: These are smaller diameter pipelines which extend from the main lines and to which the system flow is diverted for distribution to the various plots. The pipes are the same kind as the mains.

Emitting Manifolds: it consists of pipelines of a smaller diameter than the submains and is connected perpendicular to the submains which supplies water drop by drop to the root zone area of crop. They are of LDPE pipes in sizes of 12, 16, 20, 25, 32 mm.

Emitters: Emitter is a device fitted on an emitting pipe, is operated under pressure to discharge water by continuous drops (drippers).

These component parts replace the ones in the traditional surface systems, i.e. the distributaries, laterals, minors, field channels and the furrows in the plot.

Method of application of water

Drip irrigation by drippers / emitters: The water is delivered to the plants without being spread over the entire area but by being applied in low rates to a limited soil surface area around the plants. The water delivery method and the kind of the water emitter are the main characteristics of a piped irrigation system. They influence and specify the pressure, flow capacity of the system and duration of application.

The flow capacity of a system is the water flow (in cubic metres per hour or litres per second) designed to meet the irrigation requirements of the area at peak demand. It is inversely proportional to the duration of application. It is generally designed so as to economize on pipe size and other equipments. The duration of application is the time required for the completion of one irrigation cycle.

3.3 Broad design details

It is proposed to install Main Pipelines and Pressurized Irrigation Network and then connect the same to the Drip Irrigation System. The broad design details are given below:

1. Distribution design

The distribution design will have the following;

i.The distributaries will be converted in to main Pipelines.

ii.Water will be distributed through pipelines below the main canal.

iii. The pipe network carries water to individual Head Unit(s) (One Head Unit for 50 Ha Drip modules) located at different places in the command Area. The pipe network will have control Valves near to the Head Unit to control the discharge rate of water and to ON / OFF the system as per requirement.

2.Salient features

It is proposed to create a network of pipelines (GRP/PVC) below the level of main canal. Considering the topography at site, the entire project area can be operated by **GRAVITY** as well as through **LOW PRESSURE DRIP IRRIGATION SYSTEM** depending upon the availability of minimum pressure of 1 bar in the irrigation area for operation of LPS system. Where minimum pressure of 1 bar is available (10.2 m head of water), the LPS drip system will be operated under gravity without requiring power and where the required minimum pressure of 1 bar (10.2 m) is not available, the LPS system will be operated with power. The criteria followed in the drip design are,

i. Drip irrigation System is designed in multiple module of an average area of 50 Ha. For 50Ha module, one head unit is proposed. There should be continuous flow into the pipe network from the Main Canal to operate the Micro irrigation System on continuous basis.

ii. Centralized pumping from the pump house in each 50 Ha module will be operating under LPS.

Advantages:

- The centralized pumping system ensures easy operation of the system as flow of water through the network of pipes can be controlled from one place rather than from various locations.
- This also reduces O&M costs and cost of valves at various locations.

iii. The drip irrigation system is a permanent system. The mains and sub mains are installed underground and the field control valves above surface. Hence, there is no need for shifting of pipes and nozzles every day. The farmers need to only ON / OFF their respective field control valves on their need basis.

iv. The drip Irrigation system can be operated on daily or on alternate day basis. Considering the water requirement, climatic conditions, soil type, water holding capacity and crop growth stage, and the drip irrigation efficiency, provision is made in the design to irrigate the crop on daily or alternative day basis as per the requirement. Peak water requirement on daily basis works out to 3.2 mm per day.

v. Each 50Ha module is provided with secondary infield filtration with necessary safety equipments and control valves, mainlines, submains and emitting manifolds. The design process is common to all the zones of the command area of CHC. What will be varying is the design of main pipe line from the main canal which will feed water to each zone which in turn will either be gravity fed depending upon head available or under LPS system requiring little power. Drip Irrigation System will have suitable Filtration units, Mains, Sub-mains, Control Valves, Flush Valves, and Drip lines with Integral drippers/emitters. Due to variability of crops, common fertigation may not be possible, so fertigation equipments are suggested at field level.

vi. Irrigation scheduling of a sample block 50 ha is worked out and given below.

3. Advantages of LPS drip irrigation

1) This design eliminates the need of constructing distributaries, laterals, minors and filed channels thereby reducing the cost of land acquisition and the delays associated with land acquisition.
2) The piping network is further connected to the modern micro irrigation system. This will ensure water use efficiency of 90% at the farm level.
3) This also increases the overall efficiency of water use from 50% in the conventional open canal system to 81% in the drip irrigation system.
4) This system will have all the advantages that micro-irrigation system offers over flood/furrow irrigation viz. water saving, labour saving, power saving, fertilizer savings, etc.
5) Lesser operations and maintenance costs over open canals.
6) Since the design eliminates the construction of open canals, the project can be completed within a shorter span of time.
7) This system operates like a Pressurized Irrigation Network System (PINS) and therefore adequate pressure is available in the pipelines for Operation of LOW PRESSURE Micro-Irrigation system at the outlets at the farm level. This eliminates the need of creating electrical infrastructure for irrigation across the command area like in the case of sprinkler/high pressure drip irrigation.
8) The centralized pumping system ensures easy operation of the system as flow of water through the network of pipes can be controlled from one place rather than from various locations.
9) This also reduces O&M costs and cost of valves at various locations.

4. Drip modules

Block 1 under CBC which is having CCA of of 250 ha is considered for designing LPS drip system and its operation.

Location - Latitude - 13°45'30'

Longitude - 76° 3' 44.90"E

Fig 3 Block 1 of CBC

Fig 4 Block 1 of CBC google image

The Gross Command Area (GCA) under Block 1 of Chitradurga Branch Canal (CBC) is about 280 Ha, of which 90 % is considered as Cultural Command area (CCA). Total CCA of 250 Ha is designed with 5 zones of an average area of about 50 Ha.

Design Details

An abstract of irrigation data and operation schedule for 50 Ha zone is furnished below. The design considerations are explained subsequently.

i. Irrigation data

Crop		Mixed
System		Drip

Area (ha)	a	50.00
Emitter Emitter discharge (lph)	 b	DripNet Pressure Compensated (DNPC) 0.60
Emitter spacing (m)	c	0.40
Lateral spacing (m)	d	1.25
Application rate (AR) (mm/hr)	e = b/(c x d)	1.20
PWR (mm/day)	f	3.20
Shift duration (Hr)	g = f/e	2.67
No. of shifts/day	h	8.00
Actual operating hrs/day	i = g x h	21.36
Shift area (ha)	j = a / h	6.25
Shift flow (m3/hr)	k = j x e x 10	75.00
Water Source		Canal
Flow rate variation (%)		0.0

ii.Daily and alternate day irrigation

Drip irrigation system can be operated on daily or alternate day basis. There is no difference in system design except time of irrigation. Drip irrigation system design for daily irrigation holds good even for alternate day irrigation with change in time of irrigation. In alternate day irrigation, the crop water requirement of two days is to be satisfied. So, the irrigation time will also be double. E.g. for current design, it is suggested to have eight shifts with 2.67 Hr shift duration to satisfy crop water requirement of 3.2 mm* for daily irrigation. For same area, with alternate day irrigation, amount of water to be discharged will be 6.4 mm and so the time of irrigation will be 5.34 Hrs and maximum of 4 shifts/day. The operational schedule for both daily as well as alternate day irrigation is as below.

iii. Schedule of operation (see fig 5)

OPERATIONAL SCHEDULE FOR 50 Ha Module – Daily irrigation

Shift Valve No	Individual Valve					Shift	
	No.	No of valves	Area (Ha)	Flow (m3/hr)	Area (Ha)	Flow (m3/hr)	Duration (Hr)
		a	b	c = b x AR(1.2) x 10	a x b	a x c	As in irrigation data
S1	V1-V6	6	1.04	12.5	6.25	75	2.67
S2	V7-V12	6	1.04	12.5	6.25	75	2.67
S3	V13-V18	6	1.04	12.5	6.25	75	2.67
S4	NV19-V24	6	1.04	12.5	6.25	75	2.67
S5	V25-V30	6	1.04	12.5	6.25	75	2.67
S6	V31-V36	6	1.04	12.5	6.25	75	2.67
S7	V37-V42	6	1.04	12.5	6.25	75	2.67
S8	V43-V48	6	1.04	12.5	6.25	75	2.67
	Total				50		21.36

OPERATIONAL SCHEDULE FOR 50 Ha Module - alternate day irrigation								
Day	Shift Valve No	Individual Valve				Shift		
		No.	No of valves	Area (Ha)	Flow (m3/hr)	Area (Ha)	Flow (m3/hr)	Duration (Hr)
			a	b	c = b x AR(1.2) x 10	a x b	a x c	As in irrigation data
1	S1	V1-V6	6	1.04	12.5	6.25	75	5.34
	S2	V7-V12	6	1.04	12.5	6.25	75	5.34
	S3	V13-V18	6	1.04	12.5	6.25	75	5.34
	S4	NV19-V24	6	1.04	12.5	6.25	75	5.34
	Day one total					25		21.36
2	S5	V25-V30	6	1.04	12.5	6.25	75	5.34
	S6	V31-V36	6	1.04	12.5	6.25	75	5.34
	S7	V37-V42	6	1.04	12.5	6.25	75	5.34
	S8	V43-V48	6	1.04	12.5	6.25	75	5.34
	Day two total					25		21.36

iv.Crop water requirements

The approved cropping pattern for khariff season under the ICA of Chitradurga Branch Canal (1,07,265 Ha) comprises of sundry crops as shown below with 100% intensity of irrigation

Ground nut	-	45% of the ICA
Ragi	-	15% of the ICA
Maize	-	10% of the ICA
Pulses	-	10% of the ICA
Sunflower		20% of the ICA

The crop water requirements have been worked out as per Modified Penman method considering effective rainfall contribution, evapo-transpiration values and crop coefficients for surface irrigation method (overall efficiency 50%). Considering overall efficiency of 81% under drip irrigation, the fortnightly discharges and the quantum of water required under CBC are tabulated below. The Peak Water Requirement (PWR) for crops in project area is worked out as 5.2 mm.

v.Design of LPS drip system for Block 1 of CBC

From a contour map of the area, it is observed that enough elevation difference is not available in irrigation area to operate the Low Pressure Drip irrigation system. So, entire 250 ha area is designed with low head pump of about 50 HP power for operation. Block 1 is divided into 5 nos of zones with an average area of about 50 Ha. The size of each block is kept at about average 50 ha which will have separate head control unit i.e. secondary filters, pressure regulators, pressure relief valves, non return valves, air release cum vacuum release valves etc.

The Block 1 details are

Design details for Block 1		
a	GCA (Ha)	280
b	ICA (Ha) (GCA x 90%)	250
c	Application rate for selected emitter specifications (mm/hr)(as in irrigation data)	1.2
d	No. Of shifts/day (as in irrigation data)	8
e	Shift area (Ha) (b/d)	31.25
f	Shift flow (m3/hr) (e x c x 10 i.e. constant)	375
g	Shift flow (cumec) (f / 3600)	0.104

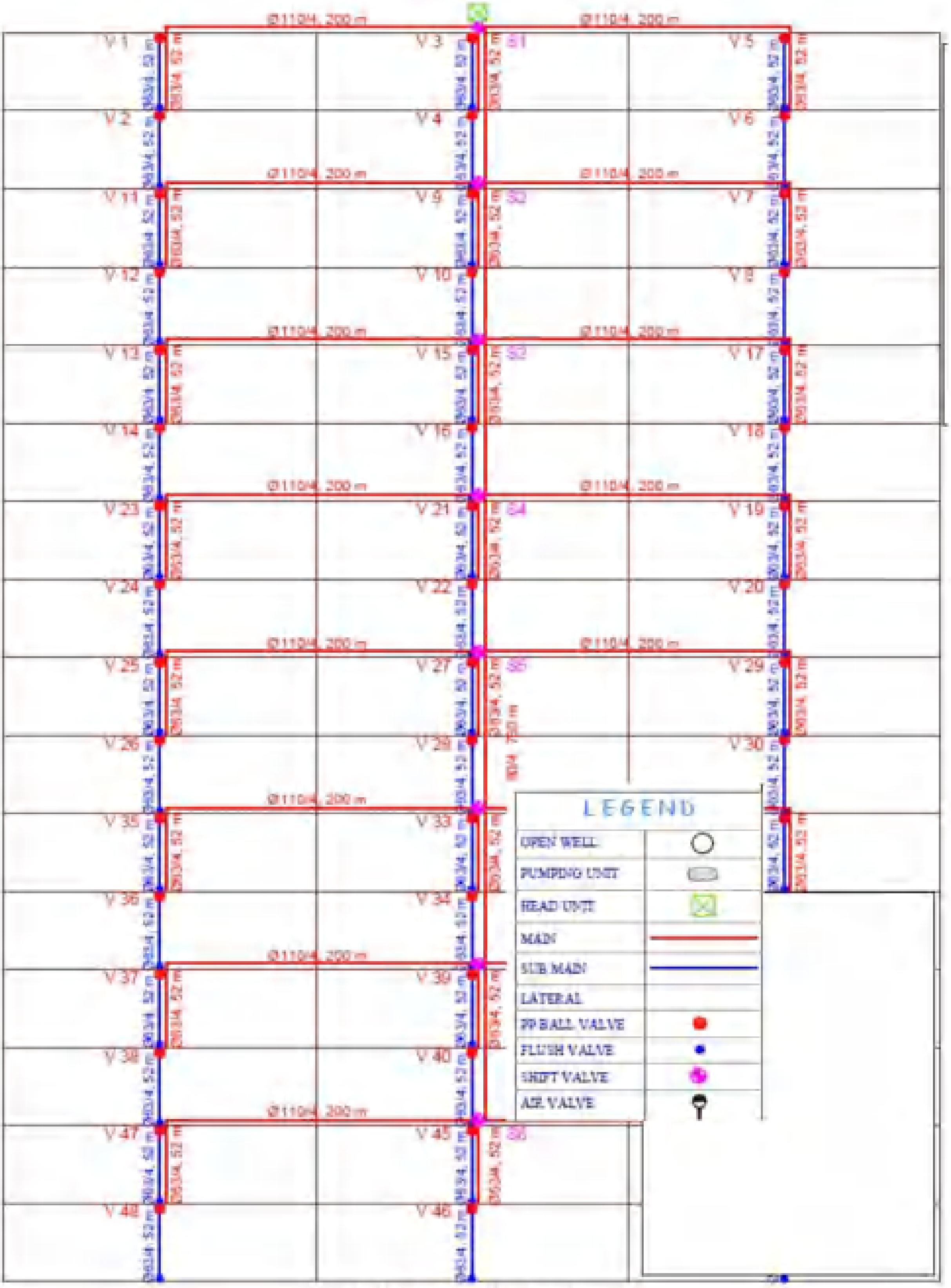

Fig 5 Drip module (50 ha)

vi.Power requirement

Power requirement for operating the drip system is worked out for the case of CBC with 1,07,265 ha ICA. The details are given below

Power requirement under CBC			
Total area under CBC		107265 ha	
		Gravity Irrigation	Low head pump irrigation
Approximate area (%)		61	39
Area (Ha)	a	65028	42237
No of shifts	b	8	8
Average shift area (Ha)	c = a/b	8128.5	5279.6
Application rate (mm/hr)	d	1.2	1.2
Average shift flow (m3/hr)	e = c*d*10	97542	63355.5
Approximate pumping head required to operate Drip system	f	0	25
Approximate pump HP (Overall pumping efficiency is considered as 80%)	g =((e/3.6) * f)/ (75*80%)	0	7332.8
Approximate power requirement (MW)	h = (g * 746 / 1000000)	0	5.47

4. TECHNICAL BACKING BY FAO

KNNL has been in the forefront in India in adopting modern technology and tools for effective management of its irrigation systems with the active backing of Food and Agriculture Organization (FAO) of United Nations (UN). KNNL has the experience in construction and management of large irrigation system (15) having a vast command area of about a million hectares. FAO has been backing KNNL efforts in improving the performance of the large irrigation systems through the MASSCOTE (Mapping SYstem and Services for Canal Operation Techniques) approach. The six training workshops that are held since 2006 in irrigation projects in Karnataka have built the technical capability of over 350 key staff of KNNL in adopting modern methods of irrigation such as sprinkler/drip and modern tools of management.

KNNL is implementing the UBP as an 'Integrated Water Resources Management' project given its combined objectives of meeting irrigation, drinking and urban water supply. KNNL looks at this project as a pioneering pilot project which will set a model not only for its new projects but also for other projects in the State and the Country. This project will therefore bring about the desired transformation and reforms in the management of water resources which will have National relevance.

5. STATUS OF PROJECT

The implementation of the UBP was taken up in the year 2008. The key components of the infrastructure viz. the lifting arrangements and tunnel that delivers water to Chitradurga Branch Canal and Tumkur Branch Canal are taken up and are in progress.The work of 6.9 km long tunnel near Ajjampura village in Tarikere taluk is a critical work that would convey water from Bhadra reservoir to CBC and TBC. The project had to face stiff resistance from the farmers of tunnel region who depended heavily on limited groundwater potential for supporting agriculture. Detailed hydrogeological study along tunnel alignment was conducted. From the study, it became clear that it would be possible to conserve and sustain groundwater in the tunnel region during and after construction by appropriate strategies which broadly include precautions to be taken during tunneling operations and augment limited groundwater reserves by providing additional surface water and by rainwater harvesting techniques/structures. Another important initiative is to extend irrigation by LPS system of drip above tunnel region to support agriculture over a large area of about 7500 ha.

Other than the above, the project had to overcome many impediments in its implementation after entrustment of the three package works; two lifts and tunnel on EPC turn key contract basis such as delays in land acquisition, power sanction, forest clearance etc. Now, with substantial progress achieved over the last three years, the UBP is poised to become a flagship project of KNNL and would benefit the farmers and the State in the years to come. Few photographs of works in progress are presented (Fig 6-9).

Fig 6: Raising main near Muttenkoppa (NR Pura Tq.) Fig 7: CC lining in canal (Km 20)

Fig 8 : Pump house near Shantipura (Tarikere Tq.)

Fig 9 : Jambadahalla aqueduct in km 17

6. CONCLUSION

The implementation of LPS drip system of irrigation in UBP is found to be feasible on a large scale to bring in an area of over 2.11 lakh hectares under irrigation with a very high project efficiency of 81% by virtue of advantages over conventional surface irrigation (efficiency 51%). In view of limited availability of water for irrigation, the only way to extend irrigation benefits under Tumkur Branch Canal is by effecting water savings under Chitradurga Branch Canal by adopting modern drip irrigation. There would be considerable savings in water, thereby increasing the water use efficiency from 50% to 81%. This is in line with the State Water Policy which promotes drip and sprinkler irrigation to improve water use efficiency. The initiative of drip system in UBP is also in line with the National Water Mission of the Ministry of Water Resources, Govt. of India which promotes the integrated management of water resources and increase water use efficiency by 20 %.

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UPPER BHADRA PROJECT

DESIGN NORMS FOR PLANNING

8.0 DESIGN NORMS FOR PLANNING

8.1 Irrigable Command Area under Upper Bhadra Project

Sl. No.	Particulars	Area(Ha)
1.	Tarikere Lift Irrigation Scheme	20150
2.	Chitradurga Branch Canal	107265
3.	Tumkur Branch Canal	84900
4.	Jagalur Branch Canal	13200
	Total Area	**2,25,515**

Proposed Cropping Pattern

Khariff semi dry

8.2 Classification of Canals

(a) Main Canal

(b) Branch Canal

8.3 Cross Section of Canals

Generally Trapezoidal section is adopted. Box sections are proposed for cross drainage works and Trough sections for aqueducts.

8.4 Proportion of Bed Width to Depth of Canal

For canal discharge above 30 cumecs B/D ratio = 1.0 to 3.50.

For canal discharge below 30 cumecs B/D ratio = 1.0 to 1.50.

8.5 Design of Canal

For calculating the velocity, Manning formula is used as under

$V=1/N \times R^{2/3} \times (S)^{1/2}$.

Where

R = Hydraulic mean depth in mtrs (a/p)
a = Area of flow in m^2
p = Wetted perimeter in m.
S = Canal Bed slope
N = Co-efficient of rugosity
V = Mean value of flow in m/sec.
Q = A x V Cumecs
Where Q = Discharge capacity in cumecs.
Rugosity Co-efficient N Value.

For	Lined Section	- 0.018
	Unlined Section	- 0.030 (Normal strata)
		- 0.035 (Rocky strata)

Note: Minimum section considered is 0.30m x 0.30m (B x D)

8.6 Criteria for Side Slopes

(a) **Cutting**

(i) Normal cutting

Water prism in HR	-	1:1	HR- Hard Rock
in AKS/ in SR/ in SRRB	-	1:1	SR- Soft Rock
in BC soil	-	1.50:1	SRRB-Soft Rock Requiring Blasting
			BC Soil - Black Cotton Soil
			KS- All Kinds of Soils

Above water prism: in HR	-	0.25:1
in AKS/SR/SRRB	-	1:1
in BC soil	-	1.50:1

(ii) In deep cut reaches

HR	-	0.25:1
SR, SRRB	-	0.5:1
AKS	-	1:1
B.C. Soil	-	1.50:1

(b) In Partial Banking / Full Banking

Inner n = 1.50
Outer n = 1.50

Note: Tentatively 1:1 slope is considered.

8.7 Normal Bed Gradient

(a) Chitradurga Branch canal - Gradient of 1:10000 at head is proposed, further the Bed gradient is changed to Steeper slope so that V_a is greater than 0.5 m/sec.

(b) Tumkur Branch canal - Gradient of 1:8000 at head is proposed, further the Bed gradient is changed to Steeper slope so that V_a is greater than 0.5 m/sec.

(c) Jagalur Branch canal - Gradient of 1:4000 at head is proposed, further the Bed gradient is changed to steeper slope so that V_a is greater than 0.5m/sec.

8.8 Free Board

Free Board in the canal is proposed as under

Sl. No.	Canal Carrying Capacity	Free Board in m
1.	30 cumecs and above	1.00
2.	Below 30 Cumecs upto 15 cumecs	0.75
3.	Below 15 Cumecs upto 3 cumecs	0.60
4.	Below 3 Cumecs upto 1 cumecs	0.50
5.	Below 1 Cumec upto 0.5 cumecs	0.45
6.	Below 0.50 cumecs	0.30

8.9 Head Loss for Structures

(i)	For cross regulators	-	5 cms
(ii)	For aqueducts / syphons	-	Depending upon the design Requirements/ site conditions
(iii)	Village road bridges / Super passages	-	2 cms.(When a pier is introduced in water prism or in box section)

8.10 Top Width of Canal Banks

(i) Main canal / Branch canals.

Service Road including Dowel Bund - 8.75m
Inspection Path including Dowel Bund - 6.75m.

8.11 Allowable Velocity in Canals

(a) Lined canals
(i) Main canal /Branch Canal - 0.6 to 1.5m/s.

8.12 Type of Lining

Type of lining is as follows.

(i) Main canal/Branch Canals having Bed Width x Full supply depth more than 1.20m x 1.20 m
(a) In situ concrete (M-15-20) paver lining for side slopes 1:1 & 1.5:1.
(b) In situ concrete (M-15&20) manual lining for side slopes 0.5:1 & 0.25:1.

(ii) Main canal/Branch Canals having Bed Width x Full supply depth less than 1.20 x 1.20 m
(a) In situ concrete (M-15&20) manual lining.

8.13 Thickness of Lining

For Main Canal and Branch Canals a uniform lining thickness of 10 cm is proposed.

8.14 Lining in Expansive Soils

Where ever canal alignment passes through BC soil reach a cohesive non swelling (CNS) lining is necessary below the CC lining in order to protect differential settlement and failure of CC lining due to cracks.

Thickness of CNS materials is related to swelling pressure and the resultant deformation.

Guidelines for choosing the thickness of CNS materials required for balancing the different swelling pressure as per IS: 9451:1994 are as under.

Table 1A Thickness of CNS Layer, Carrying Capacity Less Than 2 Cumecs

Discharge in Cumecs	Thickness of CNS Layer in Cm (Min)	
	Swell Pressure 50-150 KN/m^2	Swell Pressure More Than 150 KN /m^2
1.4 - 2	60	75
0.7 - 1.4	50	60
0.3 - 0.7	40	50
0.03 - 0.3	30	40

Table 1 B Thickness of CNS Layer, Carrying Capacity of 2 Cumecs and More	
Swell Pressure of Soil KN/m²	**Thickness of CNS Materials Cm (Min)**
50 to 150	75
150 to 300	85
300 to 500	100

For the field channels in full cutting reaches it is not necessary to provide CNS treatment behind lining, even if the channel is running in expansive soils.

8.15 Berms in Canal

Berms of 3 m at FSD + FBL and 1 m width are proposed in deep cuts for every 6 m depth. The bottom most berm will be at FBL

8.16 Side Drains

Side drain of size 0.30m x 0.30m is proposed in contour canal on IP side.

Side drain in ridge canal is proposed wherever necessary.

8.17 Diversion Works

Diversion of nalas/valleys are proposed to nearest C-D works if discharge of nala /valley is less than 1 cumec and length of diversion is within 300m.

8.18 Structures

8.18.1 Regulators

Cross regulators at every 15 Km along the main canal / branch canal are proposed. Cross regulators are located preferably before high embankment reaches, aqueducts and major offtakes and wherever bed gradient changes.

Regulators are proposed wherever distributary /direct outlet take off.

The design of the various components of the Regulators are based on the following codes I.S code No.456-2000, IRC code No.21-2000, IRC codes. IRC-21-2000, IRC-78-2000, IS 7784:2000, IS 7784:1993, IRC-SP-13.

Escapes - These are required for discharging the excess water out of the canal during periods of low demand in the command. They are generally provided upstream of cross regulators near a natural valley so as to release the water from the canal and avoid outflanking of the canal.

8.18.2 Bridges

Road Bridges are proposed as per MOST for all major Road crossings such as National Highway, State Highway and MDR. Village road bridges are proposed for metalled / mud road crossings, cart track crossings. Generally, the minimum distance between two adjacent Road / CT crossings is about 500 m.

All Road Bridges are designed for double lane traffic and the width of carriageway of the deck slab of the Road Bridge is 7.50 m. (except for National Highway - 4 & National Highway -13 crossing where carriage way proposed is 36 m for accommodating 8 lanes.) IRC class AA and class A loading is considered in the design of the deck slab. The over all width of deck slab is 8.600 m. with 0.550 m width kerb on both sides of the deck slab. Solid hand rails are proposed for a height of 0.860 m above the kerb. Approach slabs are proposed on both sides of the deck slab over levelling course. Wearing coat proposed is of concrete 7.5 cm thick over the deck slab with suitable slopes towards the kerb. Drainage spouts are proposed at both sides of deck slab for draining off the same. Provision for expansion joints is made at the junction of deck slab and dirt wall.

All Village Road Bridges are designed for single lane traffic and the width of carriageway of the deck slab of the VRB is 5.00 m. IRC class AA loading is considered in the design of the deck slab. The over all width of deck slab is 6.100 m with 0.550 m width kerb at both sides of the deck slab. Solid hand rails are proposed for a height of 0.860 m above the kerb. Approach slabs are proposed on both sides of the deck slab over which levelling course of concrete 7.5 cm thick wearing coat is proposed with suitable slopes towards the kerb. Drainage spouts are proposed at both sides of deck slab for draining of the same. Provision for expansion joints is made at the junction of deck slab and dirt wall.

The abutments will be resting on hard soil (SR/SRB). Abutment cap and dirt wall are proposed on top of the abutment.

Wing walls are proposed on both ends of the abutments. The abutments and wing walls are designed as retaining walls.

The design of the various components of the Bridges are based on the following IRC codes. IRC-5-2000, IRC-21-2000, IRC-78-2000.

Wherever there is variation in levels between the approach slab and Service Road/Inspection Path, ramps are proposed with suitable slopes.

All cross drainage works are designed to carry the high flood discharge of the nala computed from the catchment area of the nala at the crossing site. The high flood discharge is computed as per Ryve's formula taking Ryve's constant as 15. Different types of C-D works as per site conditions are detailed as below.

8.18.3 Cross Drainage Works

8.18.3.1 Super Passage

Where the nalas/valley crosses above the Canal i.e. bed level of nala is above water prism of the proposed feeder canal super passage have been proposed.

Where there is no sufficient clearance between the FBL of the canal and the Nala bed level, the trough of the super passage is suitably raised to ensure that the water prism of the canal is not encroached upon. However in exceptional cases, slight encroachment into the free board depth is proposed. In all such cases suitable ramps are proposed on both sides of the super passage to connect to the existing nala bed levels.

In the case of the super passage, the abutments on both sides of the canal are so placed that they do not interfere with the water prism. This is done to prevent creation of afflux in the canal flow. The abutments are proposed to rest on hard foundation.

Splayed wing walls and returns are proposed at both ends of the abutment. Wherever possible the foundation of the wing walls and returns are kept above the foundation of abutments to reduce the cost of the super passage.

The water way in the RCC trough of the super passage is computed by assuming the velocity of flow in the trough of 2.50 m / sec. Suitable free board is considered in fixing the top level of the side walls of the trough.

The thickness of the bottom RCC slab of the trough is designed based on the following consideration.

Where the width of the trough is less than 3.5 m the bottom slab is designed for cart track loading for movement of carts over it.

The abutments and wing walls are designed as gravity type retaining walls. The top width of the wing wall is kept as 0.500 m and the top width of abutment as 0.750 m, RCC abutment cap and dirt wall are proposed on top of abutment.

At the junction where the trough and dirt wall and wing walls meet 20 mm thick expansion joint with P.V.C water stopper is provided.

Beyond the abutment rough stone pitching is proposed over a bed of concrete. Cut off walls are proposed at the end of pitching and at also at the end of abutment.

Where there is variation in the level of S.R and the pitching suitable ramps are proposed.

After crossing the canal, the nala flows through the existing course. Rough stone pitching over a bed of concrete is proposed for the ramps and the horizontal floor.

RCC sidewalls are proposed at both longitudinal ends of the trough to sufficient height for the nala water to flow between them.

Wing walls and returns are proposed at both ends of the trough. The top level of the wing walls and returns are kept at the top level of the side walls.

Suitable ramps are proposed for the SR to cross the nala over the horizontal flood provided.

Cut off walls are proposed at the ends of sloping and horizontal floors and they are taken well below the nala bed levels at the respective locations.

8.18.3.2 **Culverts (Box Culvert, Drop Culvert)**

Where the bed level of canal is higher than the H.F.L. of the stream, culvert is proposed. Depending upon the linear waterway and foundation material the type of culvert is decided. In hard strata spanned culvert is proposed. Where the nalas/valley crosses below the Canal i.e. bed level of nala is below water prism of the proposed feeder canal and sufficient clearance is available, Box Culverts have been proposed. If sufficient clearance is not available, the floor may be depressed suitably, however the bed slope is continued till it reaches the natural bed level, thus avoiding nala syphon. This arrangement needs drop on the upstream side which is to be designed, therefore the type of structure for such cases are termed as drop culverts. If the drop is small, it is manageable with sloped floor only. If the drop is more then conventional drop with energy dissipating arrangement is proposed.

In design, Velocity of flow in the box is kept equal to the velocity of nala (but, in no case V > 2.50 m/s).

Box dimension are assumed from discharge obtained from H.F.L. calculations.

Analysis of Box Culvert is done by moment distribution method.

Since overburden depth > 2.0 m, only dead load of vehicle is considered, without considering the impact factor.

Maximum width of Box (clear width) is taken as 3.0 m and minimum depth of box (clear depth) is taken as 1.2 m.

8.18.3.3 **Superpassage cum VRB**

Where the nala cum cart track crosses Canal and nala/cart track bed level is above FBL of Canal Superpassage cum VRB are proposed.

The VRB/super passage are designed for single lane traffic and the width of carriage way of the deck slab is 5.0 m. IRC class A loading is considered in the design of the deck slab.

The design of the various components of the Cross Drainage works are based on the following codes.

I.S code No.456-2000, IRC code No.21-2000, IRC codes. IRC-21-2000, IRC-78-2000, IS 7784:2000, IS 7784:1993, IRC-SP-13.

8.18.3.4 **Aqueduct**

Where the bed level of canal is higher than the H.F.L. of the stream Aqueduct is proposed. When the height of the piers and linear waterway is more, aqueduct becomes economical and hence preferable.

8.18.3.5 **Hydraulic Design for Aqueduct**

The following losses are accounted in the design of aqueduct.

(a) **Loss at inlet transition**

(i) Loss due to friction
(ii) Loss due to contraction

(b) **Frictional loss in the aqueduct**

(c) **Loss at exit transition**

(i) Loss due to friction
(ii) Loss due to expansion

The total loss is made equal to available head so as to avoid any afflux in the aqueduct.

8.18.3.6 **Falls**

Falls are proposed when the slope of the terrain is very steep compared to the canal bed slope. Normally a series of drops are proposed depending upon the site condition.

8.18.3.7 **Canal Drops**

Usually the crest is raised above the upstream bed by $1/8^{th}$ of downstream water depth. Discharge is calculated using sharp crested formula.
$Q = 1.84\ L\ H^{3/2}$

The crest level is fixed below the upstream T.E.L. by a depth E. Cistern is proposed below the drop for dissipation of energy.

8.18.3.8 **Measuring Devices**

Parshall flumes are proposed at every 30 Km along the Main Canal/Branch Canal and before major off takes for measuring the flow of water in canals.

8.19 **Grade of Concrete**

The following grades of cement concrete are proposed for the various components of the CR cum VRB

1.	Levelling course in foundation	-	CC M10, using 40 mm and down size coarse aggregate.
2.	Head walls, Abutments and wing walls, Flume walls, Basin sidewalls, return walls, guide walls, Stilling Basin, transition floors, Cradle Concrete, Pipe Joints & cut off walls	-	CC M15 using 40 mm and down size coarse aggregate.
	Canal Lining, Transition Floor		CC M15 using 20 mm and down size coarse aggregate.
3.	RCC Box, Stilling Basin floor, Deck Slab, Dirt Wall, Abutment cap, Kerb, Approach slab, Trough	-	RCC M20 with 20 mm and downsize coarse aggregate.
4.	Wearing coat	-	CC M20 using 20 mm and downsize coarse aggregate.

8.20 Tunnel

Tunnel is designed as free flow horse shoe type with diameter of 7.2 m for carrying capacity of 79.37 cumecs. A free board of 1.00 m is provided. The permanent supports with ISMB 200 are provided in the weak zones. The permanent supports are back filled by M-10 concrete. The tunnel lining is provided with M-25 for a minimum thickness of 25 cm. A shaft is provided at the centre of tunnel.

8.21 Lift Component Works

8.21.1 Intake Canal

The intake CBL is fixed based on the MDDL arrived from the working tables. From the proposed MDDL the head loss at the intake structure is allowed to determine the water level at the start of the intake canal.

8.21.2 Surge Pool cum Forebay

The Surge pool cum forebay, the pump house and raising main are accommodated at the end of the intake canal. The flow enters the pump house chamber through an expanding forebay. The length of the forebay has been provided depending on the width of the pump house to accommodate required number of pumps.

8.21.3 Pump House

Pump house of required length is provided to accommodate the machines and the pipes with butterfly valve.

8.21.4 Raising Main

From each pump a rising main is proposed to deliver water to the delivery chamber. The raising main will be mostly resting on the excavated rocky terrain and will be anchored to the ground. The pipe may also be provided with concrete encasement. As the raising main length is very short, head loss due to friction is of no concern. The main loss will be loss at the pump house and loss due to fittings such as bends. In view of this, it is considered desirable to decrease the pipe size, but increase its thickness.

8.22 SCADA Systems

It is proposed to install PLC based SCADA system at pumping station. There are two level of control at each of the pumping station. The first level is the manual control in the Instrument Control Panel (ICP) and secondary control is through PC based SCADA system. A number of instruments like Flow Switches, Pressure Switches and level switches and transmitters, Vibration monitors and various switchyard equipments have to be supervised, controller and automated with SCADA software and PLC. A new state-of–the art SCADA system employing proven software and the latest commercially available proven hardware will be installed to enable tight line operations, monitoring and control.

Provision is also made for providing automation facilities for better management of micro irrigation system.

The following instruments are proposed to be used during execution of Ajjampur Tunnel work.

1. Load cell (50 KN) : This is used to determine the load on rock bolt and for stress measurement in tunnel support.

2. TCP (Tape extensometer) : This is designed to measure small changes in distance between two reference points in any orientation to find out deformation of underground tunnel. (wall/roof)

3. Survey Reflector : This is used for measurement of deformation during tunneling and monitoring displacement in tunneling.

UPPER BHADRA PROJECT

SOCIO ECONOMY AND COMMAND AREA DEVELOPMENT

9. SOCIO - ECONOMY AND COMMAND AREA DEVELOPMENT

9.1 Socio - Economic Scenerio of Command Area

9.1.1 Demography

The Chitradurga Branch canal command area falls in Challakere, Chitradurga, Hiriyuru and Hosadurga taluks of Chitradurga, Kadur and Tarikere taluks of Chikkamagalur, Jagalur taluk of Davangere District (Jagalur Branch Canal).

The Tumkur Branch canal command area falls in Hiriyur and Hosadurga taluks of Chitradurga, Kadur and Tarikere taluks of Chikkamagalur, Chikkanayakanhalli & Sira taluks of Tumkur Districts.

The demography characteristics of the command area according to 2011 census in Chitradurga, Tumkur, Davangere and Chikkamagalur districts are shown below.

District		Others		Schedule Tribe		Schedule Caste		Total Population (No's)
		Male	Female	Male	Female	Male	Female	
Chitradurga	Rural	407204	394362	120694	115417	150454	143881	1660378
	Urban	127921	128529	15500	14624	21638	20154	
Chikkamagalur	Rural	328029	329807	18604	18608	101466	101565	1137753
	Urban	102088	103676	1966	1841	15330	14773	
Tumkur	Rural	754690	742298	86447	83483	208919	202828	2681449
	Urban	260108	256490	12348	11541	32258	30039	
Davangere	Rural	440763	425745	89407	86366	140375	135160	1946905
	Urban	271542	265927	17525	16403	29990	27702	

Source: As per 2011 Census

The population decadal growth is 9.39% in Chitradurga district, -0.28 % in Chikkamagalur district 3.74 % in Tumkur District and 8.70 % in Davangere District. The male, female ratio is 1000:969 in Chitradurga district and 1000:1005 in Chikkamagalur district, 1000:979 in Tumkur district and 1000:967 in Davangere district. The project area has 80.22% of population in rural areas in Chitradurga district, 78.93% in Chikkamagalur district, 77.52% in Tumkur District and 67.69% in Davangere district.

9.1.2 Geographic Area and Land use

The total geographical area is 8440 Sq. Km in Chitradurga district, 7201 Sq. Km in Chikkamagalur district 10597.00 Sq.km in Tumkur District and 5924 Sq. Km in Davangere District. (As per 2001 Census).

The land use pattern are: -

District	Total area as per village papers	Land not available for Cultivation (Ha)				Other Uncultivated land (Ha)				Fallow Land	Area Sown
		Forest	Non-Agriculture	Barren	Total	Cultivable waste	Permanent Pasture	Trees and Groves	Total		
Chitradurga	770702	73719	51243	25403	150365	21612	88740	11317	121669	65276	433392
Chikmagalur	722075	200485	43125	28322	271932	19404	88585	21257	129246	21843	299054
Tumkur	1064755	45177	84504	67539	197220	62642	76453	21033	160128	148454	558953
Davangere	597597	89918	38992	20533	149443	8525	19538	4955	33018	19457	395679

Source: Directorate of Economics & Statistics, Agriculture Census 2010-11

The land under agriculture in Chitradurga, Chikkamagalur, Tumkur and Davangere is only 56.23%, 41.42%, 52.50% and 66.21% respectively.

9.1.3 Employment Pattern

District	Employment Pattern (No's)				
	Cultivators	Agricultural Labourers	Household	Other Service	Total
Chitradurga	277298	241444	24126	178967	721835
Chikkamagalur	147958	109037	12037	247645	516677
Tumkur	602361	313906	60946	339726	1316939
Davangere	241058	270703	30233	241787	783781

Source: As per 2011 Census

It may be seen that 31.24%, 22.59%, 34.17% and 26.29% of the population is in agriculture in Chitradurga, Chikkamagalu, Tumkur and Davangere district respectively. This may be due to the high risk involved in agriculture and uncertainty of rainfall. This situation is not sustainable. Assured supply of water will improve the present population in agriculture and also the percapita income.

9.1.4 Land Holdings

District	Land Holdings (%)				
	Marginal farmers (Below 1 Ha)	Small farmers (from 1-2 Ha)	Semi medium farmers (from 2-4 Ha)	Medium farmers (from 4-10 Ha)	Large farmers (More than 10 Ha)
Chitradurga	37.57%	31.10%	20.67%	9.22%	1.44%
Chikkamagalur	57.55%	25.07%	12.10%	4.40%	0.87%
Tumkur	47.60%	27.37%	17.15%	7.03%	0.85%
Davangere	47.84%	29.90%	16.24%	5.50%	0.52%

Source: Directorate of Economics & Statistics, Agriculture Census 2010-11

Majority of farmers are in the category of marginal and small. They are under subsistence farming conditions.

9.1.5 Agriculture

The present cropping pattern (Rainfall in command area in Chitradurga, Chikkamagalur, Tumkur and Davangere district) as under.

Sl. No.	Name of the Crop	Crop Percentage
1.	Ragi	9.39 %
2.	Maize	15.62 %
3.	Jowar	2.09 %
4.	Pulses	37.21 %
5.	Ground nut	23.60 %
6.	Sun flower	2.09 %
7.	Vegetables & Other Crops	10.00 %
	Total	**100 %**

The area, under rice is only a small percentage of the total agriculture area. The main crops are Maize, Pulses and Ground Nut. Due to lack of irrigation water, the farmers are heavily dependent on rains. The cropping pattern is adopted just for sustenance. The yield of crops are very low. There is always the risk of crop failure or reduced yields due to uncertain and scanty rainfall. As the net value of produce is low the general standard of living of farmers is very poor.

9.1.6 Use of Fertilizer

District	Nitrogen	Phosphorous	Potash	Total (in Tonnes)
Chitradurga	23111	17021	5083	45215
Chikkamagalur	32332	22393	18662	73387
Tumkur	32072	22974	5709	60756
Davangere	67980	48987	12118	129085

Source: Directorate of Agriculture, page no.109

9.1.7 Sericulture - No. of Persons

District	No. of Formers
Chitradurga	1480
Chikkamagalur	263
Tumkur	3970
Davangere	341

Source: Sericulture Department, 2011-12

The number of persons in sericulture is low and introduction of irrigation water to this area is expected to improve the situation both in terms of supply and demand.

9.1.8 No. of Banks and Credit Co-operation

District	No. of Banks
Chitradurga	39
Chikkamagalur	80
Tumkur	66
Davangere	57

Source: Reserve Bank of India (Quarterly Statistics on Deposits & Credits of Scheduled commercial Banks March 2012)

9.1.9 Provision of Drainage in the Command

Surface Drainage

Surface drainage is provisioned to remove the excess water from rainfall or seepage or irrigation from the surface of lands. Both areas localised for wet and ID, crops need surface drainage system. For designing surface drainage system, the following factors are to be considered:

- Intensity of rainfall 1 day, 2 days, 3 days rainfall with certain frequencies (5 years, 10 years)
- Infiltration rate of soil
- Evaporation rate
- Crops grown during rainy season or at times of heavy rainfall
- Landscape
- Gradient that can be given to the drainage channels
- Outfall conditions

9.1.10 Soil Fertility Status

The soil fertility status has been discussed earlier. It is observed from the available data that soils are low in Nitrogen and available P_2O_5 while in case of K_2O the status is medium to high. The fertility level of soils in respect of nitrogen and phosphorous has to be improved by adequate application of fertilisers as well as organic manure after soil test. The regular extension staff of the Agriculture Department generally cater to the needs of the farmer. Crop loans are distributed which covers the cost of fertilisers too. Keeping in view the above measures, no provisions for this purpose have been made.

9.1.11 Cropping Pattern

One of the main objectives of the study of soils, rainfall pattern and irrigation aspects is to suggest a suitable cropping pattern for the proposed command area.

It is generally suggested that crop rotation on irrigated soils must be base on a long term plan which should be based on the following information:

- The characteristics of the soils of the area.
- The quality and supply of the irrigation water (also climatic conditions including rainfall).
- The characteristics of the crops to be grown.
- The need for flexibility in the crop rotation programs.
- Provision for fertility maintenance, weed control and Integrated Pest Management and
- The distribution of economic returns so that farm income can be maintained at about the same level through out the rotation period.

9.1.12 Existing Cropping Pattern

The entire command is presently under cultivation and the existing cropping pattern in the command area is given in **Table 9.1**.

Table 9.1: *Existing Cropping Pattern of the Command Area*

Sl. No.	Name of the Crop	Crop Percentage
1.	Ragi	9.39 %
2.	Maize	15.62 %
3.	Jowar	2.09 %
4.	Pulses	37.21 %
5.	Ground nut	23.60 %
6.	Sun flower	2.09 %
7.	Vegetables & Other Crops	10.00 %
	Total	**100 %**

Based on the factors highlighted above and taking into consideration the existing cropping pattern, discussion with the beneficiaries in the command area and the Agriculture Department, Government of Karnataka. Cropping pattern is suggested as presented in **Table 9.2**.

Table 9.2: *Proposed Cropping Pattern of the Command Area*

Sl. No.	Name of the Crop	Crop Percentage
1.	Jowar	15%
2.	Maize	10%
3.	Pulses	10%
4.	Ground nut	45%
5.	Sun flower	20%

9.2 Communication Network

Improved communications in and around command and the reservoir area are necessary for integrated development of the project. These are described as under:

(a) Ayacut Roads

These are required within the Command Area for transport of inputs and produce.

(b) Link Roads

These are necessary to connect the command area to ayacut roads. These also include improvement and reconstruction of existing roads to bring them to project standards.

(c) Transmittal of messages from command areas

A radio/telegraph/telephone network in the command areas is necessary to quickly convey messages, concerning rainfall, demand for canal waters, regulation orders, stage of water supplies reaching various reaches of canals, and other emergency conditions like cuts and breaches on canals etc., to the control points is required to be installed.

9.2.1 Ayacut Roads

A well connected network of service roads is necessary to provide access to the fields of the farmers, movement of bullock carts, tractors and for transport of seeds, fertilisers and agricultural produce to the markets besides, for movement of equipments and materials for maintenance and repairs of canal network by the O&M organisation.

The road network in the Upper Bhadra Project is mainly connecting major towns and villages. The Remote and far flung villages in the project area had to depend upon cart tracks and village roads mostly unbridged.

The national highways, state highways and district major roads in the Karnataka state are constructed and maintained by separate divisions under PWD. District roads and village roads are under the charge of Zilla Parishads and village panchayats.

Considering the adequacy of the road network in the command for speedy development for the project as well as for providing facilities to the farmers, adequate provisions for improvement of village roads are to be made.

The criteria in general adopted for the development of road network are:

(i) To provide all-weather road access within a distance of 1.5 km from almost all parts of irrigated area.

(ii) To provide all-weather access to each village having population of 1500 and above.

(iii) To distribute roads equitably as far as possible throughout the command.

(iv) To include roads located outside the command area boundaries to the extent necessary and to link the network to market centres, railway stations, villages or administrative headquarters to have full impact on development of command area.

(v) To limit the total provisions of roads to the minimum necessary subject to fulfillment of the above criteria.

(vi) To make use of existing roads and track alignments within the limitations imposed by criteria (v) above.

(vii) To by-pass big towns wherever possible.

(viii) To provide minimum number of bridges or causeways necessary to comply with IRC requirements, which specify the acceptable interruptions to traffic appropriate to each category of road.

(ix) To allocate construction priorities in such a manner as to enable road works to be completed well in advance of the commencement of constructions of irrigation distribution network system.

All the ayacut roads are classified as village roads and relevant IRC standards, specifications and code of practice for village roads are adopted for design and construction of roads. The main specifications are:

(a) Top width 7.5 m.

(b) Single lane carriage way of 3.75 m.

(c) Minimum embankment height kept at 60 cm in B.C. Soil and 40 cm in red soil.

(d) The width of right of way is taken as 20m.

(e) Embankment slopes kept at 1.5 (h): 1 (v).

(f) Earthwork embankment in B.C. Soil or in clayey soils having low CBR, murrum blanket of 30 cm thick extending to side slopes is provided to counter swelling properties.

9.2.2 Link Roads

In addition to the ayacut roads within the command of the project, link roads would also be required. Suitable provision has been made.

9.2.3 Radio / Telegraph / Telephone Network in the Command Area

Above network is required within the command for quick transmission of messages to control points regarding state of demand and regulation work.

9.2.4 Cost Provision

Provision has been made towards the cost of work in the cost estimates for the above purposes, namely Link roads, Radio/ telecommunication network in the command areas.

UPPER BHADRA PROJECT

CONSTRUCTION PROGRAM

10.0 CONSTRUCTION PROGRAM

10.1 Project Implementation Plan

The main features of the Upper Bhadra project interms of infrastructures development are.

(i) Lifting upto 17.40 TMC of water from Tunga River to Bhadra reservoir from June to October.

(ii) Lifting of 29.90 TMC of water from Bhadra Reservoir to delivery chamber near Ajjampura from June to October.

(iii) Construction of Ajjampura tunnel to deliver water to Chitradurga Branch Canal.

(iv) Construction of Chitradurga Branch Canal, Jagalur Branch Canal and distribution system.

(v) Construction of Tumkur Branch Canal and distribution system.

(vi) Construction of gravity and lift canal around tunnel and filling up of 79 tanks in tarikere taluk.

Government of Karnataka have decided to implement the scheme on a fast track by awarding turkey contracts for creation of necessary infrastructure. The creation of infrastructure of items (i) to (iii) above is divided in to 3 different packages. The details of these packages and their work schedule is discussed below.

It is planned to complete construction of all the infrastructure necessary in a period of 05 years.

10.2 Description of Packages

10.2.1 Package I

Name of work: Survey, planning, investigation, Design construction, testing, Commissioning of Lift irrigation scheme including O and M for 5 years for lifting 17.40 TMC of water with a static head of approximately 89 m over a period of 5 months in a year from river Tunga to Bhadra reservoir including civil, electrical and mechanical works and procurement of power on lumpsum turkey basis.

The salient features of this part of the scheme are;

Water lifting point: Foreshore on Upper Tunga reservoir near Muthinakoppa village N.R. Pura taluk, Chikkamagalur district.

Quantity of water to be lifted: 17.40 TMC over a period of 5 months. The water is to be lifted in two stages, the details of which are given below.

(A)	**Stage 1 Lifting of Water from Tunga River to Bhadra Reservoir**		
1	Name of the river	Tunga	
2	Purpose	Irrigation,water supply Power generation etc	
3	Lift point location	Muthinakoppa,Tq:N.R.Pura,Dt:Chickamagalur	
4	Quantity of water to be lifted	17.40 TMC	
5	**Lift Details**	**I Lift**	**II Lift**
(a)	Length of approach canal(Intake Channel)	3014 m	5663 m
(b)	RL from which water is to be Lifted	586.398 m	623.70 m
(c)	RL of Delivery point	626.952 m	664.771 m
(d)	Static head	44.50 m	44.50 m
(e)	Length of rising Main	290 m	290 m
(f)	Discharge required	48 Cumecs	48Cumecs
(g)	Diametre of rising main	2500 mm	2500 mm
(h)	No of rows	5 Nos	5 Nos
(i)	Motor Rating	6300 BKW	6300 BKW
(j)	No of Pumps	4+1	4+1
(k)	Total Energy Required	63 MW	

	Canal Details		
(a)	Length of the Canal	11267 m	
(b)	Bed width of canal	7.10 m	
(c)	FSD	3.583 m	
(d)	Free board	1.00 m to 2.76 m	
(e)	Bed fall	1:5000	
(f)	Side Slope	1:1.5	
(g)	Velocity	1.324 m/sec	
(h)	Capacity at head	48 (60) Cumecs	

The work is expected to be completed in a period of 06 years 09 Months. The activity schedule of this package is given in **Figure 10.1**.

10.2.2 Package II

Name of work: Planning, investigation, design construction, testing and commissioning of lift irrigation scheme including O and M for 5 years for lifting 29.90 TMC of water with a static head of approximately 102 m over a period of 5 months in a year from Bhadra reservoir to delivery chamber near proposed tunnel near Ajjampura including civil, electrical and mechanical works and procurement of power on lumpsum turnkey basis.

Salient features of this part of the scheme is canal.

(B)	**Stage II Lifting of Water from Bhadra Reservoir to Chitradurga Branch Canal**		
	Lift Details	**Lift I**	**Lift II**
(a)	RL from which water is to be Lifted	649.228 m	692.360 m
(b)	RL of Delivery point	696.846 m	739.546 m
(c)	Static head	51.20 m	51.20 m
(d)	Length of rising Main	242.79 m	161.51 m
(e)	Discharge required	81.00 Cumecs	81.00 Cumecs
(f)	Diametre of rising main	3200 mm	3200 mm
(g)	No of rows	5 Nos	5 Nos
(h)	Motor Rating	12200 BKW	12200 BKW
(i)	No of Pumps	4+1	4+1
(j)	Total Energy Required	122.00 MW	
(C)	**Main Canal Details**		
(a)	Length of the Canal	40.535 Km	
(b)	Bed width of canal	7.60 to 9.60 m	
(c)	FSD	4.85 m	
(d)	Free board	0.75 m	
(e)	Bed fall	1:10000	
(f)	Side Slope	1:1 & 1:1.5	
(g)	Velocity	1.12 to 1.16 m/sec	
(h)	Capacity at head	81.00 Cumecs	

The activity scheduling of package - II is given in **Figure 10.2**. The construction activity of this part of work is expected to be completed in a period of 06 years 09 months.

10.2.3 Package III

This is the balance work on main canal beyond Package - II up to Chitradurga Branch Canal.

Name of work: Survey, planning, investigation, design estimation and construction and maintenance of 6.9 Km (approx) Tunnel connecting lift canal from Bhadra reservoir to Chitradurga Branch Canal near Ajjampura including tunnel approach and exit.

The salient features of this part of the project is given below.

(D)	**Tunnel Details**	
(1)	Total Length of Tunnel	6.90 Km
(2)	Diametre of the Tunnel	7.25 m
(3)	Discharge in Tunnel	79.37 Cumecs
(4)	Bed Slope of Tunnel	1:2100
(5)	Apporach(Length and RL)	0.330 Km, 733.575 m
(6)	Exit (Length and RL)	2.770 Km, 730.35 m

The scheduling of activity of this part of the project is given in **Figure 10.3**. The whole set of activity is scheduled to be completed in a period of 3 years.

10.2.4 Packages under Main Canal and Micro Distribution System

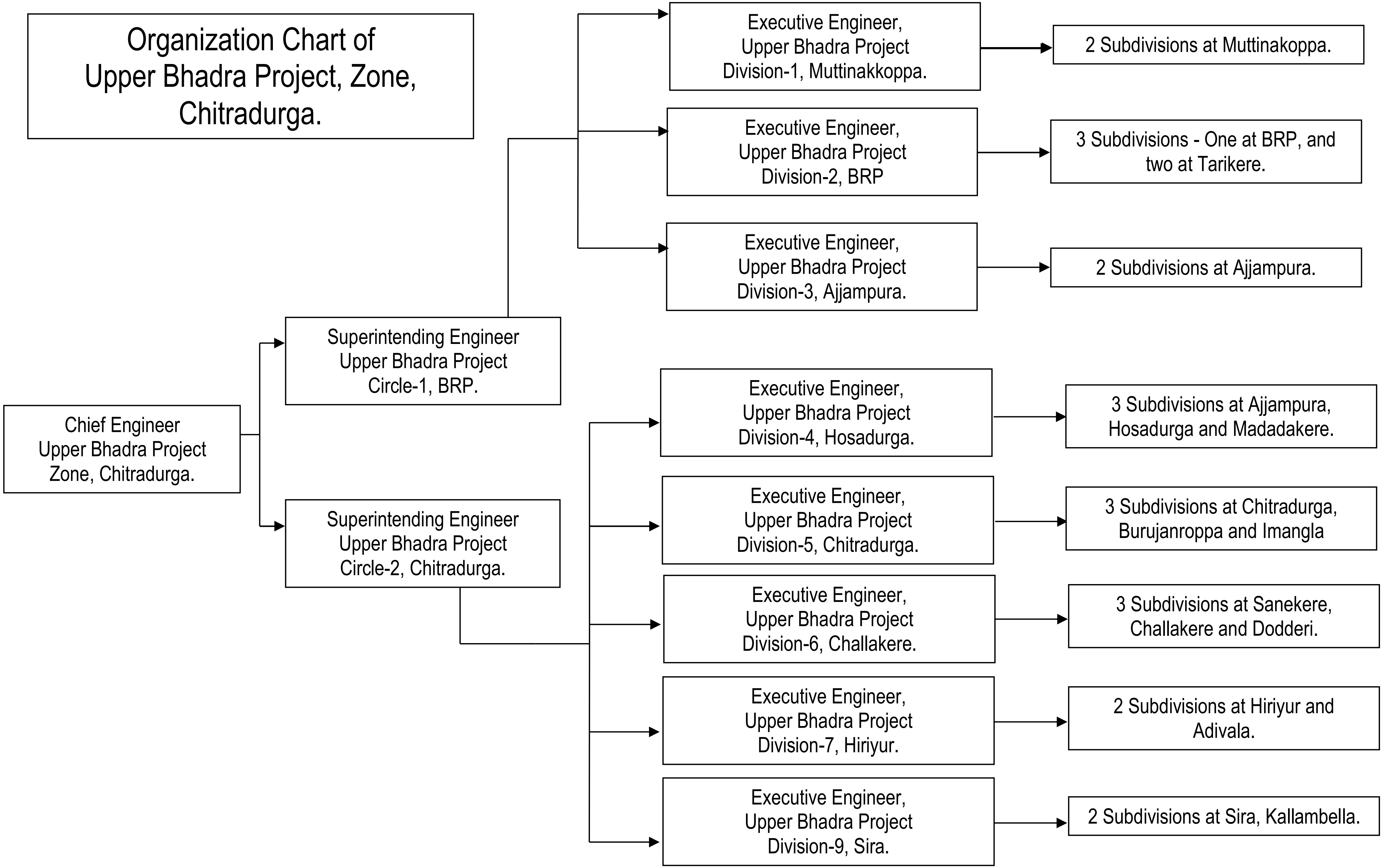
These are packages for executing the Chitradurga Branch Canal, Jagalur Branch Canal and Tumkur Branch Canal including distribution net work coming under it and maintaining it for 3 years. The total length of canal is 310.106 Kms. The broad scheduling of activities under each package is given in **Figure 10.4** and **10.5** and the set of construction activities in each package and the whole set of activities in each package is expected to be completed over a period of 03 years.

10.2.3 Organization Setup

The execution of the project is under taken by the Chief Engineer, Upper Bhadra Project, whose office is situated in Chitradurga.

Two separate circles, headed by the Superintending Engineer are also formed. Under circle-1 stationed at B.R.P three divisions are working with each one is headed by a Executive Engineer. Similarly, under circle -2 stationed at Chitradurga five divisions are working. Totally 20 subdivisions each under the control of Assistant Executive Engineers are formed to look after the implementation of this project.

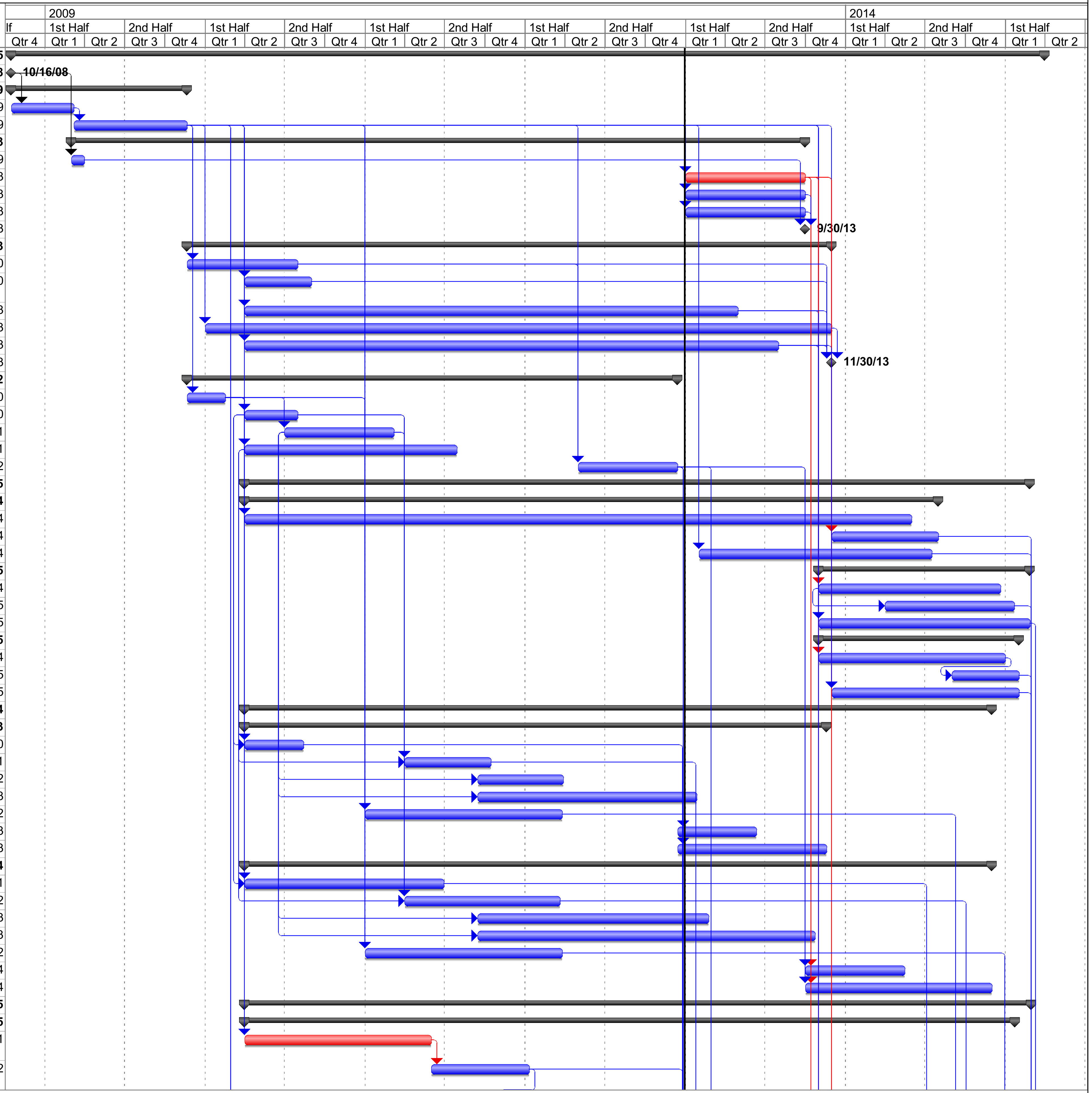
The organization chart is indicted below.


Organization Chart of Upper Bhadra Project, Zone, Chitradurga.
Chief Engineer Upper Bhadra Project Zone, Chitradurga.
Superintending Engineer Upper Bhadra Project Circle-1, BRP.
Superintending Engineer Upper Bhadra Project Circle-2, Chitradurga.
Executive Engineer, Upper Bhadra Project Division-1, Muttinakkoppa.
Executive Engineer, Upper Bhadra Project Division-2, BRP
Executive Engineer, Upper Bhadra Project Division-3, Ajjampura.
Executive Engineer, Upper Bhadra Project Division-4, Hosadurga.
Executive Engineer, Upper Bhadra Project Division-5, Chitradurga.
Executive Engineer, Upper Bhadra Project Division-6, Challakere.
Executive Engineer, Upper Bhadra Project Division-7, Hiriyur.
Executive Engineer, Upper Bhadra Project Division-9, Sira.
2 Subdivisions at Muttinakoppa.
3 Subdivisions - One at BRP, and two at Tarikere.
2 Subdivisions at Ajjampura.
3 Subdivisions at Ajjampura, Hosadurga and Madadakere.
3 Subdivisions at Chitradurga, Burujanroppa and Imangla
3 Subdivisions at Sanekere, Challakere and Dodderi.
2 Subdivisions at Hiriyur and Adivala.
2 Subdivisions at Sira, Kallambella.

CPM/PERT CHART FOR UPPER BHADRA LIFT IRRIGATION SCHEME, PACKAGE-I

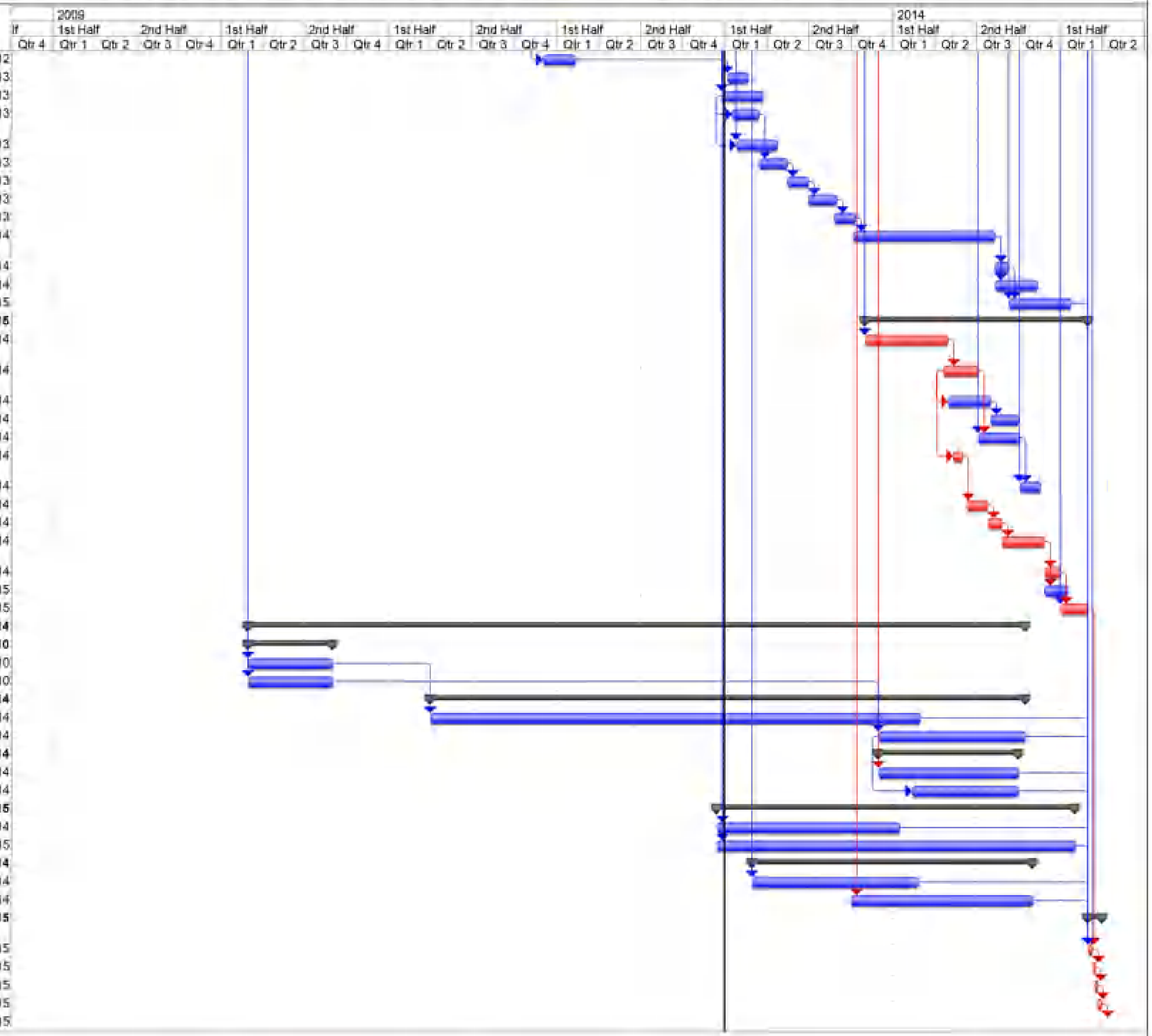
Figure 10.1

ID	Task Name	Duration	Start	Finish
1	**UPPER BHADRA PROJECT, PACKAGE-1**	**2358 days**	**Oct 16 '08**	**Mar 31 '15**
2	**Date of LOA**	**0 days**	**Oct 16 '08**	**Oct 16 '08**
3	**DPR Process**	**401 days**	**Oct 16 '08**	**Nov 20 '09**
4	DPR Preparation	143 days	Oct 16 '08	Mar 7 '09
5	Discussion and Approval	258 days	Mar 8 '09	Nov 20 '09
6	**Statutory Clearance**	**1674 days**	**Mar 2 '09**	**Sep 30 '13**
7	Environmental Clearance	30 days	Mar 2 '09	Mar 31 '09
8	Forest Clearance	273 days	Jan 1 '13	Sep 30 '13
9	Revenue Clearance	273 days	Jan 1 '13	Sep 30 '13
10	CWC Clearance	273 days	Jan 1 '13	Sep 30 '13
11	Statutory Clearances Complete	0 days	Sep 30 '13	Sep 30 '13
12	**Design and Drawing of Civil Works**	**1471 days**	**Nov 21 '09**	**Nov 30 '13**
13	Alignment of the entire project.	253 days	Nov 21 '09	Jul 31 '10
14	Intake Channel, Gravity Canal-1 and Gravity Canal-2	153 days	Apr 1 '10	Aug 31 '10
15	Fore Bay & Pump House	1126 days	Apr 1 '10	Apr 30 '13
16	Rising Main & Anchor Block	1430 days	Jan 1 '10	Nov 30 '13
17	CD works & Structures	1218 days	Apr 1 '10	Jul 31 '13
18	Complete Civil Designs	0 days	Nov 30 '13	Nov 30 '13
19	**Design of Electrical & Electro Mechanical Works**	**1119 days**	**Nov 21 '09**	**Dec 13 '12**
20	Pump House GA Drawing	88 days	Nov 21 '09	Feb 16 '10
21	Sump Model Study	122 days	Apr 1 '10	Jul 31 '10
22	Pump Model Study	250 days	Jul 1 '10	Mar 7 '11
23	Pump Drawings	485 days	Apr 1 '10	Jul 29 '11
24	Switch Yard Layout Drawings	227 days	May 1 '12	Dec 13 '12
25	**Civil Works**	**1792 days**	**Apr 1 '10**	**Feb 25 '15**
26	**Intake Canal**	**1583 days**	**Apr 1 '10**	**Jul 31 '14**
27	Excavation for Canal	1522 days	Apr 1 '10	May 31 '14
28	Lining of Canal	243 days	Dec 1 '13	Jul 31 '14
29	Construction of Structures/CD Works	531 days	Feb 1 '13	Jul 16 '14
30	**Gravity Canal - 1**	**482 days**	**Nov 1 '13**	**Feb 25 '15**
31	Excavation for Canal	415 days	Nov 1 '13	Dec 20 '14
32	Lining of Canal	295 days	Apr 1 '14	Jan 20 '15
33	Construction of Structures/CD Works	482 days	Nov 1 '13	Feb 25 '15
34	**Gravity Canal - 2**	**457 days**	**Nov 1 '13**	**Jan 31 '15**
35	Excavation for Canal	426 days	Nov 1 '13	Dec 31 '14
36	Lining of Canal	153 days	Sep 1 '14	Jan 31 '15
37	Construction of Structures/CD Works	427 days	Dec 1 '13	Jan 31 '15
38	**Supply of Electrical and Electro Mechanical Items**	**1705 days**	**Apr 1 '10**	**Nov 30 '14**
39	**Pump House-1**	**1328 days**	**Apr 1 '10**	**Nov 18 '13**
40	Supply of Draft Tubes	135 days	Apr 1 '10	Aug 13 '10
41	Supply of Spiral Casing	197 days	Apr 1 '11	Oct 14 '11
42	Supply of EOT Crane	195 days	Sep 15 '11	Mar 27 '12
43	Supply of EOPD Valves	500 days	Sep 15 '11	Jan 26 '13
44	Supply of Motors and Other Pump Parts	450 days	Jan 1 '11	Mar 25 '12
45	Supply of Transformers	180 days	Dec 14 '12	Jun 11 '13
46	Supply of other Electrical Items	340 days	Dec 14 '12	Nov 18 '13
47	**Pump House-2**	**1705 days**	**Apr 1 '10**	**Nov 30 '14**
48	Supply of Draft Tubes	455 days	Apr 1 '10	Jun 29 '11
49	Supply of Spiral Casing	355 days	Apr 1 '11	Mar 20 '12
50	Supply of EOT Crane	527 days	Sep 15 '11	Feb 22 '13
51	Supply of EOPD Valves	770 days	Sep 15 '11	Oct 23 '13
52	Supply of Motors and Other Pump Parts	450 days	Jan 1 '11	Mar 25 '12
53	Supply of Transformers	227 days	Oct 1 '13	May 15 '14
54	Supply of other Electrical Items	426 days	Oct 1 '13	Nov 30 '14
55	**Construction of Pump House Structure**	**1795 days**	**Apr 1 '10**	**Feb 28 '15**
56	**Pump House-1**	**1758 days**	**Apr 1 '10**	**Jan 22 '15**
57	Excavation of Forebay, Pump House Foundation	426 days	Apr 1 '10	May 31 '11
58	Completion of PCC and Raft Concrete of Pump House	224 days	Jun 1 '11	Jan 10 '12



CPM/PERT CHART FOR UPPER BHADRA LIFT IRRIGATION SCHEME, PACKAGE-I

ID	Task Name	Duration	Start	Finish
59	Completion of Forebay Raft	72 days	Dec 1 '11	Feb 10 '12
60	Forebay Side wall Concrete upto Top	46 days	Jan 6 '13	Feb 20 '13
61	Erection of Draft Tubes	90 days	Dec 26 '12	Mar 25 '13
62	Wall concrete upto Top of Draft Tube including Concrete bed to Draft Tube	59 days	Jan 16 '13	Mar 15 '13
63	Erection of Spiral Casing	90 days	Jan 25 '13	Apr 24 '13
64	Wall Concreting upto Intermediate Floor Slab	61 days	Mar 16 '13	May 15 '13
65	Concreting of Intermediate Floor Slab	46 days	May 16 '13	Jun 30 '13
66	Wall Concreting upto Motor Floor Slab	62 days	Jul 1 '13	Aug 31 '13
67	Concreting of Motor Floor Slab	46 days	Aug 26 '13	Oct 10 '13
68	Concreting of Colums upto Gantry/EOT Crane Level including Casting of Gantry Beam	309 days	Oct 6 '13	Aug 10 '14
69	Erection of EOT Crane	30 days	Aug 11 '14	Sep 9 '14
70	Erection of Roof Truss & Roof Cover	92 days	Aug 11 '14	Nov 10 '14
71	Erection of Motors	135 days	Sep 10 '14	Jan 22 '15
72	**Pump House-2**	**485 days**	**Nov 1 '13**	**Feb 28 '15**
73	Excavation of Forebay, Pump House Foundation	181 days	Nov 1 '13	Apr 30 '14
74	Completion of PCC and Raft Concrete of Pump House	76 days	Apr 21 '14	Jul 5 '14
75	Completion of Forebay Raft	92 days	May 1 '14	Jul 31 '14
76	Forebay Side wall Concrete upto Top	61 days	Aug 1 '14	Sep 30 '14
77	Erection of Draft Tubes	90 days	Jul 6 '14	Oct 3 '14
78	Wall concrete upto Top of Draft Tube including Concrete bed to Draft Tube	21 days	May 11 '14	May 31 '14
79	Erection of Spiral Casing	45 days	Oct 4 '14	Nov 17 '14
80	Wall Concreting upto Motor Floor Slab	45 days	Jun 11 '14	Jul 25 '14
81	Concreting of Motor Floor Slab	31 days	Jul 26 '14	Aug 25 '14
82	Concreting of Colums upto Gantry/EOT Crane Level including Casting of Gantry Beam	92 days	Aug 26 '14	Nov 25 '14
83	Erection of EOT Crane	35 days	Nov 26 '14	Dec 30 '14
84	Erection of Roof Truss & Roof Cover	51 days	Nov 26 '14	Jan 15 '15
85	Erection of Motors	60 days	Dec 31 '14	Feb 28 '15
86	**Supply and Erection of Rising Main**	**1690 days**	**Mar 1 '10**	**Oct 15 '14**
87	**Supply**	**184 days**	**Mar 1 '10**	**Aug 31 '10**
88	Supply of Rising Main-1 Pipes	184 days	Mar 1 '10	Aug 31 '10
89	Supply of Rising Main-2 Pipes	184 days	Mar 1 '10	Aug 31 '10
90	**Erection**	**1294 days**	**Apr 1 '11**	**Oct 15 '14**
91	Erection of Rising Main-1 Pipes	1065 days	Apr 1 '11	Feb 28 '14
92	Erection of Rising Main-2 Pipes	319 days	Dec 1 '13	Oct 15 '14
93	**Construction of Delivery Chamber**	**304 days**	**Dec 1 '13**	**Sep 30 '14**
94	Delivery Chamber-1	304 days	Dec 1 '13	Sep 30 '14
95	Delivery Chamber-2	232 days	Feb 11 '14	Sep 30 '14
96	**Switch Yard Works & Approval from KPTCL**	**779 days**	**Dec 14 '12**	**Jan 31 '15**
97	Switch Yard Works for Pump House-1	398 days	Dec 14 '12	Jan 15 '14
98	Switch Yard Works for Pump House-2	779 days	Dec 14 '12	Jan 31 '15
99	**Transmission Lines**	**610 days**	**Mar 1 '13**	**Oct 31 '14**
100	Transmission Lines to Pump House-1	361 days	Mar 1 '13	Feb 24 '14
101	Transmission Lines to Pump House-2	396 days	Oct 1 '13	Oct 31 '14
102	**Commissioning Procedures and Handing Over to KNNL**	**31 days**	**Mar 1 '15**	**Mar 31 '15**
103	Pre Commissioning	10 days	Mar 1 '15	Mar 10 '15
104	Commissioning	5 days	Mar 11 '15	Mar 15 '15
105	Stabilization	5 days	Mar 16 '15	Mar 20 '15
106	Performance Guarantee Test	10 days	Mar 21 '15	Mar 30 '15
107	Completion and Handing Over to KNNL	1 day	Mar 31 '15	Mar 31 '15



Project: UBP, PACKAGE-I
SEW-JYOTI (J.V)

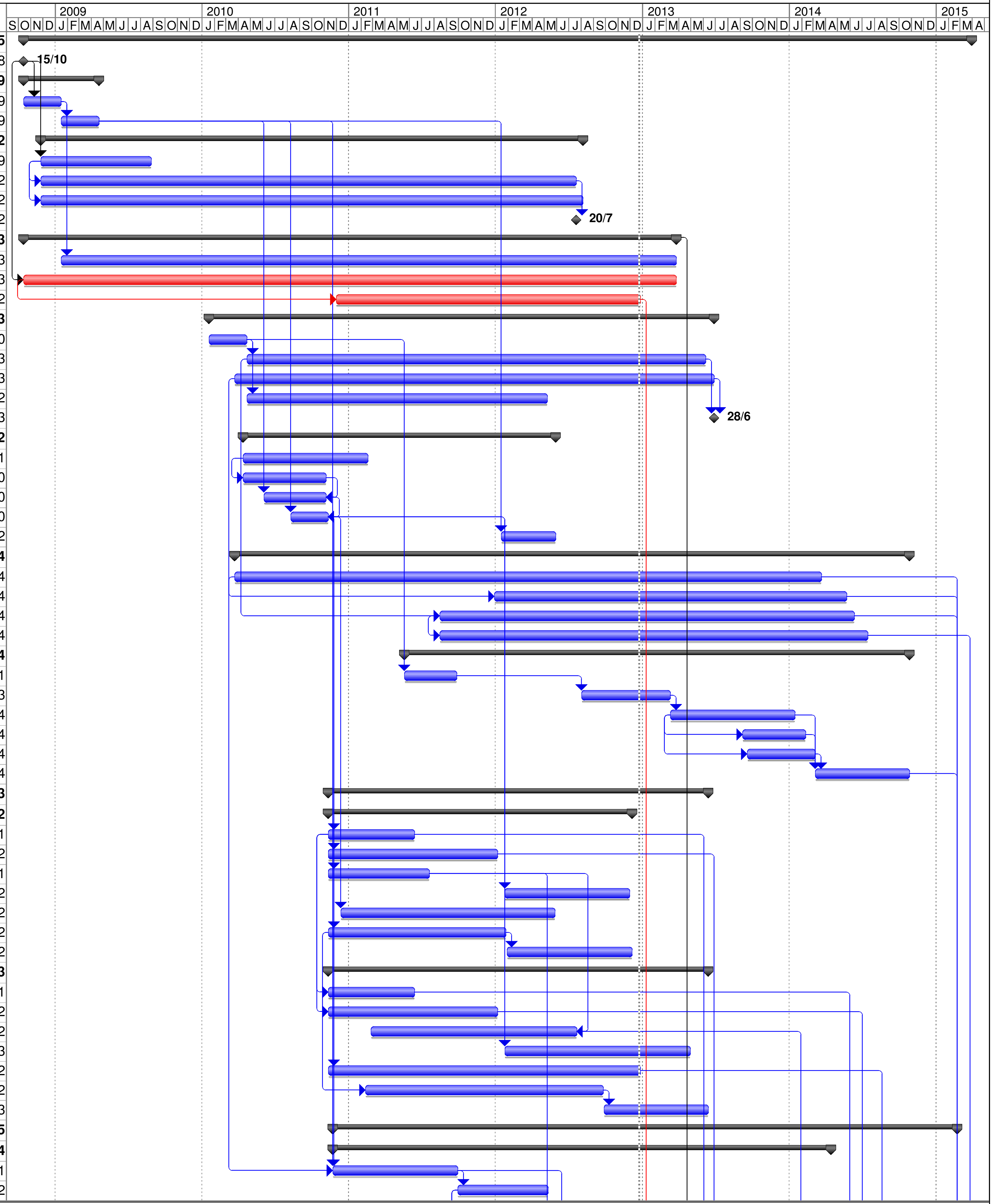
Task		Milestone		Rolled Up Critical Task		Split		Group By Summary	
Critical Task		Summary		Rolled Up Milestone		External Tasks		Deadline	
Progress		Rolled Up Task		Rolled Up Progress		Project Summary			

UPPER BHADRA PROJECT

PACKAGE - II

Figure 10.2

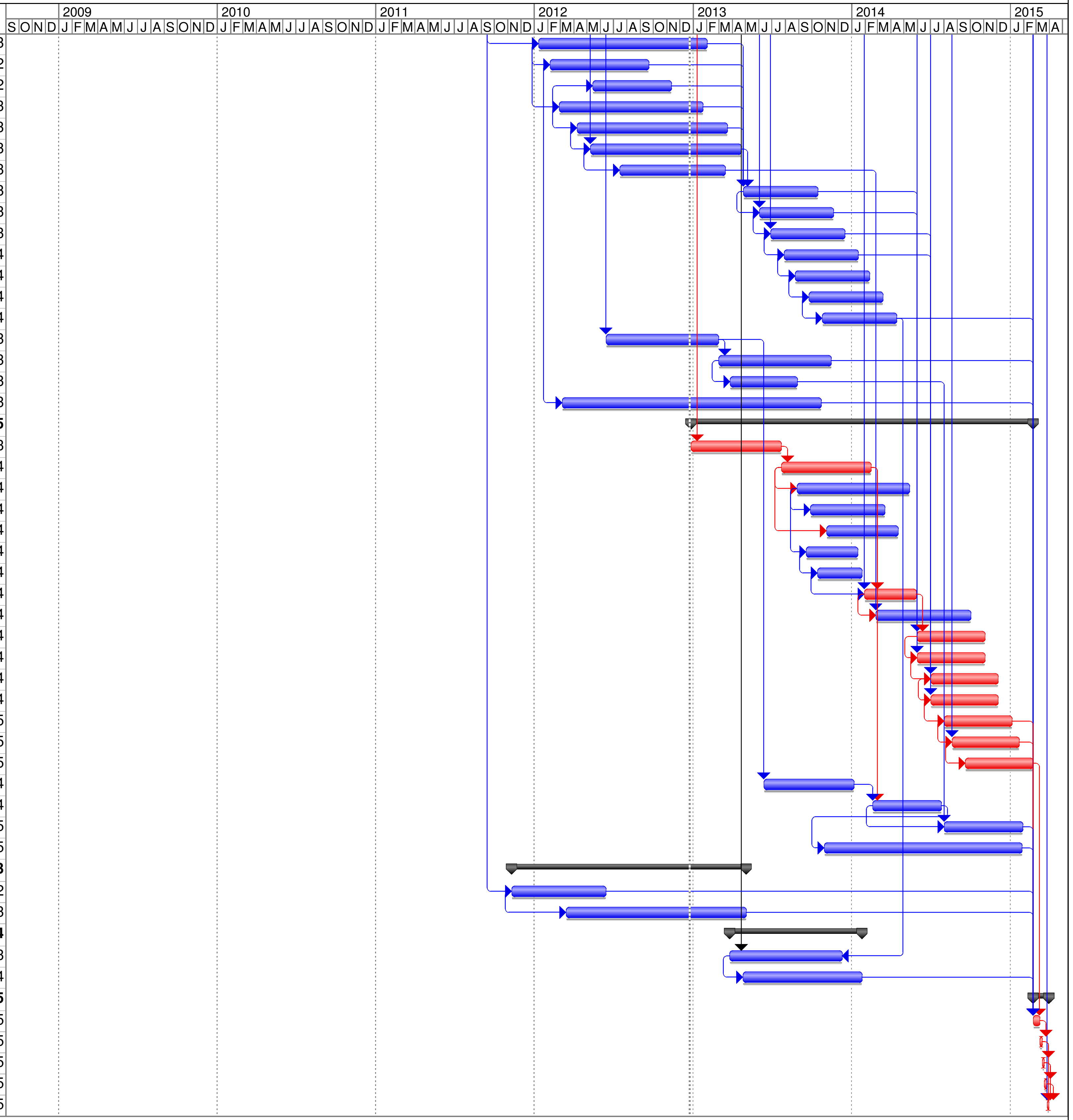
ID	Task Name	Duration	Start	Finish
1	**PROJECT - PACKAGE 2**	**2274 days**	**Wed 15/10/08**	**Tue 31/3/15**
2	AWARD OF LOI	0 days	Wed 15/10/08	Wed 15/10/08
3	**DPR PROCESS**	**180 days**	**Wed 15/10/08**	**Mon 20/4/09**
4	DPR PREPARATION	90 days	Wed 15/10/08	Fri 16/1/09
5	DISCUSSION & DPR APPROVAL	90 days	Fri 16/1/09	Mon 20/4/09
6	**ALL STATUTORY CLEARANCE**	**1300 days**	**Wed 26/11/08**	**Mon 6/8/12**
7	ENVIRONMENTAL CLEARANCE	265 days	Wed 26/11/08	Fri 28/8/09
8	FOREST CLEARANCE	1285 days	Wed 26/11/08	Fri 20/7/12
9	CWC CLEARANCE	1300 days	Wed 26/11/08	Mon 6/8/12
10	ALL STATUTORY CLEARANCE - COMPLETE	0 days	Fri 20/7/12	Fri 20/7/12
11	**TAKING POSSESSION OF THE REQUIRED LAND**	**1565 days**	**Wed 15/10/08**	**Tue 26/3/13**
12	TAKING POSSESSION OF LAND-COMPLETE	1475 days	Fri 16/1/09	Tue 26/3/13
13	LAND CONSENT FROM OWNERS	1565 days	Wed 15/10/08	Tue 26/3/13
14	LAND CONSENT FROM OWNERS FOR PH-2	730 days	Wed 1/12/10	Thu 27/12/12
15	**DESIGN AND DRAWING OF CIVIL WORKS**	**1211.88 days**	**Tue 19/1/10**	**Fri 28/6/13**
16	ALIGNMENT OF ENTIRE PROJECT	92 days	Tue 19/1/10	Fri 23/4/10
17	CD WORKS	1100 days	Fri 23/4/10	Fri 7/6/13
18	PUMP HOUSE STRUCTURE	1150 days	Wed 24/3/10	Fri 28/6/13
19	RAISING MAIN AND ANCHOR BLOCK	720 days	Fri 23/4/10	Wed 9/5/12
20	COMPLETE CIVIL DESIGNS	0 days	Fri 28/6/13	Fri 28/6/13
21	**DESIGN OF ELECTROMECHANICAL WORKS**	**749.75 days**	**Wed 14/4/10**	**Wed 30/5/12**
22	PUMP HOUSE GA DRAWING	300 days	Wed 14/4/10	Fri 18/2/11
23	SUMP MODEL STUDY	200 days	Wed 14/4/10	Sat 6/11/10
24	PUMP MODEL STUDY	150 days	Fri 4/6/10	Sat 6/11/10
25	PUMP DRAWINGS	90 days	Tue 10/8/10	Thu 11/11/10
26	SWITCH YARD LAYOUT DRAWING	131 days	Mon 16/1/12	Wed 30/5/12
27	**CIVIL WORKS CONSTRUCTION**	**1618.25 days**	**Wed 24/3/10**	**Mon 27/10/14**
28	EXCAVATION FOR CANAL	1408 days	Wed 24/3/10	Sat 22/3/14
29	CONCRETE LINING OF CANAL	845 days	Fri 30/12/11	Sat 24/5/14
30	CONSTRUCTION OF STRUCTURES /CD WORKS	995 days	Tue 16/8/11	Thu 12/6/14
31	CONSTRUCTION OF AQUEDUCT	1027 days	Tue 16/8/11	Tue 15/7/14
32	**INTAKE STRUCTURE**	**1211 days**	**Fri 20/5/11**	**Mon 27/10/14**
33	FORMATION OF DIVERSION BUND	125 days	Fri 20/5/11	Tue 27/9/11
34	EXCAVATION AND PCC	212 days	Thu 2/8/12	Mon 11/3/13
35	CONSTRUCTION OF REGULATOR STRUCTURES	300 days	Mon 11/3/13	Wed 15/1/14
36	ERECTION OF GATES	150 days	Sat 7/9/13	Tue 11/2/14
37	SIDEWALLS AND STILLING BASIN FINISHING	164 days	Wed 18/9/13	Fri 7/3/14
38	BUND REMOVAL AND CUTTING OF APPROACHES	225 days	Fri 7/3/14	Mon 27/10/14
39	**SUPPLY OF ELECTROMECHANICAL ITEMS**	**911.88 days**	**Thu 11/11/10**	**Thu 13/6/13**
40	**PUMP HOUSE-1**	**728.75 days**	**Thu 11/11/10**	**Thu 6/12/12**
41	SUPPLY OF DRAFT TUBE LINERS	207 days	Thu 11/11/10	Tue 14/6/11
42	SUPPLY OF SPIRAL CASING	407 days	Thu 11/11/10	Sat 7/1/12
43	SUPPLY OF EOT CRANE	243 days	Thu 11/11/10	Thu 21/7/11
44	SUPPLY OF EOPD VALVES	300 days	Wed 25/1/12	Fri 30/11/12
45	SUPPLY OF MOTORS & OTHER PUMP PARTS	514 days	Mon 13/12/10	Mon 28/5/12
46	SUPPLY OF TRANSFORMERS	426 days	Fri 12/11/10	Fri 27/1/12
47	SUPPLY OF OTHER ELECTRICAL ITEMS	300 days	Mon 30/1/12	Thu 6/12/12
48	**PUMP HOUSE-2**	**911.88 days**	**Thu 11/11/10**	**Thu 13/6/13**
49	SUPPLY OF DRAFT TUBE LINERS	207 days	Thu 11/11/10	Tue 14/6/11
50	SUPPLY OF SPIRAL CASING	407 days	Thu 11/11/10	Sat 7/1/12
51	SUPPLY OF EOT CRANE	493.88 days	Fri 25/2/11	Sat 21/7/12
52	SUPPLY OF EOPD VALVES	445 days	Wed 25/1/12	Tue 30/4/13
53	SUPPLY OF MOTORS & OTHER PUMP PARTS	749 days	Fri 12/11/10	Thu 27/12/12
54	SUPPLY OF TRANSFORMERS	570 days	Sat 12/2/11	Tue 25/9/12
55	SUPPLY OF OTHER ELECTRICAL ITEMS	250 days	Thu 27/9/12	Thu 13/6/13
56	**CONSTRUCTION OF PUMP HOUSE STRUCTURE**	**1497.88 days**	**Mon 22/11/10**	**Mon 23/2/15**
57	**PUMP HOUSE-1**	**1195 days**	**Mon 22/11/10**	**Tue 15/4/14**
58	EXCAVATION FOREBAY, PUMP HOUSE FOUND & DELIVE	300 days	Mon 22/11/10	Thu 29/9/11
59	COMPLETION OF PCC AND FOUNDATION	217 days	Thu 29/9/11	Fri 11/5/12



UPPER BHADRA PROJECT

PACKAGE - II

ID		Task Name	Duration	Start	Finish
60		FOREBAY BED	375 days	Wed 11/1/12	Sat 2/2/13
61		FOREBAY SIDE WALL CONCRETE	220 days	Mon 6/2/12	Fri 21/9/12
62		TRASH PIER CONCRETING INCLUDING GATES	175 days	Tue 15/5/12	Mon 12/11/12
63		CONCRETING OF COLUMNS IN PUMP HOUSE UP TO CR.	320 days	Mon 27/2/12	Wed 23/1/13
64		CASTING OF CRANE BEAM	335 days	Mon 9/4/12	Thu 21/3/13
65		ERECTION OF EOT CRANE	335 days	Wed 9/5/12	Mon 22/4/13
66		COMPLETION OF ROOF TRUSS AND ROOF COVER	235 days	Mon 16/7/12	Sat 16/3/13
67		ERECTION OF DRAFT TUBE	165 days	Fri 26/4/13	Tue 15/10/13
68		DRAFT TUBE CONCRETE	165 days	Mon 3/6/13	Wed 20/11/13
69		ERECTION OF SPIRAL CASING	165 days	Fri 28/6/13	Mon 16/12/13
70		CONCRETING OF SPIRAL CASING	165 days	Mon 29/7/13	Thu 16/1/14
71		CONCRETING ABOVE SPIRAL CASING UP TO MOTOR FC	165 days	Sat 24/8/13	Tue 11/2/14
72		ERECTION OF PUMPS	165 days	Tue 24/9/13	Fri 14/3/14
73		ERECTION OF MOTORS	165 days	Fri 25/10/13	Tue 15/4/14
74		SUPPLY OF RAISING MAIN PIPES	250 days	Thu 14/6/12	Thu 28/2/13
75		RAISING MAIN AND ANCHOR BLOCKS	250 days	Fri 1/3/13	Fri 15/11/13
76		CONSTRUCTION OF CONTROL ROOM	150 days	Wed 27/3/13	Thu 29/8/13
77		CONSTRUCTION OF DELIVERY CHAMBER	575 days	Tue 6/3/12	Wed 23/10/13
78		**PUMP HOUSE-2**	**759 days**	**Thu 27/12/12**	**Mon 23/2/15**
79		EXCAVATION FOREBAY, PUMP HOUSE FOUND & DELIVE	200 days	Thu 27/12/12	Tue 23/7/13
80		COMPLETION OF PCC AND FOUNDATION	200 days	Tue 23/7/13	Sat 15/2/14
81		FOREBAY BED	250 days	Wed 28/8/13	Wed 14/5/14
82		FOREBAY SIDE WALL CONCRETE	165 days	Sat 28/9/13	Tue 18/3/14
83		TRASH PIER CONCRETING INCLUDING GATES	160 days	Mon 4/11/13	Fri 18/4/14
84		CONCRETING OF COLUMNS IN PUMP HOUSE UP TO CR.	115 days	Wed 18/9/13	Wed 15/1/14
85		CASTING OF CRANE BEAM	100 days	Mon 14/10/13	Sat 25/1/14
86		ERECTION OF EOT CRANE	115 days	Thu 30/1/14	Fri 30/5/14
87		COMPLETION OF ROOF TRUSS AND ROOF COVER	211 days	Wed 26/2/14	Thu 2/10/14
88		ERECTION OF DRAFT TUBE	150 days	Sat 31/5/14	Tue 4/11/14
89		DRAFT TUBE CONCRETE	150 days	Sat 31/5/14	Tue 4/11/14
90		ERECTION OF SPIRAL CASING	150 days	Wed 2/7/14	Thu 4/12/14
91		CONCRETING OF SPIRAL CASING	150 days	Wed 2/7/14	Thu 4/12/14
92		CONCRETING ABOVE SPIRAL CASING LEVEL UP TO MO	150 days	Sat 2/8/14	Mon 5/1/15
93		ERECTION OF PUMPS	150 days	Wed 20/8/14	Thu 22/1/15
94		ERECTION OF MOTORS	150 days	Sat 20/9/14	Mon 23/2/15
95		SUPPLY OF PIPES FOR RAISING MAIN	200 days	Wed 12/6/13	Mon 6/1/14
96		RAISING MAIN AND ANCHOR BLOCKS	153 days	Tue 18/2/14	Sat 26/7/14
97		CONSTRUCTION OF CONTROL ROOM	175 days	Sat 2/8/14	Fri 30/1/15
98		CONSTRUCTION OF DELIVERY CHAMBER	440 days	Tue 29/10/13	Wed 28/1/15
99		**SWITCH YARD WORKS & APPROVAL FROM KPTCL**	**521.38 days**	**Thu 10/11/11**	**Fri 3/5/13**
100		SWITCH YARD FOR PUMP HOUSE-1	210 days	Thu 10/11/11	Thu 14/6/12
101		SWITCH YARD FOR PUMP HOUSE-2	400 days	Thu 15/3/12	Fri 3/5/13
102		**TRANSMISSION LINES**	**295 days**	**Tue 26/3/13**	**Sat 25/1/14**
103		TRANSMISSION LINES TO PUMP HOUSE -1	250 days	Tue 26/3/13	Tue 10/12/13
104		TRANSMISSION LINES TO PUMP HOUSE -2	265 days	Thu 25/4/13	Sat 25/1/14
105		**COMMISSIONING PROCEDURES**	**35 days**	**Mon 23/2/15**	**Tue 31/3/15**
106		PRE-COMMISSIONING	15 days	Mon 23/2/15	Tue 10/3/15
107		COMMISSIONING	5 days	Tue 10/3/15	Mon 16/3/15
108		STABILIZATION	5 days	Mon 16/3/15	Fri 20/3/15
109		PERFORMANCE GUARANTEE TEST	7 days	Fri 20/3/15	Fri 27/3/15
110		COMPLETION	3 days	Fri 27/3/15	Tue 31/3/15



UBP Package-II Rev Programme
20-12-2012
RNSIL JV

Figure 10.3

SNC POWER CORPORATION (P) LIMITED

UPPER BHADRA PROJECT, Package -3

CONSTRUCTION PROGRAMME

S.No	ACTIVITY	FROM ZERO DATE	TO	NO OF MONTHS
1	**UPPER BHADRA PROJECT PACKAGE - 3**			
IA	**ENGINEERING**			
I	Detailed Design & Engineering.	0.00	6.00	**6.00**
IB	**COSTRUCTION ACTIVITIES**			
I	Mobilisation of Men and Machinery.	0.00	3.00	**3.00**
II	Approach roads	0.00	6.00	**6.00**
II	**VERTICAL SHAFT**			
a	Excavation (Depth = 45 m).	0.00	4.00	**4.00**
b	Supports (Rock Bolt & Shotcrete).	0.00	4.00	**4.00**
III	**TUNNEL**			
1	**APPROACH END (FACE-1)**			
a	Preparation of approach through canal to reach tunnel portal from Approach end.	0.00	2.00	**2.00**
b	Tunnel Portal Construction.	0.00	2.00	**2.00**
c	Tunnel Excavation from Face-1 Approach end (Ch.0.230 to 1.230 Km) Length = 1.00 Km	3.00	19.00	**16.00**
d	Supports(Rock Bolt & Shotcrete and Permanent Support).	3.00	19.00	**16.00**
e	Tunnel Lining - Kerb : from Face-1.	13.00	20.00	**7.00**
f	Tunnel Lining from Face-1-Overt.	20.00	28.00	**8.00**
g	Drilling and Grouting.	22.00	30.00	**8.00**
h	Invert Lining from Face-1.	23.00	31.00	**8.00**
2.0	**FACE-2 THROUGH VERTICAL SHAFT**			
a	Tunnel Excavation from Vertical Shaft Face-2 (Ch.3.280 to 2.755 Km , Length = 0.525 Km).	4.00	18.00	**14.00**
b	Supports(Rock Bolt & Shotcrete and Permanent Supports).	4.00	18.00	**14.00**
c	Tunnel Lining from Face-2 - Kerb.	12.00	19.00	**7.00**
d	Tunnel Lining from Face-2 - Overt.	19.00	23.00	**4.00**
e	Drilling and Grouting from face -2 to towards face -1	20.00	24.00	**4.00**
f	Invert Lining from Face -2 to towards Face -1.	21.00	25.00	**4.00**
3.0	**FACE-3 THROUGH VERTICAL SHAFT**			
a	Tunnel Excavation from Vertical Shaft Face-3 (Ch.3.280 to 3.780 Km , Length = 0.500 Km).	4.00	24.00	**20.00**
b	Supports(Rock Bolt & Shotcrete and Permanent Supports).	4.00	24.00	**20.00**
c	Tunnel Lining from Face-3 - Kerb.	17.00	26.00	**9.00**
d	Tunnel Lining from Face-3 - Overt.	23.00	30.00	**7.00**
e	Drilling and Grouting.	24.00	31.00	**7.00**
f	Invert Lining from Face -3 to towards Face - 4.	25.00	32.00	**7.00**
4.0	**EXIT END (FACE-4)**			
a	Preparation of approach through canal to reach tunnel portal from Exit end.	0.00	2.00	**2.00**
b	Tunnel Portal Concreting on the Exit end.	2.00	3.00	**1.00**
c	Tunnel Excavation from Face-4 Exit end (Ch.7.264 to 6.289Km) Length = 0.975 Km.	3.00	21.00	**18.00**
d	Supports (Rock Bolt & Shotcrete and Permanent Supports)	3.00	21.00	**18.00**

Months: 1 Jan'21, 2 Feb'21, 3 Mar'21, 4 Apr'21, 5 May'21, 6 Jun'21, 7 Jul'21, 8 Aug'21, 9 Sept'21, 10 Oct'21, 11 Nov'21, 12 Dec'21, 13 Jan'22, 14 Feb'22, 15 Mar'22, 16 Apr'22, 17 May'22, 18 Jun'22, 19 Jul'22, 20 Aug'22, 21 Sept'22, 22 Oct'22, 23 Nov'22, 24 Dec'22, 25 Jan'23, 26 Feb'23, 27 Mar'23, 28 Apr'23, 29 May'23, 30 Jun'23, 31 Jul'23, 32 Aug'23, 33 Sept'23, 34 Oct'23, 35 Nov'23, 36 Dec'23, 37 Jan'24, 38 Feb'24, 39 Mar'24

SNC POWER CORPORATION (P) LIMITED

UPPER BHADRA PROJECT, Package -3

CONSTRUCTION PROGRAMME

S.No	ACTIVITY	FROM ZERO DATE	TO	NO.OF MONTHS	1 Jan'21	2 Feb'21	3 Mar'21	4 Apr'21	5 May'21	6 Jun'21	7 Jul'21	8 Aug'21	9 Sept'21	10 Oct'21	11 Nov'21	12 Dec'21	13 Jan'22	14 Feb'22	15 Mar'22	16 Apr'22	17 May'22	18 Jun'22	19 Jul'22	20 Aug'22	21 Sept'22	22 Oct'22	23 Nov'22	24 Dec'22	25 Jan'23	26 Feb'23	27 Mar'23	28 Apr'23	29 May'23	30 Jun'23	31 Jul'23	32 Aug'23	33 Sept'23	34 Oct'23	35 Nov'23	36 Dec'23	37 Jan'24	38 Feb'24	39 Mar'24
e	Tunnel Lining from Face - 4 - Kerb.	14.00	23.00	**9.00**																																							
f	Tunnel Lining from Face - 4 - Overt.	18.00	29.00	**11.00**																																							
g	Drilling and Grouting.	21.00	30.00	**9.00**																																							
h	Tunnel Lining from Face - 4 Invert	22.00	31.00	**9.00**																																							
IV	**MISC. TUNNEL WORKS**																																										
a	Shaft Plugging & other Misc. Works.	30.00	32.00	**2.00**																																							
V	**CANAL Works.**																																										
a	Exit Canal Excavation including rainy season (Ch.7.264 to 9.930Km), Length = 2.666 Km.	2.00	12.00	**10.00**																																							
b	Approach Canal Excavation including rainy season (Ch.0.00 to 0.230 Km), Length = 0.230 Km.	2.00	8.00	**6.00**																																							
c	Exit Canal Lining (Ch.7.264 to 9.930Km), Length = 2.666 Km.	7.00	15.00	**8.00**																																							
d	Approach Canal Lining including rainy season (Ch.0.00 to 0.230 Km), Length = 0.230 Km.	8.00	12.00	**4.00**																																							
VI	**CM & CD WORKS**																																										
a	Construction of Super Passage - 2 Nos.	5.00	13.00	**8.00**																																							
b	Construction of Road Bridges - 4 Nos.	7.00	19.00	**12.00**																																							
VII	**DRAINGE & TURFING.**	16.00	22.00	**6.00**																																							
VIII	**MISC.Civil Works**	26.00	32.00	**6.00**																																							
IX	**MISC. & FINAL CLEAN UP.**	31.00	33.00	**2.00**																																							
X	**PREPARATION AND SUBMISSION OF COMPLETION REPORT.**	32.00	33.00	**1.00**																																							

Figure 10.4: CONSTRUCTION PROGRAM FOR CHITRADURGA BRANCH CANAL & JAGALUR BRANCH CANAL

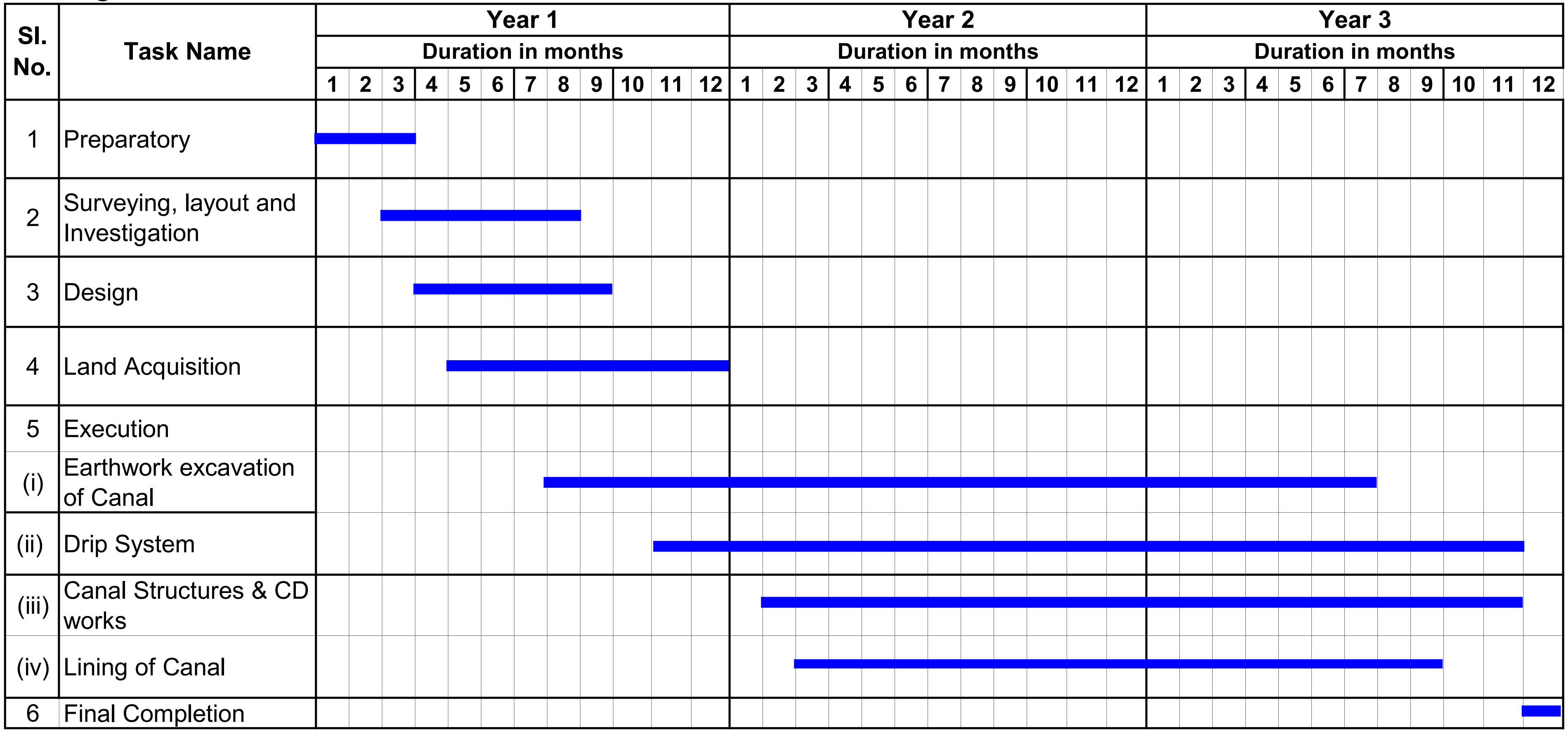
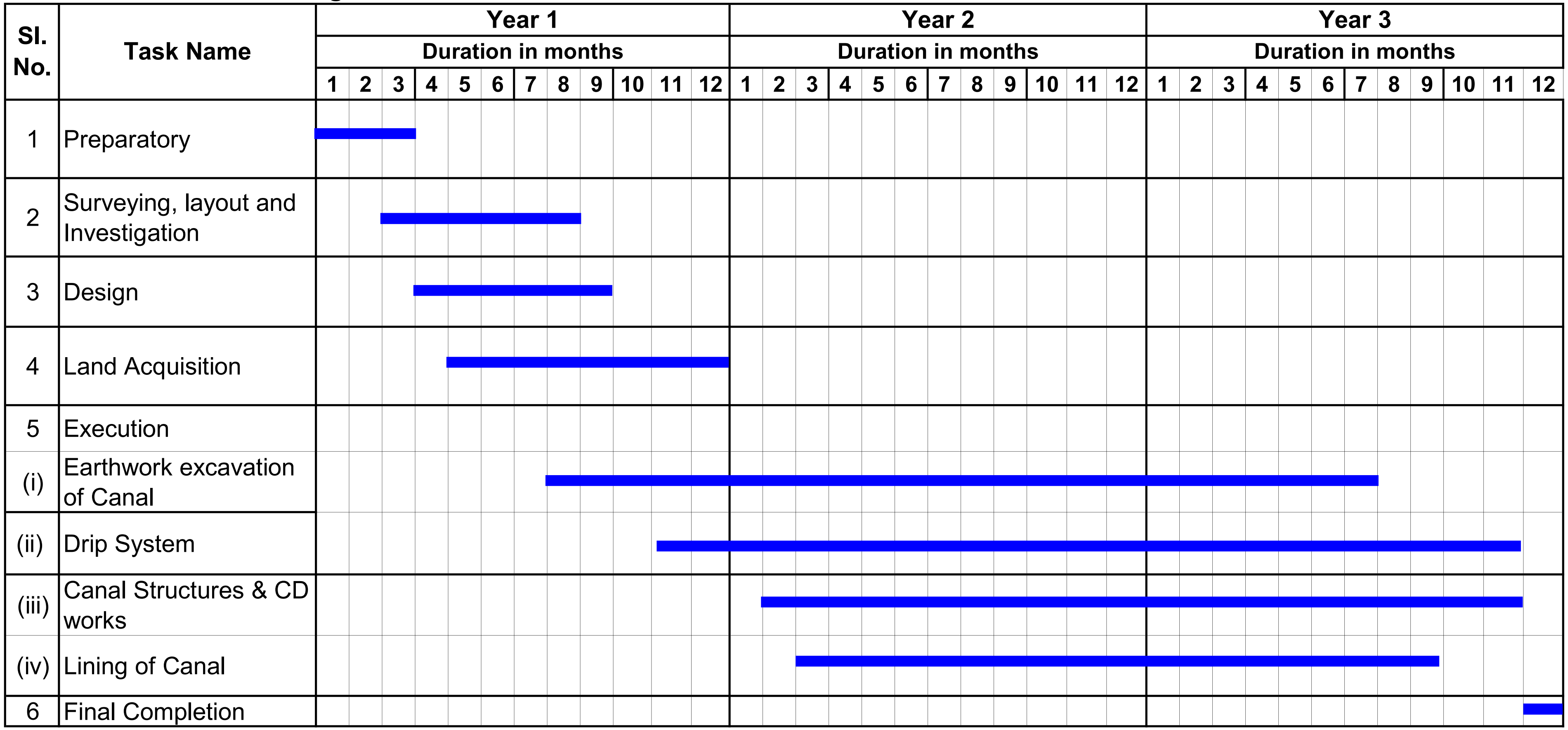


Figure 10.5: CONSTRUCTION PROGRAM FOR TUMKUR BRANCH CANAL



UPPER BHADRA PROJECT SCHEME A

ENERGY REQUIREMENT

11. ENERGY REQUIRMENT

11.1 Preamble

Energy Security and independence along with climate change is one of the most important issues & today power generation from renewable energy sources is increasingly becoming important all over the world, as we strive to mitigate greenhouse gases like carbon dioxide, methane, nitrous oxide, carbon monoxide, CFC-12, HCFC-22 which are produced by combustion of fossil fuels and climate change issues. India cannot rely indefinitely on fossil based energy sources, so there is growing need for renewable energy projects like solar, wind, biomass, small hydro etc to meet the growing needs of power requirements.

Potential for generating renewable energy is huge, there is growing realization in the Government and private sector to harness all available Renewable energy sources, which is now transforming into reality with the increased Government focus on renewables.

Solar Power is a safe bet, since it is available in abundance and offers best solution as an alternative to fossil fuel emissions and Global Warming. Mother Earth receives solar energy at the rate of approximately 1,20,000 TW. This exceeds both in the global consumption rate of about 15 TW and any conceivable requirement in future. It is a fact that Solar Energy is the largest exploitable renewable source, as more energy from Sun that Earth gets in one hour, than all the energy consumed by human in the entire year.

Now a day it is becoming very important to utilize renewable energy such as Solar Power energy since there is considerable defficiate of Hydro Electric Power and other Thermal Power generation.

Solar Power is available in abundance and offers best solution as an alternative to Hydroelectric or Thermal Power generation.

Upper Bhadra Project is a lift irrigation Project and the power required to lift the required quantum of water can be generated from Solar Power Energy with a considerable less cost as compared Thermal or Hydroelectric power.

Solar power plants provide the following benefits

- Savings of precious thermal / fuels.
- Sunlight is free & abundant.
- Solar power system are easy to operate and less maintenance.
- Reduces accumulation of Carbon content in atmosphere.
- Noise less and pollution free.
- Saves Electrical Charges.

11.2 Background

Upper Bhadra Project creates an Irrigation Potential of 2,25,515 Ha in Chikkamagalur, Chitradurga, Davanegere & Tumkur District. And provision to fill 367 tanks in command area.

17.4 T.M.C of water is proposed to be lifted from river Tunga at upstream of Upper Tunga Project in 2 stages and is led into existing Bhadra reservoir. 29.9 T.M.C of water is lifted from Bhadra reservoir, again in 2 stages and carried through a tunnel of 6.9 km. Chitradurga & Tumkur Branch Canal takes off at the exit of tunnel and distributes water for irrigation and tank filling. Chitradurga Branch Canal runs for an length of 138 km and Tumkur Branch Canal runs for a length of 157 km.

Power requirement for lifting water from Tunga to Bhadra reservoir (Package-I) is about 63 M.W and lifting water from Bhadra to tunnel near Ajjampura (Package-II) is about 122 M.W, further power requirement for drip irrigation to an extent of 2,25,515 Ha considering 39% of the area by pressurized system is about 10.43 M.W.

Thus the total requirement of power under Upper Bhadra Project including Tarikere lift scheme is about 200 M.W.

A provision of 1500 crores for required power generation by wind is made in D.P.R and this wind energy will be utilized for the entire project including drip irrigation instead of Electric Power Energy.

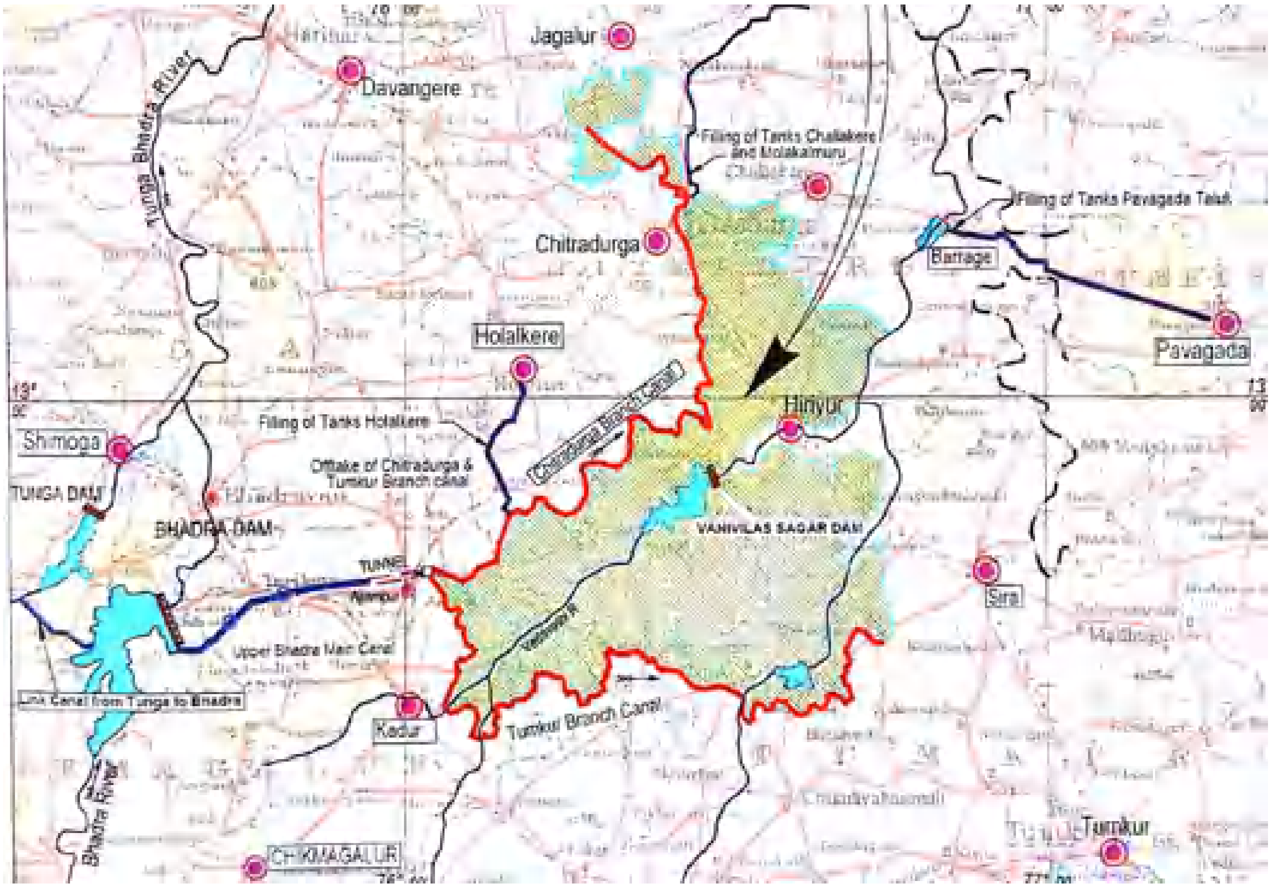
Further a project visit was undertaken by Chief Engineer (PAO), C.W.C, along with Director and Deputy Director during 17th to 19th Aug 2015. During the inspection and wrap up meeting some suggestions were made for Techno Economical improvements in the project proposal.

11.3 Objective of Present Report

One of the suggestion made is as "Appropriate tie-up with Solar Power Energy may be worked out for installation of solar panel on canal tops which would increase benefits and offset pumping energy cost and at the same time reduces evaporation losses.

As per suggestion made by C.W.C inspection team a detailed report is prepared to mitigate the required power energy by utilizing the renewable energy that is Solar Power Energy by installing solar panels on the top of the canal.

Project Area & Location:



The lifting point of Tunga water is located at the fore shore of Upper Tunga Dam near Muthinakoppa village of Narasimharaja pura taluk and water is delivered to Bhadra reservoir.

Upper Bhadra main canal takes off from Bhadra reservoir. The open canal runs for length of 40.535 km. Water is proposed to be lifted in 2 stage. The alignment passes through Tarikere Taluk and is proposed to cross the ridge between Bhadra Valley and Vedavathi Valley through a tunnel of length about 6.9 km. The tunnel ends near Ajjampura town of Tarikere taluk.

Tarikere Gravity canal off takes from the tunnel intake at Ajjampura and runs on both sides of Upper Bhadra Project Canal to provide irrigation facilities to 3650 Ha, land and filling up of 33 tanks coming under this atchkut. The water is also being lifted from tunnel in take at Ajjampura to provide irrigation facility to 16500 Ha. Of land & filling 46 tanks coming under this command.

Alignment of Chitradurga Branch Canal off takes after tunnel and passes through Tarikere, Kadur taluks of Chikkamagalur district, Hosadurga, Hiriyur, Holalkere, Chitradurga and Challakere taluk of Chitradurga district. The length of Chitradurga Branch Canal is 138 kms.

Tumkur Branch Canal also off takes after after tunnel and passes through Tarikere, Kadur taluks of Chikkamagalur district, Sira & Chikkanayakanahally taluks of Tumkur District and Hosadurga & HIriyur taluks for length of 157 kms.

Now it is proposed to install solar panels on the top of Chitradurga Branch Canal and Tumkur Branch Canal at selected reaches. Since Hosadurga, Hiriyur and Chikkanayakanahalli taluk are draught prone areas and abundant sunlight is available almost throughout the year.

From Chitradurga Branch Canal about 55 km (40% of total length of canal) and from Tumkur Branch Canal 63 km (40% of total length of canal) selected length can be utilized for installation of solar panels to generate solar power energy.

<u>Description of Canal Features:</u>

Sl. No.	Canal Features	Details
1.	Canal	Chitradurga Branch Canal and Tumkur Branch Canal
2.	Selected location	CBC - 55 km TBC -63 km
3.	Latitude	13^0 49' 12.86"
4.	Longitude	76^0 11' 20.73"
5.	Gradient along the identified location	CBC: 1:10000 ,1: 8000, 1:5000 TBC : 1:8000 ,1: 5000
6.	Bed width of canal	6.0 mts to 5.0 mts
7.	Top width of canal	Varies from 15 to 25 mts
8.	Top span in mts	Varies from 15 to 25 mts
9.	Type of Soil	Good gravally top soil and hard rock reaches
10.	Water level in canal	Average 722.227

11.4 Solar Energy Scenario

11.4.1 Background

Climate change is a derivative of unsustainable use of fossil fuels. To minimize this process of adverse alteration of weather phenomenon and reduce global warming, it is imperative to reduce the use of fossil fuels by switching to clean renewable sources. Development of solar generation plants/parks is one such endeavor to mitigate the process of climate change. Globally, this initiative has been taken up to a level of commercial generation of power. And now India has taken a proactive approach to absorb the technology to harness the vast potential of solar energy.

Solar energy is extremely beneficial as it is non-polluting and its generation can be decentralized. There is need to come together and take initiatives to create technologies for a greater use of these sources to combat climate change by reducing the emission of greenhouse gases.

This section presents a brief outlook on the solar energy scenario at national and state level, specifically in the state of Karnattaka. In addition this section discusses the available solar PV technologies, their evaluation and impact on environment.

11.4.2 Solar Energy- India Scenario

India is blessed with abundant solar energy and if harnessed efficiently, the country is capable of producing trillion-kilowatts of electricity. The fact that India is densely populated and having high solar insolation, is an ideal combination for using solar power in India. It has the advantage of permitting the decentralized distribution of energy, thereby empowering people at the grassroots level Figure on next page, shows the solar resource map of India.

The daily average solar energy incident over India varies from 4 to 7 kWh/m2 with about 1500–2000 sunshine hours per year (depending upon location). With about 300 clear, sunny days in a year, India's theoretical solar power reception, on only its land area, is about 5000 Petawatt-hours per year (PWh/yr) (i.e. 5000 trillion kWh/yr or about 600 TW). If this energy is harnessed efficiently, it can easily reduce nation's energy deficit scenario and that to with no carbon emission.

In the solar energy sector, some large projects have been proposed, and a 35,000 km2 area of the Thar Desert has been set aside for solar power projects, sufficient to generate 700 GW to 2,100 GW. Also India's Ministry of New and Renewable Energy has released the JNNSM Phase 2 Draft Policy, by which the Government aims to install 10GW of Solar Power and of this 10 GW target, 4 GW would fall under the central scheme and the remaining 6 GW under various State specific schemes.

Table below is presenting the State wise installed solar power capacity under JNNSM and various State programmes.

Table 3 -1 State Wise Installed Solar Power Capacity No.	States/ Union Territory	Solar Capacity (MW)
1.	Gujarat	698.81
2.	Rajasthan	201.65
3.	Andhra Pradesh	24.75
4.	Maharashtra	21
5.	Karnataka	19
6.	Tamil Nadu	17.1
7.	Jharkhand	16
8.	Uttar Pradesh	14.38
9.	Orissa	13
10.	Punjab	9.3
11.	Madhya Pradesh	7.96
12.	Haryana	7.8
13.	Uttarakhand	5.1
14.	Chhattisgarh	4
15.	Delhi	2.5
16.	West Bengal	2.1
17.	Lakshadweep	0.8
18.	Andaman & Nicobar	0.1
Total	**1,050 (Approx)**	

11.4.3 Solar Energy- Karnataka

Karnataka get an annual average solar insolation of 5.55 KWh/m2/day The state have very good solar potential and favorable Government policies towards solar energy utilization. Karnataka can tap solar radiations with 300-330 clear sunny days. Below Figure give the districts wise average insolation in Karnataka annually.

Government of Karnataka has already issued a Policy for harnessing Renewable Energy in year 2014. Based on the progressive views adopted in past five years in respect of solar generation under this Policy, the State is in the advanced stage of preparedness for installation of large scale Grid Interactive Solar Power Plants in next 5 to 10 years.

Karnataka has a total wasteland area of 13030.62 km2. Electric energy could be developed in that area is 5785.59 MU/day. Annual electrical energy generated in that area is about 21,11,742 MU. By considering the 2% of wastelands (260.61 km2) annual electricity generated is about 42,233 MU. This shows that the electricity generated would be at least 1.14 times higher than the present demand (36975 MU).

Government of Karnataka has identified land banks in various Districts for setting up of Grid Interactive Solar Power Projects. The Government is also planning to set up Sub stations at these vantage locations to evacuate the power generated by the developers.

The Karnataka Renewable Energy Development Ltd. (KREDL) has already taken the initiative in line with the Solar Policy and has selected project developers by conducting tariff based competitive bidding for

allocation of 80 MW of solar project capacity. The lowest winning bid was submitted at a tariff of INR 7.94/kWh.

The electricity sector in Karnataka is a major contributor to the State's growth. This sector has continuously grown and undergone major structural changes in consonance to the challenges of the changing socio-economic needs as well as the regulatory regime. The State energy sector is served by the following 100% Government owned companies.

11.5 Technology Evaluation

Solar Power can be generated using two types of technologies. These are:

- Solar Photovoltaic (PV) Technology - It collects and converts solar radiation directly into DC electricity.
- Concentrating Solar Power (CSP) - It concentrates solar radiation to high temperatures to be thermodynamically useful for conventional thermal electricity generation plants and is also known as Concentrating Solar Thermal Power (CSP) systems.

11.5.1 Solar Photovoltaic Systems Technology

In PV technology, the photovoltaic cells use 'photoelectric effect' to generate electricity on exposure to sunlight. These cells capture both direct and diffused solar radiation. The PV technology was first discovered in 1990s and today it has been matured to the capacity of large multi-megawatt generation plants. Costs associated with this technology are comparatively high, but the technology is well-known and reliable.

These are different types of photovoltaic technologies based on material used. These are:

- Silicon based Crystalline PV
- Thin Film PV

11.5.2 Concentrating Solar Power (CSP)

Concentrating solar power plants convert the sun's energy into high temperature heat using various mirror configurations. This high temperature heat can be used to generate power in a conventional steam cycle instead of, or in addition to, burning fossil fuels. The amount of power generated by a CSP plant depends on the amount of direct sunlight.

CSP is well suited for centralized power production in areas with high levels of direct solar radiation. Although far from a new technology, CSP applications are still maturing and can be quite different in formation depending on the particular site specific needs. The relatively low number of manufacturers, suppliers and CSP system designers internationally reflects the highly specialized nature of this field. Expertise tends to be limited to those countries and areas where there is high solar radiation on an annual basis.

A key advantage of CSP is that liquid salt based storage can be added to a CSP plant to allow power to continue to be generated when the sun sets thus providing supply with a similar profile to conventional power plants. These attributes make CSP an attractive renewable energy option in the sunbelt regions worldwide.

CSP technologies are generally categorized by the methods that are used to concentrate solar energy and produce a usable energy source. The two main categories are ‘line concentrators’ and ‘point concentrators’. Line concentrator systems may achieve concentrating factors up to one hundred while point concentrators may achieve concentrating factors on the order of thousands.

There are currently four main types of CSP technology in these two groups. These are:

- Parabolic Trough CSP,
- Fresnel-type CSP,
- Dish-Engine CSP Systems and
- CSP Central Receiving Systems (also called Solar Power Towers)

11.6 Technology Recommendation

Various factors should be considered while selecting a solar technology. These factors include application, implementation cost, return on investment, operation and maintenance, location, land availability and efficiency. CSP might be a suitable solution for plant capacities greater 50 MW and where water is sufficiently available. PV technology is more suitable for lesser capacities.

Considering the location identified for setting up the proposed 10 MW Solar Power Plant and various factors enumerated earlier, Solar PV is recommended. Further, choice of a particular cell technology (mono crystalline, multi-crystalline, thin film) depends mainly upon a combination of efficiency and environmental factors.

UPPER BHADRA PROJECT

ENVIRONMENTAL REPORT

12. ENVIRONMENTAL IMPACTS

12.1 In order to asses potential environmental impacts arising due to the **Proposed UPPER BHADRA PROJECT**, **M/s Environmental Health & Safety Consultants, Bangalore** have been awarded the contract to carryout Environmental Impact Assessment (EIA) study Report considering the various components/activities of the Project and their possible impacts on the surrounding environment i.e, in the study area along with incorporating baseline data for various Environmental Components, viz. Air Environment, Water Environment, Noise Environment, Land Environment, Biological Environment (Terrestrial Ecology and Aquatic Ecology), Public Health, Demography and Socio-Economics along with the parameters of human interest and to prepare Environmental Management Plan (EMP) for mitigating adverse impacts along with delineation of post project Environmental Monitoring Programme.

The EIA report presents baseline data collected during three seasons viz, **Winter Season (December 2007 to February 2008), Pre-Monsoon Season (March 2008 to May 2008) and Monsoon Season (June 2008 to September 2008)** for air, water, noise including land, biological and socio-economic components of environment; identification, prediction and evaluation of impacts and delineation of Environmental Management Plan (EMP) for mitigation of adverse impacts due to the **Proposed Upper Bhadra Project**.

Government of Karnataka have accorded administrative approval for Upper Bhadra Project (Part-1) vide Order No: WRD 152 VIBHYAE 2004 (Part-I), Bangalore dated 15-09-2008 for its Modified Estimate of ` 5985.00 Crores of which 3388.00 Crores (as per 2007-08 SR) for Irrigation Component-Part A and 2597.00 Crores (as per 2007-08 SR) for Water Supply Component-Part B. Hence, detailed EIA study Report has been prepared considering "Irrigation Component-Part A" only and Environmental Clearance sought is for the same.

The proposed project falls under Schedule 1 (c), Category "A" as per the new EIA Gazette notification dated 14.9.2006. Hence requires prior Environmental Clearance from the Ministry of Environment and Forests (MoEF), Government of India, New Delhi for establishment, operation and execution of the project.

Table 12.1: *Environmental Attributes and Frequency of Monitoring*

Sl. No.	Environmental Attributes	Parameters	Frequency of Monitoring/Particulars
1.	Air	SPM, RSPM, SO_2 and NO_x.	24 hourly continuous at each station twice a week for two consecutive weeks, in each season covering three full seasons at 38 stations.
2.	Meteorology	Wind speed and Wind direction, Temperature, Relative Humidity, Rainfall, Atmospheric Pressure, Solar Radiation and others	Micro-Meteorological Station established in the site operated continuously for three full seasons. In addition to the above, data is also collected from secondary sources like IMD, Literature etc,
3.	Water	Physico-Chemical and Bacteriological Parameters	Once during each season covering three full seasons at 38 locations.
4.	Ecology	Terrestrial Flora and Fauna, Aquatic Flora and Fauna	Through field visit during the Study period and also through literature survey of Forest Department Working Plans. Details also collected from Botanical Survey of India, Zoological Survey of India and website of IUCN, Redlist, 2008.
5.	Noise	Leq Day dB(A) and Leq Night dB(A)	24 hours continuous recording/monitoring at each station once in each season covering three full seasons at 40 stations during Day and Night.

6.	Soil	Parameters related to agricultural, irrigation and general.	Once during each season covering three full seasons at 38 locations.
7.	Land	Land use pattern, Seismicity, Soil Erosion, Forest Area, Agriculture and Cropping Pattern and others.	Through field survey also, details are collected based on data published in District Census Handbooks, from Karnataka State Remote Sensing Application Center (KSRSAC), Survey of India, and Department of Agriculture and also from the Govt. Websites.
8.	Socio-Economic Aspects	Population, Literacy, Income, Medical, Education, Transportation, Water Supply, Villages, Financial, Tourist spot, etc.,	Through field survey also, details are collected based on data published in District Census Handbooks, Health Department, Town Municipal Corporation and from Official Govt. Websites.
9.	Geology	Rocks, Minerals, Soil, Ores and others	Data/Details collected from Geological Survey of India, Geology and Mines Dept. Central Ground Water Board, Bangalore and also from Official Govt. Websites.
10.	Hydrology	Drainage area pattern, Nature of streams, Water Bodies, aquifer characteristics, water table, yield etc.,	Data/Details collected from Geological Survey of India, Geology and Mines Dept. Central Ground Water Board, Bangalore, Irrigation Dept. and also from Official Govt. Websites.

12.2 Project Site Details

The site is located at $13^{0}18'0''$ N Latitude and $75^{0}28'0''$ E Longitude. The entire project site includes the area from the offtake of Tunga River in Chikkamagalur District to Command Area under Chitradurga District, Tumkur District & Davangere District. The proposed Canal alignment, intake structure, various lift points, delivery chambers, tunnel and command areas will pass through State and Reserved Forests. This project falls under K-8 Sub-basin.

About 351.97 Ha of Forest area and 5120.555 Ha of private land is required for construction of the proposed project. Lands will be acquired as per Land Acquisition Act 2013. This includes both agriculture and undeveloped land.

The overall climate of the Chikkamagalur project site area is very agreeable and cool, as it comprises of a large extent of hilly terrain. The cold season is from December to February, followed by the hot season from March to May. The period from June to September constitutes the Southwest monsoon season. October and November may be termed the post monsoon or retreating monsoon season. The humidity is very high during the monsoon season, generally exceeding 90 percent. It is comparatively less during the rest of the year. The driest part of the year is the period of January to March.

The overall climate of the Chitradurga project site area including Command Area is very hot and semidry, as it comprises of some extent of rocky hilly terrain. The cold season is from December to February, followed by the hot season from March to May. The period from June to September constitutes the Southwest monsoon season. October and November may be termed the post monsoon or retreating monsoon season. The humidity is very high during the monsoon season, generally exceeding 80 percent. It is comparatively less during the rest of the year. The driest part of the year is the period of March to May.

The Tumkur district falls in the eastern dry agro climatic zone. The temperatures start rising from January to peak in may, around 40^{0} C is common. Thereafter it declines during the monsoon period. The humidity is lowest during the dry season and highest during the monsoon period.

The Davangere district falls under central dry agro-climatic zone of the Karnataka state and is categorized as drought prone. Normal climatic parameters of the district are increasing temperature from March to May, usually maximum April month and minimum temperature that is coldest month during month of December.

The Average Annual Rainfall in Chikkamagalur areas is 758 mm. It varies from a low of 595 mm in Kadur Taluk to a high of 2379 mm in Mudigere. Average Annual Rainfall in Chikkamagalur District is 1904mm.

The Average Annual Rainfall in Chitradurga areas is 475 mm and Average Annual Rainfall in Chitradurga District is 486.7 mm. The maximum precipitation of over 80% of total annual rainfall occurs in four months between April and October.

The probability of occurrence of Annual Rainfall of Tumkur areas between 500-800mm is 75%. September is the wettest month with monthly rainfall in excess of 170 mm. Annual Rainfalls in the district varies from over 900mm in Tumkur to around 600mm in Pavagada.

In Chikkamagalur areas, winds are generally very light during the period from May to September and in case of Chitradurga areas during Post-monsoon, there will be continuous blowing of wind, with velocities reaching 10 Km/hr. In Tumkur Areas, the winds are predominantly south westerly during the summer monsoon and northeasterly during the winter monsoon.

12.3 Project Description

The entire proposed project comprises of implementing the scheme with following components:

- Lifting water from Tunga River to Bhadra Reservoir in two stages.
- Construction of canal from Bhadra Reservoir to Delivery Chamber including two lifts and a tunnel of 6.90 Km length and
- Tarikere lift provide irrigation facility to 20,150 Ha of land in Chikkamagalur district including Restoration of 33 Tanks coming within the Command Area and filling of 46 Tanks.
- Canal network to provide irrigation facility to 2, 25,515 Ha of land in Chikkamagalur and Chitradurga, Tumkur and Davangere Districts including filling 288 tanks situated within the command area.

The requirement of water for irrigation **(Kharif season only)** and filling tanks under different taluks of Chitradurga, Chikkamagalur, Tumkur and Davangere districts (command area) will be as under:-

Table 12.2: *Requirement of Water for Proposed Irrigation*

Sl. No.	Name of District / Taluk	Area in Ha	Requirement of Water for Irrigation (TMC)
A.	**Chikkamagalur**		
	1. Tarikere	22189	1.40
	2. Kadur	22366	2.17
	Sub-Total	**44555**	**3.57**
B.	**Chitradurga**		
	1. Hosadurga	44608	4.61
	2. Holalkere	371	0.04
	3. Hiriyur	67034	6.83
	4. Chitradurga	28966	2.96
	5. Challakere	13266	1.42
	Sub-Total	**154245**	**15.86**
C.	**Tumkur**		
	1.Chikka nayakanahalli	4657	0.45
	2. Sira	14558	1.39
	Sub-Total	**19215**	**1.84**

Sl. No.	Name of District / Taluk	Area in Ha	Requirement of Water for Irrigation (TMC)
D.	**Davangere**		
	1. Jagalur	7500	0.63
	Sub-Total	**7500**	**0.63**
E .	**Water requirement for tank filling (367 no. tanks - 6.00 TMC) including Vani Vilas Sagr agumentation (2.00tmc)**	**6.00+2.00**	**8.00**
	Grand Total	**225515**	**29.90**

Requirement of land for the Proposed Project

(a) Forest Area - 351.97 Ha
(b) Private land - 5120.555 Ha

Villages Benefited by the Proposed Project

- Total villages benefited under Chikkamagalur District = 199 Nos.
- Total villages benefited under Chitradurga District = 442 Nos.
- Total villages benefited under Tumkur District = 110 Nos.
- Total villages benefited under Davangere District = 36 Nos.
- Total villages benefited = 199+442+110+36 = 787 Nos.

Benefit cost ratio of Upper Bhadra project worked out for 10% interest on Capital investment adopting technical advisory committee based “Bor Model” suggested by Gadgil committee. Finally benefit cost ratio is calculated by dividing the annual benefits from annual costs which works out to **1.024** for 10% interest.

12.4 Hydrology and Irrigation Planning

12.4.1 Proposed 29.90 TMC Utilization

The requirements for irrigation using LPS drip system and tank filling in the districts of Chikkamagalur, Chitradurga, Davangere and Tumkur that can be met out of the above allocation is worked out keeping in view the following.

(i) The total area under Chitradurga Branch Canal is 107265 Ha utilizing 11.44 TMC of water.

(ii) The area under Tumkur Branch Canal is considered as 84900 Ha utilizing 7.28 TMC of water.

(iii) The area of Jagalur Branch Canal (JBC) is considered as 13200 Ha utilizing 1.39 TMC of water.

(iv) The area under flow and lift canals in Tarikere taluk is 20150 Ha as per approved project area with drip irrigation, keeping the utilization of 1.79 TMC for Irrigation.

(v) In addition, 8.00 TMC of water is proposed to be utilized for filling of Tanks under Kadur, Tarikere, Hosadurga, Hiriyur, Chitradurga, Sira, Chikkanayaknahalli, Pavagada, Holalkere, Challkere and Molakalmuru taluks.

12.4.2 Proposed Cropping Pattern for Micro Irrigation

The cropping pattern to be adopted post irrigation during khariff season is approved by the State Agricultural Department, comprising of semidry crops as shown below with 100% intensity of irrigation.

Ground nut	-	45% of the ICA
Jowar	-	15% of the ICA
Maize	-	10% of the ICA
Pulses	-	10% of the ICA
Sunflower	-	20% of the ICA

The ICA envisaged is 2,25,515 Hectares

12.5 Baseline Environmental Studies

Table 12.3: *Primary Data Collected for Various Environmental Aspects*

Parameter	Locations for Proposed Data Collection	Source
Air Quality	37 locations	Primary
Water	38 locations	Primary
Meteorology	1 location	Primary and Secondary
Soil	38 locations	Primary and Secondary
Noise Level	40 locations	Primary
Ecology	Study Area	Primary and Secondary
Geology and Hydrology	Study Area	Secondary
Land use	Study area	Primary and secondary
Socio-Economic	Study Area	Secondary

Secondary data collected from published sources, Government agencies and from Official Websites.

12.6 Land Environment- Base Line Status

The Land use pattern of the entire proposed project site and surroundings area is categorized into Forest area, Private Lands and Agricultural Lands. Command Area of about 225515 Ha, falls under the influence of Chitradurga, Chikkamagalur, Tumkur and Davangere Districts. However, before filling up of tanks in the command areas, desilting of tanks are proposed to be taken up.

Table 12.4: *Estimated Land Acquisition and Forest Type Details*

Sl. No	Details of the Canal	Purpose of Land Acquisition	Taluk/ District	Name of the Forest	Type of Forest	Chainage of Canal (Km)		Length of Canal in Forest (m)	Area Required (Ha)
						From	To		
1.	Link Canal from River Tunga to Bhadra Reservoir	Construction of Canal	N.R.Pura/ Shimoga	Aramballi	State Forest	-			94.06
2.		Construction of Power line	N.R.Pura/ Shimoga	Aramballi	State Forest				
3.		Construction of Electrical sub station and dumping yard	N.R.Pura/ Shimoga	Aramballi	State Forest				
4. 5.	Upper Bhadra Main Canal	Construction of Headwork Construction of Canal	Tarikere/ Chikkamagalur	Gurigi Gudda	State Forest	-			88.80
6.		Construction of Canal	Tarikere/ Chikkamagalur	Gurupur	Reserved Forest				
7.	Chitradurga Branch Canal	Construction of Canal	Hosadurga/ Chitradurga	Devaragudda	State Forest	37.498	41.094	3596	19.86
8.						42.390	43.582	1192	5.48
9.			Hosadurga/ Chitradurga	Janakal	State Forest	53.4	56.741	3341	25.34
10.			Holalkere/ Chitradurga	Lakkihalli	State Forest	67.30	70.819	3519	30.61
11.			Hosadurga/ Chitradurga	Lakkihalli	State Forest	70.819	80.369	9550	59.27
12.			Hiriyur/ Chitradurga	Lakkihalli	State Forest	80.369	82.002	1633	7.71
13.	Tumkur Branch Canal	Construction of Canal	Kadur/ Chikkamagalur	Udugere	State Forest	60.291	60.948	657	2.30
14.			Chiknayakanhalli and Gubbi/Tumkur	Bukkapatna	State Forest	145.172	155.208	10036	31.06
								Total	**364.50**

12.7 Soil Quality Assessment

Standard techniques of soil survey were used to obtain qualitative and quantitative data on the soils. Various soil quality parameters viz., pH, electrical conductivity, chloride, available calcium and magnesium, phosphorus, exchangeable sodium and potassium, available nitrogen etc., were determined employing standard methods of analysis.

From the overall results of the physico-chemical analysis of the soil samples, it is noticed that, the soil pH values range between 6.5 and 8.5 and most of the values belong to soil reaction index II, which shows that the soils of the study area are under the neutral range. The electrical conductivity of the soil samples were observed to be in the range between 73 and 428 µmhos/cm indicates Salinity of the soils are in Low and Medium range. Based on the rating chart of soil tests, all the soil samples belong to Normal i.e., Salt Index I, where as Organic Carbon content of soil samples were observed to range from 0.08 to 4.8 percent. As per the nutrient index, the Organic Carbon, Available Phosphorus (P) and Available Potassium (K) in soil samples are at Medium Level. Overall, results of the soil quality analysis revealed that, it holds good for cultivation.

12.8 Water Environment - Base Line Status

Various water quality (Physico-Chemical and Bacteriological) constituents viz., pH, Turbidity, Electrical conductivity, TDS, Alkalinity, Chlorides, Total hardness, Calcium hardness, Magnesium hardness, Nitrate, Sulphate, Fluoride, Sodium, Potassium, Total Coliform and Faecal Coliform were determined employing Standard Methods.

Table 12.5: *Comparative Assessment with Standards Prescribed by BIS for Drinking Water (Winter Season - December 2007 to February 2008)*

Parameters	Maximum Permissible limits (BIS-10500: 1991)	No. of samples above maximum permissible limit prescribed by (BIS-10500:1991)
		Number
pH	6.5-8.5	01
EC (µmhos/cm)	3000	0
Turbidity (NTU)	10	0
TDS	2000	0
TH as $CaCO_3$	600	05
Ca as $CaCO_3$	200	12
Chlorides	1000	0
Sodium	200	0
Potassium	10	0
Fluoride	1.5	0
Sulphates	400	0
Nitrates	45	0
Phosphates	0.3	0
Colour (Hazen unit)	25	0
Total Coliform (MPN)	01/100 ml	04
Faecal Coliform (MPN)	Nil/100 ml	02

Note:

- All values are expressed in mg/l except for Turbidity, pH, Colour and Conductivity.
- Total Coliform and Faecal Coliform in MPN Count.

Table 11.6: *Comparative Assessment with Standards Prescribed by BIS for Drinking Water (Pre Monsoon Season - March 2008 to May 2008)*

Parameters	Maximum Permissible limits (BIS-10500: 1991)	No. of samples above maximum permissible limit prescribed by (BIS-10500:1991)
		Number
pH	6.5-8.5	02
EC (µmhos/cm)	3000	0
Turbidity (NTU)	10	0
TDS	2000	0
TH as $CaCO_3$	600	04
Ca as $CaCO_3$	200	19
Chlorides	1000	0
Sodium	200	0
Potassium	10	0
Fluoride	1.5	0
Sulphates	400	0
Nitrates	45	0
Phosphates	0.3	0
Colour (Hazen unit)	25	0
Total Coliform (MPN)	01/100 ml	03
Faecal Coliform (MPN)	Nil/100 ml	01

Note:

- All values are expressed in mg/l except for Turbidity, pH, Colour and Conductivity.
- Total Coliform and Faecal Coliform in MPN Count.

Table 12.7: *Comparative Assessment with Standards Prescribed by BIS for Drinking Water (Monsoon Season - June 2008 to September 2008)*

Parameters	Maximum Permissible limits (BIS-10500: 1991)	No. of samples above maximum permissible limits prescribed by (BIS-10500:1991)
		Number
pH	6.5-8.5	03
EC (µmhos/cm)	3000	0
Turbidity (NTU)	10	0
TDS	2000	0
TH as $CaCO_3$	600	03
Ca as $CaCO_3$	200	07
Chlorides	1000	0
Sodium	200	0
Potassium	10	0
Fluoride	1.5	0
Sulphates	400	0
Nitrates	45	0
Phosphates	0.3	0
Colour (Hazen unit)	25	0
Total Coliform (MPN)	01/100 ml	07
Faecal Coliform (MPN)	Nil/100 ml	04

Note:

- All values are expressed in mg/l except for Turbidity, pH, Colour and Conductivity.
- Total Coliform and Faecal Coliform in MPN Count.

From water quality analysis results, it is inferred that, majority of water samples analysed have shown results well within the Maximum Permissible Limits (BIS 10500:1991 Drinking Water Quality Standards). Very few water samples were bacteriologically contaminated. Also, from the above comparative assessment tables, pH of the water above 8.5 can be noticed in very few water samples i.e 6 No.s. Water quality analysed for Irrigation parameters such as Sodium Absorption Ratio (SAR), Residual Sodium Carbonate (RSC) and Percent Sodium have revealed most of the water samples suitable for Irrigation purposes and w.r.t Salinity of water, majority of water samples revealed medium salinity (Class II) which is suitable for Irrigation.

12.9 Air Environment

The ambient air quality monitoring stations (37 Stations) were selected based on the projected impact of the project on the human settlements, flora and fauna of the study area. The Respirable Dust Sampler was used for the selected stations at a suitable level (3 m height from Ground Level), for monitoring the primary pollutants [IS: 5182 (part14) 1985].

The primary pollutants were monitored at each monitoring station continuously for 8 hours twice a week for two weeks in each season completing three full seasons were:

- Suspended Particulate Matter (SPM)
- Respirable Suspended Particulate Matter (RSPM)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_x)

SPM values ranged between 15.7-158.2 $\mu g/m^3$, RSPM values ranged between 1.3 - 64.6 $\mu g/m^3$, SO_2 values ranged between 0.2 - 15.7 $\mu g/m^3$ and NOx values ranged between 0.5 -17.2 $\mu g/m^3$. Hence, Ambient Air Quality Monitoring results at all the locations were observed to be well within the National Ambient Air Quality (NAAQ) Standards.

12.10 Meteorological Conditions

Summary of the Micro-Meteorological data obtained by establishing Micro-Meteorological station near Bhadra Dam during Study Period is presented here under.

Temperature

Sl. No.	Description	Minimum Temperature (°C)	Maximum Temperature (°C)
1.	Winter season Mean	12.2°C	34°C
2.	Summer season Mean	22.5°C	36°C
3.	Monsoon season Mean	16.4°C	32°C

Humidity

Annual mean humidity (morning - 8.30 am) - 71 %
Annual mean humidity (evening - 5.30 pm) - 52 %
Max.Humidity 88 %
Minimum Humidity 48 %

Wind Speed and Wind Direction

Mean wind speeds (high) 22.5 Kmph - Feb
Mean wind speeds (Low) 3.5 Kmph - Dec

Predominant Wind Directions

Dec.2007 - Feb 2008 N, NE, NN

12.11 Noise Environment

Ambient Noise Level Monitoring was performed at 40 Stations. Sound Level Meter (SE 322 CENTER), was used for monitoring noise levels during Day and Night time and computed for Leq Day and Leq Night values using SE 322 software. The instrument used measures the sound in terms of decibel unit denoted by dB (A). Leq Day values varied between 41.9 dB (A) and 58.7 dB (A) and Leq Night values varied between 31.2 dB (A) and 46.8 dB (A). Hence, Ambient Noise Level Monitoring results at majority of the locations were observed to be well within the Central Pollution Control Board (CPCB) Standards.

12.12 Socio-Economic Environment

Table 11.8: *District Wise Details at a Glance*

ITEMS		Person / Male / Female	Chitradurga District	Chikkmagalur District	Tumkur District	Davangere District
Population	Total	Person	1660378	1137753	2681449	1946905
		Male	843411	567483	1354770	989602
		Female	816967	570270	1326679	957303
	Rural	Person	1332012	898079	2078665	1317816
		Male	678352	448099	1050056	670545
		Female	653660	449980	1028609	647271
	Urban	Person	328366	239674	602784	629089
		Male	165059	119384	304714	319057
		Female	163307	120290	298070	310032
Decimal Population Growth Rate (as per Census 2011)			9.39	-0.28	3.74	8.7
Geographical Area (Sq.Kms)			8440	7201	10597	5924
Density of Population(Persons/Sq.Kms)			197	158	253	329
Sex Ratio(No.of Females per 1000 Males)			969	1005	979	967
Sex Ratio(0-6 age-group)			933	963	952	931
Literacy Rate(as per Census 2011)		Person	73.82	79.24	74.32	76.3
		Male	81.37	85.66	82.05	83.02
		Female	66.05	72.88	66.45	69.39
Percentage of Urban population to total Population (as per Census 2001)			20.00	21.00	22.00	32.00
Percentage of Total Population						
Main Workers		Person	34.69	37.69	39.17	32.45
		Male	47.38	55.02	53.32	47.19
		Female	21.60	20.45	24.72	17.21
Marginal Workers		Person	8.78	7.72	9.94	7.81
		Male	5.07	5.19	5.10	5.42
		Female	12.61	10.24	14.89	10.28
Non-Workers		Person	47.94	54.86	47.28	51.73
		Male	39.58	41.10	38.56	40.12
		Female	56.58	68.56	56.19	63.74

ITEMS	Person/ Male/Female	Chitradurga District	Chikkmagalur District	Tumkur District	Davangere District
Percentage Among Total Workers					
Cultivators	Person	38.4	28.6	45.7	30.8
Agricultural Labour	Person	33.4	21.1	23.8	34.5
Household Industry	Person	3.3	2.3	4.6	3.9
Other Workers	Person	24.8	47.9	25.8	30.8
Percentage of Scheduled Castes	Person	22.17	20.43	18.34	18.61
Percentage of Scheduled Tribes	Person	17.54	3.6	7.5	11.71
Number of Villages		1059	1117	2708	923
Number of Towns		6	9	11	6
Number of Hoblies		22	34	50	24
Number of Taluks		6	7	10	6
Source: Census of India 2011 & 2001					

12.12.1 Study Area Details

Agricultural crops includes Cardamom, pepper, Maize, Groundnut, Ragi, Jowar, Sunflower, Maize, Coconut and Paddy. Commercial crops includes Sunflower, Groundnuts, Sugarcane. Plantation includes Coconut, Arecanut, Chillies, Pepper, Cardamom and Ginger. Endangered species includes Floral species like Dipterocarpus indicus (Dhuma, Kalpin, Challane), Vateria indica (Saldupa, Dhupadamara, Bilidamar), Hopea wightiana (Haiga), Myristica magnifica (Ramaadike) and Faunal species include Morelia viridis (Python) and Cuon alpinus (Kennai). Floral species of Economic significance is Santalum album (Sandalwood, Shriganda). Aquatic fauna of commercial/recreational value and migratory fish Species along with their spawning ground includes Oreochromis mossambica, Catla catla, Cyprinus carpio, Aorichthys oar and Aorichthys seenghala. Soil types found in the study area includes Red Sandy, Deep Black, Red loamy, Mixed Red and Black, Medium Black and Red Clay.

12.13 Biodiversity and Ecological Assessment

The extent of land required for the proposed Upper Bhadra Project is estimated as (i) Forest land - 364.50 Ha and (ii) Private land - 2289.70 Ha. A participatory and consultative approach was followed for executing the assignment on Biodiversity and Ecological Assessment of the proposed Upper Bhadra Project. A team of experts from Environmental Health and Safety Consultants, Karnataka Neeravari Nigam Limited and from concerned Forest Department visited the project site area and conducted the ecological survey. Meetings were also held during the ecological survey with Forest officials, Revenue Department and Local Community. Literature survey included review of Forest Working Plan such as Koppa Forest Division Working Plan, Chikkamagalur Forest Division Working Plan and Chitradurga Forest Division Working Plan, District Census Handbook, Gazetteer and other records related to ecology of the region were collected. Vulnerable species observed along the proposed alignment of the scheme are Pterocarpus Marsupium (Honne), Dalbergia latifolia (Beete), Santalum album (Sandalwood, Shriganda), Chloroxylon swietenia (Mashival) and Acacia Ferruginea (Banni).

12.14 Environmental Impact Assessment (Identification, Prediction and Evaluation of Impacts)

The proposed project have been analysed for two scenarios viz, during project Construction Stage and post construction stage / Operational Stage. EIA has been carried out adopting graded matrix system. Effects of various activities on the environment were ranked on a scale of 1 to 4, based on the order of increasing importance to arrive at Parameter Importance Value (PIV). The score of each parameter has been converted to probability and then recalculated by multiplying with thousand. The values thus obtained are used for evaluating the degree of impacts on the project activities. The degree of impacts range from 1 to 10 with value of 1 to 2 for minimum impacts, 3 to 4 for moderate impacts, 5 to 6 for appreciable impacts, 7 to 8 for significant impact and 9 to 10 for extreme impacts. A positive or negative sign indicates the impact value depending on its beneficial or adverse impact.

The total score (TSC) has been then calculated as under:

$$\mathbf{TSC_i = (PIV)_I \sum_{j=l}^{n} I_{ij} \qquad - (1)}$$

where,

- PIV - Parameter Importance Value.
- I - Impact Value (1 to 10 positive or negative)
- j - Project Activity
- i - Environmental parameter.

The Total Impact Score (TIS) has been calculated using the formulae:

$$\mathbf{TIS = \sum_{j=1}^{n} TSC_I \qquad - (2)}$$

Where, n is the total number of environmental parameters considered.

Based on the project details and the baseline environmental status, potential impacts as a result of the construction and operation stage of the proposed project has been studied on the following components:

- Land Environment
- Water Environment
- Terrestrial Flora
- Terrestrial Fauna
- Aquatic Ecology
- Noise Environment
- Air Environment
- Socio Economic Environment.

The proposed project has TIS (Total Impact Score) of - 840.97 at Construction Stage, whereas it is -110.1 only at Operation Stage when EMP's are not incorporated in the implementation of proposed project. This suggests that the positive impacts of the project would be just able to compensate the negative environmental impacts. It is further noted that, the TIS at Construction Stage becomes only - 213.23 when EMP's are implemented along with the execution of proposed project, still suggesting that the implementation of proposed project with EMP's would have minor impacts even when EMP's are implemented. However, the TIS became a significant 372.16 at Operation Stage when EMP's have been incorporated in the implementation of the proposed project. The above analysis clearly demonstrates that incorporation of EMP's in the implementation of the proposed Upper Bhadra Project is very necessary and helps in attaining sustainable development.

12.15 Environmental Management Plan

Environmental Management Plan (EMP) aimed at minimizing the negative impacts of the proposed project on the surrounding environment. The mitigation measures described for all the likely adverse impacts on the environment due to the project are in brief given below:

(a) Environmental safeguards (management) during construction activities
(b) Plan for restoration of quarry areas/borrow areas and areas for dumping excavated material.
(c) Management to arrest salinity/ alkalinity in the wake of irrigation
(d) Action plan for control of irrigation induced water logging, salinity etc including strategies and policies with choice of species/crop for optimum use of water for agriculture to reduce adverse impacts of excessive irrigation including water logging.
(e) Action plan for command area development in respect of irrigation potential
(f) Ground water management including harnessing of ground water in conjunction with surface water.
(g) Public Health Management Plan
(h) Provision of free fuel to labours
(i) Compensatory Afforestation Scheme in consultation with the State Forest department, Karnataka.
(j) Greenbelt Development Plan
(k) Canal Bank Plantation
(l) Road Side Plantation
(m) Muck Disposal Plan
(n) Public Health Delivery System including the provisions for drinking water facility for the local community.
(o) Sanitation & Solid Waste Management Plan for domestic waste from colonies and labour camps, etc.
(p) Land Environment Management Plan
(q) Restoration and Landscaping of Project Sites
(r) Compensation for Land Acquisition
(s) Subsidized Fuel Management Plan
(t) Socio-Economic Development Aspects
(u) Water Environment, Air Environment & Noise Environment Management during construction and post-construction periods.
(v) Environmental Monitoring Programme (With physical & financial details covering all the aspects of EMP i.e Budgetary allocation for EMP included)
(w) Environmental Management Cell

12.15.1 Environmental Safeguards (Management) during Construction Activities

The impacts during the construction stage of the proposed project on the environment are basically of transient in nature and are expected to reduce gradually on completion of the construction activities.

Table 12.9: *EMP for Construction Phase Impacts "Site Clearing"*

Environmental Impacts	Mitigation	Remarks
Soil Erosion	• Extent of vegetation removal will be minimized at best possible to prevent extent of soil erosion. • Vegetative cover shall be reprojected /rehabilitated at the earliest practicable time to minimize duration & extent of soil erosion.	Implementation responsibility: • Contractors • Project Consultants • KNNL.
Noise Generation	• Selection of equipment with less noise generation to be used. • The earth moving equipment will be periodically checked and maintained for noise levels. • The workers will be provided with PPE such as earplugs/earmuffs to reduce impact of high noise levels.	Implementation responsibility: • Contractors • Project Consultants • KNNL
Dust Generation	• The site cleared will be periodically watered to reduce emission of dust particles. • Workers will be provided with PPE such as Nose masks to reduce impact on health.	Implementation responsibility: • Contractors • Project Consultants • KNNL

Table 12.10: *EMP for Construction Phase Impacts "Transportation of Construction Materials"*

Environmental Impacts	Mitigation	Remarks
Noise Generation	• Periodic maintenance of vehicles will be done.	Implementation Responsibility: • Contractors • Project Consultants • KNNL.
Dust Generation	• Construction materials will be covered with tarpaulin sheets to prevent the material from being air borne. • The vehicle speed will be regulated. • The workers transporting materials will be provided with PPE such as nose masks to reduce impact of air borne dust on their health	Implementation Responsibility: • Contractors • Project Consultants • KNNL.
Vehicular Emissions	• Periodic emission check for vehicles will be done. • Clean fuel will be used for vehicles.	Implementation Responsibility: • Contractors • Project Consultants • KNNL.

12.15.2 Water Quality Management Plan

Following mitigation measures will be adopted to avoid impact on water resources:

- Construction equipment requiring minimum water for cooling and operation for optimum effectiveness will be chosen.
- High-pressure hose will be used for cleaning and dust suppression purposes.
- Monsoon period will be avoided for cutting and filling of earthwork.
- Water requirements for the domestic use will be met by Tunga River water. Required pre-treatment such as Filtration and Chlorination will be carried out before supply to labour camps. Aquatic sanitation facilities like Toilets, Septic Tanks and Soak Pits will be provided for the construction workers in the Labour Camps to

reduce impact on groundwater quality and also to maintain hygienic conditions in and around the site. One community Latrine for 20 persons and One Septic Tank for 500 persons will be provided.

- Drinking water and Waste disposal sites will be located away from each other.
- Water is needed to wash the boulders or cut stones and to lower the temperature of the crushing edges. About 0.1m^3 of water is required per tonne of the material crushed. Washings from the crushers contain high suspended solids and therefore proposed to treat in Settling Tanks and later reused for dust suppression purposes.
- Adequate drainage system to dispose storm water from the labour colonies will be provided.

12.15.3 Air Quality Management Plan

- During construction period, there is likely hood of generation of dust and NOx emission. This can be attributed to levelling activity and vehicular movement.
- The transport vehicles using petrol or diesel will be properly maintained to minimize smoke in the exhaust.
- Since, there is likelihood of fugitive dust from the construction activity, water sprinkling will be done at regular intervals.
- Periodic emission check will be made mandatory for the vehicles used in the proposed project's construction activity.
- Water will be sprayed by high-pressure water hoses during dust generating construction activities e.g. excavation, crushing/demolishing, concrete mixing, material handling, drilling etc., to suppress dust
- Vehicles delivering loose and fine materials like sand and fine aggregates will be covered by tarpaulin to reduce spills on roads and avoiding airborne particles.
- The height from which excavated materials and loose and fine materials like sand and fine aggregates are dropped will be controlled to a minimum practical height to limit fugitive dust generation from unloading.
- Regular wetting of the dug-up material will be done to reduce dust generation.
- The random ambient air quality monitoring shall be done to ensure that the significant impacts are being mitigated adequately.
- Systematic burden and spacing will be ensured.
- If at all drilling is done, it shall be wet drilling
- The tippers or trucks carrying the burden shall not be overloaded.
- Labour force will be provided with Dust Masks as they will be exposed to dust during construction.

12.15.4 Noise Level Management Plan

The following mitigation measures shall be implemented:

- High noise generation equipment, if used shall be operated during the daytime only and completely restricted during night hours and this eliminates any possible discomfort to the nearby residents.
- Community noise levels are not likely to be affected because of the vegetation and likely attenuation due to the physical barriers.
- Provision of insulating caps and ads at the exit of noise source on the machinery.
- Construction equipment generating minimum noise and vibration shall be chosen.
- The use of damping materials such as thin rubber / lead sheet for wrapping the work places line compressors, generators sets.
- Shock absorbing techniques shall be adopted to reduce impact.
- Inlet and outlet mufflers will be provided which are easy to design.
- Ear plugs/Ear muffs shall be provided to the workers and it will be enforced to be used by the workers working in high noise generating areas like drilling, blasting, crushing etc.,
- Ambient Noise Level Monitoring shall be conducted at suitable locations at periodic intervals during Construction Stage to conform to the stipulated standards (CPCB Standards) both during day and nighttime.

12.15.5 Solid Waste Management Plan

The increase in population due to congregation of construction labour is expected to be about 800 excluding 200 Technical Staff. The average per capita solid waste generation is expected at the order of 0.45 Kg/Person/day. The solid waste likely to be generated from labour camps will be 0.45 MT/Day.

Adequate facilities for collection, conveyance and disposal of solid waste will be developed. For solid waste collection, adequate number of masonry storage vats each of 2 m^3 capacity will be constructed at suitable locations near labour camps. These vats will be emptied at regular intervals and collected waste will then be transported to concerned municipal landfill sites identified by the Competent Authority. Three covered mini trucks to collect solid waste from the labour camps area will be put to service.

12.15.6 Public Health Management Plan

12.15.6.1 Public Health Delivery System

The increase in the water fringe area provides suitable habitats for the growth of vectors of various diseases and they are likely to increase the incidence of water-related diseases. Malaria is one such disease. Malaria control measures which aim at destroying the habitat and interrupting the life cycle of mosquitoes by Mechanical or biological or chemical means will be implemented.

The anti-malarial operations will be co-ordinated by various Public Health Centres (PHC) in the near by villages and Hospital at District Headquarters in association with KNNL.

The suggested measures are given in the following paragraphs:

- Site selected for habitation of workers will not be done in the path of natural drainage.
- Adequate drainage system to dispose storm water from the labour camps will be provided.
- Adequate vaccination and immunization facilities will be provided for workers at the construction.
- Labour camps will be located in at least 1.0 Km away from nearest water bodies.

12.15.6.2 Development of Medical Facilities

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A population of about 1000 is likely to congregate during the construction stage. It is proposed to have medical facilities at the construction sites. Hence, it is suggested to set up small dispensary near major construction site areas, so that it can serve the health aspects of labour population migrating in the area as well as the local population.

12.15.6.3 Proposed Health facilities at Construction Sites and Labour Camp

It is possible that during the construction work, technical staff operating different equipment are not only exposed to the physical strain of work but also to the physical effects of the environment in which they are working. The workers and other technical staff may come up with common manifestations such as insect's bites, fever, diarrhea, work exhaustion and other diseases. In addition, they may invariably come up with injuries caused by accidents at work site. Under all these circumstances, workers need immediate medical care.

The First Aid post is to be provided at the major construction site, so that workers are immediately attended to, in case of an injury or accident. This first aid post will have at least the following facilities:

- First Aid Box with essential medicines including ORS packets
- First Aid appliances splints and dressing materials
- Stretcher, wheel chair etc.,

12.15.7 Mitigation measures for Preventing Accidents due to Hazardous Material Handling

In order to safeguard lives and properties without facing any accidents or disasters, the explosives and other hazardous materials used during the construction phase for blasting and other works will be stored in safer places with utmost precautions, as per the safety norms prescribed by the statutory authorities. The diesel storage site will be kept away from the construction areas in order to prevent any accidental spillage of oil. The used oil generated from the DG Sets will be stored in leak proof barrels and will be handed over to KSPCB authorized reprocessors.

12.15.8 Health Extension Activities

The Health extension activities will be created in the villages near to construction sites. Awareness on hygienic habits of Environmental Sanitation especially w.r.t water pollution by domestic wastes will be given as there will be possibility of transmission of communicable diseases due to migration of labour population from other areas at the construction site.

The Doctor from the nearby dispensary will be made for regular visits to the construction sites and organize health promotional activities with the active participation of the local Village Panchayat, NGO's and available local health functionaries.

The Health functionaries would undertake the following tasks as part of Health Promotion Activities:

- Collect water samples to ascertain the potability of water from different sources so as to monitor regular disinfection of drinking water sources.
- Maintain close surveillance on incidence of communicable diseases in the villages.
- Maintain close liaison with the community leaders and health functionaries of different departments, so that they can be mobilized in case of an emergency.

12.15.9 Land Environment Management Plan

As already envisaged in the previous Chapters that, the proposed project causes severe impacts in the fields relating to Bio-diversity. Forest Lands having vegetation will be lost and hence stresses to go ahead for Compensatory Afforestation for Greenbelt removed as part of construction of the project.

12.15.10 Mitigation Measures during Tunnel Construction

The following mitigation measures would safeguard safety and environmental aspects during Tunnel construction:

- Constructing tunnel through which the canal would pass through will be with appropriate technology and methods which giving utmost care to stability, safety and environmental aspects;
- Minimizing blasting as far as possible for not disturbing stability of tunnel alignment, unless hard rock is encountered;
- Adopting appropriate blasting methods such as fixing optimum depths of blasting holes, charging them with optimum quantum of blasting media and carefully sealing them, for minimizing vibrations and noise levels in the vicinity of these construction sites.
- Providing appropriate sizes and numbers of exhaust/ventilation shafts to the tunnel for safe - breathing of construction workers in the tunnel.
- Arrangement of suitable lighting facilities in the tunnel for safe working and movements of workers and muck disposing vehicles in the tunnel.
- Ensuring adequate safety measures in the tunnel and adhering to strict discipline on safety by all personnel for avoiding any accidents in tunnels;
- Employing only those personnel and supervisors who have obtained basic training in tunnel operations and safety aspects and having adequate experience in tunnel works.
- Providing safety shoes, an industrial grade helmet and torch to each worker and supervisor deployed in tunnel works;

- Providing noise protection devices like earplugs and mufflers to the machinery - operators and workers operating the high - noise generating equipment such as vibrators and also to the others engaged at these construction sites;
- Arranging Life and Accident Insurance to all personnel deployed in tunnel construction for their security of life by the tunnel contractor.
- Fixing appropriate supporting steel frames of suitable sizes to the tunnel edges for stability of the tunnel edges;
- Lining the tunnel walls with appropriate types of mortar of adequate thickness for preventing seepage of water from and to the tunnel.
- Laying LDPE film at the subsurface of tunnel in its entire length for preventing percolation of water from the tunnel:
- Carrying out construction activities only during daytime in order to avoid disturbance and adverse noise impacts to people living in vicinities of construction sites; and
- Proper maintenance of diesel powered engines and construction vehicles to minimize smoke emissions from them.

12.15.11 Terrestrial Ecology

12.15.11.1 Compensatory Afforestation Plan

According to the norms of MoEF, Govt. of India, it is mandatory to take up Compensatory Afforestation Plan in view of forest areas subjected to removal for construction of the project. Hence in the present proposal, Compensatory Greenbelt Development/Afforestation measures will be undertaken as per the norms of Indian Forest Act-1927, Karnataka Forest Act-1963, Karnataka Forest Rules -1969, Karnataka Tree Preservation Act -1976, Karnataka Tree Preservation Rule-1977, Forest Conservation Act-1980 and Forest Conservation Rules-2003.

12.15.11.2 Cost of Afforestation

About 200-300 species per Hectare are proposed to be planted in the land allotted, in lieu of removal of Forest Areas. The afforestation activity comprises of various components such as:

- Demarcation and Survey
- Planting Material
- Transportation,
- Planting and Tilling
- Maintenance

The total cost of the afforestation for one Hectare is estimated as `.1,05,000/Ha as per actual cost worked out for Package-I. (Refer. Vol-II Cost Estimates)

12.15.12 Greenbelt Development Plan

Advantages of Greenbelt Development

- The trees will be useful as perches to the water birds for laying their effects and help in their breeding.
- After growth, these trees provide fuel, fodder, timber and others for the benefit of the society and the Government.
- It helps in maintaining ecological balance of the nature.
- The implementation for development of green belt is of immense importance, as it not only acts as pollution sink but also enhances the visual appearance of the developed site.

- The species to be grown on the site will be fast growing native species having broad leaf base so that a permanent green belt is created in a short period.
- The effective plantation will also stabilize the soil and reduce any nuisance during windstorm.
- Besides this, the visual aesthetics of the project site environment will also improve. A Green Belt Development plan will be prepared by selecting the potential flora of the region that could help in achieving the desired results as stated above.

12.15.13 Plant Species Proposed

It is proposed to take up plantation for Greenbelt Development with Non Timber Forest Plantation (NTFP) species and are as follows:

- Azadirachta indica
- Cochlospermum religiosum
- Dendro calamus strictus
- Derris indica
- Dolichandrone Crispa
- Emblica ofrficianalis
- Feroria limonea
- Fiscus bengha lesiss
- Ficus religiosa
- Hard wickia binata
- Sapinows emarginatus
- Sterculia urens
- Terminalia arjuna
- Terminalia catappa
- Ficus micro carpa
- Vitex negundo
- Wrightia finctorea

The list is only indicative and other suitable species may also be added by the supplementing agency in consultation with Forest Department. Depending upon the site conditions and local preferences, the practice could be changed. Live fencing has been preferred for its durability, renew ability and easy maintenance with locally available material. Greenbelt Development is to be compensated for the ecological impact in the project area. The general considerations involved while developing the greenbelt are as follows:

- Local/Native trees upto 10m or above in height with perennial foliage will be planted around various appurtenances of the proposed project.
- Planting of trees will be undertaken in appropriate encircling rows around the proposed project site
- Generally, fast growing trees will be planted.
- Since the trunk of the tree is normally devoid of foliage upto a height of 3.0m. It may be useful to have shrubbery in front of the trees so as to give coverage to this portion.
- The plantation will be at a spacing of 5m X 5m. Around 500 Trees per Hectare will be planted. The plantation and maintenance of the area will be done by concerned region Forest Department. For initial 02 years

weeding and soil consideration around the plants is recommended. Gap filling may be taken up in Third Year.

12.15.14 Measures for Assessing the Progressive changes in Soil and Water Environment of Proposed Command Area

- Periodical observations on Groundwater Level in the proposed Command Area will be done.
- Periodical assessment of Groundwater quality and Soil quality especially with respect to pH, Salinity, Alkalinity parameters and others as recommended will be carried out.
- Proper construction of Field Channels and Drainage in the Command Area, which will be managed by the Agricultural Department, Govt. of Karnataka at farmers cost or finances from the various land development banks.
- Agricultural Department, Govt. of Karnataka will maintain Soil and Water health after introduction of irrigation water.
- Periodical performance evaluation of Irrigation systems will be done for assessing the Soil and Water environment of proposed Command Area and also to assess soil fertility status.
- As sufficient soil depth is available in the area for providing canal irrigation, no problem on this will arise.
- Problem of Water logging is not expected as the Groundwater in the proposed Command Area is very low. As per the report/data obtained on groundwater level observations on Bore wells and Dug wells in Chitradurga, Challakere, Hiriyur and Hosadurga Taluks from 1992-2008, Maximum Ground water Level of about 37.65m was observed in April and May and 36.5m during Monsoon season.
- Soil erosion is not expected in the proposed Command Area as it varies from Negligible to moderate.

Hence, follow-up of above appropriate measures would minimize long term effects on soil and water environment of proposed command area in post-irrigation period.

12.15.15 Canal Bank Plantation

The proposed project envisages irrigation to an area of about 2,25,515 Ha of Command Area for the taluks falling in Chikmagalur, Chitradurga, Tumkur and Davangere districts. Details already presented in the earlier chapters. The same is proposed to be irrigated through Tarikere Lift, Chitradurga Branch Canal, Tumkur Branch Canal and Jagalur Branch Canal for a length of about 310.178 Km. Much of the vegetation cover will be lost due to the area occupied by the Canal System. Thus to compensate adverse effect on the land environment in the Command Area, flora has to be developed.

Hence, Canal Bank Plantation will be taken up along both the banks of the Link Canal, Upper Bhadra Main Canal, Tarikere Lift, Chitradurga Branch Canal, Tumkur Branch Canal and Jagalur Branch Canal for a total length of around 323.342 Kms. The plantations will be single row or multiple rows as per the width of land acquisitions. The Model Cost for raising Canal Bank Plantations for 1 Km of Canal is taken as 0.515 Lakhs. (Refer. Vol-II Cost Estimates).

12.15.16 Road Side Plantation

- The cost of the plantation has been calculated as per the existing labour charges, material cost (plants, FYM, tree guard, etc.,) and the total area of treatment.
- The spacing for trees is proposed 3m X 3m while 2m X 2m for shrubs. The pit size has been recommended as 45 cm X 45 cm X 45 cm for trees and 30 cm X 30 cm X 30 cm for Shrubs.
- For protection of trees from the cattle and other losses, tree guards are required.

12.15.17 Restoration and Landscaping of Project Sites

The construction of the proposed project including its various appurtenances e.g, approach roads, labour camps, project colony etc., will disturb the existing topography and physiography. Although no major alteration of the area is expected as the layout has been so conceived that no major impacts on this account are anticipated. It is proposed to landscape the area, so that it integrates with the natural surroundings and the beauty of the area is restored. A lump sum amount will be assumed for development of landscape and restoration plans of construction sites. Accordingly, it is proposed to develop a small garden and few view points, for sightseeing.

Garden establishment - A garden with local ornamental plants and trees will be developed near the project colony sites. All plants will be properly labeled with scientific and/or common names.
Native species consisting of fruit yielding, ornamental, key stone species will be considered for garden establishment; *Artocarpus heterophyllus. Mangifera indica, Azadirachta indica, Ficus religiosa, Ficus benjaminaria, Tamarindus indica, Dalburgia sp., Syzyzium cumini, Pongamia pinnata, Switenia sp., Anthocephalus cadamba, Michelia champaka, Tabebuia sp., Careyota urens (palm), Calophyllum inophyllum, Mimopsus elengii, Terminalia arjuna, Cassia sp., Alstonia scholaris, Stereospermum sp., Legerstromia sp., Madhuca sp., Emblica officinalis, Pterocarpus marsupium* etc.

Various sites in the area will be stabilized by constructing a series of benches. The walls that will be constructed for containing the slope will be embedded with local stones to integrate and enhance the aesthetics of the area. The native trees and shrubs will be positioned based on the site condition. The species for this purpose will be selected from the above mentioned, groups of plants.

12.15.18 Subsidized Fuel Management Plan

The exploitation of the forests for the fuel wood and timber since time immemorial has caused a huge loss to forests in the country. The fuel wood is being consumed by the people without any attention to conservation of Forest resource and proper and economical use of the fuel wood collected. During the execution of proposed Upper Bhadra Project, manpower of about 800 Nos. will be living in the project area who may look for fuel wood supply through local surroundings, if project proponents do not make adequate arrangements for subsidized fuel supply to labour force going to be engaged in the construction activity. This may create ample pressure on the forest resources on the area which will imbalance environmental matrix of the area.

In this regard, arrangement may also be made to provide fossil fuel such as Cooking Coal, Kerosene, LPG Connection etc., by the State Govt. on subsidized cost to local inhabitants. As far as project proponents and their contractors concerned, supply of subsidized fuel to the labour force will be ensured. So, in order to fulfill the requirements, following steps may be taken:

- A purchase requirement can be made with Govt. agencies like Indian Oil/Bharat Petroleum/Indane/HP etc., for supply of Kerosene and LPG in the project site area.
- Similarly, State Govt. may be requested to open fuel depots for supply of fuel wood, charcoal etc., in the project area so that the requirement of the local inhabitants and labours can be met with.
- Subsidized electricity may be provided to labour camps.

12.15.19 Land Compensation Details

Major infrastructure projects like River Valley Projects require a lot of area for Development. Since the proposed project involves providing irrigation water to the agricultural fields through canals, they have to pass through the private lands. A person who owns the lands have to give up rights over their property in order to help in development. The affected persons have to be identified and duly compensated for their loss. Private Lands to be acquired for the project is 5015.37 Ha. For land losing households, compensation will be as per the Government of Karnataka, vide its Government Order No. RD 118 REH 91, Bangalore, dated 18-12-1992 and RD 21 REH 94 (P) Bangalore, dated 15-5-1995. Also, R&R Benefits to the Project Affected Families (here land losers) will be provided as per the National Policy on Resettlement and Rehabilitation for Project Affected Families-2003.

There is no displacement of any households/families, Submergence and Catchment in this project.

12.15.20 Socio-Economic Development Aspects

The project requires huge amount of skilled and unskilled labourers for construction. The Construction of the project requires unskilled labourers for the following activities:

- For preparing Concrete Mix
- For preparing Masonry Mortars
- For transportation of construction material
- For excavation and foundation works
- For earthwork in embankments.
- For curing of Masonry and RCC works etc.,

The skilled and semi-skilled labourers will be required for the following works:

- For Welding works
- For operation of Machinery
- For blasting works
- For reinforcement and concreting work
- For drilling works etc.,

(i) So, contractors are proposing to recruit local unskilled labourers to assist the skilled labourers. Hence contractors planning to utilize up to 75% of the labourers required for the project from the local lands affected population.
(ii) An area of about 1,07,265 Ha will be brought under Irrigation during Khariff season.
(iii) Number of villages benefited by this scheme is 787 Nos.
(iv) Project development does not affect on the human settlement.
(v) The proposed project development would result in more food production and improvement in livelihood of Community.
(vi) It creates more working man-days for agriculture labourers.
(vii) Animal Husbandry and Ground water will improve in the region.
(viii) It would generate more income for many lives thereby improving the living conditions.
(ix) Water availability in the Command Area will improve avifauna and other wildlife in the region.

Since the proposed project involves filling up of all the tanks enrouted in the Command Area in Chikmagalur and Chitradurga Districts, it will help in ground water recharge to overcome drinking water problem in that area.

Table 12.19: *Environmental Management Cell*

Sl. No.	Members of Environmental Management Cell	Address
1.	Chief Engineer, Upper Bhadra Project (UBP) Zone	Upper Bhadra Project Zone, Chitradurga - 577 501.
2.	Superintending Engineer, UBP Circle-1	BRP-577 115, Bhadravati Taluk, Shimoga Dist
3.	Superintending Engineer, UBP Circle-2	Chitradurga.
4.	Executive Engineer, UBP Division No-1	Gajanur, Shimoga Taluk & Dist-577 201
5.	Executive Engineer, UBP Division No-2	BRP-577 115, Bhadravati Taluk, Shimoga Dist
6.	Executive Engineer, UBP Division No-3	Ajjampura, Tarikere Taluk, Chikmagalur Dist -577 547.
7.	Executive Engineer, UBP Division No-4	Hosadurga, Chitradurga District
8.	Executive Engineer, UBP Division No-5	Chitradurga

12.16 Bio-Diversity Management Plan

Since, the proposed canal alignment of the scheme passes through various State and Reserve Forests such as Aramballi Reserve Forest, Gurigi Gudda Reserve Forest, Gurupur Reserve Forest, Devaragudda State Forest, Janakal State Forest and Lakkihalli State Forest, impact will be noticed on flora and fauna of the project area.

The proposed project requires about 230 Ha of Forest areas for its development. Break-up of the same has been presented already in the earlier chapter. Floral species of the above mentioned forests along with its conservation status can be seen in the chapter stated above. The development of the project also involves impact on Fauna i.e, by constructing the canal in the forest, wildlife movement will be obstructed and also during the construction phase, noise level impact would be anticipated on the local fauna which might disturb the fauna environment. In view of the above, there is a need for Bio-diversity Management Plan which aims and strengthens conservation aspects of Flora and Fauna in the project area and helps in attaining sustainable development.

Floral Conservation Status in the Study area (as per IUCN Redlist, 2008)

Sl. No.	Name of the Forest Division	Nos. of Common Species	Nos. of Endangered Species	Nos. of Critically Endangered Species	Nos. of Vulnerable Species	Nos. of Lower Risk/least concern Species	Nos. of Data Deficient Species
1.	Koppa	185	1	1	6	5	-
2.	Chikkamagalur	201	4	-	2	4	-
3.	Chitradurga	111	-	-	6	3	-

Floral Species Conservation status (Vulnerable) observed along the proposed alignment of the scheme are: *Pterocarpus marsupium* (Honne), *Dalbergia latifolia* (Beete), *Santalum haleakalae* (Sandal wood), *Chloroxylon swietenia* (Mashival) and *Acacia Ferruginea* (Banni).

Faunal Conservation Status in the Study area (as per IUCN Redlist, 2008)

Sl. No.	Fauna	Nos. of Common Species	Nos. of Endangered Species	Nos. of Critically Endangered Species	Nos. of Vulnerable Species	Nos. of Lower Risk/least Concern Species	Nos. of Data Deficient Species	Nos. of near Threatened Species
1.	Mammals	04	03	-	04	22	-	02
2.	Birds	10	02	01	04	147	01	04
3.	Reptiles	02	01	-	02	04	-	-
4.	Bivalve	06	01	-	-	-	-	-

12.17 Wildlife Management Plan

As the proposed canal alignment affects the movement of wildlife, a suitable Wildlife Management Plan has to be prepared with necessary measures that to be undertaken without affecting neither the wildlife movement nor its habitat. As per the ecological surveys/assessment conducted during the study period along the proposed alignment of the scheme, it was revealed that, no wildlife resting sites or birds nesting sites was observed within the alignment area of the scheme that passes through various forests as stated above, except flora which will be removed as part of construction of the canal.

Mitigation measures and Management Plan for Conservation of Wildlife

- This project would be beneficial to wildlife as Filling of Tanks will help in creating an environment suitable for breeding of migratory birds.
- Shrubs and bushes around irrigation tanks will provide suitable conditions for nesting and breeding of aquatic and migratory birds.
- Presence of water for more duration would enhance positive impacts with strengthening of preybase for many predatory animals, reptiles and birds in the project area which inturn boost the ecological richness in the area.

- Cattle Ramps will be provided at suitable intervals for the free movement of wildlife.
- Imposition of strict maintenance/speed norms for construction vehicles and their movement in the forest area.
- Culverts for the crossing of reptiles in consultation with Karnataka State Forest Department will be provided.
- Minor Bridges/Cross ways will be provided at frequent intervals for movement of wildlife.
- Construction activities will be restricted to Day time only and the movement of workers and vehicles would be completely restricted during early morning and late evening when wildlife activities are at peak.
- Strict law enforcement will be undertaken for conservation of wildlife as well as those living along the shorelines of tanks i.e, water birds.
- Movements of construction vehicles in nights will be avoided as far as possible and excessive blowing of horn and lighting in nights will be avoided for not causing disturbance to the local fauna.
- Any other work desired by Karnataka State Forest Department in respect of conservation and management of wildlife will be suitably implemented with their assistance.

12.18 Rehabilitation & Resettlement (R & R) Plan

Rehabilitation & Resettlement Plan (R & R Plan) plays a most important role in the projects acquiring huge land for its development/construction of various activities of the project and displacing the inhabitants of villages and other areas while causing adverse socio-economic impacts on the Project Affected Families (PAF's).

Here, in this Upper Bhadra Project, there is no displacement of the families/houses involved and involves only land acquisition of the households for its various activity of the project. Private Land acquisition estimated for the project is 5015.37 Ha and the same will be acquired as per Land Acquisition Act, 1894 amended from time to time and monetary compensation will be paid as per the rates decided by the Government of Karnataka. Hence, the issues related to displacement of people/houses from their presently residing locations to alternate locations is not involved. Estimated amount for Land Acquisition purposes for various construction activities of the project is 184.01 Crores.

As per the National Policy On Resettlement and Rehabilitation for Project Affected Families-2003 (Published in the Gazette of India, Extraordinary Part-I, Section 1, No - 46, dated 17th February, 2004), is applicable to those projects which displace 250 families in hilly areas and 500 families in plain areas.

Though this policy doesn't apply to this project, the Government of Karnataka has already agreed to follow the guidelines in good spirit and hence, the following quantum of rehabilitation grant is proposed to be adopted for land losing households as prescribed by the Government of Karnataka, vide its Government Order No. RD 118 REH 91, Bangalore, dated 18-12-1992 and RD 21 REH 94 (P) Bangalore, dated 15.5.1995.

1.	Families losing more than 5 acres of Wet land or equivalent extent of Other categories of land	`. 40,000/-
2.	Families losing between 3 to 5 acres of wet land	`. 30,000/-
3.	Families losing up to 1 acre of wet land	`. 25,000/-
4.	Families losing up to 1 acre of dry land	`.20,000/-
5.	Landless agriculture labors / artisan & others	`.15,000/-

Also, R&R Benefits to the Project Affected Families (here land losers) will be provided as per the Policy stated above.

12.19 Command Area Development Plan

The major problems associated with dry land irrigation are Water logging and Salinity and other command area development related activities are construction of field channels and drains with related structures, land shaping including grading, leveling, handling and related structures and lining of field channels with suitable materials. The Water logging and Salinity problems will be mitigated by adopting conventional drainage methods.

Conjunctive use of surface and ground water in the command areas will enable maximization of agricultural production and optimal and judicious use of available water. This will also help in reducing ill effects of water logging. Crop planning in the command areas will be developed on this basis so that greater emphasis is given for ground water exploitation through both public and private investment in the command area. Estimated Cost on Command Area Development is **Rs.489789.76 Lakhs.**

12.20 Environmental Monitoring Programme

Table 12.20: *Environmental Monitoring Programme during Construction Stage of the Project*

Sl. No.	Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Location	Budgetary Allocation/Cost Estimates (Lakhs)
1.	Water Quality	Physico-Chemical and Bacteriological analysis for Surface water and Groundwater, Groundwater Table assessment (Pre-and Post Monsoon)	Twice a Year for 3 Years	• Near Tunga Offtake Point • Tunga River • Bhadra Backwaters • Villages near to Labour Camps • Villages near to Project Site • Near Tunnel Area • Command Areas • Others as recommended	4.00
2.	Ecology and Environmental Studies	Terrestrial Flora and Fauna Acquatic Flora and Fauna	As per specific need	• Project Areas • Study Area • Others as recommended	6.00
3.	Water related diseases	Identification of water related diseases, sites, adequacy of local vector control and curative measures etc.,	Thrice a Year for 3 Years	Villages adjacent to project sites • Labour Camps Villages near to existing Reservoir • Others as recommended	3.00
4.	Aquatic	Phyto Planktons, Zoo Planktons, Fish Population/Composition	Once a Year for 3 Years	• Tunga River • Bhadra River • Reservoir • Others as recommended	4.00
5.	Air Quality	SPM, RSPM, SO_2, NO_X	Twice a Year for 3 Years	• Near Jack Well Area • Near Pump House Area • Near Rising Main Area • Near Delivery Chamber Area • Near Bhadra Dam • Villages near to Labour Camps • Villages near to Project Site • Near Tunnel Area • Command Areas • Others as recommended	5.00

Sl. No.	Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Location	Budgetary Allocation/Cost Estimates (Lakhs)
6.	Noise Level	Leq Day Leq Night	Twice a Year for 3 Years	• Near Jack Well Area • Near Pump House Area • Near Rising Main Area • Near Delivery Chamber Area • Near Bhadra Dam • Villages near to Labour Camps • Villages near to Project Site • Near Tunnel Area • Near Crushing Area • Near Blasting Areas • Near Drilling Areas • Command Areas • Others as recommended	5.00
7.	Land	Land use pattern, soil erosion, Soil Quality Analysis (pH, EC, Na^{+}) , etc.,	Once a Year for 3 Years	• Major construction areas • Command Area • Near Tunnel Areas • Others as recommended	4.00
8.	Environmental Monitoring/Management	Execution of all Environmental Management Plans	Twice a Year for 3 Years	• As stated above.	8.00
				Total	**39.00**

Table 12.21: *Environmental Monitoring Programme during Operational Stage of the Project*

Sl. No.	Environmental Parameters	Parameters to be Monitored	Frequency of Monitoring	Location	Budgetary Allocation/Cost Estimates (Lakhs)
1.	Water Quality	Physico-Chemical and Bacteriological analysis for Surface water and Groundwater, Groundwater Table assessment (Pre-and Post Monsoon)	Twice a Year	• Near Tunga Offtake Point • Tunga River • Bhadra Backwaters/Reservoir • Villages near to Labour Camps • Villages near to Project Site • Near Tunnel Area • Command Areas • Others as recommended	4.00
2.	Water related diseases	Identification of water related diseases, sites, adequacy of local vector control and curative measures etc.,	Thrice a Year	• Villages adjacent to project sites • Labour Camps • Villages near to existing Reservoir • Others as recommended	3.00
3.	Command Area Development Assessment	Soil chemical analysis for pH, EC, Na^+, salinity, Nutrient status and concentration of pesticides and insecticides and others as suggested. Progress and Performance evaluation of Irrigation system.	Twice a Year	• Irrigable Command Area • Others as per the requirement.	1.00
				Total	**8.00**

12.21 Dam Seismicity Study

Present proposal does not involve construction of Dam, as existing Bhadra Dam is considered as a part of the proposal. The investigation, planning, survey, design and construction aspects of the Dam was undertaken according to prevailing standards and norms at that time. The entire proposed Upper Bhadra Project Scheme (Irrigation) including Bhadra Dam is located in Zone-II of Seismic Zoning Map of India indicating least earthquake prone area.

12.22 Conclusion

- An area of about 2,25,515 Ha will be brought under Irrigation during Khariff season.
- Number of villages benefited by this scheme is 720 (severely Drought Affected areas).
- Project development does not affect the human settlement.
- Compensatory Afforestation will offset the impacts on Ecology and Environment.
- The proposed project development would result in more food production and improvement in livelihood of Community.
- It creates more working man-days for agriculture labourers.
- Animal Husbandry and Ground water will improve in the region.
- It would generate more income for many lives thereby improving the living conditions.
- Water availability in the Command Area will improve avifauna and other wildlife in the region.
- Since the proposed project involves filling up of all the tanks en-route Command Area in Chikkamagalur, Chitradurga, Tumkur and Davanagere Districts, it will help in ground water recharge to overcome drinking water problem in that area.
- Socio-Economic status of the people in the Drought Affected areas will improve.

No. J-12011/7/2009-IA.I (Vol-II)
Government of India
Ministry of Environment, Forest & Climate Change
(IA.I - Division)

Indira Paryavaran Bhavan
3rd Floor, Vayu Wing
Jor Bagh Road
New Delhi—110 003.

Dated: 10th July, 2017

To

The Chief Engineer
M/s. Vishweshwaraya Jala Nigam Limited
Government of Karnataka
Upper Bhadra Project Zone
Chitradurga – 577 501
Karnataka

Sub: Upper Bhadra Lift Irrigation Project in Chikkamagalur District of Karnataka by M/s. Vishweshwaraya Jala Nigam Limited, Government of Karnataka – Environmental Clearance (EC) for Expansion Project - regarding.

Sir,

1. This has reference to your letter No. CEC/KNNL/UPBZ/Pak-2/TA-2/TS-1/MoEF/2016-17/2914 dated 8.12.2016, 20.12.2016 and 9.3.2017 on the above mentioned subject.

2. The Upper Bhadra Lift Irrigation Project (Stage-I) was accorded environmental clearance on 5.1.2010. The project neither involved submergence nor construction of new dams/weirs. The project involves lifting of water from Tunga river to Bhadra reservoirs in 2 stages. The dam has already been constructed for Bhadra reservoir and now, it is proposed to construct the canal from Bhadra reservoir to delivery chamber including 3 lifts and 6.90 km long tunnel and canal network. This canal would convey water to the drought-prone areas of Chikkamagalur and Chitradurga Districts utilizing 21.5 TMC of water to provide irrigation facility to 1,07,265 ha of dry land through gravity flow irrigation system. The project also involves filling up of 37 MI tanks to cater the needs of drinking water supply in Chitradurga, Tumakur and Kolar Districts. Considering the availability of water for the project and needs of the farmers of Davanagere and Tumakuru Districts, it was decided to provide irrigation facility to these Districts within the availability of water.

3. The expansion project (Stage-2) utilizes the same infrastructure of Stage-I to irrigate additional 1,18,250 ha of drought prone area and fill up additional 367 MI tanks in command area, thus improving water table and providing a major source of drinking water. Further, to achieve water conservation, the entire command (existing 1,07,265 ha + proposed 1,18,250 ha) area is proposed for drip irrigation system by utilizing 29.9 TMC of water. After tunneling, it is planned to irrigate an extent of 2,25,515 ha of irrigation (Stage-II) in the Districts of Chikkamagalur, Chitradurga, Tumakuru and Davanagere benefiting 787 villages.

v. The Command Area Development (CAD) Plan as proposed in the EIA/EMP report (December, 2016) report shall be strictly implemented.

vi. Consolidation and compaction of the generated muck should be carried out in the muck dumping sites. As proposed in the muck disposal plan, out of 2,88,61,973 m^3 muck generated, the entire to be utilized for service road & inspection paths, embankments, land leveling, filling trenches, construction material for CD works, road etc and restoration works for canal banks should be strictly adhered. The muck disposal sites shall be reclaimed/ restored with vegetation once capacity is utilized.

vii. To enhance the environment of project site, greenbelt, as proposed in the EIA/EMP report (December, 2016) shall be developed. The proposed greenbelt development in all the areas of project with 32 different plant species shall be undertaken in consultation with State Horticulture Department, Government of Karnataka. The allocated grant of Rs. 1216 lakhs for this purpose should be fully utilized and not be diverted for any other purpose.

viii. The proposed Agro-forestry development in the command area with 22.55 lakh saplings in consultation with State Forest Department, Government of Karnataka should strictly adhered. The allocated amount of Rs. 250.51 lakhs for this purpose should be fully utilized and not to be diverted for any other purpose.

ix. The fishery development and management plan, as proposed in the EIA/EMP (December, 2016) for the conservation fish in river shall be developed. As proposed in the programme around 10 lakh fingerlings comprised of major carp shall be introduced in Krishna river above the project site & in and around the project site shall be implemented in consultation State Fisheries Department. The allocated grant of Rs. 30 lakhs should be utilized fully and not to be diverted for any other purpose.

x. Water User Association's (WUAs) / Co-operative shall be formed and involvement of the whole community for disciplined use of available waters shall be ensured.

xi. Conjunctive use of surface water shall be planned to check water logging as well as to increase productivity.

xii. Water quality monitoring shall be carried out in the 5 km stretch in the upstream and downstream of lift points of Krishna River during construction phase for drinking water quality standards at suitable locations on bi-monthly basis and a copy of the test reports to be submitted to Regional Office, MoEF&CC, Bengaluru on six monthly basis. Further, aquatic ecology studies to assess the health of the aquatic biota to be conducted on a yearly basis during the period of construction.

xiii. The equipment likely to generate high noise levels during the construction period or otherwise shall meet the ambient noise level standards as notified under the Noise Pollution (Regulation and Control) Rules, 2000, as amended in 2010 under the Environment Protection Act (EPA), 1986. Ambient Noise level monitoring shall be conducted on a monthly basis during the period of construction at suitable locations and copy of the test reports to be submitted to Regional Office, MoEF & CC, Bengaluru on six monthly basis.

7. The Project Proponent shall provide full cooperation and all required documents / data to the Officials from concerned Regional Office of the Ministry, Bengaluru who would be monitoring the implementation of environmental safeguards.

8. The responsibility of implementation of environmental safeguards and carrying out environmental monitoring rests fully with M/s. Vishweshwaraya Jala Nigama Limited, Government of Karnataka.

9. Besides the above stated conditions, the Project Proponent shall also implement all environmental safeguards, as proposed in the EIA/EMP report and other reports from time to time. The Regional Office of the Ministry, Bengaluru shall monitor implementation of EMP at regular intervals.

10. The Environmental Management Plan (EMP) shall be strictly adhered to. The total cost of implementation of mitigation measures as per EMP is Rs 43,080.01 lakhs during construction phase and 219.68 lakhs during operation phase. In case of revision of the project cost or due to price level change, the cost of EMP shall also be updated proportionately.

11. In case of change in the scope of the project, the same shall be intimated to the Ministry and fresh approval, if required, shall be taken from the Ministry.

12. The Ministry reserves the right to add additional safeguard measures subsequently, if found necessary and to take action including revoking of the clearance under the provisions of the Environment (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time-bound and satisfactory manner.

13. This clearance letter is valid for a period of 10 years from the date of issue of this letter for completion of the project.

14. Based on the site visit of the project RO, MoEF & CC, Bangalore on 16-19th February, 2017, a certified copy of the point-wise EC conditions of the project was issued. The status of compliance conditions is reported to be satisfactory.

15. A copy of the clearance letter shall be marked to concerned Panchayat/ Zilla Parishad/Municipal Corporation, Urban local body and local NGO, if any, from whom any suggestion/representations were received while processing the proposal. The clearance letter shall also be put on website by the project proponent.

16. State Pollution Control Board / Committee shall display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's / Tehsildar's Office for 30 days.

17. The project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with the State Pollution Control Board / Committee and may also be seen at Website of the Ministry of Environment, Forest & Climate Change at http://www.moef.nic.in.

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No. J-12011/7/2009-IA.I
Government of India
Ministry of Environment & Forests
[IA.I – Division]

Indira Paryavaran Bhavan
Vayu Wing, Jor Bagh Road
New Delhi – 110 003

Dated: 26th September, 2017

CORRIGENDUM

Subject: Upper Bhadra Lift Irrigation Scheme in Chikkamagaluru District of Karnataka by M/s. Vishweshwaraya Jala Nigam Limited, Government of Karnataka – Environmental Clearance (EC) for Expansion Project – regarding.

This has reference to your letter no. NO/CEC/VJNL/UBPZ/TA-2/TS-1/MoEF (EC)/2017-18/997 dated 19.7.2017 regarding the modification of condition in the environmental clearance. In this context, attention is invited to this Ministry's letter of even number dated 10.7.2017 the correction in the environmental clearance in Part-A: Specific Conditions Sl. No. ix & xii of the above project may be read as:

i. As proposed in the programme around 10 lakh fingerlings comprised of major corp shall be introduced in Tunga and Bhadra river above the project site & in and around the project site shall be implemented in consultation State Fisheries department

Instead of

As proposed in the programme around 10 lakh fingerlings comprised of major corp shall be introduced in Krishna river above the project site & in and around the project site shall be implemented in consultation State Fisheries department

ii. Water quality monitoring shall be carried-out in the 5 km stretch in the upstream and downstream of lift points of Tunga and Bhadra river during construction for drinking water quality at suitable location

Instead of

Water quality monitoring shall be carried-out in the 5 km stretch in the upstream and downstream of lift points of Krishna river during construction for drinking water quality at suitable location

2. All other terms and conditions of the Environmental Clearance Letter No. J-12011/7/2009-IA-I dated 10.7.2017 remains unchanged.

26/10/17

Annexure - 19 ?

PROCEEDINGS OF THE GOVERNMENT OF KARNATAKA

Subject: Diversion of 110.10 ha.(revised from 186.42 ha.) of forest land in Bhadravathi Division for execution and construction of Upper Bhadra Project, Package-II (lifting of water from Bhadra Reservoir to Ajjampura delivery chamber) in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, Upper Bhadra Project Division-2, B.R. Project, Bhadravthi, Karnataka.

Read:
1. Letter No.A5(3)GFL.CR.27/2009-10 dated: 21.07.2015 & 22.07.2015 of the Principal Chief Conservator of Forests (Head of Forest Force), Bengaluru.
2. Government of Karnataka letter No. FEE 96 FLL 2014 dated: 30.09.2015
3. Government of India letter No.F.No.4KRA 1036/2014-BAN/7710, dated: 12.11.2015
4. Letter No.A5(3)GFL.CR.27/2009-10 dated: 26.10.2016 & 30.10.2017 of the Principal Chief Conservator of Forests (Head of Forest Force), Bengaluru.
5. Government of Karnataka letter No. FEE 96 FLL 2014 dated: 19.12.2016 & 30.11.2017
6. Government of India letter No.F.No.4KRB 1036/2014-BAN/1124, dated: 22.12.2017

08-02-18

A3/AE5

PREAMBLE:

The Principal Chief Conservator of Forests (Head of Forest Force), Bengaluru vide his letter dated: 21.07.2015 & 22.07.2015 read at (1) above has submitted the proposal to obtain the approval under Section (2) of the Forest (Conservation) Act, 1980 for Diversion of 110.10 ha.(revised from 186.42 ha.) of forest land in Bhadravathi Division for execution and construction of Upper Bhadra Project, Package-II (lifting of water from Bhadra Reservoir to Ajjampura delivery chamber) in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, Upper Bhadra Project Division-2, B.R.Project, Bhadravthi, Karnataka.

This proposal has been examined by the State Government & forwarded to Government of India, vide latter dated: 30.09.2015 read at (2) above, due recommendation to accord sanction under section (2) of the Forest (Conservation) Act, 1980.

The Government of India vide letter dated: 12.11.2015 read at (3) above, has accorded in principal Stage-I approval for the proposal & compliance report was

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7. In case any violation reported during the lease period, the lease shall be forfeited u/s 82 of Karnataka Forest Act, 1963. The concerned Chief Conservator, Deputy Conservator of Forest are authorised to take necessary action to this regard.
8. The User Agency has to pay the Net Present Value(NPV) of forest land diverted under this proposal as per conditions stipulated by Government of India, Ministry of Environment and Forests, New Delhi vide letter No.11-9/98-FC, dated: 13-02-2014 and orders dated 28-03-2008 and 9-5-2008 of the Hon'ble Supreme Court of India.
9. The additional amount of the Net Present Value (NPV) of the diverted forest land if any becoming due after revision of the same by the Hon'ble Supreme Court of India in future, shall be charged by the State Government from User Agency and the same shall be transferred to the designated Adhoc CAMPA Account.
10. The Compensatory Afforestation shall be raised over 110.10 ha. of identified non-forest land in Sy.No.343 of Varavu Kaval village, Nayakanahatti Hobli, Challakere Taluk, Chitradurga District at the cost of user agency. The Compensatory Afforestation area shall be protected with chain link fencing. prior permission of Central Government for change of location and schedule of compensatory afforestation, if any shall be obtained.
11. Chain link fencing shall be provided along the forest side of the canal where the canal is running on the edge of the forest, at the cost of user agency.
12. All pockets of forest land of size less than 10 ha. in extent, left outside the canal should be chain link fenced and Afforestation of the same be undertaken at the cost of user agency.
13. Cross over bridges, under passes etc. shall be constructed across the canal as decided by the CCF of the Circle for the movement of wild animals. The major cross over/bridges for animals shall not be less than 10 M wide. At every 300 M distance where the canal is passing through the forests, ramps with rough surface shall be provided for animals to exit from the canals.
14. All the raising main areas should be covered with soil to make a natural gradient for animal crossing.
15. In order to meet the water requirement of wild animals, water ponds of not less than 80 M^2 area, on the forest side shall be constructed at every 500 mtrs distance along the canal and these ponds shall be filled with water at the cost of user agency.

Narayanaswamy 24/11/18.

-4-

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31. To prevent erosion due to project activity construction of percolation tanks, check dams, gully plugs also shall be carried out around the proposed area as per the plan prepared by the user agency in consultation with the Deputy Conservator of Forest, Bhadravathi, at the project cost.
32. Any other Mitigative measure suggested by the Principal Chief Conservator of Forests (Wildlife) & Chief Wildlife Warden should be carried out by the project authorities at the project cost.
33. The lessee shall not sub-lease, mortgage or hypothecate the forest area.
34. The approval under the Forest (Conservation) Act, 1980 is subject to the clearance under the Environment (Protection) Act, 1986, if required.
35. The total forest area utilized for the project shall not exceed 110.10 ha and it shall be used only for the purpose for which it is diverted.
36. The GPS readings and location maps of the forest land diverted as well as the non-forest land selected for raising compensatory Afforestation shall be communicated to Government of India within 30 days.
37. Any other condition that the additional Principal Chief Conservator of Forests (Central), Regional Office, Bengaluru may impose from time to time for protection, improvement of flora and fauna in the forest area and public convenience, shall also be applicable.
38. Violation of any of the conditions shall invite penal action, as deemed fit by the Additional Principal Chief Conservator of Forests (Central), Regional Office, Bengaluru.
39. The user agency shall comply with all other conditions stipulated by the Ministry of Environment and Forests, Government of India while according environmental clearance vide letter No.J-12011/7/2009-IA.I dated: 05-01-2010.
40. The User Agency shall also abide by all the conditions imposed upon by Government of India, the Government of Karnataka and the Principal Chief Conservator of Forests (Head of Forest Force).

By Order and in the name of the
Governor of Karnataka,

Narayana 24/1/18.
(NARAYANA)
Under Secretary to Government
Forest, Ecology and Environment Department.

To:
The Compiler, Karnataka Gazette, Bengaluru for publication in the next issue of the Gazette and request to supply 50 copies to State Government and 50 copies to Principal Chief Conservator of Forests, Bengaluru.

Annexure - 15(3)

02 FEB 2018

PROCEEDINGS OF THE GOVERNMENT OF KARNATAKA

Subject: Diversion of 111.57 ha. (Revised from 171.546 ha.) of forest land in Jankal RF, Devaragudda RF and Lakkihalli RF of Hosadurga Range, Chitradurga Forest Division for construction of Chitradurga Branch Canal under Upper Bhadra Project in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, UBP Project, Division-4, Hosadurga, Karnataka.

EE

Read:

1. Letter No.A5(4)GFL.CR.29/2010-11 dated: 07.05.2014 & 05.09.2015 of the Principal Chief Conservator of Forests (Head of Forest Force), Bengaluru.
2. Government of Karnataka letter No. FEE 168 FLL 2011 dated: 07.08.2014 & 16.10.2015
3. Government of India letter No.F.No.4KRA 1035/2014-BAN/8084, dated: 04.02.2016
4. Letter No.A5(4)GFL.CR.29/2010-11 dated: 09.11.2016, 20.04.2017 & 13.11.2017 of the Principal Chief Conservator of Forests (Head of Forest Force), Bengaluru.
5. Government of Karnataka letter No. FEE 168 FLL 2011 dated: 07.01.2017 & 20.11.2017.

Government of India letter No.F.No.4KRB 1035/2014-BAN/1208, dated: 20.12.2017

PREAMBLE:

The Principal Chief Conservator of Forests (Head of Forest Force), Bangalore vide his letter dated: 07.05.2014 & 05.09.2015 read at (1) above has submitted the proposal to obtain the approval under Section (2) of the Forest (Conservation) Act, 1980 for Diversion of 111.57 ha. (Revised from 171.546 ha.) of forest land in Jankal RF, Devaragudda RF and Lakkihalli RF of Hosadurga Range, Chitradurga Forest Division for construction of Chitradurga Branch Canal under Upper Bhadra Project in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, UBP Project, Division-4, Hosadurga, Karnataka.

This proposal has been examined by the State Government & forwarded to Government of India, vide letter dated: 07.08.2014 & 16.10.2015 read at (2) above, due recommendation to accord sanction under section (2) of the Forest (Conservation) Act, 1980.

The Government of India vide letter dated: 04.02.2016 read at (3) above, has accorded in principal Stage-I approval for the proposal & compliance report

Narayana 24/1/18

7. In case any violation reported during the lease period, the lease shall be forfeited u/s 82 of Karnataka Forest Act, 1963. The concerned Chief Conservator, Deputy Conservator of Forest are authorised to take necessary action to this regard.
8. The User Agency has to pay the Net Present Value(NPV) of forest land diverted under this proposal as per conditions stipulated by Government of India, Ministry of Environment and Forests, New Delhi vide letter No.11-9/98-FC, dated: 13.02.2014 and orders dated 28-03-2008 and 9-5-2008 of the Hon'ble Supreme Court of India.
9. The additional amount of the Net Present Value (NPV) of the diverted forest land if any becoming due after revision of the same by the Hon'ble Supreme Court of India in future, shall be charged by the State Government from User Agency and the same shall be transferred to the designated Adhoc CAMPA Account.
10. The Compensatory Afforestation shall be raised over 111.57 ha. of identified non-forest land in Sy.No.343 of Varavu Kaval village, Nayakanahatti Hobli, Challakere Taluk, Chitradurga District at the cost of user agency. The Compensatory Afforestation area shall be protected with chain link fencing. prior permission of Central Government for change of location and schedule of compensatory afforestation, if any shall be obtained.
11. The user agency shall make online payment of the cost of CA & NPV with Adhoc-CAMPA through e-payment module of Forest Clearance portal-forestclearance.nic.in
12. The user agency shall pay all the outstanding dues with regard to the earlier approved projects to the Karnataka Forest Department.
13. The Non-forest land for Compensatory afforestation shall be notified by the State Government as RF/PF under Indian Forest Act, 1927 or the State Forest Act within a period of 6 months and Nodal Officer (FCA) shall report the compliance within 6 months.
14. The user agency shall ensure that there should be no damage to the available fauna & other flora.
15. Only minimum number of trees shall be cut based on actual requirement of the project.
16. No work shall be allowed after sunset.
17. In order to improve the vegetation in the forest area, to raise plants in the nursery and also to meet the water requirement of wild animals, water ponds are to be constructed wherever feasible along the canal in forest area and

Narayana 26/11/18. -4-

32. Violation of any of the conditions shall invite penal action, as deemed fit by the Additional Principal Chief Conservator of Forests (Central), Regional Office, Bengaluru.
33. The user agency shall comply with all other conditions stipulated by the Ministry of Environment and Forests, Government of India while according environmental clearance vide letter No.J-12011/7/2009-IA.I dated: 05-01-2010.
34. The User Agency shall also abide by all the conditions imposed upon by Government of India, the Government of Karnataka and the Principal Chief Conservator of Forests (Head of Forest Force).

By Order and in the name of the
Governor of Karnataka,

Narayana 24/1/18.
(NARAYANA)
Under Secretary to Government
Forest, Ecology and Environment Department.

To:
The Compiler, Karnataka Gazette, Bengaluru for publication in the next issue of the Gazette and request to supply 50 copies to State Government and 50 copies to Principal Chief Conservator of Forests, Bengaluru.

Copy to:
1. Secretary to Government of India, Ministry of Environment and Forest and Climate Change, Paryavaran Bhavan, CGO Complex, Lodhi Road, New Delhi 110 003.
2. The Addl.Principal Chief Conservator of Forests (Central), Government of India, Ministry of Environment and Forests and Climate Change, Regional Office,(South Zone), Kendriya Sadana, 4th Floor, E & F Wing, 17th Main, II nd Block, Koramangala, Bengaluru -34.
3. Accountant General (Audit I and II)/Accounts, Karnataka, Bengaluru.
4. The Principal Chief Conservator of Forests(Head of Forest Force), Aranya Bhavan, Bengaluru.
5. The Additional Principal Chief Conservator of Forests, (Forest Conservation) Office of the Principal Chief Conservator of Forests, Aranya Bhavan, Malleswaram, Bengaluru.
6. The Chief Conservator of Forests, Ballari circle, Ballari.

No. J-12011/7/2009-IA.I
Government of India
Ministry of Environment & Forests
[IA.I – Division]

Paryavaran Bhavan
CGO Complex, Lodhi Road
New Delhi – 110 003
Telefax: 011 2436 2827

Dated: 05.01.2010

The Executive Engineer,
Karnataka Neeravari Nigam Ltd,
Upper Bhadra Project, Division No-2,
B.R.Project – Bhadravathi (Tq),
Shimoga Dist., Karnataka.

Sub: Upper Bhadra Lift Irrigation Project Stage-I near Mutthinakoppa Village, N.R.Pura Taluk, Chikmagalur District, Karnataka – Environmental Clearance – regarding.

Sir,

This has reference to your letter No.WRD-17/VEBYAE-2009 dated 4.2.2009 subsequent letters dated 13.3.2009, 3.9.2009 and 17.11.2009 on the above subject.

2. The proposed project is located near Mutthinakoppa Village, N.R Pura Taluk Chikmagalur District of Karnataka State. The project involves lifting of water from Tunga River to Bhadra reservoir in two stages. The dam already constructed for Bhadra reservoir. Thereafter, it is proposed to construct the canal from Bhadra reservoir to delivery chamber including 3 lifts and a tunnel of 6.90 km length and canal network to provide irrigation facility to 107265 ha. of land in Chikmagalur and Chitradurga Districts and is likely to benefit 191 drought affected villages (17 - in Chikmagalur District & 174 in Chitradurga District). The total land requirement for the project is about 5245.37 ha Out of which, Forest land is 230 ha and Private land is 5015.37 ha. The total estimated cost is about Rs.5985 Crores. The project would be completed in 60 months

3. The above referred proposal was considered by the Expert Committee for River Valley & Hydroelectric Projects at its meeting held on 17.2.2009, 28.3.2009 & 21.10.2009.

4. The Ministry of Environment and Forests hereby accords environmental clearance as per the provisions of Environmental Impact Assessment Notification, 2006 subject to strict compliance of the terms and conditions as follows:

parasites. The river should be properly channelised so that no small pools and poodles are allowed to be formed. Even after taking precaution, due to unforeseen situations, breeding of mosquito and resultant malaria or mosquito borne diseases can increase. If such a situation arises, it will be the responsibility of project authorities to take all steps i.e. residual insecticidal spray in all the project area and surrounding 3 km. area keeping the flight range of mosquitoes in consideration

xii. Bhadra Wildlife Sanctuary is in the vicinity of the project. The nearest point of the main canal is 3.5 km from wildlife sanctuary. The statutory clearance, such as approval under Wildlife (Protection) Act 1972 should be obtained (if applicable) from the competent authority. Similarly prior forest clearance should be obtained under Forest (Conservation) Act, 1980.

xiii. Any other clearance from any other organization/department if required should be obtained.

Part-B: General Conditions

(i) Adequate free fuel arrangement should be made for the labour force engaged in the construction work at project cost so that indiscriminate felling of trees is prevented.

(ii) Fuel depot may be opened at the site to provide the fuel (kerosene/LPG) to the labour force.

(iii) Medical facilities/First Aid centres should be provided to the labourers with regular health check-up.

(iv) All the labourers to be engaged for construction works should be thoroughly examined by health personnel and adequately treated before issuing them work permit.

(v) All the labourers to be engaged for construction works should be provided with PPE (Personal Protective Equipments like Helmets/Gloves/Earplugs/Shoes etc.) depending upon their nature of work.

(vi) Water sprinkling arrangements shall be made to suppress the dust and fugitive emissions

(vii) Potable drinking water and proper sanitary facilities should be provided for the labour force..

(viii) Solid waste from the labour camps shall be collected in Bins/Masonry vats and the same shall be dumped/disposed to nearby municipal landfills/authorized dump sites. No dumping of solid waste will be allowed near any water body or a stream to exclude any health hazard problem to the community.

(ix) Restoration of construction area including dumping site of excavated materials should be ensured by leveling, filling up of burrow pits, landscaping etc. The area should be properly treated with suitable plantation.

(x) Financial provision should be made in the total budget of the project for implementation of the above suggested safeguard measures.

(xi) Six monthly monitoring reports should be submitted to the Ministry and its Regional Office, Bangalore for review.

(xii) The project proponent shall also submit six monthly reports on the status of compliance to the stipulated EC conditions (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF/State Pollution Control Board.

5. Officials from Regional Office, MoEF, Bangalore who would be monitoring the implementation of environmental safeguards should be given full cooperation, facilities and documents / data by the project proponents during their inspection and review.

6. The responsibility of implementation of environmental safeguards as proposed in the EIA Report and others as stated above rests fully with the Karnataka Neeravari Nigam Limited.

7. The total amount reserved for implementation of Environmental Protection Measures should be strictly adhered and not to be diverted for any other purpose.

8. In case of change in the scope of the project, project would require a fresh appraisal.

9. The Ministry reserves the right to add additional safeguard measures subsequently, if found necessary and to take action including revoking of the clearance under the provisions of the Environment (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time- bound and satisfactory manner.

10. This clearance letter is valid for a period of 10 years from the date of issue of this letter for commencement of construction works.

11. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parishad/ Municipal Corporation, Urban local body and the local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.

Annexure-5

भारत सरकार

GOVERNMENT OF INDIA

पर्यावरण ,वन एवं जलवायु परिवर्तन मंत्रालय

MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE

Regional Office (Southern Zone),
Kendriya Sadan, IVth Floor, E& F Wings, 17th Main Road,
IInd Block, Koramangala, Bangalore – 560 034,
Tel.No.080-25635905, E.Mail: rosz.bng-mef@nic.in

BY SPEED POST

F.No.4-KRA 1037/2014-BAN/2041
Dated the 11th February, 2016

To

The Additional Chief Secretary to Government of Karnataka,
Forest, Ecology & Environment Department,
M.S.Building, Dr.Ambedkar Veedhi,
Bangalore – 560 001.

Subject: Diversion of 96.95 ha. (Revised from 131.07 ha) of forest land in Muthinakoppa Minor Forest & Arambali Reserved Forest in Koppa Division for execution and construction of Upper Bhadra Lift Irrigation Project package-4 in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, Karnataka

Sir,

I am directed to refer to the State Government's letter No.FEE 80 FLL 2014 dated 15/10/2015 on the above mentioned subject seeking prior approval of the Central Government under Section'2' of the Forest (Conservation) Act, 1980.

The proposal was examined by the Regional Empowered Committee constituted under sub-rule (1) of rule 4A of the Forest (Conservation) Rules, 2003 in its meeting held on 03/11/2015 and recommended the proposal for approval.

After careful examination of the proposal of the State Government and on the basis of the approval of the Regional Empowered Committee, the Central Government hereby conveys the in-principle approval (Stage-I) for diversion of 96.95 ha. of forest land in Muthinakoppa Minor Forest & Arambali Reserved Forest in Koppa Division for execution and construction of Upper Bhadra Lift Irrigation Project package-4 in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, Karnataka, subject to fulfilment of the following conditions:-

1. The legal status of forest land shall remain unchanged.
2. Demarcation of the proposed forest area shall be carried out by erecting cement concrete pillars duly numbered at an interval of 20 mts. at the cost of user agency, before Stage-II clearance.
3. The identified non-forest land over an area of 384.50 ha. in Sy.No.343 of Varavu Kaval village, Nayakanahatti Hobli, Challakere taluk, Chitradurga district for Compensatory Afforestation for Package-I, Package-II and Chitradurga Branch Canal shall be transferred and mutated in favour of Forest Department.
4. CA Scheme shall be prepared and submitted including the provision of chain link fencing of the non-forest land. The cost of raising Compensatory Afforestation over 96.95 ha. of non-forest land including fencing shall be deposited by the user agency.

16. All along the inspection path and the road running parallel to the canal, at least two rows of, depending on the availability of space, trees of hard-wood species shall be planted at the cost of User Agency.

17. Near to 10000 M chainage, along the ridge before reaching the Bhadra reservoir, the cut canal shall be covered for a minimum distance of 50 M to provide for crossing of animals. The User Agency shall furnish an undertaking to this effect.

18. The total forest area utilized for the project shall not exceed 96.96 ha.

19. Any other condition that the Additional Principal Chief Conservator of Forests (Central), Regional Office, Bangalore may impose from time to time for protection, improvement of flora and fauna in the forest area and public convenience, shall also be applicable.

20. Violation of any of the conditions shall invite penal action, as deemed fit by the Additional Principal Chief Conservator of Forests (Central), Regional Office, Bangalore.

After receipt of the compliance report on the fulfillment of the above conditions from the State Government, formal approval will be considered in this regard under Section-2 of the Forest (Conservation) Act, 1980. This in-principle approval shall be valid for a period of five years. In the event of non-compliance of the above conditions, this in-principle approval shall automatically stand revoked after five years.

Yours faithfully,

(S.M. Somashekar)
Chief Conservator of Forests (Central)

Copy to:-

1. The Director General of Forests & Special Secretary to Govt. of India, Ministry of Environment, Forests and Climate Change, Indira Paryavaran Bhavan, Agni Wing, Aliganj, Jor Bagh Road, New Delhi – 110 003.

2. The Principal Chief Conservator of Forests (HoFF), Forests Department, Govt. of Karnataka, Aranya Bhavan, 18th Cross, Malleswaram, Bangalore – 560 003.

3. The Additional Principal Chief Conservator of Forests/Nodal Officer (FCA), Office of the Principal Chief Conservator of Forests, Forests Department, Govt. of Karnataka, Aranya Bhavan, 18th Cross, Malleswaram, Bangalore – 560 003.

4. The Executive Engineer, Karnataka Neeravari Nigama Limited, Upper Bhadra Project, Division – 2, B.R. Project, Bhadravathi, Chickmagalur District (Karnataka).

5. Guard file.

(S.M. Somashekar)
Chief Conservator of Forests (Central)

o/c 11/2/16

Annexure-8

भारत सरकार
GOVERNMENT OF INDIA
पर्यावरण ,वन एवं जलवायु परिवर्तन मंत्रालय
MINISTRY OF ENVIRONMENT, FORESTS & CLIMATE CHANGE
Regional Office (Southern Zone),
Kendriya Sadan, IVth Floor, E& F Wings, 17th Main Road,
IInd Block, Koramangala, Bangalore – 560 034,
Tel.No.080-25635905, E.Mail: roez.bng-mef@nic.in

BY SPEED POST

F.No.4-KRA 1036/2014-BAN/ /77 /0
Dated the 12th November, 2015

To

The Additional Chief Secretary to Government of Karnataka,
Forest, Ecology & Environment Department,
M.S.Building, Dr.Ambedkar Veedhi,
Bangalore – 560 001.

Subject: Diversion of 110.10 ha. (Revised from 199.42 ha.) of forest land in Bhadravathi Division for execution/construction of Upper Bhadra Project, Package-II (Lifting of water from Bhadra Reservoir to Ajjampura delivery chamber) in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, Upper Bhadra Project, Division – 2, B.R. Project, Bhadravathi.

Sir,

I am directed to refer to the State Government's letter No.FEE 96 FLL 2014 dated 30/09/2015 on the above mentioned subject seeking prior approval of the Central Government under Section'2' of the Forest (Conservation) Act, 1980.

The proposal was examined by the Regional Empowered Committee constituted under sub-rule (1) of rule 4A of the Forest (Conservation) Rules, 2003 in its meeting held on 03/11/2015 and recommended the proposal for approval.

After careful examination of the proposal of the State Government and on the basis of the approval of the Regional Empowered Committee, the Central Government hereby conveys the in-principle approval (Stage-I) for diversion of 110.10 ha. of forest land in Bhadravathi Division for execution/construction of Upper Bhadra Project, Package-II (Lifting of water from Bhadra Reservoir to Ajjampura delivery chamber) in favour of the Executive Engineer, Karnataka Neeravari Nigama Limited, Upper Bhadra Project, Division – 2, B.R. Project, Bhadravathi, subject to fulfilment of the following conditions:-

1. The legal status of forest land shall remain unchanged.

2. Demarcation of the proposed forest area shall be carried out by erecting cement concrete pillars duly numbered at an interval of 20 mts. at the cost of user agency, before Stage-II clearance.

3. The identified non-forest land over an area of 364.50 ha. in Sy.No.343 of Vararu Kaval village, Nayakanahatti Hobli, Challakere taluk, Chitradurga district for Compensatory Afforestation for Package-I, Package-II and Chitradurga Branch Canal shall be transferred and mutated in favour of Forest Department.

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15. In order to meet the fodder requirement of wild animals, the raising of fodder plantation, mainly bamboo over a distance of 100 M in open areas along the sides of canal shall be undertaken at the cost of User Agency. Forest Department will work out the cost of raising such plantation and its maintenance for 5 years and the same be realised from the User Agency before Stage-II approval. The User Agency shall furnish an undertaking to this effect.

16. All along the inspection path and the road running parallel to the canal, at least two rows, depending on the availability of space, trees of hard-wood species shall be planted at the cost of User Agency.

17. The total forest area utilized for the project shall not exceed 110.10 ha.

18. Any other condition that the Additional Principal Chief Conservator of Forests (Central), Regional Office, Bangalore may impose from time to time for protection, improvement of flora and fauna in the forest area and public convenience, shall also be applicable.

19. Violation of any of the conditions shall invite penal action, as deemed fit by the Additional Principal Chief Conservator of Forests (Central), Regional Office, Bangalore.

After receipt of the compliance report on the fulfilment of the above conditions from the State Government, formal approval will be considered in this regard under Section-2 of the Forest (Conservation) Act, 1980. This in-principle approval shall be valid for a period of five years. In the event of non-compliance of the above conditions, this in-principle approval shall automatically stand revoked after five years.

Yours faithfully,

(S.M. Somashekar)
Chief Conservator of Forests (Central)

Copy to:-

1. The Director General of Forests & Special Secretary to Govt. of India, Ministry of Environment, Forests and Climate Change, Indira Paryavaran Bhavan, Agni Wing, Aliganj, Jor Bagh Road, New Delhi – 110 003.
2. The Principal Chief Conservator of Forests (HoFF), Forests Department, Govt. of Karnataka, Aranya Bhavan, 18th Cross, Malleswaram, Bangalore – 560 003.
3. The Additional Principal Chief Conservator of Forests/Nodal Officer (FCA), Office of the Principal Chief Conservator of Forests, Forests Department, Govt. of Karnataka, Aranya Bhavan, 18th Cross, Malleswaram, Bangalore – 560 003.
4. The Executive Engineer, Karnataka Neeravari Nigama Limited, Upper Bhadra Project, Division – 2, B.R. Project, Bhadravathi, Chickmagalur District (Karnataka).
5. Guard file.

(S.M. Somashekar)
Chief Conservator of Forests (Central)

UPPER BHADRA PROJECT

COST ESTIMATE

13. GENERAL REPORT ACCOMPANYING THE COST ESTIMATE OF UPPER BHADRA PROJECT

13.1 Estimate

13.1.1 Upper Bhadra Project is proposed to Irrigate an area of 2,25,515 Ha under Chitradurga Branch canal, Tumkur Branch canal, Jagalur Branch canal & Tarikere lift including Restoration and filling of MI Tanks under the drought prone districts of Chikkamagalur, Chitradurga, Davangere and Tumkur. An important aspect of this project is that it envisages adoption of Low Pressure Drip (LPS) system of irrigation with higher efficiency when compared with conventional open canal surface irrigation system.

13.1.2 The project report deals with the project estimate for implementing the scheme consisting of the following components.

(a) Lifting water from Tunga River to Bhadra Reservoir in two stages.

(b) Construction of canal from Bhadra Reservoir to Delivery Chamber including two lifts and a tunnel of 7.00 Km length.

(c) Chitradurga Branch Canal network to provide irrigation facility to 1,07,265 Ha of land in Chikkamagalur and Chitradurga Districts including restoration of 36 tanks situated within the command area.

(d) Tumkur Branch Canal network to provide irrigation facility to 84,900 Ha of land in Chikkamagalur, Chitradurga and Tumkur Districts including restoration of 131 tanks situated within the command area.

(e) Jagalur Branch Canal network to provide irrigation facility to 13,200 Ha of land in Chitradurga and Davangere Districts including restorations of 09 tanks situated within the command area.

(f) Tarikere Lift to provide irrigation facility to 20,150 Ha of land in Chikkamagalur District and Restoration of 33 tanks coming within the command area and filling of tanks with rising and feeder lines for 46 tanks coming under Tarikere Taluk.

(g) Drinking water supply and filling of 30 MI tanks coming under Pavagada taluk of Tumkur district.

(h) Filling of 42 MI tanks coming under Chalkere taluk and 20 MI tanks coming under Molakalmur taluk.

(i) Filling of 21 MI tanks coming under Holalkere taluk.

13.1.3 Stage of Work as per Present Proposal

Sl. No.	Description of the Work	Present Stage of Work
1	Lifting of water from Tunga river to Bhadra Reservoir in two stages - Package I. 17.50 TMC Awarded as per EPC Tender cost Rs.324.00 Crores.	➢ It involves two stages of lifting (8450 Hp 5 Nos. in each stage) ➢ 60 Cumecs of water is lifted with static lift of 45 mts. ➢ 50% of the work has been completed.
2	Construction of canal from Bhadra Reservoir to Delivery Chamber including two lifts but excluding the tunnel - Package II. (29.90 TMC) Awarded as per EPC Tender cost Rs.1032.00 Crores.	➢ It involves two stages of lifting (18500 Hp (4+1) No.s.in each stage) ➢ 81 Cumecs of water is lifted from about 45 Mtr ➢ Total length of canal is 40.290 Km. ➢ Total No. of Structure 96. ➢ Work is completed
3	Construction of tunnel 7.00 Km long. Tunnel in the above canal including approach and exit - Package III. Awarded as per EPC Tender cost Rs.224.00 Crores.	➢ The work is completed
4	Tarikere lift irrigation scheme ➢ It is proposed to irrigate 20150 Ha. By Drip Irrigation and fill up 79 Nos. of Tanks work taken up in 2 packages at the cost of Rs. 812.02 Crores	➢ Work is under progress.
5	Chitradurga Branch Canal length 134.538 Km is taken up in 12 packages Tender cost Rs. 1639.52 Crores	➢ Work is under progress.

Sl. No.	Description of the Work	Present Stage of Work
6	Tumkur Branch Canal is 159.684 Km in length. Works are taken up to 159.684 Km in 8 packages at a cost of Rs. 1091.58 Crores	➢ Work is under progress.
7	Jagalur Branch Canal and Tank Filling for a length of 74.14 Km are taken up in 2 Packages at a cost of 1833.45 Crores.	➢ Survey work is completed.
8	Holalkere Branch Canal under CBC Total Tender Cost Rs. 196.75 Crores	➢ Open Canal upto 4.53 Km work is under progress. ➢ Further tank filling network is work is under progress.
9	Challakere, Molakalmuru, Pavagada Tank filling works under CBC taken in 4 Packages at the cost of Rs. 1338.32 Crores	➢ Work is under progress.
10	Chikkanayakanahalli 18 Tanks filling work as taken up in Rs. 69.7 Crore	➢ Work is under progress.
11	Sira 62 Tanks after tail end of TBC work as taken up in Rs.1165.29 Crores	➢ Work is under progress.
12	Drip Irrigation for CBC for an area of 40749 Ha were taken in 03 packages at the cost of Rs. 2389.87 Crores	➢ Work is under progress.
13	Drip Irrigation for TBC for an area of 27590 Ha were taken in 02 packages at the cost of Rs. 1286.79 Crores	➢ Work is under progress.
14	Drip Irrigation for TBC for an area of 27590 Ha were taken in 02 packages at the cost of Rs. 1286.79 Crores	➢ Survey work is under progress.

13.1.4 **The main reasons for variation observed under different components are listed below when compared to approved DPR;**

Item involves	As per previous DPR amount(2014)	As per revised amount (2019)	Reasons
A - Preliminary: Provision is made for consultancy charges for Package I, II and III and also for detailed survey, investigation of canal network of Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal, Tarikere Lift, Restoration and filling of MI tanks and other component which is essential.	7159.50	6701.26	Instead of lumsum provision, the actual amount is considered. Hence the reduction. .
B - Lands:			
Provision of towards Land acquisition required for both canals and Residential and Non-Residential Colonies is made.	22586.85	75867.00	1. Due to change in the alignment of CBC & TBC. 2. Due to increase in the land for pump houses, residential and non residential colonies
C - Works:			
Provision is made towards the head works such as offtake structure, intake channel, jackwell, pump houses, delivery chamber along with pumps and rising main.	110634.00	348206.32	1. Increased due to actual amount in UBP Package-I & II. 2. Due to increase in rates

Item involves	As per previous DPR amount(2014)	As per revised amount (2019)	Reasons
			3. Due to additional works which is not contemplated in the approved DPR.

D - Regulator & Measuring device, E - Falls, F - CD works, G - Bridges, H - Escapes - works (Construction of Structures):

Provision is made towards different types of structures coming under the Main canal of Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal, Tarikere Lift & flow canals, Restoration and filling of MI tanks.	43469.55	220503.44	1. Change in the alignment. 2. Increased due to No. of structures. 3. Due to increase in rates. 4. Increase in No. of measuring devices.

K - Building:

Provision is made for construction of Zonal Office, Circle Office, Division Office and Sub Division Office buildings. Necessary provision is also made towards camps inspection bunglow and residential quarters.	2712.00	6748.74	Increased due to considering the actual cost.

L-Earthwork:

Provision is made towards earthwork L1- Canal, Service road and Boundry. L2- Lining. L3- Tunnel	 156563.000 16900.00	 181863.00 48189.75	Due to increase in length of canal, lining quantity is increased. Due to change in the alignment, tunnel length is increased.

M - Plantation:

Provision is made for plantation all along the main canal for providing irrigation facility.	238.35	1159.12	Due to increase in the length and escalation in cost.

N - Tanks & Reservoirs:

Provision is made for Tank and Reservoirs.	-	11366.45	1.For Augmentation of V.V.Sagar additional works were to be taken up 2.provision Made towards restoration (Desilting) of tanks of Chitradurga Branch Canal under C-works in the approved DPR is shifted to component "N"

O - Miscellaneous:

Provision is made towards Deposits required for Electrical and other works is made towards training and Capacity building for adoption of Drip Irrigation.	4960.00	325.77	Due to increase in cost under C-works.

P - Maintenance:

Provision is made towards maintenance of all works at 1 % cost of I-works except (A, B, M, O, Q and X).	10489.15	11280.69	Due to increase in cost under the components A,B,M,O,Q and X

Q - Special Tools and Plants:

Provision is made towards purchase of new Vehicles required for officers.	185.00	243.07	Due to additional requirement of vehicles, the amount is increased.

R - Communication:

Provision is made towards approach roads to various works.	4132.00	3367.08	Due to additional works, the amount is increased.

S- Power Plant and Electrical System:

Provision is made for Power plant and Electrical system coming under Chitradurg Branch Canal, Tumkur Branch Cana and Jagalur Branch Canal and Tariker Lift and flow canals.	Nil	46075.56	Provision is not made in the approved DPR as the project consisted of lift drip irrigation system.

U- Distributories and Minors:

Distributories and minors	563787.50	489789.76	Provision for Bulk water supply and feeder line network for filling of tanks.

V - Drip Irrigation System:

A provision is made for Drip irrigation system coming under Chitradurga Branch Canal, Tumkur Branch Canal, Jagalur Branch Canal and Tarikere Lift & flow canals	Nil	534818.75	Provision of drip irrigation to cater irrigation facility covering an area of 2,25,515 ha is made in the Revised DPR against the provision of construction of Distributaries and Minors.

W- Drainage and Protective Works:

Drainage and Protective works	676.55	Nil	Provision made under component "W" is shifted to "X-environment & Ecology sub-heads" i.e. IMSD works. as per Guidelines.

X - Environment and Ecology

A provision is made towards consultation charges for study on Environment impact assessment.	6036.00	18105.56	1. Due to change in the alignment. 2. Due to change in the NPA value and deposited for forest clearance. 3. Due to provision of water shed development works above the Ajjampura Tunnel.

Y - Loss of Stock and Unforseen Items of Work

A lumsum provision is made under this head at 0.25% cost of I-works except (A,B,M,O,Q and X).	2622.29	-	

Z - Provision for Power Generation

Provision is made towards power generation from solar energy farm development.	150040.00	-	

Establishment Charges

A lumsum provision is made towards establishment charges at 10% of the total cost of project except B-Land.	108060.92	115811.90	Due to increase in the cost of project

Small T & P

A lumsum provision is made towards small T & P at 1% of I - Works.	11031.92	12132.59	Increase in the total cost under component of I-Works.

Receipts & Recoveries

(a) Recoveries on account of K-Buildings of the salvage value of building cost.	406.80	-	-
(b) Recoveries towards resale transfer of special T & P 75% of provision in I-works on Q-special, T & P excluding cost of inspection vehicle.	-	-	-
(c) Recoveriews towards resale-transfer inspection of vehicle (20% of inspection vehicle)	37.00	48.61	-

Indirect Charges

(a) Capitalized value of abatement of land revenue (5% of the cost of B-land)	1129.34	2726.89	Increase in the cost under the component, B-land and I-Works
(b) Audit and account chargers (1% cost of I-Works)	11031.32	12132.59	

13.2 **BC Ratio & Cost per Ha**

The estimated cost of the Upper Bhadra Project is Rs.21473.67 Crores.The Benefit cost ratio will be worked out after finalization of the cost estimate and irrigation planning. The cost per Ha works out to Rs.9.52 Lakhs/Ha.

UPPER BHADRA PROJECT

ECONOMIC APPRAISAL

14. ECONOMIC APPRAISAL

14.1 Basis for Profitability Analysis

- The profitability of the project is calculated on "With and without" concept.
- The analysis is based on annual cost and annual benefit
- The development of full potential is assumed to be over 5 years after the completion of the project. 1st year - 10%, 2nd year - 30% and 3rd year - 30%, 4th Year - 20%, 5th Year - 10%.
- The project is proposed to be implemented in 5 years with 10, 25, 35, 20 and 10% of investment respectively.
- Full "Free market" conditions are assumed. This means that all the labour and material costs of both inputs and outputs are at their opportunity cost and so no shadow pricing is done.
- Profitability index used is BC ratio which is defined as the ratio of annual benefit to annual cost.

14.2 Annual Benefits

Yield per hectare of different crops in rainfed-irrigated area in the command has been adopted.

Existing rainfed agricultural areas under different crops, the yields under rainfed and irrigated conditions and rates of agriculture products are shown in **Tables 14.1** and **14.2** along with details of inputs and value of agricultural products on full development of the project.

14.2.1 Comparison of Yield

Comparison of yield per hectare under rainfed and irrigated conditions for different crops are furnished below.

Sl. No.	Crop (Khariff and Rabi)	Maximum yield in Quintal/ Ha	
		Rainfed	Irrigated
1.	Maize	18	70
2.	Jowar	10	50
3.	Groundnut	7	25
4.	Sunflower	5	30
5.	Pulses	7	18
6.	Ragi	8	-

14.2.2 Rates of Agricultural Products

Rates of various crops grown in Upper Bhadra Command Area based on the present average market rate (which may vary from time to time and also on quality of materials) are given below.

Sl. No.	Type of Product	Average Rate per Quintal in Rupees
1.	Maize	1700
2.	Jowar	2430
3.	Groundnut	4890
4.	Sunflower	5388
5.	Pulses(Tur)	5675
6.	Ragi	2895

Calculation of Benefits

(a) **Benefits from Irrigation - 225515 Ha of UBP**

The annual benefits before and after irrigation are 751.00 and 184700.00 lakhs respectively. Hence the net annual benefit from irrigating an area of 225515 Ha is Rs.183949.00 lakhs.

Refer **Tables 14.1**, **14.2** and **14.3** attached.

Loss of productivity on land acquired for canals, distributaries, minors and field channel is not considered as benefit lost. Consideration of this loss of benefit leads to double counting, as the cost of land is already included under B-land on cost side. Benefit cost ratio of Upper Bhadra project worked out for 10% interest on capital investment adopting technical advisory committee based on the "Bor Model" suggested by Gadgil committee.

A. **Gross Receipts:** The gross receipts are worked out considering gross value of farm produce for command area of 2,25,515 Ha before irrigation and after irrigation adding dung receipts at 30% of fodder expenses.

B. **Expenses:** The total expenses are worked out considering expenses on seeds, manure, hired labour, fodder expenses and depreciation of agricultural implements.

C. **Net value of produce:** the net value produce is worked out deducting total expenses from gross receipts.

D. **Annual Benefits:** The annual benefits are computed deducting net value before irrigation from net value after irrigation and benefit from V V Sagar and drinking water supply is also added to it.

E. **Annual costs:** the annual costs are computed considering following aspects.

(i) Interest on capital @ 10% (Estimated total cost of the project including land development charges).

(ii) Depreciation of the project @ 1% of the cost of project for 100 years life of the project and at 2% for 50 years life of the project (excluding cost of pumping system and RM).

(iii) Annual operation and maintenance charges are considered only for main canal since the distribution thereafter is done by drip irrigation system.

(iv) Since separate Dam or Barrage is not built, the maintenance of head works cost is considered as Nil.

(v) Depreciation of the pumping system @ 8.33% of the estimated cost.

(vi) Depreciation of the raising mains @ 3.33% of estimated cost of the raising main assuming life of the system as 30 years.

(vii) Power generated is used for lift purpose only in one season. In the remaining seasons, the generated power is utilized for public consumption. Hence the cost of power generated for lift gets nullified by the benefit from power selling. So the power charges for lift irrigation are assumed as nil.

F. **Benefit cost Ratio:** Finally benefit cost ratio is calculated by dividing the annual benefits from annual costs which works out to 1.024 for 10% interest.

EXISTING CROP PATTERN AND PRODUCTIVITY PRE-PROJECT/PRE-ERM

Name of the project:UPPER BHADRA PROJECT

(All rates in Rs.Lakh and Area in Ha)

Sl No	Crop	Area in Ha	Yield in Quintal/Ha	Total Yield (Quintal)	Price per Qtl(Rs) (MSP)	Gross Income (in Lakh)	Breakup of Expenditure: Seed		Fertilizers, Chemicals, Manure		Hired Labour/Human, Animal and		Total expenditure	Net Income (in Lakhs)
							Rate/Ha(Rs.)	Amount (in Lakh)	Rate/Ha.(Rs.)	Amount	Rate/Ha.(Rs.)	Amount		
1	Groundnut	31933	7	223531	4890	10930.67	8442	2695.78	12478	3984.6	9892	3158.81	9839.2	1091.47
2	Maize	21135	18	380430	1700	6467.31	4866	1028.43	13158	2780.94	12145	2566.85	8376.22	91.09
3	Ragi	12706	8	101648	2895	2942.71	307	39.01	15838	2012.38	10349	1314.94	3366.33	-423.62
4	Sunflower	2828	5	14140	5388	761.86	1255	35.49	11056	312.66	9154	258.88	607.03	154.83
5	Jowar	2828	10	28280	2430	687.2	1386	39.2	10510	297.22	11508	325.45	661.87	25.34
6	Pulses(Tur)	50348	7	352436	5675	20000.74	832	418.9	12464	6275.37	9944	5006.61	11700.88	8299.87
7	Vegetables & Misc Crops	13531	10	135310	500	676.55	80	10.82	3000	405.93	1250	169.14	585.89	90.66
	Total	135309				42467.05		4267.83		16069.11		12800.67	33137.4	9329.64

Note:1. MSP declared for the year 2018-19
2. Expenditure details from Karnataka Agriculture Price Commission cost of cultivation report 2019 (for the crops grown during 2018-19)

Director of Agriculture

PROPOSED CROP PATTERN AND PRODUCTIVITY POST-PROJECT/POST-ERM

Name of the project:UPPER BHADRA PROJECT

(All rates in Rs.Lakh and Area in Ha)

Sl No	Crop	Area in Ha	Yield in Quintal/Ha	Total Yield (Quintal)	Price per Qtl(Rs) (MSP)	Gross Income (In Lakh)	Breakup of Expenditure						Total expenditure	Net Income (In Lakhs)
							Seed		Fertilizers, Chemicals,		Hired Labour(Human,			
							Rate/Ha(Rs.)	Amount (In Lakh)	Rate/Ha.(Rs.)	Amount	Rate/Ha.(Rs.)	Amount		
1	Groundnut	101482	25	2537050	4890	124061.75	8442	8567.11	12478	12662.9	9892	10038.60	31268.63	92793.11
2	Maize	22552	70	1578640	1700	26836.88	4868	1097.38	13158	2967.39	12145	2738.94	6803.71	20033.17
3	Sunflower	45102	30	1353060	5388	72902.87	1255	566.03	11056	4986.46	9154	4128.64	9681.14	63221.73
4	Jowar	33827	50	1691350	2430	41099.81	1386	468.84	10510	3555.22	11508	3892.81	7916.87	33182.93
5	Pulses(Tur)	22552	18	405936	5675	23036.87	832	187.63	12464	2810.88	9944	2242.57	5241.08	17795.79
	Total	225515				287938.17		10887		26982.9		23041.56	60911.45	227026.7

Note:1. MSP declared for the year 2018-19

2. Expenditure details from Karnataka Agriculture Price Commission cost of cultivation report 2019 (for the crops grown during 2018-19)

Director of Agriculture

ಕರ್ನಾಟಕ ನೀರಾವರಿ ನಿಗಮ ನಿಯಮಿತ

(ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ಉದ್ಯಮ)

Karnataka Neeravari Nigam Limited

(A Government of Karnataka Enterprise)

KNNL/TECH/AE3/GNL-013/15-16/5288

Dated: 28.12.2015

1. Chief Engineer, Irrigation (North) Zone, Belgaum.
2. Chief Engineer, Malaprabha Project Zone, Dharwad.
3. Chief Engineer, Upper Tunga Project Zone, Shimoga.
4. Chief Engineer, Irrigation Project Zone, Gulbarga.
5. Chief Engineer, Irrigation Central Zone, Munirabad.
6. Chief Engineer, Varahi Project Zone, Siddapur.
7. Chief Engineer, Upper Bhadra Project Zone, Chitradurga.

Sir,

Sub: Electricity Bills in LIS - Temporary reduction in the Contract Demand.

In the LI Schemes which are commissioned and running, for all the pumping stations, the KPTCL/ESCOMs have sanctioned power supply depending upon the Contract demand requisitioned by KNNL. As per the tariff regulations, all the ESCOMs are entitled to collect the electricity tariff as per Tariff Schedule HT – 3(a), which is as follows –

Applicable to Lift irrigation Schemes/ Lift irrigation societies,

HT-3 (a) (i): Applicable to LI schemes under Govt. Departments/ Govt. owned Corporations.

Energy charges/ Minimum Charges	170 paise per unit subject to an annual minimum of Rs1000 per HP/Annum.

As per Conditions of Supply of Electricity rules, clause 34.02, there is a provision to request reduction of the contract demand for a temporary period, not exceeding 6 months. An extract of the rules is enclosed. All the concerned EEs should approach the concerned ESCOMs for reduction of the contract demand temporarily during non-pumping period so as to reduce payment of minimum charges during this period. The CEs must ensure that the above is complied with and lapse by any officer would be viewed seriously. Receipt of the letter shall be acknowledged and action taken in this regard shall be reported.

Encl: As above

Yours faithfully,

Managing Director

ನಂ: 5463
31/12/2015

29-12-15

for Water

Regd. Office : 4th Floor, Coffee Board Building, No. 1, Dr. B.R. Ambedkar Veedhi, Bangalore - 560 001, Ph : 22263074-78,
Fax : 22360011, CIN : U85110KA1998SGC024003

34.00 REDUCTION / VARIATION IN THE CONTRACT DEMAND/SANCTIONED LOAD

34.01 Consumer's increased load requirement

The procedure for sanction of additional power shall be the same as for a new installation except that dues, if any, shall be cleared before sanction of additional power.

34.02 Reduction in contract demand / sanctioned load: / Surrender of RR No. (Installation) (Except IP set Installations under LT category)

During the Agreement period initial or extended, the Consumer is entitled to get his contract demand / sanctioned load reduced by executing a fresh Agreement. The reduction shall be given effect to from the meter reading date following the expiry of two months period from the date of registration of his application for reduction of contract demand / sanctioned load along with fresh Agreement for reduced contract demand / sanctioned load duly making payment of registration cum processing fee as prescribed under Clause. 30.01.

The following sub clause has been deleted by Amendment vide Notification No. K.E.R.C./COS/D/07/08 Dated: 14.3.2008 published in Karnataka Gazette dated: 20.3.2008

However, the Consumer shall continue to pay minimum charges if any, till the expiry of the initial Agreement period.

The same Conditions shall also be applicable for requisitions in case of temporary reduction of contract demand / sanctioned load as per provision in power supply Agreements subject to a maximum period of six months only.

Note: The officers who are empowered to sanction permanent power supply are also empowered to approve reduction of CD/sanctioned load to the same extent.

34.03 When a Consumer gets his contract demand / sanctioned load reduced, his energy / demand entitlement, if any, shall be reduced on prorata basis with effect from the date of reduction of CD / sanctioned load. This shall be applicable during power cut period only.

34.04 Where the Contract demand / Sanctioned load is reduced, the Security Deposit required shall be recalculated for the reduced Contract demand / Sanctioned load on a pro-rata basis on average monthly bill of the preceding calendar year. Any excess Security Deposit held over the recalculated average monthly bill amount of the preceding calendar year shall be refunded to The Consumer by cheque, within 2 months from

ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ: ನಗರ ನೀರು ಸರಬರಾಜು ಯೋಜನೆ ಮತ್ತು ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿ ಮತ್ತು ಕುಡಿಯುವ ನೀರಿನ ದರಗಳನ್ನು ಪರಿಷ್ಕರಿಸಲು ಅನುಮೋದನೆ ನೀಡುವ ಕುರಿತು.

ಓದಲಾಗಿದೆ: 1) ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ:ವನಇ 10 ಯುಡಬ್ಲ್ಯೂಎಸ್ 94 ದಿನಾಂಕ:11.08.1994.

2) ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ:ನಅಇ 204 ಯುಎಂಎಸ್ 95 ದಿನಾಂಕ;15.11.96

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ಪ್ರಸ್ತಾವನೆ:

ಬೆಂಗಳೂರು ನಗರವನ್ನು ಹೊರತು ಪಡಿಸಿ, ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ರಾಜ್ಯ ಸರ್ಕಾರದ ಯೋಜನೆಯಡಿ ಕೈಗೆತ್ತಿಕೊಳ್ಳುವ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿಯನ್ನು ಮತ್ತು ಗ್ರಾಹಕರಿಗೆ ಸರಬರಾಜು ಮಾಡುವ ನೀರಿನ ದರ ಹಾಗೂ ನಿರ್ವಹಣಾ ವ್ಯವಸ್ಥೆಯ ದರಗಳನ್ನು ಸರ್ಕಾರವು ಮೇಲೆ ಓದಲಾದ ಕ್ರಮಾಂಕ 1 ಮತ್ತು 2ರ ಆದೇಶಗಳಲ್ಲಿ ನಿಗದಿಪಡಿಸಿ ಜಾರಿಗೆ ತರಲಾಗಿತ್ತು. ಮೇಲೆ ಓದಲಾದ ಕ್ರಮಾಂಕ(2)ರ ಸರ್ಕಾರದ ಆದೇಶದಲ್ಲಿ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ಸ್ವಂತ ಮನೆ/ಬಾಡಿಗೆದಾರರು, ಜಂಟಿ ಅಥವಾ ಏಕ ವ್ಯಕ್ತಿ ಖಾತಾ ಹೊಂದಿರುವ ಎಲ್ಲಾ ಮನೆಗಳಿಗೆ ಸಂಪರ್ಕವನ್ನು ಕಲ್ಪಿಸಲು ಮತ್ತು ಎಲ್ಲಾ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿನ ಶೇ.100% ರಷ್ಟು ನೀರಿನ ಸಂಪರ್ಕಗಳಿಗೆ ಮೀಟರ್‌ಗಳನ್ನು 6 ತಿಂಗಳ ಒಳಗೆ ಅಳವಡಿಸಲು ಸೂಚಿಸಲಾಗಿತ್ತು.

ನೀರಿನ ದರಗಳನ್ನು ಮತ್ತು ಪರಿಷ್ಕೃತ ನೀರಿನ ದರವನ್ನು ಕರ್ನಾಟಕ ನಗರ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿಯು 57 ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು, 5 ಮಹಾನಗರ ಪಾಲಿಕೆಗಳು, 22 ನಗರ ಸಭೆಗಳು ಮತ್ತು 30 ಪುರಸಭೆಗಳಿಗೆ ಎಲ್‌ಐಸಿ/ಹುಡ್ಕೋ/ಎಡಿಬಿ ಇತ್ಯಾದಿ ಸಂಸ್ಥೆಗಳಿಂದ ಆರ್ಥಿಕ ಸಹಾಯದೊಂದಿಗೆ ಚಾಲನೆಗೊಳಿಸಿದ ನೀರು ಸರಬರಾಜು ಯೋಜನೆಗಳ ಗಾತ್ರದ ಆಧಾರದ ಮೇಲೆ ನಿಗದಿಪಡಿಸಿದ ಶಿಫಾರಸ್ಸಿನಂತೆ ಜಾರಿಗೆ ತರಲಾಗಿತ್ತು. ಈ ರೀತಿ ಶಿಪಾರಸ್ಸು ಮಾಡಲಾದ ಕನಿಷ್ಠ ನೀರಿನ ದರಗಳನ್ನು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳ ನೀರು ಸರಬರಾಜು ನಿರ್ವಹಣೆ ಮತ್ತು ದುರಸ್ಥಿಯ ವೆಚ್ಚ ಹಾಗೂ ಇತರೆ ಸೇವಾ ವೆಚ್ಚಗಳನ್ನೊಳಗೊಂಡಿದ್ದು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನೀರಿನ ದರಗಳನ್ನು ವಸೂಲಿ ಮಾಡಿ, ಕನನೀಸ ಒಚಮಂಡಳಿಗೆ ಸೇವಾ ವೆಚ್ಚಗಳನ್ನು ಪಾವತಿಸಬೇಕಾಗಿರುತ್ತದೆ.

ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ನೀರಿನ ಬಳಕೆಯ ಮೀಟರ್‌ಗಳನ್ನು ಅಳವಡಿಸುವವರೆಗೆ (6 ತಿಂಗಳಲ್ಲಿ ಎಲ್ಲಾ ನೀರು ಸಂಪರ್ಕಗಳಿಗೆ ಮೀಟರ್ ಅಳವಡಿಸುವ ಷರತ್ತಿಗೊಳಪಟ್ಟು) ಗೃಹಬಳಕೆಗಳಿಗೆ ಕನಿಷ್ಠ ಮಾಸಿಕ ದರ ರೂ.45/- ರಂತೆ ನಿಗದಿ ಪಡಿಸಲು ಸೂಚಿಸಲಾಗಿತ್ತು. ಇದಲ್ಲದೆ, ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಈ ದರಕ್ಕಿಂತ ಹೆಚ್ಚಿನ ದರಗಳನ್ನು ಸದರಿ ಸಂಸ್ಥೆಗೆ ಅನ್ವಯವಾಗುವ ಸೇವಾ ವೆಚ್ಚದ ಆದಾರದ ಮೇಲೆ ನಿಗದಿ ಪಡಿಸಲು ಸ್ವತಂತ್ರವಾಗಿದ್ದವು. ಗೃಹೇತರ ಬಳಕೆಗಳಿಗೆ ಗೃಹಬಳಕೆಯ ದುಪ್ಪಟ್ಟರಷ್ಟು ದರ ನಿಗದಿಪಡಿಸಲಾಗಿತ್ತು, ಮತ್ತು ವಾಣಿಜ್ಯ ಮತ್ತು ಕೈಗಾರಿಕಾ ಸಂಪರ್ಕಗಳಿಗೆ ಗೃಹ ಬಳಕೆಯ ದರದ 4 ಪಟ್ಟು ನಿಗದಿ ಪಡಿಸಲಾಗಿತ್ತು. ಬಡ ವರ್ಗದ ಜನರ ಮೀಟರ್ ದರಗಳನ್ನು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳೇ ಬರಿಸಲು ನಿರ್ದೇಶಿಸಲಾಗಿತ್ತು.

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ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಸದರಿ ಸರ್ಕಾರಿ ಆದೇಶವನ್ನು ಅನುಷ್ಠಾನಗೊಳಿಸುವಲ್ಲಿ ಬಾಗಶ: ಯಶಸ್ವಿಯಾಗಿವೆ. ಗೃಹ ಬಳಕೆ ನೀರು ಸಂಪರ್ಕಗಳನ್ನು ಅನುಷ್ಠಾನಗೊಳಿಸಲು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯ ಪೂರ್ಣ ಜನಸಂಖ್ಯೆಗೆ ವಿಸ್ತರಿಸಲು ಗುರಿ ಹೊಂದಿದ್ದು, ಅದರಲ್ಲಿ ಶೇ.51% ರಷ್ಟು ಮಾತ್ರ ಯಶಸ್ವಿಯಾಗಲು ಸಾಧ್ಯವಾಗಿದೆ. ಹುಬ್ಬಳ್ಳಿ-ಧಾರವಾಡ, ರಾಮನಗರ-ಚನ್ನಪಟ್ಟಣ, ತುಮಕೂರು, ಮೈಸೂರು ಇತ್ಯಾದಿ ಕೆಲವು ಪ್ರದೇಶಗಳನ್ನು ಹೊರತುಪಡಿಸಿ ಹೆಚ್ಚಿನ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ಮೀಟರ್ ಅಳವಡಿಕೆ ಮಾಡಿರುವುದಿಲ್ಲ. ಇದಲ್ಲದೆ, ಕನಿಷ್ಠ ನೀರಿನ ದರವಾದ ರೂ.45/- ನ್ನು ನಿಗದಿ ಪಡಿಸುವುದು ಸಹ ತುಂಬಾ ಮಂದಗತಿಯಲ್ಲಿ ಸಾಗಿದ್ದು, ಪ್ರಗತಿ ಸರಿಯಾಗಿರುವುದಿಲ್ಲ, ಕೆಲವೇ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಕನಿಷ್ಠ ನೀರಿನ ದರಗಳನ್ನು ಮೀರಿ ಹೆಚ್ಚಿನ ದರಗಳನ್ನು ನಿಗದಿಪಡಿಸಲು ಕ್ರಮ ವಹಿಸಿರುತ್ತವೆ.

ಕರ್ನಾಟಕ ಸರ್ಕಾರವು 2003ರಲ್ಲಿ ಹೊರಡಿಸಿದ, ನಗರ ಕುಡಿಯುವ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ನೀತಿಯಲ್ಲಿ, ನಗರ ನೀರು ಸರಬರಾಜು ಬೇಡಿಕೆ ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಯ ಬಗ್ಗೆ ವೈಜ್ಞಾನಿಕವಾಗಿ ಅಲೋಚಿಸಿ ಈ ಕುರಿತು ಎಲ್ಲಾ ಸಂಭಂದಪಟ್ಟ ಸರ್ಕಾರದ ಪ್ರತಿನಿಧಿಗಳೊಂದಿಗೆ ಚರ್ಚಿಸಿದ ನಂತರ ರಾಜ್ಯದ ನೀತಿಯನ್ನು ರೂಪಿಸಲು ಒತ್ತುಕೊಡುತ್ತದೆ. ಭವಿಷ್ಯದಲ್ಲಿ ಮೂಲಭೂತ ಸೌಕರ್ಯಗಳ ಮೇಲೆ ಬಂಡವಾಳ ಹೂಡಿಕೆಗಳನ್ನು, ಮತ್ತು ಅತ್ಯುತ್ತಮ ನೀರು ಬಳಕೆ ಮತ್ತು ಮೂಲಭೂತ ಅಭಿವೃದ್ಧಿ ಕುರಿತು ಆರ್ಥಿಕ ಸಂಪತ್ತನ್ನು ಸಾಮಾಜಿಕವಾಗಿ ಹಿಂಪಡೆಯುವುದರ ಮೇಲೆ ಅವಲಂಬಿಸಬೇಕಾಗಿರುತ್ತದೆ.

ಮುಂದುವರೆದು ಯೋಜನಾ ವೆಚ್ಚವನ್ನು ಹಿಂಪಡೆಯುವ ದೃಷ್ಟಿಯಿಂದ ನೀರಿನ ದರಗಳನ್ನು ಸೂಕ್ತವಾಗಿ ನಿಗದಿಪಡಿಸಿ ಸದರಿ ದರಗಳು, ನಿರ್ವಹಣೆ ದುರಸ್ಥಿ ಮತ್ತು ಸೇವಾ ವೆಚ್ಚಗಳನ್ನು ಸಮರ್ಪಕವಾಗಿ ಹಿಂಪಡೆಯುವಂತೆ ನಿಗದಿಪಡಿಸುವುದು ಸೂಕ್ತವಾಗಿರುತ್ತದೆ. ಸರ್ಕಾರವು ನೀರಿನ ದರಗಳ ಪರಿಷ್ಕರಣೆಯನ್ನು ಅವುಗಳ ಬಳಕೆಯ ಆಧಾರವಾಗಿ ಮತ್ತು ಪೋಲಾಗುವ ನೀರಿನ ಗಾತ್ರದ ಮೇಲೆ ಸಾಮಾನ್ಯ ಜೀವನಕ್ಕೆ ಅಗತ್ಯವಿರುವ ಮತ್ತು ಬಡತನ ರೇಖೆಗಿಂತ ಕೆಳಗಿರುವವರಿಗೆ ಅತ್ಯಧಿಕ ಕಡಿಮೆ ವೆಚ್ಚದಲ್ಲಿ ನೀರು ಸರಬರಾಜು ಮಾಡಲು ಒತ್ತುಕೊಡುತ್ತದೆ. ಇದಲ್ಲದೆ, ಸದರಿ ನೀತಿಯೂ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಶೇ.100ರಷ್ಟು ನೀರು ಸಂಪರ್ಕಗಳಿಗೆ ಮೀಟರ್‌ಗಳನ್ನು ಅಳವಡಿಸಿ ಅವುಗಳ ಬಳಕೆಯ ಆಧಾರದ ಮೇಲೆ ನೀರಿನ ದರಗಳನ್ನು ವಿಧಿಸಿ ಬಹುಕಾಲದವರೆಗಿನ ಆಧಾರದ ಮೇಲೆ ನೀರಿನ ವಸೂಲಿ ಕ್ರಮಗಳನ್ನು ಅನುಸರಿಸಲು ಪ್ರೋತ್ಸಾಹಿಸುತ್ತದೆ.

ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಸೇವೆಗಳನ್ನು ಪುಷ್ಟಿಕರವಾಗಿ ಮತ್ತು ಸಮರ್ಪಕವಾಗಿ ನೀಡಲು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ರಾಜಸ್ವ ವಸೂಲಿಯನ್ನು ಸೇವಾ ಶುಲ್ಕಗಳಿಂದ ಬಲಪಡಿಸಿಕೊಳ್ಳಬೇಕಾಗಿರುತ್ತದೆ ಮತ್ತು ಸರ್ಕಾರದ ಅನುದಾನ/ಸಾಲಗಳನ್ನು ಪಡೆಯುವುದನ್ನು ಕಡಿತಗೊಳಿಸಬೇಕಾಗಿರುತ್ತದೆ. ಆದ್ದರಿಂದ, ನೀರಿನ ದರಗಳನ್ನು ಪರಿಷ್ಕರಿಸುವುದು ನೀರು ಸರಬರಾಜು ಯೋಜನೆಗಳ ಕಾರ್ಯಸಾಧ್ಯತೆ ಮತ್ತು ರಾಜ್ಯದ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆ 2003ರ ನೀತಿಯನ್ನು ಕಾರ್ಯರೂಪಕ್ಕೆ ತಂದಂತಾಗುತ್ತದೆ.

ನೀರಿನ ದರಗಳ ಪರಿಷ್ಕರಣೆ ಮತ್ತು ನೀರು ಸರಬರಾಜು ಹಾಗೂ ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿಯನ್ನು ಪರಿಷ್ಕರಿಸಲು ಕನನೀಸ ಮತ್ತು ಒಳ ಚರಂಡಿ ಮಂಡಳಿ ಮತ್ತು ಕೆ.ಯು.ಐ.ಡಿ.ಎಫ್.ಸಿ., ವತಿಯಿಂದ ಅಧ್ಯಯನ ಮಾಡಿದ್ದು, ಸದರಿ ವರದಿಯ ಮೇಲೆ ಒಂದು ಸಮಿತಿಯನ್ನು ಆಯುಕ್ತರು, ಪೌರಾಡಳಿತ ನಿರ್ದೇಶನಾಲಯ ರವರ ಅಧ್ಯಕ್ಷತೆಯಲ್ಲಿ ಈ ಎಲ್ಲಾ ವರದಿಗಳನ್ನು ಅಧ್ಯಯನ ಮಾಡಿ ಅಂತಿಮ ಶಿಫಾರಸ್ಸನ್ನು ಈ ಕೆಳಕಂಡ ನಾಲ್ಕು ಅಂಶಗಳ ಮೇಲೆ ಸಲ್ಲಿಸಲು ಸೂಚಿಸಲಾಯಿತ್ತು.

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1) ನೀರಿನ ದರಗಳ ನಿಗದಿಪಡಿಸುವ ಬಗ್ಗೆ.
2) ನೀರು ಸರಬರಾಜು ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿ ಬಗ್ಗೆ.
3) ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆಗಳಿಗೆ ಬಳಕೆದಾರರ ದರವನ್ನು ನಿಗದಿಪಡಿಸುವ ಬಗ್ಗೆ.
4) ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆಗಳಿಗೆ ಆರ್ಥಿಕ ಮಾದರಿಯನ್ನು ನಿಗದಿಪಡಿಸುವ ಬಗ್ಗೆ.

ಸದರಿ ಸಮಿತಿಯು 5 ಮಹಾನಗರಪಾಲಿಕೆಗಳು, 5 ನಗರಸಭೆಗಳು , 4 ಪುರಸಭೆಗಳು ಮತ್ತು 4 ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಗಳ ನೀರು ಸರಬರಾಜು ನಿರ್ವಹಣೆ ಮತ್ತು ದುರಸ್ಥಿಯ ವೆಚ್ಚಗಳ ಬಗ್ಗೆ ಅಧ್ಯಯನ ಮಾಡಿ ಈ ಕೆಳಕಂಡ ನೀರಿನ ದರಗಳನ್ನು ನಿಗದಿಪಡಿಸಲು ಸರ್ಕಾರಕ್ಕೆ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಸಲ್ಲಿಸಿರುತ್ತದೆ.

- 0-8 ಕಿಲೋ ಲೀಟರ್ ವರೆಗೆ ದರದ ಹಂತವು – ರೂ.7/- ಪ್ರತಿ ಕಿ.ಲೀ.,
- 8-15 ಕಿಲೋ ಲೀಟರ್ ವರೆಗೆ ದರದ ಹಂತವು – ರೂ.9/- ಪ್ರತಿ ಕಿ.ಲೀ.,
- 15-25 ಕಿಲೋ ಲೀಟರ್ ವರೆಗೆ ದರದ ಹಂತವು – ರೂ.11/- ಪ್ರತಿ ಕಿ.ಲೀ.,
- 25ಕ್ಕಿಂತ ಅಧಿಕ ಕಿ.ಲೀ., ವರೆಗೆ ದರದ ಹಂತವು – ರೂ.13/- ಪ್ರತಿ ಕಿ.ಲೀ.,

ಈ ಹಿಂದೆ ನೀರಿನ ದರಗಳ ಬಗ್ಗೆ ಮೇಲೆ ಓದಲಾದ ಕ್ರಮಾಂಕ(2)ರ ದಿನಾಂಕ:15-11-1996ರಲ್ಲಿ ಹೊರಡಿಸಿದ ಸರ್ಕಾರದ ಆದೇಶದ ದರಗಳನ್ನು ಇಲ್ಲಿಯವರೆಗೆ ಪರಿಷ್ಕರಿಸಿಲ್ಲ. ಕಳೆದ 14 ವರ್ಷಗಳಲ್ಲಿ ಸುರಕ್ಷಿತ ಕುಡಿಯುವ ನೀರಿನ ಸರಬರಾಜು ವೆಚ್ಚವು ಬಹಳಷ್ಟು ಹೆಚ್ಚಾಗಿದ್ದು, ನಿರ್ವಹಣಾ ಸಿಬ್ಬಂದಿಯ ವೇತನವು ಶೇ.133ರಷ್ಟು ವಿದ್ಯುತ್ ಶಕ್ತಿ ವೆಚ್ಚವು ಶೇ.200ರಷ್ಟು ಮತ್ತು ಶುದ್ಧೀಕರಣಕ್ಕೆ ಅಗತ್ಯವಿರುವ ರಸಾಯನಿಕ ಮತ್ತು ಇತರೆ ದುರಸ್ಥಿ ವೆಚ್ಚಗಳು ಶೇ.100ರಷ್ಟು ಹೆಚ್ಚಿರುವ ಪರಿಸ್ಥಿತಿಯಲ್ಲಿ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಕನಿಷ್ಠ ನೀರಿನ ದರಗಳನ್ನು ವಸೂಲಿ ಮಾಡಲು ಶಕ್ತವಾಗಿರುವುದಿಲ್ಲ ಮತ್ತು ತಾವು ವಸೂಲಿ ಮಾಡುವ ನೀರಿನ ದರದಿಂದ ನಿರ್ವಹಣೆ ಮತ್ತು ದುರುಸ್ಥಿ ಕಾರ್ಯಗಳನ್ನು ನೋಡಿಕೊಳ್ಳಲು ಸಾಧ್ಯವಾಗುತ್ತಿಲ್ಲ. ಸಾರ್ವಜನಿಕ ವಿತರಣಾ ಕೊಳವೆಗಳಿಂದ (Pulbic Stand Post) ನೀರು ಪಡೆಯುತ್ತಿರುವ ಸಾರ್ವಜನಿಕರ ಮೇಲೆ ನೀರು ಬಳಕೆ ದರಗಳನ್ನು ವಿಧಿಸುವುದು ಸೂಕ್ತವಾಗಲಾರದೆಂದು ಅಭಿಪ್ರಾಯಪಟ್ಟು, ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಗೃಹ ಬಳಕೆ ಸಂಪರ್ಕಗಳನ್ನು ಹೆಚ್ಚಿಸಿಕೊಂಡು ಹೋಗಲು ಒತ್ತು ನೀಡಿ, ಮೇಲಿನ ಕಾರಣಗಳಿಂದಾಗಿ ನೀರಿನ ದರಗಳನ್ನು ಮತ್ತು ನೀರು ಸರಬರಾಜು/ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿಯನ್ನು ಪರಿಷ್ಕರಿಸಲು ಸಮಿತಿಯು ಸರ್ಕಾರಕ್ಕೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿದೆ.

ಪ್ರಸ್ತಾವನೆಯನ್ನು ಸರ್ಕಾರವು ಕೂಲಂಕುಷವಾಗಿ ಪರಿಶೀಲಿಸಿ, ಈ ಕೆಳಕಂಡಂತೆ ಆದೇಶಿಸಿದೆ.

<u>ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ:ನಅಇ 07 ಯುಡಬ್ಲ್ಯೂಎಸ್ 2011,</u>
<u>ಬೆಂಗಳೂರು ದಿನಾಂಕ:20.07.2011</u>

ಪ್ರಸ್ತಾವನೆಯಲ್ಲಿ ವಿವರಿಸಿರುವ ಅಂಶಗಳ ಹಿನ್ನೆಲೆಯಲ್ಲಿ ಬೆಂಗಳೂರು ನಗರವನ್ನು ಹೊರತು ಪಡಿಸಿ ಕರ್ನಾಟಕ ರಾಜ್ಯದ ಎಲ್ಲಾ ಮಹಾನಗರಪಾಲಿಕೆಗಳು/ನಗರಸಭೆಗಳು /ಪುರಸಭೆಗಳು/ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಯಗಳಲ್ಲಿ ಕೈಗೆತ್ತಿಕೊಳ್ಳುವ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿ ಮತ್ತು ಗ್ರಾಹಕರಿಗೆ ನೀರು ಸರಬರಾಜು ಮಾಡುವ ನೀರಿನ ದರ ಹಾಗೂ ನಿರ್ವಹಣಾ ದರಗಳನ್ನು ತಕ್ಷಣದಿಂದ ಜಾರಿಗೆ ಬರುವಂತೆ ಈ ಕೆಳಕಂಡಂತೆ ನಿಗದಿಪಡಿಸಿ ಪರಿಷ್ಕರಿಸಲು ಸರ್ಕಾರದ ಅನುಮೋದನೆ ನೀಡಿದೆ.

---4/-

ಎ) <u>ನೀರಿನ ದರ:</u>

(ಅ) ಬಳಕೆಗೆ ತಕ್ಕಂತೆ ನೀರು ದರ

ಗ್ರಾಹಕ ವರ್ಗ	ನೀರಿನ ಬಳಕೆಗೆ ಅನುಗುಣವಾಗಿ ಪ್ರತಿ ತಿಂಗಳು ವಿಧಿಸಲಾಗುವ ದರ			
	ದರದ ಹಂತ		ಬಳಕೆಯ ದರ	ಪ್ರತಿ ಸಂಪರ್ಕಕ್ಕೆ ಕನಿಷ್ಠ ದರ
	ಕನಿಷ್ಠ	ಗರಿಷ್ಠ	ರೂ/ಕಿ.ಲೀ	
	ಕಿ.ಲೀ	ಕಿ.ಲೀ	ರೂ/ಕಿ.ಲೀ	
ಗೃಹ ಸಂಪರ್ಕ	0	8	7.00	ರೂ.56/-
	8	15	9.00	
	15	25	11.00	
	25 ಕ್ಕಿಂತ	ಅಧಿಕ	13.00	
ಗೃಹೇತರ ಸಂಪರ್ಕ	0	8	14.00	ರೂ.112/-
	8	15	18.00	
	15	25	22.00	
	25 ಕ್ಕಿಂತ	ಅಧಿಕ	26.00	
ವಾಣಿಜ್ಯ/ಕೈಗಾರಿಕೆ	0	8	28.00	ರೂ.224/-
	8	15	36.00	
	15	25	44.00	
	25 ಕ್ಕಿಂತ	ಅಧಿಕ	52.00	

ಬಿ) <u>ಮೀಟರ್ ಹೊಂದದೆ ಇರುವಂತಹ ಸಂಪರ್ಕಕ್ಕೆ ಮಾಸಿಕ ಕನಿಷ್ಠ ದರ:</u>

ಕ್ರಮ ಸಂಖ್ಯೆ	ಗ್ರಾಹಕ ವರ್ಗ	ಪ್ರತಿ ಸಂಪರ್ಕಕ್ಕೆ ಮಾಸಿಕ ಕನಿಷ್ಠ ದರ (ರೂ.ಗಳಲ್ಲಿ)		
		ಮಹಾನಗರ ಪಾಲಿಕೆಗಳು	ನಗರ ಸಭೆಗಳು	ಪುರ ಸಭೆಗಳು/ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಗಳು
1.	ಗೃಹ ಬಳಕೆ	175	120	80
2.	ಗೃಹೇತರ ಬಳಕೆ	350	240	160
3.	ವಾಣಿಜ್ಯ/ಕೈಗಾರಿಕೆ	700	480	320

<u>ಟಿಪ್ಪಣಿ:-</u> ಯಾವುದೇ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯು ನೀರು ಸರಬರಾಜನ್ನು ತಲಾ ದಿನಂ ಪ್ರತಿ 135 ಲೀಟರ್ ನಂತೆ ಸರಬರಾಜು ಮಾಡಲು ಸಾಮರ್ಥ್ಯ ಹೊಂದಿದ್ದಲ್ಲಿ ಮಹಾನಗರಪಾಲಿಕೆಗೆ ನಿಗದಿಪಡಿಸಿರುವ ದರಗಳನ್ನು ಜಾರಿಗೊಳಿಸಬಹುದಾಗಿರುತ್ತದೆ ಮತ್ತು ಗ್ರಾಹಕರು ಮೀಟರ್ ಸಂಪರ್ಕವನ್ನು ಪಡೆಯಲು ನಿರಾಕರಿಸಿದ್ದಲ್ಲಿ ನಿಗದಿಪಡಿಸಲಾದ ಕನಿಷ್ಟ ದರಗಳನ್ನು ನೋಟೀಸ್ ನೀಡಿದ 6 ತಿಂಗಳ ನಂತರ ಶೇ.25ರಷ್ಟು ಮತ್ತು ಒಂದು ವರ್ಷದ ನಂತರ ಶೇ.50ರಷ್ಟು ಹೆಚ್ಚಾಗಿ ವಿಧಿಸುವುದು.

ಸಿ) <u>ಒಂದು ಬಾರಿ ನೀರು ಸಂಪರ್ಕಗಳಿಗೆ ವಿಧಿಸುವ ದರ.</u>

ಕ್ರಮ ಸಂಖ್ಯೆ	ಪ್ರವರ್ಗ	ಗೃಹ ಬಳಕೆ (ರೂ.ಗಳಲ್ಲಿ)	ಗೃಹೇತರ ಬಳಕೆ (ರೂ.ಗಳಲ್ಲಿ)	ವಾಣಿಜ್ಯ/ಕೈಗಾರಿಕೆ (ರೂ.ಗಳಲ್ಲಿ)
1.	ಮಹಾನಗರ ಪಾಲಿಕೆಗಳು	2,500/-	5,000/-	10,000/-
2.	ನಗರ ಸಭೆಗಳು	2,000/-	4,000/-	8,000/-
3.	ಪುರ ಸಭೆಗಳು/ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಗಳು	1,500/-	3,000/-	6,000/-

ಡಿ) <u>ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಬಳಕೆದಾರರ ದರ:</u>

ಕ್ರಮ ಸಂಖ್ಯೆ	ಗ್ರಾಹಕ ವರ್ಗ	ಪ್ರತಿ ಸಂಪರ್ಕಕ್ಕೆ ಮಾಸಿಕ ಕನಿಷ್ಠ ದರ (ರೂ.ಗಳಲ್ಲಿ)		
		ಮಹಾನಗರ ಪಾಲಿಕೆಗಳು	ನಗರ ಸಭೆಗಳು	ಪುರ ಸಭೆಗಳು/ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಗಳು
1.	ಗೃಹ ಬಳಕೆ	15	15	15
2.	ಗೃಹೇತರ ಬಳಕೆ	30	30	30
3.	ವಾಣಿಜ್ಯ/ಕೈಗಾರಿಕೆ	60	60	60

<u>ಟಿಪ್ಪಣಿ:-</u> ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆ ಹೊಂದಿರುವಂತಹ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಮೇಲಿನ ದರಗಳನ್ನು ನೀರು ಸಂಪರ್ಕ ದರಗಳೊಂದಿಗೆ ಸೇರಿಸಿ ವಿಧಿಸತಕ್ಕದ್ದು.

ಇ) <u>ನೀರು ಸರಬರಾಜು ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿ:</u>

ಕ್ರಮ ಸಂಖ್ಯೆ	ಪ್ರವರ್ಗ	ಸರ್ಕಾರದ ಅನುದಾನ	ಆರ್ಥಿಕ ಸಂಸ್ಥೆಗಳಿಂದ ಸಾಲ	ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳ ಪಾಲು
1.	ಮಹಾನಗರ ಪಾಲಿಕೆಗಳು	40%	50%	10%
2.	ನಗರ ಸಭೆಗಳು	60%	30%	~~15%~~ 10 %
3.	ಪುರ ಸಭೆಗಳು	75%	20%	5%
4.	ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಗಳು	95%	-	5%

ಎಫ್) <u>ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿ:</u>

ಹಾಲಿ ಜಾರಿಯಲ್ಲಿರುವ ಒಳಚರಂಡಿ ಯೋಜನೆಗಳಿಗೆ ಆರ್ಥಿಕ ಮಾದರಿಯು ಸರ್ಕಾರದ ಸಾಲದಿಂದ, ಹಣಕಾಸು ಸಂಸ್ಥೆಗಳಿಂದ ಸಾಲ, ಮತ್ತು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳ ವಂತಿಕೆಯಿಂದ ಯೋಜನೆಯ ಅಂದಾಜನ್ನು ಭರಿಸಲಾಗುತಿತ್ತು. ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ವಾಸಿಸುತ್ತಿರುವ ನಾಗರೀಕರ ಹಿತದೃಷ್ಟಿಯಿಂದ, ಪರಿಸರ ಸಂರಕ್ಷಣೆಯ ಹಿತದಲ್ಲಿ ಮತ್ತು ಮಲೀನ ನೀರು ನದಿಗಳನ್ನು / ಅಂತರ್ ಜಲ ನೀರನ್ನು ಕುಲುಷಿತಗೊಳಸದಿರುವ ದೃಷ್ಟಿಯಿಂದ ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆಯನ್ನು ಎಲ್ಲಾ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ಕಲ್ಪಿಸಲು ಯೋಜನೆಯ ಆರ್ಥಿಕ ಮಾದರಿಯಲ್ಲಿ ಸರ್ಕಾರದ ಸಾಲಕ್ಕೆ ಬದಲಾಗಿ ಸರ್ಕಾರದಿಂದ ಅನುದಾನ ನೀಡುವ ನಿಟ್ಟಿನಲ್ಲಿ ಪರಿಗಣಿಸಬೇಕಾಗಿರುವುದು ಅವಶ್ಯಕವಾಗಿರುತ್ತದೆ. ಆದ್ದರಿಂದ ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆಗಳ ಆರ್ಥಿಕ ಮಾದರಿಯನ್ನು ಈ ಕೆಳಕಂಡಂತೆ ಪರಿಷ್ಕರಿಸಲಾಗಿದೆ.

ಕ್ರಮ ಸಂಖ್ಯೆ	ಪ್ರವರ್ಗ	ಸರ್ಕಾರದ ಅನುದಾನ	ಆರ್ಥಿಕ ಸಂಸ್ಥೆಗಳಿಂದ ಸಾಲ	ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳ ಪಾಲು
1.	ಮಹಾನಗರ ಪಾಲಿಕೆಗಳು	50%	35%	~~10%~~ 15 %
2.	ನಗರ ಸಭೆಗಳು	70%	20%	10%
3.	ಪುರ ಸಭೆಗಳು	75%	20%	5%
4.	ಪಟ್ಟಣ ಪಂಚಾಯಿತಿಗಳು	95%	-	5%

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ಮೇಲೆ ನಿಗದಿಪಡಿಸಿರುವ ದರಗಳನ್ನು ಜಾರಿಗೆ ತರಲು ಈ ಆದೇಶಕ್ಕೆ ಲಗತ್ತಿಸಿರುವ ಅನುಬಂಧದಲ್ಲಿ ಮಾರ್ಗಸೂಚಿಗಳನ್ನು ನೀಡಿದ್ದು, ಅದರಂತೆ ಎಲ್ಲಾ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನೀರಿನ ದರಗಳನ್ನು ಪ್ರತಿ 3 ವರ್ಷಕ್ಕೊಮ್ಮೆ ಪರಿಷ್ಕರಿಸಿ ಅನ್ವಯಿಸಿಕೊಳ್ಳತಕ್ಕದ್ದು.

ಕರ್ನಾಟಕ ನಗರ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ/ಕೆ.ಯು.ಐ.ಡಿ.ಎಫ್.ಸಿ ಚಾಲನೆಗೊಳಿಸಿದ ನೀರು ಸರಬರಾಜು ಅಥವಾ ಒಳಚರಂಡಿ ಯೋಜನೆಗಳ ಹಸ್ತಾಂತರಿಸುವ ಅಥವಾ ಹಿಂದಕ್ಕೆ ಪಡೆಯುವ ಕುರಿತು ಮತ್ತು ಸಗಟು ನೀರು ಸರಬರಾಜು/ಗ್ರಾಹಕರ ಹಂತದವರೆಗೆ ನೀರು ಸರಬರಾಜು ವ್ಯವಸ್ಥೆಯನ್ನು ನಿರ್ವಹಿಸಲು ಮಂಡಳಿಗೆ ಹಸ್ತಾಂತರಿಸುವ ಹಾಗೂ ಇದಕ್ಕೆ ಸಂಬಂದಿಸಿದಂತೆ ಉದ್ಭವಿಸಬಹುದಾಂತಹ ತಂಟೆ ತಕರಾರುಗಳನ್ನು ಇತ್ಯರ್ಥಗೊಳಿಸಲು "ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿಗಳು, ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ ಇವರ ಅಧ್ಯಕ್ಷತೆಯಲ್ಲಿ ಈ ಕೆಳಕಂಡ ಸದಸ್ಯರನ್ನೊಳಗೊಂಡಂತೆ ಒಂದು ಸಮಿತಿಯನ್ನು ರಚಿಸಲಾಗಿದೆ.

ಕ್ರ.ಸಂ	ಹುದ್ದೆ	ವಿವರ
1.	ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿ,(ಎಂ.&ಯು.ಡಿ.ಎ.) ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ.	ಅಧ್ಯಕ್ಷರು
2.	ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು. ಕನನೀಸ ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ.	ಸಂಚಾಲಕರು ಮತ್ತು ಸದಸ್ಯರು
3.	ನಿರ್ದೇಶಕರು. ಪೌರಾಡಳಿತ ನಿರ್ದೇಶನಾಲಯ	ಸದಸ್ಯರು
4.	ಆಯುಕ್ತರು / ಮುಖ್ಯಾಧಿಕಾರಿಗಳು ಸಂಬಂಧಪಟ್ಟ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆ	ಸದಸ್ಯರು

ಸೂಚನೆ:-ಎಲ್ಲಾ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನೀರು ಸರಬರಾಜು/ಒಳಚರಂಡಿ ನಿರ್ವಹಣೆ ಕುರಿತಂತೆ ಉದ್ಭವಿಸಬಹುದಾಂತಹ ತಕರಾರುಗಳನ್ನು ಮೇಲಿನ ಸಮಿತಿಯ ಮುಂದೆ ಮಂಡಿಸುವ ಮುನ್ನ ಪೌರಾಡಳಿತ ನಿರ್ದೇಶಾನಾಲಯದ ಮೂಲಕ ತಮ್ಮ ಮನವಿಯನ್ನು ಸಲ್ಲಿಸತಕ್ಕದ್ದು.

ಈ ಆದೇಶವನ್ನು ಆರ್ಥಿಕ ಇಲಾಖೆಯು ಟಿಪ್ಪಣಿ ಸಂಖ್ಯೆ: FD 529 Exp-9:2009, ದಿನಾಂಕ:24.09.2009 ರಲ್ಲಿ ನೀಡಿರುವ ಸಹಮತಿಯನ್ವಯ ಹೊರಡಿಸಲಾಗಿದೆ.

ಕರ್ನಾಟಕ ರಾಜ್ಯಪಾಲರ ಆದೇಶಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ

(ಎಂ.ಎಂ.ಹಿರೇಮಠ) 20/12/11
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ,
ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ.

ಇವರಿಗೆ:

ಸಂಕಲನಕಾರರು. ಕರ್ನಾಟಕ ರಾಜ್ಯ ಪತ್ರ, ಬೆಂಗಳೂರು ಇವರಿಗೆ ಮುಂದಿನ ರಾಜ್ಯ ಪತ್ರದಲ್ಲಿ ಪ್ರಕಟಿಸಲು.

ಪ್ರತಿಯನ್ನು:

1. ಮಹಾಲೇಖಪಾಲರು. ಕರ್ನಾಟಕ ಬೆಂಗಳೂರು.
2. ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳು. ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ. ಬೆಂಗಳೂರು.
3. ಅಧ್ಯಕ್ಷರು/ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು. ಕರ್ನಾಟಕ ನಗರ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ. ಜಲಭವನ. ಬೆಂಗಳೂರು.

--7/-

4. ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕೆ.ಯು.ಐ.ಡಿ.ಎಫ್.ಸಿ. ಬೆಂಗಳೂರು.
5. ಆಯುಕ್ತರು ಮತ್ತು ನಿರ್ದೇಶಕರು, ಪೌರಾಡಳಿತ ನಿರ್ದೇಶನಾಲಯ ಬೆಂಗಳೂರು.
6. ಮಾನ್ಯ ಮುಖ್ಯ ಮಂತ್ರಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.
7. ಮಾನ್ಯ ನಗರಾಭಿವೃದ್ಧಿ ಮತ್ತು ಪೌರಾಡಳಿತ ಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ, ಬೆಂಗಳೂರು.
8. ಸರ್ಕಾರದ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ (ಸಚಿವ ಸಂಪುಟ ಪ್ರಕರಣ ಸಂಖ್ಯೆ:ಸಿ343/2011) ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.
9. ಎಲ್ಲಾ ಜಿಲ್ಲಾಧಿಕಾರಿಗಳು.
10. ಎಲ್ಲಾ ಆಯುಕ್ತರು, ಮಹಾನಗರಪಾಲಿಕೆಗಳು/ನಗರಸಭೆಗಳು.
11. ಎಲ್ಲಾ ಮುಖ್ಯಾಧಿಕಾರಿಗಳು/ಪುರಸಭೆ/ಪಟ್ಟಣಪಂಚಾಯಿತಿ.
12. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು ,ಆರ್ಥಿಕ ಇಲಾಖೆ ವೆಚ್ಚ-9, ವಿಧಾನಸೌಧ.
13. ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ, ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು.
14. ಸರ್ಕಾರದ ಉಪ ಕಾರ್ಯದರ್ಶಿಗಳ ಆಪ್ತ ಸಹಾಯಕರು, ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಬೆಂಗಳೂರು.
15. ಶಾಖಾ ರಕ್ಷ ಕಡತ/ಹೆಚ್ಚುವರಿ ಪ್ರತಿಗಳು.

ಅನುಬಂಧ

(ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖ್ಯೆ:ನಅಇ 07 ಯುಡಬ್ಲ್ಯೂಎಸ್ 2011, ದಿನಾಂಕ:18.07.2011)

1. ಪ್ರಸ್ತುತ ಸರ್ಕಾರಿ ಆದೇಶದಲ್ಲಿ ನಿಗದಿಪಡಿಸಿರುವ ದರಗಳು ರಾಜ್ಯ ಸರ್ಕಾರದ ಸಂಖ್ಯಾಧಾರಿತವಾಗಿದ್ದು, ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನೀರಿನ ಬಳಕೆಗೆ ತಕ್ಕಂತೆ ನಿರ್ವಹಣೆ ಮತ್ತು ದುರಸ್ಥಿ ವೆಚ್ಚಗಳನ್ನು ಆಧರಿಸಿ ಸದರಿ ದರಗಳು ಸೂಚಿತ ದರಗಳಿಗಿಂತ ಹೆಚ್ಚಾದಲ್ಲಿ ಅದರಂತೆ ನೀರಿನ ದರಗಳನ್ನು ನಿಗದಿಪಡಿಸಲು ಪ್ರೋತ್ಸಾಹಿಸಬೇಕಾಗಿರುತ್ತದೆ.

2. ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನೀರಿನ ದರಗಳನ್ನು ಪ್ರತಿ ಮೂರು ವರ್ಷಗಳಿಗೊಮ್ಮೆ ಪರಿಷ್ಕರಿಸಬೇಕಾಗಿರುತ್ತದೆ. ಆದರೆ, ನೀರಿನ ದರಗಳನ್ನು ಪರಿಷ್ಕರಿಸುವಾಗ ವಿದ್ಯುಚ್ಛಕ್ತಿ ದರ (ಹೆಚ್ಚು/ಕಡಿಮೆ) ಆಧಾರದ ಮೇಲೆ ಈ ಕೆಳಕಂಡ ಸೂತ್ರದಂತೆ ನಿಗದಿಪಡಿಸಬೇಕಾಗಿರುತ್ತದೆ.

   - ನೀರಿನ ದರಗಳ ಪರಿಷ್ಕರಣೆಗೆ ಪ್ರಸ್ತುತ ನಿಗದಿಪಡಿಸಿರುವ ದರಗಳಿಗೆ ಅಂಶ (i) ಇಂದ ಗುಣಿಸಿ ವಿದ್ಯುತ್‌ಛಕ್ತಿ ದರಗಳಿಂದ ಬದಲಾಗುವ ಮೊತ್ತವನ್ನು ಸೇರಿಸಿ, ನಿಗದಿಪಡಿಸಬೇಕು.
   - $i = \left(1 + pr/_{100}\right)$
     r =ಅಂಶವು ವಿದ್ಯುತ್ ದರದಲ್ಲಿ ಶೇಕಡವಾರು ಬದಲಾವಣೆ ಆಗಿರುತ್ತದೆ.
     P= ಅಂಶವು ನೀರಿನ ದರಗಳಲ್ಲಿ ವಿದ್ಯುತ್ ದರಗಳನ್ನು (ಅನ್ನಾಂಕದಲ್ಲಿ ತೋರಿಸಿದಂತೆ) ಒಂದು ವೇಳೆ ಮೇಲಿನ ಆಧಾರ ಅಂಶಗಳು ಲಭ್ಯ ವಿಲ್ಲದಿದ್ದ ಪಕ್ಷದಲ್ಲಿ ಅದನ್ನು 0.65 ಎಂದು ಪರಿಗಣಿಸತಕ್ಕದ್ದು.

3. ಸ್ವಂತ ಮನೆ / ಬಾಡಿಗೆ ಮನೆ ಅಥವಾ ಖಾತಾವನ್ನು ಭಾಗಶ: ಅಥವಾ ಪೂರ್ಣವಾಗಿ ಹೊಂದಿರುವಂತ: ಎಲ್ಲಾ ಗೃಹಗಳಿಗೆ ನೀರು ಸಂಪರ್ಕವನ್ನು ಕಲ್ಪಿಸಲು ಕ್ರಮ ಕೈಗೊಳ್ಳತಕ್ಕದ್ದು.

4. ನೀರು ಸರಬರಾಜು ಯೋಜನೆಗಳನ್ನು ಕನನೀಸ ಒಳಚರಂಡಿ ಮಂಡಳಿ ಅಥವಾ ಹೊರ ಅನುದಾನದ ಯೋಜನೆಗಳ (ಇಪಿಎ) ಕೆಯುಐಡಿಎಫ್‌ಸಿ ರವರಿಂದ ಚಾಲನೆಗೊಳಿಸಿದ ಯೋಜನೆಗಳನ್ನು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯು ನೀರು ಸರಬರಾಜು ನಿರ್ವಹಣೆ ಮತ್ತು ದುರಸ್ಥಿಯನ್ನು ಕೈಗೆತ್ತಿಕೊಳ್ಳಬೇಕು.

5. ಸಗಟು ನೀರು ಸರಬರಾಜು ವಿತರಣೆ ಮಾಡುವ ಸ್ಥಳಗಳಲ್ಲಿ ಮೀಟರ್‌ಗಳನ್ನು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯವರು ಕನನೀಸ ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ ರವರ ತಾಂತ್ರಿಕ ಸಹಾಯದೊಂದಿಗೆ ನೀರಿನ ಮಾಪನವನ್ನು ಅಳತೆ ಮಾಡಲು ಅಳವಡಿಸತಕ್ಕದ್ದು. ಹೊಸ ನೀರು ಸರಬರಾಜು ಯೋಜನೆಗಳನ್ನು ಕೈಗೆತ್ತಿಕೊಳ್ಳುವ ಮುನ್ನ ಸಗಟು ನೀರು ಸರಬರಾಜು ಅಳತೆ ಮಾಡಲು ಮೀಟರ್‌ಗಳ ವೆಚ್ಚವನ್ನು ಅಂದಾಜು ಪಟ್ಟಿಯಲ್ಲಿ ಸೇರಿಸತಕ್ಕದ್ದು.

6. ಕರ್ನಾಟಕ ನಗರ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿಗೆ ಸಗಟು /ವಿತರಣಾ ವ್ಯವಸ್ಥೆಯನ್ನು ವಹಿಸಿದ್ದಲ್ಲಿ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯು ಮಂಡಳಿಯೊಂದಿಗೆ ಒಪ್ಪಂದವನ್ನು ಎಲ್ಲಾ ಅಂಶಗಳ ಬಗ್ಗೆ ಪರಿಶೀಲಿಸಿ ಅಂತ್ಯಗೊಳಿಸುವುದು.

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7. ಸರ್ಕಾರದ ಕಾರ್ಯದರ್ಶಿಗಳು (ಎಂ.& ಯು.ಡಿ.ಎ.) ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ ಇವರ ಅಧ್ಯಕ್ಷತೆಯಲ್ಲಿ (1) ಕನನೀಸ ಮತ್ತು ಒಚ ಮಂಡಳಿಯ ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, (2) ಕೆ.ಯು.ಐ.ಡಿ.ಎಫ್.ಸಿ., ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, (3) ಆಯುಕ್ತರು, ಪೌರಾಡಳಿತ ನಿರ್ದೇಶನಾಲಯ ಮತ್ತು (4) ಆಯುಕ್ತರು/ ಮುಖ್ಯಾಧಿಕಾರಿಗಳು ಸಂಬಂಧಪಟ್ಟ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆ ಇವರುಗಳ ಸದಸ್ಯತ್ವದೊಂದಿಗೆ ನೀರು ನಿರ್ವಹಣಾ /ವಿತರಣೆಗಳನ್ನು ಹಸ್ತಾಂತರಿಸುವುದು ಯೋಜನೆಗಳ ಹಸ್ತಾಂತರ ಮತ್ತು ಇವುಗಳ ಬಗ್ಗೆ ಯಾವುದೇ ತಕರಾರು ತೊಂದರೆಗಳನ್ನು ಮತ್ತು ಇತರೆ ವಿವಾದಗಳನ್ನು ಬಗೆಹರಿಸಲು ಒಂದು ಸಮಿತಿಯನ್ನು ರಚಿಸಲಾಗಿದ್ದು, ಈ ಬಗ್ಗೆ ಪ್ರಸ್ತಾವನೆಗಳನ್ನು ನಿರ್ದೇಶಕರು, ಪೌರಾಡಳಿತ ನಿರ್ದೇಶಾನಾಲಯ ಬೆಂಗಳೂರು ಇವರ ಮುಖಾಂತರ ಸರ್ಕಾರಕ್ಕೆ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಸಲ್ಲಿಸುವುದು.

8. ಒಂದು ವೇಳೆ ಬಡತನದ ರೇಖೆಗಿಂತ ಕಡಿಮೆ ಇರುವಂತ: ಕುಟುಂಬಗಳಿಗೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀರು ಸಂಪರ್ಕ ದರವನ್ನು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯೇ ಭರಿಸತಕ್ಕದ್ದು.

9. ಎಲ್ಲಾ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನೀರು ನಿರ್ವಹಣೆ ಮತ್ತು ದುರಸ್ಥಿ ವೆಚ್ಚವನ್ನು ಗುರುತಿಸಿ, ಯೋಜನೆಯ ಪೂರ್ಣ ಮೊತ್ತವನ್ನು ಹಿಂಪಡೆಯಲು ಒಂದು ಕ್ರಿಯಾ ಯೋಜನೆಯನ್ನು ತಯಾರಿಸುವುದು ಮತ್ತು ನೀರಿನ ದರಗಳನ್ನು ಕೆ.ಯು.ಐ.ಡಿ.ಎಫ್.ಸಿ., ರವರು ಲೆಕ್ಕ ಮಾಡಿದಂತೆ ರೂಪಿಸಿಕೊಳ್ಳುವುದು.

10. ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ಎಲ್ಲಾ ನೀರು ಸಂಪರ್ಕಗಳಿಗೆ ಶೇ.100ರಷ್ಟು ಮೀಟರ್‌ಗಳನ್ನು ಮುಂದಿನ 2 ವರ್ಷಗಳಲ್ಲಿ ಅಳವಡಿಸತಕ್ಕದ್ದು.

11. ಒಂದು ವೇಳೆ ಗ್ರಾಹಕರು ಮೀಟರ್ ಅಳವಡಿಕೆ ಇಂದ ತಪ್ಪಿಸಿಕೊಳ್ಳಲು ಪ್ರಯತ್ನಿಸಿದಲ್ಲಿ, ಸದರಿ ಗ್ರಾಹಕರಿಗೆ ಕನಿಷ್ಠ ದರಗಳ ಮೇಲೆ ಶೇ.25ರಷ್ಟು ಮೊತ್ತವನ್ನು ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಯಿಂದ ನೋಟಿಸ್ ನೀಡಿ 6 ತಿಂಗಳ ನಂತರ ವಿಧಿಸುವುದು ಮತ್ತು ಶೇ.50ರಷ್ಟು ಮೊತ್ತವನ್ನು ಒಂದು ವರ್ಷದ ನಂತರ ಹೆಚ್ಚುವರಿಯಾಗಿ ವಿಧಿಸುವುದು.

12. ಒಳಚರಂಡಿ ವ್ಯವಸ್ಥೆ ಕಲ್ಪಿಸಿರುವಂತ: ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳು ನಿಗದಿಪಡಿಸಲಾದ ಒಳಚರಂಡಿ ಶುಲ್ಕವನ್ನು ವಸೂಲಿ ಮಾಡತಕ್ಕದ್ದು.

13. ಹೊಸ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವ ಮುನ್ನ ಅಕ್ಕ ಪಕ್ಕದ ಸ್ಥಳೀಯ ಸಂಸ್ಥೆಗಳಿಗೆ ನೀರು ಸರಬರಾಜು ಮಾಡುವ ಯೋಜನೆಯನ್ನು ಪರಿಶೀಲಿಸಿ ಕಡಿಮೆ ಮೊತ್ತದಲ್ಲಿ ಯೋಜನೆಗಳನ್ನು ವಿನ್ಯಾಸಿಸಿ ಆರ್ಥಿಕವಾಗಿ ಉಳಿತಾಯ ಮಾಡಲು ಪ್ರಯತ್ನಿಸುವುದು.

(ಎಂ.ಎಂ.ಹಿರೇಮಠ) 20/7/11
ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿ,
ನಗರಾಭಿವೃದ್ಧಿ ಇಲಾಖೆ.

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UPPER BHADRA PROJECT

COMPARISON OF DPR's

GENERAL ABSTRACT FOR WORKS COMING UNDER UPPER BHADRA PROJECT-PROVIDING IRRIGATION FACILITY TO CHIKMAGALUR AND CHITRADURGA DISTRICTS AND FILLING OF M I TANKS ENROUTE.

Sl. No	Sub-Head of Classification	As per Previous DPR 2014	As per Revised DPR 2019	Excess	Savings
	I - Works				
1	A - Preliminaries	7159.50	6701.26		458.24
2	B - Land	22586.84	75867.00	53280.16	
3	C - Works	110634.00	348206.32	237572.32	
4	D - Regulator and Measuring device				
5	E - Falls				
6	F - Cross Drainage Works	43469.55	220503.44	177033.89	
7	G - Bridges				
8	H - Escapes				
9	I - Navigation works	-	-		
10	J - Power plants and Civil Works	-	-		
11	K - Buildings	2712.00	6748.74	4036.74	
12	L - Earthwork				
13	L1 - Canal, Service Road and Boundary	156563.00	181863.00	25300.00	
14	L2 - Lining				
15	L3 - Tunnel	16900.00	48189.75	31289.75	
16	M - Plantation	238.35	1159.12	920.77	
17	N - Tank and Reservoirs	-	11366.45	11366.45	
18	O - Miscellaneous	4960.00	325.77		4634.23
19	P - Maintenance (1% of cost of I - works except A,B,M,O,Q and X)	10489.15	11280.69	791.54	
20	Q - Special Tools and plants	185.00	243.07	58.07	
21	R - Communication	4132.65	3367.08		765.57
22	S - Power plant and Electrical systems	-	46075.56	46075.56	
23	T - Watersupply works	-	-		
24	U - Distributories and Minors	563787.50	489789.76		73997.74
25	V - Drip irrigation	-	534818.75	534818.75	
26	W - Drainage and Protective works	676.55	-		676.55
27	X - Environment and Ecology	6036.00	18105.56	12069.56	
28	Y - Loss of stocks and unforseen (0.25% of cost of I - works except A,B,M,O,Q and X)	2622.29	-		2622.59
29	Z - Provision for power generation	150040.00	-		150040.00
30	**Total of I - Works**	**1103192.38**	**2004611.32**		
31	**II - Establishment:**				
32	Establishment charges @ 10% of I-Works (except B-Lands)	**108060.55**	**115811.9**		
33	**III - Tools and Plants :**				
34	Small T & P 1% of I -Works	**11031.92**	**12132.59**		
35	**IV - Suspense :**		-		
36	**V - Receipt & Recoveries on capital account**				
37	a)Recoveries on account of K-Building 15% salvage value of building cost.	406.80	-		
38	b)Recoveries towards resale transfer of special T & P 75% of provision in I-Works on Q-Special T & P excluding cost of inspection of vehicle		-		
39	c)Recoveries towards resale/transfer of inspection vehicle (20% of inspection vehicle)	37.00	48.61		
40	**Total Direct Charges**	**1221841.05**	**2132507.20**		
41	**Indirect Charges**				
42	a)Audit and Accounts charges (1% of I - Works)	11031.92	12132.59		
43	b)Capitalised value of abatement of land Revenue (5% of the cost of B-lands)	1129.34	2726.89		
	Grand Total	**1234002.35 Lakhs**	**2147366.68 Lakhs**		
	Say	**12340.00 Crores**	**21473.67**		
	Total CCA	**225515 Ha**	**225515.00**		
	Cost per Ha	**5.47 Lakhs/Ha**	**9.52 Lakhs/Ha**		

Note: Reason's for the excess and saving list is furnished in separate sheet is enclosed.

Superintending Engineer,
KNNL, U.B.P Circle No.1,
B.R. Project

Superintending Engineer,
KNNL, U.B.P Circle No.2,
Chitradurga

Chief Engineer,
KNNL, U.B.Project Zone,
Chitradurga