



राष्ट्रीय जल विकास अभिकरण

(जल संसाधन, नदी विकास और गंगा
संरक्षण मंत्रालय, भारत सरकार)

National Water Development Agency

**(Ministry of Water Resources, River Development
and Ganga Rejuvenation, Government of India)**

**Minutes of the
Thirteenth Meeting of the “Sub-Committee on System Studies
for identification of most appropriate alternative plan”
(Sub-Committee - II)
(Held on 4th February, 2019 at New Dehi)**

Minutes of the 13th Meeting of the Sub-Committee on “System Studies for Identification of Most Appropriate Alternative Plan” held on 04.02.2019 at 11.00 A.M in the Committee Room, NWDA, Palika Bhawan, New Delhi

The 13th Meeting of the "Sub-Committee on System Studies for Identification of Most Appropriate Alternative Plan" was held on 04.02.2019 (Monday) at 11:00 A.M in the Committee Room, NWDA, Palika Bhawan, New Delhi under the Chairmanship of Prof. P.B.S. Sarma, (Retd.) Chairman of Sub-Committee. The list of Members and other participants who attended the meeting is at Annex-I.

At the outset Chairman welcomed the Members, Invitees and other participants of the Sub-Committee with New Year wishes and appreciated all Members for their co-operation, fruitful deliberations and unanimous decisions of the Committee. Thereafter Chairman requested Shri K. P. Gupta, Director (Tech), NWDA and Member Secretary to take up the agenda items for discussion.

Item 13.1: Confirmation of the Minutes of 12th Meeting of the Sub-Committee on System Studies for identification of most appropriate alternative Plan held on 27.07.2018.

The Member Secretary informed that the Minutes of the 12th meeting of Sub-Committee were circulated to all the Members vide letter dated 07.08.2018. As no comments have been received from any of the Members, the Minutes of 12th meeting of the Sub-Committee were confirmed as circulated.

Item 13.2: Follow up actions on important decisions taken during the 12th meeting of the Sub-Committee

Decision/ Follow up action:

(i) Terms of Reference (ToR) for additional studies of Mahanadi-Godavari link

The Member-Secretary informed that the Draft ToRs of the suggested studies of Mahanadi-Godavari link were circulated among the members of the Committee vide letter dated 19.11.2018 for obtaining their views. Prof. Kamta Prasad, Member of the Committee communicated his suggestion which were placed before the Committee. The same have been approved with minor modifications (Annexure-II) .The Chairman requested other members and invitees to add their suggestions to optimize the ToR perfectly.

The Chairman suggested the issues of Climate change and its impact on hydrology, change in irrigation application methods, shifting of cropping pattern, crop water requirement etc needs to be well defined and incorporated in the ToR. He further suggested that some experts are already working in this line in the country. Such talents/expertise could be associated with these studies to get optimum and generic approach for the simulation studies based on several possible future scenarios of a link. Being National project, all efforts needs to be put in to develop a well formulated study. Chairman further suggested that NWDA can involve Premier Institutions of

India such as IIT Gandhinagar, IIT Mumbai, IIT Bangalore, NIH Roorkee, ICARs, NRM in the studies.

The Director General, NWDA opined that expert agency engaged should generate different scenarios of Climate change and their consequences for planning in command area, change in ground water scenario, etc., as per the ToR.

After detailed discussions the Sub-Committee decided the following:

- (i) NIH shall prepare the consultancy proposal based on the modified ToRs considering Multi-talented experts pooled together as part of the study team. The requisite data required by NIH will be provided by NWDA available with them for which NIH will provide a list of data requirement to NWDA.
- (ii) NIH should clearly and specifically indicate the names of the experts from the above suggested Institutions, to be involved in the study (as Consultants to NIH) along with their expected roles.
- (iii) The Consultancy proposal will be examined first by NWDA and then circulated to the Members of the Sub-Committee for consideration and finalisation of the proposal

(ii) Possibility of alternative choice for transferring water from proposed Inchampalli dam (with reduced dam height)

Dr. R N Sankhua, Chief Engineer (South), NWDA made Power Point Presentation (Annexure-III) on alternative possibility of transferring water from proposed Inchampalli dam (with FRL of 95 m to minimize submergence). It was indicated that the Inchampalli low dam at 95.0 m FRL would submerge one of the barrages of Kaleswaram project, which is already in an advanced stage.

Shri Sriram Vedire, Member after critically analyzing the note on alternative possibility of transferring water from Inchampalli dam pointed out that if the alternative proposal of NWDA for transferring of unutilized water share of Chhattisgarh State in Indravati Sub-Basin of Godavari Basin (as per GWDTA) to Cauvery Basin is providing water at Grand Anicut on Cauvery river, why the proposal of Inchampalli low dam cannot provide the water to Tamilnadu when the same water is available at Inchampalli dam also. He also indicated that the proposed dam at Inchampalli with 95 m FRL may affect the functioning of Kaleswaram project as such he suggested to consider reducing the height of Inchampalli dam further. He also suggested that NWDA should collect the TAC notes of Kaleswaram and Polavaram projects from CWC and DPRs of Tupakulagudem barrage and Sitarama LIS project from State Govt. of Telangana and examine the hydrology of these projects along with hydrology of NWDA proposal to arrive at the quantity of water available for diversion to Krishna and beyond.

Prof. Kamta Prasad, Member desired to know the contribution of ground water in the command area apart from surface water. Director General NWDA clarified that the incremental benefits of

ground water are taken in to account while preparing FR/DPR. Shri Sriram Vedire, Member emphasized the need to consider ground water recharge aspect of the project.

Item 13.3 :Manas-Sankosh-Teesta-Ganga Link (MSTG)

Manas-Sankosh-Teesta-Ganga link is very crucial link which will make available surplus water of Brahmaputra basin for use in Ganga, Damodar, Subarnarekha and Mahanadi basins for utilization in its enroute and further in the Southern India. As decided by the Sub-Committee in its 12th meeting, Shri. N. C Jain, Chief Engineer (North), NWDA made a presentation on Manas-Sankosh-Teesta-Ganga Link (Annexure-IV). It was concluded that due to shortfall of water to meet the monthly demand against availability, this link may not be in a position to transfer required water to the succeeding link unless 2 Head-works (Sankosh dam and Manas dam) are made at upstream which involve international issues.

Item 13.4 : Inclusion of Prof. S. Mohan as the member of the Sub-Committee

Committee noted the content of the agenda

Item No. 13.5 : Resignation of Shri M. Illangovan, Member and inclusion of Shri M. K. Sinha, Assessor, Krishna Water Dispute Tribunal & (Retd.) Chief Engineer, CWC New Delhi as a member of the Sub-Committee.

Committee noted the content of the agenda

Item No.13.6 : Any other item with permission of the chair

The Member-Secretary informed that the Special Committee on ILR in its 15th meeting held on 20th August, 2018 has agreed to extend the tenure of the two Sub-Committees (Sub-Committee-I & Sub-Committee-II) up to 12th February, 2019. Accordingly, MoWR, RD & GR issued the approval of the competent authority to extend the tenure of the Sub-Committees upto 12th February, 2019. Considering wide scope of work with Sub-Committees which have to provide technical inputs to Task Force for Interlinking of River (TFILR) and Special Committee, it was general consensus amongst members of the Sub Committee-II that tenure of the Sub-Committee should be co-terminus with tenure of the Special Committee. The Member Secretary was requested to put up the proposal for approval of SCILR in its forthcoming meeting.

The meeting ended with a vote of thanks to the chair

Annex-I

List of Members, Special Invitees and other participants of the Thirteenth Meeting of the “Sub-Committee on System Studies for identification of most appropriate alternative plan” held on 04.02.2019, New Delhi.

- | | |
|--|---|
| 1. Prof. P.B.S. Sarma,
(Retd.), CED, IIT Delhi,
New Delhi | In Chair |
| 2. Prof. Kamta Prasad,
Chairman, IRMED,
New Delhi | Member |
| 3. Shri Sriram Vedire,
Advisor, Ministry of WR, RD & GR,
New Delhi | Member |
| 4. Prof. Sanjeev Kapoor,
Indian Institute of Management,
Lucknow | Member |
| 5. Dr. M. K. Goel,
SC- ‘G’, WRS Division,
N.I.H., Roorkee | Representing
Dr. Sharad K. Jain
Director, NIH |
| 6. Shri K.P. Gupta,
Director (Tech.),
NWDA, New Delhi | Member- Secretary |

Special Invitees

7. Shri M. K. Srinivas,
Director General,
NWDA, New Delhi
8. Shri R.K. Jain,
Chief Engineer (HQ),
NWDA, New Delhi
9. Shri R. N. Sankhua,
Chief Engineer (South),
NWDA, Hyderabad
10. Shri N.C. Jain,
Chief Engineer (North),
NWDA, Lucknow
11. Shri Muzaffar Ahmad,
Superintending Engineer,
NWDA, New Delhi

12. Shri B.L. Sharma,
Superintending Engineer,
NWDA, Bhubaneswar
13. Shri Afroz Alam
Superintending Engineer,
NWDA, New Delhi

Other Officers from NWDA

14. Shri R.K. Sharma,
Deputy Director,
New Delhi
15. Shri Anil Kumar Jain,
Deputy Director (SCILR),
New Delhi
16. Shri R. K. Agrawal,
Consultant,
New Delhi
17. Shri P. V. Baiju,
Consultant,
New Delhi
18. Shri Rajiv Kanaujia
Assistant Engineer,
Lucknow

Terms of Reference

Subject: "Study of various possible scenarios for simulation studies for understanding the effect of link canal irrigation en-route in the long term for the proposed Mahanadi-Godavari link"

1.0 Background

In the 5th meeting of the "Sub-committee for system study for identification of most appropriate alternative plan" held on 28.07.2015, it was decided that system simulation studies of Mahanadi-Godavari link may be completed by engaging the reputed institutes viz. NIH, IIT etc. Accordingly, the NIH (National Institute of Hydrology), Roorkee was engaged for the study and a MoU was signed with the following objectives.

- (i) To carry out water availability and water balance studies at seven project sites by using monthly data. Water demands for different purposes will be given by NWDA or used as per project reports.
- (ii) Revised elevation-area-capacity curve after 50 years of operation for each proposed storage project would be worked out by using Hirakud sedimentation data or sediment rate of 0.5 mm/year.
- (iii) Integrated multi reservoir simulation study of the system would be conducted by assuming environment flows @20% of lean season flow and with and without MSTG contribution to determine storage capacities and reliabilities.

Accordingly, NIH completed hydrological study and multi reservoir simulation for the proposed M-G link. The study was discussed during various meetings of the "Sub-committee for system study for identification of most appropriate alternative plan" and in the 12th meeting of the sub-committee, it was observed that there are some issues to be addressed in the studies such as the effect of link canal on the recharge of ground water and climate change, possible changes in irrigation methods, etc., in the long term for the proposed Mahanadi-Godavari link. For these additional studies, terms of reference are prepared.

2.0 The Mahanadi-Godavari Link Project

Water balance studies done by NWDA reveal that Mahanadi and Godavari basins are water surplus basins. The combined surpluses of these basins after accounting for in basin uses in the ultimate stage of development can be diverted to meet the water requirement of deficit basins in South up to Gundar river through Mahanadi-Godavari-Krishna-Pennar-Cauvery-Vaigai-Gundar linkages (9 link system).

The proposed Mahanadi-Godavari link will originate from Barmul dam with all the design features of conveyance system as proposed in the Feasibility Report (FR) of Mahanadi-Godavari link. It is proposed to have a dam at Barmul 14 km upstream of Manibhadra on River Mahanadi. After meeting the enroute needs, 4682 MCM water is proposed to be transferred to Godavari. The total length of the link canal would be 844 km. Six dam projects at Salki and Ong in Ong sub-basin and Uttei Roul Integrated Project, Khadago, Upper Udanti and Tel Integrated Project in Tel sub-basin in Mahanadi basin will be integrated in the

Mahanadi – Godavari scheme. These six dam projects will utilize about 1376 MCM of water within Odisha State. The submergence from Barmul dam will be 21262 ha and from six dam projects will be 10222 ha. Thus, total submergence shall be about 31484 ha. These projects are in the planning stage and hence the design features may change later on.

The Mahanadi – Godavari link project shall provide irrigation (CCA) to the tune of 2.57 lakh ha in Odisha through link canal and 1.82 lakh ha through six dam projects. Thus, total irrigation in Odisha shall be 4.39 lakh ha. It is proposed to provide 125 MCM water for drinking water supply. The six dam projects have a potential of generating 240 MW of hydropower. There will also be flood moderation in Mahanadi river basin. The proposal prepared is preliminary based on remote sensing studies and will be firmed up by detailed studies.

3.0 Scope of Work

The scope of work will be as follows:

- (i) The present ground water scenario in command area of M-G link.
- (ii) Quantification of recharge to ground water due to M-G link canal irrigation.
- (iii) Its impact on the water table levels in the command area over next 50 years.
- (iv) The additional irrigation potential that may be created by recharged water while maintaining ground water at the safe level.
- (v) Scope for conjunctive use of surface and groundwater in the command area so as to avoid water logging in future due to increased recharge to ground water.
- (vi) Comprehensive study of impact of different possible scenarios arising out of:-
 - (a) Climate change in the long term, say 25 to 50 years
 - (b) Changes in food consumption and consequent changes in cropping pattern during next 50 years.
 - (c) Improved water application such as adoption of modern irrigation methods and other foreseeable factors, affecting water use efficiency.
 - (d) Different scenario of intensity of irrigation.

4.0 Study Area

The study area covers the area under Mahanadi-Godavari Link, which off-takes from the right flank of the proposed Barmul Dam on river Mahanadi in Odisha and after traversing 828 km, and outfalls in the Godavari River at 15 km upstream of the existing Dowlaiswaram barrage in Andhra Pradesh.

5.0 Basic Data Required

All data related with the study available in NWDA including data collected from field and other organizations during the course of study carried out by NIH will be made available to the consultant/ Agency. Further data required to be collected by consultant/ Agency and NWDA will assist.

6.0 Methodology

The exact methodology, to be adopted, would depend on the time and data availability. Where no specific methodology has been suggested, appropriate standard methodologies prescribed in the relevant codes of Bureau of Indian Standards (BIS)/Govt. of India, CWC/CGWB guidelines/guided by the Sub-Committee on System Studies may be followed.

7.0 Deliverables

The Firm/Agency Shall Submit Draft Report on the study describing the findings in respect of following:

- (i) The present ground water scenario in command area.
- (ii) Quantification of recharge to ground water due to link canal irrigation.
- (iii) Its impact on the water table levels over next 50 years.
- (iv) The additional irrigation potential that may be created due to increase recharge of ground Water while maintaining the same at safe level.
- (v) Scope for conjunctive use of surface and groundwater in the command area so as to avoid water logging in future due to increased recharge to ground water.
- (vi) Comprehensive study of different possible scenarios arising out of:-
 - (a) Climate change in the long term say 25 and 50 years.
 - (b) Changes in food consumption and consequent changes in cropping pattern during 50 years.
 - (c) Improved water application such as adoption of modern irrigation methods and other foreseeable factors affecting water use efficiency.
 - (d) Study with different scenario of intensity of irrigation.

8.0 Time Schedule

The consulting Firm/Agency shall complete the study in “six months” from the date of signing of MoU and advance payment after approval.

9.0 The Firm/Agency bidding to undertake the studies should

1. Submit a clear, detailed outline of how the above studies are planned to be conducted (methodologies need to be mentioned),
2. Should indicate the manpower in terms of expertise available with them / to hire experts for short terms (in this case their CVs shall be included along with their letters expressing their consent to work on the studies with the Agency/Firm)
3. Should provide a list of
 - a. similar studies completed in the past by the firm/agency and their contract value for those studies,
 - b. similar studies currently being undertaken and their contract values.



ALTERNATE POSSIBILITIES OF TRANSFERRING WATER FROM INCHAMPALLI

(With reduced dam height to minimise submergence)



Annexure-III

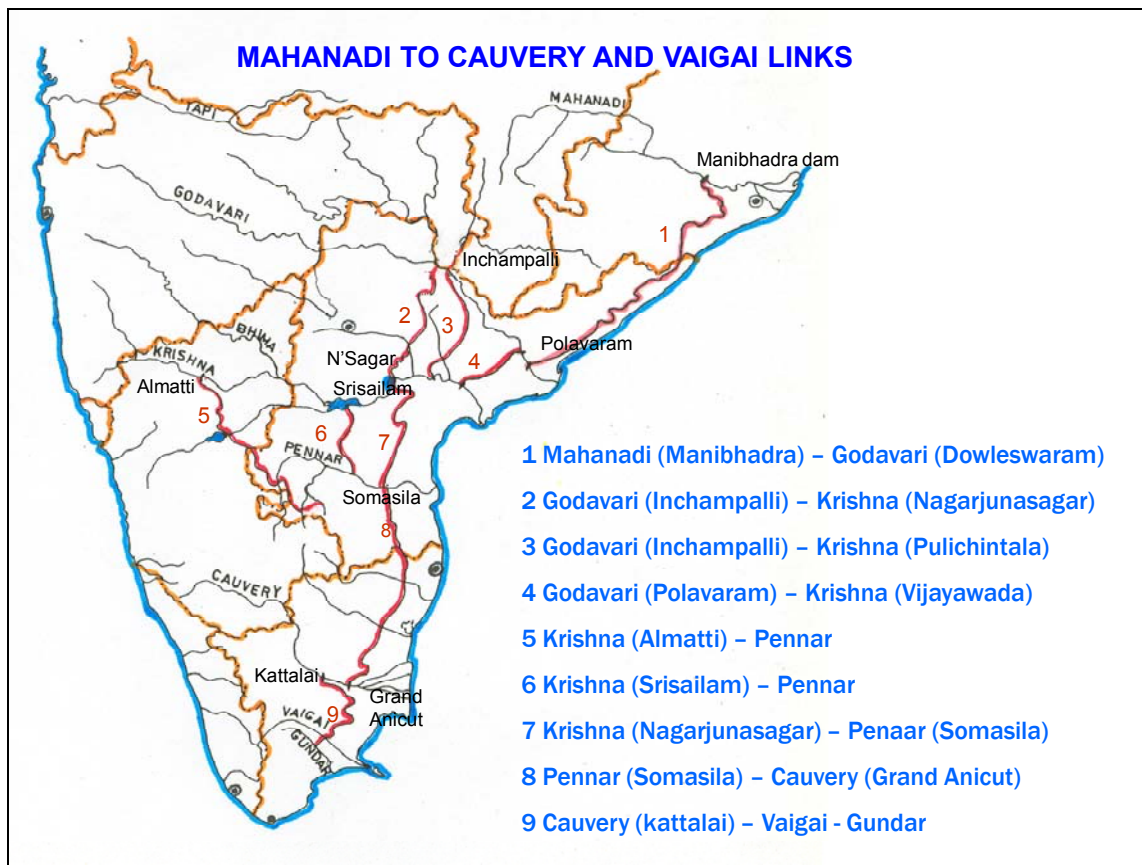
Dr R N Sankhua
Chief Engineer (S)
Hyderabad

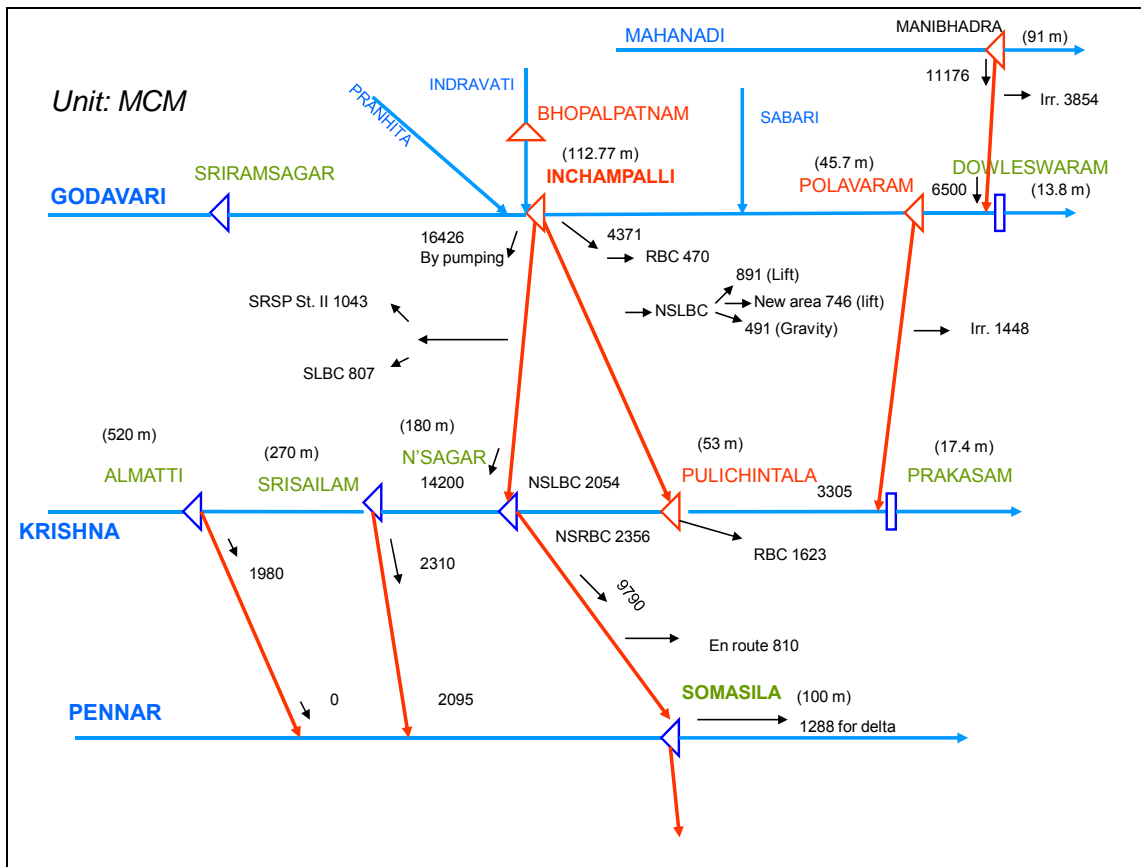
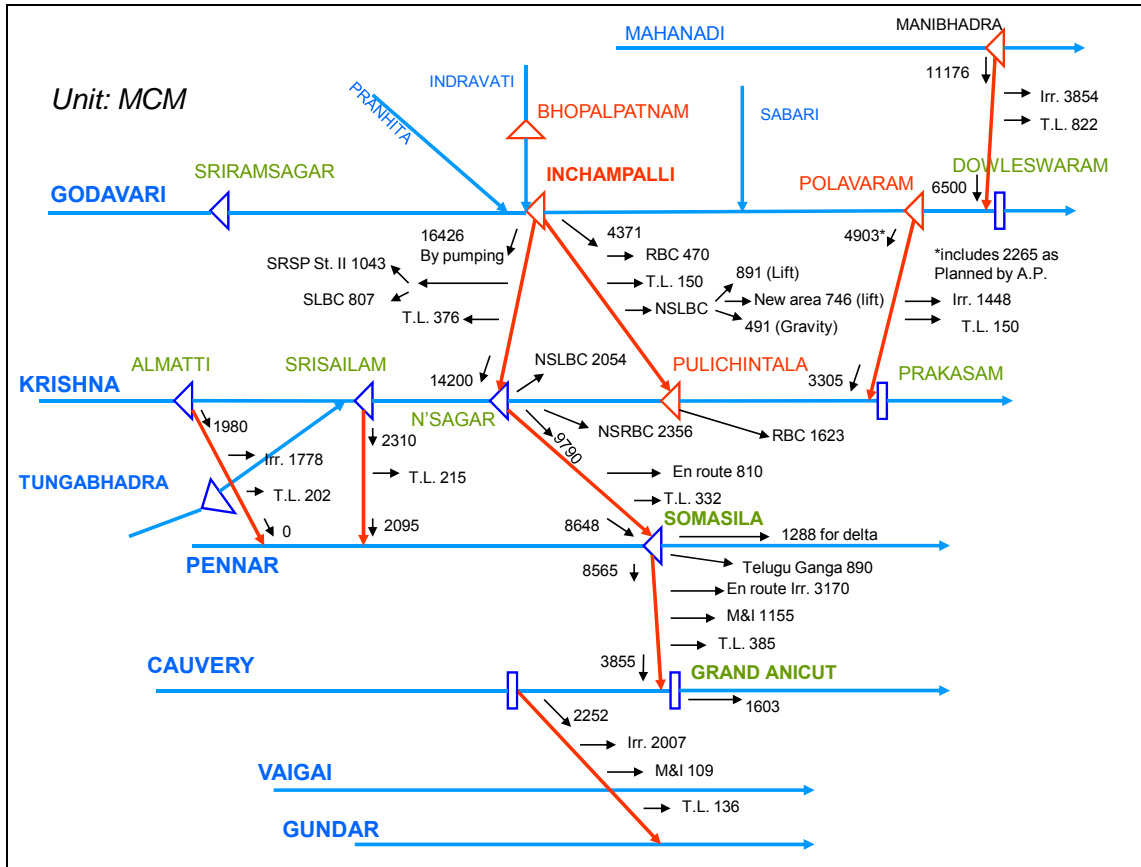
BASIC APPROACH ADOPTED BY NWDA IN FORMULATING INTERLINKING OF RIVERS

- ✓ WATER TRANSFER ONLY BY GRAVITY AS FAR AS POSSIBLE
- ✓ PUMPING PROPOSED ONLY IN UNAVOIDABLE LINKS AND RESTRICTED TO A HEAD OF 120M OR BEYOND SUBJECTED TO TECHNO-ECONOMIC VIABILITY OF THE PROJECT
- ✓ TO AVOID PUMPING AND AT THE SAME TIME TO SUPPLY WATER TO THE UPLAND AREAS THE CONCEPT OF SUBSTITUTION AND EXCHANGE ADOPTED IN MANY OF THE LINK CANALS

MAJOR LINKS SYSTEMS PROPOSED BY NWDA

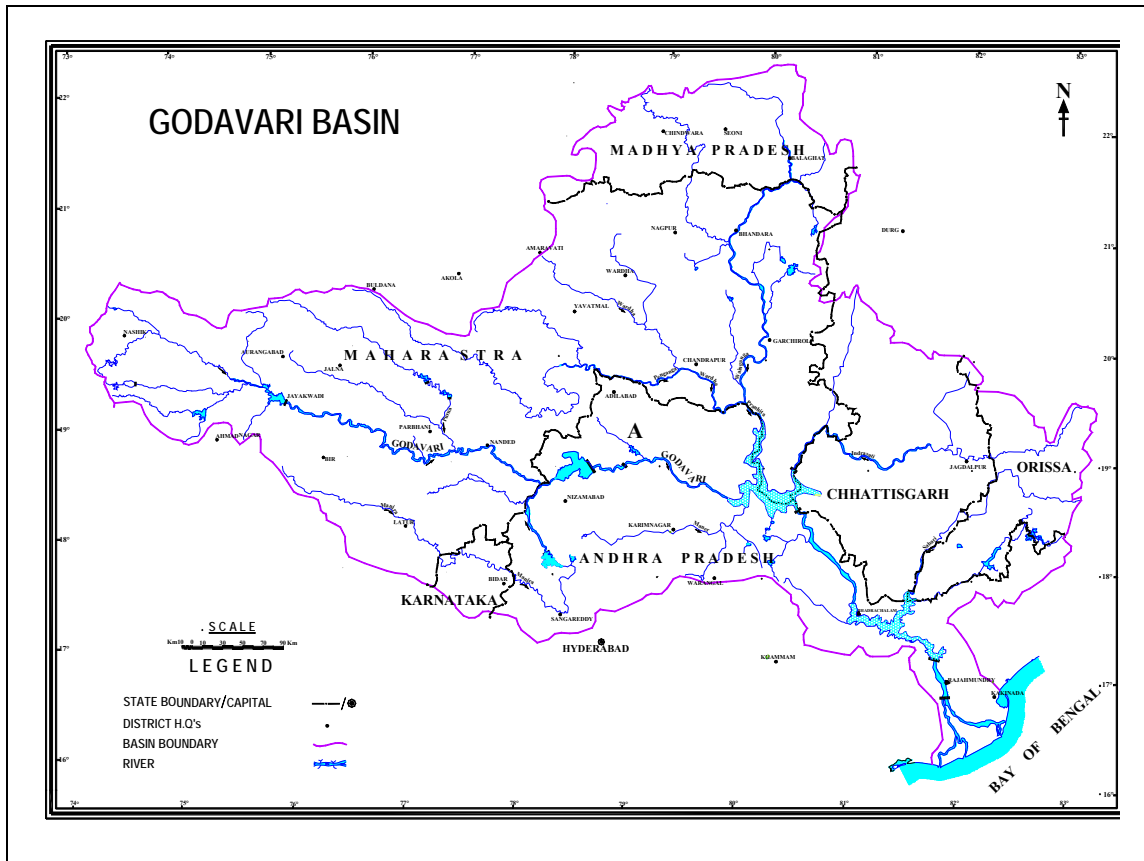
- ✓ MAHANADI – GODAVARI – KRISHNA – PENNAR – CAUVERY – VAIGAI LINK (*Southern Water Grid*)
- ✓ MANAS – SANKOSH – TISTA – GANGA – SUBERNAREKHA – MAHANADI LINK
- ✓ GANDAK – GHAGRA – YAMUNA – RAJASTHAN – SABARMATI LINK





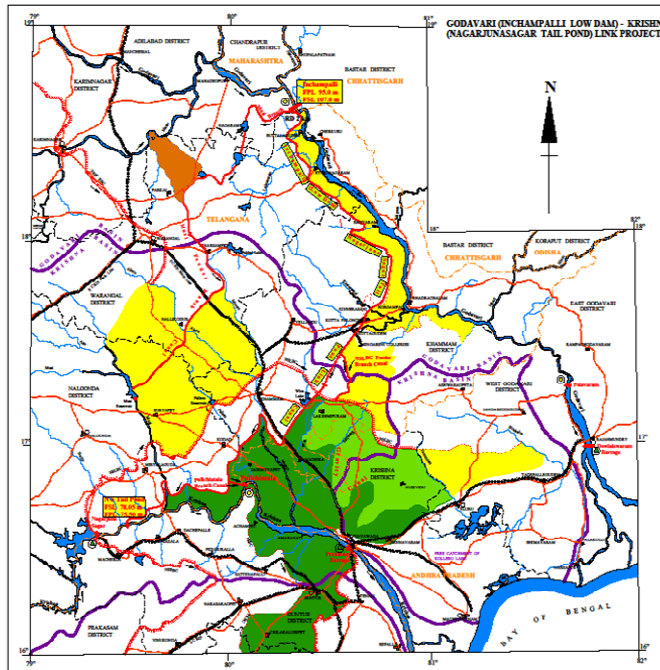
Constraints / Submergence due to proposed dams

	Forest	People
• Manibhadra on Mahanadi	5000 ha	91000
• Inchampalli on Godavari (Andhra Pradesh, Maharashtra & Chattisgarh)	22000	100000
• Bhopalpatnam (Chattisgarh & Maharashtra)	38000	9000
• Polavaram	3700	145000



Salient features of Inchampalli low dam - Nagarjunasagar tail pond link

- A low dam at Inchampalli with full pond level 95m, sill level 86m, and live storage capacity of 901 MCM
- Pumping arrangement to lift 8465 MCM of water to 107m
- A lined conveyance of 394.55km from Inchampalli to Nagarjunasagar tail pond
- A lined feeder branch canal of 230.50 km at RD 2 km from main canal to connect Musi reservoir with FRL 197m and live storage of 136 MCM, involving a lift of 117m.
- A lined feeder branch of 8.45 km at RD 303.75 km from main canal to connect Pulichintala project across river Krishna with FRL of 53.34m, MDDL of 42m and live storage of 1296 MCM.
- Utilising existing reversible turbines at Nagarjunasagar to pump 1096 MCM from tail pond depending on necessity and possibility for further use.



Salient features

Length (Kms)	Utilisation in MCM (TMC)	Cost Rs Crore 2018-19	Land acquisition (ha)		Lift (m) or Gravity
			Total	Forest	
394.55	8465 (299)	30375	Canal 6543 Low dam 458	1894 458 (River)	21 m on main canal 176m on branches
Total	8465 (299)	30375	7001	2352	

Diversion and utilisation with Inchampalli low dam (FRL 95m)

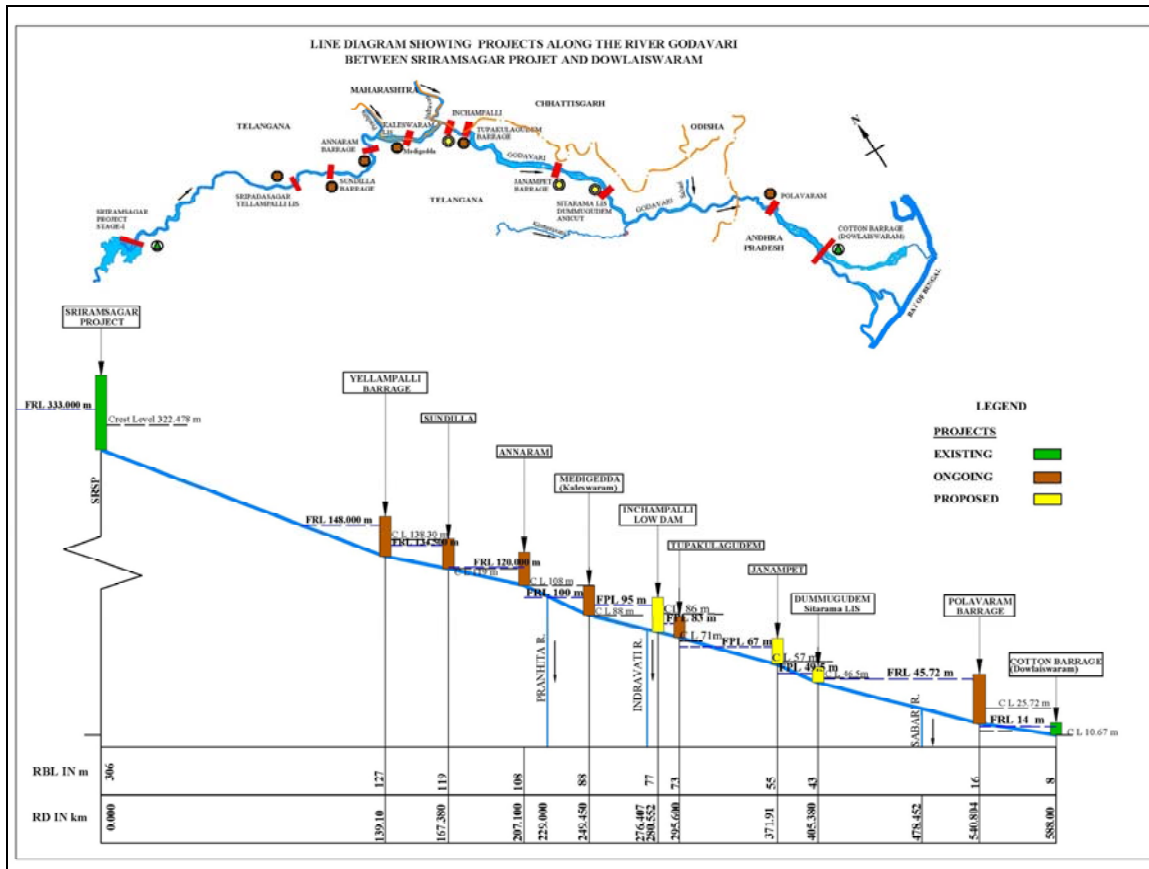
Proposed command	CCA (ha)	Irrigation intensity (%)	Annual irrigation (ha)	Annual utilisation (Mcum)
SRSP Stg I&II	178055	106	188735	886
IRBC	48230	150	72345	470
New area bet. IRBC and NSLBC	50000	150	75000	484
Part command of NSLBC By gravity	136961	140	191746	1208
By lift upto Tammileru	100975	140	141365	891
By lift beyond Tammileru	84600	140	118440	544
Part command of NRBC (Lift 10m)	203369	140	284717	1623
Municipal & industrial use				685
Transfer of water to tail pond	124263	140	173968	1096
Transmission losses				578
Total	9264530		1246316	8465

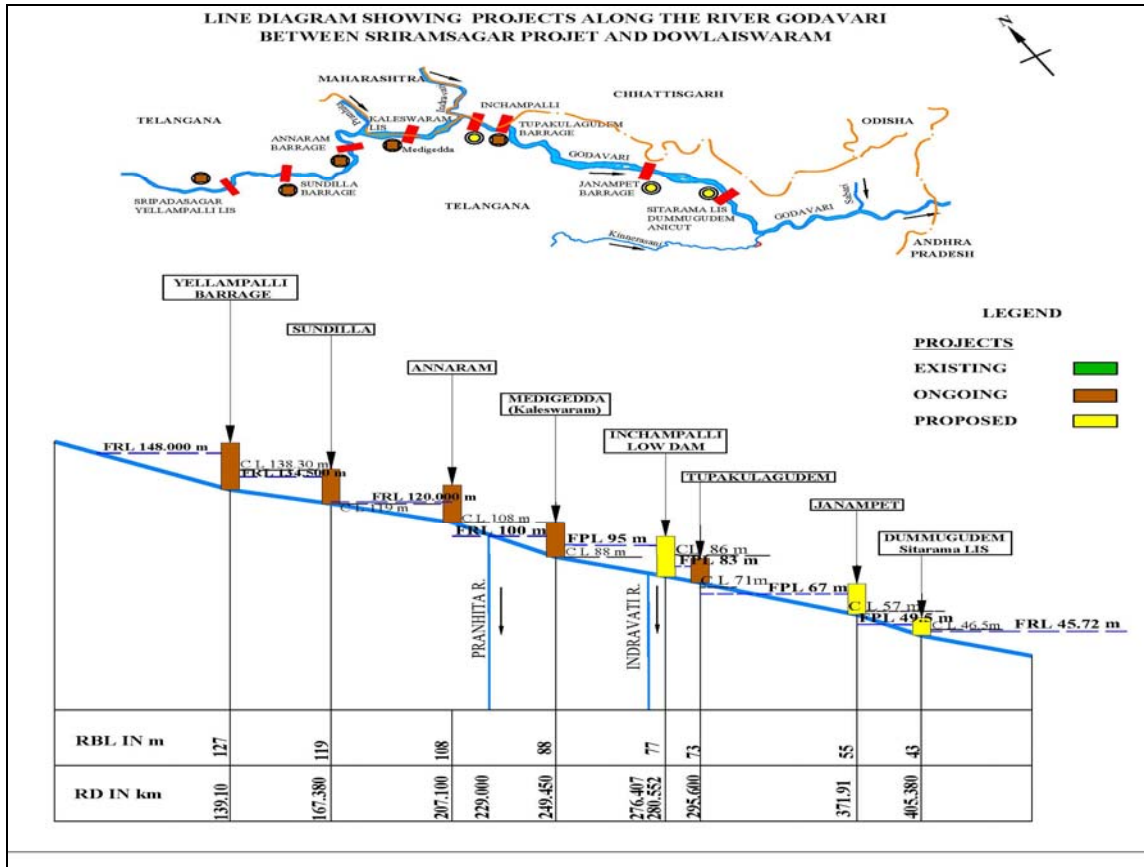
Total transfer of 8465 MCM will be exhausted in Telangana and Andhra Pradesh and thus, it is not possible to provide water to Tamil Nadu through low dam


Present development in Godavari basin between SRSP and Dummugudem

Name of the scheme	Full pond level (m)	Crest level (m)	Quantity (Mcum/ TMC)	Proposed irrigation (Lakh ha)
Kaleswaram project complex				
Medigadda barrage	100	89	5100/ 180	7.38
Annaram barrage	120	109		
Sundila barrage	130	120		
Inchappalli low dam	95	86	8465/ 299	12.46
Tupakulagudem barrage	83	70	2832/ 100	
Devadula LIS				
Tupakulagudem				
PVNR Kanthalapally				
Janampet – Grand Anicut	67	55	7000/ 247	9.38
Sirama LIS (Dummugudem)	49.50	46.50	1499/ 53	


The FPL 95 m of Inchappalli low dam is 6m above the crest level of Medigadda....thus, submerging the Medigadda barrage







National Water Development Agency
Ministry of Water Resources, River Development and Ganga Rejuvenation
Government of India




Annexure-IV

MANAS-SANKOSH-TISTA-GANGA LINK PROJECT

1

INTERLINKING OF RIVERS PROJECT



- Government of India formulated a National Perspective Plan for Interlinking of rivers .
- Diversion of water from surplus basins to deficit basins with a view to minimize the regional imbalances and optimally utilize the available water resources by interlinking of rivers.
- **30 LINKS ARE PROPOSED UNDER NPP**
- **Two Components**

	Under CE(NORTH)
– Himalayan Component – 14 links	14 links
– Peninsular Component – 16 links	3 links

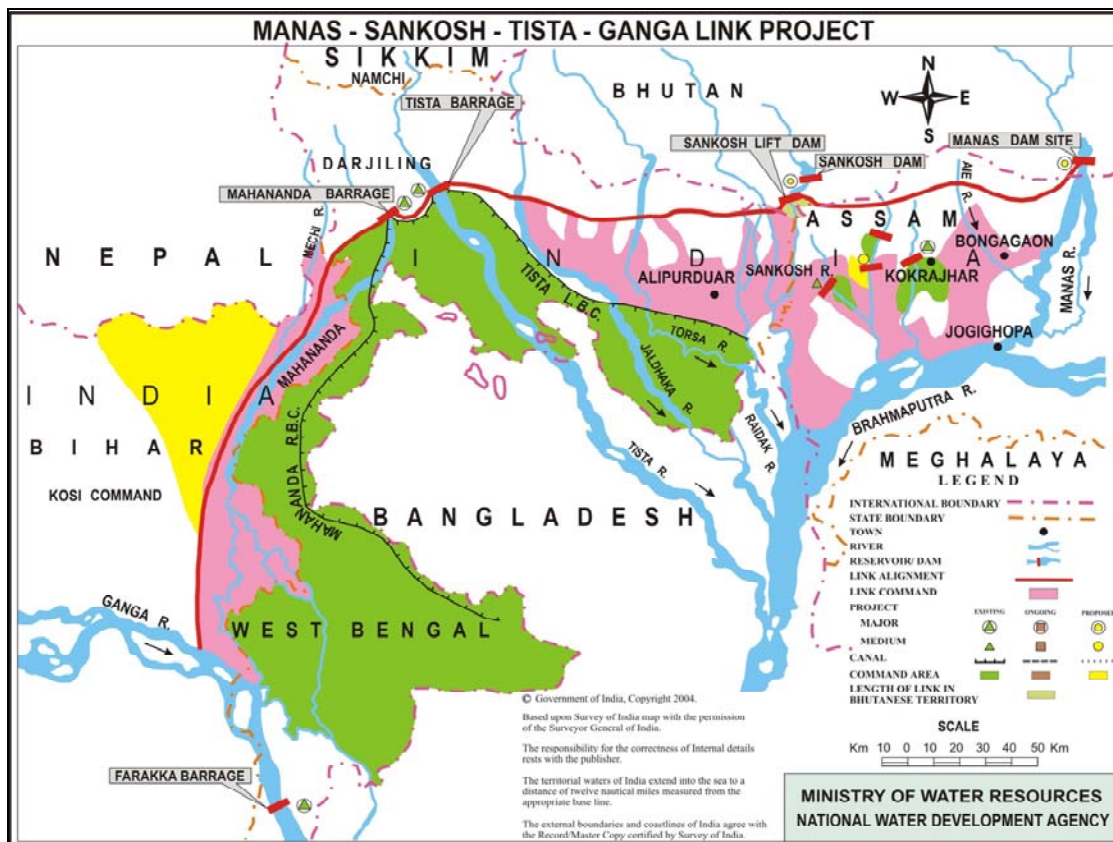
2

MSTG Link Project- PFR Proposal



- Conceived as a critical and mother link under the Himalayan Component of NPP.
- Diversion of 43 Billion Cubic Metres (BCM) surplus water from Manas and Sankosh rivers (tributaries of Brahmaputra river) with supplementation from four intermediate major streams i.e. Aie, Raidak, Torsa and Jaldhaka to the Ganga river and further towards South.
- Link project comprises of :-
 - (i) Two dams, one each on river Manas and Sankosh both inside Bhutan.
 - (ii) Link canal for irrigation and diversion of substantial quantum of water.
- Link project envisage enroute irrigation in West Bengal, Assam and Bihar and hydro power generation of power of 718 MW through 7 nos canal falls.

3



MSTG Link Project- PFR Proposal



•The PFR of MSTG link proposal was initially planned through Gravity and passes through Bhutan and Manas tiger reserve forest and envisaged 457 km long link canal out of which 114 km from Manas to Sankosh (Phase-II), 137 km from Sankosh to Tista and 206 km from Tista to Ganga (Phase-I).

•The S & I work of MSTG taken up in two parts

- (i) Work of Manas-Sankosh- Tista reach entrusted to CWC
- (ii) Work of Tista-Ganga reach done by NWDA

The surveys and investigations for Manas to Sankosh, full and Sankosh –Tista, partially could not be completed by CWC (in early 2000) as these were falling under Manas tiger reserve, Buxa Tiger reserve, Gaburbasra Reserve, tea gardens and other forests. However the NWDA completed the S&I works of Tista –Ganga reach.

5

MSTG Link Project- FR Proposal



- In view of constraints in taking up Manas dam (in Bhutan) and Reserved Forest (Manas tiger reserve, Buxa Tiger reserve, Gaburbasra Reserve, tea gardens and other forests) areas falling in the alignment of the link, it has been decided to take up this link in two phases and realign the link forest free route.

Phase-I : This comprises Sankosh-Teesta-Ganga link only (without considering contribution of water from Manas river) and avoiding the Reserve//Tiger Forest areas in the alignment to the maximum possible extent.

Quantum of Transfer: 24001 MCM

- Phase-II : This comprises Manas – Sankosh link with addition of contribution of water of Manas river and in between tributaries to the Phase-I and integrating both phases to make MSTG link with minimum Reserve Forest areas enroute.
 - i) Quantum of Transfer With Manas Dam : 43458 MCM
 - ii) Quantum of Transfer Without Manas Dam : 40763 MCM
- Accordingly NWDA completed the S& I works of forest free alignment in 2013 and out side agency works completed in 2016 (except Mahananda river surveys).

6

MSTG Link Project- FR Proposal



- Keeping above decision, NWDA has prepared Draft Feasibility Report of MSTG link avoiding forest for following three Scenarios:
- **With Sankosh dam only** (Sankosh-Tista-Ganga link only) This alternative is proposed as Phase-I of MSTG link.
- **Considering both Manas and Sankosh dams** (contribution of both the rivers are considered from the proposed new barrages on both the rivers in the downstream of proposed dams in Indian territory). This alternative-I is proposed under Phase-II of MSTG link.
- **Without Manas dam but with Sankosh dam** (contribution of both the rivers are considered from the proposed new barrages on both the rivers in the downstream of Sankosh dam and on Manas river in Indian territory). This alternative-II is proposed under Phase-II of MSTG link.

7

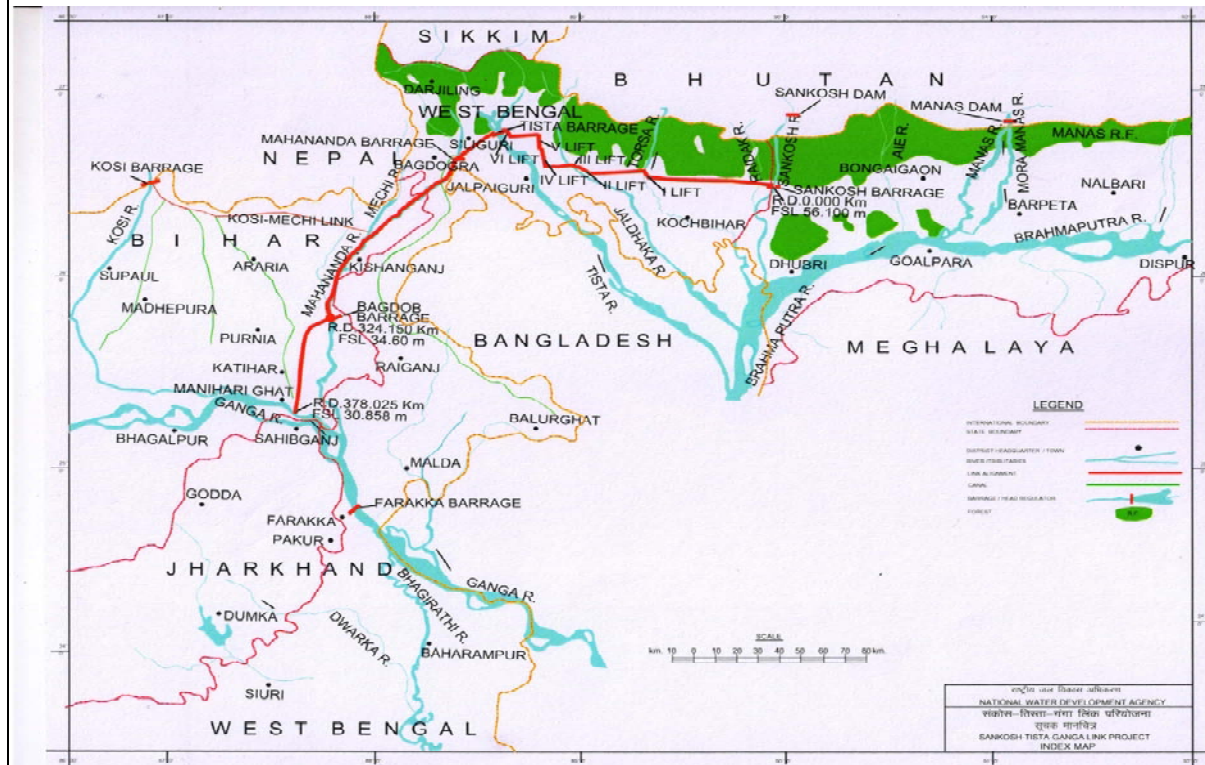
F.R.-Sankosh –Tista-Ganga Link Project-Phase-I



- Manas and Sankosh dams are lying in Bhutan, the S&I work of Manas dam could not be done by any Agency. However the S&I work of Sankosh dam H.E project completed by CWC and prepared the DPR, its techno economic appraisal in CWC/CEA is in advance stage.
- A MOU was entered into between the Govt. of India and Royal Govt. of Bhutan on 4th January 1993 for undertaking the preparation of DPR for Sankosh Multipurpose Project.
- Taking the benefit of Sankosh dam, STG link formulated by avoiding the Manas dam and also link canal of 109.85 km between Manas to Sankosh river with respective to other two previous alternatives.
- The main advantage of this link alignment is that it will pass completely through Indian Territory and forest free alignment however it requires 72 m lift.**
- Link envisaging diversion of surplus water from river Sankosh, Raidak, Torsa & Jaldhaka to the Ganga river and further towards South.

8

INDEX MAP of STG Link – Phase-I



Sankosh –Tista-Ganga Link Project-Phase-I

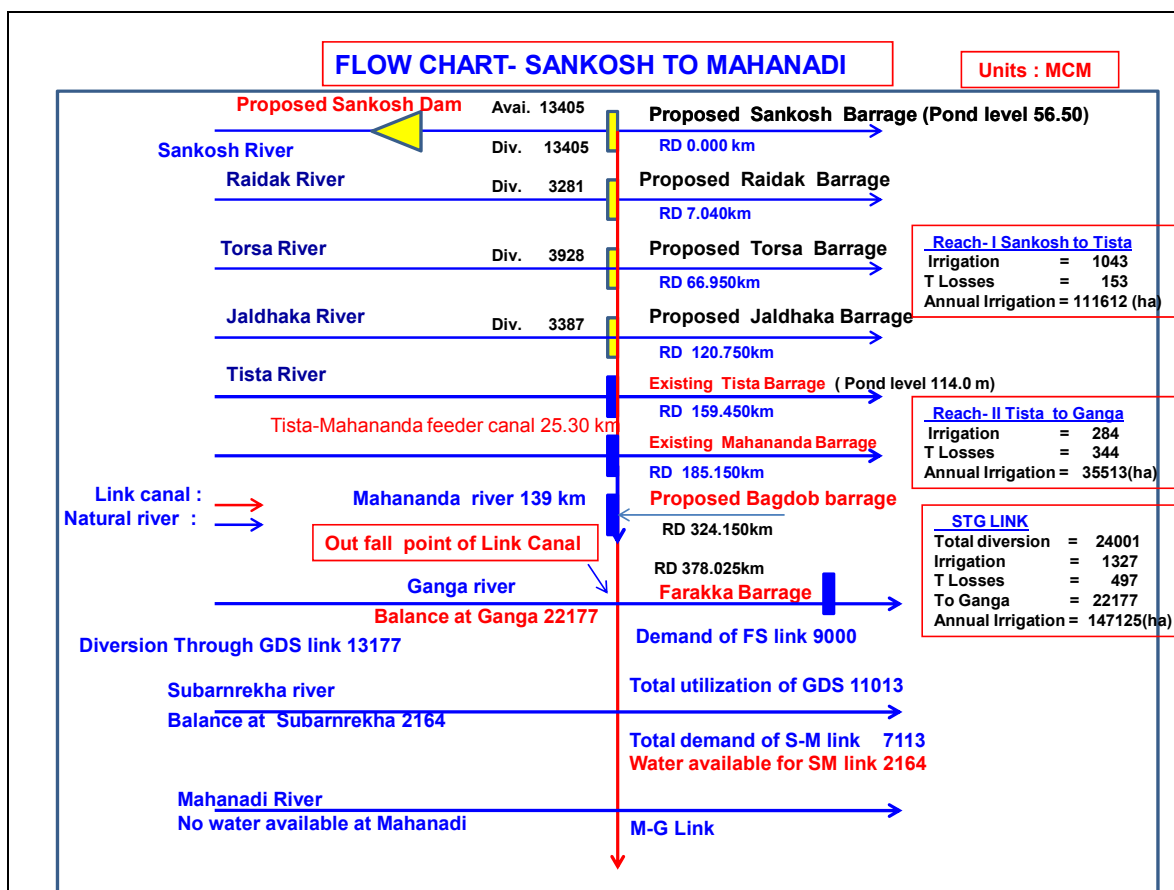


- The Sankosh-Tista-Ganga link canal is proposed to **offtake** from the right flank of proposed **Sankosh barrage** across Sankosh river, (about 28 km from Indo-Bhutan border).
- After crossing intermediate major stream i.e. Raidak, Torsa , Jaldhaka and Tista, canal falls into the Mahananda river (which will be utilized as carrier the link canal water for about 139 km) upto proposed Bagdob barrage.
- Later become independent link upto its **outfall** into Ganga river near village Katakosh, 4 km downstream of Maniharighat and 60 km upstream of Farakka barrage.
- Total length of link canal is 378 km.

STG Link : Water availability & Diversion



Quantum of water diversion from	
Sankosh	13405 MCM
Raidak	3281 MCM
Torsa	3928 MCM
Jaldhaka	3387 MCM
Total	24001 MCM
The balance water at Ganga	22177 MCM.
The balance available for further transfer to water short southern regions through a series of succeeding links F-S link, GDS link SM link, MG link after fulfillment of their requirement.	<p>All the enroute requirement of \ succeeding F-S link, GDS link, SM link, MG link including S-T-G link are works out to 39737 MCM. Thus it can be fulfill the demand of FS (9000 MCM) and GDS (11013 MCM) and partially SM link only.</p> <p>There is a shortfall to meet the monthly demands wrt to availability; therefore it is difficult to meet out demands of succeeding links wrt to the proposed diversion from STG link unless reduced the demand of preceding links i.e. GDS & FS links.</p>



MSTG Link Project- Phase-II (ALT-I & ALT- II)



Both links of Alt-I & Alt-II follow the same alignment and only difference is diversion of water quantities

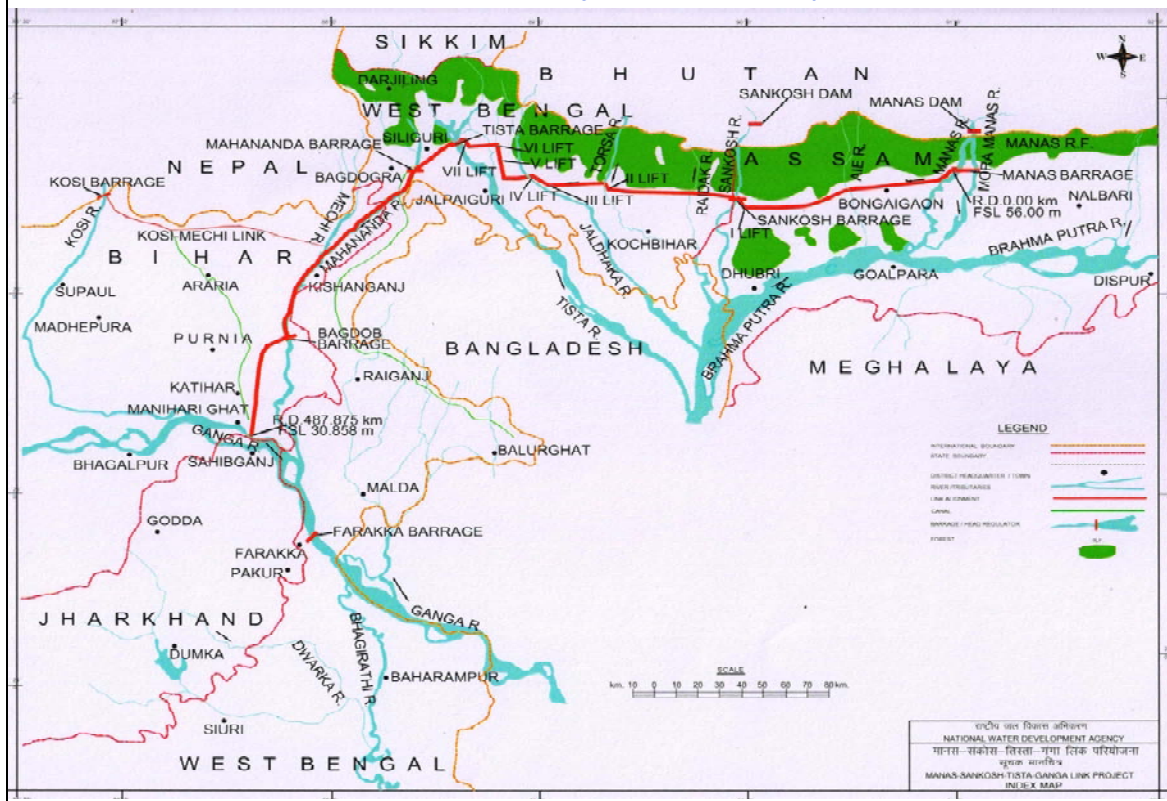
Alt-I : Link envisaging diversion of **regulated Manas river flows from Manas dam** and , surplus water with Aie, Sankosh, Raidak, Torsa & Jaldhaka to the Ganga river and further towards South.

Alt-II: Link envisaging diversion of **natural Manas river flows**, with surplus water with Aie, Sankosh, Raidak, Torsa & Jaldhaka to the Ganga river and further towards South.

The Manas -Sankosh-Tista-Ganga link canal is proposed to **offtake** from the right flank of proposed Manas barrage across Manas river, (about 3 km below the Manas Tiger Reserved Forest boundary and 18 km downstream of Indo-Bhutan border) and after crossing intermediate major stream i.e. Aie , Sankosh, Raidak, Torsa , Jaldhaka and Tista and canal falls into the Mahananda river (which will be utilized as carrier the link canal water for about 139 km) upto proposed Bagdob barrage and later become independent link upto its **outfall** into Ganga river near village Katakosh, 4 km downstream of Maniharighat and 60 km upstream of Farakka barrage. Total length of link canal (for both alternates) is 488 km.

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MSTG Link Project- Index Map



COMPARATIVE STUDY BETWEEN PHASE-I&PHASE-II



	Phase-I (Alt-III)	Phase-II(Alt-I)	Phase-II(Alt-II)
Quantum of water transfer :	24001 MCM (with Sankosh and without Manas dam/ river)	43458 MCM (with Manas and Sankosh dams)	40763 MCM (with Sankosh and Without Manas dam and with natural flows of Manas river)
The balance water at Ganga, upstream of Farakka Barrage :	22177 MCM	39361 MCM	36742 MCM
The balance available for further transfer to water short southern regions through a series of succeeding links F-S link, GDS link SM link, MG link .	All the enroute requirement of succeeding F-S link, GDS link, SM link, MG link including S-T-G link are works out to 41934 MCM There is a shortfall to meet the monthly demands wrt to availability; therefore it is difficult to meet out demands of succeeding links wrt to the proposed diversion from STG link .	The availability of water is more than requirement in monsoon but less than requirement in non-monsoon due to insufficient storage. Therefore, it is proposed that the releases from Manas dam should be in such a manner that requirement of MSTG link may be fulfilled.	There is a shortfall to meet the monthly demands wrt to availability; whereas, link as a whole will meet out demands of succeeding links wrt to the proposed diversion from MSTG Link

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COMPARATIVE STUDY BETWEEN PHASE-I&PHASE-II



link Canal	Phase-I (Alt-III)	Phase-II(Alt-I)	Phase-II(Alt-II)
Offtake point of link canal	From proposed Sankosh barrage across Sankosh River near Bhalka village in Jalpaiguri district of West Bengal.	From proposed Manas barrage across Manas river near Chamthebari village in Kokrajhar district of Assam	From proposed Manas barrage across Manas river near Chamthebari village in Kokrajhar district of Assam
Length of link (Km)	378	488	488
Tail end point of link canal	River Ganga Near Katakosh village in Katihar district of Bihar	River Ganga Near Katakosh village in Katihar district of Bihar	River Ganga Near Katakosh village in Katihar district of Bihar

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COMPARATIVE STUDY BETWEEN PHASE-I&PHASE-II



ITEMS	Phase-I	Phase-II(Alt-I)	Phase-II(Alt-II)
LENGTH (Km)	378	488	488
Lift involved (m)	72 m in 6 stages	82 m in 7 stages	82 m in 7 stages
FSL at Off take point	56.10m	56.00 m	56.00 m
FSL at outfall in Tista	114.0m	114.0m	114.0m
FSL at outfall in Ganga	30.86 m	30.86 m	30.86 m
CCA (Ha)	1,45,125 ha	3,40,519 ha	3,40,519 ha
Annual Irrigation	1,45,125 ha	3,40,519 ha	3,40,519 ha
Water Utilisation including Losses	1824 MCM	4097 MCM	4021 MCM
Proposed Diversion	24001 MCM	43458 MCM	40763MCM
Augmentation to Ganga	22177 MCM	39361 MCM	36742 MCM
Total Cost (Rs in Crore)	27416.74 (2017-18 PL)	49933.68 (2017-18 PL)	48210.38 (2017-18 PL)
B.C.RATIO	2.525	2.265	2.427
IRR	29.0%	20%	26%

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COMPARATIVE STUDY BETWEEN PHASE-I&PHASE-II



ITEMS	Phase-I	Phase-II(Alt-I)	Phase-II(Alt-II)
TOTAL LENGTH LINK (Km)	378	488	488
Open Link Canal (Km)	213.3	323.3	323.3
Tista-Mahananda Feeder canal (Km)	25.70	25.70	25.70
Mahananda river (Km)	139 km	139 km	139 km
Proposed Dams	(1)Sankosh Dam	(2)Manas Dam, Sankosh Dam	(1)Sankosh Dam
Existing barrages	(2) Tista, Mahananda	(2) Tista, Mahananda	(2) Tista, Mahananda
Proposed barrages	Sankosh, Raidak, Torsa, Jaldhaka & Bagdob	Manas, Sankosh, (NWDA), Raidak, Torsa, Jaldhaka & Bagdob	Manas, Sankosh, Raidak, Torsa, Jaldhaka & Bagdob
Enroute structures(Nos)	142 Nos.	213 Nos	213 Nos

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National Water Development Agency
Ministry of Water Resources, River Development and Ganga Rejuvenation
Government of India



Thank you