DPR GUIDELINES FOR ERM OF IRRIGATION PROJECTS

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1.0 INTRODUCTION

Modernisation of Irrigation Project includes extension, renovation & modernisation components of existing project to optimize the benefits in view of the deficiencies experience in operation & maintenance of the project over the past years and as a result of technology advancements made during the period. This also takes into account the deterioration of the system due to lack of proper maintenance. Important aspects to be looked into are to review water availability, design flood, cropping pattern, water demand, operation and safety of the headworks & water distribution system. It would include measures for conjunctive use of water & drainage of surplus water. It also includes review & strengthening of agricultural support services & plan for involvement of beneficiaries in management of the project for self sustainability in f uture. The modernisation of irrigation projects inter-alia would mean upgrading the existing headworks, canals, command area development works etc. in view of experience gained and deficiencies felt in operation and maintenance of the project over the past years in order to derive optimum benefits for the present day irrigated agriculture.

While undertaking the modernisation of existing irrigation projects, the differentiation between restoration or rehabilitation vis a-vis modernisation needs to be understood. The restoration or rehabilitation of irrigation projects may include the works required to bring the canals components to their originally designed parameters i.e. restoring them to original sections and the canal capacities etc. The modernisation would be updating and improving the components to meet modern day concepts on safety and present day demand of water for irrigation, water supply and other diverse uses. The modernisation also includes extension of the existing system. The existing canals which were designed for traditional crops may be found wanting to meet the present day enhanced requirements of high yielding varieties of crops. Moreover , the old systems were mostly designed for protective irrigation. In order to meet the

rising demand of foodgrains, the concept of irrigation has undergone a major change from protective to productive irrigation. The productive irrigation implies that for any unit of water supply on a unit of land, the production should be optimum. Due to inadequate maintenance of the system for want of adequate funds, these have deteriorated and are required to be rehabilitated/restored in the first instance. Considering present day needs, these would also require to be modernised.

Most of the existing irrigation systems in the country were planned with unlined canals for traditional cropping pattern and assumed irrigation efficiencies. These systems are therefore, not able to cope up to the modern day agriculture and a lot of deficiencies like seepage losses, inadequacy of systems/canal structure to meet higher demands have been noticed. Modernisation of irrigation system does not mean merely improvement of the engineering parameters such as lining of canal and distribution system, improvement and modification of structures but also may include review of cropping pattern, crop water requirement, efficiencies of irrigation i.e. field application of water, remodelling/re- sectioning, re-aligning of canal, maintaining of required L Section and X Section of the canal and canal banks/berms. This would also include review of hydrology i.e water availability, design flood, sedimentation etc. & strengthening/remodelling of headworks if found necessary.

2.0 GUIDELINES FOR FORMULATION OF DPR FOR ERM PROJECTS: Detailed Project Report for ERM of Irrigation Projects have to be formulated as per following Guidelines(Guidelines for preparation of DPR of irrigation and multipurpose projects – prepared by CWC (2010)

GUIDELINES FOR PREPARATION OF DPR FOR ERM OF IRRIGATION PROJECTS

Section-1

CHECK LIST

I. Was the original project given investment clearance by Planning Commission?

2. Has the performance evaluation of the existing project been carried out?

3. Have the salient features of the project as envisaged at the time of execution of project and as at present, been indicated?

4. Have the irrigation potential of the existing project as originally envisaged, potential created and utilised and reasons for variations been indicated?

5. Has the culturable command area been actually assessed and compared with that at the time of planning of the project and shortfalls/excesses, if any, discussed?

6. Has he hydraulic survey of canal/distribution system been carried out?

7. Have the deficiencies m the existing irrigation system been identified?

8. Has the need for modernisation been justified?

9. Have the hydrological studies been reviewed, compared with those made at the time of preparation of the original project if available and reasons for variations recorded in respect of:

   (i) rainfall
   (ii) runoff
   (iii) flood
   (iv) sediment
   (v) ground water
   (vi) Evaporation

I0 (a) Have changes in the upstream withdrawals/diversions for industrial use, power generation, drinking requirement and other developments in the upper catchment to the extent

which can be collected with reasonable efforts been

described?

(b) Have the changes in power generation/consumption in power for the lift irrigation scheme been described?

11. Have the semi-detailed soil surveys been carried out for the entire command (if not entire command tl)en extent covered) and soil and land irrigability classification brought- out in the report? (For the Project to be acceptable, semi detailed soil survey in at least 50% of command should have been carried out.)

12. Is the Crop Water Requirement determined by the modified Penmen method?

13. Have water requirements for other uses been worked out?

14. Has justification for the proposed cropping pattern been furnished?

15. Have the cropping pattern & proper cropping calendar been devised with a view to maximise the production and canal closures for maintenance etc. ensured? Have these been concurred by the Agriculture Department?

16. Are the areas and percentage of CCA that will be irrigated during Kharif, Rabi, two seasonal, hot weather and perennials been indicated and compared with cropping pattern as existing prior to taking of the project, originally envisaged and actually developed after completion of the project?

17. Is the justification furnished for continuing with/or taking up perennial and hot weather crops from the reservoir?

18. Have the most suitable depths and frequencies of irrigation to be adopted, based on the characteristics of the soil and crops been worked out?

19. Have the values of conveyance efficiency, field application efficiency and overall water use efficiency been indicated with basis thereof?

20. Has the pattern of releases (10 daily/monthly) from the diversion/storage headworks been worked out & compared with those envisaged originally?

21. Has the canal been red signed to cater for peak requirement with 10 percent increase (20% for small reservoirs) for rush

irrigation. If not, have the alternative proposals for carrying the required discharge been discussed?

22. Whether supplementation from ground water has been considered?

23. Are the supplies available sufficient to meet the requirements for ensuring 75 per cent dependability ? If not. have the possibilities of augmenting the supplies been discussed either by increasing the storage or supplementing by ground water etc.? Have the revised reservoir operation tables been furnished?

24. Has a study of the ground water potential of the command area. the present level of the ground water use and the scope of future ground water utilisation, been carried out and included in the project report?

25. Have the economics of ground water development been studied?

26. Has the possible impact on ground water recharge on account of lining of the system been kept in view in the scheme of ground water utilisation?

27. Has the possibility of the ground water for irrigating areas not commanded by the canal system been considered?

28. Has the quality of surface water as also ground water & drainage water, if intended for irrigation use, been tested?

29. Have the requirements of drainage in the command area, been studied and a suitable integrated drainage plan drawn up and provided for in the cost estimate?

30. Have the arrangements for the following been considered and provided for?

(a) Execution of OFD works
(b) Training programmes for field staff and farmers- existing position and proposals for strengthening
(c) Participatory Irrigation Management (PIM), Water Users Associations (WUA), and turnover of the system to WUAs.
(d) Pro-vision of extension services
(e) Providing important inputs like seeds, fertilizers etc.

31. Have adequacy of road communication facilities and if not, the necessity of improvements been-discussed and provided for?

32. Have matters about the improvement in reliability/dependability of the annual irrigation in the existing/proposed command area been discussed in the light of modernisation?

33. Have the net benefits due to the project been estimated and concurred by the Agricultural Department?

34. Has the concurrence of the State Finance Department been obtained for taking up the project at the estimated cost?

35. Whether the scheme has already been started? If so, is the present stage of construction indicated?

36. Is the scheme included in the plan? If not, what is the present position regarding its inclusion in the plan?

37. Have the year wise requirement of funds been indicated?

38. Is the scheme covered under state sector or Central sector?

39. Is the schedule covered or proposed to be covered under any foreign assistance/aid agreement?

40. Are the detailed cost estimates included in the Report?

41. Has the benefit-cost ratio been worked out? Whether depreciated cost of completed works has been included in the calculations?

42. Whether Internal Rate of Return (IRR) has been worked out?

43. Are the financial returns attached?

44. Are there any special reasons to undertake the project if it is unproductive and whether these have been recorded in the Report?

45. Have the rates of betterment levy proposed, the period of recovery and the estimated total recovery been indicated?

46. Are there any charges levied for irrigation facilities as distinct from water charges?

47. Are the water rates for different crops indicated?

48. Have the rates of betterment levy, water charges, etc. been compared with those obtained in other regions of the State?

49. Has the concurrence of the State Revenue Department been obtained for these rates ?

50. Have the O&M aspects (both financial as well as management) been discussed? How are the O&M costs proposed to be met?

51. Have the programme of construction and the expenditure involved been furnished?

52. Has the requirement of staff been estimated and furnished with justification?

53. Has the adequacy of the existing irrigation laws and revision, if any, considered necessary been discussed?

54. Has the impact of the scheme on the overall development of water resources in the basin/state been discussed?

55. Whether views of water users about proposed works in modernisation project been obtained and described in the Report?

56. Have environmental/ecological aspects been discussed in the Report & environmental clearance obtained from MOEF?

57. Does the project involve acquisition of forest land? Has the MOE&F been approached for clearance under Forest Conservation Act 1980?

58. Does the project involve any re-settlement? Weather rehabilitation of PAPs provided for?

59. Does project involve rehabilitation of SC/ST population? Has the rehabilitation package for them been cleared by Ministry of Social Justice & Empowerment?

60. Have the socio economic studies (bench mark surveys) been carried out?

61. Have the interstate aspects been examined & discussed?

62. Have the list of ongoing programs of Agriculture Department in Command Area been given?

63. Have the provisions of Indus Water Treaty, 1960 for schemes on western rivers of Indus Basin been examined and discussed?

LIST OF DRAWINGS

I. Existing layout plan of the headwork and appurtenances with super imposed proposed changes.

2. Existing cross-section of earth/rockfill dam non-overflow concrete/ masonry power dam section, spillway, regulator etc. w ith super imposed changes in these sections.

3. Existing power generation /transmission network with super imposed changes in these sections, if any.

4. Contour plan of the sample command (scale I: 10.000 contour interval 0.5 m) showing the existing alignment of existing canal. location of structures. off-taking channels with details of discharge, bed level. FSL. both of the canal and the off-taking channel at the point of off-taking culturable command area under each channel etc.

5. Contour plan of the sample command (scale I:10,000 contour interval 0.5 m) showing the proposed alignment of the canal. location of structures off- taking channels with details of discharge, bed level, FSL both of the canal and the off-taking channel at the point of off-take, culturable command area under each channel .

6. Condensed existing L-Section of the canal showing the location of the existing structures, off taking channel, bed level, full supply level, bed slope and condition thereof.

7. Condensed L-Section of the canal showing the location of the proposed structures, off-taking channel, bed level, full supply level, bed slope etc.

8. Typical cross-section of the existing canal super-imposed with the proposed section.

9. Contoured layout plan, L-Section and Cross Section of major new/proposed to be remodeled canal structures with location of the bore hole drilled, pits excavated shown on the plan and the log on the cross-sections.

10. Plan showing the classification of soils available in the command.

11. Land capability classification map of the command

12. Land irrigability classification map of command with boundaries of the area having different constraints and pre and post monsoon ground water contours.

13. Map showing existing area under irrigation and additional area proposed through modernisation.

14. Map showing the ground water potential areas.

15. Map showing the water logged and other problematic areas indicating the problems.

16. Map showing the sub-surface water quality in the command

17. Map showing depth to ground water in the Command Area (These maps are available with State/Central Ground Water Boards).

FORMULATION OF DPR AN OVERVIEW

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1. BACKGROUND

One of the important activities assigned to Central Water Commission is techno-economic appraisal of irrigation, flood control and multipurpose projects (of Water Resources) proposed by the State Governments. This task is performed and coordinated by the Project Appraisal Organization (PAO) of Central Water Commission. After the project is found technically feasible and economically viable, the Advisory Committee of Ministry of Water Resources (MOWR) on Irrigation, Flood Control and Multipurpose Projects headed by the Secretary, Water Resources (WR) considers projects for acceptance and thereafter recommends the same to the Planning Commission for investment clearance.

Ministry Of Water Resources has published revised "Guidelines for Preparation of Detailed Project reports of Irrigation and Multipurpose projects" in 2010. The Guidelines is available on CWC website **cwc.nic.in**.

It has been observed in general that DPR submitted by the Project Authorities is not prepared as per the aforesaid guidelines. As such, it takes ample and unreasonable time in CWC for getting the DPR through from techno-economic angle.

In order to enable scrutinizing agencies like Central water Commission to examine the DPR from techno economic feasibility/viability point of view, it is necessary that the intended project should be investigated thoroughly as per the CWC/MoWR guidelines and the project report should be prepared systematically as per the existing guidelines incorporating all requisite data, studies, designs & estimates.

2. PROJECT PLANNING

While carrying out Project planning of a Water Resource Project, a very comprehensive and detailed exercise of study of data, field investigation, project engineering and compilation of findings in the shape of a Project Report has to be carried out. A systematic approach for project planning and consequent report preparation involves the following stages –

- Desktop Study.
- Pre-feasibility Report preparation.
- Detailed Project Report preparation.

With the study at each stage as given above, the level of confidence for the intended project goes up. Various aspects to be studied at the time of project planning are broadly listed as under:

i. Need for project development,
ii. Type of project,
iii. Topography of the project area,
iv. Reservoir Planning
v. Hydrological Studies
vi. Geological and Geotechnical assessment
vii. Seismological Studies
viii. Construction material availability
ix. Benefit assessment
x. Engineering of project components
xi. Environmental Impact Assessment
xii. Planning of project infrastructure
xiii. Construction equipment planning
xiv. Cost estimation and financial evaluation

In this lecture, discussion shall be limited to preparation of Detailed Project report. The details will be covered in the subsequent lectures.

3. PREPARATION OF DPR:

DPR is a mirror in which one can see the image of the project. The quality of the image of the project depends on the quality of the mirror. As per the existing guidelines, the DPR should have the following sections:

Section 1 Check list- To ensure that all the information that are required are covered in the DPR.

Section 2 Salient features- to highlight the prominent parameters of the Project.

Section 3 Main report (DPR) - This section has been further explained in detail in the subsequent Para.

Section 4 Drawing Volumes covering drawings / maps of the various components of the Project.

Section 5 Appendices and annexure- Additional information related to the project.

4. MAIN REPORT (DPR)

4.1 Introduction

The following important items and sub items if any, as relevant to the project shall be discussed briefly under this chapter.

.- Aim(s) of the project and description of the works
.- Location of project area including longitude and latitude and district(s) and tehsil/taluka(s) affected/ benefited

- Access by air/rail/road/ferry/ sea/ port / and other communication facilities available in the area
- General climatic conditions of the state and project area in particular
- General descriptions of topography, physiographic and geology of the area
- Population affected and benefitted by the project
- Natural resources –
  Salient features of master plan for overall development of water resources of basin, the present level of utilisation of land & water resources and system efficiency are given.
- Land-use and socio-economic aspects (including tribal, backward and drought areas etc.)
- History (Earlier proposals)
- Choice of project: Alternative studies, carried out for various major components of the project and including water resources planning and final choice of project.
- Stages/phases of development of the project
- Fitment of the scheme in overall development of the river basin
- Intimation to the other development authorities regarding this Scheme.
- Public announcement and public hearings.
- Inter-linking of the scheme with neighboring schemes.
- Cost and Benefit of the scheme
- Public Cooperation and participation
- Provision for domestic and industrial power supply

4.2 Physical features

Details of Geographical disposition, Topography of the basin, Geology of the basin etc should be discussed in this chapter.

4.3 Interstate/International Aspect(s)

DPR should contain a separate chapter on interstate/international aspects discussing details of the following important items and additional items, if any, as relevant to the project.

- State/countries traversed by the river.
- Distribution of catchment in states/countries and yields, from the catchment of the state/country concerned.
- Effect of the following issues/aspects on the project
  (a) Interstate/International agreement on sharing of waters, sharing the benefits and costs, acceptance of submergence in the upstream state(s)/ country(s) etc., if any.
  (b) Interstate/International adjudication, if any.
  (c) Interstate/International aspect of territory, property, etc. coming under submergence, project affected people, rehabilitation, compensation, etc. Prior concurrence of other country(ies)/other

State(s)where territory/property is affected by the project should be obtained and appended in the DPR.

(d) Existing and sanctioned projects.

(e) Any other aspect of the project involving Interstate/International problems.

- Existing riparian use
- Whether operation and regulation of the project conform to the stipulation made in the Tribunal award/agreement and also the mechanism for such operation.
- In case of addition/alterations for existing project involving submergence in other states and additional utilisation of water, concurrence of the concerned states is to be included.
- Details regarding consumptive use of water in case of Hydro electric or Thermal Power Projects

4.4. Surveys and investigations

The surveys and investigations carried out for the various alternatives considered to justify the final choice of the location and type of various components of the project shall be discussed.

- Topographical Surveys

Brief details of the surveys carried out for items listed below as relevant to this project shall be furnished. For such surveys, suggested methodology shall be as under:

(a) Block level surveys shall be generally carried out on 50 m or less grid basis depending upon the site conditions.

(b) Cross-section and D-section shall be taken by taking levels at 50m or fewer intervals depending on the bed/bank slopes.

(c) The contour interval for slopes less than 10^{o} to the horizontal shall be 0.10 or 0.30 or 0.50 or 1 m depending upon the purpose of surveys. For slopes 10^{o} - 30^{o} the contour interval shall be 2 m and more than 30^{o} - 3m or more depending upon the steepness of the slopes.

- Geology, geo-technical features and seismicity.

Detailed report on geological, geo-technical features and seismicity discussing Foundation Investigations, Construction Material Investigations, Hydrological and Meteorological Investigations etc shall be discussed under this chapter.

5. HYDROLOGY

The details of the up-to date data collected and various studies made in regard to Hydrology shall be furnished/discussed in a separate volume and appended to the project report.

The points regarding the hydrological studies shall be briefly discussed in the separate chapter.

6. GROUND WATER

- Ground water resource availability
  a) Location (shallow or deep) and extent of potential Quantum available
  b) Status of present utilisation
- Ground water development prospects
- Anticipated behaviour of ground water on downstream after creation of the reservoir based on the experience in the similar projects/areas.
- Quality of ground water (Salinity, pH, SAR, Boron, Fluorine etc.) and its suitability for irrigation.
- Identification of areas of rising/declining water tables and feasibility of conjunctive use of surface and ground water.

7. DESIGN FEATURE AND CRITERIA FOR DIFFERENT RIVER VALLEY STRUCTURES

A separate volume discussing the design of project components in details relevant to the project shall form an appendix of the project report.

8. RESERVOIR

The following points and additional points, if any, as relevant to the project shall be discussed in details under this chapter:

8.1 Fixation of Storage and Reservoir Levels:

- Dead storage Level (El-m)
- Low Water Level (Minimum draw down) (El-m).
- Full Reservoir Level (El-m)
- Maximum Water Level (El-m)
- Maximum Back Water Level at Full Reservoir Level and its effect. Points to which back water effect is felt.
- Any saddles present along the rim of the reservoir, how they are being tackled etc.
- Fetch
- Direction of wind-velocity of wind, wave height, free board, Top of dam

8.2 Sedimentation data and studies
8.3 Life of Reservoir in years with basis

8.4 Capacities (M cum)
8.5 Effect on sub soil water table in the adjoining areas particularly downstream of the dam
8.6 Reservoir rim stability
8.7 Area of submergence (ha) at:
8.8 Land Acquisition, property submerged and rehabilitation
8.9 Recreation facilities
8.10 Pisciculture
8.11 Need and recommendation for soil conservation measure in the catchment
8.12 Any other relevant information

9. IRRIGATION PLANNING

The following items shall be discussed under the Chapter Irrigation Planning of the Detailed Project Report.

- Existing/proposed Irrigation facilities in the proposed project command area
- Existing cropping pattern
- Agro-climatic Conditions
- Proposed cropping pattern
- Crop water requirements
- Water Planning
- Command Area Drainage
- Water Course/field channels
- Water Management
- Agricultural support services

A separate Chapter on Irrigation Planning is to be given in the report.

10. COMMAND AREA

The Chapter on Command Area Development shall be prepared in accordance with the guidelines prescribed in Part IV (Command Area Development) of the guidelines. This Chapter shall discuss briefly the following items covered in the detailed volume.

- Command Area Details

(a) Location
(b) Classification of land (Forest, grass land, cultivated land. cultivated fallow, culturable waste barren
(c) Gross command area, Culturable command area
(d) Size of land holding

(e) Date of last revenue survey and land consolidation conducted in the proposed command area to be given village/holding wise (only abstracts).

- Climate of Command Area

(a) Average Annual Rainfall (weighted) (mm)
(b) Seasonal distribution (Monsoon & non-monsoon) (mm)
(c) Co-efficient of variation
(d) Temperature (maximum, minimum and average) (^{o}C)
(e) Humidity (maximum minimum & average)
(f) Evapo-transpiration (ETO)-annual

- Irrigation

(a) Present sources of Irrigation in the command
(b) Method(s) of irrigation followed
(c) Status of land development for Irrigated Areas
  (i) Condition of channels (lined/unlined)
  (ii) Longitudinal slopes in the field
  (iii) Status of field channels/drains
(d) Assumed field application efficiency with justification
(e) Record of water logging, salinity and flooding

- Socio-economic aspect

(a) Population major occupation(s) income etc.
(b) Classification of farmers (marginal, small, medium, big)
(c) Land tenure
(d) Income-average

- Infrastructure facilities

(a) Railways and roads (villages, district etc.)
(b) Marketing facilities
(c) Agro-industries
(d) Banks; credit societies etc.

- Topography and Soils
- Drainage Density of natural drainage (km. per sq. km. of the command area)
- Agriculture

11. FLOOD CONTROL

The following points and additional points, if any, pertaining to flood control and drainage aspects of the multipurpose project shall be discussed under this Chapter.

- Description of the flood problem in the tributary/sub-basin in which the reservoir proposed as well as in the main river basin with particular reference to the command area of the project.
- Details of the inter-state international aspects of the flood/drainage problems, if any.
- Flood Data

(a) Historical floods
  (i) Source of information
  (ii) Years of occurrence
  (iii) Estimated peak discharge
  (iv) Peak Gauge
  (v) Area affected (Map to be enclosed)
  (vi) Flood damages

(b) Observed floods (year-wise):

The following data shall be furnished for the period since observations were started:
  (i) Year
  (ii) Flood hydrograph
  (iii) Observed/estimated peak discharge
  (iv) Maximum gauge
  (v) Area affected with average depth of flooding

- Flood damage (year-wise)

The following information shall be supplied for a minimum period of preceding 10 years:
  (a) Village, Taluka or Tehsils/Towns/Districts etc affected
  (b) Population affected
  (c) Area affected (in the proposed project)
    (i) Gross area
    (ii) Culturable area
    (iii) Cultivated area
    (iv) Damage/loss
  (d) Physical and monetary year-wise (in particular river basin/sub-basin)
    (i) Property
    (ii) Crops
    (iii)Human Life
    (iv) Cattle
    (v) Public utility services
    (vi) Any other

  (e)Flood relief expenditure (year wise)

- Existing storage and flood control works in the tributary/ main river basin

(a) Existing storage works
  (i) Location

(ii) Catchment area intercepted
(iii)Live storage
(iv) Specific flood storage, if any
(v) Flood moderation by the existing reservoir
(vi) Residual floods
(vii)Possible modification for improvement of flood situation

(b) Flood control works -Details of existing works like embankments
(i) Location
(ii) Spacing of embankments in case of double embankments and distance from present river bank in case of single embankments.
(iii) Design HFL and frequency of floods for which embankments were designed
(iv) Top level of embankment
(v) Carrying capacity of river with embankments
(vi) Possible modification for improvement of flood situation

- Flood control by proposed reservoir

(a) Existing safe carrying capacity of the tributary/river in the flood prone areas

(b) Hydrological considerations for flood moderation by reservoir

(c) Impact of the proposed flood protection works including likely reduction in general damage, expenditure on relief, remission of revenues etc.

- Flood control measures for command area:

(a) Peak flood of 25, 50 and 100 year frequency at damage centres after taking into account moderation by reservoir(s) and synchronizable contribution of uncontrolled catchment.
(b) Safe carrying capacity of river in flood prone area
(c) Technical details of proposals for flood protection of command area are as under:
(i) Embankments
(ii) Channel improvement
(iii) River diversion
(iv) Programme of completion
(v) Degree of protection

12. DRAINAGE

- Basin Characteristics

(a) Geological history/geology
(b) Physiography
(c) Existing Drainage lines
(d) Farm drainage
(e) Rainfall, its distribution over space and time

- Investigation in Brief

(a) Water-table investigation and Artesian conditions
(b) Soil surveys-texture and permeability

- Cultivation practices

- Existing Drainage
- Drainage deficiencies
- Drainage requirements including alternative layout of drains, their capacities (surface and sub-surface).

13. POWER

13.1 The following points and additional points, if any, as relevant to the Power aspect of Multipurpose project shall be discussed under this chapter.

- Available generating capacity (MW) in the State/region from different sources with location, category-wise:

  a) Hydro Power (for ROR, ROR with pondage, storage, pumped storage separately).
  b) Thermal power
  c) Diesel power
  d) Gas Turbine
  e) Atomic power
  f) Tidal Power
  g) Solar power
  h) Geothermal power
  i) Pumped storage plants
  j) Any other

- Present status of utilisation of power:

  a) Agriculture
  b) Industry
  c) Domestic
  d) Commercial
  e) Others

- Energy availability (kWh) and peaking capability (MW) month wise and category-wise.
- Shortages/surpluses and import/export of power from/to the neighbouring States/regions.
- Transmission system

13.2 Power requirements

13.3 Future plans of power development in the States/region.

13.4 Assessment of power benefits of the proposed project.

13.5 Power house & equipment

13.6 Power Plant Head and Flow

- Minimum net head at MDDL
- Maximum net head at FRL
- Rated net head
- Design net head
- Maximum discharge at MDDL
- Minimum discharge at FRL
- TWL
- Minimum
- Maximum
- Maximum under flood condition

13.7 Transmission Arrangement

- Transmission Voltage
- Number of Circuits
- Single Circuit/Double Circuit
- Terminal Sub-station Details

13.8 Installed capacity

13.9 Power Benefits

- Firm power
- Annual Energy Generation in 90% dependable year

13.10 Financial Package proposed for construction of the project.

13.11 Capital Cost (base year)

- Civil works cost
- Electromechanical equipment
- Transmission cost
- Interest during Construction
- Total project cost
- Capital cost per kilowatt hour

13.12 Implementation Schedule

- Pre-construction (years)
- Construction (years)

13.13 Allocated cost of head works.

13.14 Comparison of the total cost of the hydro-electric components of the project with any other viable category viz. thermal, atomic, tidal etc.

13.15 Construction power requirement and proposed supply arrangement.

13.16 Economic Evaluation

- Unit cost of generation at Bus Bar
- B.C. ratio
- Internal rate of return (IRR)

14. NAVIGATION

If required, navigation aspect should also been discussed.

15. CONSTRUCTION PROGRAMME AND MANPOWER AND PLANT PLANNING

Information on details of year-wise construction programme, plant planning and manpower planning should be discussed in this chapter.

16. ENVIRONMENT, ECOLOGY & FOREST ASPECTS OF THE PROJECT

As per Planning Commission letter (No: 16 (2)99-WR dated 30.11.2000), the State Government shall obtain all required statutory clearances from the Ministry of Environment and Forest and Ministry of tribal Affairs like environmental clearance, Forest clearance, approval for rehabilitation and resettlement plan and all other clearances, as may be required before the investment approval is accorded.

17. ESTIMATE

"Guidelines for preparation of estimate for river valley projects" formulated by Central Water Commission should be followed for making Cost Estimate. Details are covered under Cost Estimate Chapter.

Ashok Kumar V
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NOTE ON THE GUIDELINES FOR THE CONTINUATION OF SCHEME ON REPAIR, RENOVATION & RESTORATION (RRR) OF WATER BODIES IN XIIPLAN.

1. Introduction

A water body is a structure where rain water is accumulated or water is stored by diversion from a stream, nala or river. Water bodies serve as reservoirs in the monsoon dependent areas of the country where there exists a shorter period of rainfall and a long dry spell with very high deviation of annual rainfall. The small storage tanks are called ponds which are mostly community owned. The large storage tanks whose command varies from 20 to 2000 hectares are generally constructed by government department or local bodies.

In India, tanks/ponds and lakes have traditionally played an important role in conserving water for meeting various needs of the communities.Through the ages, Indian agriculture has been sustained by natural and man-made water bodies such as lakes, tanks, ponds and similar structures. However, many of these water bodies are not inuse because of development of ground water irrigation systems, silting, inadequate maintenance and management, encroachments and diversion of land for other purposes, etc.

The water bodies are even religiously quite significant. Lakes of India, such as, Pushkar in Rajasthan, Gurudongmar in Sikkim, and others are renowned for their religious importance. The striking beauty of lakes of India, like Vemnanad Lake in Kerala, Bhimtal Lake in Uttarakhand, etc. has made them favourite haunts for the tourists. The lakes of Rajasthan add vigour to the colossal forts and palaces.

The current projections suggests that by the year 2051, there is likely to be an overall water scarcity in the country, unless either new sources of water become available or existing usages of water are conserved.As per the 4th Minor IrrigationCensus, about 6 lakhs tanks and storages in India are used for Minor Irrigation Schemes under surface flow and surface lift. Out of 6 lakhs, 1 lakh water bodies were not in use due to various reasons.

Out of the 1 lakh water bodies which were not in use, 0.74 lakh were temporarily not in use and about 0.24 lakh were permanently in use.

2. Pilot Scheme on Repair, Renovation and Restoration (RRR) of Water Bodies during X Five Year Plan

During the X Plan, the Pilot Scheme namely "Repair, Renovation and Restoration (RRR) of Water Bodies as a state sector directly linked to agriculture was launched by the Government of India in January 2005. The Pilot scheme envisaged a Plan Outlay of Rs. 300 crore to be shared by Centre and State in the ratio of 3:1 i.e. with 75% Central Assistance by Government of India and 25% by State Government. The water bodies having original irrigation cultural command area (CCA) between 40 ha to 2000 ha were eligible for funding under the pilot scheme. Under the Pilot scheme, 1098 Water Bodies were taken up in 26 districts of 15 states. Work was completed in 1085 water bodies and work was dropped in 13 water bodies. An irrigation potential of 0.78 lakh ha was restored.

Independent evaluation of the pilot scheme done by various agencies / organisations, viz., Water Technology Centre for Eastern Region, Bhubaneswar, Water & Land Management & Training and Research Institute (WALAMTARI), Hyderabad; Centre for Water Resources Development and Management (CWRDM), Kerala; Tamil Nadu Agricultural University, Coimbatore and National Remote Sensing Centre (NRSC), Hyderabad.

The reports of the agencies indicates that it has resulted in many positive outcomes like increase in storage capacity, increased utilization of water for irrigation, increased utilisation in annual irrigation etc. and the benefits of the scheme have percolated to SC/ST families.

3. Scheme of Repair, Renovation and Restoration (RRR) of water bodies with Domestic Support during XI Five Year Plan

Keeping in view the success of the Pilot Schemefor RRR of water bodies launched during X Plan and need for a comprehensive programme to upscale the gains from water bodies, the Ministry of Water Resources, GOI during the XI Plan introduced/ launched a state sector scheme for RRR of water bodies with two components– one with Domestic Support and the other with External Assistance during the year 2009. Under the Scheme of RRR of water bodies with domestic support, a total of 3341 Water Bodies from all over India (12 States)were taken up for restoration.Out of which 2145Water Bodies have been completed till date anda Central Assistance (CA) of Rs. 917.259 crore has been released so far . There is a provision of Rs 250 crore(as central grant) has been kept in the total

Central Assistance allocation of Rs 6235 crore during XII Plan implementation for completing the repair works of the ongoing works of water bodies which were approved during XI Plan .

4. Scheme of Repair, Renovation and Restoration (RRR) of water bodies with External Assistance during XI Five Year Plan:

Under the scheme of RRR of water bodies with External Assistance, 10887 Water Bodies were taken up for restoration in the 4 States of Andhra Pradesh, Odisha, Karnataka and Tamil Nadu at an estimated cost of Rs.3700 crore with CCA of 8.25 lakh ha was proposed to be covered. Under the scheme with loan assistance from World bank, GOI took 25% of the world bank loan and passed it on to the respective State Governments as Central Grant and 75% of the loan was transferred to the State Governments on back to back basis to meet the state share. The works of 4224 water bodies have been completed as on 01.01.2013. The implementation of the scheme is being dealt by Department of Economic Affairs (DEA), Ministry of Finance and World Bank.

5. Scheme of Repair, Renovation and Restoration (RRR) of water bodies for continuation during XII Five Year Plan:

To increase the participation of all the States, it was felt to frame a new scheme for Repair, Renovation and Restoration (RRR) of Water Bodies during the XII Plan as a State Sector Scheme with domestic budgetary support.

The scheme on RRR of water bodies for continuation during the XII Plan has been approved by the Cabinet on 20.09.2013. Accordingly, the guidelines were issued on 28.10.2013. The Working Group for Minor Irrigation and Watershed Management for the XII Plan period had recommended an outlay of Rs. 30,000 crore for the scheme. However, in view of resource constraint, it is proposed to cover only 10,000(9000 water bodies from Rural areas and 1000 water bodies from Urban areas) Water Bodies having culturable command area of 6.235 lakh hectares with a total project cost of Rs. 10,000 crore under the scheme during the XII Plan. The Central and State share would be Rs. 6235 crore and Rs. 3765 crore respectively. The Central share includes a liability of Rs. 250 crore on account of spilling over works of water bodies from previous years. The States would also be encouraged to seek external assistance for funding of RRR of Water Bodies.

6. Main Objectives of the scheme:

(i) Comprehensive improvement and restoration water bodies thereby increasing tank storage capacity.

(ii) Ground Water Recharge.
(iii) Increased availability of drinking water.
(iv) Improvement in agriculture/horticulture productivity.
(v) Improvement of catchment areas of tank commands.
(vi) Environmental benefits through improved water use efficiency; by promotion of conjunctive use of surface and ground water.
(vii) Community participation and self-supporting system for sustainable management for each water body.
(viii) Capacity Building of communities, in better water management.
(ix) Development of tourism, cultural activities, etc.

Therefore, it has been visualised that this programme will go in a long way in enhancing water availability in different parts of the country.

7. FUNDING PATTERN AND THE ELIGIBILITY CRITERIA FOR FUNDING

(i)The central assistance will be in the form of grant which will be 90% of project cost in case of Special Category States (North-Eastern States including Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttarakhand and undivided Koraput, Bolangir and Kalahandi (KBK districts of Orissa) as well as projects lying in desert development programme(DDP),drought prone area/tribal area/Naxal affected area and Central assistance of 25% of project cost in case of Non-Special Category States/areas. The balance cost of the project as State share (10% in case of Special Category States/areas and 75% in case of Non-Special Category States/ areas) is to be arranged by the State Governments themselves.
(ii) The works of RRR of water bodies spilling over from XI Plan would be funded as per XI Plan guidelines.
(iii) The proposals which satisfy the following criteria should be eligible for funding:
a) The water bodies are approved by the State Advisory Technical Committee (TAC) constituted by the State which includes representative from Central Water Commission (CWC) and Central Ground Water Board as Member.
b) The water bodies lying in Desert Development Programme (DDP), drought prone area/tribal area/Naxal affected area to be taken up will be decided in consultation with Planning Commission.
c) The proposals not receiving any other form of financial assistance.

d) The works shall be completed within 2 financial years excluding the year of inclusion of water bodies under RRR.

e) Proposals with B.C. Ratio of 1:1 for special category states/areas and more than 1 for non-special category states.

f) Rural water bodies having minimum water spread area of 5 hectare.

g) Urban water bodies having water spread area from 2.0 hectare to 10 hectare.

h) The scheme will emphasize development of catchment area, desiltation and command area development in respect of water bodies.The RRR scheme in rural areas is proposed to be implemented in convergence with the Integrated Watershed Management Programme so that the catchment areas of the water body selected are located either in treated micro/mini watershed or those selected for treatmentduring the next year or two. The proposals of only those water bodies in which catchment area treatment works have started under Integrated Watershed Management Programme (IWMP) would be included in the scheme of RRR of water bodies. In case, the scheme of IWMP isbeing considered for implementation in the state based on IWMP programme, the water bodies of such area will also be included in the scheme received upto March, 2013. A certificate from State Government will be required for speedily implementation of IWMP in those areas.

g) State Government is to take necessary steps for declaring the waterbody boundary through a Government order and to ensure removal ofencroachments in the water body spread area/water body boundarybefore submitting the proposal for release of 2nd instalment of grant forcompletion of work on the water body under RRR.

8. Scheme Design:

While the structure of the scheme will follow the pattern already adopted during the XI Five Year Plan period with almost the same objectives as the previous schemes,a more comprehensive approach towards integrated development of water bodies will be adopted with the following features :-

- ❖ All public and community owned water bodies may be covered under the project. Private owned water bodies will not be covered.
- ❖ All water bodies included in the project will be given a Unique Code Number. States will accordingly undertake census of these water bodies and get complete list of water bodies along with Unique Code in the first stage.
- ❖ Under the scheme, 10,000 Water Bodies would be covered out of which 9,000 water bodies would be in rural areas and 1,000 water bodies in urban

areas.For the first time, the restoration works of urban water bodies are being taken up for implementation.

- ❖ Urban water bodies having water spread area from 2 hectares to 10 hectares will be included under the scheme. Rural water bodies having minimum water spread area of 5 hectares will be included under the scheme.
- ❖ The scheme will emphasize development of catchment area, de-siltation and command area development in respect of water bodies. The RRR scheme in rural areas is proposed to be implemented in convergence with the Integrated Watershed Management Programme (IWMP) so that the catchment areas of the water body selected are located either in treated micro/mini watershed or those selected for treatment during the next year or two. The proposals of only those water bodies in which catchment area treatment works have started under IWMP would be included in the scheme of RRR of water bodies.
- ❖ Participatory Management and Project Implementation with active involvement of stake holders.
- ❖ Association of NGOs with the organization of Water Users' Association in the command areas may be encouraged.

9. Preparation of Detailed Project Reports (DPR):

The DPR of a project has to include information on the following aspects:

(i) Details of present status of the water bodies (in use or partially used or not in use) with reasons for deterioration in condition and also its categorization in terms of location, special category states, or in non- special category states.

(ii) Rainfall during the last ten years, ground water level, land use pattern, soil characteristics, climate conditions, availability of water in the catchment area for channelization into water body, water quality situation in the water body and adjoining areas.

(iii) Details of original CCA, present CCA and CCA planned in the DPR, original storage capacity/present storage capacity and storage capacity planned in the DPR, water quality situation in the water body and of ground water in adjoining areas with likely impact of the project on water quality of the water body and of the ground water.

(iv) Scope of work viz De-silting in terms of quantum of silt to be removed, repair of conveyance system, strengthening of bund(s), repair of weirs and sluices, catchment treatment, command area development, soil erosion prevention works, quality control measures. Maps of catchment and command areas are to be enclosed in the DPR.

(V) The scheme envisages capacity building of implementing agencies such as Ministry of Water Resources (MoWR) and its attached and subordinate offices, State governments, District Implementing agencies, Water Users' Associations (WUAs) and Panchayats. Accordingly, a capacity building programme aimed at sensitization of stakeholders, identification and selection of water bodies, preparation of Detailed Project Reports (DPRs), monitoring and evaluation is to be prepared and included in the DPRs.

(VI) The proposals of only those water bodies in which catchment area treatment Works have started under Integrated Watershed Management Programme(IWMP) would be included in the scheme of RRR of water bodies. In case,the scheme of IWMP is being considered for implementation in the statebased on IWMP programme, the water bodies of such area will also beincluded in the scheme received upto March, 2013. A certificate from StateGovernment will be required for speedily implementation of IWMP in theseareas.

(VII) Targeted benefits under the project will include creation of additionalirrigation potential, Increase in agriculture / horticulture / pisciculturepproductionand productivity, increase in recharge of ground water,improvement in water use efficiency, increase in availability of drinkingwater, impact on water quality, removal of weed growth, promotion oftourism and culture.

(VIII) Detailed calculation for working out the Benefit Cost ratio (BC ratio) for eachwater body.

(IX) Implementation schedule & corresponding requirement of funds; details ofarrangement for monitoring & evaluation and arrangement for use and maintenance of the restored water bodies.

(x) The checklist as enclosed in the guidelines should be the part of DPR.

10. Implementation of the Scheme

The institutional structure/activity mapping proposed is as below:

i) Water Users' Association(WUA) at the Gram Panchayat Level:

At the water body level, the Detailed Project Reports(DPRs) would be prepared and works would be implemented by Water Users Association (WUA)/ Local Panchayat / A Government agency identified by the District Level implementing Agency (DLIA). The implementation plan of the project will be placed before the Gram Sabha and its Cooperation will be solicited by timely completion of the project. The WUA would also earn revenues by charging for its services from its members and build up a corpus for maintaining and managing the water bodies over time.

ii) Arrangements at District Level

The proposals identified/received by DLIA would be scrutinised/included in the District Plan and forwarded to State Level Nodal Agency (SLNA) for putting up to State Technical Advisory Committee (TAC).

iii) Arrangements at State Level

A State Level Nodal Agency (SLNA) will be identified by the State Government which will be responsible to plan various activities envisaged under the scheme and monitor their implementation. A Technical Advisory Committee (TAC) will be constituted by the State to techno economically appraise and approve the DPR. TAC shall also include representative from Central Water Commission (CWC) and Central Ground Water Board (CGWB). After approval of the DPR by the State TAC, the State will submit the DPR to the concerned Regional/Field Office of CWC.

iv) Arrangements at Central Level

The MoWR will coordinate the programme at the central level through Central Water Commission. The Regional office of CWC shall forward the DPRs approved by the State TAC along with their recommendations to CWC Hq. Further CWC headquarter shall forward the eligible proposals to MOWR, RD & GR for their inclusion and funding. The inclusion of the Water Bodies for Central Assistance under the Scheme would be approved by the Empowered Committee of MoWR,RD& GR under the Chairmanship of Secretary/Special Secretary/Additional Secretary (WR).

11. PROCEDURE FOR SUBMISSION OF PROPOSALS

(i) At the water body level, the DPRs of the water bodies are to be prepared by WUA / Local Panchayat / a Government agency identified by DLIA. The Detailed Project

Reports (DPRs) will then be forwarded to District Level Implementation Agency (DLIA) for onward transmission to the State Level Nodal Agency (SLNA).

(ii) The proposals received by DLIA would be scrutinised, included in the District Plan and forwarded to State Level Nodal Agency (SLNA) for putting up to State TAC.

(iii) After approval of the DPR by state TAC, the States will submit DPRs to the field office of Central Water Commission, which in turn will take further necessary action for release of funds under the scheme.

11. Release of funds:

(i) Necessary budget provision for the total amount of the project for both Central and State shares are to be kept in the State Plan Budget for the relevant year.

(ii) The Central Assistance (CA) will be in the form of central grant which will be as under:

a. For Ongoing projects already under RRR: 90% of project cost in case ofspecial category States, projects benefiting drought prone area, tribalarea and flood prone area and 25% of project cost in case of Non-specialcategory States/areas.

b. For new projects under RRR : 90% of the cost of the project (workcomponent) for Special Category States, and Projects benefiting specialareas (Naxal affected areas, DPAP areas, Tribal areas, , DesertDevelopment Programme(DDP) Area of General Category States and 25% of project cost in case of Non-special category States/areas. Thebalance cost of the project as the state's share is to be arranged by thestate government from its own resources.

(iii) The State Governments will be required to enter into aMemorandum of Understanding(MoU) with the MoWR under the programme indicating estimated cost, benefits accrued like potential to be restored, targeted quantum of water after restoration, proposed ground water recharge, population benefitted from drinking water, etc., year-wise phasing of expenditure along with the target date of completion.

(iv) The state Government shall transfer the Central Grant to the project implementing authority within 15 days of its release by the Government of India.

(v) For projects receiving assistance upto 50% of the project cost, 90%of GOI share of fundsis to be released after release of at least 50% Stat's share. For projects receiving assistance higher than 50%, 50% GOI share is to be released after the State releases its full share.

(vi) Balance/second installment of GOI share is to be released after obtaining Utilization Certificate (UC) of minimum of 50% of GOI funds released earlier.

(vii) Next year installment is to be released after obtaining 100% utilization of funds released in the previous year(s).

(viii) The Utilization Certificate (UC) shall be issued by the Chief Engineer of the project and countersigned by Secretary (Water Resources / Irrigation) / Secretary (Finance) of the State Government.

(ix) The State Government shall provide annual audited statement of expenditure incurred within 9 months of release of central grant.

(x) If the State Government fails to comply with the agreed date of completion, the grant component released will be treated as loan and recovered as per the usual term of recovery of the central loan.

(xi) The cost at the time of inclusion of any new project in the scheme of RRR of water bodies will be frozen. In cases where project completion is delayed due to force majeure, time extension may be considered for maximum one year.

(xii) The check list for processing the release of funds by CWC/Ministry of Water Resources, Government of India should be enclosed.

12. Monitoring and Evaluation

(i) Regular monitoring of the project is to be carried out at each stage.Monitoring would include maintaining of both physical and financialProgress and the outcome. Monitoring would be done with the associationof the Coordination Cell of the State Govt. and standing committee of thePanchayat at the appropriate level.

(ii) The water bodies under RRR would also be monitored periodically onsample basis by Field Office of Central Water Commission.

(iii) Baseline survey would be conducted before the commencement of theproject execution. Evaluation and impact assessment of the scheme will bedone by independent agencies to be identified by the Ministry of WaterResources. Necessary reports and field visits are to be made on regularbasis for the purpose.

(iv) The State Government shall monitor the quality of works as per therelevant BIS codes through the agency independent of the executingagency.

(v) Concurrent evaluation is to be done by the State Government themselves byinvolving independent agencies which may include IIMs and IITs.

Preparation of Cost Estimate for Irrigation, Flood Management and Multipurpose Projects

Cost estimate of River Valley Projects is a prerequisite for the investment clearance of the project proposal. It is one vital aspect of Detailed Project Report (DPR). Further, cost estimate for the ongoing projects become essential when the total cost of the project exceeds 15% of the earlier approved cost, excluding the price escalation or there is some change in scope in the project. This estimate is technically termed as Revised Cost Estimate (RCE). After the completion of the project i.e., commissioning of the project, completion cost of the project is also prepared. The above three stages are applicable in case of a public sector projects. The estimated cost is tagged with a year and no escalation is considered. However, for private sector project, cost estimate at the DPR stage is prepared and total cost of the project is projected and finalized with reasonable interest during construction (IDC) and financing.

For the preparation of cost estimate of a river valley project at DPR stage, many an approximations are considered based on the past experiences and experiences from the nearby projects. Cost estimation of a DPR involves many a technological considerations like design, quantity estimation, equipment planning etc. At the DPR stage detailed design and quantity estimation are not done and some tentative calculations are only made. Based on the site conditions there may be many a variations. Still, cost estimate gives a standard idea about the technical viability of the project and helps to plan the implementation of the project with reasonability and means.

The preparation of cost estimate of a DPR is a lengthy work and involves many a calculations and specifications for wide variety of items of works and machinery. Basic inputs are quantity estimation and equipment planning besides the unit cost of material and manpower (skilled/semiskilled/unskilled). For detailed calculation the following references are very much important.

(1) Report of Committee of Cost Control of River Valley Projects, Vol-II, 1981
(2) CWC Guidelines for Preparation of Project Estimates for River Valley Projects, 1997
(3) CWC Guide Book on use rate, Hire charges and transfer value of Equipment and spare parts, Dec.1988
(4) Guidelines for Formulation of Detailed Project Reports for Hydro Electric Schemes, their Acceptance and Examination for concurrence, CEA, 2012(Revision-3)
(5) Indian Standard IS: 4877 “Guide for Preparation of Estimate for River Valley Projects”.

UNITS

According to the BIS Standard mentioned above, the project works have to be grouped into
the following units:

a) Unit-I - Headworks including main dam and auxiliary dam, dykes, spillway, outlet works, energy dissipation devices, barrages, weirs, regulators including intake structures and diversion works.
b) *Unit II*-Main canals, branches, and distribution system inclusive of all pucca works.
c) *Unit III*-Hydro-electric installation
1) Power Plant and appurtenant works:
i) Civil works, and
ii) Power equipment.
2) Transmission lines.
3) Sub-stations.
d) *Unit IV* - Navigation works.
e) *Unit V* - Water supply works.

HEADS

Each unit should be covered under the following minor heads classified as *direct* and *indirect*
charges.

Direct Charges

These shall include the following:

I. Works.
II. Establishment,
III.Tools and Plant.
IV. Suspense.
V. Receipts and recoveries on capital account.

Indirect Charges

These shall include the following:

a) Capitalized value of abatement of land revenue,and
b) Audit and account charges.

The provisions under the Minor head I-Works will be sub-divided under the following detailed sub-heads:

A- Preliminary
B- Land
i) Acquisition & Compensation
ii) Rehabilitation and resettlement

C- Works
D- Regulators and measuring devices (for canals only)
E- Falls (for canals only)
F- Cross drainage works (for canals only).
G- Bridges (for canals only)
H- Escapes (for canals only)
I- Navigation works.
J- Power Plant Civil Works.
K- Buildings.
L- (for canals only)
i) Earthwork;
ii) Lining and
iii) Service Road.

M- Plantation.
N- Tanks and reservoirs.
O- Miscellaneous.
P- Maintenance.
Q- Special T & P.
R- Communications.
S- Power Plant and electrical Mechanical System.
T- Water Supply Works.
U- Distributaries minors and subminors.
V- Water courses.
W- Drainage (to be clubbed with Environment & Ecology)
X- Environment and ecology.
Y- Losses on stock.

ABSTRACT OF COST

Detailed Abstract of cost

TO work out the total cost of the project in detail the cost of various units mentioned above should be compiled in a tabular form according to the accounts heads.

General Abstract of cost

On the basis of the detailed abstract of cost as above, general abstract of cost for the whole project tabulating all the units together may be compiled by minor and detailed heads.

EXAMINATION OF PROJECT ESTIMATES IN CWC

Under the procedure laid down by the Planning Commission, all major irrigation & multipurpose project reports including cost estimates received from the State Govts. /Union Territories have to be examined in detail by CWC and put up to the Advisory Committee of the Ministry of Water Resources for acceptance. After these schemes are accepted by the Advisory Committee, the investment clearance is issued. Thereafter, during implementation of the projects, if the cost exceeds 15% of the original approved cost including escalation due to price rise or where there is change in scope i.e. change in project parameters resulting in changes in nature and benefits such as CCA, installed capacity, energy generation etc., then a revised estimate for the project has to be submitted by the State and the estimate examined afresh for necessary clearance by CWC/Advisory Committee etc.

Feasibility estimates generally known as project estimates provide the basis for authorization of the project for construction and for the appropriation of construction funds. These estimates should be in enough detail to show the quantity, unit cost and total costs of various works and supply items.

Engineering surveys, geological explorations and similar works accomplished during the feasibility investigations are usually carried out to the extent needed to enable at least, a tentative layout to be prepared for the purpose of sound cost estimate and to prove the feasibility of the project. CWC has laid down guidelines for the minimum investigations to be done for formulation and submission of Irrigation and H.E.Projects. It is necessary that these guidelines are followed and the prescribed investigations are done to arrive at realistic estimates.

In the feasibility estimates, cost of major items is best worked out in detail on the basis of preliminary layouts and designs and unit rates which should be analyzed for the project in question. Smaller items may be computed from cost graphs and parametric rates.

PREPARATION OF ESTIMATE

The capital cost of a project includes all cost associated with investigations, design, construction and maintenance during construction period of the project. For preparation of cost estimates of civil works, the unit costs of labour, materials and equipment necessary to perform the work designated in the various pay-items for the proposed construction shall be determined. Current unit cost shall be used in all estimates and price level of the project estimate shall be mentioned.

The analysis of rates for various items shall be worked out taking into consideration the cost of materials, carriage-handling-storing, labour and share of machines involved in executing various items of the work and overhead charges.

The quantitative assessment of material requirement shall be adopted from authoritative books/publications or through independent calculations based on the data available at site or other projects. The unit cost of various materials may be taken as those prevalent in the State/ region. The appropriate cost for freight, unloading, cartage, storage, inspection and testing should also be included.

The wages of workers are periodically revised by the State under the statutory labour laws. Daily wage rates, therefore, shall be taken as those prevalent in the State at the time of formulation of the project.

For working out the use rates of machinery, the norms for life, depreciation, repair provision etc. shall be adopted as recommended by the latest CWC Guide Book on use rate, hire charges and transfer value of equipment and spare parts. Price of various equipments should be taken on the basis of recent quotations/ price list of such equipment. All taxes and freight charges should be taken into consideration while arriving at the cost of equipment at site.

Provision for contingencies and work-charged establishment is generally considered up to 3% and 2% respectively of the works' cost and provided in the detailed works estimates prepared on the heads of items rates and quantities of works to be executed. These percentage provisions should not be considered on lump-sum items.

Mention shall also be made regarding communication facilities available, terrain through which the roads are passing (hilly, plain etc.), type of road (Black top, water bound macadam, murum, kacha etc.). Suitable provisions for overhead charges and profit of the contractor has to be kept in the estimate. Since it is difficult to identify overheads and profits precisely, both these together may be provided @ 20% of the prime cost/or as per State Govt. norms in the analysis of rates. In the case of departmental works it is expected that additional departmental charges would also be about 20%. Any location specific incentives given for developing projects by States/ Union Govts should be considered in the estimate. Specific mention in this regard may also be made in the abstract of the estimate. In case of works let out on contract, the provision for II-establishment including leave and pensionary charges is generally of the order of 8 to 10 % for concentrated works and 10 to 12 % for scattered works like canals. For works to be executed departmentally the provisions could be higher than those given above say 12 to 15 %. For Hydro Electric

projects, the provisions for II-Establishment may be considered as per the latest CEA guidelines.

Project estimates are to be prepared on the basis of current costs without making any provision for future increase in price during the period of execution of the project. No allowance on future price escalation is to be considered as per government policy. However, in the case of private sector power projects, total completed project cost, including interest during construction (IDC) and financing costs, has to be arrived at before considering the project for execution.

INFORMATION TO BE GIVEN IN THE ESTIMATE

The following information is generally covered in the report of an estimate

1. Scope
2. Method of construction
3. Construction plant
4. Establishment
5. Land and resettlement of oustees
6. Time
7. Construction materials
8. Communications
9. Other public facilities
10. Labour
11. Diversion arrangement

The following documents are to be accompanied with the estimate.

1. Index map of the project, general layout and preliminary Drawings of important structures.
2. Single line diagram and layout drawings of Power House and Switchyard (applicable for Power Project only).
3. Brief specifications of work.
4. Details of micro planning for distributries, minors, water courses and drainage for 10% of the total area of the command in the case of Irrigation scheme.
5. A schedule of prevailing basic labour wages.
6. A schedule of prevailing basic cost of materials supported by analysis wherever necessary.
7. A schedule of prevailing transport rates supported by analysis wherever necessary.
8. Basic out-puts of men and machines assumed for estimating the cost.
9. Use rates of equipment supported by their analysis.
10. Analysis of unit rates of various works.
11. Copy of the latest schedule of rates of the district in which the project is located.
12. Relevant certificates from concerned Authorities/Departments.

The list is not exhaustive. Necessary supporting documents which differ from project to project may have to be attached with the estimate for transparency and future reference.

REVISED COST ESTIMATE (RCE)

In the case of major and multipurpose projects which have been approved by the Planning Commission and where the revised estimates of the project have increased by more than 15% of the original estimates, excluding escalation due to price rise or where there is

change in scope, be required to be furnished to CWC for examination in the same way as-new major and multi-purpose schemes irrespective of the fact whether the revision is due to change in scope or not. The procedure for scrutiny for such revised project estimates shall be same as for the new projects

In respect of revised project estimates where there is no change in the scope and where the cost excluding escalation due to price rise has not changed by more than 15%, the State Government need not forward a detailed estimate for examination at Centre. For such projects the State Government should send to CWC an excess note after obtaining the concurrence of the State Finance Department giving the abstract of cost under major sub head indicating the excess cost over the sanctioned cost and giving reasons thereof. The note will include the salient features of the project as originally proposed and as being executed at site. The CWC will examine such estimates broadly and send its views to the Advisory Committee for consideration and recommendation of the Planning Commission.

In the case of projects which undergo modification and revision subsequent to their pproval, the information required to be submitted to Planning Commission should be submitted in good time so that approval for the revised scheme is received from the Planning commission before any additional commitments over and above the sanctioned project estimate are made in respect of them.

The revised estimate should also include variation statement showing the variation in cost of different sub heads. Quantities and rates of important items should be furnished. Other items should be included as miscellaneous in the total cost. The revised estimate should also include an analysis of the reasons for the increase in cost of different sub heads as detailed below:

1. Rise in prices including variation due to exchange rate.
2. Rise due to change in scope.
3. Rise due to inadequate provisions in earlier estimate.
4. rise due to change in design
5. Additional requirements/new items.
6. Rise due to other causes such as inadequate plan allocation, arbitration, legal cases, poor performance of equipment, procurement problems etc.

When revised estimates are prepared during construction, the quantities of items completed should be indicated separately and the cost thereof assessed on the basis if actual expenditure. Any liability arising out of the contract for completed work and affecting the cost should also be considered in the estimate. For works in progress the estimates should be based in contract rates. If the contract document contains any clause for escalation on the prices of materials and labour wages subsequent to the award of contract, the amount involved should be assessed and included in the estimate. For the balance work to be done, the cost should be estimated on the basis of rates prevalent at the time of the preparation of the revised estimates.

ECONOMIC EVALUATION OF IRRIGATION, FLOOD MANAGEMENT AND MULTIPURPOSE PROJECTS

1. Introduction:

Economic evaluation of the project is basically an investment decision guided by cost estimate of the project on one side and the benefits expected to flow by such investments on the other. Different policy decisions adopted by various countries / agencies govern criteria to be used for assessing the economic viability of the projects.

Though the irrigation projects were earlier evaluated on the basis of rate of return criteria, a need was however felt that irrigation project in an area should not only be viewed as source of income to the Govt. but as a means for increased agricultural produce and economic development of that area and in the process, of the country as a whole.

2. Evolution of Criteria for Economic Evaluation

2.1 Pre-Independence- Development of financial policy

Systematic irrigation development took place during British era. However, at that time irrigation systems were considered as commercial ventures like any other infrastructure projects. The feasibility of irrigation projects essentially evolved from the concept of financial soundness of public investment. The beginning of financial policy can be traced to the period of rapid expansion of irrigation towards the close of last century with the acceptance of the proposal for construction of irrigation works through loan funds. The Select Committee on Indian Public Works reporting to the House of Commons in 1879 said:

" The financial results of works of irrigation are in the opinion of your committee, the best test of their utility. A rail road may traverse between its termini certain districts which it does not materially improve, yet the work may on the whole, be beneficial, to the country. Unless, however, an irrigation work benefits the immediate locality in which it is placed, it can be of no use to outside districts."

The committee further observed that:

"the construction of new works from borrowed money for the future be limited to those schemes alone which upon the responsibility of the Government are estimated to be productive by yielding an annual income equal to the interest in the capital expended on their construction including in such capital interest during construction."

This recommendation of the Committee then formed the basis for selection of irrigation projects.

First Indian Irrigation Commission (1901-1903) at the turn of the century also gave full consideration to the financial aspects of irrigation works. The Commission in its report made a brief mention of the selection criteria in vogue at that time which reads as

"An irrigation work is classed as productive and sanctioned against loan funds when it has shown to the satisfaction of the Secretary of state that it is likely to fulfil the conditions of productive public work, that is to yield a net revenue 10 years after completion, sufficient to cover interest charges on the sum at charge at that date. By sum at charge is meant the total direct and indirect capital cost plus the excess, if any, of interest charges to date over the net revenue."

2.2 Productivity rate:

The productivity of a scheme was judged with reference to the rate of return earned by it on full development. The criterion for the sanction of irrigation projects was based on financial results which were estimated as follows:

i) The capital cost of any work was taken as the sum actually spent on its construction;
ii) The revenue on account of direct receipt and indirect receipt was estimated;
iii) The revenue account was debited yearly with
  (a) the simple interest on the capital cost of the works at the commencement of the year; and
  (b) The working expenses of the year.
iv) The revenue account was credited yearly with
  (a) the direct receipts
  (b) the indirect receipts.

The difference between (iv) and (iii) above for any year gives the profit or loss for that year.

The acceptable value of 'productivity rate' was linked to prevailing Rate of interest and thus varied from time to time. The productivity rate varied between 4 to 6 percent on works sanctioned during the period 1919 to 1937. Government of India Act., was introduced in 1935. After April, 1937, Government of India prescribed Rate of Return as 6 percent as acceptable limit for sanction of projects. However, recognising the importance of irrigation to meet the food and fibre requirement of the public at large, most of the

Provinces reduced the productivity rate to 4 percent though the rate prescribed by the Government of India continued to be higher at 6 percent. This inter-alia helped in taking up more number of projects which otherwise would have failed to satisfy the prevailing financial criterion.

Schemes were sanctioned only if they satisfied the test of financial viability defined in terms of the rate of return. The financial viability test was rigidly applied to all irrigation projects Earlier large irrigation schemes were mostly diversion works and were relatively inexpensive. When new schemes were taken up, it was felt that the development of irrigation was being held up by the rigid application of the financial criterion, namely 6 percent between 1921 and 1949. Noting that apart from direct irrigation revenues, other benefits accrued to the Government in the shape of increased revenue from excise duties, income tax, sales tax, transport etc., The Central Board of Irrigation thus passed a resolution at its annual meeting held in 1936 stating that "as the expansion of irrigation is seriously handicapped by the restricted view taken of the value of irrigation, an economic survey should be carried out with a view to estimate the direct and indirect financial benefits accruing to the Central and Local Governments from Irrigation Projects". Even if studies showed that the indirect benefits of irrigation projects were substantial, criteria for selection of projects has to be acceptable value of rate of return. However, a view was taken that if a project did not fulfil the financial criterion, but was still considered necessary in the public interest, it could be sanctioned as a protective work.

Number of irrigation projects which failed to satisfy the financial criterion were accordingly taken up as protective works.

2.3 Plan era

After independence there was a change in the approach to the irrigation projects and these projects were viewed as investment in the development and social benefit where profit was not the sole motive. Sanction criteria was thus relaxed so that large number of projects could be taken up in order to meet the food and fibre requirements of ever growing population.

Rate of return on the capital outlay for classifying a capital work as productive was accordingly reduced to 3.75 percent. This rate continued upto the year 1954 and was applied to all projects financed by the Central Government as also for determining productivity of State irrigation works for which loans were obtained from the Centre. Subsequently, the rate was raised to 4.5 per cent and this rate continued up to March, 1960.

3. B.C.Ratio:

During First and Second Five Year Plans a large number of irrigation projects were taken up. It was observed that these projects could not satisfy the prevailing criterion of direct financial returns to the Government. However, it was felt that irrigation project in an area should not only be viewed as source of income to the Govt. but as a means for increased agricultural produce and economic development of that area and in the process, of the country as a whole. A need was therefore, felt to have full understanding of the various aspects of an irrigation project. Accordingly, in 1958, the Planning Commission initiated studies of some of the major projects to assess the overall benefits of the irrigation projects and to find a more appropriate criterion for deciding whether various irrigation projects should be undertaken. These studies were carried out under the Committee of Direction headed by Prof. D.R.Gadgil. These studies showed that large benefits accrued from irrigation in terms of double cropping, diversification and better quality crops, higher yields, larger income and greater opportunities of employment. Indirect benefits that accrued were the establishment of processing industries, expansion of consumer industries, retail trade, transport and communications. The Committee was of the view that total benefits from irrigation were far larger that the direct financial returns accruing to Government from water rates and betterment levy. The Committee, therefore, recommended that in future the concept of benefit cost ratio should be used for assessing the feasibility of new projects instead of the traditional criterion of the direct financial return to the Government. During the cause of whole exercise, the Committee studied the issue of direct i.e. primary benefits and primary cost and indirect i.e. secondary/ tertiary benefits and indirect cost separately. The committee was of the view that whereas it may be easy to work out the direct benefit i.e. increase in agricultural produce due to irrigation, it may not be so in case of indirect benefits. Secondary benefits are complementary in nature and are linked to overall developments of the area and as such it is difficult to quantify benefits exclusively attributable to irrigation. For simplicity, therefore, it was considered that the indirect or secondary benefits and cost need not be taken into account. The net annual benefit was to be worked out as the difference between the monetary value of the net agricultural production (total value of produce-cost of cultivation) 'before' and 'after' the introduction of irrigation. The annual cost should be taken to comprise the annual interest on capital, depreciation and expenditure on maintenance and operation.

Gadgil Committee report was submitted in 1964 wherein it was recommended that the economic benefit criterion should be adopted for sanctioning irrigation projects instead of the financial criterion. The Government accepted this recommendations and benefit cost ratio criterion has been adopted. Benefit-Cost Ratio criterion for judging the economic soundness of irrigation projects is in practice till date.

B.C. ratio is obtained by dividing the annual benefits by the annual cost. Net annual benefit is estimated as the difference in the net value of agricultural produce "before" and "after" irrigation. The annual cost in the denominator comprise (a) interest on capital cost of the project at the rate of ten percent per annum (b) depreciation charges at the rate of 1 percent in case of projects having 100 years life say storage scheme and 2% in case life of the project is considered as 50 years and (c) operation and maintenance expenses. Irrigation projects with B.C. ratio greater than 1.5 are considered acceptable from economic point of view. Benefit Cost ratio of 1.5 instead of 1.0 was suggested as a prudent precaution against likely increase in cost of the project. Subsequently acceptable value (B.C. ratio) was reduced to 1.0 for irrigation projects in drought prone areas. Further, for following categories of projects, B. C. ratio for acceptability of the project will be 1.0 instead of 1.5.

(a) For major and medium irrigation projects in special category states i. e.North eastern states, Sikkim, Uttranchal, Jammu & Kashmir and HimachalPradesh.

(b) Major and medium irrigation projects benefitting areas where 100% of the beneficiaries belong to SC/ST category or 75% of the beneficiaries belong to ST category.

The methodology for computing B.C. ratio shown in the format enclosed at Annexure I.

ESTIMATION OF B.C. RATIO FOR IRRIGATION PROJECTS

► B.C. ratio is obtained by dividing the annual benefits by the annual cost.

► Estimation of Irrigation Benefits

The net annual benefit is worked out as the difference between the monetary value of the net agricultural production (total value of produce- cost of cultivation) 'after' and 'before' the introduction of irrigation.

- Value of produce comprises of gross value of both farm produce and byproducts.
- Cost of cultivation includes expenditure on seeds, manure/fertilizers, pesticides, hired labour/equipments, depreciation, cash and share rent, Government taxes/ levies etc.

Estimation of Benefits other than Irrigation

(i) Drinking / Industrial water supply

If there is a specific reservation in storage of the reservoir, the proportionate cost of the dam be allocated to drinking/industrial water supply & the cost be excluded from the cost of the project for irrigation. Alternatively, the quantum of water supplied to the municipalities /industries be charged at the rates fixed by the Government or agreed to with the parties concerned & amount be considered as benefit.

iii) Pisciculture

The reservoir can be used for pisciculture. The output per ha of the reservoir area (average of the area at FRL and MDDL can be considered) can be estimated & its value after deducting the expenditure at the prevalent market rate is to be considered as a benefit due to the project. In this case there is no specific water allocation for it and it is an incidental benefit. However, if pisciculture is to be practiced in ponds fed by canals, water requirement can be estimated and provided for. Benefit may be considered in the similar way as from the reservoir.

iv) Animal husbandry

If any major farms are proposed in the project & water is to be supplied from the project, the net income may be considered as benefit. Augmentation of income of the farmers as a result of introduction of irrigation is difficult to estimate and need not be considered.

v) Hydro power

Generally, if power generation is proposed from the project, proportionate cost of the common works is allocated to power sector & B.C. Ratio for irrigation is calculated with remaining cost of the project.

vi) Catchment area treatment

This helps in restricting the soil erosion and augment water availability in the catchment area. This results in improvement in productivity of land. Increased yield from direct draining area may be estimated and included in the benefits. Its cost is already included in the project cost. Presently, however, this benefit is not being reflected in the DPRs.

vii) Canal bank plantation/reservoir territory afforestation

The benefits are easy to estimate and must be included in the benefits. Presently, however, this benefit is not being reflected in the DPRs.

Note:- Yield/ha and the prices to be used for converting the benefits into monetary terms shall be obtained from the State Department of Agriculture, Pisciculture & Forests. They would also furnish the basis for recommending the yields/ha under pre and post project conditions and prices to be used.

► The annual cost in the denominator comprise (a) interest on capital cost of the project at the prevailing rate. Cost of the project include Cost of land development (b) depreciation charges at the rate of 1 percent assuming 100 years as life of project (c) maintenance of Head Works @ 1% of the cost (d) operation and maintenance expenses

For lift schemes annual cost shall also include:

(i) Depreciation of the pumping system @ 8.33% of the estimated cost, assuming life of the system as 12 years.
(ii) Depreciation of the raising mains @ 3.33 % of the estimated cost, assuming life as 30 years.
(iii) Charges of the power.

ESTIMATION OF B.C. RATIO FOR FLOOD MANAGEMENT PROJECTS

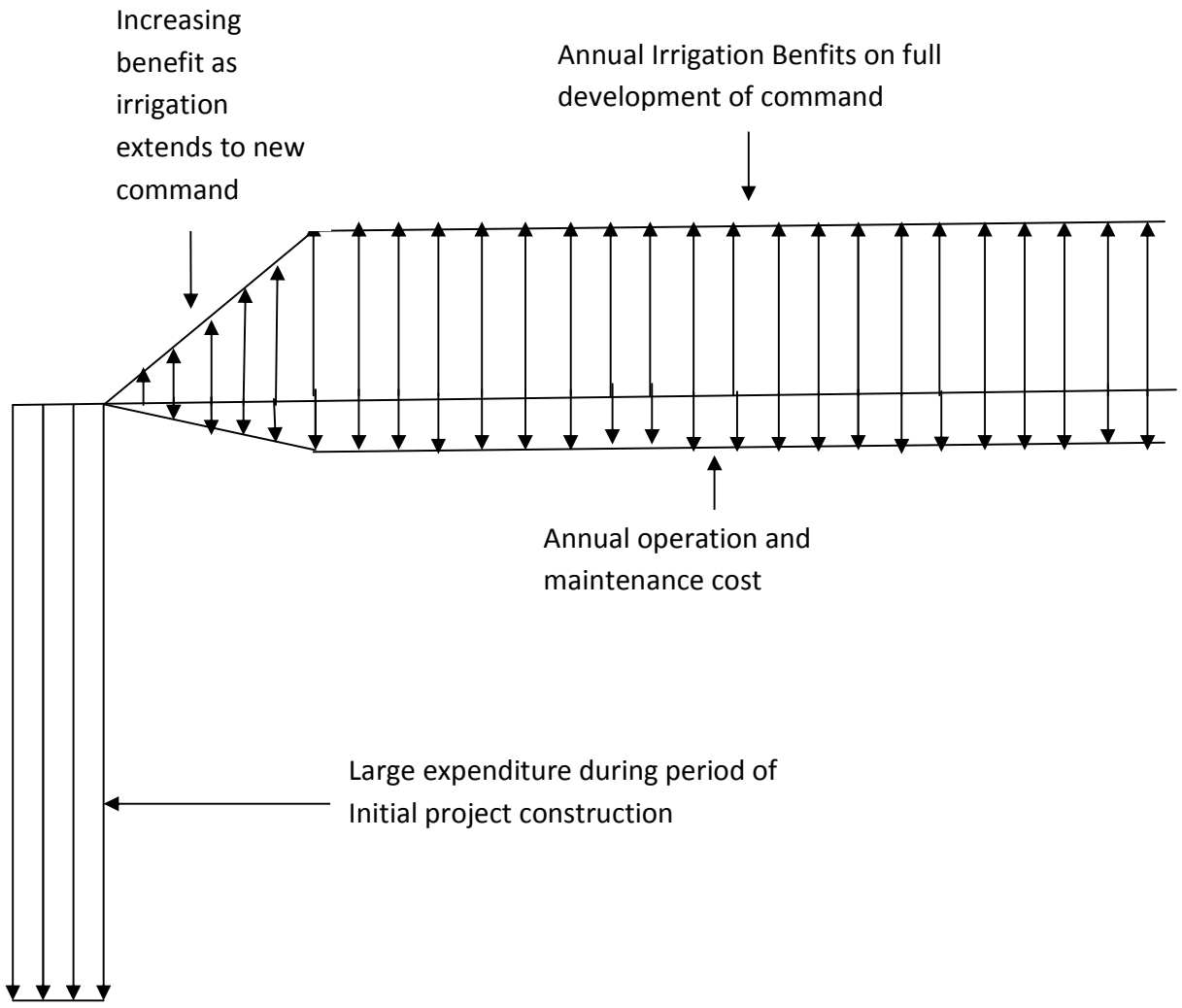
B.C. ratio should be worked out on prescribed standard and annual loss supported by documents from the revenue department of the State. Average annual damage should be computed on the basis of at least last 10 years data. B.C. Ratio calculation for flood management component of the project is worked out as under.

(i) Average annual damage computed on the basis of at least last 10 years data.
(ii) Average annual damage anticipated after the execution of the project.
(iii) Saving in annual damage {Item (i) and item (ii)}.
(iv) Annual cost of flood management component.
  (a) 12% of allocate cost of dam
  (b) 16% of allocated cost of embankment
  (c) 17% allocated cost for anti-erosion schemes
  (d) Total annual cost a+ b +c).

$$\text{B.C.Ratio} = \frac{\text{Item (iii)}}{\text{Item (iv)}}$$

4. Internal Rate of Return:

For World Bank aided project it is obligatory to work out Internal Rate of Return also beside B.C. ratio. Calculation of IRR is undertaken to reflect the further cost involved in long gestation that takes place during the construction. Cash flow diagram for a hypothetical irrigation project is indicated below. Irrigation development over large area is a slow process and projections of progress to assess flow of benefits and the stream of realisable benefits finds place in the I.R.R. analysis. The IRR is calculated as per profroma enclosed at Annexure II.



Cash Flow Diagram for Hypothetical Irrigation Project

B.C.Ratio **(Rs. In Lacs)**

			PRE PROJECT	POST PROJECT
A		**GROSS RECEIPTS**		
	1	**GROSS VALUE OF FARM PRODUCE**		
	2	**DUNG RECIEPT(30% OF B6)**		
	3	**TOTAL (A) GROSS RECEIPTS**		
B		**EXPENSES**		
	1	**EXPENDITURE ON SEEDS**		
	2	**EXPENDITURE ON MANURE**		
	3	**EXPENDITURE ON FERTILISERS**		
	4	**EXPENDITURE ON PESTICIDES**		
	5	**EXPENDITURE ON HIRED LABOUR**		
	6	**FODDER EXPENSES (15% FOR PRE AND 10% FOR POST PROJECT OF A1)**		
	7	**DEPRECIATION (2.7% OF A1)**		
	8	**SHARE AND CASH RENT(5% FOR PRE AND 3% FOR POST PROJECT OF A1)**		
	9	**LAND REVENUE (2% OF A1)**		
		TOTAL (B) EXPENSES		

C		**NET VALUE OF FARM PRODUCE**
	1	**TOTAL GROSS RECEIPTS**
	2	**TOTAL EXPENSES**
		NET VALUE (1-2)
D		**ANNUAL BENEFITS**
	1	**NET VALUE OF PRODUCE AFTER PROJECT**
	2	**NET VALUE OF PRODUCE BEFORE PROJECT**
	3	**ANNUAL BENEFIT (1-2)**
		COST OF THE PROJECT
	(a)	**CAPITAL COST (After apportionment)**
	(b)	**COST OF LAND DEVELOPMENT @ Rs 2000/- per ha of CCA - ha**
		Total
E		**ANNUAL COST**
	1	**INTEREST ON TOTAL COST**
	2	**DEPRRICIATION OF THE PROJECT @ 1 % OF THE CAPITAL COST**
	3	**O & M CHARGES @ Rs 600/- PER HA ON ha**
	4	**MAINTENANCE OF HEAD WORKS @ 1% OF THE COST OF Head Works of lac Rs.**
	5	**TOTAL ANNUAL COST**

B. C. RATIO (D3/E5)

Estimated value of Produce and cost of inputs before Irrigation

Cost of inputs

S. No.	Crops	Area (ha)	Cost of inputs per hectare						Total cost in lakh Rs.
			Seed	Manure	Fertilisers	Pesticides	Labour	Total	
	Kharif								
1									
2									
3									
4									
5									
6									
	Rabi								
1									
2									
3									
4									
5									
6									
	Total								

Estimated value of Produce before Irrigation

S.No.	Crops	Area (ha)	Yield (Qtls./ha)	Rate Rs./Qtl.		Receipt (lac Rs.)		Total Value of Produce (lac Rs.)
				Levy	Market	Levy	Market	
	Kharif							
1								
2								
3								
4								
5								
6								
	Rabi							
1								
2								
3								
4								
5								
6								
	Total							

Estimated value of Produce and cost of inputs after Irrigation

Cost of inputs

S. No.	Crops	Area (ha)	Cost of inputs per hectare						Total cost in lakh Rs.
			Seed	Manure	Fertilisers	Pesticides	Labour	Total	
	Kharif								
1									
2									
3									
4									
5									
6									
7									
	Rabi								
1									
2									
3									
4									
5									

Total

Estimated value of Produce after Irrigation

S.No.	Crops	Area (ha)	Yield (Qtls./ha)	Rate Rs./Qtl.		Receipt (lac Rs.)		Total Value of Produce (lac Rs.)
				Levy	Market	Levy	Market	
	Kharif							
1								
2								
3								
4								
5								
6								
7								
	Rabi							
1								
2								
3								
4								
5								

Total

Internal Rate of return

Sl.No.	Year (at the end of)	Project Cost Incured during the year	CCA Developed		O&M Cost per ha	Total Cost (Col.3 + Col.6)	Benefit	Net Cash Flow (Col.8-Col.7)	Discount Factor		Net Present Benefit	
			%age	Area in ha					With A% rate	With B% rate	With A% rate	With B% rate
1	2	3	4	5	6	7	8	9	10	11	12	13
1	1											
2	2											
3	3											
4	4											
5	5											
6	6											
7	7											
8	8											
9	9											
10	10											

Upto 50 (For Medium Projecs)
Upto 100(For Major Projecs)

I.R.R = Discount rate(A) = (Total of Col.12) / (Arithmetic sum of Col.12 & Col13) X (Difference of rate of Col.11-Col.10)

APPRAISAL OF IRRIGATION PROJECTS BY CENTRAL WATER COMMISSION

PRESENTED BY
PRAMOD NARAYAN
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16th March 2015, HIRMI, KURUSHETRA

PROCESS OF PROJECT APPRAISAL IN CENTRAL WATER COMMISSION IS BASED ON PROJECT PROPOSAL PREPARED

GUIDELINES FOR SUBMISSION, APPRAISAL AND CLEARANCE OF IRRIGATION AND MULTIPURPOSE PROJECTS 2010

CATEGORISATION OF IRRIGATION PROJECTS

- MINOR PROJECTS – CULTURABLE COMMAND AREA UPTO 2000 ha
- MEDIUM PROJECTS – CULTURABLE COMMAND AREA MORE THAN 2000 ha AND UPTO 10000 ha
- MAJOR PROJECTS – CULTURABLE COMMAND AREA MORE THAN 10000 ha

APPRAISAL IN CENTRAL WATER COMMISSION

- MINOR PROJECTS – Appraised in Field Unit of CWC and accepted by TAC of concern State
- MEDIUM PROJECTS – Appraised in Field Unit of CWC and accepted by Advisory Committee of MoWR
- MAJOR PROJECTS – Appraised in CWC HQ & accepted by Advisory Committee of MoWR

GUIDELINES OF APPRAISAL

- AS PER 2010-GUIDELINES, APPRAISAL OF IRRIGATION PROJECTS ARE CARRIED OUT IN TWO STAGES.
  1. PRELIMINARY REPORT
  2. DETAILED PROJECT REPORT (DPR)

APPRAISAL OF PRELIMINARY REPORT

- FOR APPRAISAL OF MAJOR & MULTIPURPOSE PROJECTS, 8 SETS OF PRELIMINARY REPORT IS SUBMITTED IN PAO, CWC HQ.
- FOR MEDIUM PROJECTS, REPORTS TO BE SUBMITTED TO REGIONAL OFFICE OF CWC.
- EIA REPORT, R&R PLAN AND BROAD COST ESTIMATE ALSO NEED TO BE SUBMITTED TO CONCERNED MINISTRIES / AGENCIES.
- APPLICATION FOR FOREST CLEARANCE, IF ANY MAY ALSO BE SUBMITTED TO MOEF.

APPRAISAL OF PRELIMINARY REPORT

- P.R. IS SCRUTINISED IN THE SPECIALISED DIRECTORATES FOR ASSESSING SOUNDNESS OF THE BASIC PLANNING OF PROJECT PROPOSAL.
- BASED ON THE RECOMMENDATIONS OF THE SPECIALISED DIRECTORATES, P.R. IS CONSIDERED BY **SCREENING COMMITTEE UNDER PAO, CWC**.
- IF REPORT FOUND ACCEPTABLE, "**IN PRINCIPLE" CONSENT OF CWC** FOR DPR PREPARATION IS COMMUNICATED TO PROJECT AUTHORITIES WHICH HAVE A **VALIDITY PERIOD OF THREE YEARS**.

PRELIMINARY REPORT

Preliminary Report should contain the chapters on:

i. **GENERAL**

This chapter would include the general information on project location, category, topo sheet (SOI), seismic zone, & complete address for correspondence.

ii. **GENERAL PLANNING**

It includes master plan for overall development of river basin, priority for proposed scheme in MP, alternative proposals with merits and demerits, the effect of the scheme on the riparian rights and existing upstream and downstream projects, provision for drinking & industrial requirement.

PRELIMINARY REPORT CONTD/…

iii. **INTER-STATE & INTERNATIONAL ASPECTS**:

Inter-state/international issues involved, if so, issues indentfied with present status of agreement/tribunal award with special focus on **(i) sharing of water, (ii) sharing of costs, (iii) sharing of benefits, (iv) acceptance of the submergence by the upstream state(s), (v) acceptance by u/s state(s) of** compensation of land coming under submergence, (vi) settlement of oustees and any other issue if so.

If there is no agreement between the states, the present position in this regard. Typical example is the Jamrani multipurpose project, UK.

PRELIMINARY REPORT CONTD/…

iv. **SURVEY & INVESTIGATIONS**

This chapter would include a **BRIEF PLAN** for detailed topographical surveys in respect of river, reservoir, head works, plant site and colonies, canals, major canal structure, power house, tunnels, adits, penstocks, command area for OFD and drainage works etc.

Geological investigation for reservoir, head works, major canal structures, regulators, tunnels, power house etc., seismic investigation, foundation investigation and construction material survey for the project should also be discussed in brief.

PRELIMINARY REPORT CONTD/...

v. **HYDROLOGY**

This chapter would include Index map showing locations of various hydrometric, climatic and rainfall stations, data availability, a brief note about consistency, processing and gap filling of the data, **AVAILABILITY OF WATER, Design flood including flood routing studies, backwater studies for inter-state submergence assessment, Sedimentation studies etc.**

PRELIMINARY REPORT CONTD/…

vi. **IRRIGATION PLANNING**

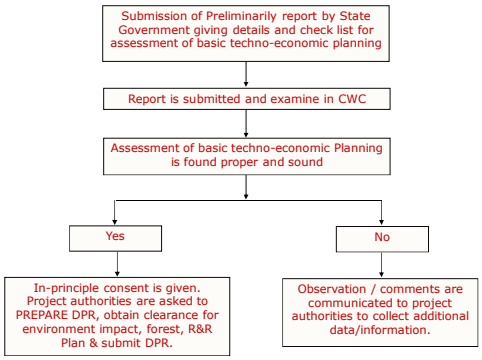
This chapter would include details about cropping pattern, crop water requirement, working table, success rate, conjunctive Use of surface & ground water etc.

vii. **PLANNING FOR OTHER INTENDED BENEFITS**

This chapter would include a brief of other benefits like **flood control and drainage, power, drinking water** etc.

vii. **ENVIRONMENTAL & ECOLOGICAL ASPECTS**

A brief about the location of project w.r.t. eco-sensitive zones, reserved wild life sanctuary & other critical environmental aspects



APPRAISAL OF DETAILED PROJECT REPORT (DPR)

- **12 SETS OF DPR** TO BE SUBMITTED IN PAO, CWC.
- IN RESPECT OF THE STATES WHERE **CDO DOS NOT EXIST**, DPR/PROFORMA REPORT EXAMINED IN DETAIL
- DPR TO BE PREPARED AS **"GUIDELINES FOR PREPARATION OF DPR OF IRRIGATION & MULTIPURPOSE PROJECTS, MoWR, 2010"**
- DPR MUST HAVE CHECK LIST, SALIENT FEATURES, ALL RELEVANT DETAILS, MAPS, ANNEXURES ETC.

APPRAISAL OF DETAILED PROJECT REPORT (DPR)

- IN RESPECT OF THE STATES WHERE **CDO EXIST**, A CERTIFICATE BY STATE TO BE APPENDED TO THAT EFFECT FOR THEIR COMPETENCY IN DESIGN.
- IN SUCH CASE, ONLY **8 SETS OF DPR** OF MAJOR PROJECTS ARE SUBMITTED:
  - ✓INTER-STATE ASPECT,
  - ✓BASIC PLANNING (GENERAL LAYOUT & DESIGN FEAURES)
  - ✓HYDROLOGY,
  - ✓COST ESTIMATE AND
  - ✓ECONOMIC ANALYSIS (BC RATIO)

EXISTING APPRAISAL TIMELINES

1.	PRELIMINARY REPORT	18 weeks
2.	DETAILED PROJECT REPORT	
2(a)	FOR THE STATES, WHERE CENTRAL DESIGN ORGANISATIONS (CDO) DO NOT EXIST	12 months
2(b)	FOR STATES, WHERE CDO EXIST	6 months

APPRAISAL OF DETAILED PROJECT REPORT (DPR)

SL. NO.	TECHNICAL ASPECT	AGENCY
1.	INTER-STATE ASPECTS	CWC
2.	HYDROLOGY	CWC
3.	CROPPING PATTERN, YIELD & OTHER AGRICULTURAL INPUTS	Min. of Agriculture
4.	IRRIGATION PLANNING	CWC
5.	CONJUNCTIVE USE OF SURFACE & GROUND WATER	CGWB
6.	SURVEY AND INVESTIGATIONS	CWC & GSI
7.	CONSTRUCTION MATERIALS	CSMRS
8.	CIVIL DESIGNS OF HYDRAULIC STRUCTURES (DAM/BARRAGE, WATER CONDUCTOR SYSTEM, POWER HOUSE ETC.)	CWC
9.	DESIGN OF HYDRO-MECHANICAL WORKS	CWC
10.	DESIGN OF CANAL AND DISTRIBUTION NETWORK	CWC

APPRAISAL OF DETAILED PROJECT REPORT (DPR)

SL. NO.	TECHNICAL ASPECT	AGENCY
11.	FLOOD CONTROL	CWC
12.	DAM SAFETY ISSUES INCLUDING SEISMIC DESIGN PARAMETERS	CWC
13.	CONSTRUCTION MACHINERY AND METHODOLOGY	CWC
14.	COST APPRAISAL	CWC
15.	ECONOMIC EVALUATION	CWC & ADVISOR COSTS M/O FINANCE
16.	INTERNATIONAL ISSUES	MOWR RELEVANT SMD
17.	POWER POTENTIAL & ELECTRO-MECHANICAL ASPECTS	CEA

APPRAISAL OF DETAILED PROJECT REPORT (DPR)

SL. NO.	STATUTORY CLEARANCE	AGENCY	RESPONSIBILITY
1.	FOREST	MOEF/STATE	PROJECT AUTHORITIES
2.	ENVIRONMENT, EMP & R &R	MOEF/STATE	PROJECT AUTHORITIES
3.	TRIBAL R&R	MIN. OF TRIBAL AFFAIRS, GOI	PROJECT AUTHORITIES
**	STATE FINANCE CONCURRENCE	STATE FINANCE DEPTT.	PROJECT AUTHORITIES

TIME FRAME FOR EXAMINATION OF PRELIMINARY REPORTS

CIRCULATION OF PRELIMINARY REPORT IN THE SPECIALIZED DIRECTORATES OF CWC FOR EXAMINATION.
(1 WEEK)

EXAMINATION IN CWC AND TRANSMISSION OF FIRST SET OF COMMENTS TO STATE.
(4 WEEKS)

SUBMISSION OF STATE'S REPLIES INCLUDING FURTHER STUDIES AND INVESTIGATION ETC TO CWC.
(4 WEEKS)

Sub-Total = 9 weeks

TIME LINES FOR EXAMINATION OF PRELIMINARY REPORTS

EXAMINATION OF STATE'S REPLIES AND DISCUSSION WITH THE PROJECT ENGINEERS (IF REQUIRED) FOR FINALIZATION OF PROJECT PROPOSALS
(6 WEEKS)

PREPARATION OF NOTE BY THE APPRAISAL DIRECTORATE FOR THE SCREENING COMMITTEE OF CWC FOR CONVEYING IN-PRINCIPLE CONSENT FOR PREPARATION OF DPR OR OTHERWISE.
(3 WEEKS)

SUB-TOTAL = 9 WEEKS

GRAND TOTAL = 18 WEEKS

FLOW CHART FOR EXAMINATION OF PROJECT REPORT (WITHOUT CDO)

PRELIMINARY EXAMINATION OF DPR AND CIRCULATION IN SPECIALIZED DIRECTORATES OF CWC / OTHER CENTRAL AGENCIES. (2 WEEKS)

EXAMINATION IN THE SPECIALIZED DIRECTORATES OF CWC/ AND TRANSMISSION OF FIRST SET OF COMMENTS. (8 WEEKS)

SUBMISSION OF REPLIES BY THE PROJECT AUTHORITIES TO THE COMMENTS RAISED BY THE APPRAISAL DIRECTORATES OF CWC/ OTHER CENTRAL AGENCIES. (8 WEEKS)

EXAMINATION OF REPLIES BY THE APPRAISAL DIRECTORATES OF CWC/ OTHER CENTRAL AGENCIES. (6 WEEKS)

SUB-TOTAL = 24 WEEKS

FLOW CHART FOR EXAMINATION OF PROJECT REPORT (WITHOUT CDO)

IF REPLIES ARE NOT FOUND SATISFACTORY, TRANSMISSION OF SECOND SET OF COMMENTS. (2 WEEKS)

SUBMISSION OF REPLIES BY THE PROJECT AUTHORITIES TO SECOND SET OF COMMENTS. (8 WEEKS)

EXAMINATION OF STATE'S FINAL REPLIES AND DISCUSSION WITH THE PROJECT ENGINEERS. (12 WEEKS)

PREPARATION OF NOTE BY THE APPRAISAL DIRECTORATES FOR THE ADVISORY COMMITTEE OF MOWR (6 WEEKS)

SUB-TOTAL = 28 WEEKS
GRAND TOTAL = 52 WEEKS (MAXIMUM)

FLOW CHART FOR EXAMINATION OF PROJECT REPORT (WITH CDO)

PRELIMINARY EXAMINATION OF DPR AND CIRCULATION IN SPECIALIZED DIRECTORATES OF CWC / OTHER CENTRAL AGENCIES. (1 WEEK)

EXAMINATION IN THE SPECIALIZED DIRECTORATES OF CWC/ AND TRANSMISSION OF FIRST SET OF COMMENTS. (4 WEEKS)

SUBMISSION OF REPLIES BY THE PROJECT AUTHORITIES TO THE COMMENTS RAISED BY THE APPRAISAL DIRECTORATES OF CWC/ OTHER CENTRAL AGENCIES. (4 WEEKS)

EXAMINATION OF REPLIES BY THE APPRAISAL DIRECTORATES OF CWC/ OTHER CENTRAL AGENCIES. (3 WEEKS)

SUB-TOTAL = 12 WEEKS

FLOW CHART FOR EXAMINATION OF PROJECT REPORT (WITH CDO)

IF REPLIES ARE NOT FOUND SATISFACTORY, TRANSMISSION OF SECOND SET OF COMMENTS. (1 WEEKS)

SUBMISSION OF REPLIES BY THE PROJECT AUTHORITIES TO SECOND SET OF COMMENTS. (4 WEEKS)

EXAMINATION OF STATE'S FINAL REPLIES AND DISCUSSION WITH THE PROJECT ENGINEERS. (6 WEEKS)

PREPARATION OF NOTE BY THE APPRAISAL DIRECTORATES FOR THE ADVISORY COMMITTEE OF MOWR (3 WEEKS)

SUB-TOTAL = 14 WEEKS
GRAND TOTAL = 26 WEEKS (MAXIMUM)

APPRAISAL OF MEDIUM PROJECT

- MEDIUM PROJECTS ARE EXAMINED BROADLY ON THE BASIS OF PROFORMA REPORT SUBMITTED BY THE STATE GOVERNMENT IN FIELD UNITS OF CWC.
- BROAD EXAMINATION COVERS THE FOLLOWING ASPECTS:
  - HYDROLOGY
  - IRRIGATION PLANNING
  - INTERNATIONAL/INTER-STATE ISSUES
  - BASIC DESIGN LAYOUT & SALIENT FEATURES
  - DIVERSION OF FOREST LAND
  - BROAD ENVIRONMENTAL SAFEGUARDS
  - REHABILITATION & RESETTLEMENT PLAN
  - COST ESTIMATE
  - ECONOMIC ANALYSIS

APPRAISAL OF MEDIUM PROJECT

- NECESSARY GUIDANCE/ASSISTANCE IS PROVIDED BY PAO, CWC TO FIELD UNITS IN CONNECTION WITH THE APPRAISAL OF MEDIUM PROJECT.
- NOTE FOR CONSIDERATTION OF ADVISORY COMMITTEE ARE PREPARED IN FIELD UNITS AND SUBMITTED TO PAO, CWC FOR APPROVAL OF MEMBER WP&P, CWC.
- DECISION ON TECHNO-ECONOMIC VIABILITY OF PROJECT IS TAKEN IN THE MEETING OF ADVISORY COMMITTEE.
- ON ACCEPTANCE BY THE ADVISORY COMMITTEE, THE PROJECT PROPOSAL IS RECOMMENDED FOR INVESTMENT CLEARANCE BY PLANNING COMMISSION.

APPRAISAL OF REVISED SCHEMES

- REVISED COST ESTIMATE (RCE) ARE SUBMITTED TO CWC FOR EXAMINATION IN CASE OF PROJECTS WHICH HAVE BEEN APPROVED BY THE PLANNING COMMISSION AND
  - WHERE THE COST OF THE PROJECT HAS INCREASED BY MORE THAN 15% OF THE ORIGINAL ESTIMATES, EXCLUDING PRICE-ESCALATION,
  - OR WHERE THERE IS CHANGE IN SCOPE I.E. CHANGE IN PROJECTS PARAMETERS RESULTING IN CHANGE IN NATURE AND BENEFITS SUCH AS CCA, INSTALLED CAPACITY, ENERGY GENERATION ETC.

APPRAISAL OF REVISED SCHEMES

- THE RCE MUST BE EXAMINED BY STATE STANDING COMMITTEE BEFORE SUBMISSION TO CWC.
- THE ESTIMATES SHOULD BE SUBMITTED TO CWC INCORPORATING THE ACTION TAKEN REPORT ON THE RECOMMENDATIONS OF THE STATE STANDING COMMITTEE.
- THE REVISED ESTIMATES FOR MEDIUM PROJECTS WITHOUT CHANGE IN SCOPE CAN BE APPROVED BY STATE UNDER INTIMATION TO CWC, MOWR AND PLANNING COMMISSION.
- IN THIS REGARD, STATE GOVERNMENT WILL HAVE TO FIRST SATISFY THE CWC THAT THERE IS NO CHANGE IN THE SCOPE OF THE PROJECT AND OBTAIN CLEARANCE FOR THIS BEFORE APPROVING REVISED COST.

APPRAISAL OF REVISED SCHEMES

- IF REQUIRED, CWC WILL CARRY OUT A SITE INSPECTION OF THE PROJECT BEFORE ISSUE OF NO OBJECTION CERTIFICATE.
- IF THE COSTS EXCLUDING PRICE ESCALATION HAVE NOT CHANGED BY MORE THAN 15% AND WHERE THERE IS NO CHANGE IN THE SCOPE, REVISED ESTIMATES ARE NOT REQUIRED TO BE FORWARD IN DETAIL TO CWC EXAMINATION.

APPRAISAL OF REVISED SCHEMES

- FOR SUCH PROJECTS/ESTIMATES THE STATE GOVT. SHOULD SEND PROJECT-WISE STATEMENT TO CWC HAVING:
  - ABSTRACT OF COSTS SHOWING EXCESS COSTS UNDER MAJOR SUB-HEADS OVER THE SANCTIONED COSTS,
  - REASONS THEREOF AND
  - CONCURRENCE OF THE STATE FINANCE DEPARTMENT.
- THE CWC WILL EXAMINE SUCH ESTIMATES BROADLY AND SEND ITS VIEWS TO THE ADVISORY COMMITTEE FOR CONSIDERATION,
- TIME FOR APPRAISAL AS WELL AS RESPONSE TIME OF STATE GOVERNMENT SHALL BE SAME.

APPRAISAL OF REVISED SCHEMES

- WHEN RCE IS PREPARED DURING CONSTRUCTION, THE QUANTITIES OF ITEMS COMPLETED SHOULD BE INDICATED SEPARATELY AND THE COST THEREOF ASSESSED ON THE BASIS OF ACTUAL EXPENDITURE.
- ANY LIABILITY ARISING OUT OF THE CONTRACT FOR THE COMPLETED WORK AND AFFECTING THE COST SHOULD ALSO BE CONSIDERED IN THE ESTIMATE.
- FOR WORKS IN PROGRESS, THE ESTIMATES SHOULD BE BASED ON CONTRACT RATES.
- CLAUSE FOR COST ESCALATION IN THE CONTRACT DOCUMENT SHOULD BE ASSESSED AND INCLUDED IN THE ESTIMATE.

APPRAISAL OF REVISED SCHEMES

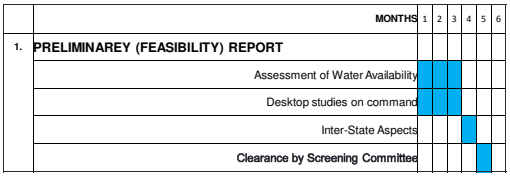
- FOR WORKS, NOT COVERED IN ANY CONTRACT, PREVAILING LOCAL RATES MAY BE TAKEN AS PER SCHEDULE OF RATES.
- FOR REMAINING ITEMS, RATES MAY BE ADOPTED ON THE BASIS OF ANALYSIS OF RATES, PREPARED IN ACCORDANCE WITH THE GUIDELINES ISSUED BY CWC.
- IN CASE OF ANY DOUBT, A CERTIFICATE FROM THE STATE/ PROJECT CHIEF ENGINEER, DULY JUSTIFYING REASONABILITY OF THE RATE, SHALL GENERALLY BE TAKEN AS FINAL AND ACCEPTABLE.

ECONOMIC CRITERIA

- ACCEPTABLE B.C. RATIO FOR IRRIGATION & MULTIPURPOSE PROJECTS IS:
  - 1.5. & ABOVE IN GENERAL AND
  - 1.0 & ABOVE IN CASE OF DROUGHT PRONE AREAS AND SPECIAL CATEGORY STATES.

PROPOSED FURTHER NEW DRAFT APPRAISAL GUIDELINES TO REDUCE DELAY

PRELIMINARY STAGE
TYPICAL BAR CHART SHOWING DIFFERENT ACTIVITIES TO BE CARRIED OUT BY PROJECT AUTHORITIES



PRE-DETAILED PROJECT REPORT
BAR CHART SHOWING DIFFERENT ACTIVITIES TO BE CARRIED OUT BY PROJECT AUTHORITIES FOR PREPARATION OF DPR

1.	NOC FROM STATE FOREST DEPARTMENT
2.	HYDROLOGICAL STUDIES
	a) Setting up Gauge & Discahrge site
	b) Hydrological Data Collection
	c) Design flood estimation in consultation with CWC
	d) Sedimentation Studies in consultation with CWC
	e) Finalisation & Submission of Hydrological Chapter
3.	SURVEY & INVESTIGATIONS
	a) Topographic survey & surface mapping in consultation with CWC & GSI
	b) Discussion with CWC, CSMRS & GSI for investigation, Desk Studies & identification of Alternatives
	c) Complete survey, Geophysical investigation, Drilling, Drifting etc., Phase-I
	d) Collection of land use data from revenue dept. etc. & compilation of existing irrigation data in the command
	e) Command area survey
	f) Discussion with CWC, CSMRS & GSI to finalize Investigations.
	g) Final Investigation Phase-II
	h) Submission of survey Reports
4.	ASSESSMENT OF ANNUAL REPLISHABLE GW & CLEARNCE BY CGWB
5.	IRRIGATION PLANNING
	a) soil survey
	b) Finalisation of proposed cropping pattern in consultation with MoA
	d) Crop Water Planning in consultation with CWC
	e) Simulation studies in consultation with CWC
	f) Finalisation & submission of Irrigation Planning Chapter
6.	SUBMISION OF LAYOUT, FINAL ALIGNMENTS UPTO DISTRIBUTARY LEVEL & BROAD SALIENT FEATURES
7.	SEISMICITY AND FIELD INVESTIGATIONS REPORT SUBMISSION
	Submission of Report/Proposal for Site specific Seismic design Parameters in case of large dam

PRE-DETAILED PROJECT REPORT
BAR CHART SHOWING DIFFERENT ACTIVITIES TO BE CARRIED OUT BY PROJECT AUTHORITIES FOR PREPARATION OF DPR

8.	CONSTRUCTION MATERIAL INVESTIGATIONS
	(a) Construction material survey & Investigations- Phase-I
	(b) Construction material Testing & Rock Testing - Phase-I
	(c) Construction material survey & Investigations- Phase-II
	(d) Construction material Testing & Rock Testing - Phase-II
	(e) Submission of Material Testing Reports
9.	FINALISATION OF DPR
10.	OBTAINING STATUTORY CLEARNCES BY PROJECT AUTHORITIES
	(a) Environment & Forest, MoEF
	(b) Tribal Affairs, MoTA

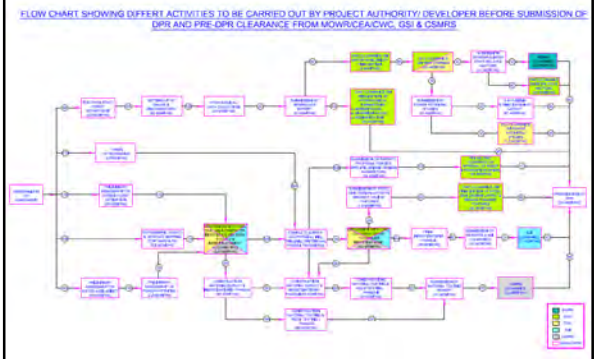
POST DETAILED PROJECT REPORT
ACTIVITIES TYPICAL BAR CHART SHOWING DIFFERENT ACTIVITIES TO BE CARRIED OUT BY CWC/ CEA/ MoWR/ GSI & CSMRS

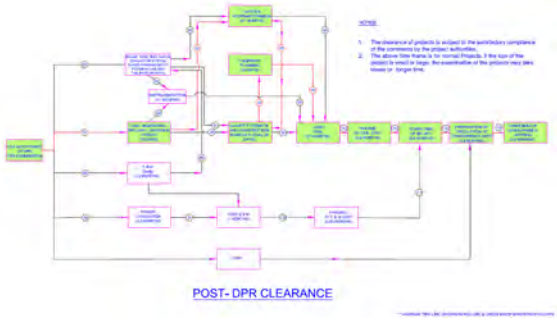
POST DETAILED PROJECT REPORT ACTIVITIES

TYPICAL BAR CHART SHOWING DIFFERENT ACTIVITIES TO BE CARRIED OUT BY CWC/ CEA/ MoWR/ GSI & CSMRS

	MONTHS
1.	HYDROLOGY CLEARENCE BY CWC
2.	IRRIGATION PLANNING CLEARANCE
3.	GEOLOGY CLEARANCE BY GSI
4.	CONSTRUCTION MATERIAL CLEARANCE BY CSMRS
5.	FINALIZATION LAYOUT AND BROAD SALIENT FEATURES
6.	SEISMICITY AND FIELD INVESTIGATIONS CLEARANCE
7.	FINALISATION OF DESIGNS
8.	FINALISATION OF COST
9.	FINALISATION OF B.C. RATIO
10.	MOWR CLEARNCVE FROM INTERNATIONAL ANGLE

FLOW CHART SHOWING DIFFERT ACTIVITIES TO BE CARRIED OUT BY PROJECT AUTHORITY/ DEVELOPER BEFORE SUBMISSION OF DPR AND PRE-DPR CLEARANCE FROM MOWR/CEA/CWC, GSI & CSMRS





FURTHER INITIATIVES

1. COMMUNICATION OF OBSERVATIONS OF CWC AND COMPLIANCES BY THE STATE GOVERNMENT THROUGH **E-MAIL/FAX**
2. **WEB-ENABLED SYSTEM** IS UNDER DEVELOPMENT FOR COMMUNICATION OF OBSERVATIONS OF CWC AND COMPLIANCES BY THE STATE GOVERNMENT THROUGH WEB-SITE OF CWC NAMELY "PROJECT APPRAISAL MANAGEMENT SYSTEM".
3. THE SYSTEM WOULD **ALSO TRACK THE TIME IN MAKING THE COMMENTS AND COMPLIANCES.**
4. THE SPECIALIZED DIRECTORATES HAVE BEEN ADVISED TO ISSUE THEIR COMMENTS **DIRECTLY TO THE PROJECT AUTHORITIES (PAS) WITH A COPY TO PAO TO MINIMIZE TIME OF COMMUNICATION & VICE-VERSA.**

FURTHER INITIATIVES

- FOLLOW-UP MEETINGS/DISCUSSIONS ARE CONDUCTED BOTH WITH THE SPECIALIZED DIRECTORATES AND THE PROJECT AUTHORITIES.
- REGULAR PRESENTATIONS AT VARIOUS STAGES OF APPRAISAL FOR RESOLVING COMPLEX ISSUES.

Preparation of Flood Control Schemes

Flood Control Schemes

1. Guidelines for submission
2. Appraisal and Clearance
3. Guidelines for Preparation of DPR
4. Flood Management Programme

Guidelines for Submission

- Categories of FM Schemes

- Schemes costing up to Rs. 12.50 crore (Minor Schemes)
- Schemes costing between Rs. 12.50 crore and Rs. 25.00 crore. (Medium Scheme)
- Schemes costing more than Rs. 25.00 crore. (Major Schemes)

(Schemes under categories 1 &2 –Project Report and under Categories 3 -DPRs required)

Difference between Project Report and Detailed Project Report

- Various alternatives measures and selection of best alternatives
- Model study , if required
- Soil testing, detailed investigation
- Year wise river Bank erosion lines
- Report of CEs and SEs

A –Schemes Costing up to 12.50 crore

- Can be sanctioned by the State Government on recommendation of state TAC for inclusion.
- Schemes in the opinion of any member of state TAC have interstate implications should be got examined & cleared by CWC(other than Ganga basin) and GFCC(Ganga Basin), in case international matters-MOWR
- No State TAC is necessary for-R/S of existing embankments, Investigation of flood control, drainage etc, Raising of villages, Retired lines of existing embankments.
- No need to send schemes to planning commission-A list of schemes sanctioned by state govt as per statement A should be sent to CWC/GFCC/MOWR and Planning commission

STATEMENT "A"

PROFORMA IN WHICH INFORMATION IS REQUIRED TO BE FURNISEHD BY THE STATE GOVERNMENT IN RESEPCT OF FLOOD CONTROL, DRAINAGE, ANTI WATER LOGGING AND ANTI-SEA EROSION SCHEMES COSTING LESS THAN Rs. 12.50 CRORE EACH SANCTIONED BY THE STATES

1. Name of the Scheme(attach index map)
2. Name of the river, river basin and district in which the scheme is situated.
3. Name of scheme-whether new embankments, raising and strengthening of existing embankment, drainage, anti-erosion, town protection etc. along with typical drawing of the components proposed.
4. Length of embankment of drainage channels.
5. Estimated cost with price level
6. Area benefited/population benefitted
7. Damage details of the area for last 3 years.
8. Date of sanction of the scheme and scheduled date of completion.
9. Whether inter-state/international aspect of the scheme, if any has been examined by the State Technical Advisory Committee and, where necessary, clearance for the CWC/GFCC and the Ministry of Water Resources has been obtained.
10. Status of requisite administrative/statutory clearance

✓Interstate issues (Embankments)-

- Schemes which lie in or extend to a limit of 8 km from border on an interstate river which does not flow down to any other state but whose effect may extend in upper state
- schemes which are on river or tributaries which flow down to another state.

✓International implications:

- Embankments schemes on indus river system.
- Embankments schemes in certain estuaries creeks affecting the adjoining estuaries in another country.
- Embankments schemes on rivers or tributaries which fall into parent rivers such as Ganga and Brahamputra flowing ultimately into another country.

✓Embankments schemes free from international implications need not be referred to MOWR

- R/S of existing embankments.
- Drainage scheme- excavation of new drains-provision of sluices.
- Channel improvement schemes away from boarder
- River training/anti erosion sufficiently away from border.

➢B –Schemes Costing more than Rs.12.5 Cr and not exceeding Rs. 25.00 Cr

- Prepared by Flood control Deptt. And processed through State TAC submitted to CWC/GFCC in Statement B. All schemes will be examined by CWC/GFCC and on Recommendation of CWC/GFCC inclusion of schemes in plan will be processed by Planning Commission.
- Schemes with international implications –State govt will obtain specific clearance from MOWR before they are recommended by CWC/GFCC for approval of PC.

STATEMENT "B"

PROFORMA IN WHICH INFORAMTION IS REQUIRED TO BE FURNISHED BY THE STATE GOVERNMENT IN RESPECT OF FLOOD CONTROL, DRAINAGE, ANTI-WATER LOGGING AND ANTI SEA EROSION SCHEMES COSTING LESS THAN Rs.25.00 CRORE BUT MORE THAN RS.12.50 CRORE EACH.

1. Name of the Scheme (attach index map)
2. Abstract of cost, including foreign exchange components, if any.
3. Skeleton reports along with typical drawing of the components proposed.
4. Area and population which will get protected by the project
5. Damage details of the area for last 3 years.
6. (i) Betterment levy or flood cess, if any, proposed for the area to be protected from floods or water logging or sea erosion.
   (ii) Anticipated revenue therefrom
7. (a) Benefit cost ratio
   (b)Cost per ha. of area protected.
8. The extent to which people's participation is envisaged for the execution of the schemes and in what form.
9. Whether inter-State/international aspect of the scheme, if any, has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/GFCC and the Ministry of Water Resources has been obtained.
10. Status of requisite administrative/statutory clearance.
11. Target date of completion.

➢C –Schemes Costing more than Rs. 25.00 Cr

- The detailed project report have to be prepared by State flood control departments and processed by state TAC then to CWC/GFCC for detailed examination with copy to Planning commission and MOWR(if required).
- Detailed Examination in specialized directorate of CWC.
- If found viable CWC/GFCC will process the scheme for Advisory committee and after acceptance of advisory committee may be considered for investment approval of Planning Commission.

✓For scheme more than 30 Cr approval of State Flood Control Board is necessary.

Guidelines for Submission contd..

- Modification and Revision of Schemes
- ✓If Scope of scheme involving interstate/international aspects required to be modified
- increase cost more than 10% but revised cost<25.00 Cr – modification should be intimated to CWC/GFCC and PL and MOWR for review and clearance/approval as required.
- If revised cost more than 25 Cr –Same procedure as adopted for scheme more than 25 cr for consideration of Advisory committee.
- ✓Scheme involving a change in estimated cost only-
- Revised cost of scheme is 25 cr or less-irrespective of percentage of increase in cost , only increase in cost and main reasons need be intimated
- Revised cost more than 25 cr –Same procedure as adopted for scheme more than 25 cr for consideration of Advisory committee.
- ✓No work would be undertaken by the state government unless the scheme are approved in accordance with procedure laid down..

Appraisal and Clearance

- Schemes costing more than 25 Cr

(A) State Level Appraisal

- Planning and design organisation of flood control department shall ensure:
- The report is required to be in accordance with guidelines of preparation of DPR and hydrographic survey of affected river reach extending upstream and downstream as per requirement and hydraulic model studies and geo morphological studies of area conducted and specific notes included.
- The basic planning & flood routing studies relating to design flood have to be carried out-for this state department shall have also get the aspect of basic planning and design flood calculation etc vetted by CWC before preparation of DPR.
- The views of State agriculture, Planning, Revenue, Environment, forest, Ground Water, tribal welfare and Roads Department and Railways have been taken, considered and incorporated in DPR.

Appraisal and Clearance contd...

- Schemes costing more than 25 Cr

(A) State Level Appraisal

- DPR prepared by the field units shall be submitted to Central design and Planning Organisation for technical examination and scrutiny in its specialized units and DPR may be amended/modified and cost estimate may be finalised accordingly.
- The concurrence of state planning and finance department shall be obtained for final estimate after scrutiny by CDO
- The project shall be discussed from techno economic aspects and recommended by state advisory committee and then approved by the state flood control Board(>30 cr)
- The suufficent nos(atleast 10-12 nos)of DPR may be submitted to CE(FM)if purely flood control and CE(PAO) if multipurpose.

Appraisal and Clearance contd...

- Schemes costing more than 25 Cr

(B) Appraisal at Center

- DPR shall be distributed to relevant directorates for technical /economical examination.
- Time Schedule for Scrutiny-12.5 cr to 25 cr-6 months, >25 Cr-9 Months
- Issues remained unsettled even after 9 months- the project shall be returned to the state government for carrying out necessary modifications- after issues are settled and the project is resubmitted with updates cost estimates, such projects will be reprocessed a fresh by CWC

Appraisal and Clearance contd...

- Schemes costing more than 25 Cr

(C) Consideration by Advisory committee of MOWR

- The state Engineers at level of CE/SE associated with Project formulation/design will be invited to attend the advisory committee to furnish clarifications/information sought by members of Advisory Committee.
- The Advisory committee shall consider the scheme and recommend to PC for investment clearance if found acceptable.

- Schemes Costing more than 12.5 cr but less than 25 cr

(A)State Level Appraisal

-Same as in 25 cr

(B) Appraisal at Center

-Same as in 25 Cr except that CWC will submit the note on scheme along with statement B except s.no 5 and 11 directly to PC after detailed examination

Guidelines for Preparation of DPR

- Works in DPRs of Flood management schemes
- FLOOD PROTECTION WORKS– Construction ,Raising and Strengthening of Embankment
- ANTI-EROSION WORKS -Revetment/Pitching, Spurs, RCC Porcupines
- DRAINAGE IMPROVEMENT WORKS- Sluice
- CHANNEL IMPROVEMENT WORKS –Pilot Channel

Information /chapters to be included in DPRs

- Reports of CE & SE which includes inspection details
- Detailed report of EE
  - Introduction
  - Flood problem
  - Various possible alternative measures and selection of best suited measures
  - Model study , if needed
  - Investigations
  - Hydrology-frequency analysis
  - Design
  - BC ratio estimation
  - Inter state/international issues
  - State TAC/SFCB clearance –MoM of the State TAC/SFCB to be enclosed
  - Time of schedule
  - Forest clearance
  - Cost estimate
  - Index map
  - Compass map showing the various proposed work in different color, benefited area , year wise erosion lines ,

Details of Head and Sub Head

- Direct Charges

  I – Works

  II-Establishment

  III- T&P

  IV-Suspense

  V- Receipt and Recovery

- Indirect Charges

  a) capitalized value of abatement of land revenue

  b) Audit and Account charges

Total Estimated cost= Direct Charges+ Indirect Charges

I-Works

- A- Preliminary
- B- Land
- C-Works
- K-Building
- M- Plantation
- O- Misc.
- P- maintenance
- Q- Spl. T&P
- X- Env. and Ecology
- Y- Losses on stock

Relevant BIS code/Manuals/Handbooks

- Embankment scheme
  - IS-12094 :2000- Design
  - IS-11532:1995- Borrow pit
  - Embankment Manual(CWC-1960)
- Anti Erosion Works
  - IS-8408:1994-Spurs/Groynes
  - IS-14262:1995- Revetments
- Drainage Improvement Works
  - IS-8835:1978- Design
- Handbook for FP, AE & RTW (CWC-2012)
- River Behavior Management & Training Vol I (CBIP-1989)

APPRAISAL PROCEDURE & GUIDELINES FOR FLOOD MANAGEMENT SCHEMES

PRAMOD NARAYAN
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16th March 2015, HIRMI, KURUSHETRA

Flood Management Programme (FMP)

- FMP was launched by the union Government to provide central assistance to the states for implementation of FM schemes including anti sea erosion during XI Plan (2007-12)
- Continued during XII Plan (2012-17) with an outlay of Rs. 10000 Crore.
- Funding pattern in XII plan
  - Non spl. Category states - Cost more than Rs 40 Crore, BC Ratio >1, Funding Ratio – 50:50
  - Spl. Category states - Cost more than Rs. 10 Crore, BC Ratio -> 1, Funding Ratio - 70:30

Contd./-

- Funding pattern for restoration of schemes & catchment area treatment for all the states - 90:10 in XI Plan
- Now in XII Plan – Central Assistance in these case would be provided as applicable to respective category of States
- Spillover works of XI Plan will be funded as per earlier formula of funding
- Anti-sea erosion works will also covered under FMP
- Central Assistance for Flood Management Scheme taken up in Integrated Manner

Scope of Funding

Provision for funding of following categories of critical flood control, river management and anti-sea erosion works in the country

- River management;
- Flood control;
- Anti-erosion works;
- Drainage development works;
- Flood proofing works;
- Flood prone area development programme in critical regions;
- Restoration of flood control/management works damaged due to force majeure like conditions *(excluding covered under CRF/NCCF);*
- Anti-sea erosion works; and
- Catchment area treatment works (*promotional in nature on selective basis with high runoff rate/convergence with similar other works).*

Eligibility Criteria for new Schemes

- For Special Category States: Estimated Cost Rs. 10 crore and above with B.C. Ratio more than 1.0
  (States: NE States, Sikkim, J&K, HP and UK)
- For General / Non-Special Category States: Estimated Cost Rs. 40 crore and above with B.C. Ratio >1.0
- State Govt. shall ensure inclusion of the scheme in the State Plan, make requisite budget provision towards Central as well as State share on annual basis.
- State Governments which adopt Flood Plain Zoning Bill would be given priority over the other States.
- Recommendation of CWC (GFCC for Ganga Basin) for inclusion is mandatory for schemes.

Other Important Conditions

- The release of Central Assistance will be made only after release of corresponding State Share. A certificate to this effect will have to be given by the Principal Secretary.
- The State Governments shall ensure that the works are executed in a well planned manner and completed within the scheduled completion period.
- Progress shall be monitored through CPM/PERT Charts; which shall be submitted within three months of release of first installment of central assistance.
- In cases where project completion is delayed due to force majeure , extension may be considered by IMC-FMP on merits on the basis of justification by State, views of appraisal agency and revised investment approval by Planning Commission.

Process for funding under FMP

- After Investment clearance by the PC , Proforma (FMP-I) has to be filled up by the state Govt. duly signed by the Secretary of the WR Dept. for consideration by the IMC-FMP
- After approval of the IMC-FMP , proforma (FMP-IV) along with necessary certificates are to be submitted to MoWR for release of Ist installment

INTRODUCTION

- Flood Management - A State Subject
- Planning, Investigation & Execution - State Government/Brahmaputra B.
- Appraisal of Schemes – CWC/GFCC
- Investment Clearance – Planning Commission

Flood Management Scheme

- Integral part of overall Water Resource Development
- Comprehensive Approach to the Problem of Flood in the area
- Proposal should aim at the Socio-Economic Development
- Should include Land Management, Ecological & Afforestation aspects, Soil Conservation, Watershed Management
- Schemes should be formulated in coordination with Railways, NHAI, State Irrigation Department

Different types of works in DPRs

- Flood Protection Works – Construction of new Embankment, Raising & Strengthening of Embankment, Guide Bunds, Protection Wall
- Anti-erosion Works – Revetment/Pitching, Launching Apron, Spurs, Porcupines
- Channel Improvement Works – Pilot Channel
- Drainage Improvement Works – Sluices

Categories of FM Schemes

- MINOR SCHEMES – Costing less than Rs. 12.5 Crore
- MEDIUM SCHEMES – Costing between Rs.12.5 Crore to Rs. 25 Crore
- MAJOR SCHEMES – Costing more than Rs. 25.00 Crore

General Format of a DPR

- Index
- Checklist
- Report of Chief Engineer/Superintending Engineer/Executive Engineer
- Hydrology
- Design
- Abstract of Cost Estimate

General Format of a DPR

- Calculation of quantities
- Rate Analysis and Schedule of Rate
- B. C. Ratio
- Annual Benefits
- Various Certificates
- Drawings

Report of Chief Engineer/Superintending Engineer/Executive Engineer

- The report of CE and SE: Brief about the area, location, problem, earlier measures proposed measures and salient features
- The Report of EE: Details description of the above the DPR.
- Salient features: Proposed Measures, Benefitted area/population, Design features of proposed work, Cost, B. C. Ratio etc

Inter State Issues

- Embankment Schemes
  - ✓Such schemes which lies in or extend to a limit of 8 km from the border on an interstate river which does not flow down to any other state but whose effect may extend in the upper state
  - ✓Schemes which are on rivers or tributaries which flow down to another state

Schemes free from Inter State Issues

- R/S of existing embankment
- Retired lines for existing embankment
- Investigation of FM schemes including anti-sea-erosion
- Raising of villages
- A/E , river training schemes sufficiently away from states border
- Any scheme which does not have inter state ramification can be sanction by the state Govt. itself of any cost.

International issues

- Embankment Schemes
  - ➢schemes in the Indus river system
  - ➢Schemes in Ganga and Brahmaputra Basin

Schemes free from International Issues

- R/S of existing embankment
- Drainage Schemes
- Schemes for channel improvement
- River training/Anti erosion schemes sufficiently away from international border

Hydrology

- Design discharge for specific return period should be worked out using the recent past 10-20 years annual data.
- Flood frequency analysis using the Log Pearson Type-III method or Gumble's method
- Design HFL should be worked out using Gauge-discharge curve.
- In the absence of past data, design discharge may be calculated using empirical formula
- Design HFL can be adopted as Max observed HFL

B C Ratio:

. Economic viability judged by Benefit Cost Ratio.
. Last 10 years damage data duly certified by the Revenue Authority.
. Life of project may be taken as 50 years

B. C. Ratio= Annual Benefits/Annual cost

. Annual cost of flood management as 17% (10%- Interest Charges +5%- Maintenance +2%- Depreciation) of the capital cost of the Schemes in case of Anti erosion schemes and 16%(10%- Interest Charges +4%- Maintenance +2%- Depreciation) in case of Raising & Strengthening of embankment schemes.
For any scheme to be economically viable, B.C. Ratio should be greater than 1.

Design

- Embankment: BIS 12094:2000.
- Bank pitching: IS 14262:1995
- Spurs/Groynes: IS 8404:1994
- Sluices: IS 8835:1978
- Pilot channel: Regime theory
- RCC porcupines: Conventional
- Handbook for Flood Protection, Anti-Erosion & River Training Works, CWC

Embankment (BIS 12094:2000)

- Free board may be kept as 1.5 m for discharge less than 3000 cumecs or 1.8 m for more than 3000 cumecs.
- Crest width may be kept as 5.0 to 5.5 m
- River side slope: 2H:1V
- Country side slope: 3H:1V
- HGL: 6H:1V
- Return period for design flood may be 25 years for rural area and 100 years for urban area

Embankment (BIS 12094:2000)

- Slope stability analysis may be done for embankment higher than 6 m.
- Proper drainage arrangement may be done along and across the C/S slope.
- Spacing of the embankment along the jacketed reach may be 3 times Laceys' wetted perimeter.

Bank pitching (IS 14262: 1995)

- Preferable at concave reaches.
- Thickness of pitching and size of launching apron may be worked out as per IS Code
- Two layers of protection layer may be provided when being provided in loose
- Single layer of protection layer may be adopted when provided in wire crates/wire mesh
- Thickness of launching apron will be 1.5 x thickness of pitching

Bank pitching (IS 14262: 1995)

- Return period for design flood may be adopted as 50 years for both rural and urban area
- Appropriate filter, preferably Geo-textile, may be provided beneath the pitching.
- Toe key near the river bed
- Launching apron may preferably be provided in wire crates

Appraisal of Schemes costing up to Rs. 12.50 crore

- To be prepared by Flood Control Department.
- Approval of State TAC
- Can be sanctioned by State Government
- However, before sanction clearance of Inter state implication by CWC and international matter by MoWR to be obtained
- Information in Statement-A with copy to MoWR, CWC and Planning Commission
- Investment Clearance by Planning C. is not needed
- If the schemes are proposed to be included under FMP then cost estimate should at least be vetted by CWC.

Appraisal of Schemes costing between Rs. 12.50 to Rs. 25.00 crore

- To be prepared by Flood Control Department.
- Approval of State TAC
- No clearance from the SFCB
- To be submitted to CWC Field Offices
- Schemes to be examined and sent to PC for IC along with information in Statement-B
- IC is to be obtained from the PC

Appraisal of Schemes costing more than Rs. 25.00 crore

- To be prepared by Flood Control Department.
- Approval of State TAC
- Clearance from the SFCB if scheme costs more than Rs. 30.00 Crore
- Forest Clearance from MoEF for Project costing more than Rs 100 Crore
- To be submitted to CWC field office

Continued……

- Detailed examination in specialized Directorate of CWC after preliminary examination in CWC field office
- If found viable than put up to Advisory Committee of MoWR for clearance.
- Investment Clearance is to be obtained from the Planning Commission.

Release of Central Assistance

- Central Assistance shall be released in two installment in a financial year
- First Installment
- Projects receiving assistance up to 50% of project cost, 90% of central share in the Annual State Budget shall be released on submission of certificate duly signed by concerned Principle Secretary that state has released at least 50 % of state share to the project as provided in Annual State budget.
- Projects receiving assistance higher than 50% of project cost, 50% of central share in the Annual State Budget shall be released on submission of certificate duly signed by concerned Principle Secretary that state has released full state share to the project as provided in Annual State Budget.

Release of Central Assistance (Contd)

- **Second/Subsequent Installment(s)**
- In the same financial year, Balance/Second installment shall be released on submission of **Utilisation certificate for utilising 50% of CA released**, due recommendation of monitoring agency, budget provision of state as well as central share, certificate by Principle Secretary that state has released full state share to project.
- In the next/subsequent financial year, installment shall be released on submission of **Utilisation certificate for utilising of full central share others released earlier,** due recommendation of monitoring agency, budget provision of state as well as central share, certificate by Principle Secretary that state has released full state share to project

Release of Central Assistance (Contd)

- **Reimbursement of Expenditure**
- CA towards expenditure incurred in previous year(s) before its approval by IMC-FMP would not be entertained.
- Actual expenditure in the financial year (yr of approval by IMC-FMP) or in a year after the approval of project would be reimbursed on submission of certificate towards actual expenditure incurred duly countersigned by concerned Principal Secretary

Documents for inclusion of Schemes in FMP

- FMP-1
- Clearance from state TAC
- Clearance from state flood control board-for schemes costing more than 30 cr
- Forest clearance
- Certificate by Chief Engineer-land has been accuired and in possession of state govt.
- Certificate by CE-the project has not received any financial assistance in past from any agency of govt of india.
- Certificate by CE- cost of projects is firm and final and escalation in cost would be borne by state govt.
- Techno-economic viability acceptance of DPR for the projects by CWC/GFCC/Advisory committee of MOWR.
- Investment clearance by Planning commission
- Assurance from state finance department that requisite funds would be provided by state as per phasing
- Any other clearance if required.

Documents for Release of Fund

- Approval IMC-FMP
- Recommendation of CWC/GFCC/BB in FMP-4 Performa
- Sate budget allocation
- A certificate duly signed by concerned principal secretary –it has released its full state share to projects as provided in the annual budget
- State wise annual ceiling fixed by planning commission under fmp(to be enclosed by Ganga wing)
- Documents required for subsequent installment -
- Physical and financial progress in FMP-2 and FMP-3
- Utilisation certificate in GFR 19 A
- State budget allocation
- A certificate duly signed by concerned principal secretary –it has released its full state share to projects as provided in the annual budget
- Recommendation of CWC/GFCC/BB in FMP-4
- Report of concurrent evaluation by independent agency
- Statement of audited expenditure of central assistance released

STATEMENT "A"

PROFORMA IN WHICH INFORMATION IS REQUIRED TO BE FURNISEHD BY THE STATE GOVERNMENT IN RESEPCT OF FLOOD CONTROL, DRAINAGE, ANTI WATER LOGGING AND ANTI-SEA EROSION SCHEMES COSTING LESS THAN Rs. 12.50 CRORE EACH SANCTIONED BY THE STATES

1. Name of the Scheme(attach index map)
2. Name of the river, river basin and district in which the scheme is situated.
3. Name of scheme-whether new embankments, raising and strengthening of existing embankment, drainage, anti-erosion, town protection etc. along with typical drawing of the components proposed.
4. Length of embankment of drainage channels.
5. Estimated cost with price level
6. Area benefited/population benefitted
7. Damage details of the area for last 3 years.
8. Date of sanction of the scheme and scheduled date of completion.
9. Whether inter-state/international aspect of the scheme, if any has been examined by the State Technical Advisory Committee and, where necessary, clearance for the CWC/GFCC and the Ministry of Water Resources has been obtained.
10. Status of requisite administrative/statutory clearance

STATEMENT "B"

PROFORMA IN WHICH INFORAMTION IS REQUIRED TO BE FURNISHED BY THE STATE GOVERNMENT IN RESPECT OF FLOOD CONTROL DRAINAGE, ANTI-WATER LOGGING AND ANTI SEA EROSION SCHEMES COSTING LESS THAN Rs.25.00 CRORE BUT MORE THAN RS.12.50 CRORE EACH.

1. Name of the Scheme (attach index map)
2. Abstract of cost, including foreign exchange components, if any.
3. Skeleton reports along with typical drawing of the components proposed
4. Area and population which will get protected by the project
5. Damage details of the area for last 3 years.
6. (i) Betterment levy or flood cess, if any, proposed for the area to be protected from floods or water logging or sea erosion.
   (ii) Anticipated revenue therefrom
7. (a) Benefit cost ratio
   (b)Cost per ha. of area protected.
8. The extent to which people's participation is envisaged for the execution of the schemes and in what form.
9. Whether inter State/international aspect of the scheme, if any, has been examined by the State Technical Advisory Committee and, where necessary clearance of the CWC/GFCC and the Ministry of Water Resources has been obtained.
10. Status of requisite administrative/statutory clearance.
11. Target date of completion.

STATEMENT-'A'

1. Name of the Scheme (Attach Location map and Index map).
2. Name of river, river basin and district in which the scheme is situated
3. Nature of scheme whether new embankments, raising and strengthening of existing embankment, drainage, anti-erosion, town protection etc.
4. Length of embankment or drainage channels.
5. Estimated cost.
6. Area benefited.
7. Date of sanction of the scheme
8. Whether inter-state/international aspect of the scheme, if any has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/Ganga Flood Control Commission and the Ministry of Water Resources has been obtained.
9. Status of requisite administrative/statutory clearance.

STATEMENT-'B'

1. Name of the Scheme (Attach Location map and Index map).
2. Abstract of cost, including foreign exchange components, if any .
3. Skeleton reports.
4. Area and population which will get protected by the project.
5. i) Betterment levy or flood cess, if any proposed for the area to be protected from floods or water logging or sea-erosion.
   ii) Anticipated revenue therefrom.
6. a) Benefit cost ratio
   b) Cost per hectares of area protected.
7. The extent to which people's participation is envisaged for the execution of the schemes and in what form.
8. Whether inter-state/international aspect of the scheme, if any, has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/Ganga Flood Commission and the Ministry of Water Resources has been obtained.
9. Status of requisite administrative/statutory clearance.

Case Study on Preparation of DPR

Presented by:

Ajay Kumar, Director, CWC, New Delhi

Why DPR ?

Irrigation / Multipurpose projects require -

- LARGE INPUT
- VARIED SOURCES
- FINANCIAL ASSESSMENT
- STATUTORY REQUIREMENTS

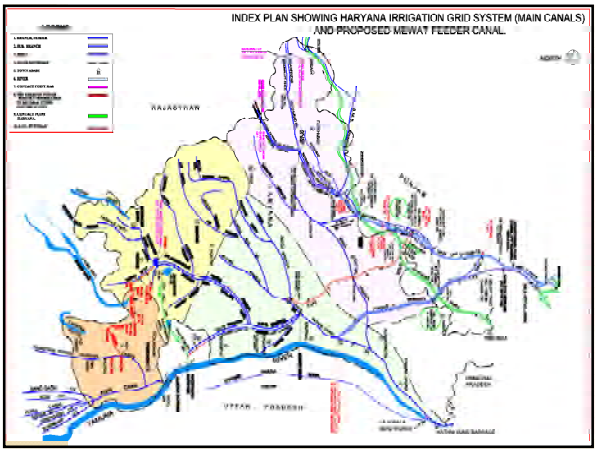
Common Deficiencies in DPR

- The guidelines are not followed properly
- Lack of Survey & Investigations
- Updated Hydrological data are not used for water availability assessment
- Planning and Designs are not carried out as per current practices
- Constraints, if any, are not clearly brought out

Common Deficiencies in DPR

- Cost Estimates are prepared without detailed design and survey.
- The project requirements are not fully included in the project proposal
- Economic analysis do not account for project specific or region specific data
- Latest technologies are not used in the design and Planning

Preliminary Report of Mewat Feeder Canal, Haryana - Case Study



Project Proposal

- Mewat Feeder Canal envisages utilization of 0.37 MAF water of river Yamuna and 0.12 MAF water of Ravi Beas system for providing irrigation benefit to culturable command area of 76238 ha including drinking water supply to the Mewat district in Haryana.
- The proposal envisages off taking 741 cusec water from existing JLN feeder at RD-104.6 km near village Sahalawas in Jhajjar district.

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Project Proposal

- Total proposed length of Mewat feeder is 117.04 km which consists of lifting arrangement at six locations having total lift of 50.21 m.
- In addition to the benefit of irrigation and drinking water, the proposed project will also provide hydro power benefit to the tune of 10 MW.

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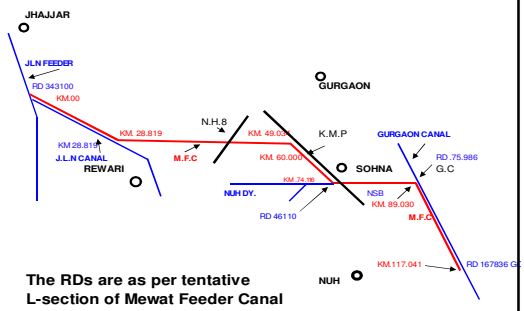
LINE DIAGRAM OF PROPOSED ALIGNMENT OF MEWAT FEEDER CANAL



The RDs are as per tentative L-section of Mewat Feeder Canal

NECESSITY OF PROJECT

- The Mewat region falls under arid zone and rainfall is scanty and erratic.
- Due to various reasons the allocation of 0.49 MAF water is not been harnessed to its full extent which has resulted into inadequate irrigation facilities in Mewat region.
- The people of Mewat area is also facing acute shortage of drinking water.

OFFTAKE POINT OF MFC

(JLN CANAL FEEDER (104.60 KM)JF-II

ALIGNMENT OF MFC - BLOW UP

SOURCE OF WATER FOR MFC

- THE WATER FOR MFC HAVING DESIGNED CAPACITY OF 741 CUSECS IS PROPOSED TO BE DIVERTED FROM JLN FEEDER WHICH OFF TAKES FROM THE KHUBRU HEADWORKS.
- PRESENTLY, THIS SHARE OF WATER IS BEING RECEIVED FROM OKHLA BARRAGE.
- WITH THIS PROJECT, THE MEWAT AREA WILL GET FRESH WATER INSTEAD OF CONTAMINATED WATER.

Appraisal of Project in CWC

- Preliminary Report was 1st submitted in CWC in August 2012.
- Chapters on Water availability, Irrigation Planning and Inter-state aspect were missing in the report.
- State Govt. was requested in September 2012 to submit the above mentioned chapters which was submitted in October 2013.
- Comments of CWC on Water availability and Inter-state aspects were communicated in Jan-Feb 2014.

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Appraisal of Project in CWC

- A presentation was made by the project authorities in June 2014.
- It was clarified that Haryana is using their own share of water of 0.49 MAF (0.37 MAF of Yamuna and 0.12 MAF of Ravi Beas System).
- It was stated that about 58% CCA of the Gurgaon canal is proposed to be shifted to Mewat canal
- Out of 0.49 MAF allocated for Gurgaon canal, 0.238 MAF (0.308 - 0.07) water will be utilized through Mewat Feeder Canal.

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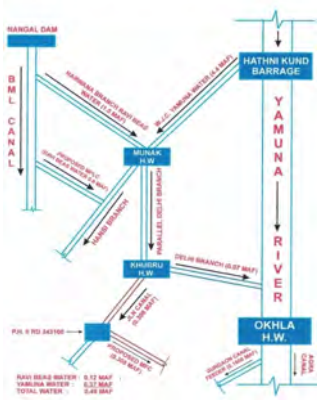
INDEX PLAN SHOWING BHAKHRA & WJC SYSTEM



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SALIENT FEATURES

OFF TAKING POINT	:	RD 343100 of JLN Feeder
COST OF THE PROJECT	:	Rs. 661.17 Crore
LENGTH OF CHANNEL	:	117.041 KM
1.Parallel along JLN Canal	:	28.819 K.M. (0 to 28.819 KM)
2.Parallel along KMP Expressway	:	13.744 KM (60.000 to 73.744 KM)
3.On existing Nuh Sub Branch		15.286 KM (73.744 to 89.030 KM)
4.Parallel along Gurgaon Canal	:	28.011 KM (89.030 to 117.041 KM)
DISCHARGE AT HEAD	:	741.31 Cs. (20.99 CUMEC)
DISCHARGE AT RD 75986 of GURGAON CANAL	:	566.09 Cs. (16.03 CUMEC)
Discharge at Tail KM 117.041	:	203Cs. (5.75 CUMEC)

SALIENT FEATURES

SECTION OF CHANNEL	:	CUP SHAPED
TYPE OF LINING	:	SINGLE LAYER BRICK LINING
TOTAL CCA OF THE PROJECT	:	188308 ACRES OR 76238 HECT.
INTENSITY OF IRRIGATION	:	KHARIF @ 34.5% = 26302 HECT RABI @ 27.5% = 20965 HECT
LIFT	:	10.0, 5.95, 6.5, 9.05, 10.05 & 8.65 MTRS. = 50.20 MTRS
NO. OF PUMP HOUSES	:	6 NOS. (KM. 0, 10.068, 16.679, 46.0, 57.50 & 63.0)
CAPACITY	:	31 NO. PUMPS (150 CS. EACH) 15 NO. PUMPS (50 CS. EACH)
POWER REQUIRED FOR LIFT	:	APPROX. 12 M.W.

SALIENT FEATURES

FALL	:	APPROXIMATE 62.25 MTRS. AFTER X-ING ARAVALI HILL NEAR VILLAGE KHOR OF SOHNA IN BETWEEN 71.684-72.810 KM
POWER GENERATION	:	APPROX 10 MW POWER CAN BE GENERATED AS PER RECOMMENDATION OF IIT ROORKEE.
STORAGE IN VALLEY PORTION	:	EXPECTED STORAGE CAPACITY OF 37150 CUM IN VALLEY CAN BE UTILIZED FOR DRINKING PURPOSE.
VILLAGES BENEFITED	:	167 NOS.

Appraisal of Project in CWC

- Project authorities was requested to furnish Water account Statement in volumetric basis.
- Replies were submitted in October 2014.
- In Principle Consent of CWC for preparation of Detailed Project Report (DPR) was accorded in November 2014.

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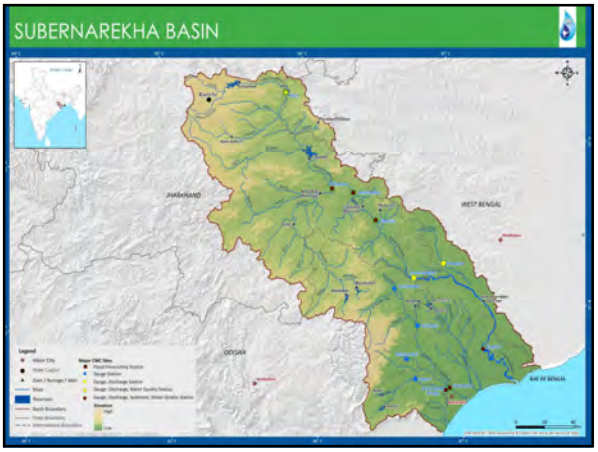
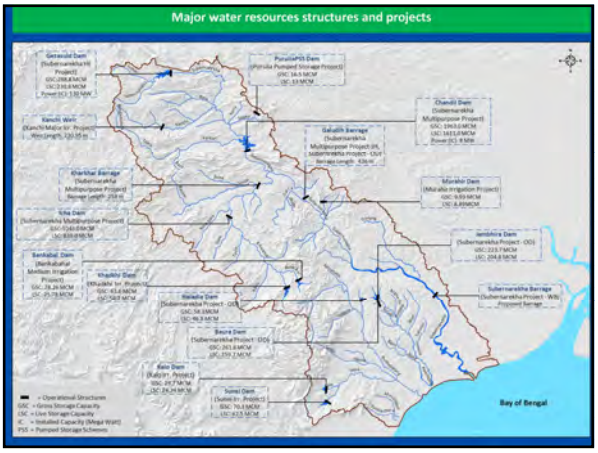
DPR of Subarnrekha Multipurpose Project, Jharkhand – Case Study



Salient Features of Subernarekha basin

S. No.	Features	Description
1	Area	29,196 Sq.km
2	States in the basin	Jharkhand - (48.84%) Odisha - (37.96%) West Bengal - (13.2%)
3	Mean Annual Rainfall	1383.35 mm
4	Highest Elevation	1166 m
5	Avg. Annual Water Potential	12.37 BCM
6	Utilizable Surface Water	6.80 BCM
7	Number of water resources structures	Dams – 38 Barrages – 4 Weirs – 12 Power houses - 3
8	Highest Dam	Lower Purulia dam - 95 m
9	Longest Dam	Jambhira dam - 7.36 km
10	Highest Barrage	Galudih barrage - 27.5 m
11	Longest Barrage	Galudih barrage - 369 m
12	Number of Irrigation projects	Major - 05 Medium - 34
13	Number of HE projects	1



Proposed Inter basin transfer links in Subernrekha basin

- Inter basin transfer link proposes river water transfer from the region of surplus to deficit areas.
- Two inter basin transfer links under Himalayan component are proposed in Subansiri basin.
  - **Subernarekha-Mahanadi Link and**
  - **Ganga-Damodar-Subernarekha Link.**

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PROJECT PROPOSAL OF SUBERNAREKHA MULTIPURPOSE PROJECT

The project envisages construction of following components:

- Chandil dam across river Subernarekha with a gross storage capacity of 1963 MCM which includes flood storage of 463 MCM to benefit Orissa and West Bengal.
- Ichha dam across river Kharkai with a gross storage capacity of 1043 MCM. this includes a storage of 222.2 MCM for utilization in Orissa.

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PROJECT PROPOSAL OF SUBERNAREKHA MULTIPURPOSE PROJECT

- A 258 m long barrage across river Kharkai.
- A 436.2 m long barrage across river Subernarekha at Galudih
- Canal system off taking from Ichha Dam, Chandil dam, Kharkai Barrage and Galudih barrage

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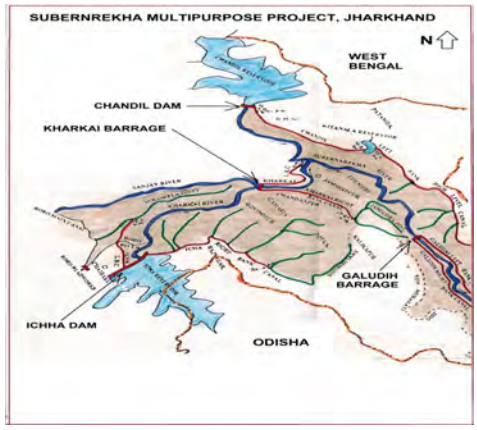

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BENEFITS OF SUBERNAREKHA MULTIPURPOSE PROJECT

- Irrigation benefit to 1,54,802 ha CCA in Jharkahnd, 90000 CCA in Odisha and 5000 CCA in West Bengal.
- Flood Control benefits to Odisha and West Bengal by providing 463 MCM flood cushion in Chandil dam.

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BENEFITS OF SUBERNAREKHA MULTIPURPOSE PROJECT

- 14.447 million Unit annual power with installed capacity of 17.36 MW at the outlet of Chandil Dam to Left Main Canal.
- 740 MCM (494 MCM from Chandil dam and 246 MCM from Ichha dam) Water supply for Industrial and Drinking purposes in Jharkhand.

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Appraisal of 2nd Revised Estimate

- The yield rates of various crops appeared to be on higher side.
- The yield per ha and rates of the crops were not approved from State Agricultural Department.
- Expenditure on seeds in post project scenario was considered lesser than in pre-project scenario.
- The O&M charges were not adopted as per approved norms.
- Water supply rates for Industrial and domestic purposes, Unit cost of electricity were not supported with proper documents.

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Appraisal of 2nd Revised Estimate

- Compliance to the observations were submitted in August 2010.
- B.C. ratio for Irrigation component of the project was reassessed in CWC which worked out to be **1.76**.
- Revised Estimate was considered by the Advisory committee in its 106th meeting held on 16th September 2010.
- The committee observed that clearance for diversion of 145.26 ha of reserve forest land falling under Dalma Wildlife Sanctuary was not obtained by the project authorities.

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Appraisal of 2nd Revised Estimate

- Therefore, the Committee deferred the proposal on account of non-submission of following documents:
  - Clearance for diversion of 145.26 ha of reserve forest land falling under Dalma Wildlife Sanctuary
  - State Finance Concurrence.
- NBWL recommended the proposal for diversion of 145.26 ha of Forest land falling under Dalma Wild Life Sanctuary in January 2011.
- State Govt also submitted Finance concurrence in February 2011.
- Advisory Committee accepted the proposal in its 109th meeting held on 14th March 2011.

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Flood Control Scheme

Flood Management Scheme

- Integral part of overall Water Resource Development
- Comprehensive Approach to the Problem of Flood in the area
- Proposal should aim at the Socio-Economic Development
- Should include Land Management, Ecological, Afforestation, Soil Conservation and Watershed Management aspects
- Schemes should be formulated in coordination with Railways, NHAI and other concerned Departments

Different types of works in DPRs

- Flood Protection Works –
  Construction of new Embankment,
  Raising & Strengthening of Embankment,
  Guide Bunds, Protection Wall etc.
- Anti-erosion Works –
  Revetment/Pitching, Launching Apron, Spurs, Porcupines
- Channel Improvement Works – Pilot Channel
- Drainage Improvement Works – Sluices

Categories of FM Schemes

- MINOR SCHEMES – Costing less than Rs. 12.5 Crore
- MEDIUM SCHEMES – Costing between Rs.12.5 Crore to Rs. 25 Crore
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- Design HFL can be adopted as Max observed HFL

Appraisal of Schemes costing up to Rs. 12.50 crore

- To be prepared by Flood Control Department.
- Approval of State TAC
- Can be sanctioned by State Government
- However, before sanction clearance of Inter state implication by CWC and international matter by MoWR to be obtained
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- To be prepared by Flood Control Department.
- Approval of State TAC
- Clearance from the SFCB if scheme costs more than Rs. 30.00 Crore
- Forest Clearance from MoEF for Project costing more than Rs 100 Crore
- To be submitted to CWC field office

Continued……

- Detailed examination in specialized Directorate of CWC after preliminary examination in CWC field office
- If found viable than put up to Advisory Committee of MoWR for clearance.
- Investment Clearance is to be obtained from the Planning Commission.

Case Study on Preparation of TAC Note

What is TAC Note ?

- **TAC NOTE IS** A DOCUMENT PREPARED AFTER COMPLETING APPRAISAL OF PROJECTS
- THIS IS A COMPREHENSIVE NOTE AND CHECK LIST FINALISED BY **CWC** AND CIRCULATED TO ALL THE MEMBERS OF THE **ADVISORY COMMITTEE OF MoWR, RD&GR** HEADED BY **SECRETARY** FOR CONSIDERATION AND ACCEPTANCE OF THE PROJCT PROPOSALS
- DOCUMENT CONTAINS BRIEF ABOUT TECHNICAL ASPECTS, STATUTORY CLEARANCES & ECONOMIC EVALUATION OF THE PROJECT

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Constitution of Advisory Committee

- Advisory Committee has been constituted by Ministry of Water Resources on 27th November, 1987. Earlier, Planning Commission constituted such committees from time to time.
- Purpose of the committee is to consider Major, Medium Irrigation, Flood Control and Multipurpose project proposals for their techno-economic viability.

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Constitution of Advisory Committee

The Committee consists of the following members:

(i) Secretary, Ministry of Water Resources - Chairman
(ii) Chairman, Central Water Commission - Member
(iii) Secretary (Expenditure), Ministry of Finance or his Nominee - Member
(iv) Secretary, Department of Power, Ministry of Energy or his Nominee. - Member
(v) Secretary, Department of Environment & Forest or his Nominee - Member
(vi) Secretary, Department. of Agriculture & Cooperation or his Nominee - Member
(vii) Secretary, Ministry of Welfare or his Nominee - Member

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Constitution of Advisory Committee

The Committee consists of the following members:

(viii) Director-General, ICAR or his nominee - Member
(ix) Chairman, Central Electricity Authority - Member
(x) Advisor (I&CAD), Planning Commission - Member
(xi) Advisor (Energy), Planning Commission - Member
(xii) Financial Advisor , Ministry of Water Resources - Member
(xiii) Chairman, Central Ground Water Board - Member
(xiv) Chief Engineer (PA), CWC - Member-Secretary

- The Nominees will not be below the rank of Joint Secretary.
- The committee may also invite representatives of any other Government organizations

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Functions of Advisory Committee

The functions of the Committee is to examine projects proposed by State Governments, Central Government or other organizations and satisfy itself that:

i) the schemes have been prepared after adequate investigations;
ii) the estimates are complete and technically correct;
iii) the financial forecasts and estimates of benefits are based on reliable and accurate data; and
iv) the need of environment conservation and proper rehabilitation of project-affected persons have been taken into account.

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Process of clearance by Advisory Committee

- The project proposals are received in the Central Water commission which carries out initial scrutiny in consultation with other concerned agencies and provide secretarial assistance to the Committee.
- On the basis of the examination conducted by the Committee, the Ministry of Water Resources conveys the **decision on techno-economic viability of the projects**.
- Their inclusion in the Five Year Plans or Annual Plans were decided by the Planning Commission having regard to the objectives and strategy of the Plan.

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Preparation of TAC Note

TAC Note should contain brief discussion about the project proposals. There are following three parts of the TAC Note:

- MAIN REPORT
- CHECK LIST
- ANNEXURES

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DETAILS TO BE GIVEN IN TAC NOTE

MAIN REPORT

- INTRODUCTION WITH BACKGOUND OF THE PROJECT
- PROJECT PROPOSAL
- HYDROLOGY
- IRRIGATION PLANNING & WATER REQUIREMENT FOR VARIOUS PURPOSES
- INTER-STATE / INTERNATIONAL ASPECTS
- DESIGN ISSUES

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DETAILS TO BE GIVEN IN TAC NOTE

MAIN REPORT cont....

- CONJUCNCTIVE USE OF SURFACE AND GROUND WATER
- STATUS OF ENVIRONMENTAL & FOREST CLEARANCES
- STATUS OF MoTA CLEARANCE
- RESETTLEMENT & REHABILITATION STATUS
- LAND ACQUISITION STATUS
- PHYSICAL & FINANCIAL STATUS

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DETAILS TO BE GIVEN IN TAC NOTE

MAIN REPORT cont....

- COST ESTIMATE AND ECONOIC EVALUATION
- PROPOSED PHYSICAL & FINANCIAL IMPLEMENTATION SCHEDULE
- APPRAISAL IN CWC & VALUE ADDITION
- RECOMMENDATION WITH SPECIFIC POINTS FOR CONSIDERATION OF THE COMMITTEE

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DETAILS TO BE GIVEN IN TAC NOTE

CHECK LIST

- Name of Project
- G.C.A, CCA, Anuual Irrigation, Intensity of irrigation
- Inclusion in the plan & allocation
- Estimated Cost & foreign exchange
- Concurrence of the state finance department
- Phasing of expenditure
- Cropping pattern
- Expected irrigation and other benefits
- Benefit cost ratio

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DETAILS TO BE GIVEN IN TAC NOTE

CHECK LIST cont....

- Cost per hectare of annual irrigation
- Engineering and other technical aspects
- Physical programme and its phasing
- Inter-state Aspects
- Water utilization & Drainage
- Measures against salinity & alkanity
- Programme for construction of the field channels and water course
- Phasing of expected benefits
- Scale of water charges & revenue
- Outstanding comments

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DETAILS TO BE GIVEN IN TAC NOTE

ANNEXURES

- LOCATION MAP
- INDEX MAP
- SALIENT FEATURES
- VARIOUS STATUTORY CLEARANCES
- PHYSICAL , FINANCIAL IMPLEMENTATION SCHEDULE
- BENEFIT COST RATIO CALCULATIONS
- STATE FINANCE CONCURRENCE

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Case Study of

SWAN RIVER FLOOD MANAGEMENT PROJECT FROM DAULATPUR BRIDGE TO GARGRET BRIDGE IN MAIN SWAN RIVER & TRIBUTORIES UPTO H.P. BOUNDARY IN UNA, (H.P.)

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APPRAISAL OF PROJECT PROPOSAL

- Swan River Flood Management Project from Daulatpur Bridge to Gagret Bridge in Main Swan River and all tributaries in Distt. Una (HP) was submitted in Nov. 2011 for Rs 598.72 Crore.
- Approval of STAC was given in September 2011.
- Examined in CWC and observations were communicated in Feb. 2012.

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APPRAISAL OF PROJECT PROPOSAL

Observations of CWC

- Reports of CE and SE were missing.
- Forest clearance was not obtained.
- Clearance from IWT angle was not obtained.
- Benefits in terms of population and area was not given

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APPRAISAL OF PROJECT PROPOSAL

Observations of CWC cont…..

- Model studies was not carried out.
- Design flood was estimated properly.
- Different Free Board was adopted for different tributaries.
- Cost estimate was not prepared as per guidelines

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APPRAISAL OF PROJECT PROPOSAL

- Compliance to observations was submitted in March to June 2012.
- Estimated Cost was finalized for Rs. 922.485 Crore.
- State Finance concurrence was obtained in June 2013.
- TAC Note was finalized and proposal was accepted by the Advisory Committee in July 2013.
- Included under FMP in Dec. 2013 under funding pattern of 70:30

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THANK YOU

धन्यवाद

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Steps of DPR Preparation

Collection of Data

Field investigations

Comprehensive and detailed study of data,

Compilation of findings in the shape of a Project Report

Stages of Project Planning

- Desktop Study
- Preparation of Pre-Feasibility Report
- Preparation of Detailed Project Report

Aspects to be studied in project planning

- Need for project development,
- Type of project,
- Topography of the project area,
- Reservoir Planning
- Hydrological Studies
- Geological and Geotechnical assessment
- Seismological Studies

Aspects to be studied in project planning

- Construction material availability
- Benefit assessment
- Engineering of project components
- Environmental Impact Assessment
- Planning of project infrastructure
- Construction equipment planning
- Cost estimation and financial evaluation

Preparation of DPR

- For establishing techno-economic viability of the project and arriving at the investment decision it is essential that the project report is prepared on the basis of-
  - Reliable data
  - Adequate investigations
  - Comprehensive studies

A Good Project Report enables speedier examination and minimizing the time taken for its approval

Evolution of Guidelines for DPR preparation

- During First Five Year Plan the projects were selected on ad-hoc basis
- During second plan a committee was constituted to recommend the projects to be taken up
- CWC was given the task of technical examination with a view that
  - All necessary investigations are carried out
  - The estimates of expenditure are reasonably correct
  - The estimates of revenue are made on adequate data

Subsequent Developments

- The committee was reconstituted by Planning Commission from time to time
- In 1987 the committee was constituted under Ministry of Water Resources
- Up to 1960 no guidelines for preparation of DPR was available
- There was no uniformity in the approach for preparation of DPR

Subsequent Developments

- In 1972 CWC circulated the guidelines outlining the investigations requirements which were updated in 1975
- In 1975 Planning Commission revised the circulated list of items of reference for preparation of river valley project and included chapters on Hydrology, Irrigation planning, construction planning, estimation of costs and benefits, and also ecological aspects

Comprehensive Guidelines

- CWC for the first time issued comprehensive guidelines in 1980.
- With the advancements in technology in terms of analysis and design, survey & investigations and changes in various policies, funding these guidelines were updated from time to time.
- Presently, the latest updated Guidelines-2010 of CWC is applicable for DPR preparation.

Sections of DPR

- **Check list** to insure that all the items are covered in the DPR.
- **Salient features** - Important features of the project
- **Main report** - This section contains details of every aspect
- **Drawings** - Various drawings/maps of the project
- **Appendices and Annexure**

Section-II, Salient Features

1. **Name of the Project**
2. **Type of Project (Irrigation or Multipurpose)**
3. **Location**
4. **International / Interstate aspects of the project**
5. **Estimated life of the project (years)**
6. **Irrigation (ha)**
7. **Flood control**

Section-II, Salient Features

8. **Navigation**
9. **Water supply (Domestic / Industrial)**
10. **Project Performance**
    - (a) Irrigation
    - (b) Power
    - (c) Flood Control
    - (d) Water Supply
    - (e) Navigation
11. **Hydrology**

Section-II, Salient Features

12. **Reservoir**
13. **Submergence**
14. **Headworks**
15. **Canal System**
16. **Cropping Pattern**
17. **Power**

Section-II, Salient Features

18. Cost

18.1 Total Cost of the project
18.2 Allocated cost
(a) Irrigation
(b) Power
(c) Flood control
(d) Navigation
(e) Water Supply
(f) Any other

19. Benefits/Revenue

Section-II, Salient Features

20. Benefit Cost Ratio

(a) B.C. Ratio
(i) Irrigation
(ii) Flood control

(b) Levelized Tariff of Power

(c) Internal Rate of Return (IRR)

Section-III, Main Report

CHAPTERS OF DPR:

1. **Introduction**
2. **Physical features**
3. **Interstate/International Aspects**
4. **Surveys and investigations**
5. **Hydrology**
6. **Design feature and criteria for different river valley structures**
7. **Reservoir**
8. **Irrigation Planning**

Section-III, Main Report

CHAPTERS OF DPR:

9. Command Area
10. Flood Control
11. Drainage
12. Power
13. Navigation
14. Construction Programme & Plant Planning
15. Environment, Ecology and Forest Aspects
16. Estimate
17. Economic Evaluation & B. C. Ratio

STATEMENT-'A'

1. Name of the Scheme (Attach Location map and Index map).
2. Name of river, river basin and district in which the scheme is situated
3. Nature of scheme whether new embankments, raising and strengthening of existing embankment, drainage, anti-erosion, town protection etc.
4. Length of embankment or drainage channels.
5. Estimated cost.
6. Area benefited.
7. Date of sanction of the scheme
8. Whether inter-state/international aspect of the scheme, if any has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/Ganga Flood Control Commission and the Ministry of Water Resources has been obtained.
9. Status of requisite administrative/statutory clearance.

STATEMENT-'B'

1. Name of the Scheme (Attach Location map and Index map).
2. Abstract of cost, including foreign exchange components, if any .
3. Skeleton reports.
4. Area and population which will get protected by the project.
5. i) Betterment levy or flood cess, if any proposed for the area to be protected from floods or water logging or sea-erosion.
   ii) Anticipated revenue there from.
6. a) Benefit cost ratio
   b) Cost per hectares of area protected.
7. The extent to which people's participation is envisaged for the execution of the schemes and in what form.
8. Whether inter-state/international aspect of the scheme, if any, has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/Ganga Flood Commission and the Ministry of Water Resources has been obtained.
9. Status of requisite administrative/statutory clearance.

STATUS OF REHABILITATION AND RESETTLEMENT

Description	Total	Rehabilitation Assistance Sanctioned	Rehabilitation Paid	Rehabilitated/ Resettled	Balance to be rehabilitated/ resettled
Displaced families	655	551	386	386	165
Total	655	551	386	386	165

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LAND ACQUISITION

Item	Total Land Requirement (ha)		Land Possession Received (ha)		Balance Land Possession (ha)	
	Govt.	Private	Govt.	Private	Govt.	Private
Head Works & Reservoir	424.65	617.35	247.58	617.35	177.07	0
Main Canal	151.99	1489.51	151.99	1109.69	0	379.82
Distributaries & Minors	0	987.00	0	19.00	0	968.00
Total	576.64	3039.86	399.57	1746.04	177.07	1347.82

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PHYSICAL & FINANCIAL PROGRESS

Component	Completed up to March 2014	Phasing during the physical year			
		1st Year	2nd Year	3rd Year	4th Year
1. Head Works					
1(a). Dam & Spillway	92.00%	6.00%	2.00%		
1(b). Other Works	65.00%	15.00%	20.00%		
2. Distribution System					
2(a) Main Canal	14.62%	6.38%	26.50%	27.16%	25.34%
2(b) Distributaries and Minors	3.23%	1.00%	19.31%	36.81%	39.65%
2(c) High-level Canal	19.40%	10.77%	40.00%	25.00%	8.83%

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Constitution of Advisory Committee

- Advisory Committee has been constituted by Ministry of Water Resources on 27th November, 1987 for consideration of techno-economic viability of Major, Medium Irrigation, Flood Control and Multipurpose project proposals.
- Earlier, a Committee for recommending projects to be included in the Second Five Year Plan was set up by the Planning commission, vide their Resolution No. PC(V)/IV(5)/54, dated the 20th February, 1954.

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Constitution of Advisory Committee

- Later, the Planning Commission constituted an Advisory Committee for Irrigation, Flood Control and Multipurpose projects, vide their letter No. II-16(25)(1)/76-I&CAD, dated the 27th September, 1976.
- This Committee was entrusted with the function of getting the project examined by the Central Water Commission and Central Electricity Authority, as required to determine their techno-economic viability.

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Constitution of Advisory Committee

- The arrangements for scrutiny of techno-economic viability of irrigation, flood control and multipurpose projects have been reviewed by Government
- The Advisory Committee constituted by the Planning Commission was replaced by an **Advisory Committee in the Ministry of Water Resources** in November, 1987.

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Inter State Issues of Flood Control Schemes

- Embankment Schemes
  - ✓Such schemes which lies in or extend to a limit of 8 km from the border on an interstate river which does not flow down to any other state but whose effect may extend in the upper state
  - ✓Schemes which are on rivers or tributaries which flow down to another state

Schemes free from Inter State Issues

- R/S of existing embankment
- Retired lines for existing embankment
- Investigation of FM schemes including anti-sea-erosion
- Raising of villages
- A/E, river training schemes sufficiently away from states border
- Any scheme which does not have inter state ramification can be sanction by the state Govt. itself of any cost.

International issues

- Embankment Schemes
  - ➢schemes in the Indus river system
  - ➢Schemes in Ganga and Brahmaputra Basin

Schemes free from International Issues

- R/S of existing embankment
- Drainage Schemes
- Schemes for channel improvement
- River training/Anti erosion schemes sufficiently away from international border

Embankment (BIS 12094:2000)

- Free board may be kept as 1.5 m for discharge less than 3000 cumecs or 1.8 m for more than 3000 cumecs.
- Crest width may be kept as 5.0 to 5.5 m
- River side slope: 2H:1V
- Country side slope: 3H:1V
- HGL: 6H:1V
- Return period for design flood may be 25 years for rural area and 100 years for urban area

Embankment (BIS 12094:2000)

- Slope stability analysis may be done for embankment higher than 6 m.
- Proper drainage arrangement may be done along and across the C/S slope.
- Spacing of the embankment along the jacketed reach may be 3 times Laceys' wetted perimeter.

Bank pitching (IS 14262: 1995)

- Preferable at concave reaches.
- Thickness of pitching and size of launching apron may be worked out as per IS Code
- Two layers of protection layer may be provided when being provided in loose
- Single layer of protection layer may be adopted when provided in wire crates/wire mesh
- Thickness of launching apron will be 1.5 x thickness of pitching

CENTRAL ASSISTANCE - ACCELERATED IRRIGATION BENEFITS PROGRAMME

By

DEEPAK KUMAR
Director, CWC

Accelerated Irrigation Benefits Programme

- To give boost to the irrigation infrastructure, Accelerated Irrigation Benefit Program (AIBP) was conceived by Government of India during 1996-97, with the aim to accelerate creation of irrigation potential and realization of benefits from completed irrigation projects in the country.
- Under the AIBP program, Central Government provides financial assistance to State Governments.
- In order to improve the implementation framework, monitoring of these scheme was introduced.

AIM of Accelerated Irrigation Benefits Programme (AIBP)

- To accelerate construction of pending projects.
- To augment fund to States.
- To create benefits of Irrigation potential simultaneously.

3

GENERAL ELIGIBILITY CRITARIA

- Major/Medium/ERM projects/project components
- In advanced stage of construction which could be completed in a maximum of 4 years.
- Investment clearance from planning commission
- Not receiving financial assistance from any other source

4

Inclusion Criteria (Major/ Medium)

- A new project having investment clearance from Planning Commission and in Advanced Stage of Construction can be included only on completion of an ongoing project in the state (1:1 Criteria)
- Relaxed in case of Projects benefitting
  - Drought prone/ Desert Prone Area/Tribal areas
  - Districts Identified under PM's package of agrarian distress
  - States with Irrigation development below National average

5

Inclusion Criteria (Major/ Medium)

- Advanced Stage of Construction would imply
- 50% of Financial Progress of latest approved estimated Cost
- 50% of Physical Progress of essential works-like H/Works, E/Works, Land Aq, R&R at Reservoir Area
- Construction Planning would be such that AIBP works and CAD works taken up simultaneously.

6

Additional Inclusion Criteria (ERM Projects)

- Having Investment Clearance from Planning Commission
- Project already completed and commissioned from at least 10 years earlier from proposed year of inclusion in AIBP
- Apart from that Advanced Stage of Construction criteria should also be satisfied along with CAD works will also be followed by ERM

7

TERMS OF FUNDING(for Major and Medium Irrigation Project i.e. MMI Projects)

The central assistance will be in the form of central grant for

(i) New and Ongoing Projects -90% central assistance(CA) of project cost(works Component) in case of special category States, and KBK region of Odissa

(ii) New and Ongoing Projects - 75 % CA of project cost in Special Area i.e. Major/medium projects benefiting drought prone area(DPA), desert prone area(DDP), tribal area (TA) and flood prone area of Non- Special category states

(iii) New and Ongoing Projects -25% CA of project cost in case of Non-special category States except for (ii) above. Could be enhanced upto 50% for new projects subject to condition that the States actually carry out water sector reforms.

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….TERMS OF FUNDING(For MMI Projects)

Till finalization of reform benchmarks by MOWR, following measures will be considered as water reforms-

- 1) Measurement on volumetric basis,
- 2) participatory Irrigation Management,
- 3) Active working of Water User Association,
- 4) Micro Irrigation,
- 5) Collection at water cess by Water User Association,
- 6) Maintenance by Water User Association.

With implementation of any three of the above, the State Government will become eligible for enhanced funding

9

….TERMS OF FUNDING (for MMI Projects)

- The Desert Development Programme (DDP) area/Desert Prone Area will be as identified by Ministry of Rural Development in their published documents.
- For the purpose of determining the quantum of assistance, a project benefiting Desert Development Programme (DDP) area/Desert Prone Area will be treated on a par with those benefiting DPAP areas.
- The balance funds to be arranged by the state government from its own resources.

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SPECIAL CATEGORY STATES FOR AIBP

- The Special Category States covers the North Eastern States, Himachal Pradesh, Jammu & Kashmir, and Uttaranchal. The projects in the undivided Koraput, Bolangir and Kalahandi (KBK) districts of Orissa will also be treated at par with Special Category States.

- All other States not covered in Special Category shall be Non-Special Category States

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…Mode of funding

- MI schemes of Special Category States and Non Special Category States (benefiting DPAP/Tribal areas) are eligible for 90% grant assistance.
- During a financial year, the sanctioned grant will be released in two installments.
- (i) For projects receiving 25% CA :- 90%(as 1st Install) after release of at least of 50% of State Share. and balance 10% (2nd Install) after obtaining the UC of minimum of 50% of CA released earlier and
- (ii) For projects receiving higher than 50 % CA:- 50% (1st Install) after the State Releases its full Share and 50% (2nd Install) same as above

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…Mode of funding

- After inclusion of project and release of grant, next year installments to be released after receipt of Utilization Certificates(UC) for 100% utilization of previous year issued by Chief Engineer and countersigned by Secretary (WR/Irrigation).
- The UC must contain Irrigation Potential achieved, financial progress/expenditure on AIBP and CAD Component as agreed in MoU
- States have to submit fresh proposals each year as per guidelines of the AIBP.

13

Completion period

- Major/medium/ERM projects or project component are required to be completed in a maximum of 4 years excluding year of inclusion of project in AIBP(The State Governments will are required to enter into an MoU with the MoWR).
- The projects not going as per schedule, Maximum time of 2 years and cost escalation by maximum 20 % allowed based on proper Justifications by the State
- Surface MI schemes are required to be completed in a maximum of 2 years excluding year of inclusion of project in AIBP.

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MEMORANDUM OF UNDERSTANDJING

State governments will be required to enter into an MoU with the MoWR for each individual project and group of MI schemes under the programme indicating

- Latest estimated cost approved by planning Commission, balance cost, balance potential, year-wise phasing balance potential and
- Agreement to create targeted irrigation potential and potential utilization under CAD activities in four financial years for major/medium projects and

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MEMORANDUM OF UNDERSTANDING

- two financial years for minor irrigation schemes MOU will also contain target date of completion
- Ensuring required Quality Control Aspect, Monitoring Mechanism, Adequate of funds for 10 years maintenance, independent evaluation of AIBP components and CAD components.
- Agreement for termination that if physical/financial progress not achieved as per schedule and State fails to submit convincing reply, grant will be **converted** into loan.

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MEMORANDUM OF UNDERSTANDING

- Agreement for monitoring of project through Three-Tier Monitoring Mechanism by State Govt and CWC/MoWR. Third party monitoring will be carried out by State Govt and report will be submitted along with utilization certificate to GoI.
- Agreement for concurrent evaluation of the projects under AIBP(AIBP Component and CAD Component) to be done by independent agency out side the administrative control of MoWR, GOI/State Water Resource Deptt at the end of each financial year during the period of funding under AIBP

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Processing of CA Proposal

- The State Government submit the CA proposals completed in all respects(including CADWM components with investment clearance to Field Unit (FU),CWC.
- The FU,CWC checks the proposal towards its completeness and recommends to CWC(HQ)/with check list issued by MoWR OR returned to State with observation for further compliance
- The CWC(HQ) finally scrutinize the proposal and its soundness and recommend to MoWR/or return to FU,CWC for further compliance

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Processing of CA Proposal

- CA Proposal includes:-
- Form (N)- for New proposal and Form(C)-for Continuing Proposal
- MoU
- Budget Certificates
- Utilization Certificate
- Audit Statement of Year-wise Expenditure
- Land Acquisition Certificate
- Capital Assets Certificate

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Processing of CA Proposal

- Special Area Certificate(if applied for)
- Copy of Investment clearance
- Abstract of Physical and Financial progress component-wise
- Quarterly physical and financial programme
- Justification for extension of time or any shortfall in potential creation or utilization(if required)

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Inclusion Criteria
(Minor Irrigation Schemes)

- Each MI scheme should be approved by State TAC
- For Special Category states and KBK districts of Odissa :
  - Individual Scheme having CCA of 10 Ha and a clushter of schemes within radius of 5Km having CCA of 20 Ha
  - benefit cost ratio of more than 1 and
  - The development cost per hectare of the scheme to be < Rs.2.5lakh. (subject to the condition that funding will be restricted to a ceiling of Rs.1.5 Lakh / Ha only)
- For Non-special category states : Individual Scheme having CCA of 20 Ha and a clushter of schemes within radius of 5Km having CCA of 50 Ha Benefitting tribal areas or drought prone areas,desret prone area and left wing extremist affected area.

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TERMS OF FUNDING(for Surface Minor Irrigation Project)

The central assistance will be in the form of central grant for

(i) Ongoing projects -90% central assistance(CA) of project cost(works Component) in case of special category States, KBK region of Odissa and Special Area i.e. Major/medium projects benefiting drought prone area, desert prone area,tribal area and flood prone area in non special category states

(ii) New Projects - 75 % CA of project cost in Special Area i.e. Major/medium projects benefiting drought prone area, desert prone area,tribal area and flood prone area in non special category states and

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THANK YOU

Government of India

Central Water Commission

PROCEDURE & GUIDELINES FOR RELEASE OF CENTRAL ASSISTANCE UNDER FLOOD MANAGEMENT SCHEMES

Deepak Kumar
Director, FM-I, CWC

INTRODUCTION

- Flood Management - A State Subject
- Planning, Investigation & Execution - State Government/Brahmaputra B.
- Appraisal of Schemes – CWC/GFCC
- Investment Clearance – Planning Commission

Flood Management Scheme

- Integral part of overall Water Resource Development
- Comprehensive Approach to the Problem of Flood in the area
- Proposal should aim at the Socio-Economic Development
- Should include Land Management, Ecological & Afforestation aspects, Soil Conservation, Watershed Management
- Schemes should be formulated in coordination with Railways, NHAI, State Irrigation Department

Different types of works in DPRs

- Flood Protection Works – Construction of new Embankment, Raising & Strengthening of Embankment, Guide Bunds, Protection Wall
- Anti-erosion Works – Revetment/Pitching, Launching Apron, Spurs, Porcupines
- Channel Improvement Works – Pilot Channel
- Drainage Improvement Works – Sluices

Categories of FM Schemes

- MINOR SCHEMES – Costing less than Rs. 12.5 Crore
- MEDIUM SCHEMES – Costing between Rs.12.5 Crore to Rs. 25 Crore
- MAJOR SCHEMES – Costing more than Rs. 25.00 Crore

Appraisal of Schemes costing more than Rs. 25.00 crore

- To be prepared by Flood Control Department.
- Approval of State TAC
- Clearance from the SFCB if scheme costs more than Rs. 30.00 Crore
- Forest Clearance from MoEF for Project costing more than Rs 100 Crore
- To be submitted to CWC field office

Continued……

- Detailed examination in specialized Directorate of CWC after preliminary examination in CWC field office
- If found viable than put up to Advisory Committee of MoWR for clearance.
- Investment Clearance is to be obtained from the Planning Commission.

Flood Management Programme (FMP)

- FMP was launched by the union Government to provide central assistance to the states for implementation of FM schemes including anti sea erosion during XI Plan (2007-12)
- Continued during XII Plan (2012-17) with an outlay of Rs. 10000 Crore.
- Funding pattern in XII plan
  - Non spl. Category states - Cost more than Rs 40 Crore, BC Ratio >1, Funding Ratio – 50:50
  - Spl. Category states - Cost more than Rs. 10 Crore, BC Ratio -> 1, Funding Ratio - 70:30

Contd./-

- Funding pattern for restoration of schemes & catchment area treatment for all the states - 90:10 in XI Plan
- Now in XII Plan – Central Assistance in these case would be provided as applicable to respective category of States
- Spillover works of XI Plan will be funded as per earlier formula of funding
- Anti-sea erosion works will also covered under FMP
- Central Assistance for Flood Management Scheme taken up in Integrated Manner

Scope of Funding

Provision for funding of following categories of critical flood control, river management and anti-sea erosion works in the country

- River management;
- Flood control;
- Anti-erosion works;
- Drainage development works;
- Flood proofing works;
- Flood prone area development programme in critical regions;
- Restoration of flood control/management works damaged due to force majeure like conditions*(excluding covered under CRF/NCCF);*
- Anti-sea erosion works; and
- Catchment area treatment works (*promotional in nature on selective basis with high runoff rate/convergence with similar other works).*

Eligibility Criteria for new Schemes

- For Special Category States: Estimated Cost Rs. 10 crore and above with B.C. Ratio more than 1.0

  (States: NE States, Sikkim, J&K, HP and UK)
- For General / Non-Special Category States: Estimated Cost Rs. 40 crore and above with B.C. Ratio >1.0
- State Govt. shall ensure inclusion of the scheme in the State Plan, make requisite budget provision towards Central as well as State share on annual basis.
- State Governments which adopt Flood Plain Zoning Bill would be given priority over the other States.
- Recommendation of CWC (GFCC for Ganga Basin) for inclusion is mandatory for schemes.

Other Important Conditions

- The release of Central Assistance will be made only after release of corresponding State Share. A certificate to this effect will have to be given by the Principal Secretary.
- The State Governments shall ensure that the works are executed in a well planned manner and completed within the scheduled completion period.
- Progress shall be monitored through CPM/PERT Charts; which shall be submitted within three months of release of first installment of central assistance.
- In cases where project completion is delayed due to force majeure , extension may be considered by IMC-FMP on merits on the basis of justification by State, views of appraisal agency and revised investment approval by Planning Commission.

Process for funding under FMP

- After Investment clearance by the PC , Proforma (FMP-I) has to be filled up by the state Govt. duly signed by the Secretary of the WR Dept. for consideration by the IMC-FMP
- After approval of the IMC-FMP , proforma (FMP-IV) along with necessary certificates are to be submitted to MoWR for release of Ist installment

Release of Central Assistance

- Central Assistance shall be released in two installment in a financial year
- First Installment

- Projects receiving assistance up to 50% of project cost, 90% of central share in the Annual State Budget shall be released on submission of certificate duly signed by concerned Principle Secretary that state has released at least 50 % of state share to the project as provided in Annual State budget.
- Projects receiving assistance higher than 50% of project cost, 50% of central share in the Annual State Budget shall be released on submission of certificate duly signed by concerned Principle Secretary that state has released full state share to the project as provided in Annual State Budget.

Release of Central Assistance (Contd)

- **Second/Subsequent Installment(s)**

- In the same financial year, Balance/Second installment shall be released on submission of **Utilisation certificate for utilising 50% of CA released**, due recommendation of monitoring agency, budget provision of state as well as central share, certificate by Principle Secretary that state has released full state share to project.

- In the next/subsequent financial year, installment shall be released on submission of **Utilisation certificate for utilising of full central share others released earlier,** due recommendation of monitoring agency, budget provision of state as well as central share, certificate by Principle Secretary that state has released full state share to project

Release of Central Assistance (Contd)

- **Reimbursement of Expenditure**

- CA towards expenditure incurred in previous year(s) before its approval by IMC-FMP would not be entertained.
- Actual expenditure in the financial year (yr of approval by IMC-FMP) or in a year after the approval of project would be reimbursed on submission of certificate towards actual expenditure incurred duly countersigned by concerned Principal Secretary

Documents for inclusion of Schemes in FMP

- FMP-1
- Clearance from state TAC
- Clearance from state flood control board-for schemes costing more than 30 cr
- Forest clearance
- Certificate by Chief Engineer-land has been accuired and in possession of state govt.
- Certificate by CE-the project has not received any financial assistance in past from any agency of govt of india.
- Certificate by CE- cost of projects is firm and final and escalation in cost would be borne by state govt.
- Techno-economic viability acceptance of DPR for the projects by CWC/GFCC/Advisory committee of MOWR.
- Investment clearance by Planning commission
- Assurance from state finance department that requisite funds would be provided by state as per phasing
- Any other clearance if required.

Documents for Release of Fund

- Approval IMC-FMP
- Recommendation of CWC/GFCC/BB in FMP-4 Performa
- Sate budget allocation
- A certificate duly signed by concerned principal secretary –it has released its full state share to projects as provided in the annual budget
- State wise annual ceiling fixed by planning commission under fmp(to be enclosed by Ganga wing)

➢ Documents required for subsequent installment -

- Physical and financial progress in FMP-2 and FMP-3
- Utilisation certificate in GFR 19 A
- State budget allocation
- A certificate duly signed by concerned principal secretary –it has released its full state share to projects as provided in the annual budget
- Recommendation of CWC/GFCC/BB in FMP-4
- Report of concurrent evaluation by independent agency
- Statement of audited expenditure of central assistance released

B C Ratio:

- Economic viability judged by Benefit Cost Ratio.
- Last 10 years damage data duly certified by the Revenue Authority.
- Life of project may be taken as 50 years

B. C. Ratio= Annual Benefits/Annual cost

- Annual cost of flood management as 17% (10%- Interest Charges +5%- Maintenance +2%- Depreciation) of the capital cost of the Schemes in case of Anti erosion schemes and 16%(10%- Interest Charges +4%- Maintenance +2%- Depreciation) in case of Raising & Strengthening of embankment schemes.

For any scheme to be economically viable, B.C. Ratio should be greater than 1.

Thank You

STATEMENT-'A'

1. Name of the Scheme (Attach Location map and Index map).
2. Name of river, river basin and district in which the scheme is situated
3. Nature of scheme whether new embankments, raising and strengthening of existing embankment, drainage, anti-erosion, town protection etc.
4. Length of embankment or drainage channels.
5. Estimated cost.
6. Area benefited.
7. Date of sanction of the scheme
8. Whether inter-state/international aspect of the scheme, if any has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/Ganga Flood Control Commission and the Ministry of Water Resources has been obtained.
9. Status of requisite administrative/statutory clearance.

STATEMENT-'B'

1. Name of the Scheme (Attach Location map and Index map).
2. Abstract of cost, including foreign exchange components, if any .
3. Skeleton reports.
4. Area and population which will get protected by the project.
5. i) Betterment levy or flood cess, if any proposed for the area to be protected from floods or water logging or sea-erosion.
   ii) Anticipated revenue therefrom.
6. a) Benefit cost ratio
   b) Cost per hectares of area protected.
7. The extent to which people's participation is envisaged for the execution of the schemes and in what form.
8. Whether inter-state/international aspect of the scheme, if any, has been examined by the State Technical Advisory Committee and, where necessary, clearance of the CWC/Ganga Flood Commission and the Ministry of Water Resources has been obtained.
9. Status of requisite administrative/statutory clearance.

Repair, Renovation and Restoration (RRR) of Water Bodies in XII Plan

DEEPAK KUMAR
Director
Central Water Commission
New Delhi

Water Body

- A water body is a structure where rain water is accumulated or water is stored by diversion from a stream , nala or river.
- Water bodies serve as storage reservoirs of water in the monsoon dependent areas of the country where there exists a shorter period of rainfall and a long dry spell with very high deviation of annual rainfall.
- The small storage tanks are called ponds which are mostly community owned.
- The large storage tanks whose commands varies from 20 to 2000 hectares are generally constructed by govt. or local bodies.

Why RRR?

- Agriculture is the main occupation of rural population on India.
- Through the ages, Indian agriculture has been sustained by natural and man-made water bodies such as lakes, tanks, ponds and similar structures.
- In India, tanks/ponds and lakes have traditionally played an important role in conserving water for meeting various needs of the communities.
- However, many of these water bodies are not in use because of the development of ground water irrigation systems, inadequate maintenance, encroachments, illegal diversion of land for construction and other purpose, etc.

Cond…

Why RRR?

- The water bodies have gone into disuse mainly due to prolonged and continuous neglect of maintenance.
- Heavy silting of tank bed, choked up feeder channels, leaking and weak bund, leaky sluices and dilapidated surplus weirs and ill maintained distribution channels are the common deficiencies in the present conditions of these minor irrigation tanks.
- Further, encroachments in tank bund, foreshore, water-spread and supply channels, deforestation and denudation in the catchments areas leading to extinction of water bodies as a whole for housing and urbanisation and indiscriminate use of tank beds as dumping yards have also contributed to the deterioration of the water bodies.

Initiation during Xth Plan

- Ministry of Water Resources launched a pilot scheme during X Plan for **Repair, Renovation & Restoration (RRR)** of water bodies.
- A pilot scheme, "National Project for Repair, Renovation and Restoration (RRR) of Water Bodies directly linked to Agriculture" was taken up in January, 2005 for implementation during the reaming period of Xth plan with an outlay of Rs.300 crores to be shared by Centre and State in the ration of 3:1.
- The scheme was sanctioned in respect of 1098 water bodies in 26 districts of 15 States with a target to create 0.78 lakh ha of additional irrigation potential.
- The aims and objectives of the Pilot Scheme on water bodies was to restore and augment the storage capacities of water bodies and to recover and extend their lost irrigation potential.

(X Plan)

- Many reputed organisations like WALAMTRARI, Hyderabad, CWRDM, Kerala, Tamilnadu Agricultural University, NRSC, Hyderabad, WTC Bhubaneswar etc. have carried out the Evaluation of the Pilot Scheme:
- There is an increase in storage capacity varying from 50% to 83% .
- Increased utilisation in Annual irrigation.
- Improvement in Socio-economic condition (income and standard of living etc.) of the people benefitting from the water body.
- The benefits of the scheme of RRR of water bodies percolated to SC/ST families.

Main objectives of RRR Scheme under XII Plan

(i) Comprehensive improvement and restoration of water bodies thereby increasing tank storage capacity.

(ii) Ground Water Recharge.

(iii) Increased availability of drinking water.

(iv) Improvement in agriculture/horticulture productivity.

(v) Improvement of catchment areas of tank commands.

(vi) Environmental benefits through improved water use efficiency; by promotion of conjunctive use of surface and ground water.

(vii) Community participation and self-supporting system for sustainable management for each water body.

(viii) Capacity Building of communities, in better water management.

(ix) Development of tourism, cultural activities, etc.

Funding Pattern & Eligibility Criteria

- **Central Assistance(CA) of 90% in the form of grant for Special Category States**

✓ *North-Eastern States including Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttarakhand and undivided Koraput, Bolangir and Kalahandi (KBK districts of Orissa)*

✓ *Projects lying in Desert Development Programme(DDP), Drought prone area/Tribal area/Naxal affected area.*

- **Central Assistance(CA) of 25 % in the form of grant for Non-Special Category States**

Eligibility Criteria For Funding

- The water bodies for funding are to be approved by the State Advisory Technical Committee (TAC) constituted by the State which includes representative from Central Water Commission (CWC) and Central Ground Water Board as Member.
- The water bodies lying in Desert Development Programme (DDP), drought prone area/tribal area/Naxal affected area to be taken up will be decided in consultation with Planning Commission.
- The proposals not receiving any other form of financial assistance.
- The works shall be completed within 2 financial years excluding the year of inclusion of water bodies under RRR.
- Proposals with B.C. Ratio of **1:0 for special category states/areas** and **more than 1.0 for non-special category states**.

Eligibility Criteria For Funding

- Rural water bodies having minimum water spread area of 5 hectare.
- Urban water bodies having water spread area from 2.0 hectare to 10 hectare.
- The scheme will emphasize development of catchment area, desiltation and command area development in respect of water bodies.
- The RRR scheme in rural areas is proposed to be implemented in convergence with the Integrated Watershed Management Programme (IWMP) so that the catchment areas of the water body selected are located either in treated micro/mini watershed or those selected for treatment during the next.

Planning of the Projects:

Criteria for identification and Selection of water bodies

- A project may be prepared with an individual water body with sub-basin approach.
- All public and community owned water bodies may be covered under the project but private owned water bodies are not covered.
- All water bodies included in the project will be given a Unique Code Number.
- States will accordingly undertake census of these water bodies and get complete list of water bodies along with Unique Code in the first stage.

Implementation of the Scheme- State Level

- A Technical Advisory Committee (TAC) will be constituted by the State to techno-economically appraise and approve the DPR.
- TAC shall also include representative from Central Water Commission (CWC) and Central Ground Water Board (CGWB).
- After approval of the DPR by the State TAC, the State will submit the DPR to the concerned Regional / Field Office of CWC.
- The Field unit, CWC shall scrutinise the DPRs and forward the proposal along with their recommendations to PPO, CWC, New Delhi
- The concurrent evaluation at the time of implementation would be got done by State Governments themselves.

Empowered Committee

- The MoWR will coordinate the programme at the Central Level through Central Water Commission.
- The inclusion of the Water Bodies for assistance under the Scheme would be approved by the Empowered Committee of MoWR under the Chairmanship of Secretary/Special Secretary/Additional Secretary (WR).

Composition of Empowered Committee of MoWR for inclusion of water bodies under the scheme of RRR of water bodies in XIIth Plan

1.	Secretary/ Special Secretary/ Additional Secretary, Ministry of Water Resources (MoWR)	- Chairman
2.	Commissioner(SP), MoWR	- Member
3.	Joint Secretary & Financial Advisor, MoWR	- Member
4.	Chief Engineer, Project Preparation Organization (PPO), Central Water Commission (CWC)	- Member
5.	Member (SAM), Central Ground Water Board	- Member
6.	Representative of Planning Commission	- Member
7.	Representative of Ministry of Urban Development	- Member
8.	Representative of Ministry of Rural Development	- Member
9.	Senior Joint Commissioner (MI),MoWR	- Member Secretary
10.	Director (Ground Water), MoWR	- Member

PROCEDURE FOR SUBMISSION OF PROPOSALS

- At the water body level, the DPRs of the water bodies are to be prepared by WUA / Local Panchayat / a Government agency identified by District Level Implementation Agency (DLIA). The DPRs will then be forwarded to DLIA for onward transmission to the State Level Nodal Agency (SLNA).
- The proposals received by DLIA would be scrutinised, included in the District Plan and forwarded to State Level Nodal Agency (SLNA) for putting up to State TAC.
- After approval of the DPR by state TAC, the States will submit DPRs to the field office of Central Water Commission, which in turn will take further necessary action for release of funds under the scheme.

RELEASE OF FUNDS

The Central Assistance (CA) will be in the form of central grant which will be as follows:

- **For Ongoing projects already under RRR:**

  90% of project cost in case of special category States, projects benefiting drought prone area, tribal area and flood prone area and **25% of project cost** in case of Non-special category States/areas.

- **For new projects under RRR :**

  90% of the cost of the project for Special Category States, and projects benefiting special areas (Naxal affected areas, DPAP areas, Tribal areas, DDDP area of General Category States and **25% of project cost** in case of Non-special category States/areas.

RELEASE OF FUNDS (contd…)

- State government shall keep necessary budget provision for the total amount of the project cost for both Central and State shares are to be kept in the State Plan Budget for the relevant year.
- State Governments will be required to enter into an MoU with the MoWR for each individual project under the programme indicating estimated cost, potential to be restored, year-wise phasing of expenditure along with the target date of completion.
- The State Government shall transfer the Central Grant to the project implementing authority within 15 days of its release by the Government of India.

RELEASE OF FUNDS (contd…)

- For projects receiving assistance upto 50% of project cost, 90% of GOI share of funds is to be released after release of at least 50% State's share.
- For projects receiving assistance higher than 50%, 50% GOI share is to be released after the State releases its full share.
- Balance/ Second instalment of GOI share is to be released after obtaining Utilization Certificate (UC) of minimum of 50% of GOI funds released earlier.
- For release of 2nd instalment, State Government shall take necessary steps for declaring the water body boundary through a Government order and to ensure removal of encroachments in the water body spread area/water body boundary.

RELEASE OF FUNDS (contd…)

- Next year instalment is to be released after obtaining 100% utilization of funds released in the previous year(s).
- The Utilization Certificate (UC) shall be issued by the Chief Engineer of the project and countersigned by Secretary (Water Resources /Irrigation) / Secretary (Finance) of the State Government.
- The State Government shall provide annual audited statement of expenditure incurred within 9 months of release of central grant.

RELEASE OF FUNDS (contd…)

- If the State Government fails to comply with the agreed date of completion, the grant component released will be treated as loan and recovered as per the usual term of recovery of the central loan.
- The cost at the time of inclusion of any new project in the scheme of RRR of water bodies will be frozen.
- In cases where project completion is delayed due to force majeure, time extension may be considered for maximum one year.

Monitoring and Evaluation

- Regular monitoring of the project is to be carried out at each stage. Monitoring would include maintaining of both physical and financial progress and the outcome. Monitoring would be done with the association of the Coordination Cell of the State Govt. and Standing Committee of the Panchayat at the appropriate level.
- The water bodies under RRR would also be monitored periodically on sample basis by Field Office of Central Water Commission.
- Baseline survey would be conducted before the commencement of the project execution. Evaluation and impact assessment of the scheme will be done by independent agencies to be identified by the Ministry of Water Resources. Necessary reports and field visits are to be made on regular basis for the purpose.

Documents/materials required to be sent by the Field unit to CWC HQ for processing the proposals:

- Appraisal Note of each of the water body(in soft and hard copy).
- Recommendation of Regional office, CWC. It shall include the amount of 1st instalment to be released.
- Soft copies of each of the water bodies in tabular column format mentioning the details.
- Copy of the Budgetary provision certificate.
- State Share release certificate.
- IWMP certificate.

THANK YOU

MONITORING OF IRRIGATION PROJECTS USING BHUVAN WEB SERVICES

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INTRODUCTION

Monitoring and evaluation of irrigation projects must play a more important role in the future if the irrigation management process is to be improved. The process is complex, since a large number of regular, specific tasks must be performed, both concurrently and sequentially, and coordinated by a variety of professionals within available time and resource constraints. For any evaluation to be used, it must be credible- objective, accurate, and fair. Reports should be clear, unambiguous, balanced in terms of strengths and weaknesses, and contain justifiable conclusions and recommendations. For monitoring and evaluation to succeed, irrigation managers need to develop a new evaluative mind-set that enables them to appraise their projects' performance objectively, reflect on what has been learned for future use, and adjust policies on the basis of that knowledge whenever necessary.

The gainful use of high resolution **CARTOSAT** satellite data for inventory of Irrigation Infrastructure (canal network, conveyance & distribution system), assessment of progress of Irrigation works, closer visualization of spatial irrigation utilization patterns, assessing the impact of irrigation developmental programme on the performance of irrigation command and to address the performance at Water Users level in the participatory irrigation management approach.

DEFINITION OF MONITORING AS PER CWC

Monitoring is the process of collecting information about the actual execution of planned tasks and factors, which might affect their execution; analyzing these in relation to the plan and exercising control, so that the deviations from the plan are minimal. This helps the central authorities to assess the real work done up to a time, so that necessary advises can be given to project authorities.

OBJECTIVES OF THIS TRAINING PROGRAMME

i.) Monitoring of Priyadarshini Jurala Project, Andhra Pradesh through spatial technique

ii.) Digital Image processing involved in the process of monitoring of irrigation projects through Remote Sensing and GIS

iii.) Assessment of irrigation potential created up to April 2007 using Cartosat high resolution satellite data and Identification of gap / critical areas in I.P creation

iv.) Inventory and Mapping of Irrigation Infrastructure consisting of canal network, cross drainage and other irrigation structures

v.) Assessment of Irrigation Potential (I.P) created as on April, 2007 as the data corresponds to April 2007.

Details of Methodology

Basic approach involved in the study consists of inventory and mapping of existing irrigation infrastructure viz. canal network, irrigation and other related structures from the Cartosat satellite data in a irrigation project and comparing with proposed irrigation infrastructure. Based on the completed irrigation infrastructure derived from the cartosat-1 satellite data and considering the hydraulic connectivity, the Irrigation Potential created in the project command is assessed. Brief description of methodological steps involved in the study area given below:

(a) Overview of Methodology

1. Field data collection: Collection of preliminary and detailed field data consisting of map(s) showing proposed canal network and canal wise CCA/ICA, I.P proposed, I.P created as on March 2009 or any other date as required by the project .

2.Cartosat data acquisition planning and procurement : Preparation of AIBP component polygon shape file(s) using the field maps to plan for acquisition of fresh Cartosat satellite data

during April 2010 - June 2010 for all the projects (both completed / ongoing) . In case atellite data is not available, either for total project during the above period, the time window will be extended beyond Jun, 2011 till it is covered for completely ongoing projects. For completed projects, in addition to the above, the archived Cartosat data from April 2008 onwards will also be utilized.

3. Field database creation: Preparation of field database on irrigation infrastructure and Irrigation Potential information

4. Cartosat database creation: Edge matching and mosaic of Cartosat satellite data tiles and preparation of satellite database.

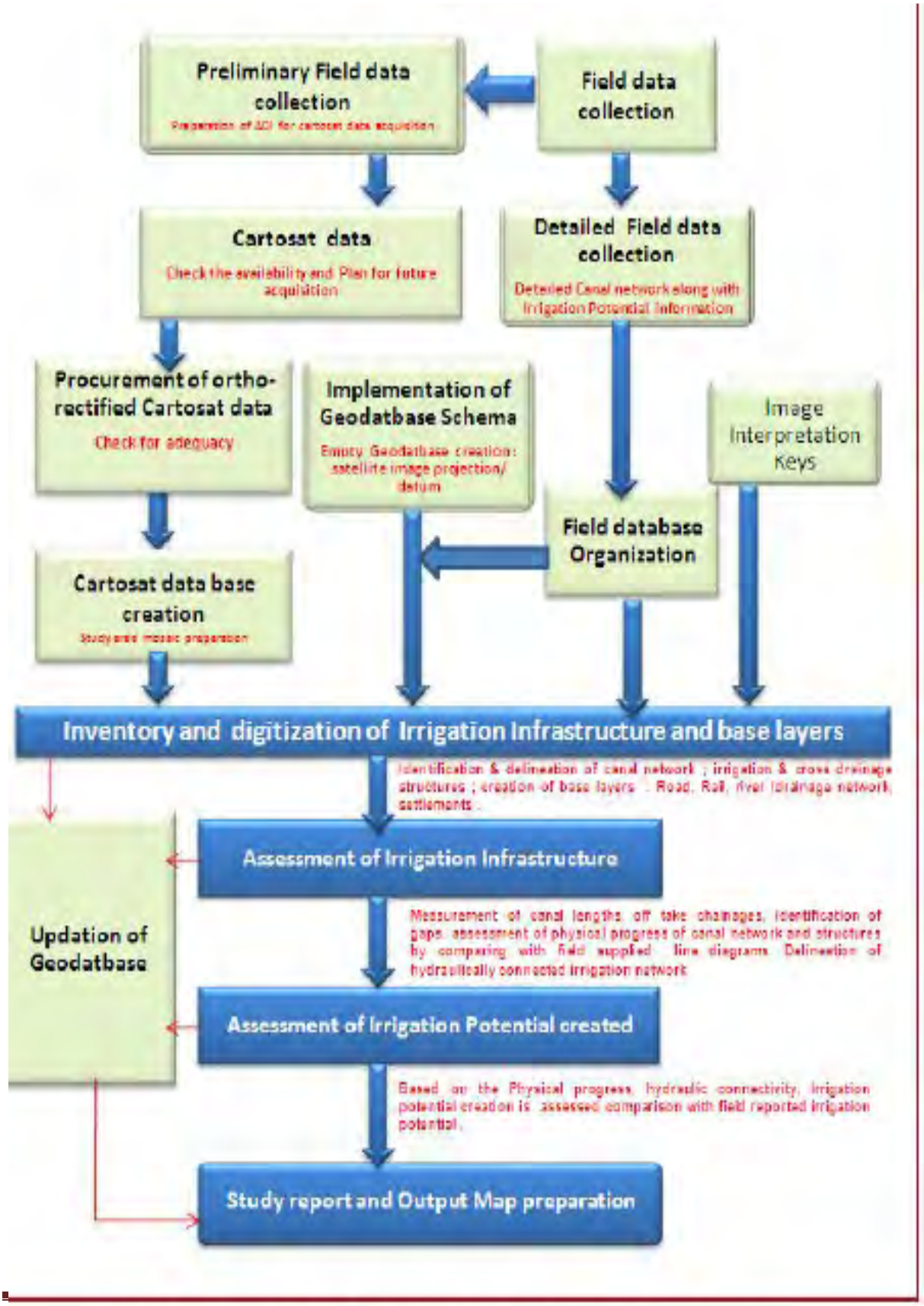
5. Geo-database creation: All the vector layers (Irrigation Infrastructure and base layers) along with attribute information will be developed in GIS environment using geo-database schema developed for the project.

6. Inventory and mapping of Irrigation Infrastructure and base layers : Identification and mapping of existing Irrigation Infrastructure consisting of Irrigation canal network up to Minor /Sub-Minor level, Cross drainage, Irrigation and other structures as on the date of satellite overpass date. Identification and mapping of base layers consisting of study area boundary, rivers, streams, roads, railway lines, settlements, balance I.P polygons etc.

7. Assessment of Irrigation Infrastructure and Irrigation Potential created: Comparison of satellite derived information with proposed Irrigation infrastructure to create planned I.P under AIBP. Assessment of Irrigation Potential (I.P) created based on the extent of accomplishment in irrigation canal network creation with hydraulic flow continuity as on the satellite data acquisition date. Finalization of assessment of I.P created.

8. Ground truth field visit: Conduct of random field visits to check for satellite data interpretation.

9. Preparations of Outputs: Preparation of output map along with study report; Preparation of digital data backup for supply to user. Flow chart showing the over view of the methodology is provided here.



Process flow chart for the Irrigation Potential assessment

The **Inputs / Parameters** required from the **field data** and **satellite data derived irrigation infrastructure** information are:

1. **Proposed length** of canal.
2. **Satellite derived Lengths** ; Physical progress of canal construction for the corresponding canal.
3. Irrigation potential proposed under each canal .
4. **Gaps** existing in different stretches of the canal network,

- Number of gaps and gap lengths, their chainages – derived hydraulically connected length of a particular canal .

5. Number of **DPOs**, their contribution to the **irrigation potential** as per field data; their **chainages** – to assess the hydraulic connectivity .

The **steps to be followed** for the satellite based assessment of irrigation potential creation: Irrigation potential assessment is made based on physical status of canal and its hydraulic connectivity to the source of irrigation. As explained earlier, canal network hierarchy consists of Main canal – Branch canal-Distributary-Lateral-sub lateral , etc and may vary from one project to another project. In addition to this, irrigation potential is also created through the Direct Pipe Outlets (DPOs) from Main canal /Distributary, etc. Various scenarios that one would come across in different irrigation projects are briefly explained.

(Details of methodology has been described in NRSC manual).

GROUND TRUTH

The ground truth photographs have been taken from the actual site and have been compared with the corresponding images to have a clear visualization.

CONCLUSION

The endeavour of bringing together the this monitoring of Irrigation projects using online monitoring, the direction and decisions in this domain will shape our future in monitoring real time scenario of any irrigation projects with no software cost. The free plug ins can be loaded to the G-GIS to have a smart way of analyzing things.

Minor Irrigation

-Manish Rathore
Deputy Director

Definitions and Concepts

Definitions

- Culturable Command Area (CCA)
  - The area which can be irrigated from a scheme and is fit for cultivation.
- Gross Irrigated Area
  - The area irrigated under various crops during a year
- Irrigation Potential Created
  - The total gross area proposed to be irrigated under different crops during a year
- Irrigation Potential Utilised
  - The gross area actually irrigated during reference year

Minor / Medium / Major Schemes

- Minor Irrigation (M.I.) Scheme
  - CCA up to 2,000 hectares
- Medium Irrigation Scheme
  - CCA more than 2,000 hectares and up to 10,000 hectares
- Major Irrigation Scheme
  - CCA more than 10,000 hectares

Minor Irrigation

- Irrigation projects with Culturable Command Area of less than 2000 hectare are minor irrigation projects
- Minor Irrigation contribute a major share in the growing irrigation across the country
- Account for about 65% of the total Irrigation Potential Utilized

- Types
  - Dugwell
  - Shallow tubewell
  - Deep tubewell
  - Surface flow schemes
  - Surface lift schemes

Advantages of MI

- Advantages
  - The minor irrigation schemes provide the farmers with controlled and timely irrigation which the new high yielding varieties of seeds demand.
  - Less implementation time required
  - Involve reasonable investments for their commissioning
  - If the surface water projects alone are not able to meet the full demand of water, farmers install wells and tube-wells in their command area to provide supplementary irrigation

Types of MI Schemes

Dug Well

- Ordinary open wells of varying dimension

Tube Well

- Shall Tubewell - depth < 100 m
- Deep Tubewell - depth > 100 m

Surface Flow Irrigation Scheme

- Use rainwater for irrigation purposes either by storing it or by diverting it from a stream, nala or river

Surface Lift Irrigation Scheme

- In regions where the topography does not permit direct flow irrigation from rivers and streams, water has to be lifted into the irrigation channels.
- It is similar to diversion schemes, but in addition pumps are installed and pump houses constructed.

Government Efforts in MI Schemes

Minor Irrigation Programme

- Implementation of minor irrigation works in States is done by various departments and organisations under different developmental programmes.
- Government of India is operating a centrally sponsored scheme "On farm Water Management for increasing Crop Production in Eastern India" for assistance to small and marginal farmers
- Under "Rural Development Programme", the minor irrigation works are taken up
- The Department of Rural Development, Government of India operate a centrally sponsored scheme titled "Integrated Rural Development Programme" (IRDP) under which subsidies are made available to the farmers for minor irrigation works.

Minor Irrigation Programme

- The renovation of tanks and construction of ponds/tanks, gully, plugging and nala bunding, etc. are also taken up under various employment generation programmes such as Jawahar Rozgar Yojna (Employment Assurance Scheme)
- Under the "Drought Prone Area Programme", about 7.45 lakh square kilometre of area is being benefited (as per the Annual Report 2003-04)
- Minor irrigation works are also taken up as a component of "Tribal Development Programme"

Some Statistics

Source: 4th Minor Irrigation Census, 2007-09, MoWR, Govt. of India

Statistics

- Total number of MI Schemes throughout India:
  - About 21 million
- Total number of Ground Water Schemes
  - About 19.75 million
- Total number of Surface Water Schemes
  - About 1.2 million

Statistics

- Numbers of MI Schemes w.r.t. states

Uttar Pradesh	42.8 Lakh
Andhra Pradesh	23.1 Lakh
Maharashtra	22.7 Lakhs
Tamil Nadu	19.12 lak
Madhya Pradesh	19.06 lakh

Thank You

CROP WATER REQUIREMENT USING CROPWAT AND CLIMWAT

Sunil Kumar, Director
National Water Academy, Pune

Introduction

CROPWAT calculates crop water requirements and irrigation schedules based on the data supplied by the user. It normally calculates CWR and schedules for one crop, it can also calculate a scheme supply, which is basically the combined crop water requirements of multiple crops, each with its individual cropping pattern. In this lecture, we will first input data by going to each individual data input module and enter new data, or load data from file, or import data from other programmes. The practical session will demonstrate all the relevant use of CROPWAT, CLIMAT, and CRI software and the intricacies involved along with the details of Penman, Penman-Montieth methods.

Interacting with CLIMAT2

The input data can be prepared from available literature and CLIMAT2 is sometimes used to access some data. It provides long-term monthly mean values of seven climatic parameters, namely:

i.) Mean daily maximum temperature in °C
ii.) Mean daily minimum temperature in °C
iii.) Mean relative humidity in %
iv.) Mean wind speed in km/day
v.) Mean sunshine hours per day
vi.) Mean solar radiation in MJ/m2/day
vii.) Monthly rainfall in mm/month

Reference ET calculated with the Penman-Monteith method in mm/day. The data can be extracted for a single or multiple stations in the format suitable for their use in CROPWAT 8.0. Two files with the extension "**.cli**" and "**.pen**" are created for each selected station. The "**.cli**" file contains long-term monthly rainfall data [mm/month]. Additionally, effective rainfall is also included calculated through the USDA Soil Conservation Service formula.

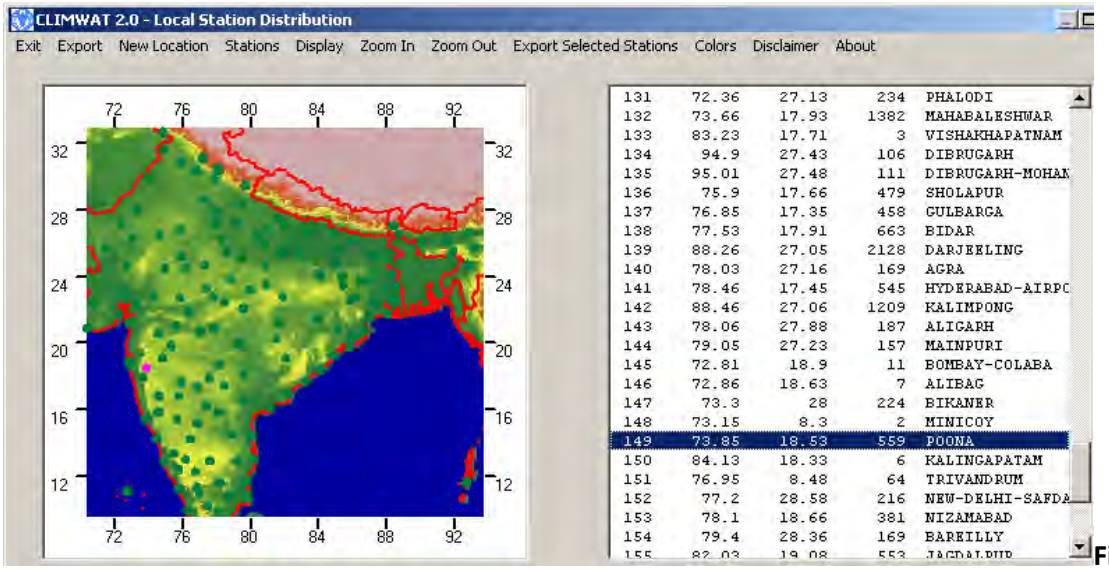


Fig 1- CLIMAT2 interface Pune

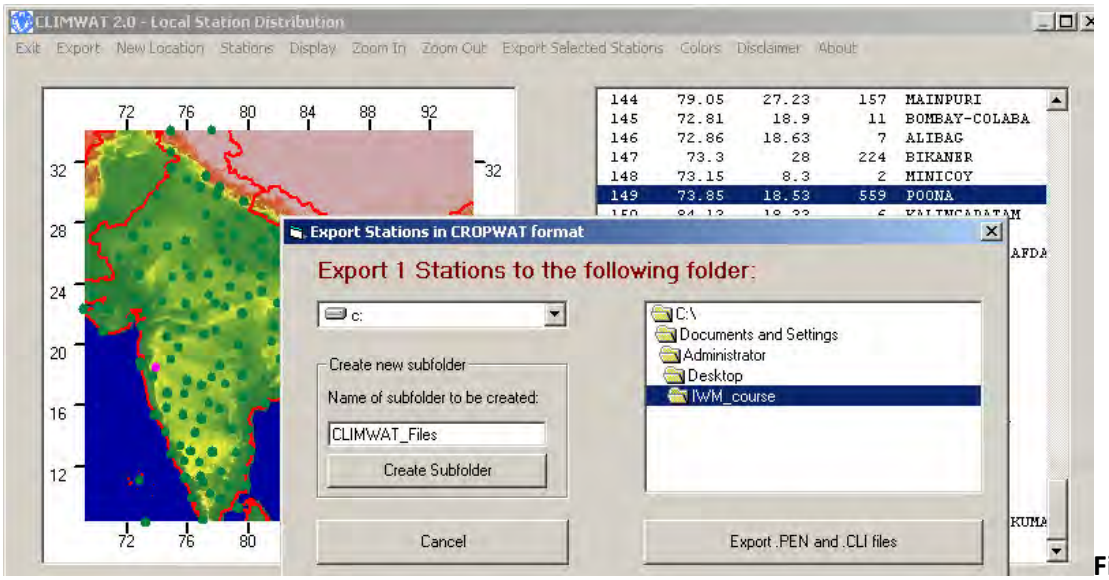


Fig. 2- Exporting file from CLIMAT2

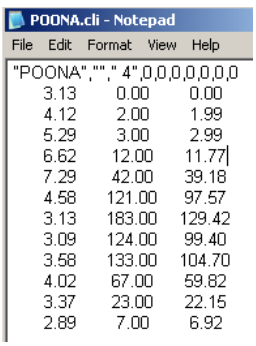


Fig 3- Pune met station cli file

The file with the extension ".**pen**" consists of long-term monthly averages for seven climatic parameters, namely maximum temp, minimum temp, relative humidity, wind speed, sunshine hours, radiation balance and reference ET calculated according to the **Penman-Monteith** method. This file also contains the coordinates and altitude of the location.

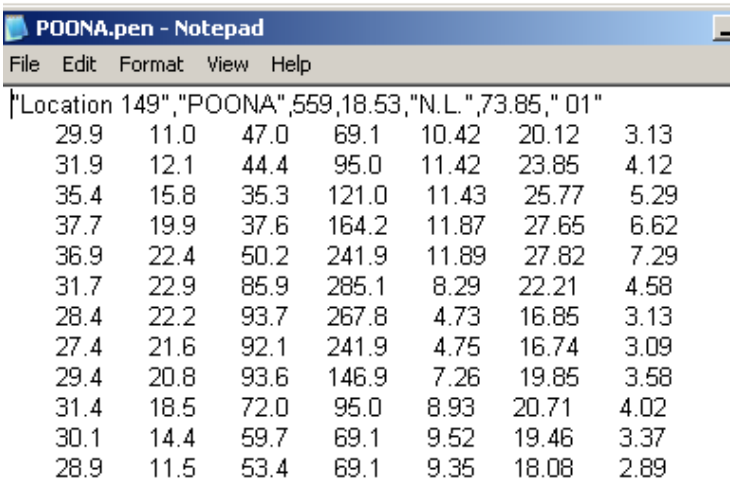


Fig 4- Pune met station .pen file

Lexonomy and definitions

Before we plunge into the software, here we discuss some of the terms and their explanations for clarity in understanding the software. Let us take an example where the fig below illustrates all.

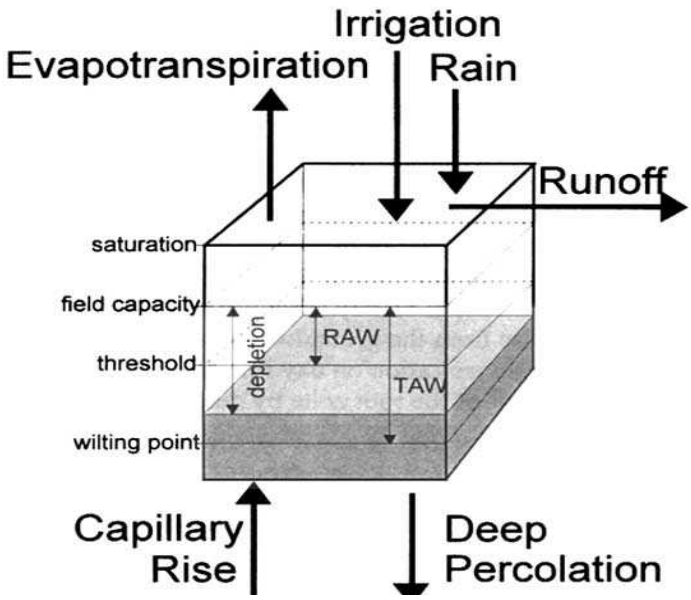


Fig 5 Concept of terms of RAW/TAW

1.1.1 EVAPOTRANSPIRATION (ET)

Evaporation and transpiration occur simultaneously and there is no easy way of distinguishing between the two processes. Apart from the water availability in the topsoil, the evap from a cropped soil is mainly determined by the fraction of the solar radiation reaching the soil surface. This fraction decreases over the growing period as the crop develops and the crop canopy shades more and more of the ground area. When the crop is small, water is predominately lost by soil evaporation, but once the crop is well developed and completely covers the soil, transpiration becomes the main process. The partitioning of evapotranspiration into evaporation and transpiration is plotted in correspondence to leaf area per unit surface of soil below it. At sowing nearly 100% of ET comes from evaporation, while at full crop cover more than 90% of ET comes from transpiration.

Evapotranspiration

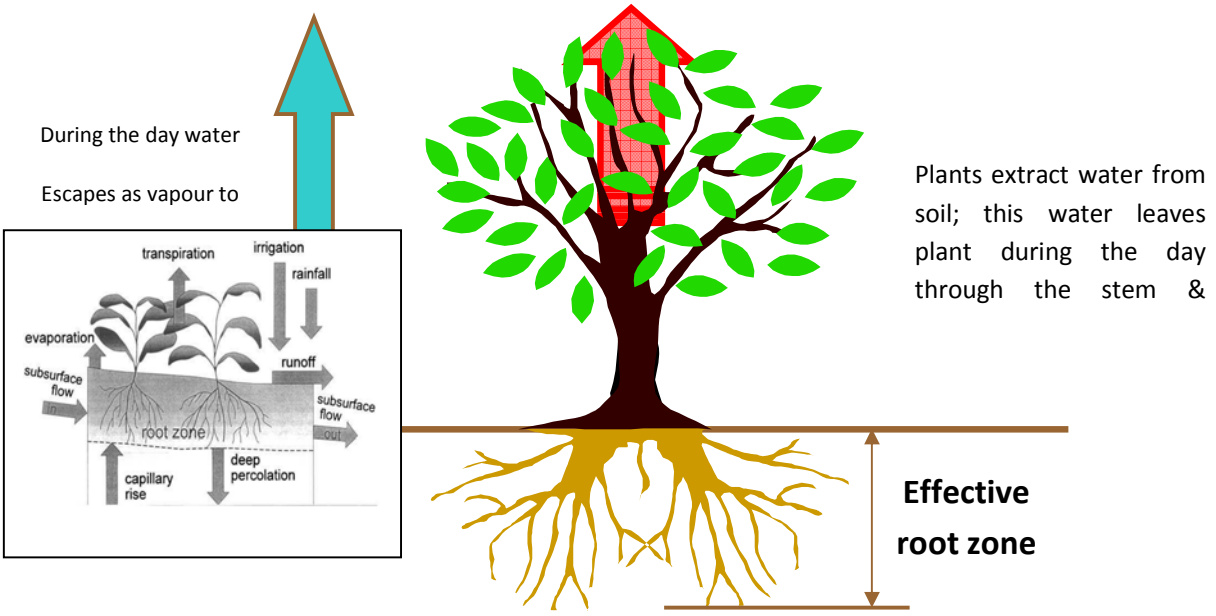


Fig 6 Concept of ET

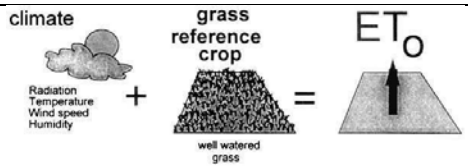
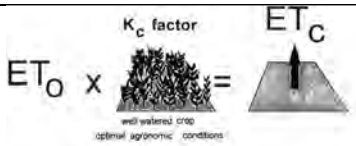
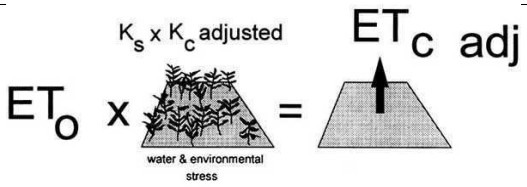
Differences between (ET_o), ET_C under standard conditions and crop ET under non-standard conditions ($ET_{c\ adj}$).	Source: FAO Cropwat ref manual)
	ET_0
	Kc factor
	Ks factor

Fig 7 Concept of ET (from FAO manual)

Reference Evapotranspiration (ETo)

The evapotranspiration rate from a **Reference** crop not short of water is called the **Reference evapotranspiration (ETo)**. The reference surface is a hypothetical grass reference crop with specific characteristics. The reference crop is a hypothetical crop with an assumed height of 0.12 m having a surface resistance of 70 siemens/m and an albedo of 0.23, closely resembling the evaporation of an extension surface of green grass of uniform height, actively growing and adequately watered. ET_o is a climatic parameter expressing the evaporation power of the atmosphere. ET_c refers to the evapotranspiration from excellently managed, large, well-watered fields that achieve full production under the given climatic conditions. Due to sub-optimal crop management and environmental constraints that affect crop growth and limit evapotranspiration, ET_c under non-standard conditions generally requires a correction. Fig 6 & 7 show the paragraph explanation above.

The concept of **ETo** was introduced to study the evaporative demand of the atmosphere independently of crop type, crop development and management practices. As water is abundantly available at the reference evapotranspiring surface, soil factors do not affect ETo.

Crop evapotranspiration under standard conditions (ETc) represents the ET from disease-free, well-fertilized crops, grown in large fields, under optimum soil water conditions, and achieving full production under the given climatic conditions. The difference in evapotranspiration between the cropped and reference grass surface is combined into a single crop coefficient (K_c).

ETc = Kc * ETo

Where, **Kc** is the crop coefficient

The Crop coefficient (Kc) integrates the effect of characteristics that distinguish a specific crop from the Reference crop. According to the Crop coefficient approach, Crop evapotranspiration under standard conditions (ETc) is calculated by multiplying the Reference evapotranspiration (ETo) by the suitable Kc.

The Crop evapotranspiration under non-standard conditions (ETc adj) is the evapotranspiration from crops grown under management and environmental conditions that differ from the standard optimal conditions.

ETc adj due to water shortage is calculated by mean of the Crop water stress coefficient (Ks) according to the following equation:

$$\mathbf{ETc\ adj = ETc * Ks}$$

$$\mathbf{Ks = (TAW - Dr) / (TAW - RAW)}$$

where:
TAW = Total Available Water,
Dr = Root zone depletion,
RAW = Readily Available Water

The **Readily Available Water (RAW)** is the fraction of **Total Available Water (TAW)** that a crop can extract from the root zone without suffering water stress.

RAW = p * TAW , where p is Critical depletion fraction.

The first one ***Kc wet*** is used when there is ponding water on the soil surface while ***Kc dry*** is used when there is no water standing on top of the soil, which is a common situation towards the end of the late season during the drying out of the soil profile.

Conversion factors for evapotranspiration

	depth	**volume per unit area**		**energy per unit area ***
	mm day^{-1}	**m^3 ha^{-1} day^{-1}**	**l s^{-1} ha^{-1}**	**MJ m^{-2} day^{-1}**
1 mm day^{-1}	1	10	0.116	2.45
1 m^3 ha^{-1} day^{-1}	0.1	1	0.012	0.245
1 l s^{-1} ha^{-1}	8.640	86.40	1	21.17
1 MJ m^{-2} day^{-1}	0.408	4.082	0.047	1

Kc for a given crop varies over the crop growing stages, since ground cover, crop height and leaf area change as the crop develops.

1) **Initial period (Init)**: during this period, the leaf area is small, and evapotranspiration is predominately in the form of soil evaporation. Therefore, the Kc during the initial period is large when the soil is wet from irrigation or rainfall and is low when the soil surface is dry.
2) **Development stage (Deve)**: as the crop develops and shades more and more the ground, evaporation becomes more restricted and transpiration gradually becomes the major process.
3) **Mid-season stage (Mid)**: at this stage the Kc reaches its maximum value.
4) **Late season stage (Late)**: the Kc value at the end of the late season stage reflects crop and water management practices. This value is high if the crop is frequently irrigated until harvested fresh. If the crop is allowed to senescence and to dry out in the field before harvest, the Kc value will be small, due to less efficient stomata conductance of leaf surfaces.

The ***Critical depletion fraction*** (p) represents the critical soil moisture level where first drought stress occurs affecting crop evapotranspiration and crop production. Values are expressed as a fraction of Total Available Water (TAW) and normally vary between 0.4 and 0.6, with lower values taken for sensitive crops with limited rooting systems under high evaporative conditions, and higher values for deep and densely rooting crops and low evaporation rates.

The Root zone depletion (Dr) represents the water shortage relative to Field Capacity (FC). It can be expressed as a percentage or in mm over the rooting depth.

Crop Coefficient (K_c)

Crop coefficients vary by type of crop, stage of growth, and geographical region. With the FAO method, crop coefficients are represented by straight lines connecting four general growth stages, as indicated in the following figure.

Generalized crop coefficients and crop growth stages

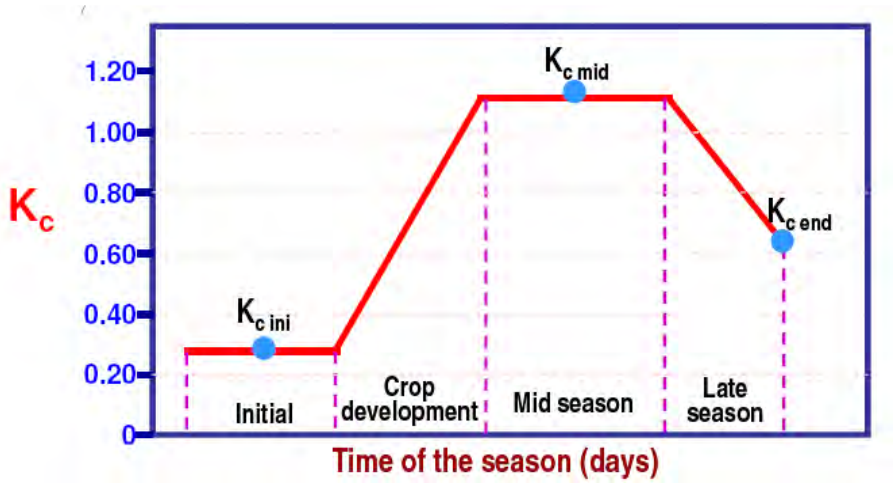


Fig 8 Kc curve

K_c Values	Growth Stage	Description
K_{c1}	Initial	The average K_C value from planting to about 10% ground cover.
K_{c1}-K_{c2}	Rapid Growth	From 10% ground cover to 75% cover or to peak water use, which ever comes first.
K_{c2}	Midseason	The average value from the end of the rapid growth stage until water use begins to decline due to crop aging.
K_{c2}-K_{c3}	Late season	From when K_C begins to decline until harvest or when water use ceases or becomes minimal.
K_{c3}	Harvest	The average value at harvest or the end of the water use season.

* For the rapid growth and the late season stage, it is assumed that KC values increase or decrease linearly with time.

Single crop coefficient approach (K_c)

In the single crop coefficient approach, the effect of crop transpiration and soil evaporation are combined into a single K_c coefficient. The coefficient integrates differences in the soil evaporation and crop transpiration rate between the crop and the grass reference surface. As soil evaporation may fluctuate daily as a result of rainfall or irrigation, the single crop coefficient expresses only the time-averaged but multi-day effects of crop ET.

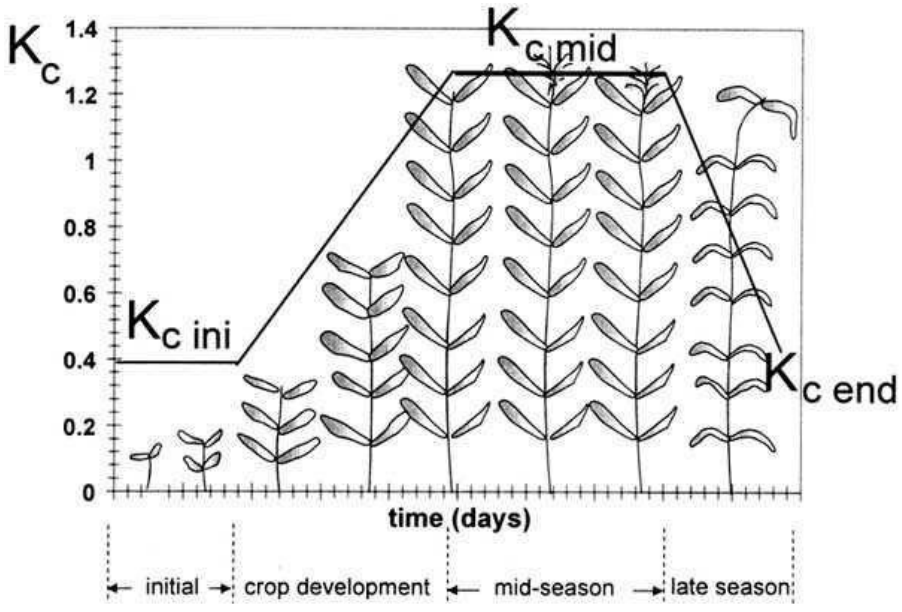


Fig 8 Concept of Single crop coefficient (source: FAO guideline)

As the single K_c coefficient averages soil evaporation and transpiration, the approach is used to compute ET_c for weekly or longer time periods, although calculations may proceed on a daily time step. The time-averaged single K_c is used for planning studies and irrigation system design where the averaged effects of soil wetting are acceptable and relevant. This is the case for surface irrigation and set sprinkler systems where the time interval between successive irrigation is of several days, often ten days or more. For typical irrigation water management, the time-averaged single K_c is valid.

Dual crop coefficient approach ($K_c = K_{cb} + K_e$)

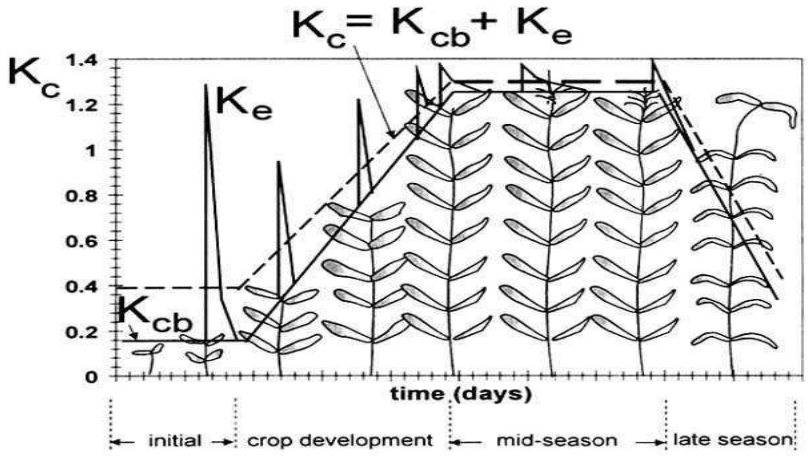


Fig 9 Concept of double crop coefficient

In the dual crop coefficient approach, the effects of crop transpiration and soil evaporation are determined separately. Two coefficients are used: the basal crop coefficient (K_{cb}) to describe plant transpiration, and the soil water evaporation coefficient (K_e) to describe evaporation from the soil surface. The single K_c coefficient is replaced by:

$$\mathbf{K_c = K_{cb} + K_e}$$

where, K_{cb} basal crop coefficient

K_e soil water evaporation coefficient

The basal crop coefficient, K_{cb}, is defined as the ratio of ET_c to ET_o when the soil surface layer is dry but where the average soil water content of the root zone is adequate to sustain full plant transpiration. The K_{cb} represents the baseline potential K_c in the absence of the additional effects of soil wetting by irrigation. The soil evaporation coefficient, K_e, describes the evaporation component from the soil surface. If the soil is wet following rain or irrigation, K_e may be large. The sum of K_{cb} and K_e can never exceed a max value, $K_{c\ max}$, determined by the energy available for ET at the soil

surface. As the soil surface becomes drier, K_e becomes smaller and falls to zero when no water is left for evaporation. The estimation of K_e requires a daily water balance computation for the calculation of the soil water content remaining in the upper topsoil.

The dual coefficient approach requires more numerical calculations than the procedure using the single time-averaged K_c coefficient. The dual procedure is best for real time irrigation scheduling, for soil water balance computations, and for studies, where effects of day-to-day variations in soil surface wetness and the resulting impacts on daily ET_c, the soil water profile, and deep percolation fluxes are important.

Determination of crop coefficient has potential advantage for proper irrigation scheduling.

$K_{c\ ini}$ for rice for various climatic conditions

Humidity	**Wind speed**		
	light	**moderate**	**strong**
arid - semi-arid	1.10	1.15	1.20
sub-humid - humid	1.05	1.10	1.15
very humid	1.00	1.05	1.10

$$K_{c\ ini} = \frac{E_{so}}{ET_o} = 1.15 \quad \text{(for } t_w < t_l\text{)}$$

t_w is the mean interval between wetting events [days] and t_1 is the time when stage 1 drying is completed ($t_1 = REW/E_{so}$) [days].

K_{cmid} Calculation (For arid climate):

$$K_{cmid} = 1.20 + [0.04(4.6 - 2) - 0.004(44 - 45)]\left(\frac{2}{3}\right)^{0.3} = 1.30$$

K_{cend} Calculation

$$K_{cend} = K_{cend(Tab)} + [0.04(u_2 - 2) - 0.004(RH_{min} - 45)]\left(\frac{h}{3}\right)^{0.3}$$

The flow chart for calculating ET_0 is depicted below diagrammatically.

Yield reduction due to soil moisture stress is expressed as a percentage of the maximum production achievable in the area under optimal conditions. It can be computed with reference to a single stage of crop cycle or to the whole growing season.

Yield reduction is expressed applying the following equation:

$$(1 - Ya/Ymax) = Ky\ (1 - ETc\ adj / ETc)$$

Where, Ya = Yield achievable under actual conditions

Ymax = Max crop yield under full satisfaction of crop water needs

Ky = Yield response factor

ET_c adj = Crop evapotranspiration under non-standard conditions

ET_c = Crop evapotranspiration under standard conditions

The response of yield to water supply is quantified through the **Yield response factor** (**Ky**) which relates relative yield decrease to relative evapotranspiration deficit. Water deficit of a given magnitude, expressed in the ratio Crop evapotranspiration under non standard conditions (ETc adj) and Crop evapotranspiration under standard conditions (ETc), may either occur continuously over the total growing period of the crop or it may occur during any one of the individual growth stages. The details of calculation of single crop coefficient Kc and double crop coefficients will be taken up in hands-on class.

Factors affecting irrigation requirements by crops

i.) *Crop Characteristics*

ii.) *Surface and sub-surface in and out flows*

iii.) *Effective Rainfall*

Whole area proposed to be irrigated need to be divided into 3 zones taking rainfall, existing irrigation arrangements and depth of water table into consideration. These zones are,

(a) Perennial
(b) Non-perennial
(c) Restricted perennial

iv.) *Kharif- Rabi ratio*

v.) *Size of Holding & Family members*

vi.) *Intensity of irrigation*

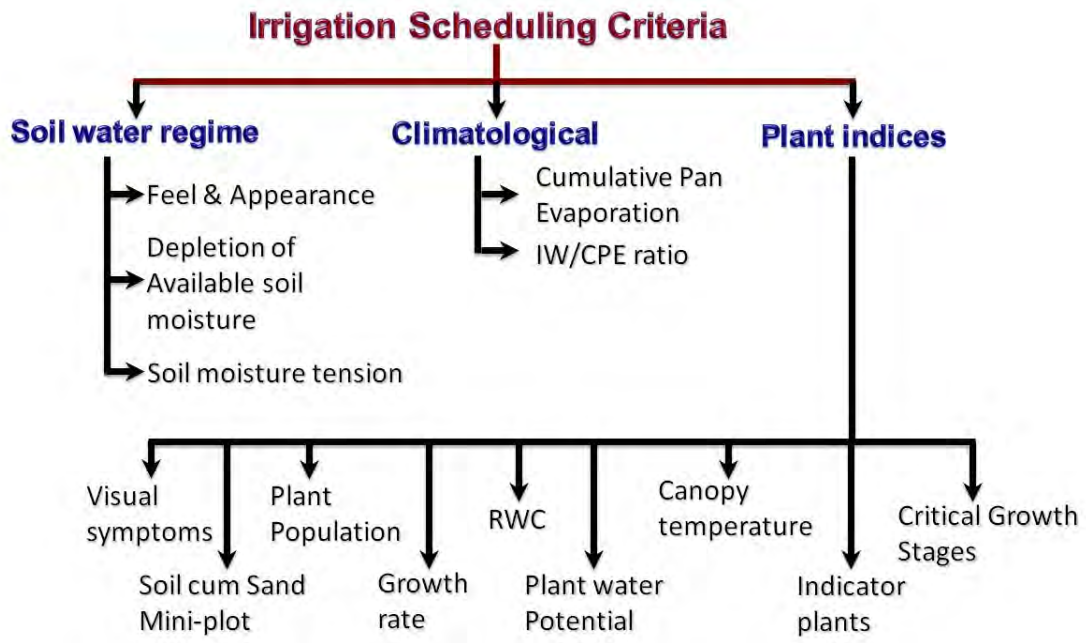
vii.) *Quality of Soil*

viii.) *Sub-soil Water Table*

ix.) *Area Proposed under each Crop*

Scheduling irrigation

With the advancement of knowledge in the field of soil-plant-atmospheric system several criteria for scheduling irrigations are available and are being used by investigators and farmers. All the available criteria can be broadly classified into the following three categories:



Advantages of Irrigation Scheduling

Irrigation scheduling offers several advantages:

a) It enables the farmer to schedule water rotation among the various fields to minimize crop water stress and maximize yields.

b) It reduces the farmer's cost of water and labor through fewer irrigations, thereby making maximum use of soil moisture storage.

c) It lowers fertilizer costs by holding surface runoff and deep percolation (leaching) to a minimum.

d) It increases net returns by increasing crop yields and crop quality.

e) It minimizes water-logging problems by reducing the drainage requirements.

f) It assists in controlling root zone salinity problems through controlled leaching.

g) It results in additional returns by using the "saved" water to irrigate non-cash crops that otherwise would not be irrigated during water-short periods.

USING CROPWAT

The main CROPWAT window is portrayed with the menu options as below. Some of the snapshots taken with the CROPWAT are presented below, however the details of application will be taken up

in the class itself. The options of the software are set from **Settings** menu as shown. The file extensions used in the software are as below.

.**ses** - CROPWAT session files
.**pen** - CLIMWAT database file with monthly climatic (temp) data
.**cli** - CLIMWAT database file with monthly rainfall data
.**pem** - monthly ETo climatic data (Penman-Monteith calculations)
.**pec** - id. but decade data
.**ped** - id. but daily data
.**pmm** - CROPWAT file with monthly measured ETo data
.**pmc** - id. but decade data
.**pmd** - id. but daily data
.**crm** - CROPWAT file with monthly rainfall data
.**crc** - id. but decade data
.**crd** - id. but daily data
.**cro** - CROPWAT crop file (dry crop or rice crop)
.**soi** - CROPWAT soil file
.**pat** - CROPWAT cropping pattern file
.**sch** - CROPWAT user adjusted schedule file (stores the irrigation days and net gifts)

All rainfall options refer to the calculation of the Effective rainfall based on the actual rainfall data. These are the methods out of many provided in the interface.

a) Fixed percentage of rainfall
b) Dependable Rain
c) Empirical formula
d) USDA Soil Conservation Service Method

The climate/ET0 /rainfall/ rice scheduling, non-rice scheduling, land preparation are entered in this.

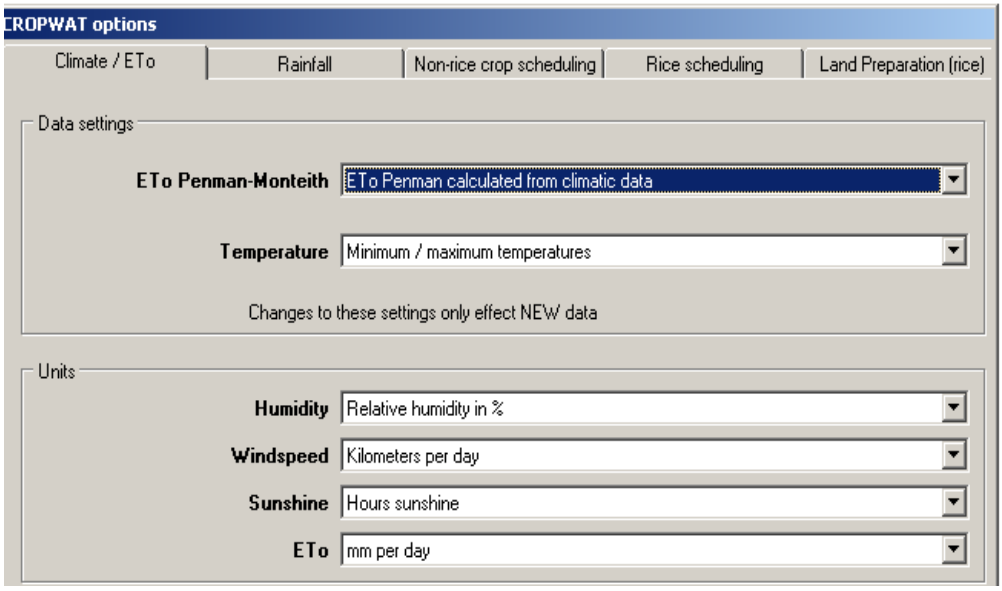


Fig 11- Cropwat options setting

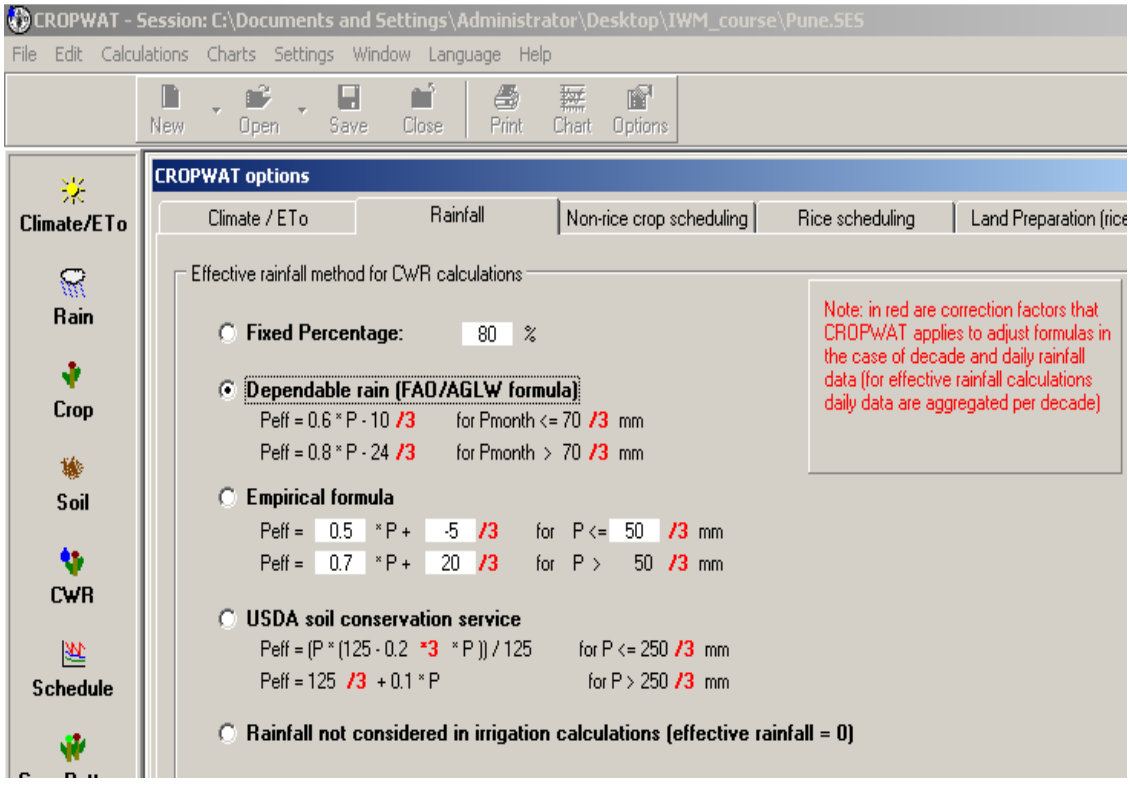
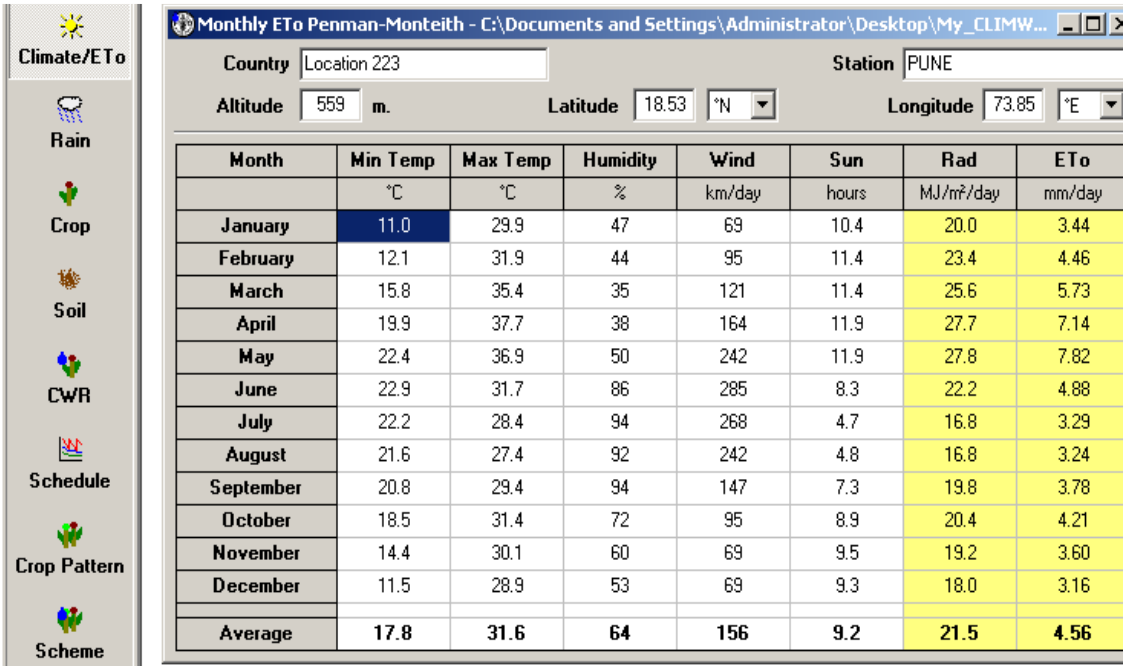


Fig 12- Cropwat effective rainfall options

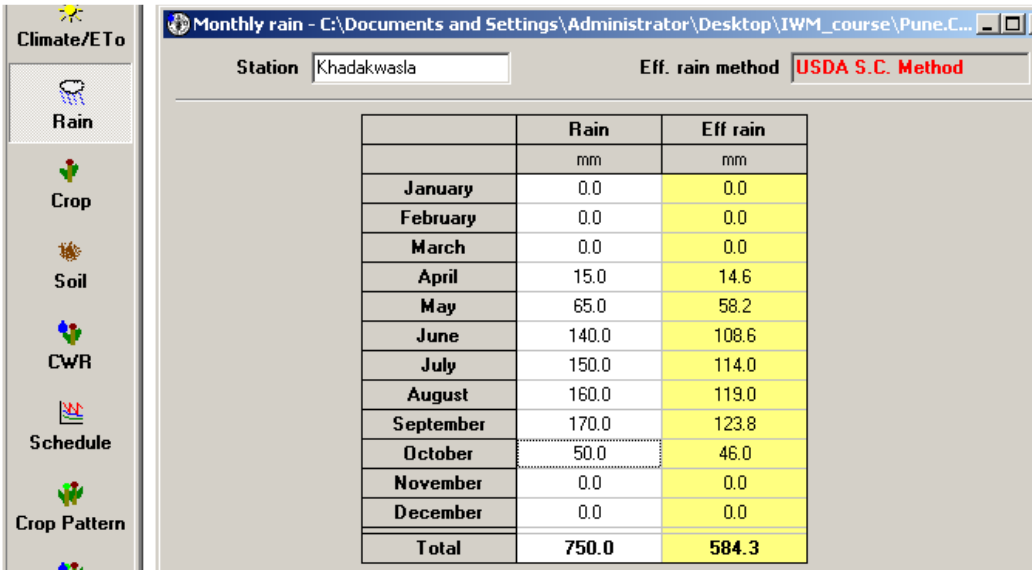
Climate data

This module can be selected by clicking on the Climate/ETo icon in the module bar located on the left of the main CROPWAT window.



Month	Min Temp	Max Temp	Humidity	Wind	Sun	Rad	ETo
	°C	°C	%	km/day	hours	MJ/m²/day	mm/day
January	11.0	29.9	47	69	10.4	20.0	3.44
February	12.1	31.9	44	95	11.4	23.4	4.46
March	15.8	35.4	35	121	11.4	25.6	5.73
April	19.9	37.7	38	164	11.9	27.7	7.14
May	22.4	36.9	50	242	11.9	27.8	7.82
June	22.9	31.7	86	285	8.3	22.2	4.88
July	22.2	28.4	94	268	4.7	16.8	3.29
August	21.6	27.4	92	242	4.8	16.8	3.24
September	20.8	29.4	94	147	7.3	19.8	3.78
October	18.5	31.4	72	95	8.9	20.4	4.21
November	14.4	30.1	60	69	9.5	19.2	3.60
December	11.5	28.9	53	69	9.3	18.0	3.16
Average	17.8	31.6	64	156	9.2	21.5	4.56

Fig 13- Climate data entry from CLIMAT file



	Rain	Eff rain
	mm	mm
January	0.0	0.0
February	0.0	0.0
March	0.0	0.0
April	15.0	14.6
May	65.0	58.2
June	140.0	108.6
July	150.0	114.0
August	160.0	119.0
September	170.0	123.8
October	50.0	46.0
November	0.0	0.0
December	0.0	0.0
Total	750.0	584.3

Fig 14- Rainfall data entry from rain gauge /IMD sources

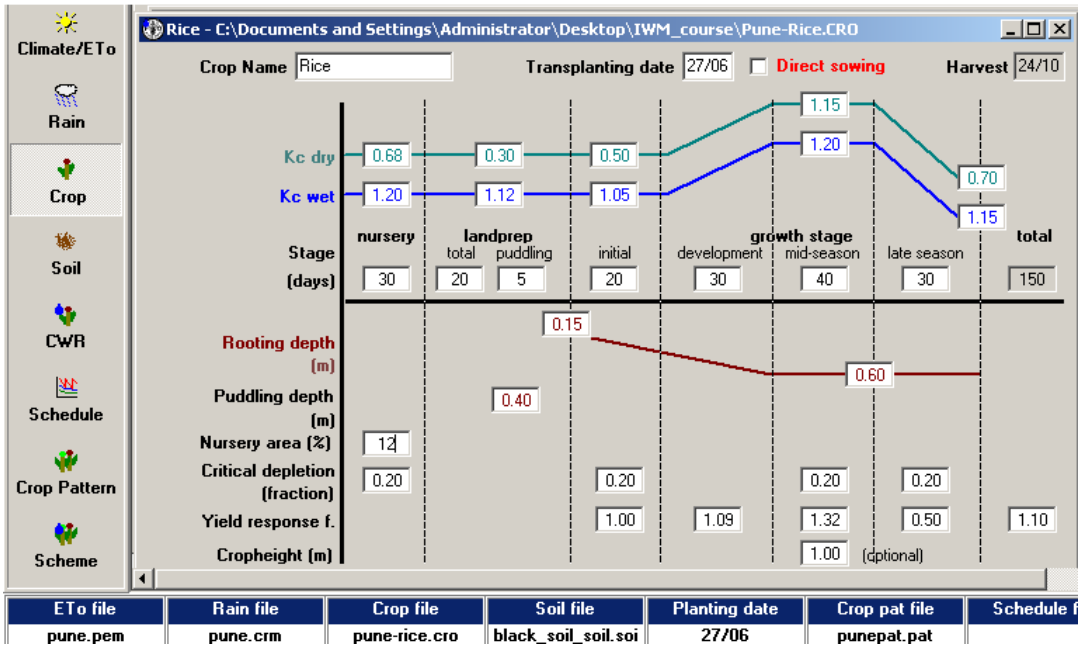


Fig 15- Crop data entry

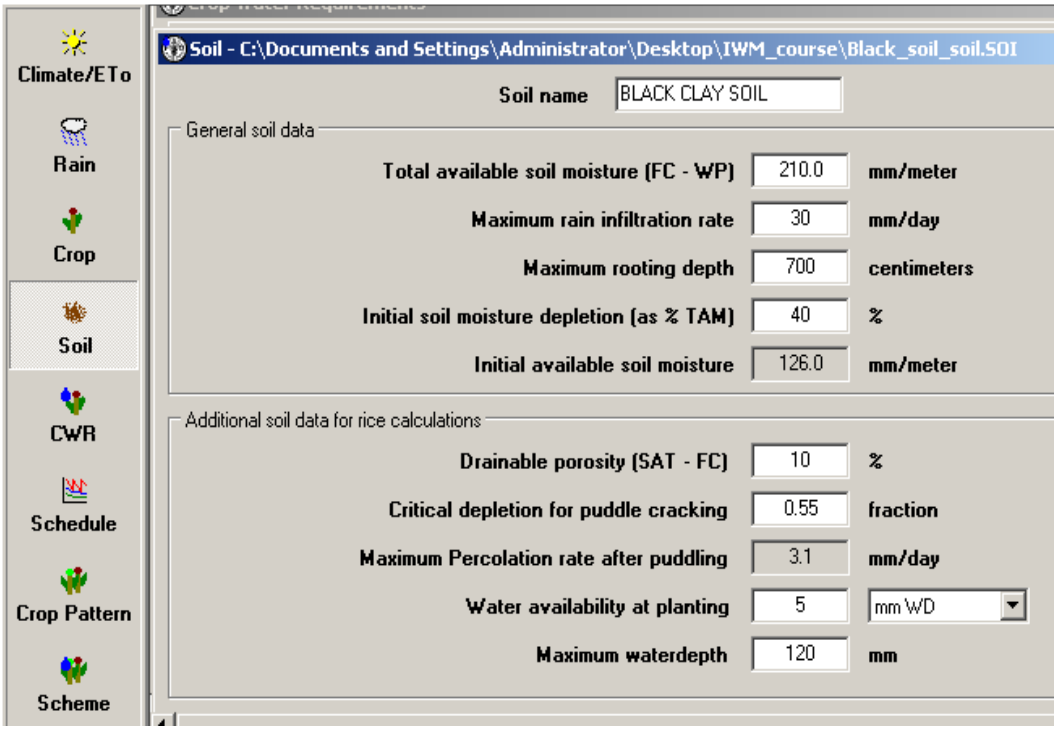
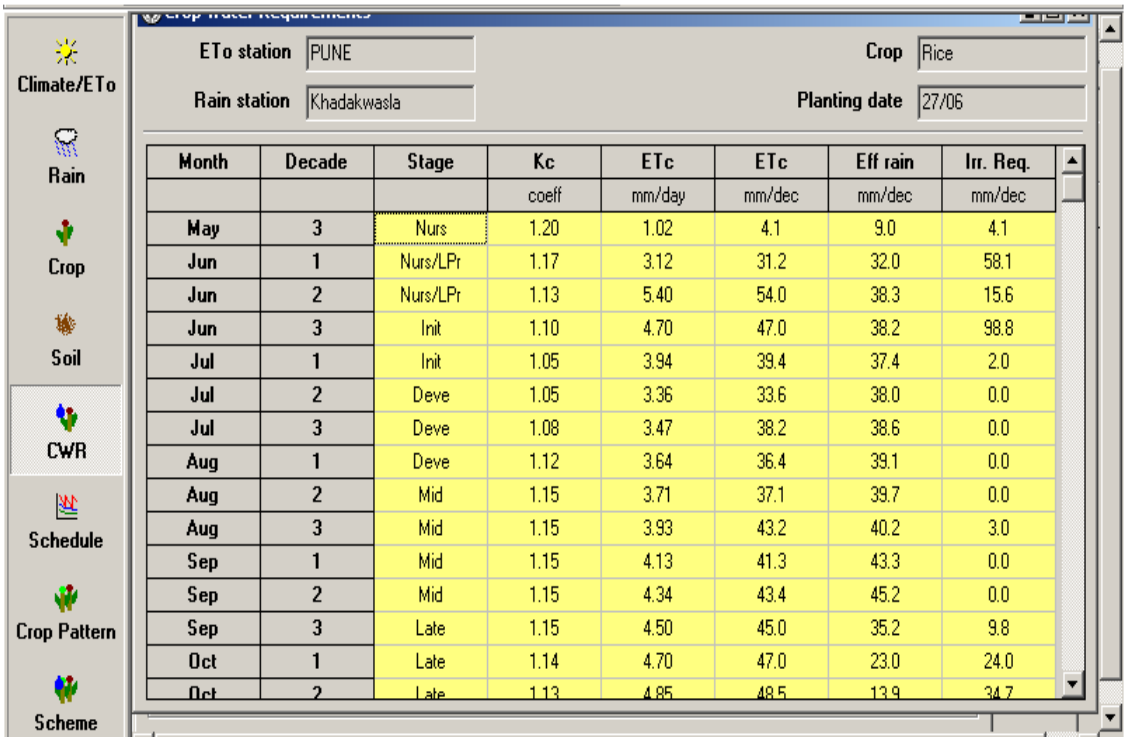
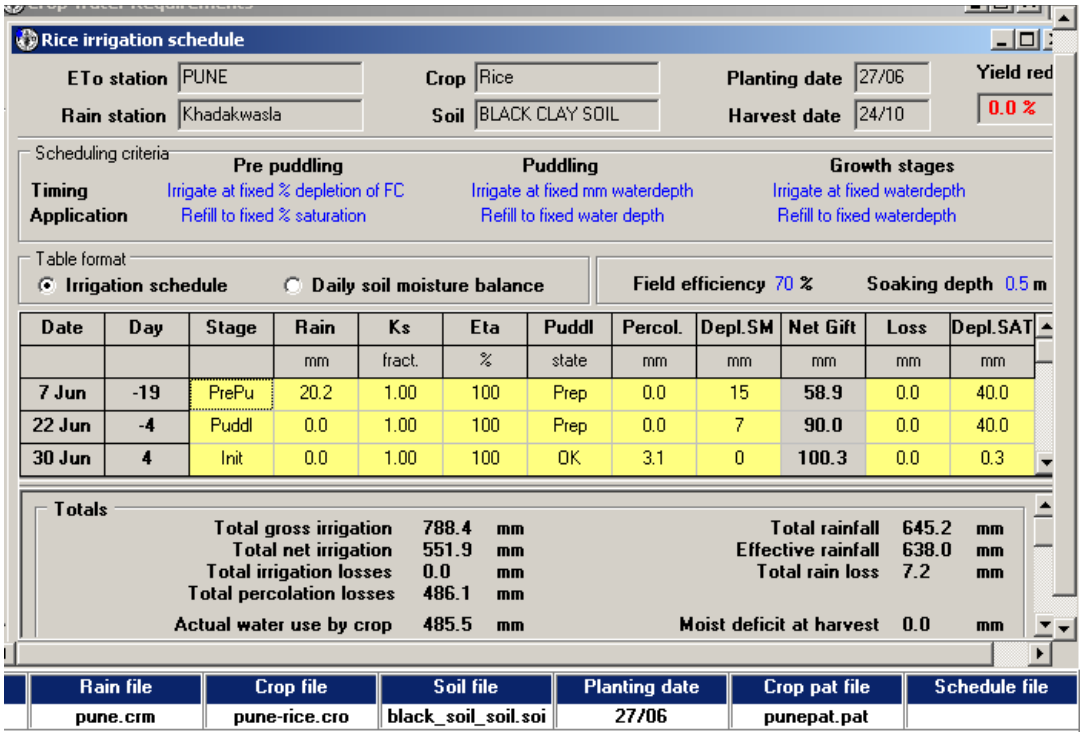


Fig 16- Soil data entry



Month	Decade	Stage	Kc	ETc	ETc	Eff rain	Irr. Req.
			coeff	mm/day	mm/dec	mm/dec	mm/dec
May	3	Nurs	1.20	1.02	4.1	9.0	4.1
Jun	1	Nurs/LPr	1.17	3.12	31.2	32.0	58.1
Jun	2	Nurs/LPr	1.13	5.40	54.0	38.3	15.6
Jun	3	Init	1.10	4.70	47.0	38.2	98.8
Jul	1	Init	1.05	3.94	39.4	37.4	2.0
Jul	2	Deve	1.05	3.36	33.6	38.0	0.0
Jul	3	Deve	1.08	3.47	38.2	38.6	0.0
Aug	1	Deve	1.12	3.64	36.4	39.1	0.0
Aug	2	Mid	1.15	3.71	37.1	39.7	0.0
Aug	3	Mid	1.15	3.93	43.2	40.2	3.0
Sep	1	Mid	1.15	4.13	41.3	43.3	0.0
Sep	2	Mid	1.15	4.34	43.4	45.2	0.0
Sep	3	Late	1.15	4.50	45.0	35.2	9.8
Oct	1	Late	1.14	4.70	47.0	23.0	24.0
Oct	2	Late	1.13	4.85	48.5	13.9	34.7

Fig 17- Crop Water requirement calculation



Date	Day	Stage	Rain	Ks	Eta	Puddl	Percol.	Depl.SM	Net Gift	Loss	Depl.SAT
			mm	fract.	%	state	mm	mm	mm	mm	mm
7 Jun	-19	PrePu	20.2	1.00	100	Prep	0.0	15	58.9	0.0	40.0
22 Jun	-4	Puddl	0.0	1.00	100	Prep	0.0	7	90.0	0.0	40.0
30 Jun	4	Init	0.0	1.00	100	OK	3.1	0	100.3	0.0	0.3

Rain file	Crop file	Soil file	Planting date	Crop pat file	Schedule file
pune.crm	pune-rice.cro	black_soil_soil.soi	27/06	punepat.pat	

Fig 18- Irrigation scheduling

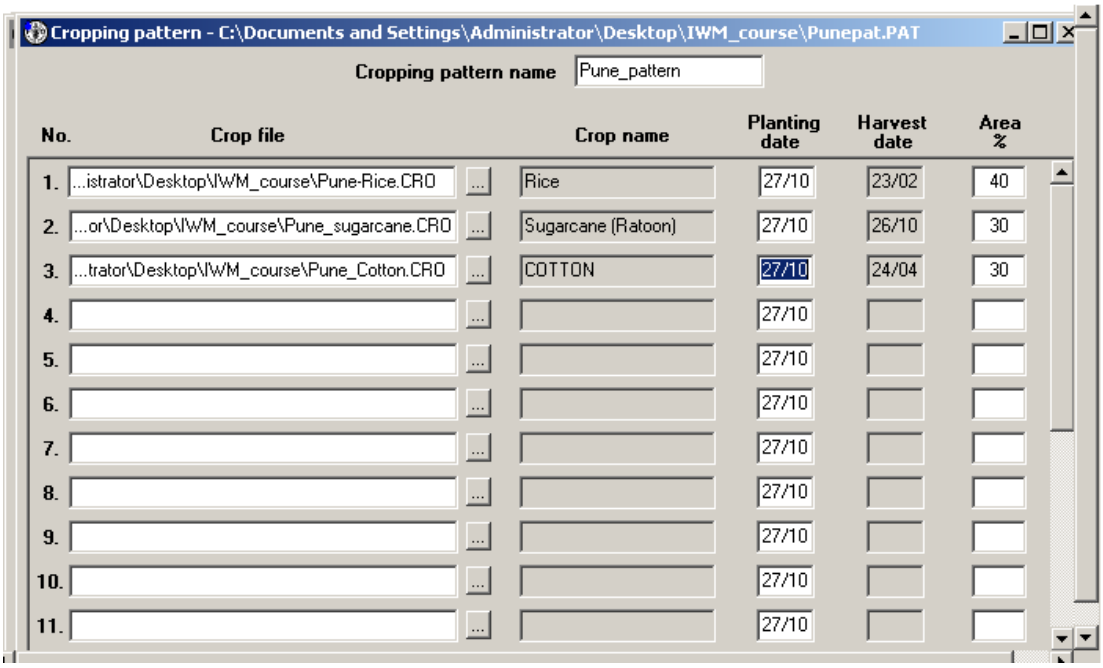
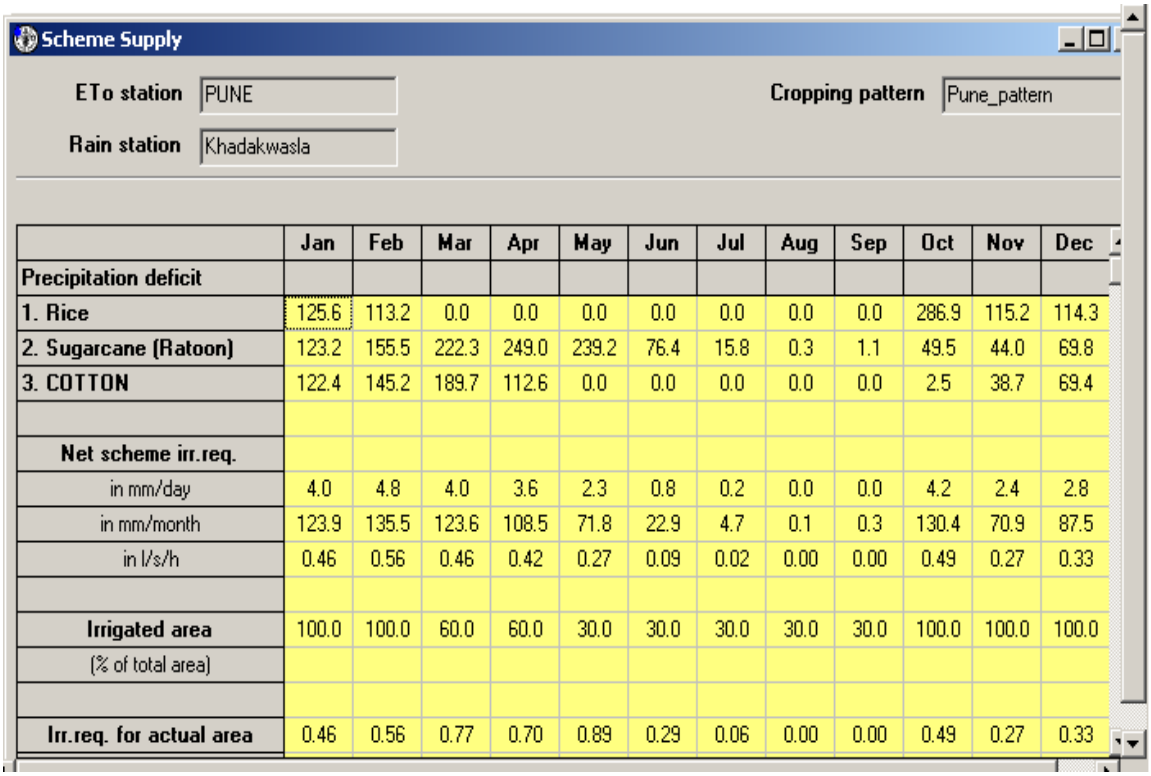


Fig 19- Cropping pattern



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation deficit												
1. Rice	125.6	113.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	286.9	115.2	114.3
2. Sugarcane (Ratoon)	123.2	155.5	222.3	249.0	239.2	76.4	15.8	0.3	1.1	49.5	44.0	69.8
3. COTTON	122.4	145.2	189.7	112.6	0.0	0.0	0.0	0.0	0.0	2.5	38.7	69.4
Net scheme irr.req.												
in mm/day	4.0	4.8	4.0	3.6	2.3	0.8	0.2	0.0	0.0	4.2	2.4	2.8
in mm/month	123.9	135.5	123.6	108.5	71.8	22.9	4.7	0.1	0.3	130.4	70.9	87.5
in l/s/h	0.46	0.56	0.46	0.42	0.27	0.09	0.02	0.00	0.00	0.49	0.27	0.33
Irrigated area	100.0	100.0	60.0	60.0	30.0	30.0	30.0	30.0	30.0	100.0	100.0	100.0
(% of total area)												
Irr.req. for actual area	0.46	0.56	0.77	0.70	0.89	0.29	0.06	0.00	0.00	0.49	0.27	0.33

Fig 20- Scheme continuous water supply

WEB BASED WATER RESOURCES INFORMATION SYSTEM (INDIA-WRIS)

1.1 *India-WARIS* VISION

The National Water Policy (2012) recognizes that development and management of water resources need to be governed by national perspectives and aims to develop and conserve the scarce water resources in an integrated and environmentally sound basis. The National Water Policy 2002 Para 14.0 on Information System reads as -

All hydrological data, other than those classified on national security consideration, should be in public domain. However, a periodic review for further declassification of data may be carried out. A National Water Informatics Center should be established to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing, and maintain in open and transparent manner on a GIS platform.

In view of the likely climate change, much more data about snow and glaciers, evaporation, tidal hydrology and hydraulics, river geometry changes, erosion, sedimentation, etc. needs to be collected. A programme of such data collection needs to be developed and implemented.

All water related data, like rainfall, snowfall, geo-morphological, climatic, geological, surface water, ground water, water quality, ecological, water extraction and use, irrigated area, glaciers, etc., should be integrated with well defined procedures and formats to ensure online updation and transfer of data to facilitate development of database for informed decision making in the management of water.

The proposed India-Water Resources Information System (*India-WRIS*) is envisaged with following vision –

THE VISION

India–WARIS aims to provide a
'Single Window solution' for all water resources
data and information in a
standardized national GIS framework.

It will allow users to
Search, Access, Visualize, Understand and Analyze
comprehensive and contextual water resources data
for assessment, monitoring, planning, development and finally IWRM.

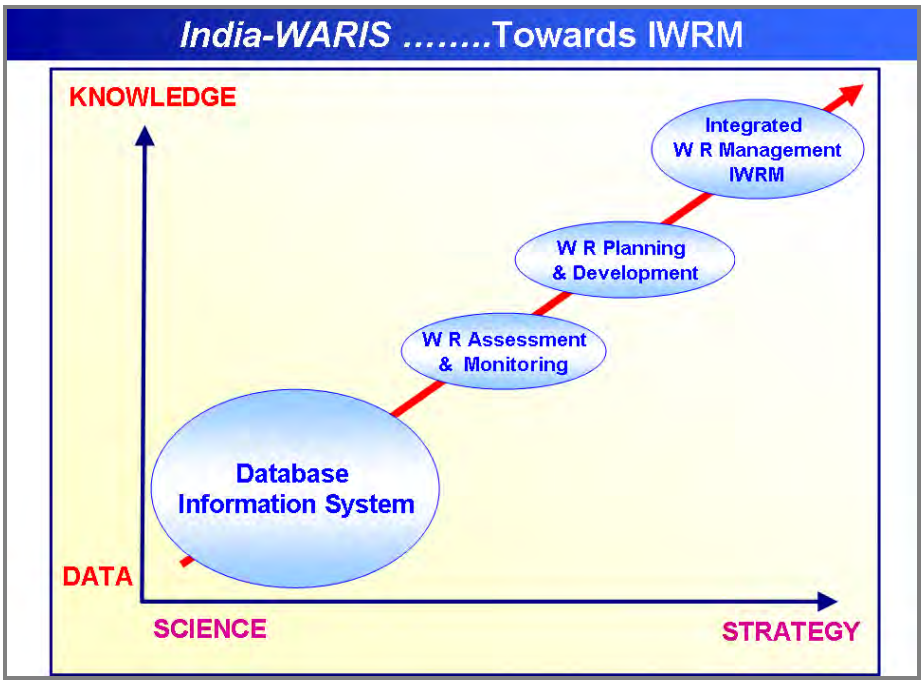
1.2 *India-WARIS* OBJECTIVES

1. To **collate** available data from varied sources, **generate** new databases of country's water resources, **organize** in standardized GIS format and **provide** a thin client scalable web-enabled information system.

2. To provide **easier and faster access** and **sharing** of nationally consistent and authentic water resources data **through a centralized database** and application server to all water resources departments, organizations, professionals and other stake holders for IWRM.

3. To **provide tools** to create value added maps by way of multi-layer stacking of GIS databases so as to **provide integrated view** to the water resources issues.

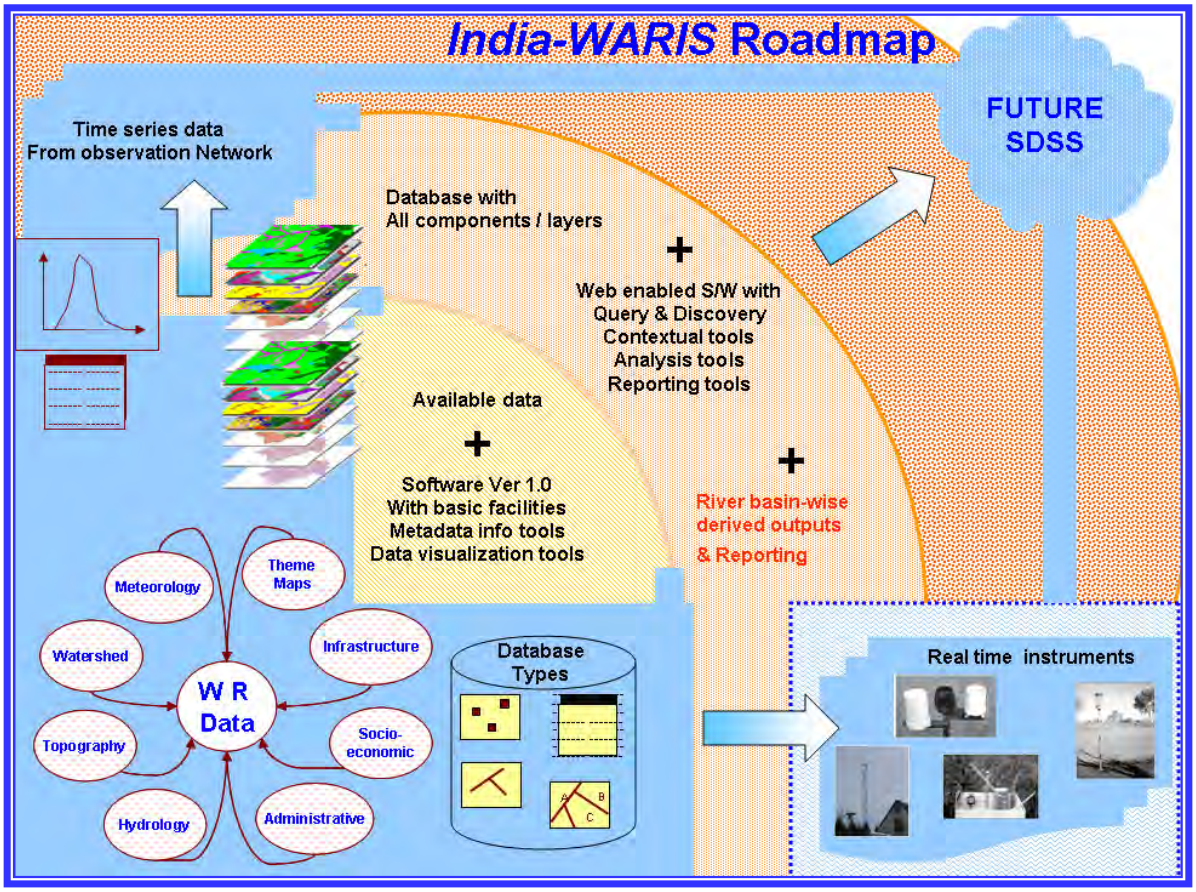
4. To provide **foundation** for advanced modeling purposes and future SDSS including automated data collection system.



Spatial Decision Support Systems specially targeted towards near real time problem solving demands require large amount of dynamic data at higher scale, which becomes increasingly complex in the initial stage. However, once the all the resources are pulled together and a centralized data repository is established the initial information system could be slowly further developed towards SDSS with application specific models. Hence, efforts right now will be to put Web Enabled Information System in place with centralized server.

The system will be primarily aimed at organizing the varied databases on common platform with standards defined for each of the database layer and further providing the user friendly interface to Geo-Visualize the diversified data. The system will employ Geo-visualization

strategy to view data at user specified scale and also in automated fashion to match the View as per the scale requirements. As the viewing scale changes the viewer contents will also change as per scale. The system will allow to stack multiple GIS layers and will provide flexible switching operations to the user for desired layer selection. System will provide ways to generate value added maps and will allow to have insight into the databases. Information system hence will allow to aesthetic display, layer stacking, query, pan/zoom operations and area of interest operations, basic report generation, printing etc.

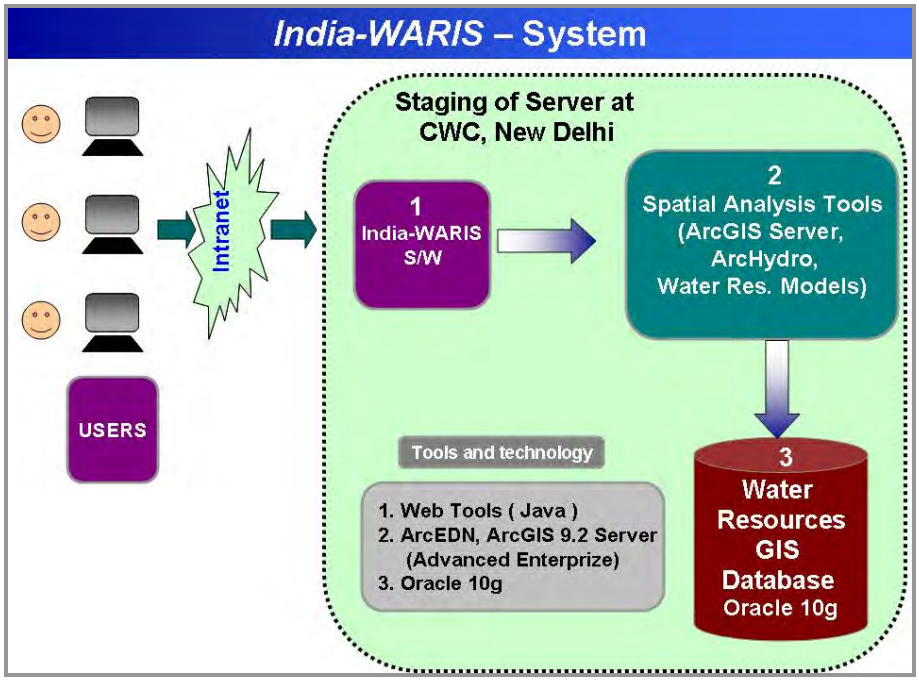


1.3 SYSTEM ARHITECTURE OF *India-WARIS*

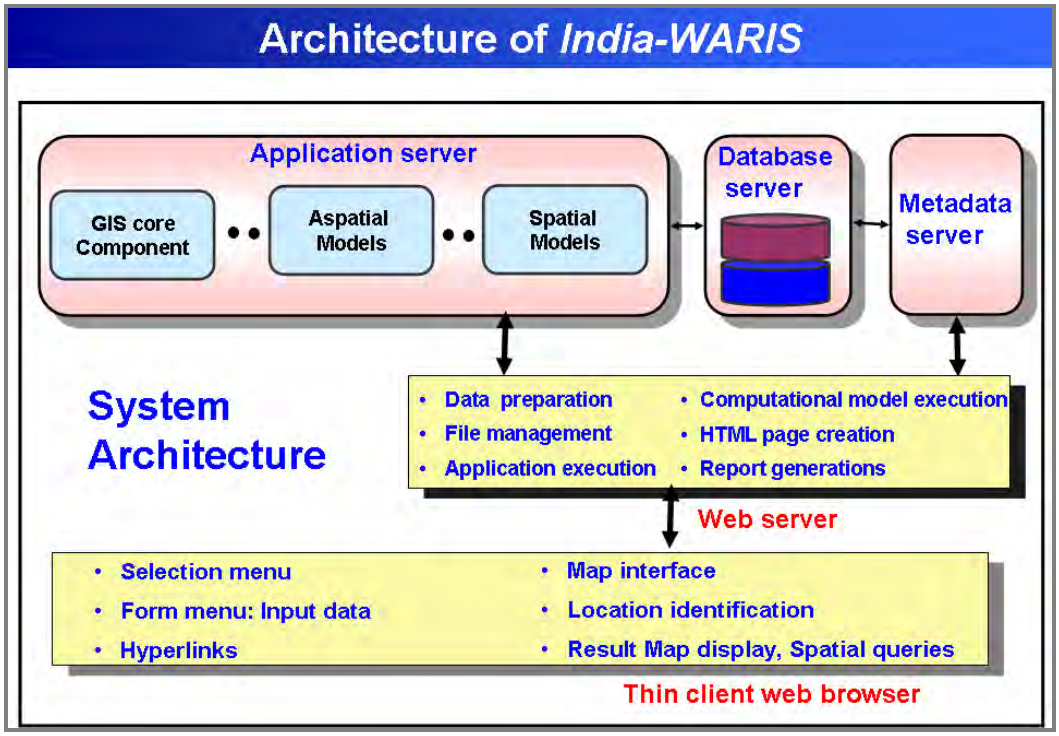
As decided by CWC, *India-WARIS* will be a client server system with server side processing. The server-side approach uses a thin client and most of the processing, including spatial data access and manipulation is performed on the server side. The resulting information and image objects are then sent to the clients to be rendered. The server-side Web enabled information system requires only a browser installed on the client machine to carryout tasks. However, every user action requires communication between the client and the server.

The server side environment typically will include a web server (Apache, IIS etc.) and a map server (ArcGIS Server) that will provide GIS services. The map server software establishes a common platform for the exchange of web-enabled GIS data and services. The web server transfers spatial and non-spatial data between the client side (Web browser) and the map server through sockets. The client side user interface will be developed using Industry

Standard Languages and web technologies provided by ArcGIS server Application Development Framework (ADF).



ArcGIS Server is an open, flexible, and scalable technology that runs on industry-standard IT infrastructure and supports geospatial Service-Oriented Architecture (SOA) initiatives. ArcGIS Desktop software complements ArcGIS Server by acting as a means of authoring, configuring, and maintaining data, models, and applications. This authored content can be published via ArcGIS Server, which provides the technology foundation for organizations to build and implement GIS-based Web services.



1.4 SCOPE OF THE PROJECT

The project envisages 30 Major spatial layers (Annexure – I) grouped under 5 heads & the report generation.

1. Watershed atlas (Basin maps – Basin, sub-basin, catchment, Watershed, River network, Digital Elevation Map)

2. **Administrative layers (**International, State, District, Tehsil / taluk, Village Boundary, Town / Villages location and extent, Infrastructure layers, Major Tourist Stations on River banks, Major water sanctuaries, Major Waterfalls & other environmental issues)

3. **Water resources projects (**Location of Major & Medium, Location of Hydroelectric projects, Location of Multipurpose projects, Major and medium Irrigation project command boundaries, Canal network, Waterlogged and salt affected area, soil sample)

4. **Thematic layers** (Water bodies, Landuse landcover, snow cover area, Groundwater well and its analyses, litholog data, land degradation, wasteland map, Drought prone area, Flood inundation map, Interbasin transfer links, inland navigation)

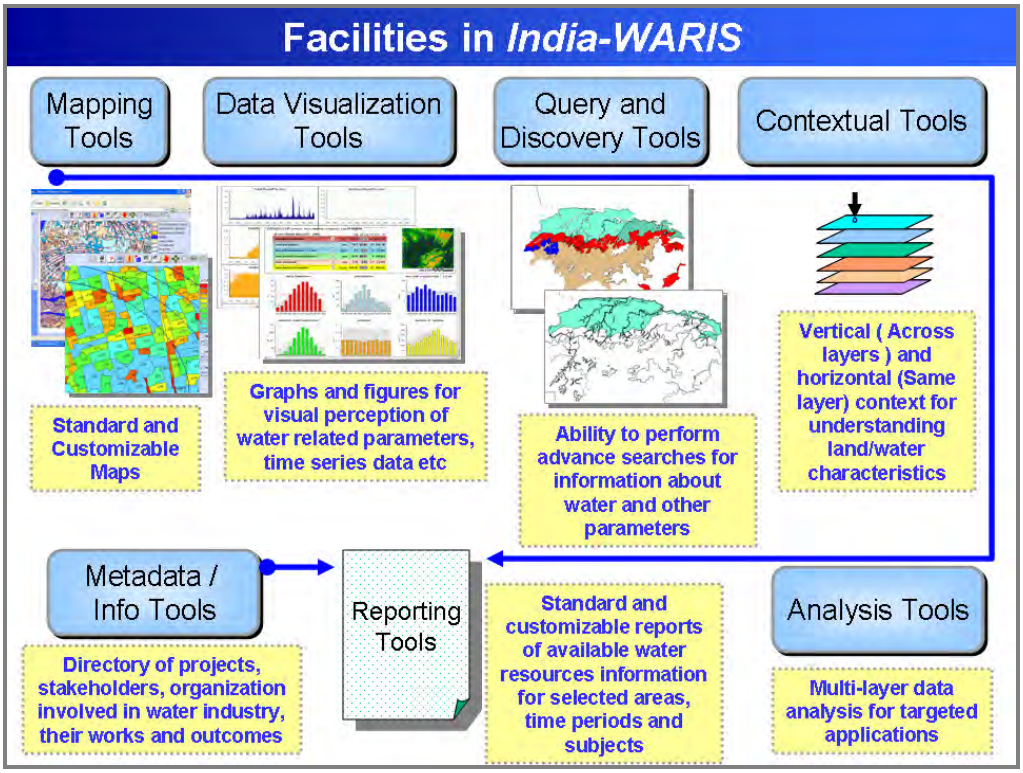
5. **Environment data** (Rainfall station, G&D station, Water quality station, climatic layer)

1.5 WEB ENABLED *India-WARIS* – PROPOSED FACILITIES

The user requirements, data types and required tools for decision support have been arrived through discussions and as of now, following facilities are proposed in India-WARIS:

Table 4: Facilities in *India-WARIS*

S N	Broad level facilities
1.	Mapping tools
	• Rendering of static styled maps with roaming, zoom-in and zoon-out facilities. Map tips to get information about any spatial unit on display on available database fields. • Multi-layer visual overlays for value added maps generation • Annotation on the maps through a database field and as graphic tools for map creation.
2.	Data visualization tools
	• Non-spatial data visualization for viewing spatial patterns • Visualization of non-spatial data in various ways to create environment for visual analysis of data and trigger decisions. • Generation of bar chart / pie chart from tabular data for data
3.	Query and discovery tools
	• Aim and shoot query to provide user required results through a single or stack of layers on the display. • Logical query through 'software provided forms' on thematic and other layers • Provide querying on single database layer • Stacking of query outputs with for visual analysis • Provide ways to discover the data
4.	Contextual tools
	• Vertical context by multi-layer stacking and identification tools and with layer transparency management
5.	Analysis tools
	• Multi-layer logical queries and unit-wise area / length statistics generation • Tools to facilitate analysis in other suitable packages providing open format inputs. • Multi-theme based analysis based on intra-theme and inter-theme weight-ages as desired by CWC
6.	Metadata / info tools
	• Metadata for the all the available data in central server • Information on projects / works of the stakeholders as provided by CEC
7.	Reporting tools
	• Generation of printable maps using standard map layout with various map elements. • Creation of area statistics report.



1.6 DATABASE STANDARDS

The Database Standards for Spatial and Non-Spatial Data: Standards are fundamental requirement for the GIS based information system. These standards enable technologies – imaging, GIS, GPS and applications – thematic mapping, services and outputs etc to work together. Standards are important not only to facilitate data sharing and increase interoperability, as is understood from many international efforts, but also to bring a systematization and "automation" into the total process of mapping and GIS itself. ISRO / DOS has put enormous amount of efforts and prepared the NNRMS standards for most of the thematic data. However all the new elements, which are not covered in earlier standards, will be standardized on the same guidelines as NNRMS standards. With regard to non-spatial data, this project will have enormous amount of such data, which will be standardized. Database table names and their linkage with corresponding spatial layer, database field type and structure of non-spatial database will be addressed by the small working level group of CWC and ISRO scientists.

Metadata Standards: The Metadata standards contain a set of relational tables that standardize the layer Metadata, the geographic search metadata, the access metadata etc. The NNRMS Metadata Standards will be followed for each of the database components.

Datum and projection: The project envisages WGS-84 datum and UTM projection for individual states and WGS-84 datum and LCC projection for entire country mosaic data.

Scale: All database creation under *India-WRIS* is proposed at 1:50,000 scale.

1.7 User of India-WRIS:

There could be three categories of users and datasets, namely -

General user : Public domain fast track system – all users will be able to the visit website and get the snapshots of the outcome of the project on reduced scale with limited access to the database.

Registered user : Public domain user registered with Login and Password. Registered user can download the data and create customize maps.

Premium user : This category of user will be able to get the access to the India-WRIS web application with the visualization of selected database and tools.

1.8 Status of Development of WRIS:

Central Water Commission (CWC), MoWR, initiated the project 'Generation of Database and Implementation of Web enabled Water Resources Information System named as **India –WRIS in XI plan.** WRIS has been jointly formulated by CWC and ISRO to generate nationally consistent water resources database to be completed by December 2012. The MOU was signed with ISRO in December 2008. Hon'ble Minister for Water Resources launched the first version during December 2010. The URL of the website is www.india-wris.nrsc.gov.in. The current version is 4.0, which contains around 95 GIS layers and is on 1:250K scale (Public domain).

Annexure – I

S.No	Name of GIS layer
1	Basin, sub basin, catchment, water shed
2	River network
3	Digital Elevation model
4	Administrative boundary like International, state, district & block boundary
5	Village boundary
6	Town/village location and extent
7	Road network
8	Major tourist station
9	Location of major & medium irrigation projects
10	Location of Hydroelectric project
11	Location of multipurpose projects
12	Major & medium irrigation command boundary
13	Waterlogged and salt affected area in major & medium command
14	Soil samples of major & medium irrigation project command
15	Canal network
16	Surface water bodies
17	Ground water observation well location & data
18	Litholog data with aquifer data
19	Landuse/land cover
20	Land degradation
21	Wasteland map
22	Snow cover area
23	Flood inundation map
24	Drought prone area map
25	Inland navigation waterways
26	Inter-basin transfer link as per NWDA
27	Hydro-meteorological (Gauge & Discharge) sites of CWC
28	Meteorological station of IMD & CWC
29	Climate related data
30	Pollution monitoring station/water quality station of CWC