



GOVERNMENT OF KERALA

Abstract

Water Resources Department- Standard Operating Procedures (SOP) for desiltation of reservoirs in Kerala and Desiltation of Mangalam and Chuliyar dams as pilot projects- Approved- Orders issued.

WATER RESOURCES(IR)DEPARTMENT

G.O.(Ms)No. 79/2017/WRD Dated, Thiruvananthapuram, 26/09/2017

- Read: 1 Minutes of the meeting convened by Honorable Chief Minister on 7.11.2016
- 2 G.O(Rt)No.898/2016/WRD dated 18.11.2016
- 3 Letter No. 2300/2007/IDRB/DS2/AD2 Dated 09.12.2016 of the Chief Engineer, IDRB, Thiruvananthapuram
- 4 Minutes of the meeting convened by the Chief Secretary on 03.01.2017
- 5 Letter No. 2300/2007/IDRB/DS2/AD2 Dated 19.08.2017 of the Chief Engineer, IDRB, Thiruvananthapuram

ORDER

The original storage capacity of majority of the reservoirs in the State has reduced over the years on account of sedimentation. There has been a demand for desilting reservoirs so as to restore them close to their original storage capacities. Capacity enhancement of reservoirs is essential to meet the growing demand for Irrigation, power generation and drinking water supply. As a first step to assess the feasibility of desiltation of reservoirs, Government of Kerala constituted a Committee, based on the decision taken in the meeting chaired by Hon. Chief Minister on 07.11.2016, as per the Government Order read as 2nd paper above to prepare draft Standard Operating Procedures(SOP) for desiltation of the reservoirs in Kerala comprising the officials of various departments viz, Water Resources Department, KSEB, Port Department, Forest Department, Kerala Water Authority, Mining and Geology Department, National Centre for Earth Science Studies (NCESS) and Centre for Water Resources Development and Management (CWRDM).

The Committee in its meetings held on 24.11.2016 and 03.12.2016 considered all the aspects to be included in the SOP as per the decision taken in the meeting convened by Hon. Chief Minister on 07.11.2016. Accordingly the Chief Engineer, Irrigation Design and Research Board as per letter read as 3rd paper above submitted a draft Standard Operating Procedure to Government for consideration. The meeting chaired by the Chief Secretary on 03.01.2017 discussed the

SOP in detail and took the following decisions.

1. Desilting shall be carried out as pilots in two dams viz, Mangalam and Chuliyar, one by adopting the work contract method and the other by turnkey method, to authenticate the process described in the SOP as well as the technology. The pilots are to be undertaken as proof of concept and to fine-tune the process and technology further in case the pilots are successful.
2. The SOP shall be put in public domain for one month for comments from the public/activists. For this multiple Government websites as well as press release may be used.
3. The SOP shall be forwarded to nationally acclaimed experts (individuals/institutions) for their scrutiny and suggestions.

Accordingly draft Standard Operating Procedure (SOP) was published in the official website of Government and the websites of Water Resources Department, Revenue Department, Power Department, Industries Department, Chief Engineer (Irrigation and Administration) and Chief Engineer (Irrigation Design and Research Board) for comments from the public/activists/experts/stakeholder Departments.

The comments received from the various institutes/public have been discussed in detail in the meeting of the Technical Committee held on 08/05/2017 and necessary changes made in the SOP. The revised SOP submitted by the Committee was evaluated in the joint meeting of Hon. Minister, Finance and Minister, Water Resources held on 14.06.2017 and based on the suggestions made in the meeting the draft SOP was again modified.

Subsequently, the Chief Engineer, Irrigation Design and Research Board modified the draft Standard Operating Procedures in accordance with the observations of Chief Technical Examiner and submitted revised draft SOP to Government as per letter read as 5th paper above.


Government, after having examined the matter in detail, are pleased to approve the Standard Operating Procedures (SOP), appended to this Order, for desiltation of reservoirs in Kerala and to accord sanction to carry out desiltation in Mangalam and Chuliyar dams as pilot projects, one by adopting the work contract method and the other by turnkey method.

Since the purpose of the desilting is to enhance reservoir capacity, Environmental Impact Assessment (EIA) is not required in these cases. However, since the dams/reservoirs are located in ecologically sensitive locations and are in the midst of regions with high density of population, it is critical that a comprehensive Environment Management Plan (EMP) be prepared before commencing the desilting operation. The Chief Engineer IDRDB shall ensure that the Environment Management Plan (EMP) is prepared separately for the two dams by a nationally accredited agency.

By order of the Governor
TINKU BISWAL
SECRETARY

To:- The Additional Chief Secretary, Finance Department
The Additional Chief Secretary, Power Department
The Additional Chief Secretary, Revenue Department
The Additional Chief Secretary, Industries Department
The Additional Chief Secretary, Forest and Wild Life Department
The Additional Chief Secretary, Environment Department
The Principal Secretary, Local Self Government Department
The Land Revenue Commissioner, Thiruvananthapuram
The Principal Chief Conservator of Forests, Thiruvananthapuram
The Chief Engineer,(Irrigation and Administration),Thiruvananthapuram
The Chief Engineer, (IDRB)Thiruvananthapuram
The Chief Engineer, (Project-1), Kozhikode
The Chief Engineer,(Project-2), Thiruvananthapuram
The Director, Port Department, Thiruvananthapuram
The Director, Mining &Geology Department, Thiruvananthapuram
The Chairman and Managing Director, KSEB, Thiruvananthapuram
The Managing Director, Kerala Water Authority, Thiruvananthapuram
The Chief Engineer,(KSEB), Thiruvananthapuram
The Chief Engineer, (Administration), Kerala Water Authority, Thiruvananthapuram
The Director, National Centre for Earth Science Studies, Thiruvananthapuram
The Principal Accountant General (Audit/A&E), Kerala, Thiruvananthapuram
General Administration (SC) Department (Vide item No.1447 dated 20.09.2017)
Finance Department(Vide U.O No. 509046/Ind&PWB3/17/Fin dated 07.08.2017)
I&PR(Web and New Media) Department
Revenue Department
Power Department
Industries Department
Forest and Wildlife Department
Environment Department
Local Self Government Department
Stock file/Office Copy.

Forwarded/By order


Section officer

**DRAFT STANDARD OPERATING PROCEDURE (SOP) FOR
DESILTATION OF RESERVOIRS IN KERALA**

PROCEDURE

(i) General

Sedimentation of storage reservoirs is the process of accumulation of silt due to the obstruction created by the dam. This causes reduction in the storage capacity of the reservoir. The progressive loss of capacity due to sediment accumulation results in reduced benefits and may even cause operational problems in the reservoir projects. Desiltation of reservoirs will help to restore the original designed capacity of the reservoirs. The desilted sediment can be separated into usable components like sand and clay which can be utilized for construction purposes and brick/tile industries respectively. This will provide a solution to the scarcity of sand in the State. Thus the desiltation of reservoirs will help in storage capacity restoration as well as in earning sizeable revenue to the State by way of sale of separated components.

(ii) Estimation of quantity of deposited sediment in a reservoir

For assessing the quantity of deposited sediments in reservoirs, sedimentation studies shall be conducted by the dam officials prior to the desiltation process using Integrated Bathymetric System and Sub Bottom Profiling. Sub Bottom Profiling is a method by which the thickness of underwater sediments, including type of sediment, can be assessed from an instrument mounted on a boat. If desired, the bidder is free to carry out detailed studies for ascertaining the quantity of sediments and its components at his own cost. After and during the desiltation process, Integrated Bathymetric Study as well as Sub Bottom Profiling shall be conducted jointly by the Department and bidder to assess the quantum of sediments removed. The Initial sounding level and final sounding level shall be reported to the Chief Technical Examiner as per rules.

(iii) Estimation of quantity of components in the deposited sediments as well as

Estimated cost of each component material/ Estimated cost of extraction, processing and packing etc. of each component material

In order to estimate the components of deposited sediments, bore samples shall be collected by officials of Kerala Engineering Research Institute, Peechi or Kerala Highway Research Institute or any other reputed Central /State Government institutions in the presence of Engineer-in-charge of the project and analysed by the said institutes. For accurate estimation of the components, representative

samples shall be collected at closer interval, one each at the centre of the grid of 50mx50m size. Bore samples are to be collected for the entire depth of sediments.

The Superintending Engineer/ Deputy Chief Engineer in charge of the project shall assess the quantity of sediments based on sounding levels, and on the basis of test results of the sedimental samples, work out the quantity of each component materials such as sand, silt, clay etc. and assess the estimate cost of each component material/ Estimated cost of extraction processing, separation and packing etc. of each component material and to submit the report to the Technical Committee through the Chief Engineer concerned to vet and accept the quantity as well as estimated cost of each component material/ estimated cost for extraction, processing, separation and packing etc. of each component material for Method 1- Turn Key method and Method 2- Work Contract Method respectively.

Method -I: - Estimated cost of each component material = Quantity of each component material in $m^3 \times$ (unit rate of each component material as per current DSR minus Unit rate for extraction, processing, separation, packing etc. of each component material.

Method 2:- Estimated cost for extraction, processing, separation and packing etc. of each component material = Quantity of each component material in $m^3 \times$ unit rate for extraction, processing, separation and packing etc. of each component material.

(iv) Vetting and acceptance of the estimated quantity by a competent technical body

Technical Committee is to be constituted as follows:-

In the case of Reservoirs under Irrigation Department, the Technical Committee shall comprise following members:-

1. The Chief Engineer (I&A)-Chairman
2. The Chief Engineer in charge of the Project-Convenor
3. The Chief Engineer (Mechanical), PWD-Member
4. The Director, Mining and Geology Department -Member
5. The Chief Hydrographer-Member
6. The Superintending Engineer in charge of the project- Member

For the works connected with the Reservoirs under KSEBL, the Technical Committee shall comprise the following members:-

1. The Director (Civil), KSEBL-Chairman
2. The Chief Engineer(Civil), Dam Safety, KSEBL-Convenor
3. The Chief Engineer (Mechanical),PWD-Member
4. The Director, Mining & Geology Department- Member
5. The Chief Hydrographer- Member
6. The Deputy Chief Engineer, Dam Safety Organization, KSEBL- Member

The Empowered Committee is to be constituted as follows

1. The Additional Chief Secretary, Finance – Chairman
2. The Additional Chief Secretary, Water Resource Department - Convenor
3. The Additional Chief Secretary, Power- Member
4. The. Additional Chief Secretary, Revenue- Member
5. The Additional Chief Secretary, Forest & Wild life

The role of Empowered Committee are as listed below:-

1. Scrutiny of the DPR in consultation with the Chief Technical Examiner. -
2. Decide and approve the bidding method (Method 1- Turn key Method or Method 2- Work contract) to be adopted for a particular project in consultation with Chief Technical Examiner.
3. Fixation of installment amount to be paid to the Government for Method 1-Turn key Method.
4. Approval of variation in the estimated quantity of total sediments and realised total quantity in consultation with the Chief Technical Examiner.
5. Monitoring the progress and redressal of disputes, if any, arised during execution of work.

The Technical Committee shall give approval for Estimated quantity of components in the deposited sediments as well as estimated cost of each

component material/ Estimated cost for extraction, processing and packing etc. of each component material.

The Chief Engineer of concerned project shall submit a detailed project report with a cost benefit analysis along with recommendation of Technical Committee to the Government for Administrative Sanction. The Administrative Sanction shall be issued by the Administrative Department concerned with the recommendation of the Empowered Committee and seeking concurrence from Finance Department (including – Chief Technical Examiner's advice).

Based on the Administrative Sanction, Chief Engineer concerned project shall issue Technical Sanction and Superintending Engineer/ Deputy Chief Engineer in charge of the Project shall tender the work after getting the approval for the methodology of bid to be followed from the Empowered Committee. The Chief Engineer concerned shall ensure that the LMR justification for the tendered work is ready before opening the tender.

The Empowered Committee comprising Government Secretaries shall scrutinize the DPR for each project, recommend Administrative Sanction and monitor the progress at regular intervals.

(v) Technology to be used for desilting of reservoir and its subsequent separation

The desilting of reservoirs shall be carried out using pneumatic de-silting pumps.

The sediments shall be removed by suction method using de-silting pumps and transported through pipelines to the processing yard for separation and the debris (plastic, glass etc) shall be disposed strictly adhering to the safety conditions stipulated by the Department and without polluting the environment in any manner. The pipeline system shall be the own responsibility of the bidder.

The de-silted sediment in slurry form shall be separated into usable components such as boulder, gravel, sand, clay, silt, organic matter etc by using suitable sediment separators (wet method). No harmful chemicals/flocculation agents shall be added during the separation phase.

The separation plant shall be located at the most technically feasible distance. The land shall be provided by the Government on lease subject to availability or arranged by the contractor, which will be decided at the time of

bidding. If the land is not provided by the Government, the bidder has to mention in the bid document about the details of the land along with location map.

The area required for the separation yard will depend on the size of the reservoir and the quantity of sediments and will be specified in the bid document.

Separation of components shall be done in such a manner that the properties of the separated materials are strictly in accordance with the market requirements and IS specifications for construction materials, for which specifications will be included in the bid document.

(vi) Issues related to turbidity of water during desiltation

Most of the reservoirs in the state are utilized for drinking water supply also, so the entire de-silting process shall be carried out with minimum turbidity caused to the reservoir water and without polluting the water for drinking water supply. The turbidity of water near intake structure as well as the treated discharged water after sediment separation shall not exceed 200NTU. Kerala Water Authority shall be informed by the Project authority before starting desiltation so that they shall monitor the compliance of the above in all the dams during the desilting process. Baseline water quality data (physical, chemical and microbial properties) of the reservoir water shall be analyzed before the desiltation process. The parameters shall be analyzed at regular intervals during desiltation to check if there is any deterioration in water quality due to the process.

Standards of Kerala State Pollution Control Board shall be followed in relation to the treated water to be released to natural streams/ reservoir. The test required for ensuring water quality and other statutory norms shall be carried out by the bidder as per the departmental direction.

(vii) Environmental concerns due to the impact of the entire chain of activities – desilting, separation of components, packing of components, disposal of waste/debris

Before desilting is undertaken, a comprehensive Environmental Impact Assessment (EIA) study by a nationally accredited agency shall be undertaken. The agency shall develop an Environment Management Plan (EMP) covering the following issues.

1. Potential environmental impacts of desilting- Upstream, downstream and within the reservoir – flora and fauna, fish habitat, other aquatic habitats, vegetative cover etc.

2. Potential environmental impacts of silt transportation network.
3. Potential environmental impacts of silt treatment plants
4. Recommended mitigation measures for impacts of desilting
5. Recommended mitigation measures for impacts of silt transportation plans
6. Recommended mitigation measures for impacts of silt treatment plants
7. Allocation of resources and responsibilities for plan implementation
8. General obligations of the desilting contractor with respect to EMP

Withdrawal of sediments shall only be carried out from the stipulated locations of reservoir area, as per the work plan approved by the tendering authority.

Locating the pipeline routes shall be done taking into account development patterns of the area, roads, rail crossings, etc. Booster pump locations, if required, shall be selected to minimize the inconvenience and potential noise impacts.

Stacking/processing of desilted materials shall be carried out as per departmental direction and supervision only.

It is highly recommended that the separated components are packed and transported, so as to reduce the chances of pollution. Packing shall be done within the separation plant. In case materials are not packed, the trucks shall be well covered during transportation to reduce pollution problems.

After the entire process is completed, debris shall be moved to the areas approved by the Department.

In case of plastic and other debris, the bidding authority shall decide the mode of disposal which shall be specified in the bid document.

User agency shall apply for permission from Forest Department for laying pipelines and for stacking of sediments within forest area. Either the bidder through the department, or the department themselves shall be made as the user agency and shall apply for the necessary clearances from Forest Department.

General laws and rules applicable to the local area where the desiltation and separation processes are to be carried out shall also be strictly adhered to.

The depth up to which desilting can be done has to be specified along with the quantity of sediments to be removed after sedimentation studies. Desilting shall not be permitted beyond the original bed levels of the reservoir and only the accumulated sediments are to be removed.

- (viii) **Process involved in the chain of activities and the necessary pre-requisite to ensure each activity is undertaken smoothly including among others land where desilted material shall be stored, space to be allotted for the separation activity etc**

Reservoir de-siltation process in brief shall include the following phases,

- Phase 1: Removal of sediment material from the reservoir
- Phase 2: Transportation to separation plant/stacking yard
- Phase 3: Separation and washing of cobble, pebble, sand, clay, and other materials
- Phase 4: Sand and clay packing and debris disposal

The de-silted sediment in slurry form shall be separated into usable components by wet method. The area for sediment stacking and processing yard shall be selected taking into account the following factors:

- The area shall be sufficient to store the separated materials for the proposed stacking period
- Areas considered as environmentally sensitive such as wetlands and streams, historical sites, river floodway etc. shall be avoided
- For economy, the site shall be located at technically feasible distance towards the downstream side of the reservoir.
- The site shall be isolated from populated areas where the pipelines and other equipments may be considered a nuisance, a safety hazard, aesthetically unpleasant etc.
- The long-term impacts of wind-blown silt that can originate from the disposal area after it dries shall also be considered

- The site shall provide the operational flexibility needed for the job, such as the ability to discharge the dredged material at different points as it moves
- The site shall be suitable for future reuse

(ix) Disposal of untreated water sucked with the dredged material and subsequently separated

The sucked water which is discharged after sediment separation shall be treated and reverted to natural streams/pipelines/ reservoir as per the direction of the departmental officers concerned. The water discharged to the natural streams shall strictly adhere to the standards specified by the Kerala State Pollution Control Board. Untreated water shall not be discharged into the rivers/streams/ reservoir under any circumstance. The required test will have to be carried out by the bidder as per the departmental direction.

(x) Environmental and social impacts of transportation of massive quantities of the desilted and separated components through fragile communities with limited road access given the remote location of reservoirs

The process of pumping the entire materials from reservoirs directly to the separating & packing plants through pipelines will ensure minimum environmental and social disturbance. The bidder shall ensure that the pipeline conveyance of de-silted material shall not affect the environment as well as the people residing in the area. Any damages to road, gates, fence, side protection works etc. due to any of the above processes, shall be maintained by the bidder.

(xi) Roles and responsibility of various stakeholders/officials involved in the process to ensure transparency and accountability

Responsibility of the bidder - It shall be the responsibility of the bidder to remove the sediments in accordance with this Standard Operating Procedure and strictly adhering to the safety conditions and logistical guidelines stipulated by the Government. The program for desiltation shall be completed within a total period of __ months based on the quantity of sediments to be removed (Below 2Mm³ – 12 months, 2Mm³ to 5Mm³ – 24 months, 5Mm³ to 10Mm³ – 36 months, above 10Mm³ – 60 months). The time of completion may be extended if needed later while carrying out pilot studies. The sediments are to be measured by weight. All

statutory norms are to be ensured and royalty if any needs to be paid by the authority/ bidder who disposes off the separated materials.

Responsibility of the officials:

- Estimation of quantity of sediments and soil sample analysis with the help of any State Government agency like KERI, KHRI etc.
- The concerned Project officials shall take necessary steps for tendering and arranging the work
- The concerned District Collector shall take over the usable materials and monitor the process of packing and selling of the same

(xii) Types of bids to be floated for work related to desiltation

Tendering may be carried out by Method 1-Turn key Method and Method 2- Work Contract Method with the prior approval of Empowered Committee.

The Superintending Engineer/ Deputy Chief Engineer in charge of the concerned project shall be delegated to tender the work as PQ Mode costing more than Rs. 5 crore or Non-PQ Mode in the case of costing less than or equal to Rs. 5 crores. The acceptance of bids shall be as per the guidelines issued by Finance Department. In the case of Turn Key Method for outright sale of sediments, the departmental officers are delegated with powers to accept the bid above the value of the component material based on prevailing PWD LMR only.

Method 1: Turn-key method

The Project authority shall assess the Probable Amount of Contract based on the methodology specified in the note below. The Project authority shall tender for outright sale of extracted components. The bidders shall quote a lumpsum amount to be paid to the Government. The bidder who quotes the maximum amount will be the successful bidder. The successful bidder shall pay the amount to the Government in advance in installments as decided by the Empowered Committee specified under clause (iv) and shall carry out the entire desiltation process as well as separation and sale of the components.

Note: The department shall work out the cost for the entire process including the separation and packing stage. The value of the separated components shall also be worked out based on current DSR in m³.

Method 2: Work Contract method

After assessing the Probable Amount of Contract based on the cost incurred for extraction and separation of sediments as per the note below, the Project authority shall tender the work of extracting the sediments and separating components including packing as specified in the bid. The bidder shall quote unit rate (per cubic meter) for the total sediment for the work. The bidder who quotes the lowest rate will be the successful bidder. After separation of components, the products shall be handed over to the District Collector concerned for disposal. The quantity of work eligible for payment shall be the total quantity of all separated components (sand + inorganic clay + organic clay + debris). As the sediment removal and separation are continuous processes, the entire process shall be treated as a single work and hence shall be awarded to a single bidder or a consortium of bidders.

Note: The department shall work out the cost for the entire process including the separation and packing stage in m³.

The Agreement authority shall ensure that total estimated quantity of component material (Sand, Silt, clay etc) shall matches with the realised total quantity of component material (Sand, Silt, Clay-etc) i.e. Input quantity matches with Output quantity. If there are any differences during execution of work, the same shall be immediately referred to the Empowered Committee substantiating with proper study report and duly recommended by the Technical Committee for approval of variation.

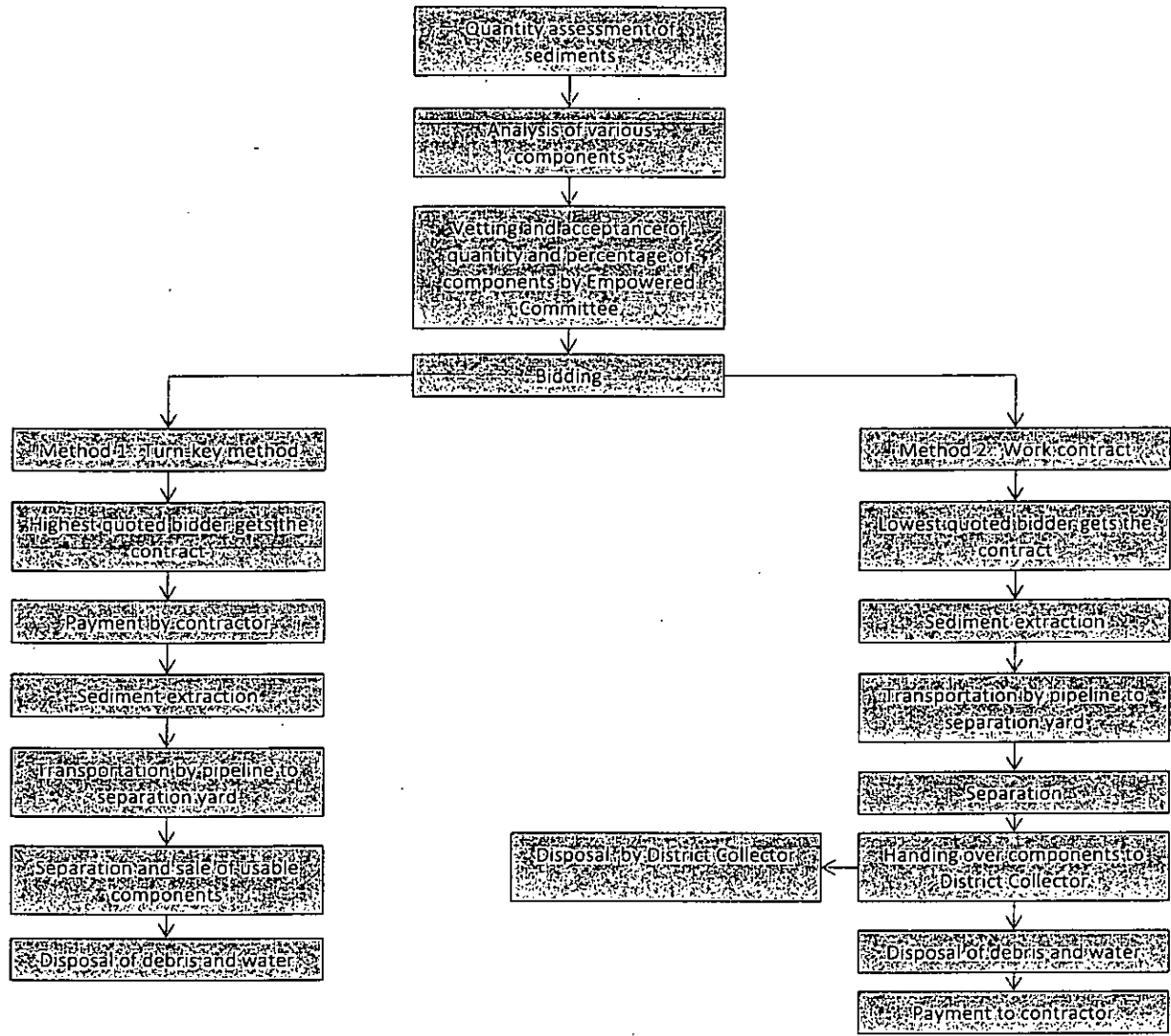
For awarding the work to a bidder, two-cover system shall be followed. The technical bids and financial bids shall be submitted in two separate sealed covers. An amount of Rs. 2.5% of Probable Amount of Contract shall be furnished as Earnest Money Deposit along with the bid document. Technical bids shall be opened first. Then the financial bids of those qualified bidders only will be opened and the work shall be awarded to the successful bidder. The bid amount once quoted shall be final and binding on the bidder.

(xiii) Monitoring, auditing and accounting mechanism during the process life cycle to ensure accountability

The accumulated sediments shall be removed only from within the boundary and sectors earmarked by Department. De-silting adjacent to the dam structure shall be under the close monitoring of Kerala Dam Safety Authority. It will be the responsibility of the bidder to convince the Department about the quantum of sediments removed by using Integrated Bathymetric Study and Sub Bottom Profiling also.

Where ever tendering is carried out following the second method as per para (xii), GPS enabled vehicles shall be used for the transport of separated components. Also CCTV surveillance systems shall be installed at the separation yard for monitoring the activities. The concerned District Collectors shall post an Inspector at the separation site for monitoring.

RESERVOIR DESILTING – BIDDING PROCESS



RESERVOIR DE-SILTING- TECHNICAL PROCESS

