GOVERNMENT OF KHYBER PAKHTUNKHWA
IRRIGATION DEPARTMENT

Terms of Reference/Guidelines for submission of Proposal for Review/Updation of Detail Design & Construction Supervision of Chashma Akhora Khel Dam District Karak

DIRECTORATE GENERAL SMALL DAMS

July 2020

BACKGROUND INFORMATION OF THE PROJECT/STUDIES

Location:

ChashmaAkhoraKhel dam site is located on LailanAlgadNallah which having outfall in Teri Toi River. It is situated in District Karak at N 33° 21' 50'' and E 71° 05' 14". The dam site is accessible from Kohat City via Krapa at a distance of 61 km.

General description:

District Karak is a district in Kohat Division of Khyber Pakhtunkhwa, Pakistan. The district has limited land and water resources.The land is much fertile but its full use cannot be made unless assured and dependable water for irrigation is provided.

At present, Directorate General Small Dams, Irrigation Department, Khyber Pakhtunkhwa is working on two Small Dam Projects in District Karak and has already built Six (06) Schemes, which are contributing to the agro-economic development of District Karak.

The construction of ChashmaAkhoraKhel Dam shall trap the water to ensure perennial supplies and provide the basic infrastructure for development of agricultural resources of the area. Most of the population in and around the project area is engaged in agriculture and livestock rearing.

It is estimated that a reasonable quantity of water from the dam will meet the irrigation demand of lands proposed in the command area, besides providing drinking water to the population, living in and around the project area through shallow wells or through laid pipeline network.

a. Project Area:

ChashmaAkhoraKhel Dam Project is located on LailanAlgad having catchment area of about 136 km2 which having outfall in Teri Toi River. It is situated in District Karak at N 33° 21' 50'' and E 71° 05' 14".

District Karak is a district in Kohat Division of Khyber Pakhtunkhwa. It is situated to the South of Kohat District and on the North side of Bannu and LakkiMarwat Districts on the main Indus Highway.

b. Physiography:

Physiographically, the district Karak consists of a succession of ranges of broken hills, whose general trend is from East to West. The general elevation of the district is from 600 to 1400 meters above sea level. The Khattak range starts from the boundary of Karak with South Waziristan and runs in East-West direction. The general drainage of the area is from West to East.

The Karak district lies between latitude 32° 48' to 33° 23' N and longitude 70° 40' to 71° 28' E. The landscape of the area is sloping, while in the project area the drainage pattern is not so deep and the people are using the LilanAlgad water for irrigation purposes where topographic features permit.

c. Climate:

The climate of the area is semi-arid subtropical; which manifests itself in great diurnal and seasonal variations in temperatures. The area receives both Monsoon and winter rains. The winter rains occur during the months of November to April and Monsoon rains from the month of May to October, with August being the rainiest month.

The temperatures vary with the elevation and presence of mountains. May to July is the hottest period with mid-day temperature up to 40^{o} C, while it reaches near freezing point by Western cold waves in the months of December to February.

d.Hydrology:

The project area is drained by the LailanAlgad, which is the tributary of Teri Toi. All are running towards East and join Indus River. The LailanAlgad has perennial flow, which provides irrigation in patches in the project command area.

e. Water Availability

ChashmaAkhoreKhel Dam site is located on LailanAlgad which has perennial flow of about 3 cusecs due to rainfall in the catchment. The high flow months are July and August, while minimum flow occurs in January.

f. Sedimentation

The life of reservoir is ultimately dependent on the amount of sediment deposited in the reservoir. The amount of sediment is proportional to the catchment's area and the volume of runoff into the reservoir. As no previous measurements of bed material, bed load, and suspended load are available for the catchments area.

The relationship between 'Sediment Yield' and 'Catchment's Area' presented in 'Design of Small Dams' has been used. The equation for the plot is given as Q=2.4 *A^ (-0.229). For a catchment's area of 52.50 square miles of ChashmaAkhoraKhel dam, the sediment yield comes out to 0.969 ac-ft per sq.mi.per year.

g. Geology

The mountain configuration of the area consists of red shales, sandstones, limestone and conglomerates. In between the broken hills, small valleys occur which is formed by the material

higher plain. The alluvium found in the valleys on either side of the main stream, is composed of clay and sand with embedded gravel forming the agricultural land.

h. Existing Agriculture Practices

Most of the cultivable area at the proposed dam site is either rainfed or dependent upon water availability in lailanAlgad.

1. Major Components of the Project

a. Main Dam

At proposed dam site, 102 m high and 758 m long, Earth Core Rockfill Dam (ECRD) with a gross storage of 4150 AF will be constructed on LailanAlgad.

b. Spillway & Stilling Basin

Main spillway, consisting of ogee type crest, a chute and a stilling basin, will be constructed near the left abutment. Spillway is designed to cater for Probable Maximum Flood (PMF) of 55,217.84 cusecs. It will pass design discharge with a crest length of 393.7 ft.

c. Intake and Outlet System

The Intake and Outlet system will be designed to deliver the maximum demand of 26 cusecs. The intake will consists of RCC intake structure having trash rack and stop logs with 2.5 ftdia pipe running through the dam body. While the outlet structure will comprise of Gate valve with chamber and impact type stilling basin.

INSTRUCTION REGARDING SUBMISSION OF PROPOSALS

1. Three copies of the technical and one copy of financial proposals in stippled/fixed binded form are required to be submitted. Proposal should be in a sealed envelope indicating original or copy on each enclosure, as appropriate.
2. The proposals shall be valid for a period of 120-days after the last date of submission, which is extendable on the expiry of above period through mutual agreement.
3. The technical and financial proposals of the consultants will be evaluated according to criteria for procurement of consultancy services of the Government of Khyber Pakhtunkhwa, applying weight-age formula of 80:20 for technical and financial proposals respectively.
4. Financial proposals of Technically Qualified consulting firm will be considered and opened by competent forum in presence of the competitive firms representatives. The contract agreement will be governed by laws and regulations of the Govt. of Khyber Pakhtunkhwa.

5. Any observation/ clarification on the TOR and EOI must be brought into the notice of the department before last date of submission of the proposals. No objection will be entertained after the submission of Technical and Financial proposals.
6. The employer reserves the right for any addition alteration or amendment in the TOR of the Project.
7. Technical proposal should include the following information as well.

   i. Year of formation, year of registration of the firm, postal address, e-mail, telephone/fax numbers with name of partners/proprietor and head and branch offices.

   ii. Registration Number and latest renewal certificate of Pakistan Engineering Council.

   iii. National Tax No. (NTN) with copy of the certificate.

   iv. List of Similar nature works completed by the firm during last 10 years with detail of year of start/completion, cost of consultancy services, scope of the work and actual services performed by the firm individually and / or in a joint venture with specific details to be given in annexure.

   v. List of Similar nature works in hand with cost of consultancy services, scope of the work and actual services performed by the firm, date of start and expected date of completion individually and / or in a joint venture with specific details to be given in annexure.

   vi. Only those similar projects will be considered for evaluation for which the scope of services is mentioned in the data sheet of the firm furnishes evidence to this effect.

   vii. The experience of the firm includes project handled by the firm and not by the individual employees of the firm in their personal capacity.

   viii. List of professional staff and CV's of the key experts (duly signed by them or by the authorized representative of the firm) who will be handling the assignment with names, qualifications, year of passing various degrees and post qualification practical experience.

   ix. A comprehensive write-up about approach and methodology, proposed work plan and manning schedule of various experts on a bar chart showing man-months of each expert, their responsibility and total time schedule for completion of the assignment.
8. Consultants shall be responsible for payment of all kind of taxes (direct & indirect both), levies etc in vogue time to time by Govt. in respect of personnel and other activities with no liability to the client.

9. The Consultants cost shall be inclusive of all kind of Taxes (direct & indirect both), levies etc. However, the Sales Tax as per applicable law shall be mentioned separately.

10. The Consultants' financial bid/ proposal shall be deemed to cover expenses for each and every item of the scope of work/TORs. No payment shall be made for any item(s)mentioned in scope of work/TORs that the Consultant have intentionally or unintentionally presented as conditional, missed or not included in their technical and financial proposal, the consultants shall have to perform the same at their own expenses.

12. Payment for the personnel will be made as per actual time consumed on the Project but not in excess of the provision of man months made in the T.O.R. of Consultancy.

13.Payment to the Consultants for the survey and Geo-technical investigation and other investigation (if required) will be made as per actual work done.

14.On the satisfactory performance of the services, the payment to the Consultants shall be made as per actual inputs, while in case of incomplete assignment; the payment will be made for the work done in accordance with the breakup of the services submitted by the Consultants and as determined by the Employer/Client.

15. Security deposit and income tax/sale tax etc will be deducted as per the prevailing Government rules notified during currency of the project.

16. The Consultant shall establish complete Project Office at Peshawer/nearest to site.

17. Consultants shall appear in Project meetings and site visits and shall also make presentation if so directed by the department for which no TA/DA, boarding, lodging and claim for incidental charges etc, shall be entertained.

18.The Consultant except with prior approval of the competent authority shall not sublet the study or any part thereof.

19. If the Consultant fails to complete any activity or part of the activity, the client reserves the right to execute the same at the consultant risk & cost.

20. If a project or part of project is dropped due to any reason, man months of the consultant key staff and logistics will be curtailed proportionally.

22. Consultant will be responsible for security of their staff. However, the security issues will be taken up with concerned security agencies.

25. Consultant shall provide indemnity bond.

26. Employer reserves the right to replace/withdraw/shared vehicle, person and equipment from the consultant if required.

27. The Consultant will have to adjust given/estimated Man-months for entire period till completion.
28. TORs will be part of contract agreement.
29. Third Party validation (if required) of the Detailed Engineering Design local or International (as required by the Employer), will be the responsibility of the consultants, to get verify their contents of the study.
30. If the client (Irrigation department, Government of Khyber Pakhtunkhwa) suffer any loss due to proven design faults by the consultants, then the consultants shall have to reconstruct the said failed structures at their own cost.
31. The successful bidder/consultancy firm will deposit performance security @ 5% of bid cost in shape of bank guarantee or CDR as per KPPRA rule. (Para 24.2 standard procedure for selection of consultant).

EVALUATION CRITERIA OF PROPOSALS

Proposals of the consultancy firms will be evaluated as under

S.No	Description	Maximum Marks
A	Qualification & Experience of Technical Key Personnel	50
B	Experience of firm in undertaking Projects of dam & Hydraulic structures of similar nature & complexity	30
C	Work Plan/Manning Schedule & Methodology	20
	Total	**100**

Note.

- Each page of the proposal must be numbered & signed by the owner of firm.
- Passing marks in each category will be 60%
- Proposals must be stippled binded. Ring binding will not be considered.
- Client reserves the right to make any change in TORs& marking criteria which is commonly applicable to all proposals.
- Any observation/clarification required should be brought in notice of the Client / Employer before submission of the proposal during clarification meeting.
- Proposals shall be submitted in two copies (Marked as Original & Copy)
- Any mis-statement or false information provided in the technical or financial proposal will render the proposal as non-responsive and shall make the firm liable for punitive action under the relevant rules.

- **Qualification & Experience of Technical Key Personnel**

ii. Marking criteria of Personnel

S.No	Description	Marks	Criteria
1	Qualification	20	BS or M.Sc. (16 Years Education)=80%, MS or M.Phil.=90%, Ph.D=100%
2	Languages	05	Pashto=2 (R W S) Urdu=1.5 (R W S) English=1.5 (R W S)
3	Experience	30	
	General Experience	7.5	Experience after completion of 16 Years education (15 years of general experience will carry full marks)
	Relevant Experience	15	Experience of particular discipline (10 years of general experience will carry full marks)
	Similar (DAM) Projects	7.5	Full marks for 10 Projects
4	Experience of Local Environment	05	Khyber Pakhtunkhwa=03 Pakistan=02
	Total	**60**	**Will be adjusted to 50**

iii. This proforma must be available on top of each CV in addition to the information to be provided as per standard format, Otherwise will not be considered.

1	2	3	4	5	6		
S#	Position	Proposed Personnel	Qualification	Knowledge of Languages	Experience		
					General	Relevant	Dam Projects
7	8	9					
Experience of Local Environment	Cell No	Duration with firm					

Note.

- The proposals must contain salary details, last degree, PEC registration certificates of the key staff
- Each CV must be signed in Original by the Personnel & owner of the firm.
- Personnel above the age of 70 will be in eligible

- **EXPERIENCE OF FIRM.**

S.No	Description	Maximum Marks
1	Relevant/Specific Experience of Firm (Completed/In progress Dam Projects in last 10 Years)	18 Feasibility Study= 25% marks, Detailed Design= 25% Marks, Procurement= 10% Marks Construction supervision= 40% Total= 100%
2	General Experience of Firm (Any completed Project of Hydraulic Structures in last 10 Years)	12 Feasibility Study= 25% marks, Detailed Design= 25% Marks, Procurement= 10% Marks Construction supervision= 40% Total= 100%

Note

- Consultancy Services of the Projects with cost less than Rs 500 million will not be considered.
- Five (05) Projects in each category will entitle the firm for full marks.
- Award & completion documents must be available in support of projects claimed as experience.
- Below proforma must be attached for any projects of sr No 1& 2 in addition to standard format.

1	2	3	4	5	6	7
S#	Name of Project	Location with Province & Country	Client	Address, Phone & Fax No of Client	Handled as: • Single Firm/ : • Lead Firm/ : • Joint Venture : Partner	Cost of Project
8	9	10		11		
Cost of Services	Scope of services • Feasibility • Detailed design • Procurement • Construction Supervision	Scope of Work				

UNDERTAKING

It is hereby certified that the above are true statements based on facts and we take full responsibility for the correctness and accuracy of the information supplied herein to the best of our knowledge and belief. This is also to certify that the owner/partners/directors working solely for the consulting engineering profession. This is further to certify that we are independent consulting engineer and have no interest in any construction and conflicting commercial industrial and business activities which are likely to influence our professional independence and neutrality. We also undertake to fully abide by KPPRA act/rules & the Pakistan Engineering Council (Conduct and Practice of Consulting Engineers) Byelaws 1986 & registered with Khyber Pakhtunkhwa Revenue Authority

TERMS OF REFERENCE FOR DESIGN REVIEW AND CONSTRUCTION SUPERVISION

The Consultant shall represent the client on site and shall engage all experts for review of design and deploy a full-time supervision team on site. The consultants shall be responsible for review of design and supervision of all the construction activities of the project.

The Consultant's tasks shall include, but not be limited to the following**:**

1. Perform design review of the Project components including dam embankment, spillway, irrigation conduit, intake and outlet structures, irrigation network, intake structure for drinking water supply, road and buildings etc including the prospects & validity of future rising of the Dam and, where appropriate, propose modifications/ omission/ correction etc in consultation with the Client before start of construction activities.

2. Carry out additional topographic , Geophysical surveys and additional sub-surface geo-technical investigation (if required and with approval of the client) for review of detail design of all components of the project.

3. Review of Construction Drawings.

4. Furnish "Detail Cost Estimate" and make periodic updating of the cost of project during construction phase along with reasons for increase/decrease of cost of individual items.

5. Assist the employer in Tendering Process/Bid Evaluation.

6. Approval of construction schedule submitted by contractor.

7. Facilitate Sites Handover for the Works to the Contractors.

8. Ensure that the Contractor's procurement schedule indicates all materials are from the right source, quality and of sufficient quantities.

9. Advise the Employer on contractual obligations and establish early warning systems to minimize occurrence from potential compensation events and subsequent claims for idle machinery, time extension and cost.

10. Ensure that the Contractor conforms with the legal, health and safety standards and all safe guards' requirements.

11. Supervise the Contractors' actual work progress versus the scheduled work programme and to make it sure that delays are kept to a minimum and, that the Contractor at their cost takes necessary steps to make up for time lost and pull the project back to planned schedule.

12. Supervise construction of the project in the capacity of Engineers Representative, to ensure that the project including all components are being constructed satisfactorily in accordance with approved drawing, design, specifications and required quality.
13. Verification/checking of contractors statements of executed quantities for making progressive payment to the contractor.
14. Verification and checking of the interim and final payment to the contractor for approval of the employer.
15. Coordinate between contractor and employer to implement the project in accordance with the contract.
16. Undertake and prepare revised designs, improvements or modifications as necessary during construction in consultation with the client.
17. In consultation with the client, and if necessary, prepare and issue variation orders to the contractor after approval of the competent authority.
18. Timely issue to the Contractors all the necessary correspondences related to information, instructions, clarifications and and revised construction drawings if required to ensure consistency in quality, positive progress and planned costs.
19. Inspect, determine and approve the part of works before, during and after construction of part and, or whole of the works to ensure all time compliance with the specifications and standards.
20. Supervise and approve the Contractors' procurements, ensuring that all materials are from the right source, quality and of sufficient quantities.
21. Supervise the material testing in contactor's field laboratory and keep record of respective test reports.
22. Provide adequate technical assistance, consultation and advice to the Client / Employer in matters that crop up during execution, may include redesigning and connected issues.
23. State all methods and procedures that are intended to ensure robust quality control, execute all procedures accordingly, and report on all quality control undertakings and their results to the client.
24. Prepare and submit Monthly Progress Report to the Client / Employer indicating any issue that could affect the work pace.
25. Participate in progress meeting convened at site and in Regional or Divisional offices at Peshawar/Kohat or any other place as and when required.
26. Maintain daily site records on prevailing weather conditions, labour productivity, availability

and operational condition of key plant, plant productivity, daily activity outputs, and disputes between employers and staff as well as between contractor and local residents, and all other observations that may be of importance in case of any arbitration or legal disputes.

27. Revision of PC-I if cost of the project over runs beyond approved cost or if there is a substantial change in the scope of work but the project cost remains within the approved cost.
28. To provide sufficient and appropriate technical and support staff at site as per requirement or as directed by Client / Employer in the interest of work.
29. Preparation of chakbandi and warabandi for outlets in the Irrigation system.
30. To submit duly verified as built drawings.
31. The consultants shall provide assistance during the defect liability period and visit the project from time to time for pointing out any defect etc. the same shall be reported to the employer in the form of punch list and monitor its rectification.
32. To appear, if required, and assist the client in the court of law, in case of any litigation by the contractor or stakeholder.
33. Preparation of revenuechakbandi&warabandi system for Irrigation system.
34. The Client may withdraw/replace the vehicle purchased by consultants in the public interest for the Project activities.

REPORTING AND DOCUMENTATION FOR DESIGN REVIEW AND CONSTRUCTION SUPERVISION

- Preparation of final design report (15 copies), tender drawings (15 copies) and specification tender documents (15 copies).
- Preparation and submission of construction drawings (15 copies).
- Preparation and submission of command and capacity statement of the outlets and canal.
- Preparation and submission of monthly progress report (10 copies).
- Preparation and submission of as built drawings in (10 copies).
- All correspondence, surveys, lab test results and construction drawings along with soft copies in binded form.
- Preparation of Chakbandi and Warabandi.
- Preparation of operation and maintenance manual for the project.
- Preparation of PC-IV for the project (10 copies).
- Preparation of draft revised PC-I Proforma in (05 copies) and final revised PC-I Proforma in required numbers if required as directed by the client.
- Preparation and submission of Punch list in defects liability period.

MODE OF PAYMENT

Design Review and Construction Supervision (Completion period 36-months)

I. Payment will be made to the consultants as per actual physical & personnel inputs regardless of the approval/award of submitted proposals.

II. No other expenses as Remunerations or Direct cost will be paid to the consultants by the client.

III. 10% of each running payment shall be withheld by the employer as security deposit which shall be released on satisfactory completion of services and submission of all reports/documents stipulated in TOR and admittance thereof by the employer.

Note:

The mode of payment indicated is tentative subject to alteration and is not to be considered as the cost of any activity but it is progressive payment for the facilitation of the consultants.

PROFESSIONALS/ KEY PERSONNEL REQUIREMENTS

Consultant Bid Cost will be sum of Key Personnel's & Logistic requirement as per below details. Payment of survey, other investigation & vehicle (Running & maintenance) will be made as per actual inputs.

A. DESIGN REVIEW AND CONSTRUCTION SUPERVISION (24 Months)

SALARY COST

S.No	Position	Man Months	Billing Rate (Rs)
1	Project Manager/Team Leader	24	
2	Hydrologist/Irrigation Engineer	03	
3	Structure Engineer	03	
4	Geotechnical Engineer	03	
5	Resident Engineer	24	
6	Geologist	06	
7	Lab Technician	24	
8	Site Inspector	24	
9	Land Surveyor	24	
10	Quantity Surveyor	24	
11	Site Supervisor (03 Nos)	24	
12	Ziladar	03	
13	Patwari	03	
Support Staff			
1	AutoCAD Operator	04	
2	Computer Operator	24	
3	Peon	24	
4	Chowkidar	24	

- **DIRECT COST**

S.No	Description	Unit	Quantity	Rate	Total Amount
I	Project Office & CampAccomodation				
1	Furnished Office & Camp Accommodation	Months	24		
2	Electricity, Water & Gas Charges	Months	24		
3	Printing & Photocopying Charges	Months	24		
4	Office Supplies & Stationary	Months	24		
6	Fax, Postage, Courier & Telephone Charges	Months	24		
6	POL, Maintenance & Driver	Months	24		
7	Geophysical survey along Dam & appurtenant structures	Job			
8	Purchase of Toyota Altis car, 1600 CC i/c registration Charges	No	1	3500000/-	3500000/-

Note: Payment for purchase of vehicle would be made as per actual receipt of the dealer

8	Mobilization/ demobilization of drilling reg/geo-tech investigation machinery	Job			
9	Drilling by diamond drilling, holes of minimum 75 mm dia. vertical or at specified inclination using diamond core drilling bit, double barrel tube in masonry, concrete or rock including cost of all materials, machinery, labour, water, collection of core samples, logging &labelling samples, supplying wooden core box and re-drilling in case of collapse of sides etc. complete. excluding cost of mobilization & demobilization. (For depth 0 to 50 m and inclined at 0o to 10o vertically downward)	Meter	150	13701.19	
10	Topographic and cadastral survey for head works/Dams & other irrigation projects by using Total station GPS, etc. with minimum 30 number of point reading per acre, to generate 15mx15m grid and 0.5 m interval contours including transfer of entire data to computer system in different geo-referenced layers / themes using features of standard software, compatible with design software packages, including supply of soft and hard copies of point readings, including digitizing village maps and super imposing the contours on village map (scale 1in 4000) including marking all permanent features like roads, cart tracks, existing canals, mosques, tanks, forest boundary and electric poles, etc. including marking of ridges and valleys on survey sheet including supply of 4 soft copies and 4 hard copies after approval of competent authority, preparation & submission of grid and L-section nalla etc. complete	100 Acres	05	46260.5	

Qualifications and Experience of consultant's key personnel.

Consultants will assign adequately qualified key personnel to carry out the implementation of the Project as described in TOR, man-month inputs for which are indicated above. The key personnel should possess the qualifications and experience as indicated against each position.

Project Manager/Team Leader

- Should have at least a Bachelor Degree in Civil Engineering from a recognized university. Additional qualification will carry extra marks.
- Should be able to lead the team of consultations and assist Small Dams Organization in timely completion of the services with quality output.
- Overall experience should be 10-years with 3-years in design related activities and 02-years as Team Leader for the Projects.

Hydrologist/ Irrigation Engineer

- Should have Master degree in Irrigation Engineering/WRE from recognized university.
- Post Master qualification in related discipline will be given additional weight age.
- He should have at least overall experience of 10-years with 03 years experience in exposure to the related activities.

Structure Engineer

- Should have Master degree in Hydraulics Engineering/Structure Engineering from recognized university.
- Post Master qualification in related discipline will be given additional weight age.
- He should have at least overall experience of 10-years with 03-years experience in exposure to the design related activities.

Geo-technical Engineer

- Should have Master in Geotechnical Engineering from recognized university.
- Post Master qualification in related discipline will be given additional weight age.
- Should have at least overall experience of 10-years with 03-years experience in exposure to the design related activities.

Resident Engineer

- Should have Bachelor degree in Civil Engineering from recognized university.
- Post Bachelor qualification in related discipline will be given additional weight age.
- He should have at least overall experience of 5-years with 03-years experience in exposure to the design related activities.
- Should have at least 5 years experience with 03 years experience in dam projects.

Geologist

- Should have Master/M. Phil degree in Geology from recognized university.
- Post Master qualification in related discipline will be given additional weight age.
- Should have at least overall experience of 10-years with 3-years experience in exposure to the related activities.

ANNEXURE-I

I. DETAIL FOR (GEO-TECHNICAL INVESTIGATION)

NOTE:

All the bore holes shall be selected in consultation with the Engineer for the project. All kind of drilling activities/sub-surface investigations should be supervised by an experienced Geologist.

DRILLING MACHINE

Straight rotary rig (Portable)

HOLEDIA

N-Q size (76 mm inner dia)

CASING

Drilling through casing in overburden materials, using casing shoe bit (101 mm inner dia)

DRILLING DEPTH

a. Both Abutments: - Height of dam.

b. Nullah bed: - Up to top bed rock +5 meter penetration in bed rock or equal to Dam Height or at least 1-1/2 times the base width of Dam.

c. Spillway: - At least 5 Meter penetration in bed rock.

d. U/s of Dam body: At least 20 meter deep & if rock encountered at shallow depth then 6 meter penetration in bed rock.

DRILLING FLUID

Plain water is allowed whereas bentonit is not allowed as a drilling fluid however cement can be used as per site condition and as per instructions by the client.

FIELD TEST

(a) At constant head (03-meters interval depth)

(b) At falling head(03-meters interval depth)

Calculation of K Values

- Water pressure test/LUGEON test at 03-meters interval.
- Collection of UDS by Shelby/Denison/Pitcher sampler.
- Standard penetration tests SPT using split spoon sampler.
- Assessment of %age core recovery.
- RQD assessment.
- Water samples collection.
- Preservation of core samples in core boxes.
- Preservation of soil samples in plastic jars.
- SPT, CPT or Denison test as per encountered sub-surface formation at 1-1.5 meters interval depth or as directed by the site Engineer/Geologist.

Preservation of rock core samples in core boxes, labeling packing and storage along with transportation of core boxes to core shed Small Dams Organization, Kohat or as directed by Engineer.

Transportation of selected rock core samples for testing to CMTL Laboratory WAPDA Lahore for the required test.

Taking of water samples from the bore hole and transportation to CMTL Laboratory WAPDA Lahore for chemical analysis.

Installation of 1-inch dia PVC pipe in line the drilled hole as a pizometer.

Excavation f test pits at 4-locations 6×6 feet up to maximum 15-feet deep below ground level or up to the bed rock/ground water, including back filling of pits to original ground level.

Collection of composite bulk samples from test pits including their labeling, packing, storage and transportation to testing Lan, CMTL, WAPDA Lahore.

Providing photographs of core and core boxes.

II. LABORATORY TESTING CONSTRUCTION MATERIAL STUDIES.

S.NO	DESCRIPTION	QTY
1	Sieve Analysis/Gradation of coarse & fine Aggregates	As per design review of construction supervision requirement
2	Flakiness and Elongation Index	
3	Atterberg Limits (LL, PL, PI)	
4	Specific Gravity wet and dry	
5	Sodium sulphate soundness test	
6	Los Angeles Abrasion Test (Coarse Aggregate)	
7	Un-confined compression and direct shear tests of clay samples	
8	Crushing Strength of rock and rip rap some samples	
9	Direct shear (rock and soil)	
10	Swell potential of soil samples	
11	Uniaxial Compressive strength test with Modulus of Elasticity	
12	Water Absorption test of coarse and find aggregates	
13	Alkali Silica Reaction tests	
14	Organic impurity test	
15	Complete chemical analysis of water sample i/c TDC, CI, SO4 ad pH	
16	Coefficient of permeability	
17	Abrasion test	

III. LABORATORY TESTING CONSTRUCTION MATERIAL STUDIES.

S.NO	DESCRIPTION		QTY
1	Grain Size Analysis		
2	Hydrometer Analysis		
3	Atterberg Limits (LL, PL, PI)		
4	NMC		
5	Un-confined compression test	Dry condition	
		Saturated condition	
6	Unconsolidated Un-drained Traixial Test (UU0		
7	Consolidated Un-drained Test (CU)		
8	Consolidation Characteristics		
9	Swell Potential of Dam Core Materials		
10	Standard Proctor Compaction		
11	Modified Proctor Compaction		

11 Geo physical survey(refraction survey) parallel to Dam axis & at least 2 cross section at the valley floor perpendicular to Dam axis (300-500 meter in depth)

12. Providing photographs of core & core boxes.