No. BBMB/DRIP-II/NANGAL/02/2020

GOVERNMENT OF INDIA

BHAKRA BEAS MANAGENEMT BOARD

DAM REHABILITATION AND IMPROVEMENT PROJECT

PHASE II AND PHASE III

NANGAL DAM

PROJECT SCREENING TEMPLATE




FEBRUARY/ 2020

Office of Chief Engineer

Bhakra Dam, BBMB

Nangal-140124

Tel: 01887-223001, **e-mail**: cebhd@bbmb.nic.in

Table of Contents

FORM-I: PROJECT DETAILS

1. Project Description:

a. Project Identification Code (PIC): PB26MH0001

(As given in National Register of Large Dams, if applicable)

b. Project Name: Nangal Dam

c. River Basin: Indus

d. Sub River Basin: Satluj

e. River/Stream: Satluj

2. Project Location:

a. State: Punjab

b. District: Ropar

c. Earthquake Zone: IV

d. Survey of India Topo Sheet No. NA

e. Nearest City: Nangal

f. Nearest Airport: Chandigarh

g. Nearest Railhead: Nangal

h. Name of Immediate u/s Project: Bhakra Dam

i. Name of Immediate d/s Project: Ropar H/W

j. Latitude/Longitude (in degrees, minutes, seconds):

Lat:	31°	22’	49’’	N
Long:	76°	21’	56’’	E

3. Project Benefits:

a. Type of Project: Multi-Purpose Project

b. Irrigation Benefits, in hectares (ha):

(i) Gross Command Area (GCA): 26800 Mm^2

(ii) Cultivable Command Area (CCA): 23700 Mm^2

(iii) Annual Irrigation Potential (AIP): 21853

c. Hydropower Benefits:

(i) Installed Capacity (MW): 153.72 (ii) Firm Power (MW): 153.72

(iii) Average Annual Energy Generation (MU): 1250

d. Domestic/Municipal/Industrial Water Supply:

(i) Annual Water Supply (MCM): 34000

(ii) Nos. of Population Benefitted (In Lakh): -----

e. Flood Protection:

(i) Flood Protected Area (ha): Area of Punjab along river Satluj

(ii) Details of Area Benefitted (ha): Area of Partner States

f. Details of Tourism/Recreational Facilities: International wetland

4. Project Ownership Details:

a. Dam Owning Agency: BBMB

b. Implementing Agency: BBMB

c. Details of Dam Incharge:

(i) Name: Er. A.K. Aggarwal (ii) Designation: CE/Bhakra Dam

(iii) Phone No. (With STD Code): 01887-223001

(iv) Fax No. 01887-223801

(v) E-mail: cebhd@bbmb.nic.in

(vi) Contact Address: Chief Engineer, Bhakra Dam, BBMB Nangal Township

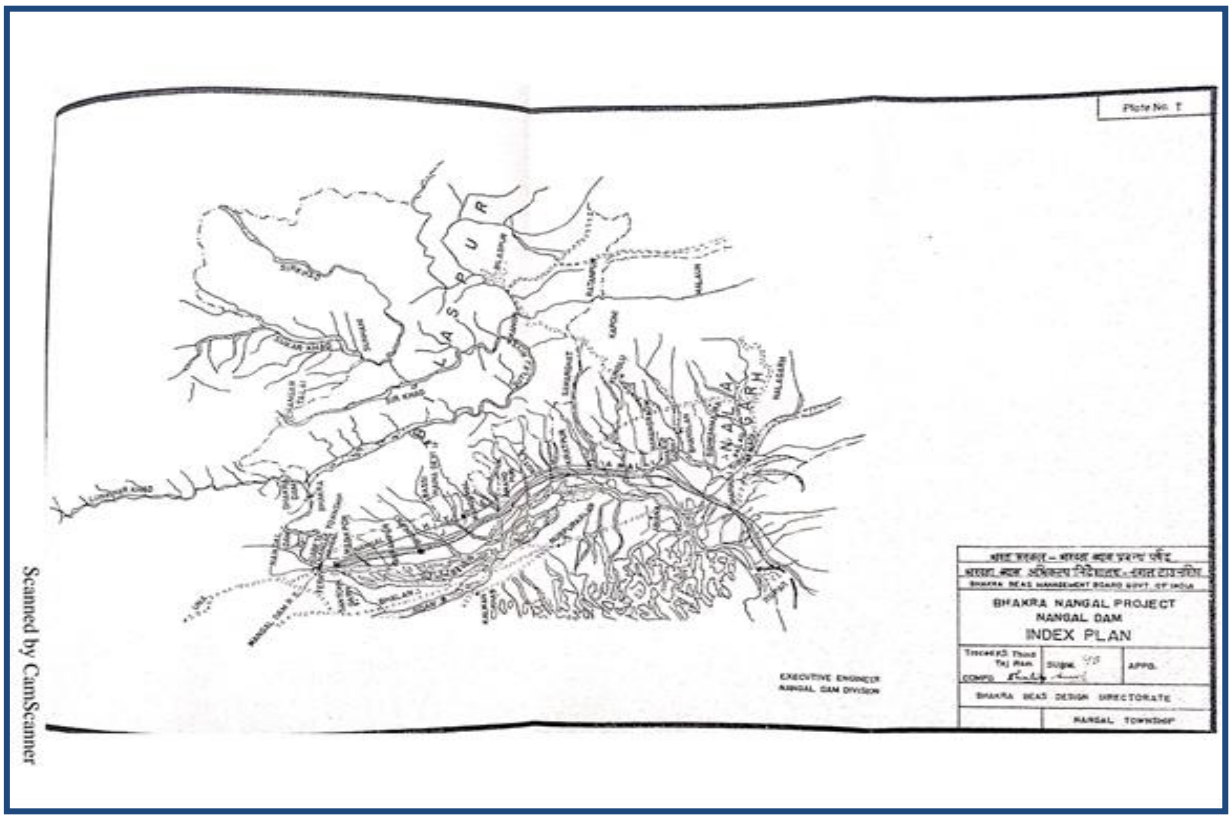
Appendix-I A

LOCATION /INDEX MAP OF PROJECT

Brief description of important features shown in map

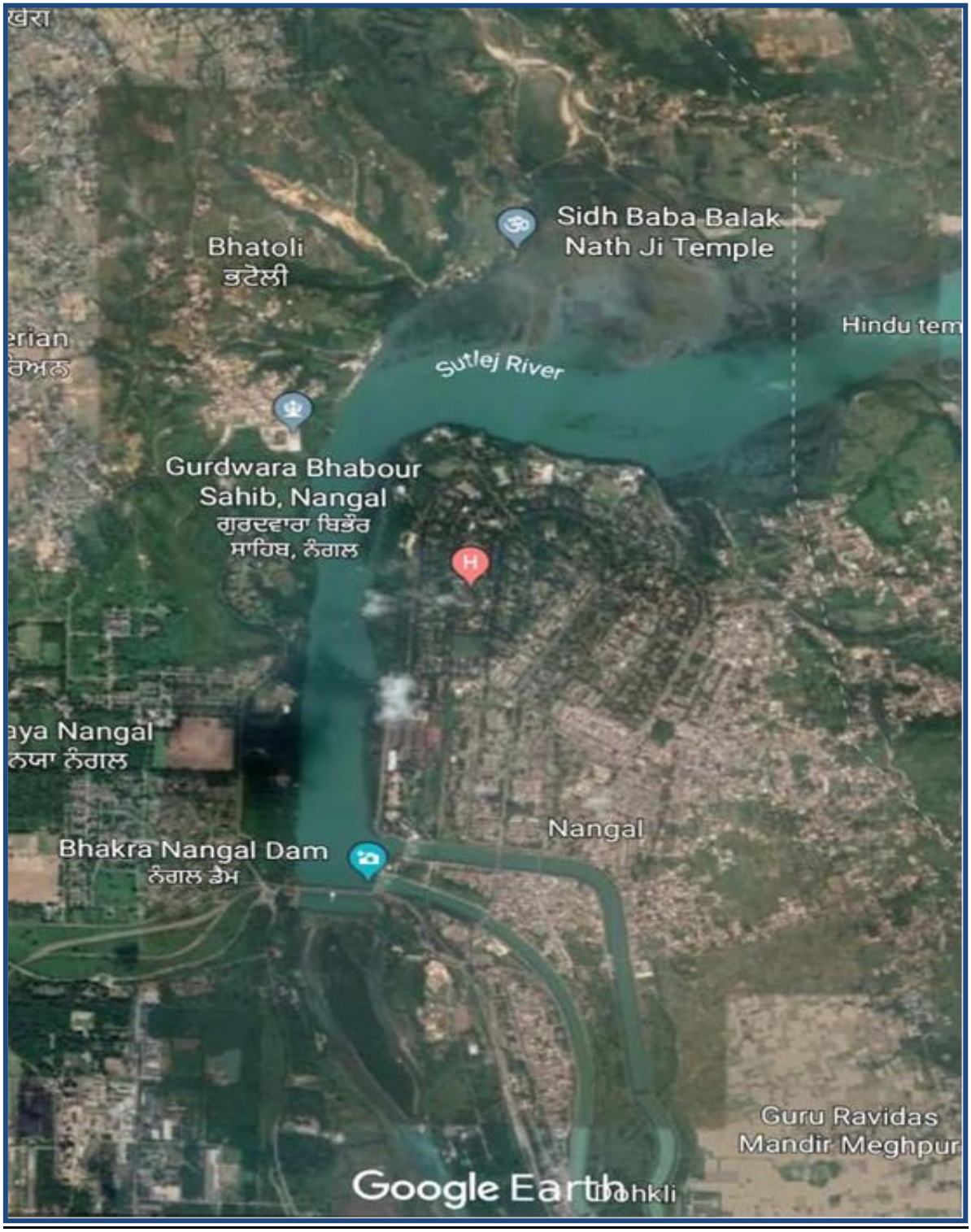
Nangal dam, Nangal Hydel Channel and the two Canal Power Houses form the important components of Bhakra Nangal Project. The scheme involved the construction of 28.96 m (95 ft) high mass concrete dam across Satluj river which is about 12.88 km (8 miles) downstream of Bhakra dam, to head up river supplies by about 16.15 m (53 ft) and to divert water through a canal head regulator into Nangal Hydel Channel with a normal full supply discharge of 353.96 cumec (12,500 cusec). The Nangal Hydel Channel 61.06 km (37.94 miles) long taking off from the left bank of the river, is a concrete/brick-lined canal with two power houses located at 19.31 km and 29.93 km at Ganguwal and Kotla respectively. The canal passes through the difficult sub-mountainous region with 58 hill torrents. The installed capacity of the two power houses at Ganguwal and Kotla was planned to take advantage of the availability of water after the construction of the Bhakra dam. These power houses have three units each with total generating capacity of 76.39 MW and 77.34 MW respectively.

From the left bank of river Satluj just upstream of Nangal dam another channel named Anandpur Sahib Hydel Channel with full supply discharge of 287.42 cumec (10,150 cusec) is off-taking (commissioned in 1984) and it is running almost parallel to the Nangal Hydel Channel on its left bank upto Lohand Khad.



Appendix-I B

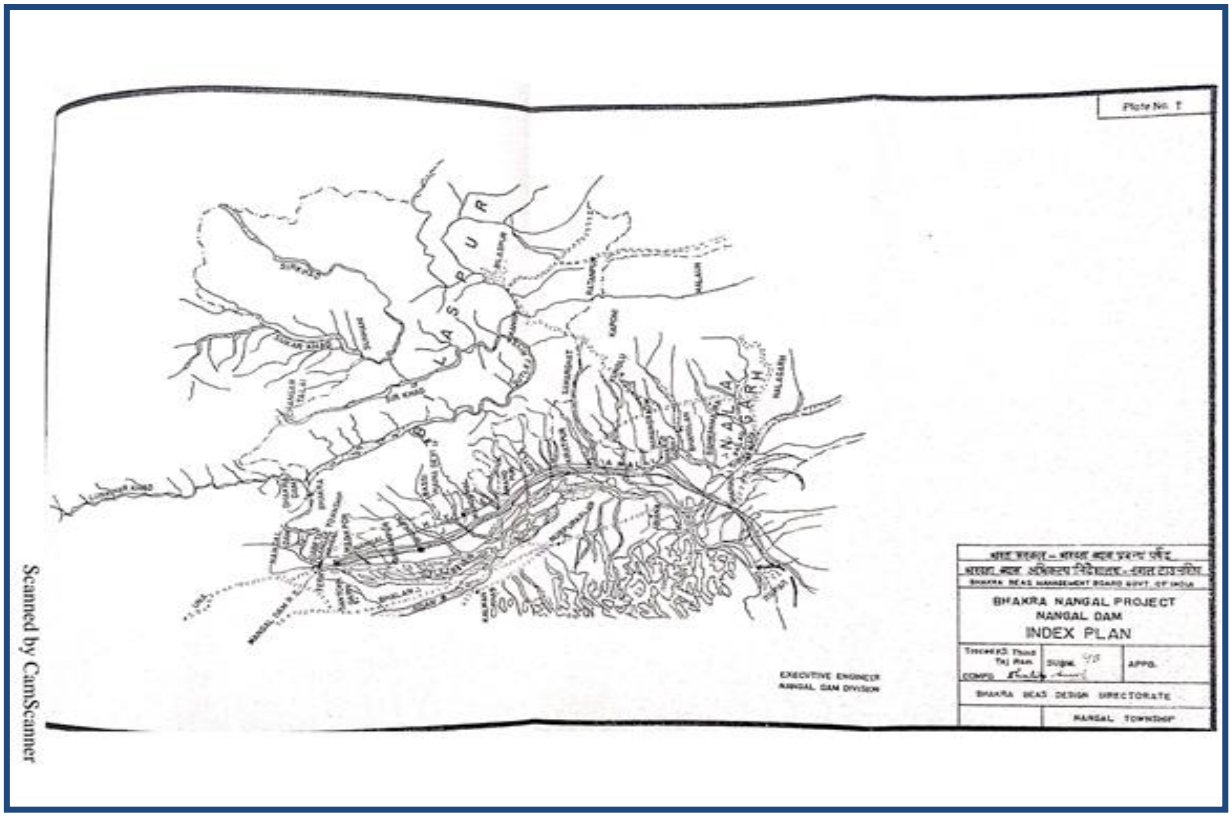
GOOGLE MAP OF DAM ATTACHED



Appendix-I C

CATCHMENT AREA MAP OF PROJECT

The Immediate upstream Project is Bhakra Dam Project. G&D sites at Olinda, Bhakra, Berthin, Kahu, Rampur etc are existing sites. Dam is constructed on Satluj River and Fatehwal, Barmula, Seer, Sukhar, Sarhali, Gambhar etc are its Major tributaries. Rampur and Reckonpeo are important places. Weather Station is installed at Nangal Dam under HP-II.



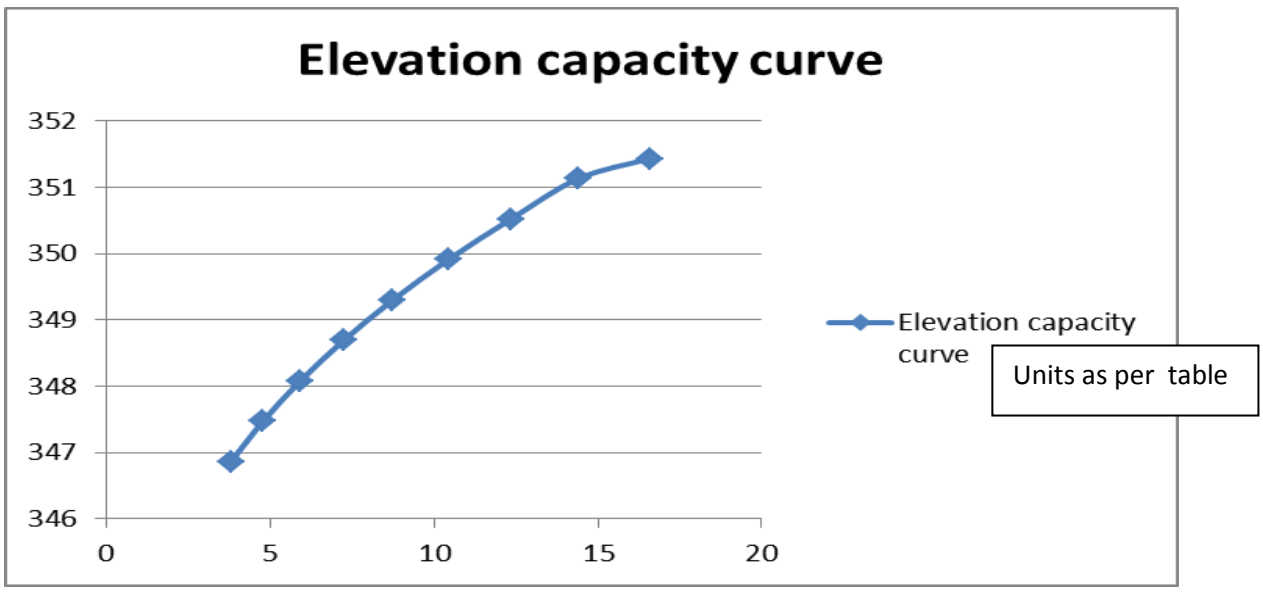
Appendix-I D

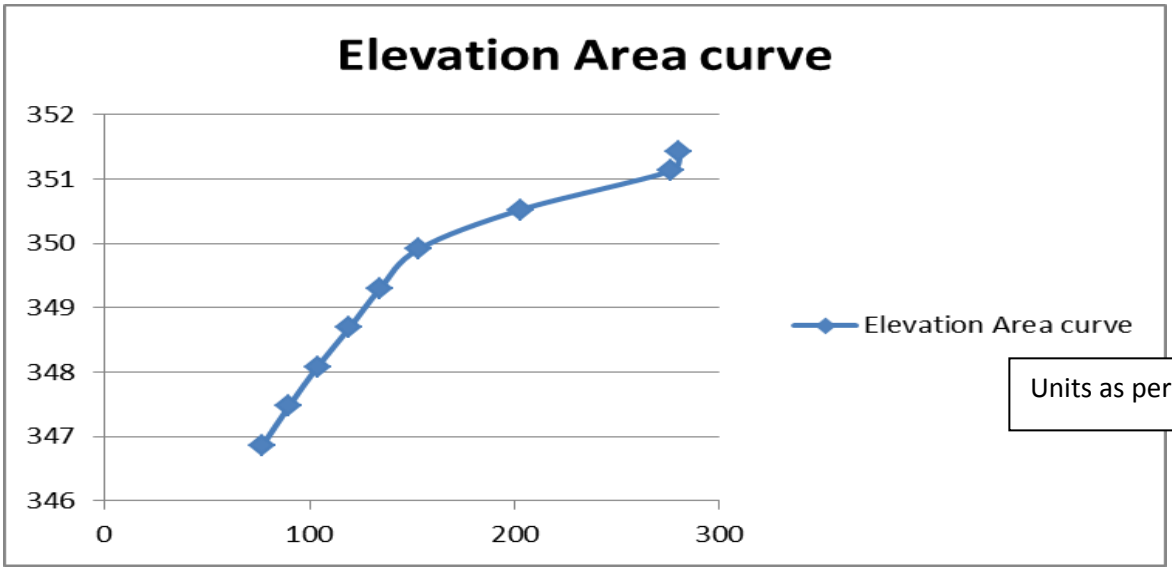
ELEVATION -AREA-CAPACITY CURVE

(ORIGINAL)

Tabular Form

Elevation (m)	Cumulative Capacity (In Million Cubic Meter)	Water Spread Area (x1000 sq m)
346.86	3.79	77.02
347.47	4.77	89.95
348.08	5.91	103.79
348.69	7.23	119.53
349.3	8.74	134.43
349.91	10.43	153.18
350.52	12.34	202.8
351.13	14.39	276.4
351.43	16.57	280.23




Elevation Area curve
352
351
350
349
348
347
346
0
100
200
300
Elevation Area curve
Units as per table

Appendix-I E

RESERVOIR SUBMERGENCE MAP OF PROJECT

(SHOWING FRL & MWL CONTOURS FOR FREEBOARD STUDY)

Brief description may be given highlighting important issues in the reservoir rim area, as well as highlighting if any restriction exists as on date in filling the reservoir up to FRL/MWL Levels due to R&R issues or any modification of operating rule curves of reservoir due to any limitation of limited spillway design outflow, etc.

Attach the Reservoir Submergence Map showing FRL, MWL, Dam Top Elevation Contours clearly.

Not Available

FORM-II: DAM SPECIFIC DETAILS

1. Dam Features:

I. Main Dam

a. Type: Concrete Gravity

b.. Total length of the Main dam (m): 291.08

c.. Length of Embankment dam (m): -----

d. Length of Masonry/Concrete dam (m): 291.08

e. Top width of Embankment Dam (m): -----

f. Top width of Masonry/Concrete Dam (m): 3.76

g. Elevation of top of Embankment Dam (m): -----

h. Elevation of top of Masonry/Concrete Dam (m): El. 353.57

i. Elevation of top of Upstream Solid Parapet Wall (m): -----

j. Height of Embankment Dam above Lowest River Bed Level (m): -----

k. Height of Masonry/Concrete Dam above deepest foundation level (m): 28.96 m

l. Lowest River Bed Elevation (m): El. 335.28

m. Deepest Foundation Elevation (m): El 325.83

II. Saddle Dam:- Not Applicable

a. Type: ------

b. Length of the Saddle dam (m): -----

c. Top width of Saddle Dam (m): -----

d. Elevation of top of Saddle Dam (m): -----

e. Elevation of top of Upstream Solid Parapet Wall (m): -----

f. Height of Saddle Dam above Lowest Bed Level in case of embankment dam or above deepest foundation level in case of concrete / masonry dam (m): ------

III Main Spillway:- Not Applicable

(a) Type of Spillway: Barrage

(b) Length of Spillway (m): 68.58

(c) Location of Spillway: Barrage

(Central Spillway/Left Flank/Right Flank/Saddle, in addition Chainage may also be mentioned) -----

(d) Spillway Crest Level (m): 338.94

(e) Number of Bays: 26

(f) Number and thickness of Piers (m): 25, 2.13 m

(g) Total Discharging Capacity at MWL (m^3/s): 9203

(h) Design head used for working out spillway crest profile (m): 16.15

(i) Type of Energy Dissipation Arrangement: Cistern with friction block

(j) Type of Spillway Gate: Vertical double leaf

(k) Size of Spillway Gate: Width (m) 10.00 Height (m) 8.84

(l) Type of Hoist for Spillway Gates: Rope Drum
(Rope Drum/ Hydraulic)

(m) Hoist Capacity of Spillway Gates (MT): 32

(n): Hoist Operation: Manual

(Manual / Electrical / Remote Control)

(o) Number of Sets of Stop-logs: 03

(p) Number of Stop Log Units per Set & Size: 13

(q) Number of Gantry Crane(s) for Stop Log Gates: 1 No.

(r) Gantry Crane Capacity (MT): 16

IV Auxiliary Spillway:- Not Applicable

(a) Type of Spillway: -----

(b) Length of Spillway (m): -----

(c) Location of Spillway: -----

(Central Spillway/Left Flank/Right Flank/Saddle, in addition Chainage be mentioned)

(d) Spillway Crest Level (m) -----

(e) Number of Bays: -----

(f) Number and Thickness of Piers: ----, ---

(g) Total Discharging Capacity at MWL (m^3/s): -----

(h) Design head used for working out spillway crest profile (m): -----

(i) Type of Energy Dissipation Arrangement: -----

(j) Type of Spillway Gate: -----

(k) Size of Spillway Gate: Width (m) ----- Height (m) -----

(l) Type of Hoist for Spillway Gates: -----

(m) Hoist Capacity of Spillway Gates (MT): -----

(n): Hoist Operation: ----------

(o) Number of sets of Stop-logs: ----------

(p) Number of Stop Log Units per set & size: ----------

(q) Number of Gantry Crane(s) for Stop Log Gates: ----------

(r) Gantry Crane Capacity (MT): ----------

V Fuse Plug:- NA

(a) Location: --------

(b) Length (m): ----------

(c) Crest Level (m): ----------

(d) Top Width (m): ----------

(e) Discharging Capacity at MWL (m^3/s): ----------

VI. Sluice Arrangement (In Concrete and Masonry Dams):- NA

(a) No. of Sluices & Sill Level (m): ---

(b) Size of Sluice: Width (m): Height (m): Dia. (m):

(c) Discharging Capacity of Sluice at FRL (m^3/s):

(d) Type of Service Gate: ---

(e) Size of Service Gate: Width (m) --- Height (m) ---

(f) Type of Hoist for Service Gates: ---

(g) Hoist Capacity of Service Gates (M.T.): ---

(h): Hoist Operation: ------

(Manual/Electrical/Remote Control)

(i) Type of Emergency Gate: ---

(j) Size of Emergency Gate: Width (m) --- Height (m) ---

(k) Type of Hoist for Emergency Gates: ---

(l) Hoist Capacity of Emergency Gates (M.T): ---

(m): Hoist Operation: ---

(Manual / Electrical)

VII. Outlet works (In Embankment, Concrete & Masonry Dams):

(a) Location: ---

(b) Number: ---

(c) Sill level (m) ---

(d) Size: Width (m) --- Height (m) --- Dia (m) ---

(e) Discharging Capacity (m^3/s ---

(f) Type of Service Gate: ---

(g) Size of Service Gate: Width (m) --- Height (m) ---

(h) Type of Hoist for Service Gates : ---

(i) Hoist Capacity of Service Gates (M.T): ---

(j) Hoist Operation:(Manual/Electrical/Both) ---

(k) Type of Emergency Gate: ----------

(l) Size of Emergency Gate: Width (m) ---------- Height (m) ----------

(m) Type of Hoist for Emergency Gates : ----------

(n) Hoist Capacity of Emergency Gates (M.T): ----------

(o) Hoist Operation: ----------

(Manual / Electrical)

2. Reservoir Features:

a. Catchment Area at Dam site (km^2): 57000 b. Maximum Water Level (m): 351.74

c. Full Reservoir Level (m): 351.74

d. Minimum Draw Down Level (m): 346.72 e. Dead Storage Level (m): 346.75

f. Live Storage Capacity (Mm^3): 19.74

g. Gross Storage Capacity (Mm^3) at FRL: 25.22

h. Reservoir Spread Area (km^2) at FRL: 3.96

3. Construction Aspects:

a. Date of Starting the Construction (DD/MM/YYYY): 1946

b. Date of Completion (DD/MM/YYYY): 1954

c. Designing Agency: BBMB

d. Construction Agency: BBMB

e. Construction Cost (Rupees in Lakh): 2704

4. Operational Aspects:

a. Date of first full impoundment (MM/YYYY): July, 1954

b. Whether Pre & Post monsoon inspection being carried out: Yes

c. Major recommendations of dam safety inspection, along with brief status on compliance:

Refer Chapter 5 and Para 5.2 & 5.3 Of DSRP Inspection Report of Nangal Dam

d. Any operational failure in the past: No

e. Any other past dam incident: No

f. Operation and Maintenance Manual: Yes

Year of publication: 1996

g. Emergency Action Plan: Yes

Year of Publication: 2008

5. Instrumentation Aspect

a. List of Instruments installed in the Dam:

Sl. No.	Name of Instrument	Working Status	Year of Installation	Nos of Year data available
1.	Water Level Sensor	N		
2.	Plumb Bob	N		
3.	Inclinometer	N		
4.	Stress meters	N		
5.	Strain meters	N		
6.	Toe Drain	N		
7.	Drain Wells	Y	Since construction	
8.	V-Notches	Y	----do----	
9.	Pressure Gauges	Y	----do----	
10.	Accelerograph	N		
11.	SCADA	N		
12.	Surveillance	N		
13.	Rain Gauge ORG	N		
14.	Rain Gauge SRRG	Y	2014	
15.	……..			

d. Summary on adequacy and justification for additional instrumentation: The dam is more like a barrage than a storage reservoir. The dam has been performing satisfactorily for the last 65 years. In view of this, modernization of the embedded instruments is not warranted. The uplift, seepage and deformation measurements need be continued and the related instruments need be maintained as well as modernized to the extent feasible.

6. List of Past Rehabilitation Works:- NIL

a. Name of Scheme (If any): NA

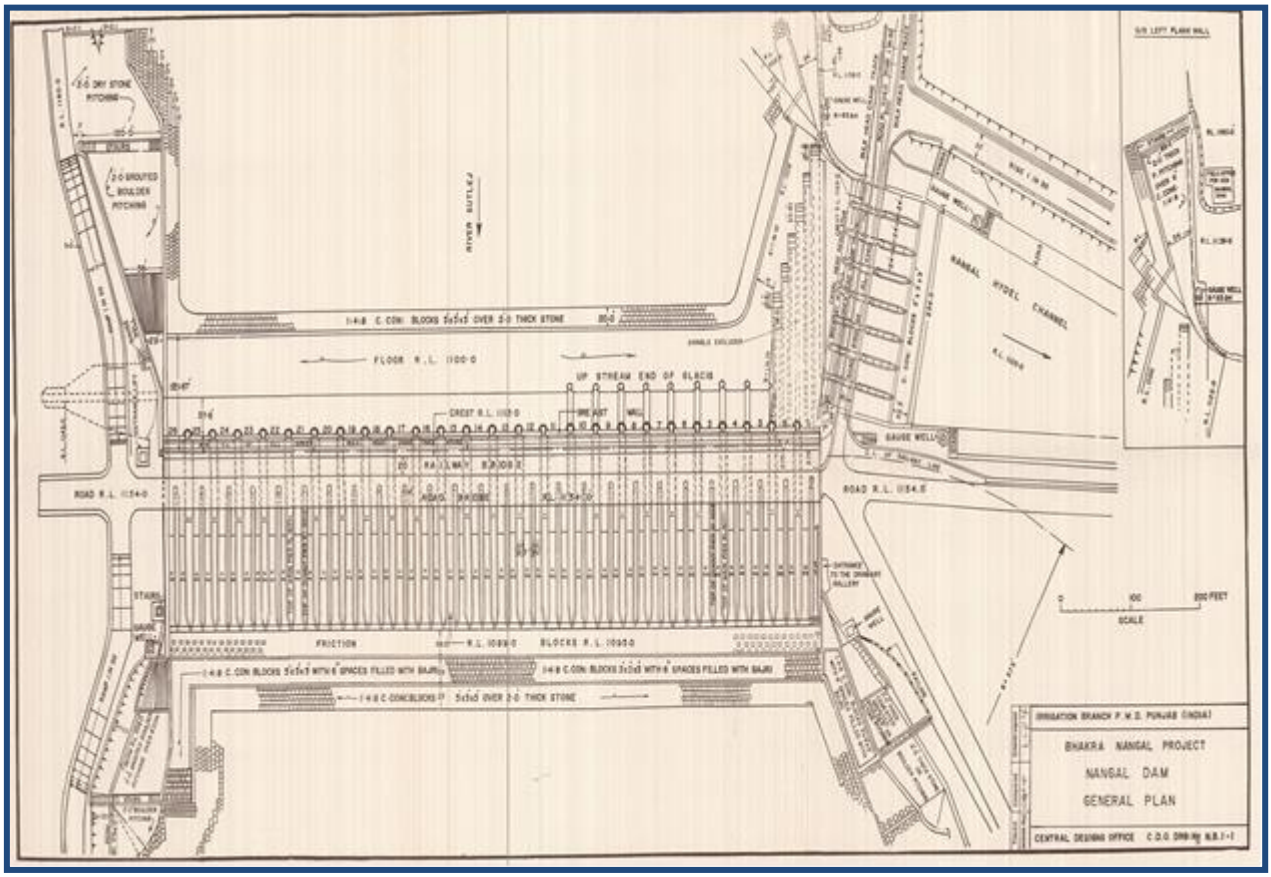
b. Period of Scheme: From NA to

c. Detail of Important Rehabilitation Works Carried Out (including by state funds):

Sl. No.	Brief Item description	Year of Work	Completion Cost (Cr)

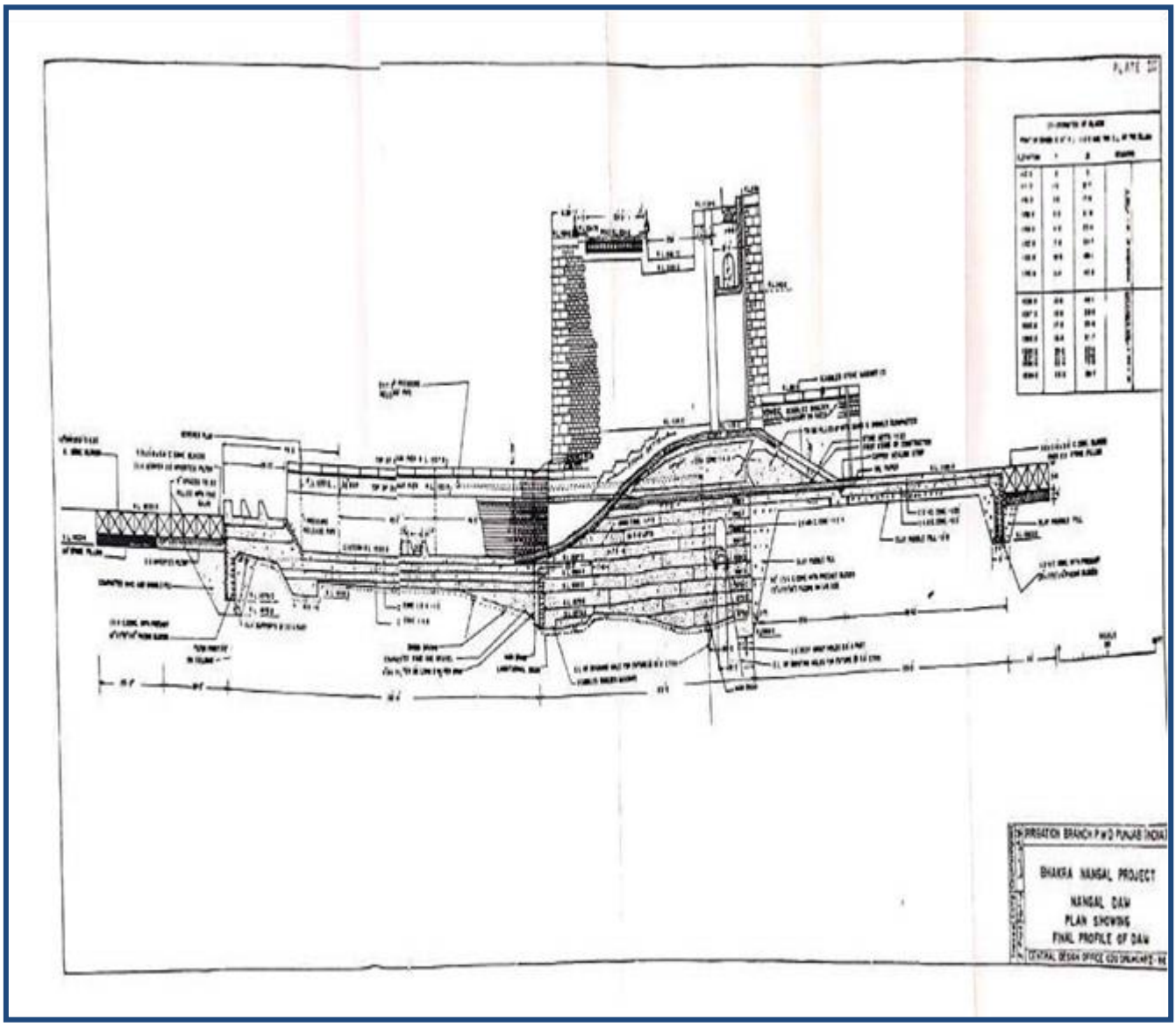
Appendix-II A

LAYOUT PLAN OF DAM



Appendix-II B

LONGITUDINAL SECTION OF THE DAM



Appendix-II C

TYPICAL CROSS SECTIONS OF THE DAM

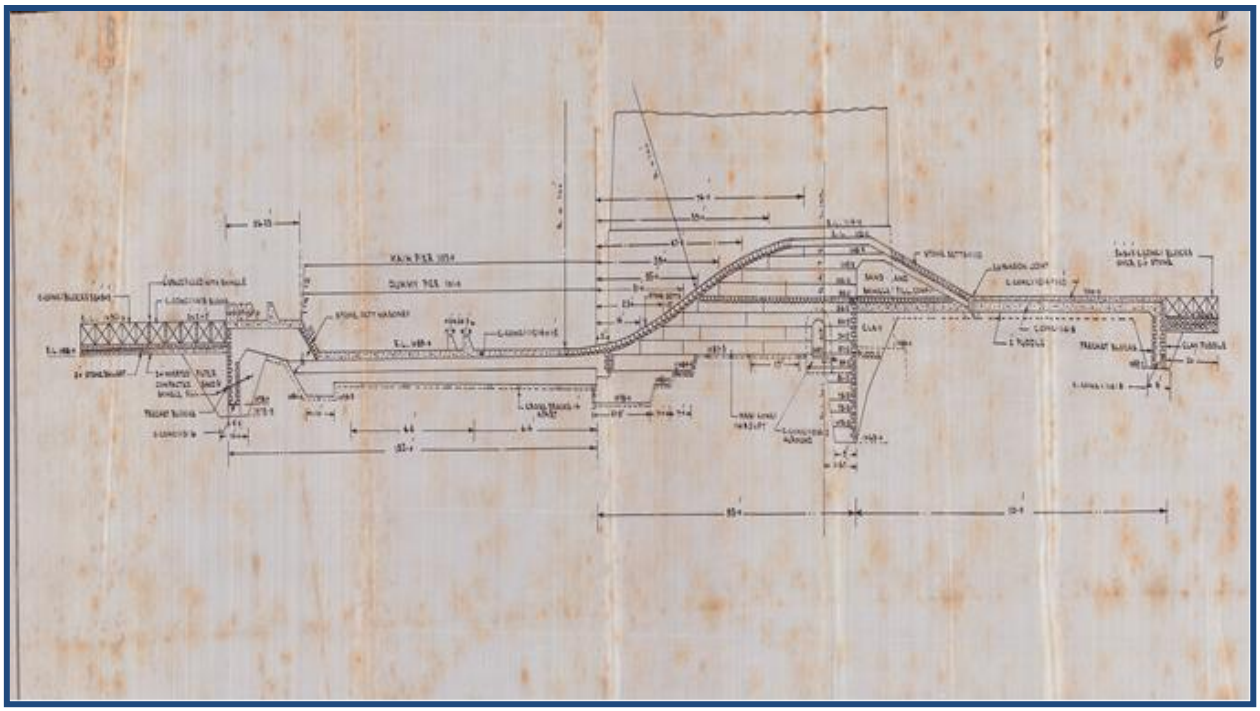
i) Embankment dam

ii) Concrete / Masonry dam (NOF & OF Sections)

iii) Sluice section

iv) Section through Outlet

Brief description & attach full drawings in A3 Size



Appendix-II D

REPORT ON DAM INSTRUMENTATION

Enclosed: Yes

Please Refer Chapter 11 and Annexure 23 of DSRP Inspection Report for various instruments installed.

TABLE NO. 3

STATEMENT SHOWING THE AVERAGE DISCHARGE OF P.R.P's OF INSPCTION GALLERY N/DAM DURING THE MONTH OF DECEMBER -2019

.R.P. NO.	AVERAGE LEAKAGE DISCHARGE cc/sec.	P.R.P. NO.	AVERAGE LEAKAGE DISCHARGE cc/sec.	P.R.P. NO.	AVERAGE LEAKAGE DISCHARGE cc/sec.	P.R.P. NO.	AVERAGE LEAKAGE DISCHARGE cc/sec.
1	27	23	05	45	08	67	02
2	08	24	04	46	34	68	06
3	10	25	NIL	47	09	69	07
4	08	26	NIL	48	08	70	05
5	12	27	NIL	49	16	71	03
6	109	28	NIL	50	09	72	09
7	07	29	02	51	16	73	08
8	08	30	05	52	08	74	09
9	07	31	04	53	07	75	29
10	06	32	03	54	08	76	NIL
11	10	33	02	55	NIL	77	NIL
12	10	34	Drops	56	68	78	NIL
13	12	35	03	57	08	79	05
14	55	36	04	58	25	80	117
15	09	37	NIL	59	05	81	63
16	08	38	04	60	03	82	NIL
17	09	39	05	61	06	83	97
18	09	40	04	62	06	84	229
19	09	41	03	63	03	85	32
20	NIL	42	04	64	02	86	08
21	NIL	43	06	65	04	87	07
22	NIL	44	08	66	03	-	-

FORM-III: HEALTH STATUS OF DAMS

1. Design Flood Review (In case of PMF/SPF, as approved by CWC): Not Required

a. Original Inflow Design Peak Flood (m^3/s): 9204

a.1. Original MWL (m): 351.74 a.2. Original Routed Outflow (m^3/s):

a.3. Maximum observed flood peak (m^3/s) and date: October/1988

b. Date of Latest Review (DD/MM/YYYY): ...../...../

c. Revised Inflow Design Peak Flood (m^3/s): (PMF / SPF / 100 Year Flood) 9204

c.1. Revised MWL (m): 351.74 c.2. Revised Routed Outflow (m^3/s):

Report of Design Flood Review is enclosed as Appendix III-A (along with copy of CWC approval, if applicable)

d. Flood Routing Conducted? No If Yes, Attach Flood Routing Report with Calculations in Appendix III-B

e. Attach Free Board Calculations in Appendix-III C

f. Proposed measures to accommodate increase in design flood, attached in Appendix-III D

g. If design flood review & flood routing is not yet done, tentative time frame for carrying out the same:

From: NA To: NA

2. Dam Safety Review Panel (DSRP) Review:

a. Date of Latest DSRP Inspection 17 / 12 / 2019

b. Attach DSRP Report as in Appendix III E:- Attached

c. Key Actionable Points for Rehabilitation:

AS PER DSRP REPORT

3. Seismic Review:

a. Seismic Zone at the time of Design: IV

b. Revised Seismic Zone: IV

c. Historical significant earthquake events in the near vicinity: -- If Yes,

Event 1: Date: -- Epicenter: --

Magnitude: --

Event 2: Date: -- Epicenter: --

Magnitude: --

d. Details of nearest project whose site specific seismic parameter study has been approved by National Committee on Seismic Design Parameter (NCSDP):

(i) Name of Project: Bhakra Nangal Project

(ii) Date of Approval: Not approved as constructed during the period from 1946 to 1954

(iii) Approved Parameters:

(a). Peak Ground Acceleration (PGA) NA

(b). Maximum Credible Earthquake (MCE): NA

(c). Design Basis Earthquake (DBE): NA

(d). Seismic Design Coefficient (Horizontal): NA

e. Whether need for seismic design review: No , If yes, attach in Appendix III-F

4. Summary of Present Distress Condition:

Sl No.	Description	Concrete Dam
1.	Leakage through dam body	No
2.	Excessive seepage through dam body	No
3.	Excessive seepage through foundation	No
4.	Leakage through contraction joints	No
5.	Excessive settlement of dam body?	No
6.	Clogging of Porous / Formed and foundation drains holes?	No
7.	Are Porous / Formed Drains Counter - sunk plug in place on top of dam?	No
8.	Are Water Seals in Place on Porous / Formed Drains in gallery?	No
9.	Undesirable vegetation?	No
10.	Deteriorated Concrete-Facing, Outlet, Spillway	No
11.	Erosion of surfaces, slides & signs of differential movement	No
12.	Are there any surface cracks?	No
13.	Adequate slope protection?	Yes
14.	Erosion of the upstream/downstream face?	No
15.	Animal Burrows?	No
16.	Any evidence of piping through dam body?	No
17.	Any evidence of piping through foundation	No
18.	Are there wet spots or areas on the downstream face, at the toe, or beyond the dam?	No
19.	Spillway glacis erosion?	No
20.	Can water flow into the principal spillway without difficulty, as intended when constructed?	Yes
21.	Is the primary spillway/waste weir structure in good condition?	N.A
22.	If there are drainage outlets, are they clear and flowing?	N.A
23.	Is the seepage water clear or muddy?	Clear
24.	Is there any unusual movement or cracking at or beyond the toe?	No
25.	Is there any evidence of instability on the slopes around the reservoir?	No
26.	Is a lot of sediment entering the reservoir, or has this happened in the past?	No
27.	Are gates/stop logs/valves and other operating equipment in working condition?	Yes
28.	Is the drainage gallery easily accessible and does it have adequate lighting facilities and safety handrails on steps?	Yes
29.	Gate corrosion	No
30.	Are Gate Seals showing signs of weathering, cracking or tearing?	No

Sl No.	Description	Concrete Dam
31.	Is the surface of gates and paint deteriorated?	No
32.	Is the alternative power system for gate operation working properly?	Yes
33.	Are the hydraulic hoists working satisfactorily?	Yes
34.	Are the decking, girders and structural supports of spillway bridge, hoist bridge and catwalks structurally sound?	Yes
35.	Is the floor of the bridge structurally sound and safe?	Yes
36.	Is there catwalk access to gate trunions?	Yes
37.	Is the concrete surface of the Energy Dissipation Arrangement (EDA) and d/s apron in good condition?	Yes
38.	Is access road to dam site well maintained?	Yes
39.	Are communication facilities available at dam site?	Yes
40.	Whether there is a standby power supply?	Yes
41.	Is fencing of project area required or needs to be strengthened?	Yes
42.	Is sufficient stock of spare which needs frequent replacement maintained at the site?	Yes
43.	Are the instruments installed properly accessible?	Yes
44.	Are all the instruments in proper working condition?	Yes
45.	Need for repair of instrument	No
46.	Need for replacing instruments	No
47.	Need for additional instruments	No
48.	Need for Stability Analysis	No
49.	Need for E/Q design review	No
50.	Need for operational review	No
51.	Need for sump/pumping arrangement to dewater Drainage Gallery	No
52.	Inspection of Sluice / Outlets conducted?	N.A
53.	Seepage through outlets / interfaces?	N.A
54.	Is there evidence of Sluice / outlet scour?	N.A
55.	Settlement of outlet head works?	N.A
56.	Is there differential settlement in outlets?	N.A
57.	Is there siltation at sluice / outlet intake?	N.A
58.	Is there impact of siltation on discharge capacity of sluice / outlet?	N.A
59.	Is there seepage in outlet gate wells?	N.A

5. Any Other Distress Conditions, if any, noted other than above:

NIL

(Details for each distress condition given above under separate number)

Photographs showing details of location and nature of distress conditions are attached in Appendix-III-G NIL

Appendix-III-A

REPORT OF DESIGN FLOOD REVIEW

Nangal Dam is an extension of Bhakra Nangal Project and is situated downstream of Bhakra Dam. The revised flood from Bhakra Dam as passed through spillway gates, river outlets and through left and right Power houses having discharging capacity of about 3,25000 Cusec can safely be passed from River Head Regulator, Canal Head Regulator and Anandpur Hydel Channel respectively. Since the functioning of Nangal pond is to act as a Balancing reservoir and is an extension of Bhakra Nangal project, no necessity is being felt to evaluate/review of Design Flood.

Appendix III-B

FLOOD ROUTING STUDIES INCLUDING SPILLWAY OUTFLOW CALCULATIONS : **NOT REQUIRED**

Appendix III-C

FREE BOARD CALCULATIONS

Revised free board calculations are not required as already freeboard of 6.00 feet exists between MWL 1154ft EL to top of the Dam as 1160 ft EL.

APPENDIX III-D

PROPOSED MEASURES TO ACCOMMODATE REVISED DESIGN FLOOD : **NA**

a. Original design flood (m^3/s): N.A
b. Revised design flood (m^3/s): N.A
c. Percentage increase (%): N.A

Proposed Rehabilitation Measures: NOT REQUIRED

(a) Structural Measures

- Provision of U/S solid Parapet Wall
- Increasing dam height
- Additional spillway
- Fuse plug

(b) Non-structural Measures

- Lowering of FRL
- Modification in Operation Rule Curve
- Provision for Early Flood Warning System

APPENDIX III-E

LATEST INSPECTION REPORT OF DAM SAFETY REVIEW PANEL (DSRP)

DSRP Report is attached as Appendix III E

Brief description of proposed Rehabilitation and Improvement Works.

1. Strengthening/Carbon Wrapping of Bearing caps and I beam girders of Nangal Dam.
2. SCADA enabled Automation of Gates of Nangal Dam.
3. Requirement of Machinery and Surveillance equipments for Nangal Dam
4. Security Arrangement of Nangal Dam by providing Chain link fencing on both sides of reservoir area.

Appendix III-F

SEISMIC DESIGN REVIEW

In case seismic design review studies have not been completed, please leave the information blank.)

Enclosed : No

Brief description.

Not Required as Dam is functioning as Barrage.

Appendix-III-G

PHOTOGRAPHS SHOWING DISTRESS CONDITION

Sl No.	Date of Photograph	Description with details of location, nature of distress and other remarks
1.	December 2019	Nangal dam Bridge showing distress due to overloading in tension and compression stresses

DAM GATES ADJACENT TO THE BRIDGE

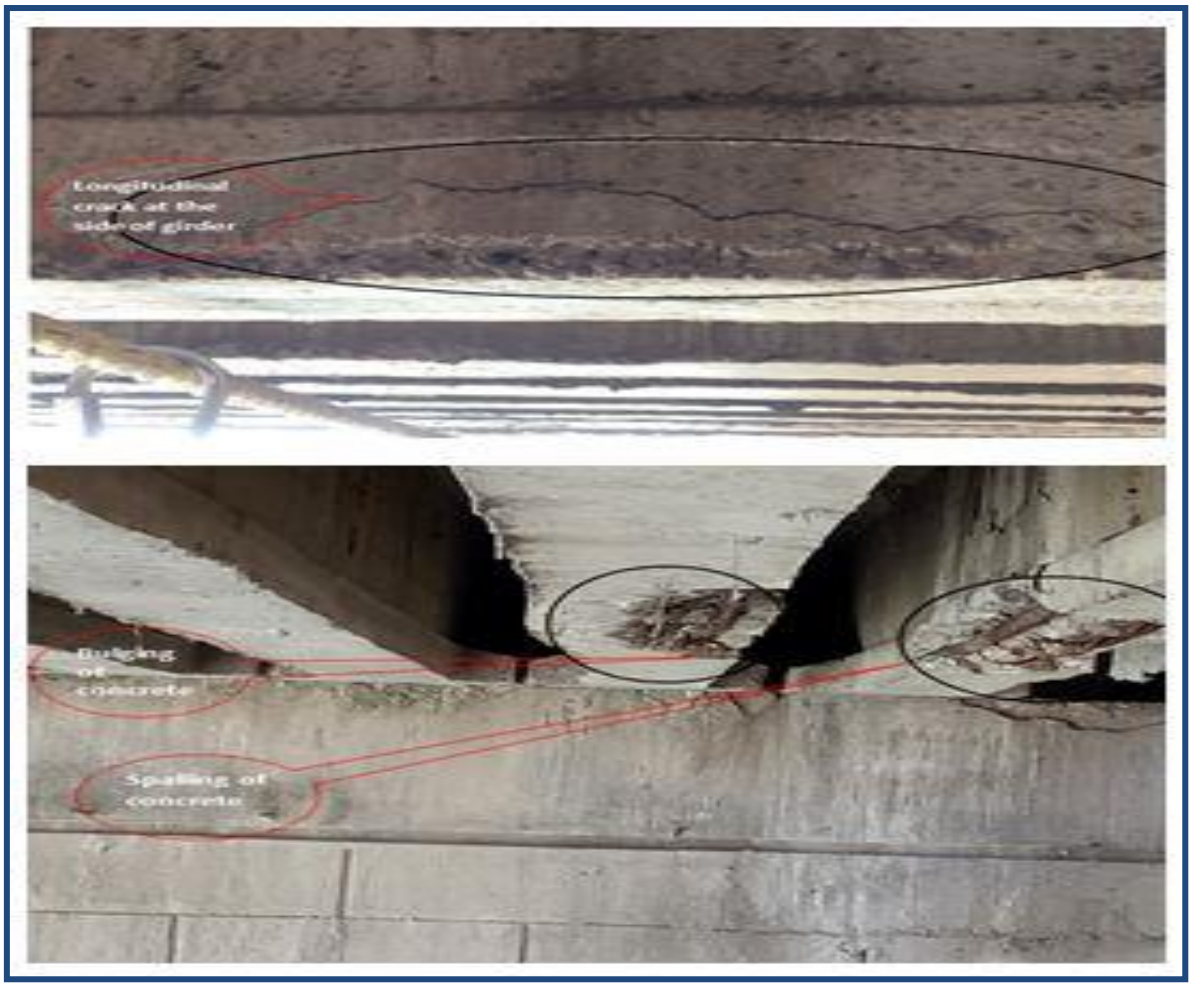
CRACKS ON PIER BEARINGS


CRUSHING OF PIERS OF NANGAL DAM BRIDGE
15-16
PIER


CRUSHING OF PIERS OF NANGAL DAM BRIDGE


DISTRESS IN BEARINGS


DISTRESS IN BEARINGS


Longitudinal crack at the side of girder
Bulging of concrete
Spalling of concrete

FORM-IV: REHABILITATION PROPOSALS

1. Structural Rehabilitation Works:

(List all the items identified for the structural rehabilitation: Civil/ HM/ Electrical)

1. Strengthening of Nangal dam bridge (CHR & RHR) girders (I-beams), pier caps along with wearing coat on RHR only
2. Inspection and Maintenance of downstream cistern of Nangal Dam.*(the work will be taken up in subsequent DRIP phases after consultation/visit of expert agency)*

2. Structural Measures for Ensuring Hydrological Safety:

(List out proposed structural measures such provision of U/S solid Parapet Wall, Increasing dam height, Additional spillway, Fuse plug, etc. – Civil/ HM/ Electrical)

NIL

3. Non-structural Measures:

(List out such proposed non-structural measures as: Revision of Reservoir Operation Rules, Lowering of FRL, setting up of early flood warning system,

NIL

Note: EAP is not to be considered as a Non-structural Measure for accommodating the increase in design flood.

4. Basic Facilities Enhancement:

(List out such proposed basic facilities as: Construction and Improvement of approach roads, Construction and Improvement of Bridges and Culverts, Construction and Improvement of Fencing, Forest area / vegetation clearance, Improving office, housing and related accommodation, stockpiling of emergency materials, sirens in dam and flood plains, lighting arrangement, renovation of IB/ Guest house, public conveniences, etc.).

1. Requirement of Machinery and Surveillance equipment's for Nangal Dam
2. Security Arrangement of Nangal Dam by providing Chain link fencing along both sides of Dam reservoir area

5. Instrumentation, SCADA, Surveillance system, etc.:

1. SCADA enabled Automation of Gates of Nangal Dam and CHR.

6. Tourism/Fisheries/Hydropower Development:

7. Latest Estimated Cost of Rehabilitation Proposal (in Rs.):

Abstract of Cost Estimate of Rehabilitation proposals attached as Appendix-IVA

Abstract & Cost estimates given in following Appendix-B onwards

APPENDIX IV-B

i. Item wise detail of cost

REHABILITATION AND IMPROVEMENT WORK No.1

Name of work: - Estimate for "Security arrangement of Nangal Dam by Providing and fixing 10.5' high Chain link fencing (including 2.5 ft. " V" shaped Concertina barbed wire coil on the top) along both sides of Nangal Dam Reservoir area.

ABSTRACT OF COST

Sr. Nos.	Description of items	Qty./ Unit	Rates as per CSR-2010 plus latest zonal premium & Note-I & II			Total Amount in Rs.
			Rate	ZP in %	Total Rate	
1	Earth work in excavation in foundations, trenches etc.in all kinds of soil where pick jumper work is not involved and not exceeding 2.0 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation, and subsequent filling around masonry in 15 cm layer with compaction including disposal of all surplus soil as directed with in a lead of 30 meter. [As per CSR-2010 item No. 6.6]	1254.18 cum	66.28	80	119.30	149624
2	Cement Concrete 1:4:8 with 40mm gauge stone ballast. [As per CSR-2010 item No. 10.10-a-ii]	418.06 cum	1885.39 +28% = 2413.30 i) Deduct difference in rate of cement i.e. 3.50 x 27.78 = 97.23 ii) Add difference in rate of bajri i.e. 0.96 x 308.81 = 296.46 Total Rate = 2612.53			1092194
3	Shuttering for faces of concrete foundations and foundation beam & plinth beam (vertical or battering) [As per CSR 2010 Item No.9.1]	3616.07 sqm	117.27	35	158.31	572460
4	Cement Concrete 1:2:4 with stone ballast or shingle using concrete mixer volumetric type. [As per CSR-2010 item No.10.12-ii]	460.69 cum	2723.85 + 28% = 3486.53 i) Deduct difference in rate of cement i.e. = 6.50 x 27.78 = 180.57 ii) Add difference in rate of sand i.e. 0.45 x 191.76= 86.29 iii) Add difference in rate of bajri i.e. 0.90 x 308.81= 277.93 Net rate = 3670.18			1690815
5	Boulder masonry in cement mortar 1:6 in foundation and plinth. (Stone boulder to be	1672.24 cum	CSR rate = 2175.14 Deduction :- i) Boulder =468.57 ii) Through & bond stone =			3481620

	supplied by the deptt free of cost) [CSR 2010 Item No. 12.33]		61.25 iii) Cont. profit 10% =52.98 (iv) Cess 1% = 5.83 Total deduction = 588.63 Net = 1586.51+35% =2141.79 Cement =1.90 x 27.78 = - 52.78 Net Amount= 2082.01			
6	Cement pointing 1:2 (Flash) on stone walls [As per CSR-2010 item No.15.63]	4876.80 sqm	61.01 + 40 % = 85.41 i. Deduct difference in rate of cement i.e. 0.065 x 27.78 = 1.81 Net Rate = 83.60			407700
7	Structural steel work in angles, tees and flats, riveted or welded including cutting fixing all gusset plates, bolts, nuts, rivets, welding rod, etc. with hoisting and erecting in position For roof trusses, well curbs, plates and trussed girders, etc. of any span for buildings and bridges up to 15 m span. (Through Rate) [As per CSR-2010 item No.18.3-a]	1176.42 Qtl.	6464.96+23% = 7951.90			9354774
8	Providing and fixing G.I chain link fabric fencing of required width in mesh size 50 x 50 mm including strengthening with 2 mm dia wire or nuts, bolts and washers as required complete as per direction of Engineer- in-charge.	9760 sqm	578.29 (AOR attached)			5644110
9	Applying priming coat with metal primer on new steel or iron work including preparation of surface With special quality primer. [As per CSR-2010 item No.16.21 a]	5466.85 sqm	13.79	25	17.24	94248
10	Painting two coats with aluminum paint to give an even shade excluding priming coat. With special quality paint. [As per CSR-2010 item No.16.26-a]	5466.85 sqm	38.18	25	47.73	260933
11	Providing and fixing concertina wire fencing in the @ 9" centre to centre fixed with G.I stapler tumbuckets etc. V portion of barbed wire fencing complete in all respect.	4000 m	267.64 (As per AOR attached)			1150560
	Total					**23899038**

REHABILITATION AND IMPROVEMENT WORK No.2

Name of work: - Strengthening of Nangal dam bridge (CHR & RHR) girders (I-beams), pier caps along with wearing coat only on RHR.

Sr. No.	Description	Qty./ Unit	Rates	Amount in Rs
A.	**In case the rebar is exposed in the beams**			
1	Chipping of unsound weak / loose concrete with electric hammer or manually and tapering all edges, making square shoulders of cavities etc. for max. thickness of 50 mm.	265.36 Sq meter	330/-	87569.00
2	The exposed steel reinforcement should be cleaned and rust (if any) should be removed with an appropriate blasting device. Cement laitance must be completely removed to ensure the protruding grain tips of the substrate are exposed so that the prepared substrate will achieve the SSD condition. The exposed reinforcement, after removal of rust, is immediately to be coated with mineral corrosion protection coat. Min 2 Coats are recommended and a waiting time of approx. 3 hours must be observed between two coats. Mixing ratio of coating material should be 100:19 parts by weight.	265.36 Sq meter	330/-	87569.00
3	Drilling and fixing aluminum NRV nozzles in RC members without using epoxy or any binding agent. Drilling holes mush be 14 mm dia., 100 mm deep holes in structural members at the intervals of 300 mm c/c in staggered manner. Cleaning of holes should be done by air blower prior to fixing nozzles. Insert NRV nozzles of dia. more than 13mm for fixing. Cut the nozzles by cut of wheel after completion of grouting without damaging structural elements.	27420 Nos.	350/-	9597000
4	Injecting the drilled holes using Injection packers with non-return valves and injecting the same using Solvent free, low viscosity epoxy resin having high compressive strength not less than 70 N/mm2 and having good capillary action and good adhesion to steel and concrete. The injection shall be done using electrically operated pump with controlled pressure. Approximate consumption of epoxy resin per square meter should be 1.5 to 2.5 litres.	7076 Ltrs	1550/-	10967800
B	**Structural strengthening of RCC beams by CFRP (Carbon Fibre Reinforced Polymer) laminates:**			

Sr. No.	Description	Qty./ Unit	Rates	Amount in Rs
	Providing and applying pre-cured CFRP laminates system having below size and properties with compatible structural adhesive primer.(Technical characteristics: Tensile Strength (MPa) > 3000, E-Modulus (GPa) > 165, Elongation at Break (%) > 1.70, Fibre Content (vol.-%) > 68, Profile (width/thickness) 100mm/1.4mm Density (kg/dm3) 1.50).Surface preparation: Grinding concrete substrate, cleaning it with wire brush removing oil, laitance if present, etc. complete. Profiling: Applying and Filling the holes and uneven surface with epoxy putty etc. complete. Application of laminate: Marking the application area on structural element, cutting the laminate to require size, applying epoxy adhesive on laminate, paste the laminate on desire area by using tamping roller to avoid any air voids etc. completely. Sand sprinkling: Applying second coat of primer, rectify air voids if any and sprinkle the river sand on it to make surface rough to take any further finishes.	4455 Rmt	3850/-	17151750
C	**Structural Strengthening with carbon wrapping for the Pier Caps**			
	Apply one directional, high strength CFRP fabric, and standard modulus (tensile E – modulus = 230 GPa) carbon-fibre sheets for structural reinforcement as per specification after surface preparation by rounding off sharp edges and cleaning it properly. Primer is to be applied at least 0.5 mm thick onto the substrate, using a trowel, a scraper or similar tool. Afterwards the CF-Sheets are pressed into the fresh adhesive, using a lamination roller or similar tool and then coated with adhesive, applied by roller. Care must be taken during application that the carbon fibres are completely embedded in the adhesive. While doing this it may be necessary to take fibre anchorage in sound concrete, which shall be provided by applicator during application, if required. If applied in several layers the subsequent layer of CF-Sheets is pressed into the fresh adhesive and afterwards coated again with adhesive. Wrapping the CFRP fabric to RCC member along horizontal axis using tamping rollers to avoid any air voids etc. and sprinkling sand over it as per direction and satisfaction of Engineer-in-charge. CFRP product used shall have minimum requirements: tensile strength (nominal) =	702.35 Square meter	4650.00	3265928

Sr. No.	Description	Qty./ Unit	Rates	Amount in Rs
	4900 N/mm2; tensile E – modulus = 230 GPa; elongation at break (nominal): 2%; fabric design thickness = 0.166 mm. Weight of the fabric 300g/m2; width of the fabric 500mm. Also the overlap for the same should be at least 100mm.			
D	**Wearing Coat cost**			
1.	Dismantling of Flexible Pavements (Bituminous Courses) (By Mechanical Means) (a) Dismantling of bituminous courses of flexible pavements by mechanical means and disposal of dismantled materials up to a lead of 1000 metres, stacking serviceable and unserviceable materials separately as per technical clause 202 of MORT&H specifications. (CSR item No.24.3(b)	74.76 Cum	250/-	18690.00
2.	Providing and applying tack coat with penetration grade bitumen VG-10 using bitumen pressure distributor at the rate of 0.40 kg per sqm on the prepared bituminous surface/granular surface treated with prime coat after cleaning the surface complete as per technical clause 503 of MORT&H specifications (CSR item No.24.18(a) (A.O.R.).	1962.83 Smt.	20/-	39256.00
3.	Bituminous Concrete 30mm to 45mm thickness (Grading II) Providing and laying bituminous concrete 30mm to 45mm thick with batch type hot mix plant using crushed aggregates of specified grading, premixed with bituminous binder VG-30 @ 6%, carriage of mixed material to site of work, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction complete as per technical clause 509 of MORT&H specifications (CSR item No. 24.23b)(AOR)	78.51 cum	9000/-	706590.00
4.	Providing tack coat with bitumen emulsion R.S. using emulsion pressure distributor @ 0.25 Kg/M2 on the prepared bituminous of surface /granler surface treated with prime coat after cleaning the surface complete as per technical clause 503 of MORT & H specifications (CSR item No. 24.18a)(A.O.R.).	792.71 Sqm	11/-	8720.00
5.	Providing, laying and compaction of close - graded premix surfacing of 20 mm thickness consisting of crushed stone aggregates of specified grading premixed in a batch type	792.71 Sqm	150/-	118906.00

Sr. No.	Description	Qty./ Unit	Rates	Amount in Rs
	hot mix plant with bituminous binder VG-30 @ 1.90 kg per sqm, laid with paver and rolling with a smooth wheeled roller 8-10 tonne capacity, finished to required level and grades complete as per technical clause 512 of MORT&H specifications (As per CSR item No.24.26b) (AOR attached)			
			Grand Total :-	**42,04,9778.00 Says 420.49 Lacs**

REHABILITATION AND IMPROVEMENT WORK No.3

Name of Work :- SCADA enabled Automation of Gates of Nangal Dam and CHR.

ABSTRACT OF COST

FOR ONE RHR GATE

Sr. No.	Description of items	Qty.	Amount in Rs	Remarks
1.	Gate position sensors assembly	2 No	185000.00	
2.	Buglers warning with RTU	1 No	20000.00	
3.	Variable Frequency Drive (VFD) for motor and motor control panel with motor protection devices	2 No	80000.00	
4.	Hardware Interface	1 No	20000.00	
5.	Automatic Gate Control System	1 No	225000.00	
6.	Software and SCADA	1Set	100000.00	
7.	Installation and Training	L.S	100000.00	
8.	Motor (7.5 hp)	2 Nos.	40000.00	
9.	Water level sensors	1 No	85000.00	(*)
10.	Discharge measurement sensor	1 No.	100000.00	
11.	Video cameras system viewing/security/ recording	1 No.	50000.00	
12.	LCD(HDD) Panel 50 inchs	1 No	80000.00	(*)
13.	Communication Modules	2 sets	20000.00	
14.	Power back up Module with DG of 20 KVA capacity with AMF controller	1 No	380000.00	(*)
15.	2 no. 5 kVA UPS with suitable battery banks. Pure sine wave UPS of 5KVA with 2 hours backup. Power Supply- Dual Redundant Power Supply Electrical Supply- 220V AC and supply from AC distribution	1 No.	347000	(*)
	TOTAL		**17,32,000.00**	

(*) The items shown above are required only for one gate,therefore the rate does not multiply if all gates is to be automated.

For other gates = Rs.1732000-(85000+80000+380000+347000)=Rs.840000

For 24 gates = Rs.840000x24+(85000+80000+380000+347000)

= Rs.2,10,52,000

ABSTRACT OF COST

FOR ONE CHR GATE

For CHR gates the item Sr. No 8 only mentioned in above table will be changed as follow:-

1.	Motor (5 hp)	2 Nos.	30000.00	

The difference of cost between RHR and CHR gate is = Rs 40000-30000

=Rs 10000/-

All conditions for CHR gates mentioned above as (*) is same as that for RHR gates.

Therefore, the total cost for automation of one gate of CHR gate is =**Rs.17,22,000.00**

For other gates CHR Gate = Rs.17,22,000-(85,000+80,000+3,80,000+347000) = Rs.8,30,000.00

For 8 Nos. CHR gates = 8 x 8,30,000+(85,000+80,000+3,80,000+347000)=Rs.75,32,000.00

Total cost =Total cost for automation of *RHR gates* + Total cost for automation of CHR gates +Total cost of connectivity to fetch Real Time data from external server

= Rs.2,10,52,000 + Rs.75,32,000 + 43,20,000 = **Rs.2,90,16,000/-**

REHABILITATION AND IMPROVEMENT WORK No.4

Name of work: - Procurement of Machinery and Surveillance equipments for Nangal Dam

Sr. Nos.	Description of item	Qty./ Unit	Rates taken as per Market Rate	Total Amount In Rs.
1	Motor Boat (12' x 4.75' x 2' front depth) 8 HP OBM petrol Yamha/Tohastu	02 Nos.	280000.00	560000.00
2	JCB super loader	01 No.	2800000.00	2800000.00
3	Drone Camera	01 No.	320000.00	320000.00
4	Loco Gantry Crane (20 MT capacity) including electric panel and fabrication and erection.	01 No.	3825000.00	3825000.00
			Total :-	**7505000.00**
			say	**75.05** lacs

APPENDIX IV-A

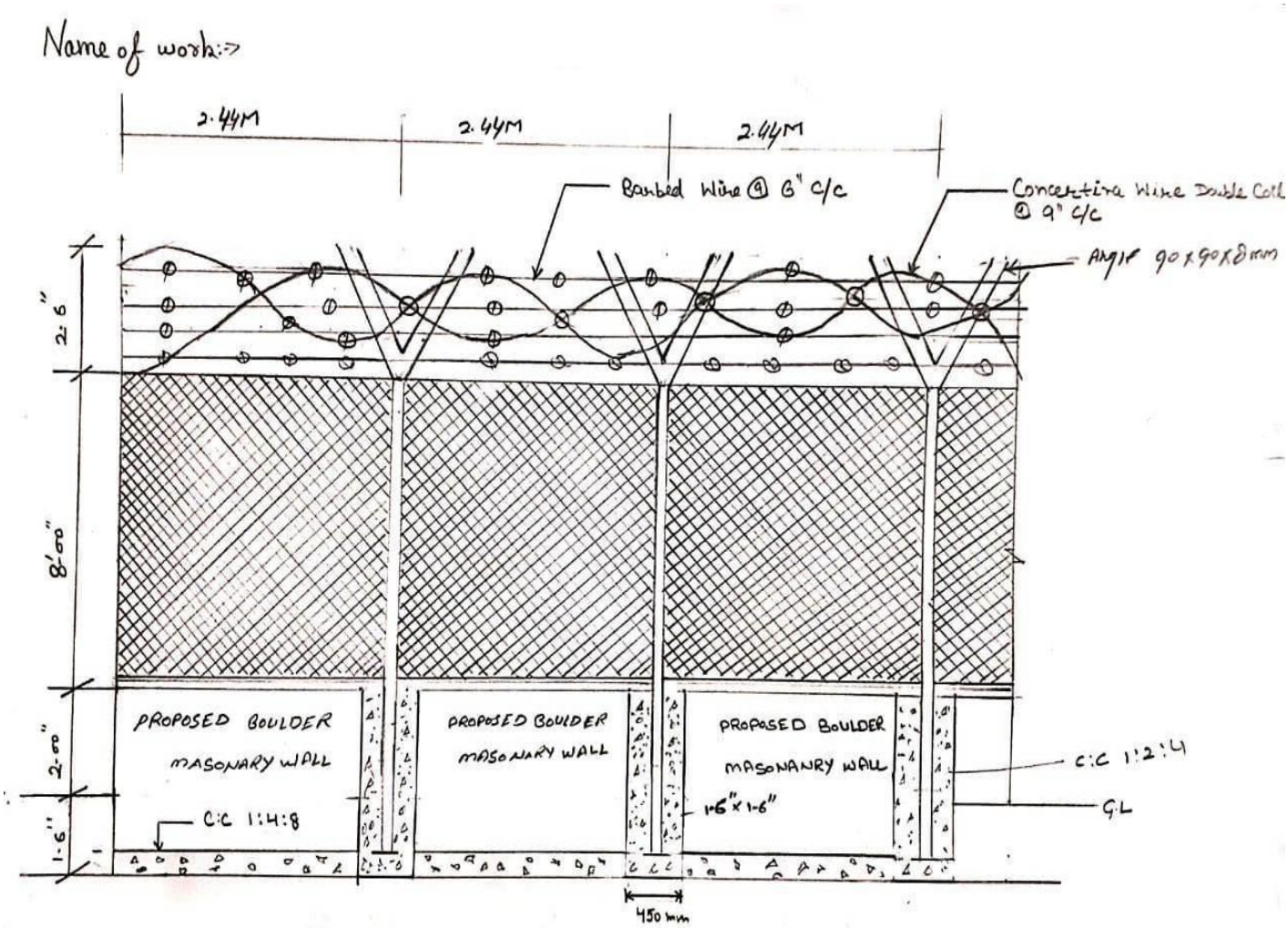
Cost Estimates of Rehabilitation Proposal

NAME OF WORK: Rehabilitation and Improvement Works of Nangal Dam		
	GENERAL ABSTRACT	
SL NO	**DESCRIPTION OF WORK**	**AMOUNT**
1.	**Structural Rehabilitation Works**	
i	Strengthening/Carbon Wrapping of Bearing caps and I beam girders of Nangal Dam	4.21 crore
ii	Inspection and Maintenance of downstream cistern of Nangal Dam. *(the work will be taken up in subsequent DRIP phases after consultation/visit of expert agency)*	3.00 crore
iii		
	Sub Total	**7.21 crore**
2.	**Structural Measures for Ensuring Hydrological Safety**	
i		
ii		
iii		
	Sub Total	**---**
3.	**Non-structural Measures**	
i		
ii		
iii		
	Sub Total	**---**
4.	**Basic Facilities Improvement**	
i	Requirement of Machinery and Surveillance equipments for Nangal Dam	0.75
ii	Security Arrangement of Nangal Dam by providing Chain link fencing on both sides of Dam Pond	2.39
iii		
	Sub total	**3.14 crore**
5.	**Instrumentation, SCADA, Surveillance system, etc.**	
i	SCADA enabled Automation of Gates of Nangal Dam	2.90 crore
ii		
	SUB TOTAL	**2.90 crore**
6.	**Tourism/Fisheries/Hydropower Development**	
i		
	SUB TOTAL	**---**
7.	**Others (Investigation, Design Studies, Consultancy)**	
i		
	SUB TOTAL	**---**
	GRAND AMOUNT	**13.25 crore**

(ii) Design and Drawings of Rehabilitation Works

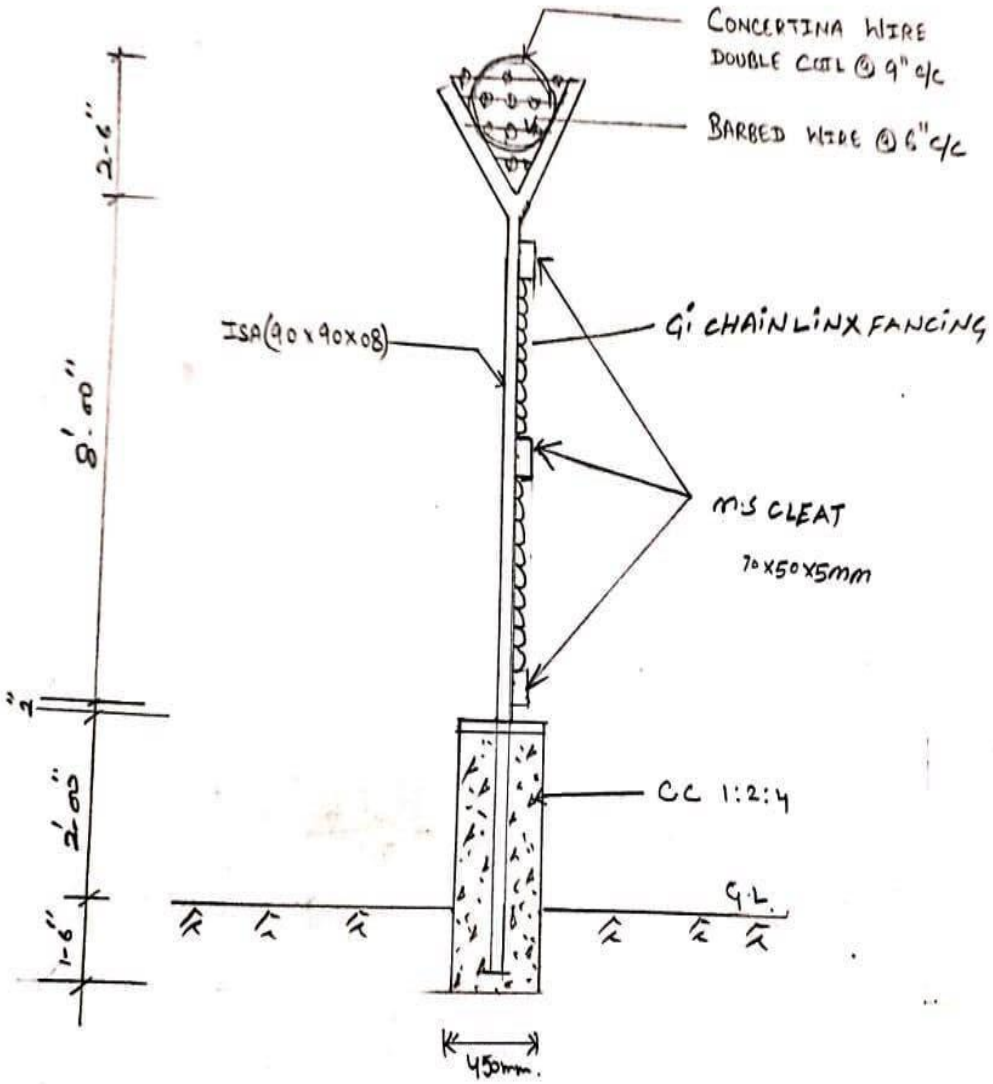
Name of work: - Estimate for "Security arrangement of Nangal Dam by Providing and fixing 10.5' high Chain link fencing (including 2.5 ft. " V" shaped Concertina barbed wire coil on the top) along both sides of Nangal Dam Reservoir area.

Drawing No.1

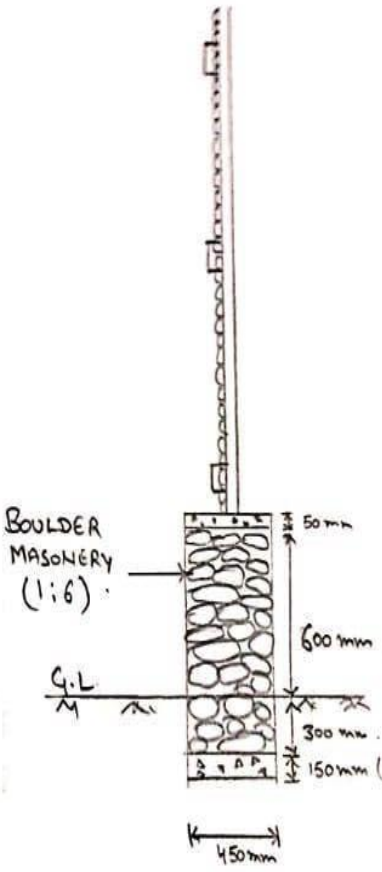


SKETCH SHOWING DETAILS OF G.I CHAIN LINK FABRIC FENCING AND CONCERTINA COIL

Drawing No.2



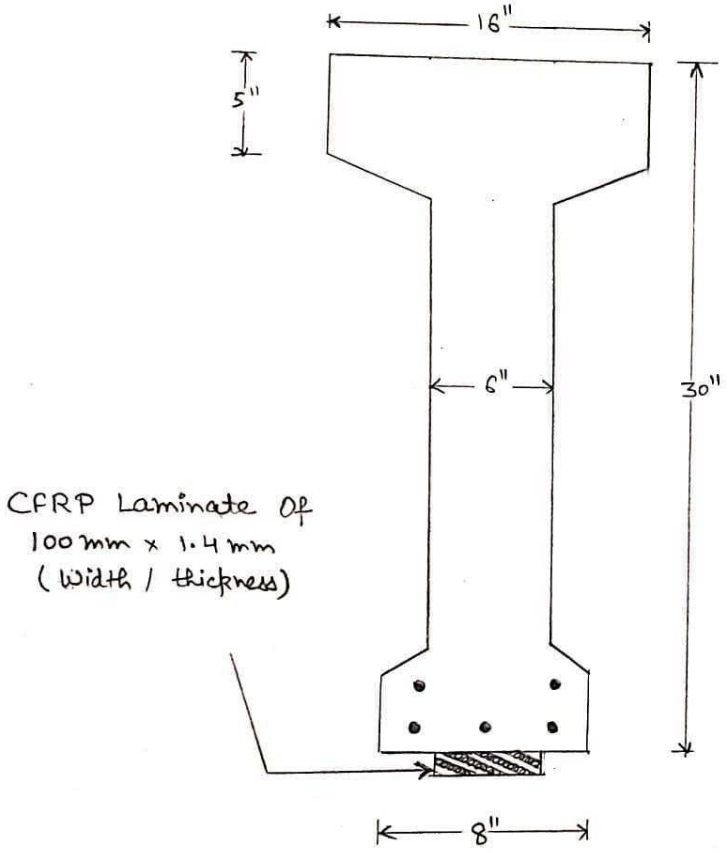
SECTION OF ANGLE IN C.C



SECTION OF BOULDER MASON

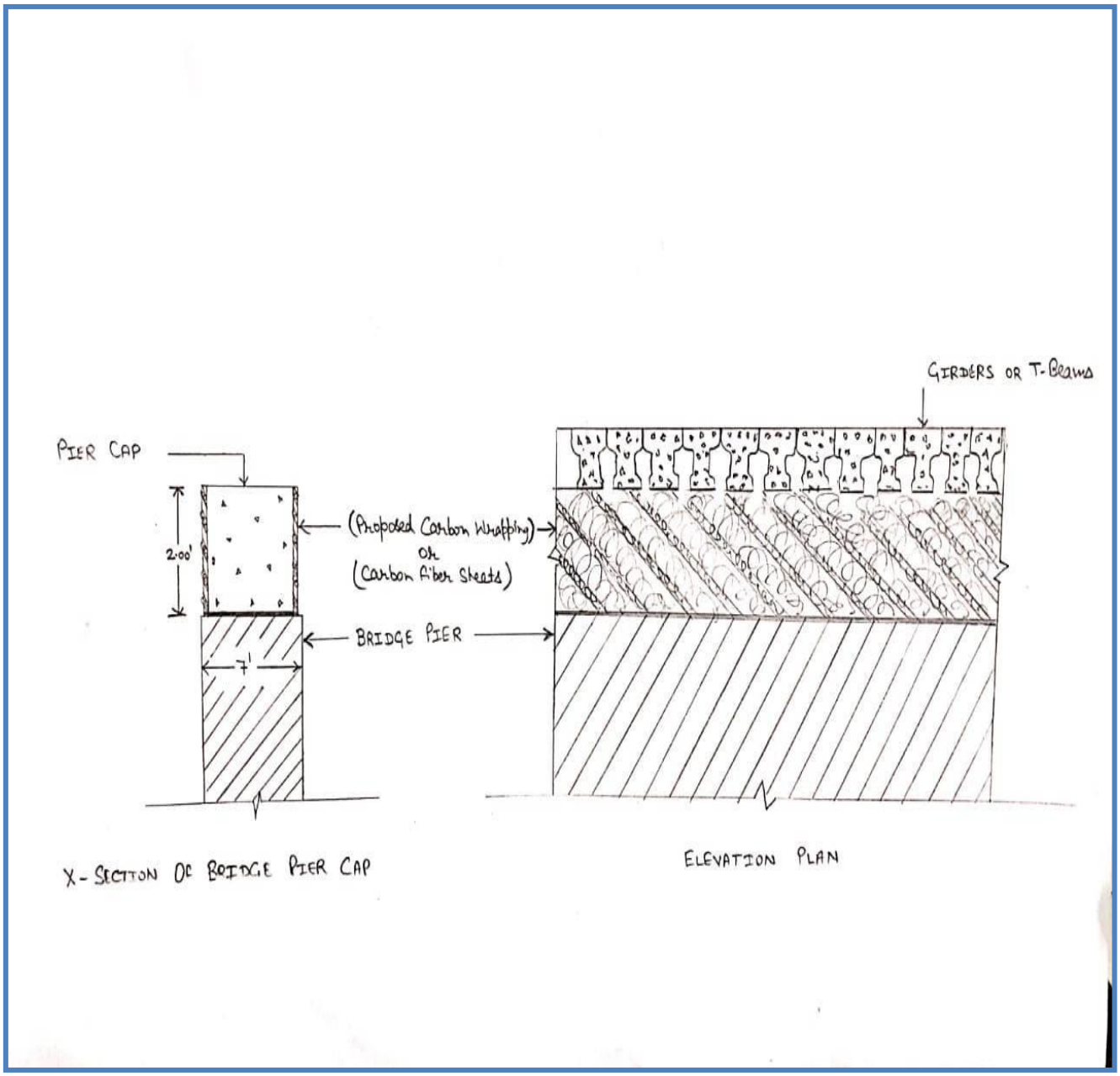
Name of work: - Strengthening of Nangal dam bridge (CHR & RHR) girders (I-beams), pier caps along with wearing coat only on RHR.

Drawing No.1



SKETCH SHOWING STRENGTHENING OF T-beams BY USING CARBON FIBER REINFORCED POLYMER

Drawing No.2


GIRDERS OR T-Beams
PIER CAP
2.00'
(Proposed Carbon Wrapping)
OR
(Carbon fiber Sheets)
BRIDGE PIER
7'
X-SECTION OF BRIDGE PIER CAP
ELEVATION PLAN

-V: ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK (ESMF) COMPLIANCE

1. Project Siting

A. Is the Project adjacent to or within any of the following environmentally sensitive areas?

Environmentally Sensitive Area	Yes	No	Name/ Identify	Distance from the project area
• Wildlife Sanctuary/ Bird Sanctuary National Parks/ Ecologically Protected Area/ Tiger Reserves	Yes		Nangal Wildlife Sanctuary	Within Reservoir area of Nangal Dam
• Reserved Forest Area		No		
• Buffer zone of protected area		No		
• Elephant movement Corridor		No		
• Designated Wildlife Migratory Route		No		
• Eco-sensitive zone		No		
• Cultural Heritage Site/ Archaeological sites		No		
• Others		No		

B. Details of Clearances required for proposed rehabilitation activities as per the table given in Appendix V-C:

S. No.	Proposed Activity	Clearance Required
1	All rehabilitation and improvement works proposed in this report.	No Clearance from any agency is required now, as necessary Clearance were accorded for construction of Nangal Dam at the start of construction during 1946 and before commissioning during 1954.

2. Identification of activities having potential environmental and social impact:

N.A

3. Whether Requirement for Specific Environment Management Plan (EMP) proposed: No

(a) If yes, tentative time frame of ESMF Study: **Not Applicable**

From: MM/DD/YYYY To: MM/DD/YYYY

4. Whether mitigation measures have been identified as per Attachment 1: No

, If yes Please attach as Appendix V-A

5. Whether mitigation measures are required to be implemented by Contractor:

Yes , If yes, Please attach as Appendix V-B

Attachment 1 – Abstract Screening for ESMF Activities and Categorization

Sr. No	ESMF Activity/ Component	Diversion of Forest Land	Resettlement and Rehabilitation	Tree Felling	Borrow Area	Quarry Area	Blasting	Dredging/ DE silting of Reservoir	Labour Camps	Transportation of constructionmaterials,manpowerandEquipmentthroughProtectedareas/ReserveForest	Heavy Machinery	Hot Mix Plant	Concrete Mixer and Heavy Pumps	Material Handling and Storage	Temporary Land Acquisition	Bush/ Vegetation Clearing	Haulage of Machinery	Debris Disposal	Transport of Materials	Small Tools and Pumps	Sheds to keep Machines and Tools	Others
1	Providing security system to guard dam / project area.	D – No action is required																				
2	Improving dam instrumentation and monitoring, SCADA and automation system of dams	D – No action is required																				
4	Other Strengthening of Bridge, I-Beams, piers Procurement of Machinery	D – No action is required																				

	and equipments	

- Fill with A/B/C/D (A-High Risk, B-Substantial Risk, C- Moderate Risk, D-Low Risk).
- For A & B – ESIA study including RAP & R&R shall be carried out by a third party. For C – Generic mitigation measures will be applicable. For D – No action is required beyond the above screening.

Appendix V-A

IDENTIFIED MITIGATION MEASURES **N.A**

In case mitigation measures have not been identified, please leave the information blank.)

Enclosed (Yes/No):

Summary on mitigation measures, if any:

NA

Appendix V-B

MITIGATION MEASURES REQUIRED TO BE IMPLEMENTED BY THE CONTRACTOR

(In case Contractor mitigation measures have not been identified, please leave blank)

Enclosed : Yes

Summary of mitigation measures to be implemented by contractor:

Sl. No	Components	Potential Impacts	Mitigation Measures	Executing Responsibilities	Supervising Responsibilities	Monitoring Responsibilities
1.	Labour Camps	Worker/ Local people exposure	- Located handling sites away from populated areas - Proper operation and handling measures would be taken to minimize exposure - Would Provide sirens in vehicles to avoid any collision with human/animals - Child labour would be strictly prohibited - Would Provide signage near construction sites and approach roads	Contractor	Dam site in-charge	SPMU
2.	Heavy Machinery	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Use of barriers to reduce exposure - Plants, machinery and equipment would be handled so as to minimize generation of dust. - All crusher used in construction should confirm to relative dust emission devises - Low emission	Contractor	Dam site in-charge	SPMU

Sl. No	Components	Potential Impacts	Mitigation Measures	Executing Responsibilities	Supervising Responsibilities	Monitoring Responsibilities
			construction equipment, vehicles and generator sets would be used			
		Worker/ Local people exposure	- Handling sites would be located away from populated areas - Sirens in vehicles would be provided to avoid any collision with human/animals - Provide signage near construction sites and approach roads	Contractor	Dam site in-charge	SPMU
3.	Material Handling And Storage	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles and generator sets may be used	Contractor	Dam site in-charge	SPMU
		Worker/ Local people exposure	- Handling sites would be located away from populated areas - Sirens in vehicles would be provided to avoid any collision with human/animals - Provide signage near construction sites and approach roads	Contractor	Dam site in-charge	SPMU

Sl. No	Components	Potential Impacts	Mitigation Measures	Executing Responsibilities	Supervising Responsibilities	Monitoring Responsibilities
4.	Haulage of Machinery	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles and generator sets would be used	Contractor	Dam site in-charge	SPMU
		Soil Pollution	- Measures to prevent accidental Spills would be under taken	Contractor	Dam site in-charge	SPMU
		Worker/ Local people exposure	- Handling sites would be located away from populated areas - Sirens in vehicles would be provided to avoid any collision with human/animals - Provide signage near construction sites and approach roads	Contractor	Dam site in-charge	SPMU
5.	Debris Disposal	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles and generator sets may be used	Contractor	Dam site in-charge	SPMU
		Water Pollution (Surface	- Solid waste would be dumped in specified place to minimize contamination of water	Contractor	Dam site in-charge	SPMU

Sl. No	Components	Potential Impacts	Mitigation Measures	Executing Responsibilities	Supervising Responsibilities	Monitoring Responsibilities
		Water)				
		Soil Pollution	- Measures to prevent accidental Spills would be under taken	Contractor	Dam site in-charge	SPMU
		Trucks Traffic increase	- Traffic in populated areas would be avoided as much as possible - Speed breaker and Signage would be installed near settlements - Roadside plantation would be taken	Contractor	Dam site in-charge	SPMU
6.	Transport of Materials	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles and generator sets would be used emission devises	Contractor	Dam site in-charge	SPMU
		Soil Pollution	- Measures to prevent accidental Spills would be under taken	Contractor	Dam site in-charge	SPMU
		Trucks Traffic increase	- Traffic in populated areas would be avoided as much as possible - Speed breaker and Signage would be installed near settlements - Roadside plantation would be taken	Contractor	Dam site in-charge	SPMU
7.	Small Tools and Pumps	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles	Contractor	Dam site in-charge	SPMU

Sl. No	Components	Potential Impacts	Mitigation Measures	Executing Responsibilities	Supervising Responsibilities	Monitoring Responsibilities
			and generator sets would be used emission devises			
	Borrow Materials/ Area	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles and generator sets would be used emission devises	Contractor	Dam site in-charge	SWRD
		Generation of Excavated material	- Remove dredged material as soon as possible from river side - Dumping of dredging material only in designated place by the engineers to minimize impact on environment	Contractor	Dam site in-charge	SPMU
		Landscape Degradation	- It is a direct, short term impact; Irreversible in nature; Severity is low; Insignificant Impact on	Dam Site In-charge	Dam Owner	SPMU
		Impact on Forest	▪ The hot mix plant will be installed and operated away from the forest area. ▪ The contractor will take all the precaution to avoid forest fire during operation of the hot mix plant	Contractor	Dam site in-charge	SPMU

Sl. No	Components	Potential Impacts	Mitigation Measures	Executing Responsibilities	Supervising Responsibilities	Monitoring Responsibilities
8.	Concrete Mixture and Heavy Pumps	Air / Noise Pollution	- Air pollution control measure like water sprinkling would be under taken - Limited hours of operation in populated areas would be considered - Use of barriers to reduce exposure - Low emission construction equipment, vehicles and generator sets may be used	Contractor	Dam site in-charge	SPMU
		Soil Pollution	- Measures to prevent accidental Spills would be under taken	Contractor	Dam site in-charge	SPMU
		Worker/Local people exposure	- Located handling sites away from populated areas - Proper operation and handling measureswould be taken to minimize exposure - Would Provide sirens in vehicles to avoid any collision with human/animals - Child labour would be strictly prohibited - Would Provide signage near construction sites and approach roads	Contractor	Dam site in-charge	SPMU

Appendix V-C

ACTIVITY-WISE CLEARANCES

Activity-wise Applicability of Environmental, Forest and Wildlife Clearances for Dam Rehabilitation and Improvement Works

S.N.	Types of Rehabilitation Works	Nature of Activities	Environmental Clearance	Forest Clearance	Wildlife Clearance	Remarks
1.	**Improving dam instrumentation and monitoring, SCADA and automation system of dams**	Involves carriage of the instruments, cables etc to project site and their installation in the project area.	No	No	No	
2.	**Dredging/ De-siltation of Cistern downstream of on selective basis.**	This is a activity limited to dam area. It requires boats and equipments, heavy equipments/carriers for removal of silt deposited in the pond/reservoir, and transportation to the approved dumping area.	No	No	(a) No, in case downstream area is not a declared bird sanctuary,	

FORM-VI: IMPLEMENTATION ARRANGEMENT

1. Civil Works-Main Package:

(a) Work Components

1. Strengthening/Carbon Wrapping of Bearing caps and I beam girders of Nangal Dam.
2. SCADA enabled Automation of Gates of Nangal Dam.
3. Security Arrangement of Nangal Dam by providing Chain link fencing on both sides of reservoir area.

(*Give details for each work component under separate number)*

1. *Work no 01:* Strengthening/Carbon Wrapping of Bearing caps and I beam girders of Nangal Dam.

   (a) Procurement Method: NCB

   (b) Estimated Cost of Package (in Rupees): 4.21 crore

1. *Work no 02:* SCADA enabled Automation of Gates of Nangal Dam.

   (a) Procurement Method: NCB

   (b) Estimated Cost of Package (in Rupees): 2.91 crore

1. *Work no 03:* Security Arrangement of Nangal Dam by providing Chain link fencing on both sides of reservoir area.

   (a) Procurement Method: NCB

   (b) Estimated Cost of Package (in Rupees): 2.39 crore

2. Other Packages

Sl. No.	Description	Procurement Method	Estimated Cost (Rs.in Lakhs)
1	NIL		

3. Procurement of Goods:

Sl No.	Description	Procurement Method	Estimated Cost(Rs.in Lakhs)
1	Requirement of Machinery and Surveillance equipment's for Nangal Dam	NCB/GeM	75.05 lakh
2			

4. Consultancy Assignment(s):

Sl No.	Description	Procurement Method	Estimated Cost (Rs.)
1	NIL		

5. Implementation Timeline:

(a) Overall Phasing of Project Implementation: DRIP PHASE-II

Proposed Starting of implementation (MM/DD/YYYY): 01/04/2020

Proposed Ending of implementation (MM/DD/YYYY): 31/03/2026

Implementation Duration (months) (MM): _72___

(b) Timeline phasing of implementation:

Sl. No.	Description	From (Month/Year)	To (Month/Year)	Status of Procurement Process
1	Civil Work – Main Package	04/2020	03/2023	NCB subject to approval of PST
2	Other Packages			
3	Procurement of Goods (a) Provision for Instrumentation (b) Provision for the inspection vehicles	04/2020	03/2022	NCB/GeM subject to approval of PST

FORM-VII: ADDITIONAL INFORMATION

This section contains information of all reports such as Emergency Action Plan (EAP), Dam Break Analysis (DBA), stability analyses, design drawings, geological report, geotechnical exploration logs, test results, geophysical results, underwater explorations, and other data that is pertinent and supports the PST work proposal.

1. Operation and Maintenance Manual

(a) Operation & Maintenance Manual: Y , if YES,

(b) Year of Publication: 1996

2. Emergency Action Plan

(a) Emergency Action Plan: Y , if YES,

(b) Year of Study: 2008

(c) Agency Conducting Study : BBMB

3. Dam Break Analysis

(a) Dam Break Analysis**: No** if YES,

(b) Year of Study:

(c) Agency Conducting Study:

NA

4. Geotechnical Investigation **No**

(a) Year of Investigation:

(b) Agency Conducting Investigation:

NA

5. Geophysical Investigation **No**

(a) Area of Study:

(b) Year of Investigation:

(b) Agency Conducting Investigation:

NA

6. Stability Analysis of Dam and any other studies **No**

(a) Area of Study:

(b) Year of Study:

(c) Agency Conducting Study

NA

7. Others **No**

(a) Area of Study:

(b) Year of Study:

(c) Agency conducting study:

NA