Schedule I
(Regulation 3(1))
Form of Application

The Registrar,

National Electric Power Regulatory authority

Subject: **Application For A Generation License**

I Haji Manzoor Hussain Chief Executive Data Hydropower Private Limited by virtue of power of Attorney dated 8-1-2015 hereby apply to the National Electric Power Regulatory Authority for the grant of a Generation License to the Data Hydropower Private Limited pursuant to section [ ] of the regulation of Generation, Transmission and Distribution of Electric power Act, 1997.

I certify that the documents-in-support attached with this application are prepared and submitted in conformity with the provisions of National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations 1999, and undertake to abide by the terms and provisions of the above said regulations. I further undertake and confirm that the information provided in the attached documents in support is true and correct to the best of my knowledge and belief.

A cheque No.9202963 on MCB in the sum of Rupees sixty nine thousand and eight dated 29-12-2014, being the non-refundable license application fee calculated in accordance with schedule II to the National Electric Power Regulatory Authority Licensing (Application and Modification Procedure) Regulations, 1999 is also attached.

Dated:_____

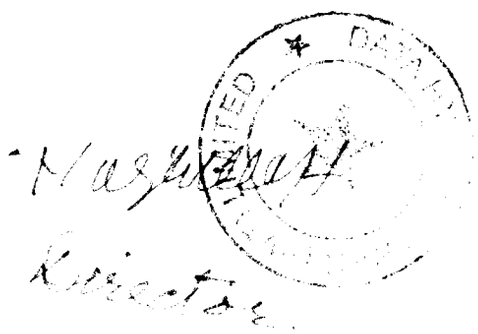
Signature
Chief Executive
Data Hydropower (Pvt) Ltd.
Faisalabad.

EXTRACT OF RESOLUTION PASSED IN THE MEETING OF BOARD OF DIRECTORS OF THE COMPANY HELD AT REGISTERED OFFICE ON DECEMBER 26, 2014 AT 10:00 AM

Resolved that Haji Manzoor Hussain, Chief Executive of Data Hydropower (Pvt) Limited company be and are hereby jointly and singly authorized to do any or all of the following acts, deeds and things on behalf of the company in connection with Generation license application to be filed with National Electric Power Regulatory Authority (NEPRA) under the Regulation of Generation Transmission and Distribution of Electric Power Act, 1997 and the National Electric power Regulatory Authority licensing (Application and Modification Procedure) Regulations, 1999.

(a) to represent the company before NEPRA and in doing so perform all lawful acts, deeds and things which we shall be entitled or permitted to do ourselves, including but not limited to filling, signing, presenting, modifying, amending, withdrawing applications and other documents, responding to any queries and meeting any objections, receiving notices and documents and

(b) to do all acts, deeds and things, which are ancillary and incidental to the aforesaid purposes and issuance of generation license.



000364

SECP

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
COMPANY REGISTRATION OFFICE
2nd Floor, FCCI Building, East Canal Road, Faisalabad
*****

CERTIFICATE OF INCORPORATION

(Under Section 32 of the Companies Ordinance, 1984 (XLVII of 1984)

Corporate Universal Identification No **0083094**

I hereby certify that **DATA HYDROPOWER (PVT.) LIMITED** is this day incorporated under the Companies Ordinance, 1984 (XLVII of 1984) and that the company is **Limited by Shares.**

Given under my hand at **Faisalabad** this **Fifteenth** day of **March** Two **Thousand** and **Thirteen**

Fee Rs.5,000/-

(MAHBOOB AHMAD)
Joint Registrar of Companies
Faisalabad

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
COMPANY REGISTRATION OFFICE FAISALABAD
SECP

No. JRF/L-60/3146 Dated: 15/03/2013

Certified to be true Copy

12/12/14

Joint Registrar
Securities & Exchange
Commission of Pakistan
Company Registration Office
FAISALABAD.

THIRD SCHEDULE

(See section 156)

FORM A- ANNUAL RETURN OF COMPANY HAVING SHARE CAPITAL

1 Registration No. : 0083094

2 Name of the Company : DATA HYDROPOWER (PRIVATE) LIMITED

Securities and Exchange Commission of Pakistan
25 NOV 2014
CRO, Faisalabad.

3 Form A made upto (Day/Month/Year) : 31/10/2014

4 Date of AGM (Day/Month/Year) : 31/10/2014

PART-A

5 Registered office address: P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad

6 Email Address: manzoorhussain@yahoo.com

7 Office Tel. No.: 0322-6309902

8 Office Fax No.:

9 Nature of Business:

10 Authorized Share Capital

Type of Shares	No. of Shares	Amount	Face Value
Ordinary Shares	10,000	100,000/-	10/-

11 Paid up Share Capital

Type of Shares	No. of Shares	Amount	Issue Price
Ordinary Shares	10,000	100,000/-	10/-

12 Amount of indebtedness on the date upto which form A is made in respect of all

Mortgages/Charges	====	====

13 Particulars of the holding company

Name	===	
Registration No.	===	% Shares Held

14 Chief Executive

Name	Haji Manzoor Hussain	NIC	33100-3046217-9
Address	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad		

15 Chief Accountant

Name	===	NIC	===
Address	===		

16 Secretary

Name	===	NIC	===
Address	===		

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP
COMPANY REGISTRATION OFFICE FAISALABAD

17 Legal Adviser

Name	====
Address	====

18 Auditors

Name	Ghulam Qaider
Address	H. No.655,Kaleem Shaheed Colony No.1,Faisalabad

19 List of Directors on the date of Form-A

Name of Director	Address	Nationality	NIC (Passport No. if foreigner)
1 Haji Manzoor Hussain	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	Pakistani	33100-3046217-9
2.Sabir Hussain	P-17, Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	-do-	33100-8401794-5
3. Nasrullah Khan	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	-do-	33100-8793370-1

PART-B

20 List of members & debenture holders on the date upto which this Form A is made

Folio	Name	Address	Nationality	No. of shares	NIC (Passport No. if forelgner)
	Members				
1	Haji Manzoor Hussain	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	Pakistani	5,000	33100-3046217-9
2	Sabir Hussain	P-17, Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	-do-	2,500	33100-8401794-5
3	Nasrullah Khan	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	-do-	2,500	33100-8793370-1
		Total		10,000	
	Debenture holders				
	===	===	===	===	===

21 Transfer of shares (debentures) since last Form A was made

	Name of Transferor	Name of Transferee	Number of shares transferred	Date of registration of transfer
	Members			
	===	===	===	===
	Debenture holders			
	===	===	===	===

22. I certify that this return and the accompanying statements state the facts correctly and completely as on the date upto which this Form-A is made

Date : 31-10-2014

Signature:
Designation : Chief Executive

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
COMPANY REGISTRATION OFFICE FAISALABAD
SECP

1.COMPANY REGISTRATION NO
2.THE DATE ON WHICH THE DOCUMENTS REGISTERED FILED OR RECORDED

12/12/14

DEPUTY REGISTRAR COMPANIES
FAISALABAD REGION.

Certified to be true Copy

12/12/14

Joint Registrar
Securities & Exchange
Commission of Pakistan
Company Registration Office
FAISALABAD.

FORM 29

THE COMPANIES ORDINANCE, 1984

(Section 205)

PARTICULARS OF DIRECTORS AND OFFICERS, INCLUDING THE CHIEF EXECUTIVE, MANAGING AGENT, SECRETARY, CHIEF ACCOUNTANTS, AUDITORS AND LEGAL ADVISORS, OR OF ANY CHANGE THEREIN

1. Incorporation Number: 0083094

2. Name of the Company: DATA HYDROPOWER (PRIVATE) LIMITED DATA HYDROPOWER (PRIVATE) LIMITED

3. Fee Paid (Rs.): 3,775/- Name & Branch of The Bank: MCB BANK LIMITED, ABDULLAHPUR, FAISALABAD.

Receipt No. Date: Day 2 4 Month 1 1 Year 2 0 1 4

(Bank challan to be attached in original)

Securities and Exchange Commission of Pakistan 35682 25 NOV 2014 CRO, Faisalabad.

5. Particulars

Present Name or Surname in full	NIC No. or passport No. in case of Foreign National	Father's/Husband Name	Usual residential address	Designation	Nationality	Nationality of origin (if other than present nationality)	Other business occupation and directorship, if any	Qualifications (in case of auditors/ legal advisors)	Date of present appointment or changed	Changes stating how appointed or changed	Remarks (state approval, if any required under law)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
5.1 New appointment/ election											
Haji Manzoor Hussain	33100-3046217-9	Haji Jan Muhammad	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	Chief Executive/ Director	Pakistani	Nil	Nil	Nil	31-10-2013	Continued	Nil
Sabir Hussain	33100-8401794-5	Haji Manzoor Hussain	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	Director	-do-	Nil	Nil	Nil	-do-	-do-	Nil
Nasrullah Khan	33100-8793370-1	Haji Manzoor Hussain	P-44,Street Main Gujjar, Ghulam MuhammadAbad No.1, Faisalabad	-do-	-do-	Nil	Nil	Nil	-do-	-do-	Nil
Ghulam Qalder	33100-0924664-1	Sher Muhammad	H.No.655,Kaleem Shaheed Colony,Faisalabad.	Auditor	- do -	Nil	Nil	===	31-10-2014	Re-appointed	Nil

1.COMPANY REGISTRATION NO
2 THE DATE ON WHICH THE DOCUMENTS REGISTERED FILED OR RECORDED

DEPUTY REGISTRAR COMPANIES FAISALABAD REGION.

5.2 Cessation of office/Retirement/Registration — NOT APPLICABLE

5.3 Any other change in particulars — NOT APPLICABLE

Certified to be true Copy

Joint Registrar
Securities & Exchange
Commission of Pakistan
Company Registration Office
FAISALABAD

Signatory

Haji Manzoor Hussain

Signature of Chief Executive/ Secretary

Designation: Chief Executive/Director

Date: Day 3 1 Month 1 0 Year 2 0 1 4

THE COMPANIES ORDINANCE, 1984

(Private Company Limited by Shares)

Memorandum of Association of

DATA HYDROPOWER (PRIVATE) LIMITED

I. The name of the Company is: DATA HYDROPOWER (PRIVATE) LIMITED.

II. The Registered Office of the Company will be situated in Faisalabad, province of Punjab.

III. The objects for which the Company is established are all or any of the following: -

1. To carry on the business or businesses of acquiring, constructing, owning, managing, setting up or operating of power stations, ice factories, cold storages, oil extraction plants, iron foundries.

2. And of the purposes of achieving the above objects, the company is authorized: -

   1. To transact such other business as may be proper, necessary and desirable for or in connection with the objects of the Company or any of them.
   2. To set up, erect, construct, purchase, take on lease, run, operate and administer plants and factories and to carry on all such functions and business as are necessary and incidental to meet the objectives of the Company.
   3. To import and purchase raw material, equipments, machineries, spare parts or other articles of use required by the Company for the purpose of carrying on the business of the Company.
   4. To set up a Hydro Power plant for power generation.
   5. To transact or carry on all kinds of agency commission, and contract business in particular in relation to industry, and to act as agents of any person, firm, company, Government or local authorities, but not to act as managing agent.
   6. To manufacturer, purchase, import, export, store, process, sell and generally to deal in all materials, articles, substances and things required for or incidental to the manufacturer, preparation, adaptation, treatment, use or working of the foregoing or the packing, storing or otherwise dispose of all or any of the same as may be thought desirable.
   7. To acquire and undertake the whole or any part of the business, property and liabilities of any person or company carrying on any business which the Company is authorized to carry on, or possessed of property suitable for the purposes of the Company.
   8. To establish laboratories and research and development centers to perform such research and development as the Company may deem advisable or feasible.
   9. To train personnel and workers, both in Pakistan and abroad, to obtain technical proficiency in various specialties connected with the objects of the company or any of them.
   10. To apply for, purchase or otherwise acquire any patents, brevets invention, licenses, concessions, and the like, conferring any exclusive or non-exclusive or limited right to use, or any secret or other information as to any invention which may seem capable of being used for any of the purposes of the Company or the acquisition of which may seem calculated directly or indirectly to benefit the Company, and to use, exercise, develop, or grant licenses in respect of, or otherwise turn to account the property. rights or information so acquired.
   11. To enter into partnership or into any arrangement for sharing profits, union of interest, co-operation, joint venture or reciprocal concession, with any person or company, local or foreign, carrying on or engaged in any business or transaction which this Company is authorized to carry on or be engaged in, or otherwise assist any such person or company, and to take or otherwise acquire shares and securities of any such company, and to sell,

hold, re-issue with or without guarantee, or otherwise deal with the same, except doing business as an investment company.

12. To take, or otherwise acquire, and hold shares in any other company, having objects altogether or in part similar to those of this Company, or carrying on any business capable of being conducted so as directly or indirectly to benefit this Company, but not to act as an investment company.
13. To enter into arrangement with any Government or authorities, supreme, national, municipal, local, railway, or otherwise, public or quasi-public bodies, or with any other persons, in any place where the Company may have interest that may seem conducive to the objects of the Company or any of them and to obtain from any such Government, authorities or persons any rights, privileges and concessions which the Company may think fit to obtain, and to carry out, exercise and comply with any such arrangements, rights, privileges and concessions.
14. To establish and support or aid in the establishment and support of associations, institutions, funds, and conveniences calculated to benefit employees of the Company or the dependants or connections of such persons, and to grant pensions and allowances, and to make payments towards their insurance.
15. To amalgamate with any other company whose objects are and/or include objects similar to those of this Company, whether by sale or purchase (for fully or partly paid-up shares or otherwise) of the undertakings, subject to the liabilities of this or any such other company as aforesaid, with or without winding up or by sale or purchase (for fully or partly paid-up shares or otherwise) of all or a controlling interest in the shares or stock of this or any such other company as aforesaid, or by partnership, or any arrangement of the nature of partnership, or in any other manner.
16. To sell or dispose of the undertaking of the Company or any part thereof for such consideration as the Company may think fit and, in particular, for shares, debentures or securities of any other company having objects altogether or in part similar to those of this Company.
17. To purchase, take on lease or in exchange, hire or otherwise acquire, any movable or immovable property, and any rights or privileges which the Company may think necessary or convenient for the purpose of its business and, in particular, any land, buildings, easement, machinery, plant and stock-in-trade.
18. To construct, maintain and alter any buildings or works, necessary or convenient for the purposes of the Company.
19. To construct, improve, maintain, develop, work, manage, carry out, or control any manufactories, warehouses, shops, stores, and other works and conveniences which may seem calculated directly or indirectly to advance the Company's interests.
20. To sell, improve, manage, develop, exchange, lease, mortgage, enfranchise, dispose of, turn to account, or otherwise deal with, all or any parts of the property and rights of the Company.
21. To invest the money of the Company, not immediately required, in such manner as may from time to time be determined, but not to act as an investment, finance, or banking company.
22. To advance money to such persons or companies and on such terms as may seem expedient and, in particular, to customers and others having dealings with the Company, but not to act as an investment, finance, or banking Company.
23. To guarantee the performance of contracts, agreements, obligations or discharge of any debt of the company or on behalf of any company or person in relation to the payment of any financial facility including but not limited to loan, advance, letter of credit or other obligations through creation of all types of mortgages, charges, pledges, hypothecation, or execution of the usual banking documents/instruments or otherwise encumbrance on any or all of the movable and immovable properties of the company, either present or future or both and issuance of any other securities or sureties by any other means in favour of banks, Non-Banking Finance Companies or any financial institutions and to

borrow money for purposes of the company on such terms and conditions as may be considered proper.

24. To open, close and operate banking accounts of the Company with any banker.
25. To draw, make, accept, endorse, discount, execute and issue promissory notes, bills of exchange, bills of lading, warrants, debentures and other negotiable or transferable instruments, but not to act as an investment or banking company.
26. To adopt such means of making known the products of the Company as may seem expedient, including, in particular, by advertisement in the press, circulars, purchase and exhibition of works of art or interests, publication of books and periodicals, and grant of prizes, rewards and donations.
27. To subscribe or contribute or otherwise to assist or to guarantee money to charitable, benevolent, religious, scientific, technical, national, public, or any other institutions, for its objects or purposes or for any exhibition.
28. To apply for and obtain any provisional order or Act of legislature or any consents, permissions and licenses from the Government, central or provincial, and any agencies of the Government for enabling the Company to carry on any of its objects into effect, or for effecting any modification of the Company's constitution, or for any other purpose which may seem expedient, and to oppose any proceeding or application which may seem calculated, directly or indirectly, to prejudice the Company's interests.
29. To sell any patent rights or privileges belonging to the Company or which may be acquired by it, or any interest in the same, and to grant licenses for the use and practice of the same or any of them and to let or allow to be used or otherwise deal with any inventions, patents or privileges in which the Company may be interested, and to do all such acts and things as may be deemed expedient for turning to account any inventions, patents and privileges in which the Company may be interested.
30. To expend money on experimenting upon and testing and improving or securing any process or processes' patent, or protecting any invention or inventions which the Company may acquire or propose to acquire or deal with.
31. To distribute among the members of the Company, in kind or otherwise, any property of the Company and, in particular, any shares, debentures or securities of other companies belonging to this Company, or of which this Company may have the power of disposing.
32. To create any reserve fund, sinking fund, insurance fund or any other special fund, whether for depreciation or for repairing, insuring, improving, extending or maintaining any of the property of the Company or for any other purpose conducive to the interests of the Company.

3. Notwithstanding anything stated in any object clause, the company shall obtain such other approval or license from competent authority, as may be required under any law for the time being in force, to undertake a particular business.

4. It is hereby undertaken that the Company shall not engage in banking business or any business of investment company or non-banking finance company or insurance or leasing or business of managing agency or in any unlawful business and that nothing contained in the object clauses shall be so constructed to entitle it to engage in such business directly or indirectly and the Company shall not launch multi-level marketing (MLM) Pyramid and Ponzi Schemes.

IV. The liability of the members is limited.

V. The authorized capital of the company is Rs.1,00,000/- (Rupees One Hundred Thousands) divided into 10,000 ordinary shares of Rs.10 each with power to increase, reduce, consolidate or otherwise the share capital and to divide the shares of the company into different classes in accordance with the provisions of the Companies Ordinance, 1984.

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP
REGISTRATION OFFICE FAISALABAD

We, the several persons whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of this memorandum of association, and we respectively agree to take the number of shares in the capital of the company set opposite our respective names.

Name and Surname (present & former) in full (in Block Letters)	NIC No.	Father's Name in full	Nationality	Occupation	Residential address in full	Number of shares taken by each subscriber	Signatures
Haji Manzoor Hussain	33100-3046217-9	Haji Jan Muhammad	Pakistani	Business	House No.P-44, Chohar Majra, Ghulam Muhammad Abad, Faisalabad.	5000	
Sabir Hussain	33100-8401794-5	Manzoor Hussain	Pakistani	Business	House No.P-17, Mian Gujjar Wali, Ghulam Muhammad Abad No.1, Faisalabad.	2500	
Nasrullah Khan	33100-8793370-1	Manzoor Hussain	Pakistani	Business	Chohar Majra, House No.P-44, Street No.1, Mohallah Ghulam Muhammad Abad, Faisalabad.	2500	

Total number of shares taken 10000
(Ten Thousands)

Dated 11th day of March 2013

Witness to above signatures.

15/3/13

Signatures

Mr. Ghulam Qadir S/o Sher Muhammad

NIC No.33100-0924664-1

R/o House No.641-B, Mohallah Hakiman Wala Chowk,
Ghulam Muhammad Abad, Faisalabad

Occupation Business

Certified to be true Copy

12/12/14

Joint Registrar
Securities & Exchange
Commission of Pakistan
Company Registration Office
FAISALABAD.

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
COMPANY REGISTRATION OFFICE FAISALABAD
SECP

THE COMPANIES ORDINANCE, 1984

(Private Company Limited by Shares)

ARTICLES OF ASSOCIATION
OF
DATA HYDROPOWER (PRIVATE) LIMITED

1. The Regulations contained in Table 'A' to the First Schedule to the Companies Ordinance, 1984 (the "Ordinance") shall be the regulations of **DATA HYDROPOWER (PRIVATE) LIMITED** (the "Company") so far as these are applicable to a private company.

PRIVATE COMPANY

2. The Company is a "Private Company" within the meaning of Section 2(1)(28) of the Ordinance and accordingly:

(1) No invitation shall be made to the public to subscribe for the shares or debentures of the Company.

(2) The number of the members of the Company (exclusive of persons in the employment of the Company), shall be limited to fifty, provided that for the purpose of this provision, where two or more persons hold one or more shares in the company jointly, they shall be treated as single member; and

(3) The right to transfer shares of the Company is restricted in the manner and to the extent herein appearing.

TRANSFER OF SHARES

3. A member desirous to transfer any of his shares shall first offer such shares for sale or gift to the existing members and in case of their refusal to accept the offer, such shares may be transferred to any other person, as proposed by the transferor member, with the approval of the Board of Directors.

DIRECTORS

4. The number of directors shall not be less than two or a higher number as fixed under the provisions of Section 178 of the Ordinance. The following persons shall be the first directors of the Company and shall hold the office upto the date of First Annual General Meeting:

1. **MANZOOR HUSSAIN**
2. **SABIR HUSSAIN**
3. **NASRULLAH KHAN**

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP
COMPANY REGISTRATION OFFICE FAISALABAD

We, the several persons whose names and addresses are subscribed, are desirous of being formed into a company, in pursuance of these articles of association, and we respectively agree to take the number of shares in the capital of the company set opposite our respective names.

Name and Surname (present & former) in full (in Block Letters)	NIC No.	Father's Name in full	Nationality	Occupation	Residential address in full	Number of shares taken by each subscriber	Signatures
Haji Manzoor Hussain	33100-3046217-9	Haji Jan Muhammad	Pakistani	Business	House No.P-44, Chohar Majra, Ghulam Muhammad Abad, Faisalabad.	5000	
Sabir Hussain	33100-8401794-5	Manzoor Hussain	Pakistani	Business	House No.P-17, Mian Gujjar Wali, Ghulam Muhammad Abad No.1, Faisalabad.	2500	
Nasrullah Khan	33100-8793370-1	Manzoor Hussain	Pakistani	Business	Chohar Majra, House No.P-44, Street No.1, Mohallah Ghulam Muhammad Abad, Faisalabad.	2500	

Total number of shares taken 10000
(Ten Thousands)

Dated 11th day of March 2013

Witness to above signatures.

Signatures

Mr. Ghulam Qadir S/o Sher Muhammad

NIC No.33100-0924664-1

R/o House No.641-B, Mohallah Hakiman Wala Chowk,
Ghulam Muhammad Abad, Faisalabad

Occupation Business

1.COMPANY RECISTRATION NO
2.THE DATE ON WHICH THE DOCUMENTS
REGISTERED FILED OR RECORDED

15/3/13.

JOINT REGISRAR OF COMPANIES
FAISALABAD REGION.

Certified to be true Copy

12/3/13

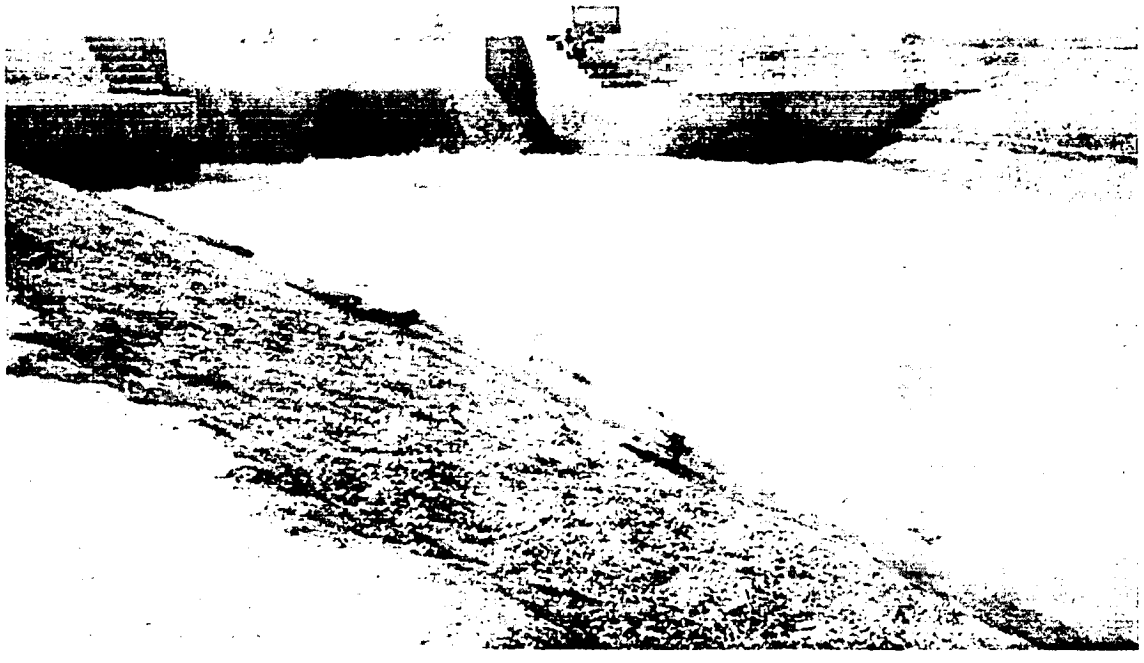
Joint Registrar
Securities & Exchange
Commission of Pakistan
Company Registration Office
FAISALABAD.

SECURITIES AND EXCHANGE COMMISSION OF PAKISTAN
SECP
COMPANY REGISTRATION OFFICE FAISALABAD

APPLICATION FOR GENERATION LICENSE

DATA HYDROPOWER PRIVATE LIMITED (300 KW)

DISTRICT CHINIOT , PUNJAB



DATA HYDROPOWER PRIVATE LIMITED

House No. P-44, Street Main Gujjar , Ghulam Muhammad-Abad No.1, Fsd.

CHECK LIST FOR EXAMINATION OF

New Generation Facility (hydel)-License Application

1. Name of company : Data Hydropower Private Limited
2. Capacity : 0.3 MW
3. Prepared / Uploaded on :
4. Application is being pursuant to NEPRA Regulations 1999 (Application and Modification Procedure

Regulation #	Information / Documents required	Yes	No	Comments/Remarks
3 (1)	An application for a license shall be made in the form specified in schedule 1 to these rules. Authorization from board of Directions Resolution / power of Attorney.	Yes	-	Format given in schedule-I has been used. The applicant is the Chief Executive Authorized
3 (3)	The Register shall not receive the application unless it is accompanied with the correct amount of application fee. (including indexation)	Yes	-	Attached
3 (4)	The application for a license shall be submitted in triplicate.	Yes	-	Three Copies attached
3 (5) (a) (i)	Certified copy of Certificate of incorporation shall be filled as documents-in-support along with application for license.	-	No	Attached
3 (5) (a) (ii)	Certified copy of Memorandum and Articles of Association shall be filled as documents-in-support along with application for license.	Yes	-	Attached
3 (5) (a) (iii)	Certified copy of Annual Return in case of applicant required to be submitted to the Registrar of Companies pursuant to section 156 of the Ordinance shall be filled as documents-in support along with application for license.	Yes	-	attached

3 (5) (a) (iv)	In case of an applicant to whom sub-clause (a)(iii) of sub-clause (s) is not applicable, a return comprising all such information, in as close a form and content as possible, laid down in the third schedule to the Ordinance.	-	**No**	Not applicable
3 (5) (b)	A reasonably detailed profile of the experience of the applicant, its management staff and its members in the electricity industry.	**Yes**	-	Haji Manzoor Hussain Chief Executive Data Hydropower Private Limited has been running a plant of oil Mills being head of his own registered firm " Data Oil Mill" since 1972. He is considered to be a successful industrialist and business man
3 (5) (c)	The curriculum vitae of the applicant's senior management, technical and professional staff	**Yes**	-	Qualified, experienced and competent management and technical staff will be appointed and after final approval of the project.
3 (5) (d) (i)	Evidence, Satisfactory to the Authority, of the availability of adequate financial and technical resources to the applicant for the purpose of the generation, transmission or distribution business, as the case may be , and such evidence may consist of : Cash balances held in reserve along with Bank certificate;	**Yes**	-	Attached
3 (5) (d) (ii)	Evidence, Satisfactory to the Authority, of the availability of adequate financial and technical resources to the applicant for the purpose of the generation, transmission or distribution business, as the case may be , and such evidence may consist of : Expression of interest to provide credit of financing along with sources and details thereof;	**Yes**	-	Ours is a self financial project no loan etc is involved.
3 (5) (d) (iii)	Evidence, Satisfactory to the Authority, of the availability of adequate financial and technical resources to the applicant for the purpose of the generation, transmission or distribution business, as the case may be , and such evidence may consist of : latest financial statements of the applicant;	**Yes**	-	Latest financial statement attached.

3 (5) (d) (iv)	Evidence, Satisfactory to the Authority, of the availability of adequate financial and technical resources to the applicant for the purpose of the generation, transmission or distribution business, as the case may be , and such evidence may consist of : employment records of engineering and technical staff of the applicant proposed to be employed;	**Yes**	-	We have hired the services of Lead Engineering Services Pakistan (Lespak), Lahore for engineering services. The engineering staff to be appointed will be submitted later.
3 (5) (d) (v)	Evidence, Satisfactory to the Authority, of the availability of adequate financial and technical resources to the applicant for the purpose of the generation, transmission or distribution business, as the case may be , and such evidence may consist of: profile of sub-contractors, if any, along with expressions of interest of sub-contractors;	**Yes**	-	Not applicable
3 (5) (d) (vi)	Evidence, Satisfactory to the Authority, of the availability of adequate financial and technical resources to the applicant for the purpose of the generation, transmission or distribution business, as the case may be , and such evidence may consist of : certifiable references in respect of experience of the applicant and its proposed sub-contractors;	**Yes**	-	Attached
3 (5) (e)	In respect of a going concern, details of any charges or encumbrances attached to the company's assets;	**Yes**	-	Pre-qualification document having financial details is attached. Ours is a new private limited Company and the project has not yet started.
(5) (f)	In case of a first applicant for a license by a going concern, technical and financial proposals in reasonable detail for the operation, maintenance, planning and development of the generation, transmission, or distribution facility or system in respect of which the license is sought;	-	**No**	Feasibility Report of the project is attached which contains detailed information

3 (5) (g) (a)	In case of : generation license applications, the type, technology, model, technical details and design of	**Yes**	-	Construction designed attached

	the facilities proposed to be acquired, constructed, developed or installed;			
3 (5)(g)(b)(i)	Distribution and transmission license application : the type, technology, model, technical details and design of the facilities proposed to be acquired, constructed, developed or installed.	**Yes**	-	Detail given in feasibility Repot
3 (5)(g)(b)(ii)	Distribution and transmission license application : a territorial map of the service area proposed to be covered	-	**No**	Not applicable
3 (5)(g)(b)(iii)	Distribution and transmission license application : particulars in respect of the availability, sources, rates and evidence of commitments from the sources of electric power.	-	**No**	Not applicable
3 (5) (h) (i)	In case of a license for a new facility or system, a feasibility report in respect of the project, specifying in details: the type, technology, model, technical details and design of the facilities proposed to be acquired, constructed, developed or installed.	**Yes**	-	Feasibility Report and Construction drawings attached
3 (5) (h) (ii)	In case of a license for a new facility or system, a feasibility report in respect of the project, specifying in details: the expected life of the facility or the system;	**Yes**	-	Thirty Three (33) Years extendable
3 (5) (h) (iii)	In case of a license for a new facility or system, a feasibility report in respect of the project, specifying in details: the location of the facility or the system, or the territory with outer boundaries within which the facilities or the system is proposed to be installed and operated by the license, along with maps and plans; and	**Yes**	-	Information included in the Feasibilty Report
5 (5) (I)	A Prospectus	**Yes**	-	All Information to be shown in prospectus is included in the Feasibility Report.

Schedule III [Regulations 3(6)]

(C) New Generation Facilities (Hydel)

1.	Location (location maps, site map)	**Yes**	-	Attached
2.	Plant : Run of the River storage, weir	**Yes**	-	The project is being built on bhowana Branch Canal
3.	Head : Minimum, Maximum	**Yes**	-	Included in the feasibility report
4.	Technology : Francis, Pelton, etc size, number of units	**Yes**	-	Turbine : Horizontal Shaft With gears, Kaplan Units : 2 Nos,
5.	Tunnel (if proposed) : length, diameter	**Yes**	-	Tunnel is not required
6.	ESSA (Environmental & Social Soundness Assessment)	**Yes**	-	Copy of IEE report along with environmental approval letter issued by the Punjab Environmental Protection Department is attached
7.	Detailed Feasibility Report	**Yes**	-	Copy provided
8.	Resettlement Issues	**Yes**	-	No such issue is involved
9.	Consents	**Yes**	-	IEE Approval. Approval of the project by the panels of experts issued by Punjab power Development Board Energy

				Department.
10.	Infrastructure development	**Yes**	-	Construction Drawing attached
11.	Interconnection with National Grid Company, Distance and name of the nearest grid, voltage level (single line diagram)	**Yes**	-	The Electricity Generated will be sold to an industrial firm, Fatima Industry near the generating plant.
12.	Project Cost, Information regarding sources and amounts of equity and dept.	**Yes**	-	Pre-qualification Document containing required information is attached
13.	Project schedule, expected life	**Yes**	-	Construction period is three years. Project life is assumed as thirty five years
14.	Peaking / base load operation	**Yes**	-	Base load
15.	Plant characteristics : generation voltage power factor, frequency, automatic generation control, ramping rate, control metering and instrumentation	**Yes**	-	Information included in attached feasibility Report
16.	System studies load flow short circuit, stability studies	**Yes**	-	Included in Feasibility Report
17.	Training and development	**Yes**	-	

Expression of interest

Regulation 3(5) (ii)

Data Hydropower Private Limited aims t Generation of Electric Power of Bhowana Branch canal at two adjacent falls. The power generated will be 300 kilowatt and will be utilized in the industrial plant set up by Fatima Industry quite adjacent to the power house. The power house will be set up on the land owned by irrigation department taken on 33 years lease.

Data Hydropower Project is self-financing. No loan etc. is involved. The company will meet all the financial requirements from its own sources.

AKRAM AND COMPANY
Chartered Accountants

AUDITOR'S REPORT TO THE MEMBERS

We have audited the annexed balance sheet of **Data Hydropower (Pvt.) Limited** as at **June 30, 2014** and the related profit and loss account, statement of comprehensive income, statement of cash flows and statement of changes in equity together with the notes forming part thereof, for the year then ended and we state that we have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit.

It is the responsibility of the company's management to establish and maintain a system of internal control, and prepare and present the above said statements in conformity with the approved accounting standards and the requirements of the Companies Ordinance, 1984. Our responsibility is to express an opinion on these statements based on our audit.

We conducted our audit in accordance with the auditing standards as applicable in Pakistan. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the above said statements are free of any material misstatements. An audit includes examining, on the test basis, evidence supporting the amount and disclosures in the above said statements. An audit also includes assessing the accounting policies and significant estimates made by the management, as well as, evaluating the overall presentation of the said statements. We believe that our audit provides a reasonable basis for our opinion and, after due verification, we report that;

a) In our opinion, proper books of account have been kept by the company as required by the Companies Ordinance, 1984;

b) In our opinion;

1 The balance sheet and profit and loss account together with the notes thereon have been drawn up in conformity with the Companies Ordinance, 1984 and are in agreements with the books of accounts and are further in accordance with accounting policies consistently applied.

2 The expenditure incurred during the year was for the purpose of the company's business; and

3 The business conducted, investment made and the expenditure incurred during the year were in accordance with the object of the company.

c) In our opinion and to the best of our information and according to the explanations given to us, the balance sheet, profit and loss account, statement of comprehensive income, statement of cash flows and statement of changes in equity together with the notes forming part thereof conform with approved accounting standards as applicable in Pakistan, and give the information required by the Companies Ordinance, 1984, in the manner so required and respectively give a true and fair view of the state of the company's affairs as at **30th June, 2014** and of the **loss,** its comprehensive income, cash flows and changes in equity for the year then ended.

d) In our opinion no Zakat was deductible at source under the Zakat and Ushr Ordinance, 1980 (XVIII of 1980).

Date: January 16, 2015
Place: Faisalabad

AKRAM AND COMPANY
Chartered Accountants
Audit Engagement Partner: Muhammad Akram, ACA

DATA HYDROPOWER (PRIVATE) LIMITED
BALANCE SHEET
AS AT JUNE 30, 2014

	Note	2014 Rupees	2013 Rupees
EQUITY AND LIABILITIES			
Share capital and reserves			
Authorized			
10,000 (2013:10,000) ordinary shares of Rs.100 each		**100,000**	100,000
Issued, subscribed and paid up			
10,000 (2013:10,000) ordinary shares of Rs.100 each fully paid in cash		**100,000**	100,000
Accumulated profit/(loss)		**(50,000)**	(20,000)
Equity		**50,000**	80,000
Non-Current liabilities			
Directors Loan	3	**2,370,000**	70,000
Current liabilities			
Trade Payables		**-**	-
		-	-
Contingent Liabilities and Committments	4	**0**	0
		2,420,000	150,000

	Note	2014 Rupees	2013 Rupees
ASSETS			
Non current assets			
Property, plant and equipment	5	**2,270,000**	100,000
		2,270,000	100,000
Current assets			
Advances, Deposits and receivables		**-**	-
Cash and bank balances	6	**150,000**	50,000
		150,000	50,000
		2,420,000	150,000

The annexed notes form an integral part of these financial statements.

CHIEF EXECUTIVE OFFICER

DIRECTOR

DATA HYDROPOWER (PRIVATE) LIMITED
PROFIT AND LOSS ACCOUNT
FOR THE YEAR ENDED JUNE 30, 2014

	Note	**2014** **Rupees**	2013 Rupees
Sales-net		-	-
Cost of sales		-	-
Gross/Trading profit		-	-
Other expenses--Depreciation/incorporation expenses		30,000	20,000
		30,000	20,000
Profit / (Loss) before taxation		**(30,000)**	**(20,000)**
Current year Taxation	#REF!	-	-
Profit / (Loss) for the year		**(30,000)**	**(20,000)**

The annexed notes form an integral part of these financial statements.

CHIEF EXECUTIVE OFFICER **DIRECTOR**

DATA HYDROPOWER (PRIVATE) LIMITED
COMPREHINSIVE INCOME STATEMENT
FOR THE YEAR ENDED JUNE 30, 2014

	2014 **Rupees**	2013 Rupees
Profit/(Loss) fot the year	**(30,000)**	(20,000)
Other comprehensive income--net of tax	**0**	0
Total comprehensive income--net of tax	**(30,000)**	(20,000)

The annexed notes form an integral part of these financial statements.

CHIEF EXECUTIVE OFFICER **DIRECTOR**

DATA HYDROPOWER (PRIVATE) LIMITED
STATEMENT OF CHANGES IN EQUITY
AS AT JUNE 30, 2014

Particular	Issued, subscribed and paid up capital	Unappropriated profit	Total
	Rupees	Rupees	Rupees
Balance as at June 30, 2012	-	-	-
Profit/(loss) for the year after tax	-	(20,000)	(20,000)
Balance as at June 30, 2013	100,000	(20,000)	(20,000)
Profit/(loss) for the year after tax	-	(30,000)	(30,000)
Balance as at June 30, 2014	**100,000**	**(50,000)**	**(50,000)**

The annexed notes form an integral part of these financial statements.

CHIEF EXECUTIVE OFFICER **DIRECTOR**

DATA HYDROPOWER (PRIVATE) LIMITED
STATEMENT OF CASH FLOWS
FOR THE YEAR ENDED JUNE 30, 2014

		2014	2013
		Rupees	Rupees
A	**Cash flows from operating activities**		
	(Loss)/Profit before tax	**(30,000)**	(20,000)
	Adjustments for		
	Depreciation	**30,000**	-
	Operating cash flows before working capital changes	**-**	(20,000)
	Working capital changes		
	(Increase)/decrease in current assets		
	Advances, Deposits and receivables	-	-
	Increase/(decrease) in current liabilities		
	Trade Payables	-	-
		-	-
	Cash generated from / (used in) operations	-	(20,000)
	Tax paid	-	-
	Net cash generated from operating activities	-	(20,000)
B	**Cash flows from investing activities**		
	Issuance of share capital	-	100,000
	Directors Loan	**2,300,000**	70,000
	Net cash (used in) investing activities	**2,300,000**	170,000
C	**Cash flows from financing activities**		
	Aquisition of property, plant and equipments	**(2,200,000)**	(100,000)
	Net cash generated from in financing activities	**(2,200,000)**	(100,000)
	Net (decrease) / increase in cash and cash equivalents (A+B+C)	**100,000**	50,000
	Cash and cash equivalents at the beginning of the year	**50,000**	-
	Cash and cash equivalents at the end of the year	**150,000**	50,000

The annexed notes form an integral part of these financial statements.

CHIEF EXECUTIVE OFFICER **DIRECTOR**

DATA HYDROPOWER (PRIVATE) LIMITED
NOTES TO THE FINANCIAL STATEMENTS
AS AT JUNE 30, 2014

1 The status and activities

1.1 Data Hydropower (Pvt) Limited was incorporated on March 15, 2013 as a private limited company under the Companies Ordinance 1984. The company is engaged in the business of manufacturing and sale of hydro electric power. The registered office of the company is situated at P-44, Street Mian Gujjar, Ghulam Muhammad Abad No. 1, Faisalabad in the province pof Punjab.

1.2 The financial statements are presented in Pak Rupee, which is the Company's functional and presentation currency.

2 Summary of significant accounting policies

2.1 Statement of compliance

These financial statements have been prepared in accordance with the requirements of the Companies Ordinance, 1984 (the ordinance) and approved accounting standards as applicable in Pakistan. Approved accounting standards comprise of Accounting and Financial Reporting Standard for Small Sized Entities (SSEs) issued by the Institute of Chartered Accountants of Pakistan and provisions of and directives issued under the ordinance. In case requirements of the ordinance or directives differ with the requirements of the standards, the requirements of the ordinance or of the said directives take precedence.

2.2 Accounting convention

These financial statements have been prepared under the historical cost convention.

2.3 Taxation

Normal

Current

Charge for current taxation is based on taxable income at current rates after taking into account rebates and tax credits, if any. Deferred taxation has not been provided as the company has no differences between accunting and taxable income.

Deferred

Deferred tax is provided using the liability method for all temporary differences at the balance sheet date between tax bases of assets and liabilities and their carrying amounts for financial reporting purposes. In this regard, the effects on deferred taxation of the portion of income subject to final tax regime is also considered in accordance with the requirement of Technical Release - 27 of The Institute of Chartered Accountants of Pakistan.

2.4 Provisions

Provisions are recognized in the balance sheet when the company has a legal or constructive obligation as a result of past events, and it is probable that an outflow of economic benefits will be required to settle the obligation. However, provisions are reviewed at each balance sheet date and adjusted to reflect current best estimate.

2.5 Trade and other payables

Liabilities for trade and other payables are measured at cost which is the fair market value of the consideration to be paid in future for goods and services received, whether billed to the company or not.

2.6 Property, plant and equipment

Owned

These are stated at cost less accumulated depreciation except freehold land which is stated at cost. Depreciation is charged to income on reducing balance method at the rates given in the property, plant and equipment note to write off the cost of assets over their expected useful life. Depreciation on normal additions during the year is charged from the date an asset isd put in use till the date of de-recognition of an asset. Maintenance and normal repairs are charged to income as and when incurred. Major renewals and improvements are capitalized.

Gain or loss on disposal of property, plant and equipment is recognized in current year's income.

2.7 Assets subject to finance lease

The lease liability recognised by using the present value of minimum lease payments and fair value whichever is lower. Assets subject to finance lease are depreciated over their expected useful lives on the same basis as owned assets are depreciated.

2.8 Trade debts and other receivables

Trade debts are recognized and carried at original invoice amount. Those considered bad and irrecoverable are written off and provision is made against those considered doubtful.

2.9 Cash and cash equivalents

Cash and cash equivalents are carried in the balance sheet at cost. For the purpose of cash flow statement, cash and cash equivalents consist of cash in hand, balances with banks, highly liquid short-term investments that are convertible to known amounts of cash and are subject to insignificant risk of change in value.

2.10 Revenue recognition

Revenue from sale of goods is recognized on dispatch of goods to customers.

2.11 Finance cost

Interest, mark-up and other charges on long term liabilities are capitalized up to the date of commissioning of respective property, plant and equipment acquired out of the proceeds of such long term liabilities. All other interest, mark-up and other charges are charge to income.

2.12 Foreign currency

All monetary assets and liabilities on foreign currencies are translated into Pak rupees at the rates of exchange prevailing at the balance sheet date or at the contracted rates while foreign currency transactions are initially recorded at the rates of exchange prevailing at the transaction date or at the contracted rates. The company charges all the exchange differences to profit and loss account.

2.13 Staff retirement benefits

The company operates unfunded grauity scheme covering all its employees. Payment for gratuity is made annually on the basis of last drawn salary and length of service and minimum qualifying period is considered to be one year.

2.14 Capital work in progress

All costs/expenditures connected with assets incurred during installations and construction period are included in this head. These are transferred to specific asset as and when assets are available for use.

2.15 Store and spares

These are valued at cost, determined on moving average method less allowance for obsolete and slow moving items. Items in transit are valued at cost comprising invoice value plus other charges incurred thereon.

2.16 Offsetting of financial asset and liability

A financial asset and financial liability is offset and the net amount is reported in the balance sheet, if the company has a legal enforceable right to offset the transaction and also intends either to settle on a net basis or to realise the asset and settle the liability simultanneously.

2.17 Related party transactions

Transactions with related parties are priced on arm's length basis. Prices for these transactions are determined on the basis of compareable uncontrolled price meth, which sets the price by reference to comparable goods and services sold in an economically comparable market to a buyer unrelated to the seller.

2.18 Impairment

The carrying amounts of the company's assets are reviewed at each balance sheet date to determine whether there is any indication of impairment. If any such indication exists, the assets recoverable amount is estimated and impairment losses are recognized in the profit and loss account.

2.19 Critical accounting estimates and judgments

The preparation of financial statements in conformity with accounting and financial reporting standards requires management to make judgments, estimates and assumptions that affect the application of policies and reported amounts of assets and liabilities, income and expenses. The estimates and associated assumptions are based on historical experience and various other factors that are believed to be reasonable under circumstances, the results of which form the basis of making judgments about carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates. The estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognized in the period in which the estimates are revised.

Significant areas requiring the use of management estimates in these financial statements relate to the useful life of depreciable assets, provision for doubtful receivables and slow moving inventory. However, assumptions and judgments made by management in the application of accounting policies that have significant effect on financial statements are not expected to result in material adjustment to the carrying amounts of assets and liabilities in the next year.

			2014 Rupees	2013 Rupees
3	**Directors Loan**			
	Director's Loan	3	2,370,000	70,000
			2,370,000	**70,000**

Loan from directors of the company was obtained for indefinite period at nill mark-up and was payable at the option of the company.

4 **Contingent Liabilities**

The company was not liable for any contingent liabilities and commmittments on the date of financial statements

5 **Property, plant and equipment**

Operating assets---Own

PARTICULARS	COST			DEPRECIATION			W.D.V	Rate %
	As at July 01, 2013	Addition/ (Deletion)	As at June 30, 2014	As at July 01, 2013	For the year	As at June 30, 2014	As at June 30, 2014	
			| R U P E E S |					
Power Plant	0	2,000,000	2,000,000	0	0	0	2,000,000	
Furniture & Fixture	100,000	-	100,000	0	10,000	10,000	90,000	10
Office Equipments	200,000	-	200,000	0	20,000	20,000	180,000	10
	300,000	**2,000,000**	**2,300,000**	-	**30,000**	**30,000**	**2,270,000**	

2013

Own

PARTICULARS	COST			DEPRECIATION			W.D.V	Rate %
	As at March 15, 2013	Addition/ (Deletion)	As at June 30, 2013	As at March 15, 2013	For the year	As at June 30, 2013	As at June 30, 2013	
			| R U P E E S |					
Furniture & Fixture	0	100,000	100,000	0	-	-	100,000	10
	-	100,000	100,000	-	-	-	100,000	

5.1 **Depreciation has been allocated as under**

Cost of sales	-	-
Administrative	**30,000**	-
	30,000	-

6 **Cash and bank balances**

Cash in hand	**150,000**	50,000
Cash at bank - in current accounts	-	-
	150,000	50,000

7 **Remuneration to Chief Executive and Directors**

	2014			2013		
	Chief Executive	**Directors**	**Total**	Chief Executive	Directors	Total
	Rupees			Rupees		
Remuneration	-	-	-	-	-	-
Allowances	-	-	-	-	-	-
	-	-	-	-	-	-
Number of persons	**1**	**2**	**3**	1	2	3

The directors have waived off their meeting fees.

8 **Related Party Transactions**

The Company in the normal course of business carries out transactions with related parties which comprise of key management personnel. Amount due to/from related parties are shown under relevant notes to the financial statements except remuneration to Chief Executive Officer which is disclosed in relevant note. There are no other significant transactions with related parties.

9 **Fair value of financial assets and liabilities**

The carrying value of all the financial assets and liabilities reported in the financial statements approximates their fair value.

10 Total number of employees

The total number of employees/workers as at the balance sheet date were Nil

11 **General**

Figures have been rounded off to the nearest rupee.

Figures have been rearranged where necessary for comparison purposes.

12 **Date of authorization**

These financial statements have been authorized for issue by the board of directors of the company on October 05, 2014.

CHIEF EXECUTIVE OFFICER **DIRECTOR**

IX

Profile of subcontractor

Name :	Munir Ahmad
Father's Name:	Shah Muhammad
Residence:	House P-45, Street Mian Gujjar, Ghulam Muhammadabad
	No.1, Faisalabad.
Profession:	Builder
Experience:	35 years as constructions of buildings.

Prospectus

Introduction

THE Directors of Data Hydropower project are experienced industrialists especially the Chief executive of the company is highly experienced industrialist. He started business in 1962 in the name of the firm Jan Muhammad and Sons. In 1972, he set up an oil mill named Data Oil Mills which has been successfully doing business till recent months. Recently we were forced to close it because of acute shortage of power.

Facility

The electric power generation plant will be set up at Bhowana Branch canal at two adjacent falls at the land owned by irrigation department. The land is being acquired on 33 years lease (extendable). The power produced will be used in industry situated quite close to the power house.

Investment.

The total cost of the project 5104 million rupees shall be borne by the company from its own financial resources. No loan etc. will be acquired from any financial organization. So, it is entirely self-financing project.

Environment

The project will not have any negative effect on environment. A detailed environmental study was undertaken (IEE report attached) and approval was given by the Punjab environmental protection department which is submitted along with the application. Healthy environmental conditions will be provided to the staff working in the project.

XII

Head Available

1. Fall at R.D, 7+449

Design discharge	506 cusses
Upstream water level	594.26 ft.
Downstream water level	584.61 ft.
Crest level	591.61ft.
Working head	9.67 ft.
Bed width upstream	57 ft.
Bed width downstream	57 ft.
Water surface slope	0.22%

2. Fall at R.D 8+950

Design discharge	785 cusses
Upstream water level	584.363 ft.
Downstream water level	576.84 ft.
Crest level	578.80 ft.
Working head	7.10 ft.
Canal bed width upstream	57 ft
Canal bed width downstream	57 ft.
Water surface slope	0.22%

XIII

SIZE AND NUMBER OF UNITS

No. of turbines 4

Very low head Kaplan bevel gear turbine, horizontal axis.

Size

Head	2.8 m
Discharge	11.32 m^3/sec
Specific weight	9810 N/m^3
Efficiency	0.75
Outer diameter of runner	1.8m
Hub diameter	0.63m
Flow velocity	5.0 m/s

Note: other details included at page 59 of feasibility report attached.

XVI

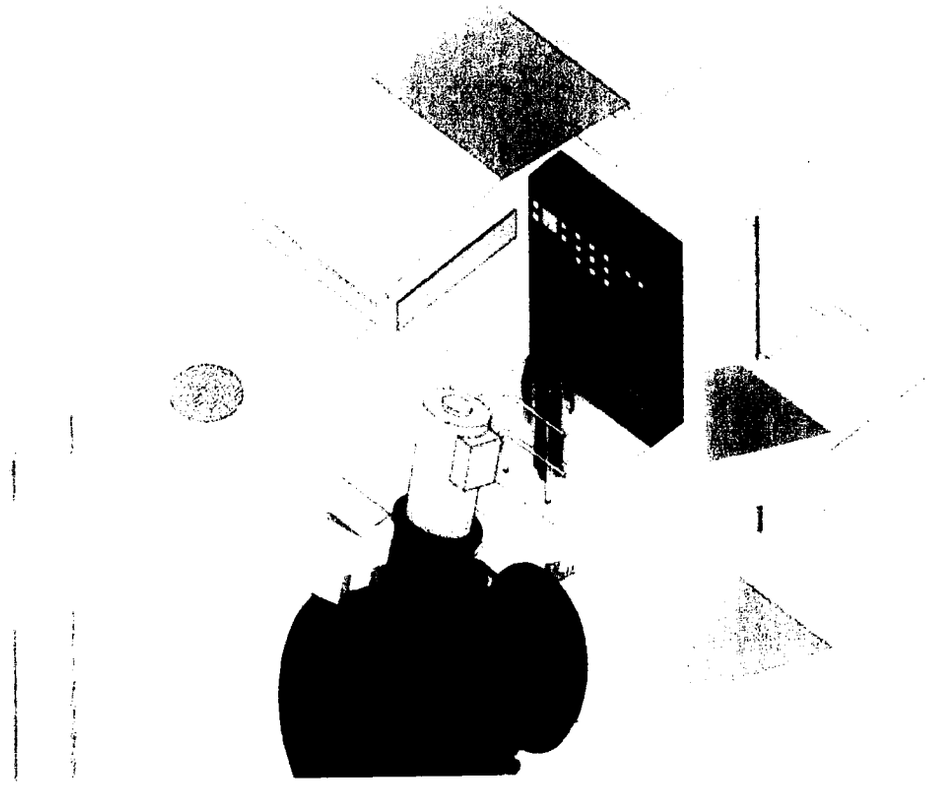
Plant characteristics

1.	Generation voltage	3/Phase, 415 V
2.	Frequency	50 Hz
3.	Power factor	0.85 Lagging
4.	Automatic generation	manual
5.	Ramping ratio	10 minutes
6.	Control metering and instrumentation	C.T operated

DRAFT

Data Oil Mills, P-100, Nar Wala Road Near Marzi pura, Faisalabad

DATA HYDROPOWER PROJECT ON Bhowana Branch at RD.7+4449 and RD 8+950, District Chiniot



FEASIBILITY REPORT

AUGUST 2013

LEAD ENGINEERING SERVICES PAKISTAN (LESPAK)
P-10, Staff Colony, U.E.T. Lahore. Pakistan.
Tel: +92-42-902 9139, +92-42-902 9342
Email: <drzulfiqaruet@yahoo.com>

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EXECUTIVE SUMMARY

ES-1 Project Background

In the Year 2002, the GOP announced a Policy, which aimed at attracting investors for energy projects in Pakistan. The main emphasis of the policy was to promote development of indigenous coal, wind and hydropower resources of the country to meet the future energy needs. Under the Policy, the provinces had authority to plan and execute projects up to 50 MW in private sector while the PPIB being a federal entity retained the authority to develop projects up to any conceivable capacity. This initiative has started giving results and a number of medium and large hydro projects are either under construction or at various stages of development.

The Government of Punjab oversees, operates and maintains a large network of canal based irrigation system. Although primarily designed and build to maximize crop yield with timely irrigation, some of the canals have potential for hydropower generation on rapids and falls, which were provided to maintain water levels and to reduce excavation costs during construction. These rapids and falls have heads in the range of 1 – 3 m where low head equipment can be installed.

ES-3 Client and Consultants

Punjab Power Development Board, Energy Department in their letter # PPDB 282/2013 dated 05/04/2013 issued LOI (Letter of Interest) for the development of 0.3 MW HPP on Bhowana Branch at RD.7+4449 and RD 8+950, District Chiniot

To Haji Manzoor Hussain, Managing Partner, Data Oil Mills, P-100, Nar Wala Road Near Marzi pura, Faisalabad.

Data Oil Mills hired Lead Engineering Services Pakistan (LESPAK), P-10, Staff Colony, University of Engineering and Technology, Lahore for the development of Project Proposal of the said Hydropower Project.

ES-3 Project Description

The Bhowana Branch canal is a subsidiary of Jhang Branch which itself is a subsidiary of Lower Chenab Canal emerging from Khanki Head Works at the Chenab River. The Bhowana Branch is perennial canal with the capacity of about 14 cumecs. The two potential falls are situated at RD 7+449 and RD 8+950 along the branch canal (Figure 0-1). Both the falls have a gross head of above 2 m. The falls may be combined together; however, the feasible option as noted in this study is to develop power projects separately. This power project is named as Data Hydropower Project.

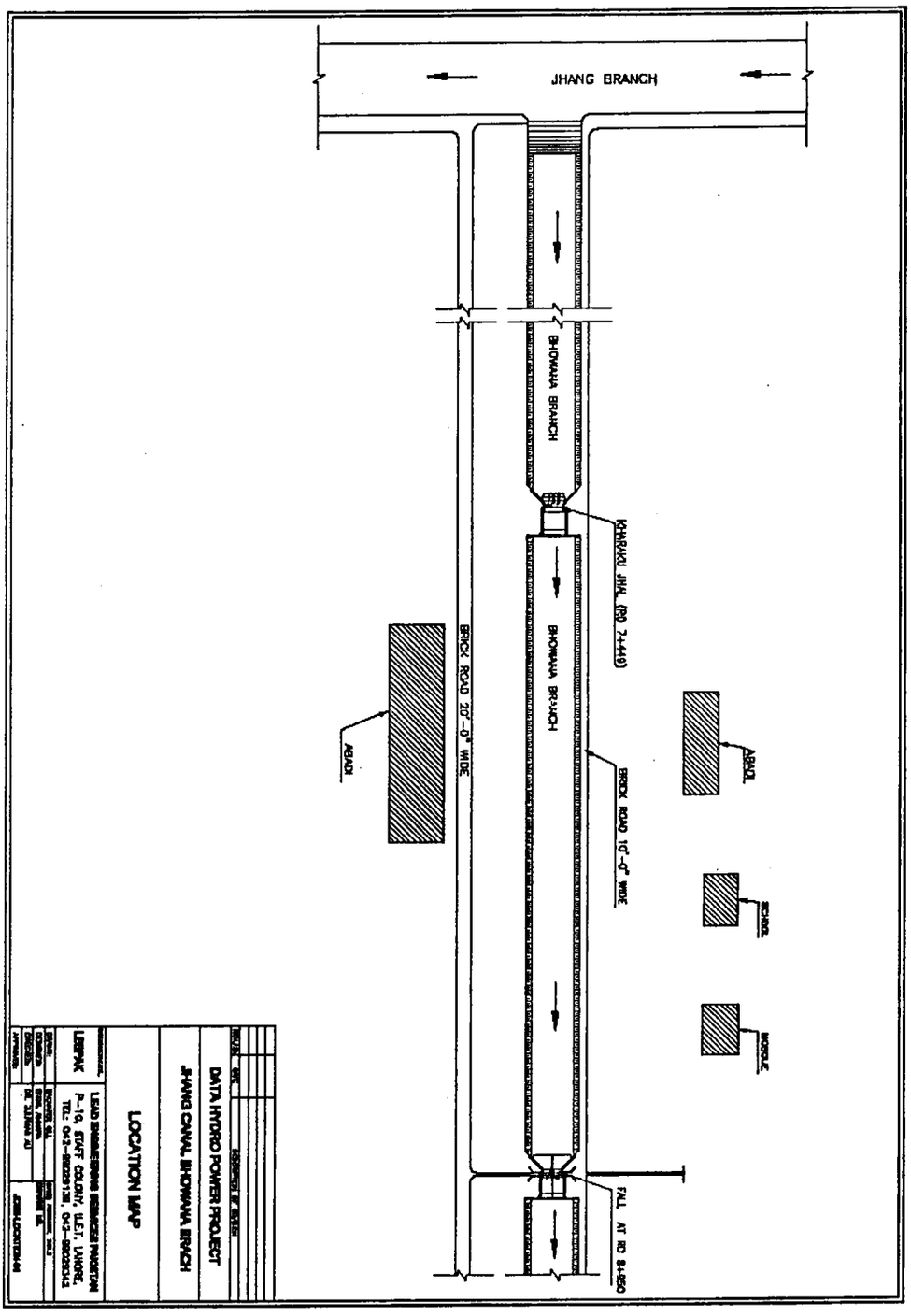


Figure 0-1 Project location map.

ES-4 Power Potential

Due to a regulated/controlled flow, it is possible to generate hydropower on the falls, rapids and barrages, where the gross head of a few meters is available. These falls and rapids are primarily created at locations where accumulated bed slope can be lumped to control water level on upstream and lower it on the downstream.

The hydropower potential of the proposed project has been assessed on the basis of discharge data provided by the Irrigation Department and head available at the falls. The power and energy is being estimated, based on historic discharge data. Table 0-1 and 0-2 shows 10-daily flows and the estimated power potential at the falls at RD 7+449 and RD 8+950, respectively.

Table0-2: 10-daily flows and power potential for the fall at RD 7+449

Month	10-daily	No of Days	Cumecs	Net Head (m)	Power (kW)	Energy (GWH)	Units (kWH)
Jan	I	10	0.0	2.80	0	0	0
	II	10	0.8	2.80	18	0.00	4438
	III	11	5.4	2.80	122	0.03	32198
Feb	I	10	9.2	2.80	209	0.05	50128
	II	10	8.6	2.80	194	0.05	46636
	III	8	7.8	2.80	177	0.03	34067
Mar	I	10	9.6	2.80	217	0.05	52154
	II	10	7.7	2.80	174	0.04	41851
	III	11	8.3	2.80	189	0.05	49835
Apr	I	10	7.2	2.80	163	0.04	39150
	II	10	7.2	2.80	163	0.04	39150
	III	10	8.9	2.80	201	0.05	48353
May	I	10	9.3	2.80	211	0.05	50649
	II	10	10.6	2.80	240	0.06	57518
	III	11	7.5	2.80	170	0.04	44847
Jun	I	10	10.4	2.80	236	0.06	56708
	II	10	8.7	2.80	198	0.05	47466
	III	11	9.0	2.80	205	0.05	54229
Jul	I	10	9.9	2.80	226	0.05	54180
	II	10	8.7	2.80	198	0.05	47620
	III	11	10.2	2.80	232	0.06	61169
Aug	I	10	8.0	2.80	182	0.04	43568
	II	10	9.7	2.80	221	0.05	53023
	III	11	8.9	2.80	201	0.05	53167
Sep	I	10	9.2	2.80	209	0.05	50090
	II	10	9.3	2.80	212	0.05	50765
	III	10	8.0	2.80	183	0.04	43838
Oct	I	10	10.8	2.80	246	0.06	59062
	II	10	6.6	2.80	150	0.04	36043
	III	11	5.6	2.80	127	0.03	33577
Nov	I	10	7.8	2.80	177	0.04	42430
	II	10	8.7	2.80	198	0.05	47543
	III	10	9.7	2.80	220	0.05	52714
Dec	I	10	8.2	2.80	187	0.04	44803
	II	10	10.6	2.80	242	0.06	58039
	III	11	5.4	2.80	123	0.03	32452
G. Total						1.61	1613463

Table 0-1 10-daily flows and power potential for the fall at RD 8+950

Month	10-daily	No of Days	Cumecs	Net Head (m)	Power (kW)	Energy (GWH)	Units (kWH)
Jan	I	10	0.0	2.00	0	0	0
	II	10	0.8	2.00	13	0.00	3173
	III	11	4.8	2.00	87	0.02	23021
Feb	I	10	8.6	2.00	149	0.04	35841
	II	10	8.0	2.00	139	0.03	33344
	III	8	7.2	2.00	127	0.02	24358
Mar	I	10	9.0	2.00	155	0.04	37289
	II	10	7.1	2.00	125	0.03	29923
	III	11	7.7	2.00	135	0.04	35631
Apr	I	10	6.6	2.00	117	0.03	27991
	II	10	6.6	2.00	117	0.03	27991
	III	10	8.3	2.00	144	0.03	34572
May	I	10	8.7	2.00	151	0.04	36213
	II	10	10.0	2.00	171	0.04	41125
	III	11	6.9	2.00	121	0.03	32065
Jun	I	10	9.8	2.00	169	0.04	40545
	II	10	8.1	2.00	141	0.03	33937
	III	11	8.4	2.00	147	0.04	38773
Jul	I	10	9.3	2.00	161	0.04	38738
	II	10	8.1	2.00	142	0.03	34048
	III	11	9.6	2.00	166	0.04	43735
Aug	I	10	7.4	2.00	130	0.03	31150
	II	10	9.1	2.00	158	0.04	37910
	III	11	8.3	2.00	144	0.04	38014
Sep	I	10	8.6	2.00	149	0.04	35813
	II	10	8.7	2.00	151	0.04	36296
	III	10	7.4	2.00	131	0.03	31344
Oct	I	10	10.2	2.00	176	0.04	42228
	II	10	6.0	2.00	107	0.03	25770
	III	11	5.0	2.00	91	0.02	24007
Nov	I	10	7.2	2.00	126	0.03	30337
	II	10	8.1	2.00	142	0.03	33992
	III	10	9.1	2.00	157	0.04	37690
Dec	I	10	7.6	2.00	133	0.03	32033
	II	10	10.1	2.00	173	0.04	41497
	III	11	4.8	2.00	88	0.02	23203
G. Total						1.15	1153597

ES-3 Design Discharge

The discharge available varies considerably and remains less than the design discharge of the canal. The maximum discharge observed in the about 10.1 cumecs against the design discharge of 14 cumecs. The design discharge for both the falls are taken as 14.3 cumecs (400 cusecs). The surplus flows can be regulated through control gates.

The Horizontal Kaplan turbines with Bevel Gear System have been selected for both the falls. Figure 0-2 shows the concept of selection of unit discharge for low head Kaplan turbines.

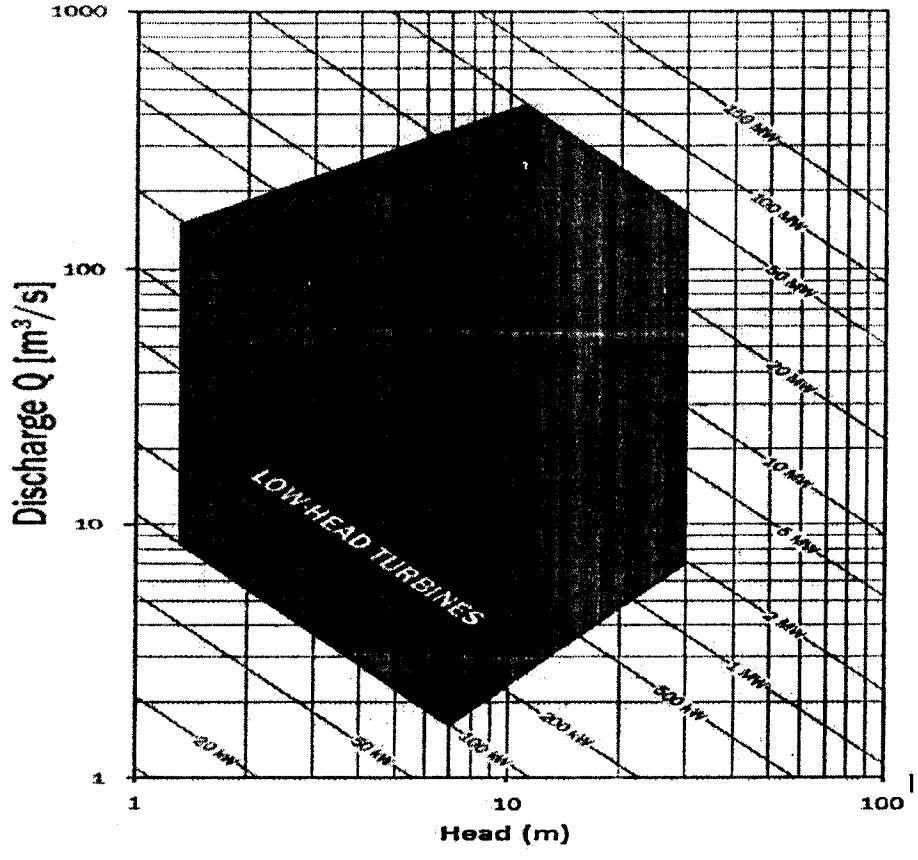


Figure 0-2 Selection of unit discharge

ES-6 Project Layout

Three options for this project have been studied. One option was the use of existing vertical drops for the development of hydro projects. Simple over-shot water wheel arrangement looks attractive, as less civil works are required. The concept was extensively debated and finally it was decided the arrangement should be independent and the amendments to the existing system should be minimum.

Bypass arrangements are being proposed on right side of both the falls. The water is proposed to be diverted on upstream of the falls by gated arrangements. The water shall be returned back in the canal on downstream of the falls. The Vertical lift gates are being proposed on both the falls. The water level on upstream shall be regulated by the gates. The finally proposed layout arrangements are shown in Figures 0-3 and 0-4.

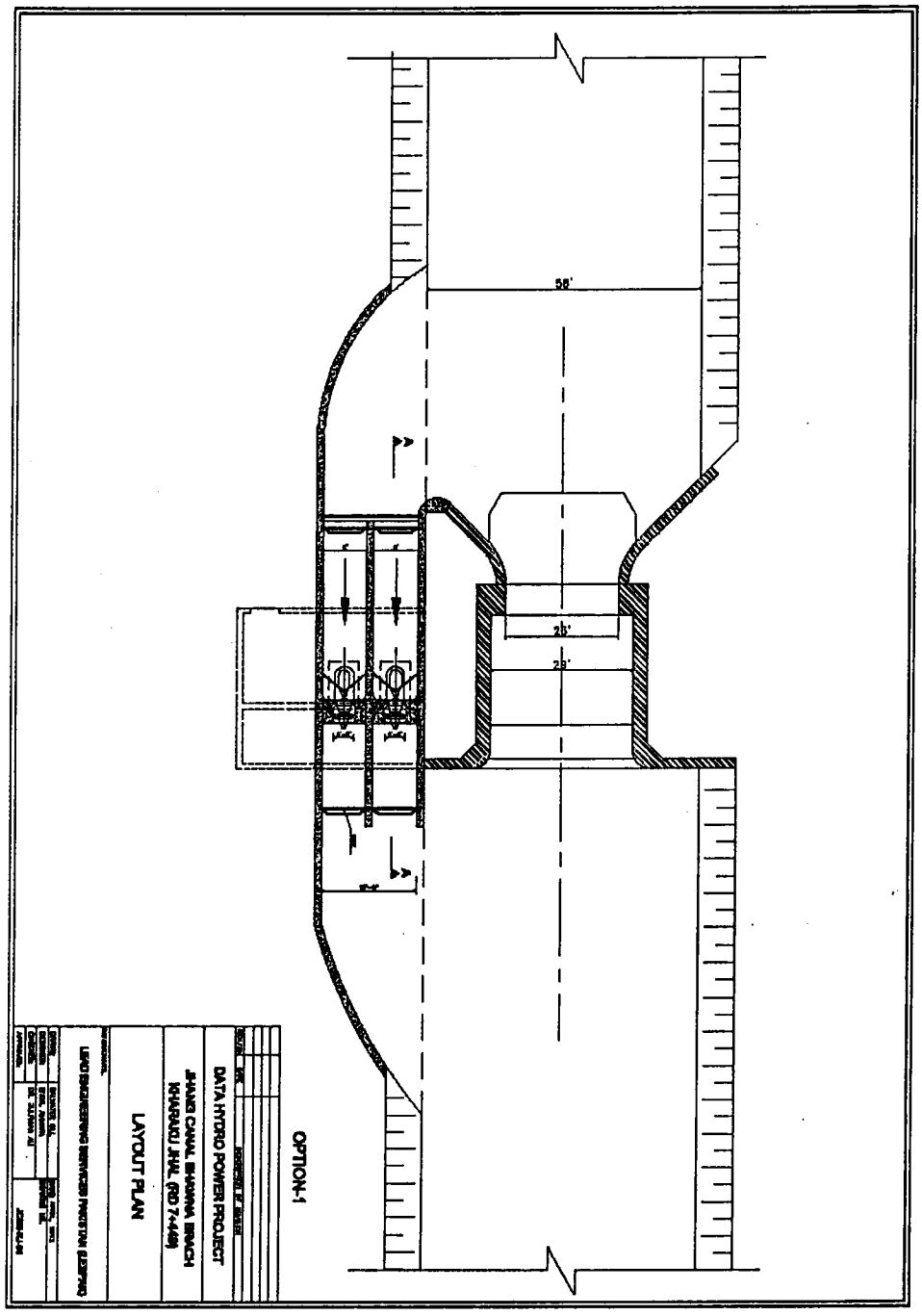


Figure 0-3 Project Layout at the fall at RD 7+449

ES-7 Turbines

As stated earlier, bypass arrangements are being proposed for the development of this hydropower project. The Kaplan turbines horizontal, vertical or inclined are possible, but each is having its own advantages and disadvantages. The real issue is coupling arrangement, between turbine and generator. Horizontal turbine arrangements as shown in Figure 0-4, with vertical Bevel gear system are proposed for both the falls.

ES-8 Project Infrastructure

The project infrastructure includes the approach channels and the tailrace structures. Both powerhouses shall house 02 units along with protection, control and other ancillary facilities. In case of emergency or routine shutdowns, water will flow through the existing falls.

Each powerhouse structure consists of two unit blocks (one turbine in each block) in the center and one service bay. The unit blocks are housed with two pit type BVG horizontal turbines. The powerhouses shall be in excavation pit, where dewatering during construction may be required. The provisions of gates at the upstream and stop-logs on downstream side may facilitate construction and subsequently the maintenance during canal operation. A mobile crane shall be used to place/remove the stop-logs.

Four horizontal Kaplan Turbines are being proposed as discussed with the manufactures. The flow is to be diverted to the turbines by a sloping RCC floor, which starts at the canal bed level and ends at sufficient depth as shown in the relevant drawings. This provides adequate water depth to avoid air entry into the turbines.

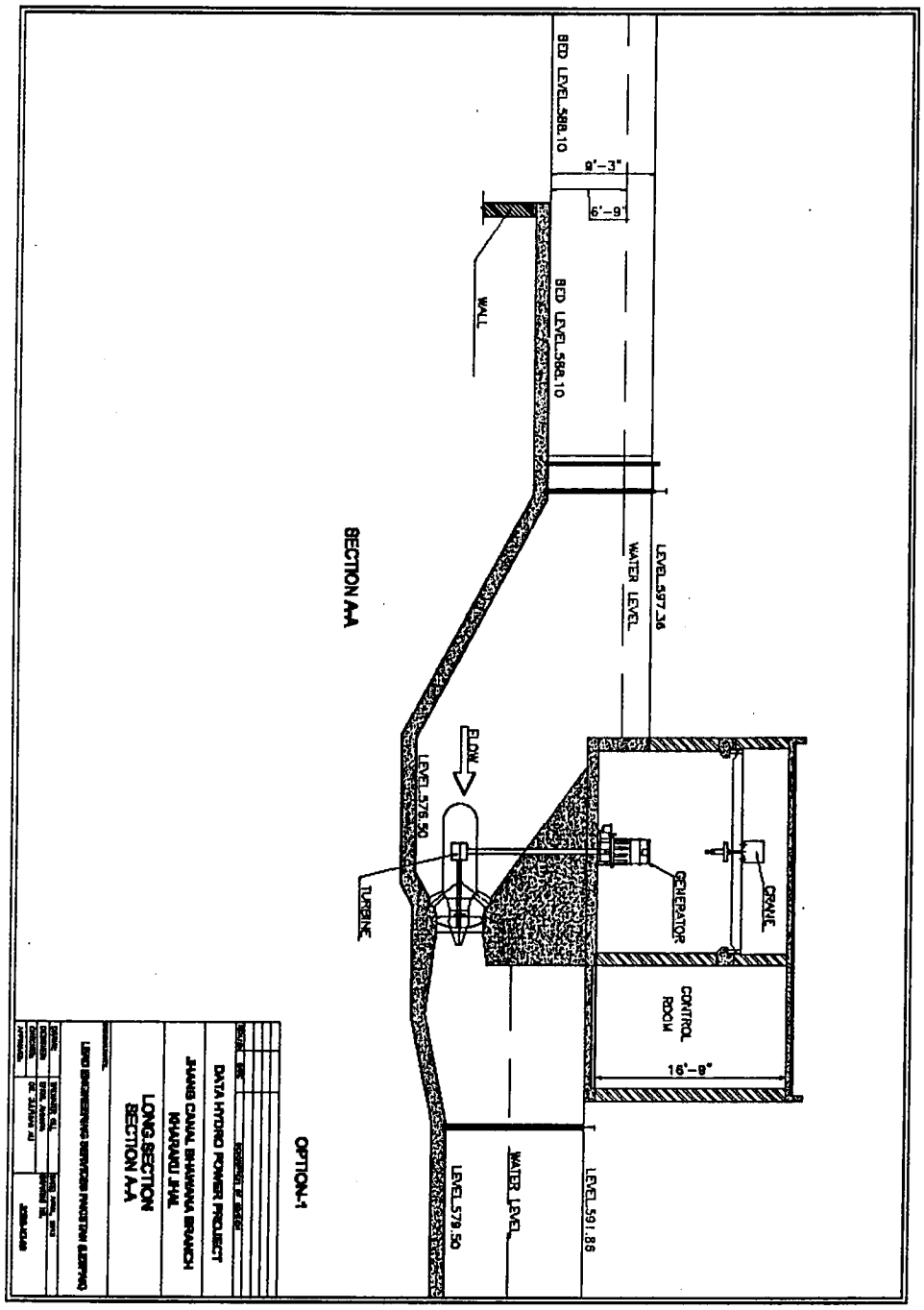


Figure 0-4 Horizontal Kaplan with Bevel Gear system proposed at RD 7+449

ES-9 Environmental Impacts

While carrying out the IEE, the main issues of concern were population resettlement and irreversible negative impacts on the social, biological or physical environments. Summary of the findings is as under:

- No resettlement or rehabilitation involved.
- The changes in hydraulic capabilities, environmental and social conditions are insignificant.
- Physical, biotic and social impacts if any at all shall be very mild and reversible.

ES-10 Project Cost Estimate

The cost estimates for civil works of the project are based upon the Scheduled rates of Punjab Government for various items of works. In some cases where the scheduled rates are silent, lump sum costs based on prevailing are applied. The cost estimates of hydro-mechanical and electrical equipment have been prepared with the discussions with local suppliers.
The project construction is estimated Rs= 51.04 Million. No foreign exchange is involved.

ES-11 Construction Planning

The construction of the project shall be started on the issuance of LOI from the Energy Department of the Punjab Government. The project shall be completed in one-year time.

ES-13 Economic Analysis

The electricity shall be used to run Data Gee Industries, which are owned by the investor himself. Therefore, fixation and approval of the tariff is not needed. However, the economic feasibility of the project has been assessed on the assumption that in the absence of Hydel generation, a thermal generation plant would be required to produce equivalent amount of energy per annum. The economic analysis is based on a comparison of costs and benefits of Hydel versus thermal generation. The Economic parameters justify the project undertaking as a least cost generation option.

ES-14 Form of Project Report

The feasibility reports have been presented in the following two volumes:

Volume 1 Main Report

Volume 2 Drawings

Volume 1 also contains an Executive Summary, discussing a brief synopsis of the feasibility study.

1. INTRODUCTION

1.1 General

Pakistan does not have enough proven sources of fossil fuels but is fortunate enough to have been endowed with hydroelectric potential available along rivers and irrigation system. Some of this potential is already being utilized by constructing hydroelectric power stations like Tarbela, Mangla, Ghazi Barotha and Warsik. Additionally, some low head power stations were planned and constructed. These hydroelectric projects play a key role to supplement the electric requirements of the country.

Due to fast growing power demand, the gap between supply and demand has increased to such an extent that power cuts have to extend beyond the closure period of irrigation canals. Besides constrains on water releases and low reservoir levels at Tarbela and Mangla; the availability of foreign currency to pay the bill for imported fuels is becoming an almost insurmountable factor. The lack of funds for imported fuels can either be solved by increasing the tariff to consume or by extending period without power supply. The decision as such seems difficult however, the situation depicts that in future, Pakistan needs to rely more on its own energy sources.

Due to limitations and financial constraints of the public sector, the Government of Pakistan announced its "Policy for Power Generation Projects 2002" package for attracting overseas investment and to facilitate tapping the domestic capital market to raise local financing for power projects. The main characteristics of this package are intentionally competitive terms, an attractive framework for domestic investors, simplified procedures and steps to create and encourage a domestic corporate debt securities market.

According to a report prepared by National Electric Power Regulatory Authority (NEPRA), the total generation capacity on June 30, 2010 was 21593 MW, out of which 14576 MW from thermal, 6555 MW from the Hydel projects and 462 MW from the nuclear projects (Figure 1.2). In terms of percentage of total generation, 67.5% is from thermal sources, 30.36% from Hydel and 2.14% is from nuclear sources. In 1980s, the ratio of installed Hydel to thermal power generation capacity was about 67% to 33%, respectively. The present situation is almost reversed.

Prosperity and development in Pakistan is highly dependent upon a reliable and continuous supply of electricity at an affordable price. At present generation of electricity relies upon imported furnace oil. This costs billions of dollars of foreign exchange every year.

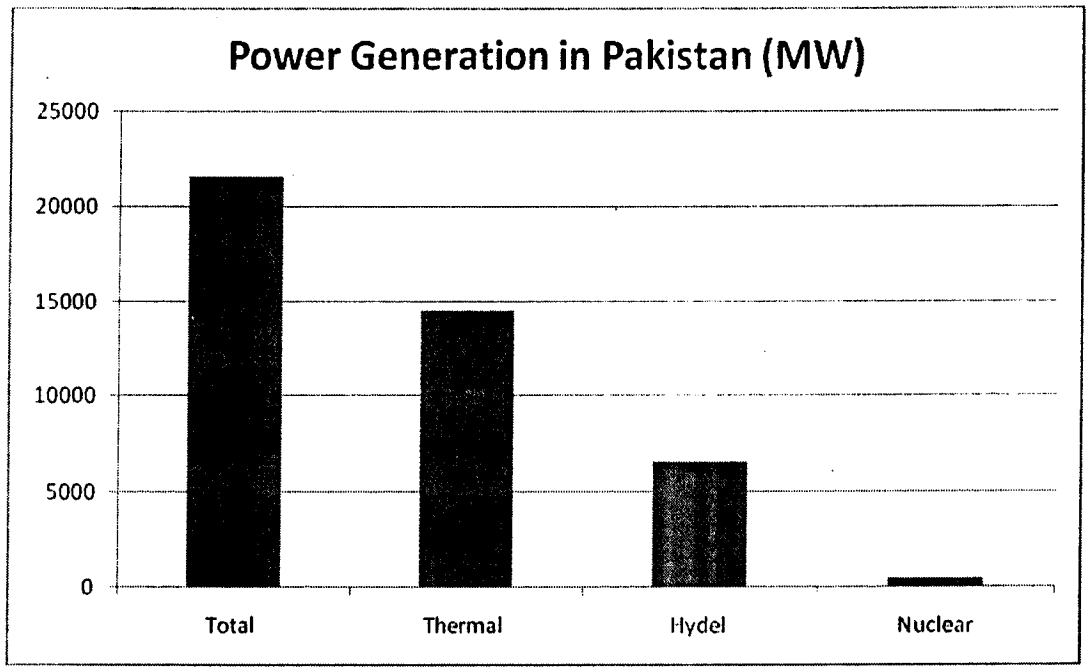


Figure 1-1: Power generation in Pakistan (June 30, 2010)

Keeping in view of the scenario, development of high head hydroelectric projects can be more economical compared to any other means of electricity production in Pakistan, but they may need more time for implementation. Contrary to this, some low head hydroelectric projects may be a less economical option but have certain advantages in Pakistan as follows:

- Comparatively shorter period from planning to completion
- Location next to load centers
- Infrastructure in the form of existing civil works and vicinity to National Grid

Due to the above advantages, emphasis is being given to the development of low head hydropower projects. Project proposal for the construction of a low head hydropower project on Bhowana Branch at RD 7+449 and RD 8+950 shall be useful addition in the existing power generating system of the country. This project can be a role model for the development of hydropower projects having less than 500 kW capacities. The project proposal is in line with the policy of the Government of Punjab to encourage private sector to undertake power generation projects.

1.2 Hydel Potential in Punjab

In 1994, national consensus was developed to plan hydel power projects on canal sites in Punjab and, in pursuance thereof; the Punjab Power Development Board (PPDB) was created for the promotion of hydel power generation. At different canals and barrages, about 324 potential sites with a total capacity of 5895 MW were identified with medium and small heads. Out of these, the following projects are in operation.

Table 1-1: Some of the operational hydropower stations in Punjab

Sr. #	Project	Capacity
1	Ghazi Barotha	1,450 MW
2	Rasul	22 MW
3	Shadiwal	14 MW
4	Nandipur	14 MW
5	Chichoki	13 MW
6	Renala	1 MW
7	Chashma	184 MW
8	Jinnah	96 MW
Total		1,794 MW

A network of barrages and irrigation canals/distributaries are also present in Pakistan. These falls are the potential sites for the generation of Hydel energy/electricity. Until now, these precious sources of energy have not been properly utilized. If Hydel projects are further delayed, this will be a wastage of national wealth. The estimated Hydel potential is above 50,000 MW but until now, only 7000 MW is being produced.

The low head, canal based hydropower development is not new in Punjab. Before and after Partition a number of low head HPPs were developed at Rasul (22 MW), Shadiwal (13.5 MW) Nandipur (13.8 MW), Chichoki Malian (13.2 MW) and Renala 1.1 MW. List of operational hydropower stations on head works / canals is given in Table 1.2 as under:

1.3 Project Location

Data Hydropower Project would be developed on Bhowana Branch near Bhowana town in District Chiniot of the Punjab Province (Pakistan). The Bhowana Branch canal is a subsidiary of Jhang Branch which itself is a subsidiary of Lower Chenab Canal emerging from Khanki Head Works at the river Chenab. The project is situated at Longitude of 73* - 06` - 30`` east and latitude of 31* - 26` - 50``.

Bhowana Branch off-takes from Jhang Branch upper at RD. 308+426, with a discharge of (14.3 cumecs) 506 cusec. There are 2 falls in its reach from RD. 0+000 to RD. 10+000. The projects are to be constructed at both the falls.

Open area is available near the project site for camping and setting up of industries. A small industry will be setup and the power developed is utilized locally. Residences for operation and maintenance staff of the project shall be developed near to the project site. The principal occupation of the population is agriculture and its related industries. The construction of hydropower station will have no negative impact on the local population of the area.

1.4 Site Accessibility

The site is about 163 km in the west of Lahore, near Faisalabad city. The Faisalabad is hub of Punjab industries and providing jobs to the millions of people. The project site is accessible by road to the west of Faisalabad, at a distance of approximately 33 Km.. The road up to the site is suitable for all the type of traffic envisaged during the project construction phase.

The project area is easily accessible by all means of communication i.e. Railway, Road and Telephone systems. Bhowana is located on main Lahore Jhang Road.

The local airport is there at Faisalabad for transportation within the country which is at a distance of 43 Km from the proposed project site. Faisalabad airport connects Faisalabad with other important cities of Pakistan including Lahore and Karachi.

2. CANAL HYDROLOGY

2.1 General

Khanki Barrage is situated on the Chenab River in Gujranwala District of Punjab province. The barrage is located about 16 km downstream of the main GT Road bridge over Chenab River. The barrage was constructed in 1892 and is considered to be oldest in Pakistan. The structure is used for flood control and irrigation as it provides water to the main line of Lower Chenab Canal which originates from it and its distributaries. Khanki Barrage controls water distribution for over 3 million acres (12,000 km²) of agricultural lands by one main line, the Lower Chenab Canal, and 59 minor distributaries.

The overall length of the barrage is 4386 ft with clear width of 3929 feet. The barrage is capable of passing a flood discharge of 800,000 ft^3/s (22,660 m^3/s). Recent history of flooding, which has safely been handled by the barrage is given in Table 2.1 as under:

Table2-1: Discharges Exceeding 800,000 Cusecs (1922- 2010)

Sr. #	Date	Discharge (ft^3/s)	HFL
1	20-09-1950	1,011,000	738.50
2	26-09-1954	806,000	736.80
3	27-08-1957	1,086,000	739.00
4	06-07-1959	1,021,000	738.70
5	10-08-1973	846,000	740.00
6	26-09-1988	864,000	739.30
7	10-09-1992	910,000	738.00
8	24-08-1996	851,000	738.50
9	28-08-1997	847,000	738.20

The frequency and volume of flooding based on probable return period is given in Table 2.2 as under:

Table 2-2: Return period and the probable discharge.

RETURN PERIOD	PROBABLE DISCHARGE (ft^3/s)
2.33	386,300
10	705,400
50	1,020,700
100	1,153,800
200	1,286,500

A new barrage 600 feet downstream of the existing Khanki Barrage is proposed by the Irrigation Department of Government of Punjab, for which a loan of US$270 million has been committed by the World Bank.

2.2 Discharge Data of Bhowana Branch Canal

Power potential of any potential site depends on the discharge duration and head/fall available on the specified location. It is reported by the department that the canal is perennial. The data collected from the site from January 2005 to December 2012 shows that the supply in the canal remains for about 11 months a year. This data has been used to compute 10-daily means and mean monthly flows. The energy production has been based on these flows.

2.2.1 Mean Monthly Flows

The mean monthly flows data of Bhowana branch has been computed from the daily discharge data, as shown in the Table-2.3 below and plotted from 2005 to 2012 as shown in Figures 2.1 and 2.2. This will be used for calculation of expected energy generation on monthly basis. In addition, monthly flow data is also used for optimization of the power plant.

Table 2-3: Return period and the probable discharge.

Month	Cumecs
Jan	2.7
Feb	8.9
Mar	8.5
Apr	7.8
May	9.1
Jun	9.4
Jul	9.6
Aug	8.9
Sep	8.9
Oct	7.6
Nov	8.8
Dec	8.0

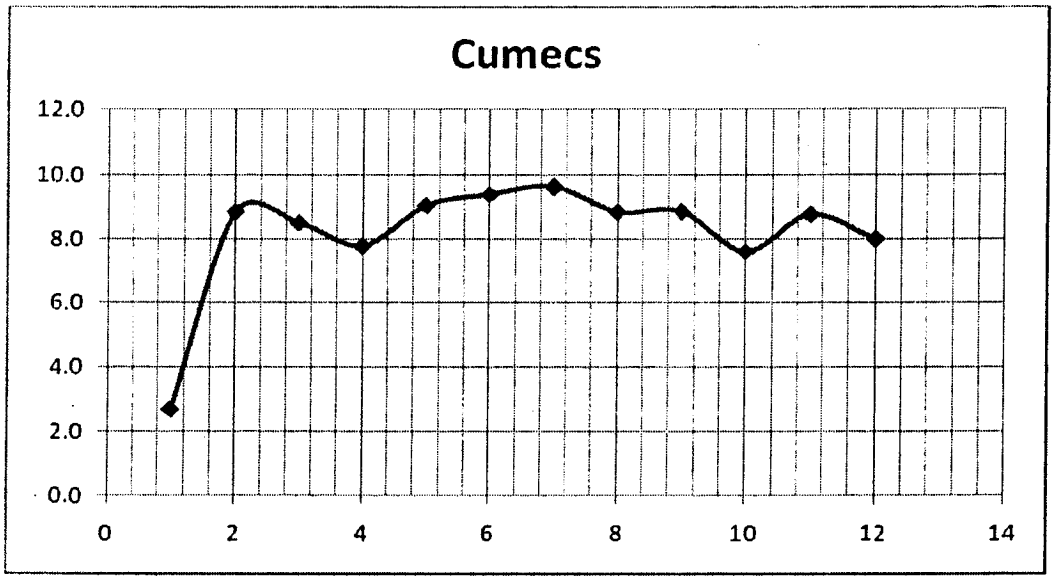


Figure 2-1 Mean monthly flows.

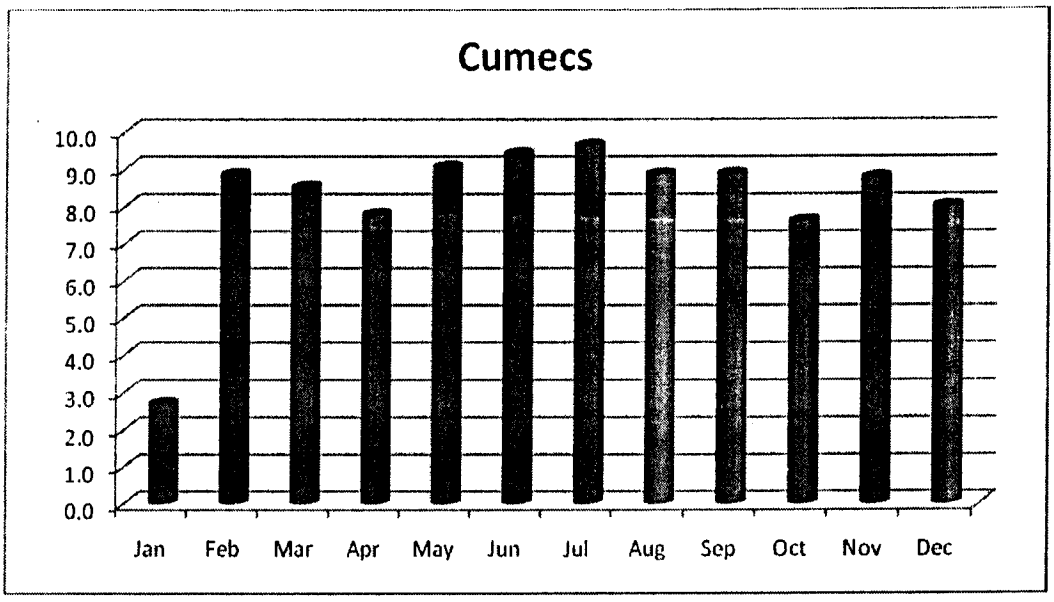


Figure 2-2: Histogram of mean monthly flows

2.2.2 Average Yearly Flows

Average yearly flows have been calculated from year 2005 to 2012 to ascertain the year wise position of flow and placed in Table 2.4

Table 2-4: Average yearly Flow (2005 - 2012)

Year	Cumecs
2005	8.7
2006	8.9
2007	9.8
2008	8.2
2009	5.9
2010	7.2
2011	7.7
2012	9

2.2.3 10-Daily Flows

For the purpose of analysis and comparison mean 10-daily flows has also been calculated and presented in Table 2.5 and plotted to observe variation in flow level. It is presented in Figure 2.3.

Table 2-5; Mean 10-Daily Flow (2005 - 2012)

Month	10-daily	Cumecs	Month	10-daily	Cumecs
Jan	I	0.0	Jul	I	9.9
	II	0.8		II	8.7
	III	5.4		III	10.2
Feb	I	9.2	Aug	I	8.0
	II	8.6		II	9,7
	III	7.8		III	8.9
Mar	I	9.6	Sep	I	9.2
	II	7.7		II	9.3
	III	8.3		III	8.0
Apr	I	7.2	Oct	I	10.8
	II	7.2		II	6.6
	III	8.9		III	5.6
May	I	9.3	Nov	I	7.8
	II	10.6		II	8.7
	III	7.5		III	9.7
Jun	I	10.4	Dec	I	8.2
	II	8.7		II	10.6
	III	9.0		III	5.4

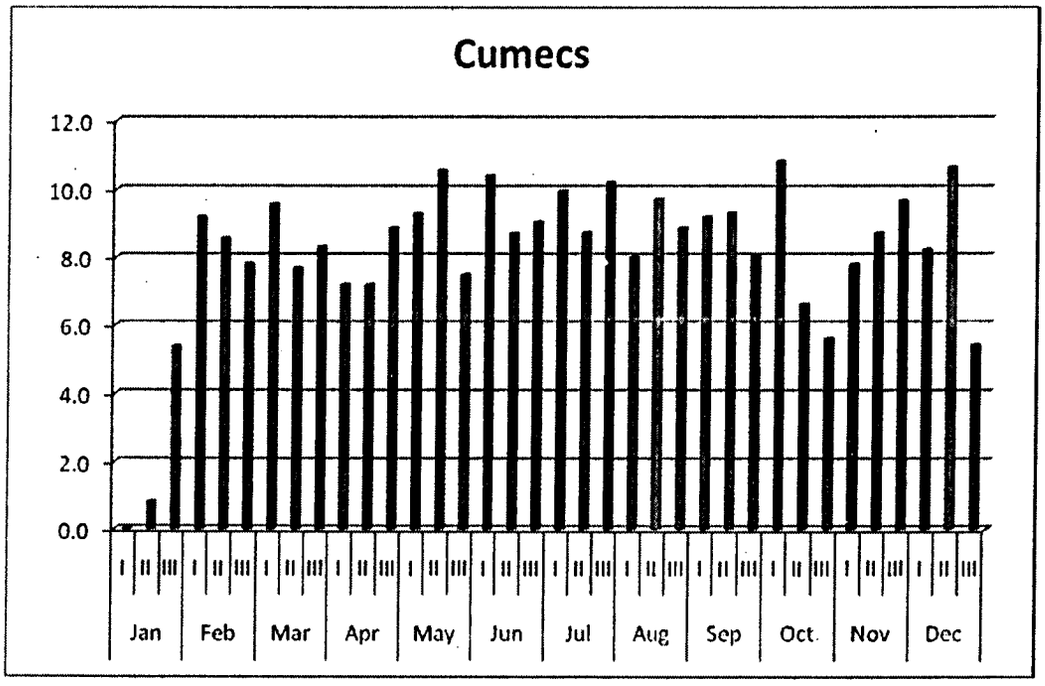


Figure 2-3: Histogram

It is observed from Figure 2.2 that for about eight months of the year i.e. February, March, May, June, July, August, September and November more than 8.0 cumecs flows will be available for power generation which would be able to generate maximum energy during these months. The flow remains above 7 cumecs for three months of the year, whereas in January it is above 2 cumecs.

Flows duration curve has been plotted for the entire period based on 10-daily average flow (Figure 2.3). It is noted that in the month of January (closure period), the flow remains suspended for about 15 days.

3. POWER POTENTIAL AND ENERGY

3.1 Project Description

Bhowana Branch canal is a subsidiary of Jhang Branch which itself is a subsidiary of Lower Chenab Canal emerging from Khanki Head Works at the river Chenab. Bhowana Branch off-takes from Jhang Branch upper at RD 308+426, with a design discharge of (14.3 cumecs) 506 cusec. There are 2 falls in its reach from RD. 0+000 to RD. 10+000. The power projects are to be constructed at both the falls.

A small industry will be setup and the power developed is utilized locally. Residences for operation and maintenance staff of the project shall be developed near to the project site. The construction of hydropower station will have no negative impact on the local population of the area.

3.2 Salient Features of the Falls

The historical flow data at fall RD 7+449 of Bhowana branch has maintained by the Executive Engineer, Jhang Division of the Punjab Irrigation Department. Although the design discharge of the branch canal is above 500 cusecs but the recorded discharge remained less than 400 cusecs. There are two off takes having design discharge of about 21 cusecs. The canal is concrete lined with bed width of about 57 ft. The salient features of the falls are given in the Tables 3.1 - 3.2.

Table 3-1: Salient features of the fall at RD 7+449.

Salient Features of fall at RD. 7+449		
Sr #	Description	Value
1	Design Discharge Q	506 Cusecs (Cs)
2	Upstream Water Level	594.26 ft
3	Downstream Water level	584.90 ft
4	Crest Level	591.61ft
5	Working Head	9.67 ft
6	Bed Width U/s	57 ft
7	Bed Width D/s	57 ft
8	Water Surface Slope	0.22 %

Table 3-2: Salient features of the fall at RD 8+050.

Salient Features of fall at RD. 8+950		
Sr #	Description	Value
2	Design Discharge	485 Cusecs (Cs)
3	Upstream Water Level	584.63 ft
4	Downstream Water level	576.84 ft
5	Crest Level	578.80 ft
6	Working Head	7.10 ft
7	Canal Bed Width U/s	57 ft
8	Canal Bed Width D/s	57 ft
9	Water Surface Slope	0.22 %

3.3 Design Discharge

The selection of design discharge for this project is straight forward as the design discharge for the branch canal is about 500 cusecs. The flow data for the last 7 years revealed that the actual discharge remains less that 380 cusecs. On the basis of discharge data, it is decided to design turbines for the discharge of 400 cusecs. For each turbine, the design discharge shall be 200 cusecs. Two units for the generation of power are proposed. Figure 3.1 shows the concept of selection of unit discharge for low head turbines.

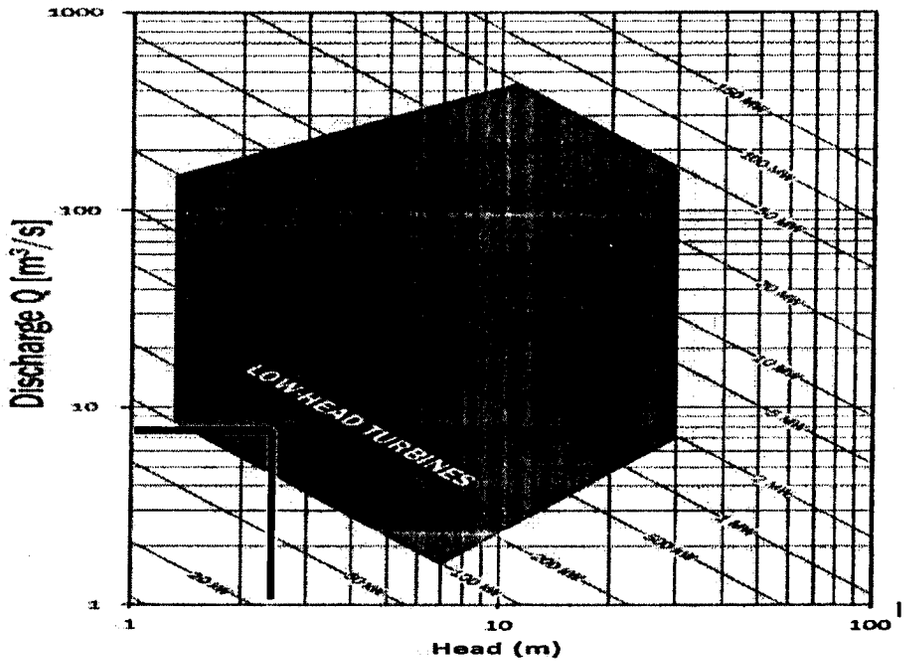


Figure 3-1: Power potential for the fall at RD 8+950

3.4 Unit Design Discharge

The unit discharge is set at 200 cusecs. According to the efficiency curve of a Bulb type double regulated Kaplan turbine, the efficiency of this turbine unit shall stay above 75% even at a discharge of 4 m^3/s. Below 4 m^3/s discharge, the efficiency drops rapidly. Since the flow remains steady, therefore the efficiency of the system always remains above 75%. The efficiency curve for a double regulated Kaplan turbine is shown in Figure 3.2

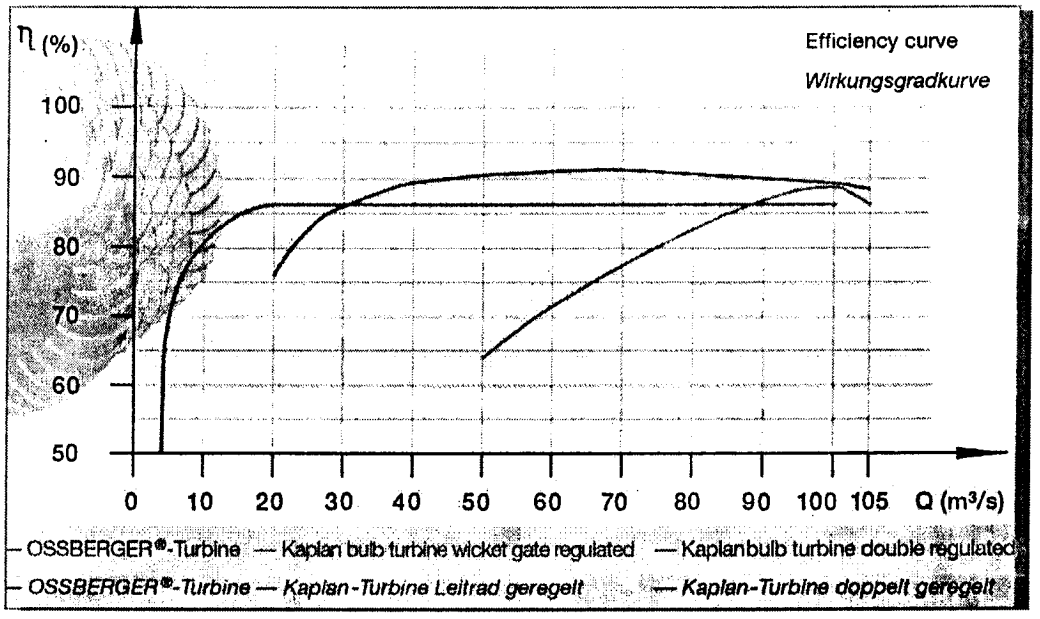


Figure 3-2: Efficiency curve of a Kaplan turbine

3.5 Hydropower potential

Due to a regulated/controlled flow, it is possible to generate hydropower on the falls, rapids and barrages, where the gross head of few meters is available. These falls/rapids are primarily created at locations where accumulated bed slope can be lumped to control water level on upstream and lower it on the downstream.

As stated earlier the discharge data for Year 2005 to 2012 was collected from the irrigation department. The data revealed a uniform trend of flows in the branch canal. 10-daily discharges for the last 7 years were computed for the power potential studies. Table 3.3 and 3.4 shows the estimated power potential at both the falls.

Table 3-3: Power potential at the fall RD 7+449

Month	10-daily	No of Days	Cumecs	Net Head (m)	Power (kW)	Energy (GWH)	Units (kWH)
Jan	I	10	0.0	2.80	0	0	0
	II	10	0.8	2.80	18	0.00	4438
	III	11	5.4	2.80	122	0.03	32198
Feb	I	10	9.2	2.80	209	0.05	50128
	II	10	8.6	2.80	194	0.05	46636
	III	8	7.8	2.80	177	0.03	34067
Mar	I	10	9.6	2.80	217	0.05	52154
	II	10	7.7	2.80	174	0.04	41851
	III	11	8.3	2.80	189	0.05	49835
Apr	I	10	7.2	2.80	163	0.04	39150
	II	10	7.2	2.80	163	0.04	39150
	III	10	8.9	2.80	201	0.05	48353
May	I	10	9.3	2.80	211	0.05	50649
	II	10	10.6	2.80	240	0.06	57518
	III	11	7.5	2.80	170	0.04	44847
Jun	I	10	10.4	2.80	236	0.06	56708
	II	10	8.7	2.80	198	0.05	47466
	III	11	9.0	2.80	205	0.05	54229
Jul	I	10	9.9	2.80	226	0.05	54180
	II	10	8.7	2.80	198	0.05	47620
	III	11	10.2	2.80	232	0.06	61169
Aug	I	10	8.0	2.80	182	0.04	43568
	II	10	9.7	2.80	221	0.05	53023
	III	11	8.9	2.80	201	0.05	53167
Sep	I	10	9.2	2.80	209	0.05	50090
	II	10	9.3	2.80	212	0.05	50765
	III	10	8.0	2.80	183	0.04	43838
Oct	I	10	10.8	2.80	246	0.06	59062
	II	10	6.6	2.80	150	0.04	36043
	III	11	5.6	2.80	127	0.03	33577
Nov	I	10	7.8	2.80	177	0.04	42430
	II	10	8.7	2.80	198	0.05	47543
	III	10	9.7	2.80	220	0.05	52714
Dec	I	10	8.2	2.80	187	0.04	44803
	II	10	10.6	2.80	242	0.06	58039
	III	11	5.4	2.80	123	0.03	32452
G. Total						1.61	1613463

Table 3-4: Power potential for the fall at RD 8+950

Month	10-daily	No of Days	Cumecs	Net Head (m)	Power (kW)	Energy (GWH)	Units (kWH)
Jan	I	10	0.0	2.00	0	0	0
	II	10	0.8	2.00	13	0.00	3173
	III	11	4.8	2.00	87	0.02	23021
Feb	I	10	8.6	2.00	149	0.04	35841
	II	10	8.0	2.00	139	0.03	33344
	III	8	7.2	2.00	127	0.02	24358
Mar	I	10	9.0	2.00	155	0.04	37289
	II	10	7.1	2.00	125	0.03	29923
	III	11	7.7	2.00	135	0.04	35631
Apr	I	10	6.6	2.00	117	0.03	27991
	II	10	6.6	2.00	117	0.03	27991
	III	10	8.3	2.00	144	0.03	34572
May	I	10	8.7	2.00	151	0.04	36213
	II	10	10.0	2.00	171	0.04	41125
	III	11	6.9	2.00	121	0.03	32065
Jun	I	10	9.8	2.00	169	0.04	40545
	II	10	8.1	2.00	141	0.03	33937
	III	11	8.4	2.00	147	0.04	38773
Jul	I	10	9.3	2.00	161	0.04	38738
	II	10	8.1	2.00	142	0.03	34048
	III	11	9.6	2.00	166	0.04	43735
Aug	I	10	7.4	2.00	130	0.03	31150
	II	10	9.1	2.00	158	0.04	37910
	III	11	8.3	2.00	144	0.04	38014
Sep	I	10	8.6	2.00	149	0.04	35813
	II	10	8.7	2.00	151	0.04	36296
	III	10	7.4	2.00	131	0.03	31344
Oct	I	10	10.2	2.00	176	0.04	42228
	II	10	6.0	2.00	107	0.03	25770
	III	11	5.0	2.00	91	0.02	24007
Nov	I	10	7.2	2.00	126	0.03	30337
	II	10	8.1	2.00	142	0.03	33992
	III	10	9.1	2.00	157	0.04	37690
Dec	I	10	7.6	2.00	133	0.03	32033
	II	10	10.1	2.00	173	0.04	41497
	III	11	4.8	2.00	88	0.02	23203
G. Total						1.15	1153597

4. PROJECT LAYOUTS

4.1 General

Development of hydropower projects at canal falls/head regulators require careful planning and state of the art hydraulic designs. For such projects, the placing of turbines on existing falls looks attractive. Simple water wheels can be used as they are easy to manufacture. However, the water wheels are usually less efficient, massive and amendments/alterations to the existing system are needed.

For both the falls, separate bypass arrangements are being proposed. Such arrangements shall have a better control to regulate flows and maintenance of the units is easy.

4.2 Falls at RD 7+449 and RD 8+950

General views of the falls (RD 7+449 and RD 8+950) are shown in Figure 4.1 and 4.2, respectively. Both the falls are vertical drop type, with stilling arrangements. The width of the fall at RD 7+449 is about 11.12m (36.5 ft), whereas the canal width is 57 ft. To divert flow in to the powerhouse, a footbridge and two gates shall be installed.

The fall at RD 8+950 is already having a bridge with two bays of equal length. The structures diverge and ultimately become equal to the canal width. Picture of downstream of the fall is shown in Figure 4.1, 4.2 respectively.

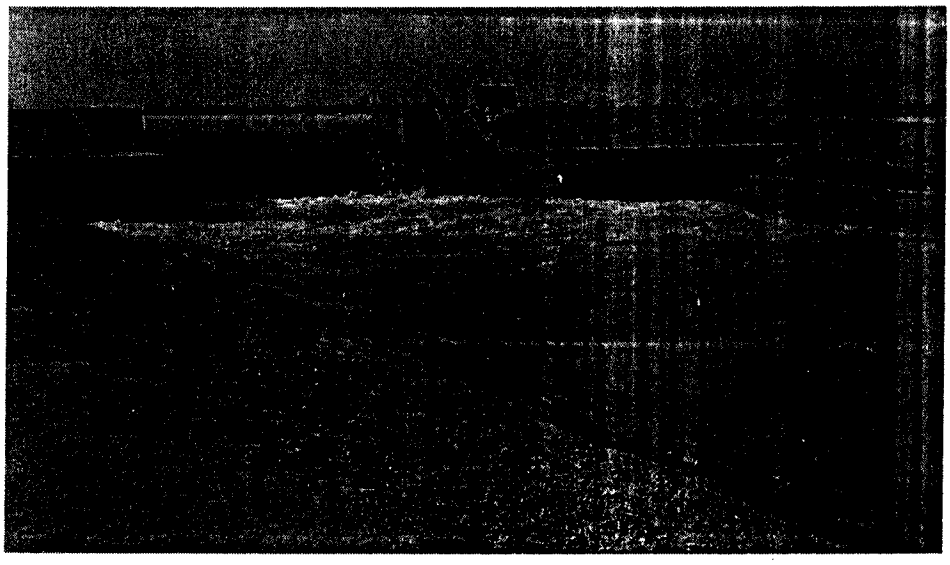


Figure 4-1: A view of downstream of the canal fall at RD 7+449.

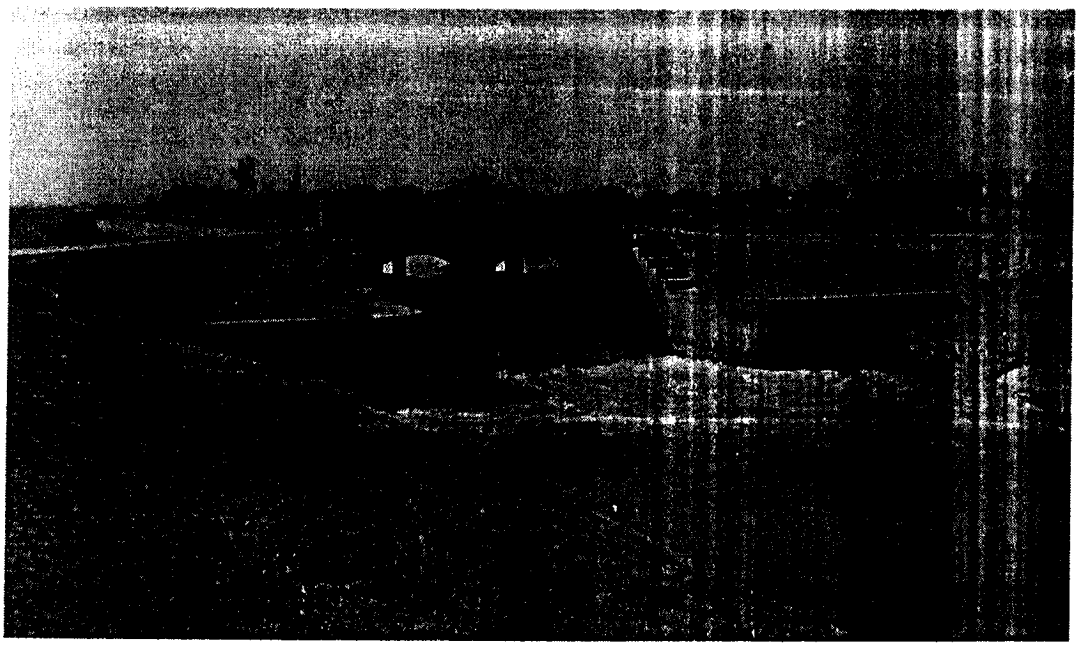


Figure 4-2: A view of downstream of the canal fall at RD 8+950.

4.3 Bypass Arrangements

As stated earlier, bypass arrangements on right side of the falls are being proposed due to the following reasons:

- The irrigation officials did not allow any alteration to the existing system.
- Without alteration, the only workable option was the water wheel.
- The water wheels are less efficient, massive and their handling will be cumbersome.

The bypass arrangement are being proposed to divert flow for the generation of power. The flow is divided in to two parts for the placing of two units. After power generation, the bypass channel rejoins the canal. Arrangements are robust, with proper intake and tailrace channels. The efforts are being made to keep hydraulic losses at the minimum. The water will re-enter in the existing stilling basin after the generation of power.

The discharge is being regulated by vertical lift gates placed at the power intake and the fall. For full diversion, the gates at the fall shall be completely closed. Moreover, the upstream water level shall be kept constant by gates operation if required.

4.2 Turbines Selection

The development of low head, small hydro site is difficult at the best of times. Low head means low power per unit of flow and hence a relatively higher cost than for sites with higher heads. In addition, small power plants suffer from the inverse scale effect, with higher costs relative to larger sites. Many entrepreneurs are under the impression that any rapids in a river/canal can be developed as an economical source of energy. Nevertheless, in reality, the case is entirely different, hence, all possible means are being considered to arrive at an economical hydro-project.

Considering the specific situation at the fall and limitations/reservations of the Punjab Irrigation Department regarding hydraulic requirements for the upstream water levels, bypass arrangements for both the falls are being proposed. The power intake is constructed in such a way that it is having sufficient area. This facilitates the full diversion at the same pond level. The two units are planned, consequently the two concrete lined channels are being proposed. Any of the following turbines can be installed for the generation of power. However, each of the turbines is having their own advantages and disadvantages. The turbines given as under are being studied for this project:

- Very low head Kaplan gear turbine
- Very Low Head Kaplan Bevel Gear Turbines

4.2.1 Horizontal Axis Bulb Kaplan with Bevel Gear Arrangement

In this layout, the generator is contained within either a bulb or a pit within the upstream water passage. A pit installation has an open-topped bulb, permitting far easier access to the generator. To keep the generator size within reason, there has to be a gear unit to increase generator speed to between 600 and 1000 rpm. A typical installation is shown in Figure 4.3.

Downstream of the bulb or pit there are the stay vanes, wicket gates, Kaplan runner and finally a conical draft tube. The runner shaft is usually set about one runner diameter below minimum tail water. There is easy access around the turbine unit for maintenance. In addition, as with all horizontal shaft units, the runner can be removed for maintenance without removing the generator. Bulb units are only available in the larger diameters, and should be avoided due to the "confined access" problems associated with the bulb. Pit type units are far preferable.

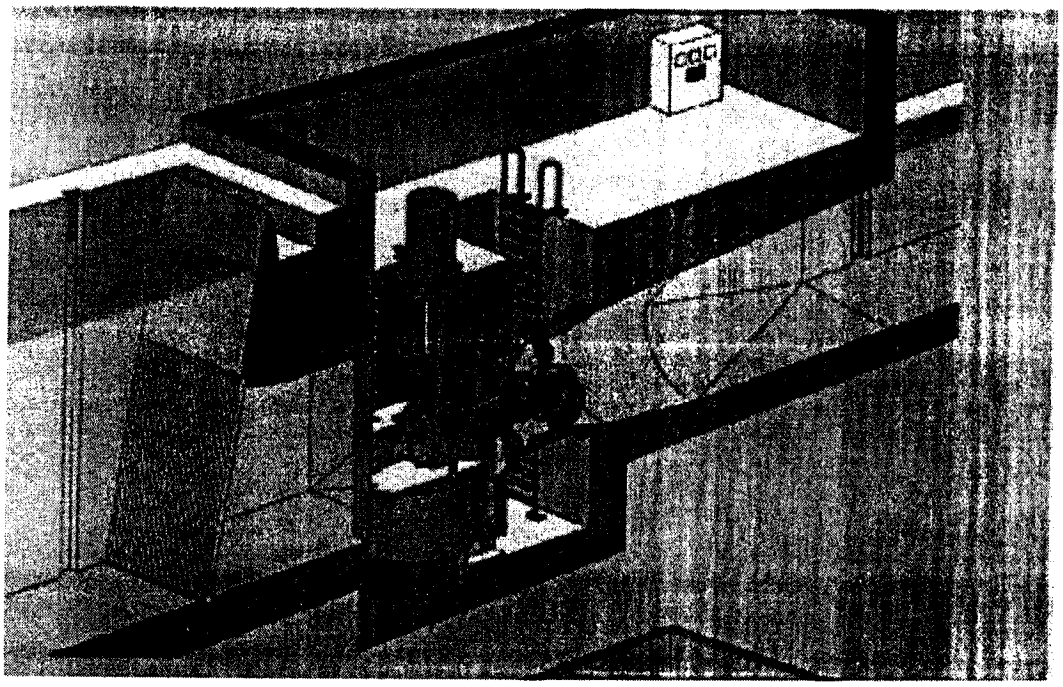


Figure 4-3: A typical arrangement for a horizontal axis Kaplan with gear arrangement.

4.2.2 Vertical Propeller Type Turbines

A vertical propeller type arrangement is also studied. Such units are having followings salient features:

- It is efficient, but having more bend losses.
- A vertical shaft and propeller arrangement is economical as compared with the water wheel.
- Handling of vertical shaft and the propeller turbine fixed at the downstream end of the shaft is easy.
- A simple pulley arrangement can be used to lift it up for repairs.
- Not very expansive and can be locally manufactured.
- The supporting arrangements are complicated and expensive.
- More head loss as compared with horizontal system.

4.3 Fall at RD 7+449 (Turbines Options 1 & 2)

Both horizontal and vertical Kaplan turbines have been studied. The arrangements are shown in Figures 4-4 to 4-7.

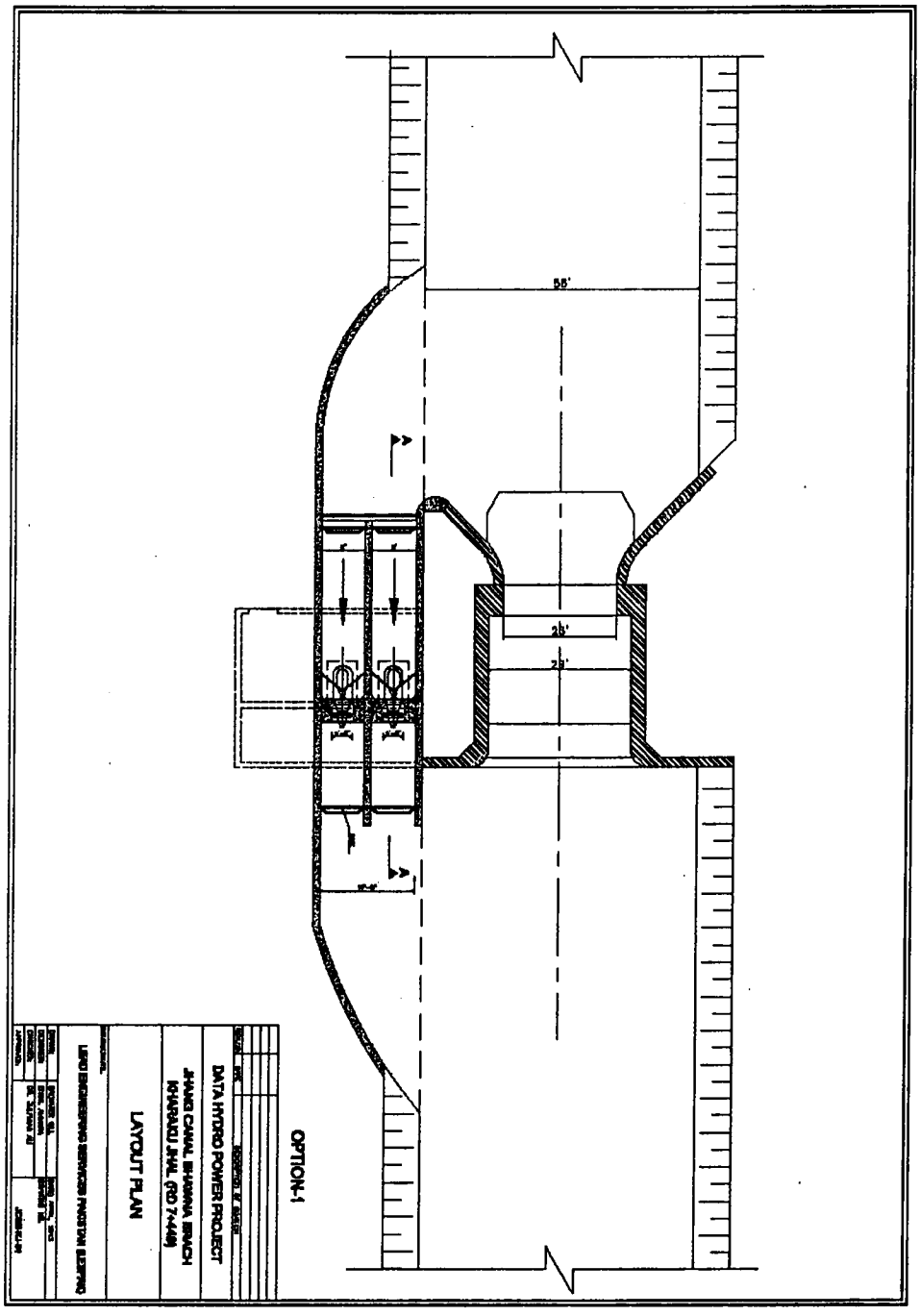


Figure 4-4: Fall at RD 7+449 (Option-1, Layout Plan)

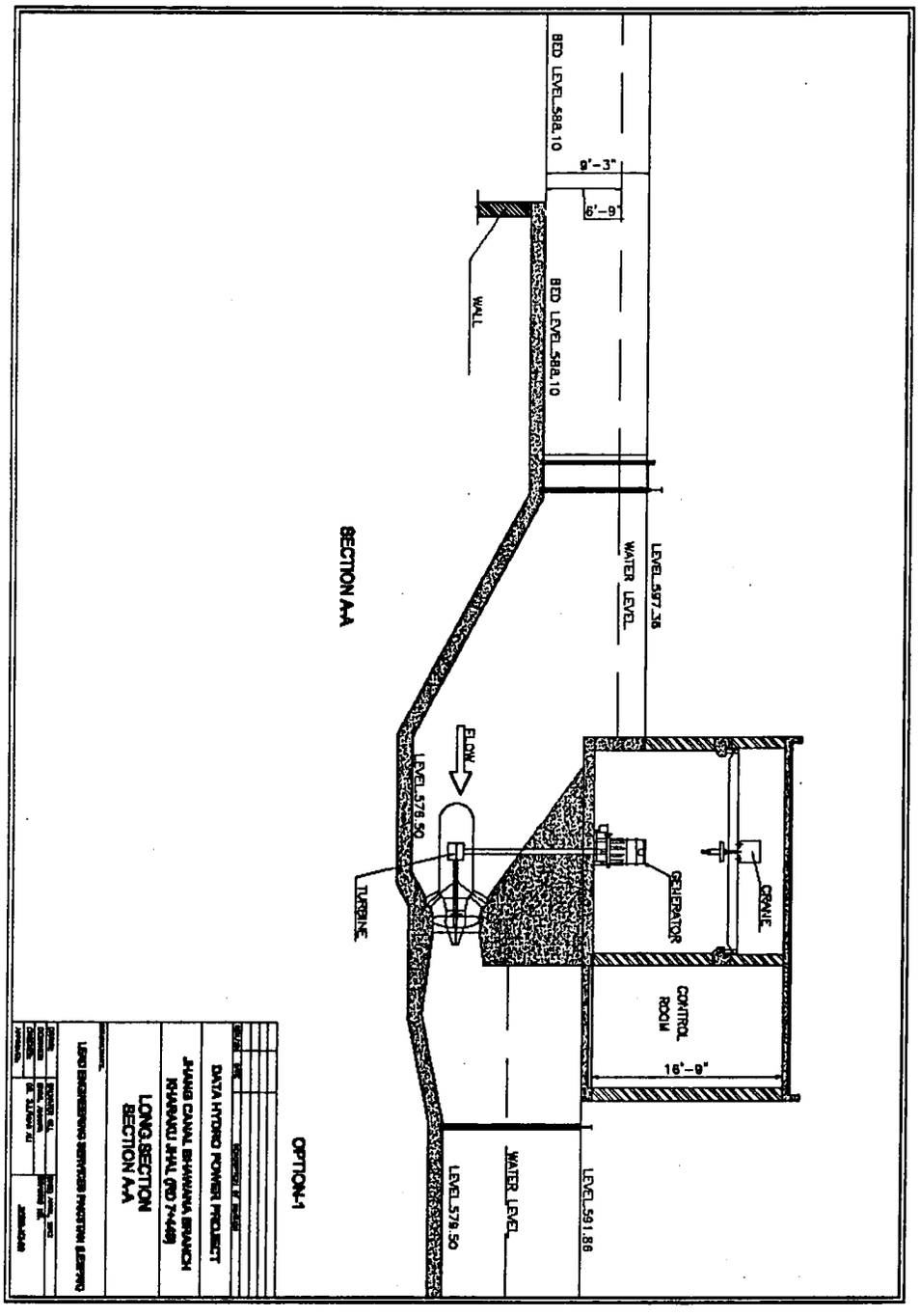


Figure4-5: Fall at RD 7+449 (Option-1, Longitudinal Profile)

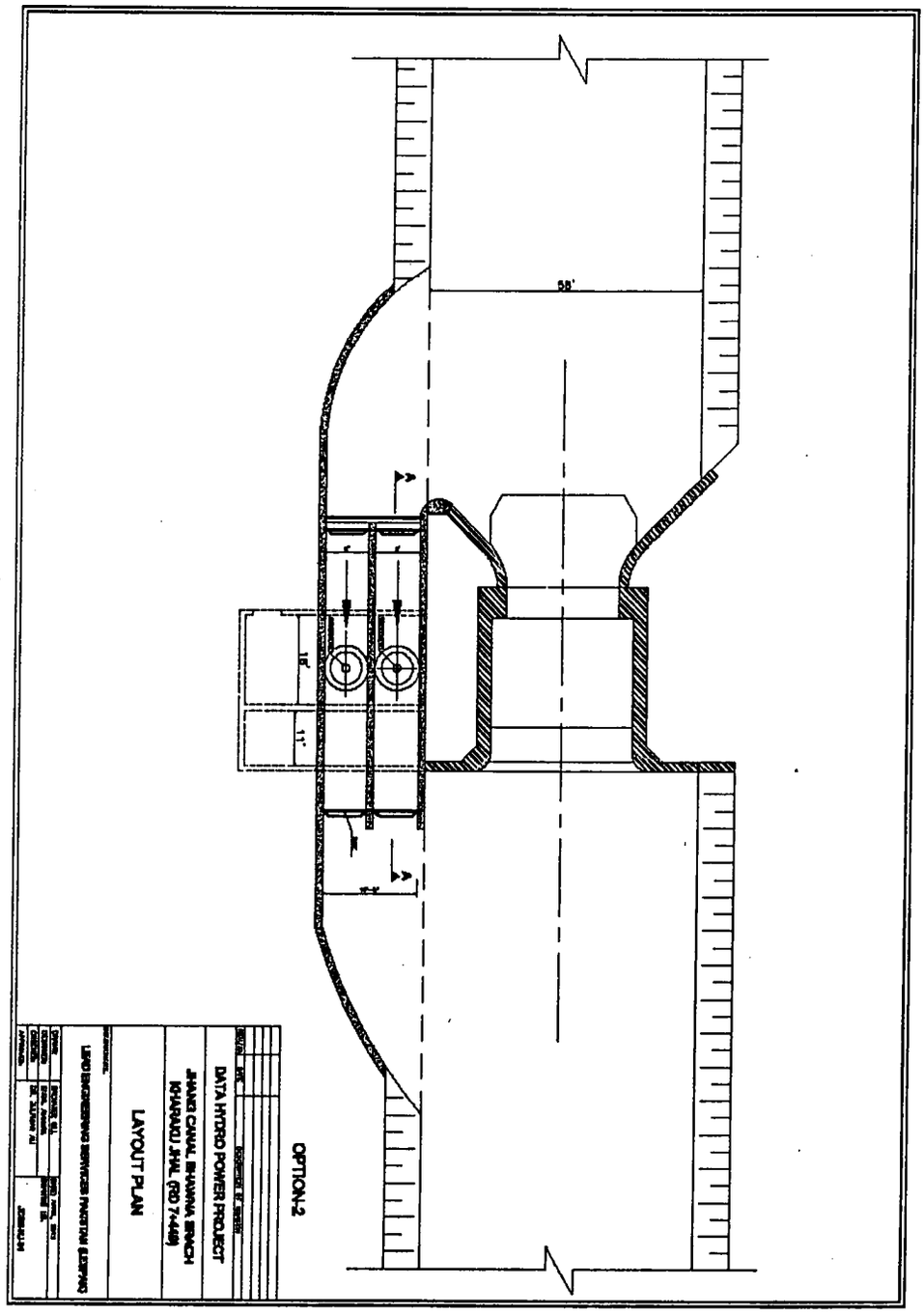


Figure 4-6: Fall at RD 7+449 (Option-2, Layout Plan)

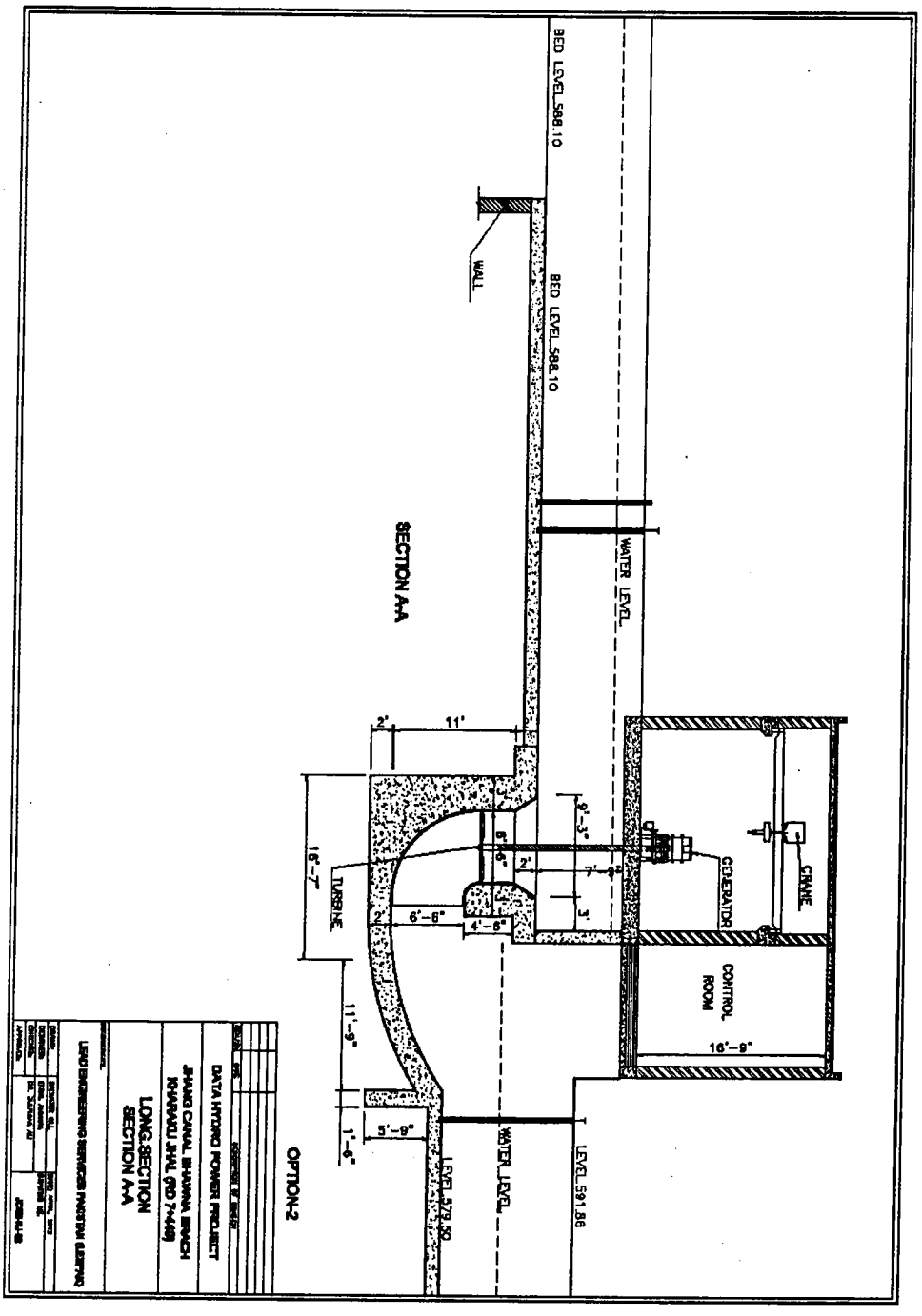


Figure 4-7: Fall at RD 7+449 (Option-2, Longitudinal Profile)

4.4 Fall at RD 8+950 (Turbines Options 1 & 2)

Both horizontal and vertical Kaplan turbines have been studied. The arrangements are shown in Figures 4-8 to 4-11.

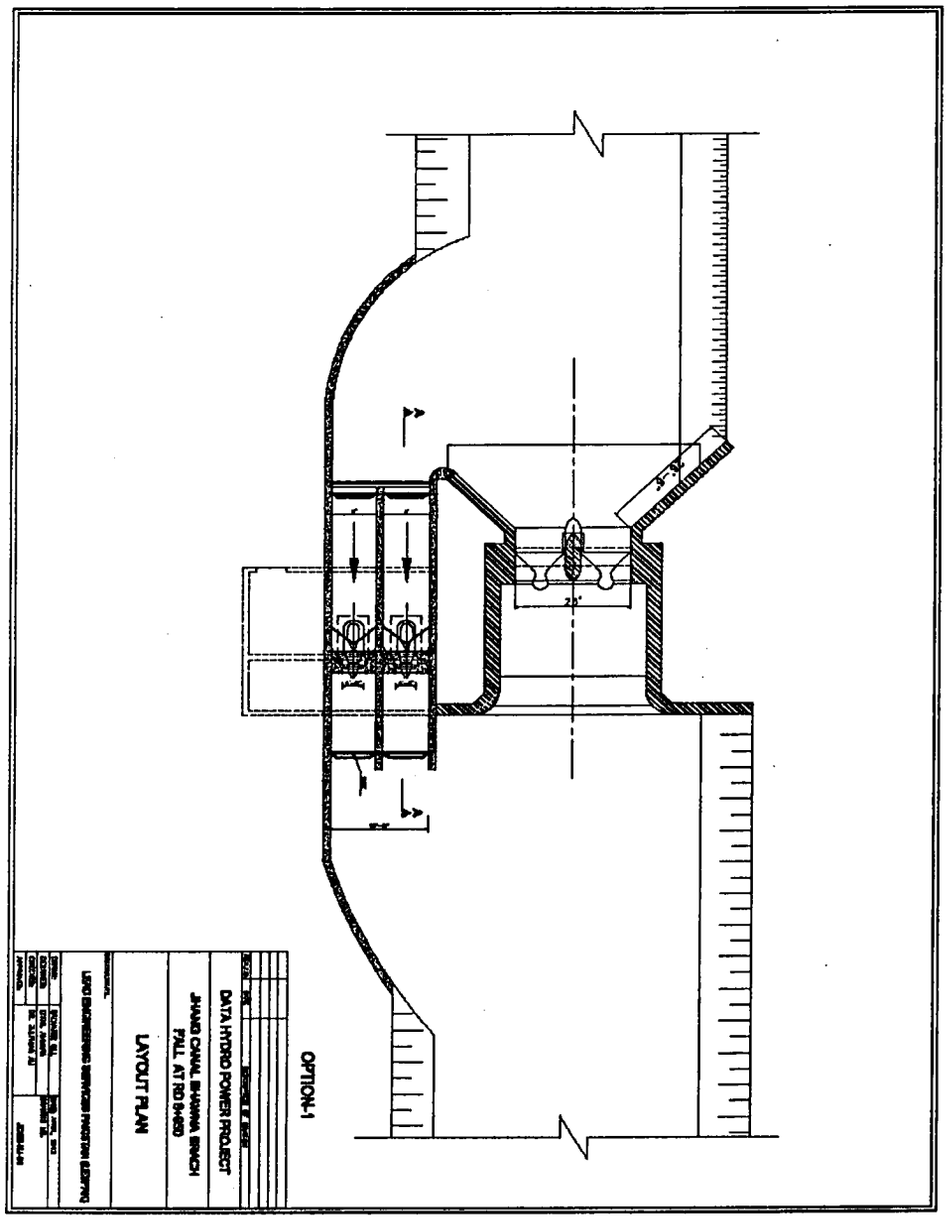


Figure 4-8: Fall at RD 8+950 (Option-1, Layout Plan)

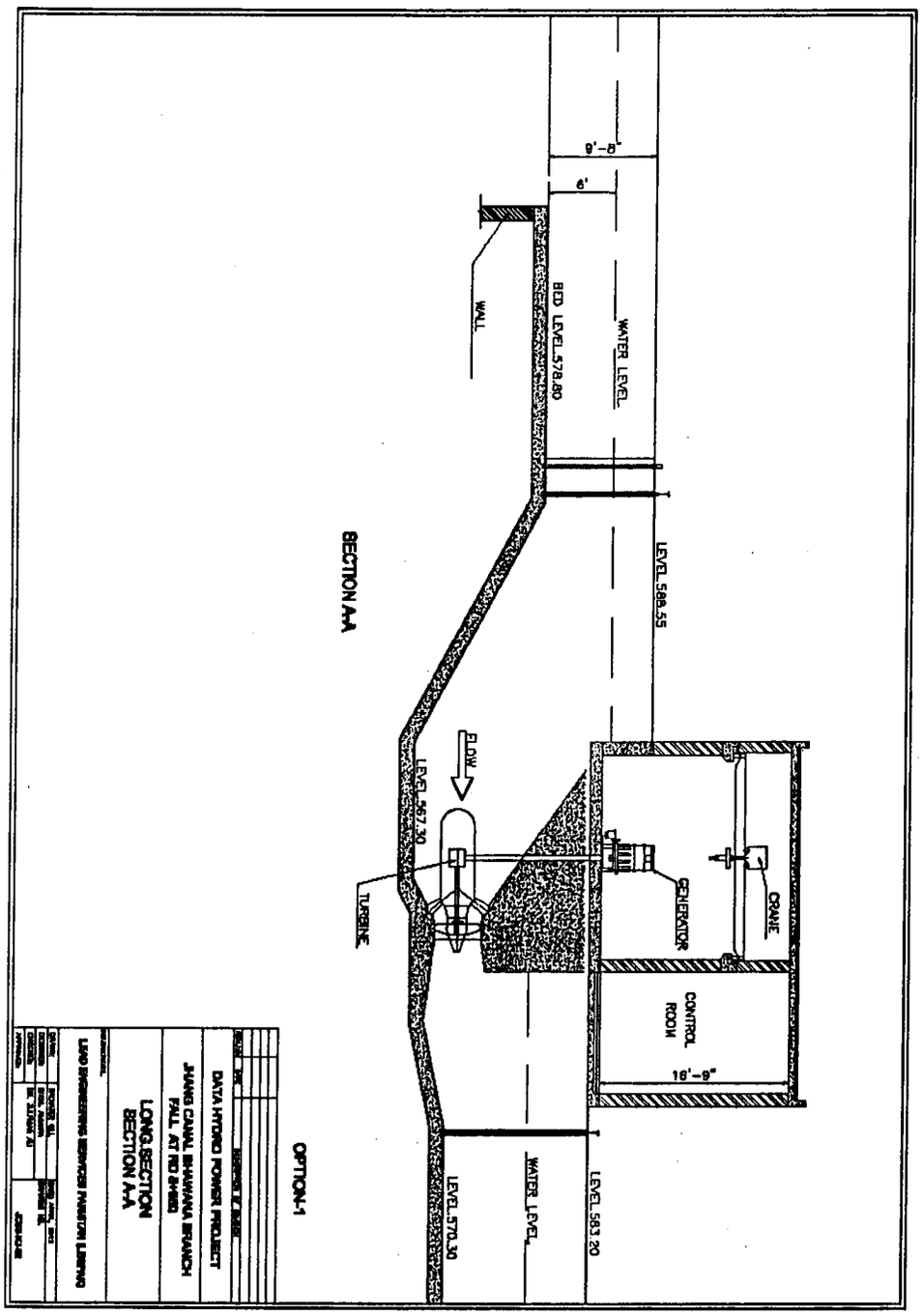


Figure 4-9: Fall at RD 8+950 (Option-1, Longitudinal Profile)

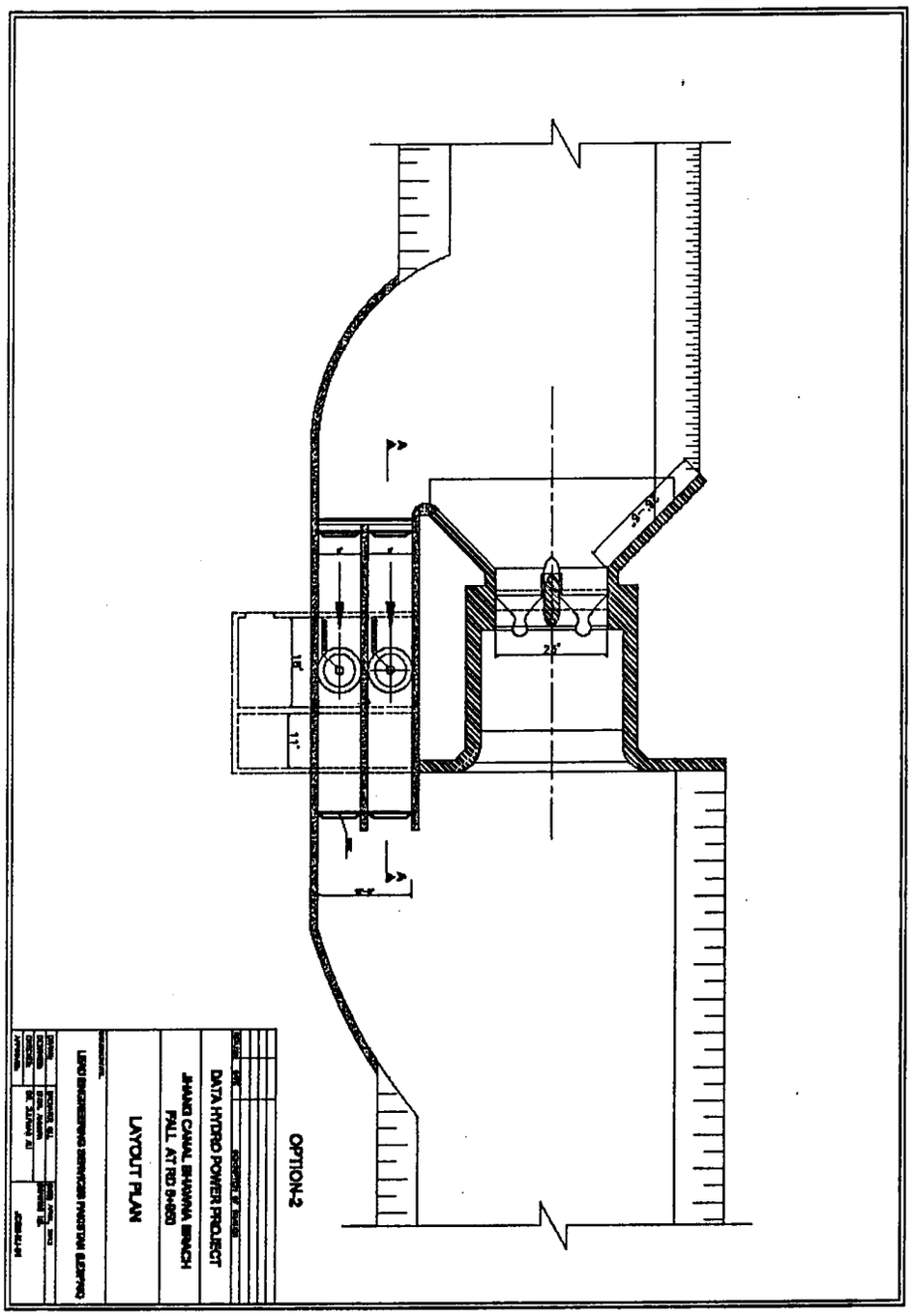


Figure 4-10: Fall at RD 7+449 (Option-2, Layout Plan)

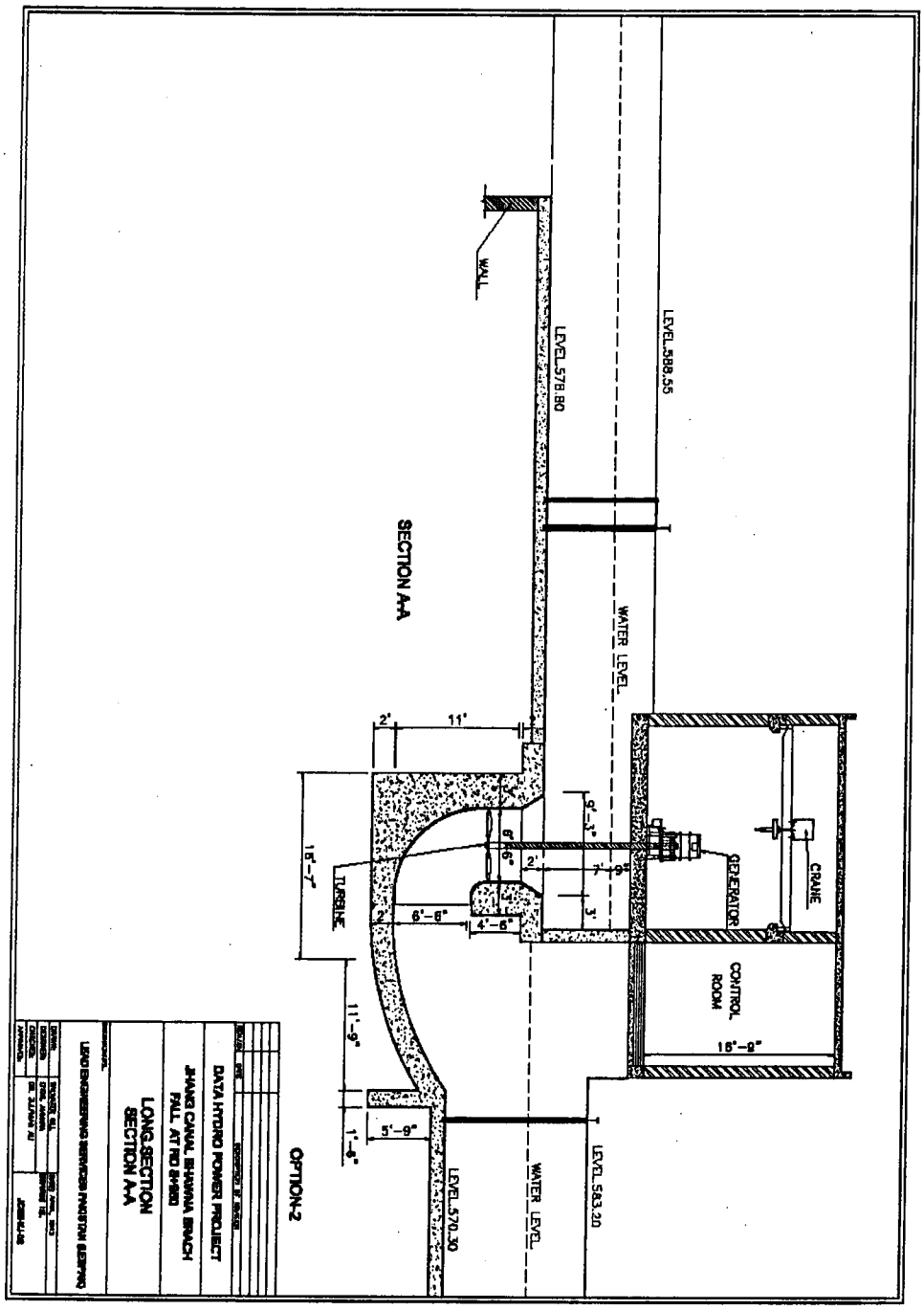


Figure 4-11: Fall at RD (8+950 (Option-2, Longitudinal Profile)

4.5 Recommended Arrangements

Various possible turbines arrangement were extensively debated within the group and local manufacturers. Finally, horizontal axis bulb turbine system, with bevel gear system are being proposed.

5. HYDRAULIC DESIGN CONSIDERATIONS

5.1 General

The basic concept for the development of the project is to divert flows keeping upstream water level constant. Moreover, the flow reenters the canal with the velocity that it will not erode the bed. A control mechanism consisting of gates at the existing falls and power intake are being proposed. These gates shall be used to regulate flow without disturbing upstream water levels.

The infrastructure to be developed for the project would include two powerhouse buildings, approach channel, pit to house turbines, inlet to guide the flow towards the turbine blades along with trash racks, stop logs and gating mechanism and the tailrace channel.

Both the powerhouses will have horizontal Kaplan bulb turbines with bevel gear driven generator units and the associated electro-mechanical equipment. The powerhouse will be essentially a reinforced concrete structure. A bridge will be provided over the channel to allow access to the existing footbridge on the fall.

As stated earlier the gates on the existing canal falls are proposed to divert flow in power intakes. In case of closure of the powerhouses, the water will be discharged in the canal by opening the gates.

5.2 Approach Channels

The powerhouses are proposed on the right side of the existing falls. The canal width at the falls are about 57 ft whereas the waterway width at the power intakes are about 40 ft. This converges in to a 20 ft wide channels with a 3% bed slope. Approach channels divides in to two rectangular channels each having a width of 10 ft.

Geometric parameters such as the channel width and the flow depth are determined using suitable Manning's n value. Other factors that have been considered in the design are freeboard, velocity of flow along its length. Measured 'n' for concrete lined channels vary from 0.014 to 0.020. New channels being designed under Command Water Management Projects have 'n' values varying from 0.016 to 0.018.

For the power channel with a conservative estimate for the high quality finish expected on the concrete surface, 0.014 values for Manning's n.

Design of lined sections using Manning's equation is a well established:

Manning's equation $$V = \frac{R^{2/3} S^{1/2}}{n}$$ (m/s)

Since, $V = Q/A$

Manning's equation for discharge can be written as; $Q = \frac{1}{n} R^{2/3} S^{1/2} A$

The above equation is solved for various values of bed width and side slopes, using suitable values for Manning roughness co-efficient. The section recommended in Table 5.1 demonstrates the optimization and confirms other hydraulic design issues.

Table 5-1: Flow parameters in the approach channel (Fall at RD 7+449)

U/S of the New Regulator						
Canal Bed Level (RL)	Water Level (RL)	Water Depth (ft)	Waterway width (ft)	Flow Area (ft^2)	Design Discharge (ft^3)/sec	Velocity of Approach (ft/s)
588.1	594.85	6.75	20	135	400	3.0

5.3 Waterway/Conveyance System

Two turbines, at each of the falls are proposed as discussed with the manufactures. At the upper fall, the flow is to be diverted to the turbines by a sloping RCC floor, which starts from the canal bed (EL 588.1 ft), and ends at EL576.5 ft. This provides sufficient water depth to avoid air entry into the turbines. Similar arrangements are being proposed for the second fall. The arrangements are shown in the relevant drawings.

A power conduit is to be converged from 10 ft wide section at the inlet to about 6 ft diameter conduit at the turbine location. After that, a divergence is provided by increasing the dimensions at the outlet. This convergence and divergence will develop smooth flow passage in the waterway.

The hydraulic losses in the turbines and waterway including frictional and minor comes out to be about 0.6 ft (0.2 m). The remaining net head will generate power at the design discharge.

5.3.1 Tailrace Channels

Flow coming out from the draft tubes is lead through the tailrace channels before it enters to the main canal. Divergence of the tailraces are enough to develop favourable flow conditions. The tailrace channel has been designed to have sufficient width, depth and divergence/transitions to ensure velocity within acceptable limits. The tailrace downstream ramp cutoff is stone lined for a length of about 32 ft (10 m).

5.4 Trash Racks

The trash rack is the first important protection element against the inflow of solid material that can provoke damage in turbines. The rack is located at start of power channels. The

rack is defined by bar spacing "a" length in the flow direction "b" thickness "c" the total cross-section, "S". These dimensions shall be established in the detail design stage. The trash rack parameters are shown in Figure 5.1

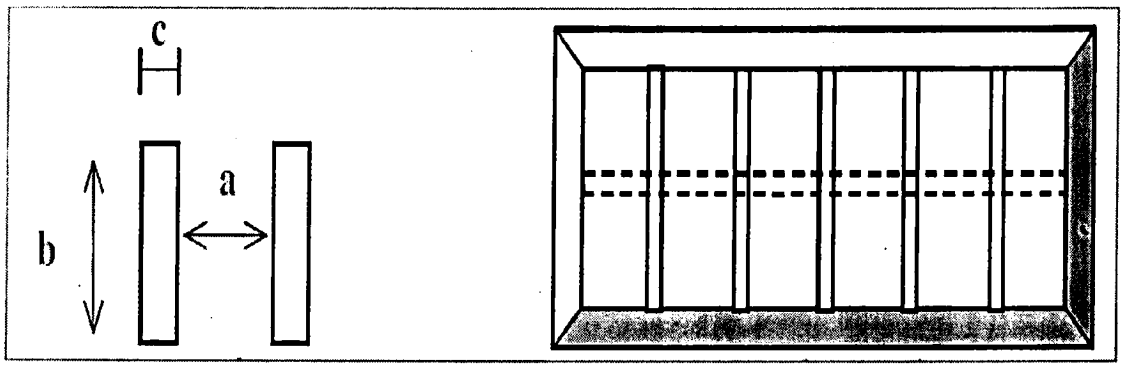


Figure 5-1: Considerations for Trash rack Dimensions

The rack must be specified in order to avoid excessive head loss by grid obstruction if the spacebars are too small, neither to allow driving solid material into the turbine flow if the spacebars are very large. For a submerged rack with the maximum flow, approach velocity is about 0.80 to 1.00 m/s. This velocity is based on the kinematic law. For Kaplan turbines, the recommended space bar "a" is 0.10 - 0.15 m

5.5 Main Intake

The hydraulic conveyance system starts with an efficient intake structure. As water is led to the turbine propellers, vortex formation by insufficient intake submergence can induce air dragging or even solid material to the turbine inlet, reducing the turbine efficiency. The vortex development will depend on the geometry of the intake, the submergence and the approach flow velocity. The relationship between depth of submergence, intake opening and velocity of flow is governed by the Equation;

$$S/d = C \times V/\sqrt{gd}$$

The components of equations are explained in Figure 5.2.

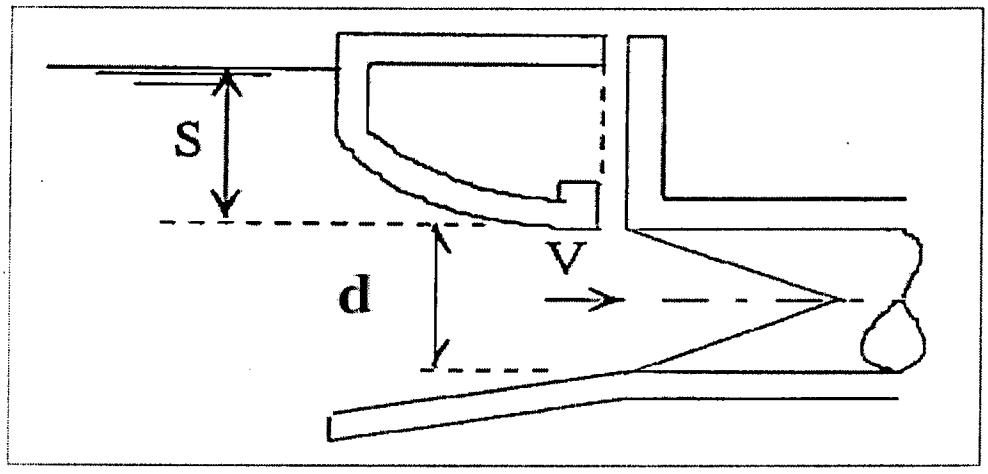


Figure 5-2: Dimensions for Turbine Intake

6. STRUCTURAL DESIGN CONSIDERATIONS

6.1 Structural Design Criteria

6.1.1 Introduction

The structure of the powerhouse will be designed and checked for safety and stability during construction, normal operation, extreme loads and earthquake forces. To achieve this objective, the relevant national and international codes and standard as detailed below will be followed.

6.1.2 Relevant Codes and References

ACI 318-05	American Standards for Concrete Structures
ACI 350 R	Environment Engineering Concrete Structures
ACI 315-04	(Details and Detailing of Concrete/ Reinforcement)
PCA Notes	(Portland Cement Association Notes)
ACI 224.3R-01	(Joints in Concrete Construction)
UBC 1997	(Uniform Building Code)
Building Code of Pakistan (SP 2007)	(Pakistan Standards for Buildings)
ASCE 7 - 05	Minimum Design loads for buildings and other Structures

6.1.3 Material Properties

28 days cylinder compressive strength of concrete:	
Columns	4000 psi
Beams & Slabs	3000 psi
Foundation	4000 psi
Shear Wall (Lift Well)	4000 psi
Retaining Wall	4000 psi
Concrete Floor	3000 psi

Minimum Yield Strength of Reinforcing bars as per ASTM A615:	
All reinforcing bars (Except Stirrups)	60,000 psi
Stirrups	40,000 psi

Unit Weight:	
Reinforced Concrete	150 pcf
Plain Cement Concrete	145 pcf
Dry weight of Soil	110 pcf
Saturated weight of soil	121 pcf
Bricks, Tiles and other imposed loads	121 pcf

Friction Factor	
Concrete to Soil	0.5
Concrete to Concrete	0.75
Minimum Concrete Cover	
Directly placed on earth	3"
Columns	1-½"
Beams	1-½"
Slab	¾"
Outer face of retaining wall	1-½"
Wall faces in contact with water	2"
All other faces of retaining wall	¾"

6.1.4 Design Loads

The load categories are defined in following sub sections:

Dead Loads

The dead loads on the structure are:

Self Weight

Self weight will be computed from the unit weight of members and their cross-sectional dimensions.

Permanent Loads in Addition to Self Weight

The loads of lining and other well-defined installation are covered under this category. These loads are sub divided into following types; Differed loading designation is given below:

a. Dead Load from Equipment	DL1
b. Dead Load from lining or insulation	DL2
c. Partition load	super dead DL3

Live Loads

Live loads which have to be taken in the design include human load, load of plant operators, furniture, equipment, traffic and material. In material loads storage, transportation, occasional accumulations, dusts and fillings are considered. The different categories of live loads are given below along with their designation:

Live load from human furniture, equipment and stored	LL1
Material accumulation and similar conditions	LL2

Extraordinary Live Loads

These loads are considered when extreme loading conditions for equipment or plant are expected. These loads include mechanical plants / installations.

Earthquake Loads

The following are earthquake design parameters as per UBC1997 and BCP (SP-2007)

Zone Coefficient	0.2(Zone-2b)
Importance Factor	1.25
Soil Profile Type	C (Stiff soil)
Lateral Force resisting system's global ductility factor	5.5
Time Period Coefficient (Ct)	0.030

Self-weight, loads of finishes, partitions and 25% of live load are taken as major source for the calculation of base shear and earth quake forces.

Wind Load

Design Wind Speed	100 MPH
Importance Factor	1.25
Exposure	B

6.1.5 Seepage and Uplift Pressures

The need to provide adequate resistance to seepage both under and around a hydraulic structure is an important determinant of its geometry. The boundary between a structural surface and foundation soil or backfill represents a potential plane of weakness, particularly along the back of earth retaining walls and around cut-offs. Good compaction of soil during construction is vital.

Uncontrolled seepage can promote the following types of failures:

- Piping through soil subjected to an excessive overall hydraulic pressure gradient that causes soil particles to be dislodged from the matrix. Progressive undermining of the structure and effective failure may result.
- 'Boiling' of the subsoil at the exit from a structure caused by a local excess pressure gradient
- Under submerged conditions, the density of most soils will be only about 50% of the un-submerged bulk density. The seepage hydraulic pressure will be directed vertically upwards at emergence.
- The combined effect may be to lift out soil particles and undermine the structure from the downstream end.
- Uplift of the whole or parts of the structure by the underlying hydraulic pressure in the soil.
- Piping starts when upward thrust of water beneath a structure is greater than the submerged weight of the soil resisting the upward thrust at the end cut-off/pile. The situation may occur when the discharge is low, but the pond level is at its maximum. For large structures, it may be practicable to conduct seepage analysis using:

i. Flow net constructed by trial and error or graphical methods

ii. Mathematical solutions of the Laplace equation using computer software

However, simplified and empirical methods are commonly used in routine while designing structures for low to medium heads. Lane's Weighted Creep theory and Khosla's Method of Independent Variables are commonly adopted for the design of barrages on permeable foundation.

A sufficiently low seepage gradient under the structure has to be maintained so that fines will not be washed out. This can be done by controlling exit gradient and keeping it in safe limit with the provision of extra cutoffs. The pier and abutment foundations and cutoffs must be extended below the likely scour depths or be provided with adequate protection.

6.1.6 Load Combinations

The following Strength Design Load Combinations recommended by UBC 1997 and ACI will be employed for proportioning of concrete sections.

a. 1.4(D + F)
b. 1.2(D + F + T) + 1.6(L + H) + 0.5(Lr or S or R)
c. 1.2D + 1.6(Lr or S or R) + (1.0L or 0.8W)
d. 1.2D + 1.6W + 1.0L + 0.5(Lr or S or R)
e. 1.2D + 1.0E + 1.0L + 0.2S
f. 0.9D + 1.6W + 1.6H
g. 0.9D + 1.0E + 1.6H

Where:

D = service dead loads
L = service live load
Lr = service roof live load
S = snow loads
W = wind loads
R = rainwater loads
E = earthquake loads
F = fluid loads
H = soil loads
T = Temperature, creep, settlement, shrinkage loads

The following Working Stress Design Load Combinations will be employed for proportioning of concrete sections of Footings, and for checking serviceability limit states:

1- Dead
2- Dead + Live
3- Dead + 0.72 Seismic
4- Dead + 0.75 Live + 0.54 Seismic

5- 0.9 Dead + 0.72 Seismic

Load combination to check the shear strength against earth-quake for intermediate moment resisting frame.

1.2 D + 2.0 E + 1.0 L

6.1.7 Vibration Limits

Necessary information about the vibration limits of the mechanical installation will be provided by the manufacturer/provider.

6.2 Structural System

The structural system of the powerhouse building will be Reinforced Concrete (R.C) Frame structure. In order to avoid the transformation of vibration to the main building of powerhouse, the foundation (mass concrete) of the turbines and generators will be kept separate from foundation of powerhouse building.

The sub-structure will also include upstream and downstream sloping floor. A minimum factor of safety of 2.5 will be considered while designing the foundation of turbines, generators and gates.

6.3 Powerhouse Design

The sub-structure of powerhouse is a mass concrete as it houses the turbines and generators and supports stop logs etc. The dimensions of the powerhouses shall be enough to accommodate two turbines along-with the generators, electrical equipment and the offices. The foundation of the power house has been designed by considering the bearing capacity of 0.64 MPa. The structural stability of powerhouse building components has been analyzed assuming an individual structure unit for the following conditions:

- Dead loads and live loads
- Normal operational conditions
- Normal headwater and tail water

The structural stability conditions against uplift, overturning and sliding have been analyzed. Reinforcing steel with yield strength of 420 MPa (60,000 psi) and structural concrete with 28 days compressive strength of 21 MPa (3000 psi) is considered for design purposes. The plan and section of the powerhouse are shown in feasibility drawings.

Design of Sub-structure

The sub-structure consists of u/s sloping floor, d/s sloping floor and mass concrete, which house turbines and the generators. The weight of mass concrete shall be sufficient to control vibration in the powerhouse building. A minimum factor of safety between mass concrete and mass of turbines/generators/gates etc shall be greater than 2.5.

The cut-off walls at the start of u/s sloping floor and end of d/s concrete floor are provided to control seepage and uplift pressure head. A nominal thickness of 600 mm is proposed for the cutoff walls. The floor thickness is varied as shown in the relevant drawings.

Design of Superstructure

The superstructure of the powerhouse will be a RCC frame structure. The structural stability of powerhouse building has been assessed under sliding and overturning both for the static and earthquake conditions. A ground acceleration of 0.2 g has been adopted for design of powerhouse. The results of the stability analysis indicate that the structure will be safe under possible loading conditions with appropriate safety factors.

6.4 Geotechnical Design Criteria

The project is proposed to be built in deposits that are typical of the Indus alluvial plain. These deposits comprise of sand, sand and clay mixtures that show lateral and vertical gradational changes resulting from their mode of deposition by shifting river canals and associated over-bank depositional environments.

A foundation (or footing) provides a critical interface between a structure and the ground beneath it. The behavior of the foundation depends on the nature of the soil and the behavior of the soil depends on the size and shape of the foundation. The soil's bearing capacity is therefore affected by the foundation's dimensions.

The bearing capacity of a soil is often limited by the amount of (differential) settlement acceptable to the structure. Where shear failure occurs, the failure mode depends mainly on the compressibility of the soil. In frictional soils, a general shear failure is likely where a clearly defined failure surface develops on one or both sides of the footing. In highly compressible clays and silts, a punching shear failure is likely, and surface bulging may be absent.

6.5 Seepage and Uplift Pressures

The need to provide adequate resistance to seepage both under and around a hydraulic structure is an important determinant of its geometry. The boundary between a structural surface and foundation soil or backfill represents a potential plane of weakness, particularly along the back of earth retaining walls and around cut-offs. Good compaction of soil during construction is vital.

Uncontrolled seepage can promote the following types of failures:

- Piping through soil subjected to an excessive overall hydraulic pressure gradient that causes soil particles to be dislodged from the matrix. Progressive undermining of the structure and effective failure may result.

- 'Boiling' of the subsoil at the exit from a structure caused by a local excess pressure gradient

- Under submerged conditions, the density of most soils will be only about 50% of the un-submerged bulk density. The seepage hydraulic pressure will be directed vertically upwards at emergence.

- The combined effect may be to lift out soil particles and undermine the structure from the downstream end.

- Uplift of the whole or parts of the structure by the underlying hydraulic pressure in the soil.
- Piping starts when upward thrust of water beneath a structure is greater than the submerged weight of the soil resisting the upward thrust at the end cut-off/pile. The situation may occur when the discharge is low, but the pond level is at its maximum. For large structures, it may be practicable to conduct seepage analysis using:

- Flow net constructed by trial and error or graphical methods
- Mathematical solutions of the Laplace equation using computer software
- However, simplified and empirical methods are commonly used in routine while designing structures for low to medium heads. Lane's Weighted Creep theory and Khosla's Method of Independent Variables are commonly adopted for the design of barrages on permeable foundation.

  A sufficiently low seepage gradient under the structure has to be maintained so that fines will not be washed out. This can be done by controlling exit gradient and keeping it in safe limit with the provision of extra cutoffs. The pier and abutment foundations and cutoffs must be extended below the likely scour depths or be provided with adequate protection.

The specification of the works shall be based on (ASTM) Standards. However, every item of works shall be explained technically for the convenience of the executing agency. The basis of measurement and payment shall be part of the specification. The special works if not covered under ASTM will be explained and described in the Technical Specifications.

The Consultant shall try to explain the works in a manner, which is clearly understood in terms of work and payments.

7. HYDRO MECHANICAL EQUIPMENT

7.1 General

Kaplan bulb turbines are well suited to situations in which there is a low head and a large amount of discharge. For gross head as low as 2.2 meter and unit discharge up to 45 m^3/s, Kaplan bulb turbine with two, three or four blades is the first choice. The turbine may be fitted with guides control the angle of water flow into the blades. The adjustable runner blades enable high efficiency even in the range of partial load, and there is little drop in efficiency due to head variation or load.

Because of recent developments, the ranges of Kaplan turbines applications have been greatly increased. They are being applied, for example, in exploiting many hydro sources previously discarded for economic or environmental reasons.

7.2 Bulb Turbine with Bevel Gear

A variation of Kaplan turbine is the bulb turbine. This type of turbine is used for the lowest possible heads. It is characterized by having the essential turbine components. A major difference between the ordinary Kaplan and Bulb turbines is that in the latter the water flows with a mixed axial-radial direction into the guide vane cascade and not through a scroll casing. The guide vane spindles are inclined (normally 60°) in relation to the turbine shaft.

Bevel gear bulb (BGB) turbine shall be executed with a horizontal shaft and a turbine housing with round shaped inlet. The statically balanced runner with movable blades shall be fixed to the turbine shaft by means of pressure oil injection method. The turbine shaft and its roller bearings shall be supported in the rigid and buckling resistant turbine housing.

Double regulated bevel gear bulb turbine shall utilize the available potential energy with highest possible equipment efficiencies and impressing part load characteristics. By means of bevel gear, the turbine transmits its power output to a high-speed synchronous generator of standard design. This design concept allows the selection of the most advantageous speed from hydraulic point of view. Arrangements of Bevel Gear Bulb Turbine in a water passage and its principal parts are shown in Figure 7-1 as under:

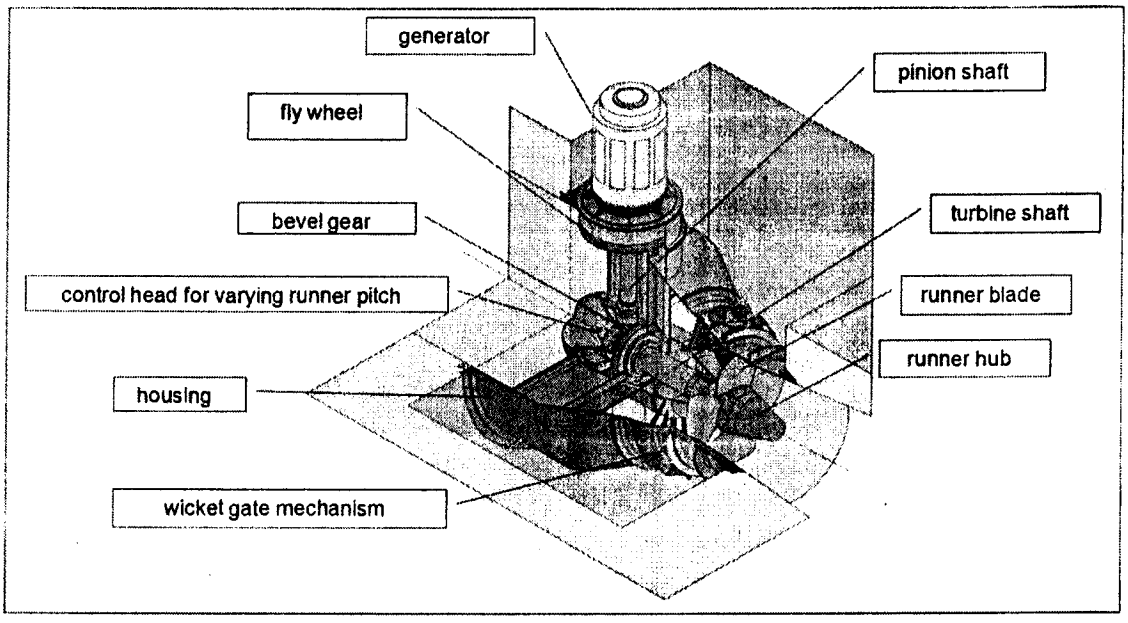


Figure 7-1: Arrangement of BGB Turbine with its Principal Components.

7.3 Unit Capacity

Mechanical power at turbines shaft is worked out with the equation as under:

Brake power at turbine shaft= $P \times \eta g \times \eta t$

Now;

Installed capacity / Unit (P)	150kW
Generator Efficiency (η_g) =	0.95%
Turbine Efficiency (ηt) =	0.9%

7.4 Selection criteria of BGB Turbine

Selection of turbines are based on the technical parameters shown in Figure 7.2

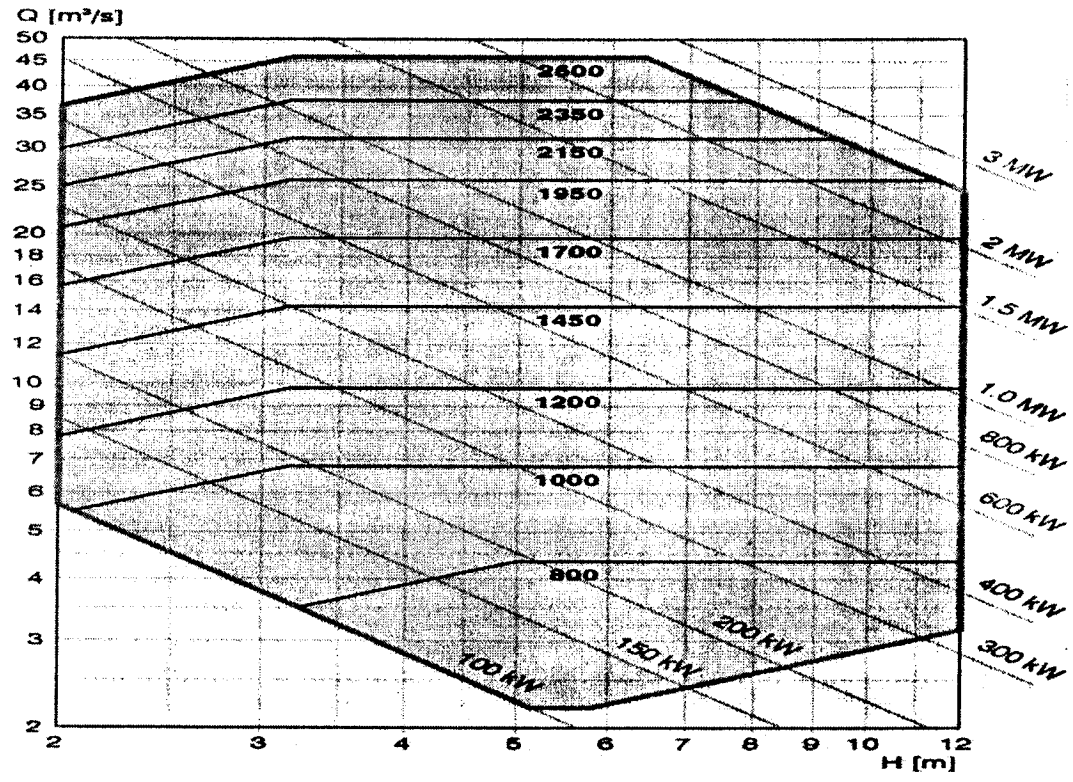


Figure 7-2: Selection criteria of BGB Turbine

7.5 Range of Turbine Efficiency

The expected range of efficiency at part gate opening is given in Table 7.1

Table 7-1: Variation of Efficiency

Q	$Q_{turbine}$	Efficiency
(%)	m^3/s	%
108	6.1	88
100	5.7	90.2
90	5.1	91.2
80	4.5	92.1
70	4.0	93
60	3.4	93.6
50	2.8	93.4
40	2.3	92.5

7.6 Summary of Design Parameters

The summary of mechanical design parameters are given in Table 7-2 & 7-3 as under:

Table 7-2: Proposed Design Parameters

	KAPLAN TURBINE DESIGN (Fall at RD 7+449)			
1	Power from Kaplan Turbine			
	Head	H	2.85	m
	Discharge	Q	11.32	m^3/sec
	Gravitational Acceleration	g	9.81	m/sec^2
	Speed Ratio	K_u	2.00	2.0 - 2.1
	Flow Ratio	K_f	0.67	0.63 - 0.7
	Specific Weight	w	9810	N/m^3
	Efficiency	η	0.75	
	Power	P	238	kW
2	Outer diameter of runner			
	Outer diameter of runner	D_o	1.8	m
	Hub or boss diameter	D_b	0.63	
	D_b/D_o		0.35	
	Flow velocity	V_f	5.0	m/sec
	Peripheral velocity	u	15.0	m/sec
		D_o	1.81	m
3	Hub diameter			
		D_b	0.63	m
4	Speed rpm			
		N	158	rpm
5	Torque			
			14	kN.m
6	Ruuner vane angles			
	Analysis at hub section			
	Peripheral velocity at hub	u_1	5.24	m/sec
	Hydraulic efficiency	η_h	0.95	
		V_{u1}	5.08	m/sec
	Runner vane angle at inlet	β_1	91.8	deg
	Runner vane angle at outlet	β_2	43.7	deg
	Analysis at extreme edge of runner			
	Peripheral velocity at outer periphery of runner	u_1	15.0	m/sec
		V_{u1}	1.8	m/sec
	Runner vane angle at inlet	β_1	159.2	deg
	Runner vane angle at outlet	β_2	18.5	deg
7	Plant Factor		72	%

Table 7-3: Proposed Design Parameters

	KAPLAN TURBINE DESIGN Fall at RD 8+950			
1	Power from Kaplan Turbine			
	Head	H	2.16	m
	Discharge	Q	11.32	m^3/sec
	Gravitational Accelerartion	g	9.81	m/sec^2
	Speed Ratio	K_u	2.00	2.0 - 2.1
	Flow Ratio	K_f	0.67	0.63 - 0.7
	Specific Weight	w	9810.00	N/m^3
	Efficiency	η	0.75	
	Power	P	180	kW
2	Outer diameter of runner			
	Outer diameter of runner	D_o	1.9	m
	Hub or boss diameter	D_b	0.68	
	D_b/D_o		0.35	
	Flow velocity	V_f	4.4	m/sec
	Peripheral velocity	u	13.0	m/sec
		D_o	1.94	m
3	Hub diameter			
		D_b	0.68	m
			2.23	ft
4	Speed rpm			
		N	128	rpm
5	Torque			
			13	kN.m
6	Runner vane angles			
	Analysis at hub section			
	Peripheral velocity at hub	u_1	4.56	m/sec
	Hydraulic efficiency	η_h	0.95	
		V_{u1}	4.42	m/sec
	Runner vane angle at inlet	β_1	91.8	deg
	Runner vane angle at outlet	β_2	43.7	deg
	Analysis at extreme edge of runner			
	Peripheral velocity at outer periphery of runner	u_1	13.0	m/sec
		V_{u1}	1.5	m/sec
	Runner vane angle at inlet	β_1	159.2	deg
	Runner vane angle at outlet	β_2	18.5	deg
7	Plant Factor		72	%

8. HYDRO ELECTRICAL EQUIPMENT

8.1 Electrical Equipment Layout Plan

The Project is proposed to be based on the arrangement of four BGB bulb type turbines and generator sets giving a unit installed capacity of 150 kW. The choice of using gear for increasing the generator RPM has been adopted due to low head, low speed of turbine runner. Without a geared driven generator, the size of generator would be very large. The electrical equipment layout plan is shown in Figure 8.1.

As stated earlier, the power produced shall be used by the sponsor's. The transmission system shall be designed accordingly. The following electrical equipment is required which shall be designed and manufactured in accordance with applicable IEC codes and standards.

No. PPDB/ 1096 /2013

PUNJAB POWER DEVELOPMENT BOARD

ENERGY DEPARTMENT

1st Floor, Central Design Building,
Irrigation Secretariat, Old Anarkali, Lahore
(Ph: 042-99213877 Fax: 99212796)

Date 10/12 /2013

1. Mr. N.A. Zuberi, Managing Director, Private Power & Infrastructure Board, Government of Pakistan, 50-Nazim-ud-Din Road, F-7/4, Islamabad
2. Dr. Engineer Javed Yunas Uppal, Chairman, Engineering Project Development Consultants, 1-A, Aibak, New Garden Town, Lahore
3. Mr. Liaqat Ali Iqbal, Project Director, Punjab Power Management Unit, 77-Shahjamal Colony, Lahore
4. The Superintending Engineer, Lower Chenab Canal (West) Circle, Irrigation Department, Faisalabad
5. The Chief Executive Officer, Faisalabad Electric Supply Company (FESCO), Faisalabad

Subject: **MINUTES OF MEETING OF PANEL OF EXPERTS (POEs) REGARDING DRAFT FEASIBILITY STUDY OF 0.30 MW DATA HYDROPOWER PROJECT ON BHOWANA BRANCH AT RD. 7 + 400 TO RD. 9 + 000, DISTRICT CHINIOT**

A meeting of Panel of Experts (POE's) was held on **28th November 2013** in the Committee Room of Energy Department, under the Chairmanship of under signed to discuss and review the revised draft of feasibility study of subject cited Hydropower project. The minutes of said meeting are enclosed for your kind information please.

Regards,

Managing Director
Punjab Power Development Board

Encl: *As stated above*

CC:

1. P.S. to Additional Chief Secretary, Government of the Punjab, Energy Department, Lahore
2. M/s Data Oil Mills Limited, P–44, Street Mian Gujjar, Ghulam Muhammadabad No. 1, Faisalabad
3. M/s LESPAK, P-10, Staff Colony, U.E.T. Lahore with request to present the report before POE's

PUNJAB POWER DEVELOPMENT BOARD
ENERGY DEPARTMENT

MINUTES OF PANEL OF EXPERTS (POEs) MEETING REGARDING REVISED DRAFT OF FEASIBILITY STUDY OF 0.30 MW DATA HYDROPOWER PROJECT ON BHOWANA BRANCH AT RD. 7 + 400 TO RD. 9 + 000, DISTRICT CHINIOT

A meeting of Panel of Experts (POE's) was held on 28th November 2013 in the Committee Room of Energy Department under the chairmanship of Managing Director, Punjab Power Development Board (PPDB). Following were the participants of meeting:

PRESENT:

Sr. #	Name	Designation	Department	POEs Formation
1	Mrs. Saniya Awais	Managing Director (Convener)	Punjab Power Development Board (PPDB)	Convener
2	Mr. Munawar Iqbal	Director (Hydel)	Private Power & Infrastructure Board (PPIB)	Member
3	Dr. Javed Yunas Uppal	Member POE	EPDC	Member
4	Mr. Mushtaq Ahmad	Executive Engineer (Jhang)	Irrigation Department	Member

IN ATTENDANCE:

Sr. #	Name	Designation	Department
1	Mr. Abdul Majid Malik	Consultant	Punjab Power Development Board (PPDB)
2	Mr. Abdul Rauf	Manager Finance	Punjab Power Development Board (PPDB)
3	Miss Afifa Jabeen	Assistant Manager (Legal)	Punjab Power Development Board (PPDB)
4	Dr. Zulfiqar Ali	Consultant	LESPAK
5	Haji Manzoor Hussain	Managing Director	Data Oil Mills
6	Mr. Ghulam Qadir	Project Director	Data Oil Mills

10/12/13

Meeting started with the **Name** of the **Almighty ALLAH**. Agenda of the meeting was to discuss and review the revised draft of feasibility study report (the "Report") forwarded by M/s Data Oil Mills (the "Project Sponsors") to PPDB. Mrs. Saniya Awais, Managing Director PPDB, being convener of the POE's, chaired further proceedings of the meeting.

Dr. Zulfiqar Ali, Consultant, M/s LESPAK made a detailed presentation of technical part of the feasibility study. The details of technical, legal and financial aspects of the project were discussed as under:

- The sponsors indicated to install locally manufactured turbine. Therefore, POEs desired to get the approval of electro-mechanical equipment of the plant fro the Irrigation Department. The said approval should be in line with the Punjab Power Generation Policy 2006 (Revised – 2009) and Government of Pakistan Policy for Power Generation Projects – 2002
- Plant installation should not have any adverse effect on the Irrigation system.
- The Initial Environmental Examination (IEE) certificate should be obtained from Environmental Protection Agency (EPA) Punjab.
- The report indicates that the energy produced will be sold to M/s Fatima Industries. Therefore, Regulatory provisions of NEPRA will be applicable especially when the Sponsors and the consumers are two different legal entities.
- The Policy – 2009 provision for sale of Power to Bulk Consumer has been invoked therefore the legal aspects in this regard and for the development of the project may be addressed appropriately by the sponsors and Assistant Manager (Legal) PPDB, should ensure legal parameters in this regard.
- Mr. Munawar Iqbal, worthy member of POE's, stressed that extra land other than required for the project installation shall not be provided.

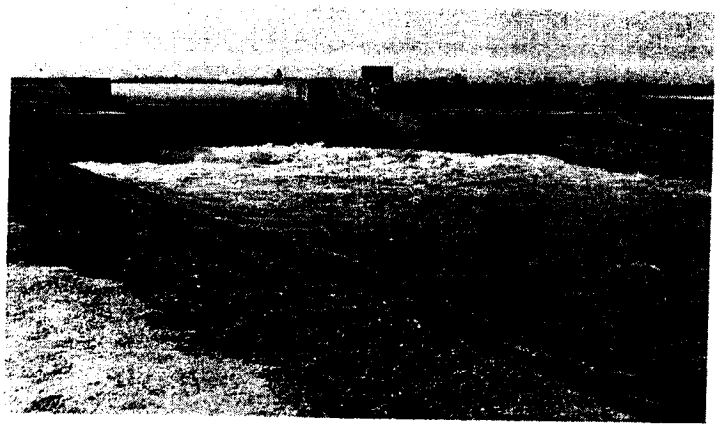
The technical part of feasibility study has been approved by the Panel of Experts (POEs) subject to the above mentioned approvals.

The meeting ended with vote of thanks from and to the Chair.

x----------x----------x----------x----------x----------x

10/12/13

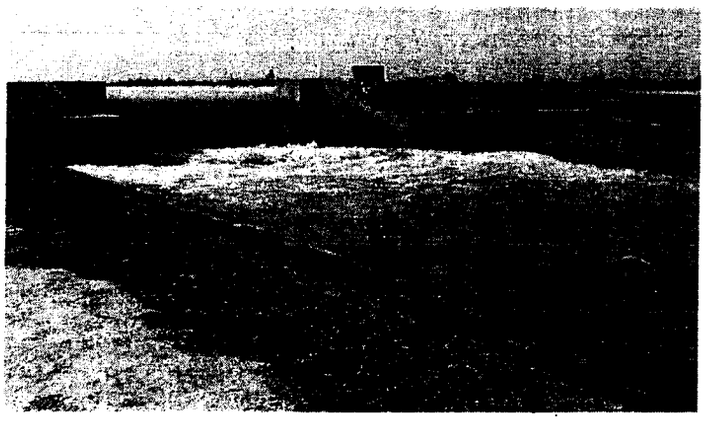
DATA HYDROPOWER PROJECT
BHOWANA BRANCH RD.7+400 TO RD.9+000
DISTRICT CHINIOT



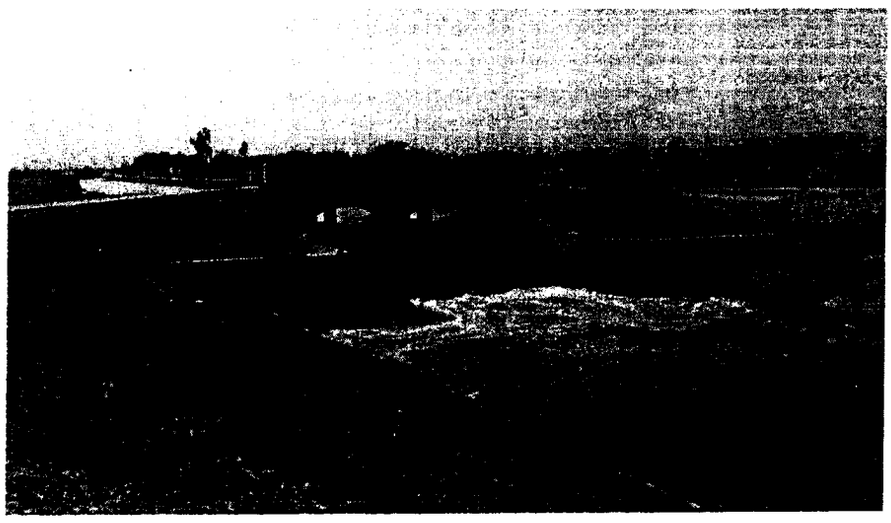
IEE REPORT

JANUARY 2014

DATA HYDROPOWER PROJECT
BHOWANA BRANCH RD.7+400 TO RD.9+000
DISTRICT CHINIOT



IEE REPORT



JANUARY 2014

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

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DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

CHAPTER-1

Environmental Laws

1. Pakistan Environmental Protection Act, 1997

The Pakistan Environmental Protection Act, 1997 (PEPA 1997) is the basic legislative tool empowering the government to frame regulations for the protection of the environment. The Act is applicable to a broad range of issues and extends to air, water, soil, marine and noise pollution, as well as the handling of hazardous waste. The discharge or emission of any effluent, waste, air pollutant or noise in an amount, concentration or level in excess of the National Environmental Quality Standards (NEQS) Specified by the Pakistan Environmental Protection Agency (Pak-EPA) has been prohibited under the Act, and penalties have been prescribed for those contravening the provisions of the Act. The powers of the federal and provincial Environmental Protection Agencies (EPAs), established under the Pakistan Environmental Protection Ordinance 1983 have also been considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible branches of environmental law either of their own accord, or upon the registration of a complaint.

The requirement for environmental assessment is laid out in Section 12 (1) of the Act. Under this section, no project involving construction activities or any change in the physical environment can be undertaken unless an initial environmental examination (IEE) or an environmental impact assessment (EIA) is conducted, and approval is received from the federal or relevant provincial EPD. Section 12 (6) of the Act states that this provisions is applicable only to such categories of projects as may be prescribed.

2. National Environmental Quality Standards (NEQS), 2000

The NEQS, promulgated under the PEPA 1997, specify Selected NEQS for liquid effluents discharged to inland waters, gaseous emission from industrial sources and emissions from motor vehicles. These standards will be applicable to the gaseous emissions and liquid effluents discharged to the environment from the proposed project.

3. Review of the IEE and EIA Regulations, 2000

IEE and EIA Regulations, 2000 provide basis for initial screening of a project which specify categories of projects requiring IEE or EIA as per nature of projects and their scale (cost, capacity etc.). According to regulations hydroelectric power generation less than 50 MW appear in the Schedule I. So, a mandatory IEE must be submitted to EPD- Punjab Government.

4. Selected NEQS for Waste Effluents

Parameter	Unit	Standards (Maximum allowable limit)
Temperature increase	C°	<3
pH value (acidity /basicity)	pH	6-9

5-days biochemical oxygen demand (BOD) at 20°C	mg/l	80
Chemical oxygen demand (COD)	mg/l	150
Total suspended solids	mg/l	200
Total dissolved solids	mg/l	3,500
Grease and oil	mg/l	10
Phenolic compounds (as phenol)	mg/l	0.1
Chloride (as CI)	mg/l	1,000
Fluoride (as F)	mg/l	10
Sulfate (SO4)	mg/l	600
Sulfide (S)	mg/l	1.0
Ammonia (NH3)	mg/l	40
Cadmium	mg/l	0.1
Chromium (trivalent and hexavalent)	mg/l	1.0
Copper	mg/l	1.0
Lead	mg/l	0.5
Mercury	mg/l	0.01
Selenium	mg/l	0.5
Nickel	mg/l	1.0
Silver	mg/l	1.0
Total Toxic metals	mg/l	2.0
Zinc	mg/l	5
Arsenic	mg/l	1.0
Barium		1.5
Iron		8.0
Manganese		1.5
Boron		6.0
Chlorine		1.0

Sources: Government of Pakistan (2000).

Notes:

1. The standards assumes that dilution of 1:10 on discharge is available. That is, for each cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
2. Toxic metals include cadmium, chromium, copper, lead, mercury, selenium, nickel, and silver. The effluent should meet the individual standards for these metals as well as the standards for total toxic metal concentration.

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

5. NEQS for Industrial Gaseous Emissions (mg/Nm3 unless otherwise stated)

Parameter	Sources of Emission	Standards (Maximum allowable limit)
Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale or equivalent smoke number
Particulate matter	(a) Boilers and furnaces (i) Oil fried (ii) Coal fried (iii) Cement Kilns	 300 500 300
	(b) Grinding, crushing, clinker coolers and related process, metallurgical process, converters, blast furnaces and cupolas	500
Hydrogen Chloride	Any	400
Chlorine	Any	150
Hydrogen Fluoride	Any	150
Hydrogen Sulphide	Any	10
Sulphur Oxides[2,3]	Sulfuric acid/Sulphonic acid Plants	5,000
	Other Plants except power Plants operating on oil and coal	1,700
Carbon Monoxide	Any	800
Lead	Any	50
Mercury	Any	10

Sources: Government of Pakistan (2000).

Explanations:

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1% sulphur content in fuel oil. Higher content of sulpher will cause standards to be pro-rated.
3. In respect of emissions of sulphur dioxide and nitrogen oxides, the power plants operating on oil and coal as duel shall in addition to NEQS specified above, comply with standards provided separately.

Parameter	Sources of Emission	Standards (Maximum allowable limit)
Cadmium	Any	20
Arsenic	Any	20
Copper	Any	50
Antimony	Any	20
Zinc	Any	200
Oxides of Nitrogen[4]	Nitric acid manufacturing unit	3,000
	Other plants except power plants operating on oil or coal: Gas fried Oil fried Coal fried	 400 600 1,200

6. NEQS for Motor Vehicles Exhaust and Noise

Parameter	Standards (Maximum allowable limit)	Measuring Method
Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode.	To be compared with Ringlemann chart at a distance of 6 meters or more.
Carbon Monoxide	New Vehicle = 4.5%	Under idling conditions: non-dispersive infrared detection through gas analyzer.
Noise	85db(A)	Sound meter at 7.5 meter from the source.

Source: Government of Pakistan (2000).

CHAPTER-2.

Description of the Project

1. Objectives

Pakistan does not have enough proven sources of fossil fuels but is fortunate enough to have been endowed with hydro electric potential available along rivers and irrigation system. Some of this potential is already being utilized by constructing hydroelectric power stations like Tarbela, Mangla and Warsick, Additionally, some low head power stations were planned and constructed within the irrigation system. These hydroelectric projects play a key role to supplement the electricity requirements of the country.

Due to fast growing power demand, the gap between supply and demand has increased to such an extent that power cuts have to extend beyond the closure period of irrigation canals. Besides constrains on water releases and low reservoir levels at Tarbela and Mangla; the availability of foreign currency to pay the bill for imported fuels is becoming an almost insurmountable factor. The lack of funds for imported fuels can either be solved by increasing the tariff to consume or by extending period without power supply. The decision as such seems difficult however the situation depicts that in future, Pakistan do needs to rely more on its own energy sources.

Keeping in view of the scenario, development of high head hydroelectric projects can be more economical compared to any other means of electricity production in Pakistan, but they may need more time for implementation. Contrary to this, some low head hydroelectric projects may be a less economical option but have certain advantages in Pakistan as follows:

- Comparatively shorter period from planning to completion.
- Location next to load centers.
- Infrastructure in the form of existing civil works and vicinity to National Grid.

Due to the above advantages, emphasis is being given to the development of low head hydropower projects. Feasibility study for the construction of a low head hydropower project on Bhowana Branch at RD 7500 + 8816 shall be useful addition in the existing power generating system of the country.

Due to limitations and financial constrains of the public sector, the Government of Pakistan announced its "Policy for Power Generation Projects 2002" package for attracting overseas investment, and to facilitate tapping the domestic capital market to raise local financing for power projects. The main characteristics of this package are intentionally competitive terms, an attractive framework for domestic investors, simplified, procedures and steps to create and encourage a domestic corporate debt securities market.

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

In Punjab, the Punjab Power Development Board was created in the Irrigation Department in 1995, for the promotion of hydel power generation on canal fall sites. At different canals numerous sites of medium and low head have been identified.

Out of these sites, Data Hydropower Project by combining falls at RD 7500 + 8816 in Tehsil Bhowana, District Chiniot of Punjab for implementation of the hydropower project. This is in line with the 2006 policy of the Government of Punjab to encourage private sector to undertake power generation projects.

This feasibility study, leading to the construction of a low head hydropower project on Bhowana Branch near Bhowana town shall be useful addition in the existing power generation system of the country.

2. Project Location

Data Hydropower Project would be developed on Bhowana Branch near Bhowana town in District Chiniot of Punjab Province (Pakistan). The Bhowana Branch canal is a subsidiary of Jhang Branch which itself is a subsidiary of Lower Chenab Canal emerging from Khanki Head Works at the river Chenab. The project is situated at Longitude of 73° - 06`- 30`` east and latitude of 31°-26` - 50``.

The nearest 132 KV grid station for power connection is located at Chakaira approximately 13 KM from the proposed site. Open area is available near the project site for camping at etc. A small canal colony can be built for operation and maintenance staff of the power station near the power generation facility. The principal occupation of the population is agriculture and its related industries. The construction of hydropower station will have no negative impact on the local population of the area.

3. Site Accessibility.

The site is about 163 KM in the west of Lahore near Faisalabad and near Lahore – Faisalabad – Karachi main railway track. The distance of proposed project site is about 1450 KM by road from the Karachi port. The proposed project site is approachable through Faisalabad. Faisalabad is the third largest city of Pakistan and the second largest city of Punjab after Lahore. To the west of Faisalabad, at a distance of approximately 33 KM. The project area on Bhowana Branch RD 7500 + 8816 is accessible by Faisalabad – Bhowana Road. The road upto the site is suitable for the type of traffic envisaged during the project construction phase.

The project area is easily accessed and can be communicated by all means of communication i.e. Railway, Road and Telephone systems. Bhowana is located on main Lahore Jhang Road. Lahore is the Provincial Capital of Punjab and is linked with seaport Karachi by a distance of 1219 km by rail.

The local airport is there at Faisalabad for transportation within the country which is at a distance of 43 Km from the proposed project site. Faisalabad airport connects Faisalabad with other important cities of Pakistan in including Lahore and Karachi.

Faisalabad is connected to Karachi through: -

i. Karachi-Lodhran-Khanewal Road.

ii. Karachi-Multan-Jhang Road.

From Faisalabad the site is approachable through Faisalabad Bhowana Road at a distance about 33 Km from Faisalabad. The site can also be approached from Jhang-Chiniot main road on which Bhowana Town is situated. The project site is about 22 Km from Bhowana.

4. Climate

Climate of the project area is generally hot and dry in the summer and cold in the winter. Summer starts from April and continues until September. Winter sets in October and lasts up to February. July and August are the months of summer rainfall (monsoon) and February to March the months of winter rainfall. Climatological features like temperature, rainfall, wind speed and humidity recorded at the Meteorological Station Faisalabad are described briefly hereunder.

5. Temperature

The hottest months are May, June and July while December, January and February are the coldest; based on data for the period 2011 and 2012 recorded at Faisalabad. The lowest and the highest values of mean monthly temperature are 3.2°, 17.3° C and 26°, 32.3° during the month of January and June respectively. The maximum mean monthly temperature varies between 3.2°C and 27.44° C; whereas the maximum mean monthly temperature varies between 17.3°C and 38.6°C. The maximum and minimum temperature data is presented.

6. Rainfall

The annual total rainfall of Faisalabad during the period 2011-12 is 498.6 mm. Most of the rainfall occurs during the summer monsoon period (July to August), which amounts to 42.4% of the total average annual rainfall. November is the month of minimum rainfall of 0.0 mm and July is of the maximum and amounts to 118.1 mm.

7. Humidity

Humidity is measured at 0500 hours and 0800 hours at Faisalabad Meteorological Observatory. There is a variation between 8.8 mm in May to 2.0 mm in December and January.

8. Wind Speed

Wind Speed is measured at 0500 hours and 0800 hours at Faisalabad Meteorological Observatory. The minimum and maximum values of wind speed are 0.4 km per hour and 10.2 km per hour in December and June, respectively.

9. Underground Water

The underground water of the project area varies in quality from place to place. Some where it is fit, some where marginally fit and at some places un-fit for irrigation as well.

10. Communication

The project area can be easily accessed and communicated by all means of communication i.e. Railways, Roads and Telephone systems.

11. Railway

The project area is located at RD 7500 + 8816 Bhowana Branch near Bhowana about 33 Km from Faisalabad. Faisalabad is located on main Railway track from Karachi to Lahore and it is linked with seaport Karachi by distance of 1025 Km.

12. Airport

Local airport is at a distance of 58 Km from the project site and the International Airport at Lahore is about 175 Km.

13. Telephone/Telegraph

Facilities of telephone and telegraph are available in the project area. Faisalabad is well connected with the main towns of the country through nationwide dialing system. Faisalabad is also connected to the most part of the world through telephone.

CHAPTER-3.

Project Layouts

1. General

Development of hydropower projects at canal falls/head regulators require careful planning and state of the art hydraulic designs. For such projects, the placing of turbines on existing falls looks attractive. Simple water wheels can be used as they are easy to manufacture. However, the water wheels are usually less efficient, massive and amendments/alterations to the existing system are needed.

For both the falls, separate bypass arrangements are being proposed. Such arrangements shall have a better control to regulate flows and maintenance of the units is easy.

2. Falls at RD 7+449 and RD 8+950

General views of the falls (RD 7+449 and RD 8+950) are shown in Figure 4.1 and 4.2, respectively. Both the falls are vertical drop type, with stilling arrangements. The width of the fall at RD 7+449 is about 11.12m (36.5 ft), whereas the canal width is 57 ft. To divert flow in to the powerhouse, a footbridge and two gates shall be installed.

The fall at RD 8+950 is already having a bridge with two bays of equal length. The structures diverge and ultimately become equal to the canal width. Picture of downstream of the fall is shown in Figure 4.1, 4.2 respectively.

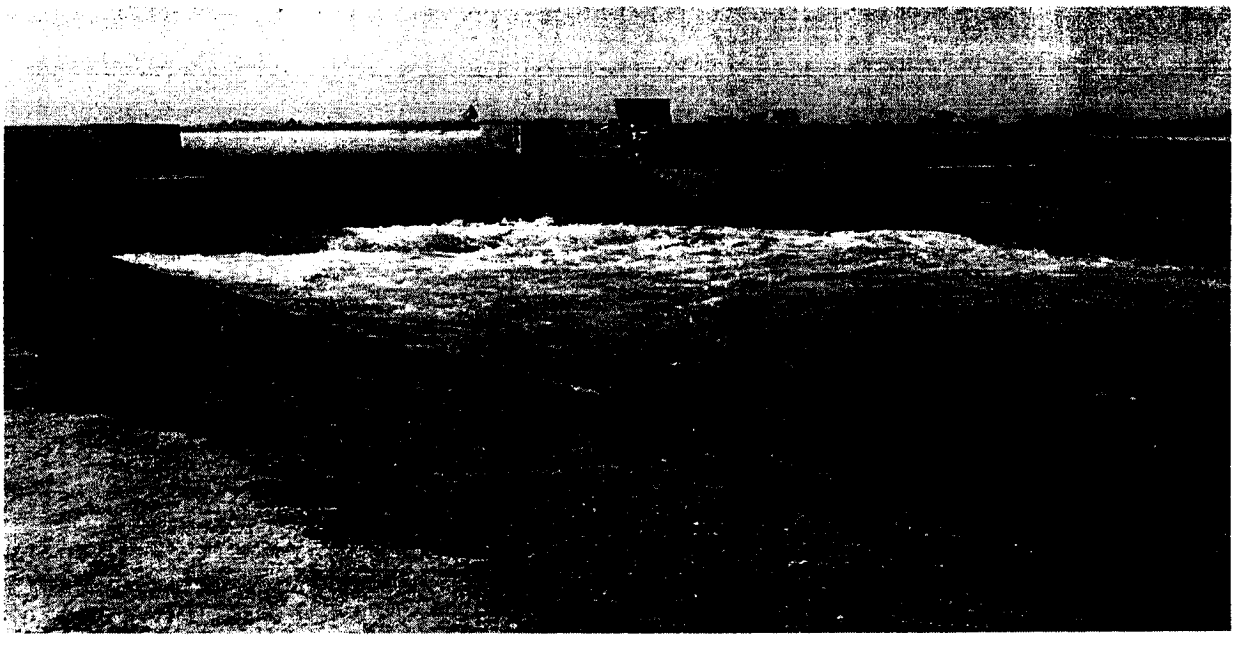

Figure 4.1: A view of downstream of the canal fall at RD 7+449

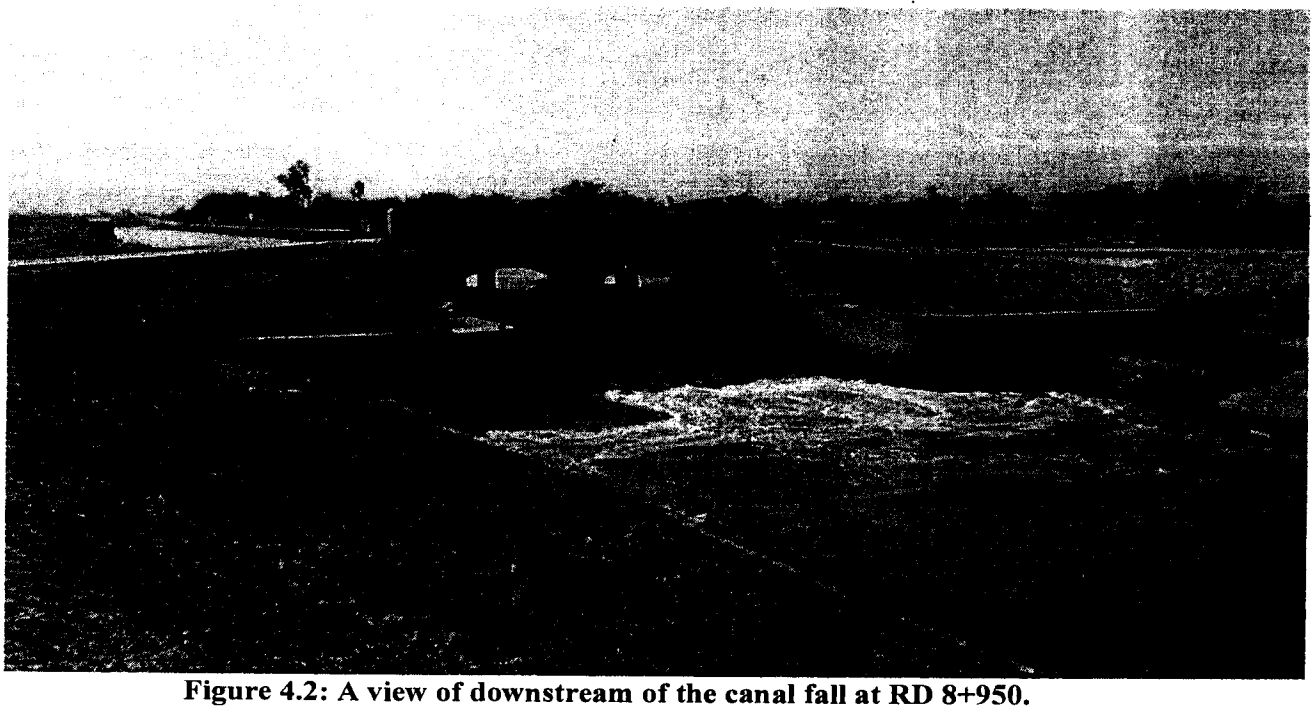

Figure 4.2: A view of downstream of the canal fall at RD 8+950.

3. Bypass Arrangements

As stated earlier, bypass arrangements on right side of the falls are being proposed due to the following reasons:

- The irrigation officials did not allow any alteration to the existing system.
- Without alteration, the only workable option was the water wheel.
- The water wheels are less efficient, massive and their handling will be cumbersome.

The bypass arrangement is being proposed to divert flow for the generation of power. The flow is divided in to two parts for the placing of two units. After power generation, the bypass channel rejoins the canal. Arrangements are robust, with proper intake and tailrace channels. The efforts are being made to keep hydraulic losses at the minimum. The water will re-enter in the existing stilling basin after the generation of power.

The discharge is being regulated by vertical lift gates placed at the power intake and the fall. For full diversion, the gates at the fall shall be completely closed. Moreover, the upstream water level shall be kept constant by gates operation if required.

4. Turbines Selection

The development of low head, small hydro site is difficult at the best of times. Low head means low power per unit of flow and hence a relatively higher cost than for sites with higher heads. In addition, small power plants suffer from the inverse scale effect, with higher costs relative to larger sites. Many entrepreneurs are under the impression that any rapids in a river/canal can be developed as an economical source of energy. Nevertheless, in reality, the case is entirely different, hence, all possible means are being considered to arrive at an economical hydro-project.

Considering the specific situation at the fall and limitations/reservations of the Punjab Irrigation Department regarding hydraulic requirements for the upstream water levels, bypass arrangements for both the falls are being proposed. The power intake is constructed in such a way that it is having sufficient area. This facilitates the full diversion at the same pond level. The two units are planned, consequently the two concrete lined channels are being proposed. Any of the following

turbines can be installed for the generation of power. However, each of the turbines is having their own advantages and disadvantages. The turbines given as under are being studied for this project:

- ❖ Very low head Kaplan gear turbine
- ❖ Very Low Head Kaplan Bevel Gear Turbines

5. Horizontal Axis Bulb Kaplan with Bevel Gear Arrangement

In this layout, the generator is contained within either a bulb or a pit within the upstream water passage. A pit installation has an open-topped bulb, permitting far easier access to the generator. To keep the generator size within reason, there has to be a gear unit to increase generator speed to between 600 and 1000 rpm. A typical installation is shown in Figure 4.3.

Downstream of the bulb or pit there are the stay vanes, wicket gates, Kaplan runner and finally a conical draft tube. The runner shaft is usually set about one runner diameter below minimum tail water. There is easy access around the turbine unit for maintenance. In addition, as with all horizontal shaft units, the runner can be removed for maintenance without removing the generator. Bulb units are only available in the larger diameters, and should be avoided due to the "confined access" problems associated with the bulb. Pit type units are far preferable.

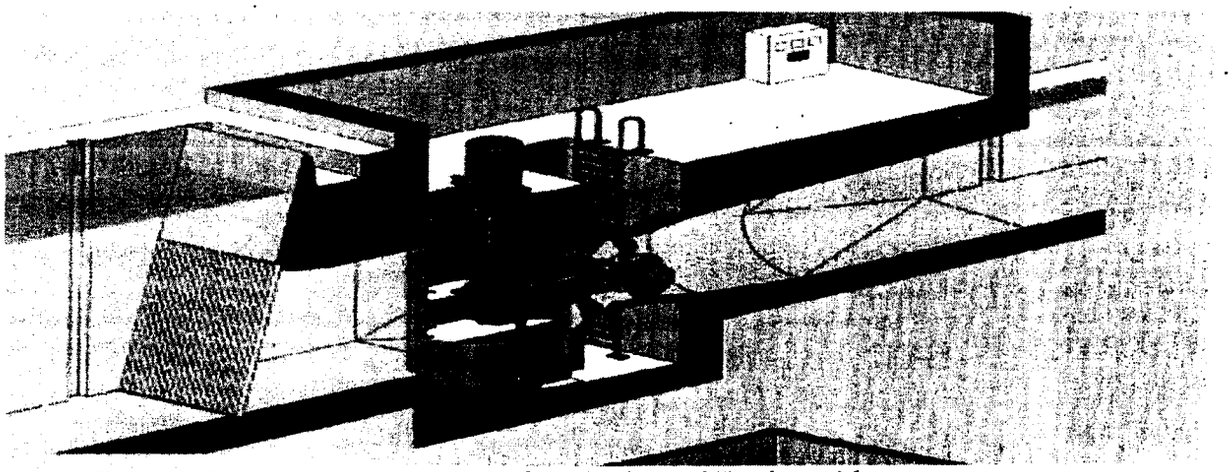

Figure 4.3: A typical arrangement for a horizontal Kaplan with gear arrangement

6. Vertical Propeller Type Turbines

A vertical propeller type arrangement is also studied. Such units are having followings salient features:

- It is efficient, but having more bend losses.
- A vertical shaft and propeller arrangement is economical as compared with the water wheel.
- Handling of vertical shaft and the propeller turbine fixed at the downstream end of the shaft is easy.
- A simple pulley arrangement can be used to lift it up for repairs.
- Not very expansive and can be locally manufactured.
- The supporting arrangements are complicated and expensive.
- More head loss as compared with horizontal system.

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

7. **Fall at RD 7+449 (Turbines Options 1 & 2)**

Both horizontal and vertical Kaplan turbines have been studied. The arrangements are shown in Figures 4-4 to 4-7.

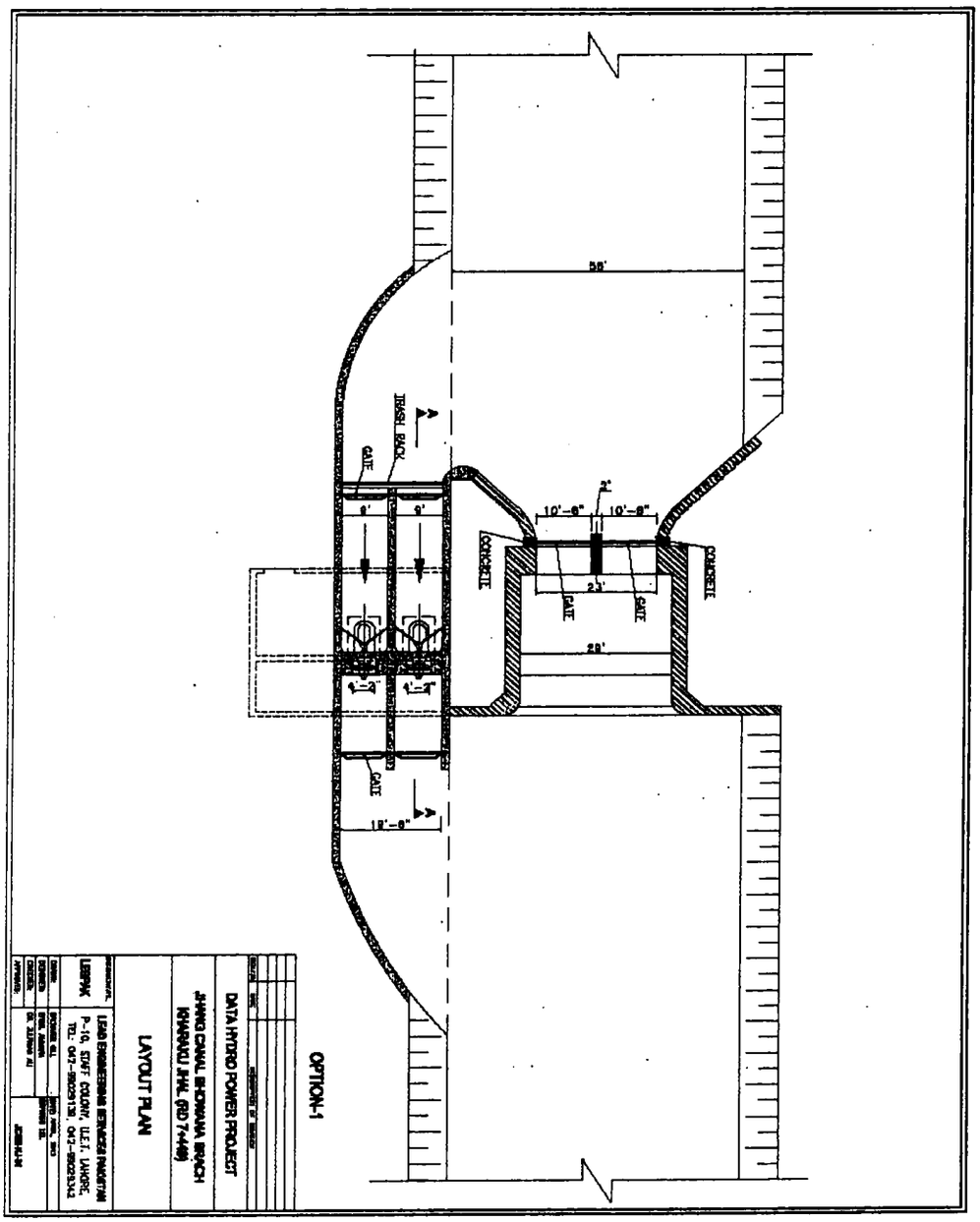

Figure 4.4: Fall at RD 7+449 (Option-1, Layout Plan)

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

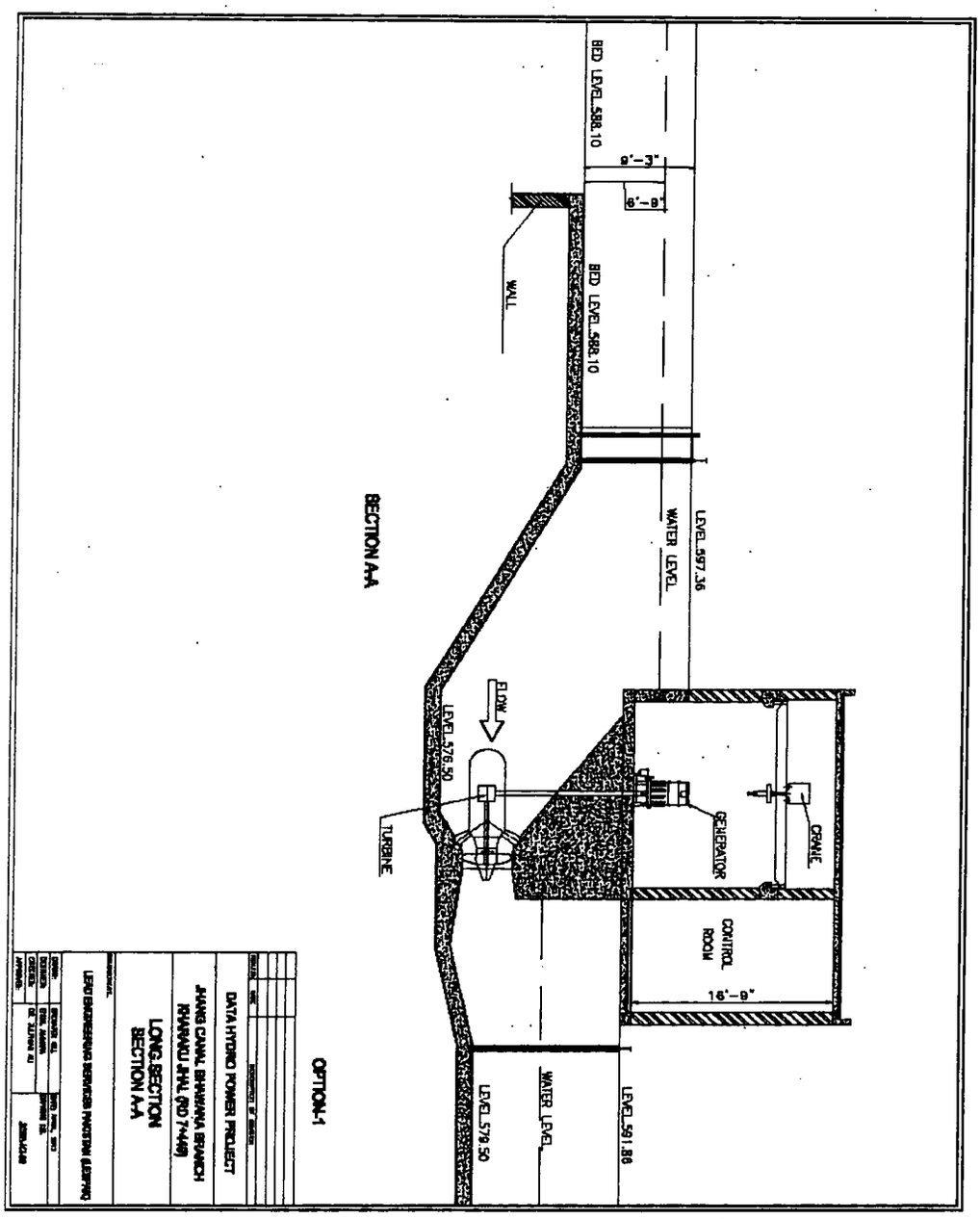

Figure 4.5: Fall at RD 7+449 (Option-1, Longitudinal Profile)

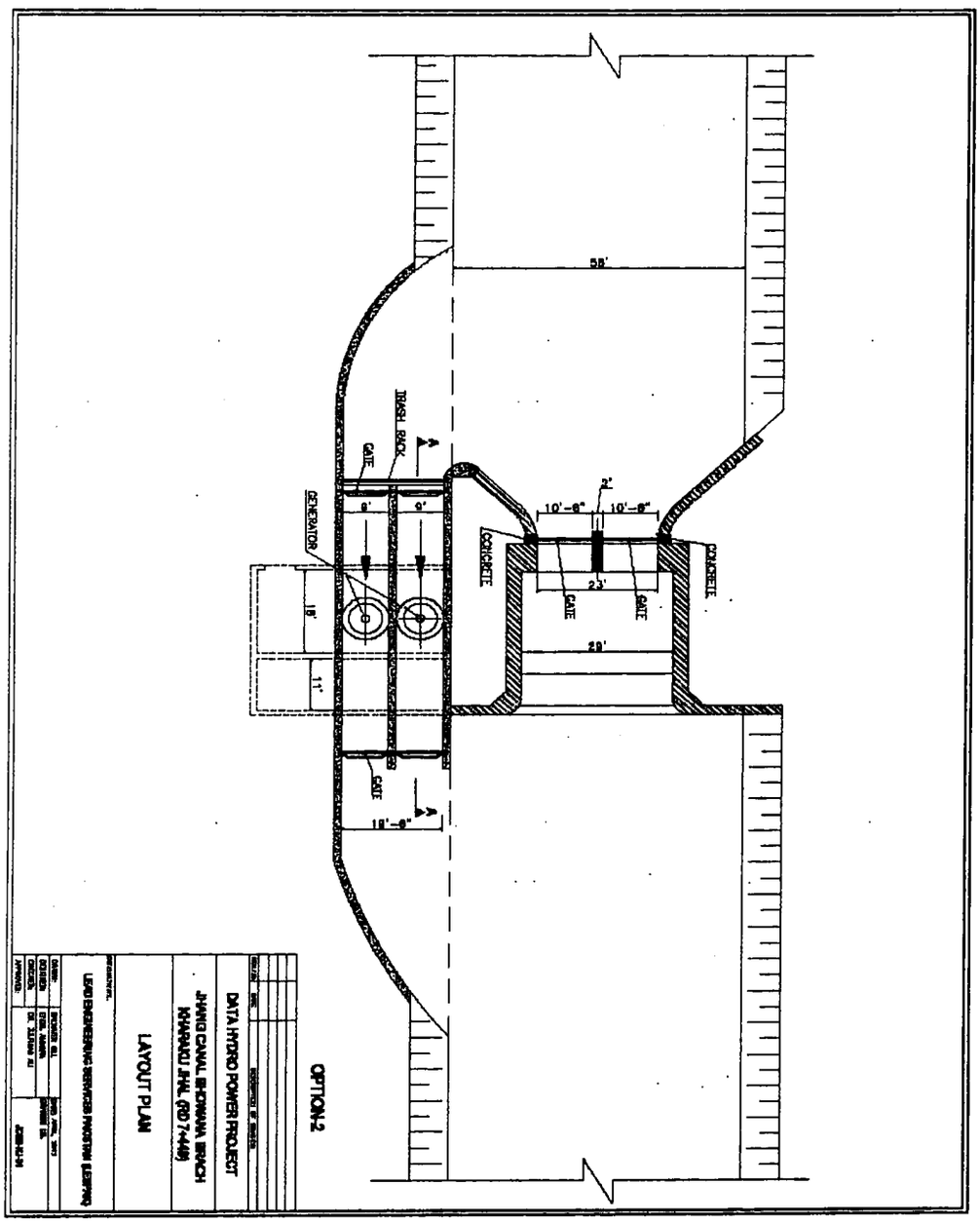

Figure 4.6: Fall at RD 7+449 (Option-2, Layout Plan)

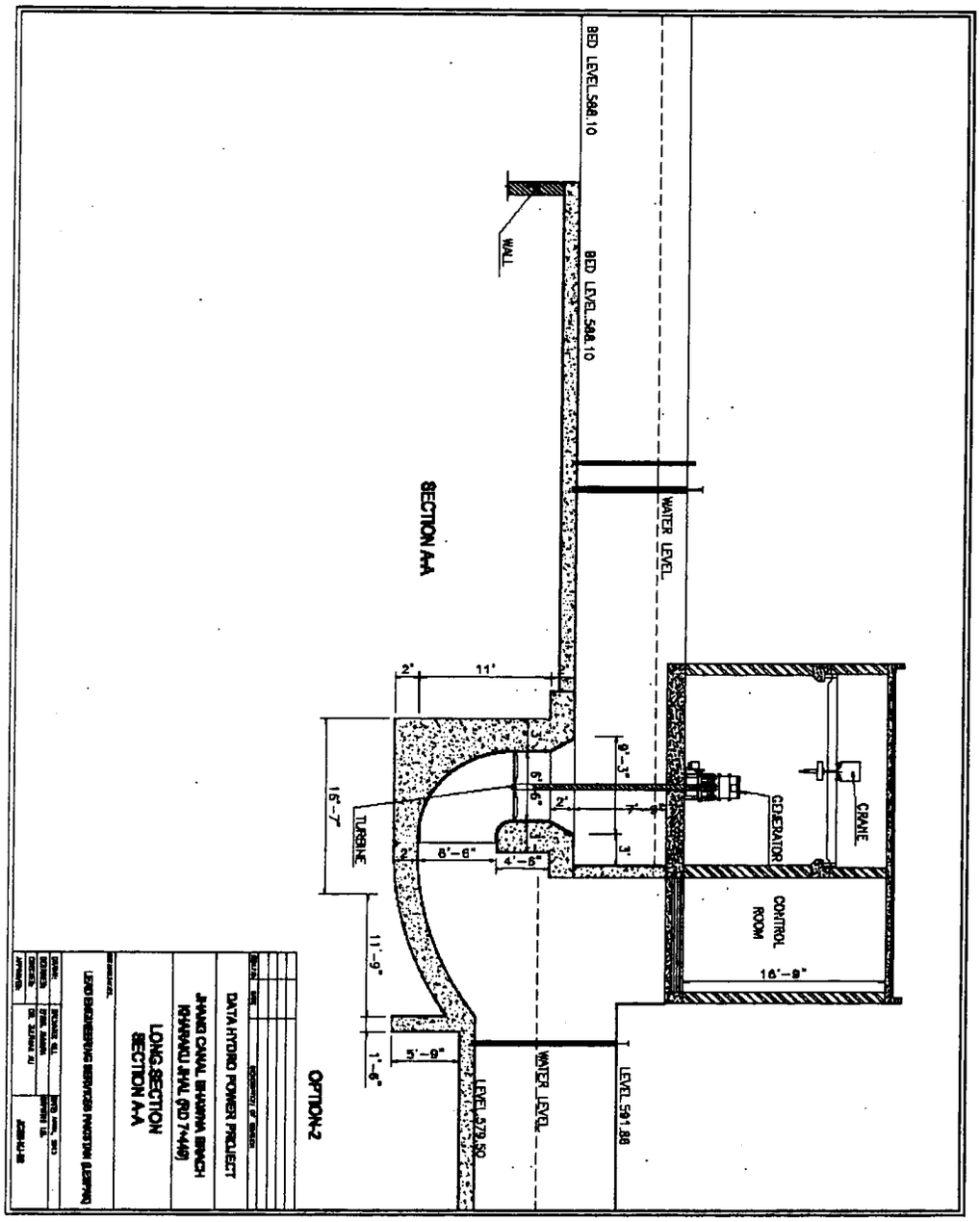

Figure 4.7: Fall at RD 7+449 (Option-2, Longitudinal Profile)

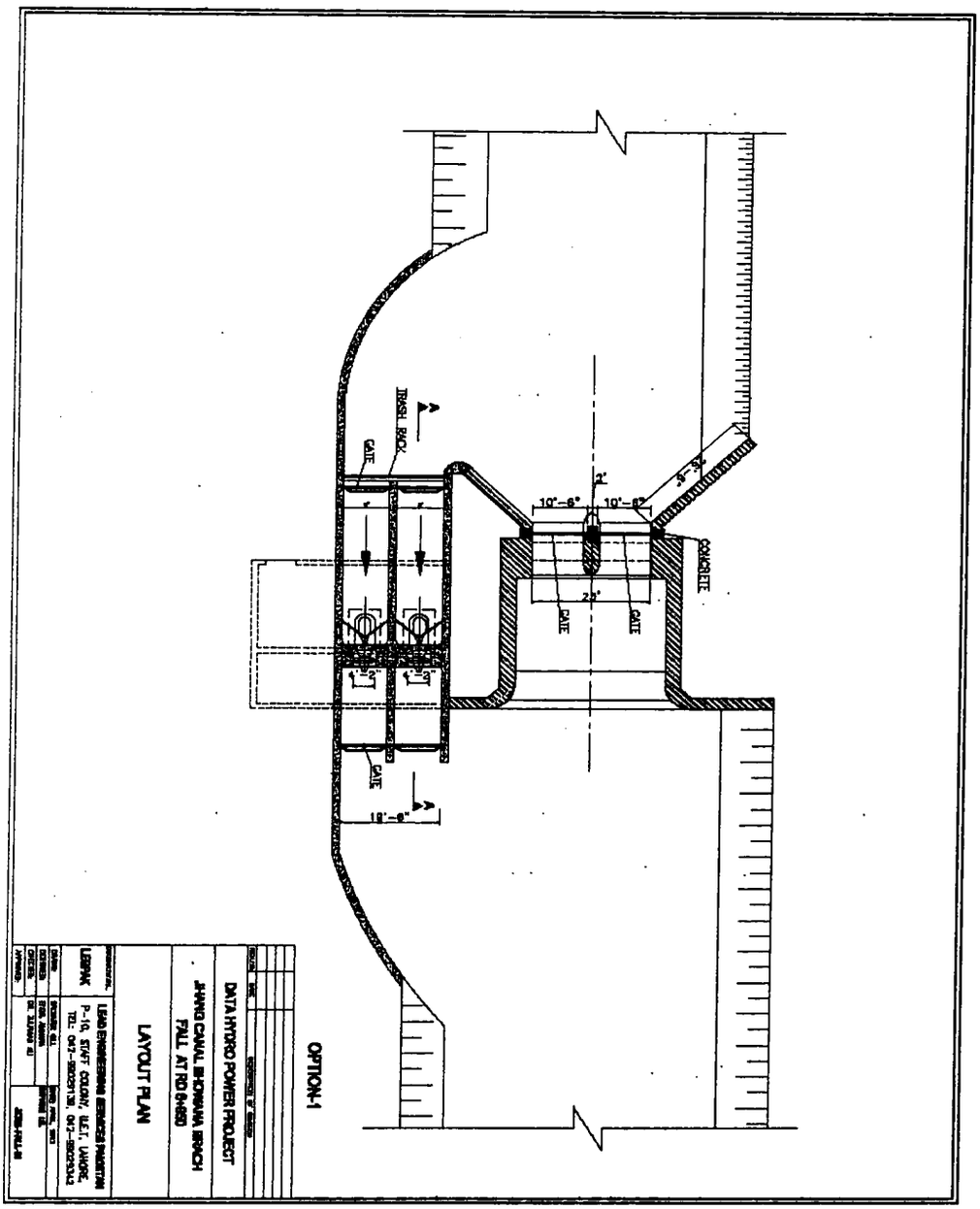

Figure 4.8: Fall at RD 8+950 (Option-1, Layout Plan)

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

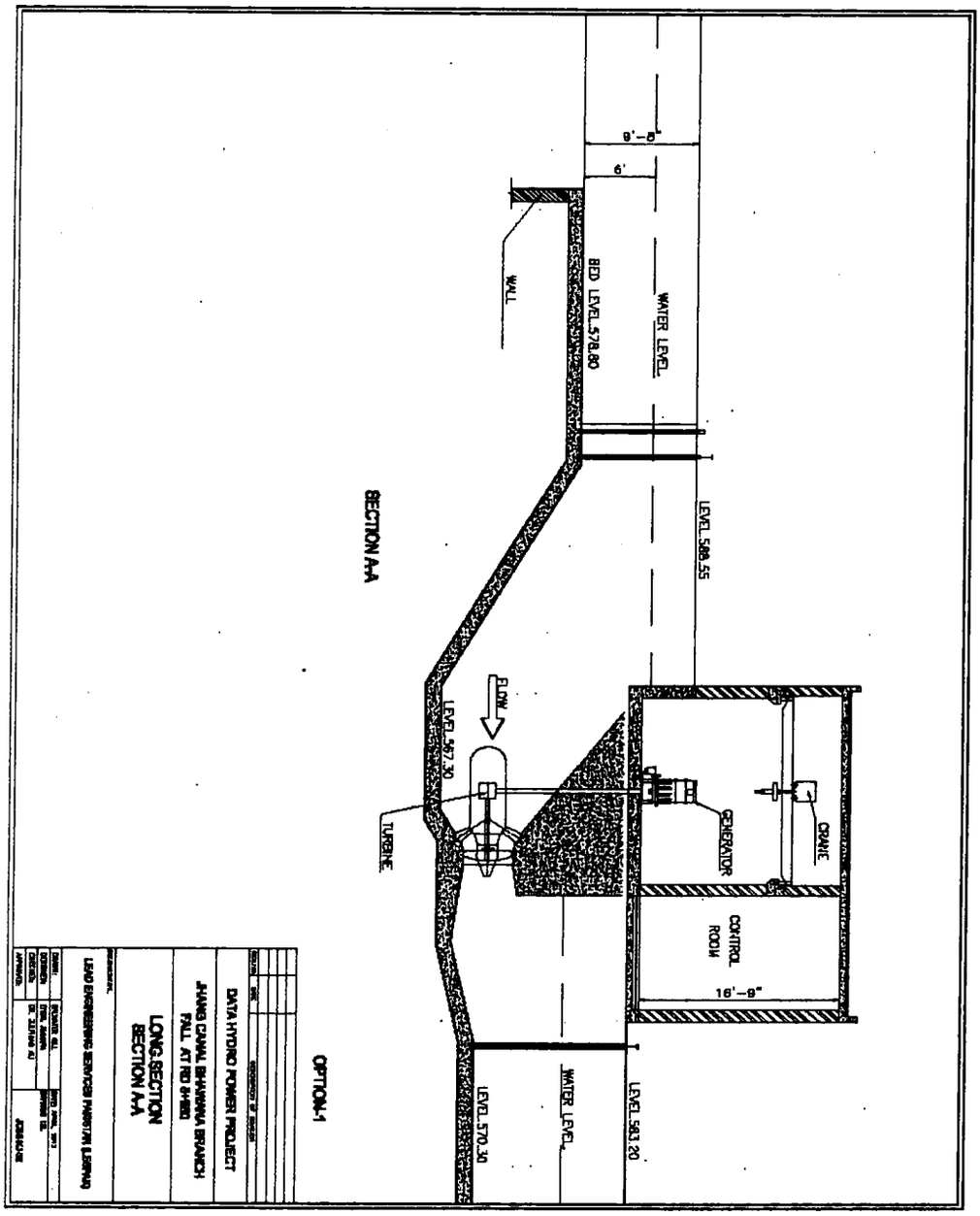

Figure 4.9: Fall at RD 8+950 (Option-1, Longitudinal Profile)

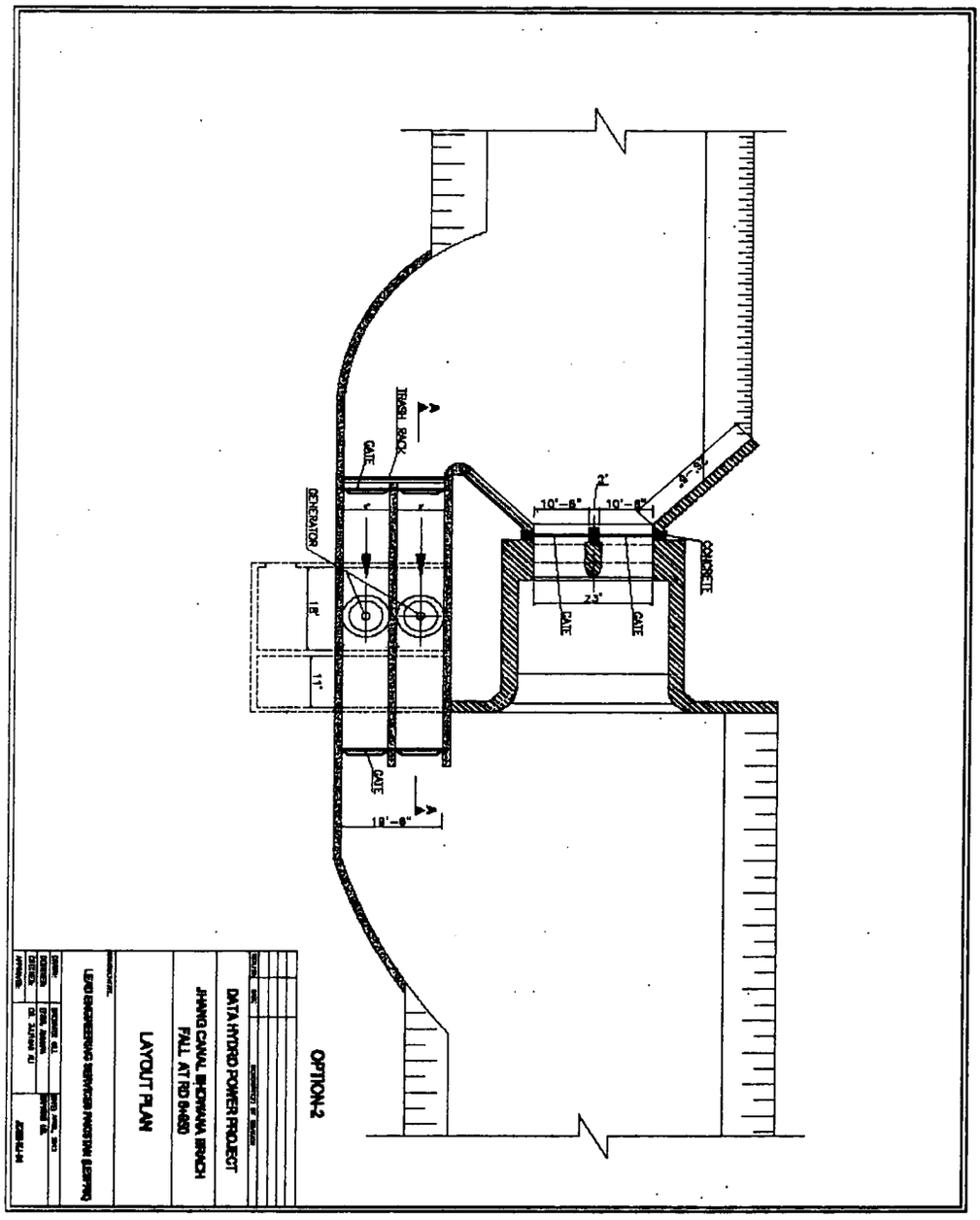

Figure 4.10: Fall at RD 7+449 (Option-2, Layout Plan)

DATA HYDROPOWER PROJECT
Bhowana Branch RD.7+400 TO RD.9+000, District Chiniot

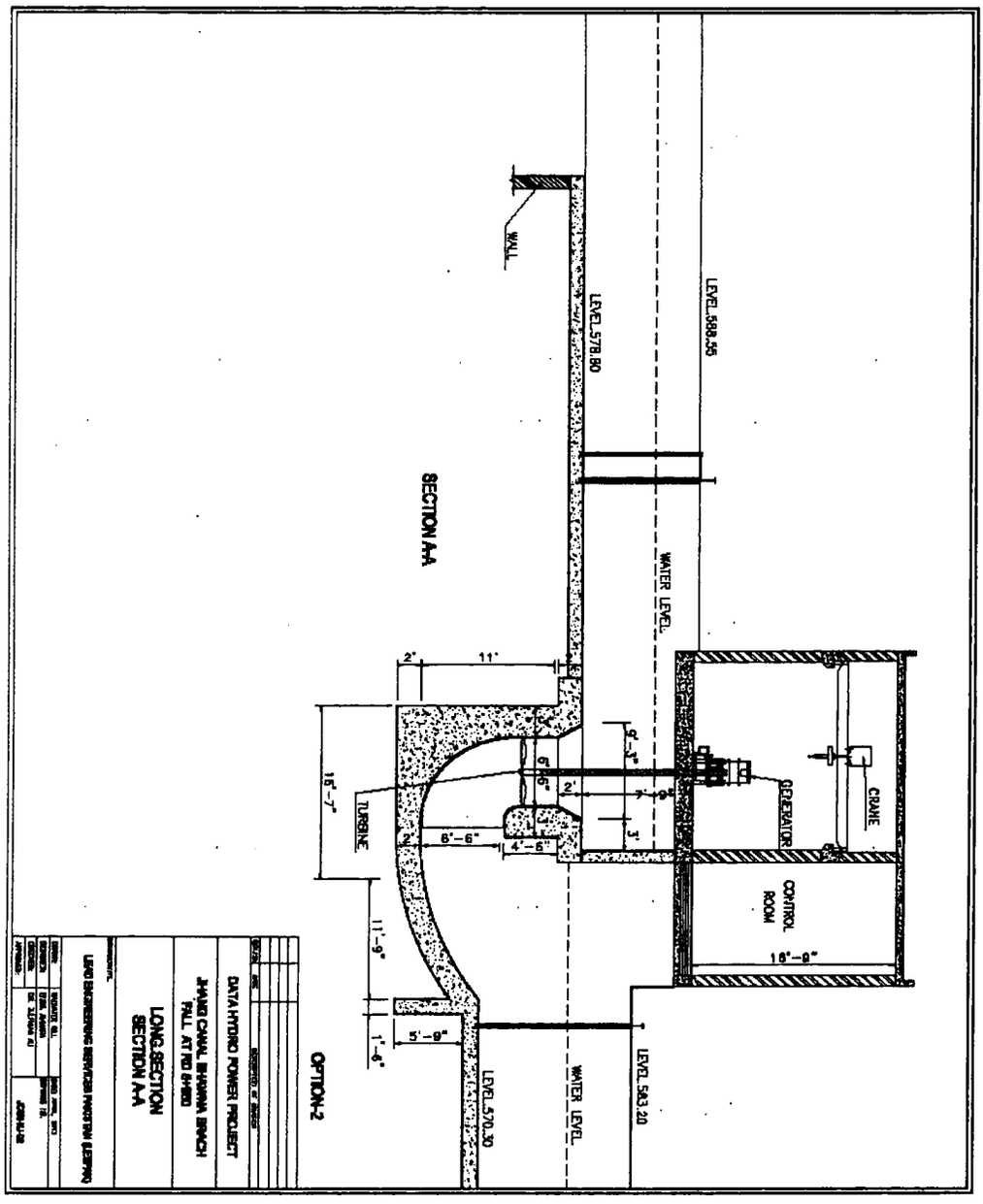

Figure 4.11: Fall at RD (8+950 (Option-2, Longitudinal Profile)

8. Recommended Arrangements

Various possible turbines arrangement were extensively debated within the group and local manufacturers. Finally, horizontal axis bulb turbine system, with bevel gear system are being proposed.

CHAPTER-4.

Description of the Environment and Social Status

1. Plants and Forests

The extensive area around the project is owned by the formers. The principal tree species found are Kikar (Acticiaarbica), Toot (Mores alba), Drek (Acacia), Niche (Azedaracf), Shisham (Dalbergiasissoo). There is no forest in the area.

2. Vegetation

The vegetation of that area is good and land is good of the agriculture the main field observed there is Rice and Sugar cane.

3. Animals

The wild animals are rarely bund in the district. However, Jackal and fox are found in some parts of the district. The important livestock species in Chiniot District includes cattle, buffalo, sheep, goat, camel, horse, mule and domestic poultry.

4. Wastage Disposal and Sanitation

The villages in the project area are devoid of any drainage or sanitation system and as such they are without any system of collection of wastage and sewerage. Hence there exists no mechanism for the disposal of the same. Waste and used water along with kitchen sludge from the households is drained through the small and inconspicuous surface drains directly to the nearby fields. Solid waste is normally dumped in the field for utilization as organic manure for crops and vegetable growth.

5. Local Economy

Agriculture is, by far, the dominant sector of economy in the region. Industrial activity has been expanding over the last three decades. The largest group of active population belongs to elementary occupations, like small time shopkeepers and other similar avocations. This group is followed by skilled agricultural workers, technicians, crafts and related traders.

6. Agriculture and Irrigation

Agriculture is by far, the dominant profession of the people. Canal irrigation followed by tube wells and rain fed irrigation in that order is practiced. Rabi crops are shown following the heavy rains in July, August and September. The winter rains are important for maturing of Rabi crops. Cultivation in the district is not of high order and people are not as good cultivators as elsewhere. The method of cultivation depends largely on the pressure on the soil. In the district holdings are small. It is common for fields especially those dependent on rains to be cultivated for two harvests in succession and then left fallow for two harvests. A field which has grown wheat or cotton must be left fallow for at least six months. But sowing of Kharif crop is generally done after the first monsoon rain although cotton is sown in April. The millets and pulses are reaped in November while cotton picking lasts until the end of December and sugarcane remained on the ground till March. The Kharif crops require ample rain which should come in September. Wheat and gram are sown in October, but if the rain is late they can be sown in December. Rabi crops need rain in January and February. Harvesting of wheat is done in April, but gram and barley are cut earlier. Green wheat for fodder is cut as needed. The principal crops are wheat and rice which are by far the most important crops in the district followed by wheat.

7. Industry

There is no industry around the project area except brick furnaces, However, we have arranged to setup certain industries adjoining to the project area and will be run by the electricity generated by this project.

8. Livestock

Livestock is another contribution in the local economy. Since the fodder for the livestock is readily available around the year, therefore, cattle holdings are convenient and economical. Milk and butter are consumed at the household level and surplus is sold out. Buffalo, sheep, goat, camels, asses, donkey and horses are kept by the people in the project area.

CHAPTER-5.

Environmental Impacts

1. Physical Environment.

Climate of the project area is extreme hot in summer and extreme cold in winter. The maximum temperature reaches 50*c (122*F) in the summer while the minimum temperature recorded in winter is as low as freezing point. In District Chiniot, highest precipitation is recorded in the months of July and August, mainly due to the moon soon rains in the area. The trend of relative humidity is quite uneven in the area. However, during most of the years July, August and September are the most humid months.

Chiniot, Faisalabad mainly comprises flat fertile plains, although there are few small hills near Chiniot, District Chiniot lies on both sides of the river Chenab. The District mainly comprises plains. The river Chenab is in the north west of the project area.

The ground Water of the area the district is different in quality at different places. The underground water of areas adjacent to the river Chenab is fit for human consumption while in the remote areas water is brackish and unfit for human consumption. Underground water of the project area is fit for drinking. Water table is not very deep and ground water is generally available at the depths of 20 feet to 25 feet.

Air quality of the project area is quite fair as there is no industrial unit located in the nearby areas of the project. Similar to other rural areas of the Punjab. Project area is the victim to the dust and particulate matter but to a very low extent as there is not much movement of vehicles.
Overall quality of ambient noise and vibration in the project area is fairly good.

The major area of Chiniot District does not fall in tectonic active Zone accordingly to the Geological survey of Pakistan, Chiniot District falls under the Zone-I of the damaged Zone of Pakistan and G. factor for this Zone is less than 0.03.

2. Biological Environment

It was observed that all the vegetation in the area was quite rich and healthy mainly due to the fairly good soil quality and plentiful supply of water. A verity of faunal species including were seen and listed during the survey. Moreover, the relevant literature was reviewed related fauna of Chiniot district and adjacent areas due to the occurrence of diverse flora in the area, mammals are present both in natural habitats and are also reared as domestic live stock. Reasonable habitats are available for reptiles and birds of the area.

There would be no significant impact on ecological resources as most of the project activities are restricted to the project site, at RD-7500 + 8816, on Bhowana Branch Canal, and hence no adverse impact on floral and faunal species are is anticipated.

The construction of proposed hydropower plant does not involve in cutting even a single tree during the construction of diversion channel and power plant components thereafter, regarding faunal species. Aquatic biodiversity is less likely to be impacted as original flow and quality of water is not going to be altered during the construction and post development phases.

3. Socio-economic Environment

First five lines after meeting at the site with local people.

The general economic condition of the area is poor to average substantial economic activities is seen in the area like shops, restaurants and work shops etc but the major contributor is the agriculture sector as the inhabitants have adequate holdings which has in turn resulted in growth of allied business like agriculture feed stock outlets, fertilizer outlets and agricultural machinery repair facilities.

Sugarcane, Wheat, Rice and Cotton are the major crops grown in the area. There is nominal area under orchards or vegetables which does not play significant role in economy.

4. Impacts

4.1. Soils

The soil-related issues include slope stability, and effects on agricultural soils due to fugitive dust created through excavation activities at site and spoil areas. The quantities of excavation and fill material have been calculated and the construction of project has been planned in such a way that all the excavated material will be utilized filling of low lying areas and stabilization of slopes along the power channel and other structures. Therefore, construction of this project will neither involve bringing in of fill material from outside the project site area nor will there be any need for disposal of material outside project sire area. The contract documents will also include specific clauses to impose environment protection practices on the part of the contractor.

4.2. Biological Environment

Biological environment of the area will have a negligible impact due to construction activity because all the effects will be limited to the proposed site area.

4.3. Resettlement

No human settlements would be overtaken as a result of project construction; therefore, no resettlement issues of any kind exist in this case.

5. Permanent Impacts

5.1. Power Channel Power House and Tailrace Channel

The body of water created in the form of power channel, tail race channel and feeder channel for Bhowana Branch will have no effect on environment except for overtaking of land area. Similarly the bridge on power channel and a short length of road will not affect the environment.

5.2. Intake Structure

The intake structure to be constructed for allowing Bhowana Branch water to flow directly into the power channel will have no effect on environment except for overtaking of land area.

5.3. Power House

Besides power channel and tail race channel, major land area (about 20 Kanals) will be taken up by the power house building. The area required for power house building will result in a land use change. The operation of the turbines and generations in the power house will raise noise level at project site. It will not be significant in terms of environmental pollution. The NEQS level for noise is 55 dBA and it is not likely to be exceeded during power house operation.

5.4. Effect on Flora

Not a single tree will be cut during construction and later. Therefore, there will be no effect on flora. However, the management shall plant trees in the area.

5.5. Effect on Fauna

The construction of the project will pose a minor hazard to reptiles, in case inhabit the site. These will, however, survive by shifting to nearby vegetation or land areas.

5.6. Effect on Water Quality

None of the villages within the project area has a proper sewerage and drainage system. The local population has use of out-house facilities or open field for defecation. The situation, therefore, shows that there is almost no pollution from village waste waters into any of water bodies like Bhowana Branch. This project will not change the already existing water quality in anyway.

5.7. Social and Cultural Resources-Overall Effects of the Project

Generally the negative effects of the project on the local population will be insignificant. However, there will be positive effects of the project on those who live and work in the surrounding villages. The contribution such a project will make to the energy sector should be a welcome development in the substantial social, occupational and economic effects on the local population in one degree or another, socio-economic effects will occur in the construction phase, the early operational phase and in the longer term period of the project. Some effects will be evident immediately; some will take time to alter current social and economic conditions, while still others are probably as yet unforeseen.

The project region is not in any way thickly populated area. The infrastructure facilities are not developed. However, the completion of the project may promote more repaid population growth and new work opportunities.

5.8. Cultural Resources

There are no cultural resources like shrines or archaeological sites which will be affected directly or indirectly by the project components.

5.9. Resettlement

There will be no danger of any human habitations or dwellings having to be taken over or done away with for the project. As a result, no resettlement issues are involved.

5.10. Final Products

Electricity will be the final products.

5.10.1 Capacity of the Project

Project should produce 0.3 MW in the regular operation.

5.10.2 Waste Generation, Emission and their Sources

(a). Liquid Waste

No continuous liquid waste stream is discharged during the operations.

(b). Solid Waste

The operational phase does not produce any specific sold waste. The only waste which may produce is from the office and kitchen.

CHAPTER-6.

Requirement of Infrastructure, Resources and Raw material

1. **Water**

Surface water will be used to meet the water requirements in operation phases. The water will be used to run the turbine only. The same quantity of water will be released in the canal afterwards. The internal requirements will be fulfilled by the pumping of ground water which will be used for drinking and bathing purposes.

2. **Energy**

As it is a power generation project, the energy requirement in the operational phase will be fulfilled by the own generation.

3. **Fuel**

Lubricants and oil will be used in different processes and will be purchased from the market as per requirement.

4. **Road Network**

No Road network is required as a melted road passes adjacent the project area.

ENVIRONMENT PROTECTION DEPARTMENT

Government of the Punjab
4 - Lytton Road, Lahore
National Hockey Stadium, Ferozepur Road, Lahore.

NO. DD(EIA)/EPA/F-54(IEE)/2802/2014/ 507
Dated: 11 /3 / 2014

To

Haji Manzoor Hussain
Chief Executive,
M/s Data Hydro Power Project,
P-44, Street Mian Gujjar, Ghulam Muhammad Abad No.01,
Faisalabad.

Subject: **ENVIRONMENTAL APPROVAL**

(Under Section 12 of PEPA-1997 (amended in 2012) read with IEE & EIA Regulations, 2000)

1. Description of Project: Installation of 0.3-MW Hydro Power Generation.

2. Location of Project: The project site is located at Bhowana Branch RD. 7+400 to RD. 9+000, Kharko Dhaal, Chak No. 235/JB, Tehsil & District Chiniot.

3. Date of Submission: 13.02.2014.

4. After review of Initial Environmental Examination (IEE) Report, SIR by DOE and other relevant record, the Environmental Protection Agency, Punjab accords approval for operational phase of the above mentioned unit at the aforementioned site, to safeguard the Environmental issues subject to the following conditions:

i) The proponent shall ensure compliance of National Environmental Quality Standards (NEQS).
ii) Mitigation measures suggested in the IEE Report and Environmental Management Plan (EMP) shall be strictly adhered to minimize any negative impacts on soil, ground water, air and biological resources of the project area.
iii) Monitoring shall be carried out during the entire period of the project activities. Monitoring reports of the whole operation shall be submitted to EPA, Punjab on monthly basis.
iv) Camping sites shall be located at suitable distance away from any settlement to avoid disturbance to the local people. Sewage generated from camping sites shall be treated in septic tanks and soak pits.
v) The proponent shall install proper equipment for dust collection.
vi) Hazard of soil erosion will be minimized with proper provision for resurfacing of exposed areas.
vii) The area around the project site shall be kept clean.
viii) The proponent shall dispose of solid waste in a proper scientific way in consultation with TMA/District Government.
ix) The proponent shall ensure efficient health and first aid treatment facilities for protection of workers.
x) The proponent shall plant3000 indigenous species of trees of minimum 6-7 feet height around the project area on available space within six months and shall do proper landscaping after completion of the project.
xi) The proponent shall provide copy of Map/drawing of the project after approval from the competent authority and copies of other NOCs also.
xii) The construction material shall be piled / stored in such a way that it shall not destroy the flora / environment of the locality.
xiii) The proponent shall care about noise issues during construction and operation stage of the project.
xiv) The objections/complaints of the locals/stakeholders (if any) shall be redressed on priority basis.

xv) The proponent shall provide compensation to the inhabitants in case of loss of agricultural land, crop, property, etc. in accordance with the rates that are agreed upon. All conflicting issues regarding compensation, etc. shall be settled amicably before the start of the project activities.

xvi) The proponent shall provide Resettlement Plan before operation of the project.

xvii) The proponent shall ensure safety of the natural habitat, surrounding buildings, community and workers during construction of the project.

xviii) The proponent shall obtain NOC / clearance from all other concerned departments before commencement of work.

xix) The proponent shall appoint Environmental Manager having qualification of BS Environmental Sciences for the project and shall convey his name along with his complete Mailing Address and Phone Numbers.

5. The proponent shall be liable for correctness and validity of information supplied to the environmental consultant.

6. The proponent shall be liable for compliance of Regulations 13, 14, 17 and 18 of IEE/EIA Regulations, 2000, regarding approval, confirmation of compliance, entry, inspections and monitoring.

7. Any change in the approved project shall be communicated to EPA, Punjab and shall be commenced after obtaining the approval.

9. This approval shall be treated as null and void if all or any of the conditions mentioned above, is /are not complied with. This approval does into absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force and is subjudice to legal proceedings in any legal for a / court.

10. This approval can be withdrawn at anytime without any prior notice if deem necessary in the public / national interest.

Salman Aslam,

(SALMAN ASLAM)
ASSISTANT DIRECTOR (EIA)
for Director General, EPA, Punjab
Ph: # 042-99232228.

NO. & DATE EVEN.

A copy is forwarded for information to:

1. The District Officers (Environment), Chiniot w.r.t. his letter No. 756/ EPA/CT dated 24.02.2014. He is requested to ensure compliance of the above-mentioned conditions under intimation to this office.

Salman Aslam

(SALMAN ASLAM)
ASSISTANT DIRECTOR (EIA)
for Director General, EPA, Punjab