The Bowersock Mills & Power Co.
Flashboard Replacement Proposal
Bowersock Dam Rubber Dam Option
October 6, 2011

Proposal

The Bowersock Mills & Power Company (BMPC) proposes to the City of Lawrence the replacement of the manually-raised flashboard system on the Bowersock Dam with a rubber dam, a more efficient and cost effective water retention structure. The Bowersock Mills & Power Company presents this proposal to the City of Lawrence because the City is a partner in the maintenance of the dam for the purposes of maintaining a pool (millpond) for the Kaw River Water Treatment Plant (KRWTP). Installation of a rubber dam system to replace all manually-raised flashboards would require the completion of an additional 80 feet of upstream dam maintenance, already planned and designed by the City of Lawrence. Bowersock proposes that for this change in dam facilities, the City of Lawrence pay only the costs the City had anticipated, but not scheduled, for the material costs of the previously planned plywood flashboard installation, and a portion of the costs for extending the 2010 upstream dam maintenance by an additional 80 feet. Bowersock would commit to paying all other expenditures related to the repair of the upstream portion of the dam, including the coffer dam, mobilization, and all other related costs of the project.

Bowersock is currently expanding its hydroelectric facility and has the team capable of conducting this work on site, which would provide significant cost savings for previously planned upstream maintenance. Were the City to complete the proposed repair separately from the current BMPC North Powerhouse Project, the effort would cost significantly more, as the project would require its own coffer dam, mobilization, and all the ancillary items associated with a project of that scope.

As proposed, the installation of a rubber dam will save flashboard maintenance expenditures for both the City and BMPC over time and benefit river users up and down stream of the Bowersock Dam.

Background

The Bowersock Mills & Power Company is currently undertaking an expansion of its hydroelectric facility at the Bowersock Dam on the Kansas River in Lawrence. Through the expansion, Bowersock will construct a new powerhouse at the north end of the Bowersock Dam, approximately tripling its total energy production potential. In August, 2010, both the existing South Powerhouse and the proposed North Powerhouse were licensed together by the Federal Energy Regulatory Commission as the Expanded Kansas River Project (FERC License P-13526). The new license granted an increase in flashboard height of 1.5 feet, from 812 NGVD to 813.5 NGVD.

Initial plans for the expansion called for the construction and installation of new plywood flashboards with an additional 1.5 feet of board to replace the previous system. Although the manual system was approved in the license, based on FERC and industry recommendation, BMPC is proposing the installation of a rubber dam in place of the previous flashboard system.

Rubber Dam / Inflatable Flashboard System

A rubber dam is superior to a manually-raised flashboard system from both a river-management and an economic standpoint. The system proposed for BMPC would include four or five separately-inflatable rubber bladders which would be monitored via a SCADA (Supervisory Control and Data Acquisition) system, and controlled by BMPC plant operators via a network computer. Historically, BMPC, the Kaw River Water Treatment Plant and other river users including the KU Rowing Facility have suffered when the flashboard system failed at high water. Often, the flashboards remained lowered until water levels were sufficiently low enough to ensure that the flashboards could be raised safely by BMPC personnel, resulting in a lowered millpond for months or even years at a time.

Through the completion of the new North Powerhouse, BMPC will maintain the existing Obermeyer System on the south end of the dam, and add a new 20 foot Obermeyer Flashboard at the north end of the dam between the new powerhouse and the dam. The two Obermeyer systems will be automated, and will raise and lower incrementally in order to maintain a consistent millpond elevation at low to medium river flows.

The installation of a rubber dam will be of greatest benefit at mid to high river flows, when the rubber dam will be employed to pass excess water. The bladders will be deflated sequentially as the river levels increase, ensuring a control of the millpond previously unattainable with the manually-raised flashboard system. As river flows recede, BMPC would inflate the bladders, such that the millpond level would not go below the authorized FERC level of 813.5 NGVD (+ or - 6 inches). Inflating the air bladders as the river levels recede will eliminate the period that the millpond had previously remained unfilled. It will also eliminate the refill period (which requires a period of decreased downstream flows) once flashboards are raised, which has been a source of concern for some downriver users. The rubber dam system would also give BMPC the capacity to lower the millpond below the authorized level should it be required for maintenance, either for the KRWTP or Bowersock.

In addition to creating significantly more control over the millpond, a rubber dam system is more cost effective over time. Flashboard systems require constant maintenance, including replacing the flashboards, the hinge systems, the flashboard supports, and the labor hours involved. Industry experience has documented the typical lifespan of current model rubber bladders of twenty years or more. Through the lifespan of a rubber bladder, very limited maintenance is required. The dams are typically constructed with layers of canvas and EPDM rubber, which is highly durable. Infrequently-performed maintenance typically involves the application of rubber sealants, which is fast and inexpensive.

Rubber dams are not only durable systems, they also improve the lifespan of the dams on which they are installed. In comparison to flashboard systems, which allow a constant flow of water through the gaps between each gate, rubber dams prevent almost all flow-through, limiting water-related erosion on the face of the dam. See Appendix A for a more detailed explanation of rubber dams. See Appendix B for the proposed design of the BMPC Rubber Dam System.

Costs to the City

As referenced, the City of Lawrence has anticipated the need to complete the proposed upstream repairs of the Bowersock Dam, the goal of which is to seal off the upstream face of the dam. The City completed a significant portion of this upstream seal in March, 2010. Approximately 1/3 of the dam on the south end remains to be sealed. BMPC proposes that approximately 80 additional feet of upstream repair be completed as a part of the North

Powerhouse Project. Were the City to complete the proposed repair separately from the current BMPC North Powerhouse Project, the effort would cost significantly more, as the project would require its own coffer dam, mobilization, and all the ancillary items associated with a project of that scope.

BMPC would like to propose that the City undertake the repair at a significant savings by conducting it in the winter of 2011-2012 in partnership with Bowersock. Bowersock recognizes that the typical City process for a project of this nature would be for the City to receive formal bids and contract directly with a contractor to complete the work. However, in order for the City to cost share with Bowersock, work on the 80 foot section would need to be approved by the winter of 2011-2012, so that the North Powerhouse contractor would have a sufficient window in which to complete the work in conjunction with the North Powerhouse Project.

If the City could approve Bowersock to complete the work, Bowersock would contract the work to the North Powerhouse contractor Kissick Construction. Upon completion of the repair, BMPC would request reimbursement from the City in the same way that BMPC currently requests reimbursement for flashboard materials.

Collaborating on the project with Bowersock limits the City costs associated with the project. Bowersock would assume all the costs of engineering, mobilization, permitting, insurance, bonding, testing and inspection, and the cost of the coffer dam for the 80 foot extension of the City upstream dam repair. Based on Bowersock's assumption of the above costs and the reuse of the existing downstream sheetpile removed for the North Powerhouse Project, Kissick Construction has provided an estimate of $295,000 for the additional 80 feet of dam maintenance.

Bowersock has budgeted for the purchase and installation of the entire rubber dam ($1.3M), but asks that the City allocate money for the $295,000 portion of the upstream repair, as well as the $129,108.00 which would have been required to pay for the replacement of the wooden flashboards. Both of those expenses are items which the City would have paid at some point. The unforeseen burden to the City in the proposal is the timing of the $295,000, which would need to be scheduled for payment in 2012, or at the latest early 2013.

Replacement of the flashboards with a rubber dam will limit the city's maintenance costs going forward. As previously referenced, rubber dams are demonstrating a life span of twenty years or longer. The chart below indicates that paying for the replacement of rubber bags once in a twenty year cycle saves approximately $17,000 per twenty-year cycle. Bowersock proposes that the City would allocate approximately $18,000.00 annually for eventual bag replacements. Further, the chart below does not include the BMPC labor associated with the building and installation of the flashboards, which makes the rubber dam system even more economical. The chart does not factor in inflation, which should be taken into account, but would have the same impact on the plywood flashboards and the rubber dam.

Maintenance Costs Over Time
Plywood Flashboards vs. Inflatable Rubber Dam

Flashboard Type	Initial Installation	Annual Maintenance	Annual Bag Replacement Escrow	20 Year Maintenance Cost
Plywood Flashboards	$129,108.00*	$19,366.20	$0.00	$367,957.80
Rubber Dam	**$646,383.00	$0.00	$18,421.05	***$350,000.00

* see Appendix C for a detailed flashboard replacement cost estimate.

** Entire initial rubber dam system cost paid by BMPC.

*** Annual Escrow * 19

Anticipated Changes to BMPC Operations Monitoring Plan

Installation of the rubber dam will require only minimal changes to the BMPC Operations Monitoring Plan, which is a FERC-required plan for BMPC river operations. The required millpond elevations will remain unchanged, with an authorized height of 813.5 NGVD, with an operations window of + or - six inches. As with other rubber dams installed throughout the U.S., the top height of the rubber dam will be above the authorized millpond height to allow for sufficient freeboard. Maintaining the top of the rubber dam at least 6 inches above the millpond minimizes issues with wave action and related icing on top of the dam. BMPC has established a top height of the rubber dam of 814.5 NGVD.

The installation of the rubber dam will allow BMPC to follow the Operations Monitoring Plan (See Appendix D for the BMPC Operations Monitoring Plan) more efficiently, as BMPC will have greater control over the millpond, and will eliminate the need to have a refilling period with the exception of maintenance-related drawdowns. The inflatable flashboard system would replace the manually-raised flashboards in the plan. The sequence of operations would remain the same, with the inflatable flashboard serving as the last to be lowered in the event of high water, and the first to be raised as water flows recede.

Appendix A
Rubber Dam Explanation

What is a Rubber Dam?

Rubber dams are flexible hydraulic structures. A rubber dam mainly consists of four parts: (1) a rubberized fabric dam body; (2) a concrete foundation; (3) a control room housing mechanical and electrical equipment (e.g. air blower/water pump, inflation and deflation mechanisms); and (4) an inlet/outlet piping system. The dam body is fixed onto a concrete foundation and abutments by a single or double-line anchoring system. A typical foundation of the rubber dam has upstream and downstream cutoff walls to lengthen the groundwater seepage path and thus reduce the uplift force of ground water.

The rubber dam concept was developed in the 1950's by N.M. Imbertson of the Los Angeles Department of Water and Power and manufactured as Fabridams by the Firestone Tire and Rubber Co. The first Fabridam was installed on the Los Angeles River, California, for groundwater recharge and flood mitigation. This early dam was filled by water, and its height was regulated by a siphon (Lu et al., 1989). In 1978, Bridgestone Corporation (Bridgestone) introduced an air-inflated rubber dam. The rubber dam has experienced continuous improvements and innovations since then.

Structural simplicity, flexibility and proven reliability are key considerations in the use of rubber dams for multiple purposes. Up to now, thousands of rubber dams have been installed worldwide for irrigation, water supply, power generation, tidal barrier, water treatment, flood control, removal of sediment deposits, environment improvement and recreation. Table 1 shows examples of rubber dams installed in different regions of the world. There are a number of rubber dam manufacturers, for example, Bridgestone and Sumitomo Electric Industries Ltd. (Sumitomo) in Japan, the Yantai Tiansheng Rubber Dam Co. Ltd. in China, Obermeyer Hydro, Soluziona Engineering and Dyrhoff AS.

A unique characteristic of the rubber dam is its ability to function as a reliable crest-adjustable water gate. When inflated by a medium (air, water or their combination) it rises to retain water; when deflated by releasing the medium, it flattens onto the foundation, completely opening the channel for free passage of water. The rubber dam can also be adjusted to operate at intermediate heights to meet the needs for different upstream/downstream water levels in different time.

http://www.waterpowermagazine.com/storyprint.asp?sc=2041203

Advantages of Rubber Dams

Long span and adaptable to different side slopes

Long rubber dams can be installed in broad rivers without piers. They are adaptable to virtually any side slope angle. Little work is needed to modify riverbanks. While for a steel gate, intermediate piers are generally needed for about every 20m. Furthermore, steel gates cannot be installed unless the side slopes are vertical.

Short construction period

Compared with a conventional steel gate the rubber dam body is lighter and easier to handle. It can be fabricated in one piece at a factory and rolled up for easy transportation to the dam site. The rubber dam only requires a simple light foundation with a 10 to 15cm recess, while steel-gates normally have a 50 to 80cm recess (Bridgestone, 1997a). The construction of the concrete foundation and installation of the rubber body can be completed quickly, easily and economically. A single or double-line clamping plate is used to anchor the rubber body onto the foundation.

Easy maintenance and repair

Minimal maintenance is needed for rubber dams. There is no need for painting, greasing, or lubrication. With a steel gate, various maintenance expenses are needed, such as removal of rust, repainting and changing of hydraulic oil. Table 2 shows the maintenance operations for Dam No. YLN 189 in Hong Kong from June 1993 to September 1995. The average maintenance time was about three hours, while the total time spent on maintenance (129 hours) was only about 0.6% of the total operation time (approximately 19,992 hours). Techniques used for repairing automobile tires and conveyor belt can be applied to repair damages to the rubber dam body.

Low project life cycle cost
The life cycle cost of a rubber dam project is low due to prefabrication of the dam body, little modification to riverbanks, light concrete foundation, quick construction and installation, easy operation and minimal maintenance.

Earthquake resistant
The simple and light upper structure, uniform load on the rubber body, and light concrete foundation make a rubber dam project more earthquake-resistant than other structures serving similar functions. It is more adaptable in sensitive ground conditions where the foundation may subside unevenly. In fact, many rubber dams are installed in Japan, a place prone to earthquakes.

Adaptable to adverse conditions
Rubber dams can be placed in adverse environments. For example, in the Santa Ana River rubber dam, California, US, steel gates were not selected because of the corrosive environment: (1) The dam is only 19 km from the ocean and the major component of the base river flows is wastewater effluent; (2) The river has a high sediment transport capability, which can clog gate operators and abrade steel gates and hinges (Markus et al., 1995)

The rubber dam is operable in very cold climatic conditions, under which a steel gate may be inoperable. For example, both vertical lift and radial-type spillway gates present operational difficulties under icy conditions. They may be unable to operate due to increased hydrostatic loading and frictional resistance caused by ice. In extreme cases, the gate may be overwhelmed by ice and frozen in place (Sehgal, 1996). Air-filled rubber dams do not suffer such problems and can be fully operational. The rubber dam absorbs the impact from drift ice by its capacity to undergo deformation during ice passage and regains its shape thereafter. Furthermore, a rubber dam also reduces the problem of flooding upstream due to the buildup of ice at a conventional hydraulic structure. In rivers prone to icing, rubber dams with sloping sides and fewer intermediate piers are preferred over multi-pier water control structures that may block ice, cause upstream flooding, jam gates and even damage the piers. Examples of rubber dams used in cold weather include the Rainbow dam at Great Falls and the Broadwater dam, Missouri river, Montana, where the temperature may be as low as - 40°C. Another example is the rubber dam at Highgate Falls, Vermont. The dam is subject to heavy ice passage (Tam, 1998).

Environmentally friendly
The crest-adjustable rubber dam can form an aesthetically pleasing impoundment in otherwise fluctuating waters. This can create a stable aquatic habitat and provide recreational opportunities for various water activities. Boards, nails, wires, plastic sheet, and roofing paper that are typically used for flashboard construction are kept out of the rivers. The flushing effect of water when the dam is deflated is very strong. Debris, garbage and other wastes behind the dam can be flushed downstream (Figure 1). In addition, the appearance of rubber dams is generally less intrusive than other similar structures such as traditional steel gates and concrete weirs. The rubber body can be produced in different shapes and in various colors. Drawings, designs and company logos can also be incorporated on the surface of the rubber body.
http://www.waterpowermagazine.com/storyprint.asp?sc=2041203

http://www.alibaba.com/product-gs/469626787/Rubber_Dam_water_treatment.html

http://www.dokar.com.tr/index.php?option=com_content&view=article&id=98&catid=64&Itemid=73&lang=en

http://www.savatech.eu/environmental-protection-and-rescue/rubber-dam.html

Appendix B
Preliminary Rubber Dam Design

A B C D E F G H I J K L M N O

THE BOWERSOCK MILLS & POWER COMPANY RUBBER DAM PROJECT

INFLATABLE RUBBER DAM EQUIPMENT DESIGN

BOWERSOCK DAM
KANSAS RIVER
DOUGLAS COUNTY, KANSAS

AUGUST 17, 2011

CONTACTS

PROJECT OWNER
THE BOWERSOCK MILLS & POWER COMPANY
PHONE: 785-766-0884
FAX:
P.O. BOX 66
LAWRENCE, KANSAS 66044
CONTACT: NATHAN WALKER

CIVIL ENGINEER
OLSSON ASSOCIATES
PHONE: 816-361-1177
FAX: 816-361-1888
1251 NW BRIARCLIFF PARKWAY
SUITE 50
KANSAS CITY, MISSOURI 64116
CONTACT: JIM GAGNE

EQUIPMENT SUPPLY
HYDROTECH ENGINEERING, LLC
PHONE: 801-662-0088
FAX: 801-662-0086
960 WEST LEVOY DRIVE, SUITE 230
SALT LAKE CITY, UTAH 84123
CONTACT: GARY PAN

PRELIMINARY

HEPI, CO., LTD

For:
The Bowersock Mills & Power Company
Lawrence, Kansas, USA

HYDROTECH ENGINEERING

THE BOWERSOCK MILLS & POWER COMPANY RUBBER DAM PROJECT
DATE: AUGUST 17, 2011
SCALE: N.T.S.

SHEET
(1 of 21)
TITLE

DRAWING INDEX

SHEET NO.	SHEET TITLE
PUMP HOUSE	
PH-01	PUMP HOUSE LAYOUT (RECOMMENDED)
PH-02	PUMP HOUSE SECTION (RECOMMENDED)
RUBBER DAM	
RD-01	RUBBER DAM ELEVATION VIEW 1
RD-02	RUBBER DAM ELEVATION VIEW 2
RD-03	RUBBER DAM SECTION VIEW
RD-04	AIR CONDUIT LAYOUT
RD-05	AIR CONDUIT LAYOUT - DETAILS 1
RD-06	AIR CONDUIT LAYOUT - DETAILS 2
RD-07	AIR PIPING CONNECTION DETAIL
RD-08	AIR CONDUIT SECTION VIEWS - 1 AND 2
RD-09	AIR CONDUIT SECTION VIEWS - 3 AND 4
RD-10	AIR CONDUIT SECTION VIEWS - 5

SHEET NO.	SHEET TITLE
ANCHOR SYSTEM	
AS-01	LAYOUT DRAWING OF FOUNDATION
AS-02	ANCHOR DETAILS - 1
AS-03	ANCHOR DETAILS - 2
ELECTRICAL CONTROLS	
EC-01	MAIN LINE DIAGRAM
EC-02	CONTROL CIRCUIT
EC-03	CONTROL CIRCUIT LIST
EC-04	CONTROL PANEL

PRELIMINARY

HEPI, CO., LTD

For:
The Bowersock Mills &
Power Company
Lawrence, Kansas, USA

HYDROTECH ENGINEERING

THE BOWERSOCK MILLS & POWER COMPANY RUBBER DAM PROJECT

DATE: AUGUST 17, 2011

SCALE: N.T.S.

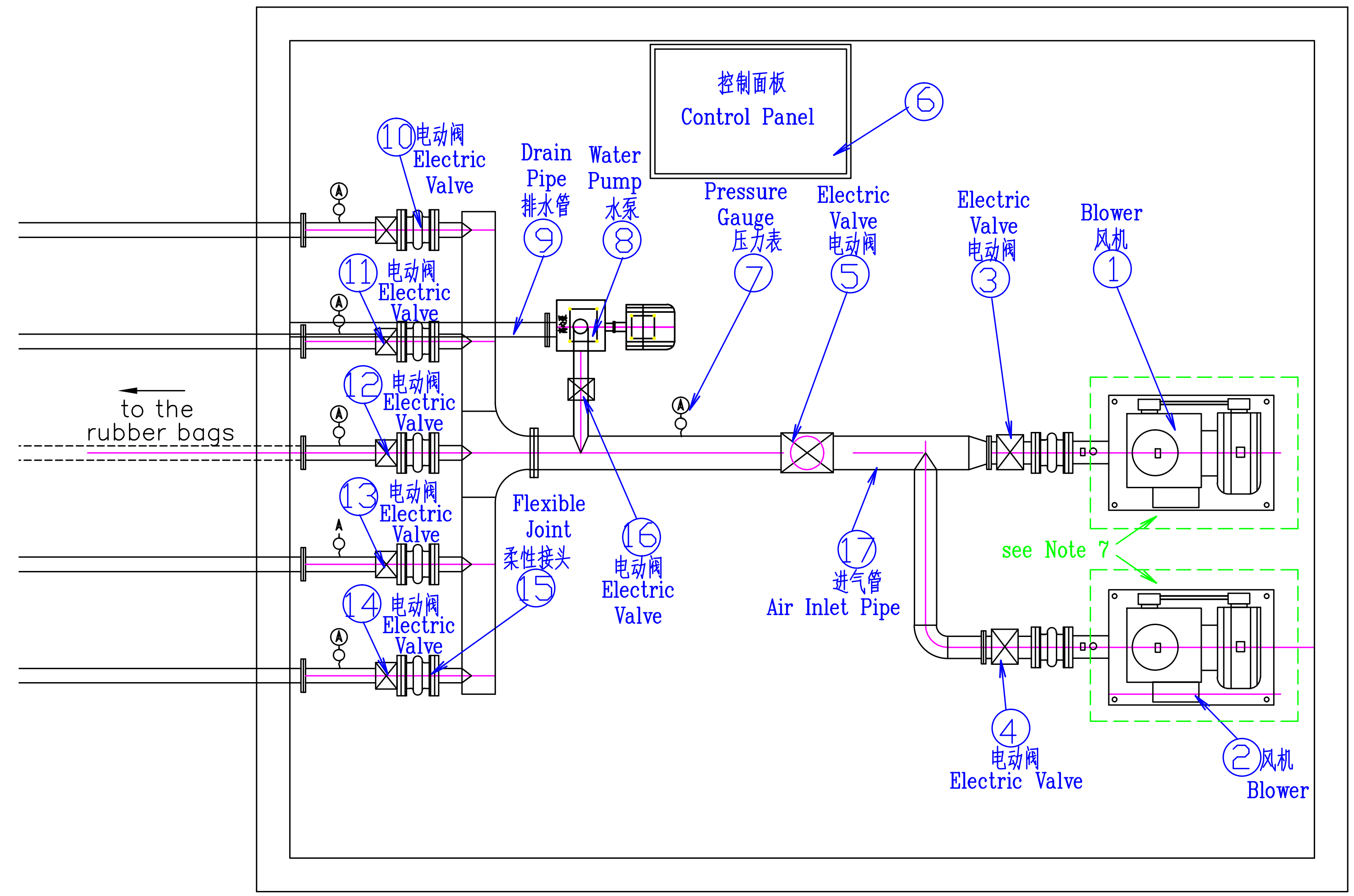
SHEET

(2 of 21)

INDEX

Pump House Specifications
泵房明细表

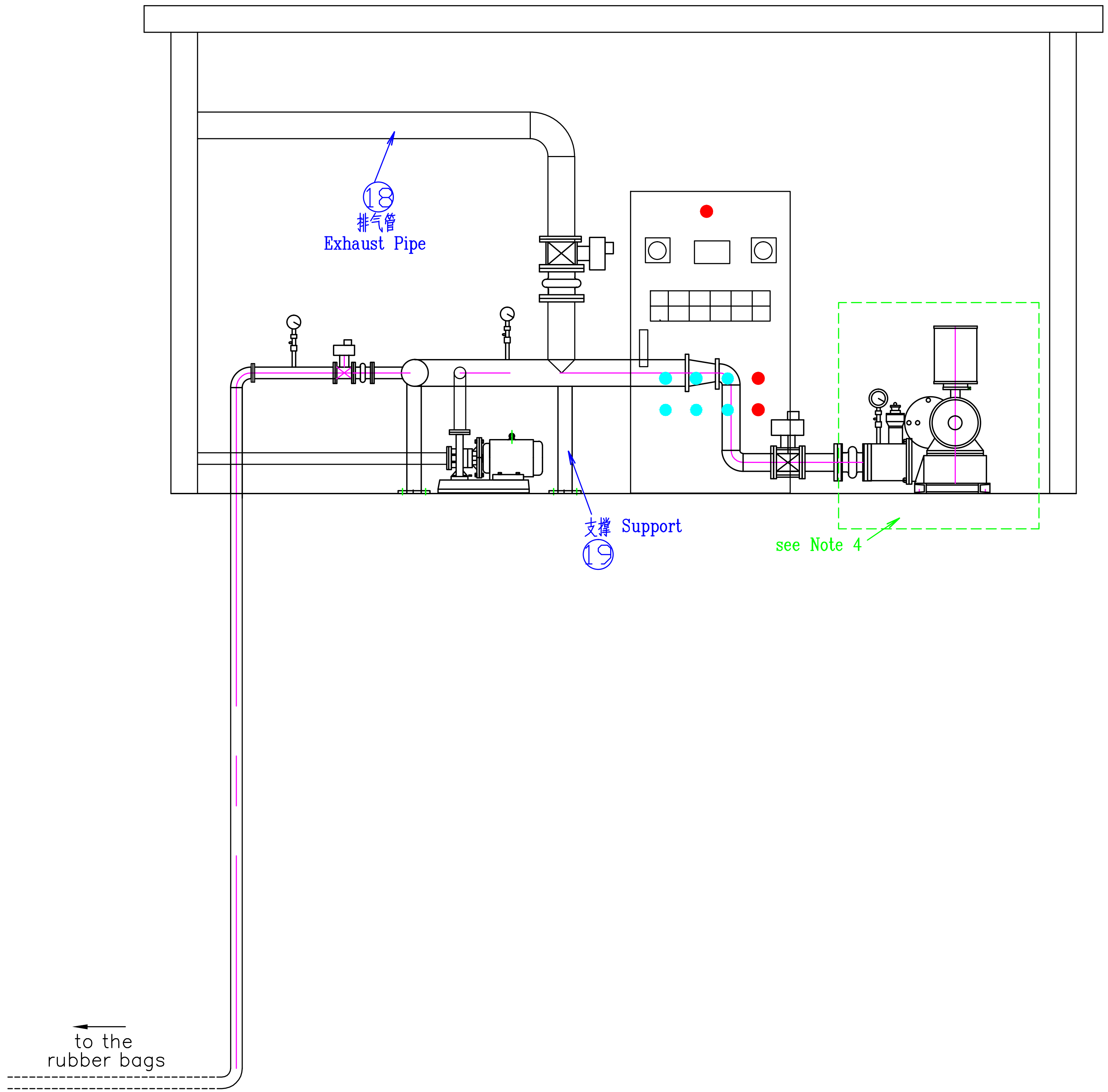
No.	Name	Spec.	Unit	Qty	Material	Notes
1	三叶罗茨鼓风机 Roots Blower	MFSA-100	台 Set	1	铸铁Cast Iron	压力 Pressure 24.5Kpa, 流量 Flow Rate 7.24m³/min, 功率 Power 5.5KW, 电压 Voltage 480V､频率 Frequency 60HZ, Optional (see Note 7)
2	三叶罗茨鼓风机 Roots Blower	MFSA-100	台 Set	1	铸铁Cast Iron	
3	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN100	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
4	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN100	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
5	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN150	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
6	控制面板 Control panel		个 Unit	1	钢 Steel	
7	电接点压力表 Electro Contact Pressure Gauge		个 Unit	6		
8	自吸离心水泵 Self-priming Centrifugal Pump	DN25	台 Set	1		电压480V､ 频率60HZ Voltage Frequency
9	排水管 Drain Pipe	DN65				
10	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN65	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
11	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN65	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
12	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN65	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
13	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN65	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
14	电动法兰蝶阀 Electric Butterfly Valve (Flanged)	DN65	个 Unit	1	钢 Steel	电压480V､ 频率60HZ Voltage Frequency
15	柔性接头 Flexible Joint	DN65	个 Unit	5		压力1.6Mpa Pressure
16	电动法兰球阀 Electric Ball Valve (Flanged)	DN25	个 Unit		钢 Steel	电压480V､ 频率60HZ Voltage Frequency
17	进气管 Air Inlet Pipe	DN150				
18	排气管 Exhaust Pipe	DN150				
19	支撑 Support			2		
	异径管Reducer	DN150 DN100	个 Unit	1		
	三通 T Joint	DN150	个 Unit	1		
	法兰 Flange	DN100	个 Unit	2		
	法兰 Flange	DN150	个 Unit	2		
	法兰 Flange	DN65	个 Unit	20		
	弯头 Elbow Joint	DN100	个 Unit	4		
	弯头 Elbow Joint	DN25	个 Unit	2		
	法兰 Flange	DN25	个 Unit	4		
	螺栓 Bolt					
	平垫 Flat Pad					



Note:
1. Dimensions are in millimeters
2. Material: Pipes will be galvanized steel pipes with flanged connections.
3. Blowers will be Roots Blowers. Dimensions of the blowers may vary slightly.
4. Structural support for pipes and valves are necessary.
5. After pipe installation, conduct pressure and seal tests.
6. This drawing is for reference only. Actual layout of blowers, pumps, piping, etc. to be based on civil engineer's pump house design.
7. The blowers shown are for reference and are optional in the scope of supply. It is HydroTech's understanding that the client has existing blowers that may be used for the project.

PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Pump House Layout (Recommended)	
		Rui Ding	Baiping Li	12 August 17, 2011	NTS		Project No.	HTE1144	Drawing No. (3 of 21) PH-01

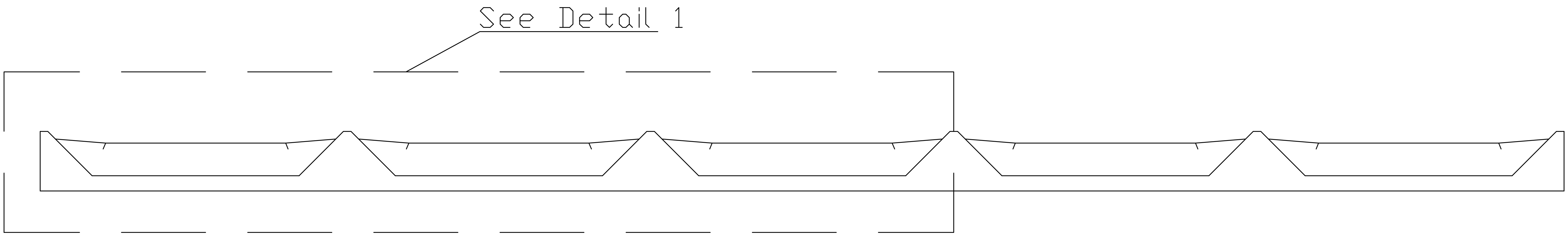


Note:
1. All dimensions are in millimeters
2. This drawing is for reference only. Actual size of pump house and layout of blowers, pumps, piping, etc. to be based on civil engineer's pump house design.
3. See Sheet PH-01 for numbered bill of materials list.
4. The blowers shown are for reference and are optional in the scope of supply. It is HydroTech's understanding that the client has existing blowers that may be used for the project.

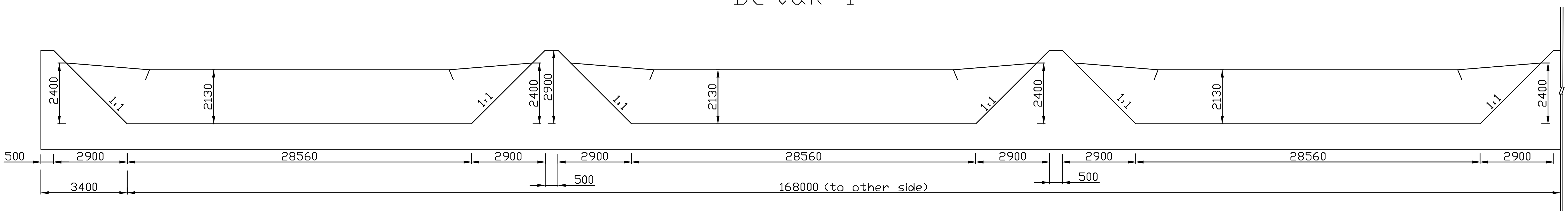
PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Pump House Section (Recommended)		
		Rui Ding	Baiping Li	13 August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(4 of 21) PH-02

Note:
1. All dimensions are in millimeters
2. Piers are concrete, according to dimensions given.



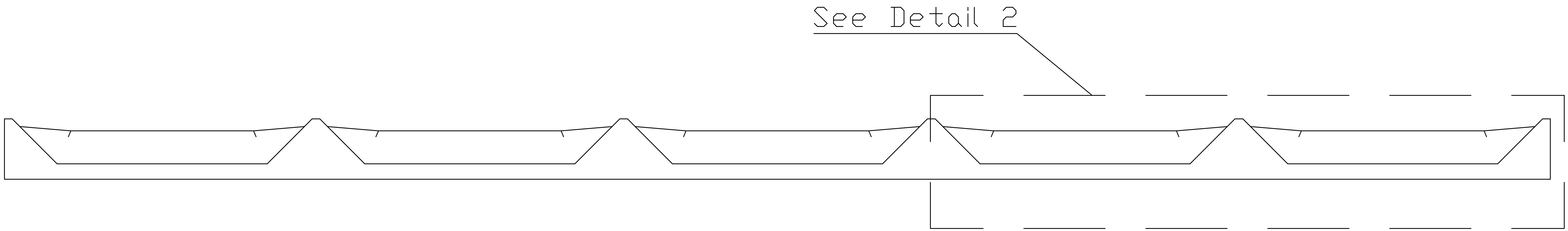
Detail 1



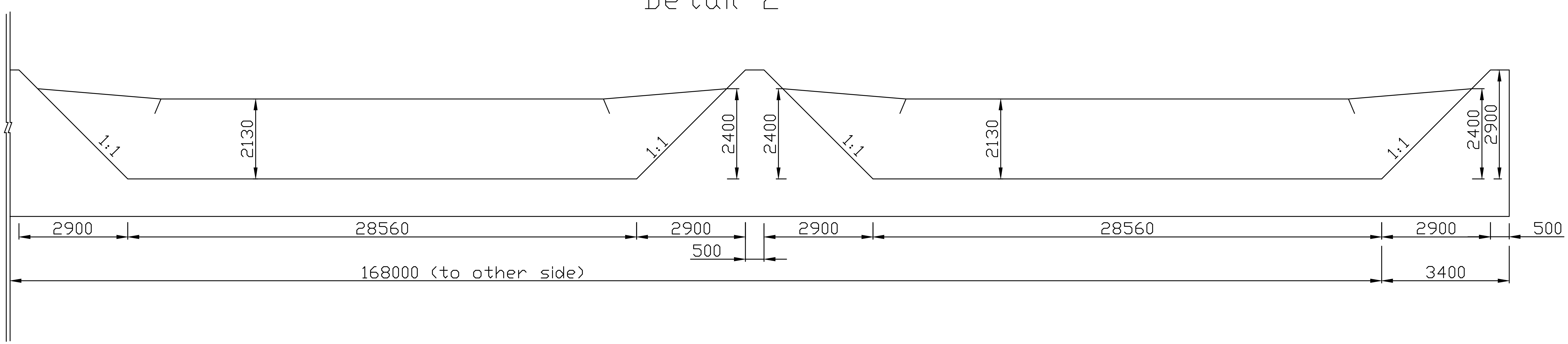
PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Rubber Dam Elevation View 1
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144 / Drawing No. / (5 of 21) RD-01

Note:
1. All dimensions are in millimeters
2. Piers are concrete, according to dimensions given.

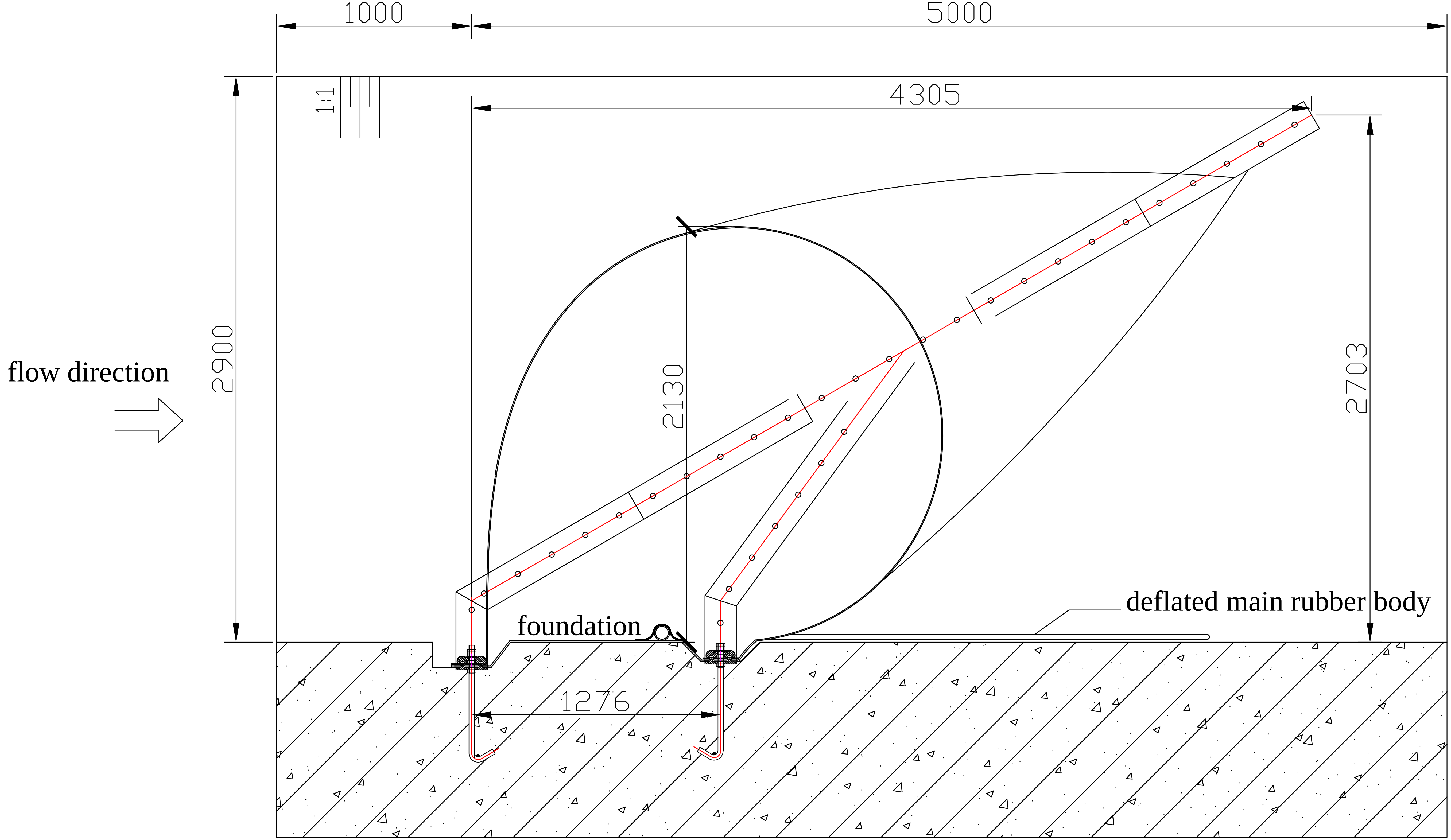


Detail 2



PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Rubber Dam Elevation View 2	
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No. (6 of 21) RD-02

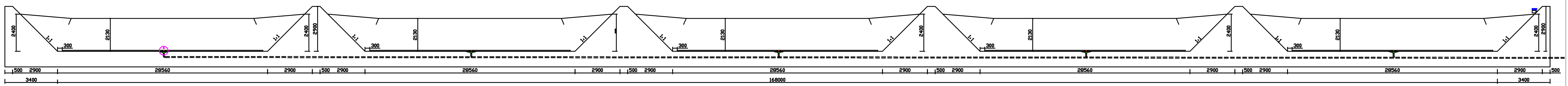


Note:
1. All dimensions are in millimeters
2. Rubber Dam height = 7 feet, Pressure Ratio = 1.0
3. Air filling rubber dam with double anchor line.
4. Maximum allowable air pressure in the rubber bag is 0.021MPa.

PRELIMINARY

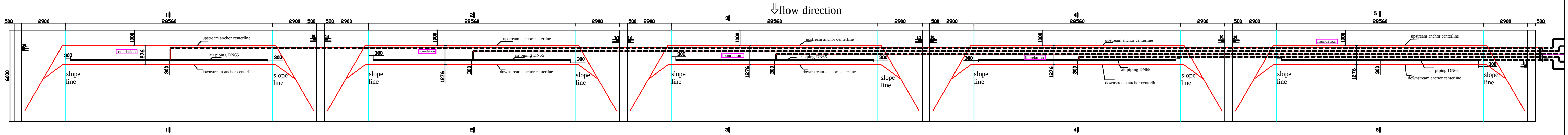
HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Rubber Dam Section View		
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(7 of 21) RD-03

Piping Elevation Diagram



Piping Plan Diagram

⇩flow direction



Note:

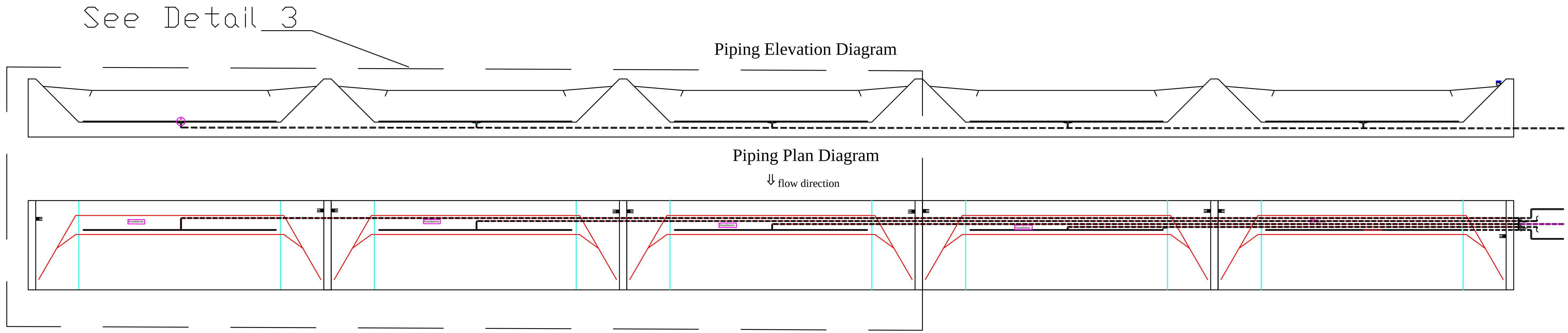
1. All dimensions are in millimeters.
2. The air piping is made of galvanized steel.
3. Conduit locations may be adjusted according to the needs of the site.

Perforated galvanized steel pipe within each rubber bag is supplied by manufacturer. All other piping supplied by plant.

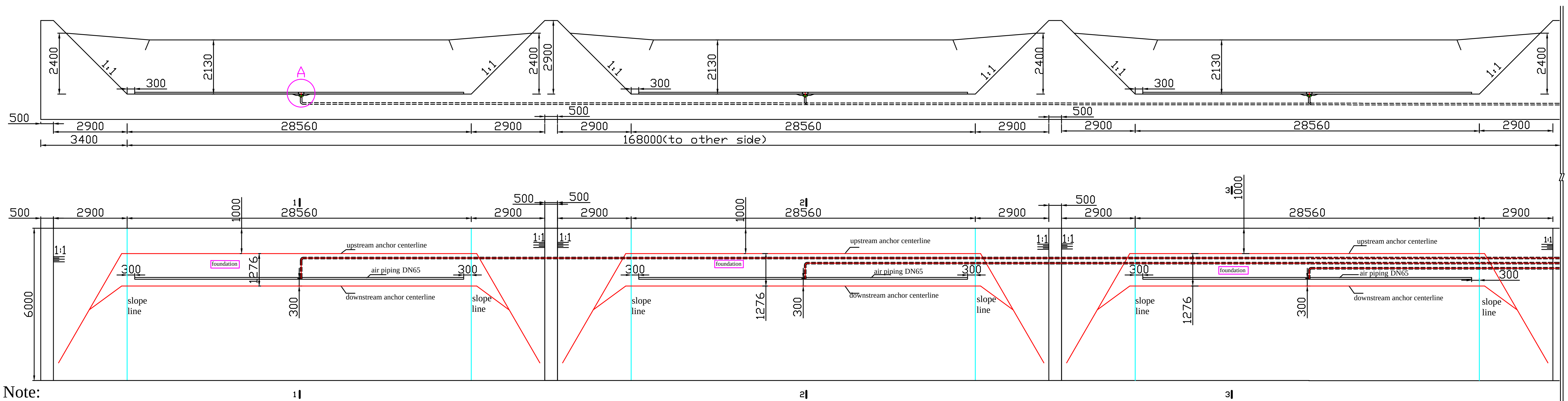
4. See Sheets RD-05 and RD-06 for additional details.
5. For sections 1-1 and 2-2, see sheet RD-08
   For sections 3-3 and 4-4, see sheet RD-09
   For section 5-5 see sheet RD-10

PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Conduit Layout		
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(8 of 21) RD-04



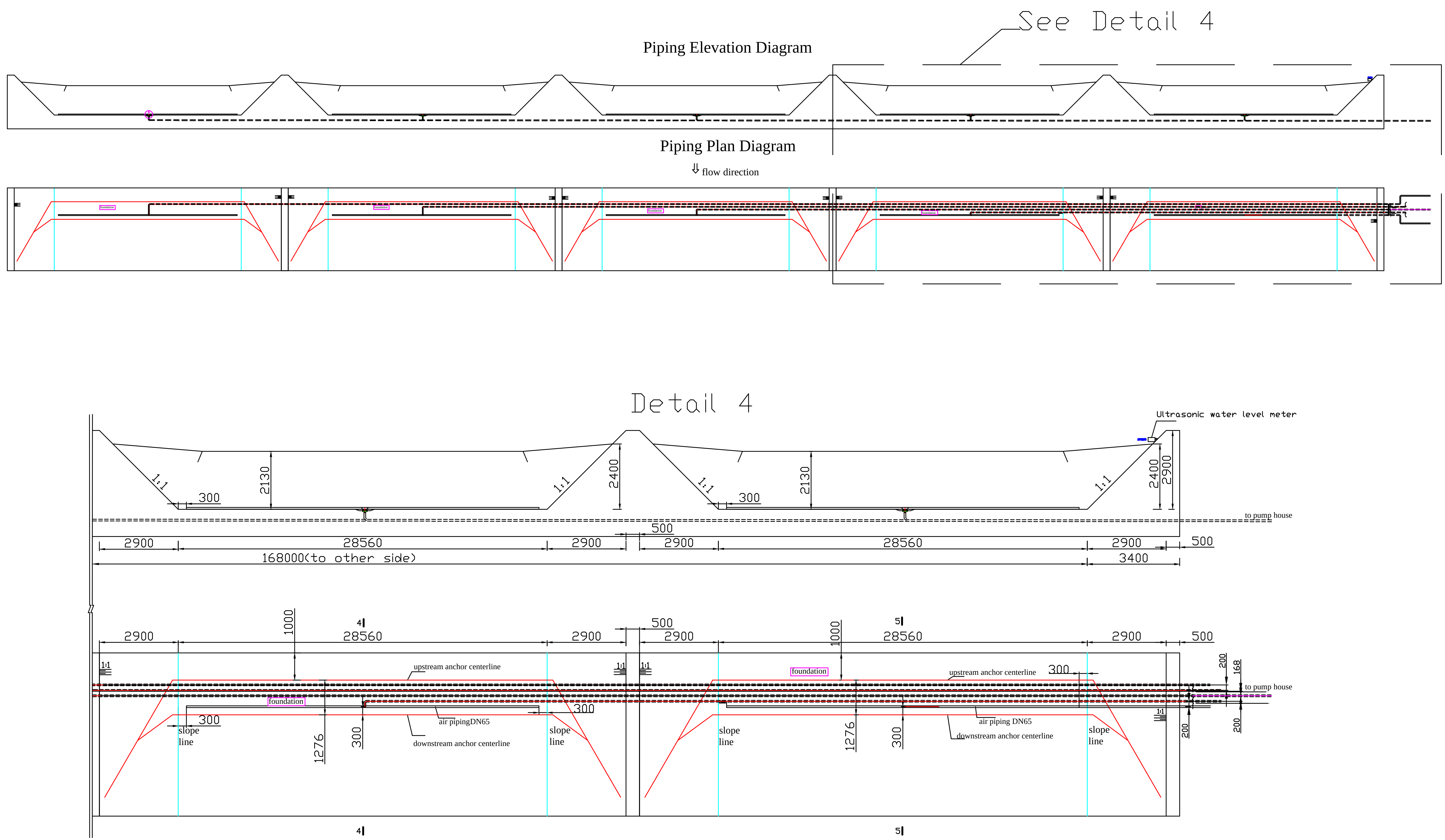
Detail 3



Note:
1. For sections 1-1 and 2-2, see cheet RD-08
For section 3-3, see RD-09
2. For Detail A, see sheet RD-07

PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Conduit Layout - Details 1	
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No. (9 of 21) RD-05

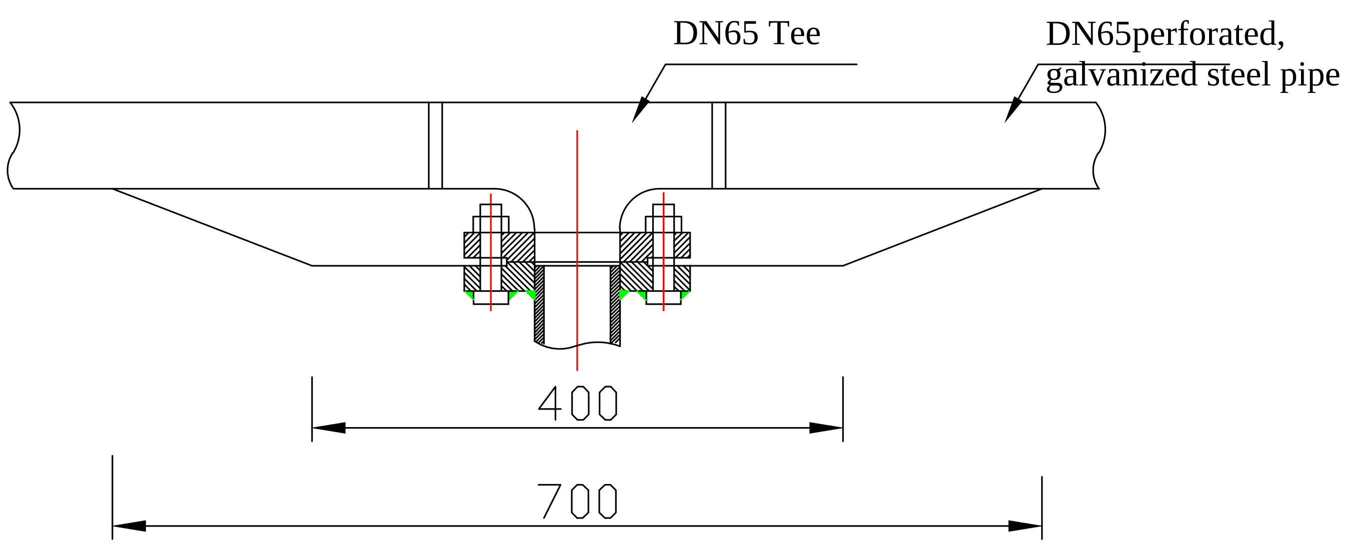


PRELIMINARY

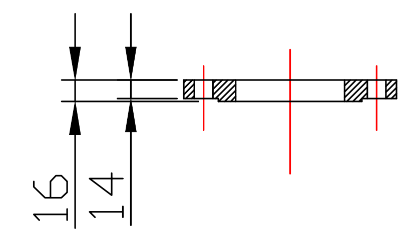
HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Conduit Layout - Details 2	
		Rui Ding	Baiping Li	19August 17, 2011	NTS		Project No.	HTE1144	Drawing No. (10 of 21) RD-06

Detail A

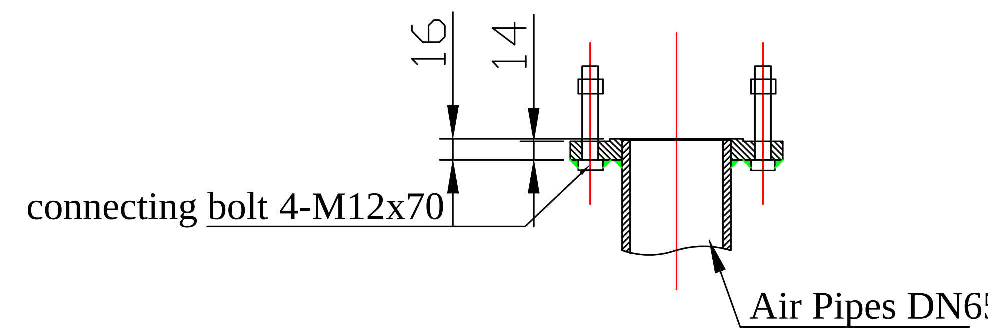
(See sheet RD-05)

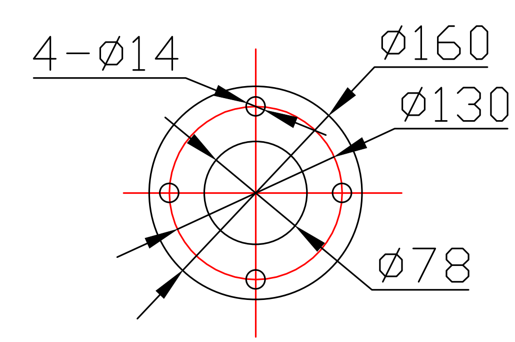


Upper Flange



Lower Flange



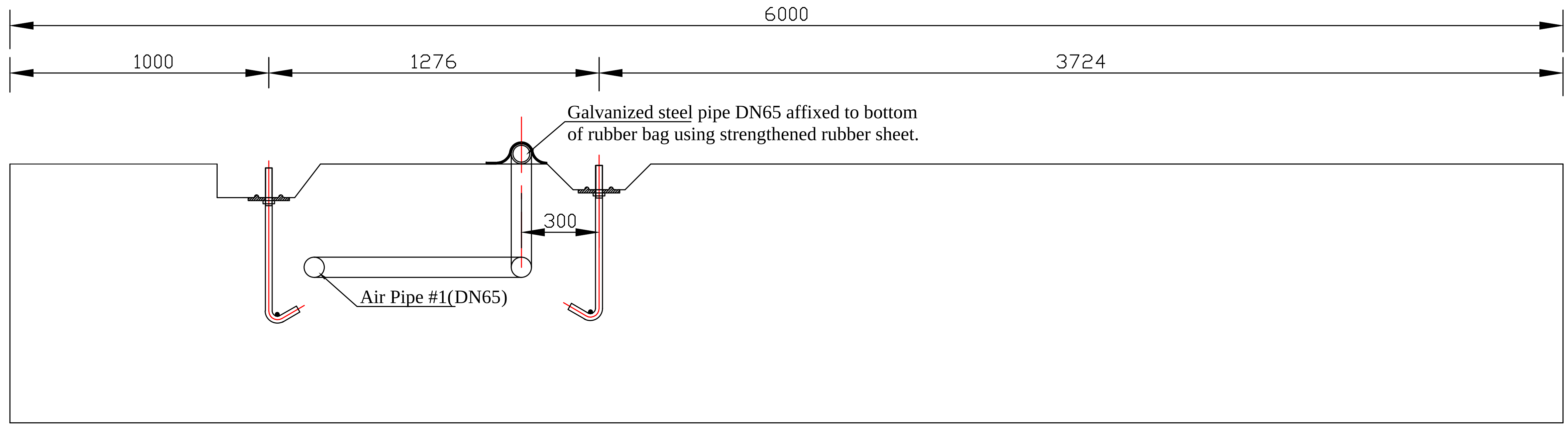


Note:
1. All dimensions are in millimeters
2. Polish and apply anti-rust coating to flanges
3. Weld lower flange and inlet galvanized steel pipe together.
4. Perforated galvanized steel pipe within each rubber bag is supplied by manufacturer. All other piping supplied by plant.

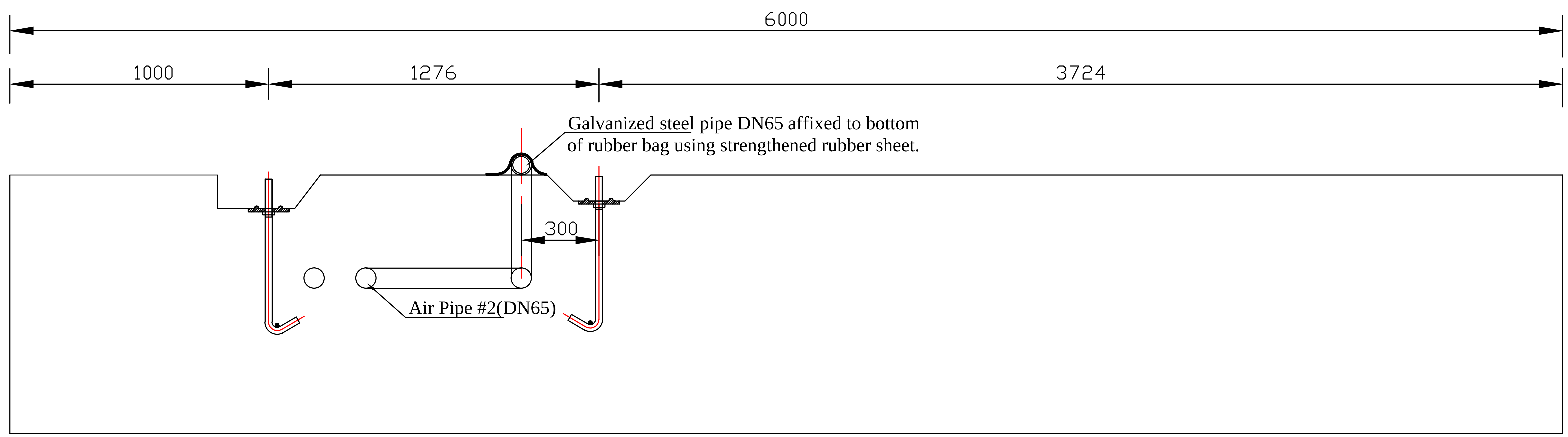
PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Piping Connection Detail			
		Rui Ding	Baiping Li	20 August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(11 of 21) RD-07	

1-1Section
(See Sheet RD-05)



2-2 Section
(See Sheet RD-05)



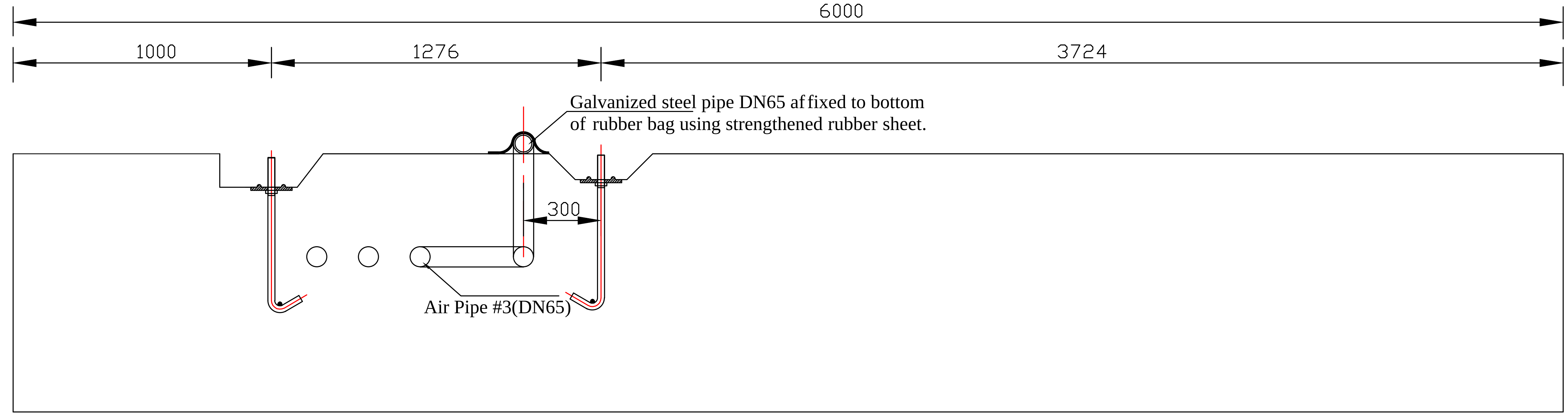
Note:
1. Dimensions are in millimeters
2. Conduit locations shown are based on a filled concrete foundation design. Manufacturer has no additional special requirements regarding conduit location, and location may be adjusted according to the needs of the site.
3. Perforated galvanized steel pipe within each rubber bag is supplied by manufacturer. All other piping supplied by plant.

PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Conduit Section Views - 1 and 2		
		Rui Ding	Baiping Li	21 August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(12 of 21) RD-08

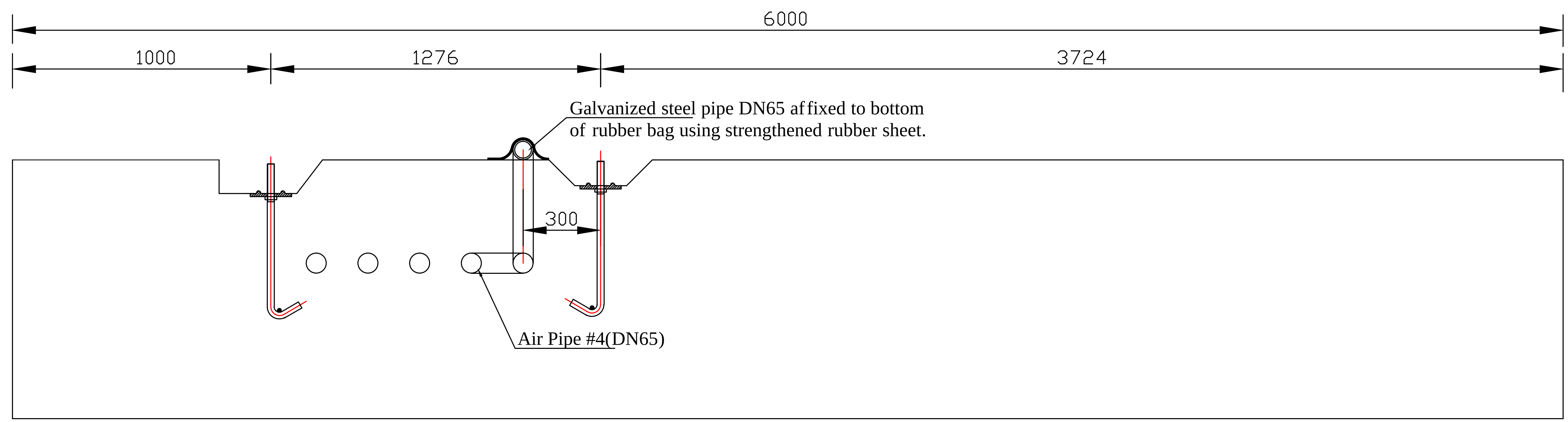
3-3 Section

(See Sheet RD-05)



4-4 Section Drawing

(See Sheet RD-06)



Note:
1. Dimensions are in millimeters
2. Conduit locations shown are based on a filled concrete foundation design. Manufacturer has no additional special requirements regarding conduit location, and location may be adjusted according to the needs of the site.
3. Perforated galvanized steel pipe within each rubber bag is supplied by manufacturer. All other piping supplied by plant.

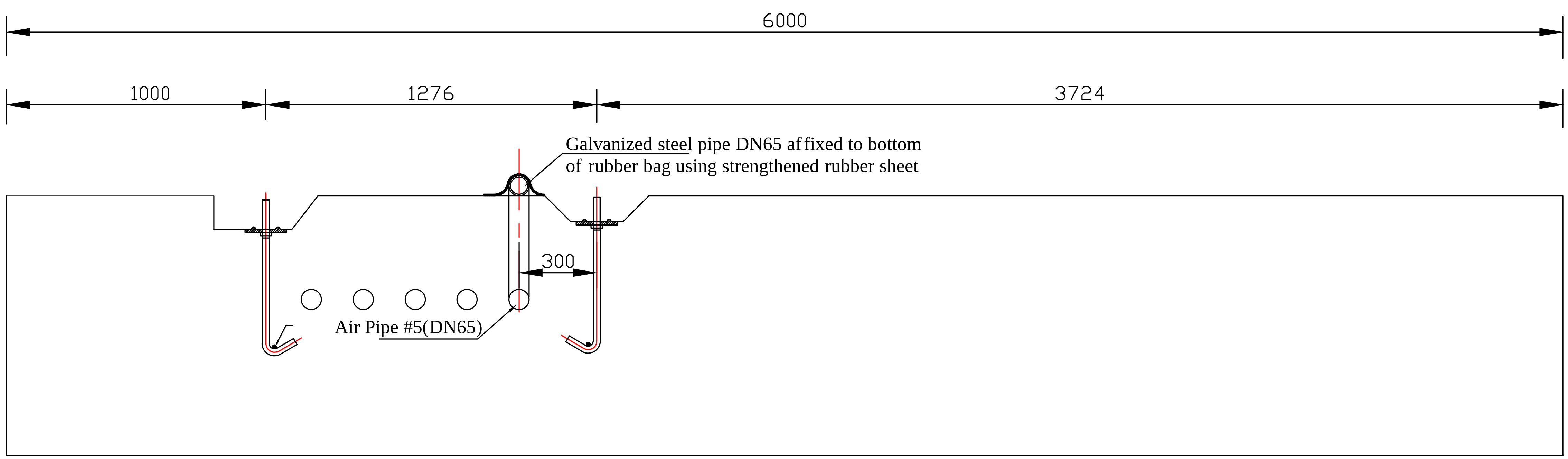
PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Conduit Section Views - 3 and 4		
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(13 of 21) RD-09

Note:
1. Dimensions are in millimeters
2. Conduit locations shown are based on a filled concrete foundation design. Manufacturer has no additional special requirements regarding conduit location, and location may be adjusted according to the needs of the site.
3. Perforated galvanized steel pipe within each rubber bag is supplied by manufacturer. All other piping supplied by plant.

5-5 Section Drawing

(See Sheet RD-06)

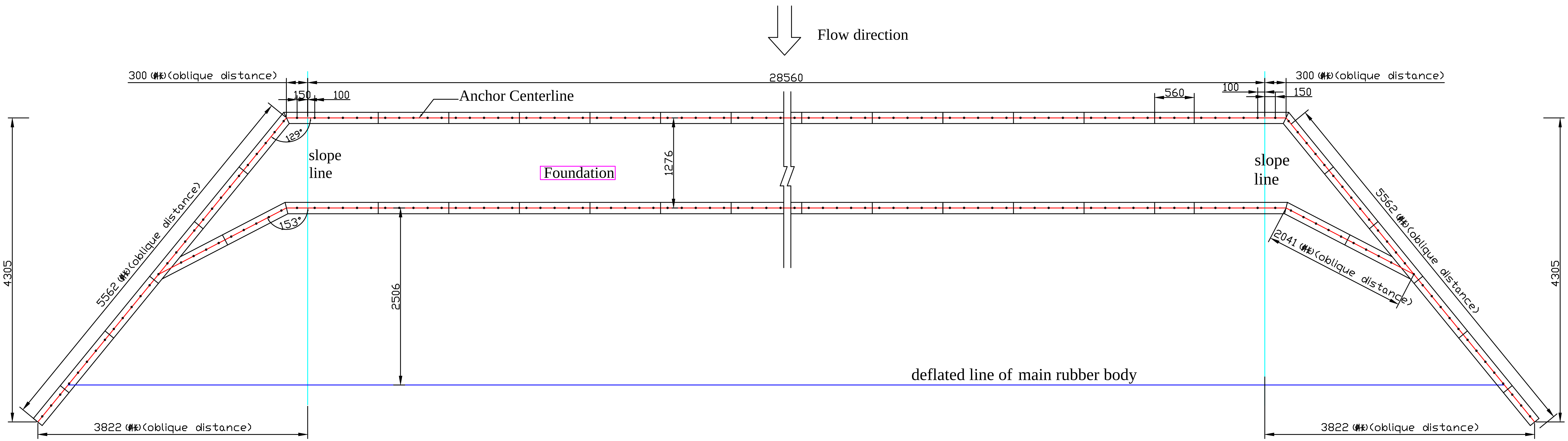


PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Air Conduit Section Views - 5	
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No. (14 of 21) RD-10

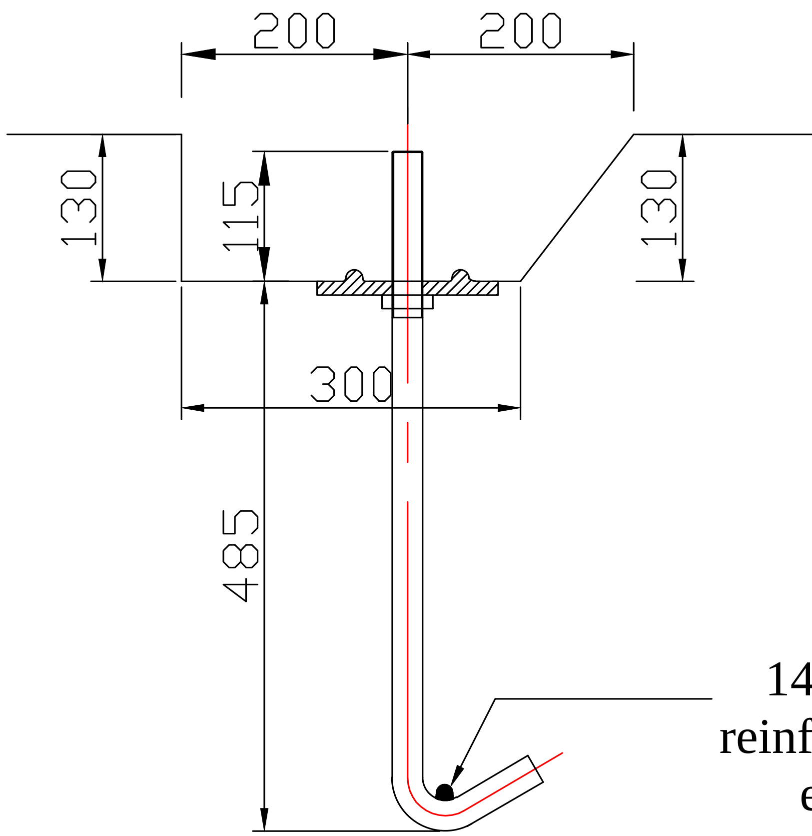
Note:
1. All dimensions are in millimeters

Layout Drawing of Foundation

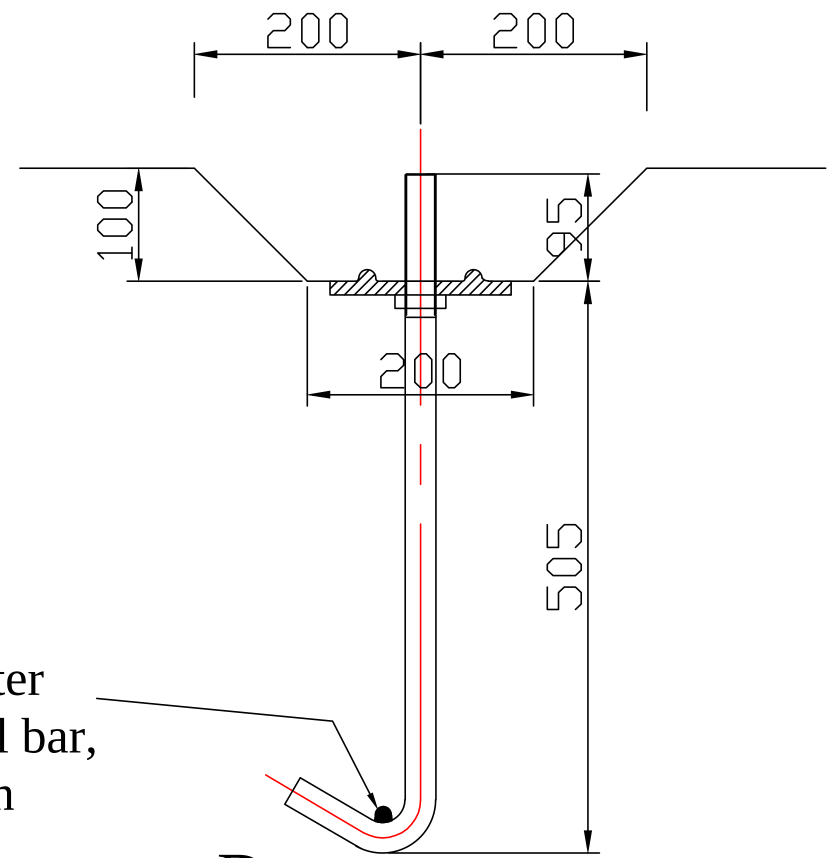


PRELIMINARY

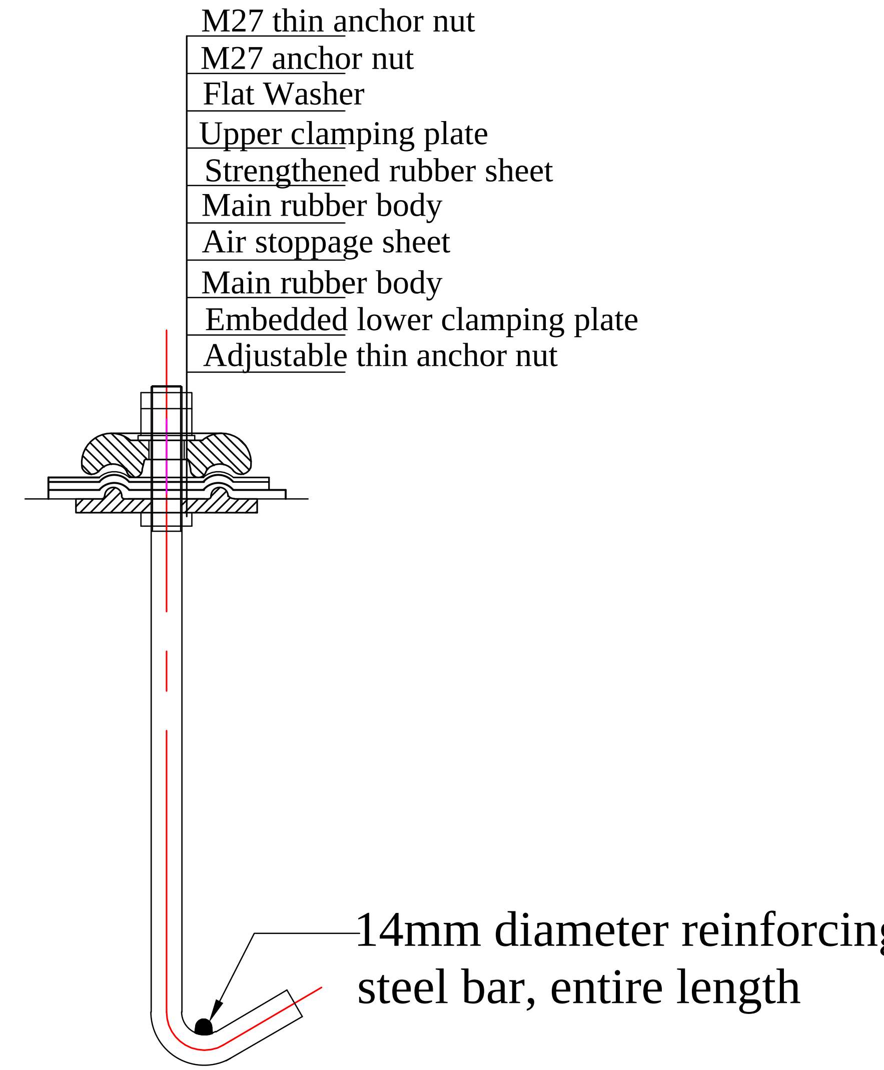
		Audit	Design	Date	Scale			
HYDROTECH ENGINEERING	HEPI Co., Ltd.	Rui Ding	Baiping Li	August 17, 2011	NTS	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Layout Drawing of Foundation
							Project No.	HTE1144
							Drawing No.	(15 of 21) AS-01



Upstream
Anchor Bolt



Downstream
Anchor Bolt



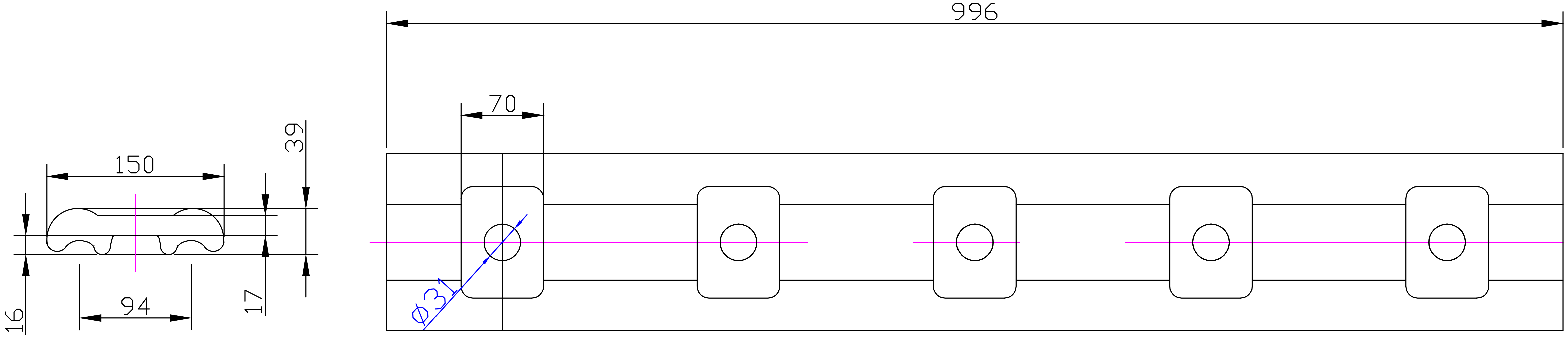
Layers for Rubber Bag
Equipment Anchoring

Note:
1. All dimensions are in millimeters
2. Anchor slot dimensions are critical to foundation design for the protection of anchoring components.

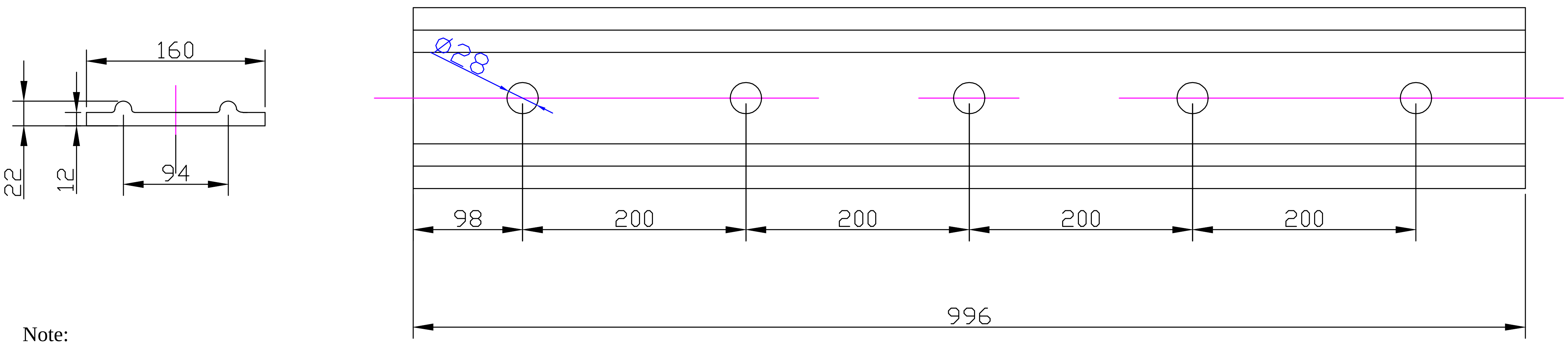
PRELIMINARY

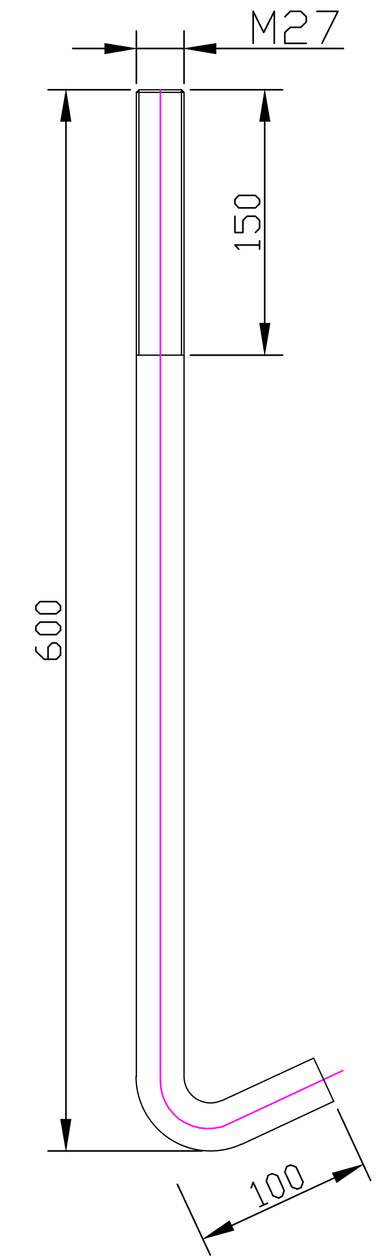
HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Anchor Details - 1		
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(16 of 21) AS-02

Upper Clamping Plate



Embedded Lower Clamping Plate



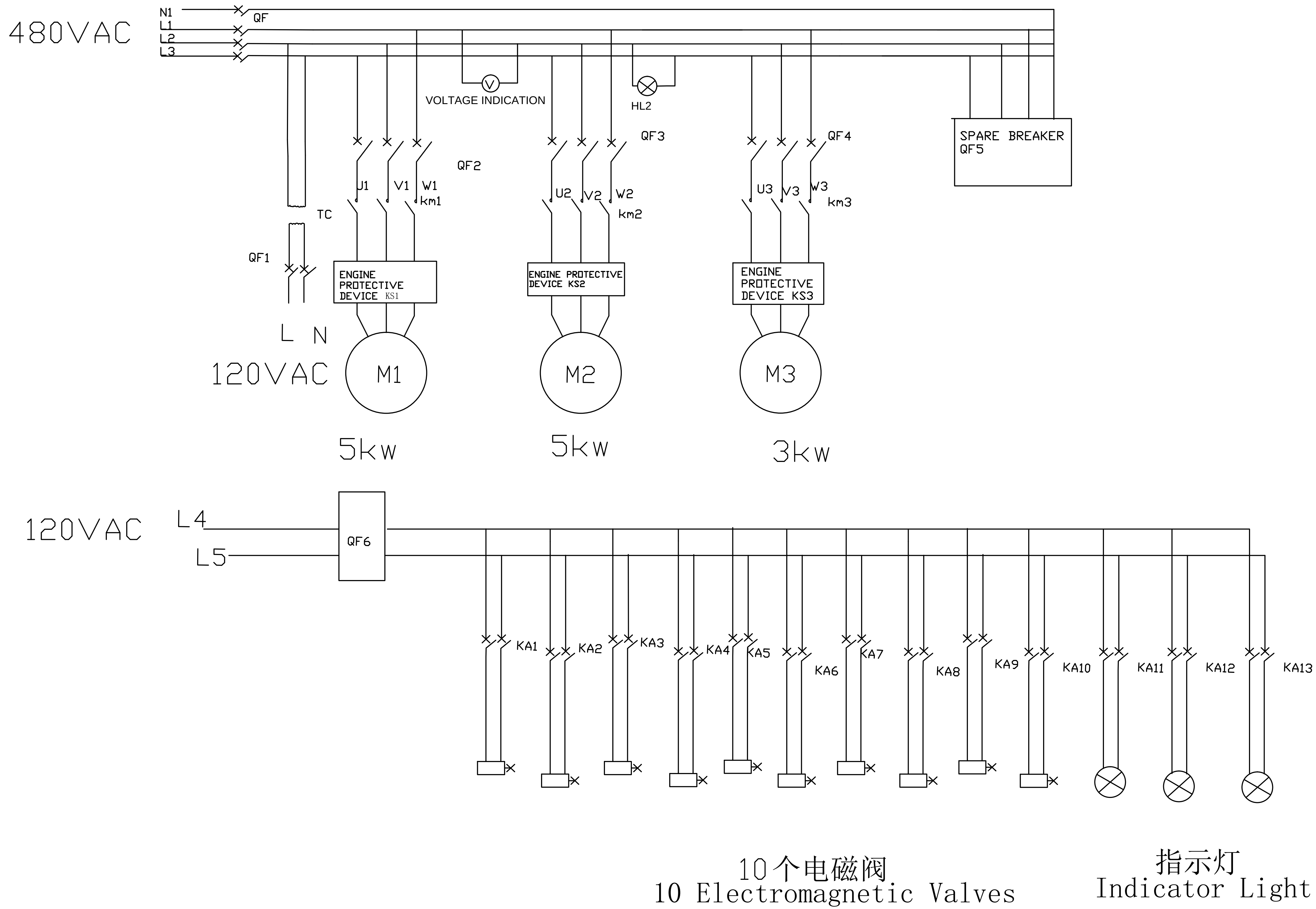


Anchor Bolt

Note:
1. Dimensions are in millimeters
2. Anchor nut size is according to GB/T41-2000 and GB/T6172-2000 Standards.
Washer size is according to GB/T97.1-2002 standards.
3. The anchor plates are specially designed by the manufacturer. The size of one upper clamping plate section: is 996x150x39mm. The size of one embedded lower clamping plate section is: 996x160x22mm.
4. The anchor bolt is M27, with a length of 700mm. The distance between two anchor bolts is 200mm.
5. Anchor plates are made of cast iron and the anchor bolt is made of cast

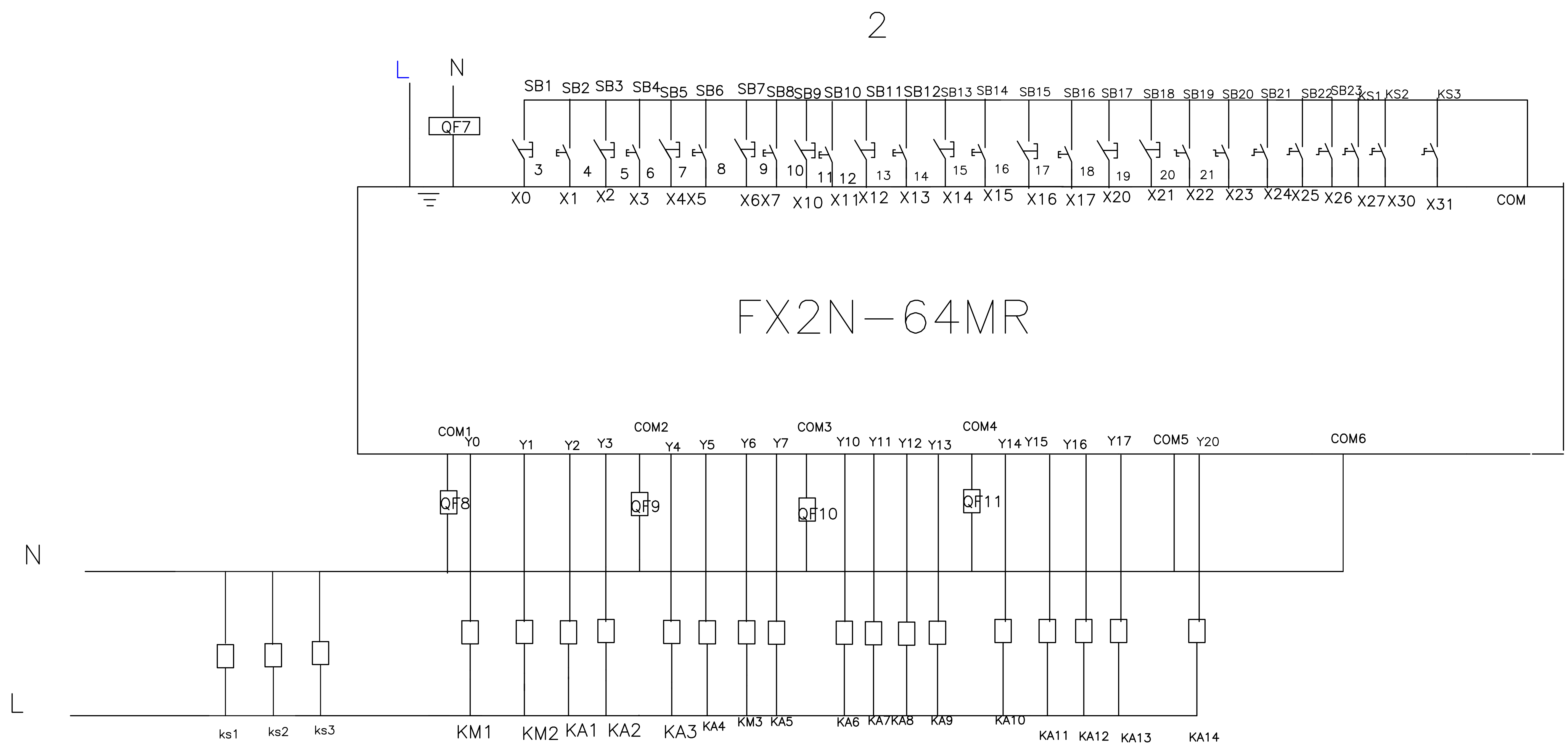
PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Anchor Details - 2		
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(17 of 21) AS-03



PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Main Line Diagram		
		Rui Ding	Baiping Li	27August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(18 of 21) EC-01



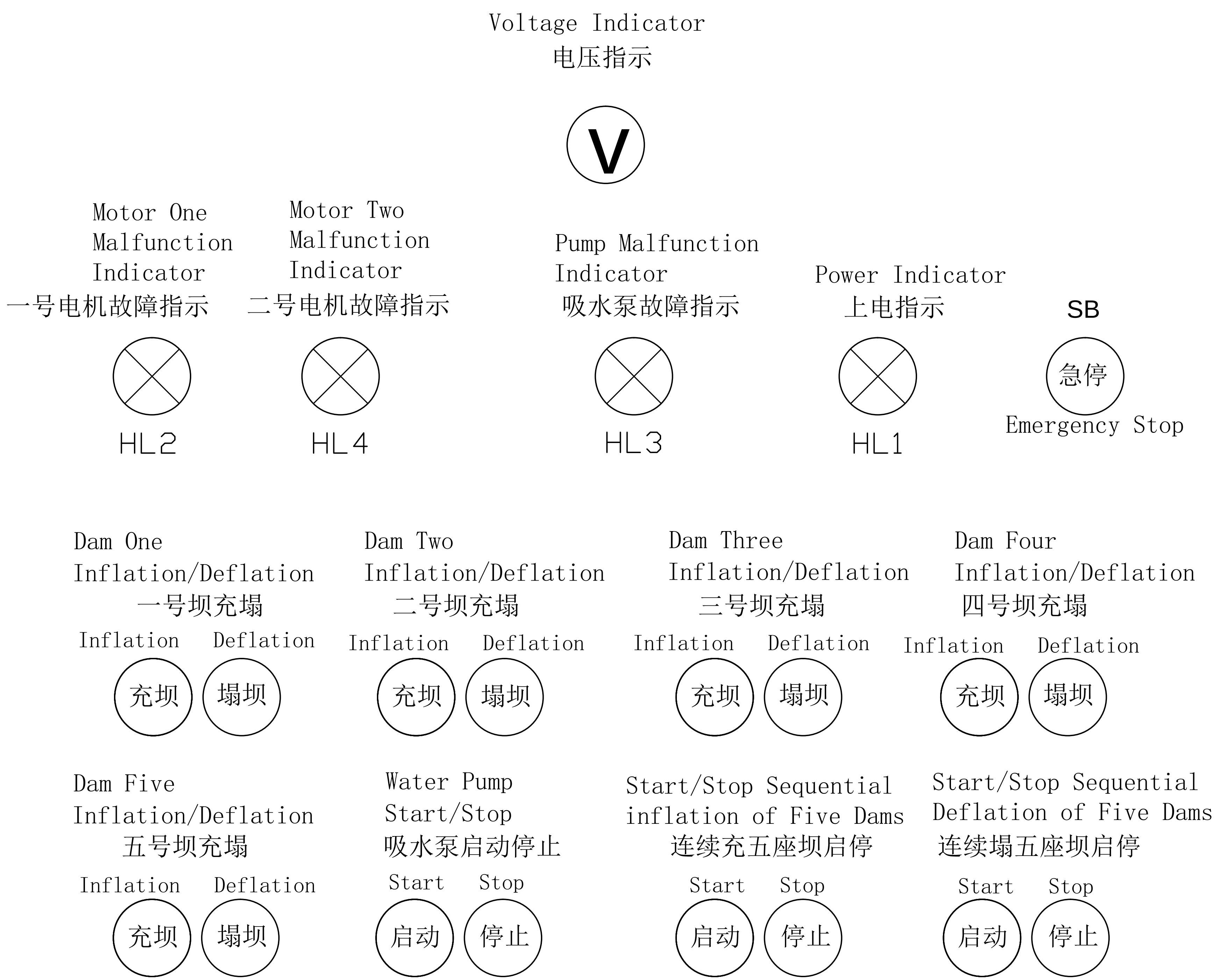
PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Control Circuit		
		Rui Ding	Baiping Li	28 August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(19 of 21) EC-02

断路器类 Breaker Type	安数 Amperage	型号 Model	个数 Qty.	代表符号 Mark
塑料式外壳断路器 Plastic Case Breaker	C100	适应额定电压为480v的电路 Fit circuits with 480V rated voltage	1	QF
4P断路器 4P Breaker	C60	适应额定电压为480v的电路 Fit circuits with 480V rated voltage	1	QF
3P断路器 3P Breaker	C60	适应额定电压为480v的电路 Fit circuits with 480V rated voltage	3	QF
2P断路器 2P Breaker	C20	适应额定电压为480v的电路 Fit circuits with 480V rated voltage	2	QF
1P断路器 1P Breaker	C10	NB1-63H	5	QF
接触器类 Contact Type				
交流接触器 AC Contactor			3	KM
电机综合保护器 Combined Motor Protector		控制电压为120v Control Voltage is 120V		KS
电机综合保护器 Combined Motor Protector		控制电压为120v Control Voltage is 120V		KS
继电器 Relay		控制电压为120v Control Voltage is 120V	13	KA
开关类 Switch Type				
启动按钮 Start Button		NP4（绿色平键） (Green Flat Button)	7	SB
停止按钮 Stop Button		NP4（红色平键） (Red Flat Button)	7	SB
急停按钮 SB Emergency Stop Button		NP4	1	SB
		NP4		SA
其它 Other				
电压表 Voltage Meter		额定电压480v Rated Voltage 480V	1	V
指示灯 Indicator Light			4	HL1
PLC (Programmable Logic Controller)	三菱 Mitsubishi FX2N-64MR		1	
变压器 Transformer			1	TC

PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Control Circuit List		
		Rui Ding	Baiping Li	29 August 17, 2011	NTS		Project No.	HTE1144	Drawing No.	(20 of 21) EC-03



Button Description 按钮说明

SB1	一号坝上的压力表接点	Pressure Gauge Contact Point of Dam One
SB2	二号坝上的压力表接点	Pressure Gauge Contact Point of Dam Two
SB3	三号坝上的压力表接点	Pressure Gauge Contact Point of Dam Three
SB4	四号坝上的压力表接点	Pressure Gauge Contact Point of Dam Four
SB5	五号坝上的压力表接点	Pressure Gauge Contact Point of Dam Five
SB6	一号坝充坝按钮	Dam One Inflation Button
SB7	一号坝塌坝按钮	Dam One Deflation Button
SB8	二号坝充坝按钮	Dam Two Inflation Button
SB9	二号坝塌坝按钮	Dam Two Deflation Button
SB10	三号坝充坝按钮	Dam Three Inflation Button
SB11	三号坝塌坝按钮	Dam Three Deflation Button
SB12	四号坝充坝按钮	Dam Four Inflation Button
SB13	四号坝塌坝按钮	Dam Four Deflation Button
SB14	五号坝充坝按钮	Dam Five Inflation Button
SB15	五号坝充坝按钮	Dam Five Deflation Button
SB16	连续充五座坝充坝开始按钮	Start button for sequential inflation of five dams
SB17	连续充五座坝充坝停止按钮	Stop button for sequential inflation of five dams
SB18	连续塌五座坝开始按钮	Start button for sequential deflation of five dams
SB19	连续塌五座坝停止按钮	Stop button for sequential deflation of five dams
SB20	排水开始	Draining Start
SB21	排水停止	Draining Stop
SB22	急停	Emergency Stop
SB23	总管道上的压力表接点	Contact point of the pressure gauge on main pipe

PRELIMINARY

HYDROTECH ENGINEERING	HEPI Co., Ltd.	Audit	Design	Date	Scale	Bowersock Mills & Power Company Rubber Dam Project	Drawing Name	Control Panel	
		Rui Ding	Baiping Li	August 17, 2011	NTS		Project No.	HTE1144	Drawing No. (21 of 21) EC-04

Appendix C
Plywood Flashboard Replacement
Estimate and Documentation

Plywood Flashboards: 7'8' Flashboard

4’ X 8’ X ¾” treated plywood	\$29.70/pc. (8pc/door = \$238.00)
4” X 4” X ¼” sq. tubing	\$16.00/ft. (44ft/door = \$704.00)
3 ½” O.D. X 8’ pipe (hinges)	\$10/ft. (8ft/door = \$80.00)
Hinge Plate	\$245.00/door
Hardware	\$70.00/door
Paint	\$15000.00
2”X 4” supports	\$1540.00
Total Per Flashboard	\$1337.00
64 Flashboards	**\$102,108.00**
Rubber Seals	\$27,000.00
Total Replacement Cost	**129,108.00**
Estimated Life =	1-3 years

sept 29 prices

MCCRAY LUMBER COMPANY
1516 W 6TH ST
,

Sold To	Ship To
BOWERSOCK MILL & POWER PO BOX 66 LAWRENCE, KS 66044	BOWERSOCK MILL & POWER PO BOX 66 LAWRENCE, KS 66044

SUB: 1

ACCT #	QUOTE#	TERMS	ENTERED	SLM	EXPIRATION
EBOWM1	sept 29	NET 25TH PROX	09/29/11	15PD	10/09/11

Quantity	U/M	Description	Price	Extension
		**** QUOTE ****		
1	EA	4X8-3/4 TREATED SHEATHING PLY	995.000/MSF	31.84*
1	EA	2X4-8 #2&BTR SPF	450.000/MBF	2.40*
1	EA	MISCELLANEOUS ITEM above item is 2x6-10' tongue and groove #1 treated southern yellow pine. It is available in 64 pc units and is a nonstock item with an increased lead time (generally 1-2 weeks)	8.060	8.06*

September 29, 2011 10:45:2 OT:15PD

****
* QUOTE *
****

PAGE 1 OF 1

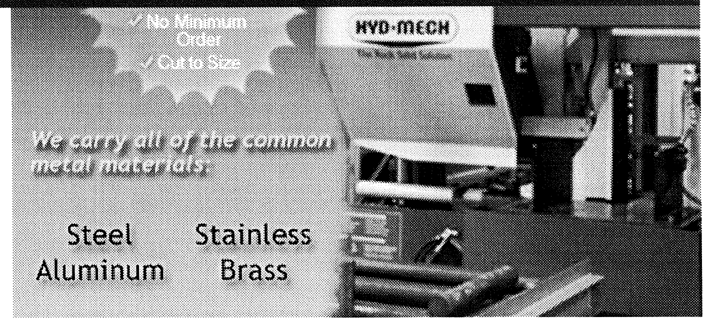
MERCHANDISE:	42.30
OTHER:	0.00
TAX:	0.00
FREIGHT:	0.00
TOTAL:	42.30

ERRORS SUBJECT TO CORRECTION
QTYS ARE ESTIMATED ONLY
& NOT GUARANTEED TO
COMPLETE THE JOB
PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

METAL by the FOOT, Inc.

Kansas City's #1 Metal Store
STEEL - ALUMINUM - BRASS - STAINLESS
Cut to Order - (816) 241-5550

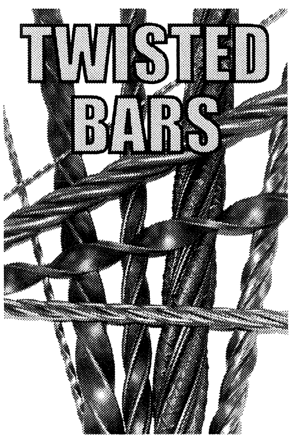
- Home
- About Us
- Services
- FAQS
- Get A Quote
- Links
- Contact Us



ONLINE STORE | SERVICES | PHOTO GALLERY | SHOPPING CART | MY ACCOUNT | CONTACT US

MY CART
You have no items in your shopping cart.

Part # [ ] QTY: 1
Add to Cart



call customer service
(816) 241-5550

Instant Material Pricing

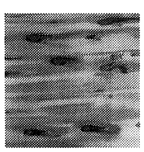
PLEASE NOTE
This is for a Quote only.
We do not offer online purchasing of materials at this time.
Quantities of each piece can be adjusted in the shopping cart and
Quoted prices are kept current with market prices and are subject to change without notice.

Type of Material	Steel
Material Shape	Flat Bar
Material Specific	Hot Rolled
Thickness	1.00 (1)
Available Size	8.00 (1 x 8)
Please Enter Length in (inches)	120
	Gets Price Reset

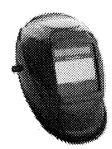
Estimated Total for Item : $ 320.00
Product Name : 1 x 8 Mild Steel Hot Roll Flat Bar
Product SKU : 1000hrf0800
Product Description : 1 x 8 Mild Steel Hot Roll Flat Bar

Add to Cart Reset

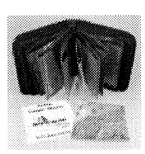
Featured Products

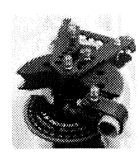

Stellar Copper
$134.95


Gloss Black Aut
$229.95


Metallic Blue A
$229.95


Red Auto Darken
$229.95


Patina Copper S
$30.00


JD2 Model 3 Ben
$295.00

HOME | ABOUT US | SERVICES | FAQS | MY ACCOUNT | HELP | CONTACT US

METAL by the FOOT, Inc.

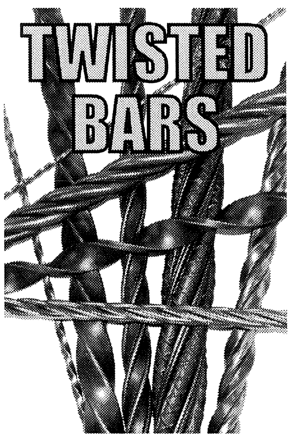
Kansas City's #1 Metal Store
STEEL - ALUMINUM - BRASS - STAINLESS
Cut to Order - (816) 241-5550

- Home
- About Us
- Services
- FAQS
- Get A Quote
- Links
- Contact Us

ONLINE STORE | SERVICES | PHOTO GALLERY | SHOPPING CART | MY ACCOUNT | CONTACT US

MY CART
You have no items in your shopping cart.

Part # [ ] QTY: [1]
Add to Cart



call customer service
(816) 241-5550

Instant Material Pricing

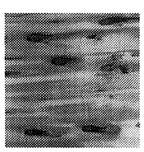
PLEASE NOTE
This is for a Quote only.
We do not offer online purchasing of materials at this time.
Quantities of each piece can be adjusted in the shopping cart and
Quoted prices are kept current with market prices and are subject to change without notice.

Type of Material	Steel
Material Shape	Round Tube
Material Specific	Black Pipe
Thickness	Sch 40
Available Size	3.00 (3.500 OD)
Please Enter Length in (inches)	12
	Gets Price Reset

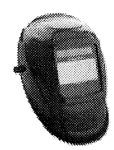
Estimated Total for Item : $ 10.30
Product Name : 3 Schedule 40 Steel Black Pipe (3.500 OD x .216 Wall)
Product SKU : 3000sch40
Product Description : 3 Schedule 40 Steel Black Pipe (3.500 OD x .216 Wall)

Add to Cart Reset

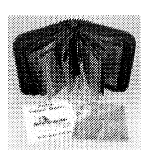
Featured Products

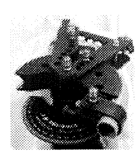

Stellar Copper
$134.95


Gloss Black Aut
$229.95


Metallic Blue A
$229.95


Red Auto Darken
$229.95


Patina Copper S
$30.00


JD2 Model 3 Ben
$295.00

HOME | ABOUT US | SERVICES | FAQS | MY ACCOUNT | HELP | CONTACT US

METAL by the FOOT, Inc.

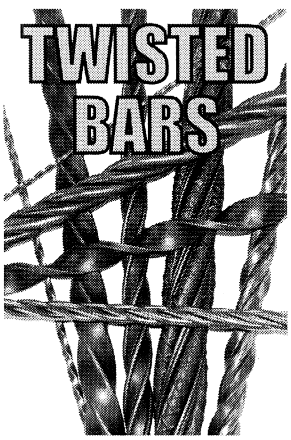
Kansas City's #1 Metal Store
STEEL - ALUMINUM - BRASS - STAINLESS
Cut to Order - (816) 241-5550

Home
About Us
Services
FAQS
Get A Quote
Links
Contact Us

ONLINE STORE | SERVICES | PHOTO GALLERY | SHOPPING CART | MY ACCOUNT | CONTACT US

MY CART
You have no items in your shopping cart.

Part # [ ] QTY: 1
Add to Cart



call customer service
(816) 241-5550

Instant Material Pricing

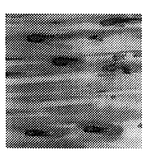
PLEASE NOTE
This is for a Quote only.
We do not offer online purchasing of materials at this time.
Quantities of each piece can be adjusted in the shopping cart and
Quoted prices are kept current with market prices and are subject to change without notice.

Type of Material	Steel
Material Shape	Square Tube
Material Specific	Standard
Thickness	.250 (1/4)
Available Size	4.00 x 4.00 (4 x 4)
Please Enter Length in (inches)	12
	Gets Price Reset

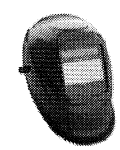
Estimated Total for Item : $ 16.11
Product Name : 4 x 4 x 1/4 Mild Steel Square Tubing
Product SKU : 400st250
Product Description : 4 x 4 x 1/4 Mild Steel Square Tubing

Add to Cart Reset

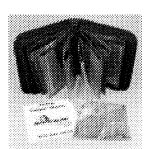
Featured Products

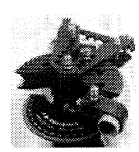

Stellar Copper
$134.95


Gloss Black Aut
$229.95


Metallic Blue A
$229.95


Red Auto Darken
$229.95


Patina Copper S
$30.00


JD2 Model 3 Ben
$295.00

HOME | ABOUT US | SERVICES | FAQS | MY ACCOUNT | HELP | CONTACT US

METAL by the FOOT, Inc.

Kansas City's #1 Metal Store
STEEL - ALUMINUM - BRASS - STAINLESS
Cut to Order - (816) 241-5550

- Home
- About Us
- Services
- FAQS
- Get A Quote
- Links
- Contact Us

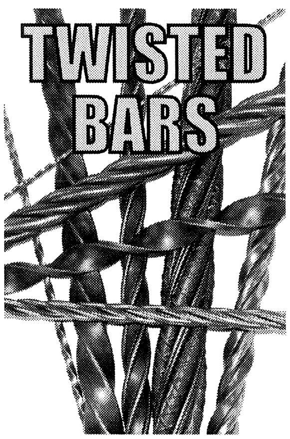
ONLINE STORE | SERVICES | PHOTO GALLERY | SHOPPING CART | MY ACCOUNT | CONTACT US

MY CART

You have no items in your shopping cart.

Part # [ ] QTY: [1]

[Add to Cart]



call customer service
(816) 241-5550

Instant Material Pricing

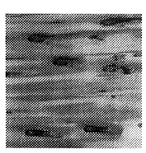
PLEASE NOTE
This is for a Quote only.
We do not offer online purchasing of materials at this time.
Quantities of each piece can be adjusted in the shopping cart and
Quoted prices are kept current with market prices and are subject to change without notice.

Type of Material	Steel
Material Shape	Plate
Material Specific	N/A
Thickness	.250 (1/4)
Available Size	Available Sizes
Please Enter Length in (inches)	72
Please Enter Width in (inches)	120
	[Gets Price] [Reset]

Estimated Total for Item : $ 631.80
Product Name : 1/4 Mild Steel Plate
Product SKU : 250sp
Product Description : 1/4 Mild Steel Plate

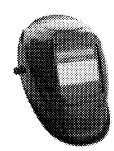
[Add to Cart] [Reset]

Featured Products

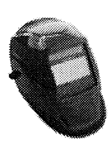


Stellar Copper
$134.95

Gloss Black Aut
$229.95

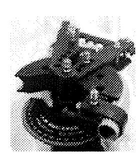


Metallic Blue A
$229.95



Red Auto Darken
$229.95

Patina Copper S
$30.00



JD2 Model 3 Ben
$295.00

Appendix D
BMPC Operations Monitoring Plan

*** Truncated version - for full appendices contact BMPC.**

THE BOWERSOCK MILLS & POWER COMPANY

EXPANDED KANSAS RIVER HYDROPOWER PROJECT
Project Operations Monitoring Plan
FERC LICENSE P-13526
January 28, 2011

Federal Energy Regulatory Commission
Project Operations Monitoring Plan Requirements
Expanded Kansas River Hydropower Project
Licensee P-13526

Article 402 of FERC License P-13526 issued to The Bowersock Mills & Power Company for the Expanded Kansas River Hydropower Project requires the development of a Project Operations Monitoring Plan. The following plan meets the requirements as set by FERC.

"The plan shall include, at minimum: (1) the location of gauges to record millpond elevations, flows through the turbines, and gated releases; (2) procedures to record water surface elevations at least hourly; (3) a description of how the project would be operated to maintain compliance with the ROR (run-of-river) requirement of Article 401; (4) procedures to maintain ROR operation during planned and emergency shut-downs; and (5) procedures for refilling the Bowersock Millpond in the event of flashboard collapse, while maintaining adequate flows downstream during refill to maintain aquatic resources. The plan shall detail the mechanisms and structures that would be used, including any periodic maintenance and calibration necessary for any installed devices or gauges, to ensure that the devices work properly, and shall specify how often the millpond elevations and ROR operational compliance shall be recorded.

The licensee shall prepare the plan after consultation with the Kansas Department of Health and Environment, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service. The licensee shall include with the plan a schedule for implementing the plan, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include licensee's reasons, based on project-specific information."

PROJECT OPERATIONS MONITORING PLAN

1. Location of gauges to record millpond elevations, flows through the turbines, and gated releases.

The Bowersock Mills and Power Company (BMPC) will utilize the existing upstream USGS Lecompton Station 0689100 and the BMPC North Powerhouse millpond gauge to document river flows upstream of the Bowersock Dam, and the BMPC North Powerhouse tailwater gauge and existing USGS DeSoto Station 06892350 to document river flows downstream of the Bowersock Dam. Upon completion of the North Powerhouse, three pressure transducers with manual float backup will monitor the water surface elevations at 3 separate points: millpond elevation directly upstream of the North Powerhouse, elevation directly behind the North Powerhouse trash racks, and the tail water directly downstream from the North Powerhouse. In addition to the transducers and floats, BMPC will install a manual gauge directly upstream and downstream from the North Powerhouse to confirm and calibrate the transducers.

As stipulated in the Kansas Division of Water Resources Vested Right, File No. DG-11 and Appropriation of Water, File Nos. 45,444 and 47,275, flows through the turbines will be calculated by obtaining two measured values 5 days per week of data necessary to convert the kWh produced and the net head to CFS flow through the turbines. These data are documented in a table that includes the summation of the water diverted through the turbines for each right daily. Gated releases for the North Powerhouse Obermeyer Gates will be calculated by the SCADA system, and via spreadsheet calculations for the South Powerhouse Obermeyer Gates.

2. Procedures to record water surface elevations at least hourly

The water surface elevations from the transducers or floats will be recorded by the SCADA program hourly and archived for documentation as required by the Kansas Division of Water Resources. A hard copy document log will be maintained at the BMPC Data Center including daily, weekly and monthly records of operation and generation from both the North and South Powerhouses. Annual reports to the Kansas Department of Agriculture Division of Water Resources, the Energy Information Administration, and any other government agency will be based on these records. An electronic database will record and track the relevant data.

Documentation of water use through the project will be conducted in accordance with the conditions 15 and 18 of the BMPC Division of Water Resources Appropriation of Water, File No. 47,275. Condition numbers 15 and 18 read as follows:

"15. That the applicant shall maintain daily records in a table format that provides two (2) measured values for five (5) days each week obtained at least six (6) hours apart for the following: a) Total feet of head b) Millpond elevation c) Discharge (in CFS). Additionally, the table should include a daily summation of the quantity of water diverted under this appropriation since the beginning of the calendar year for each day. These records shall be submitted monthly to the Division of Water Resources, Topeka Field Office, by the 15th day of each month or upon request of the Topeka Field Office. If necessary, the Chief Engineer or his designated agent can require more frequent measurements."

"18. That the applicant shall maintain an on-site record of hourly millpond surface elevation readings, which can be readily reviewed at the request of Division of Water Resources personnel."

Reports to the Division of Water Resources are public record, and are available to any requestor under the Kansas Open Records Act (KORA). These records may be obtained through a standard KORA request to the Division of Water Resources on the appropriate form. A fee may be required to process the KORA.

While the Kansas Division of Water Resources requests only millpond elevation readings, BMPC will also take hourly tailwater elevation readings in order to meet requirements as established in Article 401 of the BMPC FERC License P-13526 which require that both millpond and tailwater be monitored, so that "at any point in time, flows, as measured immediately downstream of the project, approximate the sum of inflows to the project millpond as measured by hourly water surface elevations."

By documenting both millpond and tailwater surface elevation readings on an hourly basis, BMPC will establish clear documentation of the "run of river" nature of the operation, as per the Federal Energy Regulatory Commission recommendation that BMPC "minimize fluctuations in the millpond surface elevation."

3. A description of how the project would be operated to maintain compliance with the ROR (run-of-river) requirement of Article 401;
BMPC run of river operations are defined by the Federal Energy Regulatory Commission in the license document as follows:

“Article 401. Run-of-River Operation and Bowersock Millpond Levels. To protect aquatic resources in the Kansas River, the licensee shall operate the Expanded Kansas River Hydroelectric Project in run-of-river (ROR) mode, where instantaneous outflows approximate instantaneous inflows to the project. In addition, the licensee shall operate the project to maintain the level of the Bowersock Millpond at elevation 813.5 feet National Geodetic Vertical Datum (NGVD), with deviations no greater than plus or minus 6 inches due to operational constraints.

The licensee shall at all times act to minimize the fluctuation of the Bowersock Millpond surface elevation by maintaining a discharge from the project so that, at any point in time, flows, as measured immediately downstream of the project, approximate the sum of inflows to the project millpond as measured by hourly water surface elevations.”

Under normal operations, both BMPC powerhouses would pass all river flows, such that instantaneous outflows approximate instantaneous inflows to the project. Headwater control devices mounted on the dam’s crest, Elev. 808 NGVD, will raise the millpond water surface to Elev. 813.5 NGVD. Two types of devices installed at the dam will facilitate the passage of river flows in excess of the flows which may be passed by the powerhouses. Obermeyer Gates on the north and south ends of the dam (two 10 ft. gates at the north end and fifteen 10 ft. gates at the south end), which can be lowered and raised pneumatically, and wooden flashboards that collapse under pressure when overtopped. Under normal operating conditions, the flashboards are in the raised position and the spillway gates are closed to maintain the millpond headwater at a nominal elevation of 813.5 NGVD.

The existing and new powerhouses will operate as a single unit. With larger turbine/generator sets at the North Powerhouse (maximum flow of @ 1,000 CFS for turbines 9 and 10, and 700 CFS for turbines 8 and 11), and smaller turbine/generator sets at the South Powerhouse (maximum flow of @ 300 CFS), the two powerhouses will operate in tandem to create a smooth power generation curve as flows increase in the river. As river flows increase, units will be placed into operation as indicated for maximum efficiency until all four generators from the North Powerhouse and all 7 generators from the South Powerhouse are online.

As the river flows increase beyond what the 11 turbines can pass, the South or North Obermeyer gates will lower automatically to pass excess flows. The North Obermeyer gate will use transducers and elevation set points to automatically open and close the gate to keep the millpond at elevation 813.5 plus or minus six inches. If the river flows exceed the capacity of all 11 turbines and the North Obermeyer Gates, the South Obermeyer Gates will be lowered to keep the millpond within the appropriate elevation range. The South Obermeyer Gates are automated through the use of a bubbler system. The continuous operation of both sets of Obermeyer Gates as described will allow the millpond elevation to be maintained at the nominal elevation of 813.5 up to river flows of 14,900 CFS, as the operation of the North and South Powerhouses and both sets of Obermeyer Gates have the capacity to pass approximately 14,900 CFS.

The following table demonstrates the maximum amount of flow the BMPC Expanded Project has the capacity to pass with a river elevation of 814 NGVD.

BMPC Project Structure Flow Capacities at Elevation NGVD 814

BMPC South Powerhouse	2,000 CFS
BMPC North Powerhouse	3,400 CFS
BMPC North Obermeyer Gates	1,500 CFS
BMPC South Obermeyer Gates	8,000 CFS
Total	14,900 CFS

In the event of river flows exceeding 14,900 CFS, the manually raised flashboards will begin to fall. As the river flow increases in excess of 14,900 CFS, the flashboards will progressively fall until either the river flows subside or all flashboards have fallen. The flashboards do not and will not fall all at once but rather in relation to the river flows and quantity and nature of debris. This method of operation will allow the downstream river flows to approximate the inflows of the project millpond and minimize any excessive surges in downstream river volume.

Once river flows reach 35,000 CFS or greater, both powerhouses would cease operations. Flows would continue to pass over the dam crest, lowered Obermeyer Gates and the flood passage in the north powerhouse. Operations at both powerhouses would resume when river flows diminish to approximately 35,000 CFS or below before reinitiating operations.

4. Procedures to maintain ROR operation during planned and emergency shut-downs;
Under planned or emergency shutdown of units, operation will be essentially the same as under normal operations. When the river flows exceed the capacity of the operational turbines in the North and South Powerhouses, either the North or South Obermeyer Gates will automatically lower to maintain the nominal 813.5 elevation. If the river flows exceed the capacity of the operational turbines and Obermeyer Gates then the manual flashboards will begin to fall. Each manually-raised flashboard is supported by its own support system, usually consisting of two separate supports made of 2 2x4s nailed together. Each flashboard is unique, with different age and wear patterns. Because each support system is unique, and subjected to differing stresses, flashboards all fall at different times. The first flashboards usually fall as a result of the impact of large debris. Debris does not float down the river uniformly, so the pattern is scattered.

In the event both powerhouses were to lose power, the Obermeyer gates will not immediately fall, but can be lowered by use of a relief valve on the air line supply if required to pass flows. If the millpond elevation requires the gates to be up, then a portable air compressor can be used for operation of both Obermeyer Gate Systems. The turbines will be shut down during a power outage and therefore will not pass any river flows. If the river flows exceed the capacity of the lowered spillway gates then the manual flashboards will begin to fall at a lower river flow than during normal operations.

In the event of severe icing, BMPC will continue to operate turbines as they are practicable, and will continue to pass any additional flows as required via the Obermeyer Gate Systems.

5. Procedures for refilling the Bowersock Millpond in the event of flashboard collapse, while maintaining adequate flows downstream during refill to maintain aquatic resources; Maintaining ROR Compliance During Millpond Refills

The BMPC operation is considered by FERC to be a run-of-river operation. As with any run-of-river hydropower operation with a flashboard system, a millpond refilling period is anticipated following the expected flashboard collapse which is triggered/initiated by high flow events. In addition to refilling following high flows, a refill of the millpond for run-of-river operations is also anticipated following periodic maintenance, which is required to preserve the safety and security of the dam.

Communication to Relevant Agencies

As directed by the Division of Water Resources and FERC License Article 401, BMPC will communicate significant anticipated or unplanned changes of 6 inches or more from the authorized millpond level of 813.5 as soon as possible, no later than 48 hours after any incident, and prior to any refilling with the following agencies:

- Kansas Department of Agriculture Division of Water Resources
- Kansas Water Office
- Kansas River Water Assurance District No. 1
- Kansas Department of Health and Environment
- US Army Corps of Engineers
- U.S. Fish & Wildlife Service

This plan of communication is as per the condition 19 of the Kansas Department of Agriculture Division of Water Resources Appropriation of water, File No. 47,275 which reads as follows:

"19. That per the requirements contained in Article 401 of the Federal Energy Regulatory Commission license for this project, the applicant [BMPC] shall operate the Expanded Kansas River Hydroelectric Project in run-of-river (ROR) mode, maintaining the level of Mill Pond at elevation 813.5 feet NGVD with deviations no greater than plus or minus 6 inches due to operational constraints. Further, in the event that the level of Mill Pond is temporarily modified per the provisions of Article 401, prior to commencing any refilling of Mill Pond the applicant shall contact the Chief Engineer, or an authorized representative of the Chief Engineer, for coordination purposes, and communicate its operational plan for refilling to the Kansas Water Office and the Kansas River Water Assurance District No. 1."

When BMPC experiences an Article 401 condition, BMPC will notify the above-named entities with the level in NGVD of current storage in the millpond, the current operation of each powerhouse, daily diversion under each water right, and the anticipated duration and timing of the fill. With regard to coordination of refilling, BMPC will refer to the Department of Agriculture Division of Water Resources to coordinate those discussions.

BMPC Notification Chart
Bowersock Millpond Refill

Water management on the Kansas River is a responsibility of the Kansas Department of Agriculture Division of Water Resources. As the BMPC water rights and operations are directed by Division of Water Resources, it is anticipated that BMPC will continue to report primarily to the Division of Water Resources, and will look to the Division of Water Resources for the coordination of discussion and collaboration to maintain appropriate river flows while meeting BMPC water rights under low-flow situations.

Refilling the Millpond Under Normal Flow Conditions (Not under Administration)
Once the manually raised flashboards have fallen, for safety reasons, BMPC must wait until the river flows decrease to a maximum flow of approximately 8,500 CFS to raise the flashboards back into the upright position. When raising the manual flashboards, BMPC will use the turbines to pass the river flows in an effort to draw down the river to an elevation suitable for raising flashboards (8,500 CFS or lower under the new configuration). Once the manual flashboards are raised, BMPC will operate the powerhouses at less than river inflows to facilitate refilling the millpond responsibly to maintain aquatic resources.

Refilling of the millpond under normal flow conditions may occur under BMPC's rights, File Nos. DG-11, 45,444 and 47,275, depending on priority and plant operations. Under File Nos. 45,444 and 47,275,refilling may not interfere with target flows established for the Kansas River Water Assurance Program, meaning that storage under these rights may not result in target flows falling below threshold states in the Kansas River Water Assurance District No. 1 Operations Plan, and that in no case, may any releases from storage made pursuant to the Kansas River Water Assurance District No. 1 Operations agreement be stored in the millpond under any right at any time. Water Assurance District releases are subject to protection by the Division of Water Resources, whereby BMPC shall ensure that a quantity of water equal to or greater than the released quantity will be diverted, by passed, released or otherwise shall pass by, through, or over the Millpond Dam.

It should be noted that under any flow condition, including normal flows, that BMPC relies on three water rights, the most senior of which is Vested Right DG-11, which is of particular relevance during low-flow conditions when the river is under administration.

BMPC will not report significant change in millpond level which are a reflection of natural river fluctuations which take place when the millpond is over the expected millpond height of 813.5, as these changes will be a reflection of natural river flows and not a result of BMPC management.

Refilling the Millpond Under Low Flow Conditions (Under Administration)
BMPC recognizes the importance of collaborating with all stakeholders on the Kansas River to manage water flows effectively, and has a history of over 100 years of operation with positive relationships with other river users. While underscoring the importance of clear communication with all river stakeholders, BMPC respectfully reserves the right established under its senior, Vested water right to make beneficial use of natural flows in the Kansas River to operate the BMPC Project.

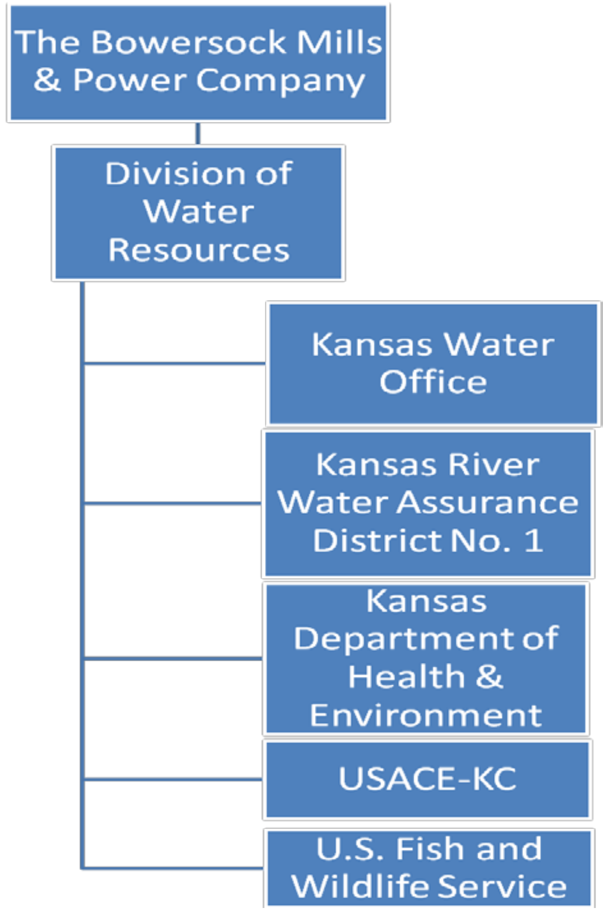
In the event of a significant change in millpond level and associated need to refill, BMPC will, for the purposes of coordination, communicate the level in NGVD of current storage in the millpond, the current operation of each powerhouse, daily diversion under each water right, and the anticipated timing and duration of the fill to the Kansas Department of Agriculture Division of Water Resources, Kansas Water Office, Kansas River Water Assurance District No. 1, Kansas

Department of Health and Environment, the USACE-KC and the U.S. Fish and Wildlife Service. The DWR will make determinations on which water right(s) will be storing based on this information and discussions with stakeholder agencies. The timing and duration of the proposed filling will be reviewed.

In consideration of downstream users and aquatic needs, if the proposed plan for refilling the millpond under the senior, Vested right will reduce flows below KRWAD threshold values, or if river flows are under 1500 CFS at the De Soto Gauge and BMPC anticipates deviating from run-of-river operations as defined (where instantaneous outflows approximate instantaneous inflows to the project) by more than 300 CFS or greater, BMPC will notify the above-named agencies, and then work with the Division of Water Resources (which will coordinate with KWO, KRWAD, KDHE, USACE-KC and USFWS), to determine if requesting an additional release from the Water Quality Storage portion of the Water Assurance storage pool pursuant to the upstream Reservation Rights from storage will be necessary, at which time the KWO will request any release necessary from the Army Corps of Engineers.

The Bowersock Mills and Power Company is the owner of vested water right DG-11, dated October 14th, 1959, which grants BMPC the right to "to continue the beneficial use of water from the source (Kansas River at the Bowersock Dam) as stated (which) has been determined and established to be a maximum quantity of 1,000,000 acre feet per year to be diverted at a maximum rate of 2,000 cubic feet per second for water power use." Under the Vested Right, BMPC recognizes the right to refill the Bowersock Millpond using only natural flows at any time the right is in use and, that releases made pursuant to an agreement between the state and the federal government or releases from storage under the authority of the state of Kansas are protected by the Division and may not be stored by BMPC during low flow conditions.

As previously stated, BMPC will report any significant fluctuation over 6 inches of the Bowersock Millpond to the relevant, listed agencies. Any anticipated changes will be communicated in advance, and any unanticipated change will be communicated within 48 hours of the incident. In the event that the BMPC Millpond must be refilled when the Kansas River is under administration, every effort will be made to coordinate the refill of the millpond with other river stakeholders with the Kansas Division of Water Resources serving as the primary point of communication between BMPC and other listed river stakeholders.



For further discussion of the BMPC vested water right and Kansas Water Assurance District rights and responsibilities relevant to the BMPC Millpond, see Appendix A.

Schedule for Implementation

The BMPC Project Operations Monitoring Plan has been established for the purposes of the expansion of the BMPC Project to include a new North Powerhouse. Many aspects of the Project Operations Monitoring Plan may only be established upon completion of the North Powerhouse and associated monitoring systems. Based upon these constraints, BMPC anticipates initiating this Project Operations Monitoring Plan upon start of commercial operations of the proposed North Powerhouse.

Incorporation of Comments from Stakeholders:

In developing this Operations and Monitoring Plan, BMPC collaborated with all the agencies stipulated in the FERC license, including the Kansas Department of Health and Environment, the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service. In an effort to engage and incorporate all the stakeholders on the river, BMPC also collaborated on the development of the plan with additional stakeholder agencies, including the Kansas Division of Water Resources and the Kansas Water Office. This submitted version of the plan incorporates as many comments and requests from stakeholder agencies as practicable for BMPC Operations, also recognizing that requests from some agencies were in conflict with requests from other agencies.

For the full text of comments from required agencies, see the following appendices:
Kansas Department of Health and Environment – Appendix B
US Army Corps of Engineers – Appendix C
US Fish and Wildlife – Appendix D

For the full text of comments from additional agencies, see the following appendices:
Kansas Division of Water Resources – Appendix E
Kansas Water Office – Appendix F

For BMPC responses to the comments from each agency, see Appendix G.

Communication with BMPC

The Bowersock Mills and Power Company
P.O. Box 66
500 South Powerhouse Road
Lawrence, Kansas 66044
BMPC South Powerhouse: 785-843-1385
BMPC Administration: 785-766-0884
Primary Contact: Sarah Hill-Nelson
Email: shn@bowersockpower.com