Increasing Flow without Increasing pressure and

stress in existing 14 year old 1800mm MS Rising main pipeline

by reducing Static head....

A CASE STUDY in the "K" network *(KHIRAI to BHACHAU to VARSHAMEDI)*

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ADDITIONAL SECRETARY (PROJECTS)

Water supply department

It has been said that, "KUTCH is a country". And by situation, geological, topographical, hydrological and approach wise also it has been learnt that "KUTCH is a country". Kutch is having 881 no of villages. Only 15 to 20 villages are remaining to connect with the NARMADA WATER PIPELINE but the situation becomes worst when we do not receive rain fall in monsoon.

Same thing happened in during 2014 due to El Nino impact on monsoon. The local sources of all dams and tube wells depleted and people of KUTCH are dependent on the water of NARMADA only. Every villagers and resident including local news papers knows all pipelines as NARMADA pipelines. GUJARAT WATER INFRASTRUCTURE LIMITED is not known to the common public. The word GWIL has been came in to an existence since last two three breakdowns observed in the pipeline.

Up to January 2014 KUTCH was getting 220 MLD of water through KHIRAI village on the MALIYA BRANCH via 1800mm MS line (sub divided in to two 1350 mm dia double conduit laid parallel to the either side of the SURAJBARI bridge) total 59km from KHIRAI to BHACHAU. However, 2.81km is laid on the Sea/ Creek bed & often in Salt Pans & Salty Brine water touches the bottom & is subjected to the High CORROSION.

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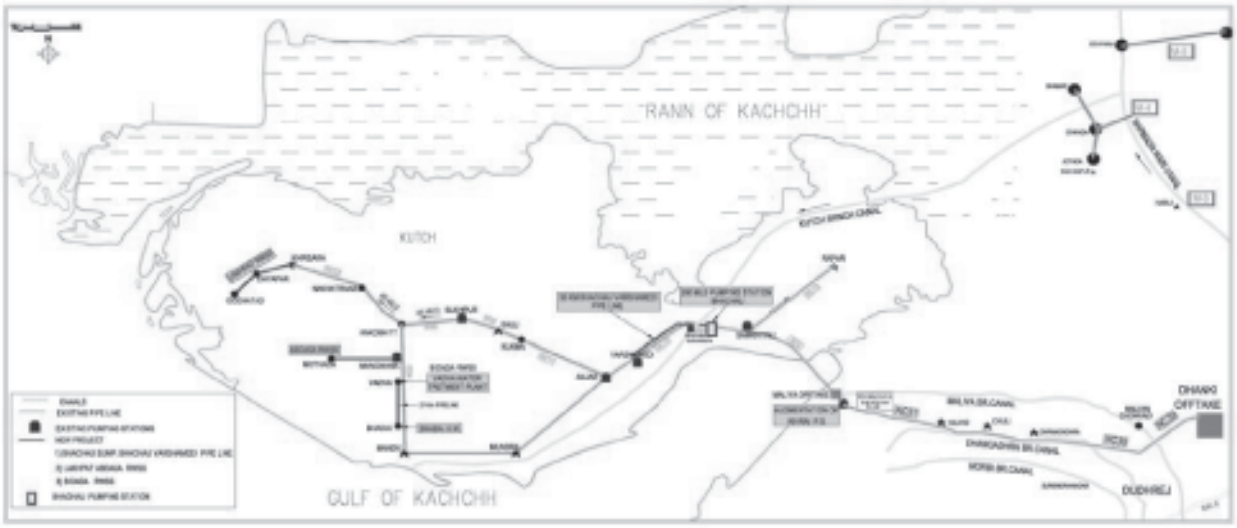


THE MOST VALUNERABLE SECTIONS ARE :

- 36 mtr of 1800 mm dia in railway culvert ;-- very highly corroded and non re-placeable, need shut down to replace, since this culvert area remains submerged in the SAULT BRINE during the entire year this has became most critical to burst out when subjected to higher pressure.
- 10 KM of pipe on pedestal on the sea coast; highly rusted welding joints from were leakage takes place.
- Pedestal itself will let the pipe to fail now because the static as well as dynamic self load withstanding ability of pipe is deteriorating day by day.
- The open surface of pipe (black outer) absorbs very high radiation in open sun and getting cool in the nights this expansion and contraction of the MS section leads frequent failures.
- Line is laid parallel to national highway; the dynamism of heavy truck transport passes pulsation up to pipe which generates resonance vibrations.
- Sometimes road accidents cause failure of pipes and shutdown.
- Internal and external anti corrosive coating is vanished and it neds refurbishment..

- Scour and BFV placement needs to be relocated.
- Surge suppression by increase in pumping volume may generate negative pressure and it may cause failure. This should be checked by a good hydraulic consultant. (The absence of good hydraulic consultant is being felt.)
- Technical or operative staff very few times be on pipe (at the moment of the pipe busting/ failure). Most of the time they are in pumping stations. So the exact reason of failure is estimated.
- Looking to the above abnormality and eventuality the challenging task of INCREASING Water in same pipeline from Maliya to Bhachau without increasing the Stresses was taken up by GWIL :

TASK PERFORMED :

1. **Water increase by replacement of pumping machinery at main feeding point (khirai);**

- The existing pumping machinery was worn out (since pumps of GWIL work 24x7x365 they wear faster than most other duties/clients, the original manufacturer of HSCF is VOLTAS and the company is closed).
- The equipment down time is unbearable and since KHIRAI is a HEART of KUTCH no one can afford the pumping loss - the frequency of failure was increasing day by day.

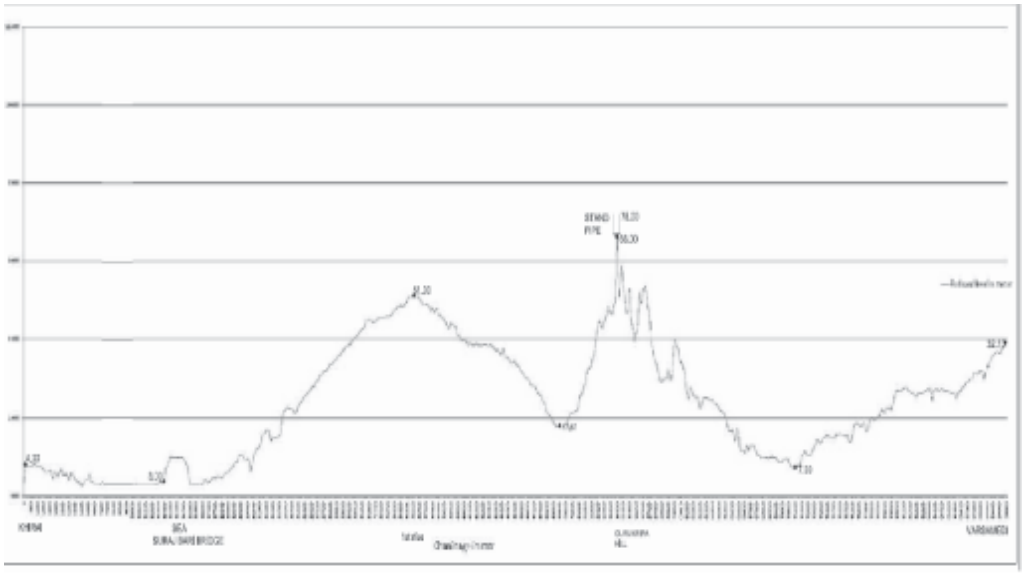
2. **Shutdown for the replacement of valves ;**

The starting point of pipeline (Khirai PS) is at just 4.0m above Sea level dropping down to almost 1.22m in the Surajbaari but at the highest point (at BHACHAU GURUKRIPA Hill Head works) the GL is almost 70m & a Stand Pipe of 6.5 meter is erected above it. Due to high static head and ground profile, possibility of water hammer & surge pressure is very high. Moreover, due to exposed pipeline to saline creek water, thickness of pipeline is decreased considerably. Hence frequent ruptures are occurring.

it is this High Static Head that is causing Severe Water Hammer & Pressure Surges which are exacerbate due to the Increased Thickness loss of pipeline Exposed to

Saline Creek water & hence frequent ruptures are occurring.

Figure of Longitudinal section of pipeline from, Khirai -Bhachau- Varsamedi :



3. To increase water, generally a New Parallel line (as well as to increase pumps at Khirai) were to be laid at Capital cost of Rs.500 crores(approx.) Moreover,Project Gestation Period would be of approx 24months (due to pipeline is to be laid on Creek) would involve Capital cost involvement as well as two years project execution period - however, GoG wanted a quick solution as already 373 villages were declared Scarcity hit.

4. **Additional pumping from KHIRAI would inevitably Increase Head as well as pressure in the already fragile pipeline**

- The utilization at the BHACHAU-GURUKRIPA head works is only 27 MLD. To carry total quantity of water of 220 MLD at the peak of 78 meter and then let it to gravitate further in 1400 mm dia pipeline is merely a waste of energy because...

1. At the Standpipe point the pipeline becomes open conduit and one cannot pump more pressure water in to that as it is flowing out .

2. stand pipe would have been put to reduce the stress in the pipe and let the flow become in gravity after that point but now it becomes constraint as it doesn't let more water pumping (only up to three pumps from KHIRAI)

3. If we close (shut down the mouth of) standpipe, we need to have generation of frictional head from Bhachau to Varshamedi hence the benefit of gravity flow will not available.

4. The system will remain unnecessary under stress and generate pressure on to

the weaker sections subjected for rupture as discussed above.

5. Total length of 59 KM of raising main + 35 KM of gravity main = 94 KM section will become raising main which is undesirable.

Best option :

By pass the stand pipe in close possible vicinity to the BHACHAU-GURUKRIPA and lower the level of the section as LOW AS POSSIBLE in order to reduce the static head and increase the volume as well as pressure in the pipe to increase water

1. in close possible vicinity to the BHACHAU-GURUKRIPA- will reduce the connecting pipeline length
2. Lower the level of the section as LOW AS POSSIBLE- will let the static head reduction and water will increase at the loss of working static head.

Planned Water increase in phases by work of below mention options;
(REFER FIGURE NO-)

1. PHASE-1 (from 220 to 270 = 50 MLD)

- Water increase by replacement of KHIRAI pumps. Specifically from 220 to 270 MLD out of six working HSCF pumps. By means of replacing pumps from 1710 m3/hr and 109 meter head to 1825 m3/hr and 113 mtr head. This replacement leads us to avail only 9 % of motor margin. HSCF pumps are having motors of 735 KW.
- Water increase by Static head Reduction and bypassing stand pipe.
- Water increase by Increasing Cross Section areas of conduit by means of laying of parallel pipeline from Bhachau to varsamedi. (existing 1400 + new parallel 900 mm)

PHASE-2 (total increase of water 220 to 320 = 100 MLD)

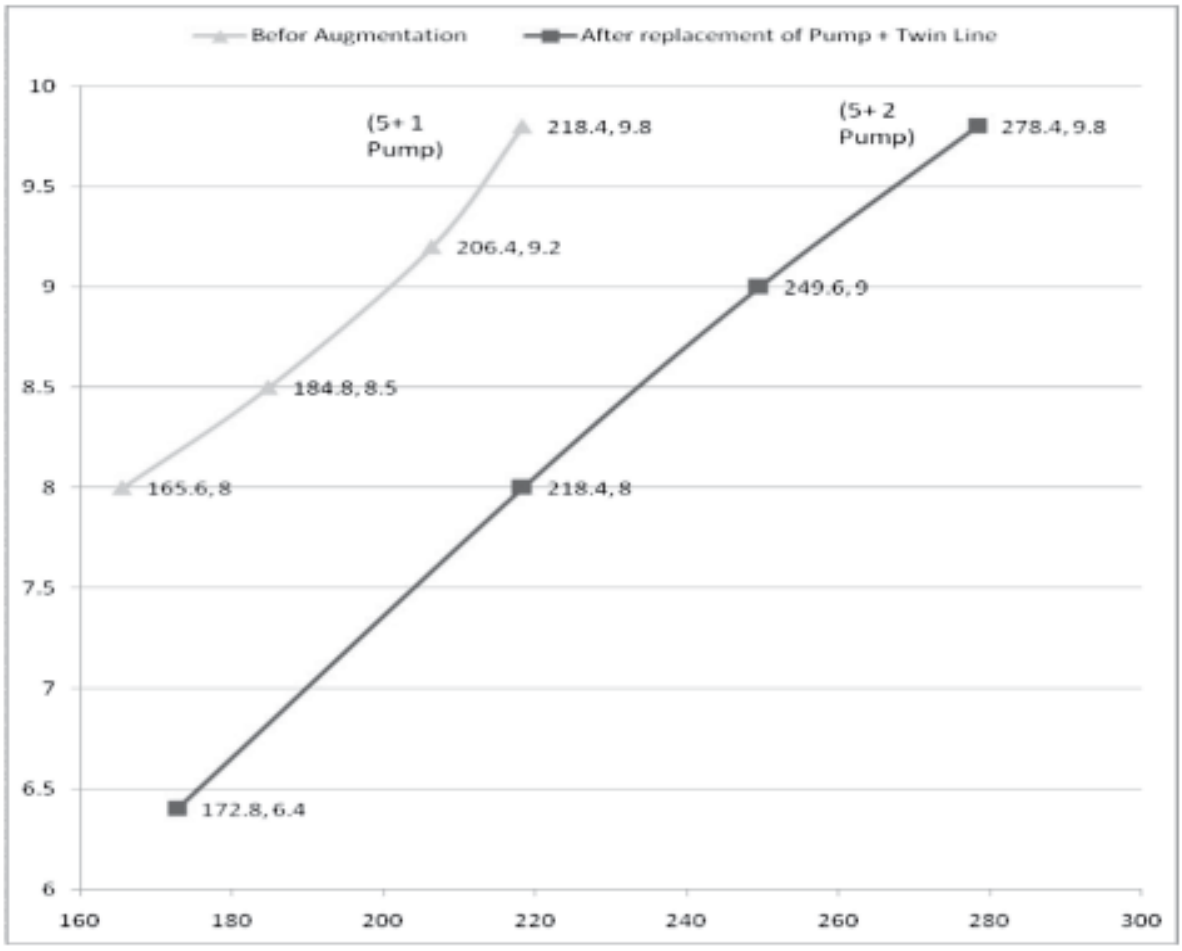
Water increase by taking out whole quantity of water in 12 ML sump and further pumping it in 1400 mm and 900 mm dia parallel pipe line to Varshamedi by installing BHACHAU BOOSTER of 250 MLD pumping capacity

At a Record speed of just 3months; GWIL has :

1. **Commissioned a 12ML Raw Water Reservoir (almost 85m x 55m), with 282mld pumping station, a 66kV 6MVA Substation**
2. **Laid down 35km of parallel 900mm MS Pipe line (Inside solvent free epoxy**

OBSERVATION OF KHIRAI PUMPING STATION BEFORE AND AFTER REPLACEMENT OF PUMP AS WELL AS BY PASS ARRANGEMENTS OF TWINE LINES.

Before Augmentation work				After replacement of new pumps				After 1800 mm ⍰ by pass line & two line from Bhachau to Varshamedi (1400 & 900 mm ⍰) commissioned			
NO OF PUMP RUN (HSCF + SCF)	TOTAL DISCHARGE IN		LINE PRESSURE IN kg/cm2	NO OF PUMP RUN (HSCF + SCF)	TOTAL DISCHARGE IN		LINE PRESSURE IN kg/cm2	NO OF PUMP RUN (HSCF + SCF)	TOTAL DISCHARGE IN		LINE PRESSURE IN kg/cm2
	m3/hr	MLD			m3/hr	MLD			m3/hr	MLD	
3+1	6900	165.6	8					3+0	7200	172.8	6.4
4+1	7700	184.8	8.5	4+1	9600	230.4	10.6	4+0	9100	218.4	8
5+0	8600	206.4	9.2	4+2	10000	240	10.6	5+0	10400	249.6	9
5+1	9100	218.4	9.8					5+2	11600	278.4	9.8



lining & outside 3LPE coating) between Bhachau to Varsamedi & augmented flow in same pipeline.

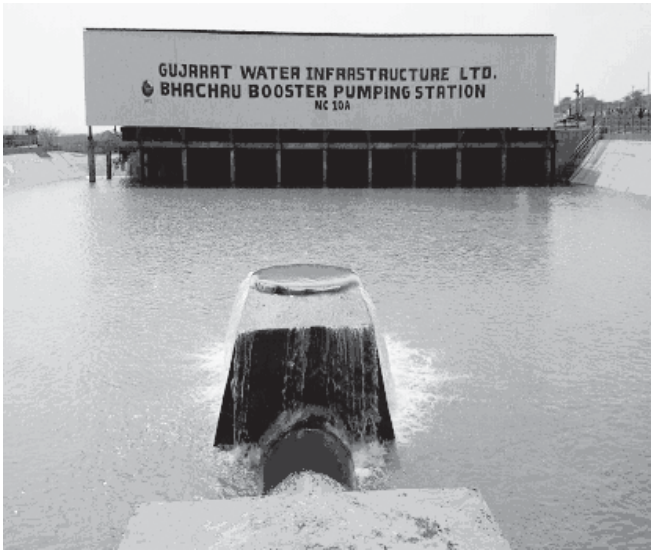
The milestone dates of the projects executions:

Sr No	Events	Milestone Dates
1	Date of presentation to CMD	19/11/2014
2	Date of presentation Hon. Chief Minister-Gujarat	03/12/2014
3	Date of uploading of tenders	27/11/2014
4	Date of opening of tenders	09/12/2014
5	Date of approval of tenders	18/12/2014
6	Date of awards of tenders	29/12/2014
7	Date of foundation stone laying of works by Hon. Mini. (water supply)	27/12/2014
8	Date of completion / commissioning of works	30/03/2015
9	Date of LOKARPAN by Hon. Chief Minister-Gujarat	18/04/2015

Achievement :

Water demand by GWSSB: increase of water from 16 MLD to 23 MLD at khirsara headwork which is 228 Km from Khirai Head work. Comparative of water increase committed by GWIL in the cascaded pumping system from KHIRAI to KHIRSARA in this summer-2015 :

	Water Supplied before Augmentation (MLD)	Increased Water Supply (MLD)	Increase (MLD)
Khirasara	16	24	8
Banni+ Bhuj Rural	7	10	3
Bhuj Nagarpalika	26	30	4
Gandhidham	24	34	10
Nagarpalika			
Gandhidham OG	6	12	6
Kandla Complex	10	14	4
Bhachau Rural	6	8	2
Anjar (Rural+Urban)	6	8	2
Industries	25	35	10
Total	126	174	48


GUJARAT WATER INFRASTRUCTURE LTD.
BHACHAU BOOSTER PUMPING STATION
NC 10A

IMPLEMENTATION CHART

NON PLAN EMERGENCY WORK

SEQUENCE OF OPERATION FOR "K" SECTION WATER INCREASE PROJECT BHACHAU TO VARSHAMEDI IN 2014-2015

1.	Principle Approval on	19-11-2014
2.	Technical Sanction on	8-12-2014
3.	Administrative Approval for Rs. 129.86 cr on	24-11-2014
4.	Uploading of Tender	27-11-2014
5.	Time limit for Completion	3 Months
6.	Tender Approval by TPC	18-12-2014
7.	Work Order Issued on	29-12-2014
8.	commissioning of Project on	30-3-2015
9.	Lokarpan on	18-4-2015