



Rejuvenation of Borewells using Hydrofracturing Technique

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HYDROFRACTURING IS A process where a hydraulic pressure is applied to an isolated zone of a borewell to initiate and propagate new fractures and will at the same time clean, sediments or other deposits from existing fractures. As per model studies on an in-situ stress measurements-

Hydrofracturing is based on Pascal's law, which states that "When the hydraulic pressure is applied in any closed body it acts in all directions and is equal at all points".

Hydrofracturing Procedure

The depth of bore well is checked in accordance to its strata chart. The packer is lowered to the depth and inflated by applying a hydraulic pressure up to 300-350 bars.

The booster pump and high pressure reciprocating pump are operated to inject the water in isolated zone. During hydrofracturing maximum and minimum pressure is noted. The fractures are cleaned by running the pump. The quantity of water is consumed during the process is noted. The water under pressure is drained by opening the outlet valve. When the bore well is under normal pressure the packer is released and it is adjusted to the next selected position.

The yield test of the bore well is conducted using a submersible pump run by a diesel generator. The test pumping is carried out for a sufficient period so that the quantity of injected water is pumped out and static water level is achieved.

In UP first hydrofracturing machine was provided by UNICEF to UP JalNigam, the core state Govt. agency for

water supply, in Yr. 1993 and subsequently 3 more HFUs were provided.

Management Strategy

During the drilling operation unsuccessful bores (Dry or low yielding) are reported along with all drilling details to the HF machine staff. These bores are duly certified by the village Chief (Pradhan). Accordingly an action plan of the HF unit is drawn. While preparing the action plan the location and the approach are also considered. It is worth mentioning that there are many sites which are approachable only in the summer season. The required funds are provided by State Govt./District administration to execute the work as per action plan.

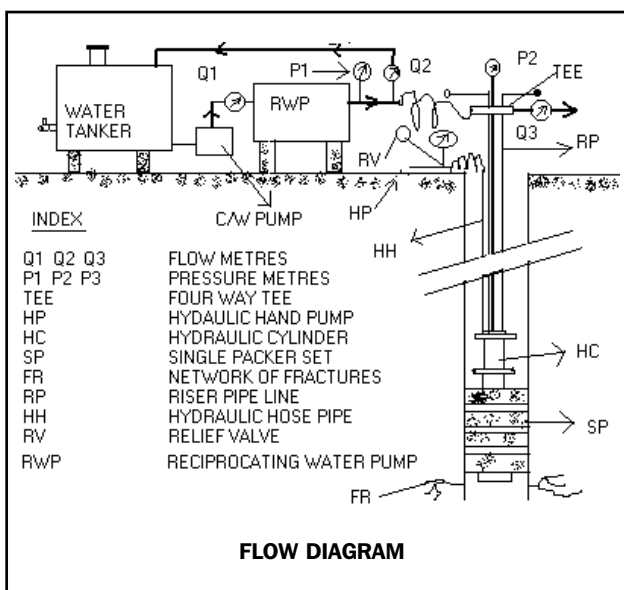
As per study of the pressure applied at different packer settings and subsequently resultant yield after the treatment on few bore wells the observations are as under-

The observations of the pressure applied at different packer settings and subsequent improvement in the yield after hydrofractured for different borewells are tabulated in Table No. I to III

Borewell. no	Depth of packer setting in m BGL	Pressure in Bar		Yield in lpm	
		Max.	Min.	Before	After
2	15	110	60	15	65
	24	60	40		
	36	40	20		
	48	20	10		
	60	20	10		
105	12	150	50	2	25
	21	120	90		
	30	120	60		

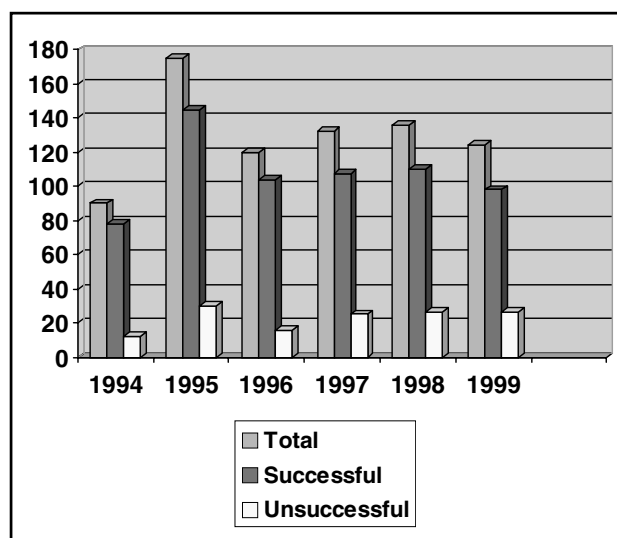
The higher reading of applied pressure (110-160 bars) and high pressure drops indicate the initiation of new fractures. When the same fractures were retreated the maximum pressure which was attained in the first treatment could not be attained.

Borewell. no	Depth of packer setting in m BGL	Pressure in Bar		Yield in lpm	
		Max.	Min.	Before	After
17	12	60	40	Dry	20
	21	40	30		
	33	30	15		
58	15	55	35	Dry	15
	24	35	20		
	63	20	15		



Applied pressure is medium 20-60 bars and pressure difference is low. The yield improvement is high. It indicates the reopening of the existing fractures took place during the treatment.

Borewell. no	Depth of packer setting in m BGL	Pressure in Bar		Yield in lpm	
		Max.	Min.	Before	After
51	12	95	70	5	3
	21	70	50		
	30	50	35		
	42	40	15		
74	12	95	80	2	Dry
	21	80	65		
	30	65	45		
	39	45	30		



In these bore wells the yield reduced. The bore wells are located at slope and it seems that such fractures are developed which cause loss of water due to hydraulic gradient.

Similarly in other observations such data could provide an insight about the rock behavior at different depths.

Success story of Distt. Sonbhadra

Sonebhadra Distt. Is situated in Vindhyaachal region of Hard rock area. This area comes under arid/semi arid zone and also is drought prone. Because of its topography rural /tribal population is habitated in small habitations situated in difficult terrain. In such circumstances borewells with India Mark II hand pumps is the only economically feasible alternative of the water supply.

Approximately 11,000 bore wells have been drilled so far in this area. Out of 11,000 about 777bore wells (7%) were unsuccessful, either dry or with very poor yield.

The following data narrates the success rate of hydrofracturing of these bore wells in Distt. Sonbhadra-

Financial aspects

In carrying out the hydrofracturing operation of one borewell following are the major expenditures incurred-

Sl.No.	Description	Amount in US\$
1	Transportation of equipment including loading / unloading.	85.00
2	Fuel / lubricants / filters / other oils / water packer	160.00
3	Casual labour / staff / insurance / taxes	40.00
4	Departmental supervision fee / rental charge etc.	90.00
		375.00

Whereas the cost of a new bore well is US\$ 625

Hence the cost of hydrofracturing is about 60% of the cost of drilling a new borewell.

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Sl. No.	YEAR	Total no. of bores hydrofractured	Successful	Unsuccessful	Percentage of Success	Saving in US \$ as compared to new bores
1	1994	90	78	12	87	20366.67
2	1995	175	145	30	83	19471.43
3	1996	120	104	16	87	20366.67
4	1997	132	107	25	81	19049.24
5	1998	136	110	26	81	19007.35
6	1999	124	98	26	79	18572.58
	TOTAL	777	642	135	83	116833.9