Report on Experimental & Pilot Rehabilitation Programmes

Maintenance Division
Danida Project Directorate
Bhubaneshwar

July 1992

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Acknowledgements

The Functionality Study of 1987, which was an analysis of the users' perception of hand pumps constructed by this project, was responsible for bringing the phenomenon on user rejection of apparently good wells, to the notice of the project.

The early work of the Drilling Adviser in the project in 1988-89, set a trend in rehabilitation of problem wells, especially in technique and perseverance.

The redevelopment of 50 wells in Delang block in 1989 was accomplished with the wholehearted cooperation of Field Division-Puri of the project and the assistance of consultants.

The **Experimental Rehabilitation Programme** on 47 wells in 1991 in Delang block was with the joint cooperation of Field Divisions of Bhubaneshwar and Puri who provided the equipment and staff for the programme.

In the **Pilot Rehabilitation Programme** on 87 wells in 1991-92 in Aul, Chandbali, Delang and Kanas blocks, all three Field Divisions of Bhubaneshwar, Cuttack and Puri assisted.

The staff of AFPRO, New Delhi, especially their Senior Specialist, Mr. L.V.R. Reddy has been involved with supervision of the rehabilitation field work and data analysis from 1989 to 1992. In a similar fashion, the project Laboratory has provided water testing facilities throughout the different stages of the rehabilitation activities.

Access to basic well records was from Water Resources Division and data analysis support came from Data Bank staff.

All this was possible with the unstinting support of the Chief Adviser's Office and the hard work of colleagues in the Maintenance Division, especially the block level Junior Engineers.

This report, therefore, represents the contributions of many people. I am grateful to then all.

Raj Kumar Daw
Maintenance Adviser

Bhubaneswar
3rd July 1992

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1. Summary:

1.1 The phenomenon of deterioration of water quality in tube wells in the Danida assisted Orissa Drinking Water Supply Project area in coastal Orissa became evident by about 1988-89 and eventually has evolved into a full fledged well rehabilitation programme after a number of experiments and limited trials.

1.2 50 problem wells were rehabilitated during 1989 with limited success after which a systematic experimentation programme was undertaken in early 1991 followed by larger pilot rehabilitation programme in late 1991 to March 1992.

1.3 This report is a compilation of the data the emerged from the rehabilitation of 134 wells, some upto 250 m deep, during the Rehabilitation Experimentation activities during March-June 91 and Pilot Rehabilitation activities during July 91-March 92.

1.4 The purpose of the experimental programme was to evolve the simplest rehabilitation techniques in order for this rehabilitation to begin on a larger scale. Based upon the above strategy, 50 wells of Beraboi and Gualipada of Delang block, Puri District were rehabilitated with chemical treatment, well cleaning, followed by pump reinstallation with non-corrodible pump components. Simultaneously, Rehabilitation Guidelines were drafted for establishing field procedures, chemical treatment and data recording needs. Air lifting was used as the method of overpumping and well cleaning. The results that emerged from the experimental programme were :

1. 70.3% wells rehabilitated recorded Fully or Partly Successful results.

2. 29.7% wells rehabilitated recorded Doubtful Success or Not Successful results.

3. Most of the wells rehabilitated were in the range of less than 50 m deep. The experiments did not extend to deeper wells.

1.5 The Pilot Rehabilitation Programme was substantially delayed in its starting. Also the work area had to change since Delang block did not offer deep wells to attempt more difficult rehabilitation techniques. Consequently, after a review in February 1992, the original target of 150 wells to be rehabilitated was reduced to about 80 wells and the work area was expanded to Kanas, Chandbali and Aul blocks, where deeper wells, low yields, sedimentation, high iron related problems were evident.

1.6 Air lifting remained as the main method of well cleaning in deep wells and was tried with some variations successfully.Manual overpumping was tried using elements of Tara DA pumps. Powered overpumping with submersible pumps was also tried in a few wells. Some other techniques such as water injection, failed. A total of 87 wells were rehabilitated under the Pilot Programme .

1.7 An elaborate methodology for data analysis was formulated which correlated basic well construction records with rehabilitation results and post rehabilitation water quality observations. The final well rehabilitation results were categorised into four main groups:

1. Fully Successful - FS
2. Partly Successful - PS
3. Doubtful Success - DS
4. Not Successful - NS

1.8 These value judgements were made by evaluation of three parameters : Depth of the well, Yield and Water Chemistry on criteria of Satisfactory or Unsatisfactory achievements.

1.9 In order to arrive at a comprehensive understanding of the results of rehabilitation of 47 wells earlier and 87 wells later, the results of all 134 wells were analysed on the following considerations:

1. Geographical - by Blocks
2. By Well Depths
3. By Well Cleaning Methods
4. On other special considerations

1.10 The results that emerged were:

1. Of 134 wells, 85% were successfully rehabilitated on the criterion of achievement of depth. There were variation between blocks, with Chandbali showing only 25% satisfactory results.

2. In comparison to the rather succesful results of restoration of depths, the yields remained low in 23% wells and water chemistry problems persisted in 51% wells, of the 134 wells rehabilitated.

3. The overall rehabilitation results showed a completely different picture. FS and PS groups constituted only 30% of the wells. 16% wells were in the DS and significantly 47% wells were in the NS category implying a failure to reestablish, either jointly or independently, yield or water chemistry.

4. 44.1% wells were less than 50 m deep; about 9% wells were in the 50 m-100 m range; 20.9% in the 100 m-150 m range; 9% in the 150 m-200 m group and 9.7 % in 200 m-250 m depth range.

5. FS was 40% to 50% for wells ≤ 50 m and for wells >150 m. In the intermediate range, >50 m to ≤ 150 m, FS was very low. A common feature of wells in the >50 m to ≤ 150 m depth range was that they were concentrated mainly in adjoining areas of Delang and Kanas blocks, indicating an area based hydrogeological problem.

6. NS assessments were high, above 50%, for most depth ranges except the shallow range of ≤ 50 m where it was 22%.

7. The total occurrence of PS was insignificant at 2.2%, but the DS category could not be ignored with 14.1% occurrence.

8. Well cleaning using the Air Lift method was done on 115 wells of which 98 wells (85%) achieved the original well depth to satisfaction. The data indicated that, as a general well cleaning method to restore well depths, this method was quite successful even for deeper wells.

9. Ten wells were cleaned with submersible pumping and resulted in 90% satisfaction on depth and 50% for FS. This method was tried generally on deep wells, in the range of 100 m to 250 m depths.

10. Manual over pumping with Tara DA pump showed 77.7% satisfaction (7 out of 9 wells) on the depth parameter, but it showed no FS at all.

11. Occurrence of sedimentation in wells was quite significant, with 30 wells having discharged noticeable sediments. This group constituted 22.4% of the 134 wells rehabilitated. It would indicate inadequate development at the time of well construction, placement of the well screen in fine sand zones and the possibility of casing failure as problem areas.

2. Conclusions & Recommendations:

From the experience that was accumulated for the experimental and pilot rehabilitation programmes, it could be concluded that:

1. The Second Draft of the Rehabilitation Guidelines formulated in December 1991 were feasible guidelines and could form the basis of a large scale rehabilitation programme. The fact that the project began the large scale rehabilitation programme at an accelerated pace in early 1992 confirms this.

2. There is a need for close monitoring of the project's rehabilitation activities in order to record worthwhile experiences as wells to analyse the characteristics of failed attempts. To this end, the completion of authentic work records at the time of work is an absolute necessity. Also monitoring of physical achievements alone is inadequate. The concentrated efforts required for a high grade of qualitative analysis is also very essential.

3. Post rehabilitation evaluation will lead to the true assessment of the degree of success of the rehabilitation programme. For this purpose monitoring regimes need to be formulated for water quality monitoring and user assessments on a long term basis on limited samples of rehabilitated wells.

4. While indications are already available that the phenomenon of water quality deterioration can be retarded and that a corresponding improvement in source utilisation is possible, an understanding of the phenomenon of water quality deterioration in this project area is far from being achieved. Long term monitoring, with increasing sophistication will be necessary to develop such an understanding. It will lead to the possibility of formulating the parameters for prescribing a rehabilitation time cycle.

5. The air lift method of well cleaning holds most promise for this project because of its relative simplicity especially for sites accessible by vehicles. However, high pressure compressors are not an absolute necessity and smaller self propelled units should be considered on a trial basis.

6. For inaccessible areas, manual overpumping with Tara pump components should be adopted as a regular procedure. The mechanisation of this system should also be attempted with a small engine or motor as a prime mover.

7. Power based overpumping based on submersible or jet pumps have good potential but present problems of access to sites and sophistication of equipment. This technique should be used only in limited manner for the purpose of establishing bench marks for yield of a small sample of wells which can then be yield tested again at a later date in order to test if rehabilitation need is related to deterioration of well yields.

8. While favourable results have been generally obtained in restoration of well depth by all of the three well cleaning methods tried, the success rate was not so encouraging for the parameters of yield and water chemistry. In 23% wells low yields were encountered and this represents a serious problem in an alluvial area with plently of groundwater. The occurrence of 50.7% wells with non-rehabilitable water chemistry problems compounds the matter further. The implication of these two unfavourable conclusions calls to doubt on the choic of groundwater as the major source option.

9. The issue of "failure criteria" has now to be faced by the project. The Experimental and Pilot Rehabilitation programmes show that rehabilitation success is of the order of 30% and outright failure on either or both criteria of yield and water quality is of the order of 47%. Some of the important questions that need answers are :

What will be the future status of the well "Not Satisfactorily" rehabilitated ?

Should they all be declared failures?

Should only some be declared failures?

On what criteria should wells be declared failures? How can such failures be minimised in future programmes?

Should eventual success of such a water supply programme be judged only when the rehabilitation needs are understood?

10. Implementation of the pilot programme would have been much more meaningful if resource allocation to the programme received the right management priority. The delayed start of the programme and the hurried pace at the later stage were easily avoidable.

3. Background :

3.1 The phenomenon of deterioration of water quality in tube wells in the Danida assisted Orissa Drinking Water Supply Project area in coastal Orissa became evident by about 1988-89 and has led to a number of attempts to rehabilitate such problem wells.The results of such efforts have been documented to some extent.

3.2 The results of rehabilitation of 9 wells, rehabilitated during 1988-89, by chemical treatment and manual operation of a Donkey Pump were reported in July 1990 in a document entitled : **Rehabilitation of Problem Wells-Results from Redevelopment by Hand Operated Donkey Pump Air Lift Method and Reinstallation with Non-corrodible Pump Components.** These results were not particularly encouraging partly because extremely difficult wells were chosen for rehabilitation by a very rudimentary manual technique.

3.3 During the latter half of 1989, 50 problem wells underwent rehabilitation adopting a sequence of chemical treatment, well cleaning and over pumping by air-lifting and reinstallation of hand pumps with non-corrodible components.

3.4 The results of this programme, also reported in the above-mentioned document, concluded that well cleaning by the air-lift method was more successful in shallow wells (upto 45 m deep) than in deep wells (more than 100 m deep). It showed that non-corrodible pump components such as stainless steel pump rods and PVC riser pipes could be successfully used with the India Mark II hand pump to control the phenomenon of water quality deterioration.

3.5 With the above experience on record, it was proposed that systematic experimentation was needed to identify different methods for rehabilitation of problem wells in the project area.

3.6 While a management level agreement in principle was reached in mid-1990, the actual start-up of rehabilitation experiments had to wait till March 1991 for a number of reasons, mainly, due to delays in equipment availability. This delay, however, provided the opportunity to base rehabilitation planning on the preliminary findings of a Status Survey of hand pumps which was conducted by the Socio Economic Division of the project to assess the nature and extent of occurrence of "problem pumps" as defined by three main criteria : **Pump Usage, Water Chemistry** and **Pump Condition.**

3.7 Based upon this preliminary analysis of the Status Survey and as a part of formulation of the new project period from June 91 called the Rehabilitation & Investigation

Project, a strategy for rehabilitation of problem wells was accepted in early 1991.

3.8 This strategy called for rehabilitation of 50 wells during March to June 91 as a Rehabilitation Experimentation phase to serve as the basis for a larger Pilot Rehabilitation phase of 150 wells in Delang block of the project during July 91 to March 92.

3.9 A preliminary report on the results of rehabilitation experiments was written in July 1991 and periodical progress reports were written on the pilot rehabilitation programme.

3.10 This current report is a consolidated presentation of the results of the Rehabilitation Experimentation activities during March-June 91 and Pilot Rehabilitation activities during July 91-March 92.

4. Rehabilitation Experimentation :

4.1 Strategy : The choice of 50 wells for rehabilitation experiments was based upon the following considerations :

1. The simplest rehabilitation technique would be attempted first. As experience was gathered, more complex techniques would be attempted and developed.

2. "Saturation Rehabilitation" would be tried, i.e. with a GP as a planning unit, every well in the GP would undergo rehabilitation if the occurrence of water quality problems was found to be wide spread, i.e., in 50% or more of the wells in the GP.

3. The purpose of the experiments would be to look for rehabilitation methods which were relatively simple and where a high success rate was expected. This would allow Field Divisions to begin large scale rehabilitation at an early stage on wells that could successfully rehabilitated with relatively simpler techniques.

4. Field Divisions would provide man-power and equipment, Chief Adviser's Office would finance the experiments. Maintenance Division would manage the experimentation activity. This would allow Field Divisions the time necessary for preparation to undertake large scale rehabilitation at a later stage.

4.2 Choice of Experimental Work Area :

4.2.1 Based upon the above strategy, Beraboi GP with 37 wells mostly in the 30 m to 40 m depth range was the first choice since there was also a high occurrence problems of odour and particles in these wells. Beraboi therefore represented a GP with shallow wells with a high occurrence relatively simple water quality problems that was expected to be remedied fairly easily.

4.2.2 The choice of the second GP was Gualipada, where there were 29 wells equally distributed in the 30 m to 40 m depth range and 100 m to 150 m depth range. As compared problems of only odour and particles in Beraboi, the wells of Gualipada also showed a fairly high occurrence of high iron content and salinity related problems. Therefore, Gualipada posed greater rehabilitation problems than Beraboi both in well depth and water quality and would present the trial ground for more complex rehabilitation methods.

4.3 Well Treatment Methodology :

4.3.1 Application of sterilant chemicals followed by cleaning and overpumping by air lifting with compressed air was the basic well cleaning method. Later, in deeper wells or in wells where air-lifting failed, other means of over pumping and back washing would be attempted.

4.3.2 Upon successful well cleaning, reinstallation of hand pumps would be done by using 40 mm PVC riser pipes, SS rods and modified IM 2 cylinders in Beraboi GP and IM 2 Solid Link Suction pumps in Gualipada GP. These pump choices were made since adequate stocks of both these pumps were available and favourable experience had already been gained using these pump configurations.

4.3.3 Draft Rehabilitation Guidelines for well rehabilitation were prepared for field procedures, chemical treatment and data recording needs. Later these underwent modifications based upon experience from usage. Field work record forms formulated in the Guidelines and details of the chemical treatment procedure are given in Annexure 4.

4.3.4 One compressor, an Atlas Copco VT6 was placed at the disposal of Maintenance Division to execute the work. Eventually, air lifting after chemical treatment was the only method used for well cleaning and over-pumping in both Beraboi and Gualipada GPs. No other rehabilitation methods were experimented with at this stage.

5. Results from Rehabilitation Experimentation :

5.1 The results from the rehabilitation experimentation phase by chemical treatment, cleaning and over-pumping by air-lifting and reinstallation of pumps with non-corrodible elements in Beraboi and Gualipada GPs are as follows and are summarised in Table 1.

Table 1 : Summary of Results of Rehabilitation Experiments

Rehabilitation Results Assessment	Beraboi GP		Gualipada GP		Totals	
	Nos	%	Nos	%	Nos	%
Fully Successful	7	22.5	6	37.6	13	27.7
Partly Successful	15	48.4	5	31.2	20	42.6
Doubtful Success	8	25.8	4	25.0	12	25.5
Not Successful	1	3.2	1	6.2	2	4.2
Total Wells Cleaned	31	100.0	16	100.0	47	100.0
Wells Not Cleaned	6		13		19	
Total Wells in GP	37		29		66	

5.2 The following conclusions are evident from Table 1:

1. Out of the total of 66 wells in the 2 GPs, rehabilitation was attempted on 47 wells.

2. 70.3% wells rehabilitated recorded Fully or Partly Successful results.

3. 29.7% wells rehabilitated recorded Doubtful Success or Not Successful results.

4. By itself, Not Successful results, or outright failure were recorded in 2 out of 47 or 4.2% wells. Both were unsuccessful on the criterion of yield.

5. Out of the total of 66 wells in the 2 GPs, 19 wells were not rehabilitated. Out of these 19 wells 6 wells were defunct wells, not yielding water.

6. Therefore, 33 out of 47 wells cleaned represented an acceptable (Fully+Partly) level of technical success, 12 wells were in an uncertain group and in 8 out of 66 wells (12%) rehabilitation failed.

7. Six wells (5 from Beraboi, 1 from Gualipada) yielded appreciable quantities of sand and pebbles during cleaning. Three of these wells were been graded as "Partly Successful" and three wells were considered as "Doubtful Success". Hydrogeological opinions were needed on these six wells to determine the cause of sand and pebble occurrence. Sample of the sediments were collected and stored. These wells would have to considered as failures if casing failures were confirmed as the cause for sand occurrence.

8. The deep wells in the group were virtually omitted from the process of rehabilitation.

6. Data Analysis Methodology :

6.1 Basic data of wells identified for rehabilitation were accessed from the project well construction records. The water chemistry observations of the Status Survey provided a bench mark for water quality. The two other main areas of observation of the Status Survey, pump usage and pump condition were kept in view for the rehabilitation work but were not considered of primary importance.

6.2 The final well rehabilitation results were categorised into four main groups:

1. Fully Successful - FS
2. Partly Successful - PS
3. Doubtful Success - DS
4. Not Successful - NS

6.3 These value judgements were made by evaluation of three parameters monitored before, during and after well rehabilitation. The 3 parameters used to judge the degree of success of well cleaning were :

1. Depth (Dp) : Was the original well depth reached ? Original well depth was considered as Satisfactorily achieved (S), if the post-rehabilitation well depth was recorded to have reached to not less than 4 m of the original recorded well depth. The reason for setting this condition has been explained in detail in the Rehabilitation Guidelines.

2. Yield (Y) : Was the well yield "adequate" after cleaning?
Yield was considered to be as adequate if the well yielded 15 lpm which was a slightly higher yield than the IM 2 pump which ideally yielded 12 lpm. However, a subjective judgement of "Satisfactory Yield" (SY) and "Low Yield" (LY) was considered acceptable in the absence

of suitable equipment to assess yield accurately in most cases .

3. **Water Chemistry (Ch)** : Did the water quality improve after well cleaning?

Water chemistry was considered to have improved if there was a favourable change in water quality between pre and post rehabilitation water chemistry observations. These changes were assessed for aesthetic (As) parameter of odour, colour, turbidity and particles and for chemical (Ch) parameters of pH, Electrical Conductivity (Ec), dissolved Iron content (Fe) and total Chlorides (Cl). These 8 parameters had been observed in the Status Survey and retained in post rehabilitation observations.

6.4 As mentioned earlier, the **Status Survey - SS** data on 8 parameters of water quality were taken as the bench mark for comparison. These 8 parameters were coded as follows:

Aesthetic Parameters	:	Odour	- O
		Colour	- C
		Turbidity	- T
		Particles	- P
Chemical Parameters	:	pH	- Lo (or Hi) pH
		Conductivity	- Ec
		Dissolved Iron	- Fe
		Total Chlorides	- Cl

6.5 If any of the above parameters were found beyond the acceptable limits, as per IS:10500-1983, the parameter codes were noted for comparison of pre and post rehabilitation behaviour. In Annexure 2 and Annexure 3, where codified rehabilitation data has been presented using the above codes, this comparison has been shown under the water chemistry column against **Status Survey-SS** and **Post Rehabilitation-PR** symbols.

6.6 The comparison of the behaviour of the eight water quality parameters before and after rehabilitation was categorised into three degrees:

1. **Satisfactory (S)** change in water quality was considered to have occurred if all 8 parameters were within acceptable limits after rehabilitation. This has been shown as **PR : OK.**

2. **Unsatisfactory** change of water quality, to a lower level of problem, was the concluded if post rehabilitation water quality showed problems in any of the aesthetic parameters,i.e. if colour and turbidity were unacceptable or if odour, taste or particles were present after rehabilitation. This

condition was symbolised by **US(As)** and were denoted by **PR : O,C,T or Pr.** Additionally if post rehabilitation values of electrical conductivity was in the range of 3000 to 4600 micro siemens, this was marked as **PR : Ec*** to denote a potential problem in the Total Dissolved Solids - TDS, a chemical parameter which could be estimated from Ec values (permissable limit of TDS is 3000 mg/l which is equivalent to Ec = 4615 micro siemens).

3. **Unsatisfactory** change of water quality, to a **higher level of problem**, symbolised by **US(Ch)**, was concluded if post rehabilitation water quality showed problems in any of the main chemical parameters,i.e., if pH, Ec, Fe or Cl were in the unacceptable range after rehabilitation. These were denoted by **PR : Lo/Hi pH, Fe, Ec or Cl.**

6.7 By this method, each of the 3 parameters, **Depth, Yield, Water Chemistry** respectively, could be classified into **Satisfactory** or **Unsatisfactory** post rehabilitation results in the detailed individual well rehabilitation data complied as Annexure 2. Similarly in Annexure 3, where the rehabilitation data is presented in a slightly abbreviated form, values of S and US, could be assigned to each well under **Dp, Y & Ch** columns. Each combination of S or US for Dp, Y and Ch was then computed into an overall assessment of rehabilitation into four categories - **FS, PS, DS and NS** (Fully Successful - FS, Partly Successful -PS, Doubtful Success - DS, Not Successful - NS). Annexure 3 & 4 also indicate this overall assessment for each well.

6.8 Inability to arrive at S or US due the lack of data occurred in a few cases and led to the need of the category **Not known - NK** in the assessment of each parameter and in the overall assessment of rehabilitation results.

6.9 **Table 2** below summarises the above analytical methodology used to process the rehabilitation data, by which each of the three parameters, Depth, Yield and Chemistry have been categorised in all possible combinations : Not known, Satisfactory and Unsatisfactory possibilities, to arrive at the overall rehabilitation result of Fully, Partly, Doubtful or Not Successful verdict for each well.

Table 2 : Sequence for Assessment of Rehabilitation Results

Parameter : Depth	Yield	Chemistry	Rehab.
S	NK	NK/S	NK
		US(As)	DS
		US(Ch)	NS
	S	NK	NK
		S	FS
		US(As)	DS
		US(Ch)	NS
	US	NK/S/US	NS
US	NK	NK/S	NK
		US(As)	DS
		US(Ch)	NS
	S	NK	PS
		S	PS
		US(As)	DS
		US(Ch)	NS
	US	NK/S/US	NS
NK	NK	NK/S	NK
		US(As)	DS
		US(Ch)	NS
	S	NK	NK
		S	PS
		US(As)	DS
		US(Ch)	NS
	US	NK/S/US	NS

6.10 As will be seen from Table 2, satisfactory results in both Yield and Water Chemistry parameters were a precondition for a well to come into the Fully (FS) or Partially (PS) Successful categories of overall rehabilitation assessment. Similarly, US(As) was common to the category of Doubtful Success (DS) after the precondition of Yield = NK or S. To that extent, Depth, as an evaluation parameter, was given secondary importance to Yield and Water Chemistry.

7. Pilot Rehabilitation Programme :

7.1 Background

7.1.1 As has been mentioned earlier, the Rehabilitation Experimentation phase during March to June 91 was to serve as the basis for a larger Pilot Rehabilitation phase of 150 wells in Delang block of the project during July 91 to March 92.

7.1.2 In comparison to the Rehabilitation experiments, it was the clear intention of the Pilot Programme to try rehabilitation in deeper wells with more complex problems.

7.1.3 Accordingly, by the end of 1990, as part of the planning process for the Rehabilitation Experiments and Pilot programme and as a part of the formulation of the new Investigation & Rehabilitation Project phase, identification of resources was completed. Lists were prepared for equipment available within the project so that such equipment would be available by June 1991. These were items such as high pressure and normal range compressors, submersible pumps, jet pumps, powered reciprocating pumps, engine operated centrifugal pumps, generators, vehicles and operating accessories.

7.1.4 Since none of this equipment was made available to Maintenance Division by June 1991, the Pilot Rehabilitation Programme could not start on schedule with the new Rehabilitation & Investigation project phase. Accordingly, a proposal to hire suitable external equipment was formulated in July 1991 but was not approved till December 1991 when it became obvious that the Pilot Rehabilitation Programme was far behind schedule.

7.1.5 During September 91, in the absence of the necessary equipment, trials were started with manual overpumping in wells over 100 m depth, using Tara Direct Action pump components. Details of this technique and the results form its application have been discussed in detail later in this report.

7.1.6 Also, a high pressure compressor was available in late 1991 and trials with over pumping by air lifting in deep wells was started. The technique and results have been presented later.

7.2 Choice of Pilot Programme Work Area :

7.2.1 Initially it had been expected that Delang block would provide a representative cross-section of problem wells in the project area. However, a more thorough examination of basic well records, maintenance and pump usage monitoring information indicated that wells beyond 150 m depth were rare in Delang and that deeper wells in other blocks had problem reports that were not common to Delang.

7.2.2 After a review of the progress of the pilot programme in February 1992, the original target of 150 wells to be rehabilitated was reduced to about 80 wells and it was agreed that the pilot programme activities would be extended to a limited number of wells in Kanas, Chandbali and Aul blocks, where deeper wells, low yields, sedimentation, high iron and high chlorides related problems were evident.

7.3 Well Treatment Methodology :

7.3.1 The process of application of chemicals in the pilot programme remained the same as outlined earlier and as has been detailed in Annexure 4.

7.3.2 Rehabilitation Guidelines formulated in December 1991 were operationalised. Three main overpumping techniques outlined in the Guidelines were tried:

1. Air lifting in deep wells was tried by a gradual increase in operating pressure, with simultaneous lowering of the air line, in order to lift progressively deeper columns of water. This method was used successfully in wells with the air line going to about 140 m with compressors delivering air starting at about 4 bar and going upto 10 bar pressure. An Elgi compressor was used initially and later an Atlas Copco compressor was used for this work.

2. Manual overpumping was tried using the below-ground elements of Tara DA pumps, both in the shallow wells (upto 40 m depth range) and in deeper wells (100 m to 150 m range).[1]

3. Powered overpumping was tried with hired equipment and external personnel. This procedure could not be systematically and extensively tried because of a number of administrative and technical considerations.

7.3.3 In the process of focusing on the three above-mentioned methods of overpumping, a few unsuccessful wells cleaning techniques were also recorded.

1. Air lifting with a combination of a 25 mm ND eductor pipe and a 8 mm dia. air hose, both lowered in the upper well casing, did not discharge much water. This was tried on three wells with no reasonable achievment of overpumping. This technique has been discussed in detail in the Rehabilitation Guidelines.

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1. After initial trials with manual overpumping with Tara pump components in Delang under the pilot programme, more intensified application of this method was successfully tried in much deeper wells (in the range of 200 m depth) in Chandbali block under the regular rehabilitation implementation programme. The progress of this effort was followed for a short period for some minor adjustments in field practices, but the results have not been reported in this document.

2. Water injection for backwashing in low yielding wells using a change-over manifold so as to alternate water injection with compressed air application or to propel water down the air line with compressed air. Eventually, in low yielding wells, water was poured into the well casing after shutting off the air line in order to achieve some extent of cleaning and flushing with external water.

3. Moving the water column up and down in wells by rapidly alternating release and shutting off compressed air supply so that the rising and falling water column would provide a surging action in the well screen area. This method was tried in low yielding wells in Kanas. While some removal of fines occurred, the yields did not show any noticeable change.

7.3.4 Data recording was in Field Work Record forms used earlier (Annexure 4) and data presentation has been done in Annexures 2 & 3 following the methodology developed for the experimental programme.

7.3.5 Reinstallation of hand pumps were IM2-PVC-SS, IM2-SL and IM2-Tara configurations. In a number of cases, the IM2-SL pump showed depletion after reinstallation confirming low yield in those wells. Such wells were then converted into IM2-PVC-SS pumps. Pump reinstallation details have been recorded in Annexures 2.

8. Results from Experimental & Pilot Rehabilitation :

8.1 Before presenting the results of the Pilot Rehabilitation Programme, a few preliminary comments are necessary:

1. Due to an extremely delayed start of the pilot programme, only 87 wells were rehabilitated against a target of 150 wells, or a mere 58% achievement of the physical target of the Plan of Operation. This is indicative of the priority that this activity recieved in the project.

2. In order to expand the data base for more representative results and since the experimental and pilot phases were complementary activities a consolidation of data was done. Consequently, the results of 47 wells rehabilitated under the Rehabilitation Experiments have been assimilated with the results of 87 wells of the Pilot activities and the data analysis has been done together.

3. The lack of equipment and resources for the initial part of the pilot programme led to a situation where the external agency engaged for a small part of the programme from Jan. 92, virtually became the programme implementing group. The delay also resulted in undue pressures of achieving quantitative targets against developing qualitative techniques for difficult cases of rehabilitation. As a result, during the period 15th. Feb. to 31st. March 1992, a total of 53 wells had to rehabilitated in 45 days. This seriously affected the innovative objectives of the programme. To that extent, the results of the pilot programme were indadequate and compromised to some extent.

4. Since the pilot programme was conducted in different blocks, geography become an additional analytical parameter for the overall interpretation of rehabilitation results. This created unexpected demands in logistical arrangements during the field work and in analytical requirements later. As can be seen from the data in Annexures 2 & 3, each block exhibited characteristics of its own. While this made the data more representative in an overall context of the project area, the data base became fragmented and was inadequate especially for Chandbali and Aul blocks, where relatively smaller number of problem wells were rehabilitated at a very rapid pace.

8.2 With the above issues in view, the results of the experimental and pilot rehabilitation programmes have been analysed under the following broad areas :

1. Analysis of results by Blocks
2. Analysis of results by Well Depths
3. Analysis of results by Well Cleaning Methods
4. Analysis of results on other considerations

8.3 Analysis of Results by Blocks:

Table 3 : Assessment of Depth & Overall Rehabilitation Results by Blocks

Sl. No.	Block	Nos. of Wells	Rehab. Depth Assessment S	DS	NK	Overall Rehabilitation Assessment FS	PS	DS	NS	NI
1.	Aul	15	13	1	1	5			10	
2.	Chandbali	16	12	4		10			6	
3.	Delang	81	70	6	5	22	3	17	32	7
4.	Kanas	22	19	1	2	1		4	15	2
5.	Total-Nos. - %	134 100%	114 85%	12 9%	8 6%	38 28%	3 2%	21 16%	63 47%	9 7%

8.3.1 From the above table it will be seen that:

8.3.2 A total of 134 wells were rehabilitated out of which 85% were successfully rehabilitated on the criterion of achievement of depth. Unsuccessful depth achievement was generally low in all blocks except in Chandbali where 4 out of 12 wells (25%) showed this problem.

8.3.3 In comparison to the relatively successful depth results, the overall rehabilitation results showed a completely different picture. Fully and Partially Successful groupings constituted only 30% of the wells. 16% wells were in the Doubtful Success group because problem of water quality on aesthetic parameters continued after rehabilitation. Significantly, 47% wells were in the Not Successful category implying a failure to reestablish, either jointly or independently, yield or water chemistry (on major chemical parameters).

8.3.4 Blockwise summary tables are presented for each of the four blocks as Tables 1.1 to 1.4 in Annexure 1. These tables gives details of distribution of depths of wells rehabilitated and corresponding results for each depth group. Along with the detailed well data in Annexures 3 & 4, the following blockwise conclusions emerge:

8.3.5 Aul block

- 15 wells were rehabilitated
- Depth range : 130 m to 260 m
- 5 wells FS (33%), 10 wells NS (77%)
- 7 wells NS on account no change in Fe
- 3 wells NS on account of low yield
- Powered overpumping was successful in restoring depth and yield in 4 wells
- Air line overpumping was attempted on 12 wells, in which of 8 cases succeeded, 3 failed because of low yield, 1 failed initially (sand occurrence) and succeeded later with power overpumping.

8.3.6 Chandbali block

- 16 wells rehabilitated
- Depth range : 120 m to 260 m
- 10 wells FS (62.5%), 6 wells NS (37.5%)
- 1 well NS on account of post rehabilitation Fe
- 5 wells NS on account of low yield
- Powered overpumping successful in 2 wells and failed in 1 well (after failure by air line)
- Air line overpumping was done 13 wells, in which of 9 cases succeeded, 4 failed on depth and yield
- Strong possibility of casing failure in 2 wells because of the occurrence of coarse to medium sand

8.3.7 Delang block

- 81 wells rehabilitated
- Depth range : upto 50 m - 59 wells
  50-100m - 2 wells
  100-150m - 14 wells
  Not known - 5 wells
- 24 wells (29.6%)wells FS, 3 (3.7%) PS, 15 (18.5%)DS, 32 (39.5%) wells NS
- Most wells belong to 5 Gram Panchayats and each GP shows its own pattern of success or failure.

- Abahayamuki Ramachandrapur GP - 7 wells, 100 m to 130 m depths, all by air line, 6 US on chemical parameters of Ec, Fe and Cl.
- Beraboi GP - 31 wells, mostly upto 50 m depths, all by air line, reoccurrence of odour and particles seen, noticeable occurrence of coarse sediments, 55% outright FS.
- Chainpur GP - 17 wells, upto 50 m depth, all by air line. No FS at all, 13 cases of NS, persistent problems of low pH, Fe, low yield, depletion, sediments.
- Gualipada GP - 20 wells, 17 by air line, 2 by manual overpumping, 1 by power overpumping. 18 wells upto 50 m depth, 3 wells in the 100 m to 150 m range. 8 FS, 1 PS, 4 DS, 7 NS. Main problems in low pH, Ec, Fe and Cl.
- Sri Purushottampur GP - 6 wells, all by manual overpumping, all successful on depth and yield parameters. However, 3 NS, 3 NK. Problems in Ec and Fe.

8.3.8 Kanas block

- 22 wells rehabilitated
- Depth range : 80 m to 100 m
- 1 well FS (9.1%), 15 wells NS (68%)
- 9 wells (41%) with low yields
- All 22 well cleaned first by air line, repeat cleaning on 2 wells with power overpumping
- 1 power overpumping successful, 1 failure.

8.4 Analysis of Results by Well Depths:

8.4.1 Table 4 below gives the summary of the distribution of rehabilitation results (depth and overall) by depth ranges. A more detailed analysis is presented in Table 1.5 of Annexure 1. From Table 4 it is seen that:

- 44.1% of the wells were less than 50 m deep.
- 20.9% wells fell in the 100 m to 150 m range.
- About 9% wells fell in each of the 3 groups of 50 m - 100 m;150 m-200 m and 200 m-250 m depth ranges.

- FS was assessed in the range of 40% to 50% for the shallow (≤ 50 m) and deeper depth ranges (> 150 m). In the intermediate ranges (>50 m to ≤ 150 m) FS was very low. A common feature of wells this depth range was that they were concentrated mainly in adjoining areas of Delang and Kanas blocks, indicating an area based hydrogeological problem.
- By and large, NS assessments were high, above 50%, for most depth ranges except the shallow range of ≤ 50 m where it was 22%.
- The total occurrence of PS was not very significant at 2.2% but the DS category was a significant group with 14.1% occurrence

Table 4 : Summary of Overall Rehabilitation Results in relation to Well Depth Ranges

Sl. No.	Well Depth Range	Nos. of Wells & %	% for Results	Overall Rehabilitation Result- Nos. & Percentages				
				FS	PS	DS	NS	NF
1.	Not known	8 6.0%	100%		2 25%		3 37.5%	3 37.5%
2.	≤ 50m	59 44.1%	100%	24 40.7%	1 1.7%	15 25.4%	13 22.0%	6 10.2%
3.	> 50m & ≤100m	12 9.0%	100%			2 16.7%	10 83.3%	
4.	>100m & ≤150m	28 20.9%	100%	2 7.1%		2 7.1%	23 82.2%	1 3.6%
5.	>150m & ≤200m	12 9.0%	100%	6 50.0%			6 50.0%	
6.	>200m & ≤250m	13 9.7%	100%	5 38.5%			8 61.5%	
7.	>250m & ≤260m	2 1.5%	100%	1 50.0%			1 50.0%	
	Total of all wells	134 100%	100%	36 28.4%	3 2.2%	21 14.1%	65 48.6%	9 6.7%

8.5 Analysis of Results by Well Cleaning Methods :

8.5.1 The analysis of rehabilitation results in relation to the method of well cleaning is presented in Table 5 below. Tables 1.6 to 1.8 in Annexure 1 gives further details in this regard.

Table 5 : Summary of all Blocks - Analysis of Well Cleaning Methods, Depth Range & Rehabilitation Results

Sl. No.	Well Cleaning Method & Depth Ranges	Nos. of Wells	Rehab. Depth Assessment			Overall Rehabilitation Result				
			S	DS	NK	FS	PS	DS	NS	NK
1.	Air Lift	115	98	9	8	34	3	19	53	6
2.	Power overpumping with submersible pump	10	9	1		5			5	
3.	Manual over pumping with Tara DA pump	9	7	2					5	4
	Overall Totals	134	114	12	8	39	3	19	64	9

8.5.2 Air Lift:

1. As can be seen from Table 5 above, most of the wells were cleaned using the Air Lift method. Of the 115 wells cleaned by this technique, 98 wells (85%) achieved the original well depth to satisfaction. From Table 1.6 in Annexure 1, it is apparent that this rate of satisfaction was common to all well depth ranges upto 250 m depth. This would imply that, as a general well cleaning method for reestablishing well depth, this method was quite successful even for deeper wells. This is an important conclusion since earlier experiences were very unfavourable for deeper wells beyond 45 m. However, the overall success rate with this method was not very high at FS for 34 wells (29.5%).

2. Theoretically 1 bar air pressure should be able to displace a water column of 10 m. However, air lift applications in the field were able to lift water columns from the 140 m depth range with a 10 bar compressor by a gradual increase in operating pressure from 4 bar to 10 bar while the air line was gradually lowered from 30 m to 150 m. Probably the inertia of a moving water column allowed a lower pressure to lift water from a greater-than-theoretical depth.

3. Later it became apparent that high pressure compressors were actually not needed and that if yields were adequate, the overpumping with air lifting could easily be achieved with the air line at 30 m. The introduction of the air line into the lower well casing of 50 mm diameter actually posed a problem in a number of wells.

4. Alternating air lifting with water injection was not successful in a low yielding well in Gualipada GP. This well ran dry after the air line evacuated the accumulated water and there was the fear of a casing collapse. However this did not occur and the well continued to function as a low yielding source.

5. Surging was tried with compressed air by moving the water column up and down in the well by rapidly alternating air discharge and shutdown in low yielding wells in Kanas. But this did not produce any significat change in yields. Time did not permit the application of polyphosphates in these wells to see if they wells could be eventually improved by different approaches.

8.5.3 **Power operated overpumping with Submersible pump:,**

1. Ten wells were cleaned with this method with 90% satisfaction on depth consideration only and 50% FS on overall considerations. From **Tables 1.6 and 1.7**, it will be seen that this method was applied to wells in the range of 100 m to 250 m depths. Overpumping by Submersible pumps was more successful, 50% FS against 29.5% FS for air lift in deeper wells. However, such a conclusion is based on the results of 10 wells only and might not be a correct conclusion.

8.5.4 **Manual over pumping with Tara DA pump :**

1. This technique evolved from a strange coincidence when Tara pumps were first installed in the project, in 1990 on apparently good wells yielding clean and clear water. Immediately upon installations of Tara pumps, most of these wells yielded dirty water and sediments for a considerable number of days before they stabilised to yielding clean water again. Attempting to analyse this phenomenon led to the conclusion that the bottom rubber seat of the Tara pump riser pipes provided a very good seal, cutting off the upper well casing and establishing a direct suction link from the well screen area. This resulted in a high velocity of water in the smaller pipe system of the lower well casing continuing to the Tara riser pipes which carried the sediments up and out. The high discharge design of the Tara pump also contributed to very effective manual overpumping.

2. The search for a suitable manual method was also important, considering that compressors would not be able to reach many sites and submersible pumping equipment could reach even fewer sites.

3. A third consideration was that the Tara system was also highly adaptable to be converted into surge plunger applications.

4. The use of the Tara pump components in overpumping has been treated in detail in the Rehabilitation Guidelines and the results from the field trials are summarised in Table 5 earlier and shown in detail in Table 1.6 and 1.8 in Annexure 1. While this method showed 77.7% satisfaction (7 out of 9 wells) on the depth parameter, it showed no FS at all in overall considerations. Again, for the same reasons as in the case of submersible pump application, the relatively small number of wells using this method weakens the basis for broad generalisations.

8.5.4 **Analysis of results on other considerations- Sedimentation:**

1. Apart from analysis on the basis of blocks, well depths and well cleaning techniques, the occurrence of sediments, especially coarse sediments was quite a significant event. The wells where this occurred to a noticeable degree have been listed in Table 1.9 in Annexure 1. As is evident from this table, 30 wells discharged significant sediments and constituted 22.4% of the 134 wells rehabilitated. Therefore, sedimentation is actually quite a significant problem that was earlier not clearly evident. Within this group, 18 wells yielded fine material which indicate development related problems at the time of well construction or placement of the well screen in unsuitable strata. 10 wells yielded coarse sediments which could not come in through the well screen, indicating the possibility of casing failure. Samples of most of the coarse sediments have been preserved for future reference in case the issue is pursued further.

ANNEXURES

ANNEXURE 1

Table 1.1 : Aul Block-Distribution of Well Depths, Rehabilitation Depth Assessment & Overall Rehabilitation Results

Sl. No.	Well Depth Range	Nos. of Wells	Rehab. Depth Assessment S	US	NK	Overall Rehabilitation Results FS	PS	DS	NS	NK
1.	Not known	1			1				1	
2.1	>130m & ≤140m	2	2						2	
2.2	>140m & ≤150m	1	1						1	
3.1	>160m & ≤170m	2	2						2	
3.2	>170m & ≤180m	1	1						1	
4.1	>210m & ≤220m	1	1						1	
4.2	>230m & ≤240m	4	3	1		2			2	
4.3	>240m & ≤250m	2	2			1			1	
7.1	>250m & ≤260m	1	1						1	
	Totals	15	13	1	1	3			12	

Table 1.2 : Chandbali Block-Distribution of Well Depths, Rehabilitation Depth Assessment & Overall Rehabilitation Results

Sl. No.	Well Depth Range	Nos. of Wells	Rehab. Depth Assessment S	US	NK	Overall Rehabilitation Results FS	PS	DS	NS	NK
1.1	>120m & ≤130m	1	1			1				
2.1	>170m & ≤180m	4	4			3			1	
2.2	>180m & ≤190m	2	2			2				
2.3	>190m & ≤200m	2	2			1			1	
3.1	>200m & ≤210m	2		2					2	
3.2	>210m & ≤220m	2	1	1		1			1	
3.3	>240m & ≤250m	2	1	1		1			1	
4.1	>250m & ≤260m	1	1			1				
	Totals	16	12	4		10			6	

Table 1.3 : Delang Block-Distribution of Well Depths, Rehabilitation Depth Assessment & Overall Rehabilitation Results

Sl. No.	Well Depth Range	Nos. of Wells	Rehab. Depth Assessment S	US	NK	Overall Rehabilitation Assessment FS	PS	DS	NS	NK
1.	Not known	5			5		2		3	
2.1	> 10m & ≤ 20m	5	5			3			1	1
2.2	> 20m & ≤ 30m	5	5			2		1	1	1
2.3	> 30m & ≤ 40m	42	40	2		18	1	13	7	3
2.4	> 40m & ≤ 50m	7	6	1		1		1	4	1
3.1	> 50m & ≤ 60m	1	1						1	
3.2	> 60m & ≤ 70m	1		1					1	
4.1	>100m & ≤110m	2	2						2	
4.2	>110m & ≤120m	8	7	1					8	
4.3	>120m & ≤130m	1	1							1
4.4	>130m & ≤140m	2	2						2	
4.5	>140m & ≤150m	1	1						1	
5.1	>150m & ≤160m	1		1					1	
	Totals	81	70	6	5	24	3	15	32	7

Table 1.4 : Kanas Block-Distribution of Well Depths, Rehabilitation Depth Assessment & Overall Rehabilitation Results

Sl. No.	Well Depth Range	Nos. of Wells	Rehab. Depth Assessment S	US	NK	Overall Rehabilitation Assessment FS	PS	DS	NS	NK
1.	Not known	2			2					2
2.1	> 80m & ≤ 90m	3	3						3	
2.2	> 90m & ≤100m	7	7					2	5	
3.1	>100m & ≤110m	8	7	1		1		1	6	
3.2	>110m & ≤120m	2	2					1	1	
	Totals	22	19	1	2	1		4	15	2

Table 1.5 : Distribution of Rehabilitation Success by Depth & Overall Rehabilitation Results

Sl. No.	Well Depth Range	Nos. of Wells	Rehab. Depth Assessment			Overall Rehabilitation Result				
			S	US	NK	FS	PS	DS	NS	NK
1.	Not known	8			8		2		3	3
2.1	≤ 10m	-								
2.2	> 10m & ≤ 20m	5	5			3			1	1
2.3	> 20m & ≤ 30m	5	5			2		1	1	1
2.4	> 30m & ≤ 40m	42	40	2		16	1	15	7	3
2.5	> 40m & ≤ 50m	7	6	1		1		1	4	1
3.1	> 50m & ≤ 60m	1	1						1	
3.2	> 60m & ≤ 70m	1		1					1	
3.3	> 70m & ≤ 80m	-								
3.4	> 80m & ≤ 90m	3	3						3	
3.5	> 90m & ≤100m	7	7					2	5	
4.1	>100m & ≤110m	10	9	1		1		1	8	
4.2	>110m & ≤120m	10	9	1				1	9	
4.3	>120m & ≤130m	2	2			1				1
4.4	>130m & ≤140m	4	4						4	
4.5	>140m & ≤150m	2	2						2	
5.1	>150m & ≤160m	1		1					1	
5.2	>160m & ≤170m	2	2						2	
5.3	>170m & ≤180m	5	5			3			2	
5.4	>180m & ≤190m	2	2			2				
5.5	>190m & ≤200m	2	2			1			1	
6.1	>200m & ≤210m	2		2					2	
6.2	>210m & ≤220m	3	2	1		1			2	
6.3	>220m & ≤230m	4	3	1		2			2	
6.4	>230m & ≤240m	4	3	1		2			2	
6.5	>240m & ≤250m	-								
7.1	>250m & ≤260m	2	2			1			1	
	Total - all blocks	134	114	12	8	36	3	21	65	9

Table 1.6 : Summary Rehabilitation Results in relation to Well Cleaning Method

Sl. No.	Well Cleaning Method & Depth Ranges	Nos. of Wells	Rehab. Depth Assessment			Overall Rehabilitation Result				
			S	US	NK	FS	PS	DS	NS	NK
1.	Air Line									
	Depth Not known	8			8		2		3	3
	≤ 50m	55	52	3		24	1	15	13	2
	>50m & ≤100m	8	8					2	6	
	>100m & ≤150m	24	23	1		2		2	19	1
	>150m & ≤200m	10	9	1		5			5	
	>200m & ≤250m	10	6	4		3			7	
	>250m	-								
	Totals	115	98	9	8	34	3	19	53	6
2.	Power over pumping with submersible pump									
	>100m & ≤150m	3	3						3	
	>150m & ≤200m	2	2			1			1	
	>200m & ≤250m	3	2	1		2			1	
	>250m	2	2			2				
	Totals	10	9	1		5			5	
3.	Manual over pumping with Tara DA pump									
	≤ 50m	4	4							4
	>100m & ≤150m	4	3	1					4	
	>150m & ≤200m	1		1					1	
	Totals	9								
	Overall Totals	134	114	12	8	39	3	19	64	9

Table 1.7 : Summary Results with Power Over Pumping using Submersible Pumps

Site		Reg.No.	Depth Drilled	Cleaning Result	Rehab. Method	Remarks Result	
Adala,	Kanas	13172601001	103.0	S* S	1:ALine 2:POP	NS	20 lpm, 6.08 m drawdown.
Badala,	Kanas	13072501109	111.0	S* S	1.ALine 2.POP	NS	
Guduçailo,	Delang	13122411304	136.5	S	POP	NS	10/88:Chem+ Donk. Pump, US. 12/89:Chem+Air, US.
Bhuinpur,	Aul	06020720903	173.0	S	POP	NS	Initially Clay
Krnaçokhari,	Chandbl.	05102311002	174.0	S	POP	FS	
Patuli,	Chandbl.	05102211802	214.0	US* US	1:ALine 2:POP	NS	
Lokaçada,	Aul	06020719507	238.0	US* S	1:ALine 2:POP	FS	Initially Sand
Khaiapda.,	Aul	06020719202	239.0	S	POP	FS	
Balamati,	Aul	06020718207	251.0	S	POP	FS	
Chasakhanada,	Chandbl.	05102202004	253.0	S	POP	FS	

Note: Result marked * indicates the result of the Air Line method

Table 1.8 : Summary of Results with Manual Over Pumping using Tara Direct Action Pump components

Site		Reg.No.	Depth Drilled	Cleaning Result	Rehab. Method	Result	Remarks
Ankula,	Sujanpur	13122406602	20.1	S	MOP	NK	Sand, Bentonite
Thentena,	SriP.pur	13122410901	34.1	S	MOP	NK	Bentonite, fine sand
Thentena,	SriP.pur	13122410902	39.95	S	MOP	NK	Bentonite, fine sand
Thentena,	SriP.pur	13122410903	40.38	S	MOP	NK	Bentonite, fine sand
Bilaspur,	SriP.pur	13122411402	100.5	S	MOP	NS	
Bilaspur,	SriP.pur	13122411401	110.5	US S*	1:MOP 2:ALine	NS	MOP US. Dirty water+sand with air line
Bilaspur,	SriP.pur	13122411403	114.5	S	MOP	NS	
Guduçailo,	Gualpada	13122411305	136.5	S	MOP	NS	
Guduçailo,	Gualpada	13122411303	150.5	US	MOP	NS	Well blocked at 30m

Note: Result marked * indicates the result of the Air Line method

Table 1.9 : Occurrence of Sedimentation

Sl. No.	Site	Site No.	Depth in m Drilled	Depth in m Reached	Remarks
Aul Block					
1.	Alkani	04	242.0	242.0	Initially sand. SY, 35 lpm.
2.	Bhuinpur	03	173.0	174.0	Initially clay came out. SY, 35 lpm.
3.	Lokapada	07	238.0	237.5	Initially sand came out. SY, 70 lpm.
4.	Patrapur	01	NK	16.0	Fine sand initially which continued. 100 mm well casing. SY.
Chandbali Block					
5.	Malbada	01	241.0	133.0	Large volume of medium grade sand came out. Depth before rehab. was 161.8 m and reduced to 133.2 m after rehab. Casing fracture? VLY.
6.	Matto	03	242.0	239.5	Screen free before development. Some fine black sand came out. SY.
7.	Paharpur	02	208.0	163.6	Little quantity of silt came out. Very low yield.
Delang Block, Beraboi GP					
8.	Beraboi(Exp)	05	112.5	108.0	Coarse sand during cleaning.
9.	Damapur	01	32.0	32.0	07/89-Chemicals, Air lift, 4.30 hrs, unsatisfactory, sand, LY.
10.	Jokanarua	01	36.0	34.0	Coarse sand during cleaning.
11.	Manijipur	01	28.1	26.0	Medium to fine sand during cleaning.
12.	Odataraboi	01	35.0	32.27	11/89-Chemicals, Air lift, 4 hrs, unsatisfactory, fine sand.
13.	Odataraboi	03	34.0	31.0	Coarse to medium sand.
14.	Pirhapatana	01	36.0	34.0	Coarse sand, pebbles during cleaning.
Delang Block, Chainpur GP					
15.	Ankoi	41	NK	52.0	Turbidity & coarse sand which cleared. Turbidity after reinst.
16.	Gadamotari	01	50.4	48.5	Black sand, dirty water, LY, which cleared. Depletion later.
17.	Bartol	04	69.0	62.6	Turbid water, sand, LY. Then clear, LY.
Delang Block, Gualipada GP					
18.	Bolakana	04	32.40	24.96	Air hose stuck, cut off. Pebbles during cleaning. Casing failure?
Delang Block, Sujanpur GP					
19.	Ankula	02	20.1	17.0	Plenty of sand & some bentonite, which cleared.
Delang Block, Sri Purshottampur					
20.	Bilaspur	01	110.5	110.0	Manual over pumping US. Black slimy water with air line. Also fine sand which cleared. R&D IRP site.
21.	Thentena	01	34.1	33.1	Substantial bentonite and fine sand cleared.
22.	Thentena	02	39.95	39.5	Substantial bentonite and fine sand cleared.
23.	Thentena	03	40.38	38.0	Substantial bentonite and fine sand cleared.
Kanas Block					
24.	Anjira	52	NK	14.0	Rejuv. well, choked. Initial depth 14 m. No chemical used. Yellow clay & sand came out. SY.
25	Bhatapada	01	97.0	97.0	SY. Initially grey fine sand came out.
26.	Dochina	03	115.0	113.1	SY. Initially, grey fine sand came out.
27.	Gadakharda	53	NK	27.0	Rejuv. well, choked. Initial depth 18 m cleaned to 27 m. No chemicals. Red clay, fine sand initially, then red medium sand and scales. Sand continued. SY.
28.	Kadua	03	100.0	100.0	SY. Initially grey medium sand came out.
29.	Sahoopada	04	91.0	88.0	LY. 3000 lit water added during cleaning. Red clay & coarse laterite-like granules.
30.	Sahoopada	05	90.0	88.5	SY. Initially red medium/coarse sand came out. 3000 lit water added during cleaning. LY.

Table 2.1 : Detailed Rehabilitation Data & Results - Aul block

Site Village Reg. No. GP	Drilling Date Depth : m	Well Cleaning Date Method Duration : hrs Initial Depth : m Final Depth : m	Yield Satis-factory: SY Low Yield : LY	Water Quality Status Survey: SS Post -rehab: PR	Pump Reinstallation Date Type	Remarks	Conclusions from Rehabilitation Satisfactory : S Fully Successful : FS Unsatisfactory :US Partly Successful: PS Doubtful Success : DS Not Successful : NS			
							Depth	Yield	Chemistry	Results
Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Balakati 06020718204 Balakati GP	Dt:29.01.88 Dp: 218	Date : 23.03.92 Meth : Air Line Dur : 3.7 Ini Dp : 218 Fin Dp : 218	SY	SS : Fe PR1: Fe	28/03/92 IM 2 SL	Discharged at 10 lpm.	S	S	US	NS
Balakati 06020718207 Balakati GP	Dt:30.01.88 Dp: 251	Date : 25.03.92 Meth : Power over pumping Dur : 6 Ini Dp : 251 Fin Dp : 251	SY	SS : Fe PR1: OK	28/03/92 IM 2 SL	SWL came up by 2 mtrs after develop-ment.	S	S	S	FS
Dhuinpur 06020720903 Dhuinpur GP	Dt:21.01.88 Dp: 173	Date : 29.03.92 Meth : Power over pumping Dur : 1.3 Ini Dp : 174 Fin Dp : 174	SY	SS : Fe PR1: Fe	30/03/92 IM 2 SL	Initially clay came out. 35 lpm	S	S	US	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Bhuinpur 06020720909 Bhuinpur GP	Dt:26.01.88 Dp:169	Date : 29.03.92 Meth : Air Line Dur : 1.1 Ini Dp : 172 Fin Dp : 172	SY	SS : Fe PR1: Fe	30/03/92 IN 2 SL	10 lpm	S	S	US	NS
Demal 06020719903 Demal GP	Dt:30.09.87 Dp: 232	Date : 27.03.92 Meth : Air Line Dur : 3 Ini Dp : 232 Fin Dp : 232	LY	SS : Fe PR1: OK	28/03/92 IN 2 SL	0.7 lpm, poor recovery, US.	S	US	S	NS
Demal 06020719906 Demal GP	Dt:13.10.87 Dp: 234.3	Date : 29.03.92 Meth : Air Line Dur : 2 Ini Dp : 197 Fin Dp : 197	LY	SS : Fe PR1: OK	27/03/92 IN 2 SL		US	US	S	NS
Demal 06020719907 Demal GP	Dt:05.03.88 Dp: 248	Date : 25.03.92 Meth : Air Line Dur : 3 Ini Dp : 248 Fin Dp : 248	LY	SS : Fe PR1: OK	30/03/92 IN 2 SL		S	US	S	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Lokapada 06020719507 Demal GP	Dt:15.10.87 Dp: 238	Date : 22 & 24.03.92 Meth 1 : Air Line Dur 1 : 1 Meth 2 : Power over pumping Dur 2 : 5 Ini Dp : 237.5 Fin Dp : 237.5	SY	SS : Fe PR1: OK	28/03/92 IN 2 SL	Initially sand removed, 70 lpm.	S	S	S	FS
Mahoo 06020723303 Mahoo GP	Dt:09.08.88 Dp: 141	Date : 28.03.92 Meth : Air Line Dur : 1.4 Ini Dp : 140.5 Fin Dp : 140.5	SY	SS : Fe PR1: Fe	29/03/92 IN 2 SL	100 lpm	S	S	US	NS
Mahoo 06020723304 Mahoo GP	Dt:08.11.88 Dp: 170	Date : 28.03.92 Meth : Air Line Dur : 2.1 Ini Dp : 172 Fin Dp : 172	SY	SS : Fe PR1: OK	29/03/92 IN 2 SL	80 lpm	S	S	S	FS
Kalapahada 06020719202 Mendhapur GP	Dt:18.12.87 Dp: 239	Date : 25.03.92 Meth : Power over pumping Dur : 5 Ini Dp : 239 Fin Dp : 239	SY	SS : Fe PR1: OK	28/03/92 IN 2 SL	35 lpm, draw-down 10 m	S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Alakani 06020719104 Bendhapur GP	Dt:07.03.88 Dp: 242	Date : 27.03.92 Meth : Air Line Dur : 2.4 Ini Dp : 241.5 Fin Dp : 242	SY	SS : Fe PR1: OK	29/03/92 IM 2 SL	Sand discharge initially. Final yield 35 lpm.	S	S	S	FS
Gopalpur 06021004904 Narendrapur GP	Dt:14.09.88 Dp: 136	Date : 30.03.92 Meth : Air Line Dur : 1.2 Ini Dp : 136 Fin Dp : 136	SY	SS : Fe PR1: Fe	31/03/92 IM 2 SL	15 lpm	S	S	US	NS
Gopalpur 06021004905 Narendrapur GP	Dt:25.09.88 Dp: 138	Date : 30.03.92 Meth : Air Line Dur : 1.3 Ini Dp : 139 Fin Dp : 139	SY	SS : Fe PR1: Fe	31/03/92 IM 2 SL	15 lpm	S	S	US	NS
Patrapur 06021002401 Patrapur GP	Dt: NK Dp: NK	Date : 28.03.92 Meth : Air Line Dur : 1 Ini Dp : 16 Fin Dp : 16	SY	SS : Fe PR1: Fe	31/03/92 IM 2 SL	Fine sand initially, 100 mm well casing.	Not Known	S	US	NS

Table 2.2 : Detailed Rehabilitation Data & Results - Chandbali block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Paharpur 05102211902 Baligan GP	Dt: 12.03.86 Dp: 208.0	Date : 08.03.92 Meth : Air Line Dur : 2 Ini Dp : 163.6 Fin Dp : 163.6	Very LY	SS :OK PR1:OK	09.03.92 IM 2 SL 9m	Small quantity of silt removed.	US	US	S	NS
Patuli 05102211802 Baligan GP	Dt: 21.02.86 Dp: 214.0	Date : 07.03.92 Meth1 : Air Line Dur : 1.75 Meth 2 : Power over pumping Dur : 4.0 Ini Dp : 163.0 Fin Dp : 163.0	LY	SS :C,T,P PR1:OK	07.03.92 IM 2 SL 9m	With PTU, no sediments. Draw down 26m at 4 lps, yield for 10 mins, recovery 15 mins.	US	US	S	NS
Charadia 05102312601 Charadia GP	Dt: 24.05.86 Dp: 180.0	Date : 17.03.92 Meth : Air Line Dur : 1.8 Ini Dp : 30.0 Fin Dp : 179.0	SY	SS : C PR1: OK	17.03.92 IM 2 SL 6m	Substantial casing depth filled initiallly.	S	S	S	FS
Charadia 05102312604 Charadia GP	Dt: 26.11.86 Dp: 186.0	Date : 17.03.92 Meth : Air Line Dur : 2 Ini Dp : 186.0 Fin Dp : 186.0	SY	SS : C PR1: OK	17.03.92 IM 2 SL 9m	Steady yield of 10 lpm	S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Jaladharapur 05102313201 Charadia GP	Dt: 05.04.86 Dp: 198.0	Date : 15.03.92 Meth : Air Line Dur : 1.75 Ini Dp : 198.0 Fin Dp : 198.0	SY	SS : OK PR1: Fe	16.03.92 IM 2 SL 6m		S	S	US	NS
Jaladharpur 05102313203 Charadia GP	Dt: 20.04.86 Dp: 124.0	Date : 15.03.92 Meth : Air Line Dur : 1.75 Ini Dp : 121.5 Fin Dp : 124.0	SY	SS : OK PR1: OK	16.03.92 IM 2 SL 6m		S	S	S	FS
Karanapokhari 05102311002 Charadia GP	Dt: 16.04.86 Dp: 174.0	Date : 12 & 13.03.92 Meth : Power over pumping Dur : 5.7 Ini Dp : 172.0 Fin Dp : 174.0	SY	SS : C PR1: OK	14.03.92 IM 2 SL 6m	Well emptied in 1.5 min at 4 lps. Recovered in 10 mins.	S	S	S	FS
Karanapokhari 05102311003 Charadia GP	Dt: 21.04.86 Dp: 201.0	Date : 11.03.92 Meth : Air Line Dur : 1 Ini Dp : 30.0 Fin Dp : 30.0	LY	SS : C,Ec* PR1: OK	11.03.92 IM 2 SL 9m	Failure of casing at 30 m ?	US	US	S	NS
Jalgohira 05102310901 Charadia GP	Dt: 27.03.86 Dp: 176.0	Date : 12.03.92 Meth : Air Line Dur : 1.5 Ini Dp : 156.5 Fin Dp : 176.0	SY	SS : C PR1: OK	13.03.92 IM 2 SL 6m		S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Nalgohira 05102310902 Charadia GP	Dt: 17.04.86 Dp: 178.0	Date : 11.03.92 Meth : Air Line Dur : 2.5 Ini Dp : 177.05 Fin Dp : 178.0	SY	SS : C PR1: OK	11.03.92 IM 2 SL 9m		S	S	S	FS
Nalgohira 05102310903 Charadia GP	Dt: 22.08.86 Dp: 178.0	Date : 13.03.92 Meth : Air Line Dur : 2 Ini Dp : 176.0 Fin Dp : 176.0	LY	SS : C PR1: OK	14.03.92 IM 2 SL 9m		S	US	S	NS
Nalgohira 05102310904 Charadia GP	Dt: 20.07.87 Dp: 218.0	Date : 14.03.92 Meth : Air line Dur : 2 Ini Dp : 213.5 Fin Dp : 218.0	SY	SS : C PR1: OK	15.03.92 IM 2 SL 9m		S	S	S	FS
Pokharisahi 05102310001 Charadia GP	Dt: 04.11.86 Dp: 194.0	Date : 14.03.92 Meth : Air Line Dur : 2 Ini Dp : 189.6 Fin Dp : 194.0	SY	SS : C PR1: OK	15.03.92 IM 2 SL 6m		S	S	S	FS
Chasakhanda 05102202004 Matto GP	Dt: 31.12.86 Dp: 253.0	Date : 10.03.92 Meth : Power over pumping Dur : 2.3 Ini Dp : 250.0 Fin Dp : 251.0	SY	SS : P PR1: OK	12.03.92 IM 2 SL 9m	Well emptied in 2 mins at 4 lps. Full recovery in 5 mins.	S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Malbada 05102201801 Matto GP	Dt: 27.09.86 Dp: 241.0	Date : 10.03.92 Meth : Air Line Dur : 2.5 Ini Dp : 161.0 Fin Dp : 133.0	Very LY	SS : OK PR1: OK	10.03.92 IN 2 SL	Large volume of medium sand & refilling. Casing failure?	US	US	S	NS
Matto 05102201903 Matto GP	Dt: 03.10.86 Dp: 242.0	Date : 08.03.92 Meth : Air Line Dur : 2 Ini Dp : 237.75 Fin Dp : 239.5	SY	SS : OK PR1: OK	09.03.92 IN 2 SL 9m	Some fine black sand removed.	S	S	S	FS

Table 2.31 : Detailed Rehabilitation Data & Results - Abhayamukhi Ramachandrapur GP, Delang block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Abhayamukhi Ramachandrapur 13122507203	Dt:28.02.87 Dp:117.0	Date : 02.11.91 Meth : Air Line Dur : 16.8 Ini Dp : 105.45 Fin Dp : 105.45	SY	SS :Od,Ec,Fe Cl PR1:Od,Pr,Ec, Fe,Cl	12.12.91 IM2		US	S	US	NS
Abhayamukhi Ramachandrapur 13122507204	Dt:13.03.87 Dp:111.5	Date : 28.10.91 Meth : Air Line Dur : 9.2 Ini Dp : 111.0 Fin Dp : 111.0	SY	SS :NK PR1:Pr,Ec,Fe Cl	12.12.91 IM2		S	S	US	NS
Abhayamukhi Ramachandrapur 13122507205	Dt:18.02.87 Dp:110.5	Date : 02.11.91 Meth : Air Line Dur : 31.0 Ini Dp : 110.0 Fin Dp : 110.0	SY	SS :Pr PR1:Fe,Cl	12.12.91 IM2		S	S	US	NS
Abhayamukhi Ramachandrapur 13122507207	Dt:NK Dp:108.0	Date : 08.11.91 Meth : Air Line Dur : 7.0 Ini Dp : 107.45 Fin Dp : 107.45	LY	SS :Ec,Fe,Cl PR1:Ec,Fe,Cl	12.12.91 IMPVCSS	Water poured in during cleaning	S	US	US	NS
Indipurdeuli 13122506401	Dt:30.12.85 Dp:125.0	Date : 30.09.91 Meth : Air Line Dur : 3.0 Ini Dp : 124.0 Fin Dp : 124.0	SY	SS :Od,Ec*,Fe PR1:NK	24.10.91 IMPVCSS	Old IRP	S	S	Not known	Not known

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Indipurdeuli 13122505402	Dt:02.02.87 Dp:114.5	Date : 25.10.91 Meth : Air Line Dur : 5.25 Ini Dp : 118.2 Fin Dp : 118.2	SY	SS :Ec°,Fe,Cl PR1:Ec°,Fe,Cl	25.10.91 INPVCSS		S	S	US	NS
Indipurdeuli 13122505413	Dt:03.05.87 Dp:118.5	Date : 25.10.91 Meth : Air Line Dur : 12.75 Ini Dp : 118.3 Fin Dp : 118.3	SY	SS :Od,Pr,Ec, Fe,Cl PR1:Ec°,Fe,Cl	25.10.91 INPVCSS		S	S	US	NS

Table 2.32 : Detailed Rehabilitation Data & Results - Beraboi GP, Delang block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Ayatnadua 13122405810]	Dt:17/04/87 Dp: 36.50	Date : 14 & 15/05/91 Meth : Air line Dur : 4.0 Ini Dp : 29.2 Fin Dp : 34.0	SY	SS :Od,Pr,Fe PR1:OK PR2:OK PR3:OK	05/06/87 IM2 15/05/91 IM2 SL		S	S	S	FS
Beraboi 13122408901	Dt:08/11/85 Dp: 36.00	Date : 11 & 12/04/91 Meth : Air line Dur : 7.0 Ini Dp : 34.00 Fin Dp : 36.00	SY	SS :OK PR1:OK PR2:Pr PR3:OK PR4:OK	24/01/86 IM2 20/04/88 IMPVCBS 18/08/89 IMPVCSS 12/04/91 IMPVCSS		S	S	S	FS
Beraboi 13122408902	Dt:17/11/85 Dp: 36.00	Date : 15/05/91 Meth : Air line Dur : 2.0 Ini Dp : 30.00 Fin Dp : 34.00	SY	SS :OK PR1:OK PR2:OK PR3:Pr PR4:Pr	25/01/86 IM2 15/05/91 IM2 SL		S	S	US	DS
Beraboi 13122408903	Dt:29/11/85 Dp: 36.00	Date : 13/04/91 Meth : Air line Dur : 3.75 Ini Dp : 33.00 Fin Dp : 34.00	SY	SS :OK PR1:Pr PR2:Pr PR3:OK	25/01/86 IM2 26/04/90 IM2TARA 14/04/91 IMPVCSS		S	S	US	DS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Beraboi 13122408904	Dt:27/11/85 Dp: 40.00	Date : 13/04/91 Meth : Air line Dur : 6.5 Ini Dp : 37.00 Fin Dp : 37.00	SY	SS :Od,Pr,Fe PR1:Od PR2:OK PR3:Pr	24/01/86 IM2		S	S	US	DS
Beraboi 13122408905 (Exploratory)	Dt:03/04/85 Dp: 112.50	Date : 16 & 17/04/91 Meth : Air line Dur : 12.5 Ini Dp : 108.00 Fin Dp : 108.00	SY	SS :NK PR1:Od,Fe PR2:Od,Fe PR3:Fe PR4:Fe PR5:Od,Pr,Fe PR6:Od,Pr,Fe	NK IM2 17/04/91 IMPVCSS	Coarse sand during cleaning.	S	S	US	NS
Beraboi 13122408941	Not known	Date : 13/04/91 Meth : Air line Dur : 2.0 Ini Dp : 11.50 Fin Dp : 11.50	SY	SS :OK PR1:OK PR2:Od PR3:OK PR4:OK	15/04/87 IML SUC 15/04/91 IML SUC		NK	S	S	PS
Brahmeswarpur 13122409001	Dt:03/03/86 Dp: 32.13	Date : 17/05/91 Meth : Air line Dur : 5.0 Ini Dp : 32.00 Fin Dp : 32.00	SY	SS :Od,Pr,Fe PR1:OK PR2:OK PR3:OK	25/04/86 IM2		S	S	S	FS
Buali 13122405701	Dt:06/01/86 Dp: 31.75	Date : 14/04/91 Meth : Air line Dur : 4.0 Ini Dp : 32.00 Fin Dp : 32.00	SY	SS :Od,Pr,Fe PR1:OK PR2:OK PR3:OK	11/03/86 IM2 14/05/91 IM2 SL		S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Damapur 13122408601	Dt:23/12/85 Dp: 32.00	Date : 10/05/91 Meth : Air line Dur : 4.0 Ini Dp : 31.98 Fin Dp : 32.00	SY	SS :Ec* PR1:Pr,Ec* PR2:Ec* PR3:Ec* PR4:Pr,Ec*	25/01/86 IM2 18/07/89 IMPVCSS 10/05/91 IMPVCSS	07/89- Chem, Air lift, 4.30 hrs, US, sand, LY	S	S	US	DS
Damapur 13122408602	Dt:22/02/86 Dp: 30.25	Date : 09/05/91 Meth : Air line Dur : 7.5 Ini Dp : 30.00 Fin Dp : 30.00	SY	SS :OK PR1:Od PR2:OK PR3:OK	24/04/86 IM2 23/04/90 IM2TARA 10/05/91 IMPVCSS		S	S	S	FS
Jokanarua 13122409401	Dt:18/11/85 Dp: 36.00	Date : 29/03/91 Meth : Air line Dur : 3.25 Ini Dp : 27.15 Fin Dp : 34.00	SY	SS :Od,Pr PR1:Od PR2:OK PR3:Pr	05/05/86 IM2 14/08/87 IM2 w Brs Cyl 30/03/91 IMPVCSS	Coarse sand during cleaning.	S	S	US	DS
Jokanarua 13122409402	Dt:25/11/85 Dp: 36.00	Date : 29/03/91 Meth : Air line Dur : 2.0 Ini Dp : 35.97 Fin Dp : 36.00	SY	SS :Od,Pr PR1:Od PR2:OK PR3:OK	10/02/86 IM2 08/07/87 IM2 OTC 30/03/91 IMPVCSS		S	S	S	FS
Manijipur 13122408401	Dt:22/01/86 Dp: 28.10	Date : 19/04/91 Meth : Air line Dur : 3.75 Ini Dp : 23.00 Fin Dp : 26.00	SY	SS :Od,Pr,Fe PR1:Od PR2:OK PR3:OK PR4:OK PR5:OK	25/04/86 IM2 23/04/91 IMPVCSS	Medium to fine sand during cleaning.	S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
)dataraboi 3122409101	Dt:08/11/85 Dp: 35.00	Date : 30/04/91 Meth : Air line Dur : 2.5 Ini Dp : 32.46 Fin Dp : 32.27	SY	SS :NK PR1:Od PR2:OK PR3:OK	11/12/85 IM2 14/08/87 IM2 w Brs Cyl 08/11/89 IMPVCBS 30/04/91 IMPVCSS	11/89- Chem, Air lift, 4 hrs, US, fine sand.	S	S	S	FS
)dataraboi 3122409102	Dt:30/11/85 Dp: 34.00	Date : 03/05/1 Meth : Air line Dur : 4.0 Ini Dp : 32.00 Fin Dp : 33.00	SY	SS :Od,Pr,Fe PR1:Pr PR2:OK PR3:Pr	22/12/85 IM2 07/04/87 IM2 OTC 25/11/89 IMPVCBS 03/05/91 IMPVCBS	11/89- Chem, Air lift, 4 hrs, US. 2.25 hrs, 2nd try, S.	S	S	US	DS
)dataraboi 3122409103	Dt:05/11/85 Dp: 34.00	Date : 29/04/91 Meth : Air line Dur : Ini Dp : 28.45 Fin Dp : 31.00	SY	SS :OK PR1:OK PR2:OK	11/03/86 IM2 07/04/87 IM2 OTC 30/04/91 IMPVCSS	Coarse to medium sand.	S	S	S	FS
irhapatana 3122409701	Dt:20/11/85 Dp: 36.00	Date : 06/04/91 Meth : Air line Dur : 2.7 Ini Dp : 31.10 Fin Dp : 34.00	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK PR4:OK	06/03/86 IM2 06/04/91 IMPVCSS	Coarse sand, pebbles during cleaning.	S	S	S	FS
irhapatana 3122409702	Dt:28/11/85 Dp: 36.00	Date : 05/04/91 Meth : Air line Dur : 2.5 Ini Dp : 31.47 Fin Dp : 34.00	SY	SS :OK PR1:Od PR2:OK	28/02/86 IM2 07/04/91 IMPVCSS		S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Pirhapatana 13122409741	NK	Date : 06/04/91 Meth : Air line Dur : 1.0 Ini Dp : 39.00 Fin Dp : 39.32	SY	SS :OK PR1:OK PR2:OK	11/05/86 INL SUC 06/04/91 INL SUC		NK	S	S	PS
Praharajpur 13122409601	Dt:24/11/85 Dp: 36.00	Date : 31/03/91 Meth : Air line Dur : 3.0 Ini Dp : 36.00 Fin Dp : 36.00	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	04/02/86 IM2 31/03/91 IMPVCSS		S	S	S	FS
Praharajpur 13122409602	Dt:07/12/85 Dp: 36.00	Date : 31/03/91 Meth : Air line Dur : 3.0 Ini Dp : 35.97 Fin Dp : 36.00	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK PR4:OK PR5:OK	04/02/86 IM2 31/03/91 IMPVCSS		S	S	S	FS
Praharajpur 13122409603	Dt:17/11/85 Dp: 36.00	Date : 03/04/91 Meth : Air line Dur : 4.5 Ini Dp : 36.00 Fin Dp : 36.00	SY	SS :OK PR1:Od PR2:OK PR3:OK	11/02/86 IM2 03/04/91 IMPVCSS		S	S	S	FS
Praharajpur 13122409604	Dt:18/11/85 Dp: 40.00	Date : 03/04/91 Meth : Air line Dur : 3.0 Ini Dp : 39.50 Fin Dp : 40.00	SY	SS :OK PR1:Od PR2:OK PR3:OK	11/02/86 IM2 03/04/91 IMPVCSS		S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Praharajpur 13122409605	Dt:27/11/85 Dp: 40.00	Date : 02/05/91 Meth : Air line Dur : 5.0 Ini Dp : 40.00 Fin Dp : 40.00	SY	SS :Pr PR1:OK PR2:OK PR3:OK	12/02/86 IM2 02/05/91 IMPVCSS		S	S	S	FS
Kencha 13122409301	Dt:18/11/85 Dp: 40.00	Date : 21/03/91 Meth : Air line Dur : 4.0 Ini Dp : 37.40 Fin Dp : 38.20	SY	SS :Od,Pr PR1:Od PR2:OK PR3:OK	15/12/85 IM2 06/07/87 IM2 OTC 15/12/89 IM2 29/03/91 IMPVCSS	12/89- Chem, Air lift, 4.50 hrs, S.	S	S	S	FS
Kencha 3122409302	Dt:25/11/85 Dp: 36.00	Date : 26/03/91 Meth : Air line Dur : 4.0 Ini Dp : 31.47 Fin Dp : 32.00	LY	SS :Od,Pr PR1:Pr PR2:Od PR3:Pr	25/12/85 IM2 11/11/89 IMPVCBS 26/03/91 IMPVCSS	11/89- Chem, Air lift, 4 hrs, 2nd try, 3.5 hrs, LY.	S	US	US	NS
Kencha 3122409303	Dt:27/11/85 Dp: 40.00	Date : 25/03/91 Meth : Air line Dur : 4.5 Ini Dp : 35.27 Fin Dp : 38.50	SY	SS :OK PR1:Od PR2:Od PR3:OK	02/01/86 IM2 14/08/87 IM2 w 8rs Cyl 11/12/89 IMPVCBS 11/04/90 IM2IARA 29/03/91 IMPVCSS	12/89- Chem, Air lift, 4.5 hrs, US.	S	S	US	DS
encha 3122409304	Dt:26/11/85 Dp: 36.00	Date : 23/03/91 Meth : Air line Dur : 4.5 Ini Dp : 34.38 Fin Dp : 35.20	SY	SS :OK PR1:Pr PR2:OK PR3:Pr	02/01/86 IM2 06/07/87 IM2 OTC 16/07/89 IMPVCSS 23/03/91 IMPVCSS	07/89- Chem, Air lift, 4.3 hrs, S.	S	S	US	DS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Rencha 13122409305	Dt:25/12/85 Dp: 36.10	Date : 23/03/91 Meth : Air line Dur : 5.0 Ini Dp : 35.00 Fin Dp : 36.00	SY	SS :NK PR1:OK PR2:OK PR3:Od,Sr	05/02/86 IM2 14/08/87 IM2 w Brs Cyl 10/11/89 IMPVCBS 23/03/91 IMPVCSS	11/89- Chem, Air lift, 4.5 hrs, S.	S	S	US	OS
Udayapur 13122408801	Dt:18/11/85 Dp: 36.00	Date : 09/04/91 Meth : Air line Dur : 10.0 Ini Dp : 34.00 Fin Dp : 34.00	LY	SS :OK PR1:Od PR2:OK PR3:OK PR4:OK PR5:OK PR6:OK	24/01/86 IM2 11/04/91 IMPVCSS		S	US	S	NS

Table 2.33 : Detailed Rehabilitation Data & Results - Chainpur GP , Delang block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Ankoi 13122404201	Dt:NK Dp:18.95	Date : 28.12.91 Meth : Air Line Dur : 3.3 Ini Dp : 18.5 Fin Dp : 18.5	SY	SS :Lo pH PR1:NK	29/12/91 Tara DA		S	S	NK	NK
Ankoi 13122404202	Dt:NK Dp:24.00	Date : 28.12.91 Meth : Air Line Dur : 3.0 Ini Dp : 23.5 Fin Dp : 23.5	SY	SS :Pr,Lo pH PR1:Lo pH	29/12/91 Tara DA		S	S	US	NS
Ankoi 13122404203	Dt:NK Dp:16.98	Date : 28.12.91 Meth : Air Line Dur : 3.0 Ini Dp : 16.2 Fin Dp : 16.2	SY	SS :Lo pH PR1:Pr,Lo pH	29/12/91 Tara DA		S	S	US	NS
Ankoi 13122404204	Dt:NK Dp:31.15	Date : 28.12.91 Meth : Air Line Dur : 4.25 Ini Dp : 31.0 Fin Dp : 31.0	LY	SS :Od,Pr, Lo pH,Fe PR1:Lo pH	29/12/91 IM2 Tara	Slight turbidity persisted	S	US	US	NS
Ankoi 13122404205	Dt:NK	Date : 28.12.91 Meth : Air Line Dur : 4.25 Ini Dp : 26.7 Fin Dp : 26.7	SY	SS :Od,Pr, Lo pH,Fe PR1:Lo pH	29/12/91 IM2 Tara	Initial turbidity, then cleared	NK	S	US	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Ankoi 13122404241	Dt:NK	Date : 28.12.91 Meth : Air Line Dur : 4.3 Ini Dp : 52.0 Fin Dp : 52.0	SY	SS :Pr, Lo pH,Fe PR1:Pr, Lo pH,Fe	29/12/91 IM2 Tara	Initial turbidity, coarse sand, then clear. Turbidity after Re-installation	NK	S	US	NS
Gadamotari 13122403901	Dt:03.10.86 Dp:50.4	Date : 29.12.91 Meth : Air Line Dur : 5.3 Ini Dp : 48.5 Fin Dp : 48.5	LY	SS :Lo pH,Fe PR1:NK	30/12/91 IM2 Tara	Initially black sand & water, LY, then clear water. Depletion with IM2 SL.	S	US	NK	NS
Gadamotari 13122403902	Dt:11.09.86 Dp:38.0	Date : 29.12.91 Meth : Air Line Dur : 3.3 Ini Dp : 36.0 Fin Dp : 36.0	SY	SS :Lo pH,Fe PR1:Lo pH	30/12/91 IM2 Tara	Initially red water then clear.	S	S	US	DS
Gadamotari 13122403903	Dt:12.11.86 Dp:46.0	Date : 29.12.91 Meth : Air Line Dur : 5.25 Ini Dp : 28.2 Fin Dp : 28.2	LY	SS :NK PR1:Pr,Lo pH	30/12/91 IM2 Tara	Initially red water, LY, then clear, LY.	US	US	US	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Gadamotari 13122403906	Dt:NK	Date : 29.12.91 Meth : Air Line Dur : 4.25 Ini Dp : 55.7 Fin Dp : 55.7	LY	SS :NK PR1:Lo pH,Fe	30/12/91 IM2 Tara	Depletion with IM2 SL	NK	US	US	NS
Bartol 13122403801	Dt:19.08.86 Dp:48.0	Date : 01.02.92 Meth : Air Line Dur : 3.25 Ini Dp : 46.37 Fin Dp : 46.37	LY	SS :Od,Pr, Lo pH,Fe PR1: NK	11/02/92 IM2 Tara	Initial turbidity, LY. Then clear, LY.	S	US	NK	NS
Bartol 13122403802	Dt:19.08.86 Dp:40.0	Date : 28.01.92 Meth : Air Line Dur : 4.0 Ini Dp : 39.0 Fin Dp : 39.0	SY	SS :Pr,Lo pH, Fe PR1:NK	12/02/92 IM2 Tara	Initial turbidity, LY. Then clear.	S	S	NK	NK
Bartol 13122403803	Dt:18.10.86 Dp:46.0	Date : 30.12.92 Meth : Air Line Dur : 4.0 Ini Dp : 44.4 Fin Dp : 44.4	LY	SS :Pr,Lo pH, Fe PR1:Lo pH	12/02/92 IM2 Tara	Red water with LY, no improvement.	S	US	US	NS
Bartol 13122403804	Dt:27.12.84 Dp:69.0	Date : 24.01.92 Meth : Air line Dur : 3.3 Ini Dp : 62.6 Fin Dp : 62.6	LY	SS :Turb, Lo pH,Fe PR1:NK	11/02/92 IM2 Tara	Turbid water, sand, LY. Then clear, LY	US	US	NK	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Gadamotari 13122403906	Dt:NK	Date : 29.12.91 Meth : Air Line Dur : 4.25 Ini Dp : 55.7 Fin Dp : 55.7	LY	SS :NK PR1:Lo pH,Fe	30/12/91 IM2 Tara	Depletion with IM2 SL	NK	US	US	NS
Bartol 13122403801	Dt:19.08.86 Dp:48.0	Date : 01.02.92 Meth : Air Line Dur : 3.25 Ini Dp : 46.37 Fin Dp : 46.37	LY	SS :Od,Pr, Lo pH,Fe PR1: NK	11/02/92 IM2 Tara	Initial turbidity, LY. Then clear, LY.	S	US	NK	NS
Bartol 13122403802	Dt:19.08.86 Dp:40.0	Date : 28.01.92 Meth : Air Line Dur : 4.0 Ini Dp : 39.0 Fin Dp : 39.0	SY	SS :Pr,Lo pH, Fe PR1:NK	12/02/92 IM2 Tara	Initial turbidity, LY. Then clear.	S	S	NK	NK
Bartol 13122403803	Dt:18.10.86 Dp:46.0	Date : 30.12.92 Meth : Air Line Dur : 4.0 Ini Dp : 44.4 Fin Dp : 44.4	LY	SS :Pr,Lo pH, Fe PR1:Lo pH	12/02/92 IM2 Tara	Red water with LY, no improvement.	S	US	US	NS
Bartol 13122403804	Dt:27.12.84 Dp:69.0	Date : 24.01.92 Meth : Air line Dur : 3.3 Ini Dp : 62.6 Fin Dp : 62.6	LY	SS :Turb, Lo pH,Fe PR1:NK	11/02/92 IM2 Tara	Turbid water, sand, LY. Then clear, LY	US	US	NK	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Ankoi 13122404241	Dt:NK	Date : 28.12.91 Meth : Air Line Dur : 4.3 Ini Dp : 52.0 Fin Dp : 52.0	SY	SS :Pr, Lo pH,Fe PR1:Pr, Lo pH,Fe	29/12/91 IM2 Tara	Initial turbidity, coarse sand, then clear. Turbidity after Re-installation	NK	S	US	NS
Gadamotari 13122403901	Dt:03.10.86 Dp:50.4	Date : 29.12.91 Meth : Air Line Dur : 5.3 Ini Dp : 48.5 Fin Dp : 48.5	LY	SS :Lo pH,Fe PR1:NK	30/12/91 IM2 Tara	Initially black sand & water, LY, then clear water. Depletion with IM2 SL.	S	US	NK	NS
Gadamotari 13122403902	Dt:11.09.86 Dp:38.0	Date : 29.12.91 Meth : Air Line Dur : 3.3 Ini Dp : 36.0 Fin Dp : 36.0	SY	SS :Lo pH,Fe PR1:Lo pH	30/12/91 IM2 Tara	Initially red water then clear.	S	S	US	DS
Gadamotari 13122403903	Dt:12.11.86 Dp:46.0	Date : 29.12.91 Meth : Air Line Dur : 5.25 Ini Dp : 28.2 Fin Dp : 28.2	LY	SS :NK PR1:Pr,Lo pH	30/12/91 IM2 Tara	Initially red water, LY, then clear, LY.	US	US	US	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Panchupala 13122408701	Dt: 23/01/86 Dp: 40.95	Date : 22/05/91 Meth : Air line Dur : 3.0 Ini Dp : 39.00 Fin Dp : 40.00	SY	SS :Od,Pr, Ec*,Cl, PR1:Ec*,Cl PR2:Ec*,Cl PR3:Ec*,Cl	16/04/86 IM2 22/05/91 IM2 SL		S	S	US	NS
Panchupala 13122408702	Dt: 31/01/86 Dp: 40.75	Date : 20/05/91 Meth : Air line Dur : 3.0 Ini Dp : 40.70 Fin Dp : 40.70	SY	SS :Od,Pr,Ec* PR1:Ec* PR2:OK PR3:Ec*	09/04/86 IM2 11/11/89 IMPVCBS 20/05/91 IM2 SL		S	S	US	DS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Kumundal 13122403701	Dt:06.05.86 Dp:28.3	Date : 03.02.92 Meth : Air Line Dur : 3.5 Ini Dp : 28.3 Fin Dp : 28.3	SY	SS :Pr,Lo pH Fe PR1:Pr,Lo pH	11/02/92 IM2 Tara	Initially red water. Then clear.	S	S	US	DS
Kumundal 13122403702	Dt:01.06.86 Dp:34.0	Date : 03.02.92 Meth : Air Line Dur : 4.3 Ini Dp : 31.97 Fin Dp : 31.97	SY	SS :Od,Pr, Lo pH,Fe PR1:Lo pH,Pr	11/02/92 IM2 Tara		S	S	US	DS
Kumundal 13122403703	Dt:10.07.86 Dp:40.0	Date : 03.02.92 Meth : Air line Dur : 4.0 Ini Dp : 38.69 Fin Dp : 38.69	SY	SS :Pr,Fe PR1:Pr,Lo pH	11/02/92 IM2 Tara		S	S	US	NS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Kumara 13122410403	Dt: 01/01/86 Dp: 40.00	Date : 24/05/91 Meth : Air line Dur : 0.25 Ini Dp : 37.50 Fin Dp : 37.60	No yield	SS :Pr PR1:OK PR2:OK	03/03/86 IM2 24/05/91 IM2		S	US	S	NS
Kumara 13122410405	Dt: 31/12/85 Dp: 41.90	Date : 25/05/91 Meth : Air line Dur : 2.3 Ini Dp : 41.90 Fin Dp : 41.90	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	03/03/86 IM2 25/05/91 IM2 SL		S	S	S	FS
Kachapada 13122411001	Dt: 20/03/86 Dp: 38.50	Date : 29/05/91 Meth : Air line Dur : 2.0 Ini Dp : 36.50 Fin Dp : 37.00	SY	SS :Od,Pr, Ec*,Fe PR1:Ec* PR2:Ec* PR3:Ec*	16/04/86 IM2 29/05/91 IM2 SL		S	S	US	PS
achapada 3122411003	Dt: 06/05/86 Dp: 17.90	Date : 30/05/91 Meth : Air line Dur : 3.3 Ini Dp : 15.50 Fin Dp : 17.45	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	31/05/86 IM2 OTC 30/05/91 IM2 SL		S	S	S	FS
achapada 3122411005	Dt: 18/11/87 Dp: 15.60	Date : 30/05/91 Meth : Air line Dur : 2.0 Ini Dp : 14.10 Fin Dp : 15.50	SY	SS :OK PR1:OK PR2:OK PR3:OK	08/01/88 INL SUC 17/04/90 TARA DA 30/05/91 TARA DA		S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Gudupailo 13122411303	Dt:13.12.86 Dp:150.5	Date : 13.12.91 Meth : Manual over pumping Dur : 8.0 Ini Dp : 30 Fin Dp : 30	LY	SS :Od PR1:Pr	14/12/91 IMPVCSS	12/91-Well blocked at 30 m BGL.	US	US	US	NS
Gudupailo 13122411304	Dt:17.07.87 Dp: 136.5	Date : 30.01.92 Meth : Power over pumping Dur : Ini Dp : 134.85 Fin Dp : 134.85	LY	SS :Od,Pr,Ec, Fe,Cl, PR1:Pr	06/02/92 IN Tara	10/88- Chem, Donkey Pump Redev, 45 hrs. US. 12/89- Chem, Air lift 11 hrs, US.	S	US	US	NS
Gudupailo 13122411305	Dt:28.06.87 Dp: 136.5	Date : 16.12.92 Meth : Manual over pumping Dur : 8 Ini Dp : 132.6 Fin Dp : 132.6	LY	SS :Od,Pr,Ec* Fe,Cl PR1:Od,Pr,Ec* Fe,Cl	16/12/91 IN Tara		S	US	US	NS
Humara 13122410402	Dt: 11/01/86 Dp: 16.10	Date : 24/05/91 Meth : Air line Dur : 1.25 Ini Dp : 17.55 Fin Dp : 17.55	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	26/05/86 IM2 OIC 24/05/91 IM2 SL		S	S	S	FS

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusion from Rehabilitation			
							Depth	Yield	Chemistry	Results
Bolakana 13122408505	Dt: 07/05/86 Dp: 32.31	Date : 17/05/91 Meth : Air line Dur : 1.5 Ini Dp : 28.35 Fin Dp : 30.60	SY	SS :Od,Pr, Ec*,Lo pH PR1:Ec* PR2:OK PR3:OK	31/05/86 IM2 OIC 17/05/91 IM2 SL		S	S	S	FS
Gualipada 13122411206	Dt: 30/06/87 Dp: 40.00	Date : 28/05/91 Meth : Air line Dur : 2.0 Ini Dp : 20.00 Fin Dp : 20.00	SY	SS :Od,Ec* PR1:Ec* PR2:Ec* PR3:Pr,Ec*	08/10/86 IML SUC 17/04/90 TARA DA 28/05/91 TARA DA		US	S	US	DS
Gualipada 13122411207	Dt: 01/10/86 Dp: 20.50	Date : 27/05/91 Meth : Air line Dur : 7.5 Ini Dp : 9.00 Fin Dp : 16.50	SY	SS :Od,Pr,Ec* PR1:Ec* PR2:Ec* PR3:OK	20/05/87 IM2 27/05/91 IM2 SL		S	S	S	FS
Gualipada 13122411208	Dt: 16/07/86 Dp: 33.95	Date : 08/05/91 Meth : Air line Dur : 4.0 Ini Dp : 33.35 Fin Dp : 33.40	SY	SS :Ec,Cl PR1:Od,Ec,Cl PR2:Ec,Cl PR3:Ec,Cl	20/08/86 IM2 06/02/88 IMPVCBS 13/08/89 IMPVCSS 08/05/91 IM2 SL		S	S	US	NS
Udupailo 13122411302	Dt:30.06.86 Dp:140.5	Date : 20.11.91 Meth : Air Line Dur : 7.0 Ini Dp : 140.2 Fin Dp : 140.2	LY	SS :Od,Pr PR1:Od	25/11/91 IMPVCSS	09/88- Chem, Donkey Pump Redev, 32 hrs. Improved	S	US	US	NS

Table 2.34 : Detailed Rehabilitation Data & Results - Gualipada GP, Delang block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Bolakana 13122408501	Dt: 09/03/86 Dp: 32.50	Date : 19/04/91 Meth : Air line Dur : 3.0 Ini Dp : 31.70 Fin Dp : 31.90	SY	SS :Od,Ec* PR1:Od,Ec* PR2:Ec* PR3:Ec*,Lo pH PR4:Ec*	11/04/86 IM2 12/07/89 IMPVCSS 20/04/91 IM2 SL	07/89- Chem, Air lift 4.25 hrs, S.	S	S	US	DS
Bolakana 13122408502	Dt: 29/03/86 Dp: 32.50	Date : 19/04/91 Meth : Air line Dur : 2.5 Ini Dp : 31.85 Fin Dp : 31.86	SY	SS :Od,Ec* PR1:Ec* PR2:OK PR3:OK	22/04/86 IM2 13/07/89 IMPVCSS 20/04/91 IM2 SL	07/89- Chem, Air lift 5 hrs, S.	S	S	S	FS
Bolakana 13122408503	Dt: 19/04/86 Dp: 32.30	Date : 22/04/91 Meth : Air line Dur : 2.25 Ini Dp : 28.95 Fin Dp : 29.30	SY	SS :Od,Pr,Ec* Lo pH,Fe PR1:Od,Pr,Ec* PR2:OK PR3:OK	15/05/86 IM2 OIC 09/07/87 IM2 22/04/91 IM2 SL		S	S	S	FS
Bolakana 13122408504	Dt: 24/04/86 Dp: 32.40	Date : 22 to 24 & 27/04/91 Meth : Air line Dur : 9.75 Ini Dp : 31.77 Fin Dp : 24.96	SY	SS :Od,Pr PR1:Pr PR2:OK PR3:OK PR4:OK	02/05/86 IM2 OIC 27/04/91 IM2 SL	04/91-Airline hose stuck, abandoned. Pebbles during cleaning. Casing failure?	US	S	S	PS

Table 2.35 : Detailed Rehabilitation Data & Results - Sri Purushottampur GP , Delang block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Bilaspur 13122411401	Dt:21.04.86 Dp:110.5	Date : 12/11/91 Meth1 : Manual over pumping Dur 1 : Meht2 : Air Line Dur 2 : (9.5) Ini Dp : 110.0 Fin Dp : 110.0	SY	SS :Od,Ec*,Fe PR1:Ec*,Fe PR2:Od,Pr, Ec*,Fe	14.11.91 IM2 Tara	Manual ov. pumping US Black slimy water with compressor use.Also fine sand then clean.	S	S	US	NS
Bilaspur 13122411402	Dt:10.09.86 Dp:100.5	Date : 04/10/91 Meth : Manual over pumping Dur : 20.5 Ini Dp : 110.2 Fin Dp : 110.2	SY	SS :NK PR1:Ec*,Fe PR2:Od,Ec*,Fe	04.10.91 IMPVCSS	R&D IRP site	S	S	US	NS
Bilaspur 13122411403	Dt:20.08.86 Dp:114.5	Date : 28/09/91 Meth : Manual over pumping Dur : 17.7 Ini Dp : 113.45 Fin Dp : 113.45	SY	SS :NK PR1:Fe PR2:Fe PR3:Od,Fe	01.10.91 IMPVCSS	R & D IRP.	S	S	US	NS
Thentena 13122410901	Dt:30.12.85 Dp:34.1	Date : 08/02/92 Meth : Manual over pumping Dur : 9.0 Ini Dp : 33.1 Fin Dp : 33.1	SY	SS :Pr PR1:NK	08.02.92 IM2 SL	Substantial bentonite and fine sand cleared.	S	S	NK	NK

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Thentena 13122410902	Dt:09.01.86 Dp:39.95	Date : 07/02/92 Meth : Manual over pumping Dur : 9.0 Ini Dp : 39.5 Fin Dp : 39.5	SY	SS :Od,Pr,Fe PR1:NK	09.02.92 1M2 SL	Substantial bentonite and fine sand cleared.	S	S	NK	NK
Thentena 13122410903	Dt:03.10.86 Dp:40.38	Date : 10/02/92 Meth : Manual over pumping Dur : 10.0 Ini Dp : 38.0 Fin Dp : 38.0	SY	SS :Pr PR1:NK	10.02.92 1M2 SL	Substantial bentonite and fine sand cleared.	S	S	NK	NK

Table 2.36 : Rehabilitation Data & Results - Sujanpur GP , Delang block

Site	Drilling	Well Cleaning	Yield	Water Quality	Pump Reinstallation	Remarks	Conclusions from Rehabilitation			
							Depth	Yield	Chemistry	Results
Ankula 13122406602	Dt:27.01.86 Dp:20.1	Date : 11.02.92 Meth : Manual over pumping Dur : 10.0 Ini Dp : 17.0 Fin Dp : 17.0	SY	SS :OK PR1:NK	11/02/92 Tara DA	Plenty of sand & some bentonite, then cleared.	S	S	NK	NK

ANNEXURE 3

Rehabilitation Data & Results - Aul block

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Balakati 06020718204	218.0	S	Air Ln	SY	SS : Fe PR1: Fe	US		S	S	US	MS
Balakati 06020718207	251.0	S	POP	SY	SS : Fe PR1: OK	S		S	S	S	FS
Bhuinpur 06020720903	173.0	S	POP	SY	SS : Fe PR1: Fe	US	Initially clay	S	S	US	MS
Bhuinpur 06020720909	169.0	S	Air Ln	SY	SS : Fe PR1: Fe	US		S	S	US	MS
Denal 06020719903	232.0	S	Air Ln	LY	SS : Fe PR1: OK	S	V LY	S	US	S	MS
Denal 06020719906	234.3	US	Air Ln	LY	SS : Fe PR1: OK	S		US	US	S	MS
Denal 06020719907	248.0	S	Air Ln	LY	SS : Fe PR1: OK	S		S	US	S	MS
Lokapada 06020719507	238.0	S	1:Air Ln 2:POP	SY	SS : Fe PR1: OK	S	Initially sand	S	S	S	FS
Nahoo 06020723303	141.0	S	Air Ln	SY	SS : Fe PR1: Fe	US		S	S	US	MS
Nahoo 06020723304	170.0	S	Air Ln	SY	SS : Fe PR1: OK	S		S	S	S	FS
Kalapahada 06020719202	239.0	S	POP	SY	SS : Fe PR1: OK	S		S	S	S	FS
Alakani 06020719104	242.0	S	Air Ln	SY	SS : Fe PR1: OK	S	Sand initially	S	S	S	FS
Gopalpur 06021004904	136.0	S	Air Ln	SY	SS : Fe PR1: Fe	US		S	S	US	MS
Gopalpur 06021004905	138.0	S	Air Ln	SY	SS : Fe PR1: Fe	US		S	S	US	MS
Patrapur 06021002401	(16.0)	NK	Air Ln	SY	SS : Fe PR1: Fe	US	Fine sand	NK	S	US	MS

Rehabilitation Results Summary - Chandbali block

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Paharpur 05102211902	208.0	US	Air Ln	Very LY	SS :OK PR1:OK	S	Little silt	US	US	S	NS
Patuli 05102211802	214.0	US	1:Air Ln 2:POP	LY	SS :C,T,P PR1:OK	S		US	US	S	NS
Charadia 05102312601	180.0	S	Air Ln	SY	SS :C PR1:OK	S		S	S	S	FS
Charadia 05102312604	186.0	S	Air Ln	SY	SS :C PR1:OK	S		S	S	S	FS
Jaladharapur 05102313201	198.0	S	Air Ln	SY	SS :OK PR1:Fe	S		S	S	US	NS
Jaladharpur 05102313203	124.0	S	Air Ln	SY	SS :OK PR1:OK	S		S	S	S	FS
Karanapokhari 05102311002	174.0	S	POP	SY	SS :C PR1:OK	S		S	S	S	FS
Karanapokhari 05102311003	201.0	US	Air Ln	LY	SS :C,Ec° PR1: OK	S	Casing break - 30 m ?	US	US	S	NS
Nalgohira 05102310901	176.0	S	Air Ln	SY	SS : C PR1: OK	S		S	S	S	FS
Nalgohira 05102310902	178.0	S	Air Ln	SY	SS : C PR1: OK	S		S	S	S	FS
Nalgohira 05102310903	178.0	S	Air Ln	LY	SS : C PR1: OK	S		S	US	S	NS
Nalgohira 05102310904	218.0	S	Air Ln	SY	SS : C PR1: OK	S		S	S	S	FS
Pokharisahi 05102310001	194.0	S	Air Ln	SY	SS : C PR1: OK	S		S	S	S	FS
Chasakhanda 05102202004	253.0	S	POP	SY	SS : P PR1: OK	S		S	S	S	FS
Nalbada 05102201801	241.0	US	Air Ln	Very LY	SS : OK PR1: OK	S	Med. sand. Casing break?	US	US	S	NS
Natto 05102201903	242.0	S	Air Ln	SY	SS : OK PR1: OK	S	Fine black sand	S	S	S	FS

Rehabilitation Data & Results - Abhayamukhi Ramachandrapur GP, Delang block

Site	Depth		Well Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Abhayamukhi Ramach.pur 13122507203	117.0	US	Air Ln	SY	SS:Od,Ec, Fe,Cl PR1:Od,Pr, Ec,Fe,Cl	US		US	S	US	NS
Abhayamukhi Ramach.pur 13122507204	111.5	S	Air Ln	SY	SS :NK PR1:Pr,Ec, Fe,Cl	US		S	S	US	NS
Abhayamukhi Ramach.pur 13122507205	110.5	S	Air Ln	SY	SS :Pr PR1:NK	US		S	S	US	NS
Abhayamukhi Ramach.pur 13122507207	108.0	S	Air Ln	LY	SS :Ec,Fe,Cl PR1:Ec,Fe,Cl	US	Water during cleaning	S	US	US	NS
I.purdeuli 13122506401	125.0	S	Air Ln	SY	SS :Od,Ec*,Fe PR1:NK	NK	Old IRP	S	S	NK	NK
I.purdeuli 13122505402	114.5	S	Air Ln	SY	SS :Ec*,Fe,Cl PR1:Ec*,Fe,Cl	US		S	S	US	NS
I.purdeuli 13122505413	118.5	S	Air Ln	SY	SS :Od,Pr,Ec, Fe,Cl PR1:Ec*,Fe,Cl	US		S	S	US	NS

Rehabilitation Data & Results - Beraboi GP , Delang block

Site	Depth		Well Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res		Dp	Y	Ch	Res
Ayatnadua 131224058101	36.50	S	Air Ln	SY	SS :Od,Pr,Fe PR1:OK PR2:OK	S		S	S	S	FS
Beraboi 13122408901	36.00	S	Air Ln	SY	SS :OK PR1:OK PR2:Pr PR3:OK PR4:OK	S		S	S	S	FS
Beraboi 13122408902	36.00	S	Air Ln	SY	SS :OK PR1:OK PR2:OK PR3:Pr PR4:Pr	US		S	S	US	DS
Beraboi 13122408903	36.00	S	Air Ln	SY	SS :OK PR1:Pr PR2:Pr PR3:OK	US		S	S	US	DS
Beraboi 13122408904	40.00	S	Air Ln	SY	SS :Od,Pr,Fe PR1:Od PR2:OK PR3:Pr	US		S	S	US	DS
Beraboi 13122408905 (Explo)	112.50	S	Air Ln	SY	SS:NK PR1:Od,Fe PR2:Od,Fe PR3:Fe PR4:Fe PR5:Od,Pr,Fe PR6:Od,Pr,Fe	US	Coarse sand	S	S	US	MS
Beraboi 13122408941	NK	NK	Air Ln	SY	SS :OK PR1:OK PR2:Od PR3:OK PR4:OK	S		NK	S	S	PS
Brahmeswarpur 13122409001	32.13	S	Air Ln	SY	SS :Od,Pr,Fe PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Buali 13122405701	31.75	S	Air Ln	SY	SS :Od,Pr,Fe PR1:OK PR2:OK PR3:OK	S		S	S	S	FS

Site	Depth		Well Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res		Dp	Y	Ch	Res
Damapur 13122408601	32.00	S	Air Ln	SY	SS :Ec* PR1:Pr,Ec* PR2:Ec* PR3:Ec* PR4:Pr,Ec*	US	07/89-Ch+Air sand, US,LY	S	S	US	DS
Damapur 13122408602	30.25	S	Air Ln	SY	SS :OK PR1:Od PR2:OK PR3:OK	S		S	S	S	FS
Jokanarua 13122409401	36.00	S	Air Ln	SY	SS :Od,Pr PR1:Od PR2:OK PR3:Pr	US	Coarse sand	S	S	US	DS
Jokanarua 13122409402	36.00	S	Air Ln	SY	SS :Od,Pr PR1:Od PR2:OK PR3:OK	S		S	S	S	FS
Manijipur 13122408401	28.10	S	Air Ln	SY	SS :Od,Pr,Fe PR1:Od PR2:OK PR3:OK PR4:OK PR5:OK	S	Med. & fine sand	S	S	S	FS
Odataraboi 13122409101	35.00	S	Air Ln	SY	SS :NK PR1:Od PR2:OK PR3:OK	S	11/89-Ch+Air sand, US.	S	S	S	FS
Odataraboi 13122409102	34.00	S	Air Ln	SY	SS :Od,Pr,Fe PR1:Pr PR2:OK PR3:Pr	US	11/89-Che+Air US, 2nd try S.	S	S	US	DS
Odataraboi 13122409103	34.00	S	Air Ln	SY	SS :OK PR1:OK PR2:OK	S	Coarse to med. sand	S	S	S	FS
Pirhapatana 13122409701	36.00	S	Air Ln	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK PR4:OK	S	Coarse sand, pebbles	S	S	S	FS
Pirhapatana 13122409702	36.00	S	Air Ln	SY	SS :OK PR1:Od PR2:OK	US		S	S	S	FS

Site	Depth		Well Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res		Dp	Y	Ch	Res
Pirhapatana 13122409741	NK	NK	Air Ln	SY	SS :OK PR1:OK PR2:OK	S		NK	S	S	PS
Praharajpur 13122409601	36.00	S	Air Ln	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Praharajpur 13122409602	36.00	S	Air Ln	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK PR4:OK PR5:OK	S		S	S	S	FS
Praharajpur 13122409603	36.00	S	Air Ln	SY	SS :OK PR1:Od PR2:OK PR3:OK	S		S	S	S	FS
Praharajpur 13122409604	40.00	S	Air Ln	SY	SS :OK PR1:Od PR2:OK PR3:OK	S		S	S	S	FS
Praharajpur 13122409605	40.00	S	Air Ln	SY	SS :Pr PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Rencha 13122409301	40.00	S	Air Ln	SY	SS :Od,Pr PR1:Od PR2:OK PR3:OK	S	12/89- Ch+Air S.	S	S	S	FS
Rencha 13122409302	36.00	S	Air Ln	LY	SS :Od,Pr PR1:Pr PR2:Od PR3:Pr	US	11/89- Che+Air 2 tries LY	S	US	US	NS
Rencha 13122409303	40.00	S	Air Ln	SY	SS :OK PR1:Od PR2:Od PR3:OK	US	12/89- Ch+Air US.	S	S	US	DS
Rencha 13122409304	36.00	S	Air Ln	SY	SS :OK PR1:Pr PR2:OK PR3:Pr	US	07/89- Ch+Air S.	S	S	US	DS

Site	Depth		Well Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res		Dp	Y	Ch	Res
Rencha 13122409305	36.10	S	Air Ln	SY	SS :NK PR1:OK PR2:OK PR3:Od,Pr	US	12/89-Ch→Air, S.	S	S	US	DS
Udayapur 13122408801	36.00	S	Air Ln	LY	SS :OK PR1:Od PR2:OK PR3:OK PR4:OK PR5:OK PR6:OK	S		S	US	S	NS

Rehabilitation Data & Results - Chainpur GP , Delang block

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Ankoi 13122404201	18.95	S	Air Ln	SY	SS :Lo pH PR1:NK	NK		S	S	NK	NK
Ankoi 13122404202	24.0	S	Air Ln	SY	SS :Pr,Lo pH PR1:Lo pH	US		S	S	US	NS
Ankoi 13122404203	15.98	S	Air Ln	SY	SS :Lo pH PR1:Pr,Lo pH	US		S	S	US	NS
Ankoi 13122404204	31.15	S	Air Ln	LY	SS :Od,Pr, Lo pH,Fe PR1:Lo pH	US	Slight turb. contd.	S	US	US	NS
Ankoi 13122404205	NK		Air Ln	SY	SS :Od,Pr, Lo pH,Fe PR1:Lo pH	US			S	US	NS
Ankoi 13122404241	NK	NK	Air Ln	SY	SS :Pr,Lo pH Fe PR1:Pr,Lo pH Fe	US	Sand. Turb. after reinst	NK	S	US	NS
Gadamotari 13122403901	50.4	S	Air Ln	LY	SS :Lo pH,Fe PR1:NK	NK	Black sand LY, Depletion	S	US	NK	NS
Gadamotari 13122403902	33.0	S	Air Ln	SY	SS :Lo pH,Fe PR1:Lo pH	US		S	S	US	NS

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Gadamotari 13122403903	46.0	US	Air Ln	LY	SS :NK PR1:Pr,Lo pH	US		US	US	US	NS
Gadamotari 13122403906	NK	NK	Air Ln	LY	SS :NK PR1:Lo pH,Fe	US	Depletion	NK	US	US	NS
Bartol 13122403801	48.0	S	Air Ln	LY	SS :Od,Pr, Lo pH,Fe PR1: NK	NK		S	US	NK	NS
Bartol 13122403802	40.0	S	Air Ln	SY	SS :Pr,Lo pH Fe PR1:NK	NK		S	S	NK	NK
Bartol 13122403803	46.0	S	Air Ln	LY	SS :Pr,Lo pH Fe PR1:Lo pH	US		S	US	US	NS
Bartol 13122403804	69.0	US	Air Ln	LY	SS :Turb, Lo pH,Fe PR1:NK	NK	Sand, LY.	US	US	NK	NS
Kumundal 13122403701	28.3	S	Air Ln	SY	SS :Pr,Lo pH Fe PR1:Pr,Lo pH	US		S	S	US	DS
Kumundal 13122403702	34.0	S	Air Ln	SY	SS :Od,Pr, Lo pH,Fe PR1:Pr,Lo pH	US		S	S	US	DS
Kumundal 13122403703	40.0	S	Air Ln		SS :Pr,Fe PR1:Pr,Lo pH	US		S	S	US	NS

Rehabilitation Data & Results - Gualipada GP , Delang block

Site	Depth		Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Bolakana 13122408501	32.50	S	Air Ln	SY	SS :Od,Ec* PR1:Od,Ec* PR2:Ec* PR3:Ec*,Lo pH PR4:Ec*	US	07/89- Ch +Air Ln, S.	S	S	US	DS
Bolakana 13122408502	32.50	S	Air Ln	SY	SS :Od,Ec* PR1:Ec* PR2:OK PR3:OK	S	07/89- Ch + Air Ln, S.	S	S	S	FS
Bolakana 13122408503	32.30	S	Air Ln	SY	SS :Od,Pr,Ec* Lo pH,Fe PR1:Od,Pr,Ec* PR2:OK PR3:OK	S		S	S	S	FS
Bolakana 13122408504	32.40	US	Air Ln	SY	SS :Od,Pr PR1:Pr PR2:OK PR3:OK PR4:OK	S	Air Ln stuck, abandoned. Pebbles Casing failure?	US	S	S	PS
Bolakana 13122408505	32.31	S	Air Ln	SY	SS :Od,Pr, Ec*,Lo pH PR1:Ec* PR2:OK PR3:OK	S		S	S	S	FS
Gualipada 13122411206	40.00	US	Air Ln	SY	SS :Od,Ec* PR1:Ec* PR2:Ec* PR3:Pr,Ec*	US		US	S	US	DS
Gualipada 13122411207	20.50	S	Air Ln	SY	SS :Od,Pr,Ec* PR1:Ec* PR2:Ec* PR3:OK	S		S	S	S	FS
Gualipada 13122411208	33.95	S	Air Ln	SY	SS :Ec,Cl PR1:Od,Ec,Cl PR2:Ec,Cl PR3:Ec,Cl	US		S	S	US	NS
Gudupailo 13122411302	140.5	S	Air Ln	LY	SS :Od,Pr PR1:Od	US	09/88- Ch+ Dn Pm, improved	S	US	US	NS
Gudupailo 13122411303	150.5	US	MOP	LY	SS :Od PR1:Pr	US	12/91-Well blocked at 30 m BGL.	US	US	US	NS

Site	Depth		Cleaning	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Gudupailo 13122411304	136.5	S	POP	LY	SS :Od,Pr,Ec, Fe,Cl PR1:Pr	US	10/88- Ch+ Dn Pm,US. 12/89- Ch, Air lift, US.	S	US	US	NS
Gudupailo 13122411305	36.5	S	MOP	LY	SS :Od,Pr,Ec* Fe,Cl PR1:Od,Pr,Ec* Fe,Cl	US		S	US	US	NS
Humara 13122410402	16.10	S	Air Ln	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Humara 13122410403	40.00	S	Air Ln	No yield	SS :Pr PR1:OK PR2:OK	S		S	US	S	NS
Humara 13122410405	41.90	S	Air Ln	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Machapada 13122411001	38.50	S	Air Ln	SY	SS :Od,Pr, Ec*,Fe PR1:Ec* PR2:Ec* PR3:Ec*	US		S	S	US	DS
Machapada 13122411003	17.90	S	Air Ln	SY	SS :Od,Pr PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Machapada 13122411005	15.60	S	Air Ln	SY	SS :OK PR1:OK PR2:OK PR3:OK	S		S	S	S	FS
Panchupala 13122408701	40.95	S	Air Ln	SY	SS :Od,Pr, Ec*,Cl, PR1:Ec*,Cl PR2:Ec*,Cl PR3:Ec*,Cl	US		S	S	US	NS
Panchupala 13122408702	40.75	S	Air Ln	SY	SS :Od,Pr,Ec* PR1:Ec* PR2:OK PR3:Ec*	US		S	S	US	DS

Rehabilitation Data & Results - Sri Purushottampur GP , Delang block

Site	Depth		Cleaning Method	Yiel d	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Bilaspur 13122411401	110.5	S	1:MOP 2:Air Ln	SY	SS :Od,Ec*,Fe PR1:Ec*,Fe PR2:Od,Pr, Ec*,Fe	US	MOP US Dirty water + sand with air line	S	S	US	NS
Bilaspur 13122411402	100.5	S	MOP	SY	SS :NK PR1:Ec*,Fe PR2:Od,Ec*,Fe	US		S	S	US	NS
Bilaspur 13122411403	114.5	S	MOP	SY	SS :NK PR1:Fe PR2:Fe PR3:Od,Fe	US		S	S	US	NS
Thentena 13122410901	34.1	S	MOP	SY	SS :Pr PR1:NK	NK	Bentonite fine sand	S	S	NK	NK
Thentena 13122410902	39.95	S	MOP	SY	SS :Od,Pr,Fe PR1:NK	NK	Bentonite fine sand	S	S	NK	NK
Thentena 13122410903	40.38	S	MOP	SY	SS :Pr PR1:NK	NK	Bentonite fine sand	S	S	NK	NK

Rehabilitation Data & Results - Sujanpur GP , Delang block

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Ankula 13122406602 Sujanpur GP	20.1	S	MOP	SY	SS :OK PR1:NK	NK	Sand, bent-onite	S	S	NK	NK

Rehabilitation Data & Results - Kanas block

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Adala 13172601001	103.0	S	1:Air Ln 2:POP	SY	SS :Lo pH, Fe PR1:Fe	US			S	US	NS
Adala 13172601004	102.0	S	Air Ln	LY	SS :Ec*,Fe PR1:Fe	US	Initially SY, then depletion	S	US	US	NS
Adala 13172601005	109.0	S	Air Ln	SY	SS :Lo pH, Fe PR1:Fe	US		S	S	US	NS
Badala 13172601101	98.0	S	Air Ln	SY	SS :Fe PR1:Fe	US	Initially SY, then depletion.	S	S	US	NS
Badala 13172501103	104.0	S	Air Ln	LY	SS :Fe PR1:Fe	US	1200 lit water added	S	US	US	NS
Badala 13172501104	103.0	US	Air Ln	LY	SS :Fe PR1:Fe	US		US	US	US	NS
Badala 13072501109	111.0	S	1.Air Ln 2.POP	LY	SS :Ec*,Fe PR1:Ec*,Fe	US		S	US	US	NS
Dochian 13172600701	108.0	S	Air Ln	SY	SS :Fe PR1:OK	S		S	S	S	FS
Dochian 13172600703	115.0	S	Air Ln	SY	SS :MK PR1:MK	MK	Fine sand	S	S	MK	DS
Dochian 13172600704	104.0	S	Air Ln	LY	SS :Fe PR1:Fe	US		S	US	US	NS
Khuntia-banapur 13172600901	91.0	S	Air Ln	SY	SS :Lo pH, Fe PR1:Fe	US		S	S	US	NS
Khuntia-banapur 13172600903	88.0	S	Air Ln	SY	SS :Lo pH, Ec*,Fe PR1:Ec*,Fe	US		S	S	US	NS
Khuntia-banapur 13172600904	87.0	S	Air Ln	SY	SS :Fe PR1:Fe	US		S	S	US	NS

Site	Depth		Cleaning Method	Yield	Water Quality		Remarks	Conclusions from Rehabilitation			
	Drilled	Res.			Obsv.	Res.		Dp	Y	Ch	Res
Gadakharada 13172600153	NK	NK	Air Ln	SY	SS :NK PR1:NK	NK	Rejuv. wl. clay, fine & med.sand & scales. Sand contd.	NK	S	NK	NK
Bhatpada 13172601401	97.0	S	Air Ln	SY	SS :Lo pH, Fe PR1:Fe	US	Fine sand	S	S	US	DS
Bhatpada 13172601402	102.0	S	Air Ln	SY	SS :Lo pH, Fe PR1:Fe	US		S	S	US	DS
Kadua 13172601303	100.0	S	Air Ln	SY	SS :Lo pH, Fe PR1:Fe	US	Sand	S	S	US	DS
Anjira 13172601852	NK	NK	Air Ln	SY	SS :NK PR1:NK	NK	Rejuv. wl. Clay & sand came out.	NK	S	NK	NK
Sahoopada 13172601602	92.0	S	Air Ln	LY	SS :Fe PR1:Fe	US	Depletion. 1200 lit water added	S	US	US	NS
Sahoopada 13172601603	92.0	S	Air Ln	LY	SS :Lo pH, Fe PR1:Lo pH, Fe	US	2000 lit water added.	S	US	US	NS
Sahoopada 13172601604	91.0	S	Air Ln	LY	SS :Fe PR1:Fe	US	3000 lit water added. Clay & laterite granules.	S	US	US	NS
Sahoopada 13172601605	90.0	S	Air Ln	SY	SS :Lo pH, Fe PR1:Lo pH, Fe	US	Sand. 3000 lit water added.	S	S	US	NS

ANNEXURE 4

Rehabilitation Basis Data & Work Record Summary :

Basic Record

1. Regn. No. : .....
2. Gram Panchayat : . . . . . .
3. Village : . . . . . .
4. Habitation : . . . . . .
5. Date of well drilling: . . . . . .
6. Depth drilled: . . . . . .
7. Type of Pump installed:

Sl. No.	Date	Pump Type	Remarks
7.1			
7.2			

Status Survey Results

8. Pump Condition: . . . . . .
9. Pump Utilisation: . . . . . .
10. Chemical Analysis Results: . . . . . .
11. Rehabilitation Required: . . . . . .

. . . . . .

Rehabilitation Work Record Summary:

1 Well details :

1.1 Date of pump removal: . . . . . .

1.2 Well depth measured: . . . . . m

1.3 Depth measured after initial cleaning: .. . . . m

1.4 Method of initial cleaning: . . . . . .

1.5 Duration : . . . . . hrs./min.

2 Chemicals used :

Sl. No.	Date	NaOCl lit	Na_2CO_3 Kg	STP Kg	
2.1	.....	.....	.....	.....	.....
2.2	.....	.....	.....	.....	.....

3 Well cleaning :

Sl. No.	Date	Method	Duration (hr/min)	Result (Satisfactory/Unsatisfactory)
3.1	.....	.....	.....	.....
3.2	.....	.....	.....	.....
3.3	.....	.....	.....	.....

4 Results of well cleaning

4.1 Full well depth was reached : Yes/ No
4.2 Yield was more than 15 lpm : Yes/ No
4.3 Water was clear & colourless : Yes/ No
4.4 Water was odourless : Yes/ No

5 Pump reinstallation details

5.1 Date: . . . . . .

5.2 Water level (b.g.l.) in well : . . . . . .

5.3 Pump Type details: . . . . . .

6 Notes on Platform/Drain/etc.: . . . . . .

WATER CHEMISTRY RECORD :

Block :............. G.P:.....................

Village:............... Pump Regd.No : ....

Test No.	Odo-ur	True Col-our	Par-tic-les	Tur-bid-ity	pH	EC	Fe++	Cl			
Results from Status Survey Date of Observations: Field Chemist:											
1.											
2.											
3.											
Post-Rehabilitation Results Date : Field Chemist:											
1.											
2.											
3.											
Post-Rehabilitation Results Date: Field Chemist:											
1.											
2.											
3.											
Post-Rehabilitation Results Date: Field Chemist:											
1.											
2.											
3.											
Post-Rehabilitation Results Date: Field Chemist:											
1.											
2.											
3.											
Post-Rehabilitation Results Date: Field Chemist:											
1.											
2.											
3.											
Post-Rehabilitation Results Date: Field Chemist:											
1.											
2.											
3.											

Codes:

Detailed Time Record of Redevelopment

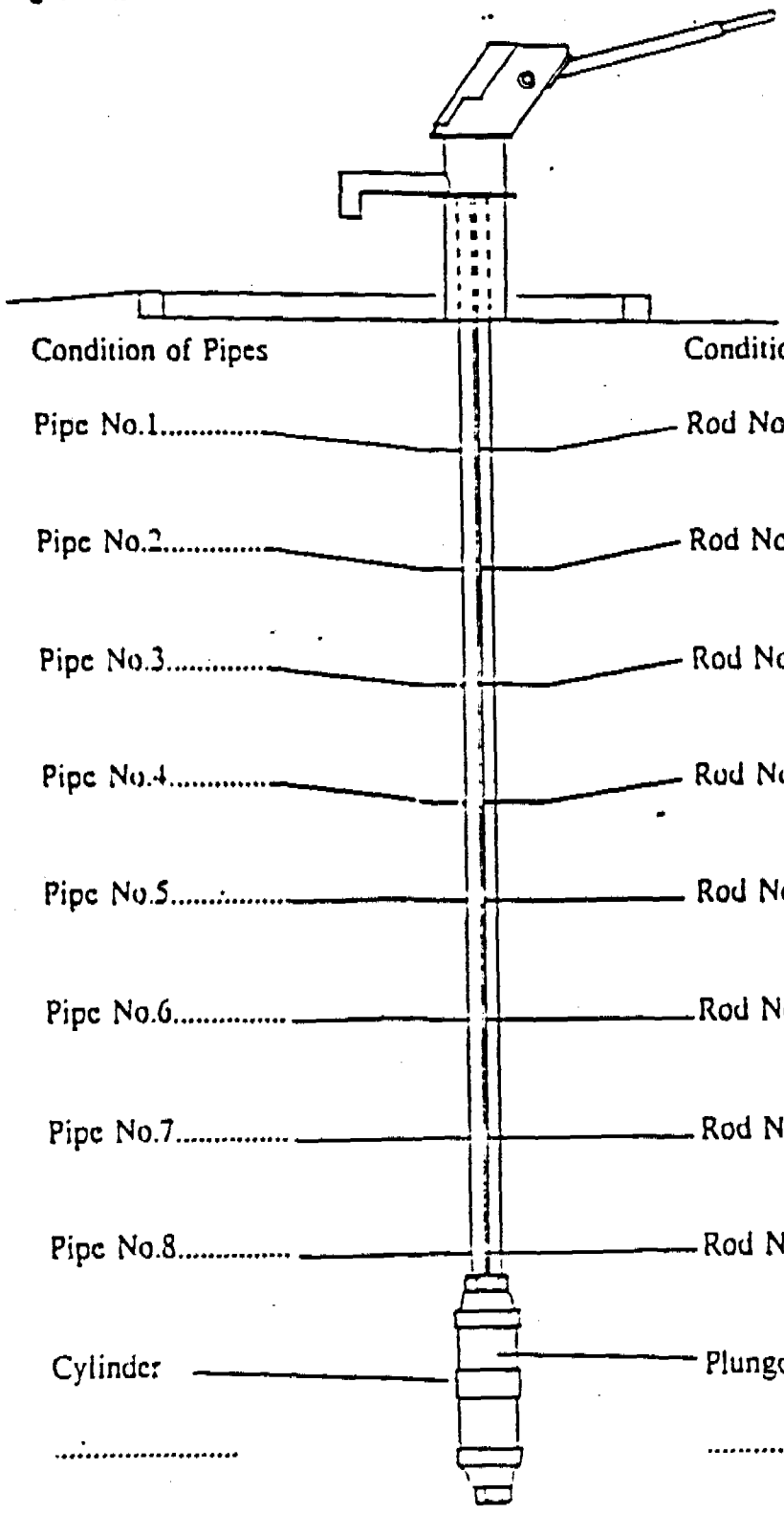
Sl. No.	Date	Chemical Treatment		Air pressure applied				Observations
		Time	Name & Quantity	Time Record			Pressure	
				Start	Stop	Duration		

FIELD NOTE SHEET
HAND PUMP REMOVAL

Block: **Date:**

G.P., Village, Hab.:

Regn. No.:



Notes: . . . . . .

. . . . . .

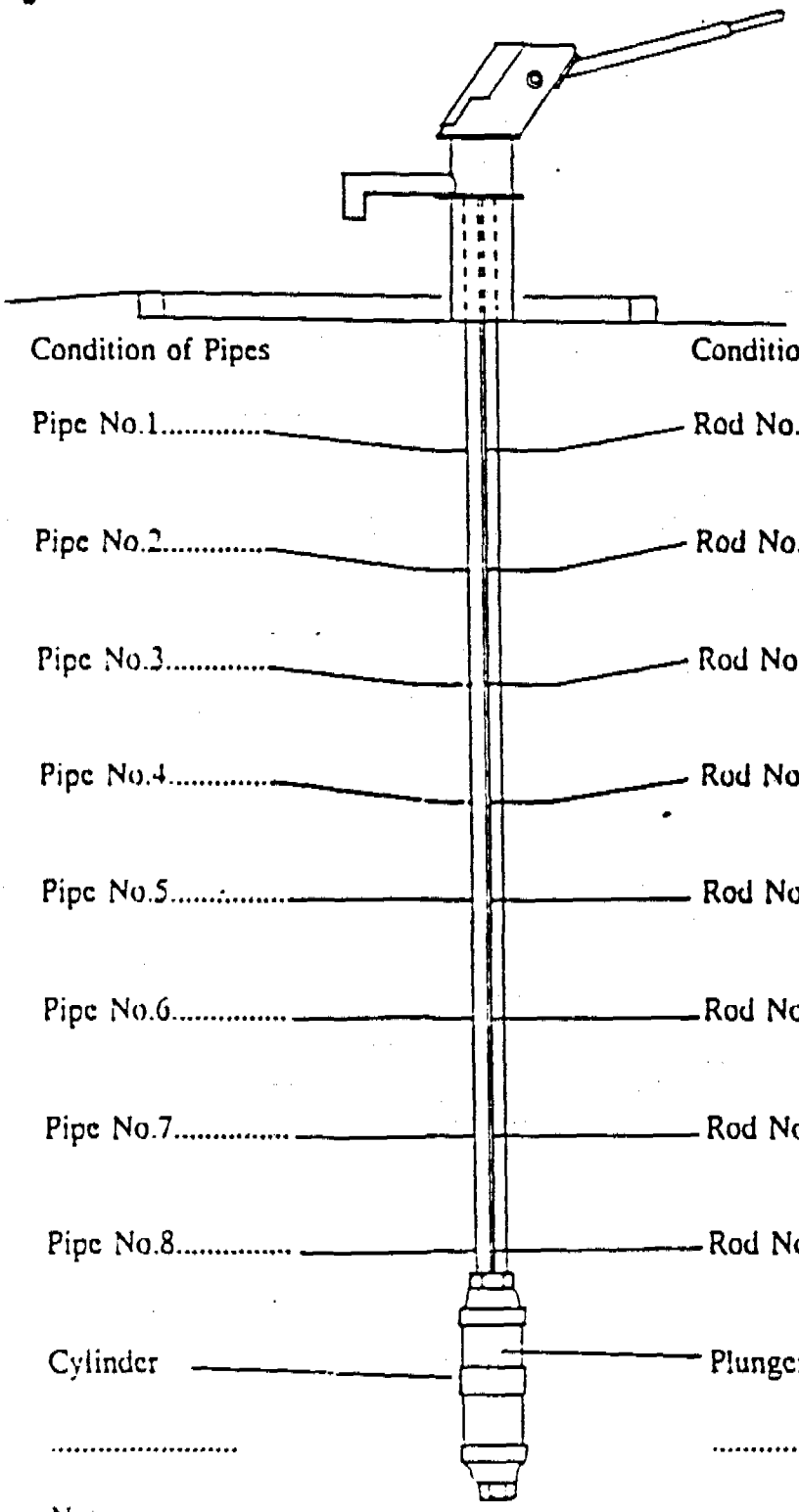
Prepared by:..... Date:.....

FIELD NOTE SHEET
HAND PUMP REINSTALLATION

Block: **Date:**

G.P., Village, Hab.:

Regn. No.:



Notes: . . . . . .

. . . . . .

Prepared by:..... Date:.....

Procedure for Chemical Treatment

Before well cleaning or redevelopment, the tube well needs to be chemically treated for sterilising the well against bacterial growth that may have occurred. The chemical commonly used is Sodium Hypochlorite in combination with Sodium Carbonate. The specific functions of these chemicals are as follows:

1.1 Sodium Hypochlorite (NaOCl) is particularly effective for well sterilisation, especially in wells containing organisms like Sulphate reducing bacteria, and Iron bacteria. The Chlorine concentration required in the well is 1000 ppm. To obtain this concentration, the following formula is useful:

$$\text{Weight of NaOCl (Kg)} = \text{Volume of water in well (liters)} \times \frac{\text{Desired Concentration}}{\text{Concentration of Cl in Sterilant}}$$

If available Chlorine in Sodium Hypochlorite solution is 5.25 %, then :

$$\text{Weight of NaOCl (Kg)} = \text{Volume of water in well (liters)} \times \frac{0.001}{0.0525}$$

1.2 Sodium Carbonate (Na_2CO_3) is used as a wetting agent (ref: Pg.4, item 7.1, IS:11632-1986)along with the use of Phosphates which are sometimes glassy. The use of 1 Kg. of Sodium Carbonate is recommended per 400 liters of water in the well.

1.3 Sodium Tripolyphosphate - STP ($Na_5P_3O_{10}$) is effective for removal of Bentonite stresses and clay particles from the formation and will help in dispersing the remanent of drilling mud around the well screen area. The recommended usage is 3.5 Kg. to 4.5 Kg. per 400 liters of water in the well. This chemical will be used only in the cases of low yielding wells. STP can be applied in the well by first mixing it with Calcium Carbonate in warm water then adding Sodium Hypochlorite to the suspension.

2. Application of Sodium Hypochlorite & its Removal:

Step 1:
The calculated quantity of Sodium Hypochlorite is mixed in a plastic bucket of 15 liters capacity, with water and

is stirred well. The person mixing the solution should use gloves and cover his face with a cloth against the strong smell of chlorine gas that comes from this chemical.

Step 2:
The solution is diluted with 5 times its volume of water and injected at the strainer depth by means of a 25 mm diameter pipe lowered in the well to the well bottom (ref: Pg.5, item 7.1, Para 8,IS:11632-1986). The solution has a higher specific gravity and displaces water upward and outward from the well as the pipe is raised and lowered repeatedly by about 1.5 m.

Step 3:
When the solution is placed at the screen, the drop pipe is removed. Then about 100 liters of water (about half the volume of water in 15 m length of 125 mm dia upper well casing) is slowly poured directly into the upper well casing (and through the drop pipe) to displace the solution from the screen and force it into the formation. Use of a surge plunger could be made, if available, as per guidelines on Pg.5, item 7.1, Para 8, IS:11632-1986.

Step 4:
The tube well is kept capped overnight with chemicals in the well.

Step 5:
The next day, the well is cleaned by backwashing and/or over pumping.

Step 6:
A test for residual Chlorine is conducted using Ortho Toliodine reagent. If residual Chlorine is present in the well water, then a drop of the reagent will turn red when introduced into a small sample (5 ml) of the well water. When the flushed water is free from residual Chlorine, the reagent will not change colour and the hand pump can be reinstalled.

3. Application of Sodium Tripolyphosphate & its Removal:

Sodium Tripolyphosphate is usually applied along with Sodium Carbonate as a wetting agent and in combination with Sodium Hypochlorite as the sterlising agent. The method of application and removal of the chemicals is the same as in the case of Sodium Hypochlorite. However the mixing of the chemicals has to be different.

Sodium Tripolyphosphate has to be carefully mixed before application. This is because STP, if not mixed properly

and clog well screen almost permanently. A solution is prepared in a plastic bucket of 15 liters capacity, with warm water and is stirred well. The solution is then sieved through a plastic mesh of 150 mesh size. This is an absolute precondition to the application of Sodium Tripolyphosphate.

The calculated quantities of Sodium Hypochlorite and Sodium Carbonate are mixed independently in separate buckets, thoroughly by hand, but using rubber gloves.

The solutions of the 3 reagents are then mixed together and then applied to the well, following Steps 2 to 4 outlined above and removed as mentioned in Steps 5 & 6.