



WATER GRID



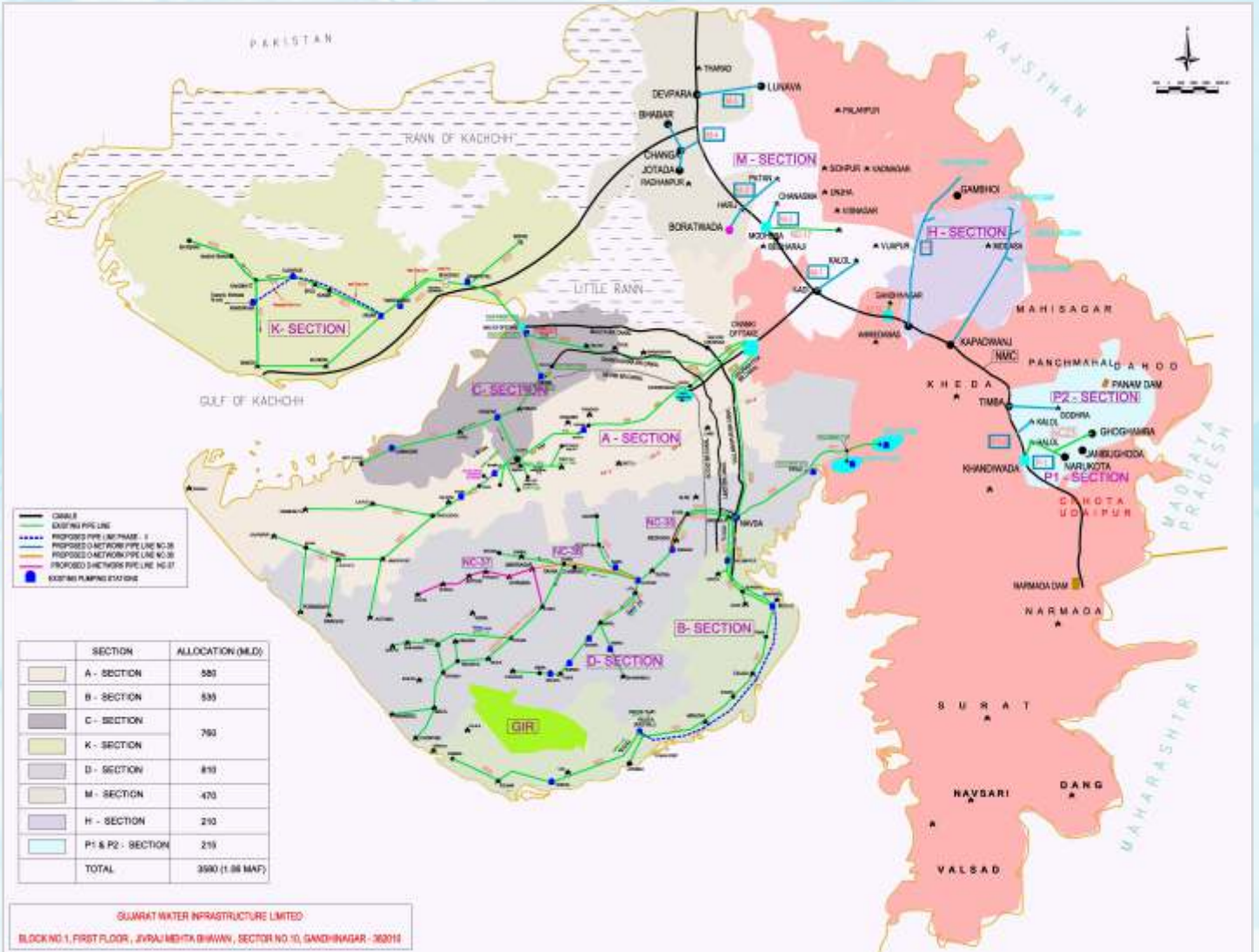
NC 26

DHANKI TO NAVDA

543mld Bulk Water Transport with VFD driven Submerged CF pumps helps overcome complex pipeline head variation
(from 69m to 16m head variation)
at Ultra Low Power Specific Consumption

India's First Comprehensive Water Supply Grid





The Water Supply Department of the Government of Gujarat has developed a state-wide water supply grid to manage the problem of water scarcity in the state.

This grid was developed and extended over a decade to augment the local resources and to quench the thirst for water in the areas facing water scarcity.

Gujarat faces scarcity of water in certain regions that are arid and receive less rainfall. Almost 70% of Gujarat's fresh water resources are located only in 30% of its geographical area restricted to South Gujarat.

Frequent droughts accentuate this scarcity of water in the state. The State had thus undertaken a sustainable measure to combat this problem by developing a 'State-wide Water Supply Grid'.

This water supply grid consists of water supply schemes based in Narmada and other Regional water supply schemes.

With this grid, the government is able to supply water to far-off places through an inter-basin bulk water transfer.

This is an enormous project, with a spread of 1,20,769 km to serve 75% of Gujarat's population.

It has become the lifeline for drinking water supply to Saurashtra, as the revolutionary water supply grid remained the only perennial source of drinking water supply in the region.





- **Project** : Swarnim Gujarat Project - NC 26 - Dhanki Navda
- **Pumpset** : ARS 4058 MM 940,11 Nos. (8W+3S)
- **Flow** : 2880 m³/hr
- **Head** : 69 meter
- **Voltage** : 6600V
- **Motor Capacity** : 700kW
- **Length of Pipeline** : 43.60km
- **Diameter of Pipes** : 2300mm Dia, 14mm Thick (Rising main)
- **Type of Pipe** : Mild Steel Fe 410 Grade with inside coating of food grade epoxy and 3LPE coating outside of 12meter of length.



- NC 26 is a very unique scheme where the Absolute Static Head (from Starting Point to End Point of the Scheme) is negative!
- Even after addition of Static Lift (from Sump Bottom to the Electrical & Manifold Deck), the Total Static Component of head is just 24% of the Rated Pump's head!
- This was an extremely challenging design for any pump manufacturer, as the Tender itself called for Unthrottled pump operation even if System Flow varies from 100% (leading to 69m head on pumps) to just 30% (leading to just 16.2m head on the pumps)!
- Aqua has helped engineer the system despite complex topographical pipeline head variation & tender terms challenges.
- This may arguably be one of the Largest Bulk Water transfer schemes relying on HT VFDs (700kW 6.6kV)

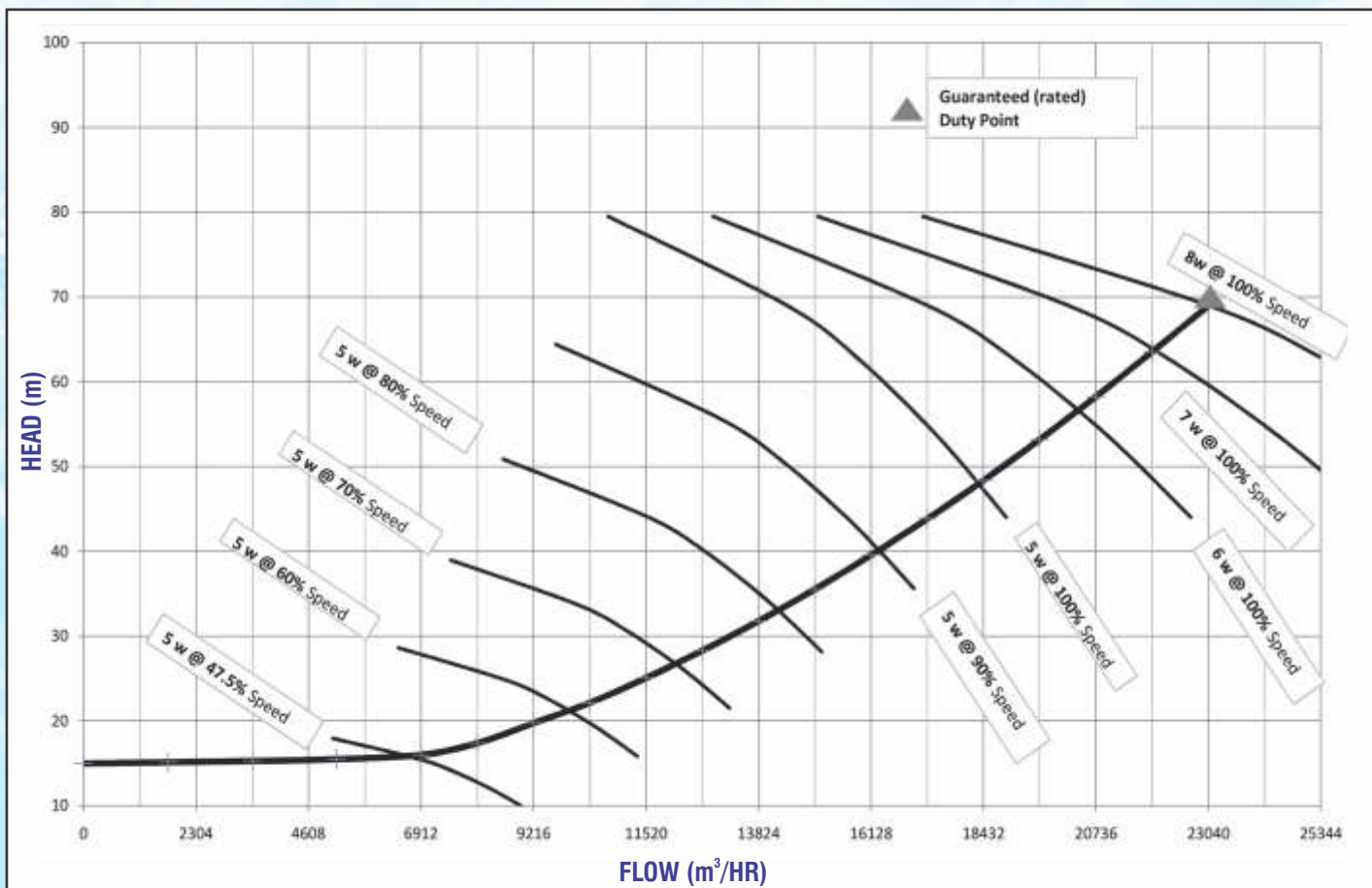


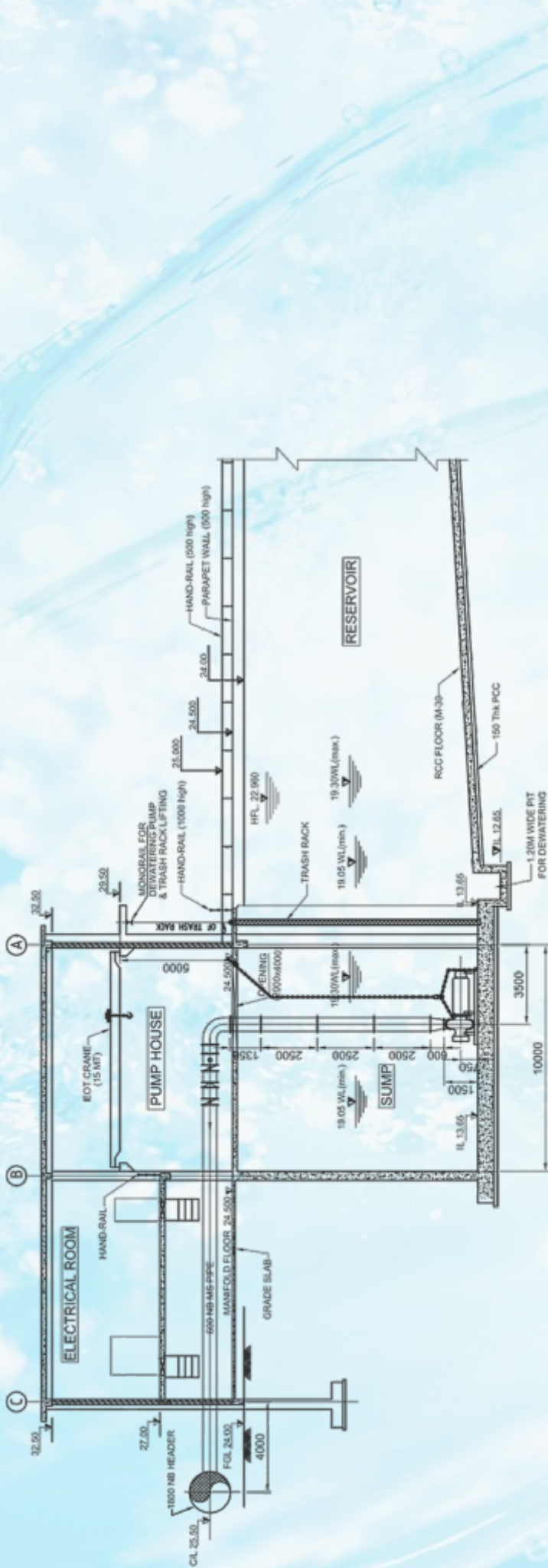
The pumping system has been designed delivering discharge of 23040m³/hr (Total 553MLD) at the head of 69 Meters. To achieve this Discharge, 11 nos (8W + 3S) “Aqua” make Submerged CF pump sets (each rated 2880m³/hr x 69m head; 700kW motor rating) have been provided out of which 5nos are equipped with 6.6kV VFD while balance are driven by 6.6kV FCMA Soft Starters.

The operational sequence of the pumping m/c is as below:

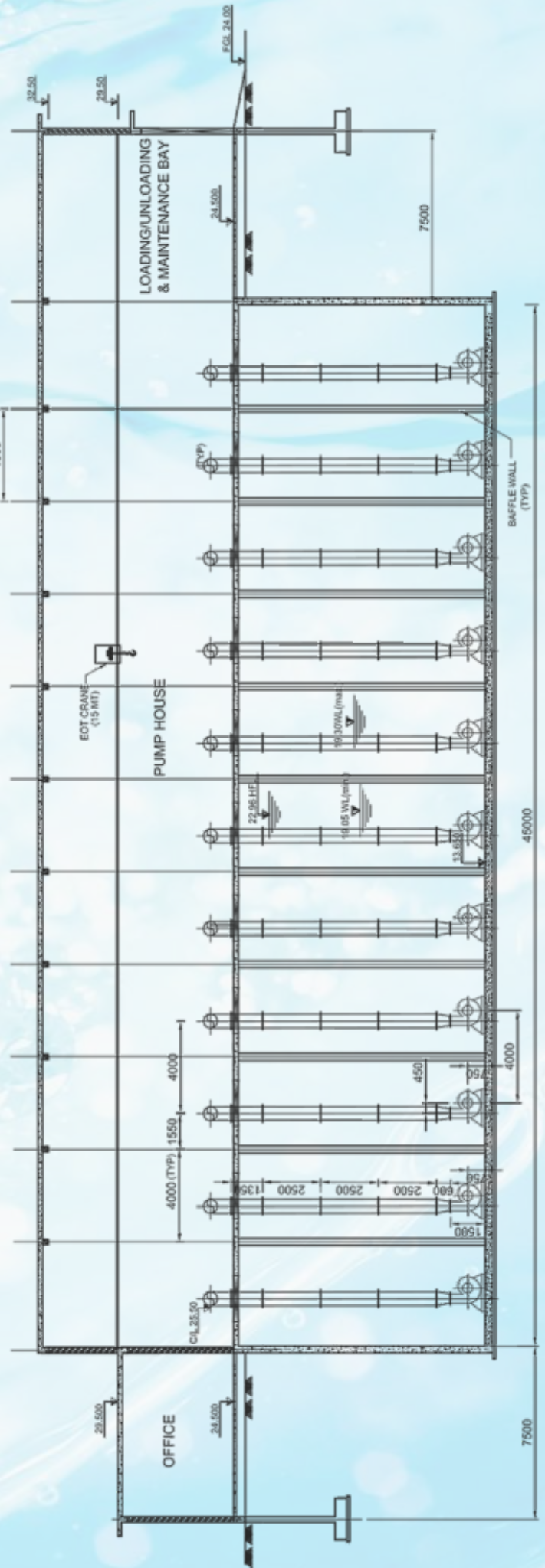
- The pumps 1 to 5 can be started with VFD to reach from 30% to 79% of the rated flow.
- Thereafter, from 79% to 100% system flow, additional 3nos of pumps (with FCMA soft starters) can be started one by one.
- If required, the 3nos pumps out of 5nos with VFD already in operation may be switched over to FCMA soft starters maintaining the 100% flow.
- This system can deliver water in steps of 528mld (@7W pumps), 490mld(@6W pumps) & 439mld (@5W pumps) without throttling-the VFDs are not used till this stage.

AQUA SUBMERGED CENTRIFUGAL RAW WATER PUMPSET			
NC_26 : UnThrottled System Operation Curve (from 30 to 100% flow variation)			
Project	GWIL Dhanki Navda (NC 26)		
Client	M/s. GWIL		
Consultant	M/s. Multimantech		
Contractor	M/s. SMPL		
Pump Model	ARS 4058 M M 940	Delivery Size	400 mm
Motor Rating	700kW	Frequency Range	50 Hz to 20 Hz





SECTION A-A



SECTION D-D



VFD Compliant Submerged Centrifuged Pumpsets The use of VFDs for Energy Savings, Fluctuating Suction Water levels & Smoother System Flow management is increasing.

As compared to Air Cooled TEFC / TETV / CACA motors; Self Water Cooled Submerged motors are more suitable for VFD applications as; being immersed under water, they:

- 1) dissipate the Built-up Capacitive Charge &/or Circulating Currents into water (thereby not endangering Operators)
- 2) dissipate their motor Heat into surrounding water with same effectiveness Irrespective of motor speed (unlike Air cooled motors whose Blower's Air Output – Motor Cooling effectiveness reduces with reduced motor speed)

Critical Speed Vibration & Structural Resonance :

VT pumps have Long Slender shafts (with multiple couplings, bearings, spiders) whose Critical speed often lies below the Rated Operating speed & hence the risk of the severe Vibration & Structural Resonance (when its speed is varied by a VFD) due to encountering a lateral Critical Speed; increases drastically often forcing shutdown.

However, having a MonoBlock, Short & Stubby shaft; the Critical Speed of SubCF pumpsets is much Higher than the Maximum Operating speed & hence they can be run safely without vibrations & structural resonance.

Rotor Dynamics

The risk of the rotating element encountering a lateral critical speed increases with the application of a VSD. Lateral critical speeds occur when running speed excitation coincides with one of the rotor's lateral natural frequencies. The resulting rotor vibration may be acceptable or excessive, depending on the modal damping associated with the corresponding mode. Additionally, drive-included torque harmonics may cause resonance conditions with torsional rotor dynamic modes. However, such conditions are usually correctible or preventable.

Variable speed vertical pumps are more likely than horizontal machines to exhibit operational zones of excessive vibratin. This is because such pumps' lower natural frequencies are more likely to coincide with running speed. Small, vertical close-coupled and multistage pumps normally do not present this type of problem.

Source: Variable Speed Pumping: A Guide to Successful Applications (Hydraulic Institute Standards, Euro Pump, U.S. Dept of Energy)



Low Maintenance due to Advanced design.

Long Maintenance Free Bearing Life Heavy duty, Anti Friction, Thrust Ball cum Radial Bearings are designed for **L10H life** in excess of **1,00,000 hours**.

Factory filled with extremely Long Life, Synthetic Grease obviating the need of subsequent ReGreasing for atleast **50,000hours &/or 5 years**.

As the Bearings, Mechanical Seals, Impeller Securing Keys, etc are **Bi-directional**; there are no major mechanical problems arising out of accidental Reverse Rotation & hence **Non Reverse Ratchet** is not required eliminating its huge maintenance as well



Gujarat Water Infrastructure Ltd.

(A Govt. of Gujarat Undertaking)

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Date: 15/05/2016


To Whom So Ever It May Concern

This is to certify that since 16th May, 2015, we are using "Aqua" make Submerged Centrifugal (SCF) Pumpsets of following ratings:

Model	:	ARS 4058 M M 940
Head	:	69 meter
Flow	:	2880 m ³ /hr
Pump Efficiency	:	88.74%
Motor Efficiency	:	96.40%
Rating	:	940 HP / 700 kW
Voltage	:	6600 V
Qty	:	11 No's. (8W + 3S)

This NC 26 Dhanki PS transports 500 - 545mld raw water as per demand to Navda Barwala through 2300mm cross country bulk line & is a vital lifeline of water supply to Bhavnagar, Amreli, Rajula, Gadhada, Chavand, Dhoraji, Junagadh etc.

In our experience, these Aqua make Submerged CF pumps are very easy to operate and require almost no maintenance. We recommend the use of Aqua make Submerged Centrifugal Pumpsets as an Equally Energy Efficient, Robust and a low maintenance alternative to the older technology coupled Pumpsets for bulk raw / clear water applications.


Sr. Manager (M)
GWIL, NC -26







સૌરાષ્ટ્ર-કચ્છના ૪૫૦૦ ગામડાઓ અને ૧૩૨ નગરોને પાણી પુરૂ પાડતુ વિશ્વનું સૌથી મોટું પંપીંગ સ્ટેશન ઢાંકી ખાતે રાજકોટના આગેવાનો અને કાર્યકર્તાઓને મુલાકાત કરાવી હતી અને સરકારની કામગીરીથી માહિતગાર કરાવતા પાણી પુરવઠા મંત્રીશ્રી વિજયભાઈ રૂપાણી



માન. મંત્રીશ્રી વિજયભાઈ રૂપાણી
વાહન વ્યવહાર, પાણી પુરવઠા,
શ્રમ અને રોજગાર

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