



Water
Grid

Puttamgandi

Since **2017**, India's **Largest**
Drinking Water Lifting Station

(drawing water from approx. 1.3km+ & 28m+ Deep Inside

Nagarjuna Sagar Dam); relies on

Aqua's Submerged pumps to feed upto 1793 MLD
(20.75 cumecs/ 732 cusecs) Krishna waters to Hyderabad.

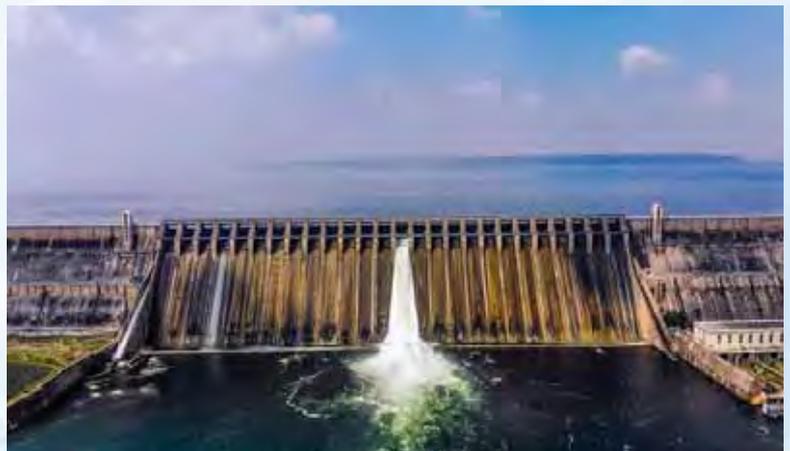


*Hydrabad Metropolitan
Water Supply & Sewerage Board
Nagarjuna Krishna WSS*



The Source of Water : Nagarjuna Sagar

The **Nagarjuna Sagar Dam** is located on the Krishna River, spanning the border between Nalgonda & Palnadu districts in erstwhile Andhra Pradesh state. The dam is a masonry structure, considered the **World's Largest of its kind**. Constructed between **1955** and 1967, it stands **125 meters tall** & spans over 1.5 - 1.6 km in length. It has 26 gates, each measuring 14m in height and 13m in width & the Reservoir has a storage capacity of over 11 trillion cubic meters.



The Beneficiaries : Hyderabad & Secunderabad

Hyderabad, occupies 650 km² (250 sq mi) on the Deccan Plateau along the banks of the Musi River; located in Telangana, India, is a major metropolitan city known for its rich history, diverse culture, and thriving technology industry.

It's the **fourth most populous city** and the sixth most populous urban agglomeration in India.

The city is a popular tourist destination, with historical landmarks like Charminar and Golconda Fort. It's also a major center for the technology industry, with numerous upscale restaurants and shops. Hyderabad is a significant technology center, attracting numerous tech companies.



With an output of **US \$ 95 billion**, Hyderabad has the **sixth-largest urban economy** in India.

Hyderabad's main sources of drinking water **were** the Musi River's reservoirs, Himayat Sagar & Osman Sagar & more recently the Godavari River via the Manjira River.

However the growth of Hyderabad & Secunderabad mean that they are getting **more & more reliant on River Krishna**.

AMR (Alimineti Madhava Reddy) Lift Irrigation Canal draws water from the Nagarjuna Sagar reservoir. This lift scheme with a Pump House located near Puttamgandi village on the Left bank of Krishna river supplies nearly 20 TMC water for the drinking water needs to Hyderabad & Secunderabad.

Built during the UnDivided AP State, Water Levels were well maintained throughout the year to sustain gravity flow into AMR Canal.

As a Practice of “*Abundance of Precaution*”, in case of Severe Drought/ Scarcity; a **734 MLD PS** based on **Vertical Turbine** pumps was set up in **2004-05**.

However, this VT based pumping station was rarely used until 2014.

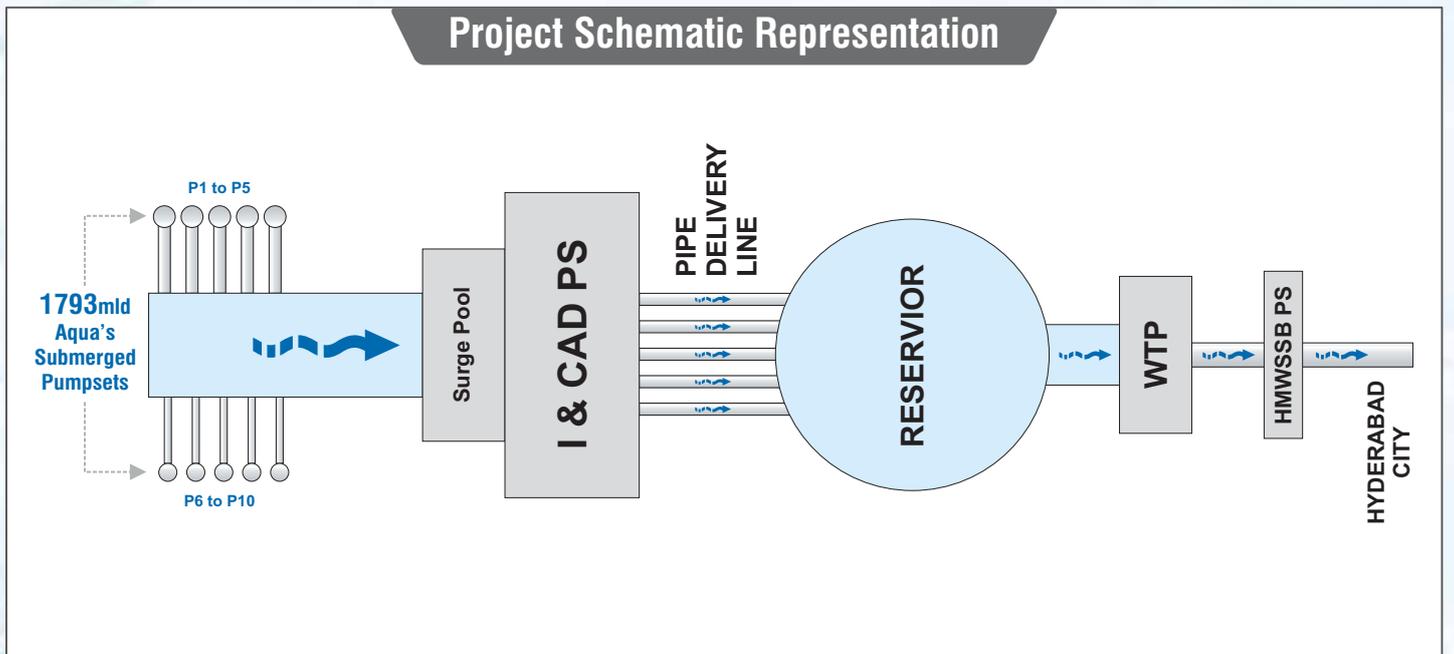
The Project



The Project

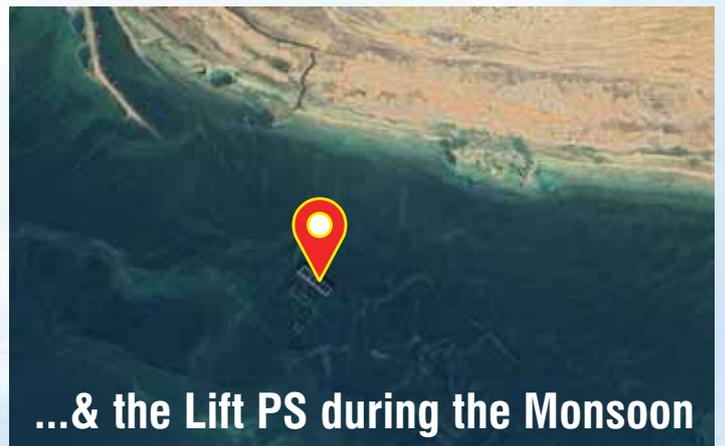


Project Schematic Representation



The Project... The Challenge

The Entire Pumping station Submerges upto approx 1.3km+ inside & 28m+ Deep Under under water...!



2014 to 2018 : The Pivotal Years

State Partition, Increasing Water Demand & need to Switch on the VT based PS :

The erstwhile Andhra Pradesh was **divided** in **2014** into Telangana & AP. The newly formed States were often at logger heads & demanded their share of water immediately after Monsoon – hence **Water Levels in Nagarjuna Sagar started frequently dipping by upto 92'** even in years without a drought..!



In most years, barely a few months after reaching full storage capacity; water

levels in the Nagarjunasagar reservoir decline dramatically & hover near the dead storage levels approaching the Minimum Drawdown Level (MDDL) of 510' - **HMWSSB was forced to Switch on Lift Pump water to AMR Canal.**

Also due to fast growth of Hyderabad & Secunderabad cities, the **demand increased from 734mld in 2004 to 1468mld in 2017 (and 1793mld in 2025).**

This caused Frequent hue & cry in the twin cities.



The Unforeseen Problem

The erstwhile **734 mld Vertical Turbine based Steel PS was put into action** in 2014. However, Vertical Turbine pumpsets, which are/were :

- Meant for Clear/ Screened Water – both of which were impossible to maintain; leading to frequent Bearing Failures;
- Suspended on Pump Floor :
 - hence with a Steel Pump Floor, it's Natural Frequency & Structural Frequency Resonated badly leading to frequent Shaft Bearing Breakages
 - caused Sagging of Pump Floor
- Fitted with Air Cooled, Non Flood Proof IP55 Motors which are :
 - Vulnerable to Humidity, Dust & Heat of Open to Sky installations
 - Prone to outright Failure in case of Flash Floods/ Rains

Hence, even Lifting the Rated 734mld with VT Pumps was difficult!

On top of it, the demand shot up from 734mld to 1468mld & **something had to be done on War Footing (just 1month) & in a Fail Safe way...!**

Aqua's Solution

The Telangana State Government entrusted m/s **HMWSSB** who in turn **entrusted** m/s **Aqua** Machineries Pvt. Ltd. (in J.V. with Local E&M Contractors m/s **Power Solutions**) to take up these **Unprecedented Challenges of Retro Fitting a 1468 mld** Lifting PS :

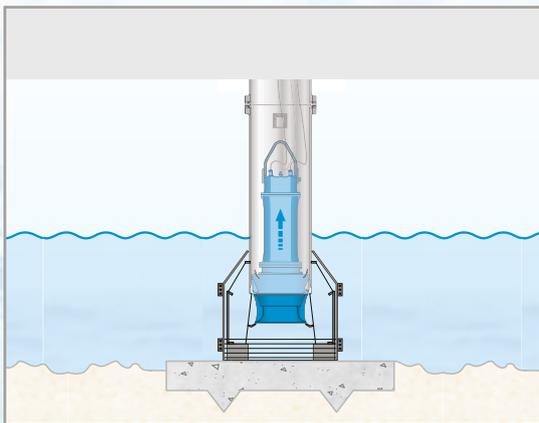
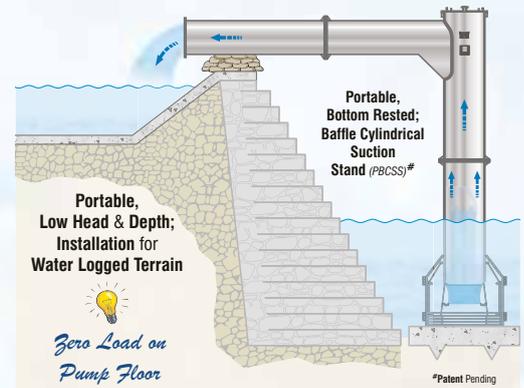


- Within **just 1 month**;
- Install **Double Capacity** pumps within the Same 12-14 year Old, **Slender, Flimsy & Corroded** Steel Pumping Structure (which was insufficient for 1/2 capacity VT pumps);
- The “Sump” was designed for Source/ Suction WL of 500' - but now it was consistently dropping further below to just 495' – i.e. Aqua's pumps would have **to work with 5' Lower Minimum Submergence & yet Deliver Twice the Flow..!**

“When the GONG gets Tough – the TONG get Going”

Drawing upon it's Immensely Capable Research & Development; Aqua Innovated:

- A Unique **Portable Bottom Rested Baffle Cylindrical Suction Stand** which not only Reduces – but rather Eliminates the Pump, Motor, Pipe, Water, etc Thrusts onto the “Pump Floor”.
- The Double Capacity Aqua pumpsets (with 1300mm Column Pipe diameter) are **Free Bottom Rested** on existing bottom thereby not imposing any Thrusts onto the fragile MS pump room structure.



- Due to the Special Site Need (to go even 5' below the Original Suction Water Level); the pumpsets were in-stalled **without any Bottom Suction Strainers** - this coupled with **Absence of Trash Rack** at Sump inlet & parallelly **ongoing Canal Dredging** would expose the pumpsets to huge amount of Silt & even sucking up MS Corrugated Sheets, fishing nets, etc.

Unique PBCSS allows Safe & Free Bottom Resting of Massive pumps

- Hence, as opposed to Bolt On Impeller/Propeller Vanes/ Blades (used by Vertical Turbine pumps); Aqua developed a Solid, **Single Piece Cast Propeller/ Impeller** which can **Handle Solids without Twisting / Cracking**.



Aqua's Submerged Pumpsets Details

Model	Capacity (m ³ hrEach)	Quantity (Nos.)
ATB._V_Tu_1st_Bo._1371_M._LLL.._0600_00415_NJ.	12,240	5
ANS..HPS_1s_VoG4052D.50nFS_6PA120hpN_ER_4_NJ.	2,300	1
ANS..HPS_1s_VoG4052TQ42nFN_6PA175hpN_ER_4_NJ.	2,800	4

Site Installation



NonClog Performance



NonClog Performance

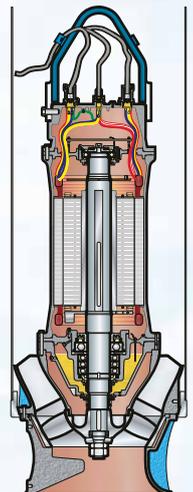


Design : Pumpset



Submerged Tubular Column Pumpsets

*Portable & Versatile...
Simple & Space Savings
Pumping Stations
Energy Saving...
Ultra Low Maintenance...*



(ii) Submerged vertical centrifugal pump rested with auto-coupling

Figure 5.9 (a) illustrates salient features of the pump.

- Merits of the submerged vertical centrifugal pump
 - Regular pump house can be dispensed with, or smaller pump house is required. However, panel room and lifting equipment are required.
 - Width of pump well can be reduced as working clearance between motors for heat dissipation is not required being under water.
 - No need for elaborate ventilation as motor is under submerged condition.
 - Noise level is negligible.
- Demerit
 - A common shaft for pump and motor making entire set out of service even if either pump or motor fail.
- The pumps are suitable for following installations:
 - I. Intake
 - II. Sump (raw water/clear water)
 - III. Low lying/waterlogged areas at the pumping station prone to floods.

Design : Pumpset



A Strong, Mono Shaft for Fail Safe Operation

Single, Robust & oversized Shaft is Common between the motor & pump. It is (upto 1550kW 4P, 1200kW 6P, 900kW 8P) made from Stainless Steel & designed without any Sleeves (below the Mechanical Seals) thereby reducing maintenance problems & eliminating need of Costly Spare Parts.



Shaft Sealing is by means of **Two**, Independent, high quality Bi-Directional; **Mechanical Seals** permitting reverse running due to accidental back-flow. The Primary seal is always of **Silicon Carbide** faces to withstand Erosion incase of increased silt content in water.



Seals are rated for at least 16 bar pressure capability for ~~107~~ life in excess of 50,000 hours &/or 10 years.

Submerged pumps are Inherently Resistant to Silty Raw Water

Conventional VT Pumpset

(utilizes Water Lubricated Pump Bearings & Leakage Prone Rope Glands)



Rope Packing in Cast Iron Gland

Pump Bearings are **exposed** to **Silt Water** leading to their **Erosion** & possible **Premature Failures**.

Submerged Pumpset

(utilizes Two, Zero Leakage Mechanical Seals)



Mechanical Seal in Stainless Steel Gland

Bearings are located deep inside the motor & are **Totally Sealed** by **Two Mechanical Seals** thereby are **totally Protected** from Water, Silt, Rust & Galling

Merits of the submerged turbine pump:

- No transmission/line shafting, hence eliminating small power loss and maintenance of line shaft bearings.
- Due to bearings lubricated by grease and not in contact with pumped water, the same pump is suitable for raw water and clear water application.
- Design of structure is economical as vibration level transmitted to structure is negligible.
- Noise level is negligible being submerged.
- No need of elaborate ventilation at operation floor, as the motor which is the major source for heat emission is submerged.
- Spacing between pump/bell mouth centres can be reduced as motor is submerged and therefore, working clearance is restricted to spacing requirement from aspect of vortex phenomenon.

Design : Pumpset

Superb Bearing Life
thanks to Heavy Duty Designs (upto quadruplex arrangements are offered)



All Thrusts are absorbed by **Grease Lubricated, Anti Friction Bearings** located deep inside the motor & inherently **isolated from the pumped media** - this makes the **bearings Fail Proof** even in case of increased Silt / Abrasive levels in Pumped Liquid.



Anti Drip, Fully Synthetic; Super Premium Synthetic Grease ensures a minimum Regreasing Interval (710%) of 75,000h (for Pumpsets rated upto 650kW) & 45,000h (for larger kW)

Intelligent InBuilt Monitoring

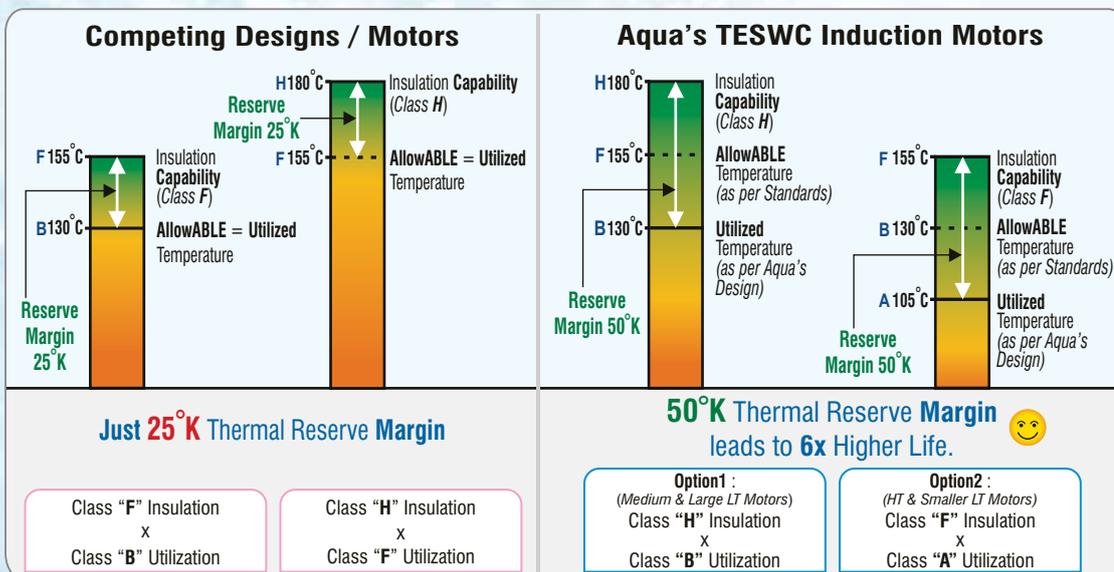
Easy Monitoring (& Remote Control[#]) of your Pumpset's Health.



- **PSLD** detects Pressurized Water Leakage from Mechanical Seals.
- **CCWLD** detects Accidental Water Leakage from Cable Sheath's Cuts &/or Nicks into the Motor.
- **SBWLD** detect Accidental Water Leakage in to Motor's Stator Chamber.
- **BTDs** in the form of Bi-metallic Switches (for All Pumpsets) & **RTD's** (PT100 - 3 Wire Simplex type - from Size > 150kW) to Monitor Bearing Temperature (without any Additional Cost) [#].
- **WTDs** in the form of Bi-metallic Switches (for All Pumpsets) & **RTD's** (PT100 - 3 Wire Simplex type - 1 per each Phase - from Size > 150kW) to Monitor Winding Temperature (without any Additional Cost) [#].

[#]requires additional communication hardware

Design : MOTOR END



Aqua's Motors are Rated for Operation in "Open to Sky" & 55°C Ambient

Concept Benefits



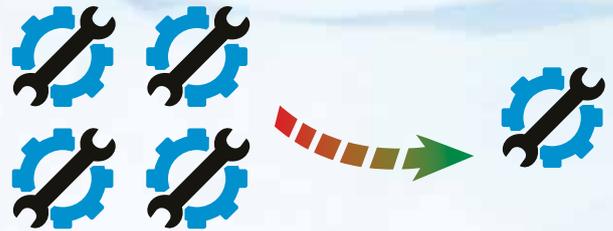
Saves (upto 40%) Land Requirement*



Saves (upto 33%) Capital Cost of Entire Pumping Station*



Saves (upto 66%) O&M Staff*



Saves (upto 75%) Spare Parts & Consumables*



Low Energy Cost : Due to Elimination of Ancillary & Auxiliaries; **Wire to Water Power Consumption** of Submerged Tubular Column Pump based Pumping Station is **slightly Lower** (compared to Conventional Bare Shaft Pump - Motor Set based Pumping Stations).*



Requires No Special Pre – Post / Ancillary-Auxillary Operations; like Operating & Maintaining the Forced Water Lubrication systems operation, No damage due to Flood or Rains.



No need for Frequent Periodic....



Shafts/Sleeves &/or Coupling



Gland Packing



Oil &/or Grease



Minimal Noise, Vibration & Heat Emission; due to **elimination** of Auxiliary & Ancillary systems (like Forced Water Lubrication, Thrust Bearing Cooling system, Motor Hear Exchanger).



Low Life Cycle Costs (LCC)*

- Minimal Station Superstructure
- Simple Pipe Work
- Simple Foundation - conducive for Water Logged Terrain

- Quick Connection & Disconnection of Pumpset.
- Inherently Flood Proof



Water Grid

Performance Certificate

Since 2017,

India's Largest

Drinking Water

Lifting Station

(drawing water from approx.

1.3km+ & 28m+ Deep Inside

Dam); relies on

Aqua's Submerged pumps

to Lift upto 1793 MLD

(20.75 cumecs/ 732)


HYDERABAD METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD
Lr.No.GM(E)Dn-XI/DB/HMWS&SB/2019-20/ 166 Dated: 17/03/2020

PERFORMANCE CERTIFICATE

Name work:-	Manufacture, supply, delivery, installation, testing & commissioning of submerged pump sets with total discharge of 600 cusecs with accessories and allied equipments for emergency pumping station at foreshore of Nagarjunasagar reservoir at Puttamgandi under EAM section, O&M Div.No.XI, Sahebnagar.
Agency:	M/s Power Solutions JV with Aqua Machineries Pvt Limited.
Experience .Lr No	Lr.No.GM(E)/DB/HMWS&SB/2017-18/1069 Dated:21/09/2017
Aggt No. & Date:-	11 /CGM(E)/Trans.Circle/T3/LS/Submersible Pump sets/ Puttamgandi/ 2017-2018 Date: 17-04-2017.

This is to certify that the M/s Power Solutions JV with Aqua Machineries Pvt Limited. has successfully completed & commissioned above work in which 5 No. of Vertical Canister Tube Installed Axial flow Propeller type Submerged Centrifugal Pump sets to draw Raw Water having Discharge Capacity (Q)12240 m³/hr @ 9m Head (H) @ 50 Hz each. Approx. 450 KW (600 HP), 415 V, 580 RPM (Syn.) with 82% minimum pump efficiency of make: M/s Aqua Machineries Pvt Limited were erected and commissioned satisfactorily and are working satisfactorily since last 3 seasons of emergency requirements at Puttamgandi under contingency arrangements of Krishna Drinking Water supply Project of HMWSSB. This certificate is issued for specific request of agency for participation of Tenders.


General Manager (Engg),
O&M Division XI,
HMWS& SB
17/3/2020



Rugged Pumps
Robust Solutions
Reliable People

AQUA MACHINERIES PVT. LTD.

Registered Office & Manufacturing Plant

Survey No.442/2, 504/1 & 2, Near Hari Darshan Estate, Ramol, Ahmedabad-382445 (Gujarat).

bd@aquapumps.com | marketing@aquapumps.com | www.aquapumps.com