



QDNT New Technology

QDNT Introduction

- The QDNT is a high-volume dewatering technology that dramatically improves solids control and waste management performance vs conventional centrifuge-based systems
- The QDNT is based on the proven IDEC' Mud Stripper technology but with greatly increased throughput and solids removal capacity
- It consists of a chemical flocculation/mixing module & a solids separator module
- Process capacity is up to +800 gpm depending on fluid type and characteristics and has been used successfully on over 200 wells to date



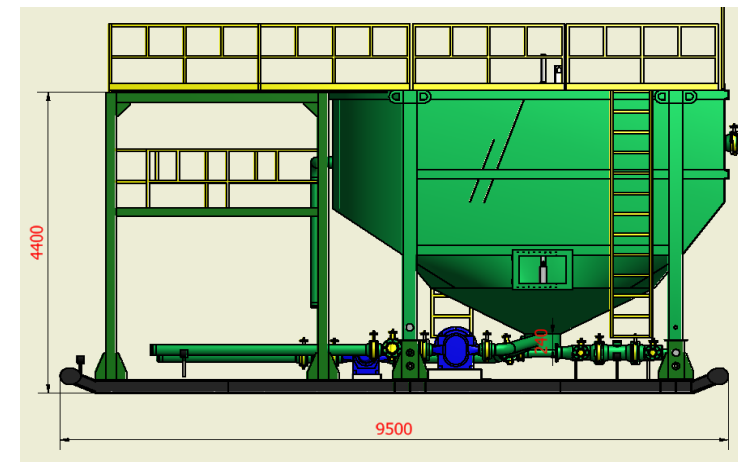
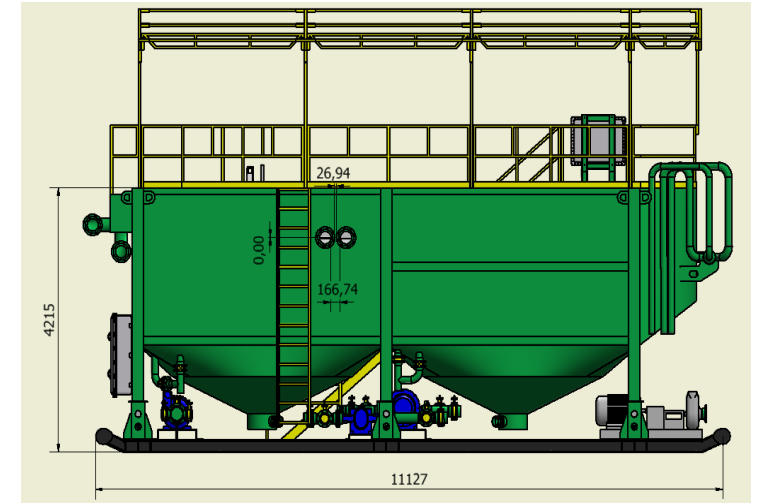


QDNT history, development and opportunities

- A pilot prototype was developed and tested in 2011 and then after some modifications a full-scale field unit was developed and introduced into the Ecuador drilling market
- 72 wells have been successfully drilled in Ecuador using the QDNT system
- The technology has potential for additional applications in other industries including dewatering of mining tailings, closed loop systems for mining exploration rigs, treatment of waste sludge in municipal potable water plants and produced water treatment

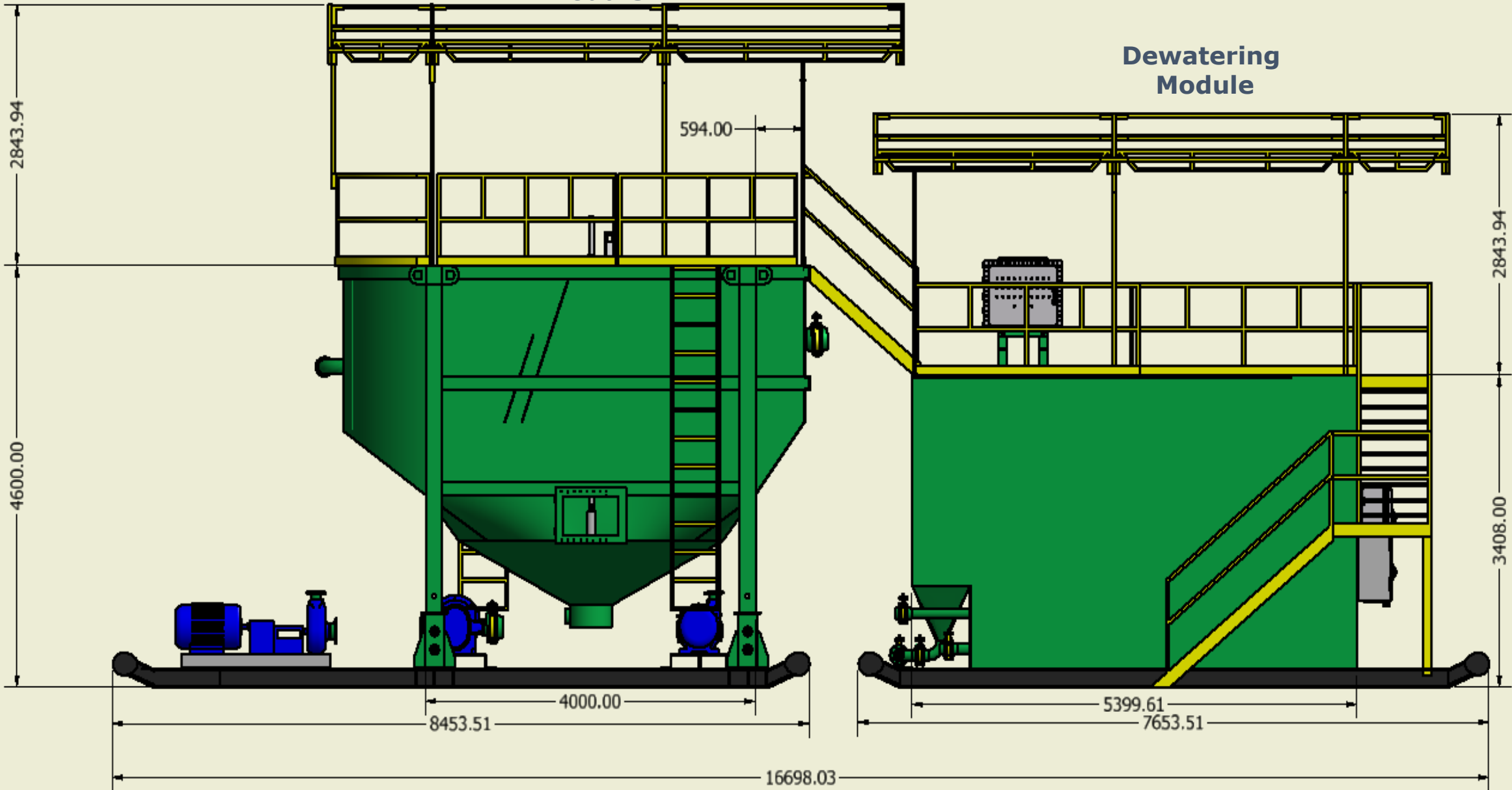
QDNT benefits include...

- Reduced drilling fluid & water costs
- Increased solids control efficiency vs conventional systems
- Cleaner drilling fluids and improved drilling performance (ROP)
- Reduced drilling location footprint & facilitates closed loop/pit-less drilling
- Improved environmental performance
- Reduced shaker screen consumption
- Reduction in rig site energy usage and energy costs vs conventional systems
- Reduced noise levels vs conventional equipment

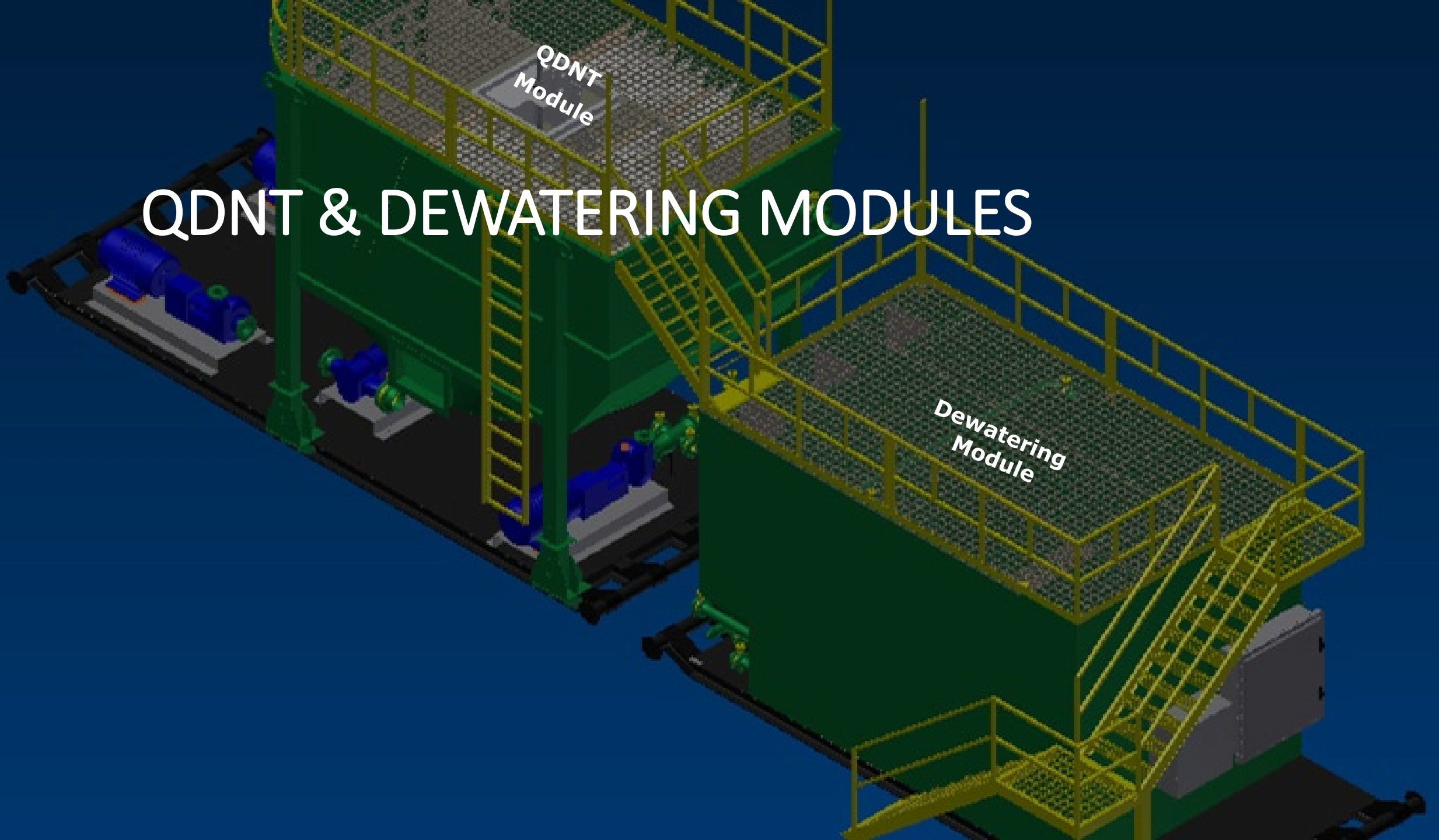


QDNT Module

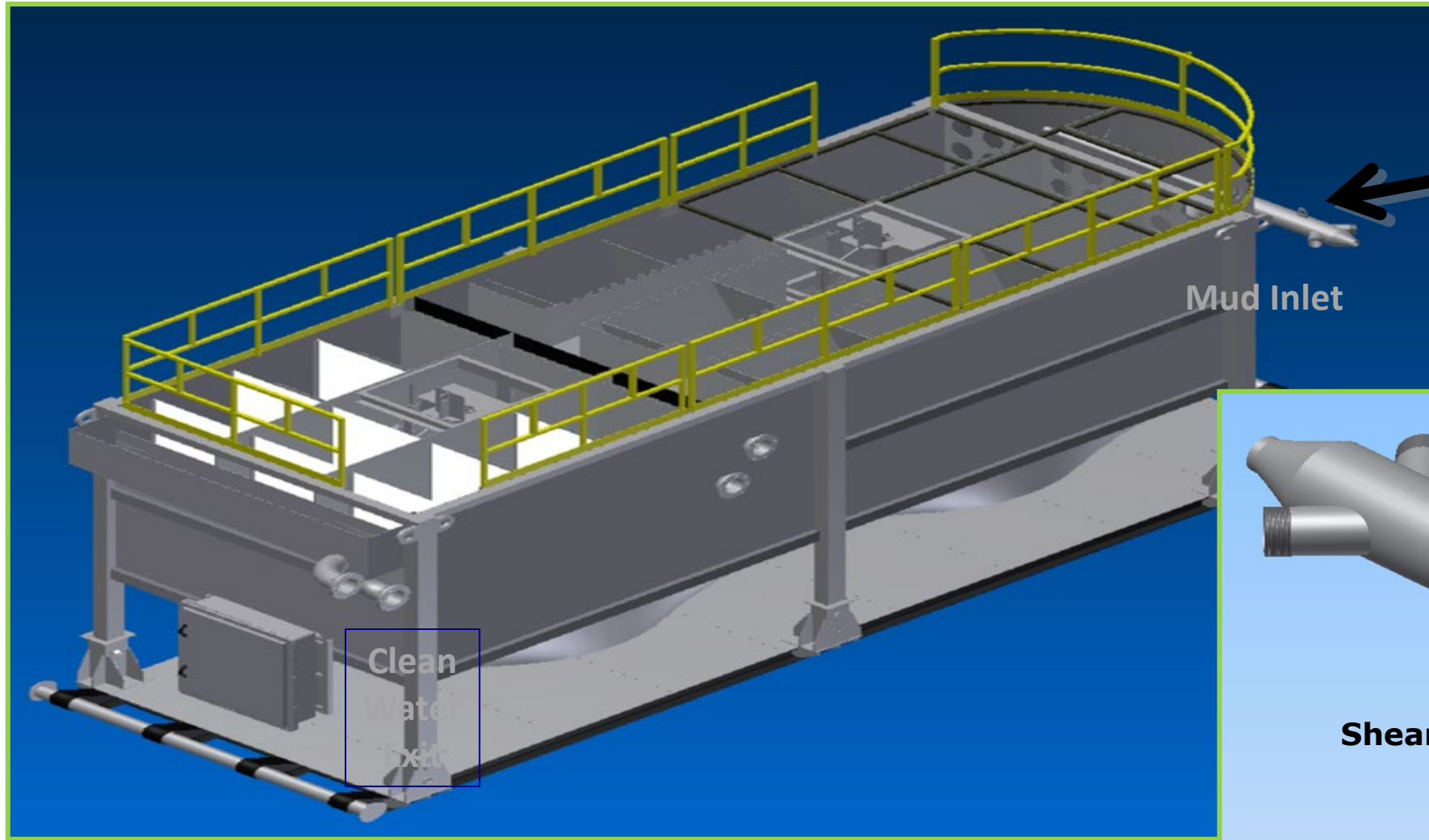
Dewatering Module



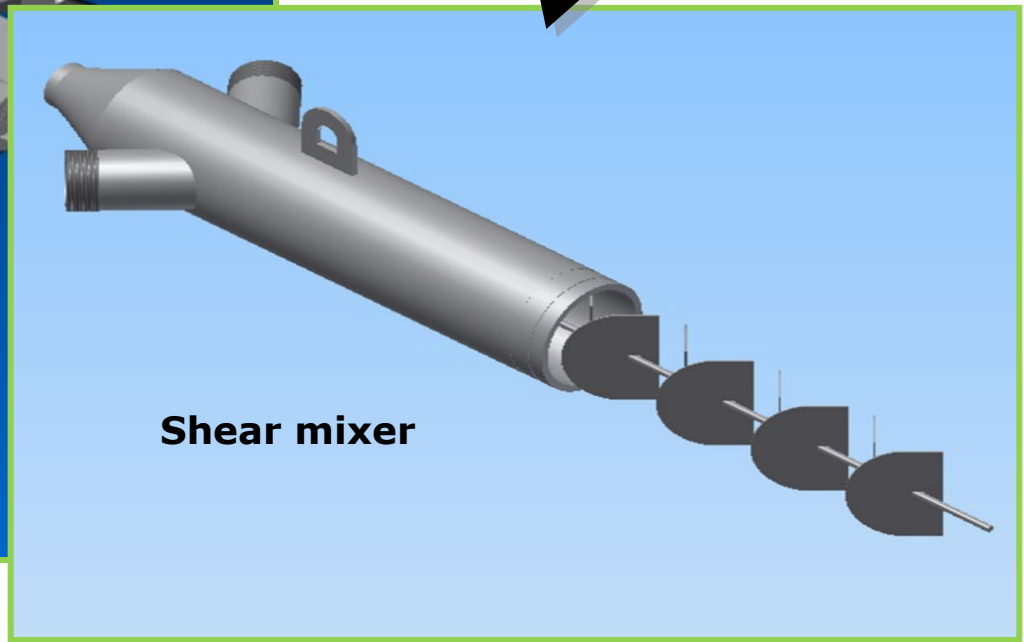
QDNT & DEWATERING MODULES



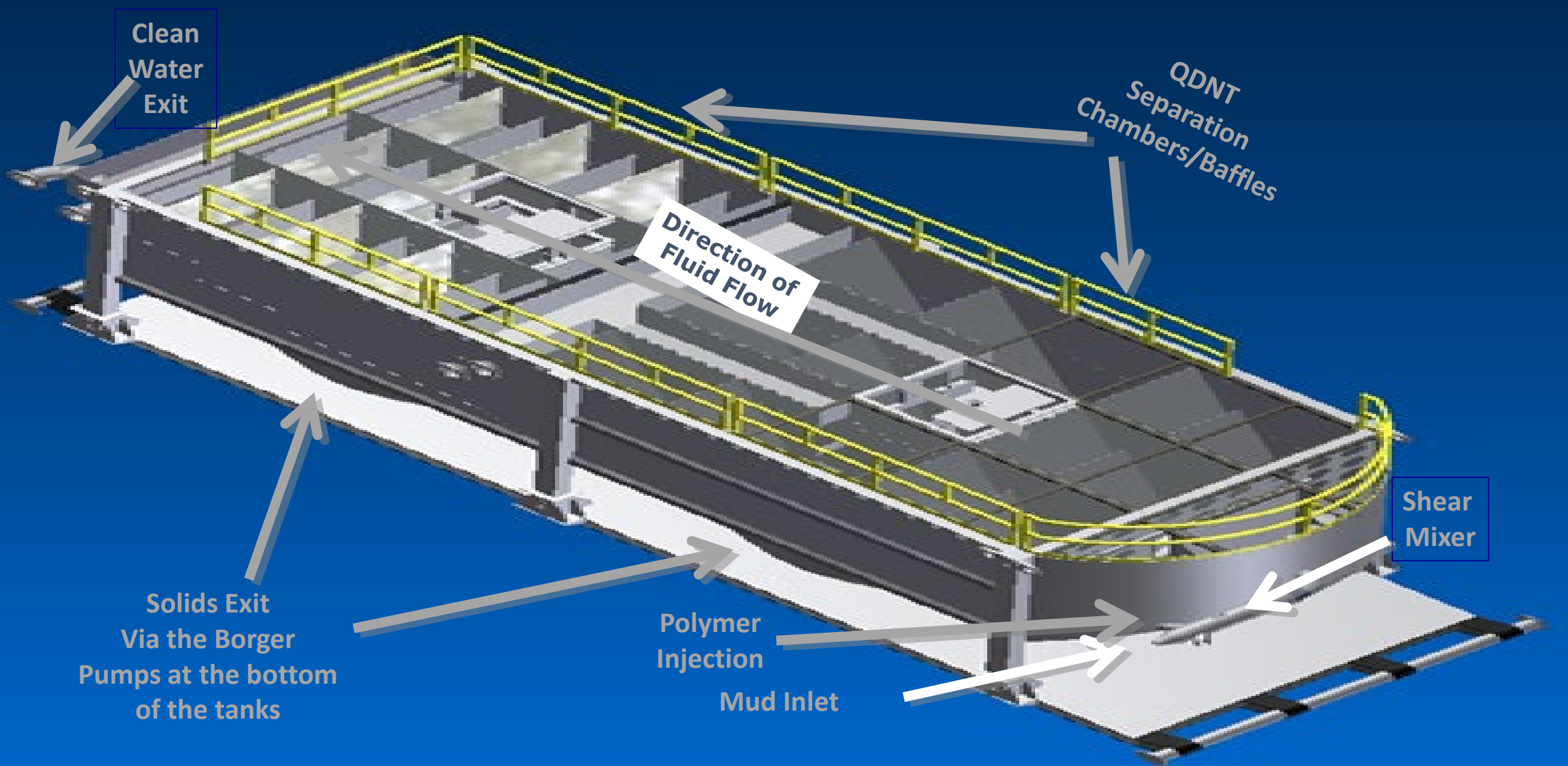
QDNT MODULE & SHEAR MIXER



Shear Mixer for mixing mud and polymer prior to entering QDNT module



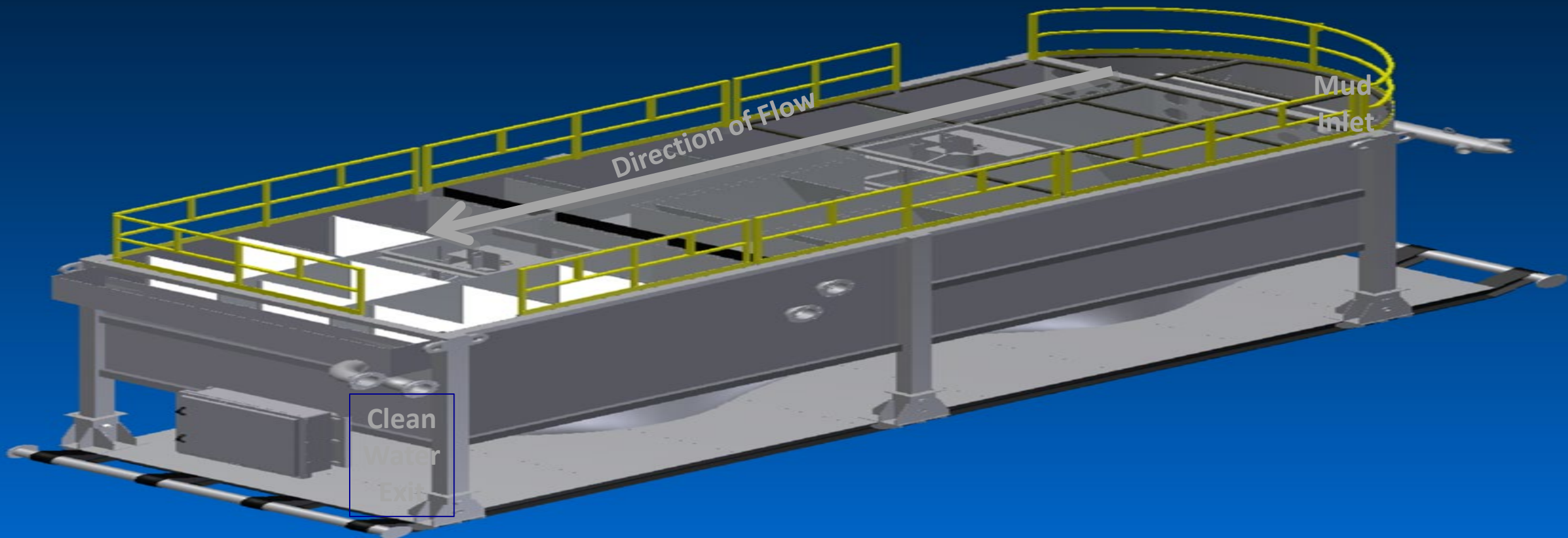
QDNT MODULE



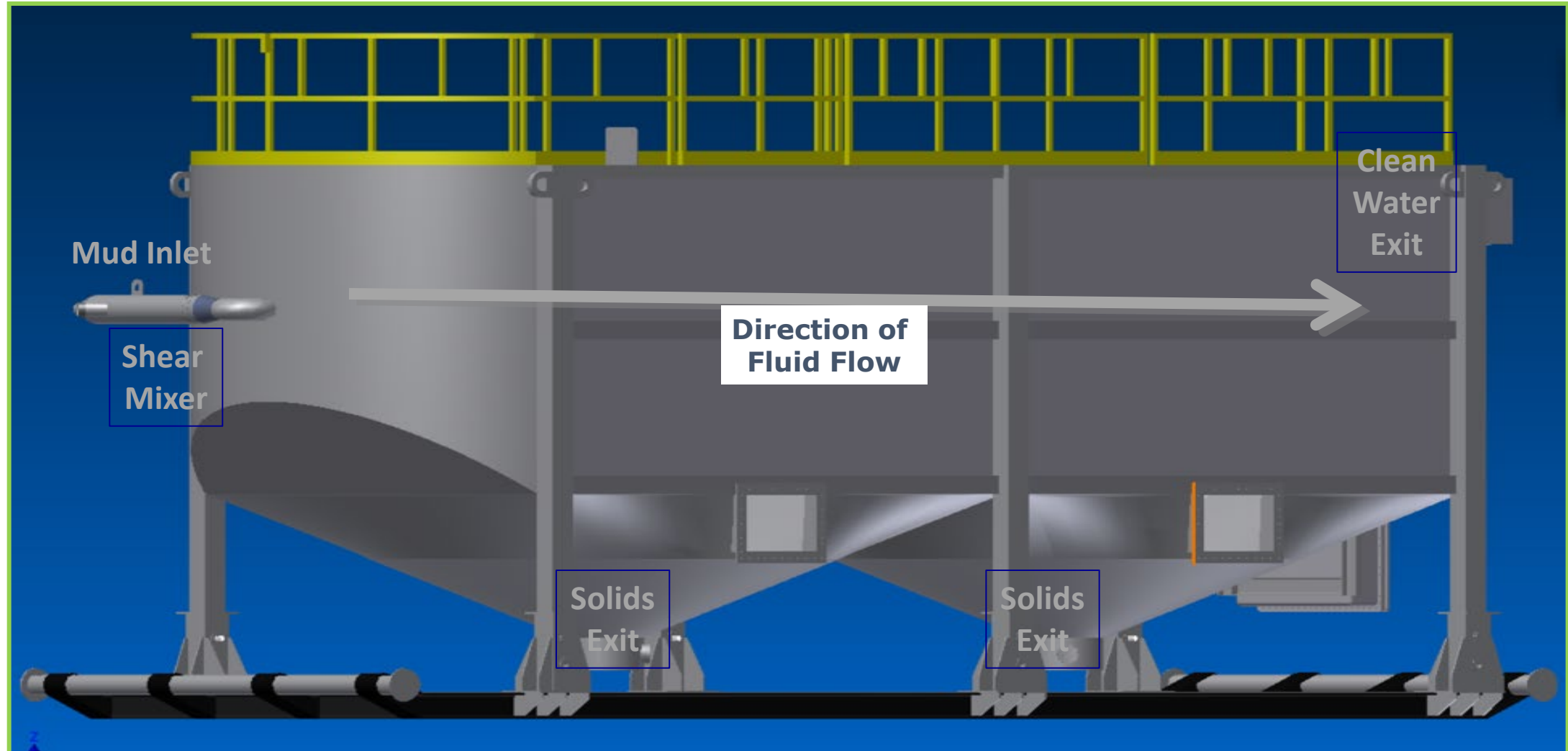
QDNT MODULE

The QDNT separation chambers are specially designed to create turbulent flow in the entry point to enhance mixing of the mud and polymer.

As the fluid passes through the other chambers laminar flow is created to enhance solids separation and provide clean water.

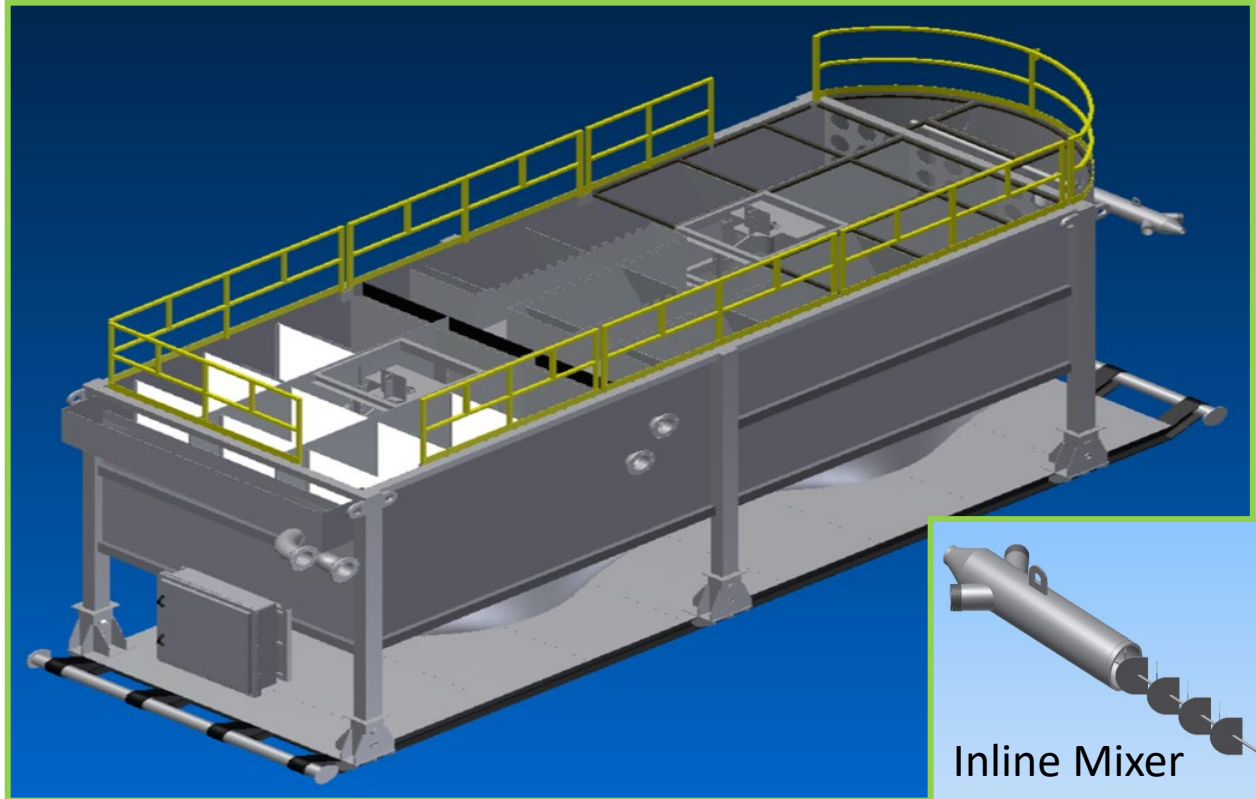


QDNT Module

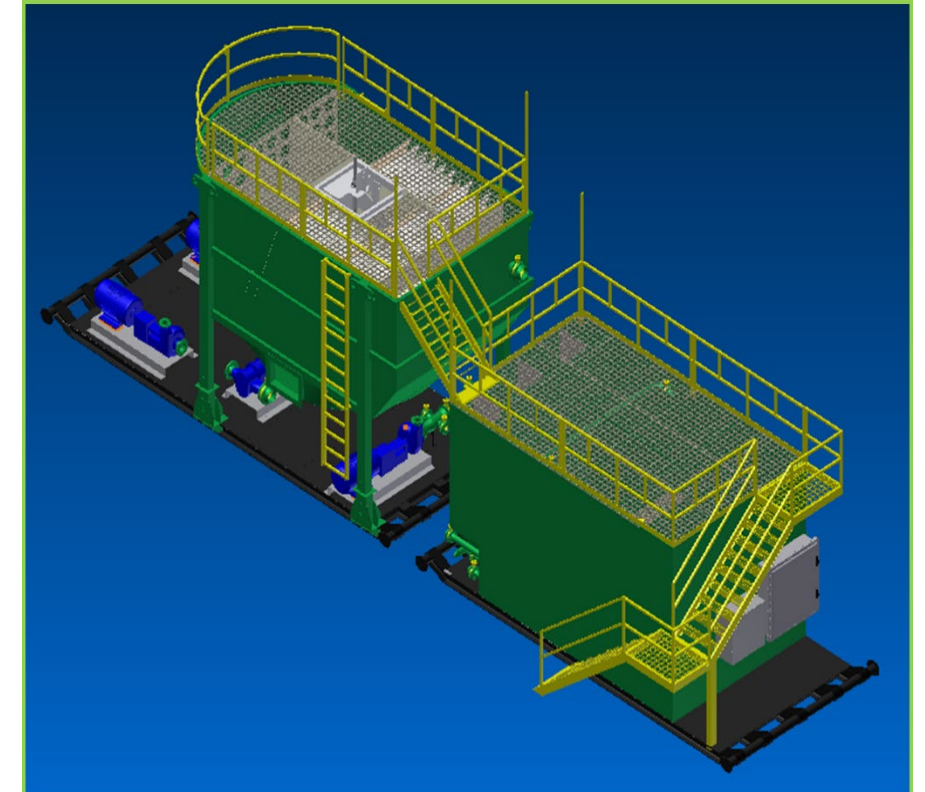


QDNT dewatering unit...

Flocculation Unit



Flocculation Unit
& Microfloc Separator/Chemical Mixer



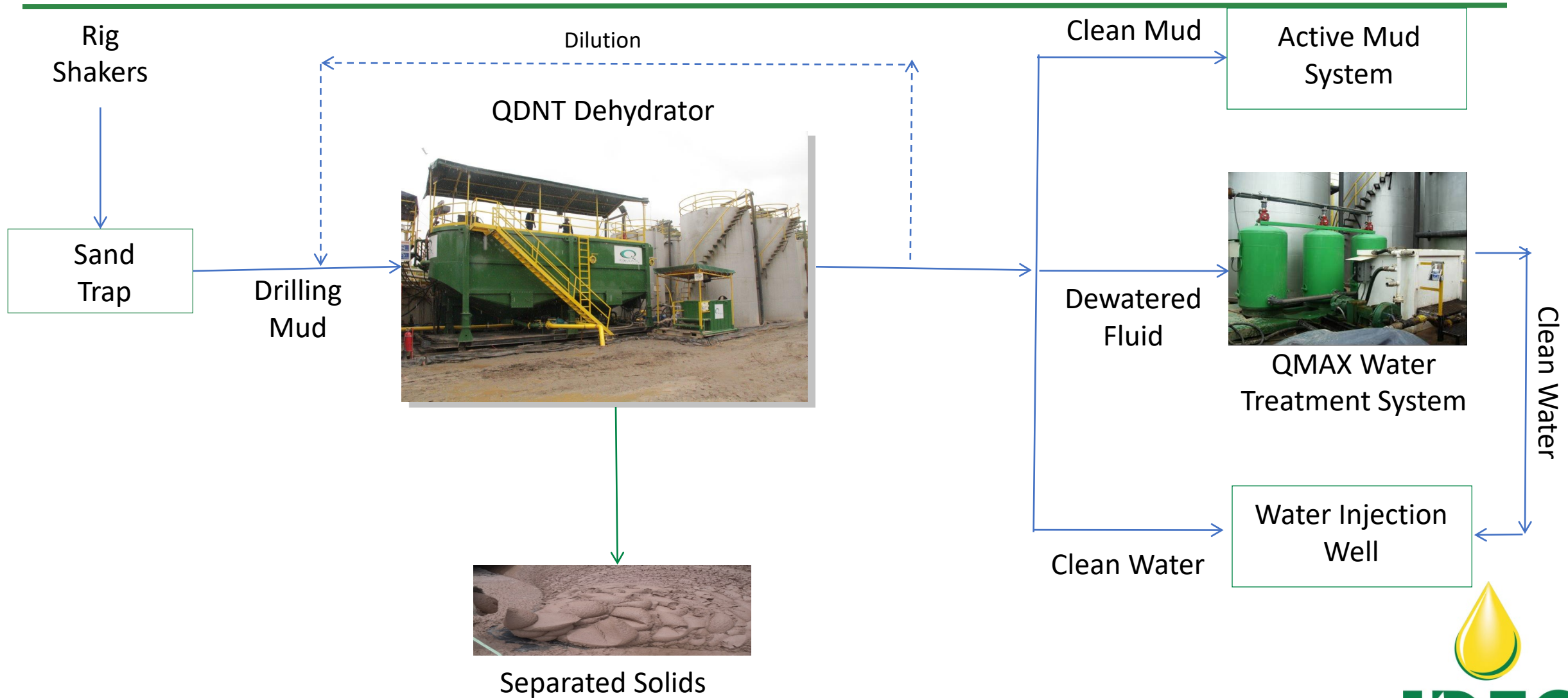
QDNT - increased throughput vs Mud Stripper

Parameter	QDNT	Mud Stripper
Flow Capacity (gpm) **	+1200	850
Tank Volume (bbl)	557	116
Separation residence time @ 700 gpm (min)	34.7	7.5
Processes Water/Brine based fluids	Yes	Yes
Processes Drilling Muds	Yes	No
Polymer mixing capacity	2 x 70 bbl tanks	1 x 10 bbl tank
# of Vertical flocculators in the tank	11	0

** The flow capacity for the QDNT above is for a solids-based drilling mud while the MS capacity is for a water/brine-based fluid with no solids.



QDNT rig site process diagram



16" Interval drilling fluid cost per ft. with QDNT

- Over a period of 4 wells in Ecuador drilling the 16" interval using QDNT, drilling fluid costs per ft drilled reduced by 31%.
- The saving equates to approx. \$32,040 per 16" interval.

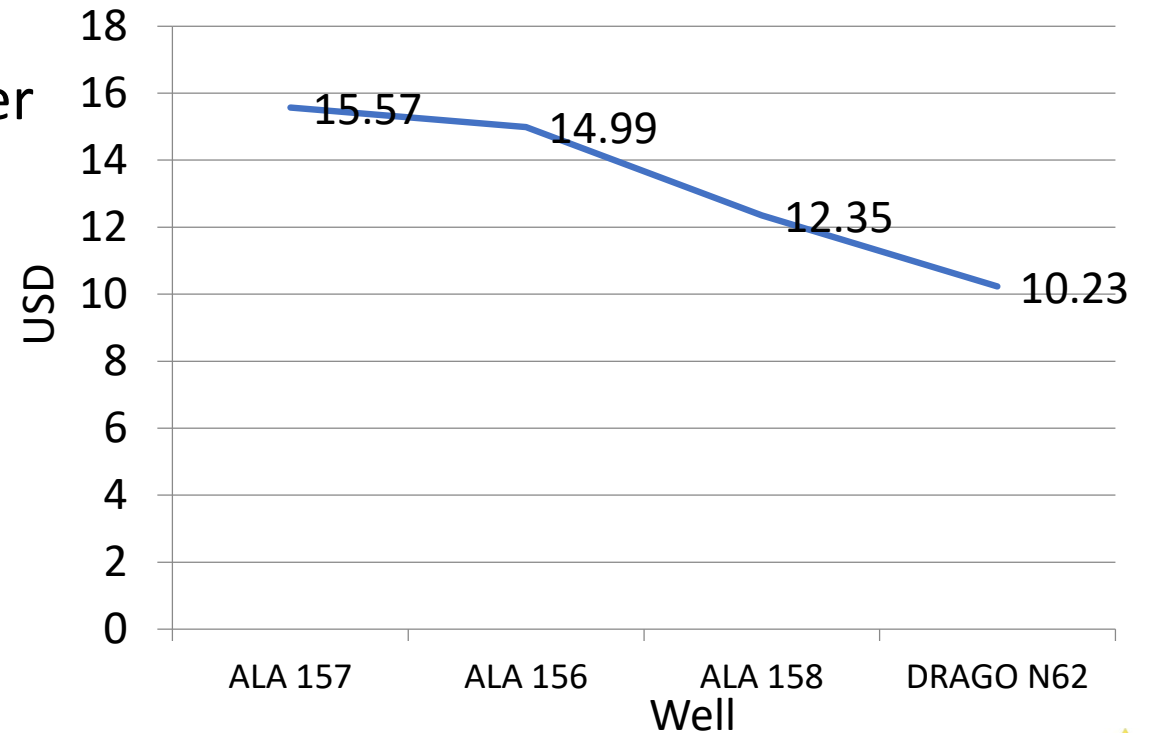


QDNT Solids Discharge



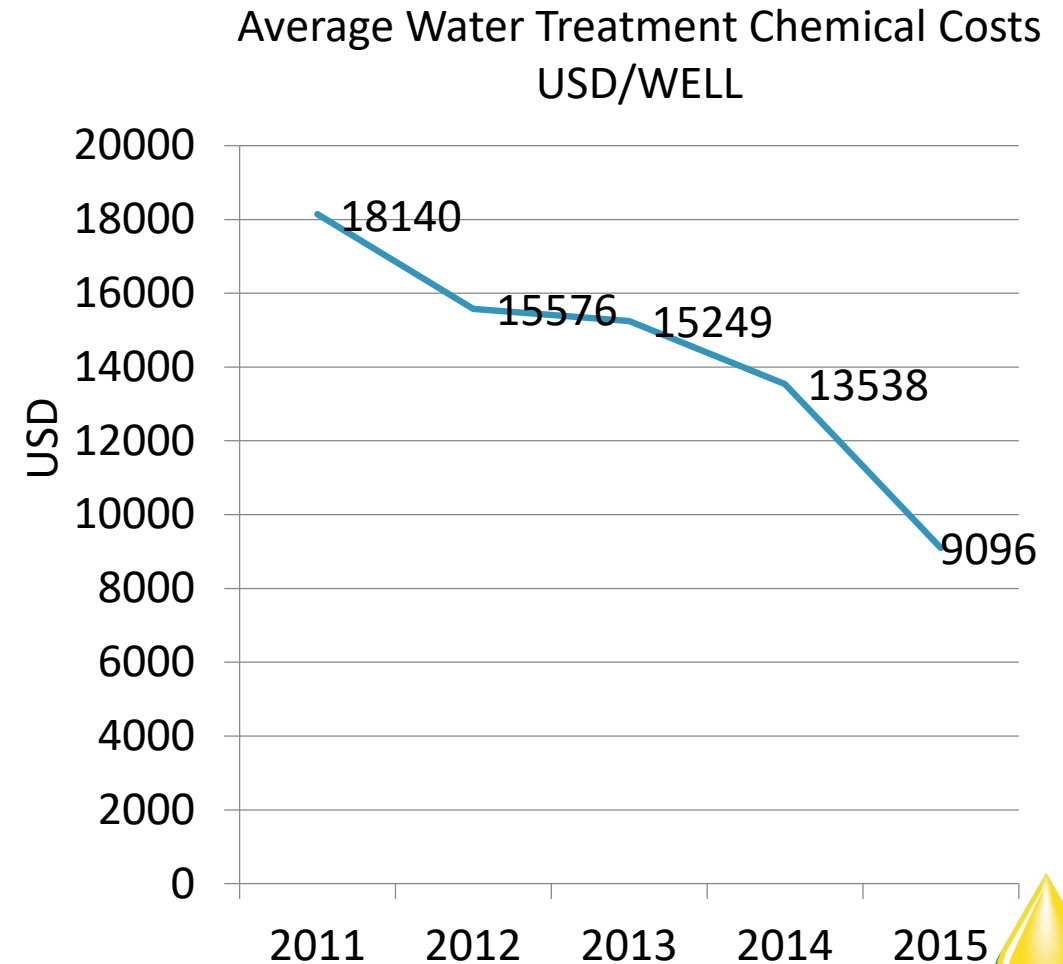
QDNT Clean Water Return

**Drilling Fluid Cost
\$/ft (16" interval)**



WT chemical savings with QDNT on rig 036

- Since the introduction of the QDNT in 2011 on Rig 036, average water treatment chemical costs reduced by 49.8 % vs. the conventional WT system.
- The saving equates to \$9044 on average per well and approximately \$542,640 on average per year.



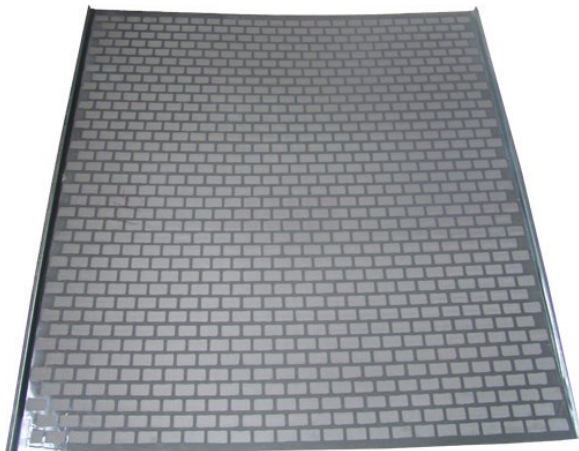
QDNT rig energy savings vs conventional system

Description	Monthly Saving/Rig (\$USD)	Yearly Saving/Rig (\$USD)
Reduction in Generator Capacity (500 to 350 KW)	\$4500	\$ 54,000
Reduction in Diesel Cost (50 gal/day)	\$6000	\$72,000
Total Rig Site Energy Savings	\$10,500	\$126,000



Rig CCDC 036 shaker screen saving with QDNT

Year	Average Cost/Well
2011	\$17000
2012	\$15481
2013	\$18623*
2014	\$14261
2015	\$9880
Total Reduction	\$7120 (41.8%)



* New shakers installed in 2013 with higher price screens

Improved environmental performance

- The QDNT process reduced suspended solids in treated water to <20 mg/l vs. >260 mg/l with the centrifuge-based system during the 16 " interval.
- Treated water from the QDNT can often be sent directly to the injection well avoiding the need for additional processing in the water treatment plant.



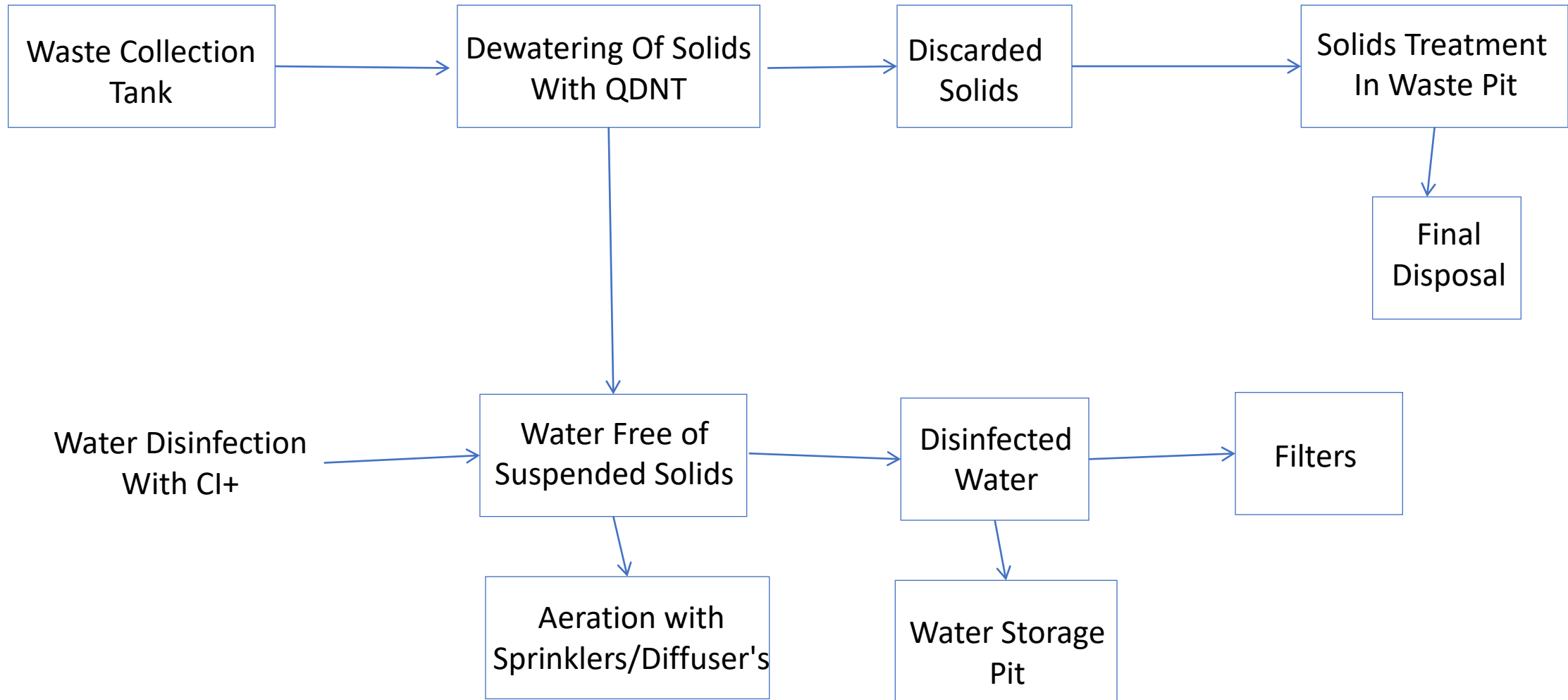


Potable water treatment opportunity

- A large volume of solid/liquid wastes are generated in municipal water treatment facilities in Ecuador that are discarded to the environment in breach of environmental laws
- According to local statistics 929,006 m³ of liquid/solid waste was discarded in 2015 from the Quito water facility
- Lab testing of wastes by Ecuador operations suggest up to 815,000 m³ of water could be recovered by using a QDNT process saving \$350,000 p.a.
- A QDNT dewatering field trial is currently ongoing in Ecuador for this application
- Contamination of potable water supplies is common in Latin American mining/industrial areas, and offers opportunities for QDNT type technology



Proposed waste treatment process



Benefits of using the QDNT dewatering process

- Discarded wastes will comply with local environmental legislation
- It is estimated that recovering 815,000 m³ of water will generate a saving of \$350,000 for the client
- The system processes high volumes that meet the needs of the water facility
- Solids will be discarded for treatment dryer and easier to handle
- Suspended solids in effluent < 10 mg/l
- The equipment works at low noise levels so as not to affect the local population





Mining

QDNT Applications &
Potential Opportunities

Mining tailings treatment market

- Contamination from mining tailings is a major issue in many Latin American countries, not only for flora and fauna but also humans
- Water scarcity is also a problem and mining tailings are often discarded with up to 80% water content
- A recent environmental disaster (mining tailings spill) in Brazil has led to a 44 billion USD lawsuit against the VALE S.A./BHP Billiton JV and has increased the environmental pressure on the industry
- An opportunity exists for QDNT technology for dewatering mining tailings to recover water for reuse, discard dryer solids for final disposal & reduce environmental risks
- After completing successful lab tests a field test of the QDNT at a mine is planned for Q3 2016 in Ecuador



The benefits of using the QDNT include

- A reduction in the volume of wastes discarded and the associated environmental risks
- Reduced consumption and increased recovery of a valuable resource – water
- A low cost continuous process
- Reduction in logistics costs associated with management of existing tailings pits
- A mobile process that can be easily moved to process in different areas as required



Mining exploration/coring rigs market

- There are approx. 200 mining exploration/coring rigs operating in Latin American countries, often drilling in remote areas where water is scarce and environmental pressures are increasing
- They use rudimentary mud and solids control systems creating large volumes of waste that result in increased water consumption, environmental risks and higher associated costs
- Some are moving to closed loop systems and an opportunity exists for small, low cost mobile QDNT dewatering systems that can recover/recycle water, lower mud costs and reduce environmental risks
- Revenue opportunities exist for equipment cap sales, rentals, mud product sales, FSI shaker and screen sales



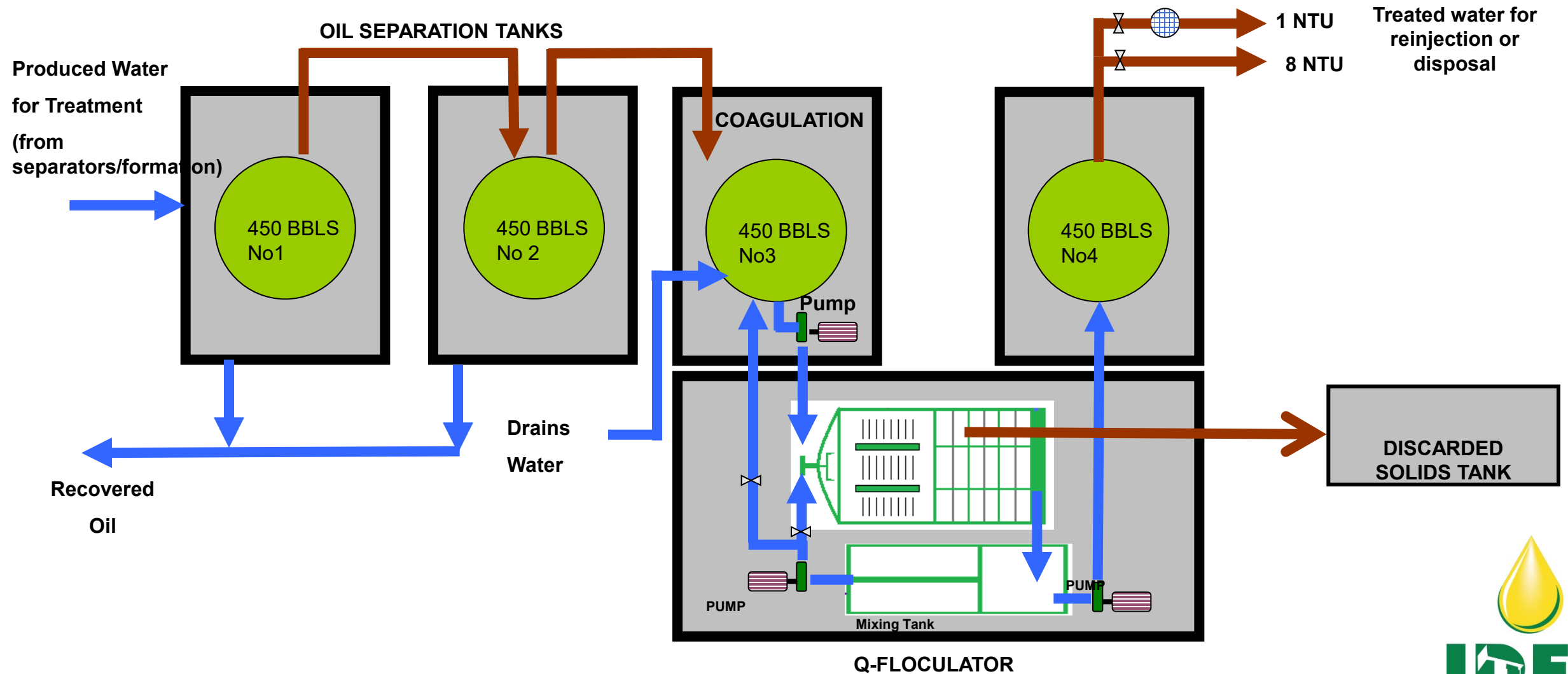


Produced Water Treatment with QDNT

- A small pilot QDNT was used in a process as part of a trial for treatment of produced water for reinjection in Campo Puma Ecuador
- The client had problems with high oil and solids content resulting in increased filtration costs
- The process was able to reduce tph from 88 ppm to <5 ppm
- Suspended solids were reduced from 10 mg/l to < 5 mg/l



Produced water treatment process with QDNT



Example of PWT integrated solution in Colombia

- A combination of process tanks and chemicals provided a low cost and effective solution for the produced water treatment market over a 6 year period with multiple clients
- Opportunity exists for providing temporary integrated processing solutions (chemical + equipment) for clients with; limited water processing capacity, out of spec water problems, remote areas without water treatment facilities, etc



Simple tank and chemical produced water treatment system used in Colombia that processed over 10 million bbls

Other Potential Applications

HDD Market



HDD & Market

- There is a potential opportunity for a low cost smaller QDNT dewatering unit for the HDD market that can recover/recycle water, lower mud costs and reduce environmental risks
- Could be an opportunity for equipment cap sales, rentals, mud product sales , FSI shaker and screen sales



HDD project in Argentina in “pump and dump” mode creating 3500 m3 of waste for each project



Summary of QDNT rig site benefits

- Reduced drilling fluid costs per ft/drilled of un-weighted top hole sections by 14.1%
- Reduced water treatment chemical costs
- Improved environmental performance
- Reduced shaker screen consumption
- Reduced energy costs

*Thank
you*

