THE CASCADE WASTE WATER SYSTEM

The Cascade Waste Water System is a combination of several differing technologies meshed together controlled by a fully automated PLC system to deal with surface water that is hydrocarbon and organic contaminated. The system in place will handle contaminants both solid and liquid. The system is built to recover as much as seven (7) metric tons per hour of hydrocarbon associated with contaminated surface water, in addition the system removes solvents, detergents, NORM'S (naturally occurring radioactive materials) and reducing contaminants such as sulphates, nitrates, calcium, phosphates, sodium, magnesium and chlorides. As well as solids from a maximum of one hundred (100) microns to as low as one (1) microns. Once the contaminants have been removed then there are two options as to what is to be done with the remaining water.

The PLC that drives the CWWS is a HMI (Human Machine Interface) that allows for an operator or any person from a rig/facility crew to easily turn the system on, pause or shut down the system with merely touching a digital screen. It will also alert the rig crew if there are any filters plugging and what exact filter that may be. Other information provided is in regards to when the evaporation system is in need of a cleaning service.

1. **Recycle** the water back to the rig, location or facility from where the water was collected from at over 110m³ per 24 hrs, requiring only up to 40 amps of power. Reducing the need for additional fresh water to be used, reducing source cost and trucking, by reusing the water, the liability of man hours trucking and generating waste streams of slightly contaminated water are reduced significantly.

2. **Dispose** of the water through the unit by atomization and evaporation. Borrowing technologies from the food process and plant heating industries, plus some original concepts we have an onsite disposal system that will completely deal with the onsite surface water waste stream.

Water disposal rates are based on the required power consumption per m³. A single stand alone evaporation system will require 45KVA/hr per 10m³ evaporated or approximately 220 amps of power to create the heat source required. A single evaporation package can dispose of 24 to 28m³ per 24 hrs. Multiple evaporation packages can be attached to the main module of the Cascade System.
This information is based on a stand alone 300 KVA generator as a power source, the system can also be run from highline power and will have lower cost/energy impact when powered from larger power plants.

Applications

1. Surface water, this pertains to any water on a location that has collected from rain, melted snow and ice and or water that has been used in an application from a facility or on site operation where water has been used for washing of equipment, lubrication or cooling of equipment and any other non production water.
This also includes water on locations, road access and construction that may have been flooded due to rain, snow or spring water.

2. Location remediation and closure. Fluids recovered from the closure of new or existing locations that are in the process of being closed or re addressed for remediation. For example if a location has previously had a sump or earthen pit that has had hydrocarbon contamination, the CWWS will be able to handle the squeezed fluids and or any surface fluids to be disposed of, recovering the hydrocarbon content and reducing contaminants such as sulphates, nitrates, calcium, phosphates, sodium, magnesium and chlorides.

3. Dewatered drilling fluids, we have been able remove excess polymers from dewatered surface mud systems so that the water can be evaporated as more importantly reused for make up water(drill water) for mud systems with no adverse effects. Although this does incur some cost due to the plugging of the scavenger filters that have two uses before they have to be disposed of.

ADDITIONAL APLICATIONS

Completion Fluids Filtration

Although the current system is built for surface water management, by changing out the feed and system pumps for larger volume pump units the Cascade system is capable of processing production/completion brine down to one (1) microns, at up to 0.25m³/min, with no disposed filters.

Solid waste recovered by the system will have to be collected from the ultra sonic cleaner and disposed of by the same means as all solid drilling waste.

The brine filtration process will work as a seamless non batch type process due to the dual bank filtration system coupled with the reusable stainless steel filter cartridges.

Each bank consists of three filter pods, each holding five filter cartridges.

Each filter cartridge is a 30” x 2” stainless steal mesh construction. These filters are reusable after a quick clean in the ultra sonic cleaning system included with each package.

The ultra sonic package also includes oleofilic oil recovery so any hydrocarbons recovered during the filter cleaning process from the associated solids are contained and controlled.

Heating of Fluids
The Cascade Unit is capable of heating water from 1ºc in a single pass at the following rates.

Liters per Minute	Output Temperature	24 hr volume
14	155ºc	20.2m³
32	80ºc	46.1m³
78	38ºc	112.3m³

This application could be used for the heating of fluids used for completion and production formation fracturing operations.

Central Site
A central site system could be implemented to manage two or more rigs from one site, this will help in the reduction of logistics when moving fluids to be recycled or disposed. In doing so Tangent would be able to man a site to operate the equipment and insure that the recycled water is of the highest possible quality and recovered hydrocarbons are handled and re-delivered to the customer in a safe and reduced liability operation.

MARKET IDICATORS

The **Surface Water** waste stream is a great source of revenue for trucking companies and disposal facilities, but for the operator it carries great cost both financial and liability. By disposing of this waste stream at its source we can reduce cost and remove most all liability associated with transportation and disposal.
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The **Produced Water** disposal industry makes surface water disposal seem insignificant in possible revenue, many of the potential clients that have contacted Tangent have questioned if this is a possibility. Processed water although a hard sell, to environmental regulatory groups is a target application. We will endeavor to continue to develop the equipment to address this waste in the future

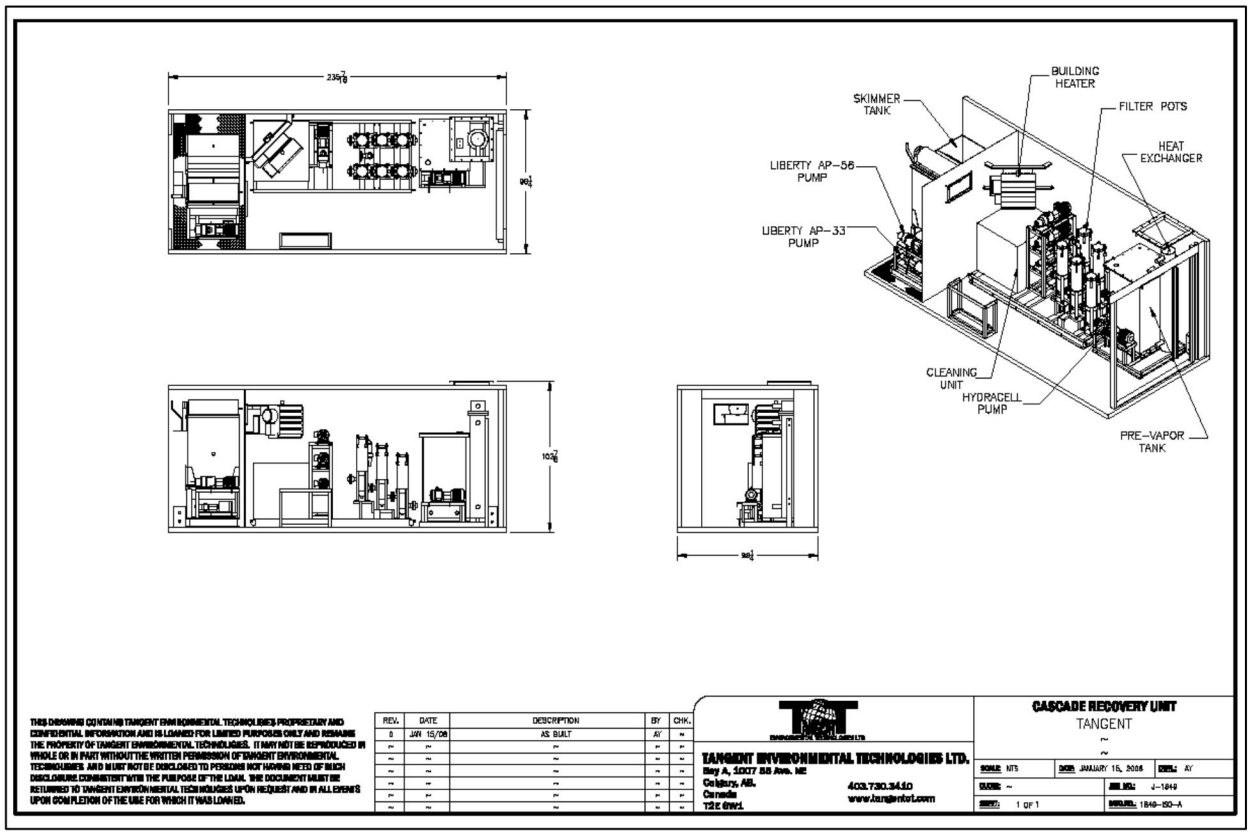
TANGENT CASCADE® unit

The Cascade® unit draws power from either a stand alone generator or from existing rig generating units according to power source capacity and electricity consumption requirements of the unit. Water is fed to the unit through a standard intake pump and large object filtration on the intake of a standard size hose system that can be extended up to 100 meters without performance implications. The unit separates hydrocarbons from the surface water in a staged filtration process and stores hydrocarbon residue in a monitored and self emptying reservoir to be recovered and returned to the mud system. Recycled water is directed back to rig operations or storage for future use via a standard size hose in water reuse applications or is atomized and discharged via a vertical outlet in disposal application

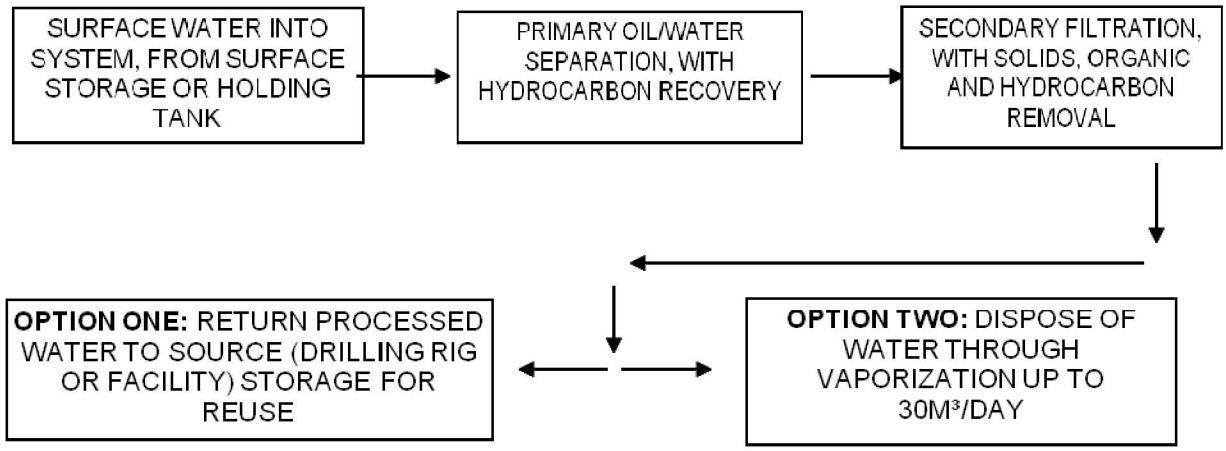
Cascade® Technical / Performance Specifications: current prototype

Architecture	
Overall Unit Length:	20' (7.24 m)
Overall Unit Width:	8' (2.8 m)
Overall Unit Height:	8' (2.8 m)
Overall Unit Weight:	16500lbs (7.5 tonns)
Overall Unit Materials	All components and materials meet the International Standard for shipping and transportation.
Hydrocarbon Receptacle Volume	10 t/hr
Technical Data	
Sorry this information can not be described in this document.	
Electrical Consumption Data	
Heat source	60 HP, 230/460 V, 60 Hz, 1,750 rpm, continuous duty, 3-Phase, Approximately 220 amps or 287 KV, or alternative diesel powered heat system.
Pumping/filtration	Liberty, moyno. Approximately 30 amps

Basic Layout of cascade system



Basic flow through of the CWWS



Competitive Advantages

-The Cascade Waste Water System can be used in a "stand alone" application as well as an "integrated" part of a project, plant or well site. It can be moved to a location prior to site preparation and drying and can also be left behind at a location to process remaining surface water for required site reclamation

- The Cascade unit can supply usable water for industrial operations from contaminated surface water or can dispose of unwanted water through evaporation.
- Simple operating parameters for ease of customer operation.
- Filtration package consisting of reusable stainless steel filters for reduced waste stream.
- Small portable footprint, perfect for quick moves and offshore applications.
- A combination of diversified technologies for optimum performance.
- integrated filter cleaning technology for reduced outsourcing time, costs and liability from filter utilization.

Initial Trial

TANGENT OILFIELD TECHNOLOGIES.
CASCADE WASTE WATER SYSTEM
TRIAL ON STONEHAM RIG 7
TALISMAN ENERGY CANADA

Actual Case Study.

- Cascade unit was shared between 2 rigs
- Rigs operated a total for 83 days
- A total of 952 m³/5978bbls of surface water was processed of which 439 m3/2756bbls was recycled and returned to the rig
- A total of 513m³/3221bbls of surface water was processed and evaporated to atmosphere for disposal.
- There was direct cost saving on the transportation and disposal on 952 m³/5978bbls of waste water
- There was a direct cost savings on the transportation and acquisition of 439 m³/2756bbls of fresh water

Cost trucking and disposal of 952 m³/5978bbls	$76,480
Cost of trucking in fresh water 439 m³/2756bbls	$18,000
Subtotal	$94,480
Less Cost of CWWS for 83 days	($50,242)
COST SAVINGS	**$44,238**

********************47% cost savings********************

What is not shown here is the soft savings of recovered hydrocarbons, water sourcing permit cost, impact and carbon foot print of vehicle movement, including reduced vehicle transportation liability.

Commercialization

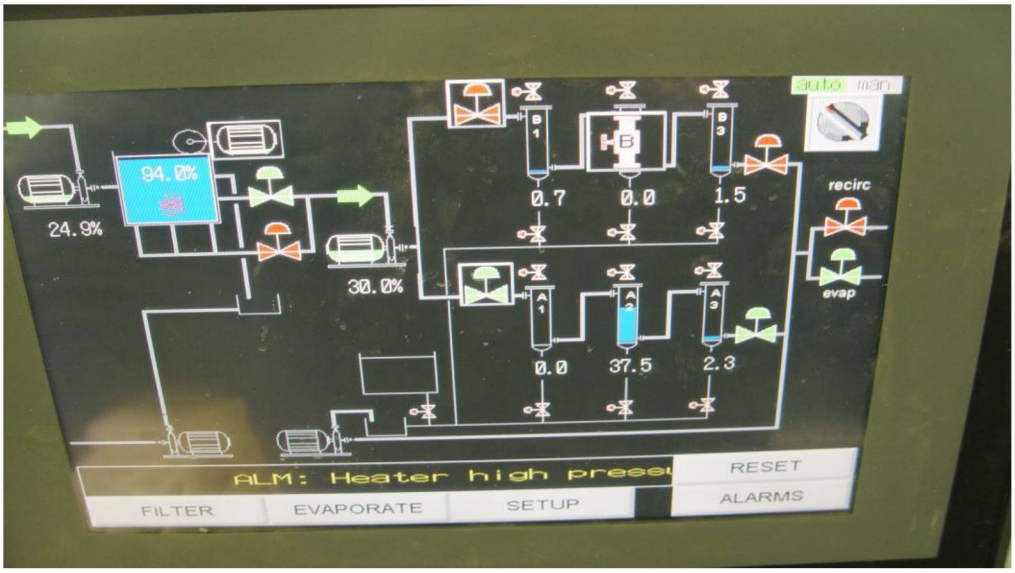
The Cascade system has been put through multiple performance and through put testing regimes. There has been multiple technologies tested for optimum performance. The system is proven on a proto type basis and is now being manufactured on a commercial basis. The system has been field tested for Talisman Energy Canada over a two well period and has out performed any other portable disposal system available in the Canadian industry as far as disposal and energy consumption are concerned. Where we are far ahead of any other system is our ability to recover hydrocarbons whilst recycling water to be reused for the rigs day to day operations, the water recovered has been used for make up water for drilling fluids, has been put into the rig tanks for general use (washing, pump lubrication etc).

Changes in Environmental policies

The Demand for the Cascade system will increase as global policies change. With this in mind we will continue to improve in the performance of the Cascade system to assure our place as leader the cost and liability when recovering hydrocarbon associated with surface water to maintain reuse of the resource (water) and minimize the cost and liability of disposal. As policies change there will be a need for further utilization of this technology and TangentOT will strive to meet the dynamic requirements of the customer.

Additional Pictures

Explosion proof hydrocarbon recovery package.



Automated HMI (human Machine Interface)