

## **Water Management Plan for Water Treatment Project**

### **Layout Plan**

All water treatment equipment will be located within the process equipment secondary containment, between the vapor recovery units and vapor combustors. Additional piping will be installed underground between the tank battery and the water treatment skids. These lines are a suction water line (6" diameter), a discharge water line (6" diameter), and a discharge oil line (2" diameter). The water treatment skids are not intended to produce any hydrocarbon vapors during normal operation, any vapors produced by this skid would be during an upset condition and will be controlled by being tied in to existing combustors.

The middle bank of eight tanks on this location will be repurposed for the water treatment pilot. They will be isolated from the existing lines from the wells that produce to this location. Four of the tanks will be inlet tanks, used to supply water to the water treatment skids. The other four will be outlet tanks, used to store treated water until it is hauled away from location.

Electricity to run the equipment will be supplied by a generator, until the utility power for this location is connected. At that time power will be switched to utility, and the generator removed.

Attachment #1 contains the site layout drawing for reference.

### **Timing**

Piping and equipment changes to the location will begin as soon as approval is received from Encana management, however treatment of produced water will not commence until after regulatory approval is received from the COGCC.

In order to get the most comprehensive data regarding water treatment feasibility in the DJ Basin, it is desirable for this system to be analyzed while treating 100% produced water from existing wells (standard mix of field water), 100% flowback water from horizontal wells only, and a mix of flowback and field water in varying percentages. As such, it is intended that this unit be in operation on the Edith Ann well site facility before the new wells on that location come online in early February.

A standard mix of field water will be trucked to this location for treatment, and the process optimized as necessary until the desired water quality is achieved. After the new wells are brought online, the system will be used to treat only flowback water from those wells until the desired quality is achieved. As the water flowback rate from the new wells declines, additional field water will be trucked in to make up the incremental capacity. The process will again be optimized.

This requires a minimum test duration of 3 months, with a maximum of 6 months.

## **Reuse Management Plan**

### **Intent**

Encana intends to perform the needed feasibility/performance testing of the mobile water treatment plant prior to recycling produced water for use as completions fluids. If the water treatment pilot performs as expected, Encana intends to maximize the use of produced water in our completions fluid to the extent possible on future development locations in the DJ Basin. Produced water recycling is expected to significantly reduce water disposal volumes, waste, haul distance, fresh water use, and truck traffic. In addition, it will be consistent with the State of Colorado regulatory agencies' objective of resource conservation, waste minimization, and recycling and re-use of produced water.

### **Detail of Process**

The feed water will be pulled from the inlet storage tanks via a small charge pump. It may initially go through a line heater to warm the water and increase the effectiveness of the treatment equipment. After that, it will go through a static mixer, at which point any necessary treatment chemicals will be added for such things as iron removal and emulsion breaking. This is the point at which most of the optimization will occur.

After the mixers, the water enters the first of the treatment skids, the corrugated plate interceptor. This unit removes larger solids and sludge from the flow stream. Any solids collected by this system will be either taken to a land farm, or to the landfill, depending on composition. Larger oil particles are then combined and removed from the water.

The water is then gravity fed into the dissolved gas flotation module, which uses dissolved gas to force mid-sized oil particles to the surface of the unit. Any oil discharged from this unit will likely contain a higher percentage of water, and will be fed back into the corrugated plate interceptor for removal.

Small charge pumps will then pull the outlet stream from the dissolved gas flotation module and push it into two nutshell filters, installed in parallel. There are two reasons for having dual filters at this point:

- 1) Each of these filters is only capable of 3,500 BWPD and the total process capacity is 5,000 BWPD.
- 2) These filters need to be backflushed daily to maintain effectiveness. The presence of two filters allows one to be backflushed while the other is in operation. Although the overall treatment rate decreases, it is not necessary to completely shut down the system to backflush the filters.

This will be the stage at which the smallest oil particles are removed. It is possible this stage will not produce the desired results. In that case, the nutshell filters will be removed and replaced with activated carbon filters.

After treatment in the nutshell filters, water is discharge to the outlet storage tanks. All discharge oil from this process is combined and discharged to an isolated tank. Vapors from this tank are controlled by the existing facility vapor control equipment.

Additional technical details of this process are shown in Attachment #2, provided by the manufacturer of the water treatment equipment.

## **Spill Prevention**

### Protection of Groundwater and Watershed

Tank berms are steel berm rings and are sized to contain 150% of the volume of the largest tank in the containment area. A Spill Prevention Control and Countermeasure (SPCC) Plan is maintained at Encana Oil & Gas (USA) Inc. Company's Longmont office. This would be referred to if a major product spill occurs. Drainage from the bermed area is controlled by Encana Oil & Gas (USA) Inc. personnel. All fluids inside bermed areas will be moved by tank truck. In the event bermed areas must be drained, the accumulated water will first be checked for product contamination. If hydrocarbon products are found, they will be removed by tank truck or portable pump, and the product will be returned to a storage tank. Encana Oil & Gas (USA) Inc. field personnel are responsible for seeing that no drainage or hydrocarbon products are allowed to escape from the bermed area.

### Emergency Response

Encana Oil & Gas (USA) Inc. has an Emergency Plan. A copy is available at Encana's Longmont office. The Senior Production Foreman is to assume full responsibility for implementing the Emergency Response Plan. Implementation will depend upon the type of emergency. The appropriate Manager/Supervisor will notify Encana Oil & Gas (USA) Inc. office personnel of any emergency which might result in news media coverage.

### Pipeline Network

All tanks and above ground piping are visually inspected on an every other day basis for leakage, malfunction of seals, and other problems. Inspections of all storage tanks are made by Encana Oil & Gas (USA) Inc. personnel or contractors and reported to its Longmont office. All storage tank material and construction comply with API specifications for hydrocarbon storage.

#### Storage and Transportation of Water

Water will be stored in 8 x 500 BBL production tanks located on the Edith Ann facility. Four of these tanks will be dedicated for use as inlet (untreated) water storage, and the other four will be dedicated for use as outlet (treated) water storage.

Any field water that is brought to the site will be delivered via water truck from other locations in the field. Water that is removed from the location will be transported in the same manner.

Flowback water from the Edith Ann wells will be dumped directly to the inlet storage tanks from the separators.

#### Tracking of Water Delivered and Removed

Water that is brought to location for the treatment pilot will be tracked separately from water produced by the wells on this location. Each load volume will be recorded and tracked. All water that leaves the treatment tanks will also be recorded and tracked.

#### Water Quality Testing

A portable water testing system is included with the rental equipment for this pilot. Samples of water will be taken regularly and tested, both to record the inlet water quality as well as the effectiveness of the treatment system. If discharged water quality is found to be lacking, discharge water will be recycled back to the inlet of the skid system and re-treated until it is of satisfactory quality.