



**Marathon
Oil Company**

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596-32C Temporary Water Storage Pond Form 15 – Earthen Pit Permit

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1 Executive Summary

Marathon Oil Company has been actively drilling in the Piceance Basin since late 2007. Through most of 2008, Marathon had 4 rigs operating. This level of drilling activity created an inventory in excess of approximately 50 wells that are currently waiting on completion.

To achieve economic gas rates from Piceance wells, fracture stimulation technology is required. Slick-water fracture stimulations have proven to be the most effective stimulation design. This application requires large volumes of water to complete each well (>20,000 bbls). Once a well is completed, a large volume of this completion water is flowed-back. Post recovery of the completion fluids (flow-back water) the produced water yield is approximately 15-30 bbls/mmcf for the life of the well. The flow-back and produced water is of sufficient quality to reuse in drilling and completion operations vs. taking to disposal. As there are no disposal options on the mesa, volumes that cannot be readily used in drilling and completion operations are currently trucked off the mountain to third-party disposal sites. These sites are located near Cisco, UT and Rangely, CO causing a direct impact to traffic on county and state roads.

All of the acreage targeted within Marathon's development is located on top of the Mesa north of Parachute, CO. This acreage is remote with limited infrastructure to directly support the development. Vehicle access is challenged as there is a dramatic elevation change (<2,000') from the access point in the adjacent valley (Piceance Creek). The mountainous terrain significantly increases the risk and cost of moving fluids via truck transports. In addition, adverse weather conditions can magnify these risks several fold.

To conserve water resources and to reduce truck traffic, Marathon Oil Company is progressing plans for water holding facilities within its operations on top of the mesa. These facilities would allow for storage of water volumes to be reused in drilling and completion operations. As the design and permitting of a permanent storage facility has not been completed, Marathon Oil Company is pursuing the option of a temporary storage facility. Although the facility will be temporary, all necessary controls to maintain and validate integrity will be in place prior to use.

In addition to reducing truck traffic to and from the field location, this facility would significantly reduce infield traffic. Marathon has invested in the construction of a fluid gathering system to move fluids between locations via pipe vs. hauling. This improves safety by removing traffic, reduces emissions (exhaust and dust), reduces road maintenance, and improves engineering controls.

As described, permitting this temporary storage facility will allow Marathon oil Company to utilize existing infrastructure to optimize many aspects of fluid management. As with all operations, Marathon is committed to responsible development and is confident that the proposed storage facility will provide tangible benefits to further demonstrate this commitment.

2 Background

Marathon Oil Company (MOC) entered the Piceance Gas Basin in 2006 with an acquisition of ~8,700 undeveloped acres. All of this acreage is located on top of the mesa north of Parachute, CO. Average elevation of the acreage is 8,000-8,500 ft above sea level vs. the adjacent valley elevation of approximately 6,000 ft.

The Williams Fork reservoir is comprised of a series of low permeability gas sands. Large scale fracture stimulation treatments are required to economically develop the natural gas resources associated with these intervals. The optimal stimulation design that has evolved for the Piceance asset is 'slick-water' fracture stimulation treatments. With a 'slick-water' stimulation, large volumes of relatively fresh water carrying a low proppant concentration are pumped at a high rate and pressure. On average, these stimulation treatments require 3,000-5,000 bbls of water per stage and each well typically has 5-10 stages completed. This equates to 20,000 – 30,000 bbls of water needed to complete each well within the Piceance development. Before the wells can produce the targeted natural gas resources, the completion fluids (water) must be recovered. The initial water volumes are defined as 'flow-back water' as the make up of the fluids is dominated by the completion fluids. The load recovery of the completion water is not 1:1 as the percent recovery is dependent on a multitude of factors within the reservoir. Relative permeability and mobility ratios are such that the fluid recovery mechanism of gas displacing water not very efficient. Typically, the initial rates of flow-back water will be the peak water production and as the well 'cleans up' the water rates will decline rapidly. For Piceance wells, Marathon Oil Company is experiencing approximately 40%-50% load recovery in the first two weeks of the wells production. The Piceance wells do produce water that is entrained within the reservoir so as a well 'cleans-up' the water becomes a mixture of completion fluid and produced water.

With the Marathon Oil Piceance development being a relatively remote location it adds risk and is expensive to transport volumes via truck. At roughly 100 bbls per load, moving large volumes of water by truck creates an excessive amount of traffic. Additionally, as water is a valuable resource, it is prudent of the operators to recycle as much of the completion fluids and produced water as possible.

To minimize truck traffic, Marathon Oil Company has invested in the construction of a pipeline network to facilitate moving fluids across its Piceance operations. This pipeline network needs to be complimented by storage facilities to be fully utilized. The storage facilities are needed to compensate for the timing discrepancies between the supply and demand periods of the recycled volumes. With no storage, the water will be hauled off the mesa to third party disposal, increasing both field traffic and water haulers on county and state roads.

3 Project Summary

The goal of the temporary water storage pond project is to conserve water by recycling flow-back and produced water to re-use in well stimulations or drilling. The ability to temporarily store water at this location has several key benefits:

- Reduced trucking / improved safety
- Use of engineering controlled transfer system
- Reduction in volumes of disposed water
- Conservation of freshwater
- Reduced road maintenance
- Overall reduction in development and operating cost

The plan is to use an existing Marathon drilling pad and pit as a temporary water storage pond. The identified location is the 596-32C pad. The proposed location has been drilled utilizing a closed loop system which does not utilize a reserve pit; therefore the pit built a 596-32C has not been used for drilling operations. Prior to storing water, the existing pit will be lined with a dual liner and leak detection system to ensure the integrity of the storage pond. The liner system for the pit is included in Attachment A: CLI Leak Detection Design. This facility will be utilized 100% by Marathon operations if approved.

The capacity and use of the proposed facility will follow a phased plan. In the initial phase, the capacity constraint will be governed by air quality limitations. Based on samples of flow-back water from current Marathon Piceance completion operations, the current APEN application to the CDPHE limits our throughput to 16,200 bbl/year. As this facility will be designed with additional separation measures to further reduce contaminants, it is expected that the actual water quality of the fluid that is stored in the pit will be improved vs. the current available samples. Once the facility is in operation, additional sampling will be conducted to validate this assumption and the APEN will be revised accordingly.

The total working capacity of the pit is 32,039 bbls so the total capacity will not be fully utilized during Phase I.

In 2010, Marathon plans to complete more than 50 wells within their Piceance Operations. The proposed temporary storage facility will allow for effective re-use of water volumes to conserve resources, improve safety and environmental exposure, and reduce costs.

If approved, the storage facilities at the 596-32C pad will be utilized through 2009 and 2010. To replace the temporary storage capacity, Marathon is progressing plans for a permanent storage facility. The permanent facility is currently in the conceptual planning phase and ideally, the project will be matured to implementation within 3 years to replace the proposed temporary option.

3.1 Land

The proposed site is in Township 5 South, Range 96 West, SE quarter of section 32. The location is named Pad 596-32C. The pad is approximately 2,125 feet from the western section line and 960 feet from the southern section line measured at ninety degrees to the western and southern edges of the pad, respectively. A map of the pad is shown in Attachment B: Drilling Well Packet Data that was developed for our drilling operations by W.H. Smith Surveyors.

The surface of this land is jointly owned by Marathon Oil Company and Berry Petroleum. As per the Surface Sharing Agreement, Marathon Oil Company reserves full rights for 100% usage of this facility. The surface area of the pad is approximately 3.5 acres.

3.1.1 Land Use

The area around this location is used for rangeland. The wildlife that has been mapped in this section are: 1. Elk summer and overall range; 2. Sage Grouse overall and production ranges, and; 3. Mule deer summer and overall production. Wildlife studies have determined this area to be non-sensitive. More details on the assessment can be found in Attachment C: Sensitive Area Determination Study.

The vegetation in the area is comprised of scrub oak, sagebrush and grasses with an estimated ground cover of 80 percent. Pictures of the area are included in Attachment D: Drilling Well Packet Data.

3.2 Water Quality Protection & Monitoring

3.2.1 Hydrology

Marathon's Project Area is located in the Colorado Headwaters Parachute-Roan Basin (USGS Hydrologic Unit Code 14010006), which is part of the Upper Colorado Drainage.

Maps have been prepared by CK Associates that show there are no public water supply areas within ¼ mile or wells within 1/8 of a mile to the 596-32C pad. No known springs exist in the vicinity of 32C that would indicate shallow groundwater. There are no lakes, rivers, irrigation canals or identified wetlands in the immediate vicinity. There are surface waters nearby which have been sampled – Little Creek is within ¼ mile and House Log is within ½ mile of the pad. Further description of the ground water sampling program is described in Section 3.1.4.

Area precipitation and evaporation data is not available through the Western Regional Climate Center (WRCC). There are other local weather stations within 60 miles of our operations that give a general idea of the climate in our project area. The WRCC regional precipitation amounts vary from 11.6 inches per year in Rifle, Colorado to 14.8 inches per year in Collbran, CO. As the 596-32C location is approximately 2,000' higher in elevation than these two weather stations, it is assumed that the annual precipitation may be slightly increased. The nearest regional evaporation data is at weather station Grand Junction 6 ESE of 64 inches per year. Due to the elevation difference (cooler temperatures) the evaporation rate is expected to be lower at the 596-32C location than at the weather station located in Grand Junction, CO.

3.2.2 Stormwater Management

All of Marathon's approved disturbances are permitted and managed under a stormwater management program that uses best management practices (BMPs) and routine inspections. BMP's are used to help control the speed, direction, and sediment content of the water. The sediment can be attributable to rocks, silt, dirt, organic matter or any other potential pollutant from our operations. The main objectives are to reduce and eliminate sediment from entering the streams and waterways as well as control erosion.

The 596-32C pad has compacted earthen berm around the perimeter of the fill slope of the pad and additional BMP's to control sediment erosion and transport as identified by the plan. A map of the current BMP's are shown in Attachment E: Stormwater Map.

3.2.3 Water Sampling Program

All of Marathon's Piceance operations are subject to a water sampling program. The sampling program consists of attaining baseline data of the all proximal water sources prior to any construction activity and then periodic sampling as the activity progresses through the construction, drilling, completion and, production phases. The targeted sampling schedule for each location is as follows:

- Prior to disturbance
- After pad construction
- After drilling activity
- After completions activity
- Annually thereafter.

Test points for water sampling relative to the 596-32C have been established for the following locations:

- MOC 20: Township 6 South, Range 97 West, Section 2
- MOC 21: Township 6 South, Range 97 West, Section 2
- MOC 22: Township 5 South, Range 96 West, Section 32
- MOC 23: Township 5 South, Range 96 West, Section 32

Sample points MOC 20 and 21 are House Log Gulch and sample points and MOC 22 & 23 are of Little Creek. These locations are mapped in Attachment F1: Water Sampling Locations. For each sample, the analytical analysis tests for the following:

Alkalinity	Potassium	Copper
Ammonia	Sodium	Lead
Bicarbonate	Sulfate	Manganese
Calcium	Sulfide	Mercury
Carbonate	Total Dissolved Solids	Molybdenum
Electric Conductance	Total Organic Carbon	Nickel
Fluoride	VOCs EPA method 8260	Selenium
Magnesium	Barium	Silver
Nitrate	Boron	Zinc
Nitrite	Cadmium	
pH	Chromium	

Table 3.1: Water Sampling Analysis

These sites were sampled 09/26/2008 prior to construction of the pad as summarized in Attachment G2: Water Sampling Field Report. Results from the baseline tests are included in Attachment H3 and Attachment D4: Water Sampling Results. The sites will be sampled again prior to the operation of the Temporary Water Storage Facility and then periodically throughout the life of the asset. Results of future sampling will be compared to the established baseline to ensure there are no offset impacts to waters of the State.

4 Project Plan

4.1 Phase 1 – Temporary Pond and Pilot Facility

As stated above, the purpose of this project is to use an existing Marathon drilling location for a temporary water storage pond. The identified location is pad 596-32C located in Section 32, Township 5 South and Range 96 West. Due to advancements in drilling water and mud management, the constructed reserve pit was not used during the drilling operations on 596-32C. Marathon's drilling operations has matured to a closed loop system. By using the closed loop system, pad 596-32C provides an opportunity to use previously constructed pit as a temporary water storage pond until permanent facilities are progressed and operational.

4.1.1 596-32C Pad Layout and Pit Design

The pad has been built to 437' x 345' with approximately 2/3 of the location on cut. On the cut side, a pit has been built as shown in Attachment I: Pad Survey. The proposed plan is to make the pit a temporary water storage pond. The pit dimensions are 301' x 85' x 15' (2:1 slope) with a total working capacity of 32,039 bbl.

If permitted, the pond will be lined with two reinforced polyethylene (RPE) liners and have a leak detection system installed. A design has been provided by CLI-Clear Water Construction to construct this system, as shown in Attachment J: CLI Leak Detection Design. The proposed design will have a 24 mil thick bottom liner and a 36 mil thick upper liner.

Security will be provided by a 6' tall wildlife fence. The fence will be constructed around the entire perimeter of the pond.

4.1.2 Transport, Separation, and Storage Facilities

The utilization of a storage location will allow Marathon to operate an existing fluid gathering network that links each pad to one another. The pipeline network will allow water to be transferred from a well pad to the 596-32C storage facility by use of temporary pumps.

The proposed design of the facilities for the well pad and the 596-32C pad are shown in Attachment K: Process Flow Diagram and in Attachment L: 596-32C Pad Layout. These diagrams show the equipment and flow path of the water. Secondary containment will be constructed for the gun barrel separation tank and condensate tank. A 1' high compacted berm

around the perimeter of the location will provide additional containment and run on / run off controls for the site.

The equipment to be utilized on the well pads are as follows:

- 3 Phase separator
- Water tank(s)
- Condensate tank
- Transfer pump

The equipment to be utilized at the 596-32C water storage location is as follows:

- Gun barrel separation tank
- Temporary water tanks (frac tanks)
- Condensate tank
- Transfer pump

A list of specifications for the proposed equipment is included in Attachment M: Facilities Equipment Specifications.

4.1.3 Facility Operations

At the production pads, the well fluids will flow from the wellhead to a 3-phase separator (gas, water and condensate). Once separated the gas will be sold via a gas gathering system, the water will be sent to water tank(s) and the condensate will be captured in a dedicated condensate tank. The water will then be transferred from the water tanks to the 596-32C pad by use of a small skid mounted pump.

As the water enters the 596-32C pad it will travel to the gun barrel separation tank. From the gun barrel tank, there will be the option to run the water to the storage pond or divert to test tanks. The test tanks will be utilized to validate the water quality of water stored in the pond. The additional condensate being separated in the gun barrel will be piped to a condensate tank to be trucked off to sales.

The 596-32C pad facility will be designed to utilize existing pipeline infrastructure to receive water and to supply volumes for drilling and completion operations. The supply water will be transferred by using a similar pump to the well pad pump. The facility will be designed to handle loading and unloading trucks to accommodate locations that are not tied into the pipeline network. The trucking operations will be restricted to loading and unloading stations on each facility and trucks will not have direct access to the pond. The truck unloading point at the 596-32C pad will be designed to eliminate the potential to send liquids straight to the pond without going through the gun barrel separation tank.

The initial proposed hours of operation for this facility are for daylight hours only.

4.2 Phase 2 – Increased Capacity of Temporary Water Storage Facilities

The second phase of this project will be to sample and validate the expectation that the pilot facility will further reduce contaminants in the water. Samples will be taken from the test water tanks on the 596-32C location after the water has been through the 3-phase separator and gun barrel separation tank. If the samples confirm the reduction of contaminants, the APEN will be revised to reflect the potential to have a higher through put.

Depending on water quality limitations and capacity needs, storage capacity of the temporary facility may be increased through additional temporary tanks (frac tanks).

5 Fluid Quality and Design Calculations

The temporary storage pond is being proposed to hold flow-back and produced water from our well completions activities. As described in the Background Section, completions will inject 20,000 to 30,000 bbl of water per well to fracture stimulate the reservoir rock. After completion stimulations, Marathon is experiencing that the wells will flow back 40% to 50% of this water in the first few weeks of production. The initial flow-back water will be primarily the injected freshwater but will contain some formation (produced) water.

When fresh water is used as a base in completion operations, analytical results have shown that the recovered flow-back water is comprised of a chloride quantity of 4,000 mg/l on average and a Total Dissolved Solids (TDS) quantity of 9,600 mg/l. As the well continues to ‘clean up’ the concentrations of chlorides are estimated to increase to a maximum of +/- 6,000 mg/l. The TDS levels will also rise but the ratio to chlorides will reduce as the chlorides make up a larger percentage of the TDS in the formation water. With these relatively low levels of chlorides and TDS, the water is of sufficient quality to be reused in drilling and completion operations.

Due to the mixture of produced water in the flow-back water the temporary pond will have a constraint on capacity that will be governed by air quality limitations. Marathon has submitted an Air Pollutant Emission Notice (APEN). The APEN limits have been set by the water chemistry determined by representative water samples of the flow-back water off of a 2-phase (gas and liquid) separator. Within the APEN application, Marathon is using a mass balance approach with an anticipated throughput of 16,200 bbl/year. At this rate, the calculated VOC emissions would be 4.94 tons per year (tpy) as shown in the detailed calculations below.

As discussed in the Project Plan, additional separation measures are being planned in conjunction with the storage facility. With additional separation, it is anticipated that the quality of the stored water will be improved. Reducing contaminants from the produced fluids will directly impact the calculated air emissions, allowing for a revised APEN to increase the capacity of the facility.

5.1 APEN Calculations

The emission calculations for the 596-32C temporary water storage pond are based on water samples from wells on the 696-18A pad after passing through a 2-phase separator.

- 1,744 mg/L TPH
- 15,000 ug/L Benzene
- 51,000 ug/L Toluene
- 3,733 ug/L Ethylbenzene
- 58,333 ug/L Xylene
- 165 mg/L Methanol
- 10 ug/L MTBE
- 617 ug/L Naphthalene
- 7,333 ug/L O-Xylene

Produced Water Volume: 16,200 bbl/year

Annual VOC Emissions (Tons/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{1,744\text{mgTPH}}{\text{Liter}} \times \frac{\text{g}}{1,000\text{mg}} \times \frac{\text{lb}}{454\text{g}} \times \frac{\text{ton}}{2,000\text{lb}} = \frac{4.94\text{tonsVOC}}{\text{Year}}$$

Annual Benzene Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{15,000\text{ugBenzene}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{85\text{lbsBenzene}}{\text{Year}}$$

Annual Toulene Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{51,000\text{ugToulene}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{289\text{lbsToulene}}{\text{Year}}$$

Annual Ethylbenzene Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{3,733\text{ugEthylbenzene}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{21\text{lbsEthylbenzene}}{\text{Year}}$$

Annual Xylene Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{58,333\text{ugXylene}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{330\text{lbsXylene}}{\text{Year}}$$

Annual Methanol Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{165\text{mgMethanol}}{\text{Liter}} \times \frac{\text{g}}{1,000\text{mg}} \times \frac{\text{lb}}{454\text{g}} = \frac{935\text{lbsMethanol}}{\text{Year}}$$

Annual MTBE Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{10\text{ugMTBE}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{0.1\text{lbsMTBE}}{\text{Year}}$$

Annual Naphthalene Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{617\text{ugNaphthalene}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{3\text{lbsNaphthalene}}{\text{Year}}$$

Annual O-Xylene Emissions (Pounds/Year)

$$\frac{16,200\text{bbl}}{\text{Year}} \times \frac{42\text{gal}}{\text{bbl}} \times \frac{3.78\text{Liter}}{\text{gal}} \times \frac{7,333\text{ugO-Xylene}}{\text{Liter}} \times \frac{\text{g}}{1,000,000\text{ug}} \times \frac{\text{lb}}{454\text{g}} = \frac{42\text{lbsO-Xylene}}{\text{Year}}$$

6 Attachments

Attachment A: Drilling Well Packet Data
Attachment B: Sensitive Area Determination Study
Attachment C: Stormwater Map
Attachment D1-4: Surface Water Sampling Data
Attachment E: Pad Survey
Attachment F: CLI Leak Detection Design
Attachment G: Process Flow Diagram
Attachment H: 596-32C Pad Layout
Attachment I: Facilities Equipment Specifications.
Attachment J: Form 15: Earthen Pit Permit
Attachment K Form 25: Water Analysis
Attachment L: Form 2A: Soils
Attachment M: Form 26: Source Wells