# AP-51-0

# Caribou Refinery/Maverik Country Stores

# 2021

**From:** Jayroe, Jason
**To:** Chavez, Carl J, EMNRD
**Subject:** [EXTERNAL] 2021 Former Caribou Refinery Annual Report
**Date:** Friday, March 11, 2022 1:14:00 PM
**Attachments:** image001.png
May 2021 Annual Rpt.pdf

---



HI Carl-

Attached is the 2021 annual report for the Former Caribou Refinery in Kirtland.

Let me know if you have questions or concerns.

Thank you!

Jason Jayroe
Senior Geologist

TRC

123 N. College, Suite 206/ 208
Fort Collins, CO 80524
T: 970.484.3263 ext 15966 | C: 970.420.5666
LinkedIn | Twitter | Blog | TRCcompanies.com

123 N. College Ave.
Suite 206 & 208
Fort Collins, CO 80524

T 970.484.3263
TRCcompanies.com

March 11, 2022

Carl J. Chavez, CHMM
NM OCD
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

**Subject**: **2021 Annual Groundwater Report, Maverik Country Stores (Former Caribou Refinery), Kirtland, New Mexico**

Dear Mr. Chavez:

This report provides the results of the 2021 Site activities for the Maverik Country Stores site (former Caribou Refinery) in Kirtland, New Mexico (**Figure 1**). These activities were completed during the 2021 calendar year to meet the annual monitoring requirements for the site. The scope of work completed included:

- Annual fluid level measurements of 17 on-site wells;
- Annual low-flow groundwater sampling of 6 on-site wells;
- Annual analytical evaluation of volatile organic compounds (VOCs) and dissolved sulfate in groundwater samples from 5 on-site wells along with analytical evaluation of VOCs only from 1 on-site well.

Field methods, results, and the conclusions from the 2021 field events are discussed below.

**Annual Groundwater Sampling**

Annual groundwater sampling activities were conducted on November 22, 2021. Prior to well sampling, site-wide fluid levels were measured using an oil/water interface probe (**Table 1**) for compilation of the site potentiometric surface map (**Figure 2**). Fluid levels were not obtainable from the following site wells:

- MW-01: The well has a blockage approximately 2 feet below ground surface that prevented collection of a fluid level measurement.

None of the monitoring wells contained measurable thicknesses of LNAPL during this event. Based on the November 2021 groundwater elevations, the groundwater flow direction is to the south-southwest across the site toward the San Juan River. This flow direction is consistent with past monitoring events. The average of horizontal gradient calculations at the site was 0.007 ft/ft (**Figure 2**).

Two monitoring wells and the four injection wells were sampled as part of the regular annual groundwater sampling event. All wells were sampled utilizing a peristaltic pump and flow-through cell. Groundwater field parameters pH, temperature, conductivity, dissolved oxygen (DO), and oxidation reduction potential (ORP) were measured using a flow through cell and YSI 556 MPS during groundwater sampling. Groundwater samples were sent to ALS in Fort Collins, Colorado under chain-of-custody (COC) protocol and analyzed for volatile organic compounds (VOCs) using EPA Method 8260C. In addition, the groundwater samples collected from MW-17 and the four injection wells (INJ-North, INJ-South, INJ-East, and INJ-West) were analyzed for dissolved sulfate using EPA Method 300.0. Laboratory deliverables are provided in **Attachment A**. Results of the groundwater sampling are summarized in **Table 2**. The results show that there were no VOC exceedances for the 2021 annual groundwater sampling event (**Figure 3**). Additionally, there were no exceedances of the New Mexico Groundwater Standard for dissolved sulfate during the 2021 annual groundwater sampling event.

**Plug and Abandon MW-1**

Monitoring well MW-1 has a blockage approximately 2 feet below ground surface that prevents collection of a fluid level measurement. The well has been damaged since 2016. MW-1 serves as an upgradient well and is currently used to collect fluid level measurements. Maverik proposes to plug and abandon MW-1 in accordance with the State of New Mexico guidelines and utilize MW-18 as the upgradient well for the site.

**Summary and Conclusions**

The annual groundwater sampling was completed during the week of November 22, 2021. Fluid levels were measured in 17 wells to establish groundwater flow conditions. Across the site, groundwater flow is to the south-southwest, toward the San Juan River. Groundwater results were below the New Mexico Groundwater Standards for all 8260 VOCs and dissolved sulfate inside of the slurry wall impoundment area.

The groundwater sampling data suggest that the In Situ Chemical Oxidation (ISCO) injections were successful in decreasing the concentrations of VOCs within the slurry wall. Overall, the slurry wall impoundment is functioning as designed and no off-site migration of constituents of concern is occurring.

Sincerely,

Jason Jayroe
Project Manager

**Tables**



**Figures**



**Attachments**

**Table 1**
**Monitoring Well Construction Summary and November 2021 Fluid Levels, Maverik Country Stores, Inc. (Former Caribou Refinery)**

| Well ID | Completion Date | Total Depth (ft. BGS) | Well Diameter (in.) | Top of Steel Casing Elevation (ft. AMSL) | Top of PVC Casing Elevation (ft. AMSL) | Ground Surface Elevation (ft. AMSL) | Top of Screen (ft. BGS) | Bottom of Screen (ft. BGS) | Screen Length (ft.) | Top of Screen Elevation (ft. AMSL) | Bottom of Screen Elevation (ft. AMSL) | Depth to Groundwater (ft.) November 2021 | Product Thickness (ft.) | Groundwater Elevation (ft. AMSL) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | 1987 | 21.5 | 2 | 5207.79 | 5207.24 | 5205.75 | 11.5 | 21.5 | 10 | 5194.25 | 5184.25 | NA | NA | NA | Well damaged |
| MW-2 | 1987 | 15 | 2 | 5197.10 | 5196.93 | 5195.25 | 5 | 15 | 10 | 5190.25 | 5180.25 | 5.98 | NA | 5190.95 | |
| MW-10 | 1987 | 12.5 | 2 | 5189.80 | 5189.30 | 5187.47 | 2.5 | 12.5 | 10 | 5184.97 | 5174.97 | 4.93 | NA | 5184.37 | |
| MW-17 | 1993 | 15 | 2 | 5196.49 | 5195.91 | 5193.43 | 5 | 15 | 10 | 5188.43 | 5178.43 | 9.41 | NA | 5186.50 | |
| MW-18 | 1993 | 15 | 2 | 5202.27 | 5201.75 | 5199.14 | 5 | 15 | 10 | 5194.14 | 5184.14 | 13.14 | NA | 5188.61 | |
| MW-19 | 1990 | 12.5 | 2 | NA | 5189.54 | 5188.28 | 2.5 | 12.5 | 10 | 5185.78 | 5175.78 | 4.24 | NA | 5185.30 | |
| MW-20 | 1990 | 12 | 2 | NA | 5191.05 | 5190.10 | 2 | 12 | 10 | 5188.10 | 5178.10 | 5.50 | NA | 5185.55 | |
| MW-21 | 1990 | 13 | 2 | NA | 5194.81 | 5193.62 | 3 | 13 | 10 | 5190.62 | 5180.62 | 7.98 | NA | 5186.83 | |
| MW-22 | 1990 | 13 | 2 | NA | 5195.86 | 5194.58 | 3 | 13 | 10 | 5191.58 | 5181.58 | 8.61 | NA | 5187.25 | |
| P-1 | 1993 | 8 | 2 | NA | 5197.66 | 5195.74 | 3 | 8 | 5 | 5192.74 | 5187.74 | 9.64 | NA | 5188.02 | |
| P-2 | 1993 | 8 | 2 | NA | 5192.32 | 5190.50 | 3 | 8 | 5 | 5187.50 | 5182.50 | 5.98 | NA | 5186.34 | |
| P-3 | 1993 | 8 | 2 | NA | 5193.21 | 5191.44 | 3 | 8 | 5 | 5188.44 | 5183.44 | 6.62 | NA | 5186.59 | |
| P-4 | 1993 | 8 | 2 | NA | 5198.82 | 5197.06 | 3 | 8 | 5 | 5194.06 | 5189.06 | 10.04 | NA | 5188.78 | |
| INJ-N | 2012 | 15 | 2 | NA | NA | NA | 5 | 15 | 10 | NA | NA | 8.92 | NA | NA | |
| INJ-E | 2012 | 15 | 2 | NA | NA | NA | 5 | 15 | 10 | NA | NA | 9.52 | NA | NA | |
| INJ-S | 2012 | 15 | 2 | NA | NA | NA | 5 | 15 | 10 | NA | NA | 9.48 | NA | NA | |
| INJ-W | 2012 | 15 | 2 | NA | NA | NA | 5 | 15 | 10 | NA | NA | 8.83 | NA | NA | |

**Notes:**

AMSL = Above mean sea level
BGS = Below ground surface
NM = Not Measured
NA = Not Applicable
ft = feet
in = inches

**TABLE 2**
**SUMMARY OF GROUNDWATER QUALITY DATA**

| WELL IDENTIFICATION | DATE | ANALYTE CONCENTRATIONS (µg/L) | | | | | |
|---|---|---|---|---|---|---|---|
| | | BENZENE | TOLUENE | ETHYL-BENZENE | TOTAL XYLENES | 1,2-DCA | DIS. SULFATE |
| **NM Groundwater Standard** | | **10** | **750** | **750** | **100** | **10** | **6,000,000** |
| MW-9 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-9 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-9 | 12/28/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-9 | 12/27/17 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-10 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-10 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-10 | 12/27/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-10 | 12/27/17 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-16 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-16 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-16 | 12/28/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-16 | 12/27/17 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-17 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | **355,000** |
| MW-17 | 12/11/15 | **290** | **11** | **151** | **227** | <1 | **2,914,000** |
| MW-17 | 12/27/16 | **1.1** | <1 | **3.4** | **13.2** | **0.44** | **4,400,000** |
| MW-17 | 12/28/17 | **2.7** | <1 | **0.35** | **1.4** | <1 | **3,300,000** |
| MW-17 | 11/21/18 | <1 | <1 | <1 | <1 | <1 | **5,600,000** |
| MW-17 | 12/02/19 | **1.2** | <1 | <1 | **0.57 J** | **0.26 J** | **5,900,000** |
| MW-17 | 12/14/20 | **1.7** | <1 | <1 | <1 | <1 | **15,000,000** |
| MW-17 | 11/22/21 | **0.59 J** | <1 | <1 | <1 | <1 | **2,800,000** |
| MW-18 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-18 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-18 | 12/27/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-19 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-19 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-19 | 12/27/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-19 | 12/27/17 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-20 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-20 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-20 | 12/27/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-20 | 12/27/17 | <1 | <1 | <1 | <1 | <1 | NS |

**Notes:**

* Groundwater Standards based on the New Mexico Administrative Code Section 20.6.2.3103

NS - Not sampled

J - Estimated result. Result is less than Reporting Limit

U - Undetected at the reporting limit or at the reported concentration; result is considered to be a false positive

**Bold** - Detected result

Highlighted - Result Exceeds New Mexico Groundwater Standard

**TABLE 2**
**SUMMARY OF GROUNDWATER QUALITY DATA**

| WELL IDENTIFICATION | DATE | ANALYTE CONCENTRATIONS (µg/L) | | | | | |
|---|---|---|---|---|---|---|---|
| | | BENZENE | TOLUENE | ETHYL-BENZENE | TOTAL XYLENES | 1,2-DCA | DIS. SULFATE |
| **NM Groundwater Standard** | | **10** | **750** | **750** | **100** | **10** | **6,000,000** |
| MW-21 | 12/07/14 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-21 | 12/10/15 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-21 | 12/27/16 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-21 | 12/27/17 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-22 | 12/07/14 | **4** | <1 | <1 | <1 | <1 | NS |
| MW-22 | 12/27/16 | **2.5** | <1 | **0.67** | **7.12** | **1.7** | NS |
| MW-22 | 11/21/18 | **1.3** | <1 | <1 | <1 | **36** | NS |
| MW-22 | 12/02/19 | **0.52 J** | <1 | <1 | <1 | **18** | NS |
| MW-22 | 12/14/20 | <1 | <1 | <1 | <1 | <1 | NS |
| MW-22 | 11/22/21 | <1 | <1 | <1 | <1 | <1 | NS |
| Injection North | 12/07/14 | 1 | <1 | <1 | <1 | **18** | **1,275,000** |
| Injection North | 12/11/15 | **370** | **229** | **402** | **2,270** | <1 | **5,815,000** |
| Injection North | 12/27/16 | **48** | **19** | **10** | **1,070** | <1 | **3,100,000** |
| Injection North | 12/28/17 | **58** | **2.3** | **2.6** | **56** | <1 | **2,800,000** |
| Injection North | 11/21/18 | **0.36 J** | <1 | <1 | <1 | <1 | **4,200,000** |
| Injection North | 12/02/19 | **0.53 J** | <1 | <1 | **0.4 J** | **0.98 J** | **14,000,000** |
| Injection North | 12/14/20 | <1 | <1 | <1 | <1 | <1 | **19,000,000** |
| Injection North | 11/22/21 | **0.45 J** | <1 | <1 | <1 | <1 | **4,000,000** |
| Injection West | 12/07/14 | <1 | <1 | <1 | <1 | <1 | **675,000** |
| Injection West | 12/11/15 | <1 | <1 | <1 | <1 | <1 | **5,423,000** |
| Injection West | 12/27/16 | <1 | <1 | <1 | <1 | <1 | **4,400,000** |
| Injection West | 12/28/17 | <1 | <1 | <1 | <1 | <1 | **2,700,000** |
| Injection West | 11/21/18 | <1 | <1 | <1 | <1 | <1 | **2,000,000** |
| Injection West | 12/02/19 | <1 | <1 | <1 | <1 | <1 | **15,000,000** |
| Injection West | 12/14/20 | <1 | <1 | <1 | <1 | <1 | **18,000,000** |
| Injection West | 11/22/21 | **0.52 J** | <1 | <1 | <1 | <1 | **4,100,000** |
| Injection South | 12/07/14 | <1 | <1 | <1 | <1 | <1 | **295,000** |
| Injection South | 12/11/15 | <1 | <1 | <1 | <1 | <1 | **2,305,000** |
| Injection South | 12/27/16 | <1 | <1 | <1 | **0.33** | <1 | **1,900,000** |
| Injection South | 12/27/17 | <1 | <1 | <1 | <1 | <1 | **1,800,000** |
| Injection South | 11/21/18 | <1 | <1 | <1 | <1 | <1 | **2,300,000** |
| Injection South | 12/02/19 | <1 | <1 | <1 | <1 | <1 | **5,800,000** |
| Injection South | 12/14/20 | <1 | <1 | <1 | <1 | <1 | **16,000,000** |
| Injection South | 11/22/21 | <1 | <1 | <1 | <1 | <1 | **1,600,000** |
| Injection East | 12/07/14 | <1 | <1 | <1 | <1 | <1 | **295,000** |
| Injection East | 12/11/15 | <1 | <1 | <1 | <1 | <1 | **3,002,000** |
| Injection East | 12/27/16 | <1 | <1 | <1 | <1 | <1 | **1,600,000** |
| Injection East | 12/27/17 | <1 | <1 | <1 | <1 | <1 | **1,800,000** |
| Injection East | 11/21/18 | <1 | <1 | <1 | <1 | <1 | **1,900,000** |
| Injection East | 12/02/19 | <1 | <1 | <1 | <1 | <1 | **3,300,000** |
| Injection East | 12/14/20 | <1 | <1 | <1 | <1 | <1 | **8,900,000** |
| Injection East | 11/22/21 | <1 | <1 | <1 | <1 | **0.50 J** | **1,200,000** |

**Notes:**

* Groundwater Standards based on the New Mexico Administrative Code Section 20.6.2.3103

NS - Not sampled

J - Estimated result. Result is less than Reporting Limit

U - Undetected at the reporting limit or at the reported concentration; result is considered to be a false positive

**Bold** - Detected result

Highlighted - Result Exceeds New Mexico Groundwater Standard

LEGEND

- MW-2 — MONITORING WELL
- MW-7 — PLUG AND ABANDONED WELL
- P1 — PIEZOMETER
- E. Gray — PRIVATE WELL
- SLURRY WALL
- MAVERIK CARIBOU FORMER REFINERY BOUNDARY
- WESTSIDE IRRIGATION DITCH FILLED IN LOCATION

Co. Road 6261

Co. Road 6257

O. Curley

I. Hull

Co. Road D 6255

E. Mclemore

E. Gray

J.L. Flack

R. Neff

Co. Road D 6259

Co. Road D 6263

MW-2

MW-1

Road

MW-21

MW-20

P4

P3

MW-22

MW-10

MW-18

P1

MW-17

P2

MW-19

U.S. Highway 64

WESTSIDE IRRIGATION DITCH

MW-16

MW-14

MW-9

MURRAY PROPERTY DITCH

DITCH IS FILLED IN AT THIS LOCATION

FARMER'S MUTUAL IRRIGATION DITCH

MW-15

(Out of Service)

MW-7

DITCH IS FILLED IN AT THIS LOCATION

MW-3

G. Nelson

R. Jackson

A. Jackson

Ryan

MW-4

Co. Road D 6271

MW-8

M. Stone

CO. Road 6100

WM. H. Walker

MW-5

100 0 200

SCALE IN FEET

TRC

2021 ANNUAL GROUNDWATER REPORT
MAVERIK CARIBOU FORMER REFINERY
KIRTLAND, NEW MEXICO

DATE: 02-01-22 | DRWN: NCP

SITE LOCATION MAP
NOVEMBER 2021

FIGURE 1

LEGEND

- MW-2 — MONITORING WELL
- MW-7 — PLUG AND ABANDONED WELL
- P1 — PIEZOMETER
- E. Gray — PRIVATE WELL
- SLURRY WALL
- MAVERIK CARIBOU FORMER REFINERY BOUNDARY
- GROUNDWATER ELEVATION CONTOURS
- WESTSIDE IRRIGATION DITCH FILLED IN LOCATION

Co. Road 6257

Co. Road 6261

Co. Road D 6259

Co. Road D 6263

Co. Road D 6271

CO. Road 6100

U.S. Highway 64

Road

E. Mclemore

E. Gray

J.L. Flack

R. Neff

O. Curley

I. Hull

MW-2 5190.95

MW-1

MW-21 5186.83

MW-20 5185.55

MW-10 5184.37

MW-19 5185.30

P4

P3

P2

P1

MW-22 5187.25

MW-18 5188.61

MW-17 5186.50

MW-16

MW-14

MW-9

MW-15

MW-3

MW-7

MW-8

MW-4

MW-5

G. Nelson

R. Jackson

Ryan

A. Jackson

M. Stone

WM. H. Walker

(Out of Service)

DITCH IS FILLED IN AT THIS LOCATION

DITCH IS FILLED IN AT THIS LOCATION

WESTSIDE IRRIGATION DITCH

FARMER'S MUTUAL IRRIGATION DITCH

MURRAY PROPERTY DITCH

5188

5187

5186

5185

5184

100 0 200

SCALE IN FEET

TRC

2021 ANNUAL GROUNDWATER REPORT
MAVERIK CARIBOU FORMER REFINERY
KIRTLAND, NEW MEXICO

DATE: 02-01-22 | DRWN: NCP

POTENTIOMETRIC SURFACE MAP
NOVEMBER 2021

FIGURE 2

LEGEND

- MW-2 — MONITORING WELL
- MW-7 — PLUG AND ABANDONED WELL
- P1 — PIEZOMETER
- INJ-W — INJECTION WELLS
- E. Gray — PRIVATE WELL
- SLURRY WALL
- MAVERIK CARIBOU FORMER REFINERY BOUNDARY
- WESTSIDE IRRIGATION DITCH FILLED IN LOCATION

ALL RESULTS ARE IN MICROGRAMS PER LITER (µg/L)
J - ESTIMATED CONCENTRATION

Co. Road 6257

Co. Road 6261

O. Curley

I. Hull

E. Mclemore

E. Gray

J.L. Flack

R. Neff

Co. Road D 6259

Co. Road D 6263

G. Nelson

U.S. Highway 64

Road

| INJ-W (Within Slurry Wall) | 11/22/21 |
|---|---|
| Benzene | 0.52 J |
| Toluene | <1 |
| Ethylbenzene | <1 |
| Total Xylenes | <1 |
| 1,2-DCA | <1 |

| MW-17 (Within Slurry Wall) | 11/22/21 |
|---|---|
| Benzene | 0.59 J |
| Toluene | <1 |
| Ethylbenzene | <1 |
| Total Xylenes | <1 |
| 1,2-DCA | <1 |

| MW-22 (On-Site) | 11/22/21 |
|---|---|
| Benzene | <1 |
| Toluene | <1 |
| Ethylbenzene | <1 |
| Total Xylenes | <1 |
| 1,2-DCA | <1 |

| INJ-N (Within Slurry Wall) | 11/22/21 |
|---|---|
| Benzene | 0.45 J |
| Toluene | <1 |
| Ethylbenzene | <1 |
| Total Xylenes | <1 |
| 1,2-DCA | <1 |

| INJ-E (Within Slurry Wall) | 11/22/21 |
|---|---|
| Benzene | <1 |
| Toluene | <1 |
| Ethylbenzene | <1 |
| Total Xylenes | <1 |
| 1,2-DCA | 0.50 J |

| INJ-S (Within Slurry Wall) | 11/22/21 |
|---|---|
| Benzene | <1 |
| Toluene | <1 |
| Ethylbenzene | <1 |
| Total Xylenes | <1 |
| 1,2-DCA | <1 |

MW-1, MW-2, MW-3, MW-4, MW-5, MW-7, MW-8, MW-9, MW-10, MW-13, MW-14, MW-15, MW-16, MW-17, MW-19, MW-20, MW-21, MW-22, P1, P2, P3, P4, INJ-W, INJ-N, INJ-E, INJ-S, SW12, SW13

WESTSIDE IRRIGATION DITCH

FARMER'S MUTUAL IRRIGATION DITCH

MURRAY PROPERTY DITCH

DITCH IS FILLED IN AT THIS LOCATION

DITCH IS FILLED IN AT THIS LOCATION

(Out of Service)

R. Jackson

A. Jackson

Ryan

MW-4

Co. Road D 6271

CO. Road 6100

M. Stone

WM. H. Walker

MW-5

100 0 200

SCALE IN FEET

TRC

2021 ANNUAL GROUNDWATER REPORT
MAVERIK CARIBOU FORMER REFINERY
KIRTLAND, NEW MEXICO

DATE: 02-01-21 | DRWN: NCP

BTEX CONCENTRATION MAP
NOVEMBER 2021

FIGURE 3