

# Oklahoma Water Resources Center

## Virtual fencing to control cattle for improved ecosystem services EPA Project No. MX – 02D00721

Quarter no. 8 From April 1, 2023 Through June 30, 2023.

### I. Abstract

Virtual fencing (VF) demonstrations and cattle movement tracking continue at the experimental ranges and at the first cooperating ranch. The base station for cooperating ranch #2 has been built and VF will be installed next quarter. On June 20, 2023, VF was implemented on the East Native Range so that cattle will graze rotationally and be excluded from riparian areas. Riparian assessments were conducted, and drone imageries were captured at both the experimental ranges and cooperating ranches. Water quality samples were collected and processed following runoff events at the flumes installed on the research ranges. Initial modeling results have been completed and comparisons with available data has started. Outreach materials were developed for the Oklahoma Conservation Commission (OCC) soil health programs and presented to OCC staff. Next quarter we will continue monitoring water quality and riparian health, implement virtual fencing at cooperating ranch #2, track cattle movement, and observe the effectiveness of VF to implement best management practices.

### II. Overall Progress and Results by Task

#### TASK 1: PROJECT ADMINISTRATION

**Subtask 1.1:** *OWRC will prepare electronic quarterly progress reports (QPRs) for submission to the EPA. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of October, January, April and July. QPRs shall be distributed to all Project Partners.*

The following actions have been completed during this reporting period:

- a. The 8<sup>th</sup> quarterly report was prepared and submitted by July 15, 2023.

**75% Complete**

**Subtask 1.2:** *OWRC will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to EPA at least quarterly.*

The following actions have been completed during this reporting period:

- a. As of June 30, \$248,038.61 (34.41%) had been expended and another \$29,458.45 encumbered.

**35% Complete**

**Subtask 1.3:** *OWRC will host coordination meetings, at least quarterly, with the project team to discuss project activities and schedule, communication needs, deliverables, and other requirements.*

The following actions have been completed during this reporting period:

- a. EPA Virtual Fencing project team meetings were held with OSU researchers and Vence on May 3, 2023, May 17, 2023, May 31, 2023, and June 28, 2023.

- b. A quarterly meeting was rescheduled for July 5<sup>th</sup> with all co-PIs to update progress on deliverables, the added cooperating ranch, and publications.

**75% Complete**

**Subtask 1.4:** *OWRC will develop a Final Report that summarizes activities completed and conclusions reached during the project and discusses the extent to which project goals and measures of success have been achieved.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

**0% Complete**

## **TASK 2: QUALITY ASSURANCE**

**Subtask 2.1:** *OWRC will develop a QAPP consistent with the most recent versions of EPA Requirements for Quality Assurance Project Plans (QA/R-5).*

The following actions have been completed during this reporting period:

- a. The project QAPP was submitted in September 2021.

**100% Complete**

**Subtask 2.2:** *OWRC will implement the approved QAPP. OWRC will submit revisions and necessary amendments to the QAPP as needed.*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

**75% Complete**

## **TASK 3: VIRTUAL FENCING DEMONSTRATIONS ON COOPERATING RANCHES**

**Subtask 3.1:** *Identify cooperating ranch(es).*

The following actions have been completed during this reporting period:

- a. Research activities have officially started at cooperating ranch #2.

**100% Complete**

**Subtask 3.2:** *Install VF system on cooperating ranch(es).*

The following actions have been completed during this reporting period:

- a. The base station has been built and is ready for installation at cooperating ranch #2.

**75% Complete**

**Subtask 3.3:** *Implement grazing management & riparian protection on demonstration ranch(es) using virtual fencing.*

The following actions have been completed during this reporting period:

- a. Demonstration of virtual fencing at cooperating ranch #1 continued this quarter.
- b. The virtual fencing management program continues at cooperating ranch #1.

**60% Complete**

**Subtask 3.4:** *Perform Stream Visual Assessment.*

The following actions have been completed during this reporting period:

- a. Stream visual assessments were conducted at cooperating ranch #1 on April 12, 2023 and at cooperating ranch #2 on May 2, 2023.

**65% Complete**

**Subtask 3.5:** *Remote assessment of wildlife & pollinator habitat.*

The following actions have been completed during this reporting period:

- a. Drone imagery was flown at cooperating ranch #1 last quarter and cooperating ranch #2 on June 15, 2023.

**35% Complete**

#### **TASK 4: VIRTUAL FENCING EVALUATION AT OSU RESEARCH RANGE(S)**

**Subtask 4.1:** *Implement grazing management and riparian protection via VF*

The following actions have been completed during this reporting period:

- a. Background data collection on cattle movement continued until June 19, 2023.
- b. Virtual fencing for best management practices began on June 20, 2023 on the East Native Range and cattle will continuously graze the Lake Carl Blackwell Range for comparison.

**70% Complete**

**Subtask 4.2:** *Perform Stream Visual Assessment at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. Stream visual assessments were conducted on the four experimental range riparian areas on April 12, 2023.

**60% Complete**

**Subtask 4.3:** *Install ISCO samplers at paired watersheds at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

**100% Complete**

**Subtask 4.4:** *Monitor water quality at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. 22 samples were collected this quarter with the most recent sample collected June 18, 2023.
- b. Regularly scheduled maintenance for ISCO samplers was conducted April 28, 2023, May 31, 2023, and June 30, 2023.

**75% Complete**

**Subtask 4.5:** *Remote assessment of wildlife & pollinator habitat at OSU Research Range(s).*

The following actions have been completed during this reporting period:

- a. Drone imagery was flown at the East Native Range on May 8, 2023 and Lake Carl Blackwell Range on May 2, 2023 and May 6, 2023.

**50% Complete**

**TASK 5: WATERSHED MODELING**

**Subtask 5.1:** *Gather input data*

The following actions were underway during this reporting period:

- a. Data was gathered and procedures reviewed for APEX modeling.
- b. Data inconsistencies addressed in meetings on June 8, 2023 and June 20, 2023.

**60% Complete**

**Subtask 5.2:** *Model development*

The following actions have been completed during this reporting period:

- a. Baseline APEX models have been created for watersheds at East Native 1 and East Native 2 watersheds.

**40% Complete**

**Subtask 5.3:** *Model calibration*

The following actions have been completed during this reporting period:

- a. Comparisons of the water quality and quantity values from the East Native 1 and East Native 2 watersheds are being compared with modeled values.

**15% Complete**

**Subtask 5.4:** *Model validation*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

**0% Complete**

**Subtask 5.5:** *Perform long-term simulations*

The following actions have been completed during this reporting period:

- a. No activity to report this quarter.

**0% Complete**

**TASK 6: OUTREACH**

**Subtask 6.1:** *Develop Extension programs and materials.*

The following actions have been completed during this reporting period:

- a. Videos have been created to show the various steps for installing virtual fencing and how the cattle react to collar cues.

**35% Complete**

**Subtask 6.2:** *Deliver Extension programs to producers.*

The following actions have been completed during this reporting period:

- a. Extension In-service training planned for August 2, 2023 at the Bluestem Research Range
- b. Virtual fence presentation in Enid, OK prepared for at Oklahoma Conservation Commission conference on July 19, 2023
- c. Field day in New Mexico with other VF scientists and industry partners on September 26, 2023

**55% Complete**

**Subtask 6.3:** *Develop standards, specifications, and guidance.*

The following actions have been completed during this reporting period:

- a. A draft of a guidance document entitled, “The Application of Virtual Fencing for Cattle Management and Environmental Sustainability” has been shared between EPA and CIG project personnel.
- b. A white paper document entitled, “Installing Vence VF (Virtual Fencing) collars on cattle” outlines the protocols for properly installing the base stations and collars required for implementing virtual fencing.

**30% Complete**

**Subtask 6.4:** *Deliver results to producers via Soil Health programs.*

The following actions have been completed during this reporting period:

- b. Presentation materials were developed and shared with the Oklahoma Conservation Commission Soil Health team.

- c. A meeting to discuss the materials was conducted on June 8, 2023.

**35% Complete**

**Subtask 6.5:** *Communicate results via social media, newsletter, webpage.*

The following actions have been completed during this reporting period:

- a. Oklahoma Water Resources Center
- Analytics for the 4 Oklahoma Water Resources Center social media posts are as follows.

	Posts	Reach/Impressions	Engagements	Reactions
Facebook	2	831	152	65
Twitter	2	159	4	N/A
Total	4	990	156	65

- b. OSU Natural Resources Extension
- Analytics for the 6 OSU Natural Resources Extension social media posts are as follows.

	Posts	Reach/Impressions	Engagements
Facebook	1	3,345	147
Instagram	1	420	22
Twitter	1	272	12
Total	3	4,037	181

**60% Complete**

**Subtask 6.6:** *Deliver presentations at conferences.*

The following actions have been completed during this reporting period:

- Virtual classroom presentation on April 11, 2023 entitled: Collars on Cows?
- Presentation on April 18, 2023 in Orlando Florida entitled: The Application of AI algorithms to Optimally Implement Virtual Fencing and Precision Livestock Grazing
- International grassland conference Marvin Klemme Range Station on May 12, 2023
- Lightening talk at Universities Council on Water Resources Annual Water Resources Conference in Fort Collins, CO on June 13, 2023 entitled: Evaluating the Impacts of Cattle Grazing Management on the Water Quality of Surface Runoff in Central OK

**50% Complete**

**Subtask 6.7:** *Publish manuscripts in peer reviewed journals.*

The following actions have been completed during this reporting period:

- Analysis and writing are underway for a paper demonstrating the effectiveness of VF on excluding cattle from sensitive areas.

**20% Complete**

**III. Related Issues/Current Problems and Favorable or Unusual Developments**

- Weather has caused adverse conditions for using the drone to capture aerial images of the research ranges and cooperating ranches.
- Preliminary APEX modeling results match the water quantity from East Native 1 watershed but not from East Native 2 watershed.

#### **IV. Projected Work for Next Quarter**

- Continued data collection for water quality sampling, riparian/stream visual assessments, and cattle movement using GPS collars.
- UAV flights and vegetation sampling continue to address pollinator and wildlife habitat assessments (2-3 annually)
- Progress on model development using available data sets and incorporating runoff data