Quarterly Report – Public Page

Date of Report: *6th Quarterly Report-April 14, 2020*
Contract Number: *693JK31810011*
Prepared for: *Government Agency: USDOT - PHMSA*
Project Title: *River Scour Monitoring System for Pipeline Threat Prevention*
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For quarterly period ending: *March 31, 2020*

1: Items Completed During this Quarterly Period:

During the 6th Quarter, the following items were completed:

Item #	***Task #***	***Activity/Deliverable***	***Title***
15	***6***	System Installation #5	Field installation of RSS
16	***7***	Daily data collection	Collection of field data
17	***7***	Monthly analysis of data	Summary report of monthly data
30	***8***	6th Quarterly Status Report	Quarterly report

2: Items Not-Completed During this Quarterly Period:

The following tasks were not completed during this Quarterly Period:

Item #	***Task #***	***Activity/Deliverable***	***Title***
22	***7***	Daily data collection	Collection of field data
23	***7***	Monthly analysis of data	Summary report of monthly data
24	***2***	System Upgrade (version 4.0)	Upgrading of system
25	***5***	Software/Website Upgrade (version 3.0)	Upgrading software/website
28	***7***	Daily data collection	Collection of field data
29	***7***	Monthly analysis of data	Summary report of monthly data

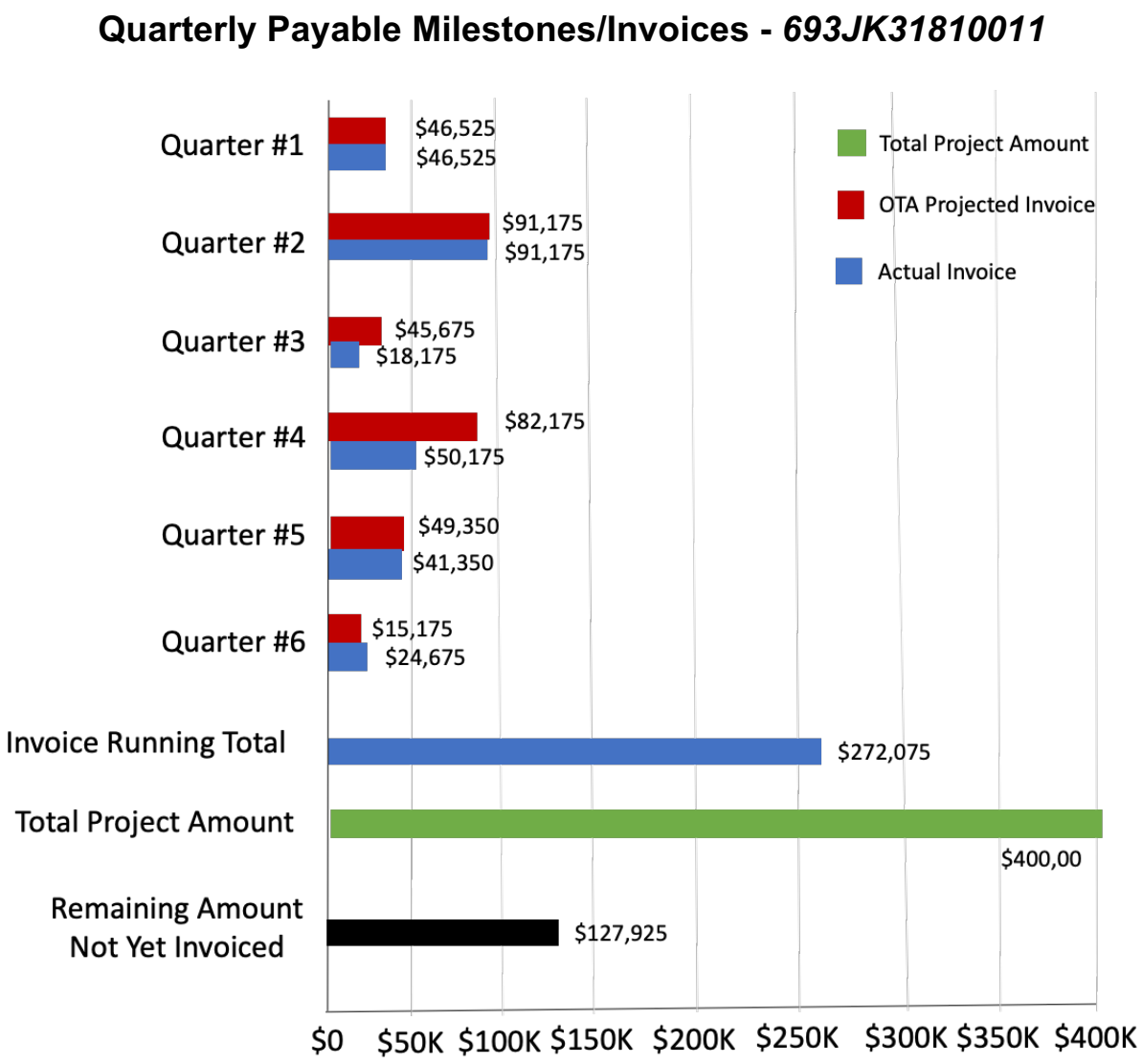
Item 22/28, Task 7 – Daily data collection, we are currently collecting data from four recent installations of the River Scour Monitoring Systems that were deployed in late November and December.

Item 23/29, Task 7 – Monthly analysis of data, we will analyze the collected data from the four recent installation at the end of this month.

Item 24, Task 2 – System Upgrade (version 4.0), we are currently working on integrating a camera into the system to give a visual indication of the river status. We have found an off the shelf product that can be tied into the existing above ground electronics, but it is progressing.

Item 25, Task 5 – Software/Website Upgrade (version 3.0), the software team is currently upgrading the website to allow viewers to view the most recent images and download additional images.

3: Project Financial Tracking During this Quarterly Period:



4: Project Technical Status

River Scour Monitoring System (RSS) Installations

Item #15, Task #6 – Installation #5 was completed between March 7 and 11, 2020 on a 16-inch pipeline owned and operated by Pembina Pipelines under the Freeman River near Fort Assiniboine, Alberta Canada. The Freeman River is a relatively short tributary of the Athabasca River that flows in the southeastern direction from Swan Hills, Alberta to Fort Assiniboine, Alberta. Normally the river experiences low flow and is not very deep; however, it is prone to large flooding events during spring run-off and during rains. The river crossing at the time of install is shown in **Error! Reference source not found.**.

Three sensors were placed on the pipeline; two upstream and one downstream. The pipeline was exposed and recoated using conventional trenchless pipeline repair methods. **Error! Reference source not**

found. shows the sensors after being epoxied to the pipe at each location and **Error! Reference source not found.** shows the above ground equipment at each location.

Figure 1. Freeman River Crossing in March 2020

One of the River Scour Monitoring Systems (RSS) was placed to monitor a buried pipeline, while the other was placed to monitor a parallel exposed pipeline. This provides an excellent comparison of the operation efficiency of the RSS. Figure 2 illustrates the sensor installation, while the above ground installed RSS units are shown in Figure 3.

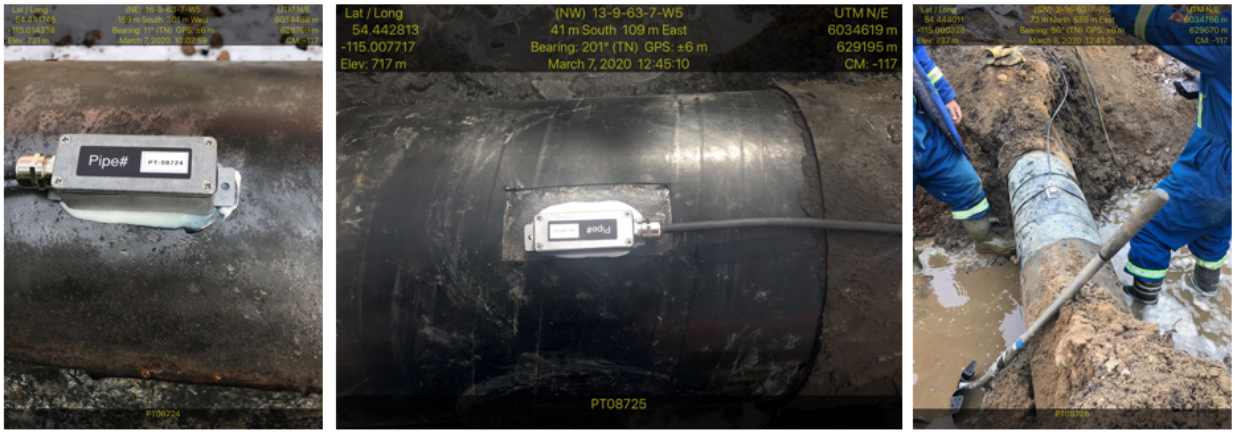


Figure 2. Sensor Installations at the Freeman River from Left to Right: Upstream 1, Upstream 2 and Downstream 1

Figure 3. Above Ground River Scour Monitoring Systems at the Freeman River from Left to Right: Upstream 1, Upstream 2 and Downstream 1

Data Collection and Monthly Data Analysis

Item #16/17, Task #7 – Daily data collection (every 10 minutes) and monthly analysis was conducted for the four installations at the Tongue River and Elk River sites installed in November and December 2019, respectively. Temperature data on the pipe, soil and air as well as a battery voltage is being collected every ten minutes at each sensor location since installation. Currently the data is viewed on the Pure hub with an interactive graph and downloaded as an excel spreadsheet.

Tongue River, North Dakota

The Tongue River system was installed between November 18th and 20th, 2019. Two pipelines are currently being monitored for temperature changes. Sample data on Pipeline #1 is presented in Figure 1, while data for Pipeline #2 is shown in Figure 2.

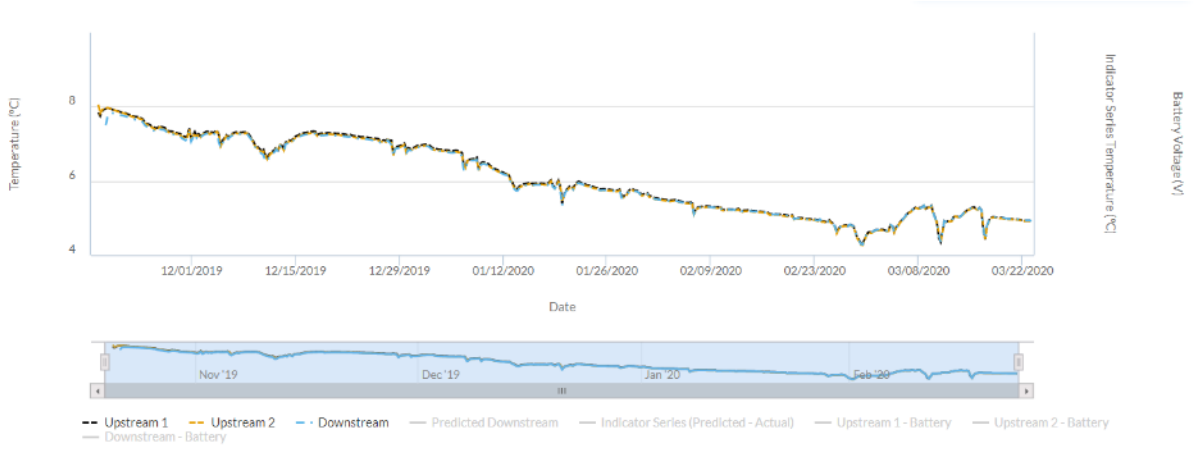


Figure 1. Pipeline Temperatures on Tongue River Pipeline #1

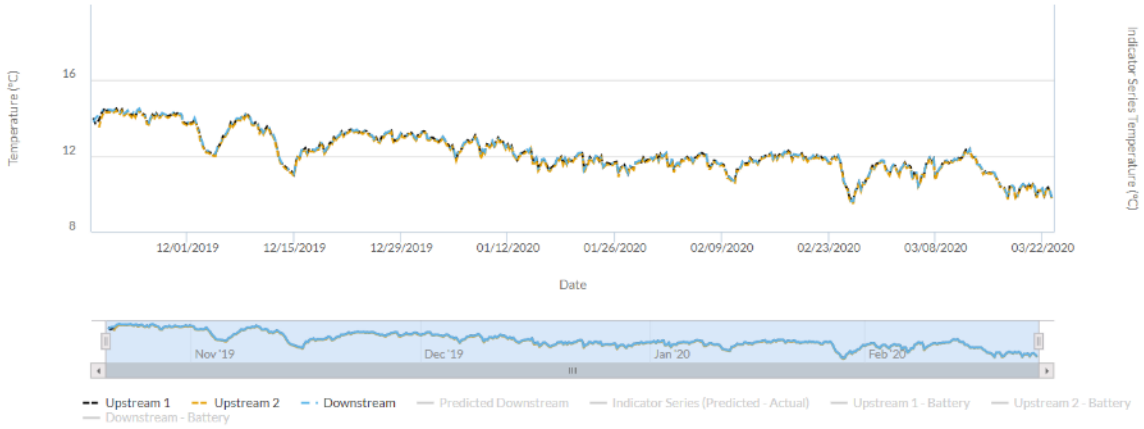


Figure 2. Pipeline Temperatures on Tongue River Pipeline #2

Elk River, Kansas

The Elk River system was installed between December 3rd and 7th, 2019 in Kansas. Two pipelines are currently being monitored for temperature changes. Pipeline #1 was installed in the 1950s using open cut construction to cross the river. Pipeline #2 was installed in the 2000s and used a horizontal directional drill to the construct the river crossing. Sample graphs and data tables for Pipeline #1 and #2 are presented in Figure 3 and Figure 4, respectfully.

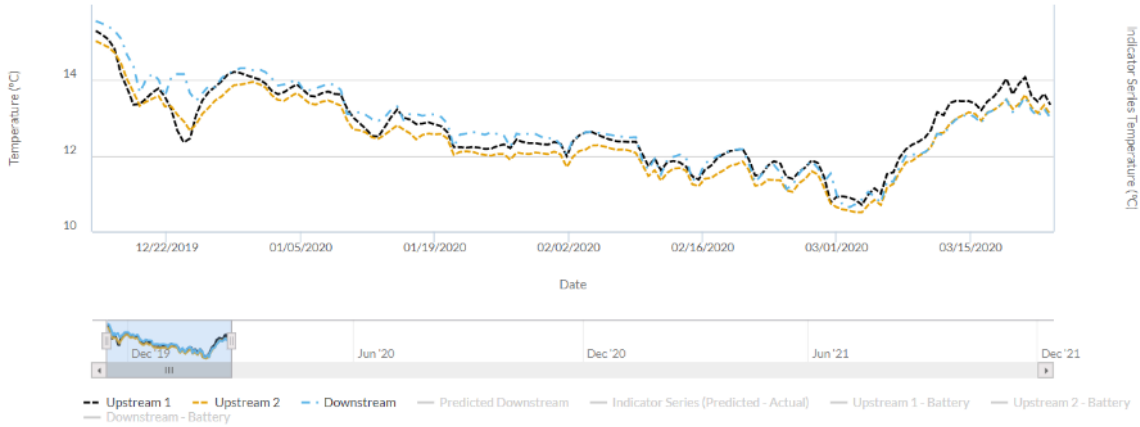


Figure 3 - Pipeline Temperatures on Elk River Pipeline #1

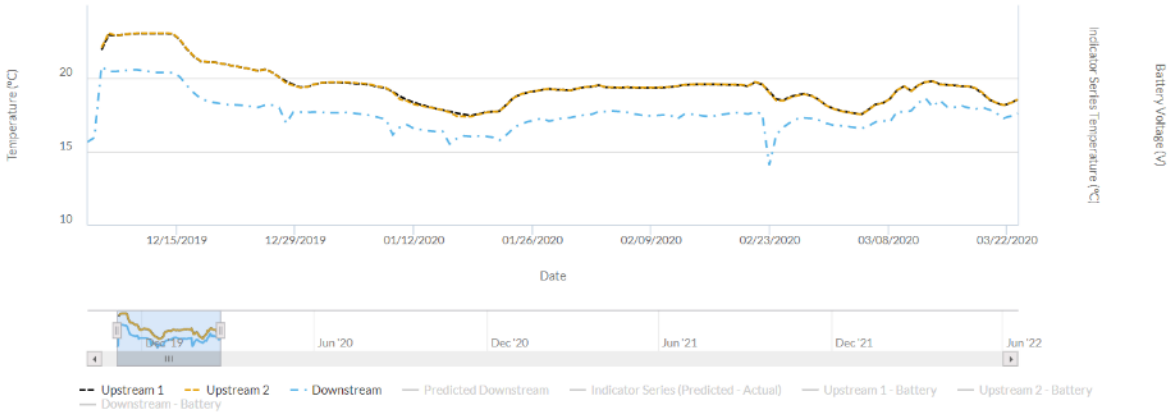


Figure 4. Pipeline Temperatures on Elk River Pipeline #2

5: Project Schedule

The project is slightly behind schedule due to permitting issues. These have been resolved and now all five installations of the River Scour Monitoring Systems (RSS) have been complete in North Dakota, Kansas, and Alberta. We have started collection and analysis of data using remote communication. Furthermore, System Upgrade (version 4.0) and Software/Website Upgrade (version 3.0) are expected to be completed within the next Quarter.

Now that we have installed all of the RSS units, the project should progress in a timely manner without any anticipated issues.