SPECIAL REPORT: KEYSTONE OIL SPILL 2022

Analysing ground changes surrounding Keystone's largest oil leak since 2010

CATALYST

The event

On the evening of Wednesday 7 December 2022, a massive leak was detected on the north-eastern Kansas stretch (Phase 2) of the Keystone pipeline, spilling more than 14,000 barrels of crude oil into the surrounding environment.

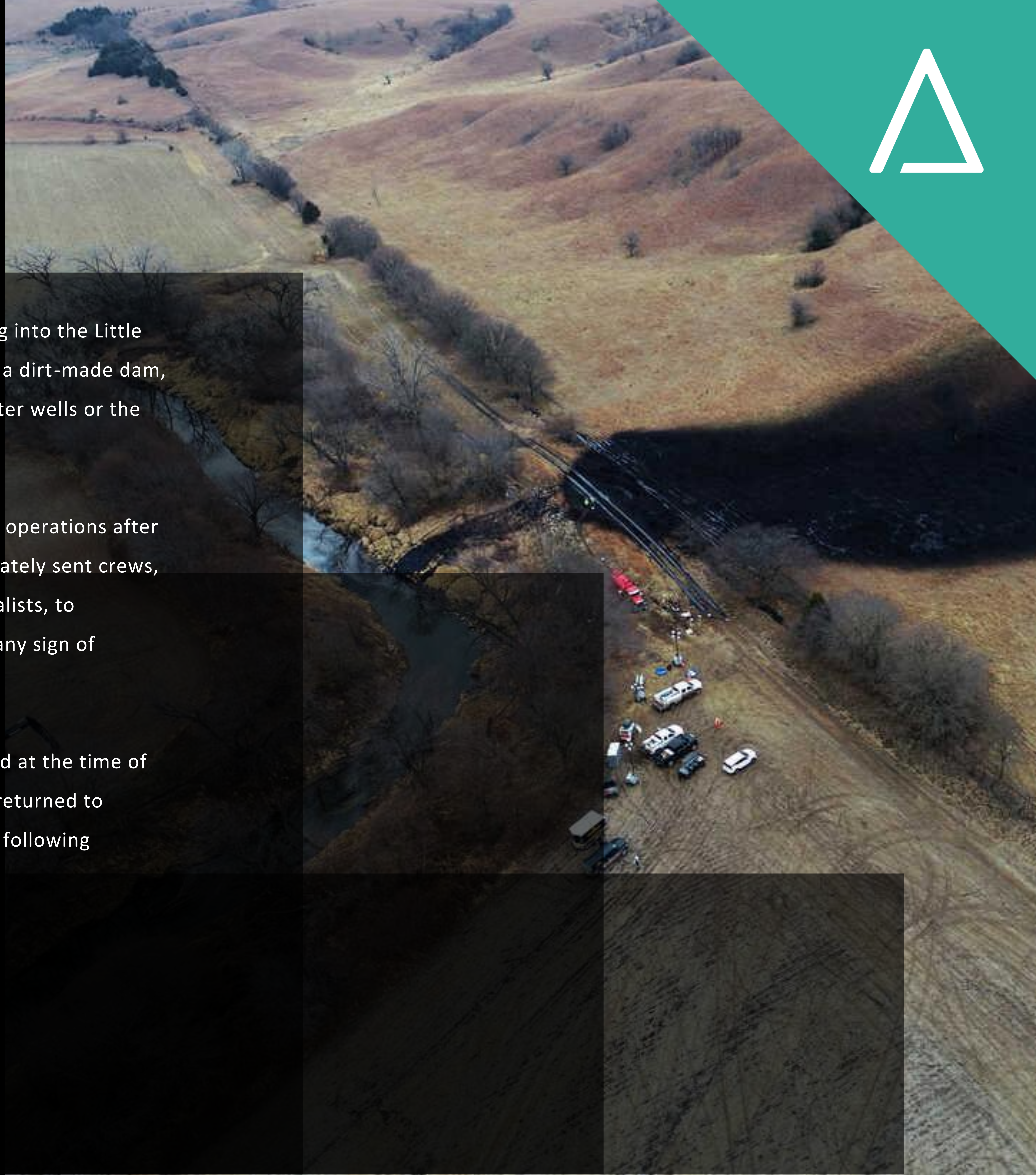
At nearly 600,000 gallons, it's one of the largest leaks to occur in the US in nearly a decade and represented a major disruption to oil transportation in the US mid-west and the Gulf coast.

It has also had significant environmental impact, with the spill flooding rural pastureland and entering the nearby Mill Creek.

Fortunately, it was prevented from flowing into the Little Blue river by a combination of booms and a dirt-made dam, meaning no known effects on drinking water wells or the public had been identified.

The pipeline owner, TC Energy, shut down operations after detecting the loss of pressure and immediately sent crews, including third-party environmental specialists, to investigate and to monitor air quality for any sign of adverse health or public concerns.

The cause of the leak hasn't been disclosed at the time of writing this feature, but the pipeline was returned to operational activity by 29 December 2022 following extensive repairs.



The event

"The affected segment has been isolated and we have contained downstream migration of the release. The system remains shutdown as a dedicated workforce are actively responding and work to contain and recover the oil.

Our estimated release volume is 14,000 barrels. Our primary focus right now is the health and safety of onsite staff and personnel, the surrounding community and mitigating risk to the environment.

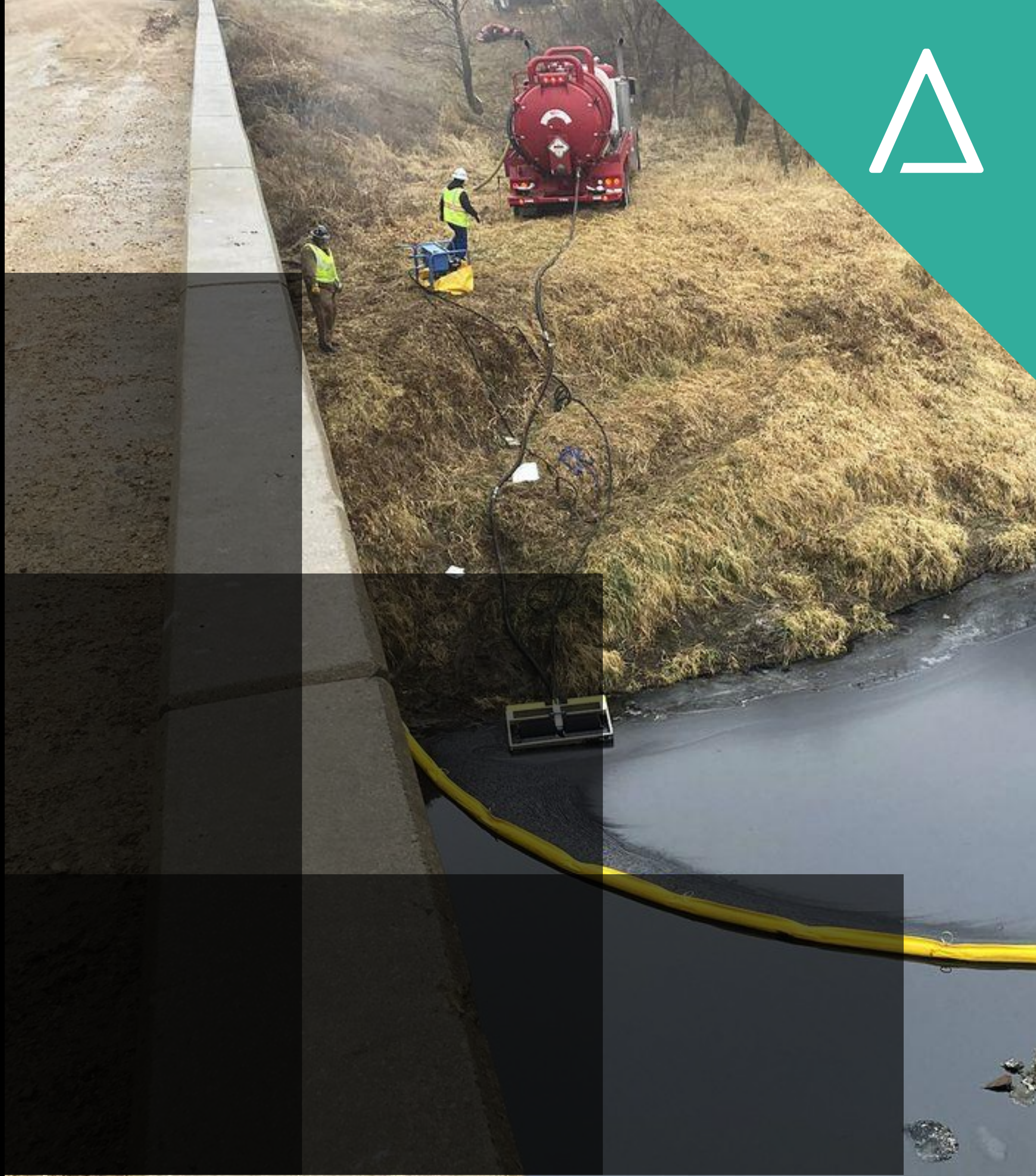
TC ENERGY STATEMENT IN RESPONSE TO INCIDENT

Special Report: Keystone Oil Spill 2022

The story of Keystone Pipeline Phase 2

KEY FACTS

Route	Western Canadian Sedimentary Basin in Alberta to refineries in Illinois and Texas.
Length	4,324 km (2,687-miles)
Ownership	TC Energy
Volume	590,000 barrels per day
Diameter	36in



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CATALYST Analysis:

While this recent event drew immediate media and environmentalist attention, it is in fact the latest in a number of leaks that has elevated the Keystone pipeline to the unwanted top spot of most US pipeline leaks in the past 13years.

That's according to a new report by Bloomberg, who found that 26,000 barrels has been spilled during that time following more than two dozen leaks.

The reason for this latest event hasn't yet been disclosed, but our team were interested in investigating whether ground movement might have been evident in the surrounding area. It's important to note here that our investigations aren't designed to make a direct causal link, but rather to use this event as a timely, relevant opportunity to utilise Earth Observation imagery and algorithms to analyse a site where a catastrophic event occurred.

Our aim, to see whether ground movement and temporal changes has been a factor in the topography in recent years and identify any significant trends that could have warranted further investigation.

The results were interesting, to say the least.

Figure 1: Mill Creek high resolution imagery from 2010 (credit USDA) showing the construction of the TC Energy pipeline.

CATALYST Analysis:

Following the spill, our starting point was to consult with leading, third-party pipeline engineers to guide our approach.

Consensus was to use high resolution digital elevation models (DEMs) to look for areas of potential concern along the pipeline at Mile 14, where the spill occurred.

High quality LiDAR based surveys are collected routinely for many parts of the US, including this portion of northern Kansas.

Freely available LiDAR based DEMs were accessed from Kansas Open Data programs from 2009 and 2017. Fortunately, this section of the pipeline was installed in 2010 (see fig.1), one year following the previous LiDAR survey.

What we observed were areas of both significant accretion (1.9m) and erosion (3m) on (see fig.2) the banks of Mill Creek close to the pipeline.

Such changes are not uncommon in features of waterways where flow passes corners and impacts the banks as it moves through.

But while not a direct link to the ground movement to any structural compromise of the pipeline can be made, it is worth noting the level of changes in the topography recorded fall well within CATALYST alert parameters and close monitoring would have been advisable.

And in fig.3, you can see why. Using CATALYST algorithms on the LiDAR DEM analysis, the level of change in the period is striking.

Figure 1: Mill Creek high resolution imagery from 2010 (credit USDA) showing the construction of the TC Energy pipeline.

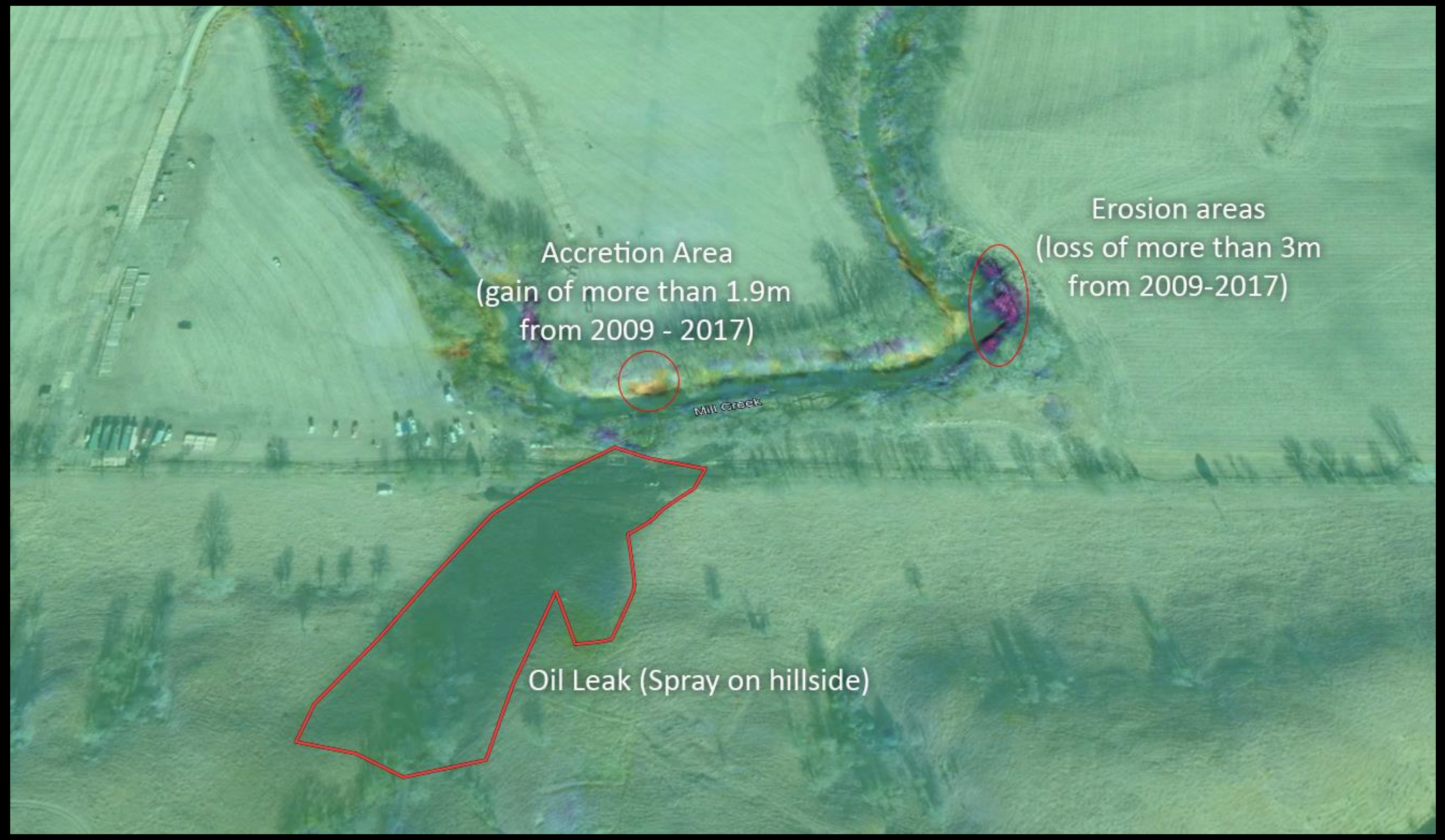


Figure 2: A recently collected satellite image (Credit Maxar) is shown with elevation change analysis carried out by CATALYST.

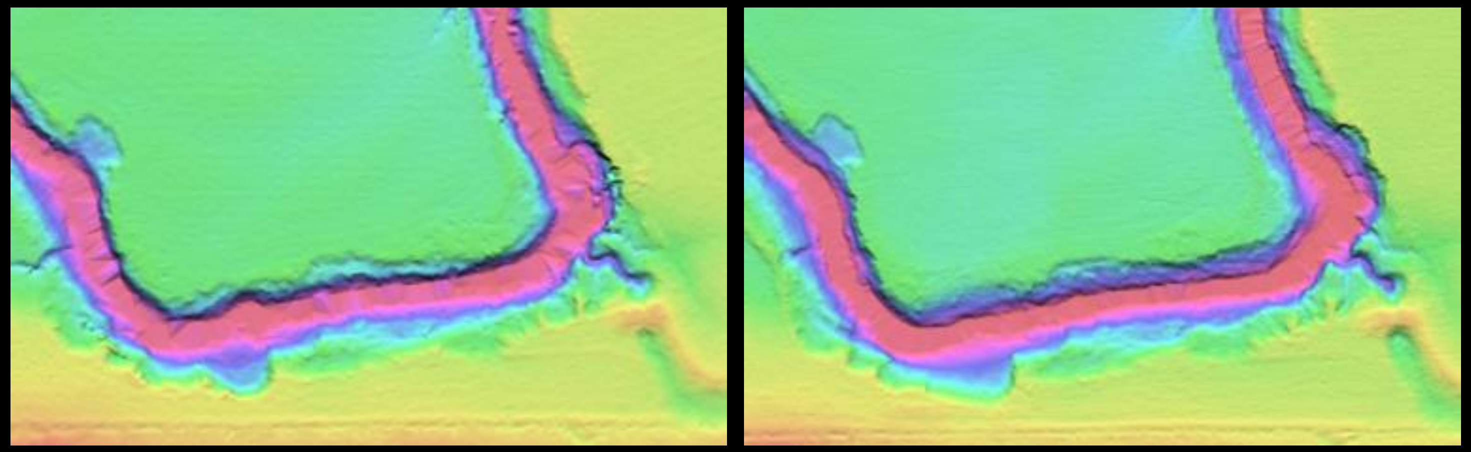


Figure 3: LiDAR DEM from 2009 (left) and 2017 (right) – CATALYST algorithms were used to examine the changes in elevation (Figure 2).

The value of this analysis

The intent of our analysis, and indeed of satellite based monitoring in general, is to highlight how the sensitivity to ground changes and displacement can be used as an early warning indicator of areas that require more monitoring.

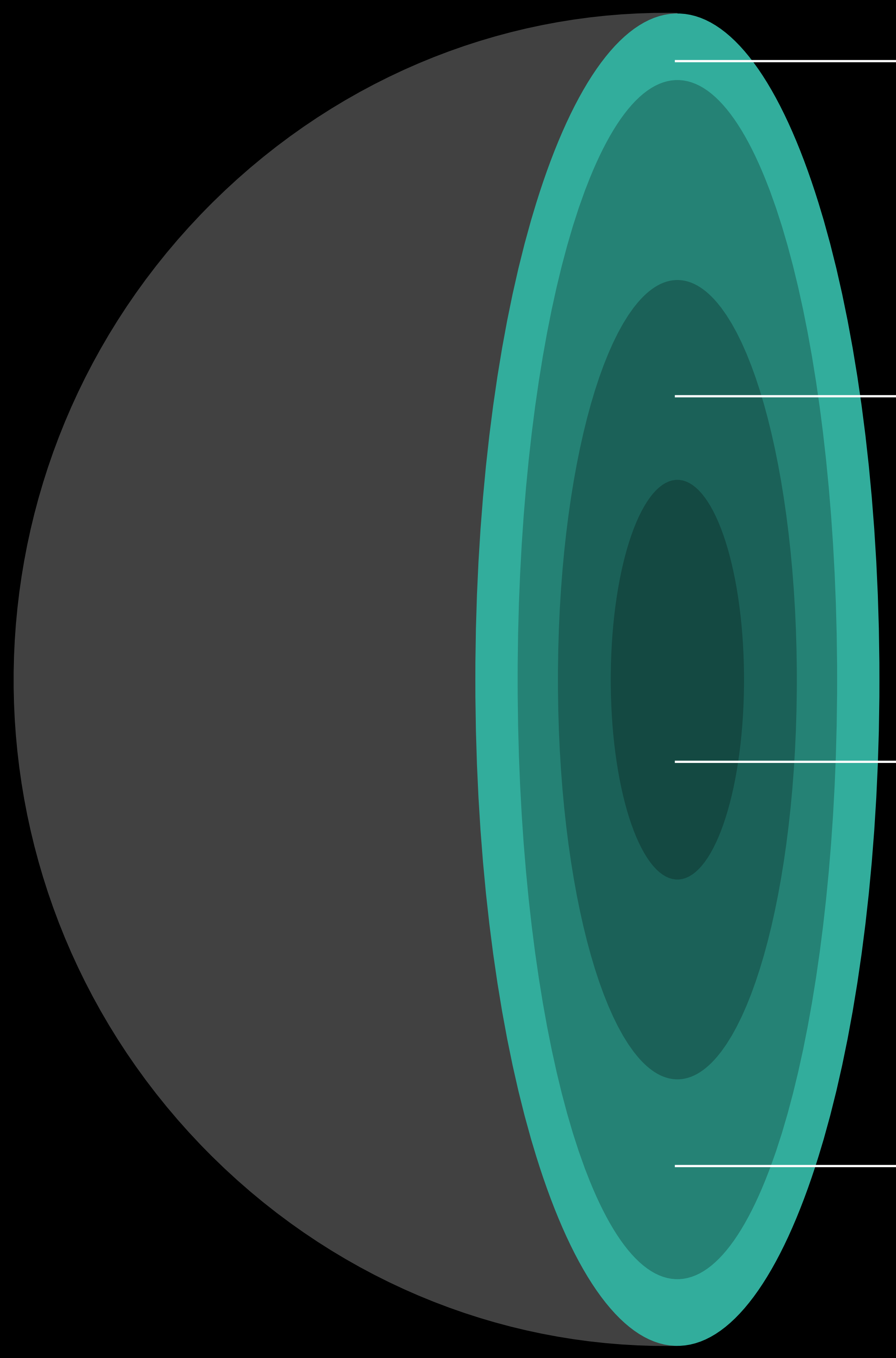
Satellite based analysis coupled with in situ ground equipment and surveying can be used as an effective risk reduction solution.

Significant structural failures, breaches or collapses can occur suddenly, and they can have both catastrophic human and economic impact. Traditional monitoring, maintenance, and risk mitigation strategies play a key role in preventing them, but they have their limitations, including operational costs and the potential safety of the maintenance teams.

Earth observation imagery and algorithms, including InSAR based ground displacement, harness the power of satellites to conduct regular monitoring of critical sites, with near-real time data delivery

This is perfect for maintenance teams to augment existing strategies at much lower cost than intermittent manual checks.

Discover what CATALYST can do for you



Earth observation and ground displacement technology is no longer a tool for the specialists.

Thanks to our cloud-based innovations, CATALYST solutions are available to all businesses, teams, and decision makers.

Integrated seamlessly into your workflows without the need for technology upgrades, they can have an immediate transformative impact on your strategies and outcomes.

Discover what they can do for you.
Get in touch with our team today.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