LOWRY LANDFILL

March 29, 2024

Executive Summary:

Status of Operations, Maintenance & Remedial Actions

INTRODUCTION

Since the last report six months ago, the City and County of Denver, Waste Management of Colorado, Inc., and Chemical Waste Management Inc., collectively referred to as the Work Settling Defendants (WSDs) conducted routine operations and maintenance (O&M) activities at and north of the Superfund Site. Details of the O&M activities are presented in this Status Report. The remedy is still working.

In summary, they consisted of extracting and treating approximately 10.3 million gallons of groundwater from several onsite and offsite extraction systems in full compliance with the Industrial Discharge Permit from Metro Water Recovery; collection and analyses of 142 samples from 100 groundwater monitoring wells; continuous operations of the Landfill Gas Extraction and Treatment system in full compliance with decision documents; collection and analyses of soil gas samples from 64 subsurface gas monitoring probes surrounding the Lowry Landfill; maintenance of stormwater conveyance ditches; and inspection and maintenance of landfill covers and buffer properties contiguous to the Superfund Site.

The area around the site consists of ongoing landfilling operations as well as residential and commercial areas. While monitoring and other operations and maintenance activities are ongoing, institutional controls, including deed restrictions, water rights, zoning, and ordinances ensure nearby residential areas are not impacted by the site contamination.

As part of the WSDs ongoing commitment to transparency and community engagement, all of site monitoring data generated during site operations and maintenance is shared on three websites maintained by USEPA, CDPHE, and the WSDs. Current and past documents, videos, presentations, and other content are available for all interested parties to download and review as desired. The WSDs will continue to provide updates on activities at the Site on publicly available websites, and opportunities for community involvement will continue to be provided through USEPA's public outreach coordinator.

Conclusions from the Fifth Five Year Review for Lowry

In its Fifth Five Year Review (2022), the EPA concluded that the remedy at the Site is protective of human health and the environment. The following are specific areas of study that informed that determination.

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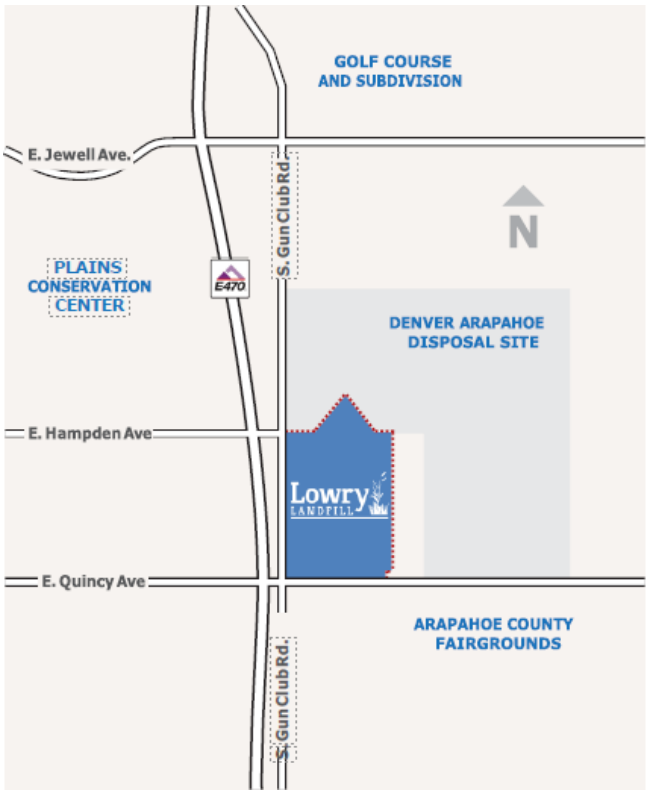
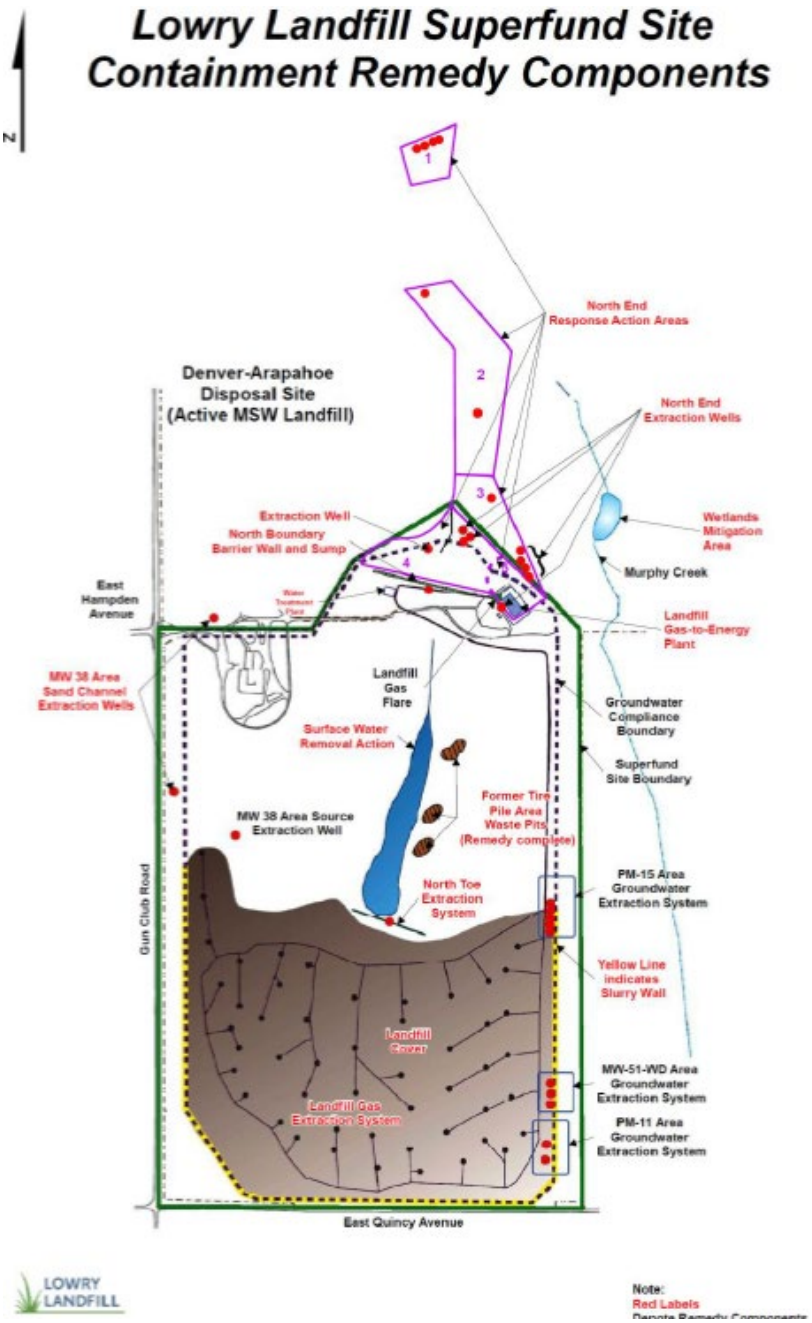
LOCATION & CONTAINTMENT REMEDY MAPS





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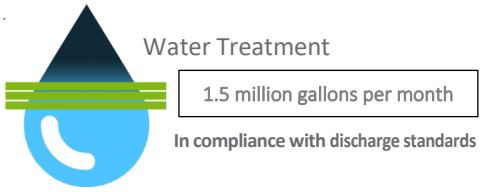
GROUNDWATER MONITORING

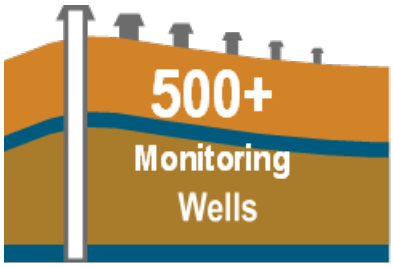
More than 500 monitoring wells extending into both shallow and deep aquifers have been installed within and outside the site to ensure that environmental resources and the community continues to be protected. Well and infrastructure inspections are a routine and critical part of the Lowry monitoring program and are conducted daily. Data shows that the monitoring system continues to be effective.

Groundwater remedy component effectiveness evaluations conducted in 2021 as part of the fourth five-year review determined that the remedial components are effective and achieve objectives. Specifically, the slurry wall – a vertical barrier wall made of clay that prevents groundwater flow – continues to effectively contain contamination inside the eastern, southern, and western limits of the landfill as designed. The North Toe Extraction System, which collects and pumps water to the treatment plant at less than 0.5 gallon per minute, continues to capture the most contaminated groundwater emanating from the landfill. The 960-foot long North Boundary Barrier Wall (NBBW) located at the north end of the site is the most significant groundwater extraction feature, removing 6 to 12 gallons per minute, which prevents contamination from migrating offsite. Finally, groundwater extraction in the northwest corner of the site, known as the MW38 area, captures contaminated groundwater flowing through this area and prevents offsite migration.

Vertical migration monitoring shows vertical migration wells are in compliance with groundwater performance standards and that contaminated groundwater has not migrated to the deeper aquifers.

There are 60 compliance wells in the network, which are monitored for 29 different chemicals. There are 52 wells in compliance or potentially in compliance, and 8 wells are out of compliance, potentially out of compliance, or indeterminant for chemicals such as 1,4-dioxane, PCE, nitrate, nitrite, TCE, bromodichloromethane, and chloroform. The 8 wells that are out of, or potentially out of, compliance are being addressed by continuing to pump contaminated water to the treatment plant and monitoring, as discussed above. This method has proven to be effective at stopping groundwater flow in these areas and reducing chemical concentrations.





SITE CROSS SECTION

1,4 dioxane

- Synthetic industrial chemical sometimes added to solvents to prolong their useful life
- Used in some consumer products such as cosmetics, deodorants, soaps, toothpaste, anti-freeze & paint
- Site groundwater standard = 0.9 ppb

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FACTORS AFFECTING CONTAMINANTS IN GROUNDWATER

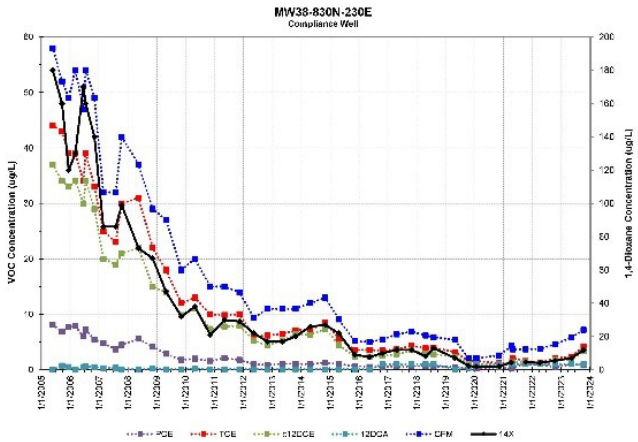
1,4-dixane and the North End

In 2005, the Colorado Water Quality Control Commission established a new groundwater standard for 1,4-dioxane. At that time, new technological advancements capable of detecting and measuring 1,4- dioxane at the new standards found 1,4-dioxane north of the site. That standard has been revised over the past 13 years, and the current state standard is now 0.35 parts per billion (ppb). Currently, the best available analytical technology is not able to reliably detect 1,4-dioxane at this concentration in site groundwater so a site-specific standard for Lowry Landfill is set at 0.9 ppb. The WSDs conduct project quantitation limit studies yearly to assess the industry's ability to detect 1,4-dioxane at lower concentrations and either confirm that 0.9 ppb remains appropriate or determine if a lower site-specific standard can be achieved.

Numerous response actions have been implemented that have effectively reduced the extent of 1,4-dioxane in the North End Area, and Compliance with discharge standards. There is a comprehensive monitoring program in place. Of the 37 current North End monitoring wells where trend analysis was performed, 89% are decreasing and 11% have no trend (i.e., are not increasing or decreasing). The observed concentration declines in all areas shows the effectiveness of the ongoing response actions and demonstrates that groundwater quality in this area is improving. Data shows that the groundwater extraction response at the site continues to significantly reduce the 1,4-dioxane concentrations, as well as the width and length of the 1,4-dioxane plume north of the site. An animation of the North End plume over time is available at www.lowrylandfillinfo.com. As stated in the 2022 Five-Year Review, "Based on the results of the North End investigation, groundwater contamination from the Site is not affecting these residential areas." Furthermore, the report states, "There are no complete exposure pathways from 1,4- dioxane in shallow groundwater. Monitoring results indicate concentrations are decreasing or stable in most off-site wells. Monitoring and extraction will continue to reduce 1,4-dioxane concentrations and prevent further migration of the plume to the north.

MW38 Sand Channel

Remedial actions to contain groundwater and reduce contaminant concentrations in the MW38 sand channel have also been successful. Water is pumped out of the sand channel to maintain inward groundwater flow ensuring the surrounding groundwater is always flowing inward, and to prevent offsite migration of contaminants. The extracted water is sent to the treatment plant for treatment and disposal. Levels of 1,4-dioxane have been reduced by 91.3% since pumping began in this area in May 2005. Chloroform and trichloroethene concentrations have also been reduced by 88% and 91%, respectively. See graph at right.



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Nitrate in the NBBW Area

One well is exceeding and nitrate standard in an area where sewage sludge was historically land farmed to cultivate and enhance microbial degradation of the sludge. This well is located along the northern boundary of the Site. There does not appear to be a potential for significant off-Site migration of nitrate at concentrations greater than the performance standard and monitoring is ongoing. Additionally, groundwater extraction from the North End wells further downgradient would capture any potential migration of these compounds if it were to occur.

WATER TREATMENT PLANT

The water treatment plant uses a natural biological process and advanced oxidation treatment to destroy more than 98% of the organic compounds coming into the plant. An ion-exchange system is used to reduce molybdenum by an average of 69%. The pretreated water is then discharged to a publicly owned wastewater treatment plant for further treatment. The on-site treatment plant removes all site chemicals to safe standards and leaves a minimal environmental footprint. It treats approximately 1.57 million gallons of contaminated groundwater every month. The data show the plant continues to operate as designed in compliance with discharge standards.

At Lowry

Extraction and treatment continue to decrease concentrations

North End Area: 37 Wells

89% *show declining concentrations*

11% *remain flat*

MW38 Channel

91.3% *Reduction of 1,4 dioxane since May 2005*

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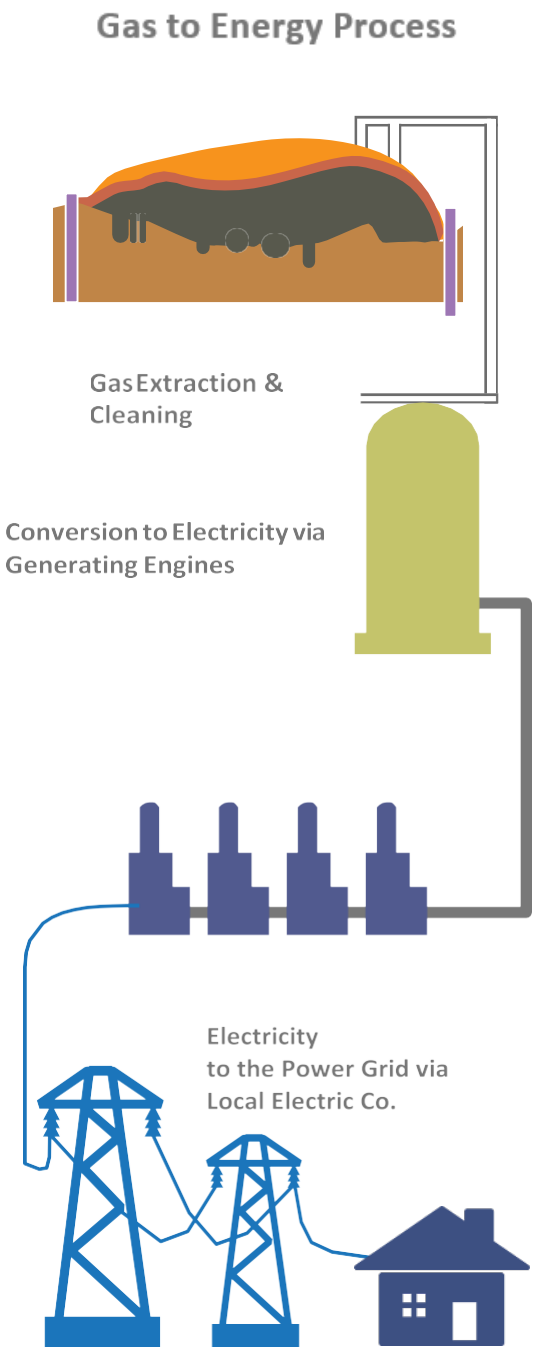
LANDFILL GAS REMEDY

Landfill gas—made up of methane, carbon dioxide, nitrogen and other gases—is created naturally by the biological decomposition of organic matter in landfills under low-oxygen conditions. The generation of landfill gas is an indication that waste disposed of in the landfill are degrading. The Site's landfill gas extraction, collection and treatment system continues to be effective and in compliance, including the gas-to-energy treatment plant, which removes roughly 5,000 tons of methane annually. This equates to removing more than 22,000 cars from the road each year. The on-site power plant, constructed in 2008, uses landfill gas to fuel four internal combustion engines that generate electricity for a local utility company. The electrical power generated is enough to supply 2,500 to 3,000 households.



LANDFILL COVER

The former landfill is covered by 4 to 12 feet of compacted clay and soil. The "cap" reduces infiltration of rain and snow into the soil, which minimizes further groundwater contamination. The cover continues to effectively drain rain and snow, keeping it from penetrating the soil. The cap is routinely monitored for any depressions that may form due to settlement that would cause rainwater to pond, among other issues. No cap settlement issues were identified in this

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