Grand Opening Fact Sheet

Central City/Clear Creek Superfund Site

July 2017

North Clear Creek Water Treatment Plant opens for business

The Colorado Department of Public Health and Environment and the U.S. Environmental Protection Agency marked the grand opening of the North Clear Creek Water Treatment Plant on Monday, July 31, 2017. The new facility, at the south end of Black Hawk, treats contaminated water from the Gregory Incline, the National Tunnel and Gregory Gulch, conveyed to the plant via a pipeline constructed in May 2012. The lime-based high-density sludge plant is designed to treat anticipated flows ranging from 150 gallons per minute to 600 gallons per minute.

Located next to Highway 119, the 1.1-acre site was created as part of a Colorado Department of Transportation (CDOT) curve-straightening project. In addition to the highway modifications and creation of the building site, CDOT reconfigured the creek to include a mix of deep and shallow water, fast and slow water, and sun and shade to promote a healthy trout population in the future.

Squeezing the building and associated infrastructure into the long and narrow site was a creative challenge for Golder Associates of Lakewood, which was responsible for the engineering design, and Bennett Wagner Grody Architects, of Denver, the project architect. The design was funded by the American Recovery and Reinvestment Act of 2009. The

construction contractor, Moltz Construction Inc. of Salida, began work on the $19 million plant in December 2015.

A brown trout fishery in North Clear Creek is a main objective of the Operable Unit 4 (OU4) Record of Decision (ROD), which was issued in 2004 to address metals contamination impacting the North Fork of Clear Creek. In April 2010 the agencies amended the ROD to change from passive treatment of the National Tunnel discharge and active treatment of the Gregory Incline discharge at a privately owned water treatment facility to full active treatment of both discharges, plus the Gregory Gulch surface water flow, at the new water treatment plant. Acidic drainage from abandoned mines carries metals such as iron, manganese, zinc, copper and cadmium. Not only are these metals toxic to fish and plants, they also add treatment expense to municipal drinking water suppliers. The water treatment plant was designed to remove around 350 pounds of these contaminants per day from sources entering the North Fork of Clear Creek.

A Colorado Department of Transportation (CDOT) contractor works on stream and habitat restoration along North Clear Creek. CDOT played an integral role, building a pad for the construction of the plant in the Highway 119 right of way as part of a major road-straightening project. Without CDOT's participation, the project would not have been possible.

The water treatment plant is the final component of a remedy designed to meet the following goals for surface water:

- Reduce in-stream metals concentrations and sediment transport to minimize water quality and habitat impacts and to maximize reasonably attainable water uses of the North Fork of Clear Creek. These actions also will support the survival of a brown trout population in the North Fork of Clear Creek.
- Reduce in-stream metals concentrations and sediment transport in North Clear Creek with the purpose of reducing adverse water quality and habitat impacts on the main stem of Clear Creek, to protect aquatic life and to support a reproducing brown trout population in the main stem of Clear Creek.
- Ensure that in-stream metals concentrations do not degrade drinking water supplies diverted from the main stem of Clear Creek.
- Reduce the toxicity to aquatic organisms living at the surface water/sediment interface or in sediment to levels that are protective of aquatic life.

The industrial aspects of the building were designed to be hidden from motorists on Highway 119. Those features include load-in and load-out areas and the lime silo. The color palette and materials blend with nearby historic structures, and varied roof lines help prevent the building from looking out of place. A multi-use path follows the creek below the plant site.

The high-density sludge process (see diagram on page 7), sends metal hydroxides into a conditioning tank where they are coated with lime and sent back through the system up to 30 additional treatment cycles. This process will efficiently remove metals from the water, creating a denser filter cake and smaller volume of material sent to landfills. A high-density sludge process can result in significant operational cost savings over traditional lime precipitation.

How water treatment removes dissolved metal

Heavy metals in the water settle to the bottom of the clarifier for removal.

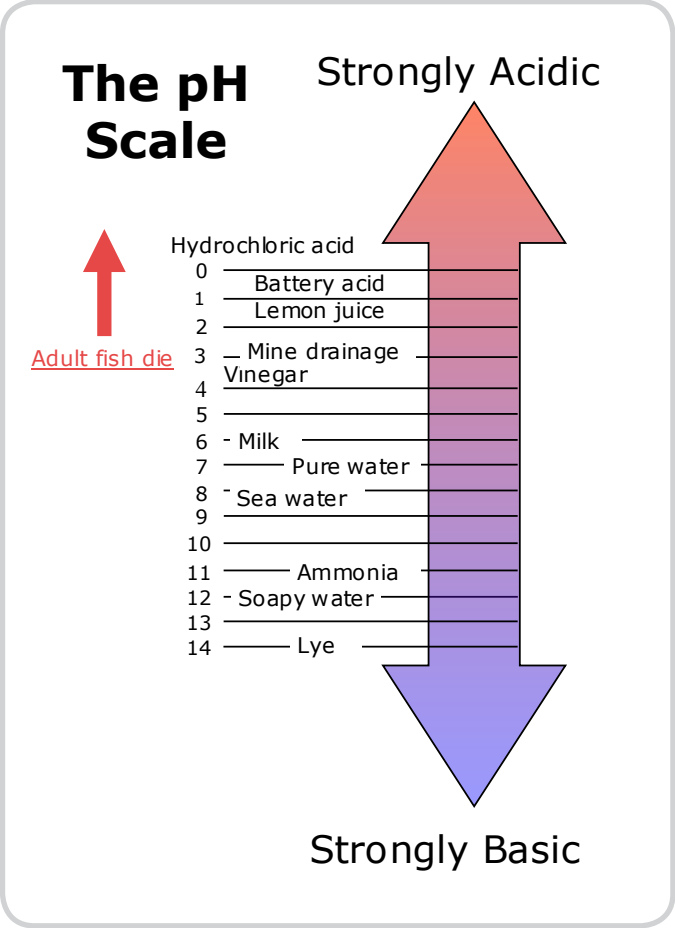
Water flowing through abandoned mines, waste rock or mill tailings becomes acidic, dissolving and mobilizing heavy metals from the rock. When this acid drainage enters streams and rivers, it harms fish and other aquatic life.

Dissolved heavy metals in high concentrations are toxic to fish. Dissolved metals also can harm the bugs and worms fish eat. The U.S. Environmental Protection Agency and the Colorado Department of Public Health and Environment have set a remedial goal of protecting aquatic life and supporting a reproducing brown trout population in the main stem of Clear Creek.

The North Clear Creek Water Treatment Plant and the Argo Tunnel Water Treatment Facility remove the metals necessary to meet that goal. To understand how they work, it's important to understand a bit about chemistry.

Water treatment chemistry

Chemicals are categorized as acids or bases. Acids dissolve heavy metals while bases cause dissolved metals to solidify. Scientists use the pH scale to measure the acidity (or alkalinity) of solutions (see chart).



Pure water has a neutral pH of 7. Acidic solutions have a lower pH value, while alkaline (basic) solutions have a higher pH value. Solutions on both ends of the pH scale are caustic and can damage living tissue.

Treatment plants manipulate pH to remove dissolved metals from water (see page 7). First, a base is added to contaminated water, raising pH and reducing acidity. As the pH value rises, dissolved metals change to a solid state. Since the metals are denser than water, they fall to the bottom of the tank, where they can be removed. Clean water flows into a trough near the top of the tank. Because this process makes the water more basic, acid is added until the pH level of the treated water falls and is safe for fish and people when it is discharged back into the creek.

NORTH CLEAR CREEK
WATER TREATMENT PLANT

Congratulations!

Design Team

Golder Associates Inc.
Bennett Wagner Grody Architects
Eaton Energy Solutions
Martin/Martin Consulting Engineers
MKK Consulting Engineers

Plant Operator

CH2M HILL Inc.

Funding Agencies

Colorado Department of Public Health and Environment
U.S. Environmental Protection Agency

Thanks to:

The members of the North Clear Creek Mitigation Advisory Committee, especially the Colorado Department of Transportation.

Construction Team

Moltz Construction Inc.
American Equipment
ASCO Construction LLC
Paso Robles Tank - Brown-Minneapolis Tank Inc.
Colorado Barricade
Cutting Edge Glass
Colorado Mechanical Insulation Inc.
Control Solutions Inc.
Douglass Colony Group Inc.
Environmental Logistics
Frontier Mechanical Inc.
Hendricks Drywall & Acoustics Inc.
HTM Construction Company Inc.
Interior Contractors Inc.
ISEC Inc.
LMS Drilling Inc.
National Coatings
Pioneer Steel Inc.
Rumler Rebar Inc.
SunDance
Sturgeon Electric
USI RG Insulation
Zylstra Baker Surveying Inc.

Special thanks to CH2M for sponsoring the ribbon-cutting ceremony!

Quartz Hill

Plant is last piece of restoration, Superfund remedy

The North Clear Creek Water Treatment Plant completes the last remedial feature required by the Operable Unit 4 (OU4) Record of Decision. To improve North Clear Creek water quality OU4 projects remediated or removed over 20 waste rock piles including the Quartz Hill Tailings Pile, completed in August 2014; built sediment-control structures and artificial wetlands; restored stream banks, and constructed the Church Placer Waste Rock Repository outside of Central City, completed in 2011.

Gregory Incline

Muddy waters

New plant addresses historic mining impacts

Gold was discovered near Idaho Springs and the Black Hawk/Central City area in 1859. For the next 20 years, the area was Colorado's leading mining center. The decline of mining in the area began with the silver crash in the 1890s and the rise in mining in Leadville. Mining continued, however, in Clear Creek and Gilpin counties until approximately 1950.

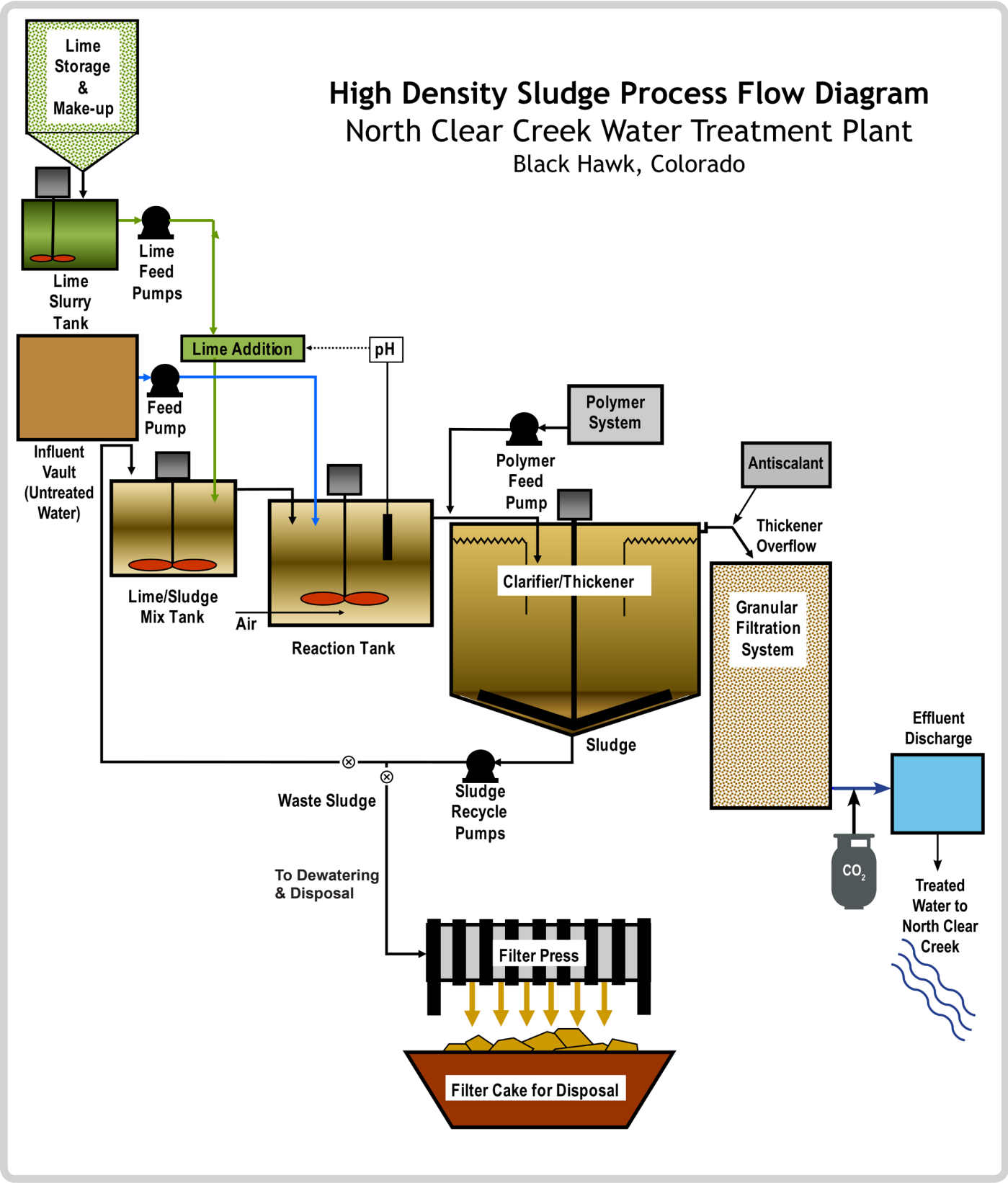
Located in Clear Creek and Gilpin counties approximately 30 miles west of Denver, the Central City/Clear Creek Superfund Study Area covers the 400-square-mile drainage basin of Clear Creek, which has been affected by a number of inactive precious metal mines. The site was listed as a Superfund site in September 1983. Since then, the Colorado Department of Public Health and Environment (CDPHE), the U.S. Environmental Protection Agency (EPA) and the local community have worked to clean up heavy metal contamination resulting from decades of hard rock mining in the area.

Environmental impacts affect the Clear Creek stream system, including a reduced fishery and impacts to other aquatic life and habitat. Acidic mine drainage contains heavy metals, and tailings and waste rock contribute to the non-point source impacts to the basin. Clear Creek is a drinking water source for over one-quarter million people living in the Denver area. It is also used for kayaking, rafting, fishing, wildlife watching and gold panning.

National Tunnel

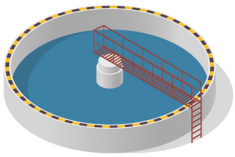
Soil from tailings and waste rock also contains heavy metals. The human health hazard from this site involves potential exposure to heavy metals, primarily lead, arsenic and cadmium.

Remediation challenges include draining mines and waste rock piles, heavy metals contaminating groundwater and surface water, impaired fish and aquatic life populations, and historic preservation needs. Remedial features include active water treatment, engineered waste pile covers and drainage systems, sediment-control structures, bulkheads and a waste rock repository.



In the reaction tank, air is added to oxidize the dissolved metals and the pH is raised to about 9.5. This forces the metals to drop out of solution. Hydrated lime (Ca(OH)2) is the reagent used to adjust the pH, and a small amount of polymer is added to build particle size and aid settling. The solution flows to the clarifier/thickener where the metals drop to the bottom of the tank creating a sludge, while relatively clear water flows off the top. The virtually clean water flows through the polishing filters prior to discharge while the sludge is dewatered in the filter presses.

FACTS: Central City/Clear Creek Superfund Site Operable Unit 4



Clarifier diameter: 60 ft

CAPACITY:

On average, the plant will process

359 *pounds of heavy metals* per day

26 Fe 55.85	*Iron* 259 lbs/day
25 Mn 54.94	*Manganese* 60 lbs/day
30 Zn 65.39	*Zinc* 24 lbs/day
13 Al 26.98	*Aluminum* 11 lbs/day
29 Cu 63.55	*Copper* 4 lbs/day

150 to **600** *gallons treated every* minute

ECONOMICS:

Construction and operations of the plant have had a positive economic impact, bringing new jobs to the area. Below is a snapshot of the economics of the project.

construction **$16.8** million

design **$1.25** million

oversight **$1.2** million

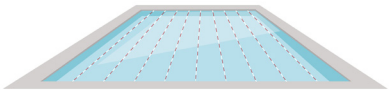
local building fees **$260,000**

special inspections **$150,000**

FOOTPRINT:

The entire water treatment process is housed in only

16,949 square feet



That is the size of **1.25** Olympic swimming pools.

The emergency generator weighs

32,770 lbs

That is more than **8** cars weigh

Energy efficiency:

92.7%

The thermal efficiency of the boiler that heats the facility

For more information:

Colorado Department of Public Health and Environment

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