
DATE: January 12, 2021

TO: Chuck Reid, CCBWQA Manager

CC: Jacob James, CCBWQA TAC Chairman

FROM: Richard Borchardt, PE & CFM

SUBJECT: Reservoir Destratification System – 2020 Compressor Replacement Project Summary



Background and Purpose:

In April 2008, the Cherry Creek Basin Water Quality Authority (CCBWQA) placed the Reservoir Destratification System (RDS) in service. Shortly after startup the air compressor began shutting down through internal overheating protection. **Figure 1** shows the location of the RDS Compressor Building where the compressor is located.

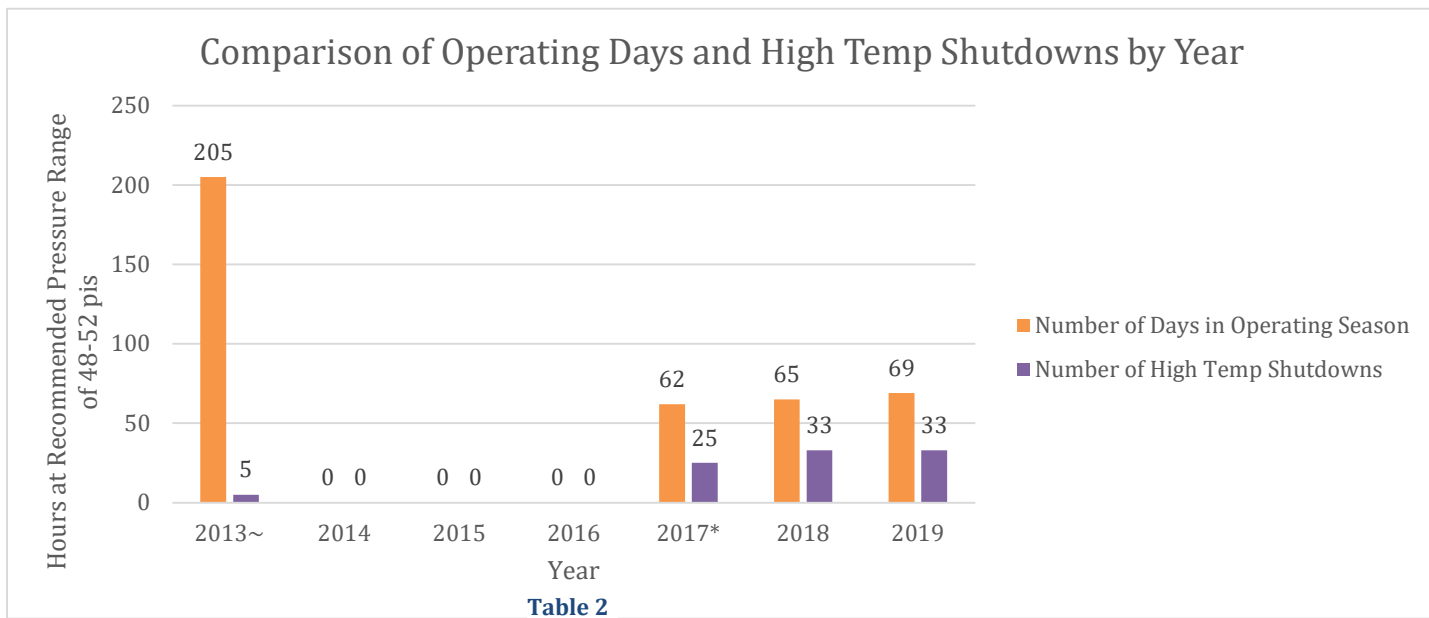
In September 2013, Eaton Energy Solutions (EES) prepared a report evaluating the RDS and providing options to improve operation of the RDS¹. EES provided several options and ultimately concluded that the compressor needed to be replaced to obtain full operation (24 hours a day, 7 days a week, through the operating season of

March 1 to November 30) at the appropriate volume of air 287 cubic feet per minute (cfm) at a pressure of 58 pounds per square inch (psi) on-site. Between 2013 and 2019, certain of EES's recommendations were implemented: replacing the above ground piping and upgrading controls to minimize manual restarts.

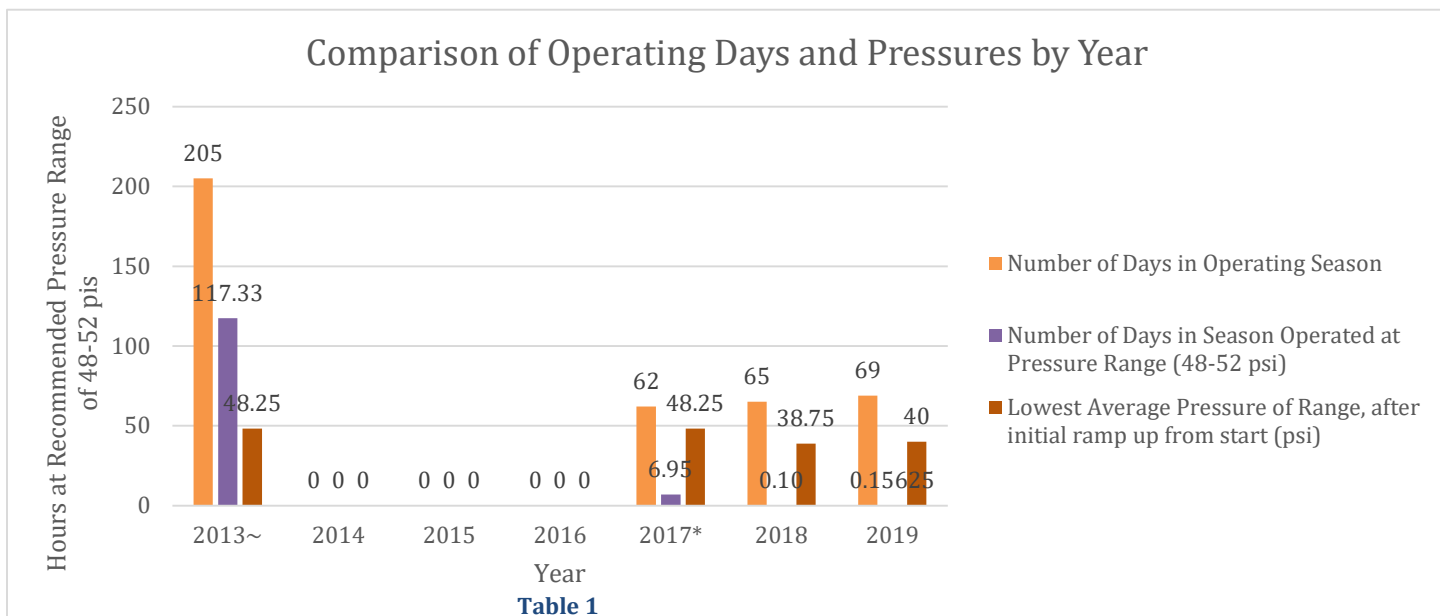
¹ Destratification System Evaluation for Cherry Creek Reservoir in Cherry Creek State Park, Co. Eaton Energy Solutions, Inc. September 27, 2013

Existing Conditions:

After the 2019 operating season, R2R Engineers prepared comparison of operating metrics from 2013 through 2019 (RDS was not operated in 2014 and 2015). These comparisons showed the continual decline operation time and pressure of the RDS. **Table 1** compares the number of days that the RDS was operated and the



corresponding number of high temperature shutdowns that occurred during that period. **Table 2** compares the number of days that the RDS was operated, with the number of days that it was operated at the best achievable pressure range (48-52 psi) with aging compressor, and the lowest average pressure range (pressure that was used to keep compressor running as much as possible). There is an apparent trend from 2018- 2019



of an increased number of high temperature shutdowns (33) with lower than ideal operating pressures (average of pressure ranges of 38.75 in 2018 and 40 in 2019).

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R2R Engineers Memorandum

Procurement and Installation:

In 2020, CCBWQA replaced the compressor through a design-build procurement process. The selected bidder, Ingersoll Rand, installed a 100 Horsepower motor compressor capable of delivering 317 cfm at 100 psi on-site (exceeds performance specification), and a variable speed drive. CCBWQA added a receiver tank in the bid alternate to lower the pressure changes and extend the life of the compressor. Pressure regulators were included to allow CCBWQA to adjust pressure to the 58 psi.

Photo 2 shows the old compressor being removed, and **Photo 3** shows the new compressor installed. ²



Photo 2

Water Quality Benefits:

The RDS' water quality benefits include:

- Reduction of approximately 810 pounds of Phosphorus per year³
- Disrupting blue-green algae life cycles as part of the whole algal assemblage, and
- Decreasing periods when the reservoir is thermally stratified during the summer⁴.

The decline in operating time and pressure (over time) has likely impacted these benefits. The compressor replacement restores the original operation parameters and associated water quality benefits.

Summary:

Water Quality Benefit of reduction of ≈ 810 pounds of Phosphorus per season

Total Project Cost = \$314,241⁵

Authority's Share = \$314,241

Engineer/Contractor: Ingersoll Rand



Photo 3

² Full Installation and Inspection Report by RG and Associates available from CCBWQA Manager.

³ CCBWQA 2020 Capital Improvement Program Supporting Data, Board Adopted Version November 21, 2019.

⁴ CCBWQA January 28, 2013. Compressor Design Basis - Daily Operation, William P. Ruzzo, P.E., Craig Wolf, GEI.

⁵ Includes 10-year maintenance plan.