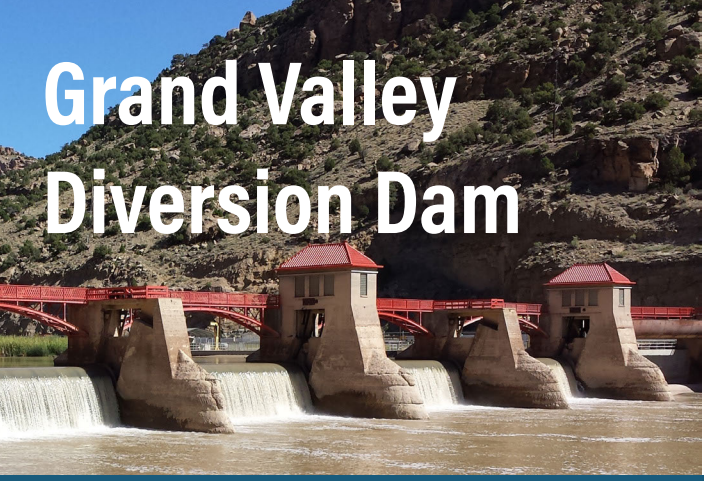


Grand Valley Diversion Dam

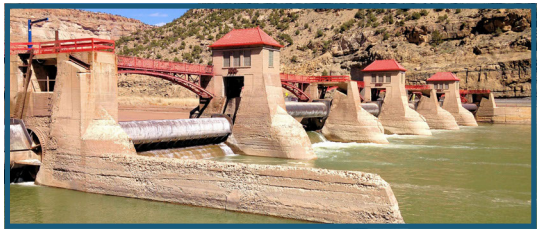
Electrical and Control Systems Upgrade Project

Joint project of

Grand Valley Water Users Association

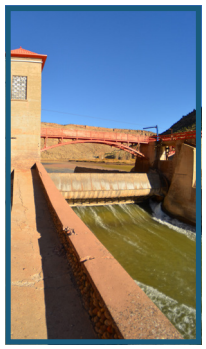
Orchard Mesa Irrigation District

Roller Dam Electrical & Controls Upgrade Project



BACKGROUND

The Grand Valley Project Diversion Dam (commonly known as the "Roller Dam") was built in 1916. The Roller Dam diverts water into the Canyon Canal for irrigation and hydropower purposes under very senior water rights. The irrigation water is provided to four irrigation entities: Grand Valley Water Users Association (GVWUA) and the Orchard Mesa (OMID), Palisade, and Mesa County Irrigation Districts, which provide irrigation water to approximately 41,000 acres of land in the Grand Valley and the Grand Valley Power Plant (GVPP). The Grand Valley Water Users Association (GVWUA) is the managing entity of a portion of the federally owned Grand Valley Project.



The existing electrical power systems were installed at the Roller Dam at the time of construction, nearly 100 years ago. Utility power was not available. Electrical power was provided by on-site generators and stored in batteries. The existing Roller Dam has an overhead three phase service from Xcel Energy. The largest load on the dam is a motor-generator which converts Alternating Current (AC) power to Direct Current (DC) power. The DC power is used to operate the seven roller gate motors. Each roller gate motor is 10 hp DC. The head gates are powered by a single 5 hp AC motor which transmits power to the gates via a bevel gear arrangement.

Part 1 of the Roller Dam Electrical Upgrade project was completed in 2019. Key elements included an extension of three-phase service, replacement and burying of all existing overhead service lines, replacement of all service safety and distribution equipment, and the installation of on-site standby power.

Part 2 was completed in 2020. Key elements included rewiring all feeder lines across the Dam, replacing AC and DC feeders to roller gate and head gate motors, installing new operational controls at the roller gate motors, repairing power service in multiple locations on the Dam, providing redundancy in overall Roller Dam electrical operations, and installing new lights, switches, and receptacles throughout the facility.

ORIGINAL MOTOR DESCRIPTIONS

There are seven existing DC motors that operate the roller gates on the Dam. The motors are mounted within open-topped, riveted-steel-plate housings within the four towers. All of the motors are Westinghouse Electric and Manufacturing Company Direct Current motors mounted on a general north–south axis perpendicular to the roller gates they regulate. They are attached on their northern ends to gear-driven gate-adjusting mechanisms. All of the motors are K type, manufactured by Westinghouse for crane and hoist applications. The motor numbers, serial numbers, and regulator numbers are listed in the table to the right. All have windings in series where the armature and the field windings are connected in series allowing the motors to draw considerable current giving them high torque. A single 20hp motor is within the westernmost tower (Tower 1), and pairs of 10 hp motors are in the other three towers (Towers 2–4), numbered from west to east. The motors regulate the flow of the Colorado River by adjusting the height of individual gates to the right and left of each tower. All of the motors have a Cutler-Hammer Clutch Company regulator mounted on their southern ends through which the electrical power is introduced. DC electricity is produced by a generator turned by an AC motor at the lower level of Tower 1. The generator is operated only when DC electricity is required to energize the seven DC motors when gate regulation is desired. The generator will be left in place.

Motor Serial & Regulator Numbers		
Motor	Serial No.	Regulator No.
1	1701403	5584A6
2	1701402	5584A1
3	1701400	5584A2
4	1701399	5584A4
5	1701398	5584A3
6	1701401	5584A5
7	1700789	507 4B

MOTORS 1-6

Motors 1–6 are situated in pairs on opposite sides of Towers 2–4 and regulate the flow of the Colorado River by adjusting the height of individual gates to the right and left of each tower. They are all No. 5 Type K, 10 hp motors. These are crane or hoist motors, but are of smaller capacity than the larger Moter 7. They are motor style 72411. Although of lower horsepower, they operated at 725 revolutions per minute (rpm). The motors are embossed "WESTINGHOUSE/NO. 5 TYPE K/M6218 N" and have attached brass nameplates, including patent dates, specifying they are

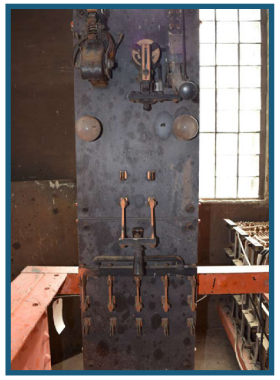
10 hp, No. 5 Type K motors, operate using 42 amps at 725 rpm, and are style number 72411A. The motors also have Cutler-Hammer Clutch Company regulators attached to their rears that are Type TK2 and matched to the motors. Motors 1-6 each have a lever-operated braking mechanism that engages a small flat wheel attached to the drive shaft protruding from the northern end of each motor.

MOTOR 7

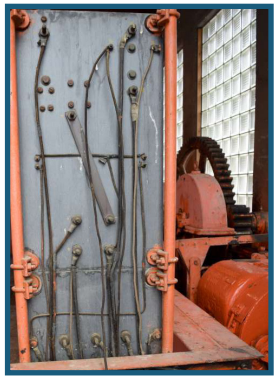
Motor 7, a 20 hp motor, is the largest of the motors to be replaced. It is situated in Tower 1 on the western end of the diversion dam and regulates the gate that controls the flow of water into the Government Highline Canal. It is a variable-speed, 620 rpm, intermittent-duty motor that draws 220 volts. The Cutler-Hammer Clutch Company Type TK3 regulator is attached to the rear of the motor. The nameplate on the Cutler-Hammer regulator demonstrates that it is matched to the Westinghouse No. 8 Type K motor, with its 20 hp rating, and its attached No. 72414 motor style.

PROJECT PHOTOGRAPHS

Looking south at the geared gate-adjusting mechanisms run by Motors 1 and 2 in Tower 2 with the switchboard left of center and the Westinghouse controller right of center.

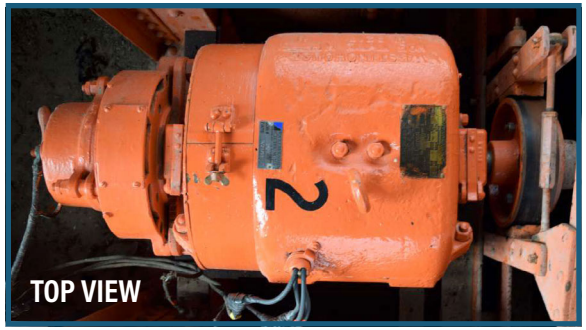


Looking south at the switchboard for Motors 1 and 2 in Tower 2.

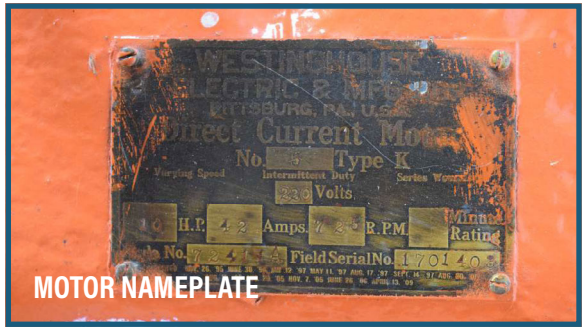


The rear view of the switchboard for Motors 1 and 2 in Tower 2.

MOTOR TYPICAL



TOP VIEW

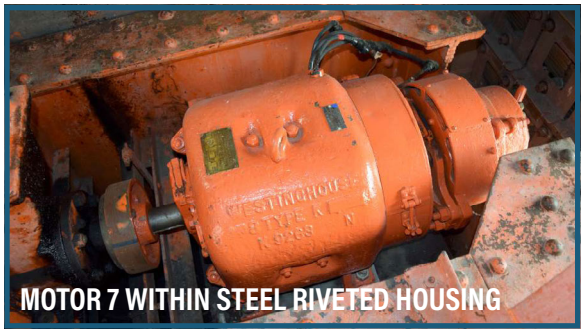


MOTOR NAMEPLATE

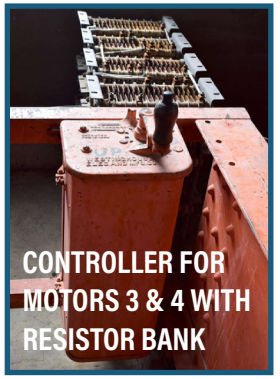
MOTOR HOUSING

REGULATOR NAMEPLATE

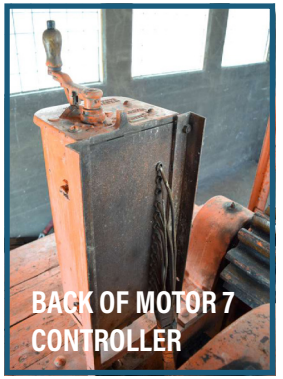
ADDITIONAL EQUIPMENT PHOTOGRAPHS



MOTOR 7 WITHIN STEEL RIVETED HOUSING



CONTROLLER FOR MOTORS 3 & 4 WITH RESISTOR BANK



BACK OF MOTOR 7 CONTROLLER

MOTOR 7 GEARED GATE-ADJUSTING MECHANISM AND CONTROLLER

Interested in Learning More?

Additional information about the Grand Valley Diversion Dam Electrical and Control Systems Upgrade Project is available on the following websites:
Grand Valley Water Users Association:
www.gvwua.com

Colorado Experience:
https://video.rmpbs.org/video/western-waterand-power-8wgiyh/