Spring 2022

BARNARD

OnSite

People building for People.

Resilience in the Rockies:

Chimney Hollow Reservoir will supply water to more than 500,000 northeastern Colorado residents

Inside

Chimney Hollow Reservoir

Resilience; noun. The capacity to recover quickly from difficulties; toughness. On the Chimney Hollow Reservoir Project in Larimer County, Colorado, this word describes both the purpose of the new 90,000-acre-foot reservoir and the ability of the project team to withstand adversity throughout planning and construction. In August 2021, Barnard broke ground on the reservoir, culminating a 20-year permitting process led by Owner *Northern Water.* Funded by 12 northeastern Colorado water providers, Chimney Hollow Reservoir will add resilience to the water supply for more than 500,000 residents.

Project Highlights

- 12.5 million CY, 355-ft.-tall zoned rockfill main dam with hydraulic asphalt concrete core
- 40-ft.-tall zoned rockfill saddle dam with clay core
- 3.1 million CY of excavation for dams and structures
- 3,600-ft.-long concrete spillway
- 7,000 LF of 72-in.-dia. conveyance piping and valves
- 2,000-ft.-long concrete-lined tunnel
- 4 million tons of aggregate processing
- 65-ft.-tall reinforced concrete inlet/outlet structure
- Valve house to regulate flows to/from four different reservoirs
- 3.8 miles of permanent access roads
- Construction will result in a 90,000 acre-foot reservoir
- Foundation curtain grouting
- Temporary cofferdam and stream diversion

As part of Northern Water's Windy Gap Firming Project, Chimney Hollow Reservoir will improve the reliability of the existing Windy Gap Project. The Windy Gap Project has been delivering water since 1985 through a diversion dam on the Colorado River, a 445-acre-foot reservoir, a pumping plant, and a pipeline from Lake Granby. With a changing climate and growing population, the region will benefit from Chimney Hollow's water supply during dry years. The reservoir will enable Northern Water to store up to 90,000 acre-feet of water, with an annual yield of 30,000-acre feet.

For Barnard, working through winter on Colorado's Front Range requires resilience. The team successfully made it through March—Colorado's snowiest month of the year—weathering several large storms while staying on schedule. With a 300-acre construction site and several miles of haul roads, maintaining site access and safe roads has been critical to advancing the project.

To build Chimney Hollow Reservoir, Barnard is constructing a zoned rockfill main dam, zoned rockfill saddle dam, reinforced concrete inlet/outlet structure, concrete-lined tunnel, and concrete spillway. Barnard is also constructing water distribution facilities, consisting of large-diameter conveyance piping and a flow-regulating valve house.

The project requires a massive earthworks operation. As of late March, the team had moved more than 2.3 million cubic yards of soil and rock within the site, mostly from the main dam and quarry footprints. The majority of this material will be used to build a laydown yard for the project's crushing operation.

Barnard's key subcontractor, *Nicholson Construction Company, Inc. (Nicholson),* will drill and grout the main dam curtain—a hydraulic cutoff wall designed to prevent water from flowing under the dam. Nicholson has been drilling and grouting the right abutment main dam grout test section to prepare for the full grouting program. From the original design of primary and secondary rows of grout holes, the test grout program has expanded to include quintenary holes in some locations to ensure water cutoff. Once Nicholson completes this test grout section, crews will move to the left abutment to complete a second test grout section in a different type of rock.

WALO, another key subcontractor, has mobilized their asphalt batch plant to construct the asphalt core of the main dam. Typically, a rockfill dam consists of a clay core, but due to a lack of available onsite clay, Designer *Stantec* selected an asphalt core for the main dam. Over the course of construction, WALO will place 75,000 cubic yards of asphaltic concrete with aggregates sourced from the onsite quarry. Dams with asphalt cores are common in Europe and Canada but are less common in the United States. Once completed, this asphalt core dam will be the largest in the United States and only the second of its kind in the country.

At the quarry, benches are taking shape as the team prepares to feed rock to the onsite crusher. Crews have removed nearly 550,000 cubic yards of overburden and weathered rock to expose the quarry rock. At full capacity, the quarry will produce 63,000 tons of rock per day and will be the largest mining operation in Colorado. Barnard subcontractor *Fred Weber* has been busy establishing the onsite crusher to produce rockfill for the main dam as well as aggregates for the dam blanket filters, the concrete batch plant, and the asphalt batch plant.

In March, crews also began excavating the 3,500-foot-long concrete spillway channel. This critical component of the project will require 100,000 cubic yards of excavation and include 12,000 linear feet of underdrains, 60,000 cubic yards of bedding/riprap, and more than 11,000 cubic yards of concrete.

In the coming weeks, the team will begin tunneling operations. Crews are completing electrical distribution work, dewatering, and setting up ventilation to mine the downstream portion of the tunnel.

There's plenty to celebrate after the first winter of work. On Feb. 9, the project celebrated what Northern Water called a "milestone day" with the installation of a bridge that crosses over the Colorado-Big Thompson Project penstocks. The bridge will facilitate construction activities over the next three years and provide access to future recreation and open space facilities. Barnard appreciates the efforts of *ConTech Engineered Solutions*, which manufactured the precast concrete bridge, as well as *Sterling Crane*, which provided hoisting to install the structure. The bridge consists of 14 sections, each weighing 52,000 pounds.

Construction will wrap up in 2025, at which point Larimer County will manage recreation activities at the reservoir. Opportunities will include wakeless boating, fishing, hiking, and biking, among other outdoor experiences.

As spring settles in at the project site, the team looks forward to a busy and productive construction season.

Cover: Aerial view of the main dam footprint.

Left and Center Left: Setting the CON/SPAN bridge over the penstocks.

Center Right: The downstream portal for the new inlet/outlet tunnel is nearly complete.

Right: The bottom 1,000 linear feet of core trench has now been exposed within the main dam, allowing plinth construction to commence.

220kV corridor overlooking San Bernardino.

Previously congested section in its final configuration.

Craft personnel and project management.

WEST OF DEVERS UPGRADE PROJECT EARNS 2022 AGC AWARDS

On March 29, our West of Devers Upgrade Project team received two major honors at the Associated General Contractors of America (AGC) Annual Convention in Grapevine, Texas. The team, including owner *Southern California Edison (SCE)*, earned the Construction Risk Partners Build America Award in Utility Infrastructure-New and the Marvin M. Black Partnering Excellence Award.

Completed in August 2021, this Engineer-Procure-Construct (EPC) project involved removing and replacing 184 circuit miles of existing 220kV transmission lines with new double-circuit 220kV transmission lines. The upgraded transmission line, which runs between San Bernardino and Palm Springs, California, tripled electricity transmission capacity from 1,600 MW to 4,800 MW.

Work on the project required the procurement and installation of 386 double-circuit lattice steel towers, 83 double-circuit tubular steel poles, and approximately 5.9 million feet of conductor.

Among many challenges, the team worked through 16 separate outages over a three-year construction period. The project concluded under budget, ahead of schedule, and with zero claims, despite working through the COVID-19 pandemic. In fact, SCE energized the line more than five months ahead of schedule, an achievement the team attributes to partnering and the "project-first" mentality it promoted. The success of this project is even more impressive when you consider the many "firsts" for SCE—this was their first time working with Barnard, using a modified EPC contract model, and implementing formal partnering.

Since the start of West of Devers, SCE has awarded 13 additional projects to Barnard—a testament to the strong relationships that formed through partnering.

We'd like to thank all stakeholders and subcontractors that helped to make this project successful for SCE.

With the addition of the West of Devers Upgrade Project's 2022 award, Barnard is now a six-time recipient of the Marvin M. Black Partnering Excellence Award. From the start, Barnard knew that partnering would be critical to the success of this project given the importance of working early and continuously with all stakeholders. We recently spoke with **Clif Stump**, who managed the West of Devers Upgrade Project, about the partnering process. Clif now oversees Barnard's power transmission projects at the executive level.

Can you describe Barnard's approach to partnering?

Barnard has used a formal partnering process on most of our projects for more than 20 years. The formal partnering process is instrumental in aligning our project teams with our clients, as well as subcontractors and other project stakeholders. Prior to project kickoff, we meet to identify the project goals for each stakeholder. The team then develops a project charter that outlines our plan for achieving all stakeholders' goals. Executive and project-level teams meet regularly throughout the project to review the project status, resolve issues, and gage progress against the charter goals. The regular meetings are key to maintaining a high functioning team that is ready to address project issues, should any arise.

What innovative ideas evolved through the partnering process?

At West of Devers, our project schedule was built around a constraint regarding existing transmission line outages. Initially, we were only able to take one existing transmission line out of service at a time. Through the partnering process, Barnard and SCE, along with other outside stakeholders, developed a construction plan that allowed multiple extended transmission line outages at one time. This allowed our team to reduce temporary construction requirements, resulting in significant cost and schedule savings to the project.

How did partnering help the team navigate project challenges?

One of the key benefits of the formal partnering process is the establishment of regular meetings, regardless of whether a project is doing well or facing adversity. On West of Devers, these meetings created an opportunity for the project team to develop good working relationships and trust in one another. A solid relationship with high levels of trust helped our project team quickly resolve issues before they impacted our goals.

SCE implemented formal partnering for the first time on West of Devers. What advice would you give Owners that are new to partnering?

One of the main concerns or questions we get from clients new to partnering relates to how the partnering process impacts Barnard's contractual obligations. The partnering process is not intended to undermine either party's contractual obligations, but rather make a commitment that each team member will work together to achieve the project goals while always maintaining compliance with the contract and specification requirements.

The project's largest crossing at Whitewater Canyon.

Whitewater Canyon crossing spanned 4,000 ft.

Homeward Bound:

Disassembled Kemano TBM Returns to its Starting Point

The Kemano T2 Tunnel at the 960 MW Kemano Generating Station has been in the works for more than 30 years, since the first blast was initiated in the T2 Adit on September 10, 1989. On October 11, 2021, Tl'ughus, the Kemano Project's Upstream Tunnel Works tunnel boring machine (TBM), broke through into the T2 Intake Stub Tunnel at the Tahtsa Intake, achieving a milestone years in the making.

The breakthrough opened the way for new scopes of work as winter rolled in at the Kemano T2 Tunnel Upstream Works Project site, located 46 miles southwest of Kitimat, British Columbia. One important scope was the disassembly and removal of the TBM. In light of the size and weight of the TBM components, this process posed logistical challenges that required careful planning and coordination with Owner *Rio Tinto*, the *Cheslatta Carrier Nation*, *Daudet Creek Contracting,* and key subcontractors, including TBM manufacturer *Herrenknecht*.

Over the course of four months, the Kemano team stripped the 1,300-metric-tonne machine down to a steel skeleton weighing approximately 560 tonnes. The cutterhead, weighing 97 metric tonnes and measuring 6.56 meters in diameter, was dismantled in place. Crews used torches and lances to cut through 3- to 6-inch steel, carving the cutterhead into manageable pieces that could be transported through the stub tunnel and lifted through the 1-meter-wide intake gate slot using a bridge crane operated by the Cheslatta Carrier Nation. This part of the removal was completed safely and efficiently before the end of November.

The remaining TBM components were dismantled and removed via rail and locomotive, traveling almost 5 miles through the upstream tunnel to Horetzky Landing, where Tl'ughus began its journey in 2018. The 300-meter-long trailing gear was removed in 14 rail-mounted loads. The last and heaviest load was the main drive, which weighed in at 95 metric tonnes. It traveled out of the tunnel in one piece, mounted on main drive removal bogies (14-axle trollies) designed and fabricated by Herrenknecht. This removal operation, which included everything from complicated crane picks to underground emergency practice drills, was completed in February, marking another project milestone.

Concurrent with the TBM removal, another important scope of work was underway: the proof grouting of the tunnel annulus, which is the void between the intrados of the bored rock tunnel and the extrados of the precast concrete tunnel lining (PCTL) rings. The proof grouting program was a significant undertaking that required multiple crews to concurrently back grout and contact grout the tunnel annulus along the full length of the tunnel, including the portion completed before Barnard began work on the project in July 2020. The grout was transported by rail cars; all ports were accessed by foot or via an elevated work platform mounted on a train car. By February, when the grouting campaign was completed, the crews had injected 1,700 cubic meters of grout in almost 2,000 different locations.

With these major features of work complete, the team is moving ahead with the final stages of the project, including rail removal, tunnel mucking, power washing, and PCTL crack repair. This last stage involves numerous work fronts and constantly changing conditions. The Kemano team is excited about having some work variety and is looking forward to delivering this tunnel safely.

Left: The TBM cutterhead, approximately 50 percent dismantled.

Right Top: The last of the main drive removed from the tunnel - a huge milestone for the Kemano Project.

Right Bottom: Crew members contact grouting.

SVCW Team Achieves Major Milestones

Since the start of the new year, the *Barnard Bessac Joint Venture (BBJV)* team has achieved several major milestones on the Silicon Valley Clean Water SVCW Gravity Pipeline Project in Redwood City, California.

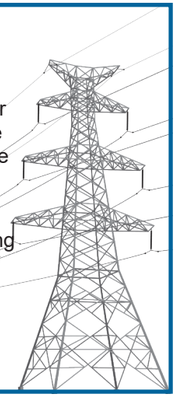
- The team completed the installation of the fiberglass reinforced polymer (FRP) pipe—an impressive feat, considering the team transported 870 pieces of FRP pipe from their storage yard approximately 25 miles from the project site. Crews successfully pressure tested every joint prior to installing adjacent pipe joints. In total, the team installed 2.2 miles of FRP pipe using a rail-mounted, custom-fabricated pipe placer.
- Subcontractor *Pacific International Grout Co. (PIGCo)* completed the annular grouting of the FRP pipe in Tunnel Drives 1 and 2. PIGCo operated a surface batch plant and a mid-tunnel satellite plant in tandem to produce low-density cellular concrete (LDCC), a mixture of water, cement, retarder, foam concentrate, and air that is economical, highly fluid, structurally sound, and lighter than water. BBJV restrained the FRP pipe within the tunnel using a complex pipe-blocking scheme to avoid buoyancy, which is one of the biggest risks with such grouting activities. This successful pipe-blocking approach reduced pipe movement to near zero during cellular concrete backfill activities.
- After a long international journey, the 10-foot-diameter, 24-foot-long FRP tee of the Bair Island drop structure arrived at the project at last. The ship transporting the tee departed from Abu Dhabi, United Arab Emirates, on September 23, 2021. The oversized "flat rack" shipment was transloaded to another vessel in China; the shipment then lingered for six weeks in the waters off the coast of Long Beach, California, waiting to be berthed, and it spent another two weeks in the customs clearing process. The day after the tee arrived at the project site, crews installed it, bringing a four-month saga to a close.
- The team estimated, negotiated, and successfully executed a contract modification for the San Carlos Pump Station Basement Connection. This additional scope is necessary to complete the San Carlos drop structure installation. In February, the *SVCW Commissioning Board* approved the funds for the change order that would allow BBJV to complete the work. The team anticipates concluding this scope in May.

Nicknamed the "**Jedi Racer**," this pipe placer is capable of picking up, transporting, positioning, and stabbing the 16,000-lb. sticks of pipe.

Barnard Lands Transmission Line Upgrade Project

In January, Barnard began the engineering phase of the Haskell Canyon Switching Station to Sylmar Switching Station - PP1/PP2 Transmission Line Conversion Project for the *Los Angeles Department of Water and Power (LADWP)*. This marks the twelfth project we have constructed for LADWP. The Haskell to Sylmar Project will increase the power transmission capacity between the Haskell Canyon Switching Station and the Sylmar Switching Station, allowing LADWP to introduce additional renewable energy to the Los Angeles electric grid.

The engineering phase, led by *Black & Veatch*, will last approximately four months, with construction kicking off in Summer 2022. This project involves the demolition of 13 miles of existing double-circuit 115kV transmission line and the installation of 13 miles of new double-circuit 230kV transmission line running from the Haskell Substation to the Sylmar Substation. Over the course of the project, Barnard will demolish 82 existing lattice structures and foundations and install 62 tubular steel poles, 11 lattice towers, and three lightweight steel poles. This project includes three freeway crossings as well as bridge crossings over Los Angeles Aqueduct Lines 1 and 2.



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Barnard's official newsletter.

Work Begins on Gross Reservoir Expansion

Denver Water has been pursuing the Gross Reservoir Expansion Project for nearly two decades, and on December 15, 2021, the Denver Water Board of Commissioners approved the project under a $531 million contract with *Kiewit Barnard JV*. Shortly after the New Year, the project team mobilized to the Denver area to co-locate with the Denver Water team, lead designer *Stantec*, and construction manager *Black & Veatch*. Over the next five years, Kiewit Barnard JV will work with all project stakeholders to safely complete this 131-foot dam raise in Boulder County, Colorado. This project will involve more than 740,000 cubic yards of roller-compacted concrete (RCC), 64,000 cubic yards of conventional concrete, approximately 1.8 million tons of aggregate production, and extensive drill/shoot and foundation excavation and cleaning operations.

Barnard's "Next Generation"

Baby boy born to **Austin** and **Brandi Dunlap**. **Archer David Dunlap** was born on Oct. 14 weighing 8 lbs. 6 oz.

Baby boy born to **Zach** and **Keeley Remus**. **Brooks Jeffrey Remus** was born on Dec. 18 weighing 8 lbs. 15 oz.

Baby girl born to **Michael** and **Molly Porter**. **Eleanor Rose Porter** was born on Feb. 2 weighing 6 lbs. 11 oz.

Baby boy born to **Quincy** and **Lauren Anderson**. **William Davis Anderson** was born on Feb. 14.