COBLACO SERVICES, INC.

COMPLICATED SIPHON REHAB CHALLENGES PRE-JOB PLANNING PROCESS

Greg Smith, Manager of Coatings
Coblaco Services, Inc.
Aurora, Colorado

ABSTRACT

The Jim Creek siphon is located in the Arapahoe National Forest in Winter Park, Colorado, elevation 9,000 feet. The siphon was constructed as part of the original Moffat Collection System in approximately 1935/1936, commencing operation in 1937. It is a 54-inch diameter steel pipeline that conveys Fraser River water from the Fraser Canal on the south side of the Jim Creek valley to the Jim Creek-Fraser Creek Canal on the north side of Jim Creek valley. The Jim Creek valley floor includes a significant wetlands complex with sensitive terraced beaver ponds, which require protection during any rehabilitation work.

The contractor was awarded part of the project scope which consisted of; cleaning and re-lining the interior of the steel pipe, completing spot repairs, making linear tape repairs on exterior coating of steel pipe, repairs to concrete supports, and, external coating of pipe at different locations. Completing this project required the navigation through 1,800' of pipeline that sloped steeply in some areas, protecting sensitive wetlands, staging and moving equipment along mountain terrain, and applying a 100% volume solids interior coating while dealing with the restrictions of pipe diameter and working with potentially hazardous materials. This paper will outline the challenges and unique requirements of the project and their outcomes.

BACKGROUND

The Jim Creek Siphon extends for approximately 1,800 feet and traverses across about 500 linear feet of wetland in the Jim Creek valley bottom. Gravity, rather than a pumping system, moves water through the siphon. It is a complex fluvial system that is common in Colorado's subalpine zone.

There are four main habitat zones in the Jim Creek valley wetland located between the Jim Creek diversion and CO Highway 40: 1) Jim Creek riverine wetlands, 2) the upper fen, 3) derelict ponds, and 4) the lower ponds. Specifications required the protection of the delicate ecosystem surrounding the siphon, including the use of as "swamp mats" or bridging, to help minimize soil compaction and vegetation disturbance. In one segment of the repair area, the contractor was instructed to devise a way to cross the open water without introducing permanent fill to the wetland (e.g., helical coil piles). Further, any vegetation removed during installation of the construction access way would have to be removed, stored, watered as necessary and reinstalled at construction completion.(1)

This was the siphon's first major rehabilitation since being put into service in 1937.(2)

Map outlining features of the valley and geographical subsections

UNIQUE PROJECT CHALLENGES

There were unique logistical, internal, and external challenges presented at the commencement of, and throughout the project.

Logistically:

- Washing, blasting, and application equipment needed to be set up with 500' of hose and transported over heavily tree-lined and narrow mountain roads.
- Some sections of pipe were steep, increasing the difficulty of the lining removal.

Internally:

- Project documentation indicated a possible lead presence, which presented both safety and environmental concerns.
- The interior lining was a coal tar material.

Externally:

- The limited accessibility over the wetlands area made it necessary for employees to set up temporary surfaces over protected vegetation in order to access the areas in need of work.
- Through natural erosion, part of the siphon became buried underground and needed to be excavated before the external repairs could be completed.

COBLACO SERVICES, INC.

- At an altitude of 9,000 feet, the weather factored daily into the window of time to complete each phase of the work as well as curing times for each coating system.

Project planning and conditional assessments were made at every phase of the project, to determine the best and safest approaches to meeting each challenge.

Part of siphon over wetlands in Jim Creek valley

CLEANING AND RE-LINING SIPHON INTERIOR

Timeline considerations and special coordination with GC work in process required blasting and painting to be completed in sections. To prepare the surface, the contractor's crew performed ultra high-pressure water jet cleaning per SSPC WJ1, minimum 30,000 psi, to remove the existing coal tar lining and reduce the risk of embedding the bitumastic material, or any contaminants, into the substrate. Following the UHP Water Jetting, the entire surface was media blasted per SSPC SP10. During the blasting work, it was realized that the age and condition of the pipe would impact the project's production. In order to meet the specified cleanliness standards, longer blast times were needed for the extremely corroded surface, which also increased the volume of media to then be removed from the pipe.

The potential of lead content inside the siphon was a noted concern as well. As a result, containing 100% of the waste became a key component to the successful removal of the interior coal-tar lining. The GC worked on the removal and replacement of all seven expansion joints on the line during the same timeframe that the coating repairs needed to be completed. This further complicated the task of controlling, capturing and segregating the waste streams.

In managing the waste, the solids were separated from the liquid stream to limit the quantities of potentially hazardous waste. The contractor's technicians designed a funnel and filtration system

to channel spent materials into separate receptacles outside the siphon. The contractor partnered with safety consultants and an industrial hygienist to ensure that a proper material disposal plan would be in place. Ultimately, the waste was tested and found to be non-hazardous.

Spent lining waste funneled out of siphon

The interior lining specifications required 100% solids epoxy to be applied using a minimum of 2 coats for a total minimum thickness of 40 mils DFT. The specification and contract documents included the use of a filler coat to address the isolated areas of severe pitting and corrosion, due to the age of the pipe. The heavy corrosion was discovered to be more widespread than anticipated, creating a need for alternative solutions to be considered.

After further discussion and review, along with a recommendation and confirmation from the manufacturer, the Owner issued a change order to increase the overall DFT for the system by 30-40 mils. In total, the complete interior lining system included: (1) coat of 68% volume solids epoxy at 6-8 mils DFT, and, (2) coats of 100% volume solids epoxy at 30-40 mils DFT per coat, for a total system of 66-88 mils. These extra efforts were accomplished within a short window of time, often requiring the application of 150 gallons or more each day in anticipation of the approaching winter weather.

EXTERNAL WAX TAPE AND COATING REPAIRS

The exterior coating system contained a lead-based primer which was a major factor in the determination of scope. Due to the presence of lead and the very sensitive surrounding environment, the contractor was charged with making spot repairs to entire length of the pipeline, rather than specific areas. Steep grading of the pipe, as well as the protection of wetlands presented their own challenges. Workers had to access the pipe by traversing the

wetlands area in waders, and/or on protective wood platforms and swamp mats to avoid permanently damaging any surrounding foliage, all while providing temporary tarping to protect the wetlands. Additionally, a sizable portion of the pipeline had been buried under dirt, as a result of years of erosion, and needed excavation to expose it for repairs.

Buried pipeline had been excavated to expose corrosion and allow for repair work

The degree of corrosion was first thought to be significantly more in these sections of the pipe, so the owner specified a wax tape system, rather than traditional preparation and application of liquid coatings, again due primarily to the presence of lead primer. Following the excavation, some areas with significant coating failures were noted, however, many other areas were in much better condition. A previously-buried large section of the pipe that was immediately adjacent to a very popular hiking trail was surprisingly found to be intact. These sections were determined to be in good enough condition for the exterior repair procedure, (surface prepared per SSPC SP2 and SSPC SP1). Moreover, an application of an epoxy/polyurethane system could be utilized in lieu of the specified wax tape. Finally, all surface prep debris had to be captured, tested and disposed of appropriately, due to the lead-based primer.

OUTCOME

The contractor and GC successfully completed a significant amount of pre-planning on the project together which was a major contributing factor in successfully completing their respective scopes of work at the same time. The contractor was able to educate and communicate to the GC the complexity and challenges of lining the siphon, which helped dictate the project schedule and coordination of tasks. By working closely together, a level of communication between GC and contractor was established and carried through the duration of the project. This proved essential to the successful and efficient completion of the work. The contractor became the expert resource that the GC consulted when faced with problems on the project that pertained to abatement, preparation, and coating.

By explaining the specific challenges of application and differing production rates for alternate materials and methods, the contractor was able to work with the Owner to change specified

methods and materials. The interior filler was changed to an additional coat of 100% solids material, offering faster production and a better overall schedule, while providing the necessary additional protection. The application of wax tape to all areas that had been buried was changed to spot repair and full overcoat, offering significant savings on both time and money, while at the same time, providing a better aesthetic finish in a highly-visible section of the pipe.

Through additional planning, creative problem solving, and coordinated efforts, the contractor and GC successfully completed the full scope of work on schedule, without harming the delicate vegetation surrounding the pipe, and without enduring any accidents or safety mishaps.

REFERENCES

(1) Johnson Environmental Consulting, LLC, "*Jim Creek Siphon Rehabilitation Project: Mitigation and Restoration of Wetland Disturbance*," Board of Water Commissioners, Denver Water, December, 2017.

(2) Dennis, Laura. "*Fixing a Mountain Siphon*," Denver Water, September, 2018.