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## **Pipe Bursting Rehabilitates Irrigation to Ogden Golf Courses**

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### **1. ABSTRACT**

Ogden is one of Utah's oldest and most densely populated cities. It is home to a wide variety of industries that has kept the economy strong and facilitated significant growth. Unlike newer Utah development, Ogden's infrastructure is more aged and much more difficult to expand and/or replace. Some of the water lines were installed at the turn of the century, with many more over 50 years old and in areas that cannot be easily excavated with conventional "dig and replace" methods.

Pineview Water Systems is comprised of three water agencies in the Ogden area: The Ogden River Water Users' Association, The South Ogden Conservation District, and The Weber-Box Elder Conservation District. Collectively, there are hundreds of miles of mostly smaller (12-inch and under) diameter water distribution and transmission mains. Pineview Water Systems has turned towards "trenchless" technology to help better address the needs of a growing city, while minimizing business and environmental impacts. Specifically, over the past few years, Pineview has implemented pipe bursting as a means to replace corroded cast iron and ductile iron pipes.

The paper reviews the design and construction challenges Pineview Water Systems faced when rehabilitating an existing pipeline located between one of the busiest roadways and a row of old growth trees that line the Ogden Golf and Country Club using pipebursting.

### **2. INTRODUCTION AND PROJECT BACKGROUND**

Ogden is a city in Weber County, Utah located approximately 40 miles north of Salt Lake City (see Figure 1). According to the US Census Bureau, the population in Ogden as of 2014 was 84,316. The area was originally settled by members of the Mormon Church, led by Daniel Burch. In 1848, Burch and his family travelled from Kentucky to Ogden along with several members of The Church of Jesus Christ of Latter-Day Saints. The area was named Burch Creek in 1850 in his honor.

By the 1930s the population in Burch Creek rose to nearly 800 people and the area was primarily a farming community. In 1934, the community experienced a severe drought, which prompted the Federal Drought Relief Agency to finance the installation of a water supply line from Burch Creek Canyon to farms and residents.

South Ogden's neighboring location to Hill Air Force Base and the Ogden Arsenal led to a boom in real estate in the 1940s. By 1946 South Ogden became known as the "City of Homes" and the population had grown to over 3,600. By the 1950s the number of residents in Ogden increased by another 150%, warranting construction of a new

municipal building, which included a fire station. Washington Boulevard, one of Ogden's main streets, was widened to four lanes south of 40th Street to increase traffic capacity and meet the needs of a larger population.

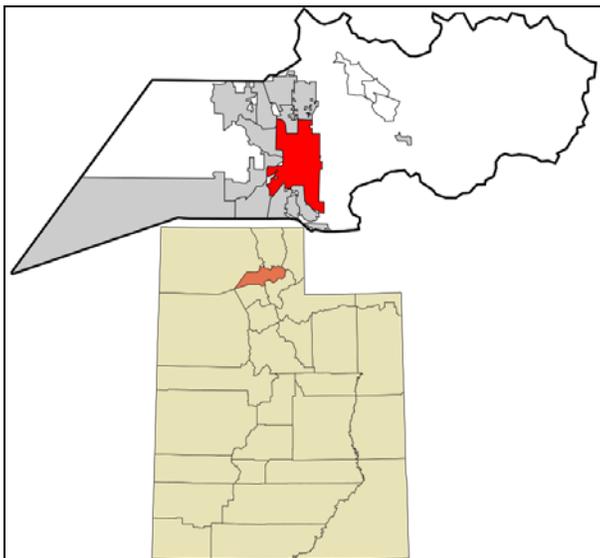


Figure 1. Location of Ogden, Utah.

For much of its history, the city of Ogden served as a major railway center, and still handles a great deal of freight rail traffic to this day, making it highly accessible for manufacturing and commerce. With its proximity to an air force base and other federal agencies, Ogden's economy is sustained largely by the consistent wages that accompany federal government jobs, contributing to the greater Ogden metropolitan area's ranking of lowest income inequality in the nation for its size. The economy of the Ogden area is recognized as steady yet successful. Unemployment rates never exceed 3.5%, nearly 2% below the national average, and residents have a higher chance of affording health coverage, a home, and college with minimal to no debt. The predominantly young work force, a result of the family oriented culture of the area, provides an additional benefit and guarantees further growth.

The Ogden River, a 35-mile long tributary in Utah, served as an essential irrigation system to approximately 3,000 acres of land in the Ogden area before 1900. Over the years the number of diversions of the river water increased, resulting in limited irrigation flow during summer seasons. In an attempt to alleviate this problem, the Ogden River Project was initiated in 1936 to incorporate existing, locally built, irrigation systems into a larger project. As part of this project, the Pineview site was adopted for a 30,000-acre-foot reservoir and the Pineview Dam was built. The Pineview Dam now holds 154,900 acre-feet of water.

Ogden's natural environment and proximity to the Wasatch Mountains, site of the 2002 Winter Olympic ski events, has made the city the center for outdoor-sporting equipment. The resulting jobs have increased the average incomes within the city, putting Ogden on the map in 2013 when it ranked number 16 on Forbes' list of the Best Places for Business and Careers. From an economic standpoint, as other cities have watched prices for real estate and services rise due to an influx of wealthier residents, average home prices in Ogden have held steady around \$150,000 for years. Membership to the city's golf and country club is \$4,000 per year, which is a rate affordable to many middle-class families.

Ogden Golf and Country Club has been a landmark in the city of Ogden since its establishment in October 1914 (see Figure 2). It originated as a nine-hole course located across the south end of Washington Boulevard, adjacent to Adams Avenue. After a fire destroyed the original clubhouse in the mid-1920s, a new clubhouse was built on the present location and a par-three, six-hole course was added. In the '60s, a tunnel was constructed under Washington Boulevard to connect the two courses. The clubhouse was remodeled and tennis courts were added around the same time. Over the years, it has played host to prestigious golf tournaments and its history plays a significant role in Ogden's development.



Figure 2. Aerial view of Ogden Golf and Country Club in 1914.

Pineview Water Systems comprises the Ogden River Water User's Association, South Ogden Conservation District, and Weber-Box Elder Conservation District, to serve Ogden and nearby areas in Weber County. Much of the Ogden area's water system was developed in the early 1900s using ductile iron pipe. Around this time, ductile iron was being introduced to the marketplace as a material proven to have higher strength yet similar corrosion resistance compared to cast iron. Although the expected lifespan of ductile iron pipe is 100 years, Pineview Water Systems experienced leaks in their water systems in the 1990s, prompting a series of repairs and replacement of pipe. Gradually, the ductile iron pipes were being completely replaced. By the early 2000s, Pineview implemented a series of pipe replacements throughout Ogden, mostly using bell-and-spigot polyvinyl chloride (PVC) pipe installed using dig and replace methods. Their objective was to keep their water system consistent by eventually replacing all of the pipe in the system with PVC pipe. In late 2016, Pineview needed to replace an aged ductile iron irrigation line that was extremely corroded and had recently experienced leaks (see Figure 3). They wanted the installation of the new pipe to be as quick and non-impactful to the environment as possible, while still saving on overall costs.



Figure 3. Section of existing ductile iron pipe.

### 3. PROJECT DESIGN

Pineview Water Systems hired J-U-B Engineers, Inc. of Kaysville, Utah to design the replacement of the existing ductile iron irrigation line along Washington Boulevard where it crosses through the Ogden Golf and Country Club (see Figure 4). This road is considered one of Ogden's busiest roadways. Pineview knew that installing the proposed pipe using the direct bury method would disrupt traffic for many commuters in the area. In addition, there was a row of old growth trees lining either side of Washington Boulevard on the boundaries of the Ogden Golf and Country Club. Protecting these trees and minimizing disruption to Washington Boulevard were key design parameters for both the utility and its design engineer. Another parameter was that the inside diameter (ID) of the proposed pipe needed be at least the same ID as the existing pipe.



Figure 4. Map of project location.

Pineview ultimately decided that the best option would be to pipe burst the existing pipe with the proposed line. This method not only would replace the existing pipeline in the same alignment without physically removing the existing line, but it would do so without having to dig trenches along the road. Pipe bursting is the only water line rehabilitation method that provides a new, structurally independent solution with full pressure capacity and the ability to maintain or increase the ID of the original host pipe. Because Pineview wanted to keep the pipe material consistent throughout their water system, PVC was selected for the new line. In similar projects previously completed within the district, a spline-and-groove PVC pipe was used to pipe burst metal pipes. But upon discovery of fusible polyvinyl chloride pipe (FPVCP), Pineview changed their standard specification. FPVCP provided a gasketless, leak-free, fully restrained pipe system with a higher safe pull force than the spline-and-groove joint system, but without the hassle of a collar that requires the bursting hardware to be upsized due its greater outside diameter (see Figure 5).

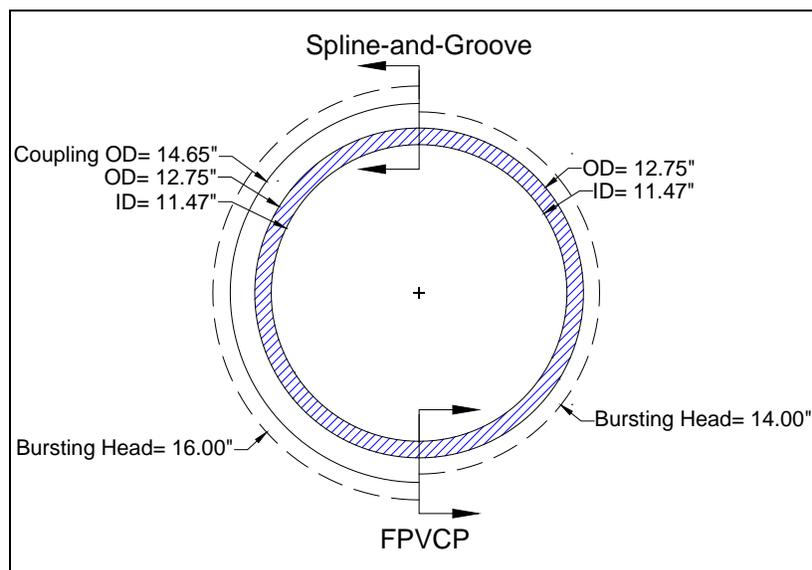


Figure 5. Comparison between 12-inch spline-and-groove PVC and FPVCP.

## 5. BIDDING AND CONSTRUCTION

After the project plans and specifications were completed, the advertisement for bid was released to prospective bidders in December 2016. Since Pineview had already chosen a pipe material during the project design, FPVCP was sole sourced in the project documents, without the option of selecting an alternate pipe material. The installation method was also established and stated in the bid form as the only option for pipe installation. The bid form specified 582 feet of 10-inch pipe burst with DR-21 FPVCP and 1,600 feet of 12-inch pipe burst with DR-21 FPVCP.

The project bid on January 30, 2017 and was awarded to AAA Excavation & Boring of Willard, Utah, who had previous experience with pipe bursting existing pipe using PVC pipe. Construction began in February 2017 where 40<sup>th</sup> Street intersects Washington Boulevard, located on the north side of the project (see Figure 6). Because construction took place during the golf off season, the water pipe was not in service and therefore a bypass line was not necessary.

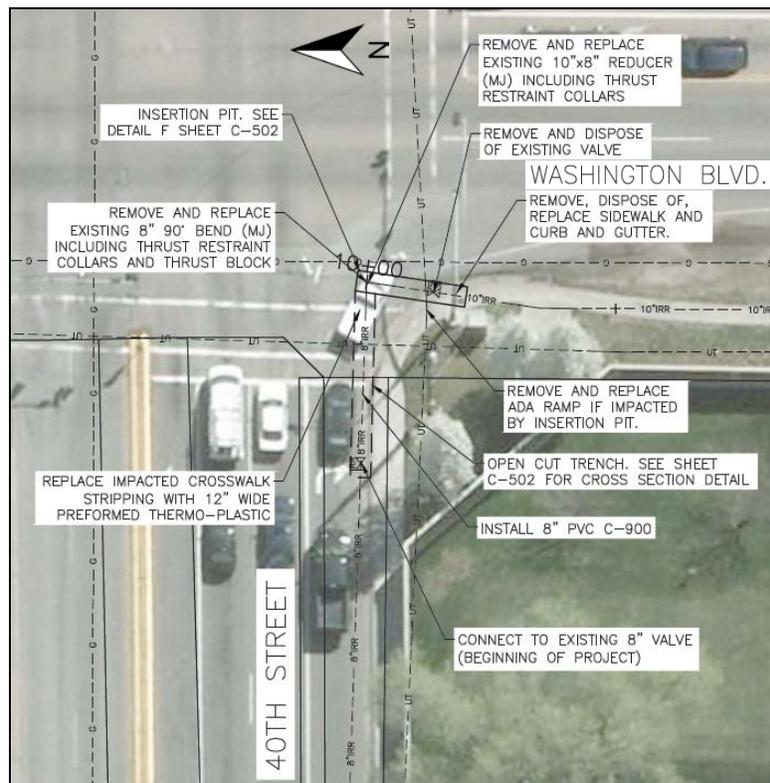


Figure 6. Aerial view of intersection of 40<sup>th</sup> Street and Washington Blvd.

Washington Boulevard is considered a main street, so traffic control would be critical during construction. Since all of the pipe to be installed was located on the side of the road underneath the sidewalk and there would be minimal trenching of the road, the only critical areas of construction were the areas where pits were required to make connections or insert or receive pipe bursting equipment. Construction barrels were placed on the corner of 40<sup>th</sup> Street and Washington Blvd where the initial connection was made between the proposed pipe and existing pipe. Barrels were also placed on the south side of the project where connections were made at the intersection of Washington Blvd and 4300 South.

The proposed pipe and project equipment were laid out on the sidewalk along the side of the road. Once fused, the pipe lengths were laid out in the same area and the pipe bursting head and corresponding hardware (see Figure 7) were attached to the end of the pipe string to prepare for installation.



Figure 7. Setup along Washington Blvd bursting hardware being placed into position (right).

A total of four pipe burst runs were installed; one run of 10-inch and three runs of 12-inch (see Figure 8). The pipe lengths for all runs were fused in one week in mid-February and staged along the road prior to pull-in. After the 582-foot length of 10-inch pipe was installed with no problems, the 12-inch pipe was ready for installation starting from the same pull pit where the 10-inch pipe ended and continuing in the same direction.

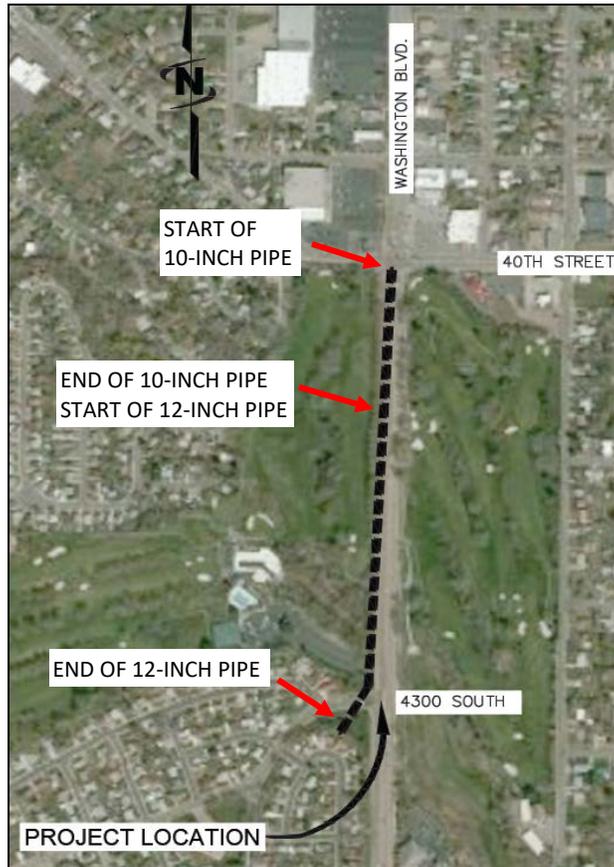


Figure 8. Overall project layout.

The approximately 1,450-foot length to be burst from the end of the 10-inch line to the bend at the intersection of Washington Boulevard and 4300 South, was completed in two runs of approximately 725 feet each (see Figure 9). After the first 12-inch pipe burst run was successfully pulled in, the connection was made between the 10-inch and 12-inch pipe inside the pull pit using a 10x12-inch mechanical joint reducer, and a 12x6-inch mechanical joint tee. A 6-inch gate valve was attached to the tee and from there the existing 6-inch ductile iron pipe connected to the valve. On the north side of the project where the 10-inch installation began, a connection was made between the 10-inch pipe and the existing 8-inch PVC pipe using a 10x8-inch mechanical joint reducer.



Figure 9. Pipe insertion pit between 12-inch pipe burst runs.

Construction continued south along Washington Boulevard on the west side of the road without any concerns or interruptions during the second 12-inch pipe burst run. Traffic continued as usual during construction and commuters were not disturbed since there was plenty of room for the contractors to layout their equipment and perform the installation. The 12-inch pipe bursting continued until it reached the intersection of Washington Boulevard and 4300 South, where the existing pipe diverted at an angle. Another pull pit was trenched at this intersection since a ductile iron mechanical joint 45-degree elbow needed to be replaced. Once the existing fittings were removed, the last 12-inch run for the remaining 150 feet of pipe was burst across 4300 South (see Figure 10). New 45-degree elbows were installed on each end of the run. The remaining 50 feet of the project was open trenched from the 45-degree elbow to the connection to the existing 12-inch PVC pipe.



Figure 10. Pull pit at corner of Washington Blvd and 4300 South.

Once all of the pipe was installed, pressure testing was performed on the new irrigation line. The pipe passed and was ready for service. All of the soil that was excavated from the insertion pits, pull pits, and trench boxes were transported and properly disposed of and replaced with compacted road base material. Then the road surface was restored back to pre-construction conditions.

## **5. CONCLUSION**

As the City of Ogden continues to replace their aging metallic water system with PVC pipe, pipe bursting has become a trusted and effective tool to minimize the disruption associated with the construction effort. The Washington Boulevard and Ogden Golf and Country Club pipe bursting project was completed successfully at the end of February of 2017. Pineview Water Systems continues towards its goal of reaching an exclusively PVC pipe material water system. Pineview Water Systems, J-U-B Engineers, and AAA Excavation worked together effectively so that the installation of the new pipe was successful. Electing to pipe burst the existing ductile iron pipe allowed for minimal disturbance of traffic flow on one of Ogden's busiest roads, while also protecting an important landmark at the Ogden Golf and Country Club in the old growth oak trees that lined the boulevard.

## **6. REFERENCES**

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