

## Utilizing Innovative Tactics and Trenchless Technology to Restore Critical Infrastructure

City of Omaha Missouri River Water Resource Recovery Facility

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The Schemmer Associates Inc.



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## Answering the Call

The Primary Clarifiers Piping Rehabilitation project was a challenging maintenance project completed by the City of Omaha to continue the level of service provided by the Missouri River Water Resource Recovery Facility. The project included lining of underground channels that carry wastewater from the Primary Clarifiers to the next step of the treatment process. These channels were originally constructed in the 1960's and had experienced significant degradation due to age and use.

The Schemmer Associates Inc. (Schemmer) was retained by the City to serve as the Project Engineer. Schemmer took a non-traditional approach to the project, beginning with a technical memo and cost analysis to determine the most effective and cost-efficient solution. After quickly eliminating full replacement, a variety of feasible rehabilitation options were analyzed against the constraints of the project, resulting in recommendations to the City for approval.

Ultimately, a structural mortar lining was constructed within the channels. This solution was a cost-effective alternative to removing and replacing the channels and was well-suited to overcome the obstacles posed by this unique and challenging undertaking. The lining used for this project is a next-generation concrete, more resilient to the harsh conditions posed by wastewater than standard concrete piping. Thanks to extensive coordination between City staff, the construction team and Schemmer, the project was completed successfully, on time and within budget with limited impacts to plant operations.

Project Team	Project Budget	Project Schedule
Owner <b>City of Omaha</b>	Engineers Estimate <b>\$1,750,000</b>	Estimated Design Duration <b>11 weeks</b>
Engineer <b>The Schemmer Associates Inc.</b>	Bid <b>\$1,448,445</b>	Actual Design Duration <b>7 weeks</b>
General Contractor <b>ACE Pipe Cleaning</b>	Final Cost <b>\$1,450,000</b>	Estimated Construction Duration <b>120 days</b>
Manufacturer <b>CentriPipe</b>		Actual Construction Duration <b>90 days</b>

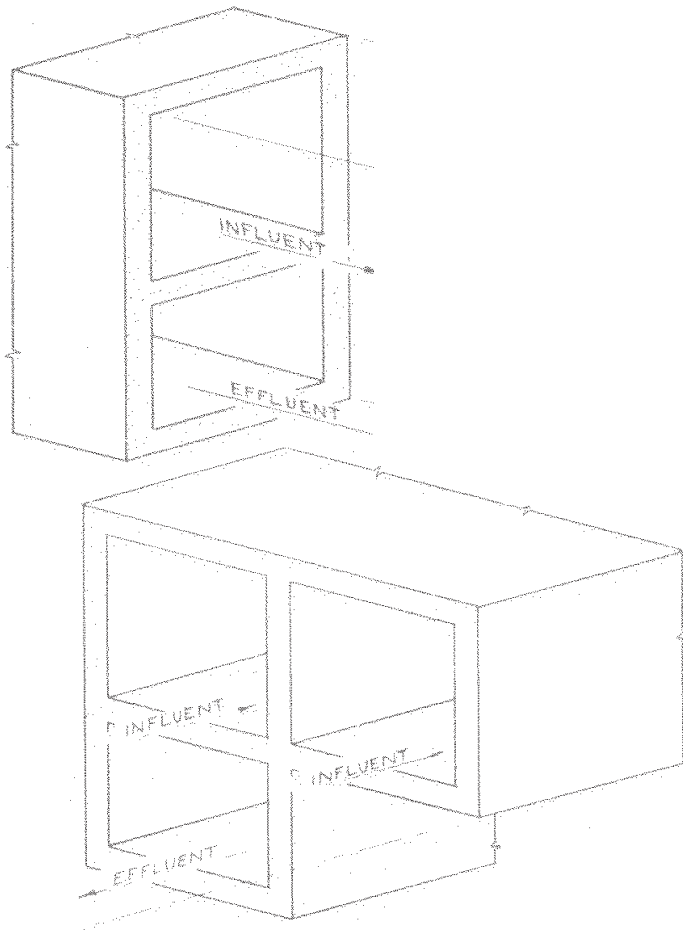


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Circular channel prior to lining



Isometric view of stacked channels  
drawing courtesy of Omaha Public Works, 1960

## Mission

The goal of the project was to repair or replace these channels to provide another 50+ years of reliable service life while maintaining full functionality and operating capacity of the water resource recovery facility. This undertaking would require an innovative design approach, advanced technology and a collaborative effort from the engineer, owner and contractor.

## Complex Challenges

After nearly 60 years of service, the reinforced concrete outlet channels from the Primary Clarifiers at the City of Omaha's Missouri River Water Resource Recovery Facility had experienced severe deterioration from hydrogen sulfide corrosion and decades of constant use. The task of fixing this issue by means of repair or replacement faced a number of complications that would inform how the project was completed.

Replacement of these channels was quickly ruled out as a feasible solution to the project. The channels are located within an active treatment plant with minimal space available for laydown and construction. Many of the channels in need of repair are part of a larger concrete structure that creates another channel atop and integral to these channels. The outlet channels would need to be addressed in a way that would ensure the lasting integrity of the channels above.

With replacement of the channels deemed impractical, the team focused on rehabilitation. If rehabilitation was the only viable method to address the issue, this unique project posed a number of challenges.

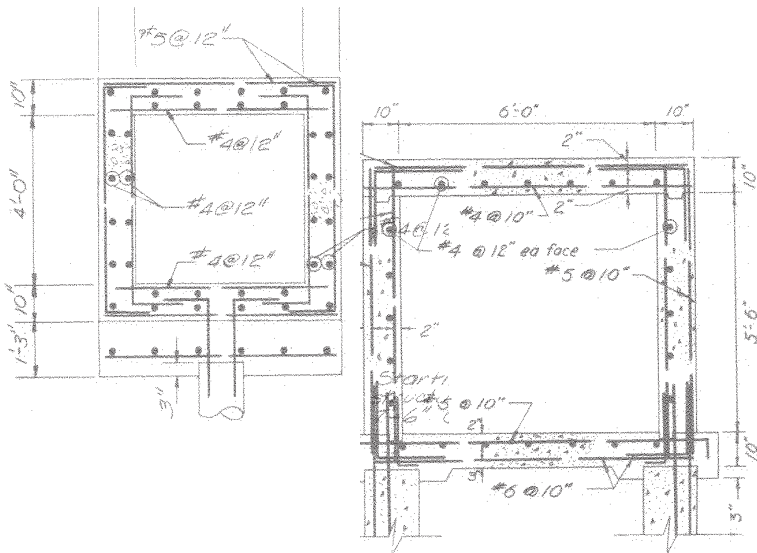
As with replacement, the available space for rehabilitation equipment was very limited, requiring a solution with a small footprint, and preferably mobile so it could be moved under short notice should plant operations require it.

Also an issue with replacement, the structural loading on many of these channels had to be taken into account. Along with the channels stacked on top of these, bury depth and a high water table would require that the rehabilitation be capable of providing structural integrity. Most of the channels to be rehabilitated had experienced a loss of approximately one-third of the wall thickness and one of their two layers of steel reinforcement.

The outlet channels in question ranged in size and shape from 54-inch round reinforced concrete pipe to 4-foot by 6-foot reinforced concrete box channels. This wide range in shapes and sizes had the potential to add significant cost to the project if common rehabilitation methods were used.







Channel section details  
drawing courtesy of Omaha Public Works, 1960

## Complex Challenges continued

Access to the subject channels was an issue. Access pits would not be possible, so the only access into the channels would be through existing structures, some of which were active throughout construction. The solution would need to be able to span from structure to structure and fit through a standard manhole lid.

In addition to the range in channel sizes and shapes and access, another obstacle to overcome was the susceptibility of these channels to flooding during heavy rainfall events. These channels can flood with rises in the Missouri River water level and the Primary Clarifiers themselves can be overwhelmed due to high inflow rates during significant rains. The rehabilitation method used would need to be able to withstand flows soon after, and potentially during, installation.

Scheduling was a major factor in determining the solution to the project. In order to utilize rehabilitation, the flows from the clarifiers would need to be isolated for periods of time to allow access into these channels. This could only coincide with plant operations if performed during the winter months when rainfall and flows to the plant are at a minimum. The solution would have to be constructed quickly and require phasing of the project to allow the plant to maintain uninterrupted operation.

Another challenge posed by the project was the very limited time for design. Based on the condition of the channels prior to rehabilitation, the project team felt the work needed to be completed as soon as possible. In order to have the project ready for construction during the upcoming winter, Schemmer accelerated the design schedule from 11 weeks to seven weeks to meet these demands.

This project required continual and constant coordination between the team consisting of City of Omaha staff, the contractor and Schemmer. The City was responsible for adjusting the processes at the facility in order to take the construction areas offline and allow the contractor access. Strict scheduling, open communication and fast turnarounds were necessary to avoid delays to the project and keep plant operations running smoothly.



Rectangular channel prior to lining



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Circular channel after lining completion



Radiused rectangular channel after lining completion

## Solution

Once rehabilitation of the existing channels was determined as the best course of action, the design team needed to decide the type of rehabilitation best-suited for this project before design could begin. With many types of trenchless rehabilitation currently being utilized in the construction industry, Schemmer's next step was to compose a Technical Memo regarding feasible rehabilitation techniques and the estimated costs for each.

The uniqueness of the project with the non-circular channels and potential for water inundation quickly eliminated many of the rehabilitation techniques currently available. Four rehabilitation systems were identified that could meet the requirements of the project. These four options were analyzed in regard to suitability for high-sulfide environments, speed of construction, design life, structural capacity and cost.

The analysis in the Technical Memo resulted in a recommendation for two potential rehabilitation solutions that could overcome the specific challenges of this project and provide the best value for the City. The options were Centrifugally-Cast Concrete Pipe and Spiral-Wound Lining. However, the City's project team had never used either of these construction techniques and were hesitant to choose a solution prior to learning more about each. To provide the project team with additional information and confidence in their decision, Schemmer arranged lunch and learns at the facility with each rehabilitation system provider to present their techniques and provide an opportunity for the team to ask questions.

## Outcome

After reviewing the technical details of the potential solutions for this project and having the opportunity to meet with and ask direct questions of the providers, it was determined the construction documents would include both options, with contractors having the ability to bid either one. This was done in order to open the project to a larger number of bidders and keep the bids competitive, resulting in a low bid below the project budget. The rehabilitation technique included in the low bid was Centrifugally-Cast Concrete Pipe (CCCP), specifically CentriPipe, a proprietary CCCP system, engineered and manufactured by AP/M Permaform from Johnston, Iowa.

This system and the winning contractor, Ace Pipe Cleaning of Kansas City, Mo., provided an excellent finished product that met the needs of the project and withstood the challenges of construction. Service was not interrupted and operations at the plant were not negatively impacted during construction, and the project was completed on time and within budget..

At the end of the project warranty period, Ace Pipe Cleaning will return to the site to inspect and document the condition of the rehabilitated channels to confirm a quality installation and ensure a lasting solution.





## About Schemmer

### WHO WE ARE

Schemmer is a full-service architecture, engineering and construction field services consultant, providing **responsible solutions for complex design and construction-related challenges**. Founded in 1959, we are grounded in our past but remain fully committed to the future. Located in three States and six offices throughout the Midwest, Schemmer is providing services to clients from coast-to-coast and border-to-border across the United States.

### WHAT WE DO

*Design with Purpose. Build with Confidence.*

There is no rule – unwritten or otherwise – that says the creation of something that is **unique, yet functional**, need be problematic and stressful. Which is why the men and women of Schemmer take the opposite tact, infusing the design and construction process with a **collaborative spirit** that forges a unified **sense of purpose and confidence** among all involved. It begins with designing a project that meets our client's goals before a single shovel of dirt is turned over, and doesn't end until what's been put to paper is included in the final build. So when you engage the Schemmer team, you know we'll **work harder and smarter**, so when all is said and done, your vision has become a reality.

#### Contact

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