STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF THE CITY OF EVANSVILLE, INDIANA, FOR AUTHORITY TO ISSUE BONDS, NOTES, OR OTHER OBLIGATIONS, FOR AUTHORITY TO INCREASE ITS RATES AND CHARGES FOR WATER SERVICE, AND FOR APPROVAL OF NEW SCHEDULES OF WATER RATES AND CHARGES	)))))))	**CAUSE NO. 45073**

OUCC PREFILED TESTIMONY

OF

CARL N. SEALS – PUBLIC'S EXHIBIT NO. 4

ON BEHALF OF THE

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

JULY 20, 2018

Respectfully Submitted,

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

Daniel M. Le Vay, Atty. No.22184-49
Deputy Consumer Counselor

CERTIFICATE OF SERVICE

This is to certify that a copy of the foregoing ***Office of Utility Consumer Counselor Prefiled Testimony Carl N. Seals*** has been served upon the following counsel of record in the captioned proceeding by electronic service on July 20, 2018.

Nicholas K. Kile
Hillary J. Close
Lauren M. Box
BARNES & THORNBURG LLP
11 South Meridian Street
Indianapolis, Indiana 46204
E-mail: nkile@.btlaw.com
hclose@btlaw.com
lbox@btlaw.com

Daniel M. Le Vay
Deputy Consumer Counselor

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR
115 West Washington Street
Suite 1500 South
Indianapolis, IN 46204
infomgt@oucc.in.gov
317/232-2494 – Phone
317/232-5923 – Facsimile

TESTIMONY OF OUCC WITNESS CARL N. SEALS
CAUSE NO. 45073
CITY OF EVANSVILLE

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is Carl N. Seals, and my business address is 115 West Washington Street, Suite 1500 South, Indianapolis, Indiana 46204.

Q: By whom are you employed and in what capacity?

A: I am employed by the Indiana Office of Utility Consumer Counselor ("OUCC") as a Utility Analyst in the Water/Wastewater Division. My qualifications and experience are set forth in Appendix A.

Q: What is the purpose of your testimony?

A: I discuss the City of Evansville's (hereinafter "Evansville" or "Petitioner") request to recover periodic maintenance expenses. I explain why the OUCC disagrees with Petitioner's proposed adjustment to Periodic Maintenance expense. I recommend the Commission approve the OUCC's adjustment to Periodic Maintenance expense.

Q: What have you done to prepare your testimony?

A: I reviewed Evansville's Petition and the testimony of Patrick R. Keepes, P.E., Water Superintendent, and Douglas L. Baldessari, CPA, H.J. Umbaugh & Associates Certified Public Accountants, LLP, as well as Petitioner's recent annual reports filed with the Indiana Utility Regulatory Commission ("Commission" or "IURC"). I also wrote discovery requests and reviewed Petitioner's responses. On May 25, 2016, OUCC Utility Analyst Jim Parks and I met with Mr. Keepes, Allen Mounts, Director, Water and Sewer Utilities and Duane Gilles, Water Distribution Manager to discuss Petitioner's current operations and plans. We visited several of Petitioner's above-ground water utility facilities at that time and I attended the Commission's field hearing at Bosse High School in Evansville.

Q: What documents are attached to your testimony?

A: My testimony includes the following attachments:

- Attachment CNS-1: Opflow Nov. 2015, "Manage Filter Assets for Media Performance and Capital Planning;"
- Attachment CNS-2: Opflow , Mar. 1998, "Filter Media Cleaning – Alternative to Replacement;"
- Attachment CNS-3: Filter Media Workpapers (Cause No.45073);
- Attachment CNS-4; Filter Media Workpapers (Cause No. 44760);
- Attachment CNS-5: ASCC Filter Report – DR 3.8;
- Attachment CNS-6: High- & Low-Service Pump Workpapers (Cause No. 44760);
- Attachment CNS-7: High- & Low-Service Pump Workpapers (Cause No. 45073);
- Attachment CNS-8: Booster Pump Workpapers (Cause No. 44760);
- Attachment CNS-9: Booster Pump Workpapers (Cause No. 45073).

II. PERIODIC MAINTENANCE

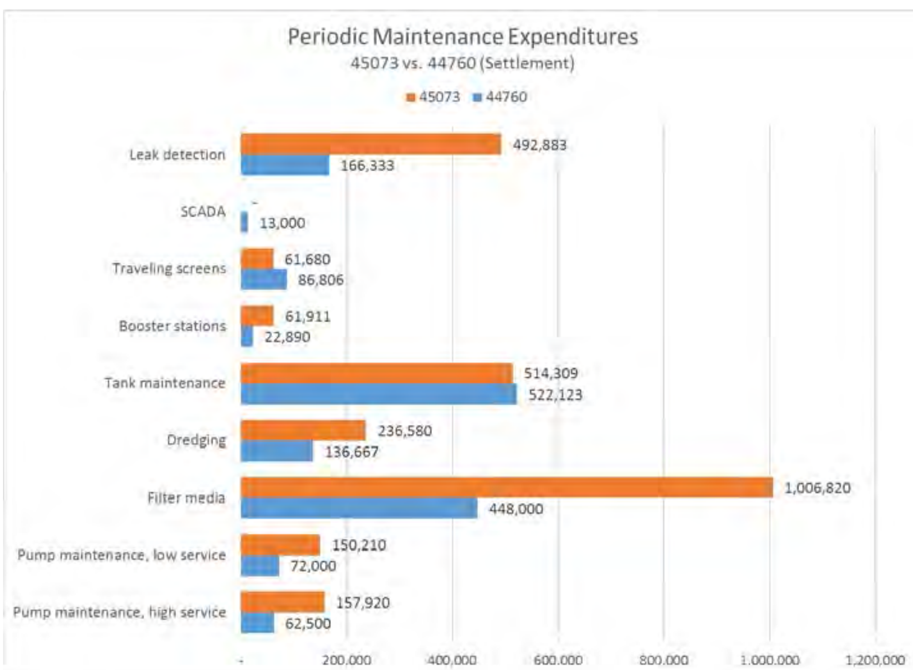
Q: Please describe Evansville's proposed adjustments to Periodic Maintenance expense.

A: In Attachment DLB-1, page 14 of 50, Petitioner made an adjustment (Adjustment 7) to its test year Periodic Maintenance Expense. Petitioner is proposing to recover the expense associated with performing maintenance on High and Low Service Pumps, Filter Media, Water Storage Tanks, Booster Stations, and Traveling Screens. Petitioner is also seeking recovery of expenses associated with Dredging in Front of the Intake Structure and with performing a Leak Detection and Distribution System Maintenance Assessment. During the test year, Petitioner spent only $709,525 on Periodic Maintenance. As a *pro forma* revenue requirement, Evansville proposes to increase these expenditures to $2,682,313, or an increase of $1,972,788 annually.

Q: How do the proposed expenditures compare to the increases sought in Evansville's previous rate case, Cause No. 44760?

A: Evansville's periodic maintenance costs as proposed in this case are significantly higher than the periodic maintenance costs proposed and approved in the last rate case. As shown below in Table 1, costs for certain of the proposed Periodic Maintenance projects have increased dramatically, in some cases more than doubling, from the previous rate case -- especially with respect to booster stations, filter media, high-service pumps, and low-service pumps.

Table 1



As is shown in Table 2, specific periodic maintenance expenditures proposed in the current case vary from a 47% reduction (Traveling Screens) to a 170% increase (Booster Stations) over the previous case. The overall increase in proposed maintenance expenditures when compared to the previous case, for essentially the same projects, is 68%.

Table 2

	-- Amount --		-- Difference --	
Periodic Maintenance Item	44760	45073	Dollars	Percent
Pump maintenance, high service	$ 71,428	$ 157,920	$ 86,492	121%
Pump maintenance, low service	96,000	150,210	54,210	56%
Filter media	448,000	1,006,820	558,820	125%
Dredging	136,667	236,580	99,913	73%
Tank maintenance	522,123	514,309	(7,814)	-1%
Booster stations	22,890	61,911	39,021	170%
Traveling screens	115,741	61,680	(54,061)	-47%
SCADA	13,000	-	(13,000)	-100%
Leak detection	166,333	492,883	326,550	196%
	$ 1,592,182	$ 2,682,313	$ 1,090,131	68%
Less test year amount	(228,264)	(709,525)		
	$ 1,363,918	$ 1,972,788		

Q: Do you accept Petitioner's *pro forma* expense amount for each periodic maintenance item?

A: No. I have accepted Petitioner's *pro forma* expenses for Tank Maintenance, Leak Detection and Distribution System Maintenance Assessment ("Leak Detection"), Dredging in front of Intake Structure and Traveling Screen Maintenance. However, I disagree with certain aspects of the proposed expenditures for (1) Filter Media, (2) Travelling Screens Maintenance, (3) Booster Stations and (4) Pump Maintenance. I propose adjustments to these expenses below.

III. ACCEPTED PERIODIC MAINTENANCE EXPENSES

Q: Why do you accept the proposed Tank Maintenance expense?

A: The proposed Tank Maintenance expense of $505,884 is the annual cost associated with the long-term, comprehensive Tank Painting and Maintenance Agreement that Petitioner entered into with Utility Service Group in May of 2016. This agreement provides for the care and maintenance of Evansville's nine (9) water storage tanks, including inspections, washouts, certain repairs, cleaning, and repainting. The OUCC supported this program and accepted the adjustment for it in the previous rate case. On page 12 of his testimony, Mr. Keepes states that "The results achieved under this agreement have exceeded expectations in terms of protecting these critical assets of the system with regularly scheduled inspections, cleanings and coatings." The OUCC also agrees with the proposed $8,425 annual expense to perform maintenance on the Campground 20 MG underground tank.

Q: Please describe Petitioner's proposed expense for Leak Detection.

A: Evansville proposes to include $492,883 ($1,478,650 amortized over three years) in its revenue requirement to assess certain critical, large (over 12 inches) cast and ductile iron mains, as well as 36- and 48-inch pre-stressed concrete cylinder pipe ("PCCP") in its system over a three-year period. This work, to be performed by M.E. Simpson Co., Inc., is an expansion of a program supported by the OUCC in Cause No. 44760, which was directed at the inspection of critical, large PCCP pipe. Under the proposed plan, additional large mains of other materials are included and by the end of the three-year period, approximately 55 miles (see Table 3) of large mains will have been inspected and seven miles of 36-inch and 48-inch PCCP will be permanently monitored.

Table 3

Size	Material	Length
12", 16"	Cast iron, Ductile iron	35.0
36", 48"	PCCP	7.0
36"	PCCP	6.0
30"	Ductile iron	3.6
20"	Ductile iron	3.6
		55.2

Q: Please describe Petitioner's proposed expense for Dredging in Front of Intake Structure.

A: Evansville proposes to include $236,580 in Periodic Maintenance for dredging to ensure the continued effectiveness of its surface water intake structure. According to Keepes' testimony, the October 2017 bid of $339,740 by Foertsch Construction was the only response to a formal Request for Proposals. The bid amount was based upon mobilization/demobilization costs of $25,840 per occurrence and $31.39 per cubic yard. Foertsch estimates that 10,000 cubic years will need to be removed and disposed.[1] Following this initial dredging, the Water Superintendent estimates two more years at $185,000 each, yielding a total, three-year expenditure of $709,740. Amortizing this amount over three years, comes to an annualized average of $236,580. The OUCC agrees that that average annual cost of $236,580 for dredging is reasonable.

Q: Why do you accept the proposed Traveling Screen Maintenance expense?

A: In Cause No. 44760, Evansville was quoted $115,741 by Atlas Traveling Water Screens ("Atlas') to remove a screen from the well, transport, disassemble, rebuild, ship back to Evansville Water and Sewer Utility and re-install it in its well. In the current Cause, Atlas has reduced its quote for the same work to $82,240 per screen or $246,720 for three (3) screens. Petitioner has amortized this cost over four (4) years for an annual expense of $61,680. The OUCC agrees with the proposed adjustment.

IV. OUCC'S ADJUSTMENT TO PERIODIC MAINTENANCE EXPENSES

Q: Please describe Petitioner's proposed periodic maintenance expense for filter media replacement.

A: Petitioner seeks to recover $1,006,821 per year for filter media replacement (Petitioner's Exhibit DLB-1, page 11, Adjustment 7(II)). Petitioner's proposal is to replace the filter media in four (4) filter beds per year over a six (6) year cycle. Petitioner estimates that it

[1] $25,840 + ($31.39 x 10,000) = $339,740

will cost $251,705 per filter bed or an annual expense of $1,006,821.

Q: Do you agree with Petitioner's proposed Filter Media maintenance schedule?

A: No. Evansville's proposed six-year replacement cycle is not based on any test, analysis or manual to support that interval. Also, I believe Petitioner's proposed costs have been incorrectly estimated. Finally, Petitioner's filter media replacement costs include capital costs that should not be included in Periodic Maintenance expense. The capital improvement Petitioner included in its revenue requirement is the cost of replacing two filters and underdrains in the amount of $235,004 and $ 234,849.

Q: How should intervals for media replacement be determined?

A: Filter media replacement cycles should be based upon qualitative and quantitative analyses of the existing media (needs-based), and not be simply time-based. An article titled "Manage Filter Assets for Media Performance and Capital Planning" in the November 2015 Opflow, a journal of the American Water Works Association (Attachment CNS-1), had this to say:

> Assessing the condition of filter media is an important first step in developing an effective filter asset management program. Laboratory analysis of filter media is an effective way to identify problems associated with system fouling, operation, and age degradation. Using the information from an analytical assessment, a utility can determine the most effective cleaning technology, the required operational changes, or the need for media replacement.

> (page 15, emphasis added)

In its Filter Maintenance and Operations Guidance Manual (2002), the AWWA Research Foundation dedicates two chapters to the assessment of filter media as precursor to decision-making involving filter media. This type of assessment may be even more critical for Evansville as it begins to assess its filters to determine a priority ranking. Finally, no evidence was presented showing that filter media cleaning (also discussed in the article) was considered as a possible option. Because Evansville has not demonstrated the need for filter media replacement at the proposed frequency, I recommend that a ten-year cycle[2] be used. Meanwhile, if Evansville can provide support for a more aggressive schedule, it can present it in its next rate case.

Q: How has Evansville estimated the costs for filter media replacement?

A: Evansville has chosen to estimate these costs as "mandatory additions" to a larger overall contract presented by a General Contractor, Deig Brothers. Pages 41-43 of Petitioner's Workpapers (Attachment CNS-3) illustrate these costs and summaries of bids received. This is in marked contrast to cost data for filter media replacement that was provided in Cause No. 44760, which set out the prices and services performed by Utility Service Group (Attachment CNS-4).

Q: Why is underdrain replacement a capital improvement and not Periodic Maintenance?

A: The underdrain replacement is a replacement of a long lived asset and, as such, should be more appropriately regarded as a capital expenditure. Evansville's response to OUCC Data Request 3.8 supports this conclusion. The response included a "Filter Report" by All Service Contracting Corp. ("ASCC") detailing the work to be performed. (See Attachment CNS-5.) In this report, ASCC concludes that "The new system should last in our opinion 50 years or more." This is not periodic maintenance,[3] but is instead a capital improvement.

---

[2] "Filter Media Cleaning – Alternative to Replacement," Opflow, March 1998, also appearing as Attachment CNS-2.

[3] According to the AWWA Water Dictionary, Second Edition (2010), maintenance involves "Repairs and general upkeep necessary for the efficient operation of physical plants, property and equipment. Maintenance is not to be confused with replacement or retirement."

Q: What is the ratemaking effect of your determination that the underdrain replacement should be considered capital improvements?

A: There appear to be only two filters that *may* require underdrain replacement. Since the proposed Periodic Maintenance cost adjustment on Attachment DLB-1, page 14 of 50, shows *four* "filter media" replacements (which are costed as underdrain replacements), I recommend that the two filters incurring underdrain replacement be capitalized at the Deig Brothers prices of $235,004 and $ 234,849. I also recommend that Period Maintenance expense for filter media be based on 24 filters having their filter media replaced on a ten-year cycle at the price Utility Service Group quoted of $112,000 per filter.

The annual Periodic Maintenance expense for replacing filter media on a ten-year cycle can be calculated as follows:

Table 4

Media replacement cost (44760)	112,000
x 24 filters	24
Total cost all filter media	2,688,000
Replacement cycle (years)	10
Annual maintenance cost	268,800

This calculation results in a $738,020[4] reduction to the amount proposed by Evansville for "Filter Media."

Q: Why do you disagree with Petitioner's Pump Maintenance expenses?

A: Petitioner's High-Service Pump and Low-Service Pump maintenance expenditures focuses on the per-unit cost of maintenance, which is unexpectedly high, particularly when compared with the same costs from the previous rate case. In Cause No. 44760, Evansville proposed a per-unit maintenance cost of $35,714 and $48,000 for High- and Low-Service

[4] $268,800 – $1,006,820 = ($738,820).

pump maintenance, respectively (see Attachment CNS-6), based upon a quote from Xylem, an established water utility service and equipment provider.

Evansville has proposed per-unit periodic maintenance costs for high-service pumps at $90,240 and low-service pumps at $100,140 (Attachment CNS-7). These new, proposed costs are increases of 153% and 109% respectively, and are based only upon "Mandatory Deducts" from a larger base bid by Deig Brothers. No engineering estimate was provided by Evansville's engineer, HNTB. Significantly, the estimates provided by Xylem in Cause No. 44760 were much more detailed, breaking down the different costs by individual high service pumps.

The best available evidence of this cost is that provided in detailed quotes by Xylem in the previous case. As such, I recommend that the prior Xylem estimates for periodic maintenance (not replacement) be used to calculate annual periodic maintenance costs as follows:

Table 5

	44760 (Xylem)	45073 (Deig)	Difference
Average Cost All High Service Pumps	35,714	90,240	
x 1.75 per year (4 year interval)	1.75	1.75	
Annual maintenance cost	62,500	157,920	(95,421)
	44760 (Xylem)	45073 (Deig)	Difference
Average Cost All Low Service Pumps	48,000	100,140	
x 1.75 per year (4 year interval)	1.50	1.50	
Annual maintenance cost	72,000	150,210	(78,210)
Total adjustment to pumps			(173,631)

This change yields a reduction of ($173,631) to Evansville's proposed total, annual pump maintenance expenditures.

Q: Why do you disagree with Evansville's proposed Booster Station Maintenance expenses?

A: Evansville's proposal relies on per-unit costing for pumps at the Booster Stations. In Cause No. 44760, a quote from Xylem (Attachment CNS-8) showed pricing for each of the booster pumps at $7,630. In the current Cause (see Attachment CNS-9), Petitioner is requesting an average maintenance cost per pump of $20,637, a 170% increase in just two years.

The invoices (included in Attachment CNS-9) provided by Petitioner highlight the possible problem – at least one of these quotes involve *replacement* of the pump and not maintenance.[5] The best evidence of this cost is that provided in detailed quotes, by Xylem, in the previous case. I recommend that the prior *maintenance* cost of $7,630 per pump be used in Petitioner's calculations for booster pump maintenance, as follows:

Table 6

	Unit Cost	Done Per year	Total Cost
44760 Xylem maintenance quote	7,630	3	22,890
45073 "Superintendent Estimate"	20,637	3	61,911
Difference (adjustment)			(39,021)

I recommend a reduction of ($39,021) to Evansville's proposed Booster Station expenses.

Q: What periodic maintenance expense do you recommend?

A: I recommend the following periodic maintenance expenses be approved by the Commission:

[5] I was able to confirm Invoice 0012909 from Eemsco involved replacement of the pump not maintenance. This invoice is included in page 3 of my Attachment CNS-9.

Table 7

I.	Pump Maintenance			
	a.	High service pumps		$ 62,500
	b.	Low service pumps		$ 72,000
II	Filter Media			$ 268,800
III	Dredging in Front of Intake Structure			$ 236,580
IV	Tank Maintenance			
	a.	Cleaning, inspection & tank coating		$ 505,884
	b.	Campground 20 MG tank		$ 8,425
V	Booster Station Maintenance			$ 22,890
VI	Traveling Screen Maintenance			$ 61,680
VII	Leak Detection			$ 492,883
			Total:	$ 1,731,642
			Less test year amount:	$ (709,525)
			Adjustment:	$ 1,022,117

V. RECOMMENDATIONS

Q: Please summarize your recommendation:

A: I recommend the Commission adopt the OUCC's Periodic Maintenance expenses shown in Table 7.

Q: Does this conclude your testimony?

A: Yes.

APPENDIX A

Q: Please describe your educational background and experience.

A: In 1981 I graduated from Purdue University, where I received a Bachelor of Science degree in Industrial Management with a minor in Engineering. I was recruited by the Union Pacific, where I served as mechanical and maintenance supervisor and industrial engineer in both local and corporate settings. I then served as Industrial Engineer for a molded-rubber parts manufacturer before joining the Indiana Utility Regulatory Commission ("IURC") as Engineer, Supervisor and Analyst for more than ten years. It was during my tenure at the IURC that I received my Masters degree from Indiana University. After the IURC, I worked at Indiana-American Water Company, managing their Shelbyville operations for eight years, and later served as Director of Regulatory Compliance and Contract Management for Veolia Water Indianapolis. I joined Citizens Energy Group as Rate & Regulatory Analyst following the October 2011 transfer of the Indianapolis water utility and joined the Office of Utility Consumer Counselor in April of 2016.

AFFIRMATION

I affirm the representations I made in the foregoing testimony are true to the best of my knowledge, information, and belief.

By: Carl N. Seals
Cause No. 45073
Indiana Office of
Utility Consumer Counselor

7/20/2018
Date:

A filter asset management program can help any utility optimize operations and reduce costs.

Filter Optimization

Manage Filter Assets for Media Performance and Capital Planning

Filters are a water treatment plant's last barrier for particulate and microbial contamination. Filter asset management can maximize filter service life, maintain optimal performance, and allow proactive budgeting BY RANDY MOORE, ROGER D. MILLER, TAD BASSETT, AND STEPHEN SIEGFRIED

MAINTAINING FILTER performance and continuously producing water that exceeds industry standards is every operator's goal. However, only a small percentage of US water filtration plants have filter asset management plans, and an even smaller subset follow the plan they have. Filter asset management includes underdrain design, filter media condition assessment, and filter media cleaning. Implementing a filter asset management program can help any utility optimize operations and reduce costs.

UNDERDRAIN DESIGN CONSIDERATIONS

During a filter rehabilitation, the underdrain system will often require maintenance or replacement. Before your utility replaces its underdrain system, it's critical to clearly understand the role of an underdrain within a filter.

Filter media and an underdrain system drive filter performance, including water production, water quality, and maintenance and operating costs. Filtration is a batch process, so the effectiveness of each filter cycle depends on the effectiveness of each backwash.

An underdrain's purpose is threefold: collect the filtered water, prevent media from entering the effluent/backwash circuit, and maintain the filter media. Maintaining and cleaning the filter media is accomplished during the backwash cycle. During the backwash cycle, the underdrain should uniformly distribute backwash water and air scour to flush the accumulated solids from the filter media. To accomplish this, the underdrain should use the least amount of backwash water possible as constrained by media depth and collection trough location.

When the underdrain fails to properly perform any of its three purposes, the results can be any combination of the following:

http://dx.doi.org/10.5991/OPF.2015.41.0067

Randy Moore is vice president of market development with Pure Technologies (www.puretechltd.com), Columbia, Md. Roger D. Miller is technical director with Water Systems Engineering (www.h2osystems.com), Ottawa, Kan. Tad Bassett is senior process engineer with AWI (www.awifilter.com), Sandy, Utah. Stephen Siegfried is vice president of water quality with Utility Service Group, (www.utilityservice.com), Atlanta.

- Loss of filter media into the filter effluent
- Shortened filter cycle times
- Reduced quality of finished water
- Wasted backwash water
- Reduced plant capacity
- More frequent and/or more costly filter maintenance

If you have determined your existing underdrain needs to be replaced to correct one or more of these problems, your utility should consider how the existing basin configuration will challenge the replacement system. Foremost, consider where and how the backwash water enters the filter box. Backwash entrance location and the method by which the water is distributed to the underdrain will result in areas of high water velocity. The replacement underdrain system should be able to compensate for areas of high entrance and channel velocities to prevent lower backwash rates in these areas.

Many newer underdrain systems offer direct retention, which means they can prevent the loss of media into the filter effluent without the use of support gravel. Support gravel is often thought of as filter media; however, it's really a part of the underdrain system. Support gravel takes up volume that could be used for filter media. It can also mound and migrate over time, which reduces filter performance, so eliminating gravel should be a goal with any underdrain replacement.

FILTER MEDIA CONDITION ASSESSMENT

Assessing the condition of filter media is an important first step in developing an effective filter asset management program. Laboratory analysis of filter media is an effective way to identify problems associated with system fouling, operation, and age degradation. Using the information from an analytical assessment, a utility can determine the most effective cleaning technology, the required operational changes, or the need for media replacement.

Filter problems such as head loss, media growth, reduced run times, and water quality can be attributed to deposit accumulation, both mineral and bacterial; media degradation; and operational issues such as excessive chemical feed. Bacterial deposits, referred to as biofilm, incorporate considerable volumes of polysaccharide slime that can reduce flow; promote mineral deposition; and, over time, harbor problematic organisms. Mineral deposits, which are a function of water chemistry, can smooth and round the media, reducing filtration effectiveness. Degraded media, displaying fractures and rounding, reduces filtration capacity.

FILTER MEDIA CLEANING

The laboratory analysis should be designed to assess the presence of fouling deposits and the media's effectiveness. With this information, your utility can develop a cleaning program that targets the problems identified. A bacteriological analysis should cover the identity, quantity, and maturity of the biofilm to effectively evaluate potential issues. Mineral analysis can guide the potential cleaning process and identify operational issues such as excess coagulant or polymer. Sieve tests measure particle size and grain size distribution, identifying potential media loss and effects on filtration capacity. A laboratory bench-test study can evaluate the most effective cleaning chemistry and application procedures that target the problems identified in the analysis.

The cleaning chemistries most effective on mineral deposits are generally acid reactions. Various acids, both mineral and

Before and after photos show how filter media can be cleaned and restored to its original specification provided it hasn't lost angularity.

Filter Optimization

A plant condition assessment includes physical observations about filters. Be sure to notice (from left to right) mud ball diameter and appearance as well as mud present on top of filters. Also, observe backwash for even flow and boils.

organic, have various effects on specific materials, underlining the need to know what your utility's cleaning process is targeting. However, solubility is common to all acids. As the acid is neutralized and pH increases, the solubility decreases, resulting in reprecipitation. To maintain solubilized mineral ions and prevent the organic biofilm from reforming, use dispersion polymers with the acid to prevent reprecipitation and enhance the cleaning process.

A comprehensive asset management plan entails monitoring your system by evaluating records, inspecting on-site processes and equipment, and analyzing media samples at a laboratory. Such a plan yields many benefits for your utility, including more efficient operations, early identification of potential problems, and effective maintenance or replacement protocols.

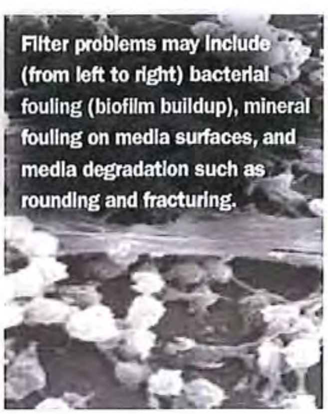
FILTER ASSET MANAGEMENT

Filter asset management planning is a key component of maintaining a sustainable utility. The components of a filter asset plan should be reviewed and organized into a comprehensive asset management plan. Tools for developing a filter asset management plan include the following:

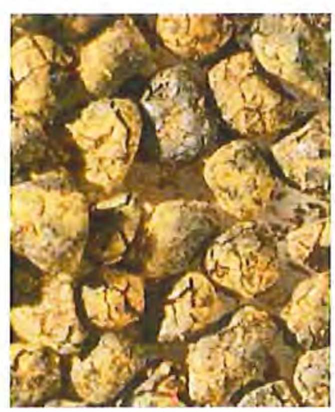
- Condition assessment
- Media sampling and analysis
- Renovation cost and life expectancy estimates

Condition Assessment. Condition assessment starts with a plant's overall condition and how well it meets the operating parameters of an optimized filtration plant. Filter run times for dual and multimedia filters should be 72–140 hr; for monomedia filters, run times should be 24–72 hr. Filtration rates should fall between 1.4 gpm/ft^2 and 4 gpm/ft^2. Filter effluent turbidity regulations require 0.3 ntu 95 percent of the time. Best practice for filter effluent turbidity is 0.1 ntu, with optimized, well-operated plants showing .03–.05 ntu below the filters.

Physical observations about the filters should be recorded before and during the backwash cycle. A filter report should identify the media surface condition with any cracks, mounds, craters, or the presence and location of mud balls. During the backwash cycle, observe the troughs; there should be even flow into and out of the troughs. Report uneven flow through the media and media boils as well as the condition and operation of the surface wash or air scour system.



Filter problems may include (from left to right) bacterial fouling (biofilm buildup), mineral fouling on media surfaces, and media degradation such as rounding and fracturing.



A comprehensive asset management plan includes the cost of all filter room upgrades, planned media sampling, planned cleaning, and media replacement.

Record observations on the condition of the overall plant and building, including paint, electrical, lighting, heating, ventilation, air conditioning, flooring, instrumentation and controls, concrete, and windows and doors. The purpose is to identify anything and everything that needs to be part of a long-term plan to sustain filter operations.

Media Sampling and Analysis. Sampling filter media and tracking media degradation allow utilities to project when the media needs to be cleaned or replaced. Filter media can grow over time as a result of calcium carbonate, iron, manganese, and biological deposits. Media also wears out, or erodes, as it's backwashed and the grains collide, causing the media to round and lose size and uniformity. Media can last 20–30 yr if managed properly, or it may need to be cleaned or replaced in 4–10 yr in a depositing environment. Tracking media degradation through sampling every 2 yr in depositing and 4 yr in nondepositing conditions provides the information necessary for projecting media replacement and asset planning.

Renovation Cost and Life Expectancy Estimates. Regular periodic cleaning extends the life of media in a depositing environment. Media sample analysis results should include a laboratory's chemical, physical, and biological findings. Based on the laboratory recommendations, media can be cleaned and restored to its original specification provided it hasn't lost angularity (become rounded). Media should be cleaned before acid solubility reaches 10–12 percent. When it exceeds 10–12 percent, the media will require two or more chemical cleanings. Multiple-cleaning costs usually exceed replacement costs.

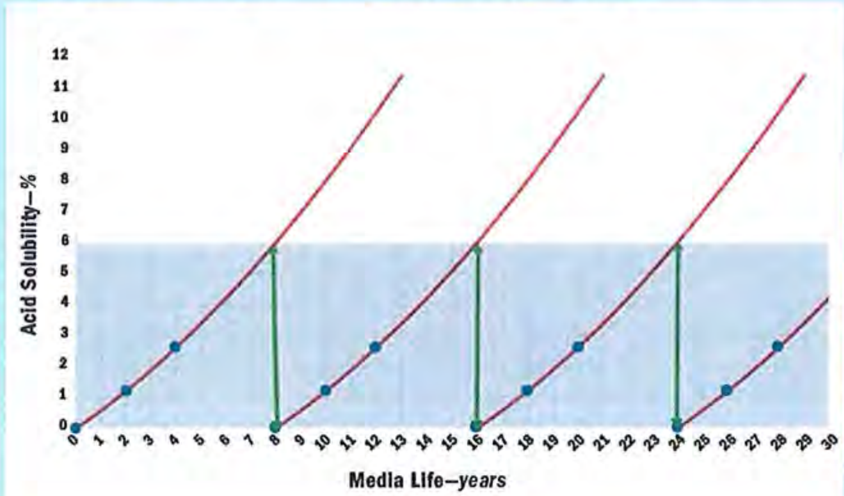
A comprehensive asset management plan includes the cost of all filter room upgrades, planned media sampling, planned cleaning, and media replacement. The life cycle used for predicting a scheduled media replacement can be based on historic replacement or projections of future needs. An asset management plan provides predictable fiscal budgeting and future cost estimates to help predict your utility's future financial needs.

FINANCIAL BENEFITS

Developing and following a filter asset management plan can maintain, restore, and improve filter performance while extending asset life. Building a future-cost model will help identify the anticipated financial needs of your utility going forward and provide predictable budgeting into the future. Also, communicating the filter asset plan to utility managers and board members is critical to ensure accurate forecasts for short- and long-term capital funding.

Extending Media Life

Regular periodic cleaning extends the life of media in a depositing environment.



Develop a Financial Plan

A filter asset management plan can maintain, restore, and improve filter performance while extending asset life.
Be sure to identify and price all necessary repairs and equipment life cycles.

Hypothetical Plant Asset Management Plan

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Sample Media	$ 2,000		$2,000		$2,000		$ 2,000		$2,000		$2,000		$2,000		$2,000		$ 2,000		$2,000		$ 2,000
Clean Media						$30,000						$30,000					$30,000				
Replace Media	$250,000																				$ 250,000
Replace Surface Wash	$100,000																				$ 10,000
Rehab Surface Wash							$10,000							$10,000							
Epoxy Coat Filters Box	$300,000																				$ 300,000
Rehab Underdrains	$ 60,000																				
Replace Underdrains																					$ 400,000
	$712,000	$-	$2,000	$-	$2,000	$30,000	$12,000	$-	$2,000	$-	$2,000	$30,000	$2,000	$10,000	$2,000	$-	$32,000	$-	$2,000	$-	$ 962,000

Opflow
Vol. 24 No. 3
March 1998
American Water Works Association
Dedicated to Safe Drinking Water

Media Frenzy

Filter Media Cleaning—Alternative to Replacement

by Brian Jobb

Filtration is an extremely important component of any conventional water plant. The role of a filter is even more critical for direct-filtration facilities. To ensure optimal performance, many experts recommend replacing the sand and anthracite in a typical dual-media filter every 10 to 20 years. Operating authorities often go to the trouble and expense of replacing media that are fouled but remain within an acceptable size range.

Media replacement may not be necessary, provided that the effective sizes and uniformity coefficients for the sand and anthracite remain within original specifications. It is often possible to regenerate filter media without removal by means of chemical cleaning. This technique was documented in the 1960s and has become routine maintenance at numerous facilities.

Causes of Fouling

Media fouling and mudball formation can occur for many reasons. The most typical causes are inadequate backwash rates, uneven backwash flow distribution, ineffective surface wash, and improper chemical dosages. Poor clarifier performance may also lead to floc carryover and fouling of filter media. Filters equipped with air scour appear to be less susceptible to fouling and mudball formation, probably because of the effective scrubbing action of the air.

Initial inspection of the media is necessary to ensure that the depths of the sand and anthracite layers remain within original specifications. If the media are more than 10 years old—five years if air scour has been used continuously—samples should be removed and subjected to sieve analyses to determine effective sizes and uniformity coefficients.

Media sampling is readily accomplished by pushing a 4-ft (1-m) length of 6-in. (150-mm) pipe into the media and removing the media inside the pipe with a wet–dry shop

The huge amounts of filter media in use can lead to considerable problems with fouling caused by ineffective backwashing and other factors.

vacuum cleaner. Four or five samples taken along a transect from corner to corner across the filter are usually sufficient. Sieve analysis of the media samples should be conducted according to the ASTM standard method for sieve analysis of fine and coarse aggregates, ASTM standard test C136-84A.

Fouling can occur in the form of mudballs, visible debris clinging to media, media agglomeration (clumping), or media homogeneity (sand and anthracite caked together). If fouling is apparent, add a small amount of the media to two flasks—one containing a weak solution of acid (5 percent sulfuric acid) and the other caustic (5 percent sodium hydroxide). Swirl the flasks and look for separation of media from the debris. If dense mudballs are present, allow at least an hour soaking time and reexamine the media. If little success is achieved with acid or caustic, weak solutions of hydrogen peroxide, sodium hypochlorite, or soda ash also may be used.

How to Clean the Media

After determining the most effective cleaning agent, it is possible to clean the media by taking the filter out of service, draining it down so that only a small amount of water remains above the anthracite, and adding the chemical directly to the filter. The soaking time is variable

continued on page 4

Filter Media Cleaning—Alternative to Replacement continued from page 1

and will depend on numerous factors; two hours may be adequate, but large, dense mudballs may take much longer to dissolve. Based on the extent of fouling, two cleaning cycles may be necessary.

A typical filter wash procedure is outlined below. Site-specific applications may require modification of these guidelines.

1. Take the filter out of service and drain it down, leaving some water on top of the anthracite.
2. Add sufficient sodium hydroxide to obtain a 2 percent solution in the water remaining in the filter, considering a void volume of approximately 40 percent. (Forty percent of the filter media is water.)
3. Allow the filter to soak or, preferably, air scour for at least two hours. A longer cleaning cycle will generally produce cleaner media.
4. Initiate a normal water backwash. Reexamine the media and, if necessary, repeat the cleaning procedure with a 1 percent sodium hydroxide solution.
5. The final backwash should be monitored for pH and turbidity to ensure that all residue from the cleaning process has been removed. It may be necessary to extend the duration of backwash before putting the filter back into service.

Dry or Wet?

Sodium hydroxide is available in dry or liquid form. Using dry product may alleviate certain safety-related concerns associated with application in an aqueous form. Liquid sodium hydroxide (50 percent) is very slippery if spilled and may have a greater tendency than pellets to burn if it comes into contact with the skin.

The solid form is shipped in 50-lb (20-kg) bags that are more easily handled than the 55-gal (210-L) drums or totes commonly used to transport liquid material. Solid sodium hydroxide pellets may take several minutes to dissolve, while liquid disperses throughout the filter more readily.

Air Scour Helps

The effectiveness of the cleaning process is improved dramatically by air scour, which can help reduce soaking time and will loosen debris. A temporary air scour system may be set up by introducing air through a fabricated PVC pipe grid that rests on top of the backwash troughs and extends down into the media. If air scour is not available, an air or water probe can be used to stir up the media, paying particular attention to the walls and corners.

From experience at numerous facilities, a conditioning period may be required before achieving optimum filter performance. As is typical of new media, it may take several full cycles to obtain very low finished-water turbidities or particle counts. Low dosages of an organic polymer added to the backwash water may reduce the conditioning period.

Numerous benefits of media cleaning have been observed at various facilities. A significant reduction in filtered turbidity has been a common result. Other benefits that have been noted include a reduction in final effluent particle counts, an increase in filter run duration before reaching terminal head loss, and reduced backwash water consumption.

The most significant advantage is probably the reduction in material and labor costs when compared to media replacement. The cost of cleaning the media in a 16-ft × 16-ft (5-m × 5-m) filter using sodium hydroxide as described above is expected to be approximately $300 to $400, depending on the availability and freight charges.

For years, utilities have replaced fouled filter media, but media can be washed and saved if sizes remain within acceptable ranges.

Precautions

- Media fouled with organic compounds may generate a substantial amount of foam, particularly during air scour. Caustic-laden foam is very slippery.
- It is important to follow appropriate safety precautions whenever aggressive chemicals are used. Ensure that safety equipment is available.
- For facilities using granular activated carbon filter adsorbers instead of anthracite, check with your carbon supplier before proceeding.
- Depending on the cleaning agent, the backwash water may require additional treatment before disposal.
- Following addition of the cleaning agent, the water may be corrosive to filter materials—hardware, plumbing, and concrete. If in doubt, consult your supplier before proceeding.
- When added to water, sodium hydroxide undergoes an exothermic reaction—it generates heat. This should not be a problem when used at concentrations described previously.

Brian Jobb is a drinking-water specialist for Sternson, Ltd., and chair of the AWWA Ontario Section Treatment Committee. For more information on this procedure, contact Jobb at (800) 265-0712.

EVANSVILLE (INDIANA) MUNCIPAL WATER UTILITY

SCHEDULE OF PRO FORMA FILTER MEDIA MAINTENANCE

Prepared by: MDE
Date prepared: 1/8/18
Source documents: Water Superintendent - file: "IURC Rate Case PM and CIP Update 2019-2021 PK 1-8-18"
Includes contractor quote
Purpose: To project annual filter media maintenance

Number	Number of Filter Beds	Source	Pro Forma Annual Maintenance Cost
1	8	Construction Bids Received November 28, 2017	$2,013,641
		Divided by 8 filters	8
		Cost per filter	251,705
		Mutliplied by 4 filters per year	4
		Total Annual Allowance for Filter Media Maintenance	$1,006,821

WTP Filter and High/Low Service Pump Improvements
EWSU Project No. W 11117 NC

SUMMARY OF BIDS RECEIVED 11/28/2017

Bid Item	2 Bids Received		Bid Item Description
	Deig Brothers	DeBra-Kuempel	
Contract 'A' Base Bid	$1,220,723	$1,243,292	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2 - HSP#4
Contract 'B' Base Bid	$1,173,678	$1,179,200	South Filters 27 and 28 Phelps Filters 30 and 31 LSP#4 - HSP#5
Base Bid Combination Contract 'A' and 'B'	$2,389,396	$2,422,492	South Filters 21, 23, 24, 27, and 28 Phelps Filters 29, 30, 31 LSPs #2 and #4 - HSPs #4 and #5
Mandatory Addition Item #1 UnderDrains (1) South Filter	$235,004	$240,793	ADD UnderDrain System for one (1) South Filter
Mandatory Addition Item #2 UnderDrains (1) Phelps Filter	$234,849	$236,000	ADD UnderDrain System for one (1) Phelps Filter
Mandatory Deduct Item #1 (1) LSP	-$100,140	-$151,680	DEDUCT work on one (1) LSP (#2 or #4)
Mandatory Deduct Item #2 (1) HSP	-$90,240	-$100,033	DEDUCT work on one (1) HSP (#4 or #5)

POSSIBLE CONTRACT ' A' AWARD SCENARIOS

ADJUSTED CONTRACT ' A' OPTIONS	Adjusted Contract 'A' Amount*		Adjusted Bid Option Description
	Deig Brothers	DeBra-Kuempel	
Contract 'A' Base Bid (Only)	**$1,220,723**	$1,243,292	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2 - HSP#4
Contract 'A' Base Bid **without LSP#2**	$1,120,583	**$1,091,612**	South Filters 21, 23, and 24 Phelps Filter 29 HSP#4
Contract 'A' Base Bid **without HSP#4**	**$1,130,483**	$1,143,259	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2
Contract 'A' Base Bid - Filters Only - **without LSP#2 and without HSP#4**	$1,030,343	**$991,579**	South Filters 21, 23, and 24 Phelps Filter 29
Contract 'A' Base Bid **with add of 1 South Filter Underdrain System**	**$1,455,727**	$1,484,085	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2 - HSP#4 UnderDrain System for 1 Filter

*Note: Bold font indicates apparent low bid amount for the adjusted Contract A option.

EVANSVILLE (INDIANA) MUNCIPAL WATER UTILITY

SCHEDULE OF PRO FORMA FILTER MEDIA MAINTENANCE

Prepared by: MDE
Date prepared: 1/12/16
Reviewed by: __________
Date reviewed: __________
Source documents: Water Superintendent - file: "IURC Rate Case PM and CIP Update 2016-2018 PK 1-29-16";
Includes contractor quote
Purpose: To project annual filter media maintenance

Number	Number of Filter Beds	Source	Pro Forma Annual Maintenance Cost
1	24	Utility Service Group quote dated January 6, 2016	$2,688,000
		Divided by 24 filters	24
		Cost per filter	112,000
		Mutliplied by 4 filters per year	4
		Total Annual Allowance for Filter Media Maintenance	$448,000

Utility Service Group

Budgetary Letter

From: Marc Hansen – Water System Consultant (USG)
mhansen@utilityservice.com
Cell: (317) 987-2227

Chadd Matthewson - Water Quality Product Manager (USG) – Filtration Maintenance | cmatthewson@utilityservice.com
Phone: 678-705-6705 Cell: 704-281-5288

To:

Customer: City of Evansville, IN

Date: January 6, 2016

Dear Mr. Cris Cottom ,

Utility Service Group (USG) is pleased to submit this budgetary estimate for the scope of work to be performed on one (1) gravity media filter. As detailed below, this estimate includes all labor and materials required to provide a turnkey solution. The budgetary estimate and associated scope of work is a preliminary offering for budgetary purposes. We look forward to discussing any adjustments for your specific application and welcome the opportunity to review and address any comments you have on this proposal.

USG is a maintenance services contractor providing assistance with maintenance services related to storage tanks and treatment plant filters for water utilities. Tank maintenance services include cleaning services and protective coatings. Filter maintenance services include cleaning services, installation of protective coatings, media analyses, media replacement, underdrain rehabilitation services, and inspection and replacement of wash water troughs and air scour equipment. USG specializes in filter maintenance services through comprehensive analyses of media deposits and biofilms that often foul filter media, that reduce its useful life, and that can impact filter performance.

The purposes of filter maintenance plans are numerous, but are unique to filter operations to maintain filter performance and effective removal of suspended solids, particulates, and microbial contaminants that remain in the water following pretreatment operations. Filters typically are the last barrier for particulate and microbial contaminants in water treatment operations. Properly maintained filters help provide the best water quality and often reduce operating costs for utilities. Customary purposes for maintaining filters are include below.

- Remove accumulated deposits from filter media to regain original shape, composition, effective size, and uniformity coefficient of media,
- Ensure filter media meets design and operating specifications for its intended use,
- Evaluate the current condition of filter media based on its age and historical use,

- Determine the accumulation of depositing materials (calcium, iron, manganese, etc.) adhering to the media surface,
- Remove unwanted staining from the filter walls to protect the filter box (or vessel) from corrosion,
- Evaluate filter equipment components for operability and effective operations (includes underdrain systems, surface wash equipment, air scour equipment, wash water troughs, etc.),
- Determine the remaining useful life of the filter media,
- Determine the type of cleaning chemicals and concentration for effective removal of deposits from the filter media.

Effective filter maintenance properly maintains the filter media to maximize its longevity and to maintain water quality as it was designed and intended. Maintenance plans should be implemented for filters to capture changing media characteristics and to maintain optimal filter performance.

Please find below the budgetary estimate for the scope of work using the information you have provided. That information, along with the preliminary cost estimate are summarized below.

Scope of Work

1. Replace media per OEM specifications (gravel, sand, anthracite).

2. Demolition of Old underdrains.

3. Providing and install of new media per AWWA specifications.

4. Chemical cleaning of all backwash troughs inside filter.

5. Concrete coating and repair work. 100 mils of Warren 301-01 at 80-100 mils DFT on the concrete walls of the filter and 15 LF of crack repair.

6. Estimated project completion time is 4 weeks.

<u>Budgetary Pricing</u>

Option 1: Spread UR over 5-year equal annual payment term

Yr. 1 $106,586 | Yr. 2 $106,586 | Yr. 3 $106,586 | Yr. 4 $106,586 | Yr. 5 $106,586

Option 2: Spread UR over 3-year term paying $100K upfront

Yr. 1 $100,000 | Yr. 2 $116,015 | Yr. 3 $116,015

Option 3: Payment upfront

Yr. 1 $345,746

****Pricing is +/- 20%****

Itemized estimated price to:

- Replace media per OEM specifications (gravel, sand, anthracite).
- Providing and install of new media per AWWA specifications.

Is $112,018 / filter bed. This does not include any landfill costs if media is required to go to landfill.

USG appreciates your interest in our services and looks forward to working with you on this project. If you have any questions, feel free to contact me or Chadd Matthewson (information listed above).

Sincerely,

Marc Hansen

Marc Hansen – Water System Consultant (USG)
317-987-2227
mhansen@utilityservice.com

All Service Contracting Corp.
AllService.com
1.888.233.3018
Complete Water and Wastewater Treatment Plant Filter Rehab Service
Municipal - Industrial - Recreational - Construction
Nationwide Services Worldwide Sales
A Womens Business Enterprise (WBE)
Listed with Central Contractor Registration (CCR)
All Service... our name says it all

To: Mr. Brian West

At: Deig Brothers

Re: Filter Report
Job # 17-4592
EWSU WTP

On May 14, 2018 All Service Contracting Corp. started the removal process on filters # 21 & 29. During the removal process it was very apparent that filter 21 is in very poor condition. Stress cracks are very noticeable, multiple grout joints missing at the head joint locations as well as at the end of the lateral runs, exposing the end caps on the makeup blocks. In the attached photos you will also see internal issues that actually occurred causing the external conditions. Pressure test were performed on various grout joints with very poor results. Test came back at 800-1100 psi. This is well below the manufactures recommendation of 3,000 psi. (Actually 1,900 -2200 psi lower.) Power washing the joints removed grout from the joint areas reflecting the very weak state of the grout.

See attached photos with brief description of the above details

Filter 29 appears to be in significantly better condition to the naked eye while viewing the top surface. Pressure testing of the grout joints came back at 1,200 – 2,800 with one spot coming is at 3,400 psi. The bulk of the testing came back at 1,200 – 2,200 psi which is well below the manufactures recommendations of 3,000 psi, with one spot showing 400 psi over recommendation

Surface stress cracks do exist in filter 29, however not to the extent of filter 21.

As we moved our inspection to the internal part of the underdrain system of filter # 29, a completely different story is developing. As mentioned previously the deterioration of an underdrain system of this type starts at the internal part of the system. The attached photos show grout missing at the head joint locations. This is a sign that the grout at the surface are will soon be experiencing failure such as that which has occurred in filter 29. You will also notice in the attached photos stress cracks have and are developing at the underdrain surface and internal.

In conclusion A.S.C.C. highly recommend that the owner replace filter 21 without question. It is our opinion that complete failure will occur in the very near future.

Filter 29 is not in near as bad of condition as filter 21. However, with that being said the photos are undisputable evidence that failure for this filter is forth coming due to all the grout that is missing from the internals. As mentioned previously these types of failures start on the inside of the system. The clay tile system was the top of the line technology at the time and they have served the water industry well. But, it is most common at this stage of their life, failure is occurring more and more each day.

As far as filter 29 replacement goes, this is a decision that the owner will have to make and weigh the risk verses the cost and the life of this filter. But it is our opinion this filter should be replaced.

A few thing the owner may want to weigh is if they replace the existing underdrain with new, there would be no supporting gravel to pay for, freight to pay for delivery of the supporting material. With the new system they are looking at, they would get longer filter runs and use less backwash water to clean the filters along with the energy to run the pumps. The new system should last in our opinion 50 years or more.

If the owner decides not to replace filter 29 a few things to consider are as follows. How much life is left in the existing underdrain system? Not if the underdrain fails, but when the underdrain fails, what would the cost be in one year, 2 years or 5 years from now. Should the owner decide to keep the existing underdrain, rest assured that the new media and supporting gravel will without a doubt out live the underdrain. All though A.S.C.C. cannot say for certain how long the existing underdrain will last, we can say with certainty that it will fail. The internal condition of the system is without question as mentioned above undisputable evidence of a future failure.

All Service Contracting Corp. has completed well over 15,000 filter beds across the United States totaling well over 2.75 million square feet of filtering surface area. We have worked with every underdrain manufacture out there today and some that are no longer in business. We have worked on filters that were as old as 1898. All though we have been asked by many manufactures to represent them, we have made the decision not to ever represent any manufactures. This decision was made due to the fact of the ever-changing technology and if someone were to come out with a better underdrain we want to be able to utilize that underdrain for our clients. This decision has also allowed us to be completely objective no matter whose underdrain we are evaluating The underdrain system that the owner has indicated they are considering is in our opinion is the most advanced underdrain on the market today. It is our experience that the company they are considering has always been and all indications show they have been far more advanced than any other manufacture.

All the above and below photos with description is the opinion based upon our experience and knowledge of this system.

All Service recommends that Deig Brothers and the owner share this report with the Leopold firm to see if they agree. They may have other opinions that differ from A.S.C.C.

Should you have any questions pertaining to this report, please contact our office at 217-233-3018.

All Service Contracting Corp.

By:________________________ Date May 16, 2018

Brian K. Burcham President
Associate Member
A.W.W.A.

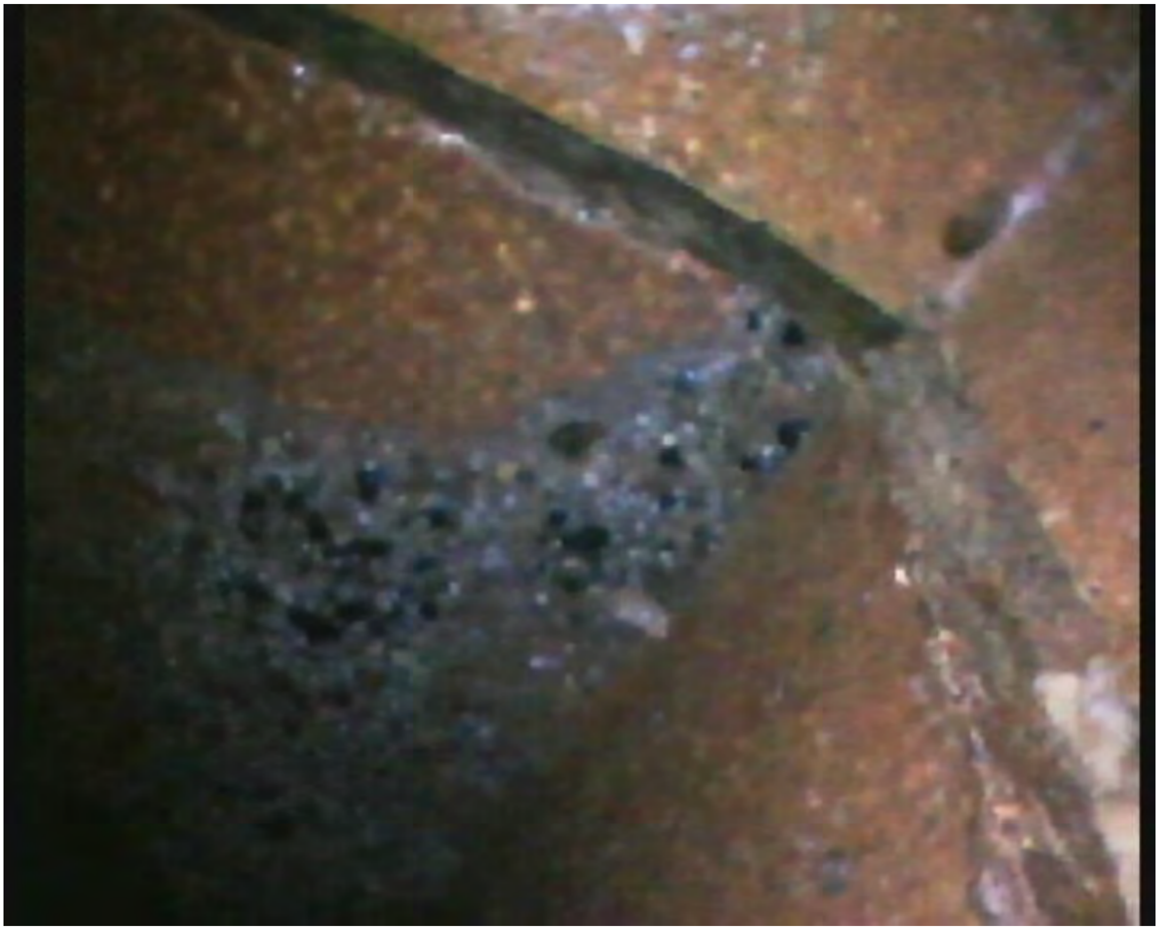
Filter # 21 showing surface cracks and grout missing at the end of the lateral runs where the makeup blocks

Typical surface cracks found throughout filter 21.

Typical grout missing and surface stress cracks

Typical filter 21 grout missing and separation from block.

Internal filter 21 showing fractures.

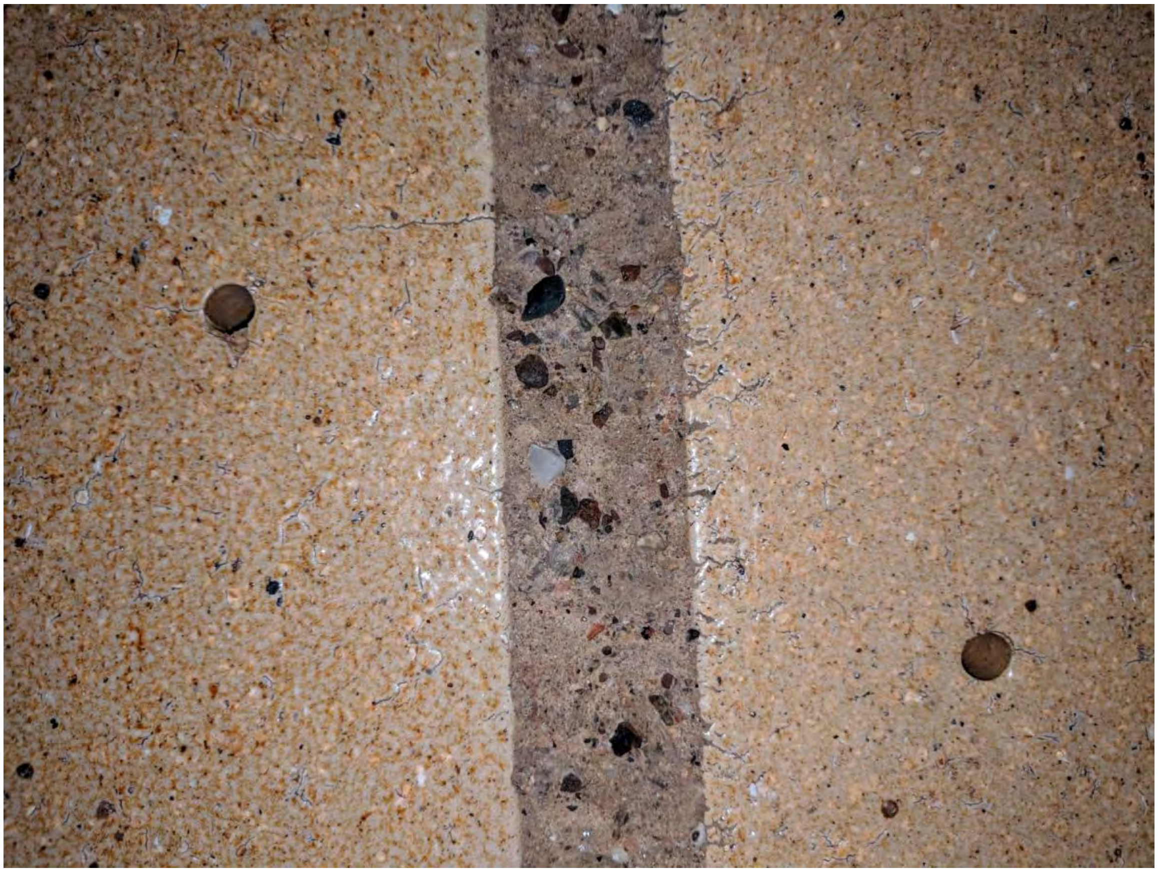


Internal Filter 21 missing grout on bottom. Grout is still in head joint.

Filter 21 grout missing sides and bottom typical.

Filter 29 surface crack

Filter 29 surface cracks. You may have to enlarge this photo, but it is very apparent that the surface crack are starting to extend from the orifice holes and throughout the block surface.



Filter 29. Once again, a large amount of surface crack developing.

Filter 29 internal missing grout. Keep in mind as explained above the deterioration of the internal underdrain system is the beginning of the surface failure that at this time is not visible from the top of the underdrain system.

Filter 29 missing grout at the bottom head joint.

Filter 29 typical, missing grout between blocks. 100% conclusive that internal grout joints have failed and is only a matter of time before it is noticeable from the surface.

Filter 29, actual block breakage and cracks.

EVANSVILLE (INDIANA) MUNCIPAL WATER UTILITY

SCHEDULE OF PRO FORMA PUMP MAINTENANCE EXPENSES - HIGH AND LOW SERVICE PUMPS

Prepared by: MDE
Date prepared: 1/11/16
Reviewed by: __________
Date reviewed: __________
Source documents: Water Superintendent - file: "IURC Rate Case PM and CIP Update 2016-2018 PK 1-29-16"
Includes contractor quote
Purpose: To project annual period maintenance for pumps

High Service Pumps:

HS Pump Number	Source	Pro Forma Annual Maintenance Cost
4	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	$36,000
5	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	36,000
6	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	26,000
7	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	26,000
8	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	42,000
9	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	42,000
10	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	42,000
	Average Cost All High Service Pumps - 2 per Year	35,714
	Times two pumps per year	2
	Total Allowance for High Service Pumps	$71,428
	Rounded Use	$71,400

Low Service Pumps:

LS Pump Number	Source	Pro Forma Annual Maintenance Cost
1	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	$48,000
2	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	48,000
3	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	48,000
4	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	48,000
5	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	48,000
6	Based on the Xylem Water Solutions USA, Inc. quote dated 1/29/16.	48,000
	Average Cost All High Service Pumps	48,000
	Times two pumps per year	2
	Total Allowance for Low Service Pumps	$96,000
	Rounded Use	$96,000

EVANSVILLE (INDIANA) MUNCIPAL WATER UTILITY

SCHEDULE OF PRO FORMA PUMP MAINTENANCE EXPENSES - HIGH AND LOW SERVICE PUMPS

Prepared by: MDE
Date prepared: 1/8/18
Source documents: Water Superintendent - file: "IURC Rate Case PM and CIP Update 2019-2021 PK 1-8-18"
Includes contractor quote
Purpose: To project annual period maintenance for pumps

High Service Pumps:

HS Pump Number	Source	Pro Forma Annual Maintenance Cost
4	Based on bids received November 28, 2017.	$90,240
5	Based on bids received November 28, 2017.	90,240
6	Based on bids received November 28, 2017.	90,240
7	Based on bids received November 28, 2017.	90,240
8	Based on bids received November 28, 2017.	90,240
9	Based on bids received November 28, 2017.	90,240
10	Based on bids received November 28, 2017.	90,240
	Average Cost All High Service Pumps	90,240
	Times 1.75 (4 year replacement interval) pumps per year	1.75
	Total Allowance for High Service Pumps	$157,920
	Rounded Use	$157,920

Low Service Pumps:

LS Pump Number	Source	Pro Forma Annual Maintenance Cost
1	Based on bids received November 28, 2017.	$100,140
2	Based on bids received November 28, 2017.	100,140
3	Based on bids received November 28, 2017.	100,140
4	Based on bids received November 28, 2017.	100,140
5	Based on bids received November 28, 2017.	100,140
6	Based on bids received November 28, 2017.	100,140
	Average Cost All High Service Pumps	100,140
	Times 1.50 pumps per year	1.50
	Total Allowance for Low Service Pumps	$150,210
	Rounded Use	$150,210

WTP Filter and High/Low Service Pump Improvements
EWSU Project No. W 11117 NC

SUMMARY OF BIDS RECEIVED 11/28/2017

Bid Item	2 Bids Received		Bid Item Description
	Deig Brothers	DeBra-Kuempel	
Contract 'A' Base Bid	$1,220,723	$1,243,292	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2 - HSP#4
Contract 'B' Base Bid	$1,173,678	$1,179,200	South Filters 27 and 28 Phelps Filters 30 and 31 LSP#4 - HSP#5
Base Bid Combination Contract 'A' and 'B'	$2,389,396	$2,422,492	South Filters 21, 23, 24, 27, and 28 Phelps Filters 29, 30, 31 LSPs #2 and #4 - HSPs #4 and #5
Mandatory Addition Item #1 UnderDrains (1) South Filter	$235,004	$240,793	ADD UnderDrain System for one (1) South Filter
Mandatory Addition Item #2 UnderDrains (1) Phelps Filter	$234,849	$236,000	ADD UnderDrain System for one (1) Phelps Filter
Mandatory Deduct Item #1 (1) LSP	-$100,140	-$151,680	DEDUCT work on one (1) LSP (#2 or #4)
Mandatory Deduct Item #2 (1) HSP	-$90,240	-$100,033	DEDUCT work on one (1) HSP (#4 or #5)

POSSIBLE CONTRACT ' A' AWARD SCENARIOS

ADJUSTED CONTRACT ' A' OPTIONS	Adjusted Contract 'A' Amount*		Adjusted Bid Option Description
	Deig Brothers	DeBra-Kuempel	
Contract 'A' Base Bid (Only)	**$1,220,723**	$1,243,292	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2 - HSP#4
Contract 'A' Base Bid **without LSP#2**	$1,120,583	**$1,091,612**	South Filters 21, 23, and 24 Phelps Filter 29 HSP#4
Contract 'A' Base Bid **without HSP#4**	**$1,130,483**	$1,143,259	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2
Contract 'A' Base Bid - Filters Only - **without LSP#2 and without HSP#4**	$1,030,343	**$991,579**	South Filters 21, 23, and 24 Phelps Filter 29
Contract 'A' Base Bid **with add of 1 South Filter Underdrain System**	**$1,455,727**	$1,484,085	South Filters 21, 23, and 24 Phelps Filter 29 LSP#2 - HSP#4 UnderDrain System for 1 Filter

*Note: Bold font indicates apparent low bid amount for the adjusted Contract A option.

EVANSVILLE (INDIANA) MUNCIPAL WATER UTILITY

SCHEDULE OF PRO FORMA BOOSTER STATION MAINTENANCE EXPENSES

Prepared by: MDE/AJR
Date prepared: 1/9/16
Reviewed by: __________
Date reviewed: __________
Source documents: Water Superintendent - file: "IURC Rate Case PM and CIP Update 2016-2018 PK 1-29-16";
Includes contract quotes
Purpose: To project annual period maintenance for Booster Station pumps

BS Number	Location	No. of Pumps	Source	Pro Forma Annual Maintenance Cost (1)
1	1st Ave.	2	Quote from Xylem dated 12/22/15	$15,260
2	Weinbach (2 total)	1	Quote from Xylem dated 12/22/15	7,630
3	Weinbach (2 total)	1	Quote from Xylem dated 12/22/15	7,630
4	Campground	2	Quote from Xylem dated 12/22/15	15,260
5	Killian (4 total)	3	Quote from Xylem dated 12/22/15	22,890
6	Stallings	3	Quote from Xylem dated 12/22/15	22,890
7	Lincoln	3	Quote from Xylem dated 12/22/15	22,890
8	Killian (4 total)	1	Quote from Xylem dated 12/22/15	7,630
9	Ward	2	Quote from Xylem dated 12/22/15	15,260
	Total			137,340
	Divided by total number of pumps			18
	Maintenance costs per pumps			7,630
	Times three pumps per year			3
	Total Allowance for Booster Station Pumps			$22,890

(1) Per Water Superintendent - 3 pumps per year.

xylem
Let's Solve Water

9745 Hedden Road
Evansville, IN 47725
Tel: 812/602-6800
Fax: 812/402-6128

Guy Hammond
Evansville Water & Sewer.

Guy,

We are pleased to offer the following budget quotation for expected maintenance of an average of three 125 HP Horizontal Split Case Booster Pumps.

For the sum of **$7630.00** per pump we will:

- Remove the top of the pump Casing.
- Remove and transport the Rotating Assembly to our facility here in Evansville for inspection.
- Replace the Bearings.
- Replace the Shaft Sleeves and Nuts.
- Perform Clean & Test on the Electric Motor.
- Dip and Bake the Stator
- Install new Bearings.
- Transport and reinstall Rotating Assembly and top of Casing.
- Install new Shaft Packing and Lantern Rings on Pump.

If you have any questions, please give me a call.

Best Regards,
Glenn Fischer

EVANSVILLE (INDIANA) MUNCIPAL WATER UTILITY

SCHEDULE OF PRO FORMA BOOSTER STATION MAINTENANCE EXPENSES

Prepared by: MDE/AJR
Date prepared: 1/8/18
Source documents: Water Superintendent - file: "IURC Rate Case PM and CIP Update 2019-2021 PK 1-8-18"
Includes contract quotes
Purpose: To project annual period maintenance for Booster Station pumps

BS Number	Location	No. of Pumps	Source	Pro Forma Annual Maintenance Cost (1)
1	1st Ave.	2	Average of actual costs for 2017 (1 ea. Lincoln, Stallings & Campground) (P.O. No's 20171973 (Eemsco), 20174011 (Xylem) & 20177249 (Straeffer))	$41,274
2	Weinbach (2 total)	1	Water Superintendent Estimate	20,637
3	Weinbach (2 total)	1	Water Superintendent Estimate	20,637
4	Campground	2	Water Superintendent Estimate	41,274
5	Killian (4 total)	3	Water Superintendent Estimate	61,911
6	Stallings	3	Water Superintendent Estimate	61,911
7	Lincoln	3	Water Superintendent Estimate	61,911
8	Killian (4 total)	1	Water Superintendent Estimate	20,637
9	Ward	2	Water Superintendent Estimate	41,274
	Total			371,466
	Divided by total number of pumps			18
	Maintenance costs per pumps			20,637
	Times three pumps per year			3
	Total Allowance for Booster Station Pumps			$61,911

(1) Per Water Superintendent - 3 pumps per year.

03/07/2017 08:35 | CITY OF EVANSVILLE - LIVE | P 1
larflack | | poinqury

PURCHASE ORDER

20171973-00 FY 2017

BILL TO

WATER ADMINISTRATION
1 MLK JR BLVD ROOM 104

EVANSVILLE , IN 47708

VENDOR

EEMSCO, INC

600 W EICHEL AVE

EVANSVILLE, IN 47710
USA

Tel# 812-426-2224

SHIP TO

WATER FILTER PLANT
1301 WATERWORKS RD

EVANSVILLE, IN
47713

Requisition
20172130

DATE ORDERED	VENDOR NUMBER	DATE REQUIRED	FREIGHT METHOD/TERMS	DEPARTMENT/LOCATION
03/06/17	002518			WATER FILTER PLANT

LN	DESCRIPTION	QTY	UOM	UNIT PRICE	NET PRICE
001	INSTALL NEW PUMP AND REBUILT MOTOR- CAMPGROUND BOOSTER STATION	1.00	EACH	19000.000	19,000.00

PO TOTAL 19,000.00

$17,867.00

** END OF REPORT - Generated by LARRY ARFLACK **

Invoice # 0012909

Invoice Date: 4-24-17

Larry Arflack

"CLOSE"

EEMSCO, INC.
600 W. EICHEL AVE., PO BOX 4717
EVANSVILLE, IN 47724
Phone: (812)-426-2224 / Fax: (812) 421-4158

DUPLICATE Invoice

Invoice No.:	0012909
Invoice Date:	04/24/17
Page:	1

Sold To:		Ship To:	
	Customer Number: EWAT2 **EVANSVILLE WATER - WATERWORKS** 1301 WATERWORKS ROAD ***EMAIL INVOICE*** EVANSVILLE, IN 47713		Ship To Number: **EVANSVILLE WATER DEPARTMENT** 1301 WATERWORKS ROAD ***EMAIL INVOICE*** EVANSVILLE, IN 47713

Order	Order Date	Sales Code	Ship Date	Ship Via	Terms
J005491	01/24/17	250	04/24/17		NET 30 DAYS

Customer PO	PO Release	Misc Number
20171973		

Order	Ship	B/O	Item #	Description	Unit Price	Extension
				Nameplate Data: DESCR:200HP MOTOR, ,:SPILT CASE PUMP, ,:AURORA Special Instructions: CAMPGROUND RD On-Site Service		
				LABOR		2,102.00
				MATERIALS		15,765.00
				THANK YOU FOR YOUR BUSINESS !!!		

Sub Total	17,867.00
Discount	.00
Tax	.00
Freight	.00
Total	17,867.00

Customer

Snowbound Eval

Xylem Water Solutions U.S.A., Inc.

9745 HEDDEN ROAD
EVANSVILLE, IN 47725
Tel.(812)602-6800 Fax:(812)402-6128

REMIT TO
26717 Network Place
Chicago, IL 60673-1267

INVOICE			YOUR PURCHASE ORDER 2017401100
INVOICE NO 3556968270	FUS NO. B31048	DATE SHIPPED 7/28/17	DELIVERY NOTE B27965
INVOICE DATE 7/28/17	TRN A3 / WHS 088	PAYMENT TERMS 100% N60 FROM INVOICE	

Sold To: Customer No. 208169 / Global No. 8078657

EVANSVILLE WATER & SEWER UTIL
PO BOX 19
1 NW MARTIN LUTHER KING JR BLV
ROOM 104
EVANSVILLE IN 47740

Ship To:

EVANSVILLE WATER & SEWER UTIL
WATER FILTER PLANT
1301 WATERWORKS RD
EVANSVILLE IN 47713

FREIGHT TERMS	DELIVERY TERMS	ORDER PROCESSED BY
Jobsite	PP/Add Order Positio	FLYGT-EVANSVILLE,IN BRANC
SHIP VIA: Shipper choice-Ground	ORDER TEXT: GOULDS G&L PUMPS	CUSTOMER TEXT: JUDY FISCHER

LINE	ITEM/DESCRIPTION	QUANTITY SHIPPED UM	UNIT PRICE DISCOUNT/CHARGE	NET PRICE	EXTENDED AMOUNT
001	14080130007000 150,6X8X12XL GOULDS HOR.SPLIT CASE PUMP 13.4:IMP,404-405T	1 EA	11,322.48	11,322.480	11,322.48
002	14080130007810 MOTOR,125HP,1800RPM,230/460 405T FRAME ODP WEG	1 EA	4,307.69	4,307.690	4,307.69
003	1400000659830N SHIPPING AND HANDLING-NO TAX	1 EA	722.00	722.000	722.00
	SUB-TOTAL OF POSITIONS *S & H CHARGED AS LINE ITEM*				16,352.17
	NET AMOUNT BEFORE TAXES USD				16,352.17
	DISPATCH INFO: 816290703			ORDER TOTAL USD	16,352.17

IMPORTANT - This invoice is governed by and subject to TERMS AND CONDITIONS OF SALE - XYLEM AMERICAS. [illegible]

Snowbound Eval

Bell & Gossett
8200 N. Austin Ave
Morton Grove, IL 60053

Packing List

xylem

Our Order Number:	Shipment:
SA0843274	001

Sold To:
XYLEM WATER SYSTEMS USA
2881 EAST BAYARD STREET
SUITE B
SENECA FALLS, NY 13148

Ship To:
EVANSVILLE WATER & SEWER UTILITY
% WATER FILTER PLANT
1301 WATERWORKS ROAD
EVANSVILLE, IN 47713

PO# 20174011

Date Shipped	Your Order Number	Carrier Name	Freight Terms
7/27/2017	13033780	XPOLOGISTICS	Third Party

Pallet	Line	Part Number	Description	Quantity Shipped	Total Weight
		Tag: FO# 4426719 / PO# 839206			
P1306291 — Pump					
	1	QFG979	HORIZONTAL SPLIT CASE PUMP	1	1865

A-C Pump 8100 & G&L Pump,Model 150.
8X8X12XL,Frame: 406,Horizontal, T
frame,Cast iron/bronze fitted pump,
COUNTER-CLOCKWISE ROTATION,2100 GPM, RAT
flow,155 Feet, Rated head,1770 RPM,
Rated speed,13.4 Inches, Impeller
dia.,85 Degrees F. Temp.,Cast Iron,
125# FF flanges, 175# WP,Bronze
Impeller,No impeller rings,Bronze
casing ring,Mechanical seal on shaft,
Crane 21 BF(60)1C(10)1
Buna/Carbon-Ceramic,416 SS shaft
(high strength),Internal stuff box,
Woods Sureflex coupling (STANDARD),Go
blu paint std process,Xylem to supply
and mount motor,,No Special
Requirements,
125 HP,1800 RPM, 60 HZ,3 PH, 230/460 V,
ODP enclosure,NEMA Premium efficiency,
Mfr.: Weg.,1.15 SF,Std. Insulation,
Across the Line,Frame: 405,Horizontal,
T frame,
MTR,125,TT,60,3,1800,DPPE WEG ELEC
PREM,
**LABEL
TAG/AC8100SERIES-00260

Page 1 of 1

11/06/2017 15:20 |CITY OF EVANSVILLE - LIVE |P 1
larflack | |poinqury

PURCHASE ORDER

20177249-00 FY 2017

BILL TO

WATER ADMINISTRATION
1 MLK JR BLVD ROOM 104

EVANSVILLE , IN 47708

VENDOR

SCHAEFFER PUMP & SUPPLY INC

PO BOX 99

CHANDLER, IN 47610

SHIP TO

WATER FILTER PLANT
1301 WATERWORKS RD

EVANSVILLE, IN
47713

Requisition
20177614

DATE ORDERED	VENDOR NUMBER	DATE REQUIRED	FREIGHT METHOD/TERMS	DEPARTMENT/LOCATION
11/06/17	003408			WATER FILTER PLANT

LN	DESCRIPTION	QTY	UOM	UNIT PRICE	NET PRICE
001	INSTALLATION OF PUMPS & MOTORS AT (2) BOOSTER STATIONS, LINCOLN & STALLINGS	1.00	LOT	17075.000	17,075.00
				PO TOTAL	17,075.00

** END OF REPORT - Generated by LARRY ARFLACK **

Invoice # 22877

Invoice Date: 12-7-17

Larry Arflack

6309001-436010

WG 0630

Straeffer Pump & Supply, Inc

Remit Payment To:
PO Box 99
Chandler, IN 47610
PH: 812.476.3075 FX: 812.476.5164
ddietrich@straefferpump.com
www.straefferpump.com

a KM Company

INVOICE

Date	Invoice #
12/7/2017	22877

Bill To	Ship To (Same As Bill To unless noted)
Evansville Sewer Dept - Email 1500 Waterworks Rd EVANSVILLE IN 47713 I 82 EMAIL INVOICES US	Evansville Sewer Dept - Email 1500 Waterworks Rd EVANSVILLE IN 47713 I 82 EMAIL INVOICES USA

Pump S/N		Terms	Net 30	TAG	

KM Job #	Customer P.O. No.	Buyer	Job No	Main Job #	Job Name	Ter
R17H-7255	20177249	Kimme Bu...	R17H-7255		Evansville IN Water	2

Qty	Item Code	Description	Price Each	Amount
1	Field Labor	and material to install customer supplied pump at Hwy 41 Booster Station	8,170.00	8,170.00

	Total	$8,170.00

DUE TO THE RISING COST OF CHARGE CARD PROCESSING FEES, EFFECTIVE SEPTEMBER 1, 2015, WE WILL BE ADDING A 3% CHARGE CARD PROCESSING FEE TO ALL PAYMENTS MADE VIA CREDIT CARD.

TERMS: NET 30 DAYS. 1 1/2% PER MONTH SERVICE CHARGE WILL BE ADDED TO PAST DUE ACCOUNTS AS WELL AS ALL COSTS AND EXPENSES INCURRED IN COLLECTING ANY AMOUNTS DUE, INCLUDING ATTORNEY'S AND COLLECTION FEES. PLEASE PAY FROM THIS INVOICE. NO STATEMENT WILL BE ISSUED.

Account # [illegible]

Straeffer
Pump & Supply, Inc.

September 5, 2017

Larry Arflack
Evansville Water Dept.
1301 Waterworks Drive
Evansville, IN 47713

Re: Pump Installation

Larry,

Thank you for the opportunity to quote the following. If you have any questions please don't hesitate to let me know.

Station #1 (Lincoln and Green River)

One (1) Labor and materials to install and start-up customer supplied booster pump with existing piping. Customer responsible for isolating pump during installation.

Total cost - $8,905.00

Station #2 (Hwy. 41)

One (1) Labor and materials to install and start-up customer supplied booster pump with existing piping. Customer responsible for isolating pump during installation.

Total Cost - $8,170.00 [illegible]

Payment terms – Net 30 Days TOTAL $17,075.00

We are available to start immediately once order is received.

Thank you,

Dan Pritchard

Dan Pritchard

3055 State Route 62W | Chandler, IN 47610
Toll Free 800 837 7867 | Phone: 812 476 3075 Fax 812 476 5164
www.straefferpump.com

11/06/2017 15:20 | CITY OF EVANSVILLE - LIVE | P 1
larflack | | poinqury

PURCHASE ORDER

[illegible]-00 FY 2017

BILL TO

WATER ADMINISTRATION
1 MLK JR BLVD ROOM 104

EVANSVILLE , IN 47708

VENDOR

[illegible] PUMP & SUPPLY INC

PO BOX 90

CHANDLER, IN 47610

SHIP TO

WATER FILTER PLANT
1301 WATERWORKS RD

EVANSVILLE, IN
47712

Requisition
20177814

DATE ORDERED	VENDOR NUMBER	DATE REQUIRED	FREIGHT METHOD/TERMS	DEPARTMENT/LOCATION
11/06/17	003408			WATER FILTER PLANT

LN	DESCRIPTION	QTY	UOM	UNIT PRICE	NET PRICE
001	INSTALLATION OF PUMPS & MOTORS AT (2) BOOSTER STATIONS, LINCOLN & STALLINGS	1.00	LOT	17075.000	17,075.00
				PO TOTAL	17,075.00

** END OF REPORT - Generated by LARRY ARFLACK **

Invoice # 23141

Invoice Date: 1-12-18

6309001-436010

Larry Arflack

Straeffer Pump & Supply, Inc

Remit Payment To:
PO Box 99
Chandler, IN 47610
PH: 812.476.3075 FX: 812.476.5164
ddietrich@straefferpump.com
www.straefferpump.com

INVOICE

Date	Invoice #
1/12/2018	23141

Bill To	Ship To (Same As Bill To unless noted)
Evansville Sewer Dept - Email 1500 Waterworks Rd EVANSVILLE IN 47713 182 EMAIL INVOICES US	

Pump S/N		Terms	Net 30	TAG:	

KM Job #	Customer P.O. No.	Buyer	Job No	Main Job #	Job Name	Ter
R17H-7301	20177249	Stewart May	R17H-7301		Evansville Water	[illegible]

Qty	Item Code	Description	Price Each	Amount
1	Field Labor	Labor and Material to install customer supplied Booster Pump at Lincoln and Green River Booster Station	8,905.00	8,905.00
			Total	$8,905.00

DUE TO THE RISING COST OF CHARGE CARD PROCESSING FEES, EFFECTIVE SEPTEMBER 1, 2015, WE WILL BE ADDING A 3% CHARGE CARD PROCESSING FEE TO ALL PAYMENTS MADE VIA CREDIT CARD.

TERMS: NET 30 DAYS, 1 1/2% PER MONTH SERVICE CHARGE WILL BE ADDED TO PAST DUE ACCOUNTS AS WELL AS ALL COSTS AND EXPENSES INCURRED IN COLLECTING ANY AMOUNTS DUE, INCLUDING ATTORNEYS AND COLLECTION FEES. PLEASE PAY FROM THIS INVOICE. NO STATEMENT WILL BE ISSUED.

Account # 975