



Audit of Wastewater System Operations

Reclamation

The City of Denton's wastewater rate structure is generally designed to equitably allocate reclamation costs. However, the rate structure has not been fully implemented.

Water Utilities is in the process of completing long-term water reclamation infrastructure plans and has developed an effective short-term forecasting methodology. A preventative maintenance program for reclamation assets has been established; however, work order documentation could be improved.

Finally, Environmental Services has established effective processes to monitor compliance with pretreatment regulations and report on effluent discharge quality.

Audit Team

City Auditor

Madison Rorschach, CIA, CGAP

Audit Staff

Amber Jackson, MBA, CFE

Neeraj Sama, MBA, MS

Andy Fernandezdelara

Table of Contents

Audit at a Glance	3
Introduction	4
Management Responsibility	4
Audit Objectives, Scope, and Methodology	4
Findings & Analysis.....	6
Adjustments to Wastewater Billing Practices May Improve Cost Allocation Equity	7
Pretreatment Program Ensures Regulatory Compliance	11
Long-Term Infrastructure Planning In Progress; Short Term Effluent Forecasting Adequate.....	13
Plant Maintenance Completed Timely; Work Order Documentation Could be Improved.....	16
Effluent Quality Reporting Practices are Generally Effective	20
Appendix A: Management Response Summary	22
Appendix B: Peer City Benchmarking Study Results	25

Audit at a Glance

Why we did this Audit:

Annually, the City reclaims about four billion gallons of wastewater. Adequate safeguarding, planning, and maintenance of reclamation infrastructure is critical to prevent public health impacts. In addition, the City collects about \$26 million annually in revenue for the reclamation of water. This audit was included on the City's fiscal year 2021-22 Audit Plan as approved by the City Council.

What we Recommend:

Recommendation 1

Formalize process for ensuring commercial & industrial wastewater customer bill codes are accurate.

Recommendations 2 & 3

Evaluate usage of wastewater strength surcharges & bill code subclasses.

Recommendation 4

Refine & develop a reuse water system expansion & promotion plan.

Recommendation 5

Provide staff with guidance & training on the details needed for work order completion.

Recommendation 6

Consider consolidating Water Utilities asset & work order management software.

What we Found:

This audit generally evaluated the City's water reclamation activities including, rate structure, pretreatment program compliance, reclamation infrastructure planning & maintenance, & discharge quality reporting. Our findings are summarized below:

Rate Structure. Wastewater rates generally align with best practices and are designed to facilitate cost allocation equity through the use of facility, volume, and strength charges. However, the City has not historically billed customers based on wastewater strength. Further disaggregation of certain commercial customer classes could further improve cost allocation equity.

Pretreatment Program Compliance. The Pretreatment Program Division generally ensures compliance with federal pretreatment regulations. In addition, FOG Control Program monitoring is performed timely and performance metrics have been developed.

Reclamation Infrastructure Planning & Maintenance. Water Utilities is currently developing its first Wastewater Master Plan & is developing a Department-wide Asset Management Program. An adequate short-term flow forecasting methodology has been implemented. Increased reuse water system promotion could defer needed capacity expansions.

The Water Reclamation Division has also established a preventative maintenance program for reclamation plant maintenance. While this program appears to be generally effective, work order documentation quality could be improved.

Discharge Quality Reporting. In order to comply with State regulations, the City must submit monthly water discharge quality reports. The Environmental Services Department's process to test, verify, & report discharge quality minimizes the risk of intentional misstatement or error. Similarly, the Division has adequately licensed staff to meet State requirements.

Introduction

The Internal Audit Department is responsible for providing: (a) an independent appraisal¹ of City operations to ensure policies and procedures are in place and complied with, inclusive of purchasing and contracting; (b) information that is accurate and reliable; (c) assurance that assets are properly recorded and safeguarded; (d) assurance that risks are identified and minimized; and (e) assurance that resources are used economically and efficiently and that the City's objectives are being achieved.

The Internal Audit Department has completed a performance audit of the City's wastewater reclamation processes. We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Management Responsibility

City management is responsible for ensuring that resources are managed properly and used in compliance with laws and regulations; programs are achieving their objectives; and services are being provided efficiently, effectively, and economically.

Audit Objectives, Scope, and Methodology

The Internal Audit Department has completed an audit of the City's water reclamation processes. This report is intended to provide assurance that the City's water reclamation processes are adequate, including evaluating if wastewater rates equitably reflect system impact, pretreatment device program monitoring requirements are complied with, reclamation infrastructure is effectively planned and maintained, and effluent discharge quality is reported in compliance with State regulations.

This report is the second phase in an audit project series covering wastewater system operations. Phase One Collections was published in April 2022.

Audit fieldwork was conducted during February, March, and April 2022. The scope of review varied depending on the procedure being performed. The following list summarizes major procedures performed during this time:

¹ The City of Denton Internal Auditor's Office is considered structurally independent as defined by generally accepted government auditing standard 3.56.

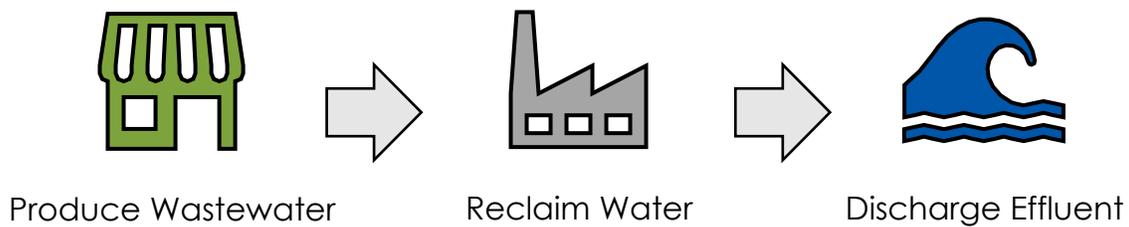
- Reviewed documentation to develop criteria including industry standards, best practices, policies, and procedures;
- Developed process narratives to identify current control activities in the wastewater treatment reporting, water reclamation infrastructure maintenance, and pretreatment device program processes that were certified by Water Utilities and Environmental Services Department staff;
- Interviewed Water Utilities and Environmental Services Department staff and reviewed policies and procedures pertaining to wastewater treatment quality reporting, wastewater reclamation infrastructure planning and maintenance, and the wastewater pretreatment program;
- Compared wastewater rate structure to industry best practices and benchmarked rates to a set of 11 peer cities;
- Reviewed wholesale wastewater contracts and most recent wastewater cost of service documentation;
- Analyzed wastewater rate bill codes and historical usage;
- Examined pretreatment program sampling, inspection, and reporting compliance for categorical and significant industrial users, non-permitted industrial users, and other commercial wastewater users;
- Reviewed short-term effluent forecasting methodology to determine its adequacy;
- Reviewed a judgement sample of 30 preventative maintenance work orders and a statistical sample² of 85 unscheduled maintenance work orders to verify the timeliness and effectiveness of wastewater reclamation infrastructure maintenance and repairs; and
- Reviewed a judgement sample of three Discharge Monitoring Reports and relevant supporting documentation to verify report accuracy, quality control review compliance, and discharge permit limits compliance.

² This sample size provides with 95 percent confidence that the true population mean is within ± 10 percent of the sample estimate.

Findings & Analysis

The City of Denton currently owns and operates a municipal wastewater utility, which collects and treats wastewater in order to discharge the treated effluent safely back into the environment. In order to discharge this effluent, the City must obtain a permit from the Texas Commission on Environmental Quality, which sets limits on the amount and quality of effluent that can be discharged into the State of Texas's rivers, lakes, and other bodies of water. Currently, the City has two wastewater treatment plants which are permitted to discharge 21 million gallons of effluent per day into Pecan Creek and an average 375,000 gallons per day into Hickory Creek.

Figure 1: Water Reclamation Process



Wastewater is collected from the City's customers by gravity flow collection lines which are aided by wastewater lift stations in order to move the wastewater to the City's two treatment plants. Some of the City's commercial and industrial wastewater customers are also required to install and maintain pretreatment devices, that remove materials such as metals, chemicals, and fats from their wastewater before it is discharged into the City's collection lines.

At the reclamation plant, the wastewater is filtered through screens and sand before going through the clarification process, which allows solids to settle and be pumped to a digester. Biosolids are then activated to break down organic matter before the effluent goes through a final clarification process. Finally, an ultraviolet treatment is applied to the effluent before it is discharged to deactivate the biosolids. In addition, solids sent through the digester are used to create the City's DynoDirt product.³

This audit generally evaluated the City's wastewater reclamation processes including, treatment cost allocation equity, pretreatment program compliance, reclamation infrastructure maintenance and planning, and discharge quality reporting.

³ DynoDirt production and sales were not reviewed as part of this audit project.

Adjustments to Wastewater Billing Practices May Improve Cost Allocation Equity

According to industry best practices, wastewater rates should generally be structured to allocate treatment costs based on the “strength” and volume of wastewater discharged. Wastewater strength is generally indicated by the following two measures:

- Biochemical Oxygen Demand (BOD)
- Total Suspended Solids (TSS)

Per the City’s rate structure, wastewater bills are generally made up of four types of charges: 1) a fixed facility charge based on the customer type, 2) a variable usage charge based on the amount of water consumed, 3) a variable strength surcharge, and 4) a fixed pretreatment program surcharge based on the customer’s pretreatment program status.⁴ The City has generally established four types of customers as shown in Table 1.

Table 1: Summary of Average Annual Billed Wastewater

Customer Type	Customers	Avg. Annual Billed Usage (Million Gallons)	Annual Billed (Million Dollars)
Residential	41,000	1,785.89	\$10.69
Commercial	3,800	1,671.99	\$9.52
Industrial	400	355.32	\$2.22
Wholesale	4	215.53	\$0.75
All:	45,204	4,028.73	\$23.18

What We Found

- Residential wastewater rate structure aligns with best practices.
 - Denton’s method of billing residential customers based on 100 percent of their average winter month usage is similar to seven of the 11 peer cities reviewed. Appendix B includes further wastewater rate benchmarking details.
 - Residential customers that have not established a winter month average are billed based on an assumed average winter month usage of 5,400 gallons, which is slightly higher than the actual average winter month usage of all residential customers of 4,988 gallons – amounting to an estimated \$1.57 difference in bill. According to Finance Department staff, this usage was established as part of the most recent wastewater cost of service study.

⁴ The rate structure includes facility and usage charges for all customer types; however, residential customers do not have a separate strength or pretreatment program surcharge rate.

- Commercial wastewater rates are generally designed to promote cost allocation equity; however, some surcharges are not being billed.
 - The City’s commercial, industrial, and wholesale wastewater rate structure includes BOD and TSS surcharges, which appear to be intended to account for differing wastewater strengths – likely improving cost allocation equity.
 - However, the City has historically not billed commercial, industrial, or wholesale customers these surcharges.⁵ This is at least partly because the City has not historically tested some commercial and wholesale customers for BOD and TSS due to prioritizing significant industrial customers.
 - Based on review of 11 peer cities’ rate structures, nine include wastewater strength surcharges for BOD and TSS for industrial customers, especially if the municipality conducts sampling as part of its current pretreatment program.
 - According to Water Utilities and Environmental Services staff, Environmental Services recently began testing wholesale wastewater customers to establish their BOD and TSS levels and have begun working to charge these customers.

- In addition, the City has established a single wastewater rate for equipment services and eating establishments since these customers generally discharge higher strength wastewater than other commercial customers.
 - Based on review of wastewater usage by industrial category for these accounts, there is evidence that users within this category may have different usage patterns – indicating that a single rate category may hinder equitable cost allocation as illustrated in Table 2.

Table 2: Comparison of SEE Accounts by Major Industry

Major Industry	% of Accts.	% of Billed Amt.	% of Used Amt.
Food Services	58%	61%	62%
Automotive Services	18%	15%	15%
Construction	4%	9%	9%
Other	20%	15%	14%
Total	382	\$1,372,701	187,665,138

- Some commercial and industrial wastewater customers have been billed inaccurately.

⁵ The rate ordinance specifies that customers whose BOD and TSS strength exceed 250 milligrams per liter should receive a surcharge.

- The wastewater rate structure also includes facility fee surcharges for industrial customers who are monitored as part of the City's industrial pretreatment program.
- Three significant industrial users were not billed for this surcharge as they should have been. In addition, 12 commercial customers were inappropriately billed for this surcharge.
- Based on review of the City's four wholesale wastewater agreements, all wholesale customers are charged similarly.
 - One wholesale wastewater customer's agreement with the City has expired and a second is set to expire during 2022.

Why It Matters

In general, utility rate structures are designed to recoup money for their services based on a customer's impact on the utility system in an effort to charge customers equitably. The City's wastewater rates are designed to allocate system costs to customers based on their system impact through its four different charges and surcharges. That being said, the City has not historically charged its commercial, industrial, or wholesale wastewater customers for BOD or TSS surcharges potentially impacting cost allocation equity.

It should be noted that the facility and pretreatment program charges may account for some of the differences between the impact that different customer types have on the wastewater system. However, the strength surcharge is specifically designed to account for higher than normal impacts. That being said, it is not possible with current resources for the City to test all commercial, industrial, and wholesale wastewater customers for BOD and TSS every month. For that reason, the applicability of these surcharges for each customer class should be evaluated.

Recommendations:

1. Formalize a process for ensuring commercial and industrial wastewater customer bill codes are accurate. Potential procedures should include ensuring the bill code is accurate promptly once a customer's impact on the wastewater system is identified or changes.

Environmental Services Comments: *A memorandum outlining the responsible parties and their duties for determining billing codes for industrial wastewater customers was recently shared with Customer Service. The memorandum is an initial step and outlines how billing codes are to be assigned based on wastewater surveys, and how sewer billing codes are subsequently updated due to industrial process changes. Environmental*

Services will participate in creating an internal process agreed upon by all affected parties.

Customer Service Division Comments: Customer Service is coordinating with Environmental Services to develop a formalized process to ensure billing is notified of each commercial service customer whose wastewater strength moves them from the standard commercial bill class to a different wastewater bill class. Updates will be applied to accounts as early as possible to promote billing equity.

2. Evaluate the applicability of BOD and TSS surcharges for commercial, industrial, and wholesale wastewater customers. If certain customers' BOD and TSS levels are unlikely to exceed normal impact levels, the rate ordinance should be adjusted accordingly. Similarly, if the BOD and TSS surcharges are intended to be used as an enforcement mechanism, written criteria should be established to ensure surcharges are enforced equitably.

Water Utilities Comments: TKN (Total Kjeldahl Nitrogen) and TPH (Total Petroleum Hydrocarbons) surcharges should be developed for these users also.

Environmental Services Comments: Environmental Services is currently evaluating Customer Cities and other industries that may discharge BOD / TSS waste for comparison to surcharge limits. Environmental Services will collect the data and work with Water Utilities in determining the application of a surcharge.

Customer Service Division Comments: Customer Service will coordinate with Environmental Services and Finance to ensure accurate billing based on the adopted rate ordinance and the established BOD/TSS criteria.

Finance Department Comments: The Finance Department will update the rate ordinance based on recommendations received from Water, Environmental Services, and Customer Services.

3. Consider establishing subclasses within the SEE bill code in order to more equitably allocate wastewater treatment costs.

Water Utilities Comments: None.

Environmental Services Comments: Texas Water Code 13.182 specifies that rates should be consistent in application to each class of consumer. Environmental Services will be active in the process with Water Utilities reviewing the SEE bill code and any need for subclasses.

Finance Department Comments: The Finance Department will evaluate the possibility of establishing subclasses when updating the next Cost of Service

and Rate Study for the Wastewater Utility. Finance plans to start the process of updating the Study in 2024 for inclusion in the FY 2024-2025 budget.

Pretreatment Program Ensures Regulatory Compliance

According to the U.S. Environmental Protection Agency's – or EPA's – General Pretreatment Regulations, some commercial and industrial facilities are required to install and utilize wastewater pretreatment devices or processes due to the way water is used in their facility. As a publicly owned treatment works with a pretreatment program, the City is responsible for identifying all possible industrial facilities to determine if they must have a federally mandated pretreatment device or process.

Furthermore, the City is required to establish local limits – or limits on the amount of a pollutant that can be discharged to the wastewater system – and an enforcement response plan that details procedures indicating how instances of industrial user noncompliance will be investigated and responded to.

In addition, the City has established a fats, oils, and grease – or FOG – Control Program that is intended prevent pollutants from entering the wastewater system from commercial sources in an effort to safeguard the wastewater system assets. In general, the FOG Control Program requires:

- Food processing or service facilities to install and operate grease traps;
- Automobile washing, cleaning, or servicing facilities to install or operate grit traps or oil separators; and
- Grease traps to be evacuated every 90 days and grit traps or oil separators to be evacuated every 180 days.

The City's Pretreatment Program Division of the Environmental Services Department is generally responsible for monitoring wastewater system user's compliance with these regulations.

What We Found

- The City appears to be using all methods recommended by the EPA to assess wastewater user impacts and identify industrial wastewater system users, including: wastewater survey completed as part of the new commercial building permitting process, triennial survey of City businesses to verify their wastewater usage, and industrial user permit applications.
- The City has established local limits as required by federal law. These local limits include parameters for 12 of the 15 pollutants of concern

recommended by the EPA in its *Local Limits Development Guidance*. These parameters are outlined in Table 3.

- While local limits for three pollutants have not been adopted, the Pretreatment Program Division has appropriately developed and implemented technically based local limits and determined that limits on these pollutants are not necessary.

Table 3: Summary of Adopted Local Limits (mg/L)

POC	Adopted	POC	Adopted	POC	Adopted
Arsenic	0.12	Lead	0.51	Molybdenum	1.18
Cadmium	0.08	Mercury	0.0006	Selenium	0.09
Chromium	2.19	Nickel	1.10	5-day BOD	Not Needed
Copper	0.84	Silver	0.13	TSS	Not Needed
Cyanide	0.36	Zinc	0.96	Ammonia	Not Needed

- Pretreatment Program Division staff generally perform monitoring activities of industrial users in a timely manner.
 - In general, all of the City's active categorical and significant industrial users had active permits for 2020 and 2021 and received annual inspections for 2020 and 2021. Thirteen of the City's 14 categorical and significant industrial users were appropriately sampled either annually or semiannually.
 - Based on a statistical sample of 32 non-permitted industrial users,⁶ 29 appeared to have had at least one site visit. Of these 29, two had not had a site visit completed in over three and a half years.
- Pretreatment Program Division staff have established a goal to inspect about one third of food service establishments annually on a rotating basis and for about 90 percent of grease interceptors to pass inspection. During inspections, Division staff complete a checklist and take samples from the relevant interceptor to test compliance with the City's FOG Control Program.
 - Based on review of a statistical sample of 40 active FOG Program interceptors,⁷ about 80 percent of the interceptors passed their most recent triennial inspection. Based on review of FOG Program policies and procedures, it is unclear if this average pass rate indicates that the Program is effective.

⁶ This sample provides with 95% confidence that the true statistical value is within ±15% of the sample statistical value.

⁷ This sample provides with 95% confidence that the true statistical value is within ±15% of the sample statistical value.

- In addition, about 85 percent of interceptors have historically been inspected in a timely manner (i.e. within 42 months of their previous inspection).
- Furthermore, about 73 percent of interceptors had submitted their device evacuation reports in a timely manner. While some reports were submitted late, there was only one instance where an evacuation report had not been submitted at all.
- The Pretreatment Program Division has established a Pretreatment Enforcement Response Plan that provides guidance to the Division in the event of identified noncompliance as required by Federal law.

Why It Matters

Per industry standards, pretreatment programs are an effective method of safeguarding wastewater systems as they help to minimize the strength of wastewater discharged into the system. Based on review, the City generally appears to be meeting all federal requirements for its pretreatment program including development and implementation of industrial user identification methods, local limits, and an enforcement response plan.

Furthermore, the Pretreatment Program Division generally appears to carry out pretreatment program and FOG control program facility monitoring activities in a timely manner. In addition, the Division has established performance metrics for number of inspections and percentage of inspections that pass.

Recommendation: None.

Long-Term Infrastructure Planning In Progress; Short Term Effluent Forecasting Adequate

The amount of treated effluent a wastewater system can discharge from a plant is regulated by the Texas Commission on Environmental Quality, which requires the following once flow rates exceed certain thresholds for a rolling 365-day average:

- At 75 percent of rated capacity, design on capacity improvements should be initiated; and
- At 90 percent of rated capacity, construction on capacity improvements should be initiated.

In order to effectively comply with these requirements, a wastewater system must be able to effectively monitor its effluent discharge flows. Similarly, to

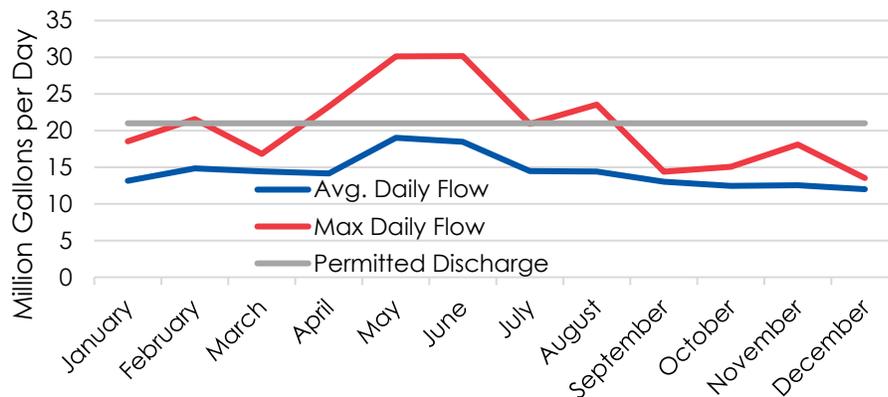
ensure wastewater does not impact public health and safety, a wastewater system must ensure it has adequate wastewater influent treatment capacity to meet its daily demand.

What We Found

- The City currently operates two water reclamation plants – Pecan Creek and Robson Ranch – that are permitted to discharge 21 million gallons and 0.375 million gallons of treated effluent on average per day respectively.
 - The City’s permitted discharge amount has not changed in over 20 years.
 - According to Water Reclamation Division staff, the City has been planning for several years to decommission the Robson Ranch Water Reclamation Plant and build a second water reclamation plant to help support expected additional capacity needs.

- The City appears to currently have adequate permitted effluent discharge volumes.
 - On average during 2021, effluent discharge volumes fell below the permitted volume; however, maximum daily flows and expected future growth indicate that permitted discharge increases will likely be needed in the future as shown in Figure 2.

Figure 2: Pecan Creek Daily Discharge Volumes



- The City has not previously developed a wastewater master plan to guide water reclamation capacity improvements; however, staff is in the process of developing the first Wastewater Master Plan.
 - The City has not completed any major capacity improvements for the Pecan Creek or Robson Ranch reclamation plants in the past five years.

- According to Water Reclamation Division staff, the City is currently in the process of having the Pecan Creek Water Reclamation Plant’s capacity being rerated by TCEQ once improvements to the final clarification process are complete.
- In addition, some improvements have been made to the Pecan Creek Water Reclamation Plant’s sludge handling infrastructure and the wastewater system lift stations and collections lines.
- Annually, Water Utilities forecasts water reclamation needs as part of the budgeting process in order to project revenues and inform the capital planning process. This forecasting methodology appears to be based on reasonable assumptions, that may be more conservative than necessary.
 - This process annually forecasts the City’s average daily wastewater influent using the formula shown in Equation 1, whereby GPCD means gallons per capita per day.

Equation 1: Daily Influent Forecast Equation

$$\frac{GPCD * Population}{Days in the Year * 1,000,000} = Projected Daily Influent$$

- Based on review of the Department’s forecast, GPCD estimates appear to be more conservative than historical GPCD influent data would suggest is necessary as shown in Table 4.

Table 4: Influent GDPC Forecast Evaluation (2005-2021)

Rain Year	Forecast GDPC	Avg. Historical GDPC
Normal Year (32-42 inches)	128	120
Wet Year (>42 inches)	141	128
Drought Year (<32 inches)	115	119
	All:	122

- In addition, population is generally estimated to grow about two percent, which appears to be consistent with the City’s growth rate for the last ten years. Furthermore, the forecast increased this population estimate to account for the Hunter and Cole Ranch Development in future years.
- On the other hand, the influent forecast does not generally consider population growth in the City’s wholesale wastewater customers as customer data is not regularly requested or received according to Water Utilities staff. That being said, growth in wholesale customers’

populations is unlikely to significantly impact the City's water reclamation treatment capacity based on historic population data.

- The City's Pecan Creek Reclamation Plant is also currently permitted to divert six million gallons of treated effluent a day to it's reuse water system instead of discharging it.
 - Currently the City has ten reuse water customers who on average use about 0.5 million gallons of reuse water each day.
 - Based on discussions with Water Utilities and Customer Service Division staff, there is currently no coordinated effort to promote the reuse water system to new or existing water customers. However, the Department is currently working with the Finance Department to develop a business plan to determine the financial and operational viability of expanding the reuse water system.

Why It Matters

Ensuring wastewater treatment capacity is adequate is critical to the City's public health and safety. The Wastewater Department appears to have developed an effective, if conservative, process to forecast wastewater treatment capacity needs. In addition, the City's water reclamation capacity currently meets forecasted needs and is in the process of having its main water reclamation plant rerated to increase permitted discharge amounts. Moreover, expansion of the City's reuse water system would help to delay permitted discharge increases as well as water production capacity expansions.

Recommendation:

4. Refine and develop a reuse water system expansion and promotion plan.

Water Utilities Comments: *Water Utilities has funded a reuse water master plan project that is scheduled to begin in FY23.*

Plant Maintenance Completed Timely; Work Order Documentation Could be Improved

Over time, the performance of water reclamation equipment eventually degrades. In order to ensure each water reclamation plant continues to be capable of treating wastewater, this equipment must be adequately maintained and repaired.

Timely and appropriate maintenance of water reclamation equipment also helps ensure this equipment meets its useful life and water reclamation is not

impacted. In general, there are three types of maintenance programs as defined below:

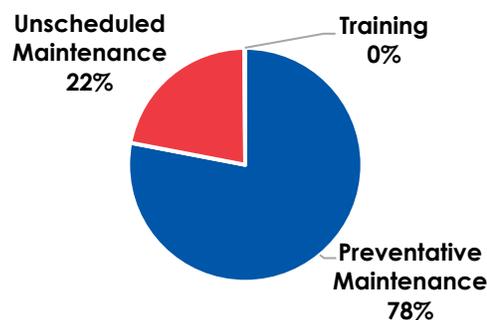
- Reactive Maintenance – no actions or efforts are taken to maintain equipment to ensure expected life is reached;
- Preventative Maintenance – actions performed on a time- or machine-run-based schedule that detect, preclude, or mitigate degradation with the aim to extend the useful life of equipment; and
- Predictive Maintenance – measurements that detect the onset of system degradation, thereby allowing casual stressors to be eliminated prior to deterioration.

Each of these program types has its own advantages and disadvantages, though it should be noted preventative and predictive maintenance programs still include reactive maintenance activities – these activities just make up a smaller percentage of work performed.⁸

What We Found

- Water Reclamation Division has generally established a preventative maintenance program for treatment plants and lift stations, where about 21 percent of maintenance activities are reactive – or unscheduled maintenance – as shown in Figure 3.
 - While additional cost savings could be observed in the long run from increasing predictive maintenance activities, this type of program requires large, short-term investment in technologies to monitor equipment condition. Due to the size of the City, this type of large, technological investment may not be necessary at this time.

Figure 3: Reclamation Plant Work Orders by Type



⁸ Typically, a maintenance program is considered reactive if more than 55 percent of maintenance activities are reactive.

- Water Reclamation utilizes an asset and work order management software to assign maintenance work to staff. This process appears to effectively ensure work orders are assigned to appropriate staff.
 - According to staff, Water Reclamation Division crew managers generally complete spot checks on completed work orders to ensure effectiveness. However, based on review of 30 preventative maintenance and 85 unscheduled maintenance work orders, there was no documented evidence that these spot checks were performed.
 - According to Water Reclamation Division staff, they have not developed Division-specific work order completion training or procedures; however, they reference and use the work order training and procedures developed by the Water Production Division.
- Preventative maintenance work orders are generally completed timely; however, work completed is not documented in detail despite developed checklists.
 - Based on review of a judgement sample of 30 preventative maintenance work orders – or PMs, 25 were completed before the next PM was scheduled to be due. PMs that were not completed until after the due date had shorter frequencies.
 - For most PMs reviewed, there was no documentation (i.e. completed checklist or comments) of what work was completed.
- Unscheduled maintenance work orders generally completed timely; work completed generally not documented.
 - Based on review of a statistical sample of 85 unscheduled maintenance work orders, 92 percent of work began on the day it was scheduled to begin and 80 percent of work was completed within three days.
 - For about 65 percent of reviewed work orders, there was no documented evidence (i.e. comments) of what work was completed.
- Water Reclamation does not use the same asset and work order management software as Wastewater Collections.
 - While this work order system appears to be effective, it is possible that efficiencies may be gained if Water Utilities vertical and horizontal assets were monitored through the same work order software.

- Water Utilities is in the process of developing a formal Asset Management Program to improve work order functionality, processes, and data to support financial and long-range capital planning across the entire Department.⁹
 - Water Utilities has created a formal Asset Management Team including hiring an Asset Management and Vertical Infrastructure Division Manager.
 - In addition, the Department is planning to contract to define the City's Vision for the Asset Management Program, conduct an asset management security assessment, and perform a Water System Management Plan.

Why It Matters

An effective work order system is critical to ensure that maintenance work for water reclamation plants is completed effectively and timely. Water Reclamation staff appear to have established a preventative maintenance program, which generally appears to be effective at ensuring critical plant equipment is monitored for maintenance needs. Most preventative maintenance work orders appear to be completed in a timely manner. Similarly, unscheduled maintenance work generally appears to be completed in a timely manner.

That being said, most preventative maintenance and unscheduled maintenance work orders reviewed had limited documentation of the work performed and there was no evidence of quality control review. Developing guidance and training staff on the details that should be included in a complete work order would provide further assurance that maintenance work is completed and reviewed appropriately.

In addition, Water Utilities is in the process of developing a Department-wide Asset Management Program. Planned Asset Management Program development activities should help to minimize operations and maintenance costs, improve asset-related financial planning, and reduce operating and financial risk. In addition, consolidating work order systems within the Water Utilities Department may increase asset management and maintenance efficiency.

⁹ Development and adoption of a formal, comprehensive asset management plan was recommended as part of the [Audit of Water System Operations: Distribution](#) originally issued in July 2021.

Recommendations:

5. Provide staff with written guidance and periodic training on how to complete work orders to ensure all needed information is included. Ensure that management spot checks and follow-up on work orders are included in the comments.

Water Utilities Comments: *Water Reclamation will begin documenting spot checks immediately and will refine process as we migrate to future CMMS Software (see below). Since migration is about to start, Water Rec will implement a training component to the work order process as part of the project.*

6. Consider consolidating Water Utilities horizontal and vertical asset and work order management processes to use one software. If consolidation is chosen, consideration should be given to the costs and benefits of each system before migration.

Water Utilities Comments: *There is currently a desire to look for a city-wide enterprise asset management system (EAMS) or to consolidate multiple systems into a few which would include the feature of work management (work orders). Water Utilities' plants are currently using INFOR and have recognized the need to move assets to City Works which should support and consolidate Asset Management efforts. However, the city-wide EAMS project will impact the current effort being initiated to migrate to City Works.*

Effluent Quality Reporting Practices are Generally Effective

The City of Denton's wastewater system is required to comply with the requirements of its Texas Pollutant Discharge Elimination System permit, which is issued by the Texas Commission on Environmental Quality. Per this permit, the City must monitor and report on the quality of its effluent discharge each month to ensure that it is within its permitted limits.

What We Found

- The duties of wastewater treatment, reclaimed water quality testing, and test results reporting are adequately segregated to prevent intentional misstatement and to minimize data entry errors.
 - Based on comparison of a sample of three Water Discharge Monitoring Reports and the supporting testing documentation, only one discrepancy of a potential 705 were noted.

- Based on recalculation of report statistics generated by the City's WIMS, there were generally only minor discrepancies that were attributable to rounding.
- Water reclamation processes generally appear to ensure compliance with permitted limits.
 - All of the City of Denton's Wastewater treatment plant operators are licensed as required by Texas State regulations and City requirements.
 - Based on review of a sample of three Water Quality Discharge Monitoring Reports, there were only two instances of the reported values exceeding the City's permitted limits of 514 possible instances.
- In addition, the Environmental Services Department has established effective quality control processes to review effluent sample test results to ensure they are accurate.
 - Based on review of supporting documentation for three Discharge Monitoring Reports, all contained adequate evidence of quality control review with the exception of two days for the total suspended solids variable.

Why It Matters

The treatment of wastewater in order to be discharged into bodies of surface water in the United States is highly regulated by the Federal and state governments. Non-compliance with licensing and reporting requirements could lead to significant penalties and public health impacts. Based on this review, the Water Reclamation Division and Environmental Services Department appears to have established effective processes to report on reclaimed water quality and ensure plant operators are appropriately licensed.

Recommendation: None

Appendix A: Management Response Summary

The following summarizes the recommendations issued throughout this report. The auditors found that staff and the Department were receptive and willing to make improvements to controls where needed. Management has provided their response to each recommendation.

1	<p><i>Formalize a process for ensuring commercial and industrial wastewater customer bill codes are accurate.</i></p> <p>Water Utilities Comments: None.</p> <p>Environmental Services Comments: A memorandum outlining the responsible parties and their duties for determining billing codes for industrial wastewater customers was recently shared with Customer Service. The memorandum is an initial step and outlines how billing codes are to be assigned based on wastewater surveys, and how sewer billing codes are subsequently updated due to industrial process changes. Environmental Services will participate in creating an internal process agreed upon by all affected parties.</p> <p>Customer Service Division Comments: Customer Service is coordinating with Environmental Services to develop a formalized process to ensure billing is notified of each commercial service customer whose wastewater strength moves them from the standard commercial bill class to a different wastewater bill class. Updates will be applied to accounts as early as possible to promote billing equity.</p>	Concur	<p>Expected Completion: FY23</p> <p>Responsibility: Environmental Services & Customer Service</p>
2	<p><i>Evaluate the applicability of BOD and TSS surcharges for commercial, industrial, and wholesale wastewater customers.</i></p> <p>Water Utilities Comments: TKN (Total Kjeldahl Nitrogen) and TPH (Total Petroleum Hydrocarbons) surcharges should be developed for these users also.</p> <p>Environmental Services Comments: Environmental Services is currently evaluating Customer Cities and other industries that may discharge BOD / TSS waste for comparison to surcharge limits. Environmental Services will collect the data and work with Water Utilities in determining the application of a surcharge.</p> <p>Customer Service Division Comments: Customer Service will coordinate with Environmental Services and Finance to ensure accurate billing based on the adopted rate ordinance and the established BOD/TSS criteria.</p>	Concur	<p>Expected Completion: FY23</p> <p>Responsibility: Water Utilities, Environmental Services, and Finance</p>

Finance Department Comments: The Finance Department will update the rate ordinance based on recommendations received from Water, Environmental Services, and Customer Services.

3	<i>Consider establishing subclasses within the SEE bill code in order to more equitably allocate wastewater treatment costs.</i>	Concur	Expected Completion: FY25
---	--	---------------	-------------------------------------

Water Utilities Comments: None.

Environmental Services Comments: Texas Water Code 13.182 specifies that rates should be consistent in application to each class of consumer. Environmental Services will be active in the process with Water Utilities reviewing the SEE bill code and any need for subclasses.

Finance Department Comments: The Finance Department will evaluate the possibility of establishing subclasses when updating the next Cost of Service and Rate Study for the Wastewater Utility. Finance plans to start the process of updating the Study in 2024 for inclusion in the FY 2024-2025 budget.

Responsibility:
Finance, Water Utilities, and Environmental Services

4	<i>Refine and develop a reuse water system expansion and promotion plan.</i>	Concur	Expected Completion: FY24
---	--	---------------	-------------------------------------

Water Utilities Comments: Water Utilities has funded a reuse water master plan project that is scheduled to begin in FY23.

Responsibility:
Dir. Of Water Utilities & Water Rec Superintendent

5	<i>Provide staff with written guidance and periodic training on how to complete work orders to ensure all needed information is included. Ensure that management spot checks and follow-up on work orders are included in the comments.</i>	Concur	Expected Completion: FY22
---	---	---------------	-------------------------------------

Water Utilities Comments: Water Reclamation will begin documenting spot checks immediately and will refine processes as we migrate to future CMMS Software (see below). Since migration is about to start, Water Rec will implement a training component to the work order process as part of the project.

Responsibility:
Reclamation Plant Managers

6	<i>Consider consolidating Water Utilities horizontal and vertical asset and work order management processes to use one software.</i>	Concur	Expected Completion: FY24
---	--	---------------	-------------------------------------

Water Utilities Comments: There is currently a desire to look for a city-wide enterprise asset management system (EAMS) or to

Responsibility:

consolidate multiple systems into a few which would include the feature of work management (work orders). Water Utilities' plants are currently using INFOR and have recognized the need to move assets to CityWorks which would support and consolidate Asset Management efforts. However, the city-wide EAMS project will impact the current effort being initiated to migrate to CityWorks.

Asset
Management
Team

Appendix B: Peer City Benchmarking Study Results

Based on an evaluation of population, population growth, income per capita, and estimated college enrollment, the following were included as part of a wastewater utility rate benchmarking study. As part of the study, the residential and commercial rate structures of each city as well as is shown in Table 5.

Table 5: Peer City Wastewater Utility Rate Structure Summary

City	Population	Volume Charge Calculation	
		Residential	Commercial
Killeen	153,095	Water Volume - 3000 Gal.	100% Water Volume
McAllen	142,210	100% Water Volume	100% Water Volume
Denton	139,869	100% Winter Average	95% Water Volume
Waco	138,486	100% Winter Average	100% Water Volume
Carrollton	133,434	100% Winter Average	100% Water Volume
Midland	132,524	100% Winter Average	90% Water Volume – 3000 Gal.
College Station	120,511	100% Water Volume	100% Water Volume
Richardson	119,469	98% Winter Average	100% Water Volume
Round Rock	119,468	100% Winter Average	100% Water Volume
Odessa	114,428	100% Winter Average	100% Water Volume
Lewisville	111,822	100% Winter Average	100% Water Volume
Tyler	105,995	100% Water Volume	100% Water Volume

Finally, Table 6 summarizes the wastewater strength surcharges included in each peer cities' rate structure.

Table 6: Wastewater Strength Surcharge Rates

Peer City	Customer Type	Price per lb per Million Gallons			
		BOD	TSS	COD	TKN
Killeen	Commercial/Industrial with high strength WW	\$0.3825	\$0.2400	\$0.1913	NA
McAllen	Industrial	\$0.2880	\$0.6710	NA	NA
Denton	Non-Residential	\$0.4700	\$0.4200	NA	NA
Waco ¹⁰	Non-Residential	\$0.0700	\$0.0800	NA	\$0.2900
Carrollton	Users that Complete Sampling	CND	CND	CND	NA
Midland	None	NA	NA	NA	NA
College Station	None	NA	NA	NA	NA
Richardson	Industrial	CND	CND	CND	NA
Round Rock	Commercial/Industrial	\$0.4770	\$0.477	\$0.2270	NA
Odessa	Commercial/Industrial with ≥ 5000 GPD Usage	\$0.4307	\$0.4454	NA	NA
Lewisville	Industrial	\$0.4581	\$0.3872	NA	NA
Tyler	Industrial	\$0.3206	\$0.1797	\$0.1550	NA
Average:		\$0.3621	\$0.3625	\$0.1911	NA

¹⁰ Waco's rate structure has an inking block structure for wastewater strength surcharges.