PENNSYLVANIA AMERICAN WATER

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VIA eFiling

May 1, 2023

Rosemary Chiavetta, Secretary
Commonwealth of Pennsylvania
Pennsylvania Public Utility Commission
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120

Re: Annual Water Audit Summaries for year ended December 31, 2022
Docket No.: M-2023-3037451

Dear Secretary Chiavetta:

On behalf of Pennsylvania-American Water Company, I am filing the Company's annual water audit summaries for the year ended December 31, 2022.

As directed by the Commission's filing requirements, the Company is also providing a working electronic copy in Microsoft Excel format.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Teresa K. Harrold

Enclosures

cc: C. McKinley w/Annual Water Audit Summaries and Microsoft Excel Files

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Pittsburgh Districts (110;210;220)
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

		n	g			n	g				
VOS	Volume from Own Sources:	n	g	10	22,772.806 MG/Yr	n	g	9	0.64%	percent	under-registration VOSEA
WI	Water Imported:	n	g	9	3.340 MG/Yr	n	g	9	0.64%	percent	under-registration WIEA
WE	Water Exported:	n	g	9	511.043 MG/Yr	n	g			percent	WEEA

WATER SUPPLIED: 22,411.809 MG/Yr

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	12,924.042 MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	28.811 MG/Yr			
UUAC	Unbilled Unmetered:	n	g	8	829.189 MG/Yr	custom	829.189	MG/Yr

AUTHORIZED CONSUMPTION: 13,782.042 MG/Yr

WATER LOSSES

8,629.767 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	32.310 MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	264.344 MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	32.310 MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 328.964 MG/Yr

Real Losses

Real Losses: 8,300.803 MG/Yr

WATER LOSSES: 8,629.767 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 9,487.767 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	3,174.0 miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	209,307	(active *and* inactive)
	Service connection density:				66 conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No	
Lp	Average length of (private) customer service line:	n	g	10	17.2 ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	110.0 psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$479.29	$/Million gallons	$68,966,573 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

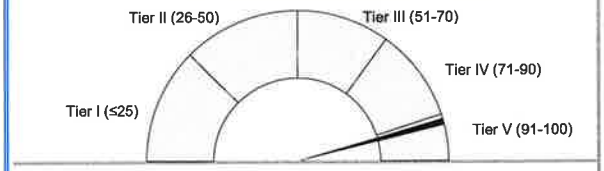
go to worksheet | go to grading | go to references

Water Audit Report for: PAW- Pittsburgh Districts (110;210;220) Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

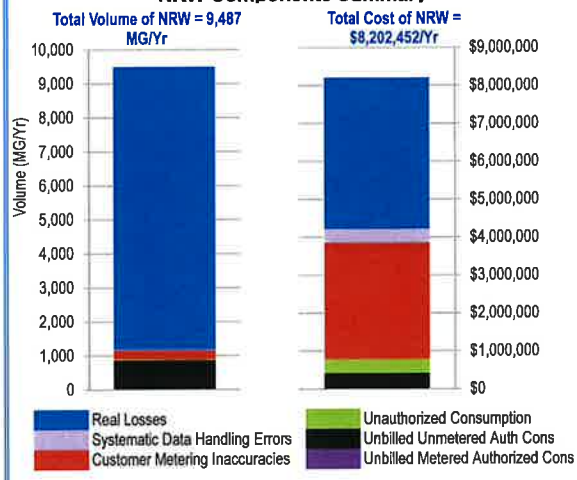
Data Validity

Data Validity Score: 91 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

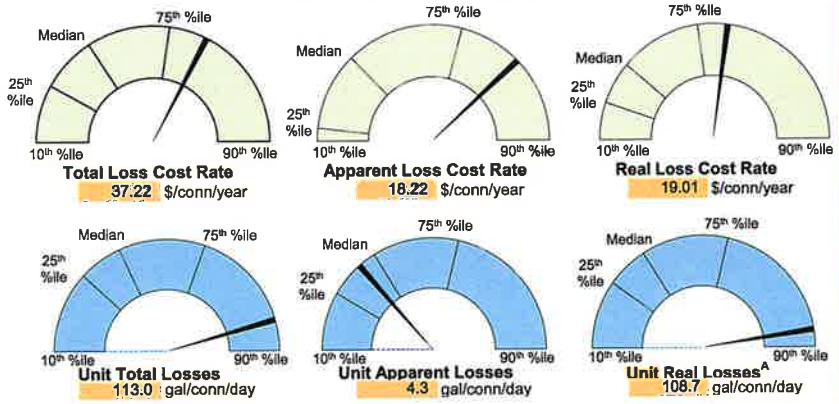


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	329.0	$3,812,729	CRUC
Real Losses	8,300.8	$3,978,492	VPC
Unbilled Authorized Cons	858.0	$411,231	VPC
Non-Revenue Water	9,487.8	$8,202,452	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 110 psi (AOP is above 90th %ile)

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 2,155.3 MG/Yr 28.2 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 140 Steelton
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	10	351.119	MG/Yr	n	g	10	0.51%	percent	under-registration VOSEA
WI	Water Imported:	n	g	9	0.473	MG/Yr	n	g	9	1.37%	percent	over-registration WIEA
WE	Water Exported:	n	g	9	0.138	MG/Yr	n	g	9	1.37%	percent	over-registration WEEA

WATER SUPPLIED: 353.249 MG/Yr

AUTHORIZED CONSUMPTION

		n	g				choose entry option:
BMAC	Billed Metered:	n	g	9	220.292	MG/Yr	
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr	
UMAC	Unbilled Metered:	n	g	10	42.346	MG/Yr	
UUAC	Unbilled Unmetered:	n	g	8	51.353	MG/Yr	custom 51.353 MG/Yr

AUTHORIZED CONSUMPTION: 313.991 MG/Yr

WATER LOSSES

39.258 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

		n	g				choose entry option:	
SDHE	Systematic Data Handling Errors:	n	g	3	0.551	MG/Yr	0.25% default	
CMI	Customer Metering Inaccuracies:	n	g	7	5.360	MG/Yr	2.00% percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.551	MG/Yr	0.25% default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 6.461 MG/Yr

Real Losses

Real Losses: 32.797 MG/Yr

WATER LOSSES: 39.258 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 132.957 MG/Yr

SYSTEM DATA

		n	g				
Lm	Length of mains:	n	g	10	29.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	2,434		(active *and* inactive)
	Service connection density:				84	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	16.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	83.6	psi	

COST DATA

		n	g				Total Annual Operating Cost
CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	$750,896 $/yr (optional input)
VPC	Variable Production Cost:	n	g	10	$934.99	$/Million gallons	

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

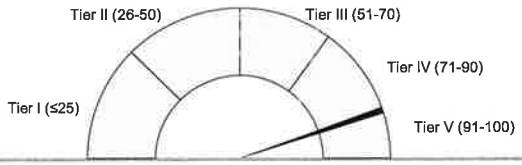
go to worksheet | go to grading | go to references

Water Audit Report for: PAW - 140 Steelton **Audit Year:** 2022 Calendar **Jan 01 2022 - Dec 31 2022**

Data Validity

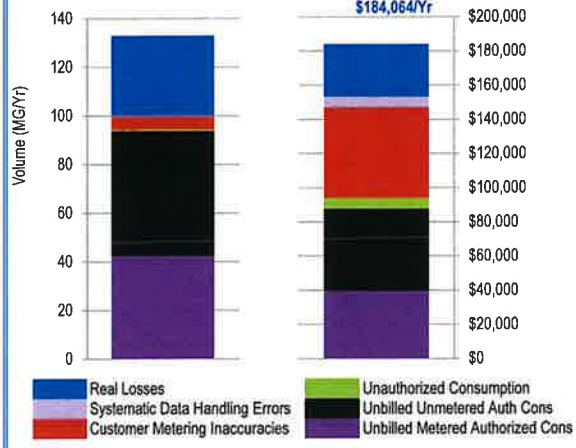
Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 132 MG/Yr **Total Cost of NRW = $184,064/Yr**

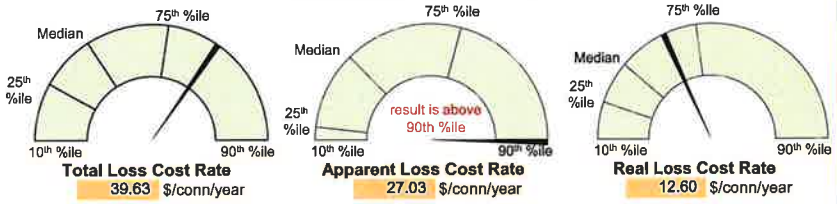


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	6.5	$65,792	CRUC
Real Losses	32.8	$30,665	VPC
Unbilled Authorized Cons	93.7	$87,608	VPC
Non-Revenue Water	133.0	$184,064	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

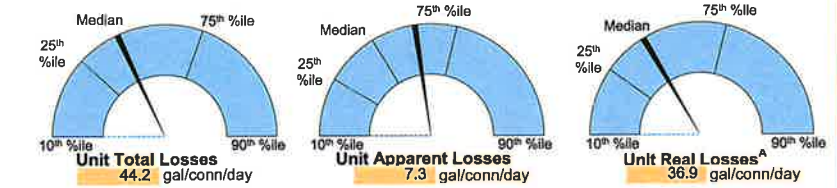
gauge %iles per validated industry ranges[2]



Total Loss Cost Rate 39.63 $/conn/year

Apparent Loss Cost Rate 27.03 $/conn/year

Real Loss Cost Rate 12.60 $/conn/year

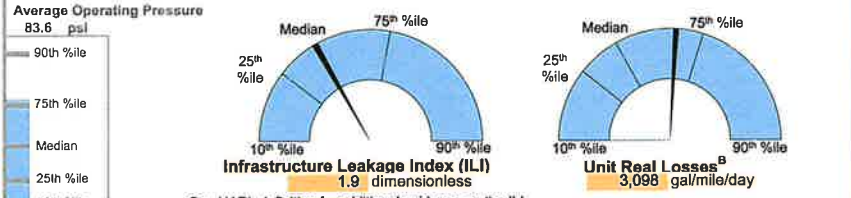


Unit Total Losses 44.2 gal/conn/day

Unit Apparent Losses 7.3 gal/conn/day

Unit Real Losses[A] 36.9 gal/conn/day

Average Operating Pressure 83.6 psi



Infrastructure Leakage Index (ILI) 1.9 dimensionless

Unit Real Losses[B] 3,098 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 17.7 MG/Yr 19.9 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Uniontown/Connellsville District 230
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	10	597.081	MG/Yr	n	g	9	2.00%	percent	under-registration VOSEA
WI	Water Imported:	n	g	9	798.648	MG/Yr	n	g	9		percent	WIEA
WE	Water Exported:	n	g	n/a		MG/Yr						WEEA

WATER SUPPLIED: 1,407.914 MG/Yr

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	801.427	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr			
UMAC	Unbilled Metered:	n	g	10	11.110	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	8	69.209	MG/Yr	custom	69.209	MG/Yr

AUTHORIZED CONSUMPTION: 881.746 MG/Yr

WATER LOSSES

526.168 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	2.004	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	16.582	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	2.004	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 20.590 MG/Yr

Real Losses

Real Losses: 505.579 MG/Yr

WATER LOSSES: 526.168 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 606.487 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	237.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	11,810		(active *and* inactive)
	Service connection density:				50	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	16.4	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	98.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$1,449.10	$/Million gallons	$4,301,775	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

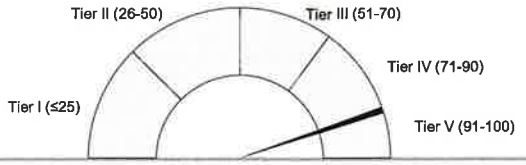
go to worksheet | go to grading | go to references

Water Audit Report for: PAW- Uniontown/Connellsville District 230 **Audit Year:** 2022 Calendar Jan 01 2022 - Dec 31 2022

Data Validity

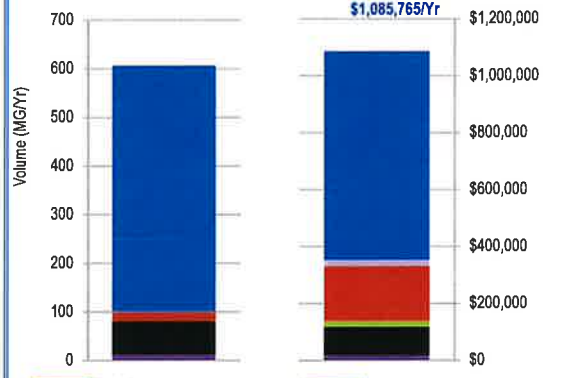
Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 606 MG/Yr **Total Cost of NRW = $1,085,765/Yr**



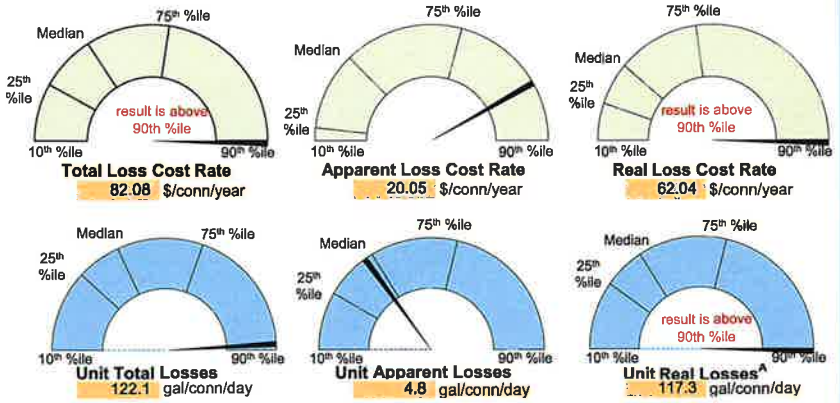
Real Losses
Systematic Data Handling Errors
Customer Metering Inaccuracies
Unauthorized Consumption
Unbilled Unmetered Auth Cons
Unbilled Metered Authorized Cons

	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	20.6	$236,741	CRUC
Real Losses	505.6	$732,634	VPC
Unbilled Authorized Cons	80.3	$116,390	VPC
Non-Revenue Water	606.5	$1,085,765	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Total Loss Cost Rate 82.08 $/conn/year

Apparent Loss Cost Rate 20.05 $/conn/year

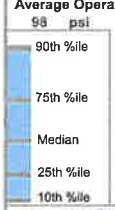
Real Loss Cost Rate 62.04 $/conn/year

Unit Total Losses 122.1 gal/conn/day

Unit Apparent Losses 4.8 gal/conn/day

Unit Real Losses[A] 117.3 gal/conn/day

Average Operating Pressure 98 psi



Infrastructure Leakage Index (ILI) 4.2 dimensionless

Unit Real Losses[B] 5,845 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 119.1 MG/Yr 27.6 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW-Brownsville District 250
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	9	325.110	MG/Yr	n	g	9	2.00%	percent	under-registration VOSEA
WI	Water Imported:	n	g	9	0.156	MG/Yr	n	g	9	0.00%	percent	WIEA
WE	Water Exported:	n	g	n/a		MG/Yr						WEEA
	WATER SUPPLIED:				331.901	MG/Yr						

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	8	243.341	MG/Yr		
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr		
UMAC	Unbilled Metered:	n	g	10	0.000	MG/Yr		
UUAC	Unbilled Unmetered:	n	g	8	4.661	MG/Yr	custom 4.661	MG/Yr
	AUTHORIZED CONSUMPTION:				248.002	MG/Yr		

WATER LOSSES

83.899 MG/Yr

Apparent Losses

choose entry option:

	Default option selected for Systematic Data Handling Errors, with automatic data grading of 3							
SDHE	Systematic Data Handling Errors:	n	g	3	0.608	MG/Yr	0.25% default	
CMI	Customer Metering Inaccuracies:	n	g	7	4.966	MG/Yr	2.00% percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.608	MG/Yr	0.25% default	
	Default option selected for Unauthorized Consumption, with automatic data grading of 3							
	Apparent Losses:				6.183	MG/Yr		

Real Losses

	Real Losses:				77.716	MG/Yr	
	WATER LOSSES:				83.899	MG/Yr	

NON-REVENUE WATER

	NON-REVENUE WATER:				88.560	MG/Yr	

SYSTEM DATA

Lm	Length of mains:	n	g	10	114.5	miles	(Including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	3,702		(active *and* inactive)
	Service connection density:				32	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	16.4	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	93.4	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$2,418.26	$/Million gallons	$1,488,388	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Billed Metered (BMAC)
2: Volume from Own Sources (VOS)
3: Unauthorized Consumption (UC)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

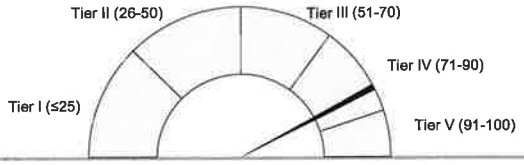
go to worksheet | go to grading | go to references

Water Audit Report for: PAW-Brownsville District 250 **Audit Year:** 2022 Calendar Jan 01 2022 - Dec 31 2022

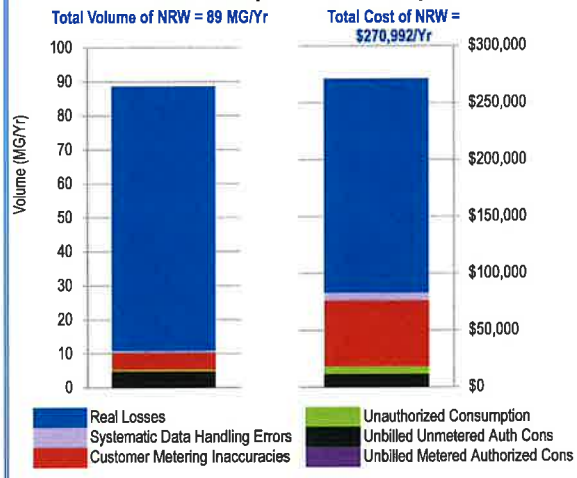
Data Validity

Data Validity Score: 84 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

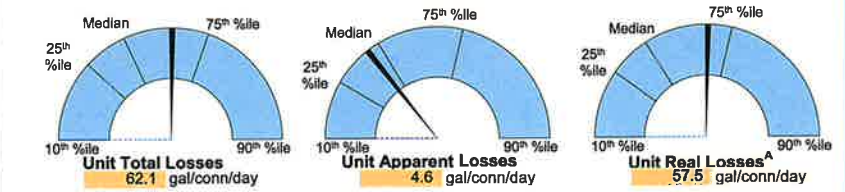


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	6.2	$71,783	CRUC
Real Losses	77.7	$187,938	VPC
Unbilled Authorized Cons	4.7	$11,272	VPC
Non-Revenue Water	88.6	$270,992	Blended

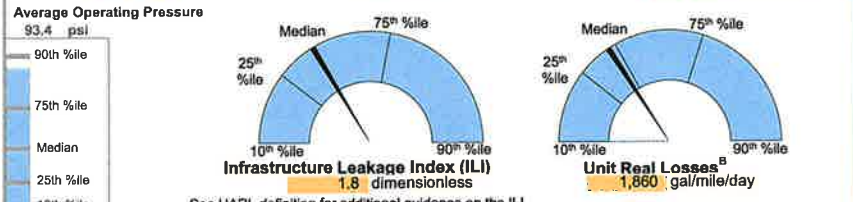
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 93.4 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	43.0 MG/Yr	31.8 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- New Castle District 310
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	2,759.422	MG/Yr	n g 9	2.00%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a		MG/Yr				WIEA
WE	Water Exported:	n	g	9	75.607	MG/Yr	n g		percent	WEEA
	WATER SUPPLIED:				2,740.130	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	1,659.701	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr			
UMAC	Unbilled Metered:	n	g	10	2.639	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	43.004	MG/Yr	custom	43.004	MG/Yr
	AUTHORIZED CONSUMPTION:				1,705.344	MG/Yr			

WATER LOSSES

1,034.786 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	4.149	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	33.925	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	4.149	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 42.224 MG/Yr

Real Losses

Real Losses: 992.562 MG/Yr

WATER LOSSES: 1,034.786 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,080.429 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	508.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	30,093		(active *and* inactive)
	Service connection density:				59	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.8	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	92.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$563.58	$/Million gallons	$8,548,660	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

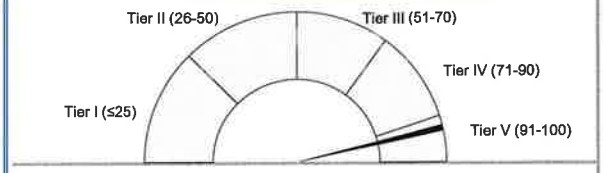
go to worksheet | go to grading | go to references

Water Audit Report for: PAW- New Castle District 310 | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

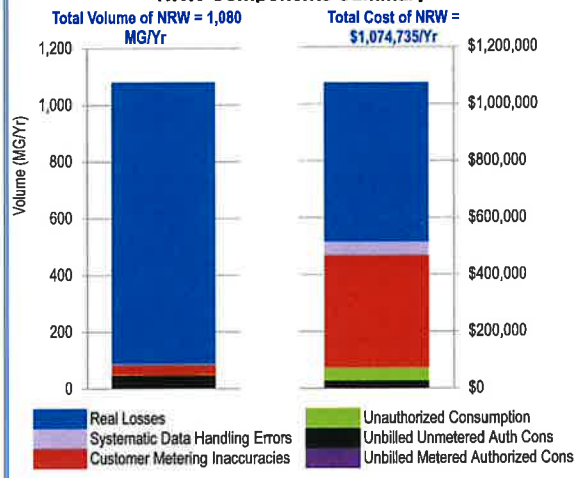
Data Validity

Data Validity Score: 92 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

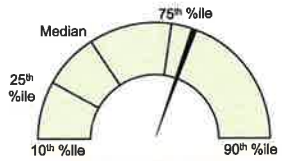


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	42.2	$489,624	CRUC
Real Losses	992.6	$559,388	VPC
Unbilled Authorized Cons	45.6	$25,723	VPC
Non-Revenue Water	1,080.4	$1,074,735	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

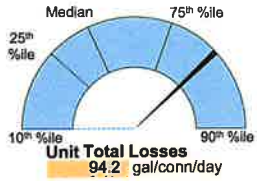
gauge %iles per validated industry ranges[2]



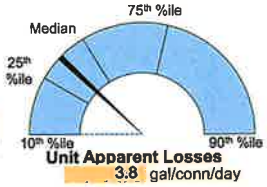
Total Loss Cost Rate 34.86 $/conn/year

Apparent Loss Cost Rate 16.27 $/conn/year

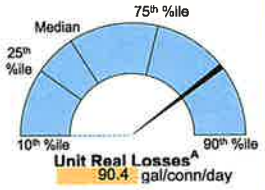
Real Loss Cost Rate 18.59 $/conn/year



Unit Total Losses 94.2 gal/conn/day

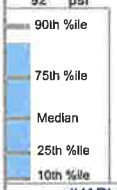


Unit Apparent Losses 3.8 gal/conn/day

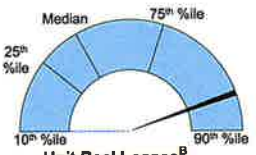


Unit Real Losses[A] 90.4 gal/conn/day

Average Operating Pressure 92 psi



Infrastructure Leakage Index (ILI) 3.7 dimensionless



Unit Real Losses[B] 5,353 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 270.9 MG/Yr 24.7 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
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- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association.

Water Audit Report for: PAW-Butler District 330
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	2,026.929	MG/Yr	n g 9	0.57%	percent	over-registration VOSEA
WI	Water Imported:	n	g	n/a		MG/Yr				WIEA
WE	Water Exported:	n	g	n/a		MG/Yr				WEEA
	WATER SUPPLIED:				2,015.441	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	1,658.738	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr			
UMAC	Unbilled Metered:	n	g	10	86.389	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	78.544	MG/Yr	custom	78.544	MG/Yr
	AUTHORIZED CONSUMPTION:				1,823.671	MG/Yr			

WATER LOSSES

191.770 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	4.147	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	35.615	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	4.147	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 43.909 MG/Yr

Real Losses

Real Losses: 147.861 MG/Yr

WATER LOSSES: 191.770 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 356.703 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	330.1	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	20,394		(active *and* inactive)
	Service connection density:				62	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.1	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	78.2	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$626.71	$/Million gallons	$6,261,507	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

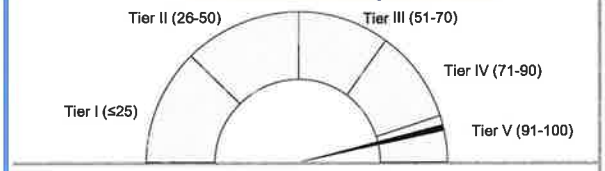
Water Audit Report for: PAW-Butler District 330

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

Data Validity

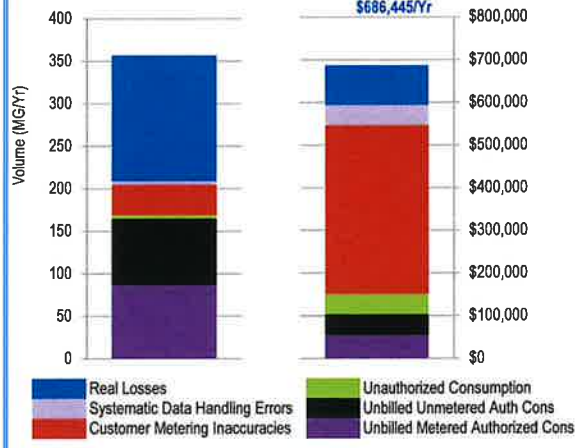
Data Validity Score: 92 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 355 MG/Yr **Total Cost of NRW = $686,445/Yr**

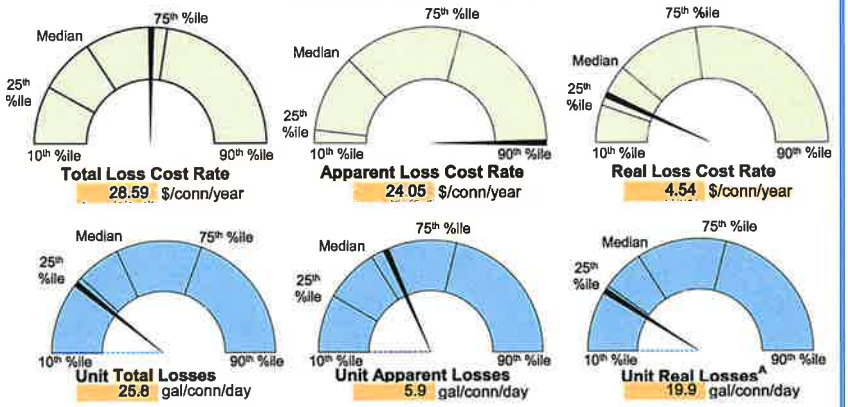


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	43.9	$490,414	CRUC
Real Losses	147.9	$92,666	VPC
Unbilled Authorized Cons	164.9	$103,365	VPC
Non-Revenue Water	356.7	$686,445	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Total Loss Cost Rate 28.59 $/conn/year

Apparent Loss Cost Rate 24.05 $/conn/year

Real Loss Cost Rate 4.54 $/conn/year

Unit Total Losses 25.8 gal/conn/day

Unit Apparent Losses 5.9 gal/conn/day

Unit Real Losses[A] 19.9 gal/conn/day

Average Operating Pressure 78.2 psi

90th %ile
75th %ile
Median
25th %ile
10th %ile

Infrastructure Leakage Index (ILI) 1.0 dimensionless

Unit Real Losses[B] 1,227 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 153.3 MG/Yr 20.6 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Indiana District 410
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	709.676	MG/Yr	n g 9	2.00%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a		MG/Yr				WIEA
WE	Water Exported:	n	g	9	19.600	MG/Yr	n g		percent	WEEA
	WATER SUPPLIED:				704.559	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	563.181	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr			
UMAC	Unbilled Metered:	n	g	10	0.000	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	8	4.748	MG/Yr	custom	4.748	MG/Yr
	AUTHORIZED CONSUMPTION:				567.929	MG/Yr			

WATER LOSSES

136.630 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	1.408	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	11.493	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	1.408	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 14.309 MG/Yr

Real Losses

Real Losses: 122.321 MG/Yr

WATER LOSSES: 136.630 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 141.378 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	122.7	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	7,149		(active *and* inactive)
	Service connection density:				58	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	19.4	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	79.4	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$541.04	$/Million gallons	$2,396,293	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

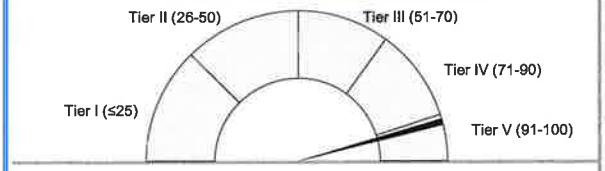
go to worksheet | go to grading | go to references

Water Audit Report for: PAW- Indiana District 410 | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

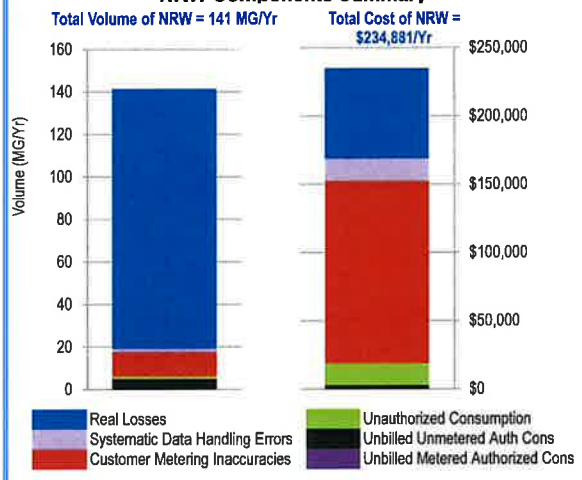
Data Validity

Data Validity Score: 91 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

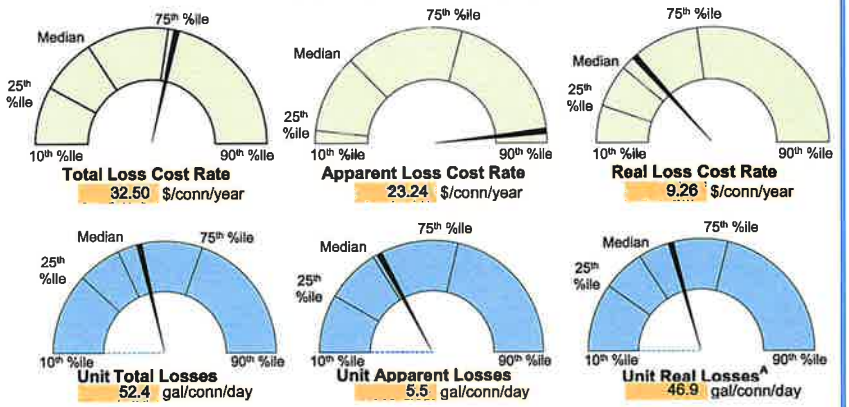


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	14.3	$166,132	CRUC
Real Losses	122.3	$66,180	VPC
Unbilled Authorized Cons	4.7	$2,569	VPC
Non-Revenue Water	141.4	$234,881	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 56.0 MG/Yr 21.5 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Punxsutawney District 420
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	10	293.489	MG/Yr	n	g	9	2.00%	percent	over-registration VOSEA
WI	Water Imported:	n	g	n/a		MG/Yr						WIEA
WE	Water Exported:	n	g	n/a		MG/Yr						WEEA

WATER SUPPLIED: 287.734 MG/Yr

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	214.745	MG/Yr						
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr						
UMAC	Unbilled Metered:	n	g	10	0.420	MG/Yr						
UUAC	Unbilled Unmetered:	n	g	10	6.793	MG/Yr	custom	6.793	MG/Yr			

AUTHORIZED CONSUMPTION: 221.958 MG/Yr

WATER LOSSES

65.776 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	0.537	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	4.391	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.537	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 5.465 MG/Yr

Real Losses

Real Losses: 60.311 MG/Yr

WATER LOSSES: 65.776 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 72.989 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	86.2	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	3,702		(active *and* inactive)
	Service connection density:				43	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.0	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	93.7	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$516.67	$/Million gallons	$1,152,990 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

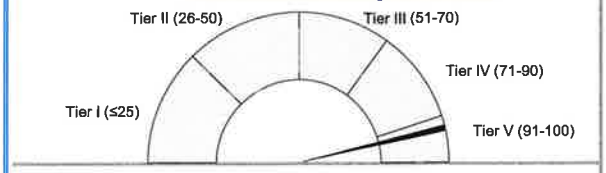
go to worksheet | go to grading | go to references

FWAS v6.0 | Water Audit Report for: PAW- Punxsutawney District 420 | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

Data Validity

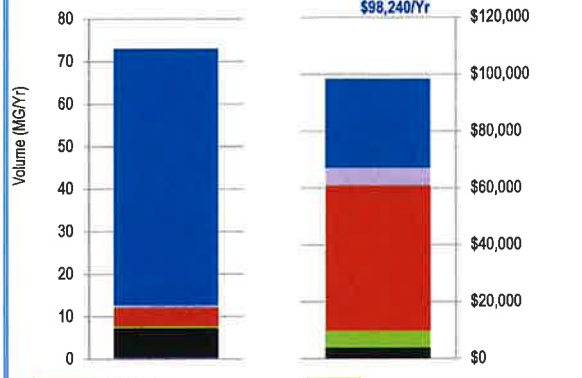
Data Validity Score: 92 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 73 MG/Yr **Total Cost of NRW = $98,240/Yr**

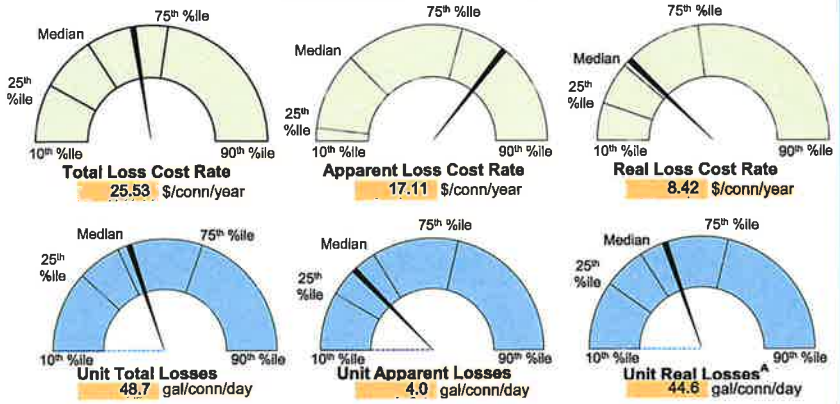


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	5.5	$63,352	CRUC
Real Losses	60.3	$31,161	VPC
Unbilled Authorized Cons	7.2	$3,727	VPC
Non-Revenue Water	73.0	$98,240	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure 93.7 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	38.2 MG/Yr	28.3 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Clarion District 430
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	522.585	MG/Yr	n g 9	0.50%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a		MG/Yr				WIEA
WE	Water Exported:	n	g	10	20.714	MG/Yr	n g		percent	WEEA
	WATER SUPPLIED:				504.497	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	279.383	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr			
UMAC	Unbilled Metered:	n	g	10	5.649	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	13.451	MG/Yr	custom	13.451	MG/Yr
	AUTHORIZED CONSUMPTION:				298.483	MG/Yr			

WATER LOSSES

206.014 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	0.698	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	5.817	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.698	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 7.214 MG/Yr

Real Losses

Real Losses: 198.800 MG/Yr

WATER LOSSES: 206.014 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 225.114 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	130.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	4,560		(active *and* inactive)
	Service connection density:				35	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	21.3	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	85.2	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$827.51	$/Million gallons	$1,349,570	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

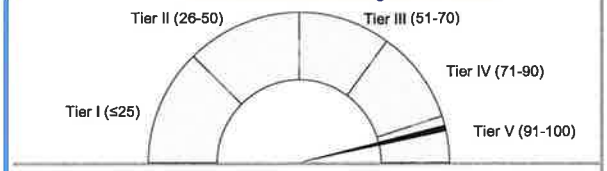
Water Audit Report for: PAW- Clarion District 430

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

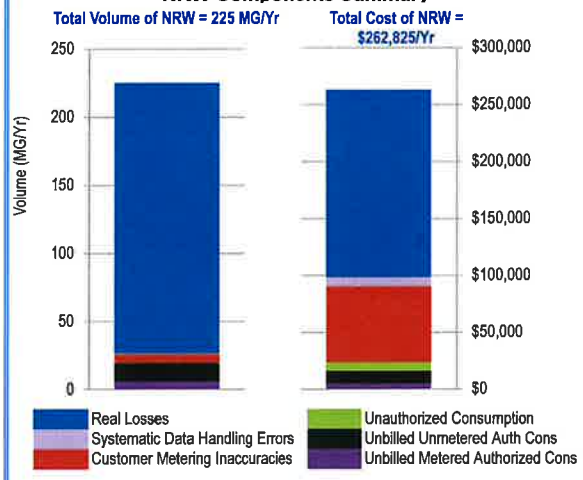
Data Validity

Data Validity Score: 92 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

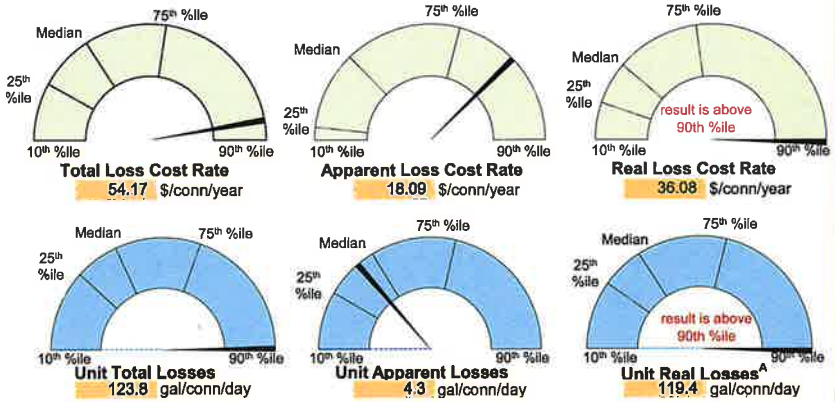


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	7.2	$82,510	CRUC
Real Losses	198.8	$164,509	VPC
Unbilled Authorized Cons	19.1	$15,805	VPC
Non-Revenue Water	225.1	$262,825	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure 85.2 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 47.4 MG/Yr 28.5 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Kittanning District 440
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n g 10	108.275	MG/Yr	n g 9	1.00%	percent	under-registration	VOSEA
WI	Water Imported:	n g n/a		MG/Yr					WIEA
WE	Water Exported:	n g n/a		MG/Yr					WEEA
	WATER SUPPLIED:		109.369	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 10	92.737	MG/Yr			
BUAC	Billed Unmetered:	n g n/a		MG/Yr			
UMAC	Unbilled Metered:	n g 10	0.018	MG/Yr			
UUAC	Unbilled Unmetered:	n g 3	0.232	MG/Yr	0.25%	default	

Default option selected for Unbilled Unmetered, with automatic data grading of 3

AUTHORIZED CONSUMPTION: 92.987 MG/Yr

WATER LOSSES

16.382 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n g 3	0.232	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 7	1.893	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	0.232	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 2.357 MG/Yr

Real Losses

Real Losses: 14.025 MG/Yr

WATER LOSSES: 16.382 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 16.632 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	21.4	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	2,034		(active *and* inactive)
	Service connection density:		95	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	15.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 10	87.6	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$1,243.00	$/Million gallons	$624,523	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

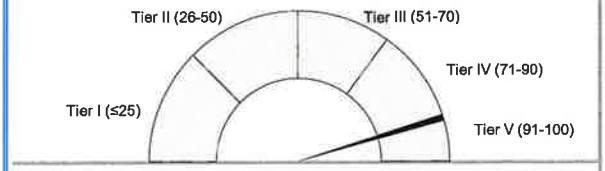
Water Audit Report for: PAW- Kittanning District 440

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

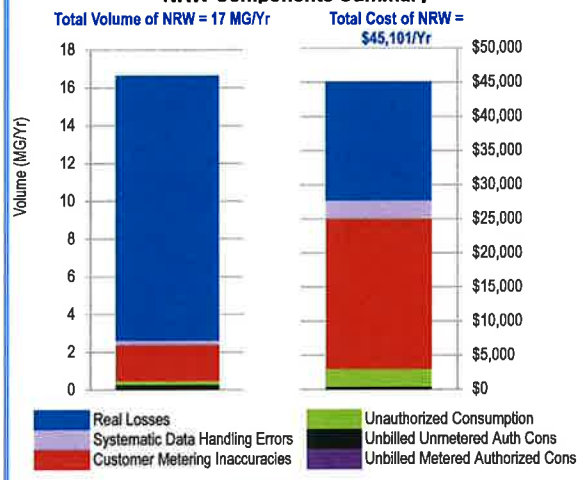
Data Validity

Data Validity Score: 90 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

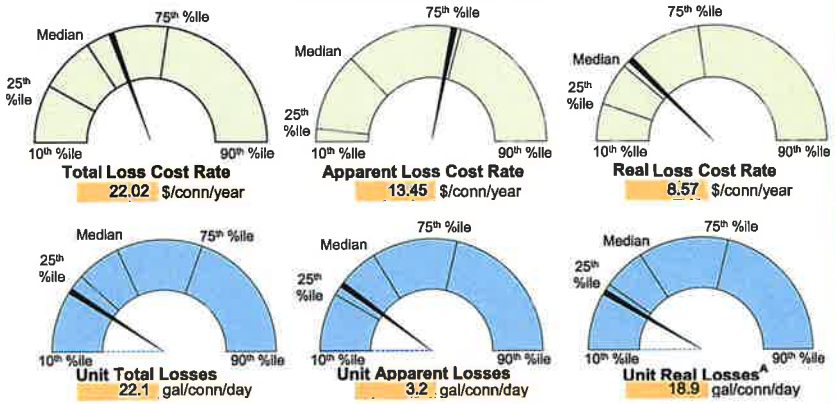


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	2.4	$27,357	CRUC
Real Losses	14.0	$17,433	VPC
Unbilled Authorized Cons	0.2	$311	VPC
Non-Revenue Water	16.6	$45,101	Blended

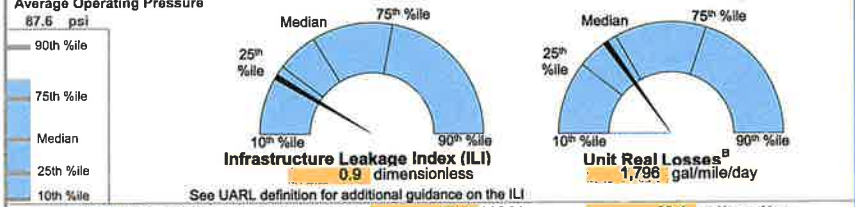
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure
87.6 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	14.9 MG/Yr	20.1 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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Table 1

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Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Warren District 450
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	740.449	MG/Yr	n g 9	2.00%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a		MG/Yr				WIEA
WE	Water Exported:	n	g	n/a		MG/Yr				WEEA
	WATER SUPPLIED:				755.560	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	10	538.816	MG/Yr				
BUAC	Billed Unmetered:	n	g	n/a		MG/Yr				
UMAC	Unbilled Metered:	n	g	10	0.001	MG/Yr				
UUAC	Unbilled Unmetered:	n	g	10	50.701	MG/Yr		custom	50.701	MG/Yr
	AUTHORIZED CONSUMPTION:				589.518	MG/Yr				

WATER LOSSES

166.042 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	1.347	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	10.996	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	1.347	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 13.690 MG/Yr

Real Losses

Real Losses: 152.352 MG/Yr

WATER LOSSES: 166.042 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 216.744 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	89.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	5,756		(active *and* inactive)
	Service connection density:				65	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	20.3	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	10	84.5	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$143.52	$/Million gallons	$1,729,645 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

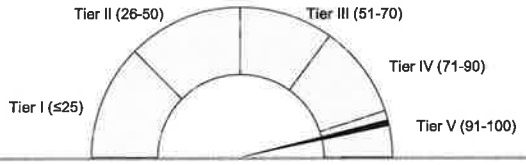
go to worksheet | go to grading | go to references

FWAS v6.0 | Water Audit Report for: PAW- Warren District 450 | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

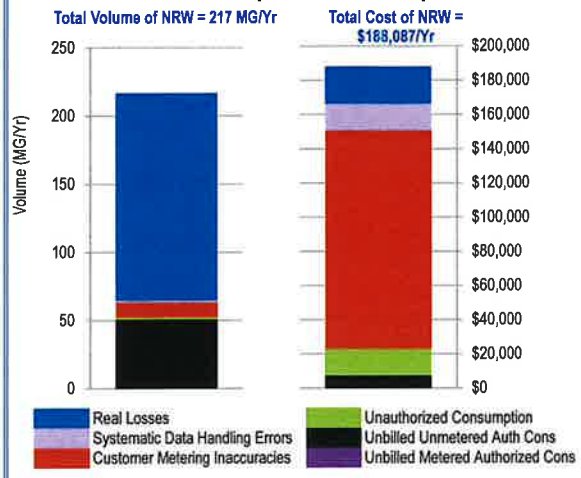
Data Validity

Data Validity Score: 92 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary

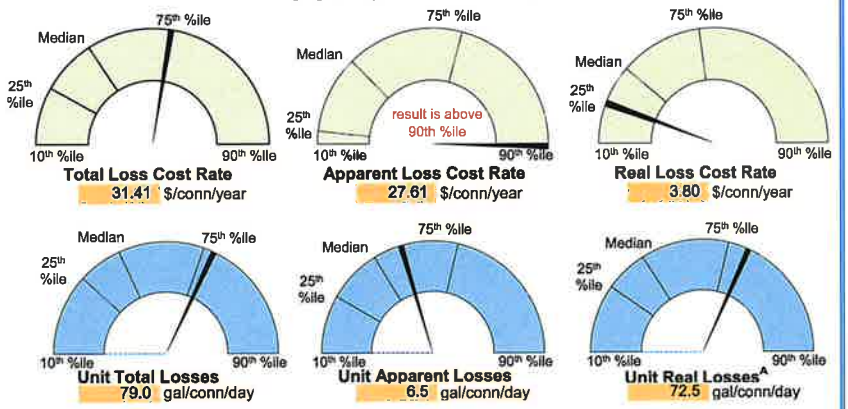


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	13.7	$158,945	CRUC
Real Losses	152.4	$21,866	VPC
Unbilled Authorized Cons	50.7	$7,277	VPC
Non-Revenue Water	216.7	$188,087	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated Industry ranges[2]



Total Loss Cost Rate 31.41 $/conn/year

Apparent Loss Cost Rate 27.61 $/conn/year

Real Loss Cost Rate 3.80 $/conn/year

Unit Total Losses 79.0 gal/conn/day

Unit Apparent Losses 6.5 gal/conn/day

Unit Real Losses[A] 72.5 gal/conn/day

Average Operating Pressure 84.5 psi

Infrastructure Leakage Index (ILI) 3.3 dimensionless

Unit Real Losses[B] 4,690 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 46.6 MG/Yr 22.2 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW- Kane District 460
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n g 10	150.127	MG/Yr	n g 9	2.00%	percent	under-registration	VOSEA
WI	Water Imported:	n g n/a		MG/Yr					WIEA
WE	Water Exported:	n g 10		MG/Yr					WEEA

WATER SUPPLIED: 153.191 MG/Yr

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 10	100.033	MG/Yr			
BUAC	Billed Unmetered:	n g n/a		MG/Yr			
UMAC	Unbilled Metered:	n g 10	4.605	MG/Yr			
UUAC	Unbilled Unmetered:	n g 10	7.630	MG/Yr	custom	7.630	MG/Yr

AUTHORIZED CONSUMPTION: 112.268 MG/Yr

WATER LOSSES

40.923 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	0.250	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 7	2.135	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	0.250	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 2.636 MG/Yr

Real Losses

Real Losses: 38.287 MG/Yr

WATER LOSSES: 40.923 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 53.158 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	43.1	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	2,384		(active *and* inactive)
	Service connection density:		55	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	20.0	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 10	97.9	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$736.59	$/Million gallons	$657,393	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier V (91-100). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

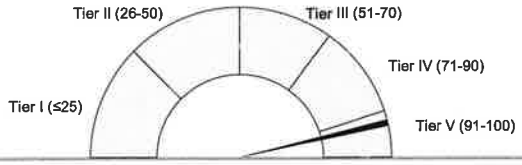
Water Audit Report for: PAW- Kane District 460

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

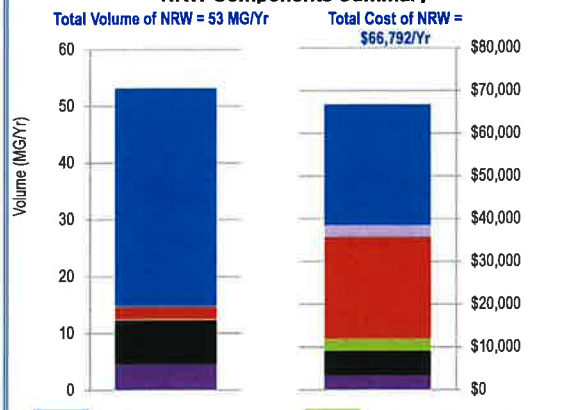
Data Validity

Data Validity Score: 92 **Data Validity Tier:** Tier V (91-100)

See Loss Control Planning for Tier Details



NRW Components Summary



	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	2.6	$29,578	CRUC
Real Losses	38.3	$28,202	VPC
Unbilled Authorized Cons	12.2	$9,012	VPC
Non-Revenue Water	53.2	$66,792	Blended

Key Performance Indicators

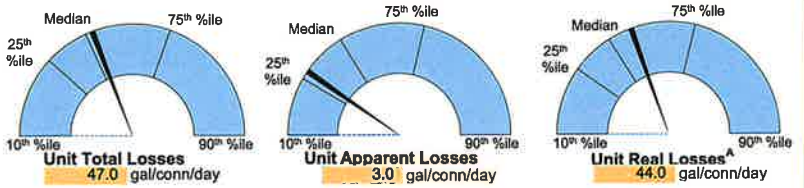
Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]

Total Loss Cost Rate 24.24 $/conn/year

Apparent Loss Cost Rate 12.41 $/conn/year

Real Loss Cost Rate 11.83 $/conn/year

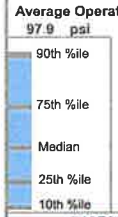


Unit Total Losses 47.0 gal/conn/day

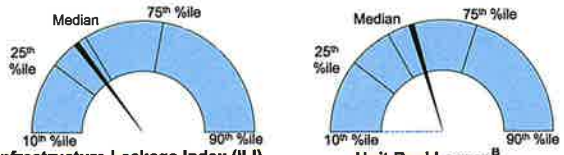
Unit Apparent Losses 3.0 gal/conn/day

Unit Real Losses[A] 44.0 gal/conn/day

Average Operating Pressure 97.9 psi



AOP is above 90th %ile



Infrastructure Leakage Index (ILI) 1.6 dimensionless

Unit Real Losses[B] 2,434 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 23.5 MG/Yr 27.0 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 510 Norristown
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

							choose entry option:				
VOS	Volume from Own Sources:	n	g	9	3,394.675	MG/Yr	n g 10	1.03%	percent	under-registration	VOSEA
WI	Water Imported:	n	g	3	0.871	MG/Yr	n g 4	0.00%	percent		WIEA
WE	Water Exported:	n	g	9		MG/Yr					WEEA
	WATER SUPPLIED:				3,430.875	MG/Yr					

AUTHORIZED CONSUMPTION

							choose entry option:		
BMAC	Billed Metered:	n	g	9	2,309.394	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	7.117	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	36.103	MG/Yr	custom	36.103	MG/Yr
	AUTHORIZED CONSUMPTION:				2,352.614	MG/Yr			

WATER LOSSES

1,078.261 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

							choose entry option:		
SDHE	Systematic Data Handling Errors:	n	g	3	5.773	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	47.276	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	5.773	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 58.823 MG/Yr

Real Losses

Real Losses: 1,019.438 MG/Yr

WATER LOSSES: 1,078.261 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,121.481 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	388.9	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	31,553		(active *and* inactive)
	Service connection density:				81	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	19.4	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	6	80.3	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$870.74	$/Million gallons	$10,584,344	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Unauthorized Consumption (UC)
3: Systematic Data Handling Errors (SDHE)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

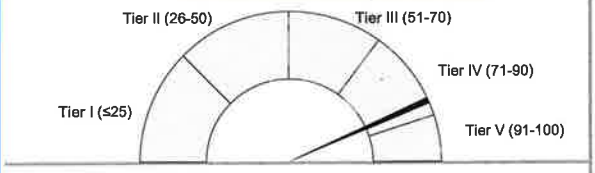
Water Audit Report for: PAW - 510 Norristown

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

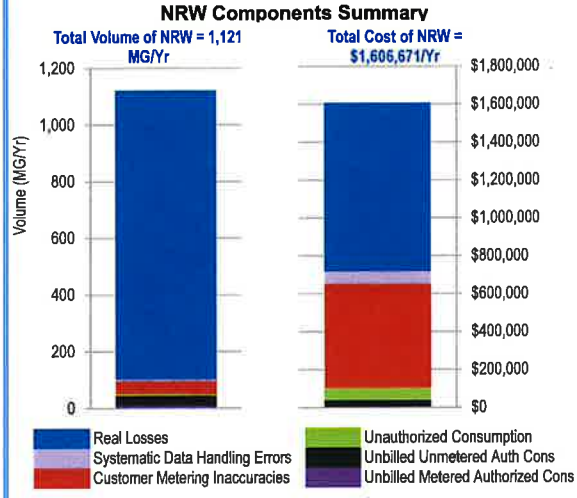
Data Validity

Data Validity Score: 86 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary



	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	58.8	$681,372	CRUC
Real Losses	1,019.4	$887,666	VPC
Unbilled Authorized Cons	43.2	$37,633	VPC
Non-Revenue Water	1,121.5	$1,606,671	Blended

Key Performance Indicators

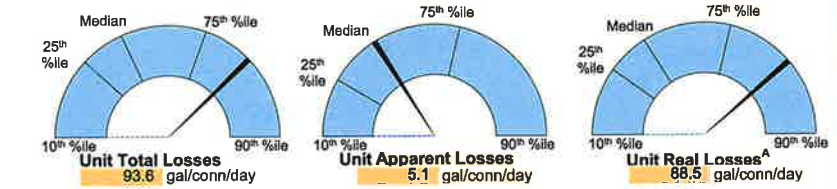
Actual KPI result | Target (see Worksheet)

gauge %iles per validated Industry ranges[2]

Total Loss Cost Rate 49.73 $/conn/year

Apparent Loss Cost Rate 21.59 $/conn/year

Real Loss Cost Rate 28.13 $/conn/year

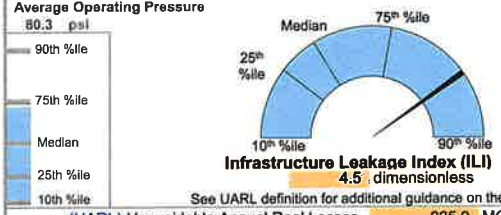


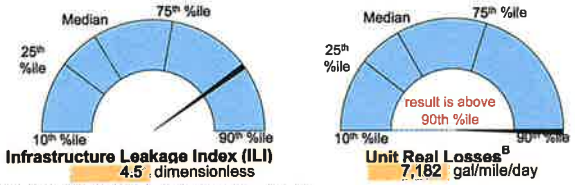
Unit Total Losses 93.6 gal/conn/day

Unit Apparent Losses 5.1 gal/conn/day

Unit Real Losses[4] 88.5 gal/conn/day

Average Operating Pressure 80.3 psi





Infrastructure Leakage Index (ILI) 4.5 dimensionless

Unit Real Losses[B] 7,182 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 225.9 MG/Yr 19.6 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
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- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
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- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 520 Yardley
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	1,114.340	MG/Yr	n g 10	0.17%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n	g	8	73.230	MG/Yr	n g 9	1.95%	percent	under-registration WEEA
	WATER SUPPLIED:				1,041.551	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	9	859.594	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	4.223	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	8.418	MG/Yr	custom	8.418	MG/Yr
	AUTHORIZED CONSUMPTION:				872.235	MG/Yr			

WATER LOSSES

169.316 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	2.149	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	17.629	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	2.149	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 21.927 MG/Yr

Real Losses

Real Losses: 147.389 MG/Yr

WATER LOSSES: 169.316 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 181.957 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	191.7	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	11,761		(active *and* inactive)
	Service connection density:				61	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	22.0	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	62.4	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$556.89	$/Million gallons	$10,584,344 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

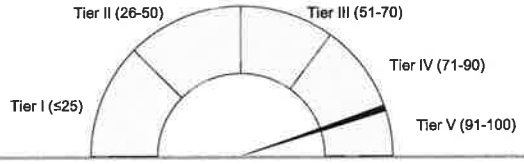
Water Audit Report for: PAW - 520 Yardley

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

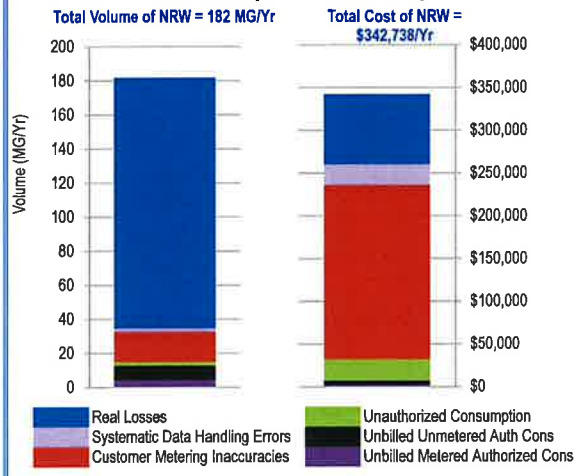
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary



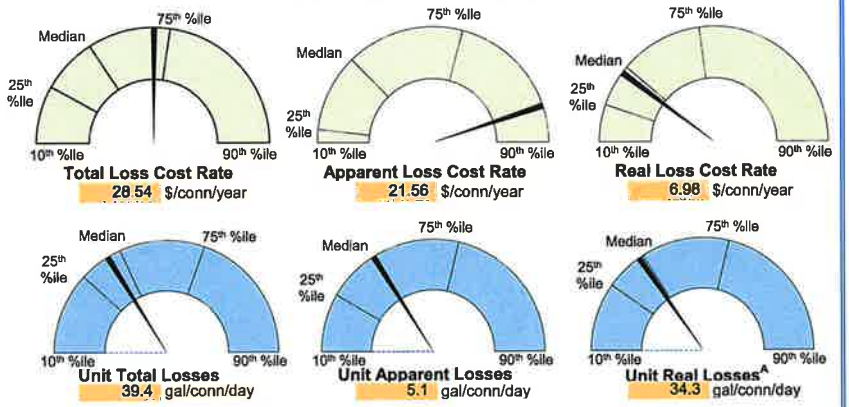
	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	21.9	$253,619	CRUC
Real Losses	147.4	$82,080	VPC
Unbilled Authorized Cons	12.6	$7,040	VPC
Non-Revenue Water	182.0	$342,738	Blended

Key Performance Indicators

Actual KPI result

Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure 62.4 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	72.2 MG/Yr	16.8 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 530 Abington
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	543.594	MG/Yr	n	g	10	0.72% percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:				547.536	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	9	371.096	MG/Yr					
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr					
UMAC	Unbilled Metered:	n	g	10	0.921	MG/Yr					
UUAC	Unbilled Unmetered:	n	g	10	9.350	MG/Yr	custom	9.350	MG/Yr		
	AUTHORIZED CONSUMPTION:				381.367	MG/Yr					

WATER LOSSES

166.169 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	0.928	MG/Yr	0.25%	default			
CMI	Customer Metering Inaccuracies:	n	g	7	7.592	MG/Yr	2.00%	percent			under-registration
UC	Unauthorized Consumption:	n	g	3	0.928	MG/Yr	0.25%	default			

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 9.448 MG/Yr

Real Losses

Real Losses: 156.722 MG/Yr

WATER LOSSES: 166.169 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 176.440 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	138.7	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	6,571		(active *and* inactive)
	Service connection density:				47	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	20.8	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	95.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$375.65	$/Million gallons	$2,023,238 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

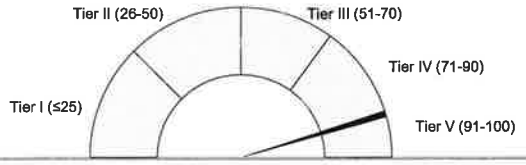
Water Audit Report for: PAW - 530 Abington

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

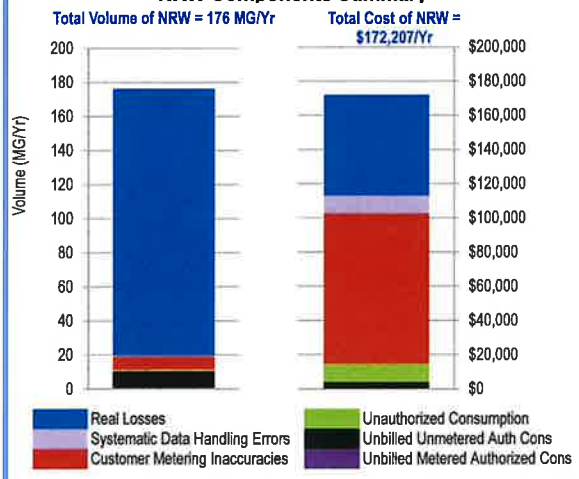
Data Validity

Data Validity Score: 90 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

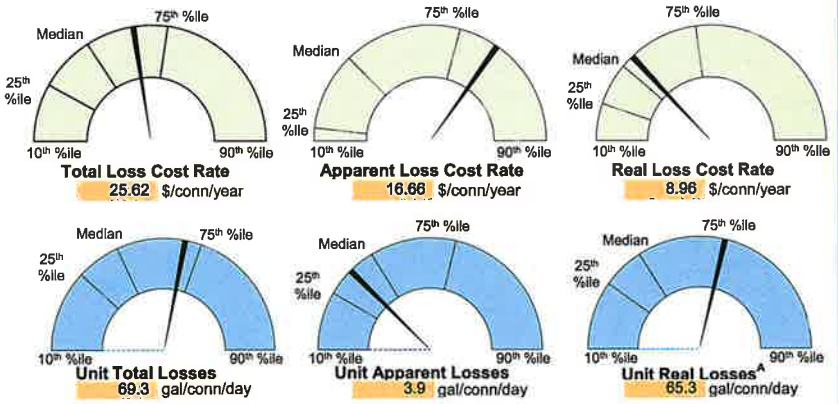


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	9.4	$109,476	CRUC
Real Losses	156.7	$58,872	VPC
Unbilled Authorized Cons	10.3	$3,858	VPC
Non-Revenue Water	176.4	$172,207	Blended

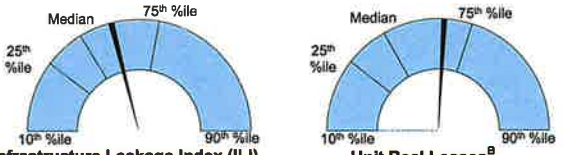
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validdated Industry ranges[2]



Average Operating Pressure
95 psi
90th %ile
75th %ile
Median
25th %ile
10th %ile



(UARL) Unavoidable Annual Real Losses	66.9 MG/Yr	27.9 gal/conn/day

See UARL definition for additional guidance on the ILI

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
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	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 540 Susquehanna
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	207.649	MG/Yr	n g 10	5.76%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr				WEEA
	WATER SUPPLIED:				220.341	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	9	129.789	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	0.693	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	8	2.427	MG/Yr	custom	2.427	MG/Yr
	AUTHORIZED CONSUMPTION:				132.909	MG/Yr			

WATER LOSSES

87.432 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	0.324	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	4	2.663	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.324	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 3.312 MG/Yr

Real Losses

Real Losses: 84.120 MG/Yr

WATER LOSSES: 87.432 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 90.552 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	62.2	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	2,893		(active *and* inactive)
	Service connection density:				47	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.9	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	79.2	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$904.49	$/Million gallons	$806,423	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score Is In Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Customer Metering Inaccuracies (CMI)
2: Unauthorized Consumption (UC)
3: Systematic Data Handling Errors (SDHE)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

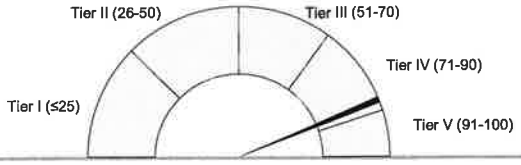
go to worksheet | go to grading | go to references

FWAS v6.0 | Water Audit Report for: PAW - 540 Susquehanna | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

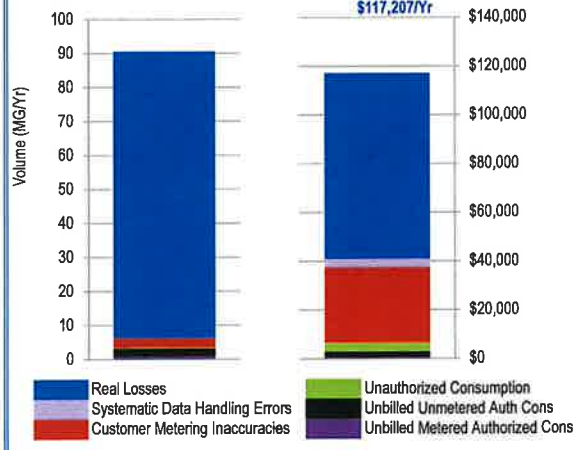
Data Validity

Data Validity Score: 87 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

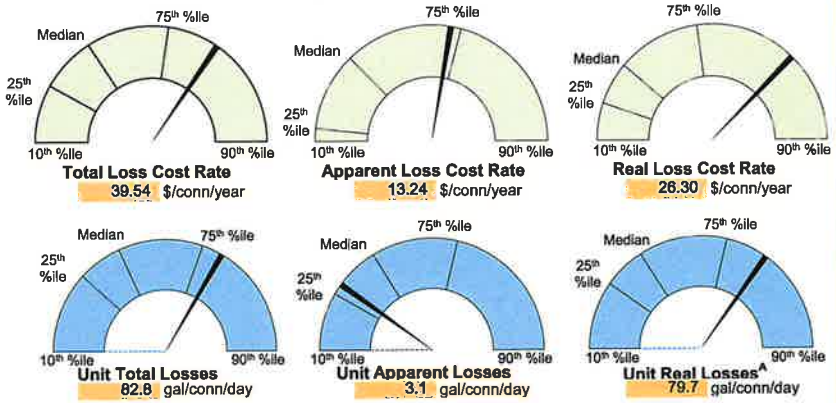


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	3.3	$38,299	CRUC
Real Losses	84.1	$76,085	VPC
Unbilled Authorized Cons	3.1	$2,822	VPC
Non-Revenue Water	90.6	$117,207	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 79.2 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses: 24.5 MG/Yr | 23.2 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 550 Bangor
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

			choose entry option:						
VOS	Volume from Own Sources:	n g 10	267.083	MG/Yr	n g 10	1.04%	percent	over-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		264.334	MG/Yr					

AUTHORIZED CONSUMPTION

					choose entry option:		
BMAC	Billed Metered:	n g 9	176.970	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	0.488	MG/Yr			
UUAC	Unbilled Unmetered:	n g 8	10.507	MG/Yr	custom	10.507	MG/Yr
	AUTHORIZED CONSUMPTION:		187.965	MG/Yr			

WATER LOSSES

76.369 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

					choose entry option:		
SDHE	Systematic Data Handling Errors:	n g 3	0.442	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 7	3.622	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	0.442	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 4.506 MG/Yr

Real Losses

Real Losses: 71.862 MG/Yr

WATER LOSSES: 76.369 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 87.364 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	57.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	3,487		(active *and* inactive)
	Service connection density:		61	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	16.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 8	83.9	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$399.50	$/Million gallons	$1,196,072	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

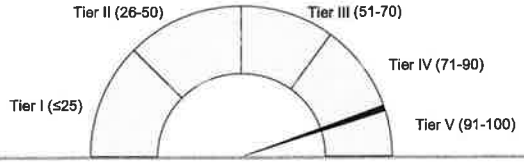
Water Audit Report for: PAW - 550 Bangor

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

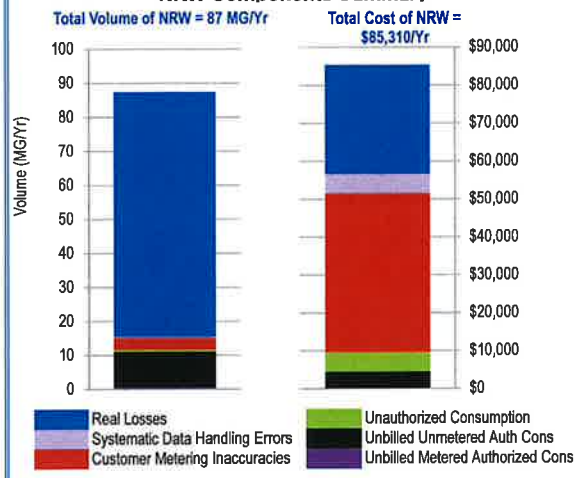
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

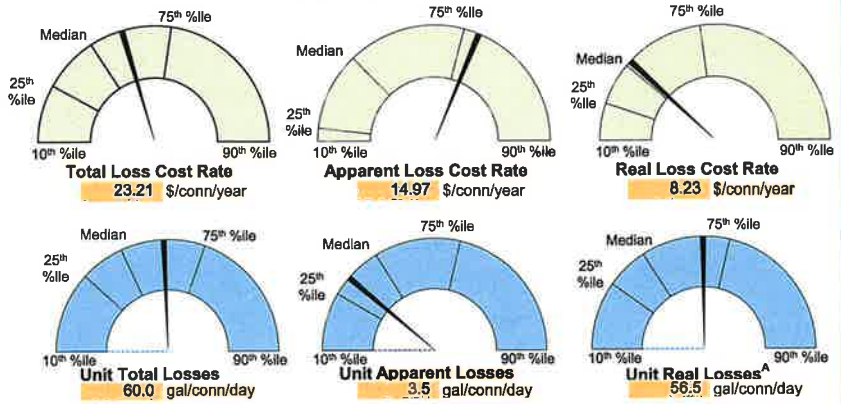


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	4.5	$52,208	CRUC
Real Losses	71.9	$28,709	VPC
Unbilled Authorized Cons	11.0	$4,393	VPC
Non-Revenue Water	87.4	$85,310	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 83.9 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses: 28.0 MG/Yr | 22.0 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 560 Nazareth
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n g 10	755.368	MG/Yr	n g 10	0.21%	percent	under-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		756.958	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 9	617.240	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	6.158	MG/Yr			
UUAC	Unbilled Unmetered:	n g 10	6.964	MG/Yr	custom	6.964	MG/Yr
	AUTHORIZED CONSUMPTION:		630.362	MG/Yr			

WATER LOSSES

126.596 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	1.543	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 6	12.722	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	1.543	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 15.809 MG/Yr

Real Losses

Real Losses: 110.787 MG/Yr

WATER LOSSES: 126.596 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 139.718 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	157.8	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	10,462		(active *and* inactive)
	Service connection density:		66	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	18.9	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 8	94.9	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$322.68	$/Million gallons	$3,240,691	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

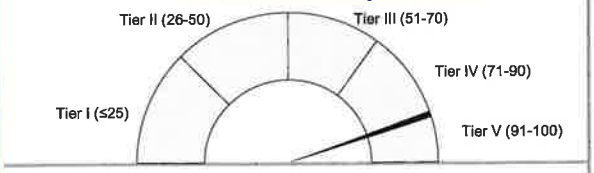
Water Audit Report for: PAW - 560 Nazareth

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

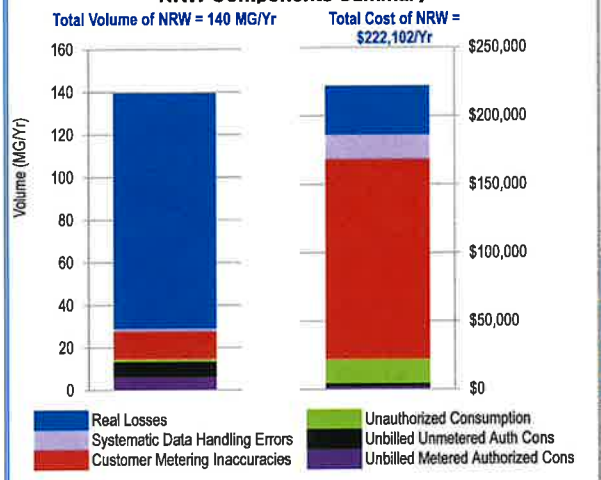
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

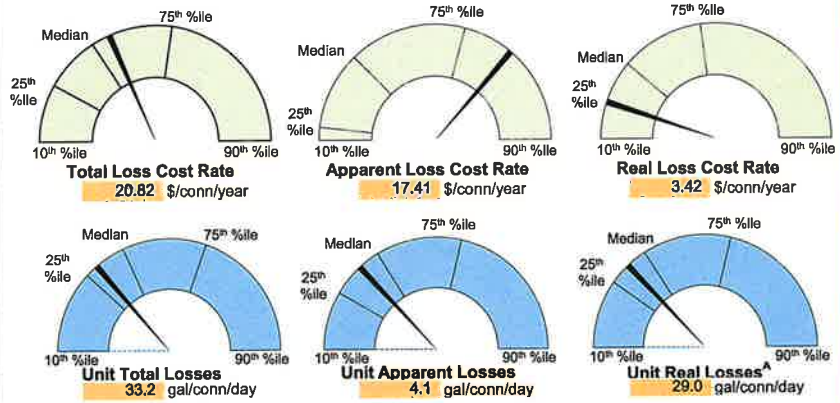


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	15.8	$182,119	CRUC
Real Losses	110.8	$35,749	VPC
Unbilled Authorized Cons	13.1	$4,234	VPC
Non-Revenue Water	139.7	$222,102	Blended

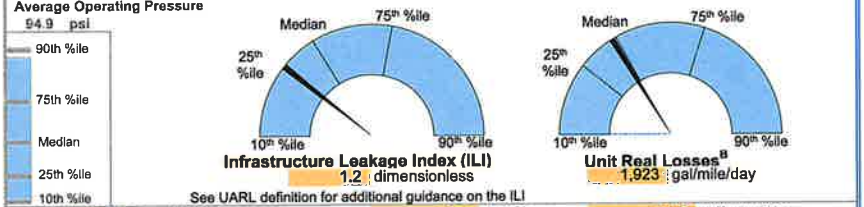
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 94.9 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses: 93.7 MG/Yr | 24.5 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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Table 1

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Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 570 Pocono
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	10	591.367	MG/Yr	n	g	10	0.74%	percent	over-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr						WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr						WEEA
	WATER SUPPLIED:				587.023	MG/Yr						

AUTHORIZED CONSUMPTION

choose entry option:

		n	g						
BMAC	Billed Metered:	n	g	9	359.135	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	7.521	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	10.104	MG/Yr	custom	10.104	MG/Yr
	AUTHORIZED CONSUMPTION:				376.760	MG/Yr			

WATER LOSSES

210.263 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

		n	g						
SDHE	Systematic Data Handling Errors:	n	g	3	0.898	MG/Yr	0.25%	default	under-registration
CMI	Customer Metering Inaccuracies:	n	g	6	7.483	MG/Yr	2.00%	percent	
UC	Unauthorized Consumption:	n	g	3	0.898	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 9.278 MG/Yr

Real Losses

Real Losses: 200.985 MG/Yr

WATER LOSSES: 210.263 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 227.888 MG/Yr

SYSTEM DATA

		n	g				
Lm	Length of mains:	n	g	10	156.4	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	10,045		(active *and* inactive)
	Service connection density:				64	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	21.4	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	67.2	psi	

COST DATA

		n	g				Total Annual Operating Cost
CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	
VPC	Variable Production Cost:	n	g	10	$669.36	$/Million gallons	$2,695,311 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

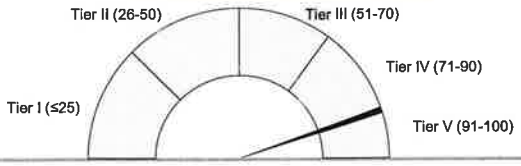
Water Audit Report for: PAW - 570 Pocono

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

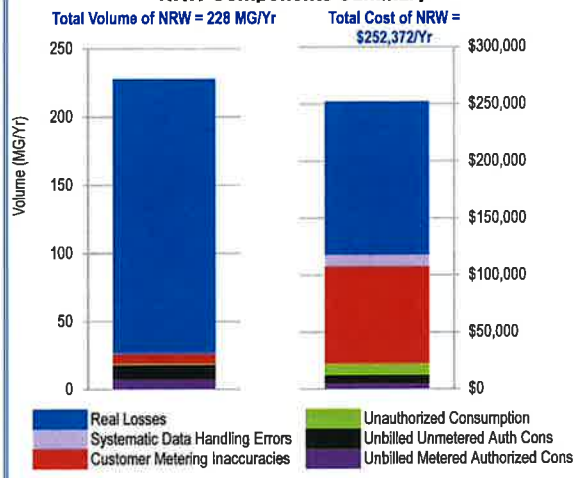
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

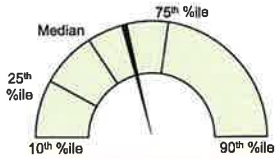


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	9.3	$106,044	CRUC
Real Losses	201.0	$134,531	VPC
Unbilled Authorized Cons	17.6	$11,797	VPC
Non-Revenue Water	227.9	$252,372	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated Industry ranges[2]

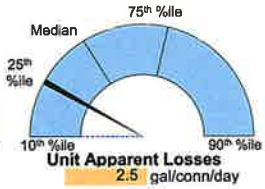


Total Loss Cost Rate
23.95 $/conn/year

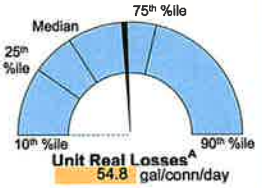
Apparent Loss Cost Rate
10.56 $/conn/year

Real Loss Cost Rate
13.39 $/conn/year

Unit Total Losses
57.3 gal/conn/day

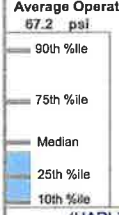


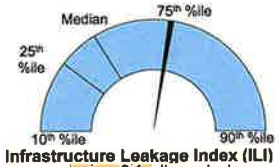
Unit Apparent Losses
2.5 gal/conn/day



Unit Real Losses[A]
54.8 gal/conn/day

Average Operating Pressure
67.2 psi





Infrastructure Leakage Index (ILI)
3.1 dimensionless

Unit Real Losses[B]
3,521 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	65.2 MG/Yr	17.8 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 590 Glen Alsace
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

							choose entry option:				
VOS	Volume from Own Sources:	n	g	10	458.990	MG/Yr	n g 10	0.68%	percent	under-registration	VOSEA
WI	Water Imported:	n	g	7	152.450	MG/Yr	n g 9	0.25%	percent	over-registration	WIEA
WE	Water Exported:	n	g		0.000	MG/Yr					WEEA
	WATER SUPPLIED:				614.202	MG/Yr					

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n	g	9	547.946	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	1.576	MG/Yr	choose entry option:		
UUAC	Unbilled Unmetered:	n	g	10	12.853	MG/Yr	custom	12.853	MG/Yr
	AUTHORIZED CONSUMPTION:				562.375	MG/Yr			

WATER LOSSES

51.827 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

							choose entry option:		
SDHE	Systematic Data Handling Errors:	n	g	3	1.370	MG/Yr	0.25%	default	under-registration
CMI	Customer Metering Inaccuracies:	n	g	7	11.215	MG/Yr	2.00%	percent	
UC	Unauthorized Consumption:	n	g	3	1.370	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 13.954 MG/Yr

Real Losses

Real Losses: 37.873 MG/Yr

WATER LOSSES: 51.827 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 66.256 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	146.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	9,380		(active *and* inactive)
	Service connection density:				64	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	21.3	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	81.8	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$1,428.63	$/Million gallons	$3,031,028	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Water Imported (WI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

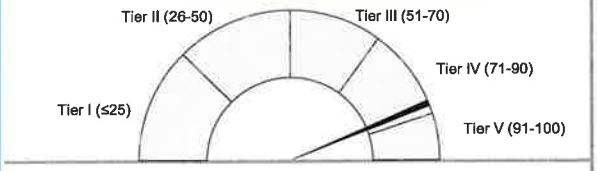
go to worksheet | go to grading | go to references

FWAS v6.0 | Water Audit Report for: PAW - 590 Glen Alsace | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

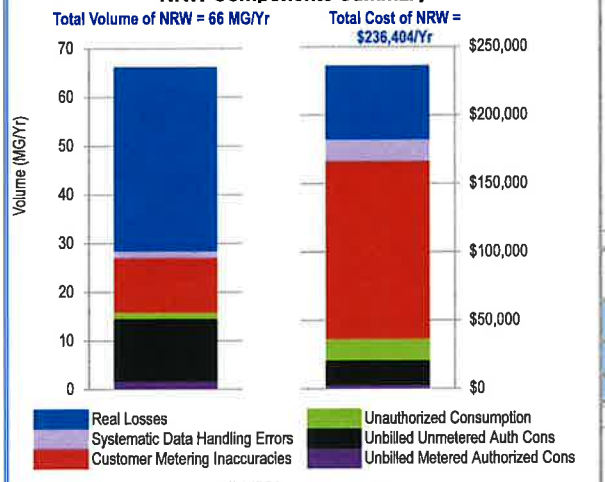
Data Validity

Data Validity Score: 87 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary



	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	14.0	$161,684	CRUC
Real Losses	37.9	$54,106	VPC
Unbilled Authorized Cons	14.4	$20,614	VPC
Non-Revenue Water	66.3	$236,404	Blended

Key Performance Indicators

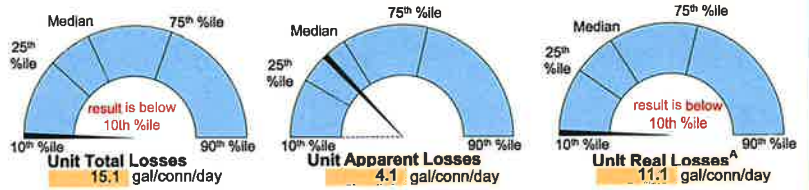
Actual KPI result | Target (see Worksheet)

gauge %iles per validated Industry ranges[2]

Total Loss Cost Rate 23.01 $/conn/year

Apparent Loss Cost Rate 17.24 $/conn/year

Real Loss Cost Rate 5.77 $/conn/year

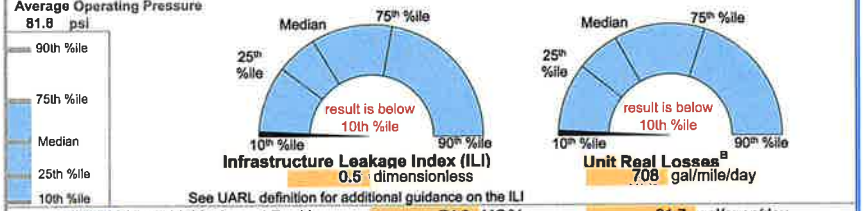


Unit Total Losses 15.1 gal/conn/day

Unit Apparent Losses 4.1 gal/conn/day

Unit Real Losses[A] 11.1 gal/conn/day

Average Operating Pressure 81.8 psi



Infrastructure Leakage Index (ILI) 0.5 dimensionless

Unit Real Losses[B] 708 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 74.2 MG/Yr 21.7 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 610 Mechanicsburg
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the Input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n g 10	3,907.536	MG/Yr	n g 10	0.35%	percent	over-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		3,893.907	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 9	2,812.940	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	12.164	MG/Yr			
UUAC	Unbilled Unmetered:	n g 10	220.421	MG/Yr	custom	220.421	MG/Yr
	AUTHORIZED CONSUMPTION:		3,045.525	MG/Yr			

WATER LOSSES

848.382 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	7.032	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 6	57.655	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	7.032	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 71.720 MG/Yr

Real Losses

Real Losses: 776.662 MG/Yr

WATER LOSSES: 848.382 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 1,080.967 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	550.9	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	50,806		(active *and* inactive)
	Service connection density:		92	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	17.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 10	92.8	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$588.42	$/Million gallons	$13,412,410	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

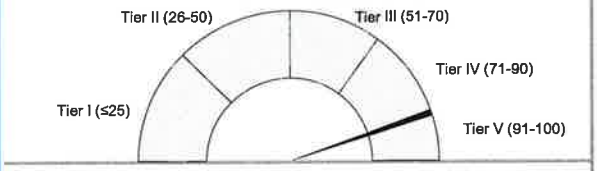
Water Audit Report for: PAW - 610 Mechanicsburg

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

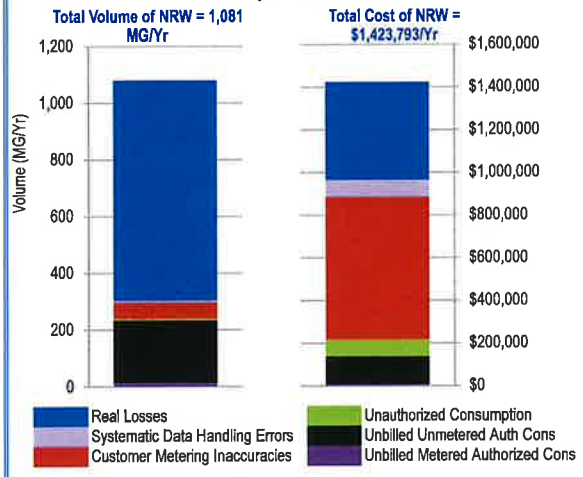
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

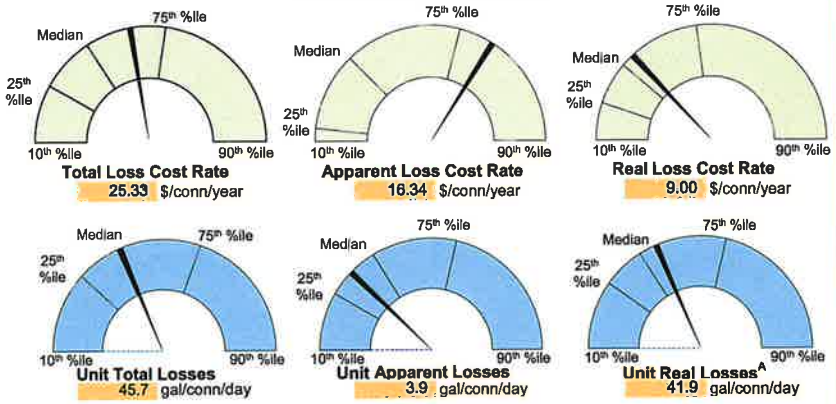


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	71.7	$829,932	CRUC
Real Losses	776.7	$457,004	VPC
Unbilled Authorized Cons	232.6	$136,858	VPC
Non-Revenue Water	1,081.0	$1,423,793	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure
92.8 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	401.9 MG/Yr	21.7 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 620 Hershey
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

VOS	Volume from Own Sources:	n	g	10	2,396.659	MG/Yr	n g 10	0.13%	percent	under-registration VOSEA
WI	Water Imported:	n	g	9	2.824	MG/Yr	n g 10		percent	WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr				WEEA
	WATER SUPPLIED:				2,402.603	MG/Yr				

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n	g	9	1,849.366	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	19.457	MG/Yr	choose entry option:		
UUAC	Unbilled Unmetered:	n	g	10	14.232	MG/Yr	custom	14.232	MG/Yr
	AUTHORIZED CONSUMPTION:				1,883.055	MG/Yr			

WATER LOSSES

519.548 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	4.623	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	38.139	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	4.623	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 47.386 MG/Yr

Real Losses

Real Losses: 472.162 MG/Yr

WATER LOSSES: 519.548 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 553.237 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	332.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	23,960		(active *and* inactive)
	Service connection density:				72	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	20.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	79.1	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$516.14	$/Million gallons	$6,506,594 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score Is In Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

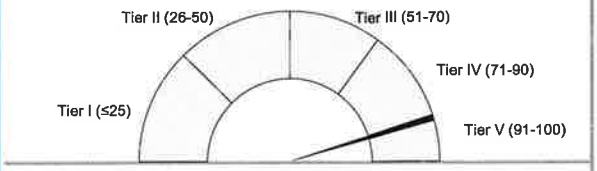
Water Audit Report for: PAW - 620 Hershey

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

Data Validity

Data Validity Score: 90 **Data Validity Tier:** Tier IV (71-90)

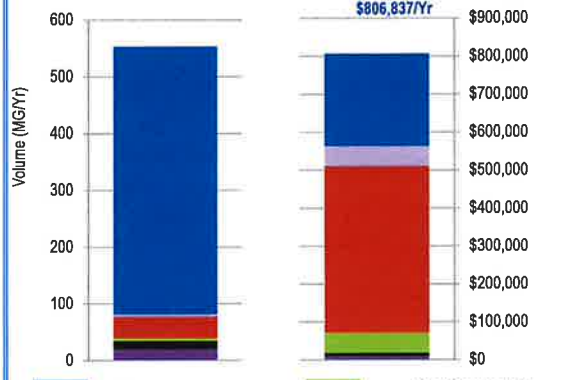
See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 553 MG/Yr

Total Cost of NRW = $806,837/Yr



Real Losses
Systematic Data Handling Errors
Customer Metering Inaccuracies
Unauthorized Consumption
Unbilled Unmetered Auth Cons
Unbilled Metered Authorized Cons

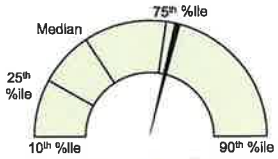
	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	47.4	$545,747	CRUC
Real Losses	472.2	$243,702	VPC
Unbilled Authorized Cons	33.7	$17,388	VPC
Non-Revenue Water	553.2	$806,837	Blended

Key Performance Indicators

Actual KPI result

Target (see Worksheet)

gauge %iles per validated Industry ranges[2]

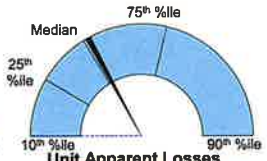


Total Loss Cost Rate
32.95 $/conn/year

Apparent Loss Cost Rate
22.78 $/conn/year

Real Loss Cost Rate
10.17 $/conn/year

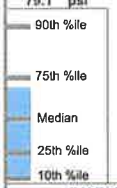
Unit Total Losses
59.4 gal/conn/day

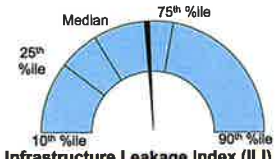


Unit Apparent Losses
5.4 gal/conn/day

Unit Real Losses[A]
54.0 gal/conn/day

Average Operating Pressure
79.1 psi





Infrastructure Leakage Index (ILI)
2.7 dimensionless

Unit Real Losses[B]
3,896 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 175.8 MG/Yr 20.1 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 630 Wyomissing
Audit Year: 2022 | Jan 01 2023 - Dec 31 2023 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

			n	g				n	g				
VOS	Volume from Own Sources:		n	g	9	918.693	MG/Yr	n	g	10	1.72%	percent	under-registration VOSEA
WI	Water Imported:		n	g	n/a	0.000	MG/Yr						WIEA
WE	Water Exported:		n	g	n/a	0.000	MG/Yr						WEEA
	WATER SUPPLIED:					934.771	MG/Yr						

AUTHORIZED CONSUMPTION

choose entry option:

			n	g						
BMAC	Billed Metered:	n	g	9	782.501	MG/Yr				
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr				
UMAC	Unbilled Metered:	n	g	10	3.518	MG/Yr				
UUAC	Unbilled Unmetered:	n	g	10	16.012	MG/Yr	custom	16.012	MG/Yr	
	AUTHORIZED CONSUMPTION:				802.031	MG/Yr				

WATER LOSSES

132.740 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

			n	g						
SDHE	Systematic Data Handling Errors:	n	g	3	1.956	MG/Yr	0.25%	default		
CMI	Customer Metering Inaccuracies:	n	g	7	16.041	MG/Yr	2.00%	percent		under-registration
UC	Unauthorized Consumption:	n	g	3	1.956	MG/Yr	0.25%	default		

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 19.954 MG/Yr

Real Losses

Real Losses: 112.786 MG/Yr

WATER LOSSES: 132.740 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 152.270 MG/Yr

SYSTEM DATA

			n	g				
Lm	Length of mains:	n	g	10	168.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	12,019		(active *and* inactive)
	Service connection density:				72	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	21.1	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	86.2	psi	

COST DATA

			n	g				
CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$233.88	$/Million gallons	$4,036,903	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Unauthorized Consumption (UC)
3: Systematic Data Handling Errors (SDHE)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

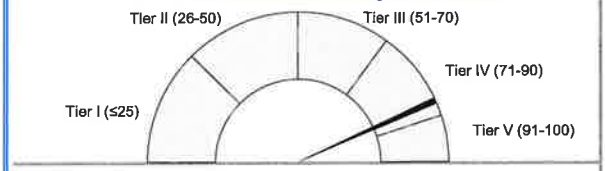
FWAS v6.0 | Water Audit Report for: PAW - 630 Wyomissing | Audit Year: 2022 Calendar | Jan 01 2023 - Dec 31 2023

go to worksheet | go to grading | go to references

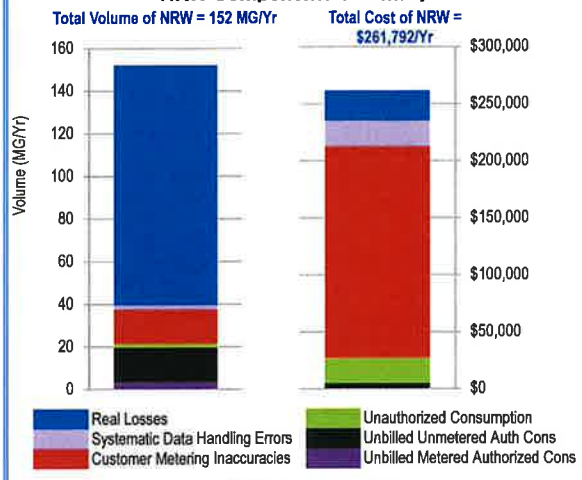
Data Validity

Data Validity Score: 86 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

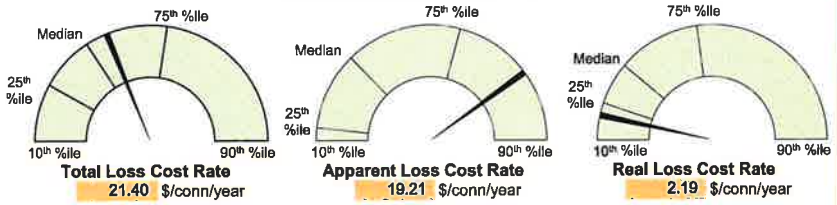


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	20.0	$230,846	CRUC
Real Losses	112.8	$26,378	VPC
Unbilled Authorized Cons	19.5	$4,568	VPC
Non-Revenue Water	152.3	$261,792	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

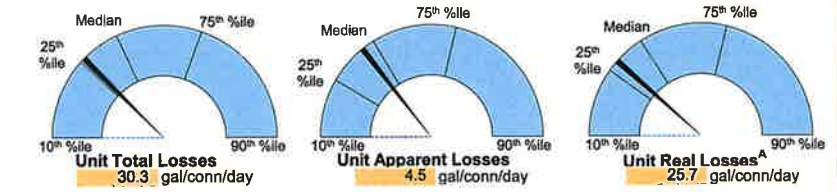
gauge %iles per validated Industry ranges[2]



Total Loss Cost Rate 21.40 $/conn/year

Apparent Loss Cost Rate 19.21 $/conn/year

Real Loss Cost Rate 2.19 $/conn/year

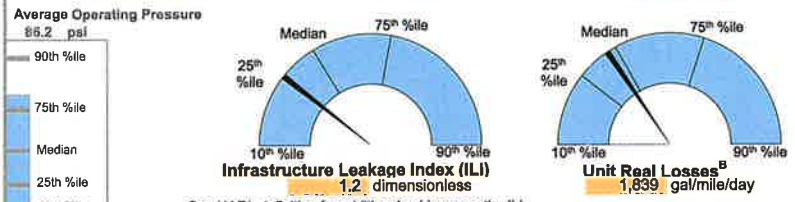


Unit Total Losses 30.3 gal/conn/day

Unit Apparent Losses 4.5 gal/conn/day

Unit Real Losses[A] 25.7 gal/conn/day

Average Operating Pressure 86.2 psi



Infrastructure Leakage Index (ILI) 1.2 dimensionless

Unit Real Losses[B] 1,899 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 96.7 MG/Yr 22.0 gal/conn/day

Guidance Information for Key Performance Indicators

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- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
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Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association.

Water Audit Report for: PAW - 640 Royersford
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n	g	10	1,489.086	MG/Yr	n g 10	0.02%	percent	under-registration	VOSEA
WI	Water Imported:	n	g	9	51.896	MG/Yr	n g 9	0.00%	percent		WIEA
WE	Water Exported:	n	g		0.000	MG/Yr					WEEA
	WATER SUPPLIED:				1,541.280	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	9	1,361.775	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	7.653	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	7.170	MG/Yr	custom	7.170	MG/Yr
	AUTHORIZED CONSUMPTION:				1,376.598	MG/Yr			

WATER LOSSES

164.682 MG/Yr

Apparent Losses

choose entry option:

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	3.404	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	27.948	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	3.404	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 34.756 MG/Yr

Real Losses

Real Losses: 129.925 MG/Yr

WATER LOSSES: 164.682 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 179.505 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	294.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	17,582		(active *and* inactive)
	Service connection density:				60	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	20.0	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	70.3	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$565.10	$/Million gallons	$6,084,075	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

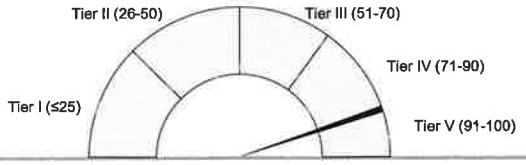
Water Audit Report for: PAW - 640 Royersford

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

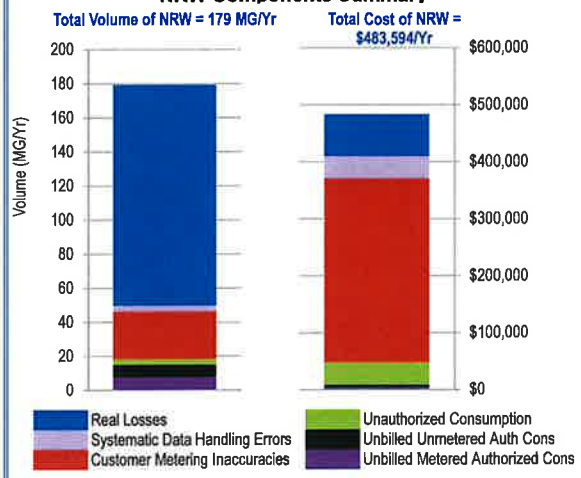
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

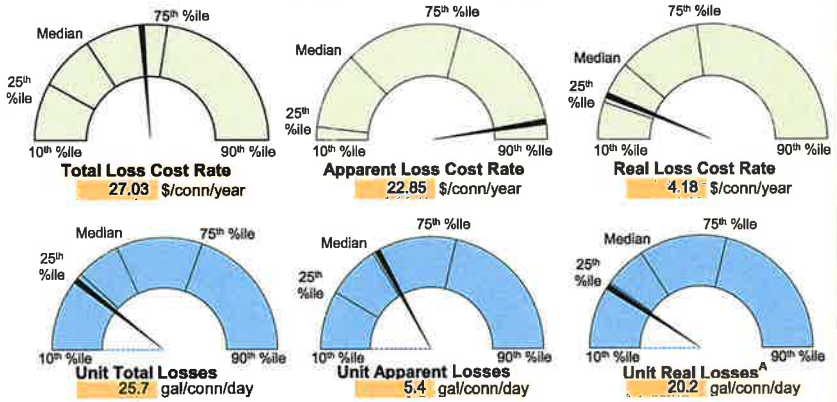


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	34.8	$401,797	CRUC
Real Losses	129.9	$73,421	VPC
Unbilled Authorized Cons	14.8	$8,376	VPC
Non-Revenue Water	179.5	$483,594	Blended

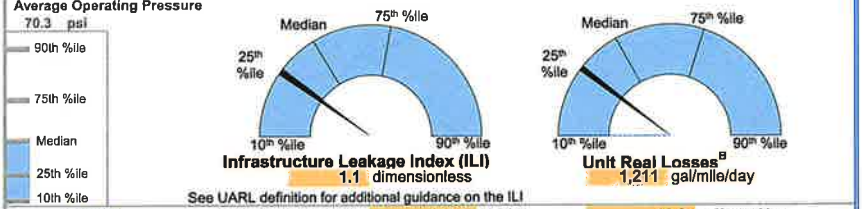
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 70.3 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 121.3 MG/Yr 18.9 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association.

Water Audit Report for: PAW - 650 Coatesville
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	10	1,285.150	MG/Yr	n	g	10	2.50%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr						WIEA
WE	Water Exported:	n	g	9	5.861	MG/Yr	n	g	10	0.15%	percent	under-registration WEEA

WATER SUPPLIED: 1,312.233 MG/Yr

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n	g	9	1,042.872	MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n	g	10	48.740	MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	36.860	MG/Yr	custom	36.860	MG/Yr

AUTHORIZED CONSUMPTION: 1,128.472 MG/Yr

WATER LOSSES

183.761 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n	g	3	2.607	MG/Yr	0.25%	default	under-registration
CMI	Customer Metering Inaccuracies:	n	g	7	22.278	MG/Yr	2.00%	percent	
UC	Unauthorized Consumption:	n	g	3	2.607	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 27.492 MG/Yr

Real Losses

Real Losses: 156.269 MG/Yr

WATER LOSSES: 183.761 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 269.361 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	226.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	13,243		(active *and* inactive)
	Service connection density:				59	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	19.6	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	83.4	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$957.63	$/Million gallons	$4,677,382	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

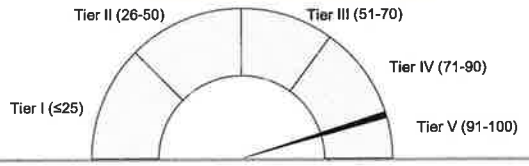
Water Audit Report for: PAW - 650 Coatesville

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

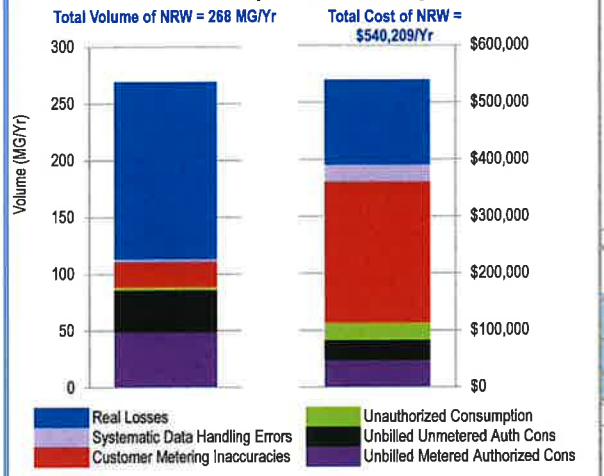
Data Validity

Data Validity Score: 90 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

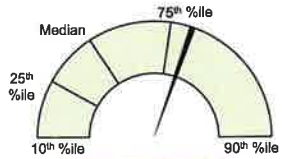


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	27.5	$308,588	CRUC
Real Losses	156.3	$149,648	VPC
Unbilled Authorized Cons	85.6	$81,973	VPC
Non-Revenue Water	269.4	$540,209	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



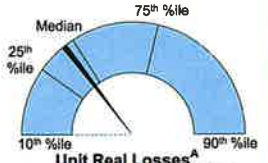
Total Loss Cost Rate 34.60 $/conn/year

Apparent Loss Cost Rate 23.30 $/conn/year

Real Loss Cost Rate 11.30 $/conn/year

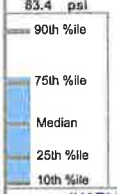
Unit Total Losses 38.0 gal/conn/day

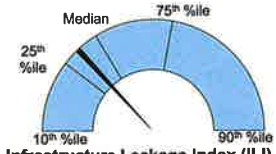
Unit Apparent Losses 5.7 gal/conn/day



Unit Real Losses[4] 32.3 gal/conn/day

Average Operating Pressure 83.4 psi





Infrastructure Leakage Index (ILI) 1.4 dimensionless

Unit Real Losses[B] 1,894 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 108.9 MG/Yr 22.5 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 660 Lake Heritage
Audit Year: 2023 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

		n	g				n	g				
VOS	Volume from Own Sources:	n	g	9	47.547	MG/Yr	n	g	10	1.00%	percent	over-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr						WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr						WEEA
	WATER SUPPLIED:				47.076	MG/Yr						

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n	g	9	37.200	MG/Yr						
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr						
UMAC	Unbilled Metered:	n	g	10	0.620	MG/Yr						
UUAC	Unbilled Unmetered:	n	g	10	1.601	MG/Yr	choose entry option: custom 1.601 MG/Yr					
	AUTHORIZED CONSUMPTION:				39.421	MG/Yr						

WATER LOSSES

7.655 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

Default option selected for Unauthorized Consumption, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	0.093	MG/Yr	choose entry option: 0.25% default					
CMI	Customer Metering Inaccuracies:	n	g	3	0.772	MG/Yr	2.00% percent					under-registration
UC	Unauthorized Consumption:	n	g	3	0.093	MG/Yr	0.25% default					
	Apparent Losses:				0.958	MG/Yr						

Real Losses

	Real Losses:				6.697	MG/Yr
	WATER LOSSES:				7.655	MG/Yr

NON-REVENUE WATER

	NON-REVENUE WATER:				9.876	MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	13.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	755		(active *and* inactive)
	Service connection density:				58	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	20.9	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	74.6	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$274.55	$/Million gallons	$277,956	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Customer Metering Inaccuracies (CMI)
2: Volume from Own Sources (VOS)
3: Unauthorized Consumption (UC)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

Water Audit Report for: PAW - 660 Lake Heritage

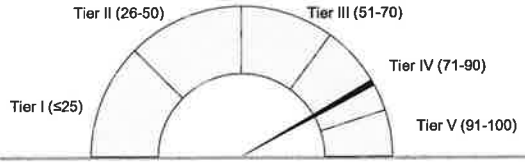
Audit Year: 2023 Calendar

Jan 01 2022 - Dec 31 2022

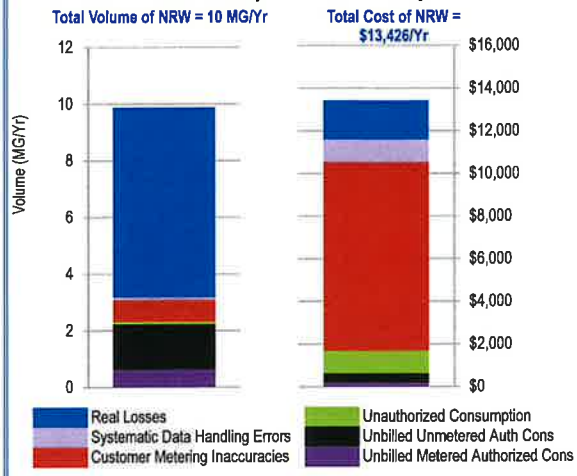
Data Validity

Data Validity Score: 83 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

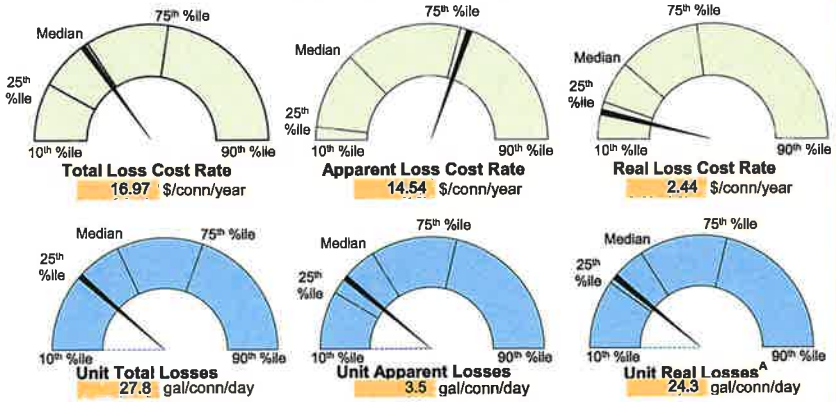


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	1.0	$10,977	CRUC
Real Losses	6.7	$1,839	VPC
Unbilled Authorized Cons	2.2	$610	VPC
Non-Revenue Water	9.9	$13,426	Blended

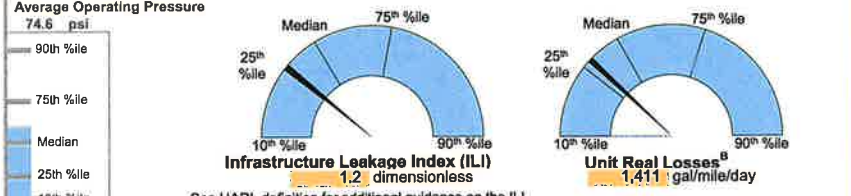
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure 74.6 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 5.6 MG/Yr 20.4 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 680 Lehman Pike
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

VOS	Volume from Own Sources:	n	g	9	541.279	MG/Yr	n g 10	0.04%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr				WEEA
	WATER SUPPLIED:				541.496	MG/Yr				

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n	g	9	411.998	MG/Yr				
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr				
UMAC	Unbilled Metered:	n	g	10	9.721	MG/Yr	choose entry option:			
UUAC	Unbilled Unmetered:	n	g	10	19.210	MG/Yr	custom	19.210	MG/Yr	
	AUTHORIZED CONSUMPTION:				440.929	MG/Yr				

WATER LOSSES

100.567 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

Default option selected for Unauthorized Consumption, with automatic data grading of 3

SDHE	Systematic Data Handling Errors:	n	g	3	1.030	MG/Yr	choose entry option: 0.25%	default	under-registration
CMI	Customer Metering Inaccuracies:	n	g	7	8.607	MG/Yr	2.00%	percent	
UC	Unauthorized Consumption:	n	g	3	1.030	MG/Yr	0.25%	default	
	Apparent Losses:				10.667	MG/Yr			

Real Losses

	Real Losses:				89.900	MG/Yr
	WATER LOSSES:				100.567	MG/Yr

NON-REVENUE WATER

	NON-REVENUE WATER:				129.498	MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	173.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	9,727		(active *and* inactive)
	Service connection density:				56	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	22.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	53.7	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$928.31	$/Million gallons	$2,671,376 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Unauthorized Consumption (UC)
3: Systematic Data Handling Errors (SDHE)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

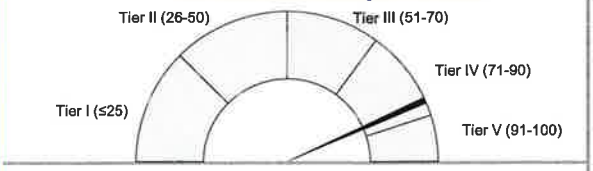
Water Audit Report for: PAW - 680 Lehman Pike

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

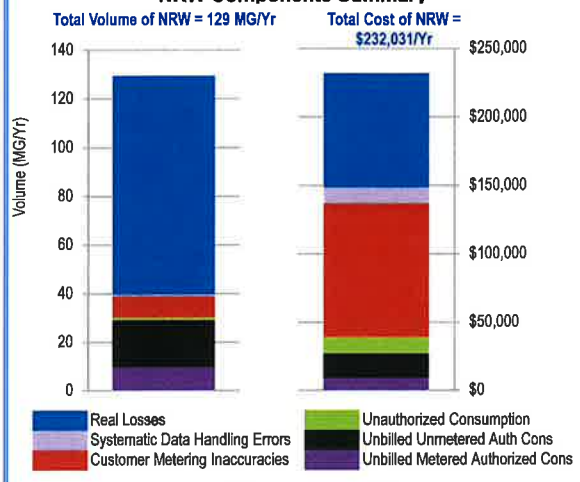
Data Validity

Data Validity Score: 86 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary



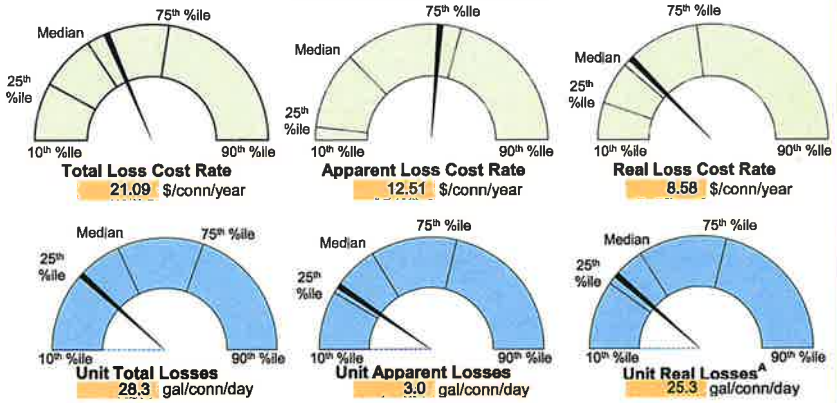
	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	10.7	$121,719	CRUC
Real Losses	89.9	$83,455	VPC
Unbilled Authorized Cons	28.9	$26,857	VPC
Non-Revenue Water	129.5	$232,031	Blended

Key Performance Indicators

Actual KPI result

Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure 53.7 psi

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 53.1 MG/Yr 15.0 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 710 Milton
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

Water Supplied Error Adjustments

WATER SUPPLIED

choose entry option:

VOS	Volume from Own Sources:	n g 10	2,059.520	MG/Yr	n g 10	0.55%	percent	under-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		2,070.910	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 9	1,548.914	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	2.600	MG/Yr			
UUAC	Unbilled Unmetered:	n g 10	35.938	MG/Yr	custom	35.938	MG/Yr
	AUTHORIZED CONSUMPTION:		1,587.452	MG/Yr			

WATER LOSSES

483.458 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	3.872	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 6	31.664	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	3.872	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 39.408 MG/Yr

Real Losses

Real Losses: 444.050 MG/Yr

WATER LOSSES: 483.458 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 521.996 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	242.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	13,808		(active *and* inactive)
	Service connection density:		57	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	20.6	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 8	73.3	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$357.43	$/Million gallons	$4,105,514	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

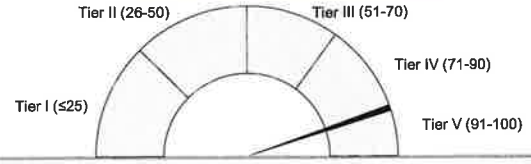
Water Audit Report for: PAW - 710 Milton

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

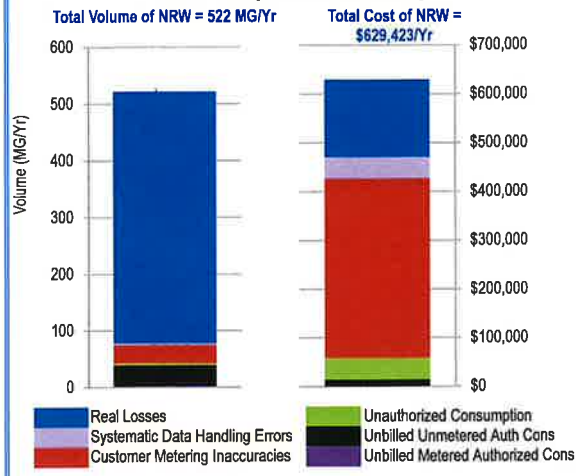
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary



	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	39.4	$456,931	CRUC
Real Losses	444.0	$158,717	VPC
Unbilled Authorized Cons	38.5	$13,775	VPC
Non-Revenue Water	522.0	$629,423	Blended

Key Performance Indicators

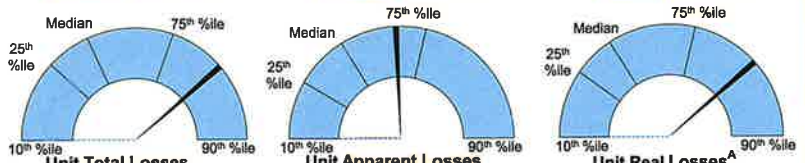
Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]

Total Loss Cost Rate 44.59 $/conn/year

Apparent Loss Cost Rate 33.09 $/conn/year

Real Loss Cost Rate 11.49 $/conn/year

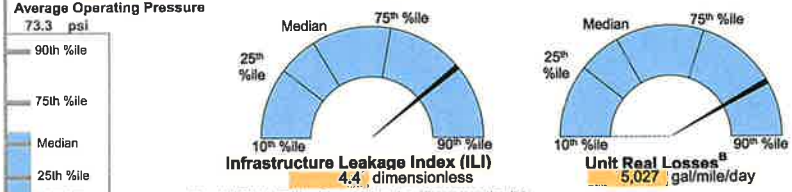


Unit Total Losses 95.9 gal/conn/day

Unit Apparent Losses 7.8 gal/conn/day

Unit Real Losses[A] 88.1 gal/conn/day

Average Operating Pressure 73.3 psi



Infrastructure Leakage Index (ILI) 4.4 dimensionless

Unit Real Losses[B] 5,027 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 101.3 MG/Yr 20.1 gal/conn/day

Guidance Information for Key Performance Indicators

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	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 720 Philipsburg
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

VOS	Volume from Own Sources:	n g 10	707.495	MG/Yr	n g 10	0.72%	percent	over-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		702.437	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option: custom 14.729 MG/Yr

BMAC	Billed Metered:	n g 9	383.595	MG/Yr	
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr	
UMAC	Unbilled Metered:	n g 10	0.946	MG/Yr	
UUAC	Unbilled Unmetered:	n g 10	14.729	MG/Yr	
	AUTHORIZED CONSUMPTION:		399.270	MG/Yr	

WATER LOSSES

303.167 MG/Yr

Apparent Losses

choose entry option:

	Default option selected for Systematic Data Handling Errors, with automatic data grading of 3						
SDHE	Systematic Data Handling Errors:	n g 3	0.959	MG/Yr	0.25%	default	under-registration
CMI	Customer Metering Inaccuracies:	n g 6	7.848	MG/Yr	2.00%	percent	
UC	Unauthorized Consumption:	n g 3	0.959	MG/Yr	0.25%	default	
	Default option selected for Unauthorized Consumption, with automatic data grading of 3						
	Apparent Losses:		9.766	MG/Yr			

Real Losses

	Real Losses:		293.402	MG/Yr
	WATER LOSSES:		303.167	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 318.842 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	301.5	miles	(Including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	9,628		(active *and* inactive)
	Service connection density:		32	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	17.0	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 10	99.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$574.42	$/Million gallons	$2,524,899	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** — go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

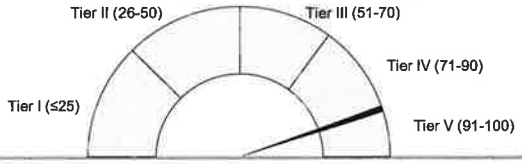
Water Audit Report for: PAW - 720 Philipsburg

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

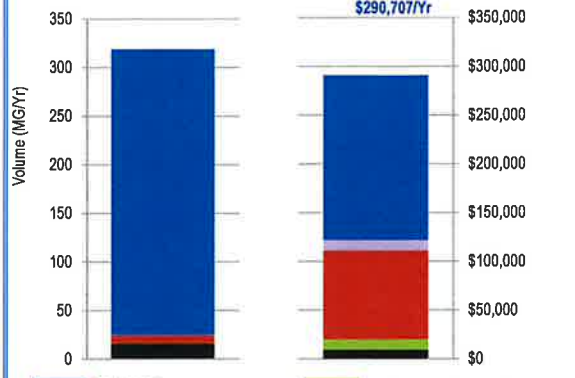
See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 319 MG/Yr

Total Cost of NRW = $290,707/Yr



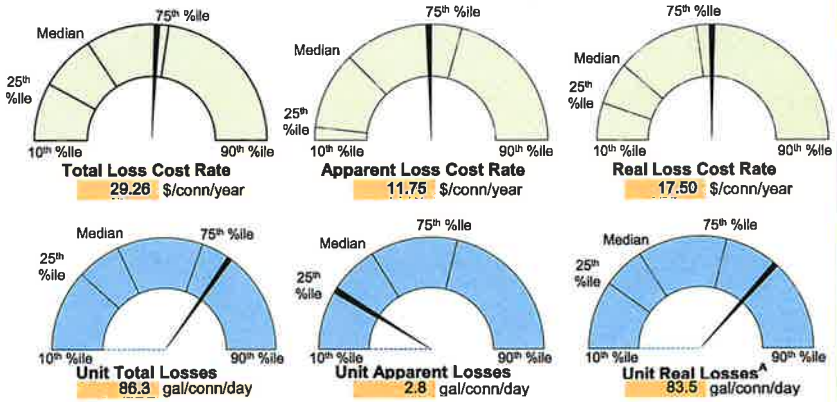
Real Losses
Systematic Data Handling Errors
Customer Metering Inaccuracies
Unauthorized Consumption
Unbilled Unmetered Auth Cons
Unbilled Metered Authorized Cons

	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	9.8	$113,167	CRUC
Real Losses	293.4	$168,536	VPC
Unbilled Authorized Cons	15.7	$9,004	VPC
Non-Revenue Water	318.8	$290,707	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Total Loss Cost Rate 29.26 $/conn/year

Apparent Loss Cost Rate 11.75 $/conn/year

Real Loss Cost Rate 17.50 $/conn/year

Unit Total Losses 86.3 gal/conn/day

Unit Apparent Losses 2.8 gal/conn/day

Unit Real Losses[A] 83.5 gal/conn/day

Average Operating Pressure 99 psi

AOP is above 90th %ile

90th %ile
75th %ile
Median
25th %ile
10th %ile

Infrastructure Leakage Index (ILI) 2.5 dimensionless

Unit Real Losses[B] 2,666 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 119.5 MG/Yr 34.0 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association.

Water Audit Report for: PAW - 730 Berwick
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

VOS	Volume from Own Sources:	n g 10	461.256	MG/Yr	n g 10	0.70%	percent	under-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		464.508	MG/Yr					

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n g 9	314.971	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	0.977	MG/Yr	choose entry option:		
UUAC	Unbilled Unmetered:	n g 10	11.631	MG/Yr	custom	11.631	MG/Yr
	AUTHORIZED CONSUMPTION:		327.579	MG/Yr			

WATER LOSSES

136.929 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	0.787	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 6	6.448	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	0.787	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 8.023 MG/Yr

Real Losses

Real Losses: 128.906 MG/Yr

WATER LOSSES: 136.929 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 149.537 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	82.5	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	7,041		(active *and* inactive)
	Service connection density:		85	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	17.5	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 8	90.5	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$241.74	$/Million gallons	$2,006,963	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

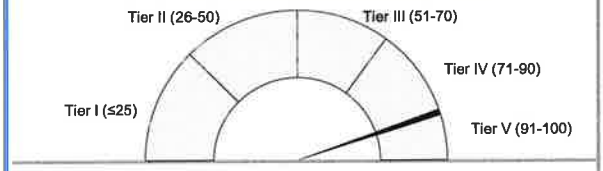
Water Audit Report for: PAW - 730 Berwick

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

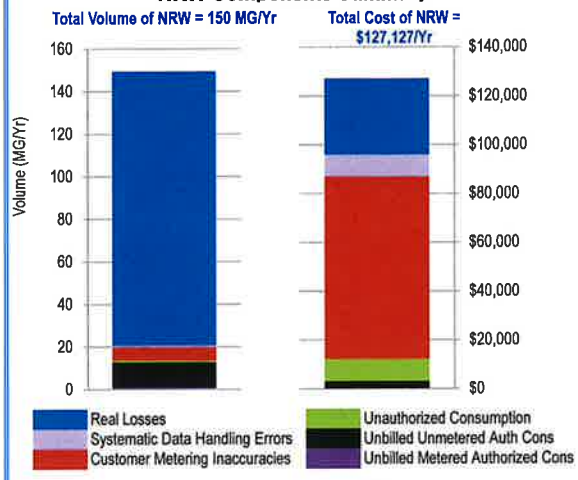
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

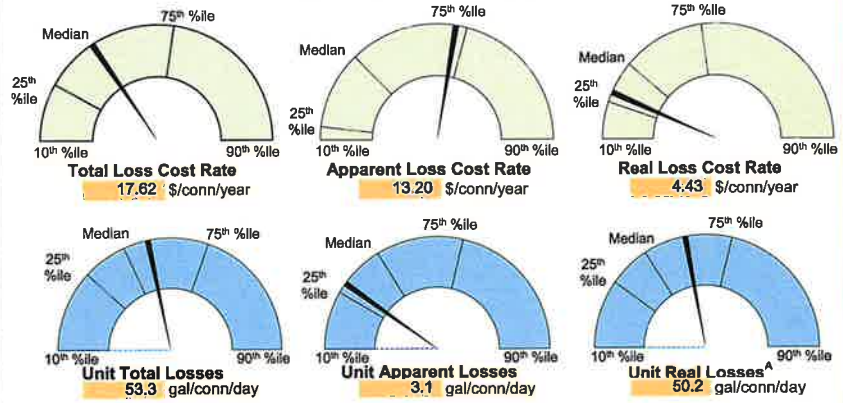


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	8.0	$92,918	CRUC
Real Losses	128.9	$31,162	VPC
Unbilled Authorized Cons	12.6	$3,048	VPC
Non-Revenue Water	149.5	$127,127	Blended

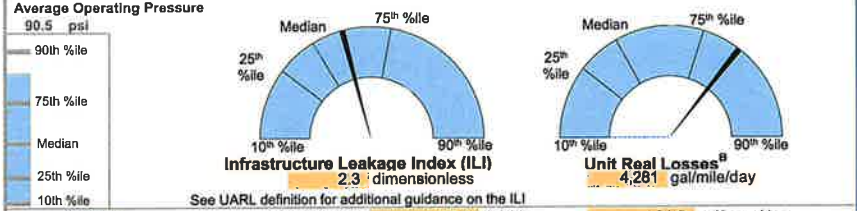
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated Industry ranges[2]



Average Operating Pressure 90.5 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 55.4 MG/Yr 21.6 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 740 Frackville
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

		n	g				n	g					
VOS	Volume from Own Sources:	n	g	10	112.017	MG/Yr	n	g	10	0.35%	percent	over-registration	VOSEA
WI	Water Imported:	n	g	9	2.230	MG/Yr	n	g	10	0.15%	percent	under-registration	WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr							WEEA
	WATER SUPPLIED:				113.860	MG/Yr							

AUTHORIZED CONSUMPTION

BMAC	Billed Metered:	n	g	9	101.965	MG/Yr							
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr							
UMAC	Unbilled Metered:	n	g	10	0.349	MG/Yr							
UUAC	Unbilled Unmetered:	n	g	10	1.182	MG/Yr	choose entry option:						
							custom	1.182	MG/Yr				
	AUTHORIZED CONSUMPTION:				103.496	MG/Yr							

WATER LOSSES

10.364 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

		n	g						
SDHE	Systematic Data Handling Errors:	n	g	3	0.255	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	2.088	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.255	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 2.598 MG/Yr

Real Losses

Real Losses: 7.766 MG/Yr

WATER LOSSES: 10.364 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 11.895 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	26.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	2,739		(active *and* inactive)
	Service connection density:				103	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.9	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	49.7	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$806.49	$/Million gallons	$744,832	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

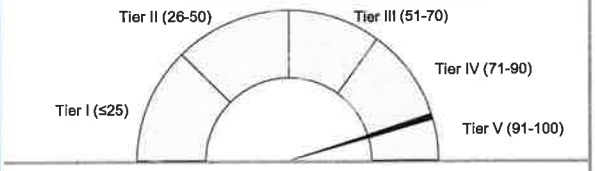
Water Audit Report for: PAW - 740 Frackville

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

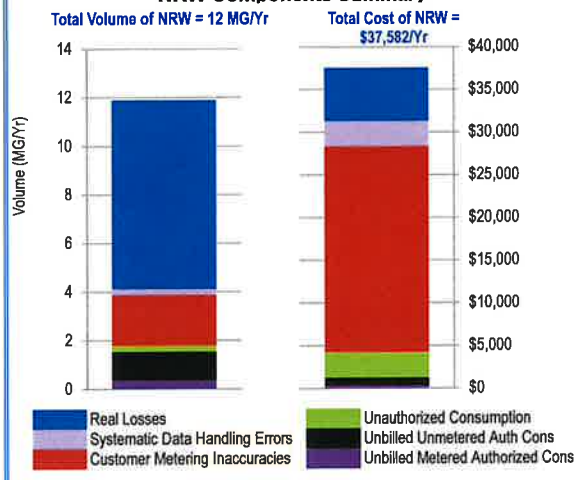
Data Validity

Data Validity Score: 90 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary



	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	2.6	$30,084	CRUC
Real Losses	7.8	$6,263	VPC
Unbilled Authorized Cons	1.5	$1,235	VPC
Non-Revenue Water	11.9	$37,582	Blended

Key Performance Indicators

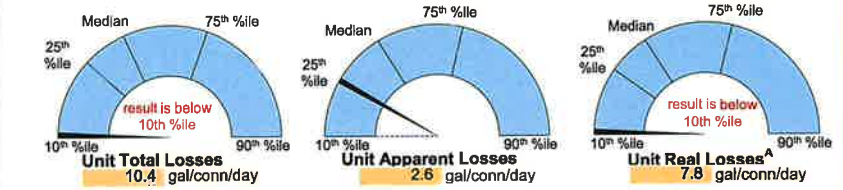
Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]

Total Loss Cost Rate 13.27 $/conn/year

Apparent Loss Cost Rate 10.98 $/conn/year

Real Loss Cost Rate 2.29 $/conn/year



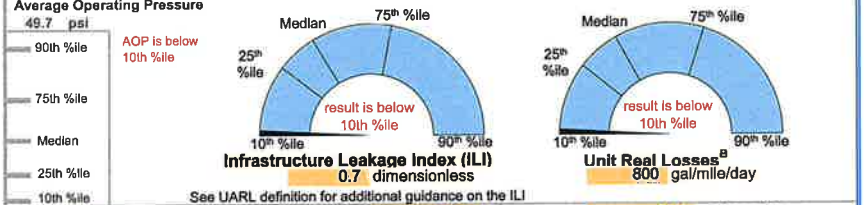
Unit Total Losses 10.4 gal/conn/day

Unit Apparent Losses 2.6 gal/conn/day

Unit Real Losses[A] 7.8 gal/conn/day

Average Operating Pressure 49.7 psi

AOP is below 10th %ile



Infrastructure Leakage Index (ILI) 0.7 dimensionless

Unit Real Losses[B] 800 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 11.4 MG/Yr 11.4 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 770 Boggs
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

						choose entry option:				
VOS	Volume from Own Sources:	n	g	7	7.745 MG/Yr	n g 10	0.52%	percent	under-registration	VOSEA
WI	Water Imported:	n	g	n/a	0.000 MG/Yr					WIEA
WE	Water Exported:	n	g	n/a	0.000 MG/Yr					WEEA
	WATER SUPPLIED:				7.785 MG/Yr					

AUTHORIZED CONSUMPTION

						choose entry option:		
BMAC	Billed Metered:	n	g	9	7.184 MG/Yr			
BUAC	Billed Unmetered:	n	g	n/a	0.000 MG/Yr			
UMAC	Unbilled Metered:	n	g	n/a	0.000 MG/Yr			
UUAC	Unbilled Unmetered:	n	g	10	0.210 MG/Yr	custom	0.210	MG/Yr
	AUTHORIZED CONSUMPTION:				7.394 MG/Yr			

WATER LOSSES

0.391 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

						choose entry option:		
SDHE	Systematic Data Handling Errors:	n	g	3	0.018 MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	3	0.073 MG/Yr	1.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	0.018 MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 0.108 MG/Yr

Real Losses

Real Losses: 0.283 MG/Yr

WATER LOSSES: 0.391 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 0.601 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	29.0 miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	2,434	(active *and* inactive)
	Service connection density:				84 conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No	
Lp	Average length of (private) customer service line:	n	g	10	16.5 ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	110.0 psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$1,775.08	$/Million gallons	$7,659 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Customer Metering Inaccuracies (CMI)
3: Unauthorized Consumption (UC)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

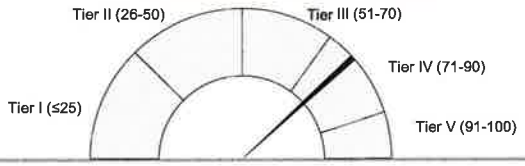
Water Audit Report for: PAW - 770 Boggs

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

Data Validity

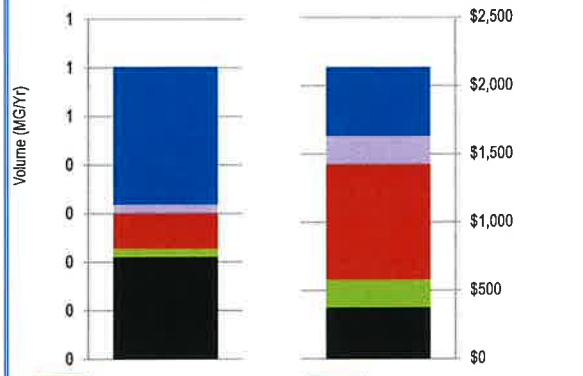
Data Validity Score: 76 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 1 MG/Yr **Total Cost of NRW = $2,135/Yr**

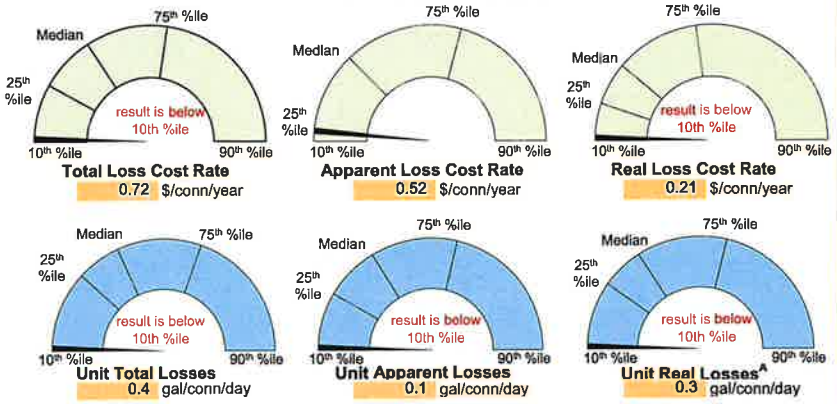


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	0.1	$1,260	CRUC
Real Losses	0.3	$502	VPC
Unbilled Authorized Cons	0.2	$373	VPC
Non-Revenue Water	0.6	$2,135	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 110 psi

AOP is above 90th %ile

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses: 23.2 MG/Yr | 26.2 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
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- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 780 Nittany
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

VOS	Volume from Own Sources:	n	g	7	53.832	MG/Yr	n g 10	0.38%	percent	under-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n	g	1	0.116	MG/Yr	n g 4		percent	WEEA
	WATER SUPPLIED:				53.921	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option: custom 0.314 MG/Yr

BMAC	Billed Metered:	n	g	9	36.628	MG/Yr
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr
UMAC	Unbilled Metered:	n	g	10	0.210	MG/Yr
UUAC	Unbilled Unmetered:	n	g	10	0.314	MG/Yr
	AUTHORIZED CONSUMPTION:				37.152	MG/Yr

WATER LOSSES

16.769 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option: under-registration

SDHE	Systematic Data Handling Errors:	n	g	3	0.092	MG/Yr	0.25%	default
CMI	Customer Metering Inaccuracies:	n	g	2	0.752	MG/Yr	2.00%	percent
UC	Unauthorized Consumption:	n	g	3	0.092	MG/Yr	0.25%	default

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 0.935 MG/Yr

Real Losses

Real Losses: 15.834 MG/Yr

WATER LOSSES: 16.769 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 17.293 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	14.6	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	738		(active *and* inactive)
	Service connection density:				51	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.3	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	85.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost
VPC	Variable Production Cost:	n	g	10	$394.17	$/Million gallons	$184,134 $/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. ***** go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Customer Metering Inaccuracies (CMI)
3: Unauthorized Consumption (UC)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

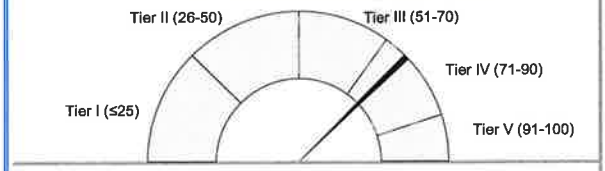
Water Audit Report for: PAW - 780 Nittany

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

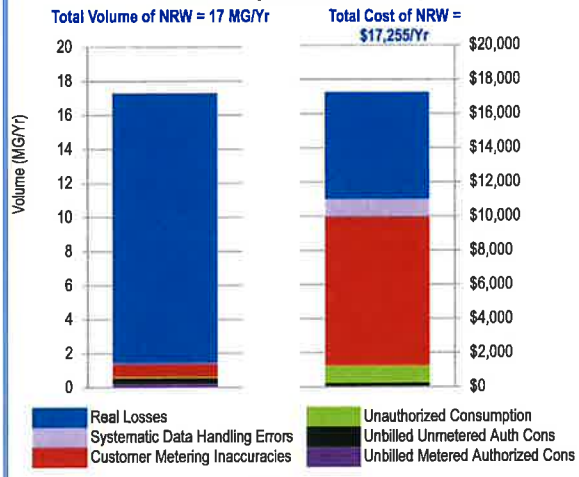
Data Validity

Data Validity Score: 75 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

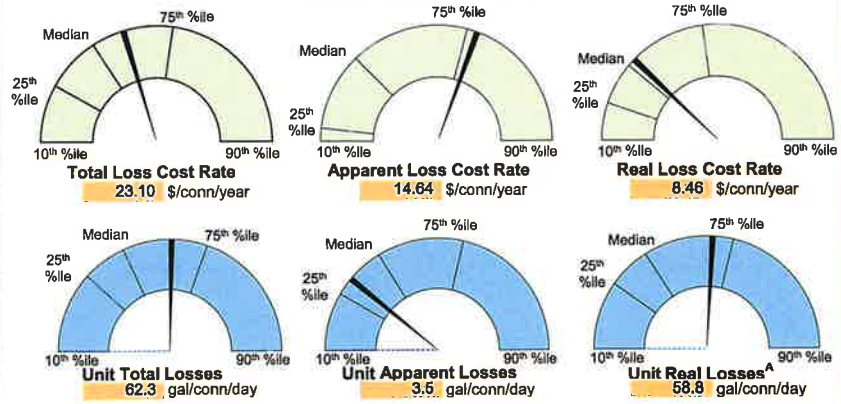


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	0.9	$10,807	CRUC
Real Losses	15.8	$6,241	VPC
Unbilled Authorized Cons	0.5	$207	VPC
Non-Revenue Water	17.3	$17,255	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Total Loss Cost Rate 23.10 $/conn/year

Apparent Loss Cost Rate 14.64 $/conn/year

Real Loss Cost Rate 8.46 $/conn/year

Unit Total Losses 62.3 gal/conn/day

Unit Apparent Losses 3.5 gal/conn/day

Unit Real Losses[A] 58.8 gal/conn/day

Average Operating Pressure 85 psi

90th %ile
75th %ile
Median
25th %ile
10th %ile

Infrastructure Leakage Index (ILI) 2.4 dimensionless

Unit Real Losses[B] 2,971 gal/mile/day

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 6.5 MG/Yr 24.1 gal/conn/day

Guidance Information for Key Performance Indicators

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Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
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	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: PAW - 840 McEwensville
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

VOS	Volume from Own Sources:	n g 10	5.959	MG/Yr	n g 10	0.00%	percent	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr				WEEA
	WATER SUPPLIED:		5.959	MG/Yr				

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 9	4.961	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	0.015	MG/Yr			
UUAC	Unbilled Unmetered:	n g 10	0.167	MG/Yr	custom	0.167	MG/Yr
	AUTHORIZED CONSUMPTION:		5.143	MG/Yr			

WATER LOSSES

0.816 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	0.012	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 6	0.050	MG/Yr	1.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	0.012	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 0.075 MG/Yr

Real Losses

Real Losses: 0.741 MG/Yr

WATER LOSSES: 0.816 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 0.998 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	2.7	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	158		(active *and* inactive)
	Service connection density:		59	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	22.6	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 8	50.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$882.53	$/Million gallons	$41,167	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

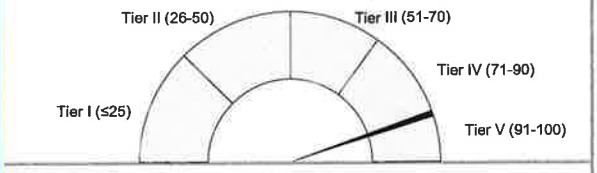
Water Audit Report for: PAW - 840 McEwensville

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

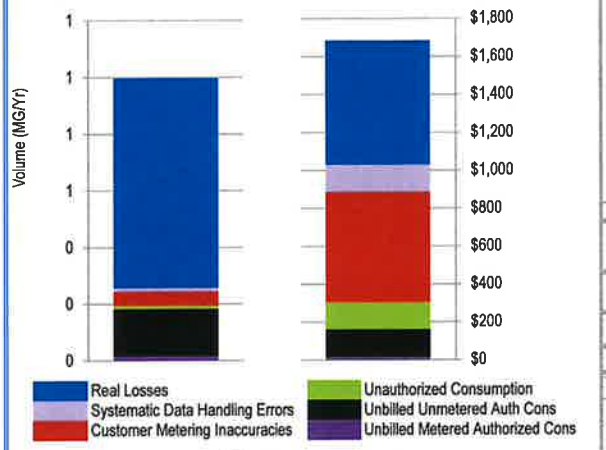
See Loss Control Planning for Tier Details



NRW Components Summary

Total Volume of NRW = 1 MG/Yr

Total Cost of NRW = $1,684/Yr

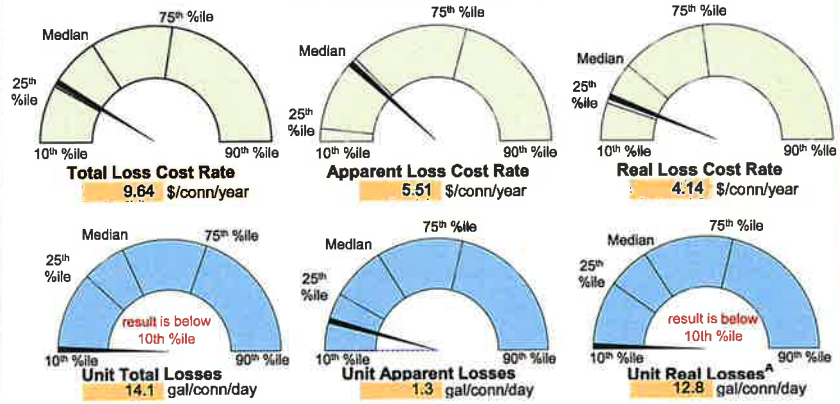


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	0.1	$870	CRUC
Real Losses	0.7	$654	VPC
Unbilled Authorized Cons	0.2	$161	VPC
Non-Revenue Water	1.0	$1,684	Blended

Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated Industry ranges[2]



Average Operating Pressure 50 psi

AOP is below 10th %ile

See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	0.8 MG/Yr	13.7 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

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American Water Works Association

Water Audit Report for: PAW - 880 Turbotville
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments — choose entry option:

VOS	Volume from Own Sources:	n g 10	20.766	MG/Yr	n g 10	1.25%	percent	under-registration	VOSEA
WI	Water Imported:	n g n/a	0.000	MG/Yr					WIEA
WE	Water Exported:	n g n/a	0.000	MG/Yr					WEEA
	WATER SUPPLIED:		21.029	MG/Yr					

AUTHORIZED CONSUMPTION

choose entry option:

BMAC	Billed Metered:	n g 9	14.221	MG/Yr			
BUAC	Billed Unmetered:	n g n/a	0.000	MG/Yr			
UMAC	Unbilled Metered:	n g 10	0.433	MG/Yr			
UUAC	Unbilled Unmetered:	n g 10	1.541	MG/Yr	custom	1.541	MG/Yr
	AUTHORIZED CONSUMPTION:		16.195	MG/Yr			

WATER LOSSES

4.834 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

choose entry option:

SDHE	Systematic Data Handling Errors:	n g 3	0.036	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n g 6	0.299	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n g 3	0.036	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 0.370 MG/Yr

Real Losses

Real Losses: 4.464 MG/Yr

WATER LOSSES: 4.834 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 6.808 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n g 10	4.8	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n g 10	305		(active *and* inactive)
	Service connection density:		63	conn./mile main	
	Are customer meters typically located at the curbstop/property line?		No		
Lp	Average length of (private) customer service line:	n g 10	22.2	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n g 8	56.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n g 10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n g 10	$1,037.66	$/Million gallons	$103,396	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Unauthorized Consumption (UC)
2: Systematic Data Handling Errors (SDHE)
3: Customer Metering Inaccuracies (CMI)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

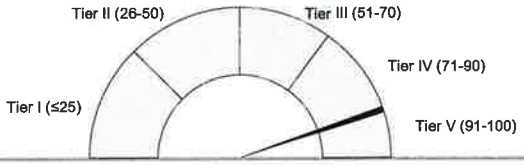
go to worksheet | go to grading | go to references

FWAS v6.0 | Water Audit Report for: PAW - 880 Turbotville | Audit Year: 2022 Calendar | Jan 01 2022 - Dec 31 2022

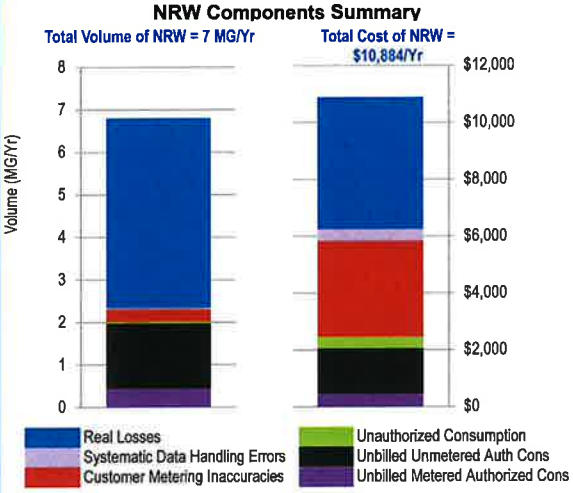
Data Validity

Data Validity Score: 89 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

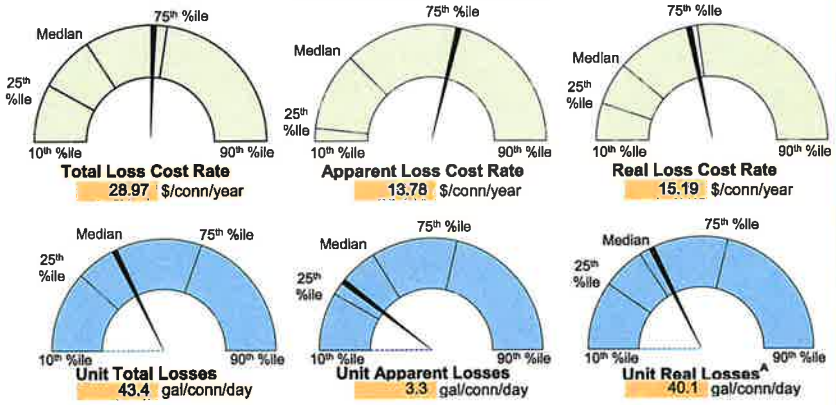


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	0.4	$4,204	CRUC
Real Losses	4.5	$4,632	VPC
Unbilled Authorized Cons	2.0	$2,048	VPC
Non-Revenue Water	6.8	$10,884	Blended

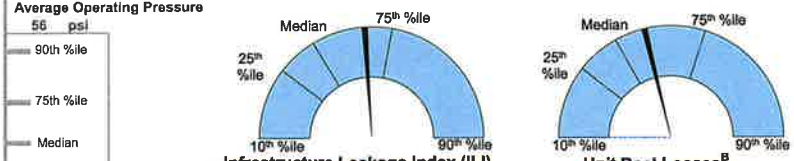
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 56 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	1.7 MG/Yr	15.0 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
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- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

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American Water Works Association

Water Audit Report for: PAW - 910 Scranton
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments

						choose entry option:				
VOS	Volume from Own Sources:	n	g	9	17,838.887	MG/Yr	n g 10	1.03%	percent	over-registration VOSEA
WI	Water Imported:	n	g	n/a	0.000	MG/Yr				WIEA
WE	Water Exported:	n	g	n/a	0.000	MG/Yr				WEEA
	WATER SUPPLIED:				17,657.020	MG/Yr				

AUTHORIZED CONSUMPTION

								choose entry option:		
BMAC	Billed Metered:	n	g	9	9,572.480	MG/Yr				
BUAC	Billed Unmetered:	n	g	n/a	0.000	MG/Yr				
UMAC	Unbilled Metered:	n	g	10	528.316	MG/Yr				
UUAC	Unbilled Unmetered:	n	g	5	370.155	MG/Yr		custom	370.155	MG/Yr
	AUTHORIZED CONSUMPTION:				10,470.951	MG/Yr				

WATER LOSSES

7,186.069 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3

							choose entry option:		
SDHE	Systematic Data Handling Errors:	n	g	3	23.931	MG/Yr	0.25%	default	
CMI	Customer Metering Inaccuracies:	n	g	7	206.139	MG/Yr	2.00%	percent	under-registration
UC	Unauthorized Consumption:	n	g	3	23.931	MG/Yr	0.25%	default	

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 254.001 MG/Yr

Real Losses

Real Losses: 6,932.068 MG/Yr

WATER LOSSES: 7,186.069 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 8,084.540 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	1,788.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	125,786		(active *and* inactive)
	Service connection density:				70	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	18.2	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	95.0	psi	

COST DATA

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)	Total Annual Operating Cost	
VPC	Variable Production Cost:	n	g	10	$237.43	$/Million gallons	$43,455,263	$/yr (optional input)

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Unauthorized Consumption (UC)
3: Systematic Data Handling Errors (SDHE)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

FWAS v6.0

AWWA Free Water Audit Software: Dashboard

go to worksheet | go to grading | go to references

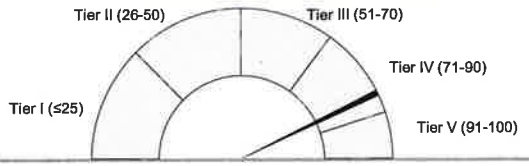
Water Audit Report for: PAW - 910 Scranton

Audit Year: 2022 Calendar Jan 01 2022 - Dec 31 2022

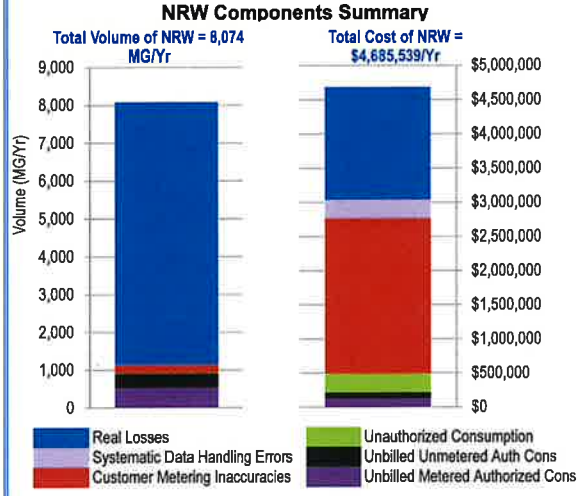
Data Validity

Data Validity Score: 85 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

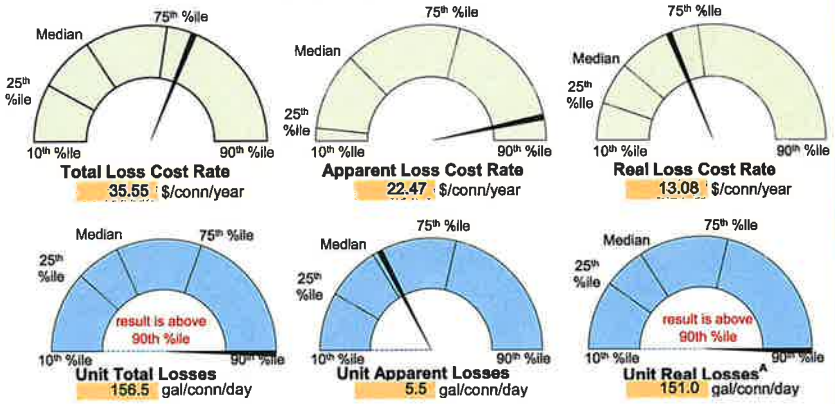


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	254.0	$2,826,334	CRUC
Real Losses	6,932.1	$1,645,881	VPC
Unbilled Authorized Cons	898.5	$213,324	VPC
Non-Revenue Water	8,084.5	$4,685,539	Blended

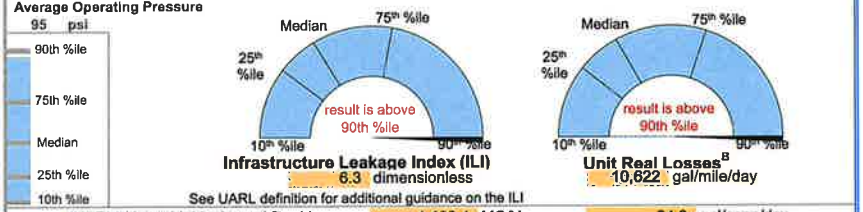
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure: 95 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses 1,102.4 MG/Yr 24.0 gal/conn/day

Guidance Information for Key Performance Indicators

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Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

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Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities

AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association

Water Audit Report for: Pennsylvania American Water
Audit Year: 2022 | Jan 01 2022 - Dec 31 2022 | Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To edit water system info: go to start page

To access definitions, click the input name

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

Water Supplied Error Adjustments
choose entry option: under-registration

VOS	Volume from Own Sources:	n	g	9	70,543.561	MG/Yr	0.71%	percent	VOSEA
WI	Water Imported:	n	g	9	1,012.888	MG/Yr	0.00%	percent	WIEA
WE	Water Exported:	n	g	9	706.309	MG/Yr	0.00%	percent	WEEA
	WATER SUPPLIED:				71,354.581	MG/Yr			

AUTHORIZED CONSUMPTION

choose entry option: custom 3,025.620 MG/Yr

BMAC	Billed Metered:	n	g	9	44,921.171	MG/Yr
BUAC	Billed Unmetered:	n	g	10		MG/Yr
UMAC	Unbilled Metered:	n	g	10	1,836.732	MG/Yr
UUAC	Unbilled Unmetered:	n	g	10	3,025.620	MG/Yr
	AUTHORIZED CONSUMPTION:				49,783.523	MG/Yr

WATER LOSSES

21,571.058 MG/Yr

Apparent Losses

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3
Default option selected for Unauthorized Consumption, with automatic data grading of 3

choose entry option: under-registration

SDHE	Systematic Data Handling Errors:	n	g	3	112.303	MG/Yr	0.25%	default
CMI	Customer Metering Inaccuracies:	n	g	7	954.243	MG/Yr	2.00%	percent
UC	Unauthorized Consumption:	n	g	3	112.303	MG/Yr	0.25%	default
	Apparent Losses:				1,178.849	MG/Yr		

Real Losses

	Real Losses:				20,392.209	MG/Yr
	WATER LOSSES:				21,571.058	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 26,433.410 MG/Yr

SYSTEM DATA

Lm	Length of mains:	n	g	10	10,434.0	miles	(including fire hydrant lead lengths)
Nc	Number of service connections:	n	g	10	680,206		(active *and* inactive)
	Service connection density:				65	conn./mile main	
	Are customer meters typically located at the curbstop/property line?				No		
Lp	Average length of (private) customer service line:	n	g	10	19.2	ft	(average distance between property line and meter)
AOP	Average Operating Pressure:	n	g	8	82.7	psi	

COST DATA

Total Annual Operating Cost: $223,230,187 $/yr (optional input)

CRUC	Customer Retail Unit Charge:	n	g	10	$11.61	$/1000 gallons (US)
VPC	Variable Production Cost:	n	g	10	$732.76	$/Million gallons

WATER AUDIT DATA VALIDITY TIER:

***** The Water Audit Data Validity Score is in Tier IV (71-90). See Dashboard tab for additional outputs. *****

go to dashboard

A weighted scale for the components of supply, consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:

Based on the information provided, audit reliability can be most improved by addressing the following components:

1: Volume from Own Sources (VOS)
2: Unauthorized Consumption (UC)
3: Systematic Data Handling Errors (SDHE)

KEY PERFORMANCE INDICATOR TARGETS:

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

Unit Total Losses:		gal/conn/day
Unit Apparent Losses:		gal/conn/day
Unit Real Losses[A]:		gal/conn/day
Unit Real Losses[B]:		gal/mile/day

If entered above by user, targets will display on KPI gauges (see Dashboard)

AWWA Free Water Audit Software: Dashboard

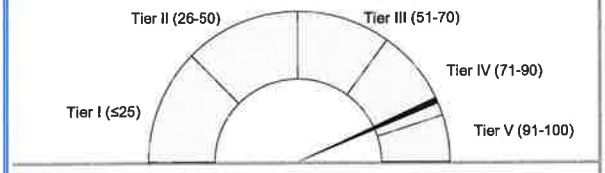
go to worksheet | go to grading | go to references

FWAS v6.0 **Water Audit Report for:** Pennsylvania American Water **Audit Year:** 2022 Calendar Jan 01 2022 - Dec 31 2022

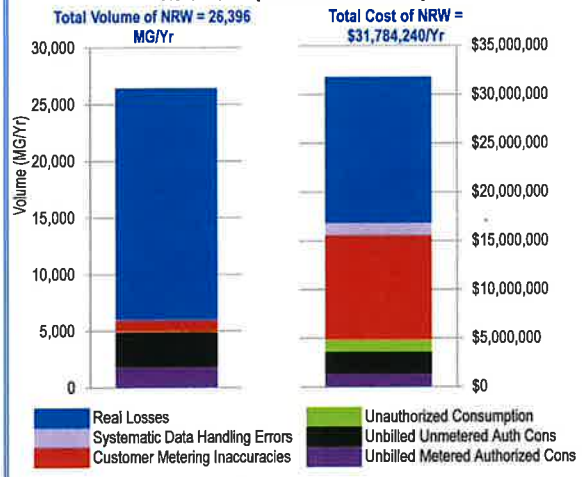
Data Validity

Data Validity Score: 88 **Data Validity Tier:** Tier IV (71-90)

See Loss Control Planning for Tier Details



NRW Components Summary

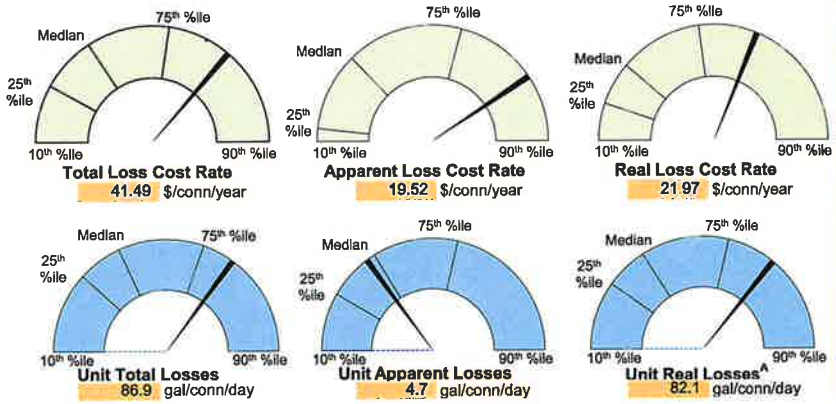


	Volume MG/Yr	Value $/Yr	Basis of Valuation
Apparent Losses	1,178.8	$13,278,708	CRUC
Real Losses	20,392.2	$14,942,595	VPC
Unbilled Authorized Cons	4,862.4	$3,562,937	VPC
Non-Revenue Water	26,433.4	$31,784,240	Blended

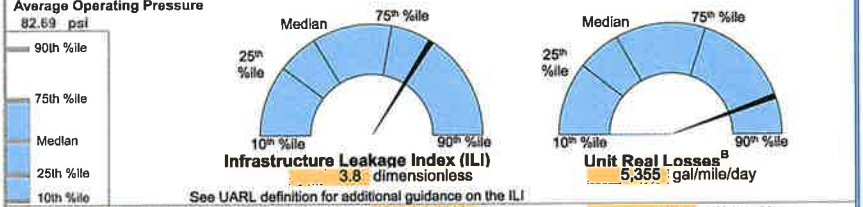
Key Performance Indicators

Actual KPI result | Target (see Worksheet)

gauge %iles per validated industry ranges[2]



Average Operating Pressure
82.69 psi



See UARL definition for additional guidance on the ILI

(UARL) Unavoidable Annual Real Losses	5,343.1 MG/Yr	21.5 gal/conn/day

Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can holistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- Percentiles (%iles) shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[3].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Table 1

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations

Type	Indicator	Description	Suitable Purposes: Assessment	Bench-Marking	Target-Setting	Planning	Tracking	Uses and Limitations	Principal Users
Attribute	Apparent Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Apparent Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess cost loss level	Utility, Regulators
	Real Loss Volume	Calculated by Free Water Audit Software	✓				✓	Assess loss level	Utility, Regulators
	Real Loss Cost	Calculated by Free Water Audit Software	✓				✓	Assess loss cost level	Utility, Regulators
	Unavoidable Annual Real Loss (UARL)	Calculated by Free Water Audit Software	✓				✓	Reveal theoretical technical low level of leakage	Utility, Regulators
Volume	Unit Apparent Losses (vol/conn/day)	Strong and understandable Indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators
	Unit Real Losses[A] (vol/conn/day)	Strong and understandable Indicator for multiple users.	✓	✓	✓	✓	✓	Used for performance tracking and target-setting	Utility, Regulators, Policy Makers
	Unit Real Losses[B] (vol/pipeline length/ day)	Strong and understandable indicator for use by utilities with low connection density.	✓	✓	✓	✓	✓	Data collection and assessment of systems with "low" connection density	Utility, Regulators, Policy Makers
	Unit Total Losses (vol/conn/day) **New KPI**	Strong and understandable Indicator, suitable for high-level performance measurement.	✓				✓	High level indicator for trending analysis. Not appropriate for target-setting or benchmarking	Utilities, Customers
	Infrastructure Leakage Index (ILI)	Robust, specialized ratio KPI; can be influenced by pressure and connection density.	✓	✓			✓	Benchmarking after pressure management is implemented	Utilities
Value	Apparent Loss Cost Rate (value/conn/year) **New KPI**	Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.	✓			✓	✓	Data collection and assessment on AWWA Indicators or contextual parameters to use in conjunction with Loss Cost Rates	Utilities, Regulators, Customers
	Real Loss Cost Rate (value/conn/year) **New KPI**		✓			✓	✓		Utilities, Regulators, Customers
Validity	Data Validity Tier (DVT)	Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.	✓	✓		✓	✓	Assess caliber of data inputs of the water audit	Regulators, Utilities