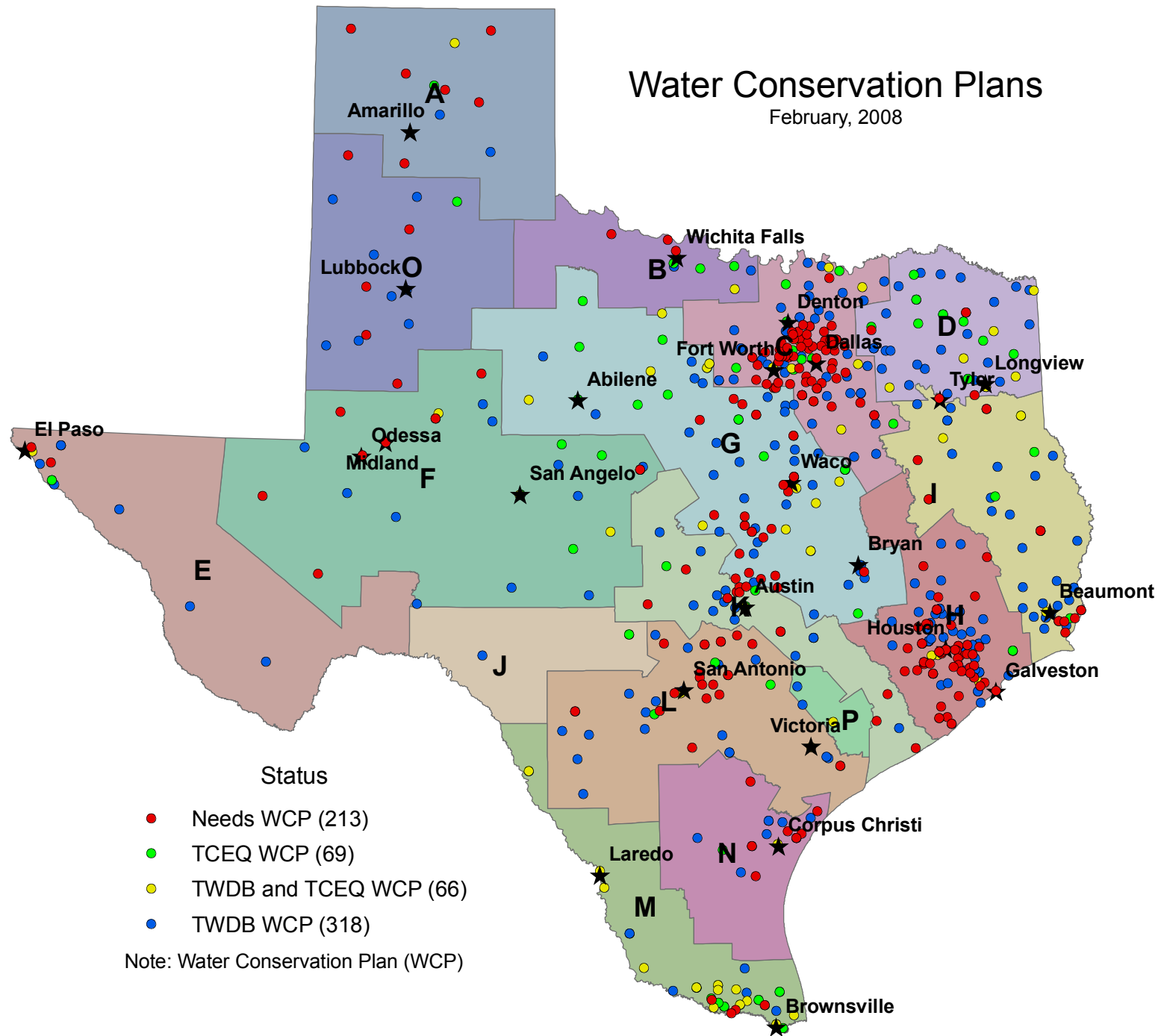


TWDB Description, Summary & Example of Agency Reports

- ❖ These are the guidelines for developing a water conservation plan for entities that are applying for financial assistance of \$500,000 or more from the TWDB:
<http://www.twdb.state.tx.us/assistance/conservation/Municipal/Plans/WaterConsPlanGuide.pdf>
- ❖ These are the guidelines for developing a water conservation plan for entities with 3,000 or more connections (due May 2009):
http://www.twdb.state.tx.us/assistance/conservation/Municipal/Plans/3300_Guidelines.pdf
- ❖ This is the utility profile form that need to be submitted with each water conservation plan:
<http://www.twdb.state.tx.us/assistance/conservation/Municipal/Plans/UtilityProfile.pdf>
- ❖ This is the annual report form currently used for entities with conservation plans:
<http://www.twdb.state.tx.us/assistance/conservation/Municipal/Plans/ConsProgAnnualRpt.pdf>
- ❖ Attached you will find the following:
 - A map showing distribution of water conservation plans in Texas.
 - A TWDB Water Audit Worksheet.

Water Conservation Plans

February, 2008



Texas Water Development Board Water Audit Worksheet

A. WATER UTILITY GENERAL INFORMATION

1. Water Utility Name: _____
 2. Contact: Name _____
Telephone# _____ Email Address _____
 3. Reporting Period: From ____/____/____ to ____/____/____
 4. Source Water Utilization, percentage: Surface Water _____% Groundwater _____%
 5. Population Served:
 - a. Retail Population Served _____
 - b. Wholesale Population Served _____
- | | | Assessment
Scale |
|---|-------|-----------------------------|
| 6. Utility's Length of Main Lines, miles | _____ | _____ |
| 7. Number of Wholesale Connections Served | _____ | |
| 8. Number of Retail Service Connections Served | _____ | |
| 9. Service Connection Density
<i>(Number of retail service connections/Miles of main lines)</i> | _____ | |
| 10. Average Yearly System Operating Pressure (psi) | _____ | _____ |
| 11. Volume Units of Measure (check one):
_____ acre-ft _____ million gallons _____ thousand gallons _____ gallons | | |

B. SYSTEM INPUT VOLUME

12. Water Volume from own Sources _____
13. Production Meter Accuracy (enter percentage) _____%
14. Corrected Input Volume _____
15. Wholesale Water Imported _____
16. Wholesale Water Exported _____
17. **System Input Volume**
*(Corrected input volume, plus imported water,
minus exported water)* _____

		Assessment Scale
C. AUTHORIZED CONSUMPTION		
18. Billed Metered	_____	_____
19. Billed Unmetered	_____	_____
20. Unbilled Metered	_____	_____
21. Unbilled Unmetered	_____	_____
22. Total Authorized Consumption	_____	
D. WATER LOSSES		
23. Water Losses	_____	
<i>(Line 17 minus Line 22)</i>		
E. APPARENT LOSSES		
24. Average Customer Meter Accuracy	_____ %	_____
<i>(Enter percentage)</i>		
25. Customer Meter Accuracy Loss	_____	
26. Systematic Data Handling Discrepancy	_____	_____
27. Unauthorized Consumption	_____	_____
28. Total Apparent Losses	_____	
F. REAL LOSSES		
29. Reported Breaks and Leaks	_____	_____
<i>(Estimated volume of leaks and breaks repaired during the audit period)</i>		
30. Unreported Loss	_____	_____
<i>(Includes all unknown water loss)</i>		
31. Total Real Losses	_____	
<i>(Line 29, plus Line 30)</i>		
32. Water Losses (Apparent + Real)	_____	
<i>(Line 28 plus Line 31) = Line 23</i>		
33. Non-revenue Water	_____	
<i>(Water Losses + Unbilled Authorized Consumption)</i>		
<i>(Line 32, plus Line 20, plus Line 21)</i>		

G. TECHNICAL PERFORMANCE INDICATOR FOR APPARENT LOSS

34. Apparent Losses Normalized
(Apparent Loss Volume/# of Retail Service
Connections/365) _____

H. TECHNICAL PERFORMANCE INDICATORS FOR REAL LOSS

35. Real Loss Volume (*Line 31*) _____

36. Unavoidable Annual Real Losses, volume (calculated) _____

37. Infrastructure Leakage Index (calculated)
(*Equals real loss volume divided by unavoidable
annual real losses*) _____

38. Real Losses Normalized
(Real Loss Volume/# of Service Connections/365)
(*This indicator applies if service connection
density is greater than 32/mile*) _____

39. Real Losses Normalized
(Real Loss Volume/Miles of Main Lines/365)
(*This indicator applies if service connection
density is less than 32/mile*) _____

I. FINANCIAL PERFORMANCE INDICATORS

40. Total Apparent Losses (*Line 28*) _____

41. Retail Price of Water _____

42. Cost of Apparent Losses
(*Apparent loss volume multiplied by
retail cost of water, Line 40 x Line 41*) _____

43. Total Real Losses (*Line 31*) _____

44. Variable Production Cost of Water*
(**Note: In case of water shortage, real losses
might be valued at the retail price of water
instead of the variable production cost.*) _____

45. Cost of Real Losses
(*Real loss multiplied by variable production
cost of water, Line 43 x Line 44*) _____

46. Total Assessment Score _____

47. Total Cost Impact of Apparent and Real Losses _____

This page is intentionally blank.

Water Audit Worksheet Instructions

(All numbers used in this worksheet are for example purposes only)

The following instructions can be used in completing the Water Audit Worksheet. The instructions are labeled by line number shown on the worksheet. The Water Audit Worksheet requests that the water utility enter general information and water supply, consumption, and loss quantities. It also requests assessment scores representing the degree of validation of individual components. For those components that include an assessment line, enter a number between 1 and 5. (See Appendix 1.3 for more information.) If a component does not apply, then enter 0 (for example, if the water utility does not import any water, enter 0 for wholesale water imported). You may visit the TWDB Web site for the online version of the water audit:

http://www.twdb.state.tx.us/assistance/conservation/Municipal/Water_Audit/wald.asp

A. Water Utility Information

1. **Water Utility Name:** List the formal name of the water utility for which the water audit exists.
2. **Contact:** List the name of the primary contact person responsible for completing the water audit for the water utility, the telephone number, and email address.
3. **Reporting Period:** Enter calendar year or fiscal year dates for the reporting period.
4. **Source Water Utilization:** Enter percentages to represent the proportions of surface water and groundwater withdrawn for source water supply. Remember that the total of the two percentages must equal 100%.
5. **Population Served:** List separately the retail and wholesale populations served. You may multiply the number of connections by three if needed to estimate the retail population.
6. **Utility's Length of Main Lines, miles:** List the total length of pipeline in the water distribution system in miles.
7. **Number of Wholesale Connections Served:** List the number of wholesale interconnections supplying water to other water utilities.
8. **Number of Retail Service Connections Served:** List the number of retail customer service connections served by the utility's water distribution system.
9. **Service Connection Density:** Calculate the service connection density by dividing the number of retail customer service connections by the length of miles of pipeline in the water distribution system.
10. **Average Yearly System Operating Pressure:** List the average pressure across the entire water distribution systems for the audit period. If a hydraulic model of the network exists, the average pressure can be calculated by the model; otherwise, an estimate can be used.
11. **Volume Units of Measure:** Select the volume units of measure for the water audit. The units must be consistent throughout the entire water audit. If choosing million gallons for system input (from production meters), then authorized consumption (billed and unbilled) and all other entries must also be entered in million gallons. This typically requires a conversion for billed metered consumption.

B. System Input Volume: The total water supplied to the infrastructure. It is the total of all production meter readings for the entire year. List the volume or percentage requested in each item, along with the scores from Appendix 1.3 that in your judgment best represent the degree of validation of the data.

12. **Water Volume from own Sources:** Includes all water taken as source water from permitted sources, such as rivers, lakes, streams, and wells.
13. **Production Meter Accuracy (enter a percentage):** Achieved by calibrating or verifying the accuracy level (expressed as a percentage) of production meters. For example purposes, if the meter over-registered by 4 percent, enter 1.04; if it under-registered by 4 percent, enter .96.
14. **Corrected Input Volume (calculated automatically online):** The sum obtained when the production meter adjustment is either added to or subtracted from the system input volume. Divide “water volume from own sources” by the production meter accuracy. You must add the decimal point when the calculation is done manually (for example, to .96).

Example: If “water volume from own sources” registered 1.8 MG/year through two production meters, which were found to be collectively under-registering flow by 4 percent, then the corrected input volume (CIV) is:

$$\text{Corrected Input Volume} = (1,800,000)/(0.96) = 1,875,000$$

15. **Wholesale Water Imported:** Amount of purchased wholesale water transferred into the utility’s water distribution system from other water suppliers.
16. **Wholesale Water Exported:** Amount of wholesale water transferred out of the utility’s distribution system. It may be put into the system initially but is only in the system for a brief time for conveyance reasons.
17. **System Input Volume:** Calculated as the corrected input volume plus water imported minus water exported (Line 14, plus Line 15, minus Line 16).

C. Authorized Consumption: All water that has been authorized for use or consumption by the utility or its customers. Remember to convert these volumes into the same units as the water delivery volume. Note: Any type of legitimate consumption should be classified in one of the four components of authorized consumption.

18. **Billed Metered:** All retail water sold and metered.
19. **Billed Unmetered:** All water sold but not metered.
20. **Unbilled Metered:** All water metered but not billed, such as back flushing water, parks, golf courses, and municipal government offices.
21. **Unbilled Unmetered:** All water not billed or metered, such as flushing fire hydrants.
22. **Total Authorized Consumption:** The total of the above four components, automatically calculated in the online worksheet.

D. Water Losses: Water delivered to the distribution system that does not appear as authorized consumption.

23. Calculated as the difference of the system input volume and total authorized consumption (Line 17 minus Line 22).

E. **Apparent Losses:** Water that has been consumed but not properly measured or billed. These losses represent under-registered or under-billed water that occurs via customer meter inaccuracy, systematic data handling error in the customer billing system, and unauthorized consumption:

24. **Average Customer Meter Accuracy:** List the composite accuracy percentage for your customer's meters. This percentage is typically derived from meter testing results. A representative assessment of customer meter accuracy can be obtained by testing as few as 50 meters.
25. **Customer Meter Accuracy Loss:** Obtained by dividing the billed metered water volume by the degree of average customer meter accuracy (Line 18 ÷ Line 24).

Example: If billed metered (line 18) consumption registered 1.5 MG/year and random meter testing found customer meters to be collectively under-registering flow by 8 percent (so they are 92 percent accurate), then the customer meter accuracy loss is:

$$\text{Custom Meter Accuracy} = [(1,500,000)/(0.92) - 1,500,000] = 130,434.78 \text{ gallons}$$

26. **Systematic Data Handling Discrepancy:** List the estimated volume of water recorded by customer meters but distorted by meter reading or billing system error.
 27. **Unauthorized Consumption (theft):** Estimate amount of water loss due to theft. Include an estimate of water taken illegally from fire hydrants, as well as water loss at the customer service connection. Theft at the customer connection can include tampering with meters or meter reading equipment, in addition to illegal taps and other similar occurrences.
 28. **Total Apparent Losses:** This value is calculated automatically online as the sum of customer meter accuracy loss, systematic data handling error, and unauthorized consumption.
- F. **Real Losses:** These are physical losses from the pressurized water distribution system, including water mains and all appurtenances (for example, valves and hydrants) and customer service connection piping. Real losses represent water that is lost from the distribution system prior to reaching the customer destination.
29. **Reported Breaks and Leaks:** Reported breaks and leaks are brought to the attention of the water utility by customers, public safety officials, other utilities, or other members of the general public. Usually these visible water main breaks are very disruptive and water utilities respond quickly to these events, so the run duration of the break or leak is relatively short. Estimate the total volume of water loss during the water audit period from reported breaks and leaks that were repaired during the year. Leakage flow rates must be estimated for various types of breaks and leaks, as well as the approximate duration of the breaks or leaks prior to repair.
 30. **Unreported Loss:** This is a "catch-all" volume, meaning that this volume of real losses is the quantity that remains after authorized consumption, apparent losses, and reported leakage have been subtracted from the system input volume. In every water distribution system, even those employing effective active leakage control programs, there exists some amount of undetected leakage. Some of this loss is comprised of unreported leakage that has not yet been detected in leak surveys. It also includes a subcomponent known as background leakage, which is the collective weeps and seeps at pipe joints and on customer service connections that cannot be detected with acoustic sounding devices. Any degree of error in quantifying metered and estimated volumes in the water audit results in error in this component. As the validation of the water audit improves over time, so will the level of validation of the unreported loss volume.

31. **Total Real Losses:** This value is calculated automatically online as the sum of reported breaks and leaks and unreported loss.
 32. **Water Losses:** Calculated as the sum of apparent losses and real losses. This value should equal the value of Line 23. This line is included as a balancing check.
 33. **Non-revenue Water:** Calculated as the sum of apparent losses, plus real losses, plus unbilled metered consumption and unbilled unmetered consumption. This is the water that does not contribute to the water utility billings.
- G. Technical Performance Indicator for Apparent Loss:** Performance indicators are quantitative measures of key aspects within the utility. Using these indicators, the utility will have a history to track its performance from year to year. One performance indicator exists for apparent loss.
34. **Apparent Losses Normalized:** Calculated as the volume of apparent loss, divided by the number of retail customer service connections, divided by 365 days. This performance indicator allows for reliable performance tracking in the water utility's efforts to reduce apparent losses.
- H. Technical Performance Indicator for Real Loss:** Several performance indicators exist for real loss.
35. **Real Loss Volume:** This is the quantity from Line 31.
 36. **Unavoidable Annual Real Losses:** Calculated reference value using the equation shown in Table 3-2. This is a theoretical value of the technical low level of leakage that might be attained in a given water utility, based upon several system specific parameters.
 37. **Infrastructure Leakage Index:** This performance indicator is calculated as the ratio of real losses over the unavoidable annual real losses. The index measures the water utility's leakage management effectiveness and is an excellent performance indicator for comparing performance among water utilities. The lower the value of the infrastructure leakage index, the closer the utility is operating to the theoretical low level of the unavoidable annual real loss. Appendix 1.4 gives general guidance on setting preliminary leakage reduction targets using the infrastructure leakage index without changing water pressure.
 38. **Real Losses Normalized:** Calculated as the real loss volume, divided by the number of retail service connections, divided by 365. Use this calculation if the service connection density is greater than, or equal to, 32 per mile. This indicator allows for reliable performance tracking in the water utility's efforts to reduce real losses.
 39. **Real Losses Normalized:** Calculated as the real loss volume, divided by the number of miles of pipeline, divided by 365. Use this calculation if the service connection density is less than 32 per mile. This indicator allows for reliable performance tracking in the water utility's efforts to reduce real losses.

I. Financial Performance Indicators

40. **Total Apparent Losses:** List the volume from line 28.
41. **Retail Price of Water:** Water utility rate structures usually feature multiple tiers of pricing based upon volume consumed. For the water audit, it is best to use a single composite price rate to represent the retail cost of water, which is used to place a value on the apparent losses. The largest number of accounts in most utilities is residential accounts; therefore, the residential pricing tier may be used in place of weighted calculations to determine a composite rate.
42. **Cost of Apparent Losses:** Calculated by multiplying the apparent loss volume by the retail price of water. This represents the potential amount of missed revenue due to apparent losses.
43. **Total Real Losses:** List the volume from line 31.
44. **Variable Production Cost of Water:** Marginal production cost including variable costs, which are typically the costs of raw water, energy, and chemicals. If applicable, the cost of raw water should include the price of take or pay contracts. These costs are applied to determine the cost impact of real losses. In cases of water shortage, real losses might be valued at the retail price of water instead of the variable production cost.
45. **Cost of Real Losses:** Calculated by multiplying the real loss volume by the variable production cost of water. These costs represent the additional operating costs incurred by the water utility due to the real losses (in other words, leakage).
46. **Total Assessment Score:** Add the individual assessment scores to obtain a total.
47. **Total Cost Impact of Apparent and Real Losses:** Calculated by adding lines 42 and 45. This amount indicates the cost inefficiency encountered by the water utility for losses. This cost value can be objectively weighed against potential loss control programs to determine the cost effectiveness of such programs.

If you or the utility has any software application questions, please call Mark Mathis at 512-463-0987 or email: mark.mathis@twdb.state.tx.us

For more information on water audits, visit the American Water Works Association Web site: <http://www.awwa.org/Resources/topicspecific.cfm?ItemNumber=3653&navItemNumber=1583>