KUNIA VILLAGE AND AGRIBUSINESS COMPLEX

New Potable Water Source

Groundwater Use Permit Application

Submitted to the
The Department of Land and Natural Resources

Commission on Water Resources Management

CONTENTS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

APPLICATION FOR GROUND WATER USE PERMIT

FORM GWUPA

☑ New Use
☐ Modification of WUP No. _____
☐ Existing Use

For Official Use Only:

For detailed instructions on filling out this application form completely, refer to the attached instructions. Incomplete applications will not be accepted for processing.

APPLICANT INFORMATION

1. APPLICANT INFORMATION			2. SOURCE LANDOWNER INFORMATION		
Name/Company: Kunia Village Development Corporation	Contact Person: Dave Robichaux		Name/Company: Hawaii Ag. Research Center	Contact Person: Stephanie Whalen	
Mailing Address: 66-031 Mahaulu Lane Haleiwa,HI 96712			Mailing Address: PO Box 100 Kunia Hawaii 96759		
Phone: (808) 368-5352	Fax:	E-mail: robichaud001 @ hawaii.rr.com	Phone: (808) 228-0272	Fax:	E-mail: swhalen@HARC-HSPA.com

SOURCE INFORMATION

3. ISLAND: Oahu

4. AQUIFER SYSTEM AREA: Waiawa-Waipahu

4A. SUSTAINABLE YIELD FOR ITEM 4: 104 MGD

5. SOURCE INFORMATION
Attach additional sheets, if necessary.

Well Number (if known)	Well Name	Existing or Proposed?	TMK (zone - sector - plat : parcel)	Flowmeter installed?
TBD	Kunia Village source 1	proposed	9 - 2 - 005 : 0230014	☐ Yes, date installed ___/___/___ ☑ No
			- - :	☐ Yes, date installed ___/___/___ ☐ No
			- - :	☐ Yes, date installed ___/___/___ ☐ No
			- - :	☐ Yes, date installed ___/___/___ ☐ No
			- - :	☐ Yes, date installed ___/___/___ ☐ No
			- - :	☐ Yes, date installed ___/___/___ ☐ No

USE INFORMATION

6. TOTAL QUANTITY OF WATER REQUESTED: In the space below, enter total from Box M in Item 11 (Table 1) of this application.
150,000 gallons per day, averaged over 1 year

7. USE: Check all that apply.
☑ Agriculture ☑ Domestic ☐ Industrial
☐ Irrigation ☐ Military ☐ Municipal

8. LOCATION OF WATER USE: Show the location of the use on a map, attached as a .pdf to this application. See Item 11 (Table 1, column B) of this application.

Note 2: Signing below indicates that the signatories understand and affirm that the information provided on this application is accurate and true to the best of their knowledge. Further, the signatories understand that: (1) if necessary, further information may be required before the application is considered complete; (2) if a water use permit is granted by the Commission, this permit is subject to any existing legal uses, changes in sustainable yields and instream flow standards, reserved uses as defined by the Commission, and Hawaiian Home Lands' future uses; and ***(3) the applicant is responsible for paying the public notice fees associated with this application.*** Additionally, as stated in Note 1, above, HRS § 174C-51(1) the landowner shall be the joint applicant in the event the applicant is a lessee, licensee, developer or any person with a terminable interest or estate in the land that is the water source of the permitted water.

9. APPLICANT

David M. Robichaux
Signature

David Robichaux, Secretary — 9/4/2024
Print Name — Date

10. SOURCE LANDOWNER/JOINT APPLICANT (if applicable)

Signature

STEPHANIE A WHALEN — 9/17/24
Print Name — Date

USE INFORMATION

11. TABLE 1: LAND USE CONSISTENCY (Attach additional copies, if necessary.)

LAND USE CONSISTENCY						EFFICIENCY OF USE			
A	B	C	D	E	F	G	H	I	J
PURPOSE / WATER USE CATEGORY (See the Instructions for water use category descriptions.)	TMK FOR LOCATION OF USE ATTACH THE FOLLOWING: • Property tax map, showing location of use referenced to established property boundaries. • Photograph of the area of use.	STATE LAND USE DISTRICT	CDUP REQUIRED? Check the appropriate box, and write in the date approved, if applicable.	COUNTY ZONING CODE	SMAP REQUIRED? Check the appropriate box, and write in the date approved, if applicable.	UNITS OR NET ACREAGE	GPD/UNIT or GPD/ACRE	QUANTITY OF USE (GPD)	JUSTIFICATION FOR QUANTITY OF WATER REQUESTED (If applicable, attach additional sheets showing how the quantity was calculated.) For irrigation uses, fill in Table 2.
USES THAT REQUIRE POTABLE (DRINKING) WATER									
Dom	9 - 2 - 005 : 023 (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No	200	650/unit	130,000	650 residents @ 200 gallons per day each
	- - : (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No				
	- - : (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No				
	- - : (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No				
							TOTAL POTABLE USE	**K**	GPD
USES THAT DO NOT REQUIRE POTABLE WATER									
agrcp	9 - 2 - 005 : 023 (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No	0.5 ac.	30,000	15,000	Licensed Marijuana farm
agraq	9 - 2 - 005 : 023 (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No		☐ Yes, date approved: / / ☐ Yes, not acquired ■ No	1	5,000	5000	Hydroponic lettuce/fish
	- - : (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No				
	- - : (zone - sector - plat : parcel)		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No		☐ Yes, date approved: / / ☐ Yes, not acquired ☐ No				
							TOTAL NON-POTABLE USE	**L**	GPD
							TOTAL QUANTITY OF WATER REQUESTED (sum of total potable use and total non-potable use) =	**M**	GPD

Please explain if there are any limitations (e.g., legal, contractual) on the proposed water use(s) described in Table 1. Ref. HRS § 174C-51(5).

USE INFORMATION (continued)

12. TABLE 2: AGRICULTURE/IRRIGATION INFORMATION

List all crops that will be grown, including landscape and golf course irrigation uses. Copy Table 2 and attach additional sheets to complete your list, if necessary.

A TMK FOR LOCATION OF USE ATTACH THE FOLLOWING: • Property tax map with an outline around the area of each irrigation use listed in this table. • Photograph of the area of each use.	B CROP	C TOTAL ACREAGE	D NET IRRIGATED ACREAGE	E BEGIN GROWTH PERIOD (month)	F END GROWTH PERIOD (month)	G IRRIGATION SYSTEM (refer to instructions)	H IRRIGATION PRACTICE (refer to instructions)	I COMMENTS (Continue comments below, if more space is needed.)
9 - 2 - 005 : 023 zone - sector - plat : parcel	Marijuana	0.5	0.4	1	12	trickle spray	deficit	soil-less drip multiple times daily
9 - 2 - 005 : 023 zone - sector - plat : parcel	lettuce	1	1	1	12	flood	other	rinsing and processing lettuce
zone - sector - plat : parcel								
zone - sector - plat : parcel								
zone - sector - plat : parcel								
zone - sector - plat : parcel								
zone - sector - plat : parcel								
zone - sector - plat : parcel								
zone - sector - plat : parcel								

Comments (continued from Column I). Please clearly indicate the crop (i.e., the row in table) these comments relate to.

OTHER PERTINENT INFORMATION

13. TABLE 3: ALTERNATIVES ANALYSIS

	A. Analysis of *potable* alternatives Attach additional sheets if necessary.	**B. Analysis of *non-potable* alternatives** Attach additional sheets if necessary.
Municipal sources	not available within 4 miles	Not available
Wastewater reuse	Recycled water is available in Kunia Village and used for hydrants, landscape irrigation, and agriculture	not permitted
Ditch system	Not available	Not recommended
Desalinization	Not available	Not available
Surface water	Not available	Not available
Other	Wells #3-2803-005& 007. 1 mi North	contaminated with PFAs

14. PUBLIC INTEREST

§174C-2(C), HRS states: *The state water code shall be liberally interpreted to* **[a]** *obtain maximum beneficial use of the waters of the State for purposes such as domestic uses, aquaculture uses, irrigation and other agricultural uses, power development, and commercial and industrial uses. However,* **[b]** *adequate provision shall be made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation. Such objectives are declared to be in the public interest.*

Explain how the use in your application is consistent with items **[a]** and **[b]** above.

a. Proposed well will be strictly for use by tenants of Kunia Village and Agribusiness Complex; an affordable housing development for farm workers. Housing and agribusiness is dependent on clean water supply. b. Proposed well will not increase existing water demand. It replaces current use from well #3-2803-007 due to contamination. No new demands for domestic or agriculture foreseen as a result of the proposed new well

15. KA PA'AKAI ANALYSIS:

a. Please provide the identity and scope of cultural, historical, and natural resources in which traditional and customary Native Hawaiian rights are exercised in this area.

Ka Pa'akai Analysis is in preparation. Anticipated publication date November 2024. The scope includes (a) discovery of cultural, historical, and natural resources; (b)identification of the extent to which Native Hawaiian rights will be affected; and (c) determination of appropriate mitigation measures.

b. Identify the extent to which those resources, including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action.

The proposed action will transfer usage from the Wahiawa water management section to the Waiawa-Waipahu section, but will not change the current usage. The Waiawa-Waipahu sectors are less utilized than the Wahiawa (central) sector when measured as a percentage of sustainable yield.

c. What feasible action, if any, could be taken to reasonably protect Native Hawaiian rights?

The proposed action will not create new demand on groundwater resources. Requested allocation is <0.15% of the sustainable yield, which will not be pumped from the existing source. Anticipated finding of no significant impacts on Native Hawaiian rights or resources.

OTHER PERTINENT INFORMATION

16. INTERFERENCE WITH THE RIGHTS OF THE DEPARTMENT OF HAWAIIAN HOME LANDS

Explain how the use of water will not interfere with the rights of the Department of Hawaiian Home Lands, as provided in section 221 of the Hawaiian Homes Commission Act.

See attached correspondence with DHHL.

17. INTERFERENCE WITH ANY EXISTING LEGAL USES

Explain how the use of water will not interfere with any other existing legal use(s) of water.

The proposed well does not increase net demand on groundwater resources or interfere with

18. EFFICIENCY

☑ If a water conservation plan was prepared, please attach to this application.

☐ If no water conservation plan was prepared, please explain how your use of water will be as efficient as possible.

See attached water conservation plan

19. PUBLIC WATER SYSTEM INFORMATION

Check the appropriate box or boxes.

☐ PUC-Regulated Private System / ■ Non-PUC-Regulated Private System / ☐ Not a Public Water System

☐ Intended dedication to Honolulu Board of Water Supply or to County of Maui, Department of Water Supply.

☑ If a Level-1 validated AWWA water loss audit was completed, please attach.

20. CHAPTER 343 ***Anticipated publication Date November 2024***

This project proposes:

- ■ Use of state or county lands, or use of state or county funds
- ☐ Use within a state conservation district
- ☐ Use within a shoreline setback area
- ☐ Use within a national or Hawaii registered historic site
- ☐ Use within the Waikiki Special District
- ☐ The construction, expansion or modification of helicopter facility
- ☐ A wastewater treatment unit
- ☐ Waste-to-energy facility
- ☐ Landfill
- ☐ Oil refinery
- ☐ Power-generating facility
- ☐ None of the above 11 items

☐ If none of the above 11 items are applicable, no 343 compliance is necessary

■ An Environmental Assessment was completed, and

☐ An Environmental Impact Statement was required and has been accepted (attach letter of acceptance). Publication date in The Environmental Notice:

☐ A Finding of No Significant Impact has been determined (attach letter). Publication date in The Environmental Notice:

21. TABLE 4: 12-MONTH AVERAGE CALCULATION AS OF THE DATE OF DESIGNATION. FOR EXISTING USES ONLY.

MM/YY	Average Daily Pumpage for the Month (Gallons per Day)	Check one per row			
		Metered	Estimated	Active but unknown	Inactive
July 23	86,131	✔			
August 23	114,762	✔			
September 23	62,963	✔			
October 23	90,486	✔			
November 23	64,223	✔			
December 23	47,005	✔			
January 24	40,343	✔			
February 24	62,065	✔			
March 24	59,771	✔			
April 24	55,497	✔			
May 24	56,471	✔			
June 24	74,452	✔			

INSTRUCTIONS FOR FILLING OUT APPLICATION FOR GROUND WATER USE PERMIT

This application form is to be used for **both** existing uses in newly designated ground water management areas and proposed new uses, including modifications of existing ground water use permits.

Most questions can be addressed by visiting our website at http://www.hawaii.gov/dlnr/cwrm or by contacting the Ground Water Regulation Branch at 587-0225 or by e-mail at dlnr.cwrm@hawaii.gov.

The current application form link is here: https://files.hawaii.gov/dlnr/cwrm/forms/GWUPA.pdf

REQUIREMENTS FOR A COMPLETE APPLICATION

a. Fill in the most recent application form. An updated fillable PDF can be found at https://files.hawaii.gov/dlnr/cwrm/forms/GWUPA.pdf
b. We require a digital copy to be circulated for review. If you are unable to submit a digital copy, print in ink or type the information on the application form but be aware that there will be delays in processing your application.
c. E-mail a PDF of the application to dlnr.cwrm@hawaii.gov A check for the non-refundable filing fee of $25 payable to Department of Land and Natural Resources can by dropped off at 1151 Punchbowl Street, Room 227, Honolulu 96813, or mailed to P.O. Box 621, Honolulu, HI 96809. Please attach a printed copy to this filing fee check. Note that government agencies as applicants are not required to pay this filing fee.
d. The applicant is responsible for paying the cost of publishing any required public notices associated with this application, and unlike the application fee, government agencies are *not* exempt from this. The cost for public notices is approximately $1000.00. Commission staff will pay this fee up front and will provide instructions later regarding your reimbursement of this cost. Failure to reimburse the Commission will result in non-action on your water use permit application.
e. Attach photos showing the well source(s), meter(s) (if applicable), and end use area(s).
f. The water user and the landowner of the source location ("source landowner") must sign the application form.

INSTRUCTIONS FOR COMPLETING THE APPLICATION FORM

PAGE 1

APPLICANT INFORMATION

In accordance with the Hawaii Water Code, both the applicant and the person who owns the property where the water source is located are required to apply for a water use permit. §174C-51(1)(B), HRS, states, *In the event a lessee, licensee, developer, or any other person with a terminable interest or estate in the land, which is the water source of the permitted water, applies for a water permit, the landowner shall also be stated as a joint applicant for the water permit.*

1. **APPLICANT INFORMATION** Fill in the applicant's contact information. This should be the person who will be responsible for all conditions of the water use permit. If this is for multiple sources and it doesn't fit on the table, please attach a separate sheet listing these sources.
2. **SOURCE LANDOWNER INFORMATION** Fill in the information for the landowner of the property where the proposed ground water source (e.g., well, modified spring, tunnel, shaft, etc.) is located. If this is for multiple sources and different landowners, please attach a separate sheet listing these landowners and their acknowledgement regarding this application.

SOURCE INFORMATION

3. **ISLAND** Indicate the island on which the source is located.
4. **AQUIFER SYSTEM AREA** The name of the aquifer system area where the source is located. https://dlnr.hawaii.gov/cwrm/info/maps/

4A. **SUSTAINABLE YIELD** The sustainable yield for the aquifer system area.

5. **SOURCE INFORMATION**
   - **WELL NUMBER** If the source already has a state-assigned well number, enter the state well number here.
   - **WELL NAME** If the source has a name, enter the name here. Otherwise, assign a short name that will differentiate it from other wells. This should be the same as the name listed on the accompanying well construction / pump installation permit application, where applicable.
   - **SOURCE TMK** Fill in the current Tax Map Key number of the parcel on which the source resides.
   - **FLOWMETER INFORMATION** You must have a flowmeter to accurately indicate that your water usage is in compliance with your proposed approved allocation. Check either "Yes" or "No." If you answer "Yes," write in the date the flowmeter was installed month/day/year in the space provided. The definition of a working flowmeter is a water meter with a totalizer that gives the total quantity of water used from a source.

WATER USE INFORMATION

6. **TOTAL QUANTITY OF WATER REQUESTED** Enter the amount of water requested as gallons per day (GPD) averaged over one year from Box M of Table 1.
7. **USE(S)** Check all the boxes that apply for the use. Refer to the instructions for Table 1: Land Use Consistency/Efficiency of Use, Item 1: Purpose/Water Use Category below to determine which water use categories to use.
8. **LOCATION OF WATER USE(S)** Show the location of the use on a map. This is essential for agricultural uses and will be attached to your water use permit, if approved.

APPLICANT SIGNATURES REQUIRED

9. **APPLICANT** The applicant must sign and date the application.
10. **SOURCE LANDOWNER** The source landowner must also sign and date the application.

PAGE 2

USE INFORMATION

Note that you will need to fill out each section for potable and non-potable needs separately. This means that even though your source is defined as potable, you may have end use needs that don't require potable water, such as landscape irrigation. This will help the Commission determine whether or not non-potable alternatives are available for your non-potable needs.

11. **Table 1: USE INFORMATION** Provide information on all of the uses you are applying for or seeking to modify to. In the space provided below the table or on a separate sheet, explain whether there are any limitations [e.g., a contract or other legal agreement(s)]on your water use(s), as required by §174C-51(5), HRS.

A. **PURPOSE / WATER USE CATEGORY** For each purpose of use, choose one of the categories listed in the table below and enter the appropriate code in the space provided (e.g., AGRAQ, IRRGC, etc.)

AGRICULTURE AGRAQ Aquatic Plants & Animals AGRCP Crops & Processing AGRLI Livestock & Processing, and Pasture AGRON Ornamental & Nursery Plants AGROTH Other	**DOMESTIC** DOM Single & Multi Low-Rise & High-Rise Household DOMN Domestic (Non-residential) DOMNCB Commercial Businesses DOMNRI Religious Institutions DOMNHOS Hospitals DOMNHOT Hotels DOMNOB Office buildings DOMNOTH Domestic Non-Residential - Other DOMNSC Schools
IRRIGATION IRRGC Golf Course IRRHM Habitat Maintenance IRRHOT Hotel IRRLA Landscape/Water Features IRROTH Other IRRPA Parks IRRSC Schools	**INDUSTRIAL** INDEL Geothermal, Thermoelectric Cooling, Power Development INDFP Fire Protection INDMI Mining, Dust Control INDOTH Industrial – Other
MILITARY MIL Military	**MUNICIPAL** MUNCO County MUNPR Privately-owned but defined as public water system by MUNST DOH State

B. **USE TMK** Enter the tax map key (TMK) number for the parcel of land over which the use is applied. There should only be one parcel for each line. Also, attach:

C. **STATE LAND USE DISTRICT** Write in the name of the current land use district. To find the Land Use District, contact the Land Use Commission at (808) 587-3822.

D. **CDUP REQUIRED?** Check the appropriate box. If a Conservation District Use Permit (CDUP) is required and you have a CDUP applicable to this project, check "Yes" and write in the date approved in the space provided (month/day/year). If your parcel is in a conservation district, as indicated in Column C of this table, contact the Office of Conservation and Coastal Lands at (808) 587-0328 to find out if a CDUP is required.

E. **COUNTY ZONING CODE** To find out the County Zoning Code for Oahu, contact the City and County of Honolulu at 768-8041. For Maui County, contact at 270-7253.

F. **SMAP REQUIRED?** Check the appropriate box. If a Special Management Area Permit (SMAP) is required, and you have an SMAP applicable to this project, check "Yes" and write in the date approved in the space provided (month/day/year). To find out if your parcel is in a Special Management Area and requires an SMAP, for Oahu contact the City and County of Honolulu Department of Planning and Permitting or for Maui County contact the Planning Department.

G. **UNITS or NET ACREAGE** This is the total number of units or the net number of acres as a basis for calculating your requested allocation. "Unit" can mean a dwelling unit, number of people, acres, number of animals, etc. Some examples of units or acreages to enter in this column would be 400 dwelling units, 500 people, or 3.74 acres.

H. **GPD/UNIT or GPD/ACRE** (GPD = gallons per day) Enter the gallons per day per unit (GPD/unit) or gallons per day per acre (GPD/acre) for each water use category listed in Column A.

I. **QUANTITY OF USE** Enter the quantity of water use in gallons per day (GPD). Justification (see Column J) for the quantity requested may depend on the information provided in columns G and H of this table.

J. **JUSTIFICATION FOR QUANTITY OF WATER REQUESTED** Explain how you are justifying the quantity of water requested for each use, in Column I of this table. Attach additional sheets, if necessary, showing how the proposed quantity was calculated. For all proposed irrigation uses, you are required to also complete Item 12 (Table 2) of the application.

K. **TOTAL POTABLE USE NEEDS** Add the quantities listed in the Column I for proposed potable water use. Enter the total quantity in gallons per day (GPD) in Box K.

L. **TOTAL NON-POTABLE USE NEEDS** Add the quantities listed in Column I for proposed uses that do not require potable water. Enter the total quantity of proposed non-potable water use in gallons per day (GPD) in Box L.

M. **TOTAL QUANTITY OF WATER REQUESTED** Add the totals in Box K and Box L, and enter the sum in Box M. The quantity in Box M should be the same as the amount entered under Item 6 on the page 1 of the application.

PAGE 3

12. TABLE 2: AGRICULTURE/IRRIGATION INFORMATION

On Table 2, provide the information requested for all of the plant types or other needs such as aquaculture, etc. Enter only one plant and one parcel number (TMK) per line. For multiple crops, list each one as a separate line item. All uses you are applying for must be listed. Attach additional copies of Table 2, if necessary.

A. **TMK FOR LOCATION OF USE** Enter the parcel number where the crop is/will be grown. Also, attach a map with an outline around the area(s) of use(s) and a photograph of each area of proposed use.

B. **CROP** Enter the crop type

C. **TOTAL ACREAGE** Enter the total acreage of the parcel listed.

D. **NET IRRIGATED ACREAGE** Enter the acreage that the specific crop will be grown.

E. **BEGIN GROWTH PERIOD (MONTH)** This is the month of the start of the growth cycle.

F. **END GROWTH PERIOD (MONTH)** This is the month of the end of the growth cycle.

G. **IRRIGATION SYSTEM** Enter one of the following:

TRICKLE, DRIP
TRICKLE, SPRAY
MULTIPLE SPRINKLERS

SPRINKLER, CONTAINER NURSERY
SPRINKLER, LARGE GUNS
SEEPAGE, SUBIRRIGATION
CROWN FLOOD
FLOOD (TARO)
OTHER – Please describe in the space provided for comments (Column I and/or below the table).

H. IRRIGATION PRACTICE Enter one of the following:
IRRIGATE TO FIELD CAPACITY
APPLY A FIXED DEPTH PER IRRIGATION
DEFICIT IRRIGATION
OTHER – Please describe in the space provided for comments (Column I and/or below the table).

PAGE 4

13. TABLE 3: ALTERNATIVES ANALYSIS

You should address every alternative and explain why each alternative is or is not available for your potable and non-potable water needs. Note that simple "not available" answers are not acceptable. If the alternative is not feasible, please explain.

Municipal sources Please contact your County's Department of Water Supply to identify if a municipal source is available to supply water to your area of need.

Wastewater reuse Please contact your County's Wastewater Division to identify if reuse water is available to supply water to your area of need.

Ditch system Please identify whether a ditch system is available to supply water to your area of need. You can contact the Department of Agriculture, but you should also identify private ditch systems and the availability of that source as well.

Desalinization Please explain why drilling a well deeper or finding an alternative source of saline water and desalinizing is not a feasible alternative.

Surface water is defined in §174C-3, HRS as: *…both contained surface water–that is, water upon the surface of the earth in bounds created naturally or artificially including, but not limited to, streams, other watercourses, lakes, reservoirs, and coastal waters subject to state jurisdiction–and diffused surface water–that is, water occurring upon the surface of the ground other than in contained waterbodies. Water from natural springs is surface water when it exits from the spring onto the earth's surface.*

Other Other alternatives may include stormwater reclamation, rainwater catchment, or other alternatives not already listed above.

14. PUBLIC INTEREST

Explain in the space provided or on a separate sheet why the use(s) on your application are consistent with the public interest.

15. KA PA'AKAI ANALYSIS

In the case of Ka Pa'akai O Ka'Aina vs. the Land Use Commission, State of Hawaii, it was determined that an analysis must be conducted for the following items:

a. The identification and scope of cultural, historical, and natural resources in which traditional and customary Native Hawaiian rights are exercised in the area.
b. The identification of the extent to which those resources listed in item a., including traditional and customary Native Hawaiian rights, will be affected or impaired by the proposed action.
c. The determination of the feasible action, if any, that could be taken to reasonably protect Native Hawaiian rights.

PAGE 5

16. INTERFERENCE WITH THE RIGHTS OF THE DEPARTMENT OF HAWAIIAN HOME LANDS

Explain in the space provided or on a separate sheet how the use(s) of water will not interfere with the rights of the Department of Hawaiian Home Lands, as provided in section 221 of the Hawaiian Homes Commission Act. To inquire about potential interference, you may contact the Department of Hawaiian Home Lands main line at 620-9500, or the DHHL Planning Office at 620-9480. You may also visit their website at dhhl.hawaii.gov, where you can review DHHL's Island Plans, Regional Plans, and their Water Policy Plan.

The State Water Code in §174C-101(a), HRS [Native Hawaiian water rights], states: *Provisions of this chapter shall not be construed to amend or modify rights or entitlements to water as provided for by the Hawaiian Homes Commission Act, 1920, as amended, and by chapters 167 and 168, relating to the Molokai irrigation system. Decisions of the commission on water resource management relating to the planning for, regulation, management, and conservation of water resources in the State shall, to the extent applicable and consistent with other legal requirements and authority, incorporate and protect adequate reserves of water for current and foreseeable development and use of Hawaiian home lands as set forth in section 221 of the Hawaiian Homes Commission Act.*

17. INTERFERENCE WITH ANY EXISTING LEGAL USES

Explain in the space provided or on a separate sheet how the use(s) of water will not interfere with any other existing legal use(s) of water.

18. EFFICIENCY

A **conservation plan** should describe any conservation measures that will be used to ensure that your water use is or will be efficient, and is different from a water shortage plan. Conservation measures may include, but are not limited to, water reuse or recycling systems, monitoring the water distribution system for pressure drops that are indicative of leaks or line breaks, or use of drought-tolerant and xeriscape landscape plants.

19. PUBLIC WATER SYSTEM INFORMATION

Check the appropriate box or boxes relating to your water system.

20. CHAPTER 343 If an Environmental Assessment was completed, fill in the dates of publication and acceptance. For additional information about the proposed uses checkboxes, refer to http://luc.state.hi.us/docs/hrs_343.pdf

21. TABLE 4: 12-MONTH MOVING AVERAGE CALCULATION AS OF THE DATE OF DESIGNATION. FOR EXISTING USES ONLY.

For existing use permit applications, list the pumpage for the 12 months prior to designation. Also identify how that measurement was taken.

Kunia Village Water Conservation Plan

Goals

- Assure quality water through reliable and highly efficient system.
- Anticipate and adapt to changing climactic conditions while demonstrating stewardship of our environment.
- Minimize the need for expanding water infrastructure through conservation measures.
- Ensure organizational efficiency and manage financial resources

Plan introduction

Potable water is supplied to Kunia Village through the wells, pumps and distribution lines owned and operated by the Kunia Water Association (KWA), a not-for-profit Water Association that began providing water service to Kunia Village and others in 2010. KWA supplies irrigation water to other members, but this plan only applies to the sole drinking water user, The Kunia Village and agribusiness Center

As a public water supply, KWA is responsible for providing reliable, quality drinking water to its customers. This includes managing water supplies available to the community; conducting water quality treatment and testing; constructing necessary facilities; and operating and maintaining water treatment, storage and distribution facilities. As the oly potable water consumer in the Association Kunia Village Title Holding Corporation (KVTHC) is responsible for developing and implementing water conservation plans for its residents and businesses.

Kunia Village is an affordable housing community that provides respectable housing to farm workers making less than 60% of the Area Median Income. Rental rates are limited to 30% of household income as recommended by HUD. As such, majr improvements are largely dependent on public funding. Funding for water system improvements are difficult to obtain and require advance planning. A water conservation plan can reduce the cost and effort associated with operating the water system by minimizing the operational costs and increasing the period between major system improvements.

Systems overview

Kunia Village receives water from Del Monte Well #4 (State ID 3-33011-007) located approximately 1 mile north of the village. Well #4 is nearly 1000 feet deep and pumped using an 500-hp vertical shaft pump that is activated on demand. The water flows toward the west to an aeration tower that is used to volatilize Trichloroethane, and other volatile contaminates. From there it flows by gravity into 2 potable water storage tanks having a maximum volume of 258,000 gallons. Water from the storage tanks flows by gravity into one of two booster pump

stations that increase the pressure to standard line pressure for distribution to individual connections.

Kunia Village has 3.6 miles of transmission piping, 135 active service connections. The average use is approximately 22 million gallons per year (60,000 gallons per day). The 2022 Water loss audit reports that 29 million gallons per year are lost from the system.

Water Conservation

Kunia Village meters water to select businesses and to the entire residential areas only. Water meters are not installed on individual houses and most of the agribusiness tenants. Two of the business tenants are metered due to larger demands associated with their business. All others are billed at a flat rate. Residential users are not billed for water because of the affordable standards of the village.

Water efficiency standards

Plumbing fixtures in new residential or commercial buildings incorporate state and federal standards for plumbing fixtures, including water-use standards for toilets, faucets, showerheads and urinals.

The Hawaii standards define the maximum flow for residential toilets, showerheads and bathroom faucets, as well as commercial urinals. Efficiency standards are presented in terms of gallons per minute (gpm) and/or gallons per flush (gpf).

Fixture/Appliance	Current Standard
Toilet	1.28 gpf
Urinal	0.5 gpf
Showerhead	2.5 gpm
Faucets	1.2 gpm

Water loss management and prevention

Water loss management and prevention represent a significant opportunity to reduce water use within the system.

System maintenance

KWA performs regular maintenance of its small systems to ensure operational efficiency and reduce water loss. Production wells and reservoirs are inspected to ensure their integrity; production meters are regularly maintained and calibrated; and service crews address significant

water leaks as identified. Water systems are aging, however, and future improvements will likely be required as discussed below.

Leak monitoring & notification

KWA maintains water pumping records for pumping volume. The records are retrieved through the Supervisory Control and Data Acquisition (SCADA) system, which provides reliable, real-time high-speed communications over a wide area. The system monitors data from various sensors and transmits real-time data back to KWA for analysis.

KWA monitors small systems daily for sudden changes in reservoir water levels or water pressure. Typically, anomalies are first investigated by comparing trends with meter data to determine if system changes are related to a customer account. In these instances, customers are notified to investigate potential problems. If meter data does not reveal a customer issue, KWA typically deploys portable leak detection equipment to determine if there are any visible signs of leaks.

Likewise, the KWA generates a series of reports using meter data, including one that records constant water flow for 24 consecutive hours prior to a meter read. Residents may be alerted to investigate potential issues if their account is flagged for continuous water use.

Water system improvements

The best opportunity to minimize water loss is to eliminate the majority of offsite transmission. Transmission from the existing source to Kunia Village involves 3.6 miles of pipes, an aeration tower, and numerous unused connections. The current proposal to install a new well adjacent to the village storage tank would eliminate the aeration tower and all but 80 feet of transmission line. This improvement is anticipated to reduce leakage and loss to negligible levels.

Water pressure management

Another method to reduce water usage is through pressure regulation. Kunia Village potable water system operated for many years at 25 030 PSI, which is half of the standard municipal water pressure. The system now operates at 60 PSI. Controlling pressure saves water by reducing fixture flow rates and reducing flows when leaks are present.

Water reuse

AS of 2019 KWA began supplying fire hydrants, farms, and landscape irrigation with recycled water from the Schofield Barracks recycled water system. Recycled water is available at a fraction of the price as new water and additional opportunities to expand the non-potable usage will continue to be investigated.

Mandatory watering restrictions and drought surcharges

Much of the water used for watering is recycled water. At this time there are no plans to institute watering restrictions or drought surcharges in the Kunia Village water supply.

Notification of well operating conditions

KWA will make efforts to notify customers via mail, printed fliers, bill messaging and/or other available means if or when known water operating conditions are expected to pose a risk to continued water services. Notices will include instructions for reducing water use and other relevant information.

Alternate supply

In the event of an emergency water-service interruption, KWA has plans in place to provide limited-term potable water supplies from an emergency connection to the potable water system operated by the US army at Schofield Barracks.

Kale Watson, Director
Department of Hawaiian Home Lands
91-5420 Kapolei Pkwy, Kapolei, HI 96707

August 28, 2024

Consultation for new Potable water source
In Kunia, Oahu TMK # 9-2-005:023

Director Watson:

The State Water Code in Section 174C-101(a)States:

Provisions of this chapter shall not be construed to amend or modify rights or entitlements to water as provided for by the Hawaiian Homes Commission Act, 1920, as amended, and by chapters 167 and 168, relating to the Molokai irrigation system. Decisions of the commission on water resource management relating to the planning for, regulation, management, and conservation of water resources in the State shall, to the extent applicable and consistent with other legal requirements and authority, incorporate and protect adequate reserves of water for current and foreseeable development and use of Hawaiian home lands as set forth in section 221 of the Hawaiian Homes Commission Act.

By this letter Kunia Village Development Corporation requests your assessment on the probable impacts associated with our proposed construction and operation of a new potable water well in Kunia Village (TMK # 9-2-005:023) as described below. The new well will replace pumpage from an existing well that has been found to contain Per and Polyfloroalkyl substances (PFAS). It will not increase demand for groundwater resources. The allocation of water will be transferred from the existing, contaminated well to the new one, which is less likely to be contaminated.

Kunia Village is the former Del Monte Plantation Camp, which was turned over to the Hawaii Agriculture Research Corporation in 2009. It is located off of Kunia Road approximately 6 miles north of the intersection between Kunia Road and H-1 Freeway, at Latitude (north) 21° 18' 46, Longitude (west) 158° 05' 07 (Figure 1). This location is approximately 2 miles south of the Wheeler Army Air Field in Central Oahu. The site elevation ranges from approximately 835 feet to 890 feet above mean sea level (MSL). The subject property Tax Key Map # 9-2-005:023 shown in Figure 2.

The Del Monte Corporation grew and processed pineapple on the plantation from about 1946 to 2006 and used pesticides to control nematodes and other pineapple pests. The water supplies serving Kunia Village, and the surrounding areas have been repeatedly threatened by previous practices by the plantation and surrounding users.

In 1977, an accidental 500-gallon pesticide spill occurred next to the Kunia drinking water supply well (Well 1), which contributed to contaminated site soil and groundwater. EPA added the site to the Superfund program's National Priorities List (NPL) in 1994. Del Monte treated contaminated groundwater in the basal aquifer from 2004 until 2014 through pumping water to other farm sites.

66-031 Mahaulu Lane
Hale`iwa, HI 96712
robichaud001@hawaii.rr.com
(808)368-5352

Figure 1: Site location South of Schofield Barracks and west of Mililani.

Figure 2: Kunia Village Aerial Photograph showing the approximate location of the proposed well in the southwest corner of the property. (Google Earth 2023). The proposed well location is shown as a yellow spot in the figure.

In September 2020, EPA concluded that groundwater levels in the basal aquifer are near or below "background" levels of ethylene dibromide (EDB), 1,2-dibromo-3-chloropropane (DBCP) , 1,2-dichloropropane (1,2-DCP) and 1,2,3-trichloropropane (1,2,3-TCP). However, the levels of DBCP and 1,2,3-TCP are above Hawaii maximum contaminant levels (MCLs). The background levels are due to the historic application of pesticides in the area.

The 1977 spill and application of now-banned pesticides permanently removed Kunia's only source of drinking water from service. Del Monte previously leased Wells 3 and 4 one mile north of the site from the US Army for irrigation. When Well 1 was taken out of service the plantation installed the pumps and piping from Wells 3 and 4 to deliver drinking water to the village.

Wells 3 and 4 tap into Oahu's Central aquifer, also known as the Schofield High Level Water Body. In the mid 1980s the Central aquifer was found to contain unacceptable concentrations of Trichloroethene (TCE). In 1986, the Army installed a groundwater treatment system to treat TCE contamination in drinking water from Wells 3 and 4. The long-term remedy involves rapid aeration of water originating in wells that utilize the central aquifer. TCE is highly volatile and is removed during aeration by evaporation. Treatment and monitoring of Kunia's water from Wells 3 and 4 is ongoing.

In January 2023 Chemicals known as PFAS (perfluoroalkyl and polyfluoroalkyl substances) were detected for the first time in water samples collected at the Kunia Village Well 3. Well 4 was tested serval months later and found to contain equivalent concentrations of certain PFAS. PFAS cannot be removed through aeration.

Kunia Village purchased bottled water for its residents for a period of 3 months while the water source was switched to an emergency connection to an Army water system, which continues to serve the Village residents and businesses. The Army determined that the current connection is temporary until a permanent solution is determined.

The proposed construction and operation of a new potable water well is to provide a permanent source of drinking water for the residents and businesses of Kunia Village. This action is required to maintain the potable water supply to Oahu's last plantation camp at a time when is needed more than ever.

Groundwater near the proposed well site is near the intersections of the Wahiawa, Waiau-Waipahu, and Ewa-Kunia Water management sectors (Figure 3). Kunia Village currently obtains is water from Del Monte Well #4 which is in the Wahiawa water management sector. Due to PFAS contamination Well 4 will no longer supply potable water to Kunia Village. The proposed location of the new well is in the Pearl Harbor Aquifer Waiau-Waiphau water management sector, immediately south of its boundary with the Wahiawa sector. The well site is intentionally placed near the suspected non-conformity that marks the boundary between the Waipahu-Waiawa Sector (30203111) and the Ewa-Kunia sector (30205111). According to studies by John Mink the Ewa-Kunia sector underlies the Waipahu-Waiawa sector, so if the well was drilled to the first groundwater layer it will draw from the Waiau-Waipahu Sector, if it is drilled deeper, it would intercept the underlying Ewa-Kunia Sector. A final determination will be made following installation and testing of the pilot well. If the pilot well shows contamination from either PFAS or TCE the well will be drilled to the lower water body to determine if it is cleaner.

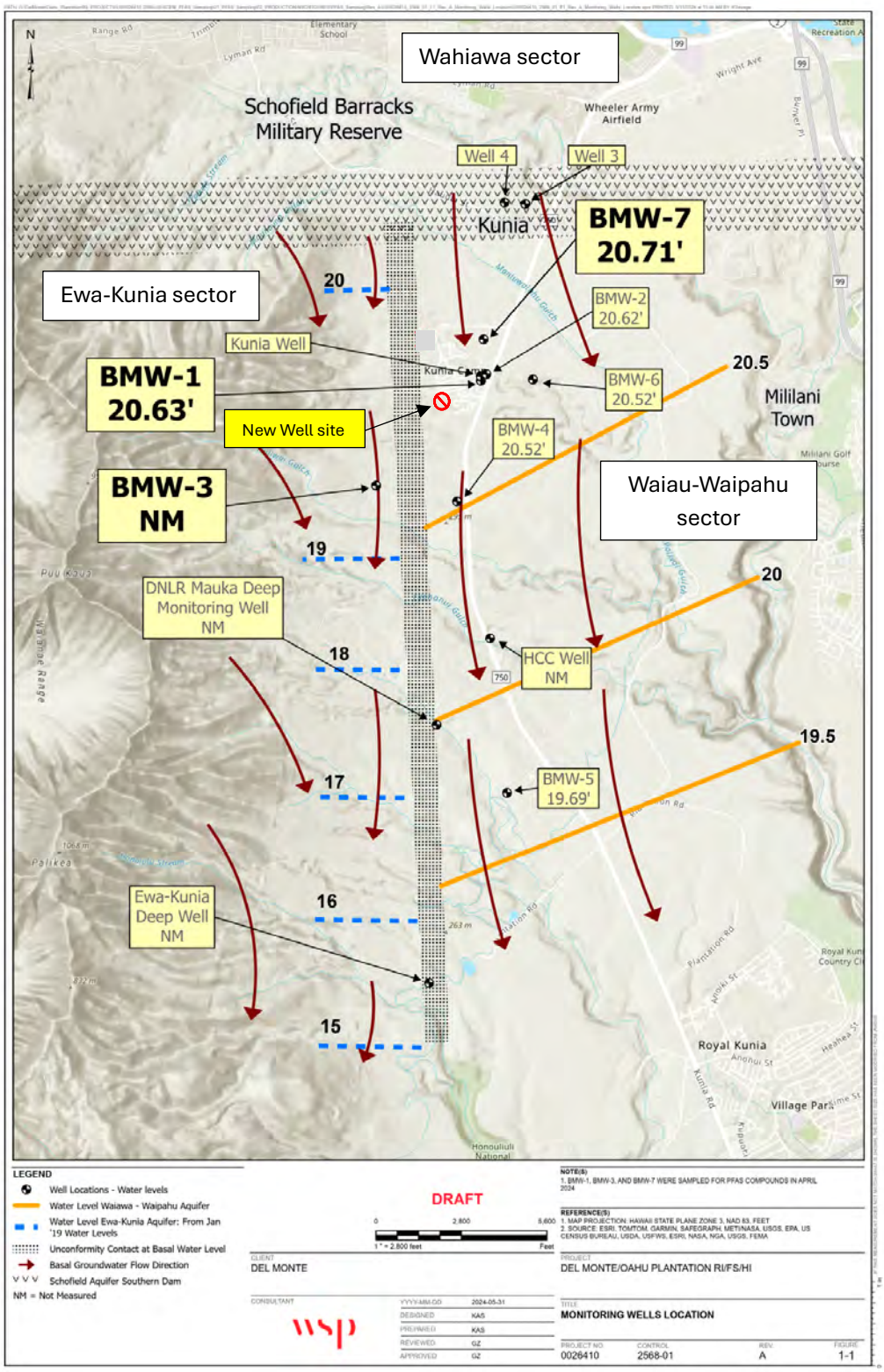
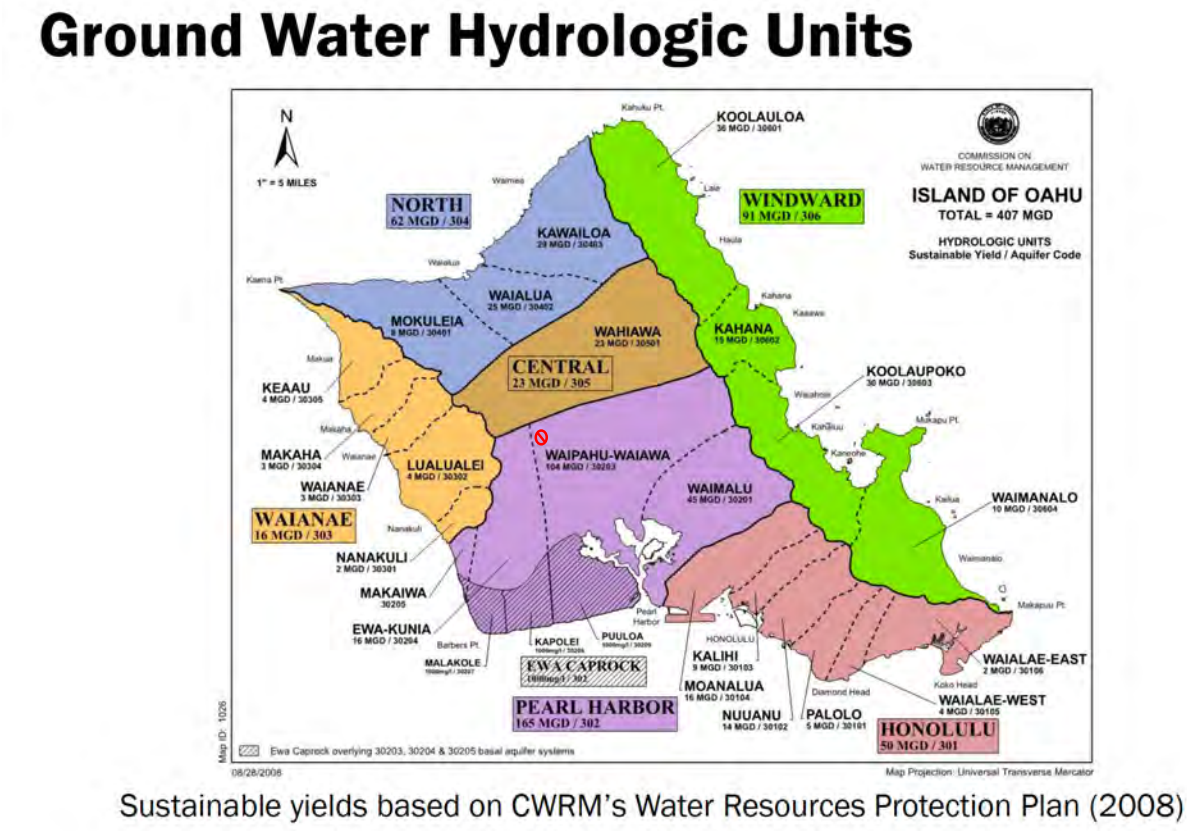


Figure 4: showing the groundwater hydrology. The existing water source is Well 4 in the Wahiawa groundwater management sector. The proposed location of the new well is in the Waiau-Waipahu Sector.

Anticipated Groundwater Impacts

The proposed new well has requested an allocation of 150,000 gallons per day. This represents less that 0.15% of the sustainable yield (104 million gallons per day) determined for the Waipahu-waiau water management section. The same volume will not be pumped from Del Monte Well #4 in the Central water management sector. Because the Central sector is a high-level water body, it overflows into the Waipahu-Waiau sector at a rate estimated to be in the millions of gallons per day.

The proposed well will not increase the demand on Oahu's groundwater. Groundwater flowing into Pearl Harbor or supplied to the DHHL communities in Ewa-Kunia or Waianae coast is not expected to be measurably affected.



Sustainable yields based on CWRM's Water Resources Protection Plan (2008)

If we can provide additional information or clarification please do not hesitate to contact me directly.

David Robichaux. Principal
North Shore Consultants, LLC

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	Shane Lee
Email Address:	Shane_m_lee@me.com
Telephone | Ext.:	808-228-0591
Name of City / Utility:	Kunia Village
City/Town/Municipality:	Kunia
State / Province:	
Country:	Oahu
Year:	2022 Financial Year
Start Date:	01/2022 Enter MM/YYYY numeric format
End Date:	01/2023 Enter MM/YYYY numeric format
Audit Preparation Date:	
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	303

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell to the right

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

? Click to access definition
+ Click to add a comment

Water Audit Report for: Kunia Village (303)
Reporting Year: 2022 1/2022 - 1/2023

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

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

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED				Pcnt:	Value:	
Volume from own sources:	3	51.802	MG/Yr			MG/Yr
Water imported:	n/a	0.000	MG/Yr			MG/Yr
Water exported:	n/a	0.000	MG/Yr			MG/Yr
WATER SUPPLIED:		**51.802**	MG/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION				Pcnt:	Value:	
Billed metered:	2	5.208	MG/Yr			
Billed unmetered:	2	17.520	MG/Yr			
Unbilled metered:	n/a	0.000	MG/Yr			
Unbilled unmetered:	1	0.000	MG/Yr		0.000	MG/Yr
AUTHORIZED CONSUMPTION:		**22.728**	MG/Yr			

Click here: ? for help using option

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)		**29.074**	MG/Yr			
Apparent Losses				Pcnt:	Value:	
Unauthorized consumption:	10	0.000	MG/Yr		0.000	MG/Yr
Customer metering inaccuracies:	3	0.106	MG/Yr	2.00%		MG/Yr
Systematic data handling errors:		0.013	MG/Yr	0.25%		MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses:		**0.119**	MG/Yr
Real Losses (Current Annual Real Losses or CARL)			
Real Losses = Water Losses - Apparent Losses:		**28.954**	MG/Yr
WATER LOSSES:		**29.074**	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER:		**29.074**	MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	5	3.6	miles
Number of active AND inactive service connections:	3	124	
Service connection density:		34	conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes	
Average length of customer service line:			

(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	1	40.0	psi

Note: Average pressure this low will not allow for calculation of UARL

COST DATA

Total annual cost of operating water system:	7	$198,460	$/Year	
Customer retail unit cost (applied to Apparent Losses):	1	$0.00	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	5	$1,252.69	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losses

Retail costs are less than (or equal to) production costs; please review and correct if necessary

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 37 out of 100 *****

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

PRIORITY AREAS FOR ATTENTION:

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

1: Volume from own sources
2: Billed metered
3: Customer retail unit cost (applied to Apparent Losses)

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: Kunia Village (303)
Reporting Year: 2022 | 1/2022 - 1/2023

***** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 37 out of 100 *****

System Attributes:

	Apparent Losses:	0.119	MG/Yr
+	Real Losses:	28.954	MG/Yr
=	**Water Losses:**	**29.074**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$0	
	Annual cost of Real Losses:	$36,271	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	56.1%	
	Non-revenue water as percent by cost of operating system:	18.3%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	2.64	gallons/connection/day
	Real Losses per service connection per day:	639.74	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	15.99	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	28.95	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

AWWA Free Water Audit Software:
User Comments

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

General Comment:	

Audit Item	Comment
Volume from own sources:	Measured by Village Dom meter. This is the volume of water treated at the air stripping tower which enters the distribution system.
Vol. from own sources: Master meter error adjustment:	
Water imported:	No water imported from HBWS during this audit period.
Water imported: master meter error adjustment:	
Water exported:	
Water exported: master meter error adjustment:	
Billed metered:	Commerical usage average 300,000 for Kohana, Noa 67,000, Oils of Aloha 35,000, and Paina 32,000 on average per month = 5,208,000 gallons
Billed unmetered:	120 homes with 4 people average for 12 months at 100 gal/per day/ per person = 17,520,000
Unbilled metered:	No Meters to be billed

Audit Item	Comment
Unbilled unmetered:	No Meters to be billed
Unauthorized consumption:	No Meters to be billed
Customer metering inaccuracies:	No Meters to be tested
Systematic data handling errors:	
Length of mains:	
Number of active AND inactive service connections:	
Average length of customer service line:	
Average operating pressure:	About 80 homes have pressure of 40 psi, other half has about 20 psi
Total annual cost of operating water system:	Fixed and variable costs, SCPM $65,000 + R&M $15,000 + $53,568 (Fixed + Capital Cost).+ $64,892 (water cost from Kunia Water Association)
Customer retail unit cost (applied to Apparent Losses):	N/A
Variable production cost (applied to Real Losses):	Variable costs are KWA Water cost - $64,892. $64,892 / 51.802 MG = $1,252.69

AWWA Free Water Audit Software: Water Balance

WAS v5.0

Water Audit Report for:	Kunia Village (303)	
Reporting Year:	2022	1/2022 - 1/2023
Data Validity Score:	37	

Own Sources (Adjusted for known errors) *51.802*

Water Imported *0.000*

System Input *51.802*

Water Exported *0.000*

Water Supplied *51.802*

Authorized Consumption *22.728*

Water Losses *29.074*

Billed Water Exported

Billed Authorized Consumption *22.728*

- Billed Metered Consumption (water exported is removed) *5.208*
- Billed Unmetered Consumption *17.520*

Unbilled Authorized Consumption *0.000*

- Unbilled Metered Consumption *0.000*
- Unbilled Unmetered Consumption *0.000*

Apparent Losses *0.119*

- Unauthorized Consumption *0.000*
- Customer Metering Inaccuracies *0.106*
- Systematic Data Handling Errors *0.013*

Real Losses *28.954*

- Leakage on Transmission and/or Distribution Mains *Not broken down*
- Leakage and Overflows at Utility's Storage Tanks *Not broken down*
- Leakage on Service Connections *Not broken down*

Revenue Water 0.000

- Revenue Water *22.728*

Non-Revenue Water (NRW) *29.074*

AWWA Free Water Audit Software:
Dashboard

WAS v5.0

The graphic below is a visual representation of the Water Balance with bar heights propotional to the volume of the audit components

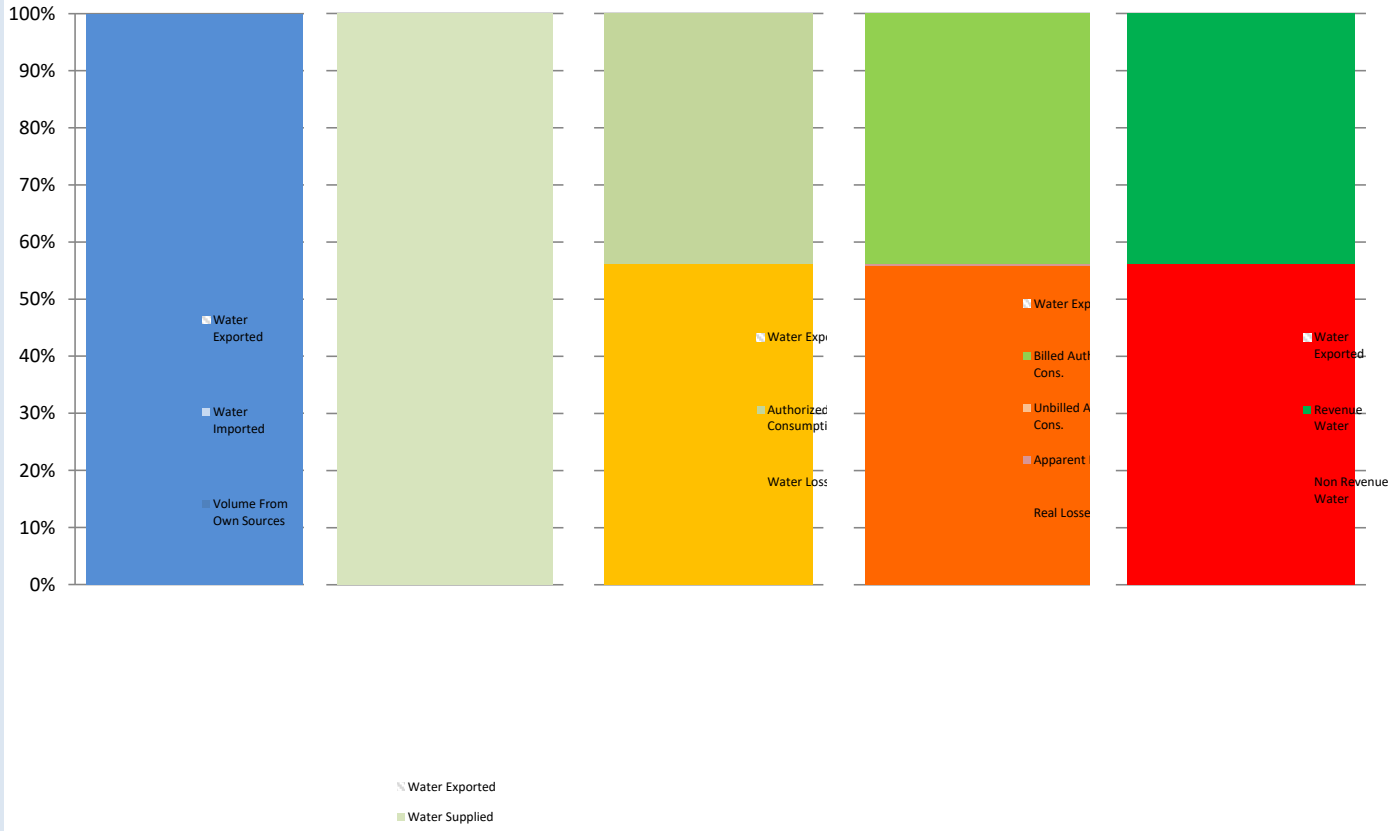
Water Audit Report for: Kunia Village (303)

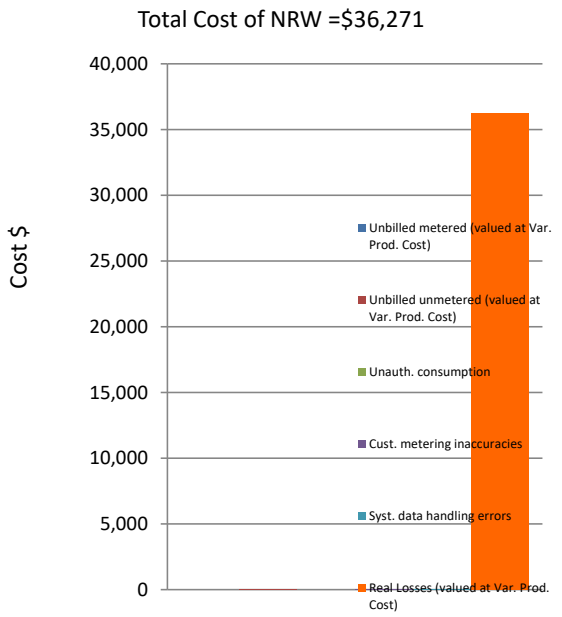
Reporting Year: 2022 | 1/2022 - 1/2023

Data Validity Score: 37

○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water





AWWA Free Water Audit Software: Grading Matrix

WAS 5.0

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
WATER SUPPLIED											
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowledgeable in the M36 methodology.
Improvements to attain higher data grading for "Volume from own Sources" component:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meters.		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibration of related instrumentation for all meter installations. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to further improve meter accuracy.		to maintain 10: Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data is adjusted only when grossly evident data error occurs.	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing deems this necessary.	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources" component, and data gaps in the archived data are corrected on at least a weekly basis.	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data gaps in the archived data are corrected on a daily basis.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically balances flows from all sources and storages; results are reviewed each business day. Tight accountability controls ensure that all data gaps that occur in the archived flow data are quickly detected and corrected. Regular calibrations between SCADA and sources meters ensures minimal data transfer error.
Improvements to attain higher data grading for "Master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature.	to qualify for 4: Install automatic datalogging equipment on production meters. Complete installation of level instrumentation at all tanks/storage facilities and include tank level data in automatic calculation routine in a computerized system. Construct a computerized listing or spreadsheet to archive input volumes, tank/storage volume changes and import/export flows in order to determine the composite "Water Supplied" volume for the distribution system. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps.		to qualify for 6: Refine computerized data collection and archive to include hourly production meter data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Use daily net storage change to balance flows in calculating "Water Supplied" volume. Necessary corrections to data errors are implemented on a weekly basis.		to qualify for 8: Ensure that all flow data is collected and archived on at least an hourly basis. All data is reviewed and detected errors corrected each business day. Tank/storage levels variations are employed in calculating balanced "Water Supplied" component. Adjust production meter data for gross error and inaccuracy confirmed by testing.		to qualify for 10: Link all production and tank/storage facility elevation change data to a Supervisory Control & Data Acquisition (SCADA) System, or similar computerized monitoring/control system, and establish automatic flow balancing algorithm and regularly calibrate between SCADA and source meters. Data is reviewed and corrected each business day.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters. Continue to replace or repair meters as they perform outside of desired accuracy limits. Stay abreast of new and more accurate water level instruments to better record tank/storage levels and archive the variations in storage volume. Keep current with SCADA and data management systems to ensure that archived data is well-managed and error free.
Water Imported:	Select n/a if the water utility's supply is exclusively from its own water resources (no bulk purchased/ imported water)	Less than 25% of imported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of imported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of imported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of imported water sources are metered, meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually for all meter installations. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of imported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Water Imported Volume" component: (*Note: usually the water supplier selling the water - "the Exporter" - to the utility being audited is responsible to maintain the metering installation measuring the imported volume. The utility should coordinate carefully with the Exporter to ensure that adequate meter upkeep takes place and an accurate measure of the Water Imported volume is quantified.*)		<u>to qualify for 2:</u> Review bulk water purchase agreements with partner suppliers; confirm requirements for use and maintenance of accurate metering. Identify needs for new or replacement meters with goal to meter all imported water sources.	<u>To qualify for 4:</u> Locate all imported water sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered imported water interconnections and replace obsolete/defective meters.		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all imported water meters, planning for both regular meter accuracy testing and calibration of the related instrumentation. Continue installation of meters on unmetered imported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all imported water interconnections. Maintain annual meter accuracy testing for all imported water meters and conduct calibration of related instrumentation at least annually. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Conduct meter accuracy testing for all meters on a semi-annual basis, along with calibration of all related instrumentation. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Continue to conduct calibration of related instrumentation on a semi-annual basis. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.
Water imported master meter and supply error adjustment:	Select n/a if the Imported water supply is unmetered, with Imported water quantities estimated on the billing invoices sent by the Exporter to the purchasing Utility.	Inventory information on imported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with water Exporter(s) are missing or written in vague language concerning meter management and testing.	No automatic datalogging of imported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Imported supply metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis by the Exporter with necessary corrections implemented. Meter data is adjusted by the Exporter when gross data errors are detected. A coherent data trail exists for this process to protect both the selling and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly Imported supply metered data is logged automatically & reviewed on at least a weekly basis by the Exporter. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error confirmed by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling and the purchasing Utility.	Conditions between 6 and 8	Continuous Imported supply metered flow data is logged automatically & reviewed each business day by the Exporter. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the Exporter. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water imported master meter and supply error adjustment" component:		<u>to qualify for 2:</u> Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the selling and purchasing Utility.	<u>to qualify for 4:</u> Install automatic datalogging equipment on Imported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the Exporters to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		<u>to qualify for 6:</u> Refine computerized data collection and archive to include hourly Imported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		<u>to qualify for 8:</u> Ensure that all Imported supply metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		<u>to qualify for 10:</u> Conduct accountability checks to confirm that all Imported supply metered data is reviewed and corrected each business day by the Exporter. Results of all meter accuracy tests and data corrections should be available for sharing between the Exporter and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreement between the selling and the purchasing Utility; at least every five years.		<u>to maintain 10:</u> Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the Exporter to help identify meter replacement needs. Keep communication lines with Exporters open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
Water Exported:	Select n/a if the water utility sells no bulk water to neighboring water utilities (no exported water sales)	Less than 25% of exported water sources are metered, remaining sources are estimated. No regular meter accuracy testing.	25% - 50% of exported water sources are metered; other sources estimated. No regular meter accuracy testing.	Conditions between 2 and 4	50% - 75% of exported water sources are metered, other sources estimated. Occasional meter accuracy testing conducted.	Conditions between 4 and 6	At least 75% of exported water sources are metered, meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually, less than 10% of meters are found outside of +/- 6% accuracy	Conditions between 8 and 10	100% of exported water sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually for all meter installations, with less than 10% of accuracy tests found outside of +/- 3% accuracy.
Improvements to attain higher data grading for "Water Exported Volume" component: (*Note: usually, if the water utility being audited sells (Exports) water to a neighboring purchasing Utility, it is the responsibility of the utility exporting the water to maintain the metering installation measuring the Exported volume. The utility exporting the water should ensure that adequate meter upkeep takes place and an accurate measure of the Water Exported volume is quantified.*)		<u>to qualify for 2:</u> Review bulk water sales agreements with purchasing utilities; confirm requirements for use & upkeep of accurate metering. Identify needs to install new, or replace defective meters as needed.	<u>To qualify for 4:</u> Locate all exported water sources on maps and in field, launch meter accuracy testing for existing meters, begin to install meters on unmetered exported water interconnections and replace obsolete/defective meters		<u>to qualify for 6:</u> Formalize annual meter accuracy testing for all exported water meters. Continue installation of meters on unmetered exported water interconnections and replacement of obsolete/defective meters.		<u>to qualify for 8:</u> Complete project to install new, or replace defective, meters on all exported water interconnections. Maintain annual meter accuracy testing for all exported water meters. Repair or replace meters outside of +/- 6% accuracy.		<u>to qualify for 10:</u> Maintain annual meter accuracy testing for all meters. Repair or replace meters outside of +/- 3% accuracy. Investigate new meter technology; pilot one or more replacements with innovative meters in attempt to improve meter accuracy.		<u>to maintain 10:</u> Standardize meter accuracy test frequency to semi-annual, or more frequent, for all meters. Repair or replace meters outside of +/- 3% accuracy. Continually investigate/pilot improving metering technology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Water exported master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its exported supply interconnections.	Inventory information on exported meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined Written agreement(s) with the utility purchasing the water are missing or written in vague language concerning meter management and testing.	No automatic datalogging of exported supply volumes; daily readings are scribed on paper records without any accountability controls to confirm data accuracy and the absence of errors and data gaps in recorded volumes. Written agreement requires meter accuracy testing but is vague on the details of how and who conducts the testing.	Conditions between 2 and 4	Exported metered flow data is logged automatically in electronic format and reviewed at least on a monthly basis, with necessary corrections implemented. Meter data is adjusted by the utility selling (exporting) the water when gross data errors are detected. A coherent data trail exists for this process to protect both the utility exporting the water and the purchasing Utility. Written agreement exists and clearly states requirements and roles for meter accuracy testing and data management.	Conditions between 4 and 6	Hourly exported supply metered data is logged automatically & reviewed on at least a weekly basis by the utility selling the water. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and to correct for error found by meter accuracy testing. Any data gaps in the archived data are detected and corrected during the weekly review. A coherent data trail exists for this process to protect both the selling (exporting) utility and the purchasing Utility.	Conditions between 6 and 8	Continuous exported supply metered flow data is logged automatically & reviewed each business day by the utility selling (exporting) the water. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and any error confirmed by meter accuracy testing. Any data errors/gaps are detected and corrected on a daily basis. A data trail exists for the process to protect both the selling (exporting) Utility and the purchasing Utility.	Conditions between 8 and 10	Computerized system (SCADA or similar) automatically records data which is reviewed each business day by the utility selling (exporting) the water. Tight accountability controls ensure that all error/data gaps that occur in the archived flow data are quickly detected and corrected. A reliable data trail exists and contract provisions for meter testing and data management are reviewed by the selling Utility and purchasing Utility at least once every five years.
Improvements to attain higher data grading for "Water exported master meter and supply error adjustment" component:		to qualify for 2: Develop a plan to restructure recordkeeping system to capture all flow data; set a procedure to review flow data on a daily basis to detect input errors. Obtain more reliable information about existing meters by conducting field inspections of meters and related instrumentation, and obtaining manufacturer literature. Review the written agreement between the utility selling (exporting) the water and the purchasing Utility.	to qualify for 4: Install automatic datalogging equipment on exported supply meters. Set a procedure to review this data on a monthly basis to detect gross anomalies and data gaps. Launch discussions with the purchasing utilities to jointly review terms of the written agreements regarding meter accuracy testing and data management; revise the terms as necessary.		to qualify for 6: Refine computerized data collection and archive to include hourly exported supply metered flow data that is reviewed at least on a weekly basis to detect specific data anomalies and gaps. Make necessary corrections to errors/data errors on a weekly basis.		to qualify for 8: Ensure that all exported metered flow data is collected and archived on at least an hourly basis. All data is reviewed and errors/data gaps are corrected each business day.		to qualify for 10: Conduct accountability checks to confirm that all exported metered flow data is reviewed and corrected each business day by the utility selling the water. Results of all meter accuracy tests and data corrections should be available for sharing between the utility and the purchasing Utility. Establish a schedule for a regular review and updating of the contractual language in the written agreements with the purchasing utilities; at least every five years.		to maintain 10: Monitor meter innovations for development of more accurate and less expensive flowmeters; work with the purchasing utilities to help identify meter replacement needs. Keep communication lines with the purchasing utilities open and maintain productive relations. Keep the written agreement current with clear and explicit language that meets the ongoing needs of all parties.
AUTHORIZED CONSUMPTION											
Billed metered:	n/a (not applicable). Select n/a only if the entire customer population is not metered and is billed for water service on a flat or fixed rate basis. In such a case the volume entered must be zero.	Less than 50% of customers with volume-based billings from meter readings; flat or fixed rate billing exists for the majority of the customer population	At least 50% of customers with volume-based billing from meter reads; flat rate billing for others. Manual meter reading is conducted, with less than 50% meter read success rate, remainding accounts' consumption is estimated. Limited meter records, no regular meter testing or replacement. Billing data maintained on paper records, with no auditing.	Conditions between 2 and 4	At least 75% of customers with volume-based, billing from meter reads; flat or fixed rate billing for remaining accounts. Manual meter reading is conducted with at least 50% meter read success rate; consumption for accounts with failed reads is estimated. Purchase records verify age of customer meters; only very limited meter accuracy testing is conducted. Customer meters are replaced only upon complete failure. Computerized billing records exist, but only sporadic internal auditing conducted.	Conditions between 4 and 6	At least 90% of customers with volume-based billing from meter reads; consumption for remaining accounts is estimated. Manual customer meter reading gives at least 80% customer meter reading success rate; consumption for accounts with failed reads is estimated. Good customer meter records eixst, but only limited meter accuracy testing is conducted. Regular replacement is conducted for the oldest meters. Computerized billing records exist with annual auditing of summary statistics conducting by utility personnel.	Conditions between 6 and 8	At least 97% of customers exist with volume-based billing from meter reads. At least 90% customer meter reading success rate; or at least 80% read success rate with planning and budgeting for trials of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) in one or more pilot areas. Good customer meter records. Regular meter accuracy testing guides replacement of statistically significant number of meters each year. Routine auditing of computerized billing records for global and detailed statistics occurs annually by utility personnel, and is verified by third party at least once every five years.	Conditions between 8 and 10	At least 99% of customers exist with volume-based billing from meter reads. At least 95% customer meter reading success rate; or minimum 80% meter reading success rate, with Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) trials underway. Statistically significant customer meter testing and replacement program in place on a continuous basis. Computerized billing with routine, detailed auditing, including field investigation of representative sample of accounts undertaken annually by utility personnel. Audit is conducted by third party auditors at least once every three years.
Improvements to attain higher data grading for "Billed Metered Consumption" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Conduct investigations or trials of customer meters to select appropriate meter models. Budget funding for meter installations. Investigate volume based water rate structures.	to qualify for 4: Purchase and install meters on unmetered accounts. Implement policies to improve meter reading success. Catalog meter information during meter read visits to identify age/model of existing meters. Test a minimal number of meters for accuracy. Install computerized billing system.		to qualify for 6: Purchase and install meters on unmetered accounts. Eliminate flat fee billing and establish appropriate water rate structure based upon measured consumption. Continue to achieve verifiable success in removing manual meter reading barriers. Expand meter accuracy testing. Launch regular meter replacement program. Launch a program of annual auditing of global billing statistics by utility personnel.		to qualify for 8: Purchase and install meters on unmetered accounts. If customer meter reading success rate is less than 97%, assess cost-effectiveness of Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system for portion or entire system; or otherwise achieve ongoing improvements in manual meter reading success rate to 97% or higher. Refine meter accuracy testing program. Set meter replacement goals based upon accuracy test results. Implement annual auditing of detailed billing records by utility personnel and implement third party auditing at least once every five years.		to qualify for 10: Purchase and install meters on unmetered accounts. Launch Automatic Meter Reading (AMR) or Advanced Metering Infrastructure (AMI) system trials if manual meter reading success rate of at least 99% is not achieved within a five-year program. Continue meter accuracy testing program. Conduct planning and budgeting for large scale meter replacement based upon meter life cycle analysis using cumulative flow target. Continue annual detailed billing data auditing by utility personnel and conduct third party auditing at least once every three years.		to maintain 10: Continue annual internal billing data auditing, and third party auditing at least every three years. Continue customer meter accuracy testing to ensure that accurate customer meter readings are obtained and entered as the basis for volume based billing. Stay abreast of improvements in Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) and information management. Plan and budget for justified upgrades in metering, meter reading and billing data management to maintain very high accuracy in customer metering and billing.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Billed unmetered:	Select n/a if it is the policy of the water utility to meter all customer connections and it has been confirmed by detailed auditing that all customers do indeed have a water meter; i.e. no intentionally unmetered accounts exist	Water utility policy does not require customer metering; flat or fixed fee billing is employed. No data is collected on customer consumption. The only estimates of customer population consumption available are derived from data estimation methods using average fixture count multiplied by number of connections, or similar approach.	Water utility policy does not require customer metering; flat or fixed fee billing is employed. Some metered accounts exist in parts of the system (pilot areas or District Metered Areas) with consumption read periodically or recorded on portable dataloggers over one, three, or seven day periods. Data from these sample meters are used to infer consumption for the total customer population. Site specific estimation methods are used for unusual buildings/water uses.	Conditions between 2 and 4	Water utility policy does require metering and volume based billing in general. However, a liberal amount of exemptions and a lack of clearly written and communicated procedures result in up to 20% of billed accounts believed to be unmetered by exemption; or the water utility is in transition to becoming fully metered, and a large number of customers remain unmetered. A rough estimate of the annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 4 and 6	Water utility policy does require metering and volume based billing but established exemptions exist for a portion of accounts such as municipal buildings. As many as 15% of billed accounts are unmetered due to this exemption or meter installation difficulties. Only a group estimate of annual consumption for all unmetered accounts is included in the annual water audit, with no inspection of individual unmetered accounts.	Conditions between 6 and 8	Water utility policy does require metering and volume based billing for all customer accounts. However, less than 5% of billed accounts remain unmetered because meter installation is hindered by unusual circumstances. The goal is to minimize the number of unmetered accounts. Reliable estimates of consumption are obtained for these unmetered accounts via site specific estimation methods.	Conditions between 8 and 10	Water utility policy does require metering and volume based billing for all customer accounts. Less than 2% of billed accounts are unmetered and exist because meter installation is hindered by unusual circumstances. The goal exists to minimize the number of unmetered accounts to the extent that is economical. Reliable estimates of consumption are obtained at these accounts via site specific estimation methods.
Improvements to attain higher data grading for "Billed Unmetered Consumption" component:		to qualify for 2: Conduct research and evaluate cost/benefit of a new water utility policy to require metering of the customer population; thereby greatly reducing or eliminating unmetered accounts. Conduct pilot metering project by installing water meters in small sample of customer accounts and periodically reading the meters or datalogging the water consumption over one, three, or seven day periods.	to qualify for 4: Implement a new water utility policy requiring customer metering. Launch or expand pilot metering study to include several different meter types, which will provide data for economic assessment of full scale metering options. Assess sites with access difficulties to devise means to obtain water consumption volumes. Begin customer meter installation.		to qualify for 6: Refine policy and procedures to improve customer metering participation for all but solidly exempt accounts. Assign staff resources to review billing records to identify errant unmetered properties. Specify metering needs and funding requirements to install sufficient meters to significant reduce the number of unmetered accounts		to qualify for 8: Push to install customer meters on a full scale basis. Refine metering policy and procedures to ensure that all accounts, including municipal properties, are designated for meters. Plan special efforts to address "hard-to-access" accounts. Implement procedures to obtain a reliable consumption estimate for the remaining few unmetered accounts awaiting meter installation.		to qualify for 10: Continue customer meter installation throughout the service area, with a goal to minimize unmetered accounts. Sustain the effort to investigate accounts with access difficulties, and devise means to install water meters or otherwise measure water consumption.		to maintain 10: Continue to refine estimation methods for unmetered consumption and explore means to establish metering, for as many billed remaining unmetered accounts as is economically feasible.
Unbilled metered:	select n/a if all billing-exempt consumption is unmetered.	Billing practices exempt certain accounts, such as municipal buildings, but written policies do not exist; and a reliable count of unbilled metered accounts is unavailable. Meter upkeep and meter reading on these accounts is rare and not considered a priority. Due to poor recordkeeping and lack of auditing, water consumption for all such accounts is purely guesstimated.	Billing practices exempt certain accounts, such as municipal buildings, but only scattered, dated written directives exist to justify this practice. A reliable count of unbilled metered accounts is unavailable. Sporadic meter replacement and meter reading occurs on an as-needed basis. The total annual water consumption for all unbilled, metered accounts is estimated based upon approximating the number of accounts and assigning consumption from actively billed accounts of same meter size.	Conditions between 2 and 4	Dated written procedures permit billing exemption for specific accounts, such as municipal properties, but are unclear regarding certain other types of accounts. Meter reading is given low priority and is sporadic. Consumption is quantified from meter readings where available. The total number of unbilled, unmetered accounts must be estimated along with consumption volumes.	Conditions between 4 and 6	Written policies regarding billing exemptions exist but adherence in practice is questionable. Metering and meter reading for municipal buildings is reliable but sporadic for other unbilled metered accounts. Periodic auditing of such accounts is conducted. Water consumption is quantified directly from meter readings where available, but the majority of the consumption is estimated.	Conditions between 6 and 8	Written policy identifies the types of accounts granted a billing exemption. Customer meter management and meter reading are considered secondary priorities, but meter reading is conducted at least annually to obtain consumption volumes for the annual water audit. High level auditing of billing records ensures that a reliable census of such accounts exists.	Conditions between 8 and 10	Clearly written policy identifies the types of accounts given a billing exemption, with emphasis on keeping such accounts to a minimum. Customer meter management and meter reading for these accounts is given proper priority and is reliably conducted. Regular auditing confirms this. Total water consumption for these accounts is taken from reliable readings from accurate meters.
Improvements to attain higher data grading for "Unbilled Metered Consumption" component:		to qualify for 2: Reassess the water utility's policy allowing certain accounts to be granted a billing exemption. Draft an outline of a new written policy for billing exemptions, with clear justification as to why any accounts should be exempt from billing, and with the intention to keep the number of such accounts to a minimum.	to qualify for 4: Review historic written directives and policy documents allowing certain accounts to be billing-exempt. Draft an outline of a written policy for billing exemptions, identify criteria that grants an exemption, with a goal of keeping this number of accounts to a minimum. Consider increasing the priority of reading meters on unbilled accounts at least annually.		to qualify for 6: Draft a new written policy regarding billing exemptions based upon consensus criteria allowing this occurrence. Assign resources to audit meter records and billing records to obtain census of unbilled metered accounts. Gradually include a greater number of these metered accounts to the routes for regular meter reading.		to qualify for 8: Communicate billing exemption policy throughout the organization and implement procedures that ensure proper account management. Conduct inspections of accounts confirmed in unbilled metered status and verify that accurate meters exist and are scheduled for routine meter readings. Gradually increase the number of unbilled metered accounts that are included in regular meter reading routes.		to qualify for 10: Ensure that meter management (meter accuracy testing, meter replacement) and meter reading activities for unbilled accounts are accorded the same priority as billed accounts. Establish ongoing annual auditing process to ensure that water consumption is reliably collected and provided to the annual water audit process.		to maintain 10: Reassess the utility's philosophy in allowing any water uses to go "unbilled". It is possible to meter and bill all accounts, even if the fee charged for water consumption is discounted or waived. Metering and billing all accounts ensures that water consumption is tracked and water waste from plumbing leaks is detected and minimized.
Unbilled unmetered:		Extent of unbilled, unmetered consumption is unknown due to unclear policies and poor recordkeeping. Total consumption is quantified based upon a purely subjective estimate.	Clear extent of unbilled, unmetered consumption is unknown, but a number of events are randomly documented each year, confirming existence of such consumption, but without sufficient documentation to quantify an accurate estimate of the annual volume consumed.	Conditions between 2 and 4	Extent of unbilled, unmetered consumption is partially known, and procedures exist to document certain events such as miscellaneous fire hydrant uses. Formulae is used to quantify the consumption from such events (time running multiplied by typical flowrate, multiplied by number of events).	Default value of 1.25% of system input volume is employed	Coherent policies exist for some forms of unbilled, unmetered consumption but others await closer evaluation. Reasonable recordkeeping for the managed uses exists and allows for annual volumes to be quantified by inference, but unsupervised uses are guesstimated.	Conditions between 6 and 8	Clear policies and good recordkeeping exist for some uses (ex: water used in periodic testing of unmetered fire connections), but other uses (ex: miscellaneous uses of fire hydrants) have limited oversight. Total consumption is a mix of well quantified use such as from formulae (time running multiplied by typical flow, multiplied by number of events) or temporary meters, and relatively subjective estimates of less regulated use.	Conditions between 8 and 10	Clear policies exist to identify permitted use of water in unbilled, unmetered fashion, with the intention of minimizing this type of consumption. Good records document each occurrence and consumption is quantified via formulae (time running multiplied by typical flow, multiplied by number of events) or use of temporary meters.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Unbilled Unmetered Consumption" component:		to qualify for 5: Utilize the accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 2: Establish a policy regarding what water uses should be allowed to remain as unbilled and unmetered. Consider tracking a small sample of one such use (ex: fire hydrant flushings).	to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of this use. to qualify for 4: Evaluate the documentation of events that have been observed. Meet with user groups (ex: for fire hydrants - fire departments, contractors to ascertain their need and/or volume requirements for water from fire hydrants).		to qualify for 5: Utilize accepted default value of 1.25% of the volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process, and should focus on other components since the volume of unbilled, umetered consumption is usually a relatively small quatity component, and other larger-quantity components should take priority.	to qualify for 6 or greater: Finalize policy and begin to conduct field checks to better establish and quantify such usage. Proceed if top-down audit exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policy and procedures for various unmetered usages. For example, ensure that a policy exists and permits are issued for use of fire hydrants by persons outside of the utility. Create written procedures for use and documentation of fire hydrants by water utility personnel. Use same approach for other types of unbilled, unmetered water usage.		to qualify for 10: Refine written procedures to ensure that all uses of unbilled, unmetered water are overseen by a structured permitting process managed by water utility personnel. Reassess policy to determine if some of these uses have value in being converted to billed and/or metered status.		to maintain 10: Continue to refine policy and procedures with intention of reducing the number of allowable uses of water in unbilled and unmetered fashion. Any uses that can feasibly become billed and metered should be converted eventually.
APPARENT LOSSES											
Unauthorized consumption:		Extent of unauthorized consumption is unknown due to unclear policies and poor recordkeeping. Total unauthorized consumption is guesstimated.	Unauthorized consumption is a known occurrence, but its extent is a mystery. There are no requirements to document observed events, but periodic field reports capture some of these occurrences. Total unauthorized consumption is approximated from this limited data.	conditions between 2 and 4	Procedures exist to document some unauthorized consumption such as observed unauthorized fire hydrant openings. Use formulae to quantify this consumption (time running multiplied typical flowrate, multiplied by number of events).	Default value of 0.25% of volume of water supplied is employed	Coherent policies exist for some forms of unauthorized consumption (more than simply fire hydrant misuse) but others await closer evaluation. Reasonable surveillance and recordkeeping exist for occurrences that fall under the policy. Volumes quantified by inference from these records.	Conditions between 6 and 8	Clear policies and good auditable recordkeeping exist for certain events (ex: tampering with water meters, illegal bypasses of customer meters); but other occurrences have limited oversight. Total consumption is a combination of volumes from formulae (time x typical flow) and subjective estimates of unconfirmed consumption.	Conditions between 8 and 10	Clear policies exist to identify all known unauthorized uses of water. Staff and procedures exist to provide enforcement of policies and detect violations. Each occurrence is recorded and quantified via formulae (estimated time running multiplied by typical flow) or similar methods. All records and calculations should exist in a form that can be audited by a third party.
Improvements to attain higher data grading for "Unauthorized Consumption" component:		to qualify for 5: Use accepted default of 0.25% of volume of water supplied. to qualify for 2: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)	to qualify for 5: Use accepted default of 0.25% of system input volume to qualify for 4: Review utility policy regarding what water uses are considered unauthorized, and consider tracking a small sample of one such occurrence (ex: unauthorized fire hydrant openings)		to qualify for 5: Utilize accepted default value of 0.25% of volume of water supplied as an expedient means to gain a reasonable quantification of all such use. This is particularly appropriate for water utilities who are in the early stages of the water auditing process.	to qualify for 6 or greater: Finalize policy updates to clearly identify the types of water consumption that are authorized from those usages that fall outside of this policy and are, therefore, unauthorized. Begin to conduct regular field checks. Proceed if the top-down audit already exists and/or a great volume of such use is suspected.	to qualify for 8: Assess water utility policies to ensure that all known occurrences of unauthorized consumption are outlawed, and that appropriate penalties are prescribed. Create written procedures for detection and documentation of various occurrences of unauthorized consumption as they are uncovered.		to qualify for 10: Refine written procedures and assign staff to seek out likely occurrences of unauthorized consumption. Explore new locking devices, monitors and other technologies designed to detect and thwart unauthorized consumption.		to maintain 10: Continue to refine policy and procedures to eliminate any loopholes that allow or tacitly encourage unauthorized consumption. Continue to be vigilant in detection, documentation and enforcement efforts.
Customer metering inaccuracies:	select n/a only if the entire customer population is unmetered. In such a case the volume entered must be zero.	Customer meters exist, but with unorganized paper records on meters; no meter accuracy testing or meter replacement program for any size of retail meter. Metering workflow is driven chaotically with no proactive management. Loss volume due to aggregate meter inaccuracy is guesstimated.	Poor recordkeeping and meter oversight is recognized by water utility management who has allotted staff and funding resources to organize improved recordkeeping and start meter accuracy testing. Existing paper records gathered and organized to provide cursory disposition of meter population. Customer meters are tested for accuracy only upon customer request.	Conditions between 2 and 4	Reliable recordkeeping exists; meter information is improving as meters are replaced. Meter accuracy testing is conducted annually for a small number of meters (more than just customer requests, but less than 1% of inventory). A limited number of the oldest meters are replaced each year. Inaccuracy volume is largely an estimate, but refined based upon limited testing data.	Conditions between 4 and 6	A reliable electronic recordkeeping system for meters exists. The meter population includes a mix of new high performing meters and dated meters with suspect accuracy. Routine, but limited, meter accuracy testing and meter replacement occur. Inaccuracy volume is quantified using a mix of reliable and less certain data.	Conditions between 6 and 8	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for various types of meters.	Ongoing meter replacement and accuracy testing result in highly accurate customer meter population. Statistically significant number of meters are tested in audit year. This testing is conducted on samples of meters of varying age and accumulated volume of throughput to determine optimum replacement time for these meters.	Good records of all active customer meters exist and include as a minimum: meter number, account number/location, type, size and manufacturer. Ongoing meter replacement occurs according to a targeted and justified basis. Regular meter accuracy testing gives a reliable measure of composite inaccuracy volume for the customer meter population. New metering technology is embraced to keep overall accuracy improving. Procedures are reviewed by a third party knowledgeable in the M36 methodology.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Customer meter inaccuracy volume" component:	If n/a is selected because the customer meter population is unmetered, consider establishing a new policy to meter the customer population and employ water rates based upon metered volumes.	to qualify for 2: Gather available meter purchase records. Conduct testing on a small number of meters believed to be the most inaccurate. Review staffing needs of the metering group and budget for necessary resources to better organize meter management.	to qualify for 4: Implement a reliable record keeping system for customer meter histories, preferably using electronic methods typically linked to, or part of, the Customer Billing System or Customer Information System. Expand meter accuracy testing to a larger group of meters.		to qualify for 6: Standardize the procedures for meter recordkeeping within an electronic information system. Accelerate meter accuracy testing and meter replacements guided by testing results.		to qualify for 8: Expand annual meter accuracy testing to evaluate a statistically significant number of meter makes/models. Expand meter replacement program to replace statistically significant number of poor performing meters each year.		to qualify for 9: Continue efforts to manage meter population with reliable recordkeeping. Test a statistically significant number of meters each year and analyze test results in an ongoing manner to serve as a basis for a target meter replacement strategy based upon accumulated volume throughput.	to qualify for 10: Continue efforts to manage meter population with reliable recordkeeping, meter testing and replacement. Evaluate new meter types and install one or more types in 5-10 customer accounts each year in order to pilot improving metering technology.	to maintain 10: Increase the number of meters tested and replaced as justified by meter accuracy test data. Continually monitor development of new metering technology and Advanced Metering Infrastructure (AMI) to grasp opportunities for greater accuracy in metering of water flow and management of customer consumption data.
Systematic Data Handling Errors:	Note: all water utilities incur some amount of this error. Even in water utilities with unmetered customer populations and fixed rate billing, errors occur in annual billing tabulations. Enter a positive value for the volume and select a grading.	Policies and procedures for activation of new customer water billing accounts are vague and lack accountability. Billing data is maintained on paper records which are not well organized. No auditing is conducted to confirm billing data handling efficiency. An unknown number of customers escape routine billing due to lack of billing process oversight.	Policy and procedures for activation of new customer accounts and oversight of billing records exist but need refinement. Billing data is maintained on paper records or insufficiently capable electronic database. Only periodic unstructured auditing work is conducted to confirm billing data handling efficiency. The volume of unbilled water due to billing lapses is a guess.	Conditions between 2 and 4	Policy and procedures for new account activation and oversight of billing operations exist but needs refinement. Periodic, limited internal audits conducted and confirm with approximate accuracy the consumption volumes lost to billing lapses.	Conditions between 4 and 6	Policy and procedures for new account activation and oversight of billing operations is adequate and reviewed periodically. Computerized billing system is in use with basic reporting available. Any effect of billing adjustments on measured consumption volumes is well understood. Internal checks of billing data error conducted annually. Reasonably accurate quantification of consumption volume lost to billing lapses is obtained.	Conditions between 6 and 8	New account activation and billing operations policy and procedures are reviewed at least biannually. Computerized billing system includes an array of reports to confirm billing data and system functionality. Checks are conducted routinely to flag and explain zero consumption accounts. Annual internal checks conducted with third party audit conducted at least once every five years. Accountability checks flag billing lapses. Consumption lost to billing lapses is well quantified and reducing year-by-year.	Conditions between 8 and 10	Sound written policy and procedures exist for new account activation and oversight of customer billing operations. Robust computerized billing system gives high functionality and reporting capabilities which are utilized, analyzed and the results reported each billing cycle. Assessment of policy and data handling errors are conducted internally and audited by third party at least once every three years, ensuring consumption lost to billing lapses is minimized and detected as it occurs.
Improvements to attain higher data grading for "Systematic Data Handling Error volume" component:		to qualify for 2: Draft written policy and procedures for activating new water billing accounts and oversight of billing operations. Investigate and budget for computerized customer billing system. Conduct initial audit of billing records by flow-charting the basic business processes of the customer account/billing function.	to qualify for 4: Finalize written policy and procedures for activation of new billing acocunts and overall billing operations management. Implement a computerized customer billing system. Conduct initial audit of billing records as part of this process.		to qualify for 6: Refine new account activation and billing operations procedures and ensure consistency with the utility policy regarding billing, and minimize opportunity for missed billings. Upgrade or replace customer billing system for needed functionality - ensure that billing adjustments don't corrupt the value of consumption volumes. Procedurize internal annual audit process.		to qualify for 8: Formalize regular review of new account activation process and general billing practices. Enhance reporting capability of computerized billing system. Formalize regular auditing process to reveal scope of data handling error. Plan for periodic third party audit to occur at least once every five years.		to qualify for 10: Close policy/procedure loopholes that allow some customer accounts to go unbilled, or data handling errors to exist. Ensure that billing system reports are utilized, analyzed and reported every billing cycle. Ensure that internal and third party audits are conducted at least once every three years.		to maintain 10: Stay abreast of customer information management developments and innovations. Monitor developments of Advanced Metering Infrastructure (AMI) and integrate technology to ensure that customer endpoint information is well-monitored and errors/lapses are at an economic minimum.
SYSTEM DATA											
Length of mains:		Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.	Conditions between 2 and 4	Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.	Conditions between 4 and 6	Sound written policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.	Conditions between 6 and 8	Sound written policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.	Conditions between 8 and 10	Sound written policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases. Records of annual field validation should be available for review.
Improvements to attain higher data grading for "Length of Water Mains" component:		to qualify for 2: Assign personnel to inventory current as-built records and compare with customer billing system records and highway plans in order to verify poorly documented pipelines. Assemble policy documents regarding permitting and documentation of water main installations by the utility and building developers; identify gaps in procedures that result in poor documentation of new water main installations.	to qualify for 4: Complete inventory of paper records of water main installations for several years prior to audit year. Review policy and procedures for commissioning and documenting new water main installation.		to qualify for 6: Finalize updates/improvements to written policy and procedures for permitting/commissioning new main installations. Confirm inventory of records for five years prior to audit year; correct any errors or omissions.		to qualify for 8: Launch random field checks of limited number of locations. Convert to electronic database such as a Geographic Information System (GIS) with backup as justified. Develop written policy and procedures.		to qualify for 10: Link Geographic Information System (GIS) and asset management databases, conduct field verification of data. Record field verification information at least annually.		to maintain 10: Continue with standardization and random field validation to improve the completeness and accuracy of the system.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Number of active AND inactive service connections:		Vague permitting (of new service connections) policy and poor paper recordkeeping of customer connections/billings result in suspect determination of the number of service connections, which may be 10-15% in error from actual count.	General permitting policy exists but paper records, procedural gaps, and weak oversight result in questionable total for number of connections, which may vary 5-10% of actual count.	Conditions between 2 and 4	Written account activation policy and procedures exist, but with some gaps in performance and oversight. Computerized information management system is being brought online to replace dated paper recordkeeping system. Reasonably accurate tracking of service connection installations & abandonments; but count can be up to 5% in error from actual total.	Conditions between 4 and 6	Written new account activation and overall billing policies and procedures are adequate and reviewed periodically. Computerized information management system is in use with annual installations & abandonments totaled. Very limited field verifications and audits. Error in count of number of service connections is believed to be no more than 3%.	Conditions between 6 and 8	Policies and procedures for new account activation and overall billing operations are written, well-structured and reviewed at least biannually. Well managed computerized information management system exists and routine, periodic field checks and internal system audits are conducted. Counts of connections are no more than 2% in error.	Conditions between 8 and 10	Sound written policy and well managed and audited procedures ensure reliable management of service connection population. Computerized information management system, Customer Billing System, and Geographic Information System (GIS) information agree; field validation proves truth of databases. Count of connections recorded as being in error is less than 1% of the entire population.
Improvements to attain higher data grading for "Number of Active and Inactive Service Connections" component:	**Note: The number of Service Connections does <u>not</u> include fire hydrant leads/lines connecting the hydrant to the water main**	<u>to qualify for 2</u>: Draft new policy and procedures for new account activation and overall billing operations. Research and collect paper records of installations & abandonments for several years prior to audit year.	<u>to qualify for 4</u>: Refine policy and procedures for new account activation and overall billing operations. Research computerized recordkeeping system (Customer Information System or Customer Billing System) to improve documentation format for service connections.		<u>to qualify for 6</u>: Refine procedures to ensure consistency with new account activation and overall billing policy to establish new service connections or decommission existing connections. Improve process to include all totals for at least five years prior to audit year.		<u>to qualify for 8</u>: Formalize regular review of new account activation and overall billing operations policies and procedures. Launch random field checks of limited number of locations. Develop reports and auditing mechanisms for computerized information management system.		<u>to qualify for 10</u>: Close any procedural loopholes that allow installations to go undocumented. Link computerized information management system with Geographic Information System (GIS) and formalize field inspection and information system auditing processes. Documentation of new or decommissioned service connections encounters several levels of checks and balances.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of system.
Average length of customer service line:	Note: if customer water meters are located outside of the customer building next to the curb stop or boundary separating utility/customer responsibility, then the auditor should answer "Yes" to the question on the Reporting Worksheet asking about this. If the answer is Yes, the grading description listed under the Grading of 10(a) will be followed, with a value of zero automatically entered at a Grading of 10. See the Service Connection Diagram worksheet for a visual presentation of this distance.	Gradings 1-9 apply if customer properties are unmetered, if customer meters exist and are located inside the customer building premises, or if the water utility owns and is responsible for the entire service connection piping from the water main to the customer building. In any of these cases the average distance between the curb stop or boundary separating utility/customer responsibility for service connection piping, and the typical first point of use (ex: faucet) or the customer meter must be quantified. Gradings of 1-9 are used to grade the validity of the means to quantify this value. (See the "Service Connection Diagram" worksheet)									<u>Either of two conditions can be met for a grading of 10</u>: a) Customer water meters exist outside of customer buildings next to the curb stop or boundary separating utility/customer responsibility for service connection piping. If so, answer "Yes" to the question on the Reporting Working asking about this condition. A value of zero and a Grading of 10 are automatically entered in the Reporting Worksheet . b). Meters exist inside customer buildings, or properties are unmetered. In either case, answer "No" to the Reporting Worksheet question on meter location, and enter a distance determined by the auditor. For a Grading of 10 this value must be a very reliable number from a Geographic Information System (GIS) and confirmed by a statistically valid number of field checks.
		Vague policy exists to define the delineation of water utility ownership and customer ownership of the service connection piping. Curb stops are perceived as the breakpoint but these have not been well-maintained or documented. Most are buried or obscured. Their location varies widely from site-to-site, and estimating this distance is arbitrary due to the unknown location of many curb stops.	Policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. The piping from the water main to the curb stop is the property of the water utility; and the piping from the curb stop to the customer building is owned by the customer. Curb stop locations are not well documented and the average distance is based upon a limited number of locations measured in the field.	Conditions between 2 and 4	Good policy requires that the curb stop serves as the delineation point between water utility ownership and customer ownership of the service connection piping. Curb stops are generally installed as needed and are reasonably documented. Their location varies widely from site-to-site, and an estimate of this distance is hindered by the availability of paper records of limited accuracy.	Conditions between 4 and 6	Clear written policy exists to define utility/customer responsibility for service connection piping. Accurate, well-maintained paper or basic electronic recordkeeping system exists. Periodic field checks confirm piping lengths for a sample of customer properties.	Conditions between 6 and 8	Clearly worded policy standardizes the location of curb stops and meters, which are inspected upon installation. Accurate and well maintained electronic records exist with periodic field checks to confirm locations of service lines, curb stops and customer meter pits. An accurate number of customer properties from the customer billing system allows for reliable averaging of this length.	Conditions between 8 and 10	
Improvements to attain higher data grading for "Average Length of Customer Service Line" component:		<u>to qualify for 2</u>: Research and collect paper records of service line installations. Inspect several sites in the field using pipe locators to locate curb stops. Obtain the length of this small sample of connections in this manner.	<u>to qualify for 4</u>: Formalize and communicate policy delineating utility/customer responsibilities for service connection piping. Assess accuracy of paper records by field inspection of a small sample of service connections using pipe locators as needed. Research the potential migration to a computerized information management system to store service connection data.		<u>to qualify for 6</u>: Establish coherent procedures to ensure that policy for curb stop, meter installation and documentation is followed. Gain consensus within the water utility for the establishment of a computerized information management system.		<u>to qualify for 8</u>: Implement an electronic means of recordkeeping, typically via a customer information system, customer billing system, or Geographic Information System (GIS). Standardize the process to conduct field checks of a limited number of locations.		<u>to qualify for 10</u>: Link customer information management system and Geographic Information System (GIS), standardize process for field verification of data.		<u>to maintain 10</u>: Continue with standardization and random field validation to improve knowledge of service connection configurations and customer meter locations.
Average operating pressure:		Available records are poorly assembled and maintained paper records of supply pump characteristics and water distribution system operating conditions. Average pressure is guesstimated based upon this information and ground elevations from crude topographical maps. Widely varying distribution system pressures due to undulating terrain, high system head loss and weak/erratic pressure controls further compromise the validity of the average pressure calculation.	Limited telemetry monitoring of scattered pumping station and water storage tank sites provides some static pressure data, which is recorded in handwritten logbooks. Pressure data is gathered at individual sites only when low pressure complaints arise. Average pressure is determined by averaging relatively crude data, and is affected by significant variation in ground elevations, system head loss and gaps in pressure controls in the distribution system.	Conditions between 2 and 4	Effective pressure controls separate different pressure zones; moderate pressure variation across the system, occasional open boundary valves are discovered that breech pressure zones. Basic telemetry monitoring of the distribution system logs pressure data electronically. Pressure data gathered by gauges or dataloggers at fire hydrants or buildings when low pressure complaints arise, and during fire flow tests and system flushing. Reliable topographical data exists. Average pressure is calculated using this mix of data.	Conditions between 4 and 6	Reliable pressure controls separate distinct pressure zones; only very occasional open boundary valves are encountered that breech pressure zones. Well-covered telemetry monitoring of the distribution system (not just pumping at source treatment plants or wells) logs extensive pressure data electronically. Pressure gathered by gauges/dataloggers at fire hydrants and buildings when low pressure complaints arise, and during fire flow tests and system flushing. Average pressure is determined by using this mix of reliable data.	Conditions between 6 and 8	Well-managed, discrete pressure zones exist with generally predictable pressure fluctuations. A current full-scale SCADA System or similar realtime monitoring system exists to monitor the water distribution system and collect data, including real time pressure readings at representative sites across the system. The average system pressure is determined from reliable monitoring system data.	Conditions between 8 and 10	Well-managed pressure districts/zones, SCADA System and hydraulic model exist to give very precise pressure data across the water distribution system. Average system pressure is reliably calculated from extensive, reliable, and cross-checked data. Calculations are reported on an annual basis as a minimum.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
Improvements to attain higher data grading for "Average Operating Pressure" component:		to qualify for 2: Employ pressure gauging and/or datalogging equipment to obtain pressure measurements from fire hydrants. Locate accurate topographical maps of service area in order to confirm ground elevations. Research pump data sheets to find pump pressure/flow characteristics	to qualify for 4: Formalize a procedure to use pressure gauging/datalogging equipment to gather pressure data during various system events such as low pressure complaints, or operational testing. Gather pump pressure and flow data at different flow regimes. Identify faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) and plan to properly configure pressure zones. Make all pressure data from these efforts available to generate system-wide average pressure.		to qualify for 6: Expand the use of pressure gauging/datalogging equipment to gather scattered pressure data at a representative set of sites, based upon pressure zones or areas. Utilize pump pressure and flow data to determine supply head entering each pressure zone or district. Correct any faulty pressure controls (pressure reducing valves, altitude valves, partially open boundary valves) to ensure properly configured pressure zones. Use expanded pressure dataset from these activities to generate system-wide average pressure.		to qualify for 8: Install a Supervisory Control and Data Acquisition (SCADA) System, or similar realtime monitoring system, to monitor system parameters and control operations. Set regular calibration schedule for instrumentation to insure data accuracy. Obtain accurate topographical data and utilize pressure data gathered from field surveys to provide extensive, reliable data for pressure averaging.		to qualify for 10: Annually, obtain a system-wide average pressure value from the hydraulic model of the distribution system that has been calibrated via field measurements in the water distribution system and confirmed in comparisons with SCADA System data.		to maintain 10: Continue to refine the hydraulic model of the distribution system and consider linking it with SCADA System for real-time pressure data calibration, and averaging.

Grading >>>	n/a	1	2	3	4	5	6	7	8	9	10
COST DATA											
Total annual cost of operating water system:		Incomplete paper records and lack of financial accounting documentation on many operating functions makes calculation of water system operating costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to estimate the major portion of water system operating costs.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. However, gaps in data are known to exist, periodic internal reviews are conducted but not a structured financial audit.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited periodically by utility personnel, but not a Certified Public Accountant (CPA).	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited at least annually by utility personnel, and at least once every three years by third-party CPA.	Conditions between 8 and 10	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Data audited annually by utility personnel and annually also by third-party CPA.
Improvements to attain higher data grading for "Total Annual Cost of Operating the Water System" component:		<u>to qualify for 2</u>: Gather available records, institute new financial accounting procedures to regularly collect and audit basic cost data of most important operations functions.	<u>to qualify for 4</u>: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6</u>: Establish process for periodic internal audit of water system operating costs; identify cost data gaps and institute procedures for tracking these outstanding costs.		<u>to qualify for 8</u>: Standardize the process to conduct routine financial audit on an annual basis. Arrange for CPA audit of financial records at least once every three years.		<u>to qualify for 10</u>: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		<u>to maintain 10</u>: Maintain program, stay abreast of expenses subject to erratic cost changes and long-term cost trend, and budget/track costs proactively
Customer retail unit cost (applied to Apparent Losses):	Customer population unmetered, and/or only a fixed fee is charged for consumption.	Antiquated, cumbersome water rate structure is used, with periodic historic amendments that were poorly documented and implemented; resulting in classes of customers being billed inconsistent charges. The actual composite billing rate likely differs significantly from the published water rate structure, but a lack of auditing leaves the degree of error indeterminate.	Dated, cumbersome water rate structure, not always employed consistently in actual billing operations. The actual composite billing rate is known to differ from the published water rate structure, and a reasonably accurate estimate of the degree of error is determined, allowing a composite billing rate to be quantified.	Conditions between 2 and 4	Straight-forward water rate structure in use, but not updated in several years. Billing operations reliably employ the rate structure. The composite billing rate is derived from a single customer class such as residential customer accounts, neglecting the effect of different rates from varying customer classes.	Conditions between 4 and 6	Clearly written, up-to-date water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average residential rate using volumes of water in each rate block.	Conditions between 6 and 8	Effective water rate structure is in force and is applied reliably in billing operations. Composite customer rate is determined using a weighted average composite consumption rate, which includes residential, commercial, industrial, institutional (CII), and any other distinct customer classes within the water rate structure.	Conditions between 8 and 10	Current, effective water rate structure is in force and applied reliably in billing operations. The rate structure and calculations of composite rate - which includes residential, commercial, industrial, institutional (CII), and other distinct customer classes - are reviewed by a third party knowledgeable in the M36 methodology at least once every five years.
Improvements to attain higher data grading for "Customer Retail Unit Cost" component:		<u>to qualify for 2</u>: Formalize the process to implement water rates, including a secure documentation procedure. Create a current, formal water rate document and gain approval from all stakeholders.	<u>to qualify for 4</u>: Review the water rate structure and update/formalize as needed. Assess billing operations to ensure that actual billing operations incorporate the established water rate structure.		<u>to qualify for 6</u>: Evaluate volume of water used in each usage block by residential users. Multiply volumes by full rate structure.	<u>Launch effort to fully meter the customer population and charge rates based upon water volumes</u>	<u>to qualify for 8</u>: Evaluate volume of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		<u>to qualify for 10</u>: Conduct a periodic third-party audit of water used in each usage block by all classifications of users. Multiply volumes by full rate structure.		<u>to maintain 10</u>: Keep water rate structure current in addressing the water utility's revenue needs. Update the calculation of the customer unit rate as new rate components, customer classes, or other components are modified.
Variable production cost (applied to Real Losses):	Note: if the water utility purchases/imports its entire water supply, then enter the unit purchase cost of the bulk water supply in the Reporting Worksheet with a grading of 10	Incomplete paper records and lack of documentation on primary operating functions (electric power and treatment costs most importantly) makes calculation of variable production costs a pure guesstimate	Reasonably maintained, but incomplete, paper or electronic accounting provides data to roughly estimate the basic operations costs (pumping power costs and treatment costs) and calculate a unit variable production cost.	Conditions between 2 and 4	Electronic, industry-standard cost accounting system in place. Electric power and treatment costs are reliably tracked and allow accurate weighted calculation of unit variable production costs based on these two inputs and water imported purchase costs (if applicable). All costs are audited internally on a periodic basis.	Conditions between 4 and 6	Reliable electronic, industry-standard cost accounting system in place, with all pertinent water system operating costs tracked. Pertinent additional costs beyond power, treatment and water imported purchase costs (if applicable) such as liability, residuals management, wear and tear on equipment, impending expansion of supply, are included in the unit variable production cost, as applicable. The data is audited at least annually by utility personnel.	Conditions between 6 and 8	Reliable electronic, industry-standard cost accounting system in place, with all pertinent primary and secondary variable production and water imported purchase (if applicable) costs tracked. The data is audited at least annually by utility personnel, and at least once every three years by a third-party knowledgeable in the M36 methodology.	Conditions between 8 and 10	Either of two conditions can be met to obtain a grading of 10: 1) Third party CPA audit of all pertinent primary and secondary variable production and water imported purchase (if applicable) costs on an annual basis. or: 2) Water supply is entirely purchased as bulk water imported, and the unit purchase cost - including <u>all</u> applicable marginal supply costs - serves as the variable production cost. If <u>all</u> applicable marginal supply costs are not included in this figure, a grade of 10 should <u>not</u> be selected.
Improvements to attain higher data grading for "Variable Production Cost" component:		<u>to qualify for 2</u>: Gather available records, institute new procedures to regularly collect and audit basic cost data and most important operations functions.	<u>to qualify for 4</u>: Implement an electronic cost accounting system, structured according to accounting standards for water utilities		<u>to qualify for 6</u>: Formalize process for regular internal audits of production costs. Assess whether additional costs (liability, residuals management, equipment wear, impending infrastructure expansion) should be included to calculate a more representative variable production cost.		<u>to qualify for 8</u>: Formalize the accounting process to include direct cost components (power, treatment) as well as indirect cost components (liability, residuals management, etc.) Arrange to conduct audits by a knowledgable third-party at least once every three years.		<u>to qualify for 10</u>: Standardize the process to conduct a third-party financial audit by a CPA on an annual basis.		<u>to maintain 10</u>: Maintain program, stay abreast of expenses subject to erratic cost changes and budget/track costs proactively

Average Length of Customer Service Line

The three figures shown on this worksheet display the assignment of the Average Length of Customer Service Line, Lp, for the three most common piping configurations.

Figure 1 shows the configuration of the water meter outside of the customer building next to the curb stop valve. In this configuration Lp = 0 since the distance between the curb stop and the customer metering point is essentially zero.

Figure 2 shows the configuration of the customer water meter located inside the customer building, where Lp is the distance from the curb stop to the water meter.

Figure 3 shows the configuration of an unmetered customer building , where Lp is the distance from the curb stop to the first point of customer water consumption, or, more simply, the building line.

In any water system the Lp will vary notably in a community of different structures, therefore the average Lp value is used and this should be approximated or calculated if a sample of service line measurements has been gathered.

Click for more information

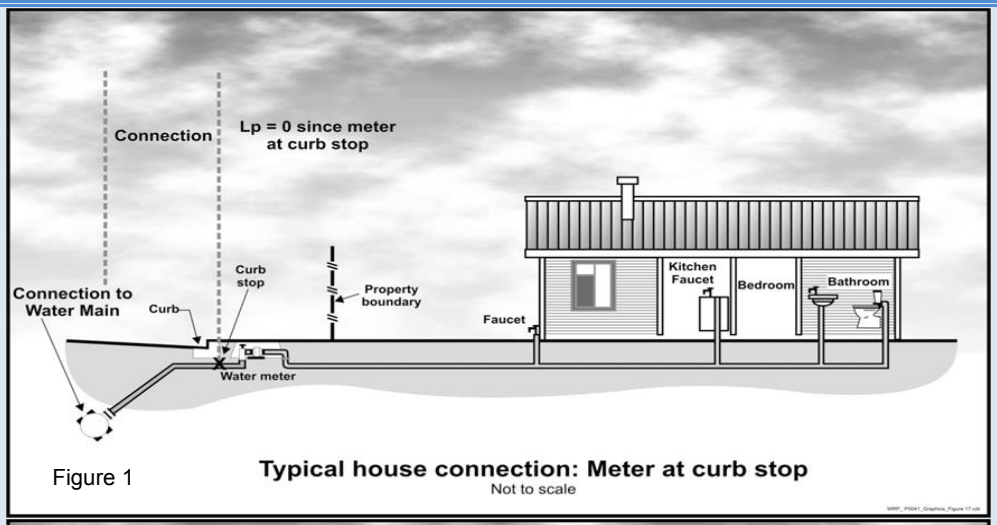


Figure 1 **Typical house connection: Meter at curb stop**
Not to scale

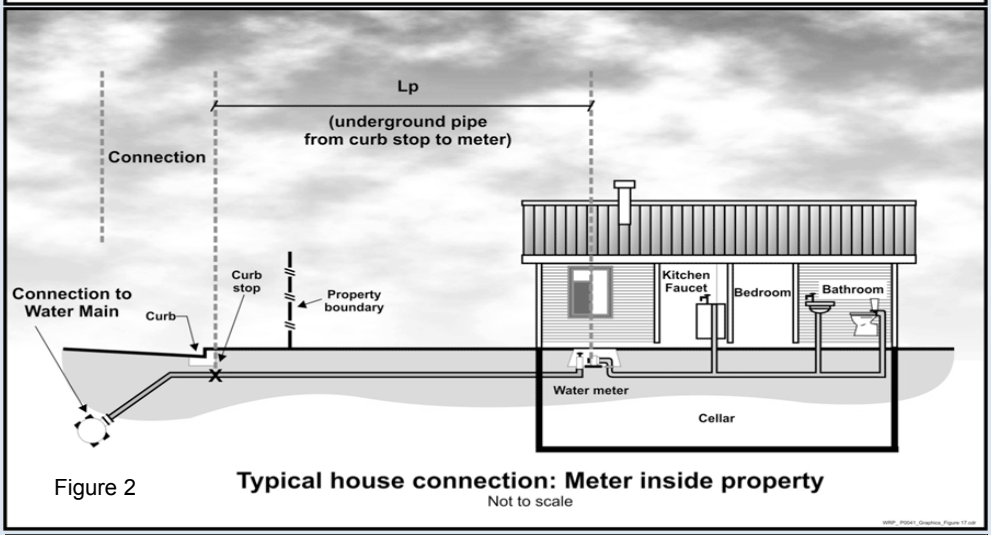


Figure 2 **Typical house connection: Meter inside property**
Not to scale

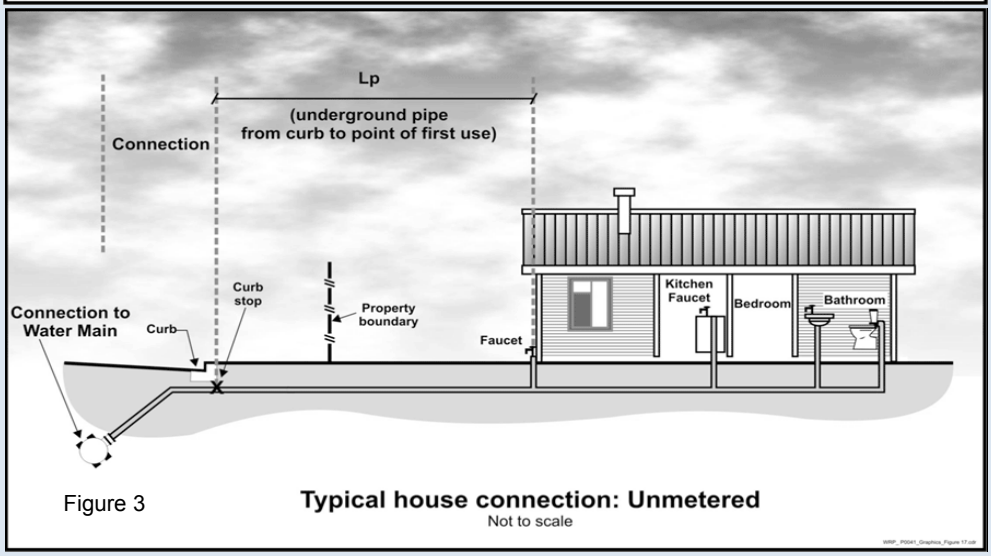
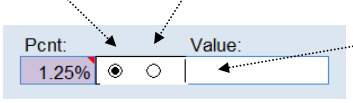


Figure 3 **Typical house connection: Unmetered**
Not to scale

Item Name	Description
Apparent Losses Find	= unauthorized consumption + customer metering inaccuracies + systematic data handling errors Apparent Losses include all types of inaccuracies associated with customer metering (worn meters as well as improperly sized meters or wrong type of meter for the water usage profile) as well as systematic data handling errors (meter reading, billing, archiving and reporting), plus unauthorized consumption (theft or illegal use). NOTE: Over-estimation of Apparent Losses results in under-estimation of Real Losses. Under-estimation of Apparent Losses results in over-estimation of Real Losses.
AUTHORIZED CONSUMPTION Find	= billed water exported + billed metered + billed unmetered + unbilled metered + unbilled unmetered consumption The volume of metered and/or unmetered water taken by registered customers, the water utility's own uses, and uses of others who are implicitly or explicitly authorized to do so by the water utility; for residential, commercial, industrial and public-minded purposes. Typical retail customers' consumption is tabulated usually from established customer accounts as billed metered consumption, or - for unmetered customers - billed unmetered consumption. These types of consumption, along with billed water exported, provide revenue potential for the water utility. **Be certain to tabulate the water exported volume as a separate component and do not "double-count" it by including in the billed metered consumption component as well as the water exported component.** Unbilled authorized consumption occurs typically in non-account uses, including water for fire fighting and training, flushing of water mains and sewers, street cleaning, watering of municipal gardens, public fountains, or similar public-minded uses. Occasionally these uses may be metered and billed (or charged a flat fee), but usually they are unmetered and unbilled. In the latter case, the water auditor may use a default value to estimate this quantity, or implement procedures for the reliable quantification of these uses. This starts with documenting usage events as they occur and estimating the amount of water used in each event. (See Unbilled unmetered consumption)
View Service Connection Diagram **Average length of customer service line** Find	This is the average length of customer service line, Lp, that is owned and maintained by the customer; from the point of ownership transfer to the customer water meter, or building line (if unmetered). The quantity is one of the data inputs for the calculation of Unavoidable Annual Real Losses (UARL), which serves as the denominator of the performance indicator: Infrastructure Leakage Index (ILI). The value of Lp is multiplied by the number of customer service connections to obtain a total length of customer owned piping in the system. The purpose of this parameter is to account for the unmetered service line infrastructure that is the responsibility of the customer for arranging repairs of leaks that occur on their lines. In many cases leak repairs arranged by customers take longer to be executed than leak repairs arranged by the water utility on utility-maintained piping. Leaks run longer - and lose more water - on customer-owned service piping, than utility owned piping. If the customer water meter exists near the ownership transfer point (usually the curb stop located between the water main and the customer premises) this distance is zero because the meter and transfer point are the same. This is the often encountered configuration of customer water meters located in an underground meter box or "pit" outside of the customer's building. The Free Water Audit Software asks a "Yes/No" question about the meter at this location. If the auditor selects "Yes" then this distance is set to zero and the data grading score for this component is set to 10. If water meters are typically located inside the customer premise/building, or properties are unmetered, it is up to the water auditor to estimate a system-wide average Lp length based upon the various customer land parcel sizes and building locations in the service area. Lp will be a shorter length in areas of high density housing, and a longer length in areas of low density housing and varied commercial and industrial buildings. General parcel demographics should be employed to obtain a composite average Lp length for the entire system. Refer to the "Service Connection Diagram" worksheet for a depiction of the service line/metering configurations that typically exist in water utilities. This worksheet gives guidance on the determination of the Average Length, Lp, for each configuration.
Average operating pressure Find	This is the average pressure in the distribution system that is the subject of the water audit. Many water utilities have a calibrated hydraulic model of their water distribution system. For these utilities, the hydraulic model can be utilized to obtain a very accurate quantity of average pressure. In the absence of a hydraulic model, the average pressure may be approximated by obtaining readings of static water pressure from a representative sample of fire hydrants or other system access points evenly located across the system. A weighted average of the pressure can be assembled; but be sure to take into account the elevation of the fire hydrants, which typically exist several feet higher than the level of buried water pipelines. If the water utility is compiling the water audit for the first time, the average pressure can be approximated, but with a low data grading. In subsequent years of auditing, effort should be made to improve the accuracy of the average pressure quantity. This will then qualify the value for a higher data grading.
Billed Authorized Consumption	All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Billed metered consumption Find	All metered consumption which is billed to retail customers, including all groups of customers such as domestic, commercial, industrial or institutional. **It does NOT include water supplied to neighboring utilities (water exported) which is metered and billed. Be sure to subtract any consumption for exported water sales that may be included in these billing roles. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.** The metered consumption data can be taken directly from billing records for the water audit period. The accuracy of yearly metered consumption data can be refined by including an adjustment to account for customer meter reading lag time since not all customer meters are read on the same day of the meter reading period. However additional analysis is necessary to determine the lag time adjustment value, which may or may not be significant.
Billed unmetered consumption Find	All billed consumption which is calculated based on estimates or norms from water usage sites that have been determined by utility policy to be left unmetered. This is typically a very small component in systems that maintain a policy to meter their customer population. However, this quantity can be the key consumption component in utilities that have not adopted a universal metering policy. **This component should NOT include any water that is supplied to neighboring utilities (water exported) which is unmetered but billed. Water supplied as exports to neighboring water utilities should be included only in the Water Exported component.**

Item Name	Description
Customer metering inaccuracies Find	Apparent water losses caused by the collective under-registration of customer water meters. Many customer water meters gradually wear as large cumulative volumes of water are passed through them over time. This causes the meters to under-register the flow of water. This occurrence is common with smaller residential meters of sizes 5/8-inch and 3/4 inch after they have registered very large cumulative volumes of water, which generally occurs only after periods of years. For meters sized 1-inch and larger - typical of multi-unit residential, commercial and industrial accounts - meter under-registration can occur from wear or from the improper application of the meter; i.e. installing the wrong type of meter or the wrong size of meter, for the flow pattern (profile) of the consumer. For instance, many larger meters have reduced accuracy at low flows. If an oversized meter is installed, most of the time the routine flow will occur in the low flow range of the meter, and a significant portion of it may not be registered. It is important to properly select and install all meters, but particularly large customer meters, size 1-inch and larger. The auditor has two options for entering data for this component of the audit. The auditor can enter a percentage under-registration (typically an estimated value), this will apply the selected percentage to the two categories of metered consumption to determine the volume of water not recorded due to customer meter inaccuracy. Note that this percentage is a composite average inaccuracy for all customer meters in the entire meter population. The percentage will be multiplied by the sum of the volumes in the Billed Metered and Unbilled Metered components. Alternatively, if the auditor has substantial data from meter testing activities, he or she can calculate their own loss volumes, and this volume may be entered directly. Note that a value of zero will be accepted but an alert will appear asking if the customer population is unmetered. Since all metered systems have some degree of inaccuracy, a positive value should be entered. A value of zero in this component is valid only if the water utility does not meter its customer population.
Customer retail unit cost Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied routinely to the components of Apparent Loss, since these losses represent water reaching customers but not (fully) paid for. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell. Finally, the weighted average cost should also include additional charges for sewer, storm water or biosolids processing, but only if these charges are based upon the volume of potable water consumed. For water utilities in regions with limited water resources and a questionable ability to meet the drinking water demands in the future, the Customer Retail Unit Cost might also be applied to value the Real Losses; instead of applying the Variable Production Cost to Real Losses. In this way, it is assumed that every unit volume of leakage reduced by leakage management activities will be sold to a customer. Note: the Free Water Audit Software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet, or $/1,000 litres) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. The monetary units are United States dollars, $.
Infrastructure Leakage Index (ILI) Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilities in operational management of real losses.
Length of mains Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant). It is also recommended to include in this measure the total length of fire hydrant lead pipe. Hydrant lead pipe is the pipe branching from the water main to the fire hydrant. Fire hydrant leads are typically of a sufficiently large size that is more representative of a pipeline than a service connection. The average length of hydrant leads across the entire system can be assumed if not known, and multiplied by the number of fire hydrants in the system, which can also be assumed if not known. This value can then be added to the total pipeline length. Total length of mains can therefore be calculated as: Length of Mains, miles = (total pipeline length, miles) + [{(average fire hydrant lead length, ft) x (number of fire hydrants)} / 5,280 ft/mile] or Length of Mains, kilometres = (total pipeline length, kilometres) + [{(average fire hydrant lead length, metres) x (number of fire hydrants)} / 1,000 metres/kilometre]
NON-REVENUE WATER Find	= Apparent Losses + Real Losses + Unbilled Metered Consumption + Unbilled Unmetered Consumption. This is water which does not provide revenue potential to the utility.
Number of active AND inactive service connections Find	Number of customer service connections, extending from the water main to supply water to a customer. Please note that this includes the actual number of distinct piping connections, including fire connections, whether active or inactive. This may differ substantially from the number of customers (or number of accounts). **Note: this number does not include the pipeline leads to fire hydrants - the total length of piping supplying fire hyrants should be included in the "Length of mains" parameter.**
Real Losses Find	Physical water losses from the pressurized system (water mains and customer service connections) and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Revenue Water	Those components of System Input Volume that are billed and have the potential to produce revenue.
Service Connection Density Find	=number of customer service connections / length of mains

Item Name	Description
Systematic data handling errors Find	Apparent losses caused by accounting omissions, errant computer programming, gaps in policy, procedure, and permitting/activation of new accounts; and any type of data lapse that results in under-stated customer water consumption in summary billing reports. **Systematic Data Handling Errors result in a direct loss of revenue potential. Water utilities can find "lost" revenue by keying on this component.** Utilities typically measure water consumption registered by water meters at customer premises. The meter should be read routinely (ex: monthly) and the data transferred to the Customer Billing System, which generates and sends a bill to the customer. Data Transfer Errors result in the consumption value being less than the actual consumption, creating an apparent loss. Such error might occur from illegible and mis-recorded hand-written readings compiled by meter readers, inputting an incorrect meter register unit conversion factor in the automatic meter reading equipment, or a variety of similar errors. Apparent losses also occur from Data Analysis Errors in the archival and data reporting processes of the Customer Billing System. Inaccurate estimates used for accounts that fail to produce a meter reading are a common source of error. Billing adjustments may award customers a rightful monetary credit, but do so by creating a negative value of consumption, thus under-stating the actual consumption. Account activation lapses may allow new buildings to use water for months without meter readings and billing. Poor permitting and construction inspection practices can result in a new building lacking a billing account, a water meter and meter reading; i.e., the customer is unknown to the utility's billing system. Close auditing of the permitting, metering, meter reading, billing and reporting processes of the water consumption data trail can uncover data management gaps that create volumes of systematic data handling error. Utilities should routinely analyze customer billing records to detect data anomalies and quantify these losses. For example, a billing account that registers zero consumption for two or more billing cycles should be checked to explain why usage has seemingly halted. Given the revenue loss impacts of these losses, water utilities are well-justified in providing continuous oversight and timely correction of data transfer errors & data handling errors. If the water auditor has not yet gathered detailed data or assessment of systematic data handling error, it is recommended that the auditor apply the default value of 0.25% of the the Billed Authorized Consumption volume. However, if the auditor has investigated the billing system and its controls, and has well validated data that indicates the volume from systematic data handling error is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations and select an appropriate grading. Note: negative values are not allowed for this audit component. If the auditor enters zero for this component then a grading of 1 will be automatically assigned.
Total annual cost of operating the water system Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the drinking water supply and distribution system. It should include the costs of day-to-day upkeep and long-term financing such as repayment of capital bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. Depending upon water utility accounting procedures or regulatory agency requirements, it may be appropriate to include depreciation in the total of this cost. This cost should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Unauthorized consumption Find	Includes water illegally withdrawn from fire hydrants, illegal connections, bypasses to customer consumption meters, or tampering with metering or meter reading equipment; as well as any other ways to receive water while thwarting the water utility's ability to collect revenue for the water. Unauthorized consumption results in uncaptured revenue and creates an error that understates customer consumption. In most water utilities this volume is low and, if the water auditor has not yet gathered detailed data for these loss occurrences, it is recommended that the auditor apply a default value of 0.25% of the volume of water supplied. However, if the auditor has investigated unauthorized occurrences, and has well validated data that indicates the volume from unauthorized consumption is substantially higher or lower than that generated by the default value, then the auditor should enter a quantity that was derived from the utility investigations. Note that a value of zero will not be accepted since all water utilities have some volume of unauthorized consumption occurring in their system. Note: if the auditor selects the default value for unauthorized consumption, a data grading of 5 is automatically assigned, but not displayed on the Reporting Worksheet.
Unavoidable Annual Real Losses (UARL) Find	UARL (gallons)=(5.41Lm + 0.15Nc + 7.5Lc) xP, or UARL (litres)=(18.0Lm + 0.8Nc + 25.0Lc) xP where: Lm = length of mains (miles or kilometres) Nc = number of customer service connections Lp = the average distance of customer service connection piping (feet or metres) (see the Worksheet "Service Connection Diagram" for guidance on deterring the value of Lp) Lc = total length of customer service connection piping (miles or km) Lc = Nc X Lp (miles or kilometres) P = Pressure (psi or metres) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). Striving to reduce system leakage to a level close to the UARL is usually not needed unless the water supply is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been proven as fully valid for very small, or low pressure water distribution systems. If, in gallons: (Lm x 32) + Nc < 3000 or P <35psi in litres: (Lm x 20) + Nc < 3000 or P < 25m then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

Item Name	Description
Unbilled Authorized Consumption	All consumption that is unbilled, but still authorized by the utility. This includes Unbilled Metered Consumption + Unbilled Unmetered Consumption. See "Authorized Consumption" for more information. For Unbilled Unmetered Consumption, the Free Water Audit Software provides the auditor the option to select a default value if they have not audited unmetered activities in detail. The default calculates a volume that is 1.25% of the Water Supplied volume. If the auditor has carefully audited the various unbilled, unmetered, authorized uses of water, and has established reliable estimates of this collective volume, then he or she may enter the volume directly for this component, and not use the default value.
Unbilled metered consumption Find	Metered consumption which is authorized by the water utility, but, for any reason, is deemed by utility policy to be unbilled. This might for example include metered water consumed by the utility itself in treatment or distribution operations, or metered water provided to civic institutions free of charge. **It does not include water supplied to neighboring utilities (water exported) which may be metered but not billed.**
Unbilled unmetered consumption Find	Any kind of Authorized Consumption which is neither billed or metered. This component typically includes water used in activities such as fire fighting, flushing of water mains and sewers, street cleaning, fire flow tests conducted by the water utility, etc. In most water utilities it is a small component which is very often substantially overestimated. **It does NOT include water supplied to neighboring utilities (water exported) which is unmetered and unbilled – an unlikely case.** This component has many sub-components of water use which are often tedious to identify and quantify. Because of this, and the fact that it is usually a small portion of the water supplied, it is recommended that the auditor apply the default value, which is 1.25% of the Water Supplied volume. Select the default percentage to enter this value. If the water utility has carefully audited the unbilled, unmetered activities occurring in the system, and has well validated data that gives a value substantially higher or lower than the default volume, then the auditor should enter their own volume. However the default approach is recommended for most water utilities. Note that a value of zero is not permitted, since all water utilities have some volume of water in this component occurring in their system.
Units and Conversions	The user may develop an audit based on one of three unit selections: 1) Million Gallons (US) 2) Megalitres (Thousand Cubic Metres) 3) Acre-feet Once this selection has been made in the instructions sheet, all calculations are made on the basis of the chosen units. Should the user wish to make additional conversions, a unit converter is provided below (use drop down menus to select units from the yellow unit boxes): Enter Units: 1 — Convert From… Million Gallons (US) = **Converts to…..** 3.06888329 Acre-feet (conversion factor = 3.06888328973723)
Use of Option Buttons	To use the default percent value choose this button To enter a value choose this button and enter the value in the cell to the right  **NOTE:** For Unbilled Unmetered Consumption, Unauthorized Consumption and Systematic Data Handling Errors, a recommended default value can be applied by selecting the Percent option. The default values are based on fixed percentages of Water Supplied or Billed Authorized Consumption and are recommended for use in this audit unless the auditor has well validated data for their system. Default values are shown by purple cells, as shown in the example above. If a default value is selected, the user does not need to grade the item; a grading value of 5 is automatically applied (however, this grade will not be displayed).
Variable production cost (applied to Real Losses) Find	The cost to produce and supply the next unit of water (e.g., $/million gallons). This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It may also include other miscellaneous unit costs that apply to the production of drinking water. It should also include the unit cost of bulk water purchased as an import if applicable. It is common to apply this unit cost to the volume of Real Losses. However, if water resources are strained and the ability to meet future drinking water demands is in question, then the water auditor can be justified in applying the Customer Retail Rate to the Real Loss volume, rather than applying the Variable Production Cost. The Free Water Audit Software applies the Variable Production costs to Real Losses by default. However, the auditor has the option on the Reporting Worksheet to select the Customer Retail Cost as the basis for the Real Loss cost evaluation if the auditor determines that this is warranted.
Volume from own sources Find	The volume of water withdrawn (abstracted) from water resources (rivers, lakes, streams, wells, etc) controlled by the water utility, and then treated for potable water distribution. Most water audits are compiled for utility retail water distribution systems, so this volume should reflect the amount of treated drinking water that entered the distribution system. Often the volume of water measured at the effluent of the treatment works is slightly less than the volume measured at the raw water source, since some of the water is used in the treatment process. Thus, it is useful if flows are metered at the effluent of the treatment works. If metering exists only at the raw water source, an adjustment for water used in the treatment process should be included to account for water consumed in treatment operations such as filter backwashing, basin flushing and cleaning, etc. If the audit is conducted for a wholesale water agency that sells untreated water, then this quantity reflects the measure of the raw water, typically metered at the source.

Item Name	Description
Volume from own sources: Master meter and supply error adjustment Find	An estimate or measure of the degree of inaccuracy that exists in the master (production) meters measuring the annual Volume from own Sources, and any error in the data trail that exists to collect, store and report the summary production data. This adjustment is a weighted average number that represents the collective error for all master meters for all days of the audit year and any errors identified in the data trail. Meter error can occur in different ways. A meter or meters may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Data error can occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of inaccuracy in master meters and data errors in archival systems are common; thus a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration.
Water exported Find	The Water Exported volume is the bulk water conveyed and sold by the water utility to neighboring water systems that exists outside of their service area. Typically this water is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water utility that is selling the water: i.e. the exporter. If the water utility who is compiling the annual water audit sells bulk water in this manner, they are an exporter of water. Note: The Water Exported volume is sold to wholesale customers who are typically charged a wholesale rate that is different than retail rates charged to the retail customers existing within the service area. Many state regulatory agencies require that the Water Exported volume be reported to them as a quantity separate and distinct from the retail customer billed consumption. For these reasons - and others - the Water Exported volume is always quantified separately from Billed Authorized Consumption in the standard water audit. **Be certain not to "double-count" this quantity by including it in both the Water Exported box and the Billed Metered Consumption box of the water audit Reporting Worksheet. This volume should be included only in the Water Exported box.**
Water exported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Exported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived exported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some degree of error in their metered data, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment. Corrections to data gaps or other errors found in the archived data should also be included as a portion of this meter error adjustment.
Water imported Find	The Water Imported volume is the bulk water purchased to become part of the Water Supplied volume. Typically this is water purchased from a neighboring water utility or regional water authority, and is metered at the custody transfer point of interconnection between the two water utilities. Usually the meter(s) are owned by the water supplier selling the water to the utility conducting the water audit. The water supplier selling the bulk water usually charges the receiving utility based upon a wholesale water rate.
Water imported: Master meter and supply error adjustment Find	An estimate or measure of the volume in which the Water Imported volume is incorrect. This adjustment is a weighted average that represents the collective error for all of the metered and archived imported flow for all days of the audit year. Meter error can occur in different ways. A meter may be inaccurate by under-registering flow (did not capture all the flow), or by over-registering flow (overstated the actual flow). Error in the metered, archived data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All water utilities encounter some level of meter inaccuracy, particularly if meters are aged and infrequently tested. Occasional errors also occur in the archived metered data. Thus, a value of zero should not be entered. Enter a negative percentage or value for metered data under-registration; or, enter a positive percentage or value for metered data over-registration. If regular meter accuracy testing is conducted on the meter(s) - which is usually conducted by the water utility selling the water - then the results of this testing can be used to help quantify the meter error adjustment.
WATER LOSSES Find	= apparent losses + real losses Water Losses are the difference between Water Supplied and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission systems, pressure zones or district metered areas (DMA); if one of these configurations are the basis of the water audit.

Water Audit Report for: Kunia Village (303)
Reporting Year: 2022 | 1/2022 - 1/2023
Data Validity Score: 37

Water Loss Control Planning Guide

	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.

Once data have been entered into the Reporting Worksheet, the performance indicators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

Example 1a: Million Gallons: | **Example 1b**: Million Gallons: Performance Indicators | **Example 2a**: Megalitres: Reporting Worksheet | **Example 2b**: Megalitres: Reporting Worksheet

Example Audit 1a:

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0
American Water Works Association.
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? Click to access definition
+ Click to add a comment

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 7/2012 - 6/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

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

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter Error Adjustments

WATER SUPPLIED

<---------- Enter grading in column 'E' and 'J' ----------> Pcnt: Value:

Volume from own sources:	7	7,352.880	MG/Yr	3			285.450	MG/Yr
Water imported:	n/a	0.000	MG/Yr					MG/Yr
Water exported:	n/a	0.000	MG/Yr					MG/Yr

Enter negative % or value for under-registration
Enter positive % or value for over-registration

WATER SUPPLIED: 7,067.430 MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

Pcnt: Value:

Billed metered:	8	4,782.250	MG/Yr		
Billed unmetered:	n/a	0.000	MG/Yr		
Unbilled metered:	7	27.757	MG/Yr		
Unbilled unmetered:	8	157.790	MG/Yr		157.790 MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

Use buttons to select percentage of water supplied OR value

AUTHORIZED CONSUMPTION: 4,967.797 MG/Yr

WATER LOSSES (Water Supplied - Authorized Consumption) 2,099.633 MG/Yr

Apparent Losses

Pcnt: Value:

Unauthorized consumption:		17.669	MG/Yr	0.25%	MG/Yr
Customer metering inaccuracies:	7	111.220	MG/Yr	2.26%	MG/Yr
Systematic data handling errors:	5	11.956	MG/Yr	0.25%	MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses: 140.844 MG/Yr

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 1,958.789 MG/Yr

WATER LOSSES: 2,099.633 MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 2,285.180 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4	1,236.5	miles
Number of active AND inactive service connections:	7	55,256	
Service connection density:		45	conn./mile main

Are customer meters typically located at the curbstop or property line? Yes

Average length of customer service line:

(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 4 145.3 psi

COST DATA

Total annual cost of operating water system:	10	$33,630,676	$/Year
Customer retail unit cost (applied to Apparent Losses):	10	$3.22	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	6	$335.94	$/Million gallons

☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

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

PRIORITY AREAS FOR ATTENTION:

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

1: Volume from own sources
2: Variable production cost (applied to Real Losses)
3: Unauthorized consumption

Example Audit 1b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: City of Asheville (01-11-010)
Reporting Year: 2013 | 7/2012 - 6/2013

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

	Apparent Losses:	140.844	MG/Yr
+	Real Losses:	1,958.789	MG/Yr
=	**Water Losses:**	**2,099.633**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	794.34	MG/Yr
	Annual cost of Apparent Losses:	$606,265	
	Annual cost of Real Losses:	$658,036	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	32.3%	
	Non-revenue water as percent by cost of operating system:	3.9%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	6.98	gallons/connection/day
	Real Losses per service connection per day:	97.12	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.67	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	1,958.79	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.47	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

Example Audit 2a:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

? Click to access definition
+ Click to add a comment

Water Audit Report for: The City of Calgary
Reporting Year: 2013 | 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MEGALITRES (THOUSAND CUBIC METRES) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<----------- Enter grading in column 'E' and 'J' ---------->

					Master Meter Error Adjustments Pcnt:	Value:	
WATER SUPPLIED							
Volume from own sources:	7	174,324.000	ML/Yr	7	1.00%		ML/Yr
Water imported:	n/a	0.000	ML/Yr				ML/Yr
Water exported:	7	8,190.131	ML/Yr	7	1.00%		ML/Yr
WATER SUPPLIED:		**164,488.979**	ML/Yr				

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:	Value:	
Billed metered:	6	125,111.268	ML/Yr			
Billed unmetered:	8	3,503.386	ML/Yr			
Unbilled metered:	7	166.157	ML/Yr			
Unbilled unmetered:	6	1,444.000	ML/Yr		1,444.000	ML/Yr
AUTHORIZED CONSUMPTION:		**130,224.811**	ML/Yr			

Use buttons to select percentage of water supplied **OR** value

				Pcnt:	Value:	
WATER LOSSES (Water Supplied - Authorized Consumption)		**34,264.168**	ML/Yr			
Apparent Losses						
Unauthorized consumption:		411.222	ML/Yr	0.25%		ML/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	6	1,265.429	ML/Yr	1.00%		ML/Yr
Systematic data handling errors:		312.778	ML/Yr	0.25%		ML/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Apparent Losses:	**1,989.429**	ML/Yr
Real Losses (Current Annual Real Losses or CARL)		
Real Losses = Water Losses - Apparent Losses:	**32,274.739**	ML/Yr
WATER LOSSES:	**34,264.168**	ML/Yr

NON-REVENUE WATER

NON-REVENUE WATER:	**35,874.325**	ML/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	8	4,945.0	kilometers	
Number of active AND inactive service connections:	8	312,075		
Service connection density:		63	conn./km main	
Are customer meters typically located at the curbstop or property line?		No		
Average length of customer service line:	8	12.0	metres	(length of service line, beyond the property boundary, that is the responsibility of the utility)
Average operating pressure:	8	50.8	metres (head)	

COST DATA

Total annual cost of operating water system:	9	$169,973,759	$/Year	
Customer retail unit cost (applied to Apparent Losses):	9	$2.35	$/1000 litres	
Variable production cost (applied to Real Losses):	9	$73.54	$/Megalitre	☑ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 72 out of 100 *****

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

PRIORITY AREAS FOR ATTENTION:

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

1: Volume from own sources
2: Billed metered
3: Customer metering inaccuracies

Example Audit 2b:

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: The City of Calgary
Reporting Year: 2013 | 1/2013 - 12/2013

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 72 out of 100 ***

System Attributes:

	Apparent Losses:	1,989.429	ML/Yr
+	Real Losses:	32,274.739	ML/Yr
=	**Water Losses:**	**34,264.168**	ML/Yr
?	Unavoidable Annual Real Losses (UARL):	8,015.57	ML/Yr
	Annual cost of Apparent Losses:	$4,675,159	
	Annual cost of Real Losses:	$75,845,637	Valued at **Customer Retail Unit Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	21.8%	
	Non-revenue water as percent by cost of operating system:	49.6%	Real Losses valued at Customer Retail Unit Cost
Operational Efficiency:	Apparent Losses per service connection per day:	17.47	litres/connection/day
	Real Losses per service connection per day:	283.34	litres/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per meter (head) pressure:	5.58	litres/connection/day/m
	From Above, Real Losses = Current Annual Real Losses (CARL):	32,274.74	ML/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.03	

* This performance indicator applies for systems with a low service connection density of less than 20 service connections/kilometre of pipeline

AWWA Water Audit Software Version 5.0 Developed by the Water Loss Control Committee of the American Water Works Association August, 2014

This software is intended to serve as a basic tool to compile a preliminary, or "top-down", water audit. It is recommended that users also refer to the current edition of the AWWA M36 Publication, Water Audits and Loss Control Programs, for detailed guidance on compiling a comprehensive, or "bottom-up", water audit using the same water audit methodology.

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- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

- AWWA Water Audits and Loss Control Programs, M36 Publication, 3rd Edition, 2009

- Service Connection Diagrams courtesy of Ronnie McKenzie, WRP Pty Ltd.

VERSION HISTORY:

Version:	Release Date:	Number of Worksheets:	Key Features and Developments
v1	2005/ 2006	5	The AWWA Water Audit Software was piloted in 2005 (v1.0 beta). The early versions (1.x) of the software restricted data entry to units of Million Gallons per year. For each entry into the audit, users identified whether the input was measured or estimated.
v2	2006	5	The most significant enhancement in v2 of the software was to allow the user to choose the volumetric units to be used in the audit, Million Gallons or Thousand Cubic Metres (megalitres) per year. Two financial performance indicators were added to provide feedback to the user on the cost of Real and Apparent losses.
v3	2007	7	In v3, the option to report volumetric units in acre-feet was added. Another new feature in v3 was the inclusion of default values for two water audit components (unbilled unmetered and unauthorized consumption). v3 also included two examples of completed audits in units of million gallons and Megalitres. Several checks were added into v3 to provide instant feedback to the user on common data entry problems, in order to help the user complete an accurate water audit.
v4 - v4.2	2010	10	v4 (and versions 4.x) of the software included a new approach to data grading. The simple "estimated" or "measured" approach was replaced with a more granular scale (typically 1-10) that reflected descriptions of utility practices and served to describe the confidence and accuracy of the input data. Each input value had a corresponding scale fully described in the Grading Matrix tab. The Grading Matrix also showed the actions required to move to a higher grading score. Grading descriptions were available on the Reporting Worksheet via a pop-up box next to each water audit input. A water audit data validity score is generated (max = 100) and priority areas for attention (to improve audit accuracy) are identified, once a user completes the requied data grading. A service connection diagram was also added to help users understand the impact of customer service line configurations on water losses and how this information should be entered into the water audit software. An acknoweldgements section was also added. Minor bug fixes resulted in the release of versions 4.1 and 4.2. A French language version was also made available for v4.2.
v5	2014	12	In v5, changes were made to the way Water Supplied information is entered into software, with each major component having a corresponding Master Meter Error Adjustment entry (and data grading requirement). This required changes to the data validity score calculation; v5 of the software uses a weighting system that is, in part, proportional to the volume of input components. The Grading Matrix was updated to reflect the new audit inputs and also to include clarifications and additions to the scale descriptions. The appearance of the software was updated in v5 to make the software more user-friendly and several new features were added to provide more feedback to the user. Notably, a dashboard tab has been added to provide more visual feedback on the water audit results and associated costs of Non-Revenue Water. A comments sheet was added to allow the user to track notes, comments and to cite sources used.


Kunia Dr
Kunia Rd
Paani St
Luawai St
Luawai St
McAngus St
3rd St
2nd St
1st St
Kunia Dr
Kunia Dr
Kunia Camp
750


1st St
Kunia Dr

State Historic Preservation Division
HRS 6E Submittal Form

Per §6E, Hawai'i Revised Statutes, if the Project requires review by the State Historic Preservation Division (SHPD), please review and fill out this form and submit all requested information to SHPD. All forms and project documentation must be submitted **electronically** via HICRIS. Please visit our website.

https://shpd.hawaii.gov/hicris

If you are unable to submit electronically, please contact SHPD at (808) 692-8015. Mahalo.

The submission date of this form is:

1. APPLICANT (select one)

☐ Property Owner ☑ Government Agency

2. AGENCY (select one)

☐ Planning Department ☐ Department of Public Works ☑ Other (specify): DLNR -CWRM

Type of Permit Applied For: Well construction permit

3. APPLICANT CONTACT

3.1) Name: Ryan Imata 3.2) Title: Hydrology Program Manager

3.3) Street Address: 1151 Punchbowl Street, Room 227 Honolulu, Hawaii 96813

3.4) County: Honolulu 3.5) State: HI 3.6) Zip Code: 96813

3.7) Phone: (808) 636-8502 3.8) Email: dlnr.cwrm@hawaii.gov

4. PROJECT DATA

4.1) Permit Number (if applicable):

4.2) TMK [e.g. (3) 1-2-003:004]: (1) 9-2-005:023-0001

4.3) Street Address: 92-1700 Kunia Road

4.4) County: Honolulu 4.5) State: HI 4.6) Zip Code: 96759

4.7) Total Property Acreage: 12.221

4.8) Project Area (acreage, square feet): 400 sf

4.9) List any previous SHPD correspondence (LOG Number & DOC Number, if applicable):

LOG NO. NA DOC NO. 141OJLP24

5. PROJECT INFORMATION

5.1) Does the Project involve a Historic Property? A Historic Property is any building, structure, object,

district, area, or site, including heiau and underwater site, **which is over 50 years old** (*HRS §6E-2*).

☑ Yes ☐ No

5.2) The date(s) of construction for the historic property (building, structure, object, district, area, or site, including heiau and underwater site) is 1930s

5.3) Is the Property listed on the Hawai'i and or National Register of Historic Places? To check: http://dlnr.hawaii.gov/shpd/

☑ Yes ☐ No

5.4) Detailed Project Description and Scope of Work:

Construction of a new well to supply potable water to Kunia Village. Project site is in vacant land outside of the historic district. No structures over 50 yr.s old within/near the immediate project area. The well site will be adjacent to new water storage tanks.

5.5) Description of **previous** ground disturbance (e.g. previous grading and grubbing):

Historically pineapple fields, irrigated landscape nursery within the past 10 years

5.6) Description of **proposed** ground disturbance (e.g. # of trenches, Length x Width x Depth):

Verticle boring 22-inches to 960 feet deep. Trenching approximately 60 feet to water storage and fiters. Trenches are also in distubed areas. Anticipated trench depth - 4 feet.

5.7) The Agency shall ensure whether historic properties are present in the project area, and, if so, it shall ensure that these properties are properly identified and inventoried. Identify all known historic properties:

Project site is adjacent to the Kunia Village Historical District.

5.8) Once a historic property is identified, then an assessment of significance shall occur.

Integrity (check all that apply):

☐ Location ☐ Design ☑ Setting ☑ Materials ☐ Workmanship ☐ Feeling ☑ Association

Criteria (check all that apply):

☑ a – associated with events that have made an important contribution to the broad patterns of our history
☐ b – associated with the lives of persons important in our past
☑ c – embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value
☐ d – have yielded, or is likely to yield, information important for research on prehistory or history
☐ e – have an important value to the Native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out or still carried out, at the property or due to associations with traditional beliefs, events, or oral accounts - - these associations being important to the group's history and cultural identity

5.9) The effects or impacts of a project on significant historic properties shall be determined by the agency.

Effect Determination (select one):

☑ No Historic Properties Affected
☐ Effect, with Agreed Upon Mitigation Commitments (§6E-42, HRS)
☐ Effect, with Proposed Mitigation Commitments (§6E-8, HRS)

5.10) This project is (check all that apply, if applicable):

☑ an activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency;

☐ carried out with Federal financial assistance; and or

☐ requiring a Federal permit, license or approval.

If any of these boxes are checked, then the Project may also be subject to compliance with Section 106 of the National Historic Preservation Act (NHPA).

6. PROJECT SUBMITTALS

6.1) Please submit a copy of the Tax Map Key (TMK) map

6.2) Please submit a copy of the property map showing the project area and indicate if the project area is smaller than the property area.

6.3) Please submit a permit set of drawings. A permit set is a set of drawings prepared and signed by a licensed architect or engineer and is at least 65% complete.

6.4) Are you submitting a survey?

☐ Yes ☑ No

Specify Survey:

6.5) Did SHPD request the survey?

☐ Yes ☑ No

If 'Yes', then please provide the date, SHPD LOG NO, and DOC NO:

Date: LOG NO. DOC NO.

6.6) **SURVEY REVIEW FEES**. Fee for Review of Reports and Plans (§§13-275-4 and 284-4). A filing fee will be charged for all reports and plans submitted to our office for review. Please go to:

The Submittal Filing Fee Form is located on the Forms page

A check payable to the Hawaii Historic Preservation Special Fund should accompany all reports or plans submitted.

6.7) Please submit color photos/images of the Historic Property (any building, structure, object, district, area, or site, including heiau and underwater site) that will be affected by the Project.

The following are the minimum number and type of color photographs required:

Quantity	Description
1-2	Street view(s) of the resource and surrounding area
1-2	Over view of exterior work area
1	exterior photo of the North elevation (if applicable)
1	exterior photo of the South elevation (if applicable)
1	exterior photo of the East elevation (if applicable)
1	exterior photo of the West elevation (if applicable)
1-2	interior photos(s) of areas affected (if applicable)

CHECKLIST

☑ **SHPD FORM 6E** (this form)

☑ **PROJECT SUBMITTALS** (any requested documentation for items 6.1 - 6.7 of this form)

☑ **FILING FEE FORM** (if applicable)

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

HRS 6E Submittal Filing Fees

All submittals must have the appropriate filing fee in accordance with HAR §13-275-4 or HAR §13-284-4.
All contact fields below must be complete and accurate.

Landowner: Kunia Village Title Holding Corporation
(if privately-owned historic property on Hawaii Register, HRS §6E-10)

Agency:
Contact Name: Ryan Imata
Mailing Address: PO Box 100 Kunia, Hawaii 96759
Phone: alan@prloffice.com Email:

Title of Report/Plan: HRS 6E submittal

Ahupua'a: Hono`uli`uili District: Ewa Island:
TMK(s): (1) 9-2-005:023-0001

Contract Firm: Mason Architects Inc.
(firm who completed the work on behalf of the agency)
Contact Name: swhalen@HARC-HSPA.com
Phone: Email:

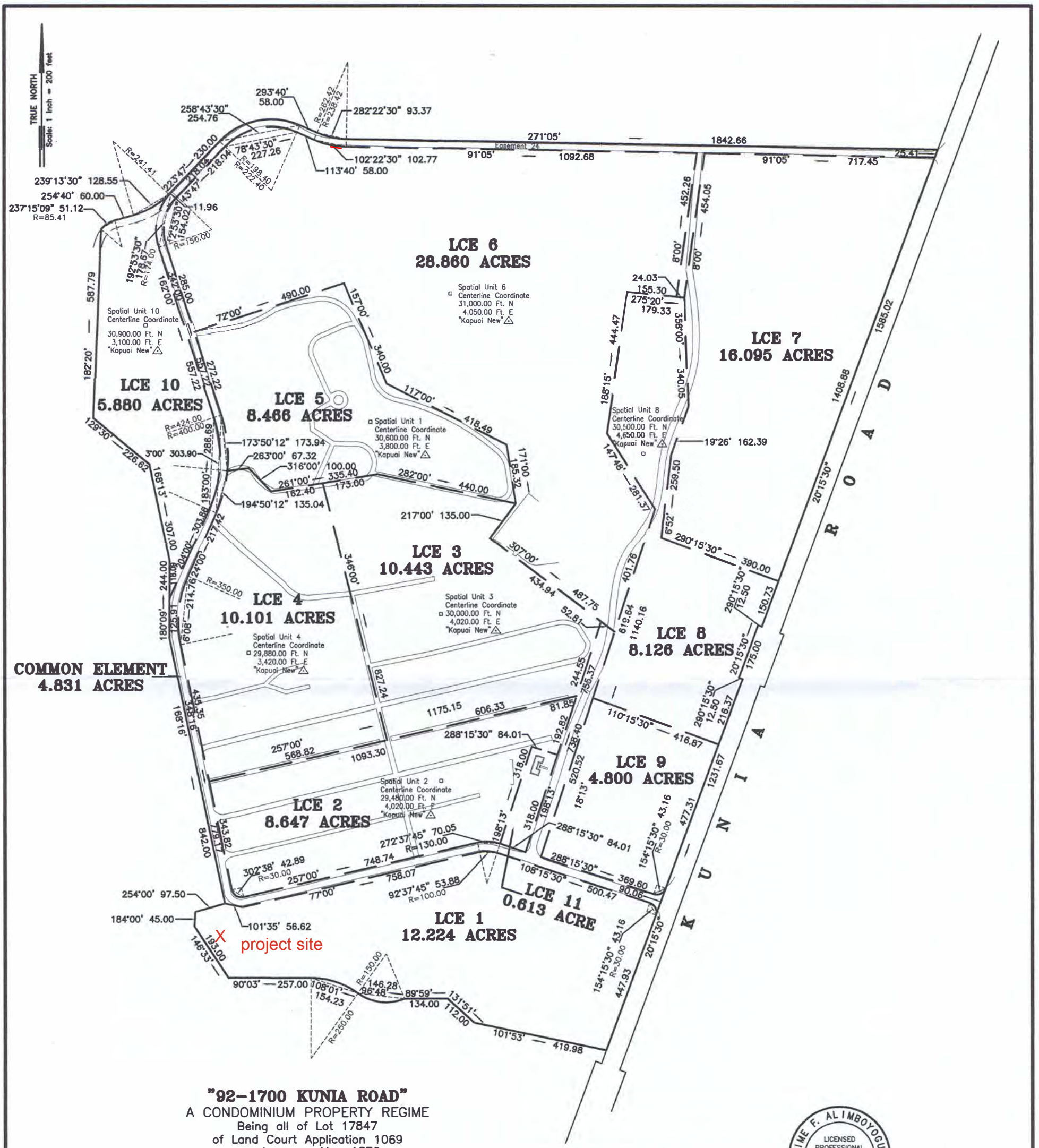
_____ Check if Report/Plan is a re-submittal (no fee)
_____ Check if Field Inspection Report requested by SHPD (no fee)
_____ Check if **Final Report** (no fee)

_____ $0 Archaeological Monitoring Report, no resources reported
_____ $25 Archaeological Monitoring Plan
_____ $25 Burial Disinterment Report
X $25 Request from Agency for Determination Letter per HAR §13-275
_____ $50 Archaeological Assessment (AIS with negative findings)
_____ $50 Osteological Analysis Report
_____ $100 Archaeological Monitoring Report, resources reported
_____ $150 Archaeological Inventory Survey Plan, Archaeological Data Recovery Plan, or Preservation Plan
_____ $250 Burial Treatment Plan (BTP)
_____ $450 Archaeological, Architectural, or Ethnographic Survey Report
_____ $450 Archaeological Data Recovery Report
_____ Fee Total: Make check payable to "Hawaii Historic Preservation Special Fund"

For Office Use Only:

Date Received:	Payment Method: Cash Amount $
Log No.:	Check No. Amount $
Receipt Issued:	Money Order Amount $

rev. 11/9/2017



"92-1700 KUNIA ROAD"

A CONDOMINIUM PROPERTY REGIME

Being all of Lot 17847
of Land Court Application 1069
as shown on Map 1370

Honouliuli, Ewa, Oahu, Hawaii

Tax Map Key: 9-2-05:23

Scale: 1 inch = 200 feet

Date: January 30, 2012

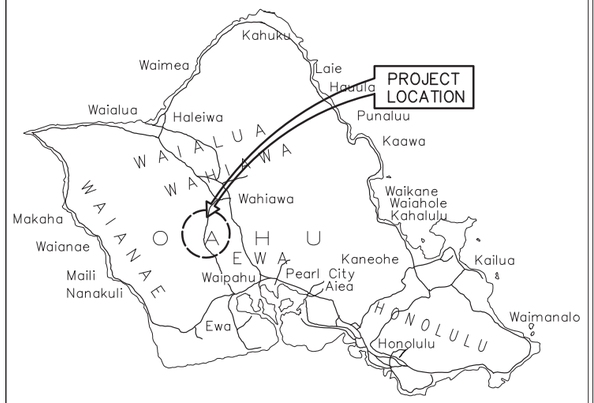
Owner: Hawaii Agriculture Research Center

NOTES:

1. Only improvements shown were located.
2. Dashed lines indicated do not represent the boundary of a legally subdivided lot. They represent either a limited common element area or common element area.
3. If this sheet is less than 17" X 22", it is not to scale, the 17" X 22" sheet must be examined to obtain the accurate scale.
4. LCE = Limited Common Element

JAIME F. ALIMBOYOGUEN
LICENSED PROFESSIONAL LAND SURVEYOR
No. 8216
HAWAII, U.S.A.

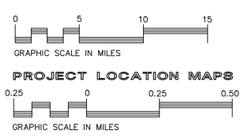
This work was prepared by me or under my direct supervision.



ISLAND OF OAHU

NORTH

HAWAIIAN ISLANDS



CONSTRUCTION PLAN FOR THE DRILLING, DEVELOPMENT, AND PUMP TESTING OF

KVDC POTABLE WELL

LOCATED AT:

KUNIA, OAHU, HAWAII

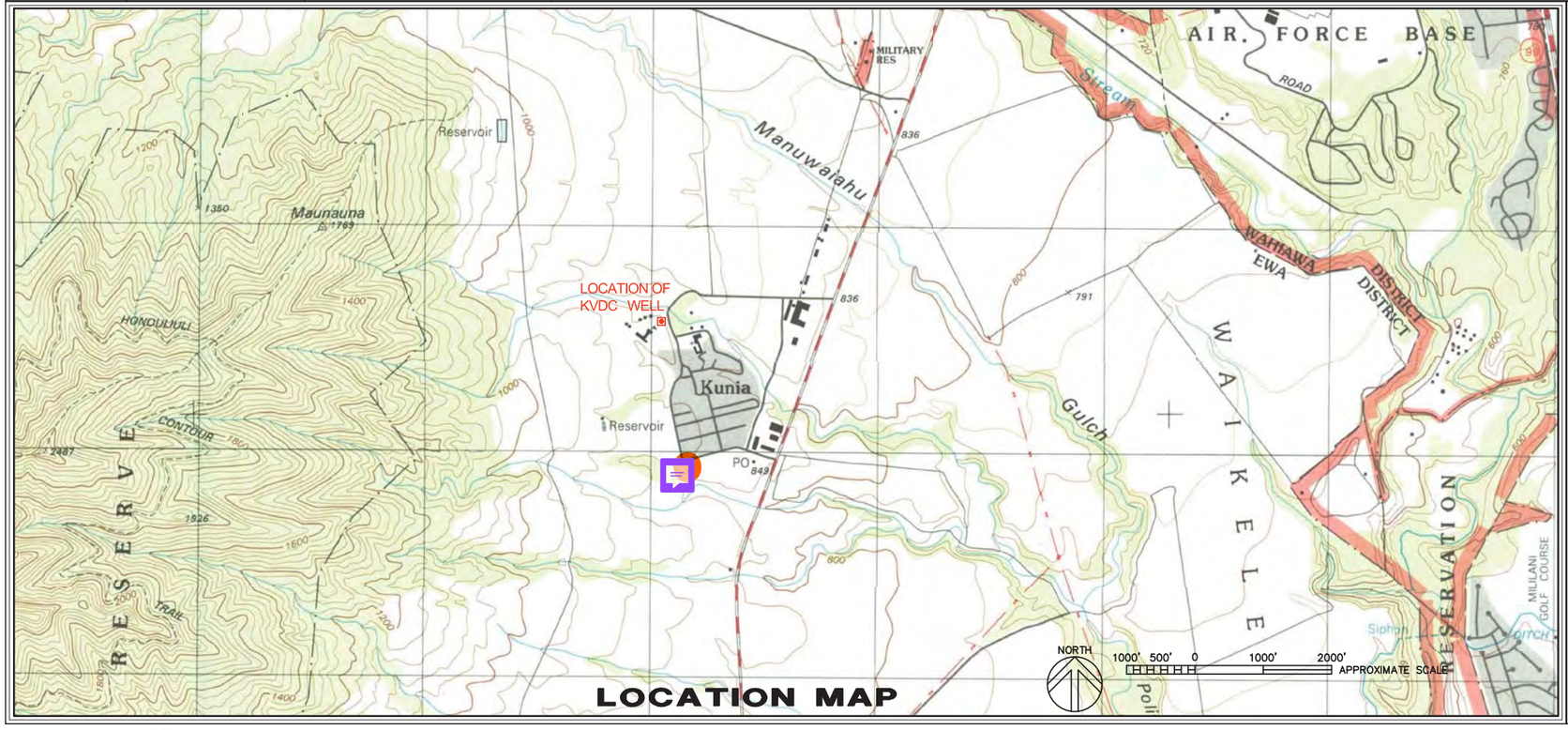
TAX MAP KEY 9-2-005:023

PREPARED FOR:

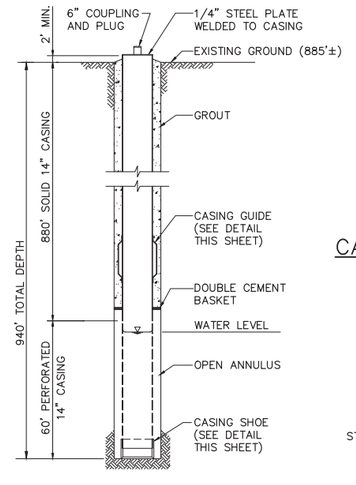
KUNIA VILLAGE DEVELOPMENT CORP.
P.O. BOX 700489
KAPOLEI, HAWAII 96709

PREPARED BY:

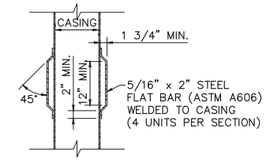
Tom Nance Water Resource Engineering
560 N. NIMITZ HWY., SUITE 213
HONOLULU, HAWAII 96817
TELEPHONE: (808) 537-1141 FACSIMILE: (808) 538-7757



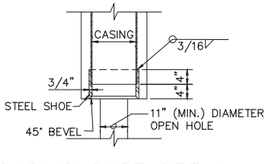
LOCATION MAP



SECTION THRU WELL
NOT TO SCALE



CASING GUIDE DETAIL
NOT TO SCALE



CASING SHOE DETAIL
NOT TO SCALE

WELL DETAILS

File: WMASTER_23-45_KV_6-11-24.dwg Project No. (TN)23-45 Date: JUL 2024

o_24-27


Kunia Dr
Kunia Rd
Paani St
Luawai St
Luawai St
McAngus St
3rd St
2nd St
1st St
Project site
Kunia Dr
Kunia Dr
Kunia Camp
750

Well site and piping to connect to existing filter station

Looking east at the proposed well site

Looking southwest across the proposed location. Trenches extend to the spot this photo was taken

Looking southwest at the new water storage tanks where well will discharge

Looking north at the proposed well site

Looking north at the proposed well site

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

JESSE K. SOUKI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

DATE: October 27, 2014

LOG: N/A
DOC: 1410JLP24

TO: David M. Robinchaux
President
Kunia Village Holding Corporation
PO Box 100
Kunia, HI 96759

SUBJECT: **Section:** Survey & Inventory/Section 106 – Cultural Resource Management Review
Project: Draft Kunia Village Affordable Housing Environmental Assessment
Location: Kunia, Oahu, Hawaii
Tax Map Key: (1) 9-4-005:023

Aloha Mr. Robinchaux,

Mahalo for the opportunity to review the Draft Kunia Village Affordable Housing Environmental Assessment (EA); which was received by the Hawai`i State Historic Preservation Division (SHPD) on September 14, 2014. SHPD understands that future development of Kunia Village will include the rehabilitation or replacement of 82 residential housing units, with the rehabilitation of an additional 39 existing historic units and construction of an additional 79 single and multi-family residential units at a later phase. The EA has been prepared in accordance with HRS §343 to support an application under HRS §201-H for the Kunia Village and Agribusiness Complex, Affordable Housing Project on the Island of Oahu, Hawai`i.

In addition, the Kunia Villages Affordable Housing project has received funding from the United States Department of Agriculture and has gone through the Section 106 consultation process, outlined in 36 CFR §800, per the National Historic Preservation Act [NHPA § 101.b(3)(E) and (F)].

The proposed project, as outlined within the EA, will not have an adverse effect on historic properties within the project's Area of Potential Effect (APE). All proposed work associated with this project will be reviewed and approved by the SHPD for appropriateness and consistency with the Secretary of Interiors Standards for Rehabilitation of Historic Resources.

We look forward to the opportunity to review and provide our concurrence with the final draft of the Kunia Village Affordable Housing Environmental Assessment. If you have any questions please contact Jessica Puff, SHPD Architectural Historian at (808) 692-8023 or by email at Jessica.L.Puff@hawaii.gov. **Please reference our DOC number in all communication with this office regarding this undertaking.**

Sincerely,

Dr. Alan Downer
Deputy State Historic Preservation Officer

MING-LI WANG
DAVID M ROBICHAUX
66-031 MAHAULU LN.
HALEIWA, HI 96712-1435

59-7965/3213

4067

DATE 09/19/24

PAY TO THE ORDER OF Dept. of Land & Natural Resources | $ 25 00

Twenty Five dollars & 00/100 DOLLARS

Heat Reactive Ink

SPECIALTY MINT HIGH SECURITY

UNIVERSITY OF HAWAI'I
FEDERAL CREDIT UNION
UHFCU.COM
PO Box 22070 • Honolulu, HI 96823-2070

MEMO GWUP - Kunia Village

DM Robichaux MP

⑆321379656⑆ 2000206207⑈ 4067 TMK # 9-2-005:023

LOOK FOR FRAUD-DETERRING FEATURES INCLUDING THE SECURITY SQUARE AND HEAT-REACTIVE INK. DETAILS ON BACK.

Kunia Village Development Corporation
c/o 66-031 Mahaulu Lane Haleiwa, HI 96712

Commission on Water Resources Management
P.O. Box 621, Honolulu, HI 96809.