Certified Level 1 Validation Report, Part A: Validator Provided Details

Validator Provided

Audit Information:

Water Supplier Name: Pasadena Water & Power **PWS ID:** 1910124

System Type: Potable **Audit Period:** CY 2018

Utility Representation: Brad Bowman, District Engineer Tony Estrada, Pasadena Engineer

Validation Date: 10/7/2019 **Call Time:** 13:00 **Sufficient Supporting Documents Provided:** Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 67 **Data Validity Band (Level):** Band III (51 – 70)

ILI: 0.81 **Real Loss:** 13.32 (Gal/conn/day) **Apparent Loss:** 20.02 (Gal/conn/day)

Non-revenue water as percent of cost of operating system: 4.4%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

If not, rejected recommendations are included here.

Validator Information:

Water Audit Validator: Justin Bailey, Rubio Cañon Land and Water Association

Qualifications: Water Audit Validator Certificate issued by the CA-NV Section of the AWWA

Utility Provided

Certified Level 1 Validation Report, Part B: Utility Provided Details

Audit Information:

Water Supplier Name:	Pasadena Water & Power
Water Supplier ID Number:	1910124
Water Audit Period:	CY 2018

Water Audit & Water Loss Improvement Steps:

- PW&P conservation program team is piloting the "Flume" leak detection device, which is a water sensor that straps onto a customer's water meter. Real time waste usage data is transmitted to the Flume Bridge via the cloud and provides the customer with real time water usage on their smart phone, and notifies of leaks across the entire property.
  - PWP is currently testing this device and will be piloting it for a sample of residential customers.

- PW&P provides all residential customers with bi-monthly Home Water Reports and access to a customer facing portal where customers receive data on their water use, potential leaks and leak resolution tips; and customized water savings recommendations. PWP customers who have opted in to receive leak notifications via email, also receive an email when their water use pattern indicates they might have a leak.

- PWP provides customers with desktop analysis of their water use to help identify and resolve potential leaks; and provides onsite water use surveys to check for potential leaks.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audit and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Executive Name (Print)	Executive Position	Signature	Date
Bradley Boman	Engineering Manager	Bradley Boman	10-17-19

Pre-Interview Notes	Pasadena Water and Power is a not-for-profit public service owned and operated by the City of Pasadena for the benefit of its customers and the community. The distribution system server more than 38,000 metered connections and supplied more than 29,000 Acre Feet of water in 2018. 67% of that volume was imported from MWD, and 33% of overall production was supplied by Pasadena owned and operated wells and facilities. Preliminary information and supporting documentation necessary to perform this validation was provided 9/18/2019. Supplemental data provided and Interview conducted between 9/24/2019 and 10/9/2019. All information requests were met and all provided information was detailed and specific.

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Volume from Own Sources (VOS)	**Supply meter profile:** Water entering the system is comprised of combined flows of (18) wells and (5) MWD imported water connections. **VOS Input Data Source:** Meter registers are manually on a weekly basis and flows are tracked real time via SCADA. Produced volumes are recorded monthly and annually. **Comments:** 33% of water produced is from the (18) ground water production wells. The meters for each are tested volumetrically on an annual basis. Confirmed input value: **9,857.359 AF**	**Percent of VOS metered:** 100% **Signal calibration frequency:** Reactive, following observed discrepancy between mechanical meter and SCADA flow. **Volumetric testing frequency:** Annual **Volumetric testing method:** Timed flow through test meter or pitot tube method **Percent of VOS tested and/or calibrated:** 100% Volumetric, 0% Signal Calibration **Comments:** The volumetric testing occurs annually and procedures are well known by staff. Confirmed DVG: **7**
VOS Master Meter Error Adjustment	**Adjustment Basis:** Pump Check annual volumetric testing reports **Net Storage Change Included:** No **Comments:** Pasadena W&P conducts regular volumetric testing of each well on an annual basis. Confirmed input value: **31.990 AF**	**Supply meter read frequency:** Meter registers are read each week and daily while running. **Supply meter read method:** Manual **Frequency of data review:** Weekly **Storage level monitoring frequency:** Hourly **Comments:** Known meter accuracy (%) is applied to each recorded monthly registered volumes to calculate highly accurate actual volume produced by each well. Confirmed DVG: **3**

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Water Imported (WI)	**Import meter profile:** Imported water is supplied by MWD through (5) separate metered connections. **WI Data Source:** Meter registers are read weekly and flows are recorder by SCADA in real time. Production reports track cumulative production on a monthly basis throughout the year. **Comments:** 67% of total water supplied was imported Confirmed input value: **19,604.688 AF**	**Percent of WI metered:** 100% **Signal calibration frequency:** Annually **Volumetric testing frequency:** Unknown **Volumetric testing method:** Unknown **Percent of WI tested and/or calibrated:** Volumetrically: Unknown. Signal Calibration: 100% completed annually **Comments:** MWD performs annual signal calibration of all (5) of their imported water meters annually. Confirmed DVG: **7**
WI Master Meter Error Adjustment	**Adjustment Basis:** N/A **Comments:** No adjustment made due to no volumetric testing performed on the WI meters by the wholesaler (MWD). However, Signal Calibration testing was performed to assure remote monitoring tightly matched meter volume totalizer Confirmed input value: **N/A**	**Import meter read frequency: Manually** weekly, SCADA full time **Import meter read method:** Manual + Remote (SCADA) **Frequency of data review:** Monthly **Comments:** Signal Calibration testing was performed to assure remote monitoring tightly matched meter volume totalizer Confirmed DVG: **5**
Water Exported (WE)	**Export meter profile:** Metered interconnection with South Pasadena **WE Data Source:** Reporting spreadsheet provided with monthly volumes exported & billed. **Comments:** None Confirmed input value: **19.753 AF**	**Percent of WE metered:** 100% **Signal calibration frequency:** Unknown **Volumetric testing frequency:** Unknown **Volumetric testing method:** Unknown **Percent of WE tested and/or calibrated:** Unknown **Comments:** No testing of WE meters is currently conducted Confirmed DVG: **3**

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
WE Master Meter Error Adjustment	**Adjustment Basis: N/A** **Comments:** Left blank for lack of test data Confirmed input value: **N/A**	**Export meter read frequency:** N/A **Export meter read method:** N/A **Frequency of data review:** N/A **Comments:** None Confirmed DVG: **N/A**
Billed Metered Authorized Consumption (BMAC)	**Customer Meters & Reads Profile:** Customer meters are a mix of residential Single family (76%), Residential Multi-Family (10%), Commercial (10%), Fire Service (3%), and City (<1%). Meters are electronically read on a monthly basis for billing and consumption totals. - **Age profile:** Oldest meters are 14 years old. The entire system was upgraded to new meters with AMR radio registers - **Reading system:** AMR electronic read with computerized billing software - **Read frequency:** Monthly **Billing Data Pro-rated?** Yes, in the event of meter failure. The corresponding month from the previous years is used to best inform estimated usage. **Comments:** Detailed report with cumulative breakdown of all customer accounts and class provided by Pasadena W&P. Includes all metered water sales of 27,906.446 AF. Confirmed input value: **27,906.446 AF**	**Percent of customers metered:** 100% **Small meter testing policy:** Reactive meter testing based on customer requests or complaints. 3rd party conducts removal and bench testing of selected meters. **Number of small meters testing/year:** Quantity not provided. Estimated as "limited". **Large meter testing policy:** Reactive meter testing based on customer requests or complaints via 3rd party removal & testing **Number of large meter tested/year:** Unknown **Meter replacement policy:** Yes. Meter replacement is performed annually. **Number of replacements/year:** 1,962 meter replacements performed **(5.1%)** **Billing data auditing practice:** Meter reads are electronically entered. Billing software generates consumption and flags inconsistent usage. Billing totals are audited in-house monthly and by a 3rd party annually. **Comments:** Meter testing only occurs under limited conditions; however, Pasadena dedicates a departmental team towards focused and ongoing meter replacement. Confirmed DVG: **6**

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Billed Unmetered Authorized Consumption (BUAC)	**Billed Unmetered Profile:** N/A **Input Derivation:** **Comments:** No estimated billing. Confirmed input value: **N/A**	**Policy for metering exemptions:** Strict policy for approval and invoicing are in place. **Comments:** Confirmed DVG: **N/A**
Unbilled Metered Authorized Consumption (UMAC)	**Unbilled Metered Profile:** N/A **Input Derivation:** **Comments:** All metered water is billed Confirmed input value: **N/A**	**Policy for billing exemptions:** **Comments:** None. Confirmed DVG: **N/A**
Unbilled Unmetered Authorized Consumption (UUAC)	**Unbilled Unmetered Profile:** Services such as public works, street sweepers, and fire department utilize unmetered connections. **Input Derivation if Estimated:** known but incomplete records of approved unmetered water use. **Comments:** Flushing volumes & frequency greatly reduced during Ca. drought. Default of 0.25% x WS utilized Confirmed input value: **73.530AF**	**Default or Adjusted Default Applied:** 0.25% x WS used to calculate UUAC. **Completeness of Documentation:** Documentation is incomplete and thus far based on infrequent occurrences and calculated estimates. **Comments:** All fire flow volumes and hydrant flushing are monitored and calculated by time and flow formulae to minimize UUAC volumes. Confirmed DVG: **5**
Unauthorized Consumption (UC)	**Default Applied?** Yes **Input Derivation if Customized:** N/A **Comments:** Default input of 0.25% WS is applied Confirmed input value: **73.526 AF**	**Instances and extent of UC documented:** Instances do occur and are investigated, but have not been consistently documented. **Comments**: An auditable form was created as a recommendation of last year's Validation for continuous documentation and future reference. Residents identified taking unmetered water are billed directly via estimates and (BMAC) and water trucks, construction companies will be tracked and recorded via UC (non-revenue) volumes. Confirmed DVG: **5**

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Customer Metering Inaccuracies (CMI)	**Input Derivation:** See BMAC activities for meter testing and replacement practices. Meter accuracy estimated on average meter age of 10+ years. **Comments:** Good record keeping and tracking exists and entire system has been converted to AMR technology. Confirmed input value: **(2.5%) 715.550 AF**	**Characterization of meter testing:** Limited proactive meter testing is conducted annually. However, a total test quantity for 2018 was unable to be provided. Cannot confirm greater than 1% of inventory (382 meters) tested in 2018. **Characterization of meter replacement:** Dedicated field crew conducts meter replacements based on failure and customer complaints. **Comments:** Practices are balanced between reactive and proactive replacements. 1,962 meters were replaced (5.1% of total) and 56 new meter connections were installed. Confirmed DVG: **3**
Systematic Data Handling Errors (SDHE)	**Input Derivation:** AMR + Computerized billing software and reporting is in place. In house audits of data occur monthly and a 3rd party auditor review takes place annually. **Comments:** Oversight and auditing of account data is standardized, with regularly corrected totals applied each month for consumption and billing accuracy. Billing software is capable of generating multiple reports and queries including in/out water balance. Utilized default volume (0.25% BMAC), but scored DVG 6 due to higher features of computerized billing / accounting system with regular internal audits performed Confirmed input value: **69.766 AF**	**If custom estimate provided –** Default input volume applied **Characterization of read collection & billing process:** Electronic meter reading with AMR is employed throughout the system and reading occurs on a monthly basis **Characterization of billing process and billing data auditing:** Computerized billing software with In house review of data performed monthly and 3rd party audits performed annually. Confirmed DVG: **6**
Length of Mains	**Input Derivation:** Hydraulic Model and regularly updated GIS were leveraged to determine accurate distribution system data. **Hydrant lateral length included:** Yes. Overall length reported includes 11 miles of cumulative hydrant lateral lengths. **Comments:** Pasadena operates a robust GIS software and a regularly updated hydraulic model in its overall asset management and project planning process Confirmed input value: **521.0 Miles**	**Mapping format:** GIS and hydraulic model **Asset management database:** Yes, relying on both paper maps and GIS **Map updates & field validation:** Engineering practices include field verification of each project after completion. **Comments:** Pasadena is not yet incorporating break history into their GIS, but other characteristics (type, installation date) are incorporated. Confirmed DVG: **8**

Level 1 Validation Summary Notes

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Number of Active and Inactive Service Connections	**Input Derivation:** Routine query from billing software to produce accurate record of accounts. Reviewed monthly and annually **Basis for database query:** Account ID, Address, or Parcel ID **Comments:** From Pasadena W&P billing query and consumption tracking. Includes verified count of 38,215 Active accounts Confirmed input value: **38,298**	**CIS updates & field validation:** Accomplished through normal meter reading process and in-house audit of data **Estimated error of total count within:** 2% **Comments:** No additional comments Confirmed DVG: **9**
Average Length of Customer Service Line	**Are customer meters at the curbstop? Yes** **Where are customer meters installed if not at curbstop?** **Customer service line derivation** **Comments:** Default input grade applied. Customer meters are typically located at the property boundary. Confirmed input value: **YES**	**Comments:** Default input grade applied. Customer meters are typically located at the property boundary. Confirmed DVG: **10**
Average Operating Pressure	**Number of zones, general setup:** The system has 28 pressure zones and pumping facilities. **Typical pressure range:** 30 – 90 psi with average of 73.4 psi calculated by model. **Input derivation:** Hydraulic Model, SCADA, and GIS inputs **Comments:** Pressure zone integrity is tightly monitored and no valves are left in a position to breech pressure zones. Inter-zone PRV's are kept regularly maintained to further reduce the potential for pressure fluctuations. Confirmed input value: **73.4**	**Extent of static pressure data collection:** SCADA records system pressures while pumps and wells are on or off, allowing static and dynamic pressures to be well identified. **Characterization of real-time pressure data collection:** SCADA telemetry archives real time system pressures at all pumping and storage facilities with some temporary pressure gauges capturing pressure data along the distribution system. **Hydraulic model in place?** Yes **Calibrated?:** 2014 **Comments:** Hydrant pressures are also recorded during testing / fire flows to further document static system pressures Confirmed DVG: **5**

Level 1 Validation Summary Notes

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Total Operating Cost (TOC)	**Input Derivation:** From internal budgeting reports. **Comments:** Financial Statements and Supplementary Information provided by Pasadena including annual budget documents and annual cost auditing. Salaries, benefits, insurance, depreciation, & power costs all confirmed in provided budget reports. Confirmed input value: **$58,282,184 / Year**	**Frequency of internal auditing:** Monthly **Frequency of third-party CPA auditing:** Annual **Comments:** Well-structured cost accounting system is in place with internal review taking place monthly, and 3rd party audit of data occurring annually. Confirmed DVG: **10**
Customer Retail Unit Cost (CRUC)	**Input Derivation:** Calculation of Commodity + CIC annual costs divided by 2018 water sales total. Reference 'Customer Retail Unit Cost' sheet provided by PW&P **Sewer Charges Volumetric?** N/A **Sewer Charges Included?** N/A **Comments:** This value includes all tiers and is weighted appropriately. Confirmed input value: **$4.97 / 100 Cubic Feet**	**Characterization of calculation:** Detailed cost tracking confirmed with generated reports using accounting totals. **Comments:** Input calculations have not been reviewed by an M36 water loss expert. Confirmed DVG: **9**
Variable Production Cost (VPC)	**Supply profile:** 33% VOS + 67% Imported from MWD. **Direct variable costs included:** Cost defined as cost of imported water and average pumping cost per unit. **Secondary costs included:** Unknown **Comments:** Cost accounting system in place with annual audits conducted by a CPA Confirmed input value: **$1,078.98 / AF**	**Characterization of calculation:** Primary costs only included. Calculation of volumetric charges divided by metered consumption. **Comments:** Although variable costs are well known and tracked, the input calculations do not yet include liability insurance or depreciation costs. The input calculations are not reviewed by an M36 water loss expert. Confirmed DVG: **5**

Level 1 Validation Summary Notes

Audit Input	Confirmation of Input Derivation	Confirmation of DVG Assignment
Pending Items needed to complete the validation	None	