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Zamboanga City Special Economic Zone Authority **WATER AUDIT REPORT**



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This publication was produced by the USAID Water Security for Resilient Economic Growth and Stability (Be Secure) Project in collaboration with the Zamboanga City Water District (ZCWD).

Zamboanga City Special Economic Zone Authority

WATER AUDIT REPORT

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USAID Water Security for Resilient Economic Growth and Stability (Be Secure) Project in collaboration with the Zamboanga City Water District (ZCWD)

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TABLE OF CONTENTS

I. Introduction	I
II. Scope of the Audit	I
III. Facility Description	I
IV. Methodology	3
V. Audit Finding and Observations	4
VI. Potential Water Savings Opportunities:	7
Estimated Annual Toilet Water Savings	7
Estimated Annual Urinal Water Savings	7
Estimated Annual Bathroom/Handwashing Faucet Water Savings	7
Estimated Annual Kitchen And Utility Faucet Water Savings	7
Estimated Annual Showerhead Water Savings	8
Estimated Annual Water Savings From Leaks	8
VII. Savings and Cost Benefit Analysis	8
VIII. Recommendations	9
IX. Recommended Water Efficient Best Practices	11
X. Additional Resources	13
ANNEX: Summary of Behavioral Survey on Water Use at the Zamboanga City Ecozone	14

I. INTRODUCTION

The Zamboanga City Special Economic Zone Authority (Ecozone), is an economic zone and Freeport, developed for use as an industrial park. In an effort to improve the efficiency of their facility operations and to instill a new environmental ethic into their business practices, a water audit was conducted by Zamboanga City Water District (ZCWD) at their administration building. The purpose of the water audit is to provide a thorough understanding of the Ecozone water uses by identifying and measuring all water using fixtures, appliances, and practices in order to recommend potential water saving efficiencies.

Prior to the on-site water audit a brief three-day behavioral study of hygiene habits was conducted with randomly selected employees of the Ecozone. This information was gathered to better understand how cultural behaviors impact bathroom water use specific to the Ecozone facility. Because water audits are new in the Philippines, there are no baseline studies specific to Filipino water use behavior. As such, water use data is currently based on U.S. standards. It was anticipated that the results of this study could be used to calculate water use and potential savings as it relates to the EOP facility and its' employees. (The Summary of Water Behavior Study is attached as Annex A.)

II. SCOPE OF THE AUDIT

The Ecozone on-site water audit was conducted on July 15, 2016. The scope of the water audit focused on identifying: leaks; sanitary fixtures (toilets, urinals, faucets and showers); kitchen fixtures and appliances; janitorial water use; and fleet vehicle washing. In addition, interviews were conducted with the facility manager to gather site specific information including: water supply records to determine current water use and water costs; any alternative water supply sources; size of the facility; and the population occupying the facility during various shifts of operation. Water meters and sub-meters were noted along with any other additional water using processes and water saving opportunities.

Upon completion of the on-site audit, the findings were processed. Water usage, including water loss from leaks, were calculated for all identified fixtures, appliances and processes. Potential water and cost savings were then calculated based on retrofitting or replacing fixtures with water efficient fixtures. The recommendations follow in this report.

III. FACILITY DESCRIPTION

The Ecozone Administration Building is an office building primarily dedicated to administration of the surrounding industrial park, with exception of the two tenants, SRPI located on the ground floor and Art Nature Philippines (ANP), located on the second floor. ANP is a cooperative that manufactures hair wigs. The basement level provides gym, along with a canteen and cafeteria that is serviced by separate vendors. The fourth floor houses a lactation room, a pantry room, and individual board member's offices, each with its own private bathroom. The roof deck is not enclosed, with exception of enclosed male and female bathrooms.

The building was built in approximately 1999. It has 6 floors, that includes a finished basement and a roof deck. These floors encompass a total of 6,150 square meters. The lot size including the building and landscaping is approximately 4,978.48 square meters. No remodeling has taken place since the building was initially built, with exception of the cafeteria lavatory which is still under construction. It was also noted that the bathroom in the Office of the Chairman and Admin Division on the fourth floor was closed due to being condemned. No information was provided as to whether it would be re-opened.

Ecozone’s primary water source is a deep well for roughly 70% of the water use and spring water for the remaining 30% of water use. Drinking water is delivered from a private water supplier. Currently, there are no re-use, reclaim, or harvested rain water sources being used as an alternative water supply. At this time, no records could be provided to accurately determine the volume of water supply withdrawals from the deep well and spring. As such, we are unable to determine the average daily water use based on historical water use. Storage Tank is located at more or less 800 meters away from the Maim building. As to the waste water coming from the locators, there is no existing treatment of such. While the drinking water delivered by Eco Bottling is purely for water dispensers. Kitchen and bathroom water are sourced from the Storage Tanks.

One master meter was identified, along with three sub-meters serving the canteen, SRPI, and ANP. Sub-meters are used, with the purpose of billing those tenants for their water consumption. It was noted, that rates used for billing the tenants are based on ZCWD water rates.

Ecozone is unique, since water supply is not provided by ZCWD, there are no costs for water, with exception of minor costs associated with pumping and treatment. No information could be provided at the time, as to what those costs might be.

Information was provided by managers of the canteen and cafeteria in the basement. There are approximately 145 dining seats available. Meals are served throughout the day to accommodate the different work shifts, Monday through Friday. They estimate that approximately 200 meals are served by the canteen and 300 meals are served by the cafeteria daily. While most meals are served to occupants of the Ecozone administration building, some are consumed by customers from elsewhere in the park. It was noted during the focus group discussions, that most employees purchase their meals through the canteen or cafeteria due to the remote location of the Ecozone. Some employees consume two meals per day. Kitchen staff estimated water use to be at 1 minute per customer for dishwashing and cooking combined.

Table 1: Building population was based on information provided by staff as follows:

Basement	29 Employees/Security	Mon. – Fri.	8 hrs./day	44% male
Ground Floor	8 SRPI/10 Employees & Security	Mon. – Fri.	8 hrs./day	44% male
Second Floor	250 ANP*/139 Employees & Security	Mon. – Fri.	8 hrs./day	44% male
Third Floor	46 Employees & Security	Mon. – Fri.	8 hrs./day	44% male
Fourth Floor	33 Employees	Mon. – Fri.	8 hrs./day	44% male
Second Floor	250 ANP*/ 9 Security	Saturday	8 hrs./day	44% male
Ground Floor	9 Security	Sunday	8 hrs./day	44% male
Visitors	9	Mon.-Fri.	4 hrs./day	40% male

* ANP consists of two shifts daily, approx. 125 employees per shift.

No seasonal fluctuations were identified at the time, with exception of occasional use of the conference room located on the third floor for events.

IV. METHODOLOGY

Key components of the water audit

1. Obtaining information through interviews with administrative and engineering personnel to identify facility schematics; population, current water supply sources and the nature of water uses.
2. A walk through of the entire facility that included identifying the type of water fixtures and measuring water usage based on flow rates. Leaks were also identified and measured accordingly. Defective fixtures and appliances were also noted.
3. Based on the findings, calculating water usage and estimating potential water and costs savings.

Methodology for measuring fixture flow rates, flow volume and leaks

1. Toilet flush volumes were measured by calculating the amount of water in the tank before and after flushing.
2. Toilet leak tests were conducted by placing colored food dye in the tank. Color appearing in bowl within 10 minutes, is an indication of a leak at the flapper valve.
3. Urinal flush volumes were measured by how long it takes to complete the flush, measured in seconds. Ex. Number of seconds x .95 liters per second = liters per flush for flushometer (FOM) valve urinals.
4. Bathroom, kitchen and utility faucets were measured by turning the taps at full volume and measuring the volume of water captured for 5 seconds.
5. Showerheads were measured by turning the taps at full volume and measuring the volume of water captured for 5 seconds.
6. Water leaks were measured by the number of drops p/minute x 13.5 = liter per month or measuring the stream flow. Where possible leaks were measured by reading the sub-meter after ensuring that all water using fixtures and processes were shut off.

Parameters for calculating water usage and water savings

1. A number of toilet and urinal flushes were calculated by considering various work shifts and visitors. It is reasonable to assume each a flush occurs every 2.5 hours per person. This represents an average of 3.2 flushes per person for every 8-hour shift. It is estimated that when urinals are available, men will use a urinal for 2 out of 3 flushes.
Based on the information in Table 1, Building Population and the parameters for calculating toilet and urinal usage, the following assumptions were made:
 - Female Toilet Flushes per week - 5,139
 - Male Toilet Flushes per week - 1,330
 - Male Urinal Flushes per week – 2,701
 - Total Flushes per week – 9,170
2. Bathroom handwashing faucets are estimated based on 20 seconds of use per toilet or urinal flush. Based on the total flushes of 9,170 per week x 20 seconds (.3333), it was estimated that the total bathroom faucets rinse minutes per week is 3,053.

3. Canteen handwashing faucets are estimated based on 500 customers per day, 5 days a week at 15 seconds each. This represents a total of 625 rinse minutes per week for canteen handwashing faucets.
4. Kitchen faucet use is estimated based on 500 customers per day, 5 days a week at 1 minute each. This represents 2500 rinse minutes per week for kitchen faucets.
5. Utility faucets, primarily used in bathrooms with the purpose of filling buckets, are estimated at 60 minutes per faucet, per week.

Table 2: Fixture and Appliances Water Efficiency Standards

Fixture and Appliances Water Efficiency Standards	Maximum Water Use
Toilets	4.8 Liters per flush
Urinals	1.9 Liters per flush
Public lavatory faucets	1.9 Liters per minute
Public metering self-closing faucet	1 Liter per metering cycle
Showerheads	7.6 Liters per minute
Kitchen faucets	8.3 Liters per minute

V. AUDIT FINDINGS AND OBSERVATIONS

Based on a walk-through audit of the entire facility, the following fixtures were identified and measured for flow rates or flush volume if they were functioning properly. Inoperable fixtures are noted as defective.

Table 3: Audited Fixtures

Fixtures	Functioning Properly	Defective	Total
Gravity tank toilets	32	9	41
Flushometer Valve Urinals	6	2	8
Bathroom/Handwashing Faucets	39	8	47
Kitchen Faucets	2	1	3
Utility Faucets	28	1	29
Showerheads	14	3	17

None of the fixtures had markings that identified the flush volume or flowrate. The following is a breakdown of the measured flow rates and flush volumes at the time of the audit and other observations:

- I. Toilets
 - 14 toilets between 9 to 11.7 liters per flush
 - 13 toilets between 6.1 to 8.8 liters per flush
 - 3 toilets between 5.3 to 5.6 liters per flush
 - 2 toilets at 4.8 liters per flush

Leaking toilets were located at:

- Basement gym women's bathroom
- 1st Floor women's bathroom
- 2nd Floor women's bathroom
- 3rd Floor COA office bathroom
- Roof deck women's bathroom

Defective toilets were located at:

- Basement gym men's bathroom (2)
- 2nd Floor men's bathroom (2)
- 2nd Floor women's bathroom (2)
- 3rd Floor COA office
- Roof deck men's bathroom (2)

It was noted during the focus group discussions, that some women conduct double flushes. They flush prior to using the toilet or, an additional flush after flushing their own waste, as a courtesy flush. At this time, there is no statistics to verify the additional flushes, therefore these were not taken into consideration when calculating toilet use.

2. Urinals

- 2 urinals between 12.4 – 13.3 liters per flush
- 2 urinals at 6.7 liters per flush
- 1 urinal at 3.8 liters per flush
- 1 urinal at 1.9 liters per flush

Leaking urinals were located at:

- 2nd Floor men's bathroom
- Roof deck men's bathroom

Defective urinals were located at:

- 2nd Floor men's bathroom
- Roof deck men's bathroom

3. Bathroom/Handwashing faucets

- 3 faucets between 25.5 – 30 liters per minute
- 7 faucets between 12 – 16 liters per minute
- 15 faucets between 8.5 – 9.7 liters per minute
- 3 faucets between 2.4 – 3.9 liters per minute
- 2 metered faucets at 1.0 liter per cycle

Leaking bathroom/handwashing faucets were located at:

- Basement gym women's bathroom
- 2nd Floor ANP manager's bathroom

Defective bathroom faucets were located at:

- Basement gym (4)
- Basement canteen (1)
- 2nd Floor women's bathroom (2)
- 2nd Floor men's bathroom (2)
- 4th Floor pantry room

It was noted during the focus group discussions, that the bathroom faucets are also used for tooth brushing, face washing and individual dishwashing in addition to handwashing. This was considered when calculating the bathroom faucet usage by increasing rinse minutes from 15 to 20 seconds.

4. Kitchen faucets

- 1 faucet at 20 liters per minute
- 1 faucet at 8.3 liters per minute

Leaking kitchen faucets were located at:

- Basement kitchen faucet
- 4th Floor pantry room

5. Utility faucets

- 4 faucets between 19.2 – 26.4 liters per minute
- 14 faucets between 12 – 18 liters per minute
- 4 faucets at 9.6 liters per minute
- 6 faucets at 8.3 liters per minute

Most utility faucets are located in the bathrooms and are used primarily for filling buckets. The water is then used for hygiene purposes or to assist with flushing the defective toilets.

6. Showerheads

- 7 showerheads between 1.2 – 5.4 liters per minute
- 6 showerheads between 6.0 - 7.8 liters per minute
- 1 showerhead at 12 liters per minute

Leaking showerheads were located at:

- Basement gym women's bathroom

Defective showerheads were located at:

- Basement gym (3)

CAR WASHING

It was noted that a total of 8 vehicles were washed at the facility, 3 to 4 times during the week with an outdoor water hose. Recommend using recycled water to wash the vehicles; don't wash vehicles as often; and use a hose with an automatic shut off spray nozzles.

LANDSCAPING

Based on visual inspection, landscaping consists of grass and shrubs. The landscaping was not measured, but was observed to be well maintained. Watering of the landscaping is done three times a week. Water source is from the main source which is a treated source the same source for toilets and kitchen.

Information was not captured during the audit for other water using equipment such as air conditioning equipment, nor were measurements taken for water used in the buckets located next to the toilets for hygiene purposes and flushing of defective toilets.

VI. POTENTIAL WATER SAVINGS OPPORTUNITIES

The following potential water savings opportunities were identified for the Ecozone facility. Because Ecozone water supply is from their own deep well and spring, water is not provided or charged from ZCWD, making estimated payback and return on investment higher. At the time of the audit, Ecozone staff was unable to provide a cost of water. For this report, we based consumer cost on 10.93 PHP per m³. This was estimated by ZCWD staff based on their current rate structure.

ESTIMATED ANNUAL TOILET WATER SAVINGS

Based on the audit, all 32 functioning toilets except for 2 were measured to have a flush volume at twice the volume of a water efficient toilet of 4.8 liters per flush. Replacing the toilets with a water efficient toilet, could yield a potential savings of 1,076 cubic meters of water annually. If replacing all toilets is not possible due to budget constraints, consider replacing the most used toilets first. Because of the heavy volume, dual flush toilets are not recommended.

ESTIMATED ANNUAL URINAL WATER SAVINGS

The audit identified 6 functioning flushometer valve urinals. With exception of 1 urinal, all of them flushed at a higher volume than a water efficient urinal of 1.9 liters per flush. Replacing these urinals could save approximately 782 cubic meters of water annually. There is also a potential to save 1,049 cubic meters of water annually, if they are replaced instead with waterless urinals.

ESTIMATED ANNUAL BATHROOM/HANDWASHING FAUCET WATER SAVINGS

Based on the audit, all 39 functioning faucets were measured with a flow rate exceeding the water efficient faucet standard of 1.9 liters per minute for public lavatories. Installing water efficient aerators on the faucet to meet the acceptable standard would save approximately 1031 cubic meters of water annually. By far, this is one of the most cost effective measures and should be implemented immediately.

ESTIMATED ANNUAL KITCHEN AND UTILITY FAUCET WATER SAVINGS

The audit identified 2 functioning kitchen faucets and 28 utility faucets. With exception of 7 faucets, all exceeded the water efficient standard of 8.3 liters per minute. Installing a pre-rinse spray valve with an automatic shut-off nozzle with a water efficient standard of 6 liters per minute in the canteen would save an average of 14 liters per minute. Installing aerators on the remaining utility faucets could save approximately 2641 cubic meters of water annually. Depending on the use of the utility faucet, it may not be appropriate to install an aerator. Consideration should be given to whether the utility faucet is used for rinsing or for filling buckets.

ESTIMATED ANNUAL SHOWERHEAD WATER SAVINGS

The audit identified 14 functioning showerheads. Only one showerhead is used in the entire facility with an average of 3 showers per week. This showerhead had a flow rate of 7.8 liters per minute, slightly higher than the water efficient standard of 7.6 liters per minute. Because showers are not being used, potential water savings will not be calculated for this report. It is recommended that showerheads not in use be capped off and closed to prevent water waste and potential leakage.

ESTIMATED ANNUAL WATER SAVINGS FROM LEAKS

Leaks are a significant waste of water. Based on the audit, leaks that were identified and measured waste approximately 4,366 cubic meters annually. It was noted, that the men's urinal located on the 2nd floor was purposely adjusted by maintenance to constantly run as means to control the odor. This should be repaired immediately. With minimal labor and costs, fixing these leaks will save approximately 4,366 cubic meters of water annually.

Table 4: Potential Water Savings

Fixture	Potential Annual Savings (m ³)
Toilets	1,076
Urinals	782
Bathroom/Handwashing Faucets	1,031
Kitchen/Utility Faucets	2,641
Water Waste from Leaks	4,366
Total	9,896

VII. SAVINGS AND COST BENEFIT ANALYSIS

Shown below are estimated savings and cost benefit analysis based on retrofitting or replacing current fixtures with water efficient fixtures at the Ecozone facility. They are not a guarantee and may change depending on future fixture, water, and sewer costs. Cost to retrofit or replace is an estimate based on current market prices and labor. It is strongly recommended that costs and labor be confirmed by getting quotes from a qualified plumber before proceeding.

Table 5: Estimated Cost and Savings Analysis

Water Savings Action **	Cost to Retrofit/Replace	Annual Savings*	Annual ROI	Payback (Years)
Replace All Toilets	232,000 PHP	11,764 PHP	5 %	19.72
Replace All Urinals	138,000 PHP	8,546 PHP	6 %	16.15
Install Aerators Bathroom Faucets	10,200 PHP	11,269 PHP	110 %	.91
Install Aerators Kitchen/Utility Faucets	7,800 PHP	28,862 PHP	370 %	.27
Repair Leaks	250 PHP	47,725 PHP	19,090 %	.01
Total	388,250 PHP	108,166 PHP	28 %	3.6 years

* Based on 10.93 PHP per cubic meter

** Does not include replacing fixtures that are already water efficient and meet the standard. Savings and costs may vary depending the quantity and type of fixtures retrofitted.

The proposed water efficiency retrofits for the Ecozone building is cost effective with a payback period of 3.6 years. Most of the individual water saving actions are cost effective on their own, with the least cost effective being the replacement of toilets and urinals. By implementing all the water saving actions together, the Ecozone can maximize potential water savings while retaining an attractive investment offer.

If replacing all toilets is not possible due to budget constraints, consider replacing the most used toilets first. This would most likely be the toilets on the 2nd floor where ANP is located. Because of the heavy volume, dual flush toilets are not recommended.

Prices listed below for each fixture is based on local research:

- | | |
|--|------------|
| • Water efficient gravity tank toilets | 8,000 PHP |
| • Water efficient FOM urinals | 23,000 PHP |
| • Water efficient aerators | 300 PHP |
| • Water efficient pre-rinse spray valves | 3,300 PHP |

Even though some of the fixtures are currently not being used, that could change in the future, should more tenants occupy the facility. As such, it is recommended to retrofit or replace fixtures that are not currently being used or defective, as financial budgets permit.

VIII. RECOMMENDATIONS

1. Replace all 32 functioning toilets with water efficient 4.8 liters per flush toilets. Replacing these toilets, will save approximately 1,076 cubic meters of water annual. If budget constraints do not allow for replacement of all toilets, replace the highest used toilets first. These would be the toilets located on the 2nd floor. Due to the heavy volume of toilet flushes, dual flush toilets are not recommended.
2. Replace all 6 functioning urinals with water efficient 1.9 liters per flush urinals. Replacing these urinals will save approximately 782 cubic meters of water annually. There is also potential to replace them with waterless urinals, potentially saving 1,049 cubic meters of water annually. Because they require special care in cleaning and maintenance they are only recommended in situations where maintenance personnel are diligent. Further investigation should be considered prior to installing waterless urinals.
3. Retrofit all bathroom and handwashing faucets with an aerator or new faucet if necessary. Water efficient faucets which can significantly reduce the water flow without sacrificing performance. Aerators save water by reducing the flow rate and splash, while increasing effectiveness. An aerator reduces volume, while increasing velocity by adding air to the water. The aeration also increases the water's scrubbing action. Retrofitting faucets with aerators is one of the most common conservation strategies, and is relatively inexpensive. Retrofitting the 39 faucets with an aerator providing 1.9 liters per minute flow will yield approximately 1,031 cubic meters of water annually.

4. Retrofit all kitchen and utility faucets where feasible. Install a kitchen pre-rinse spray valve with an automatic shut-off nozzle that has a water efficient standard of 6 liters per minute. Many kitchen faucets and utility faucet uses are not discretionary. Higher flows are needed for filling pots or buckets, while some are used for dishwashing, requiring less volume of water. If they are used for filling containers, ensure that the aerator is appropriate for the task. It may make sense to use a higher flow aerator. Most faucets can easily be easily retrofitted with a water- efficient aerator designed specifically for kitchen or utility use with a variety of spray patterns and flow-control features. By retrofitting these faucets with an aerator providing a water-efficient flow rate of 8.3 liters per minute, approximately 2,641 cubic meters of water can be saved annually.
5. Repair all leaks immediately as identified in Section 5. As part of a Ecozone's water management plan, leaks should be the first area targeted. On average, leaks can account for more than 6% of a facility's water use. On a daily basis leaks from a dripping faucet or defective toilet may seem small, but on a monthly basis such leaks can add up to thousands of liters of water being wasted. A key aspect to managing leaks, is making sure that all employees and facility occupants are educated to report leaks immediately. They should be provided with information as to whom, leaks can be reported. Thus, leaks should be repaired immediately. This shows them that management is committed to water efficiency. Repairing these leaks will save approximately 4,366 cubic meters of water annually.
6. Repair or replace all inoperable equipment as soon as possible. It was noted that there are 14 functioning showerheads in the facility. Only one showerhead is used on average of 3 showers per week. Consider capping off the remaining showerheads and closing them to prevent water waste and potential leakage.
7. Implement a water efficiency action plan that includes educating employees and routine leak detection. Raising awareness with employees or tenants, and encouraging cooperation with management's efforts to practice water efficiency is essential and provides a high return with minimal to no additional cost. Awareness should begin with a letter to all employees or tenants from someone in authority, such as an owner, mayor, etc., describing the water efficiency program. In addition, establish a water education program as part of employee training programs that stresses the need for individual responsibility as part of a team effort to achieve water efficiency goals. By implementing even simple ways to conserve small amounts of water, this attention to water efficiency increases awareness, shows company commitment, and sets an example for employees, tenants and visitors.
8. Immediate action should be taken by doing the obvious first, such as identifying leaks and fixing them immediately. There should be regularly scheduled walk -throughs of the facility during working hours to locate broken pipes, leaks, and faulty hoses. Some leaks can only be found during shutdown by checking meters. All areas should be checked thoroughly, including: kitchens, laundry, janitor areas, bathrooms, outdoor water uses, and any other plumbing or water processes.

9. It is crucial to have the support of top management. There are many reasons managers should support WDM. Investment in efficient, long-term water demand management can reduce operations costs such as: water supply and, waste water treatment costs and/or fees. Improved water efficiency may make additional water available for increased production without the need to purchase additional water supplies.

IX. RECOMMENDED WATER EFFICIENT BEST PRACTICES

TOILETS

- Periodically check and repair leaks.
- Educate users on proper toilet use and maintenance.
- Educate users if flushing trash is an issue. Water- efficient toilets cannot be used as trashcans. Excessive paper (toilet paper, disposable seat covers, and paper towels) are the most common causes of clogged toilets. Place signs in the restrooms.
- Train users to report continuously flushing, leaking, or otherwise improperly operating toilets to the appropriate personnel.
- Periodically check to ensure fill valves are working properly and the water level is set correctly. Remove the toilet tank and check to see if water is flowing over the top of the overflow tube inside of the tank. Ensure that the refill water level is set below the top of the overflow tube. Adjust the float lower if the water level is too high. If the toilet continues to run after the float is adjusted, replace the fill valve.
- Annually test toilets to ensure the flappers are not worn or allowing water to seep from the tank into the bowl and down the sewer. Conduct a dye test to see if the toilet is leaking. If there is a leak, check for a tangled chain in the tank or replace a worn flapper valve. If leaking does not subside after a flapper valve is replaced, consider replacing the flapper seat.

URINALS

- At least annually (or more, depending on volume of use), inspect the FOM diaphragm or piston valves, and replace any worn parts. If replacing valve inserts, verify that the replacements are consistent with the manufacturer's specifications, including the rated flush volume.
- If replacing the entire valve, ensure it has a rated flush volume consistent with manufacturer specifications for the urinal fixture itself.
- Train users to report continuously flushing, leaking, or otherwise improperly operating urinals to the appropriate management or maintenance personnel.
- Prior to installing waterless urinals, it is important to contact local authorities having jurisdiction over plumbing codes to ensure that it is not prevented by code.

BATHROOM AND HANDWASHING FAUCETS

- Install faucet aerators to reduce the bathroom faucet flow to 1.9 depending on use.
- Turn off the faucet while lathering hands, brushing teeth, and shaving. Do not leave the water running continuously.
- Check for leaks on a regular basis and repair immediately.

KITCHEN AND UTILITY FAUCETS

- Regularly check for leaks and repair immediately.
- Retrofit faucets with the appropriate water- efficient aerator.
- Adjust the flow valves to the faucet. Keep in mind this modification can also be easily modified by users.
- Do not let water run when washing dishes. Fill a basin with soap water to clean dishes and another with water to rinse.
- Do not thaw frozen food under running water. Thaw it in the refrigerator overnight or in a microwave.
- Wash fruit and vegetables in a basin, instead of under running water.

PRE-RINSE SPRAY VALVES

- Periodically check for leaks and repairs.
- Routinely inspect and clean for scale buildup to ensure flow is not being restricted.
- Train users how to properly use the shut-off clamp, instead of having a constant flow of water.
- Manually scrape and pre-soak dirty dishes in a basin of water as much as possible.

ADDITIONAL KITCHEN BEST MANAGEMENT PRACTICES

- Periodically check and fix any faucet leaks and worn gaskets.
- Practice dry clean-up using brooms, brushes, vacuums, scrapers and other utensils to clean material or waste before water is used.
- Do not use a hose as a broom. Sweep floors instead of hosing with water
- Vacuum or sweep dry materials that spill.
- Use squeegees and scrapers first to remove waste before washing.

CAR WASHING

- If available, use a commercial car wash that recycles water.
- Limit the amount of times fleet vehicles are washed in a month.
- Soap and wash the vehicle using a bucket.
- Install an automatic shut off nozzle on the hose, so that water does not flow continuously.
- Use recycled water to wash the car.
- Sweep the surfaces and driveway instead of using a hose.
- Make sure that all shut off valves are working correctly.
- Regularly check for leaks and repair immediately.

LANDSCAPING AND OUTDOOR

- Use an efficient spray nozzle with automatic shut-off on the end of hose.
- If possible, decrease grass areas, keeping only areas that are beneficially used for activities, such as a children's playground.
- When designing landscape, select only drought-resistant ground cover.
- Water only during early morning or late evening to prevent evaporation and run-off.
- Water only as necessary and avoid watering after rainfall.

- Use recycled water to irrigate landscape where possible.
- Use a broom to clean exterior sidewalks and driveways, rather than using a hose.

ADDITIONAL BEST PRACTICES

- Turn off running water when not in use.
- Recycle and reuse water whenever feasible
- Consider opportunities for reuse of cleaning and rinsing water. Be careful and wary of rules and regulations regarding this. Check with the proper authorities first.
- Read and monitor water use billing records monthly.
- Read and monitor water meters monthly.
- Shut off water supply to areas and equipment not in use.

X. ADDITIONAL RESOURCES

Website Links:

<http://www.arcs.org> for rain harvesting

https://www3.epa.gov/watersense/product_search.html for water- efficient products

<http://fishnick.com/savewater/resources/watersense/> for commercial kitchen equipment

<http://www.map-testing.com/> for performance tested toilets and urinals

<http://cuwcc.org/>

<http://www.allianceforwaterefficiency.org/default.aspx>

<http://www.iapmo.org/Pages/IAPMOgroup.aspx>

<https://www3.epa.gov/watersense/commercial/index.html>

<https://www.buildinggreen.com/water-efficiency>

<http://www.conserveh2o.org/water-lost-toilet-leaks> how to detect and fix toilet leaks

<http://www.conserveh2o.org/how-to-videos-water-conservation/how-toilet-works> how a toilet works

https://www.youtube.com/watch?v=QqgF_0kfzp4 how to fix a leaking faucet

Note: All applicable laws, codes, standards and more importantly, health and safety requirements associated with fixtures, devices, and appliances, related to plumbing or water system connections, should be observed prior to implementing water efficiency measures.

ANNEX

Summary of Behavioral Survey on Water Use in the Office Bathrooms at the Zamboanga City Special Economic Zone Authority (Zamboanga City Ecozone)

July 13-15, 2017

I. INTRODUCTION

The Water Security for Resilient Economic Growth and Stability (Be Secure) Project is supporting efforts to promote water demand management (WDM) to cope with water scarcity caused by El Niño and climate change impacts. WDM is a management tool that includes a variety of strategies to obtain greater water efficiency. Be Secure is promoting this tool in the focal areas which includes activities that focus on conserving water, reducing waste water, harvesting rainwater and impounding water.

In line with WDM, the Zamboanga City Special Economic Zone Authority and Freeport Authority (Zambo Ecozone) requested Be Secure to conduct a full water audit of their administrative building as part of their efforts to improve their facilities. Prior to the audit, Be Secure conducted a behavioral study of water use in the building on July 13-15, 2016 to understand the cultural and hygiene behavior of Filipinos in public spaces where they might use water and to generate data that will be used as input for the calculation of water savings for the water audit.

Some caveats should be established in this study. First, the figures presented are not representative of the entire employees of the Zamboanga ecozone administrative building and are by no means precise, but do provide reasonable estimates for water use behavior. Second, this behaviour study is focused only on water use in office bathrooms and does not cover other facilities such as office pantries or kitchen sinks. Third, this study did not also consider water used for drinking purposes since Zambo ecozone generates its own water supply and does not depend from the Zamboanga City Water District.

ABOUT THE ZAMBOANGA CITY ECOZONE

The Zamboanga City Special Economic Zone Authority and Freeport or ZAMBOECOZONE was primarily conceived to be a critical and vital economic hub that would bring about positive change for the city and the region through jobs generation and adequate investments as mandated through Republic Act 7903.

The Act was authored by the late Congresswoman Maria Clara Lorenzo Lobregat and was enacted into law on February 23, 1995, and made operational a year later with the appointment of a Chairman and Administrator as well as the members of the Board by former President Fidel V. Ramos.

By nature of its operation, ZAMBOECOZONE is unique in being both an economic zone and Freeport, and is, in fact, the only Freeport in Visayas and Mindanao. The Authority has two development sites. The first development site consists of the First and Second Industrial Parks. These sites are ideal for information technology, call centers, processing plants, shopping centers, hotels, and retirement centers. The second development site, on the other hand, is located in the hinterlands of barangays Pamucutan and La Paz, and consists of 15, 391 hectares of logged-over forests. The said area is to be developed into agro-forestry and eco-tourism parks and projects.

2. METHODOLOGY

Be Secure developed a journal-type survey form that captures the following data:

- Time of day
- Activities undertaken inside the bathroom
- Means of flushing the toilet
- Frequency of flush
- Activities undertaken at the bathroom sink
- Frequency of bathroom faucet use
- Duration of faucet use

The form was pre-tested to five Be Secure staff prior to administration at the Zambo ecozone to check legibility and understandability of the contents. The forms were made to collect anonymously although tracking numbers were included. A sample form is attached as Annex I.

The Zambo ecozone staff assisted in the recruitment of 40 women, who are working in the administration building and who would be willing to keep a journal for three days (July 13-15, 2016) of their bathroom use. The 10 women respondents should be of mixed age group and be full-time employees. Twenty (20) men were also recruited to fill up the form served as control group. The men were recruited on the third and fourth floors of the building respectively.

The recruits were selected randomly from the employees of the building. The journal needs to be marked every single time they do something relevant and not just fill in the form from memory at the end of the day. The forms were collected at the end of each day.

In addition, Be Secure conducted three focus group discussions (FGDs) to validate the journal keepers. Two groups of 3-4 females who were 18-40 years and 40 years and above and a mixed-age group of males were organized on the last day of the survey (July 15, 2016). A short guide question was developed and attached as Annex 2.

3. PROFILE OF RESPONDENTS

Out of the 60 forms handed out to the Zambo ecozone employees, 46 individuals completed the three-day survey corresponding to a 77% response rate. The distribution of respondents in the building by sex is as follows:

Floor	Women	Men
Basement	3	0
First	3	0
Second	9	0
Third	8	8
Fourth	7	8
TOTAL	30	16

More than half (57%) of the female respondents were young employees. This is more prominent among those working on the second floor¹ where one major locator² of the Zambo ecozone is housing.

Age	Women	Men
18-30 years	17	5
31-40 years	4	5
41-50 years	2	6
51-60 years	6	0
No answer	1	0
TOTAL	30	16

Majority (76%) of the total respondents were college graduates while 20% of the female respondents have finished high school.

Education	Women	Men
Elementary Graduate	0	0
High School Graduate	6	0
College Graduate	21	14
Master's Graduate	2	1
PhD Degree	0	0
Others	0	1
No answer	1	0
TOTAL	30	16

4. RESULTS

BATHROOM USE

The survey showed for a three-day period, female employees spent 283 trips to the bathroom to urinate or an average of 4 trips per person per day. The said average is consistent with the FGD results of women aged 18-40 years although women belonging to the 40 years and above group mentioned they have slightly higher than the average. It was also noted that women in the second floor have lower than the average trips per day to urinate in the bathroom.

Men, on the other hand, spent a total 158 trips to the bathroom to urinate or an average of 3 trips per person per day. This average is also consistent with the results of the FGD. During the discussion, it was also mentioned that some men have fewer trips to the bathroom particularly when they are assigned to do fieldwork.

¹ The whole second floor is occupied by one locator called Helping Hand Development Cooperative.

² A locator is a business enterprise which sets up investment activities in the Philippine economic zone.

Activities	Average per person per day	
	Women	Men
Urinate	4	3
Defecate	0.3	0.5
Change Sanitary Pad	0.2	NA
Others	0.0	0.1

Note: NA – not applicable

Respondents reported fewer activities for defecation (both sexes) and changing sanitary pads for women.

PEAK TIME BATHROOM USE

Based on the submitted three-day journal, office bathrooms were mostly occupied during mid-morning at 9:30 AM, during lunch time from 12:30 PM to 1:00 PM, during mid-afternoon at 3:00 PM and before the end of the office hours at 4:30 PM.

TOILET FLUSHING METHOD

Majority of the respondents flushed the toilet bowls using the attached water tank/closet. All the women reported a total of 203 times using the water closet to flush the toilet or an average of 7 flushes per day per person. Men meanwhile flush the toilet bowls 121 times for the three days or at a higher average of 8 times in a day per person. It was noted that both women and men employees at the fourth floor flushed the toilet bowl more frequent with a total of 65 and 86 flushes for the three-day period, respectively.

For bathrooms where the water tank/closets are not functional, women flushed the toilet using pail and *tabo*³ at an average of 2 times per person per day while men only used 0.4 times per person per day.

Flushing Method	Total for 3 days	
	Women	Men
Pail with <i>tabo</i>	73	6
Water closet	203	121

Among all floors, women employees at the second floor reportedly used pail and *tabo* as the major method to flush the toilet bowls.

FREQUENCY OF TOILET FLUSH

Both men and women reportedly flushed their toilets mostly once every use. For the three-day period, women flushed had a total of 184 one-time flushes for all toilets in the building. Men, on the other hand, had 107 one-time flushes for the said period. There were only few employees who reported to have flushed the toilets twice or thrice.

³ *Tabo* is a Filipino term for water dipper.

Frequency of Flush	Total for 3 days	
	Women	Men
Once	184	107
Twice	46	9
Thrice	3	4

When asked during FGD whether they flushed the toilets before using, all groups mentioned they do not do so. One group explained that they do not flush the toilet before use since the water takes longer to fill the tank. All the groups also mentioned that they just need to flush only once after they urinate.

BATHROOM FAUCET USE

Over a three-day period, women reported to have washed their hands 140 times while those washing their hands with soap did this 96 times. Men washed their hands 111 times while they did this only 44 times using soap. Based on FGD, men wash their hands after urinating while women either wash or use hand sanitizer or alcohol after urinating.

In terms of brushing teeth, women did this 103 times for three days or at an average of 3 times per person per day while men had an average of 2 brushes per person per day.

On the other hand, more men reportedly washed their face at 29 times compared to 11 times in women. Both sexes have the same frequency of using the *tabo* for hygiene purposes over the three-day period.

Activities	Total for 3 days	
	Women	Men
Wash hand	140	111
Wash hand with soap	96	44
Brush teeth	103	38
Wash face	11	29
Wash feet	6	8
<i>Tabo</i> for hygiene purpose	15	14
Others	9	1

Other activities spent on the sink were mostly on washing plates, utensils and mugs that were used after eating. Women washed dishes or utensils 9 times during the period covered while men reportedly did this only once.

FREQUENCY OF FAUCET USE

In conducting their activities using the faucet such as hand washing without soap, majority of the employees mentioned to have used the faucet only once. Women reported to have used the faucet once 153 times over the three-day period while men used the faucet once 89 times. According to the employees, they use the faucet more than once if they brushing their teeth and wash their utensils. It was noted during the FGD, that all of the participants do not bring a glass or cup when they brush their teeth.

Frequency of Use	Total for 3 days	
	Women	Men
Once	153	89
Twice	72	17
Thrice	19	15

DURATION OF FAUCET USE

Majority of the women employees reported to open the faucets for only five seconds (a total of 134 times) compared to men during the three-day period. However, it should be noted that there were more men who opened the faucet for more than 15 seconds compared to women. This was evident among those who worked at the fourth floor of the building based on their journal.

Duration of Use	Total for 3 days	
	Women	Men
5 seconds	134	46
10 seconds	60	34
15 seconds	36	13
More than 15 seconds	27	39

5. CONCLUSIONS

The water behavior study provided Be Secure and the Zamboanga Ecozone an insight on the cultural and hygiene behavior of Filipino men and women in public spaces where they use water. The journal-type survey provides an idea on the frequency of use of bathroom fixtures and the peak time of bathroom use in the building. The survey can complement the water audit as a means to determine the amount of water being used per floor based on the activities undertaken by the employees and the potential water savings it could generate if the bathroom fixtures will be improved or if water conservation practices will be implemented by the Zamboanga Ecozone management.

While Zamboanga Ecozone is a unique case for understanding water behavior considering that the institution generates its own water and is not dependent on Zamboanga City Water District for supply, the water district could use this survey to generate information from other highest water consuming concessionaires to complement the water audits that they are undertaking.

The journal-type survey needs further updating to cover urinal use among men and refine other items indicated in the form.

SURVEY FORM AND GUIDE QUESTIONS

Tracking Number: _____

Behavioral Survey on Water Use in the Office Bathrooms

Good day! The USAID Water Security for Resilient Economic Growth and Stability (Be Secure) Project and Zamboanga Ecozone is conducting a survey to understand individual behavior on using water inside the office bathroom. We would like to learn about the amount of water used in your office bathrooms in order to develop improved water fixtures in public places and effectively promote more efficient water use.

We greatly appreciate you taking the time to complete this survey. Your responses in this form are **completely anonymous and are all kept confidential**. We do not need your name on this form. Your responses will not be linked to you individually; they will be combined with other people's responses to provide general results. We do however expect you to be as honest as possible.

General Instructions

This survey is drafted in two parts. Part 1 focuses on the generic profile of the respondents and Part 2 is a diary/journal where you will record your hygiene practices inside the office bathroom over a three day period each time you visit the bathroom. **For each question asked in the forms, please mark the appropriate response by shading or marking the circle.** Please note that there are no right or wrong answers in this survey. Please submit your journal sheet at the end of each day to your Survey Coordinator.

Part 1: Respondent profile

1. Age

- 18-30 years 31-40 years 41-50 years
 51-60 years 61 years and above

2. Educational attainment

- Elementary graduate High school graduate
 College graduate (BA/BS/Engr.) Master's graduate (MA/MS)
 PhD degree Others (specify) _____

3. Religious affiliation

What is your religion? _____

Part 2: Daily journal on water use in the office bathroom

We are interested to know your water use inside the office bathroom over the next three days. For each visit to the bathroom, please indicate by **shading or marking the circle** the times of the day you went inside, for what purpose, whether you used the toilet and faucet or just one or another, and how long you ran the water from the faucet if you used the faucet. Include any filling of containers such as *tabo* or bottles to be used in personal hygiene but not necessarily for drinking purposes. **Please note that all of your responses are anonymous and confidential.** Please submit your journal sheet at the end of each day to your Survey Coordinator.

Example:

Daily journal on water use inside the office bathroom

Day 1 of 3

Date: July 13, 2016

Tracking No.: 065

Time of Day	What did you do inside the bathroom?			What did you use to flush the toilet bowl?		How many times did you flush the toilet bowl?			What did you do at the bathroom sink?							How many times did you use the faucet?			How long did you run the water from the faucet? (in seconds)				
	Urinate	Defecate	Others (Please specify)	Pail with <i>tabo</i>	Water closet	1	2	3	Wash hands	Wash hands with soap	Brush teeth	Wash face	Wash feet	Fill <i>tabo</i> for hygienic purposes	Others (Please specify)	1	2	3	5	10	15	More than 15	
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Daily journal on water use inside the office bathroom

Day 1 of __

Date: _____

Tracking No.: _____

Time of Day	What did you do inside the bathroom?			What did you use to flush the toilet bowl?		How many times did you flush the toilet bowl?			What did you do at the bathroom sink?							How many times did you use the faucet?			How long did you run the water from the faucet? (in seconds)				
	Urinate	Defecate	Others (Please specify)	Pail with tabo	Water closet	1	2	3	Wash hands	Wash hands with soap	Brush teeth	Wash face	Wash feet	hygienic	Others (Please specify)	1	2	3	5	10	15	More than 15	
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Guide Questions for the Focus Group Discussion (FGD)
Behavioral survey on water use in the office bathrooms
Zamboanga Ecozone, Zamboanga City
July 13-15, 2017

- How long (in minutes) do you usually spend inside the office bathroom?
- Do you flush the toilet before using it?
- How many flushes do you do after urinating? After defecating?
- How often do you wash your hands in a day?
- Do you open the faucet continuously while washing your hands? While brushing teeth? While washing feet?
- *For female users:* How often do you go to the toilet during your period?
- What other issues / concerns do you encounter in using the office bathroom?
- What improvements do you wish to see inside the bathroom?

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