Design Checklist for EWB-USA Chapters Working on Rainwater Catchment Projects

The following checklist provides a list of specific information that must be incorporated into your team's 525-Pre-Impementation Report for a Rainwater Catchment Project. For additional clarification and instruction on each item, refer to the commentary that follows the checklist. This list represents the minimum requirements specific to rainwater catchment. Your specific project may require additional detail not listed here. For example, if your chapter determines that treatment is required, additional design details on the treatment method would be required in your 525 report.

For more complete instructions on design requirements that apply to all EWB-USA projects, please refer to the 525 – Pre-Implementation Report Instructions. It is intended that these two instructional documents be used together as your team prepares your design documentation.

Checklist

1. **Design Details**
    - **1.1. Design Criteria and Standards**
    - **1.2. Problem Definition**
    - **1.3. Intended Use**
    - **1.4. Calculations**
        - **1.4.1. Water Demand**
        - **1.4.2. Water Supply**
        - **1.4.3. Tank Sizing**
        - **1.4.4. Gutter Sizing**
        - **1.4.5. Tank Structural Calculations**
        - **1.4.6. Tank Geotechnical Analysis**
        - **1.4.7. First Flush Sizing**
        - **1.4.8. Hydraulic Analysis**
    - **1.5. Water Quality**
    - **1.6. Soils Investigation**
    - **1.7. Property Ownership**

2. **Design Drawings**

2.1. Site Plan

2.2. Tank Foundation

2.3. Tank Structure

2.4. Tank Plumbing

2.5. Tank Level Controls

2.6. Gutter Detail

2.7. First Flush Detail

2.8. Additional Plumbing Details

3. Materials List

4. Operation and Maintenance

4.1. Gutter Cleaning

4.2. First Flush Draining

4.3. Personnel

4.4. Costs

4.5. Tank Cleaning

Checklist Commentary

1. Design Details

1.1. Design Criteria. Identify criteria to be used in design such as country specific standards if available, World Health Organization or other regional governmental organization if not available and provide engineering justification for any variance from these standards. Teams are also expected to refer to all other EWB-USA water resources guidance documents including the 3-part Water Supply Webinar that is pre-recorded and available on the myEWBUSA website.

1.2. Problem Definition. Provide a clear, concise description of the exact problem that the rainwater catchment system is intended to solve.

Example: A residential and day student high school is connected to an unreliable community water system and would like to have access to drinking water during those times that the community system is not operating.
Example: A medical clinic has access to a surface water source that provides adequate year-round water supply quantity but is of poor quality. The source is a 20 minute walk from the clinic necessitating a significant effort in hauling water to the clinic.

1.3 Intended Use. Clearly describe how water from the rainwater catchment system will be used.

Example: The proposed system is intended to provide 100% of the drinking water for 400 day students and drinking and cooking water for 20 boarding students at a high school for all months except January, June and July.

Example: The proposed system will provide 100% of the water needed for drinking and hand washing for a medical clinic during the dry season months of May – August.

1.4 Calculations. All calculations must be consistent with the drawings

1.4.1 Water Demand:

Provide a narrative description of the demand to be supplied by the system.

Define the unit demand (liters per person per day) for the system.

Provide references for the unit demand value used. The chapter must include information from a survey of the community regarding the amount of water currently used, types of water uses, distance or time traveled for water and water quality. Please also refer to the guidance sheet on estimating average daily water demand available on myEWB-USA website under EWB-USA Guidelines.

Define total demand for the system on an appropriate time step. This may be daily or monthly depending on the system design.

1.4.2 Water supply:

The supply should be estimated using monthly rainfall for the design year with the lowest rainfall, and days of rainfall each month of that year. Use an 18-month analysis period to mitigate impacts of using a calendar year.

Provide information about the source of rainfall data that are used for the design. Are the data from specific rainfall measurement sites at a nearby airport, city or published isohyets? If you are using data from isohyets provide the following information:

- Provide the isohyetal mapping with the project site marked
- Provide the citation to the publication that includes the isohyets. The publication must be readily available so that the entire publication is available for review.

If you are using data from one or more rainfall measurement sites, provide the following information:

- Describe whether you are using rainfall information from one rain gage or more than one rain gage.
- Provide a map showing the project site and the rain gage sites.
- For each rainfall gage site used in the analysis, describe the location of the site, length of records that are available from the site, whether the data are available on a daily or monthly basis and the organization that is responsible for the site.
- State how you determined that the data from the rain gage site is characteristic of the rainfall at the project site.
- Provide all rainfall data in an appendix with a summary in the text of the report.

1.4.3 Tank Sizing: Provide calculations showing how the tank size was determined. See the Rainwater Catchment Sizing Worksheet on the Example Documents page of the EWB-USA website.

1.4.4 Gutter Sizing: Provide calculations showing how the size and slope of the gutters were determined.

1.4.5 Tank Structural Calculations: Provide calculations showing that the tank can resist the lateral water load, any anticipated roof loading and lateral loads from earthquakes or wind as appropriate.

1.4.6 Tank Geotechnical Analysis: Provide a description of the geotechnical conditions at the site including the soil type as per the Unified Soil Classification System or other appropriate system. Describe any geologic hazards that will affect the design. State the soil bearing pressure used in the design.

1.4.7 First Flush Sizing: Provide the criteria used for first flush sizing and show the first flush volume size calculations.

1.4.8 Hydraulic Analysis: Provide calculations to select pipe sizes and slopes for the connections from the gutters to the tank, the tank to the taps and overflows.

1.5 Water Quality. Discuss the water quality of the existing source that the population that will be served by the rainwater catchment system currently uses.

Discuss the expected water quality from the rainwater catchment system. Document all potential pollutant sources (nearby trees, roof material, etc.) and present sampling results.

If water quality is a potential concern, discuss your plans for continued monitoring and treatment of the system.

If treatment is necessary, discuss the water treatment methodology to be employed with a clear statement on the treatment standards. Your design will need to include all applicable calculations and drawings specific to that treatment method.

1.6 Soils Investigation. Provide a description of the soil conditions at the site including any issues impacting excavation, drainage, and erosion.

1.7 Property Ownership. Provide confirmation that community has permission to use land for rainwater catchment project and there are no landownership issues.

2 Design Drawings

The design drawings should be in one coherent drawing set, not individual drawings spread throughout a report. The drawings must be consistent with the calculations.

2.1 Site Plan. The site plan should be drawn to an appropriate scale and include (at a minimum) the following items as appropriate: the footprint and outline of the building receiving the system, the tank, area topography, property lines, nearby man made features (adjacent buildings, latrines, fences, areas dedicated to special uses such as cooking or farming, roadways, etc.), nearby natural features (steep slopes, drainage ways, trees) and sources of possible airborne contamination. It should also show the site grading and explicitly show the drainage path for overflows from the tank to an outfall.

2.2 Tank Foundation Design. Show the foundation dimensions and reinforcement.

2.3 Tank Structure. The tank structure must include detailed structural drawings drawn at an appropriate scale.

If the tank is a concrete tank or masonry block tank, show the foundation, walls and roof dimensions and configuration. Show the reinforcing bars including corner bars and dowels. Show the details of the roof hatch giving consideration to the practicality of removing the hatch. Provide details of the tank waterproofing.

If the tank is a ferro-cement tank, show the tank dimensions and configuration. Show reinforcing. Provide proof that the chapter has successfully constructed a half scale or larger tank as a pilot in the states or with a previous project or that the community has experience in this type of construction. Provide details of the tank waterproofing.

If the tank is a pre-fabricated plastic tank, show the foundation dimensions and reinforcing. Show the tie down straps for the tank and a detail of how they will be attached to the foundation. Provide the vendor or source of the tank.

The tank should include watertight roof and sidewall, securable access points, and screened vents, which should be indicated on the drawing. Waterproofing for cementitious and masonry tanks should be provided.

The drawing should also show every inflow and outflow from the tank including the type of tap if water is accessed at the tank. Also show the area where water will be withdrawn from the tank – it should allow for drainage of spilled water and allow easy withdrawal of water using the area's standard water containers.

2.4 Tank Plumbing. Show details of all piping connections, screening overflow lines, fill lines, connection to distribution system, and drains**.**

2.5 Tank Level Controls. Features to control the tank level should be detailed.

2.6 Gutter Detail. The gutter design should show the lineal extent of the gutter, gutter shape and material, connection to the building and extension of the gutter from the building to the tank inflow point. If screens will be used, they also should be specified.

2.7 First Flush Detail. Show the details of the first flush mechanism giving special consideration of how the water will drain away from the building to an outfall. Also show how the first flush unit will be supported by the tank, building, or separate structure.

2.8 Additional Plumbing Details. Show the plumbing details for pipe lengths in between the gutters, tank(s), and tap(s). If pipeline will be underground, trench details will need to be provided. If pipeline will be overhead, their structural support will need to be specified.

3.0 Materials List

List the specific materials that will be used in the design, which must be available locally. It is not appropriate to make assumptions based on material availability from U.S. hardware stores. For example, materials and practices for hanging gutters vary from region to region based on the common roof types, rainfall intensities, etc. The team needs to propose materials that are consistent with the local resources. This requires spending time at the hardware stores and observing existing practices during the assessment phase of the project.

4.0 Operation and Maintenance.

The following is a list of factors that are unique to rainwater catchment systems and that must be considered in your overall operation and maintenance plan. The plan should be provided to the community in the local language or pictorially.

4.1 Gutter Cleaning. The team needs to demonstrate that they understand exactly how the gutters will be cleaned and who will be responsible.

4.2 First Flush Draining. The first flush unit will need to be drained after every storm. This can either be done manually by removing a cap at the bottom or automatically by cutting a small drain hole in the bottom of the unit. The preferred option should be discussed with those responsible for draining the first flush.

4.3 Personnel. Rainfall catchment systems are typically implemented at a household or some sort of communal building. The homeowner is typically responsible for operation and maintenance at the household level, but it is not always clear who is responsible at a communal building. For example, a school could designate students, teachers, administrators, parents, or maintenance staff to manage the system. The team will need to discuss this specific point directly with the responsible parties and document all decisions in the operation and maintenance plan and community agreement.

4.4 Costs. The cost to operate and maintain a rainwater catchment system is minimal but there are costs and the team needs to clearly document what these costs are and how they will be covered. For example, a school would need to confirm that they have the budget to cover all operation and maintenance costs.

4.5 Tank Cleaning. All rainwater storage tanks have the high potential for larvae and bacterial growth within the tank and contamination of the water by insects, rodents and other animals. To prevent this, the tank openings must be well screened and must be periodically cleaned with chlorine solution (>50mg/l) or other disinfectant. Specify the method, frequency and responsibility for the cleaning and disinfecting.

