Case Study #2

"Site & Building Water Use"

For this mini–Case Study assignment you will investigate water use for a building and its site. We will use one of the following schools for this assignment.

-Fayetteville Montessori Elementary School / *Marlon Blackwell Architects*
-Duranes Elementary School / *Baker Architecture + Design*
-Lakeland Elementary School / *DLR Group*
-Barcelona Elementary School / *Baker Architecture + Design*

If choosing a building…

- Occupancy Classification is easily identified.
- Choose a building for which the sq.ft. is available.
- Smaller, rectangular buildings.
- Under 60% of site coverage
- No residential, single or multi-family.
- If in doubt, choose from the example list above.

Your Case Study will consist of six parts:

1	Introduction – include the names of your group members	**0 pts.**
2	Building Profile	**2 pts.**
3	Conventional Performance – Question A	**5 pts.**
4	LEED Performance – Question B	**5 pts.**
5	Living Building Challenge Performance – Question C	**5 pts.**
6	Conclusion	**3 pts.**

Investigative questions:

A. How does the WUI of the building at a conventional performance compared to the National Median WUI for a similar property type?
B. How does the WUI of the building at LEED performance compare to the conventional performance WUI?
C. How does the WUI of the building at L.B.C. performance compare to the LEED performance WUI?

Present your Case Study in lab February 29th as a digital slide show, limited to 20 slides and 15 minutes. Points (2 pts) are deducted for exceeding these limits. Follow the instructions for each question as described below.

Building Profile: Describe your building. Remember that it does not matter if you make assumptions. It matters that once the assumption is made, you stick to it.

-Building Name:

-Location:

-Building total sqft.:

-Site sqft. :

-Percentage of site coverage at ground level.

-Levels

-Occupancy Type:

-Design Occupant Load:

-WUI for median national building type

-Yearly Precipitation

-Sketch of site:

Consider that this assignment is designed to teach you the impact of design on water consumption and how to reduce it. For this we will use WUI as a benchmarking value.

These sections will guide you through each one of the questions.

Question A - How does the WUI of the building at a conventional performance compared to the National Median WUI for a similar property type?

Water Use Intensity (WUI) is a measurement of how many gallons of water per square foot a building uses a year. Use the US Energy Use Intensity by Property Type Benchmark Table to find out the national median WUI for the building type of your case study. Enter all the necessary information on the excel workbook provided, *Plumbing Fixture Schedule and WUI Calculator*.

1. Using 2021 IBC, Chapter 10, Section 1004 estimate the occupant load (you may reasonably simplify this process by adding up all of the classroom space and dividing by the net value, we will later use the same load as the number of students) :_____
2. Create a plumbing fixture schedule using the Minimum Number of Plumbing Facilities TABLE 20.3 from Chapter 20 in M.E.E.B or 2021 IBC Chapter 29, section 2902 Remember to add to your schedule elements that might not be required but expected. For example, a kitchen sink in break rooms, or showers in a gym. Most buildings will have toilets, urinals, lavatories, drinking fountains, and service sinks.
3. In the plumbing fixture schedule note the Water Supply Fixture Unit Value (WSFU) by referencing TABLE 19.15 from Chapter 19 of M.E.E.B. If your building has a fixture not listed on the table, just estimate a WSFU by comparing it to similar, listed fixtures. This value is used to estimate the share of water used by each fixture. Add all the WSFU values to obtain the Total WSFU :_____
4. Using the occupant load and the occupancy classification calculate the Daily Usage per Capita. Use TABLE 18.2 from Chapter 18 of M.E.E.B. to multiply the occupant load by the Gallons used daily for you building type. Reduce the value by 25% (the MEEB data is a little outdated) Daily Usage:_____
5. Because WSFU is not a measuring unit but a way to identify the share of usage by each fixture, we must now find out what is the value of each WSFU in gallons per day for our building. Divide the Daily Usage by the Total WSFU. WSFU value in gallons per day: _____
6. Estimate your building's Interior WUI by multiplying the Daily Usage by the number of days the building is used in a year, and then dividing it by the square footage. Conventional Performance Interior WUI: _____
7. Create a rainwater system diagram showing how the site deals with rainwater. Make assumptions as needed. Show roof slope, directions, gutters and leaders, drains, pervious surfaces, bioswales, storm drains, gravel trenches, etc.
8. Calculate yearly water needs (in gallons per year) for landscaping using the Guidelines for estimating Unmetered Landscaping Water Use from the U.S Department of Energy. Use the Evapotranspiration method, pages 3-17. Ignore actual landscape design.

Choose a percentage of site square footage to be landscaped and assume all landscaped areas are of Moderate Water Requirements, and Average Density Open Microclimate. Select appropriate Annual Irrigation Factor for the location, with Medium Efficiency sprinkler type system.

9 Annual Landscape Usage (gallons a year):

10 Combine all water used in site to calculate the Building WUI (same as before but include landscaping use, while still only dividing by the buildings sqft. Building WUI_____

$$Annual\ Landscape\ Usage = \frac{Annual\ Irrigation\ Factor\ \left(\frac{gal}{sqft-yr}\right) X\ Irrigation\ Area\ (sqft)}{Irrigation\ System\ Efficiency}$$

Question B -How does the WUI of the building at LEED performance compare to the conventional performance WUI?

LEED (Leadership in Energy and Environmental Design) is a green building rating system. “LEED certification provides a framework for healthy, highly efficient, and cost-saving green buildings, which offer environmental, social and governance benefits.” (from LEED site). The program is run by USGBC and uses a scorecard to achieve a specified number of possible credits for a variety of aspects. We will use the LEED scorecard to achieve credits for water related items and compare the water consumption at conventional performance with the same building at a conserving system. Many credits ask for a percentage of savings compared to a benchmark. Use the national median WUI for a similar building as the benchmark.

1. Review the LEED v4.1 BC+C Scorecard and LEED Credit Guide page 61, 79-98
2. Design a system capable of earning at least 1 point for Rainwater Management by retaining 80% on site. Combine strategies with Water efficiency to earn credits on both sections.
3. Achieve at least 4 points under the Water Efficiency Section. Remember that the required prerequisites of the section must be satisfied but do not earn points. Use the WaterSense Water Budget Tool to stablish the baseline and compare to it.
4. Design your rainwater containment system by following the Design Procedure on pg. 283-284 of The Green Studio Handbook.
5. Create a new Plumbing Fixture Schedule with updated consumptions, and/or new landscaping plan.
   Tip: Assume that reducing the water consumption of one item by a given percentage would reduce the total use of water on the same percentage for that fixture. For example, for the conventional use system, the toilets were 1.6 gallons per flush Let’s imagine that those toilets were adding up to 15 gallons a day per toilet x 10 toilets that equals 150 gallons a day for all toilets combined. If instead high efficiency toilets were used at 80% of the max gpf, we will estimate a 20% savings on water used by the toilets. So, 150 X 0.80 = 120 gallons a day.
6. What is the Building WUI with the conserving system?

Question C -What is the WUI for your Building Using an advanced conserving system?

LBC (Living Building Challenge) is a visionary and holistic program that requires very high-performance design in order to satisfy the requirements of 7 sections or “Petals”. (Place, water, energy, health + happiness, materials, equity, beauty.) Each “Petal” requires several Imperatives. We will concentrate on imperative #6 Net Positive Water. While not impossible, it might be challenging to achieve this imperative. Get creative and consider all options. If it is not possible in your building, explain why and how close you can get to it.

1. Review the Living Building Challenge 4.0 Standard
2. Reduce water consumption as much as possible. Consider waterless toilets, very low flow sinks, etc. Create a new Plumbing Fixture schedule.
3. Review the landscape water needs and update it as much as possible. Remember, most humans love plants, and buildings do need to be beautiful.
4. Update the rainwater catchment system if necessary.
5. Create a diagram to reuse gray water as much as possible.
6. Estimate the water waste loads per gallon using Table 20.4 from M.E.E.B
7. Following the Design Procedures on page 276 design a Living Machine.
8. Sketch a site plan showing all the water systems and uses. This can be a hand sketch paying reasonable attention to scale. The main point is to verify what size system would fit on your site when you consider all the elements together. Including rain catchment systems, landscaping, bioswales, etc.
9. Recalculate your Building WUI.