RAINBELLOWS

A biomimicry case study: RainBellows is inspired by nature’s solution for stormwater capture, storage and filtration to the urban environment.

The building achieves the requirements of the Living Building Challenge, with 75% reduction of potable water as well as reuse of at least half of the stormwater that falls on the site.

INSPIRATION BEHIND RAINBELLOWS

Our basis for the design is a highly-sustainable commercial building currently under development in Seattle. Designed to meet the Living Building Challenge, the project revealed opportunities to further reduce use of potable water in an urban environment.

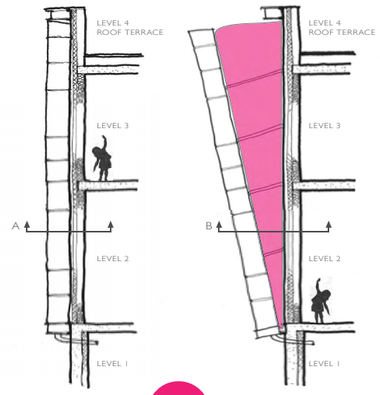
1: IDENTIFY
CHAMPION

2: RESEARCH
BIOLOGICAL STRATEGY

3: UNDERSTAND
MECHANIC

4: DISTILL
DESIGN PRINCIPLE

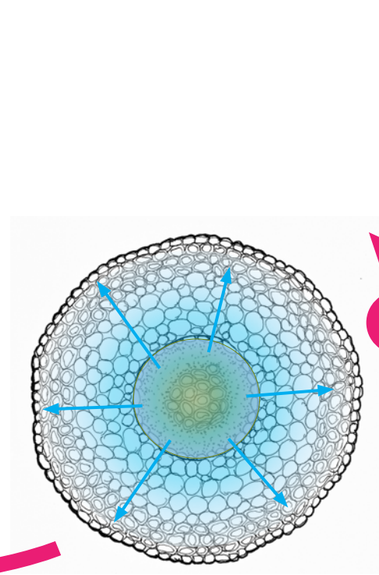
5: SOLUTION
APPLICATION



1 CHAMPION

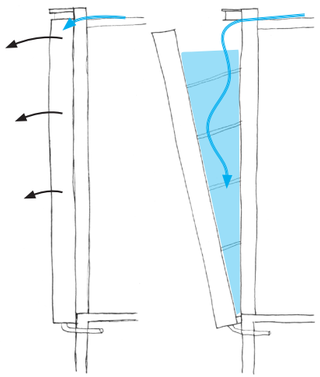
2 BIOLOGICAL STRATEGY

WATER USE
WATER STORAGE
WATER FILTRATION



3 MECHANIC

DESIGN PRINCIPLE 4



5 APPLICATION

RAINBELLOWS FIVE-STEP METHODOLOGY

The project team's five-step method allows design through biomimicry to become a more approachable design strategy. Breaking down the steps into a simple sequence helps translate strategies from nature into design ideas.

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1. IDENTIFY CHAMPION: ICE PLANT

RainBellows selected the Common Ice Plant as it's Champion species for its distinctive water processes – filtration, storage, and reuse. It also showcases these properties in bright-specialized cells on the exterior of the project.

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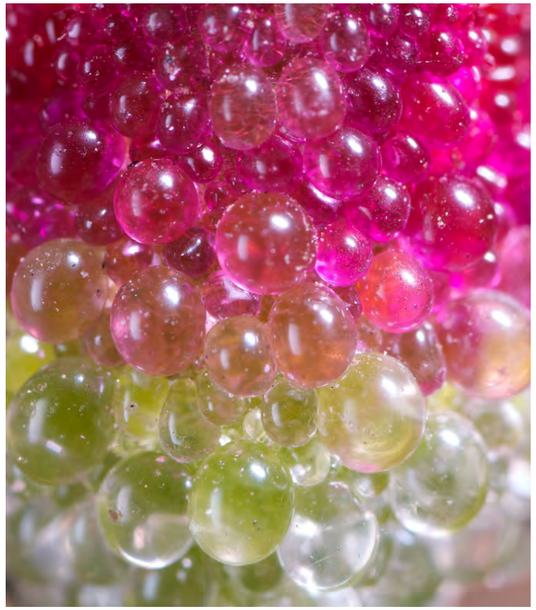

WATER FILTRATION

Through transpiration, the Ice Plant draws water and contaminants (salt, cadmium, and copper) from the soil into its roots and up through the xylem. As the water moves up the plant the endodermis, or core plant cells, act as a barrier to the contaminants filtering the water on the way to the epidermal cells for storage.

WATER STORAGE

While most plants transpire water through their leaves, the Ice Plant's Epidermal Bladder Cells (EBCs) have a waxy, expandable coating that allows it to grow and store water. The EBCs act as a reservoir for excess water when it is plentiful.

WATER USE

During times of drought, the Ice Plant's full EBCs come in handy. Water is pulled back through the cortex when water cannot be found in the soil. The use of this reservoir of water provides for the plant longer into the summer desert drought season.

2. RESEARCH: BIOLOGICAL STRATEGY

The Ice Plant has three biological strategies most relevant for our project. Its unique cellular structure allows for the filtration, storage, and later use of water. Unlike typical leaf structures that use transpiration to move fluids, the Ice Plant retains the liquid for future use.

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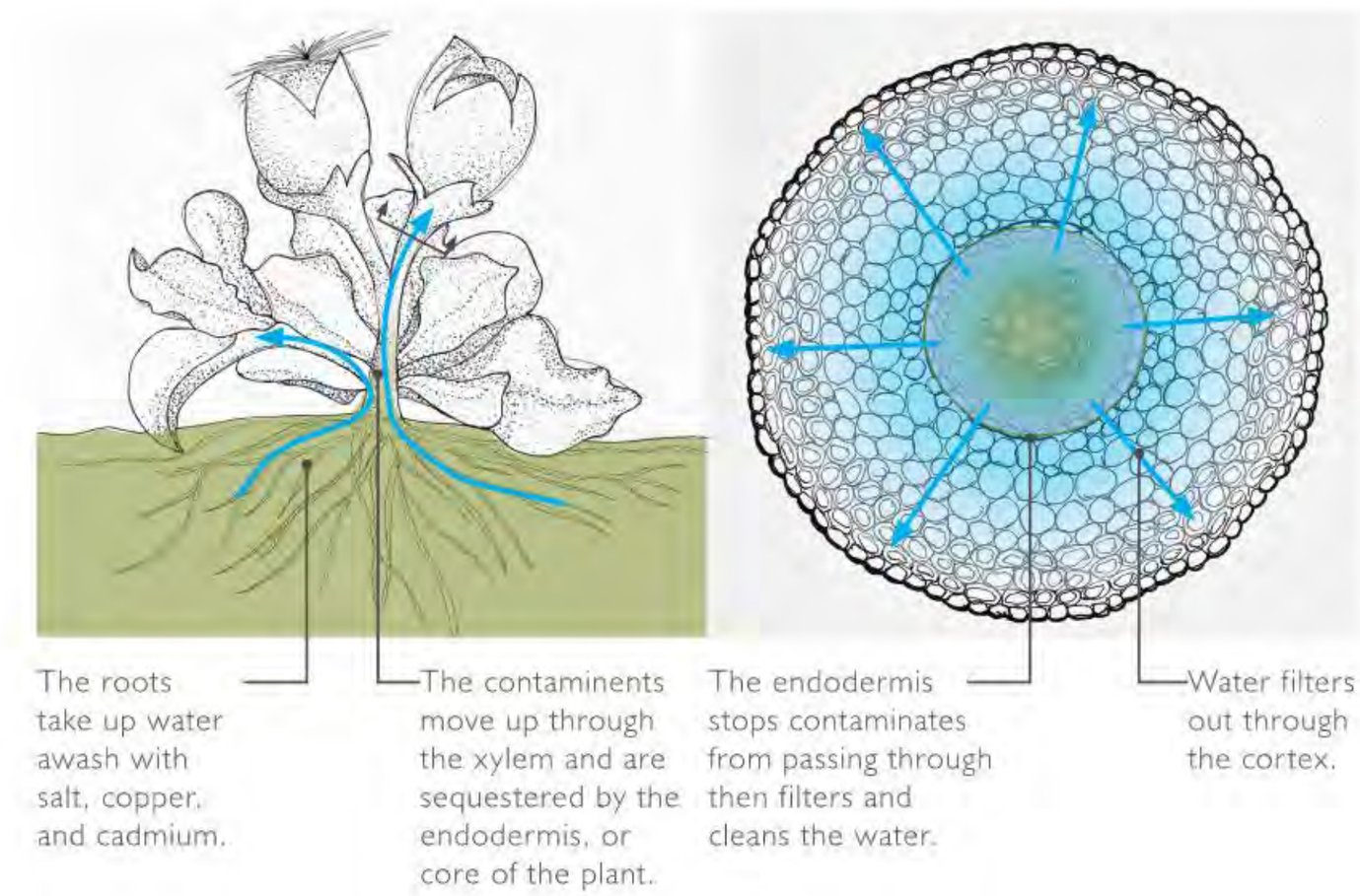

3. UNDERSTAND: MECHANIC

Simplifying unique plant characteristics is crucial in translating an idea from nature to built environment. Mechanics show intake and filtration of water, filling of the Epidermal Bladder Cells (EBC), and re-intake of water from EBC's for use during drought.

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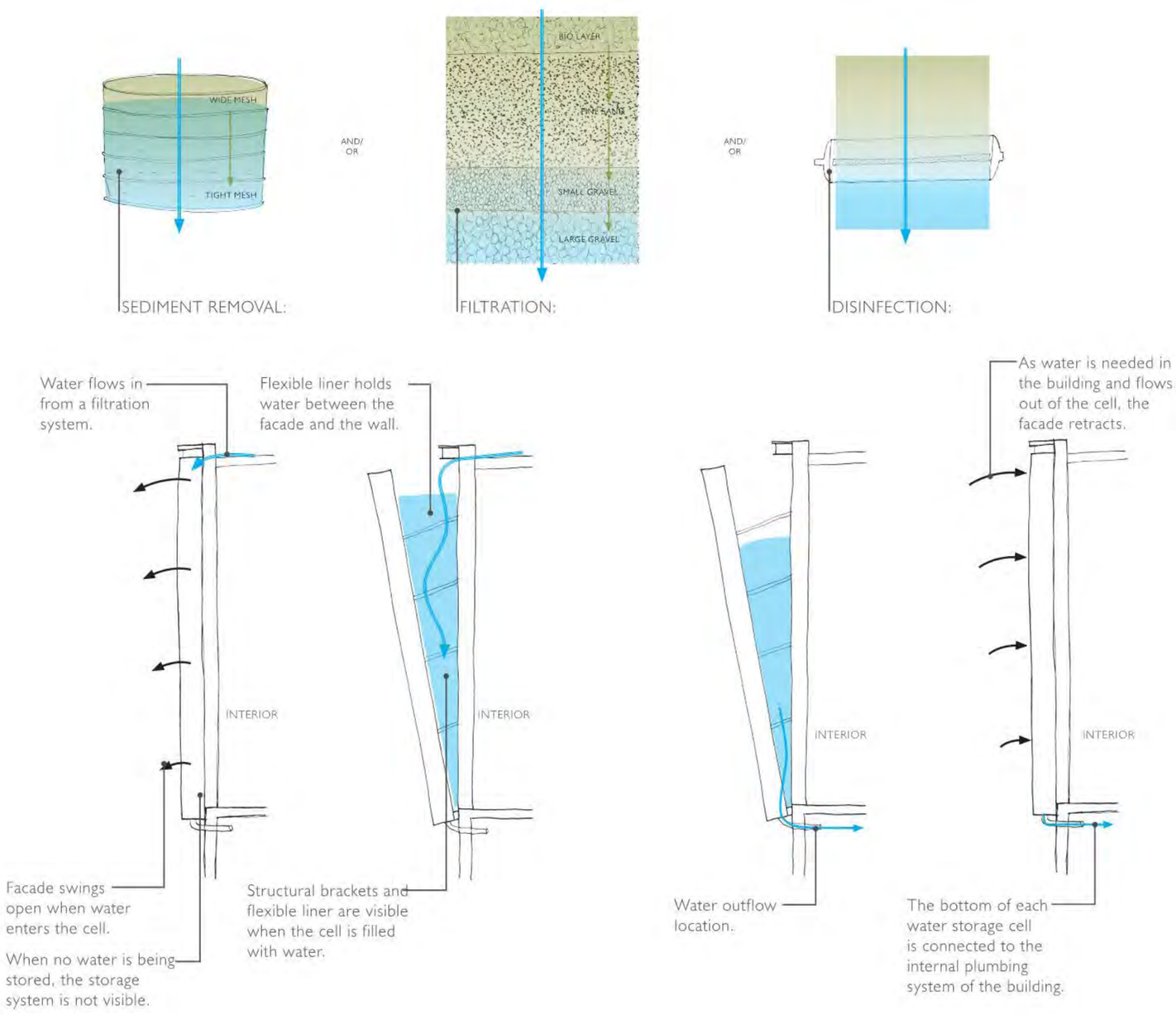

4. DISTILL: DESIGN PRINCIPLE

The biological process can then be translated into forms that relate to the built environment. In this case, using the building façade as an opportunity for storage before it is needed in irrigation.

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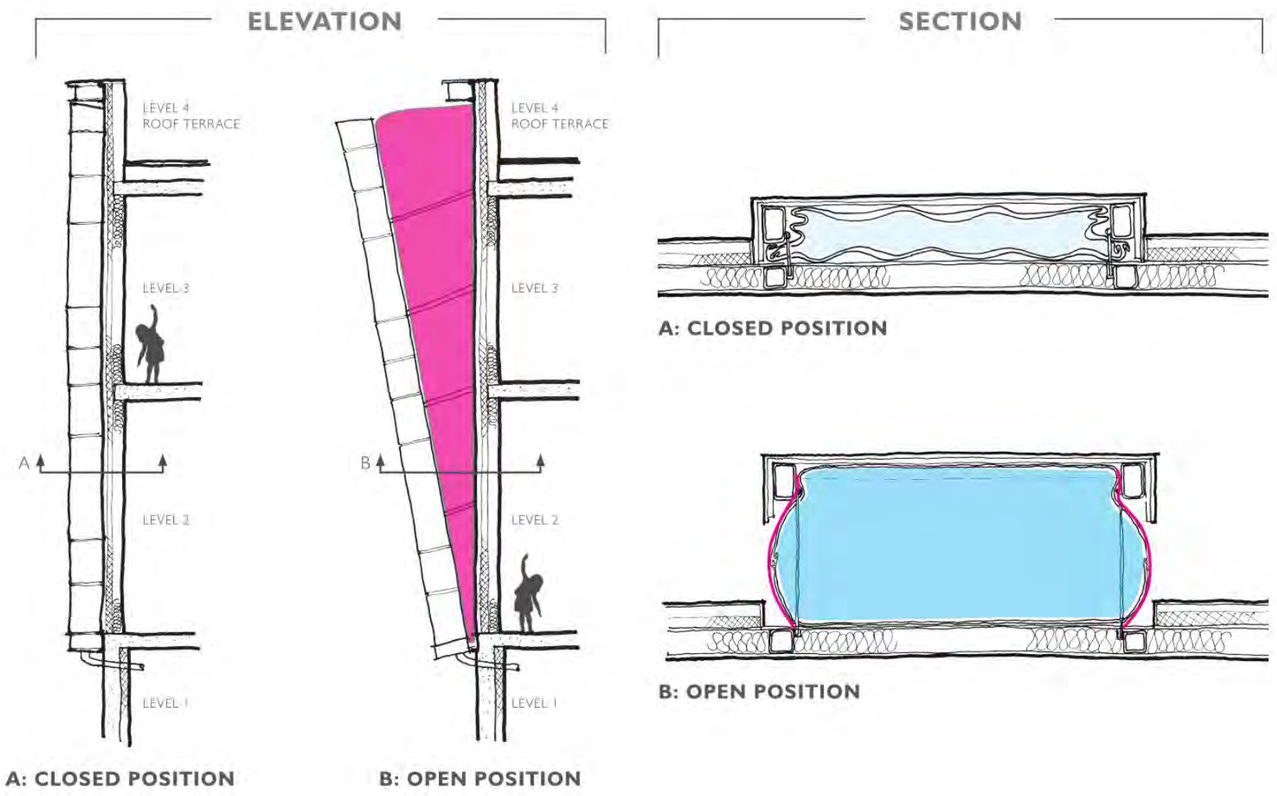

The project team created a prototype of the concept.

5. SOLUTION: APPLICATION

Through refinement, materials and dimensions take shape. The RainBellows, located on the western side of the building, are about two stories tall to maximize storage capacity. A magenta bladder emphasizes the RainBellow when it's full of water.

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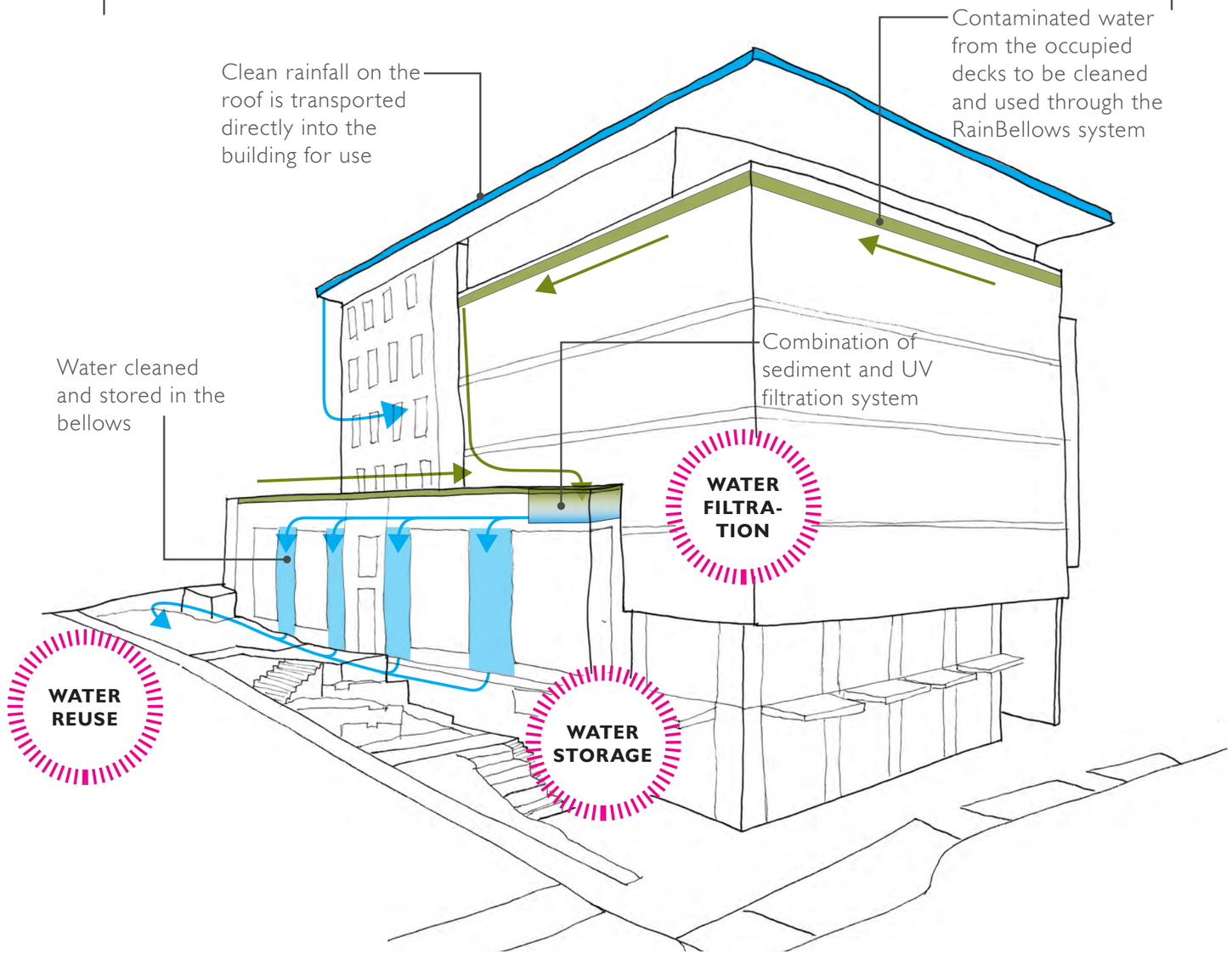
SYSTEM DIAGRAM



5. SOLUTION: APPLICATION

The building includes UV filtration and sediment removal systems to clean water from occupied roof decks before flowing to the RainBellows. From the RainBellows, water flows into the landscape, extending the period of non-potable water usage for irrigation.

RAINBELLOWS REALIZED

Alternative to conventional stormwater storage and filtration, RainBellows utilizes the building skin unconventionally. Highly supported by the client, the goal is to implement this strategy first as a prototype and hopefully as part of a future project.