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Programme	MLA - Landscape Architecture
Studio	Critical Zones

Nature's Ebb and Flow

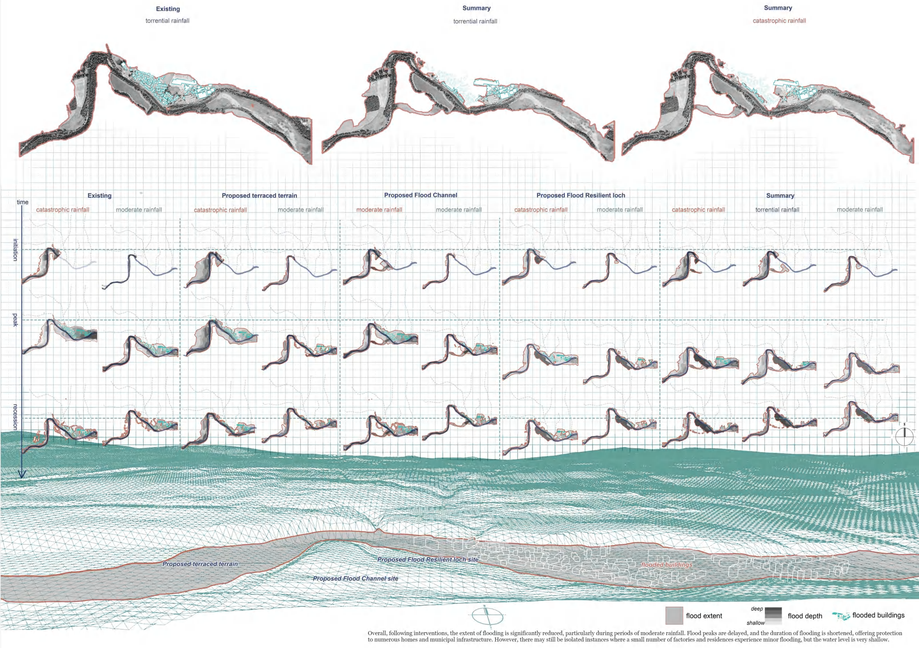
The interaction between nature and urban areas resembles the ebb and flow of tides. In this dynamic interplay, flooding, as a natural disaster, profoundly impacts cities, gradually eroding them and leaving indelible scars as the waters recede. However, it's crucial to recognize that urban expansion itself constitutes a form of encroachment upon nature.

My design begins by examining the historical expansion of Brechin town, gradually unveiling the escalating factors contributing to the exacerbation of flooding. Through HEC-RAS simulations utilizing rainfall, terrain, and river flow data, I aim to understand the formation, progression, and recession of floods. Based on this understanding, I categorize flooding into riverine flooding and runoff-induced flooding, proposing corresponding mitigation strategies.

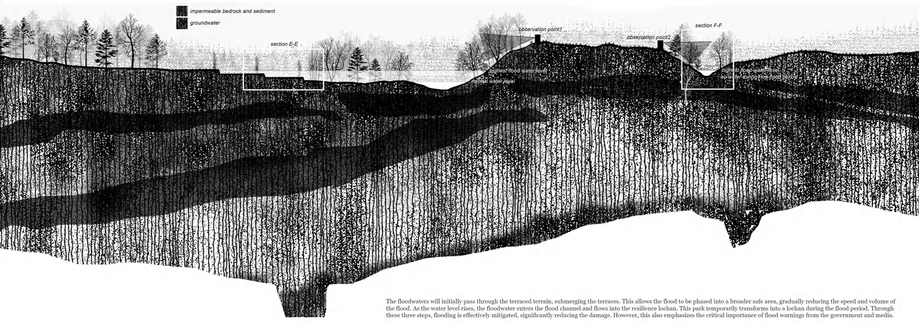
For runoff management, I employ Low Impact Development (LID) techniques. By strategically placing interconnected facilities along runoff pathways, I establish a network within the town to reduce runoff volume, slow down flow velocity, and purify water quality, thereby delaying the onset of flood peaks and alleviating pressure on riverine flooding.

Addressing riverine flooding, I adopt a more direct approach through terrain modification. Recognizing the severity of future climate emergencies, traditional ecological conservation methods may prove insufficient against catastrophic flooding. I divide terrain modification into three stages: terraced terrain, flood channels, and flood resilience lakes. Each stage is interconnected, serving to delay, divert, and store floodwaters, respectively. Simulation results validate the effectiveness of these interventions.

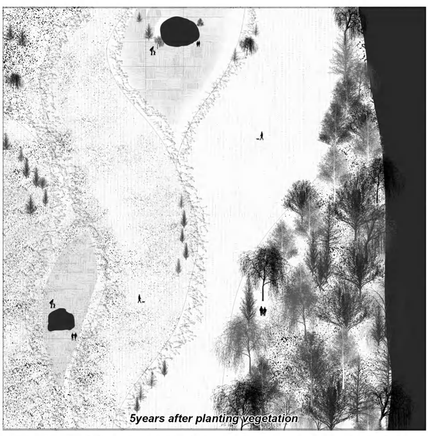
Through this design, I aim to respond to the shifting landscape design methodologies necessitated by future climate extremes. Whether we should boldly intervene in natural processes based on evidence is a question worthy of contemplation.



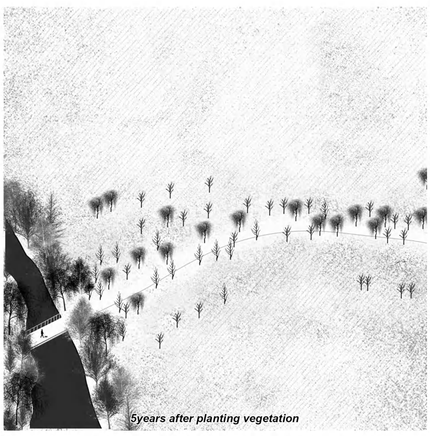
Overall, following interventions, the extent of flooding is significantly reduced, particularly during periods of moderate rainfall. Flood peaks are delayed, and the duration of flooding is shortened, offering protection to numerous homes and municipal infrastructure. However, there may still be isolated instances where a small number of factories and residences experience minor flooding, but the water level is very shallow.



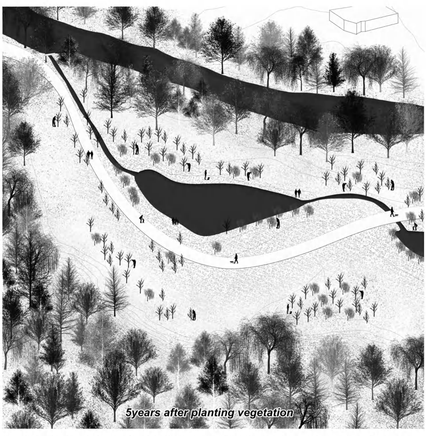
The floodwaters will initially pass through the terraced terrain, submerging the terraces. This allows the flood to be phased into a broader safe area, gradually reducing the speed and volume of the flood. As the water level rises, the floodwater enters the flood channel and flows into the resilience lochan. This park temporarily transforms into a lochan during the flood period. Through these three steps, flooding is effectively mitigated, significantly reducing the damage. However, this also emphasizes the critical importance of flood warnings from the government and media.



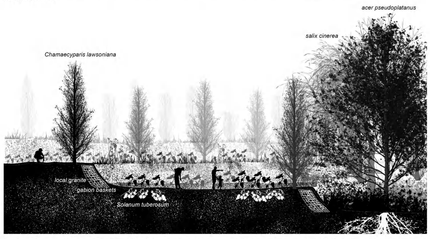
During prolonged inundation, non-flood-resistant vegetation may succumb, giving way to the introduction of more water-tolerant species such as willows . The collapsed vegetation, in turn, serves as a nutrient source for the newly established flora. This is similar to a natural succession process.



The linearly planted vegetation matures and naturally expands into the surrounding area over the course of 60 years. Eventually, this channel not only serves to mitigate floodwaters but also facilitates water absorption by the extensive root systems of the vegetation. Additionally, the slopes become stabilized through the development of robust root networks.

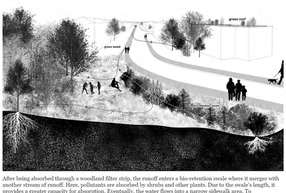


Above: After the park is submerged and transformed into a lochan, the vegetation inside will inevitably perish. As the water recedes, the community will need to come together to rebuild the park, replant vegetation, and restore facilities. In the past, the community had to contend with rubble and devastation. However, now we only need to reconstruct this park, significantly reducing the cost and complexity. This effort also allows us to maintain our remembrance and respect for history.

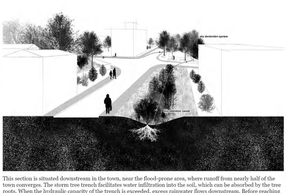


By excavating terraces on the western slope of the river, these platforms can accommodate more water during floods. The terraces are divided into five levels, each incrementally increasing water capacity to handle different rainfall intensities, thereby reducing the volume and peak flow of water reaching downstream areas. Additionally, the terraces will be replanted with crops, transforming some of the farmland into allotment gardens that serve as places for family education, and integrated into community management to ensure food security.

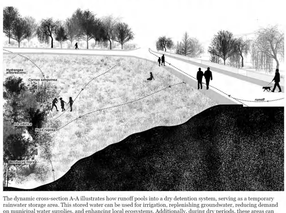
Right side: After the park is submerged and transformed into a lochan, the vegetation inside will inevitably perish. As the water recedes, the community will need to come together to rebuild the park, replant vegetation, and restore facilities. In the past, the community had to contend with rubble and devastation. However, now we only need to reconstruct this park, significantly reducing the cost and complexity. This effort also allows us to maintain our remembrance and respect for history.



After being absorbed through a woodland filter strip, the runoff enters a bio-retention swale where it merges with another stream of runoff. Here, pollutants are absorbed by shrubs and other plants. Due to the swale's length, it provides a greater capacity for absorption. Eventually, the water flows into a narrow sidewalk area. To accommodate the limited space, a narrow grass swale is used to connect to downstream LID facilities.



This section is situated downstream in the town, near the flood-prone area, where runoff from nearly half of the town converges. The storm tree trench facilitates water infiltration into the soil, which can be absorbed by the tree roots. When the hydraulic capacity of the trench is exceeded, excess rainwater flows downstream. Before reaching the flood-prone area, the surplus runoff undergoes final detention in the Dry Detention System to minimize flood pressure to the greatest extent possible.



The dynamic cross-section A-A illustrates how runoff pools into a dry detention system, serving as a temporary rainwater storage area. This stored water can be used for irrigation, replenishing groundwater, reducing demand on municipal water supplies, and enhancing local ecosystems. Additionally, during dry periods, these areas can serve as recreational spaces for residents to relax and picnic.