

Seasonal isles / a drought & flood resilient future for Berat

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Design concept / introduction

The Berat Island competition centers on a group of temporal islands (i.e. sandbanks; sediment deposits) in the Osum River that left bare during summer when the river's baseflow is limited. During the driest periods, only a small stream is flowing through Berat, leaving most of the riverbed exposed. Apart from a bottleneck West of the city, the river sections around Berat are relatively wide. This leaves the city with an unused wasteland, covered by temporal vegetation. Due to the flood hazard during winter, the islands are left relatively untouched. This paradox needs to be resolved, without significantly interfering with the current river regime.

This proposal attempts to overcome this paradox by introducing a development strategy for the islands that is both drought and flood resilient, but most importantly connects the dry riverbed with the city. The proposed solution might not only be feasible for Berat, but might also provide a generic strategy for many of the other cities in Albania facing similar problems.

Resiliency / From fashion to guiding principle to cope with an uncertain future

'Resiliency' has replaced 'sustainability' as the next buzzword for many projects. Yet, the concept of resiliency has a solid body of scientific work in ecology and engineering (e.g. Holling, 1973; Hollnagel et al, 2007). The basic notion of resiliency is how a

system copes and recovers when it is experiencing conditions beyond its initial design criteria. This makes it especially fit for conditions that are clouded by future uncertainties: instead of being optimized to operate within a predetermined range of conditions, the system is designed to cope with a relatively wide range of different conditions. This can be achieved by making the system robust (i.e. making it able to withstand extreme conditions), or by making the system flexible (i.e. ensuring that it can be adapted in the future to cope with changing conditions).

Main challenges / Developing a robust river for all seasons

The seasonal variability in discharge of the Osum River is large: during summer the river's baseflow barely sustains a small stream while in spring the steep river basin can cause peak discharge levels that almost mimic those of flash floods. Thus, coping with such extremes requires a design that can accommodate periods of drought as well as abundance of water while ensuring value and use to the city of Berat. These observations change the focus of the task, where the issue is not only how to make Berat's islands and river bank more resilient to high river discharge levels and subsequent floods, but maybe even more importantly, how to maintain the river during summer and early autumn when water levels barely sustain



*Fig1a / High water in Osum River in Berat
source / competition report*



*Fig1b / Low water in Osum River in Berat
source / competition report*

a stream and the riverbed is dominated by sandbanks covered with low quality vegetation and deposited litter.

The seasonal variability in river discharge creates also another characteristic feature of the islands: the islands' morphology is continually changing. Compared to for instance many of the large river basins in the rest of Europe, the Osum river is relatively steep which causes high flow velocities. This results in high erosion levels and (partly due to the soil composition) a large sediment load during winter and spring. The erratic hydrodynamic behavior of the Osum River causes the sandbanks in the broad sections of the river to continually shift. While these dynamics might be regarded as a characteristic feature of the Berat river, they also limit or even prevent actual use of the islands and hence their role as an active component of Berat city.

The hydrology of the Osum River defines to a large extent Berat's problematic position: Located on elevated and steep river banks the city is well prepared to cope with high water levels; flood hazard is limited to adjacent villages and towns located within the floodplains. Yet, during periods of low flow, the city is unable to profit from the river. The marginal streamflow, the emerging sandbanks and the resulting amphibious river landscape only create an underused, low quality environment that does not serve the characteristic of this UNESCO-protected city. The outcome is therefore to develop Berat's river islands as resilient systems able to cope with the hydrologic conditions associated to all seasons; to make the Berat islands both flood resilient and drought resilient; to be able to cope and recover from extremes but most of all to develop an active use of the river. Develop a proposal in which Berat profits from the Osum river during all seasons: during the high waters in winter but also during the dry periods in summer.

Operational resilience / building by nature, preparing for

Making interventions in the river bed does not necessarily imply the introduction of large scale structural measures; e.g. the introduction of quays, dams or other barriers that while ensuring a controlled steady flow during dry periods, create inflexible obstacles that limit the Osum River's discharge capacity during peaks in the wet seasons. Instead, it is possible to create a better 'guidance' of the river's hydrology by combining small interventions with the potential building capacity provided by the river's

hydrodynamic: a controlled erosion and deposition of river sediment to create a relatively stable development of sandbanks and channels. Thus, by using the river flow and the resulting flood patterns due to the introduction of small obstacles (e.g. boulders, poles, etc.), we can shape the the landscape which during dry periods will constitute the sandbanks or 'islands'. 'Building with Nature'. Such an approach is not new: in various projects the hydrodynamic properties of water systems are used to change the morphology or flow patterns. For instance in the so-called Sand Engine project, beach and dune nourishment is achieved by using the tidal flows along the coast south of The Hague, Netherlands. The sand of a man-made peninsula, is distributed along the coast to maintain the beaches and dunes that protect the country against storm surges. In a similar fashion, boulders are used in many rivers surrounding Bergen, Norway to adjust the stream flows without the need for large, civil engineering-based structural interventions.

Currently, enough scientific knowledge in the field of fluvial geomorphology has been developed to create computer and/or physical models that mimics the effects of small interventions (e.g. deflectors) in streams and rivers (e.g. Knighton, 1996). Depending on an initial classification (e.g. Rosgen, 1994) and the collection of adequate data describing the hydrological features of the river in combination with the river geology (including an analysis of the sediment), a precise model can be constructed to determine which places are likely for sediment deposition based on the location, shape and size of non-movable elements in the river bed. Likewise the resulting channel(s) that are sustained by higher flow velocities can be determined and located to where they provide the highest value to the city of Berat in terms of usability. Additionally, depending on the sediment size, small ridges can be constructed resulting in alternating riffles and pools of deeper water to ensure a minimal water level in the river section adjacent to Berat. Especially in smaller streams, boulders (i.e. rocks) or tree trunks are often used to influence flow patterns and the stream morphology. For larger, more engineered solutions the use of gabion baskets is often preferred. These are relatively cheap, flexible and have been extensively tested by reinforcing embankments in order to limit erosion as well as deflectors for the alteration of flow patterns.

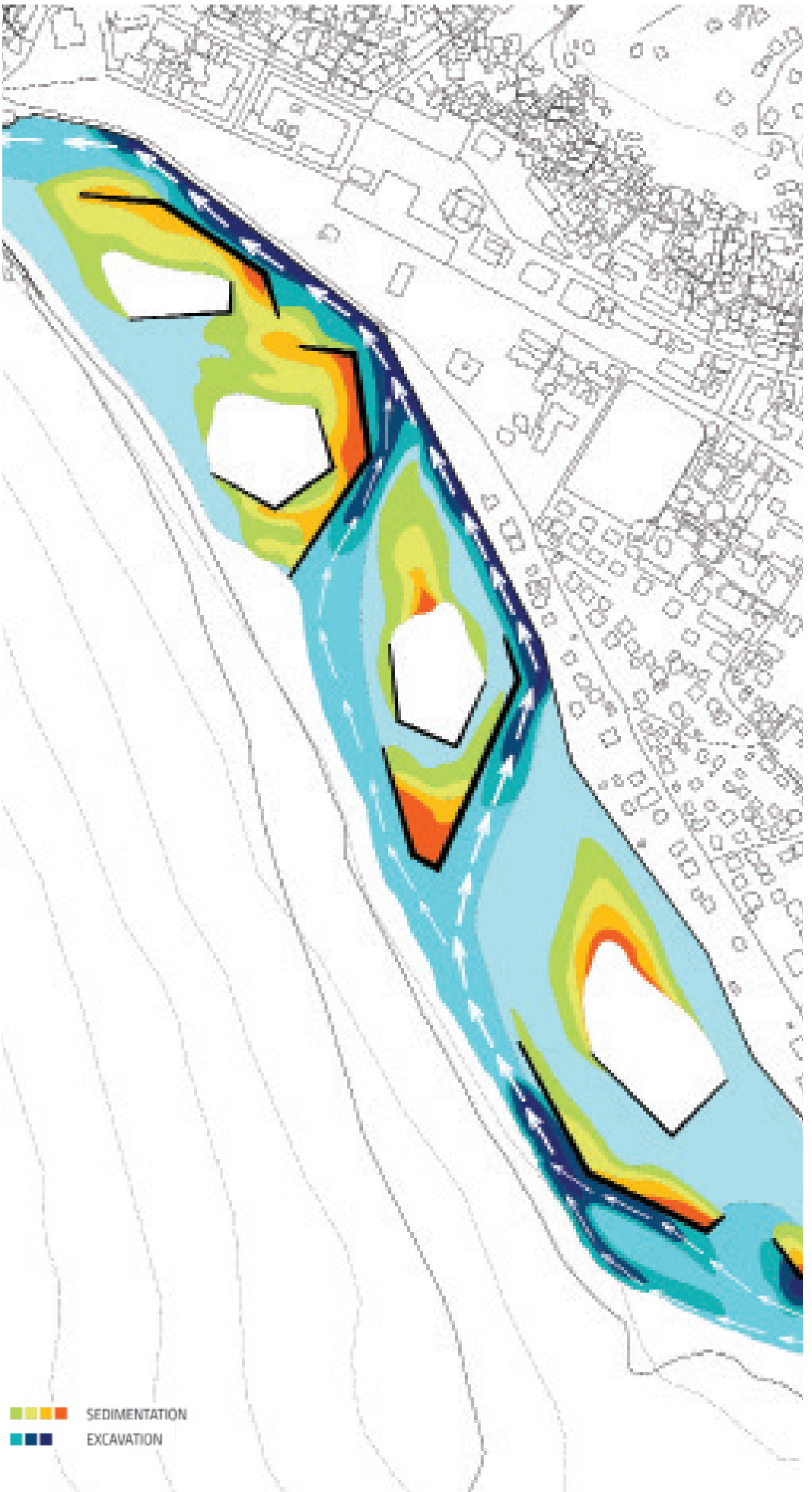


Fig2/ Position of structures in relation to streams of the water: sedimentation and excavation source / competition panels

Design strategies / controlled dynamics

Manipulating the river flow patterns by a 'building with nature'-approach provides the tools to develop a design strategy that is not only resilient to both droughts and floods, but also enhances the usability of the islands by providing a more robust basis for use. The design consists of 4 main pillars:

1. Give Berat a river / Ensure a minimal, steady streamflow during dry periods along a steady trajectory (i.e. channel). The river is guided by a first system of low curbs.

2. Develop the berat islands / By partially protecting the crests of the existing sandbanks, the contours of the islands are to a certain extent stabilized. The islands therefore become more robust and better equipped for vegetation and hosting activities. The river is guided by a second system of higher curbs.

3. Use the seasons to shape the land / By carefully adjusting to the different water levels associated to the seasonal variability in river discharge, a design can be developed in which the islands shrink and grow, reaching a minimal footprint during winter and early spring when water levels are highest, and a maximal extent during summer when only a steady streamflow is reached.

4. Integrate early warning into Berat / Extreme peak flows during winter and early spring could provide a possible flood hazard for Berat. Climate change will only exacerbate those extremes in the coming decades. It is therefore essential to not only develop an early warning system for floods, but also to manifest the warning in the city of Berat to ensure awareness among Berat's citizens and to restore the relation to the river by creating visible signposts. The bridge, used to make the islands accessible, could be opened when flash floods are coming. As such the opened bridge prevents the accessibility of the islands, and functions as a striking mark to warn the inhabitants of Berat for the high water.

These main focus points provide the basic framework from which the design is developed. Instead of focussing on objects or functions, the proposal is approached from the different seasons and the associated river characteristics.

Low water isles / summer & autumn

During the summer, Berat becomes alive. The city is vibrant and tourism flourishes which means that the riverfront should add to the city's scenery.

By introducing a low curb into the riverbed,

the modest base flow is directed into a single stream predominantly adjacent to the Northern quay. The curb is widened to create a walking path along the canal; a second quay that provides a new routing through and along the 'summer version' of the Osum River. The new quay is connected to the city by a new bridge. Apart from providing a pedestrian walkway along the river, the curb-quays act as the perimeter of the largest set of islands: the first terrace level that becomes available when the sandbanks dry out during summer. Although providing the largest area, these flower gardens exist only for a few months annually; on average from mid July until late September.

That requires a vegetation that can flourish within only a few months but can be sustained when (partially) submerged when the water level raises (see Winter and Spring). This flower plane is criss-crossed with mown trails. The 'tail' of the islands, which unlike the 'head' is not protected by a curb, is dynamic and moves depending on the seasonal deposition of sediments during winter and spring.

A second higher curb system, providing the perimeter for a second terrace layer, covers a set of smaller islands when streamflows are somewhat more substantial. Due to this protecting curb, this terrace level emerges during a longer period, which means that the vegetation options are wider. Grasslands with bushes and trees create a parklike environment that adds to the public realm of Berat. It offers a place for residents to stay, and festivities to be organised.

The curbs are covered with wooden boardwalks. The low and higher curbs are connected with these boardwalk through the first terrace level, preserving a smooth connection through the entire islands in every season.

Low to high water isles / winter & spring

During winter and spring the discharge levels of the Osum River increase. The lowest curb level (and terrace) is overflowed at certain spots, which effectively means that the 'summer version' of the Osum River is widened. The summer gardens are now gradually submerged and transforming into seasonal wetlands. The flowering zones are overflowed by small streams and ponds, the former mown reed paths transform into fullgrown reedbeds. Small boulders (i.e. rocks) or tree trunks are used to steer the flow of the streams. The level of inundation depends on the flow rate of the river, and varies constantly

through the season, creating an everyday changing landscape.

The higher islands stay protected from the stream, as they are covered by the higher curbs. The grasslands are managed less intensively during this timeframe, creating a safe haven for birds and animals. The first terrace levels stays accessible through the boardwalks, preserving as well the connection from the city to the islands.

High to peak water isles / designing for exceedance

During certain periods in winter and spring, the water level in the Osum River reaches the highest stages. While the first terrace level, including the curbs that mark the perimeters, are overflowed by water, a small set of islands remains, the winter islands. This last set of plateaus is no longer accessible for pedestrians, providing a last resort for animals and birds within a now formidable river that almost covers the complete cross section. Peak discharge levels, occurring with return periods of 10 years or more will overflow all river islands, including the winter islands with relatively high elevations. To accommodate such discharge levels, it is essential that the interventions within the river bed do not create significant narrowing of the river section, which could increase the flood hazard for Berat. It is crucial that the level of the winter islands never transcends the height level of the quay of the city, to enable the submersion the islands, to accommodate the required discharge level within the river basin. During these particular floods, the first and second curb system secure the terrace levels, so they are not washed away.

It is essential that high and especially peak water levels (and the associated flood hazard) is communicated to Berat. After all, the level of the quays, the street levels and elevation of the built-up areas are historically based on observed peak river levels. These levels provided safety for the inhabitants and ensured sustainable occupation. To reinspire the century old relation to the Osum River, the rivers stages should become part of the city again. This is done by using the pedestrian bridge, that in case of high river discharge (i.e. flood hazard) is turned upwards. Depending on the lead time, and the flood warning system, the bridges can be turned upwards hours prior to the peak levels are reached. This symbolic act, can become a signpost for inhabitants, visitors to increase awareness and flood preparedness. This might be especially prudent in the coming decades, when

climate change induced rainfall (possibly combined with snow melt) might boost river levels to unprecedented heights.

Creating multiple values / increasing usability, identity and livability in Berat

The main aim of the project is to activate the islands both as new places for the local community and as emerging entities, able to take a role in guiding the flow of the water and therefore in turning a potential crisis (the flooding) into a collection of diverse opportunities. Essentially, the intervention deals with the allowing of a next step of human actions towards the river: starting from the riverbed and the historical creation of a community and the foundation of the city, to the contemporary involvement in the transformation and maintenance of the city's identity.

Therefore the riverbed is regarded as the focus of the proposal. This position can be seen as an inversion of the common attitude. Rather than insisting on the river's borders, the center of the proposed actions is the riverbed, which is considered as the starting point to finally reach the urban environment. A trend is inverted: the city and the river, which are normally regarded as a dichotomy and therefore, as separated, opposites and antagonists, become coupled, aimed to give rise to a collaborative relationship between the natural and the artificial environment. The history of many Albanian and Mediterranean cities is exactly the story of this coupling. As such, we would regard the project, as the attempt to establish a tandem where the islands, the borders, the city and the local communities cooperate in the creation of multiple values and reciprocal benefits. The word tandem, which essentially refers to the ability of conducting and arranging things together, is activated through a series of landscape actions. Rather than focusing exclusively on the aesthetical side of the transformation, these actions attach flood risks through a landscape approach to new cultural possibilities. By reinforcing and making the islands a permanent part of the city environment, the flooding crisis can be treated integrally.

The project involves new relations in terms of cultural usability. The three islands allow for compatible activities. The Northern island could have a recreational function and facilitate festivities, linked to the historical center. The Southern islands hosts functions which are related to the ambient residential areas. The central islands might not be accessible, focussing



Fig3a / Plan drawing, low water level source / competition panels

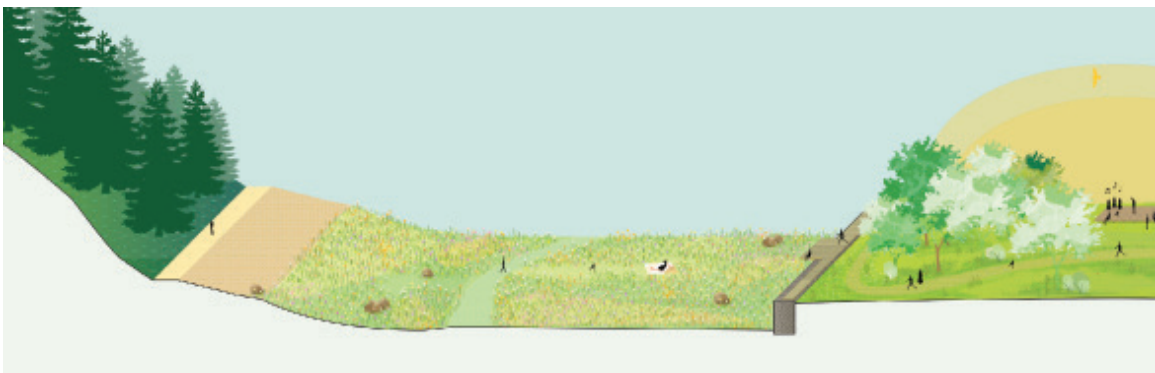




Fig3b / Berat waterfront source / competition panels



Fig3b / Single stream, dry and accessible islands source / competition panels

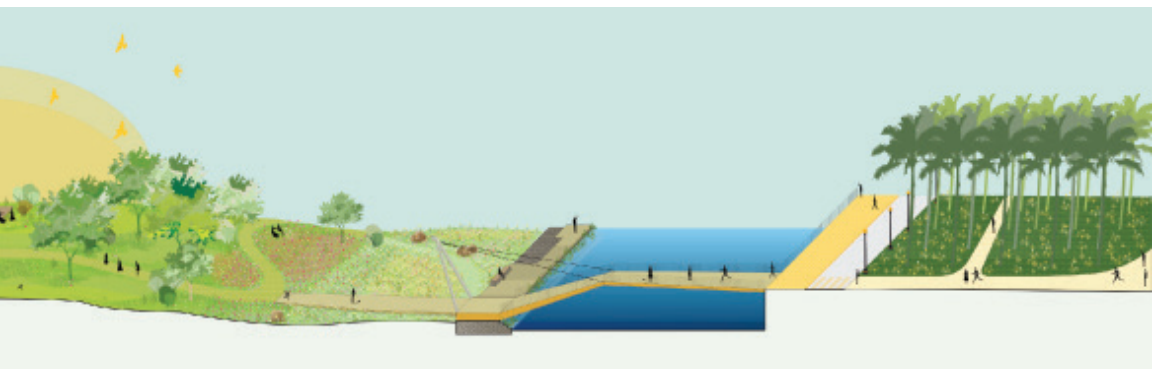


Fig3c / Section, low water level source / competition panels



Fig4a / Plan drawing, high water level source / competition panels

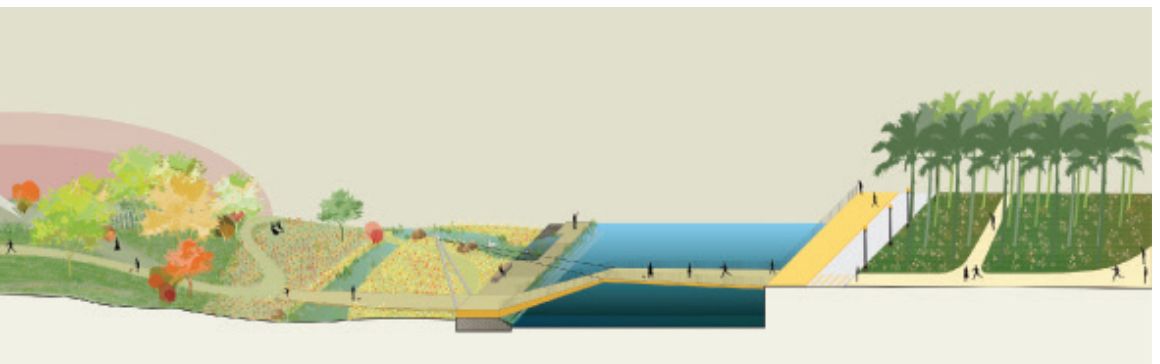




*Fig4b / Berat islands
source / competition panels*



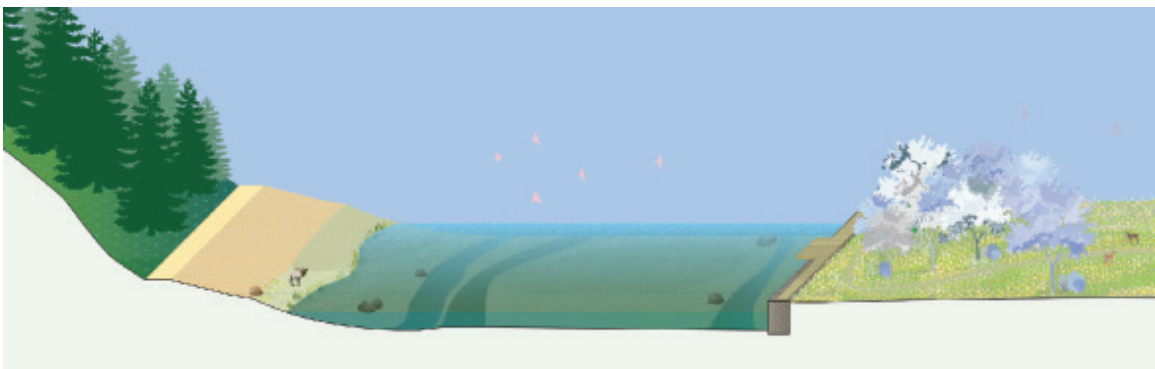
*Fig4c / Wetlands, dry islands and large river
source / competition panels*



*Fig4d / Section, high water level
source / competition panels*



Fig5a / Plan drawing, high water level source / competition panels

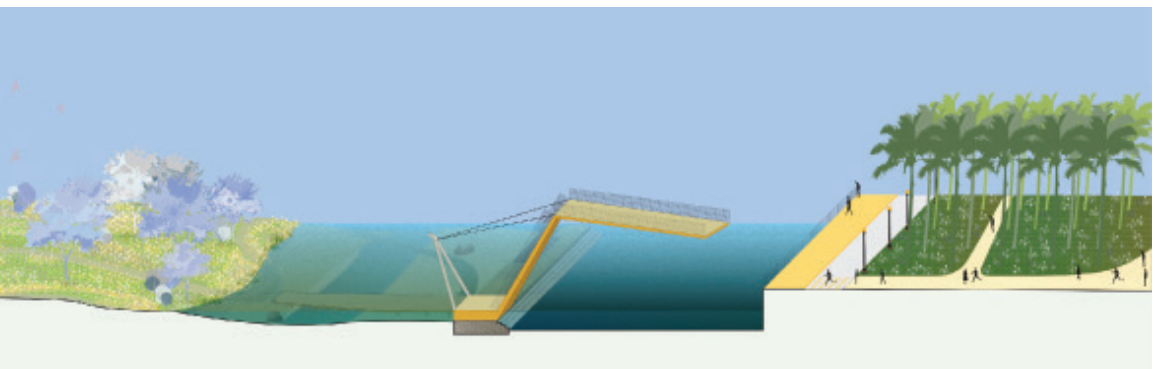




*Fig5b / Early warning, bridge is open
source / competition panels*



*Fig5c / Inaccessible islands, due to peak water
source / competition panels*



*Fig5d / Section, high water level
source / competition panels*

on ecological enhancement.

Increasing the uses on the islands involves a new possibility for the local community. Citizens (it might be for the first time) can watch the city from the riverbed, and through this get a better understanding of the values, arising from the relationships between the river and city, whereas each identity reinforces the other one. Along with activities like pick nick, walking in the nature, sport etc., the fundamental activity of knowing the ecology of the places where someone lives, becomes more relevant. To specify the use and programming of the islands, the project seeks to generate several layers of citizen's involvement. This could result in a wide range of possibilities: from proposing the island as a kind of reservoir for the incrementing of local biodiversity, up to the organisation of various activities and functions.

Berat is as well an important heritage site, resulting in substantial interest from visitors. The islands offer space to accommodate new leisure and sport activities, avoiding the transformation of the meaningful historical heritage of Berat to facilitate these functions. Moreover these functions could establish a meaningful interconnection between the historical and ecological values of Berat city. Standing away from the rhetoric of pure conservation, or on the opposite side the total transformability, the project creates a gentle negotiation between natural values, habits, needs and ecological crises, preferring more the way of compromise than that one of forcing. This attitude derives from the decision to handle the problem of flooding at the roots, suggesting an intervention which is regarded as a new alliance between nature and human activities, as to allow the ground snatched from the waters of triggering a cycle of life where human activity is excluded. It is definitely an intervention, which works in terms of viability, as both the city and the river, through a renewed co-existence could create a new layer of Berat identity.

Scaling things up / using seasonal isles as a strategy across Albania

Climate change and changing land use patterns (i.e. an increase of built-up areas and subsequent infiltration capacity) change drainage patterns and river regimes all over Albania. Seasonal variability will increase, which in practise means more severe and longer periods of drought as well as torrential rains and associated peak discharges. This alters the usability of the rivers and their relation

to adjacent villages, towns and cities. A successful adaptation strategy to better cope with this seasonal variability thus has to accommodate reduced base flows in summer and increasing river levels in winter. The presented strategy is a first stage to re-establish the relation of built-up settlements with their adjacent rivers and ultimately, the catchment they are located in. Early warning systems already identify potential downstream floods by identifying peak rainfall and/or snowmelt way up in the catchment. In turn, the increasing areas occupied by sandbanks or low quality wetlands during the drier summers, are transformed into usable areas that allow for temporal (seasonal) use. Instead of withdrawing from the river and the emerging dry areas, the proposal attempts to utilize the opportunities the areas provide for the adjacent cities. Such a strategy is not only applicable to Berat, but could be extended to many other cities. Actual functions or activities can be tailored to local conditions, thus providing local solutions within a generic approach. Such activities can be developed together with local stakeholders to accommodate the needs of local communities.

The proposal also attempts to bridge the gap between hydrology, landscape and urban design, which is essential for the future development of flood and drought resilient urban communities. Scaling up the strategy could provide a boost for the development and application of new hydraulic river models, that can enhance knowledge and water management strategies within the urbanizing river catchments of Albania. Apart from Berat, this can be essential for the development of flood resilient strategies for urbanized areas further downstream within the river deltas. An additional benefit is the cooperation between local communities and regional/national government agencies by linking local developments to those within the wider area of the catchments. This could lead to improved knowledge exchange, empowerment of local communities but also to a more coherent and integrated development of a future Albania. In conclusion, the project includes a community involvement, which results from the restitution of the river back to the community itself. Only through the opportunity of making experience of the river by discovering its unique characteristics, a virtuous cycle of affection and understanding of the local ecology could be triggered. The project therefore, also seeks to involve an eminent pedagogical value.

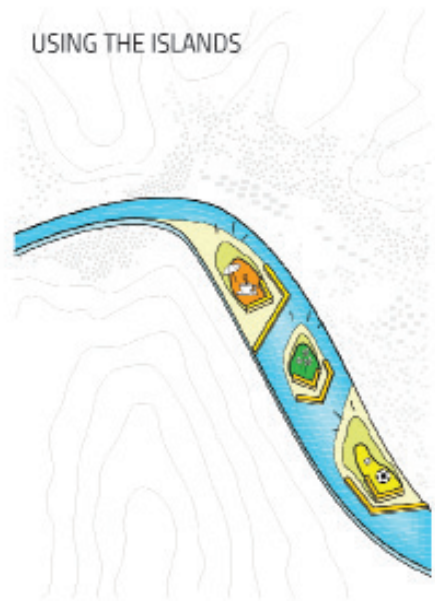
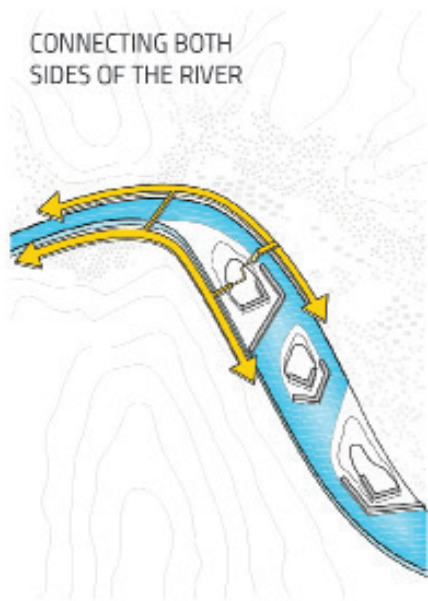


Fig6 / Connection diagrams
source / competition panels

Flexibility, phasing and community involvement

The developed approach is relatively robust to a variety of design proposals, i.e. different designs can be developed without compromising the developed objectives. This relates to:

1. Number of islands / The current proposal consists of 4 islands, incl. 4 distinct curbs that divert the stream flow. Alternative options (e.g. 3 or 5 islands) are possible and require different dredging efforts and require a different layout of the curbs.
2. Curb construction / The current curbs are developed from gabion baskets, which are flexible and can be easily deployed on site. Yet, they might require maintenance and might limit the usability in relation to the development of pedestrian routes and attaching structures. The curbs might therefore alternatively be constructed from concrete. This in turn, requires a more elaborate construction process.
3. Curb and platform heights / The terrace levels are based on the mean seasonal river levels. To our knowledge, no river gauges have been installed at Berat thus only a limited number of records might exist to estimate those levels. By setting up a 1d hydraulic river model, calibrated using measurements from other stations, statistically significant predictions can be made. Still, climate change as well as upstream developments could require that the terrace levels to be lowered or heightened after initial construction. The design needs to be further elaborated to accommodate such changes.
4. Integrated functions / The islands can

host a number of temporary activities. The projected football pitch can easily be changed into some other recreational facility depending on the local community's requirements.

5. Bridges / By far, the most costly intervention is the proposed drawbridge. Alternative designs might include other options for movable or even fixed bridges. These might include floating pontoons to ensure adjustment during variable water levels. Also, the materialisation and detailing of the bridge significantly influence the implementation and maintenance costs.

The flexibility regarding the actual design also extends to the phasing of the project: the project does not necessarily need to be implemented all at once. Construction of the curbs can be on a one-by-one basis, to for instance study the effects on the changes in island morphology due to the altered sediment deposition and deepening of channels. Also the construction of terraces at different elevations can be phased over a longer period of time. In this case, only the provisions for the "summer island" are constructed. In a secondary phase, the construction of the late spring/autumn terrace level and finally the winter/early spring level can be constructed.

Apart from involving the local community in the choice for temporal functions located on the island(s), the community also might play an important role in maintaining the river and islands. Since the project's aim is to connect the islands to the city and



make them literally accessible, the local community also can play a role in upgrading the quality of the islands and the adjacent streams. Apart from flood hazard, Berat also has to cope with significant amounts of solid waste that are dumped in the Osum river. Especially, during the dry periods, much of this waste is ending up along the embankment and on the sandbanks. Apart from the obvious effects on water quality and the environmental impact downstream, the dumping of waste also affects the attractiveness of Berat which ultimately has effects on tourism.

Future outlook / developing best practises and obtaining funding

The project is aiming for better integration of river management and urban development. Although the interventions

are relatively modest, the project might prove to be a pilot for developing best practises by:

- Integrating urban usability with flood and drought management;
- Connecting early warning with flood risk awareness (i.e. urban signposts);
- 'Building with nature' within the riverbed;
- 'Water sensitive' design based on seasonal variability;
- Developing best practises might give the project an advantage in finding external funding (e.g. World Bank financing).

Especially if the project is embedded in a regional or even national strategy and the effects on sustainable future river management can be demonstrated, external funding opportunities seems feasible.



Fig7 / Night view of Berat waterfront source / competition panels

Financing

At this stage it is virtually impossible to develop a decent cost estimate for the project. Both the Albanian pricing system, regulatory framework (that might opt for significant constraints or changes) and ultimately a critical set of design decisions by involving the local community (see Community Involvement) might significantly impact the actual project cost estimates. Nevertheless, the project has been aimed at low cost-high impact. The interventions are relatively modest and do not require costly dredging or the construction of sheet pile walls to create a dry environment for the construction of broad foundation works. The proposed use of gabion baskets, ensures low implementation costs and flexibility. The most costly element in the design is

the proposed bridge. Yet, depending on the available budget, the bridge can be designed within the available financial means.

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