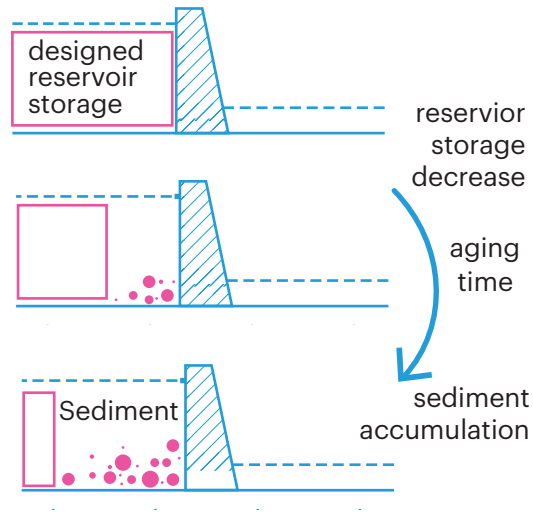
Structure

Dam Aging

1 Structure



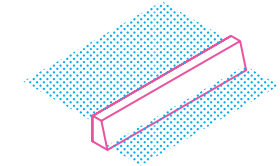
DAM AGING

sedimentation
is the most significant factor on dam aging, other factors are structual intergrity of construction materials, climate, and human disturbance.

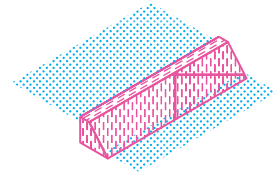
Dam Materials

Structure

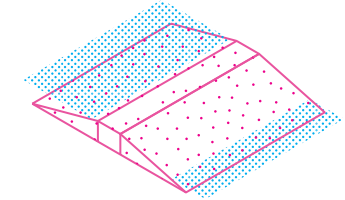
2 Structure



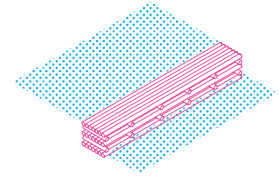
concrete dam



masonry dam



earth dam



timber dam

DAM MATERIALS

stability

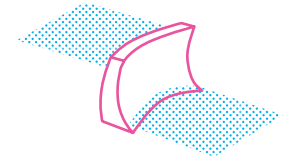
concrete>masonry>earth>timber

strong → weak

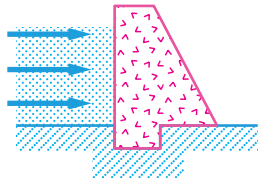
Concrete Dam

Structure

3 **Structure**

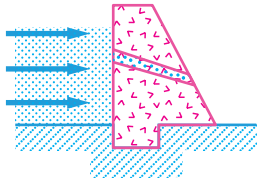


arch dam

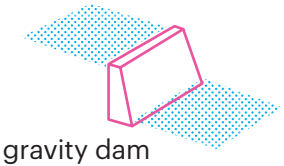


typical section
width: bottom>top

butress dam



spillway



gravity dam

CONCRETE DAM

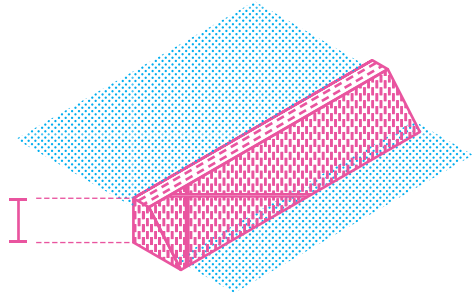
massive, strong

Concrete dam can be over 300ft high and used for reservoirs, Hydroelectricplants, Flood Control and Irrigation strategies

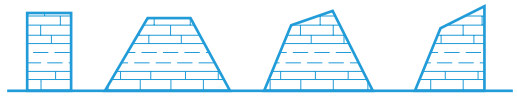
Masonry Dam

Structure

4 Structure



10’ to 100’ high type:solid, hollow, arch



Profiles of Common Small Masonry Dams in New England

MASONRY DAM

10’ to 100’ high

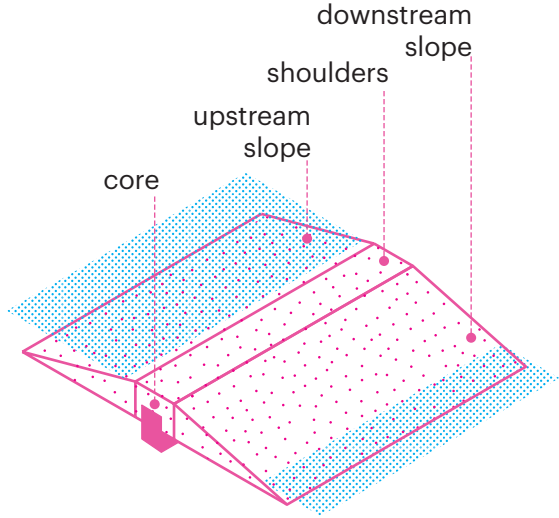
masonry dams are in smaller scale than concrete dams.

brick, stone, gravel, concrete, steel, mortar are used as materials to built masonry dams.

Earth Dam

Structure

5 Structure



EARTH DAM

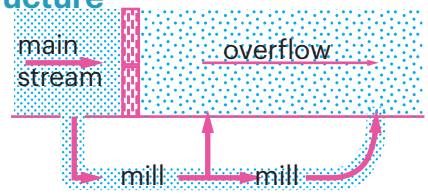
less strong foundation

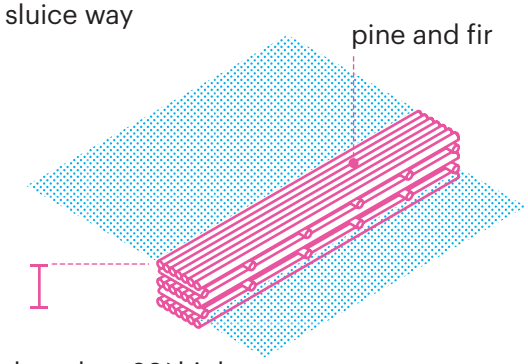
The earth dam constructed with the nature materials is probably the oldest and most wide-spread dam form in existence.The function is generating hydroelectricity; diversion dam, irrigation; detention dam, control flood.

Timber Dam

Structure

6 Structure





TIMBER DAM

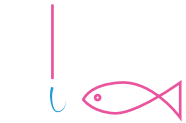
sluice way

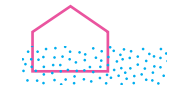
Most of wood dams were built in the pre-to early industrial period. The main use of these dams were for small scale direct energy mills - like grist mills or micro forges.

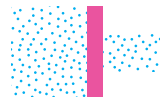
Function

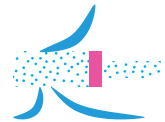
Structure

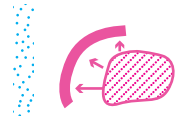
7 **Structure**


recreation


flood control


water storage


Irrigation


mine tailings


electrical Generation


debris control


navigation

FUNCTION

Dams can be used for multi purpose and in different scales. Small mill dams are common in New Egland during early industrial time.

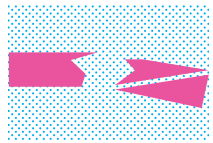
Failure

Structure

8 Structure

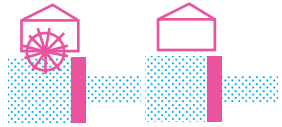
+breach

+abandoned



+Poor maintenance, especially of outlet pipes

+extreme inflow



+Internal erosion, especially in earthen dams

+earthquakes

FAILURE

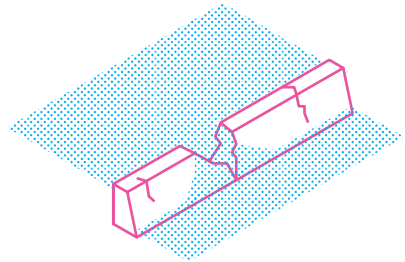
In New England, a typical type of not functional dam is the dam built for mills in early industrial time. Since the mill does not function any more, the dam does not function as well.

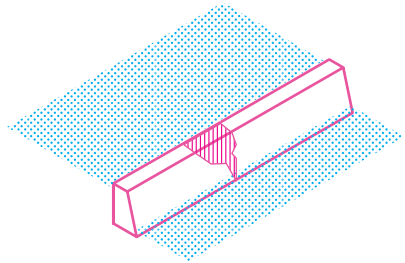
8

Repair costs

Structure

9 Structure





REPAIR COSTS

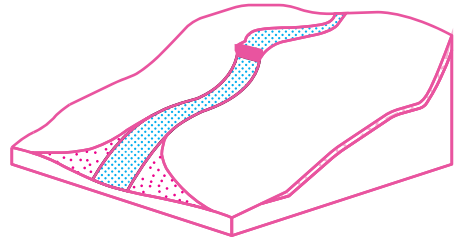
on going, usaully>removal costs

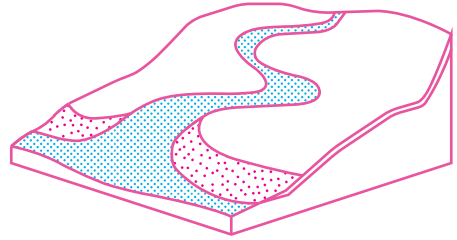
+ feasibility analysis
+ structure repair and material costs
+local market
+landscape management
+maintenance

Removal costs

Structure

10 Structure





REMOVAL COSTS

one time investiment

+ feassibility analysis
+approval process
+ deconstruction
+ local market
+scenario after removal

Dam Hazards

Structure

1 Structure

	Human Life Losses	Economic, Environmental, Lifeline Losses
Low	None expected	Low and generally limited to owner
Significant	None expected	Yes
High	Probable. One or more expected	Yes (but not necessary for this classification)

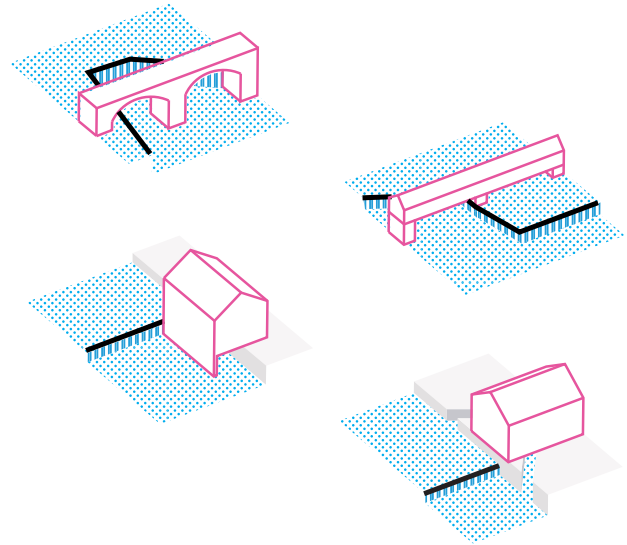
DAM HAZARDS

Dam harzards potential

Adjacent Structure

Structure

1 Structure



ADJACENT STRUCTURE

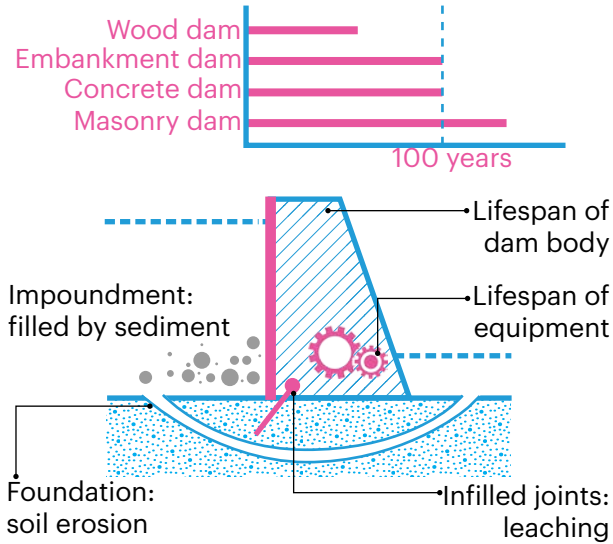
Adjacent buildings/bridge

A bridge or a house may adjacent to the dam to form a integrity.

Structural Integrity

Structure

1 Structure



STRUCTURAL INTEGRITY

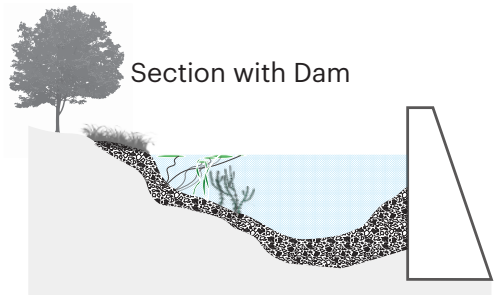
Factors affected by ageing

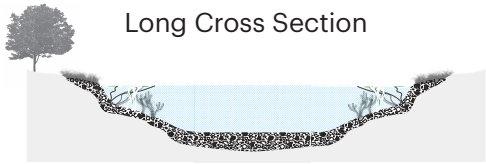
Besides dam body, ageing also affects the equipment of dam, foundation and impoundment.

Impoundment Wetland

Biotic

1 Biotic





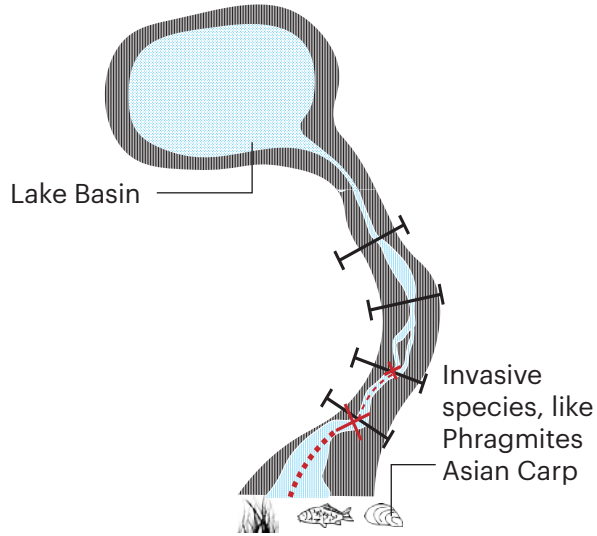
IMPOUNDMENT WETLAND

Impondment creates a vast, quiet and low-flow speed lake environment which forms its unique eco-system.

Invasive Species

Biotic

1 Biotic



INVASIVE SPECIES MOVEMENT

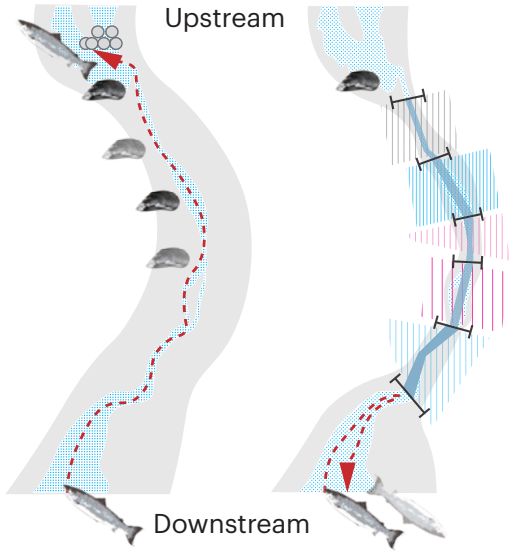
Dams could create a system to prevent the spread of common invasive species like Phragmites, Asian Carp and Zebra Mussels

1

Habitat Fragmentation

Biotic

1 Biotic



HABITAT FRAGMENTATION

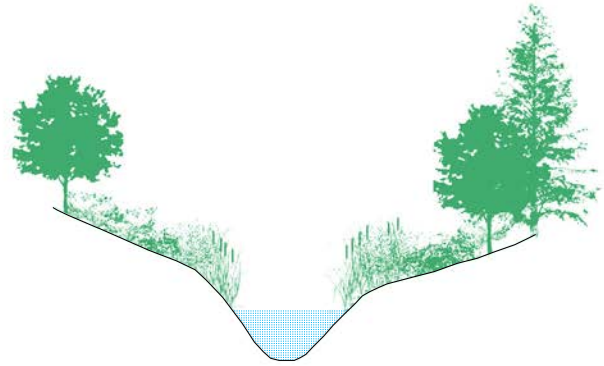
Dams cause the habitat fragment along the river, which will affect fish migrating and genetic biodiversity of inland species

1

Riparian Habitat

Biotic

1 Biotic



RIPARIAN HABITAT

Edge Condition of Narrow Channel

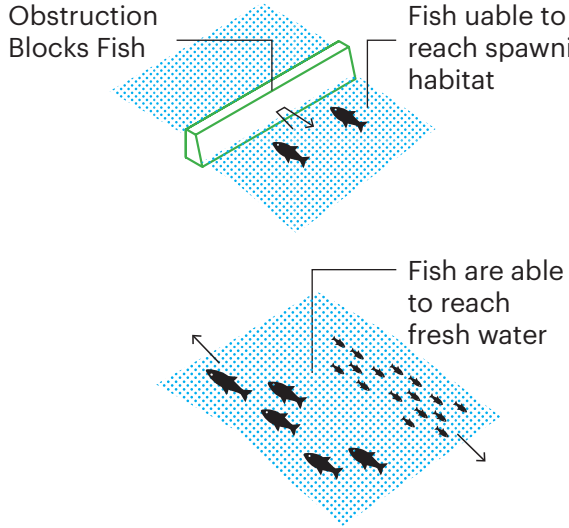
Edge condition along a narrow river channel. Consisting of dense vegetation that acts a buffer zone/transitional zone between the river and upland for flood protection.

1

Biotic

Fish Passage

1 Biotic



FISH PASSAGE

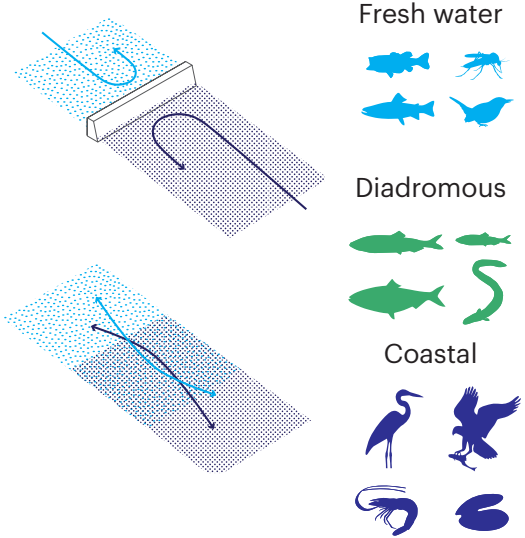
River Herring + American Eel

Dams obstruct diadromous (salt and fresh water dwelling) fish from migrating to spawning areas in rivers or coastal waters.

Tidal Factors

Biotic

2 Biotic



TIDAL FACTORS

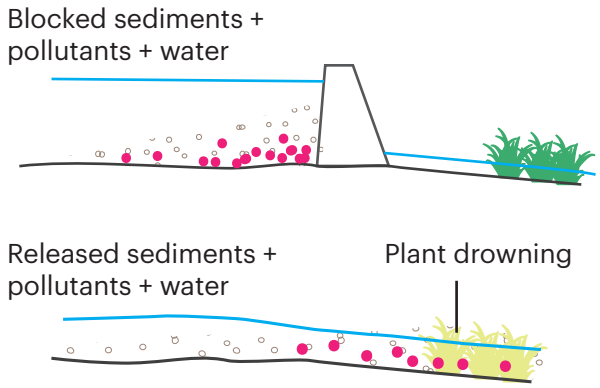
Salt / Brackish / Fresh Water

The tide plays a large role in what type of habitat exists in the landscape. The level of salinity in the water determines which species inhabit an area.

Downstream Ecology

Biotic

3 Biotic



DOWNSTREAM ECOLOGY

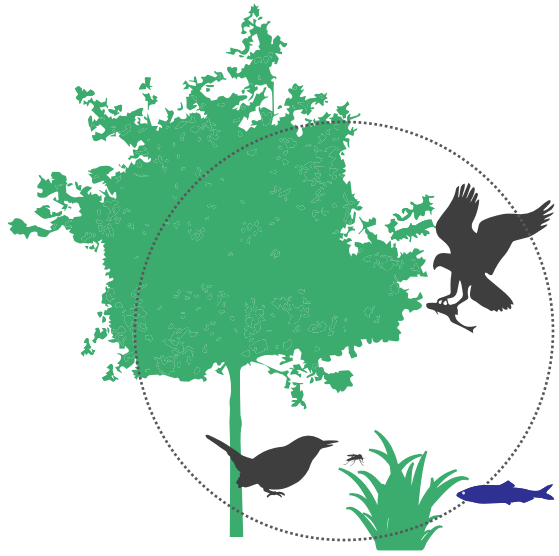
Sediment/Pollutant Release

Dam removal allows trapped sediments and potential contaminants to flow downstream potentially injuring downstream ecologies

Flyway Habitat

Biotic

4 Biotic



FLYWAY HABITAT

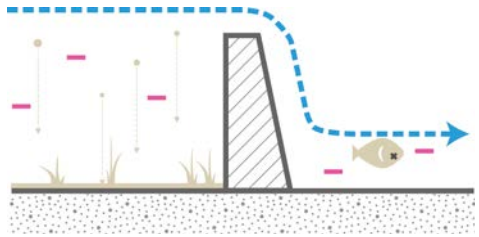
Bird Habits

Dam removal often improves habitat for local and migratory birds. In some cases the disruption of downstream ecology can negatively affect habitat

Water pH

Geo-Physical

1 Geo-Physical



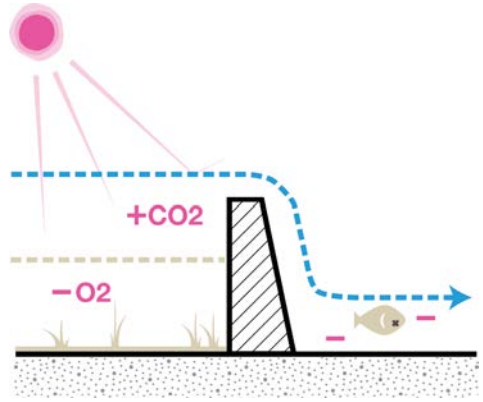
WATER PH

acidity
levels in water is a result of many factors. In an impoundment, decomposition of organic matter cause the pH levels to drop, making the water more acidic.

Water Quality

Geo-Physical

1 Geo-Physical



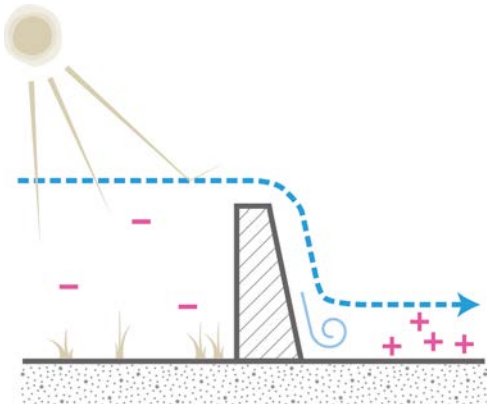
WATER QUALITY

impounded water
behind the dam is slow-moving, shallow, and has higher water temperatures, lower oxygen levels and greater fluctuations in pH than more swiftly moving waters, particularly during the summer months.

Dissolved Oxygen

Geo-Physical

1 Geo-Physical



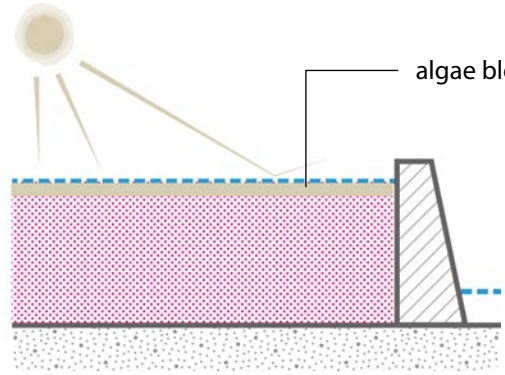
DISSOLVED OXYGEN

oxygen in the reservoir is lowered by the decomposition of organic matter, warmer water temperature, and limited sunlight reaching the seagrasses. At the same time, the dam creates DO for downstream habitats.

Nutrients

Geo-Physical

1 Geo-Physical



NUTRIENTS

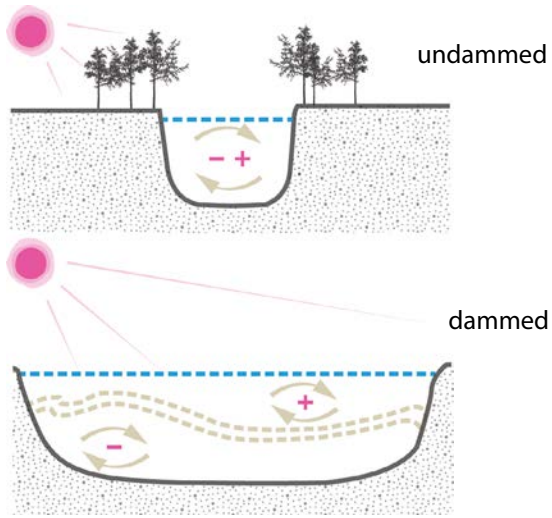
trapped

within the impoundment, nutrients can attract algae causing the water flowing downstream to become cold, oxygen and nutrient-poor, and acidic. Some potential sources could be the textile mill, the town's septic systems/cesspools, upstream agricultural activities, and wildlife waste since only 75% of the watershed is undeveloped.

Water Temperature

Geo-Physical

1 Geo-Physical



WATER TEMPERATURE

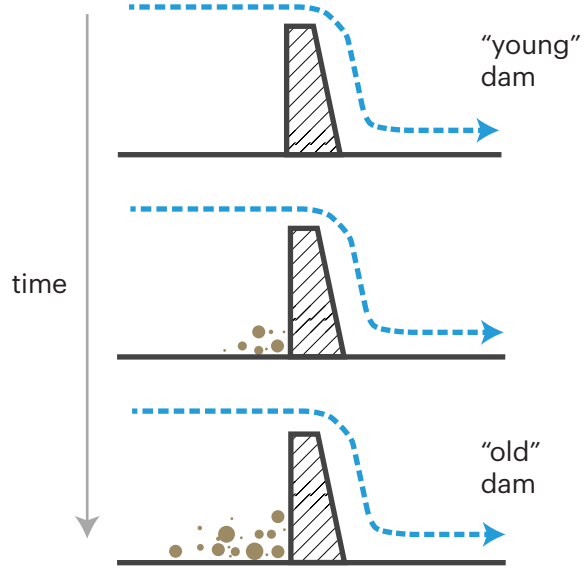
temperature

increases as a river's width increases at the reservoir by exposing more water surface to the sun. The target fish species have a very restrictive temperature requirements for survival, growth and reproduction.

Sediment Build-Up

Geo-Physical

1 Geo-Physical



SEDIMENT

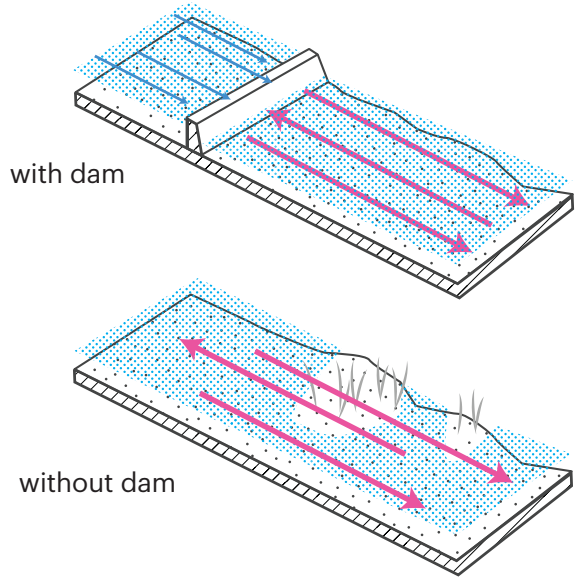
Over time, sediments build up behind a dam. This eventually results in failure, unless this material is regularly dredged from behind it. Wetlands are unable to sustainably build downstream without this material.

1

Sediment Build-Up

Geo-Physical

2 Geo-Physical



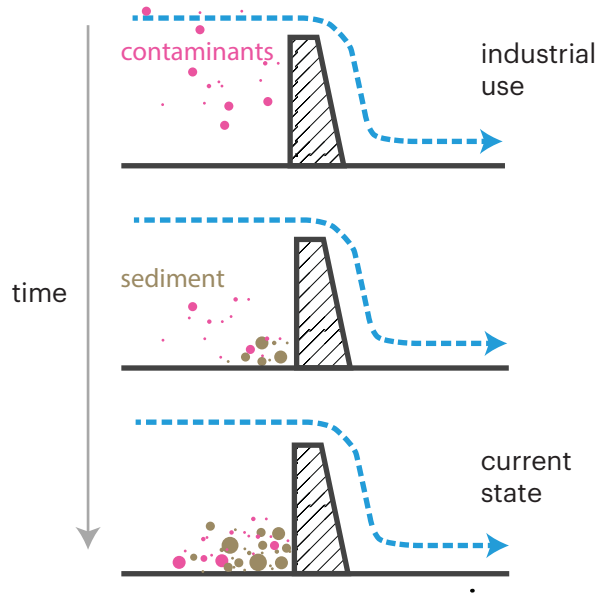
TIDAL SALINITY

When in a riparian zone, a dam is constricts the tidal flow of a river. If allowed to flow naturally, sediments can deposit downstream to build marshes, and the original salt water ecologies can flourish.

Sediment Build-Up

Geo-Physical

3 Geo-Physical



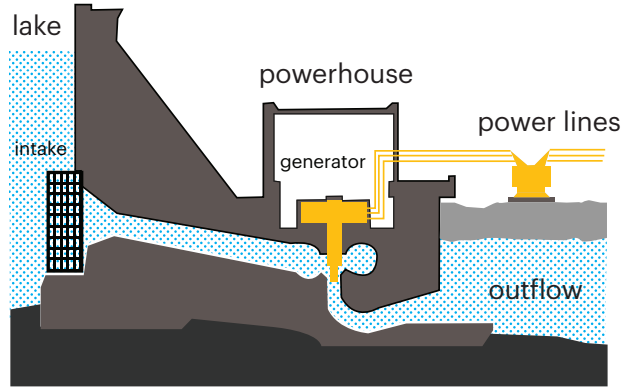
CONTAMINATION

With historic industrial dams, toxins like heavy metals can gather beind the dam and bind with sediments. Removal of these toxins is costly and time intensive, and can make their way downstream if the dam is removed.

Hydropower

Infrastructure

1 Infrastructure



HYDROPOWER

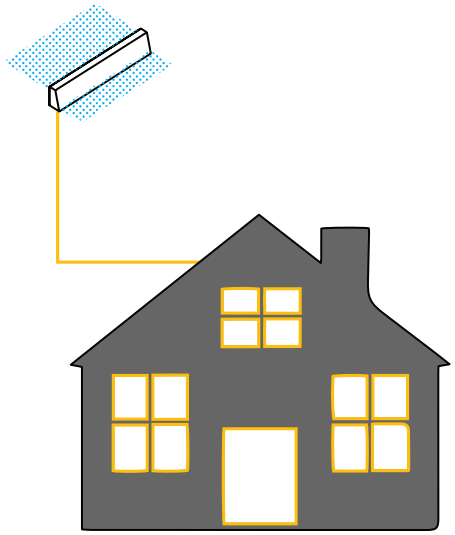
Energy by Impoundment

Dams create power by impounding water and releasing it through a turbine. Depending on the flow of the river and how large the impoundment is, the power capacity or average load, can vary greatly.

Pico Hydropower

Infrastructure

2 Infrastructure



PICO HYDRO

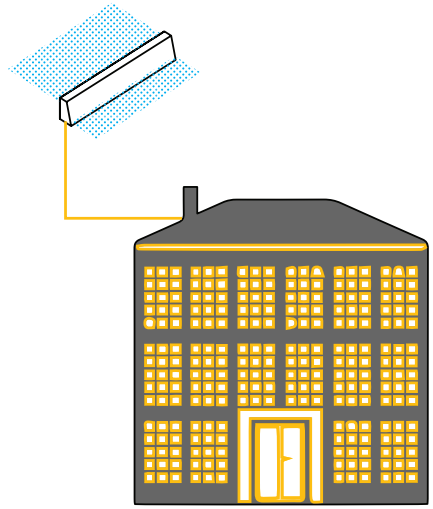
up to 5 kw

An incredibly small scale type of hydropwer which provides energy to 1 home or a small operation.

Micro Hydropower

Infrastructure

3 Infrastructure



MICRO HYDRO

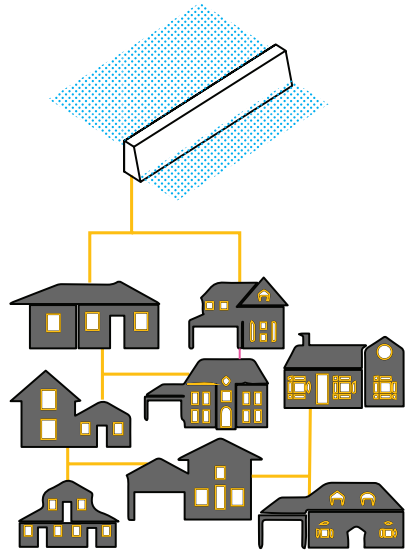
5 kw to 100 kw

Power for 28 homes or 1 factory.
The scale most dams were constructed during the Industrial Revolution, using small waterways.

Small Hydropower

Infrastructure

4 Infrastructure



SMALL HYDRO

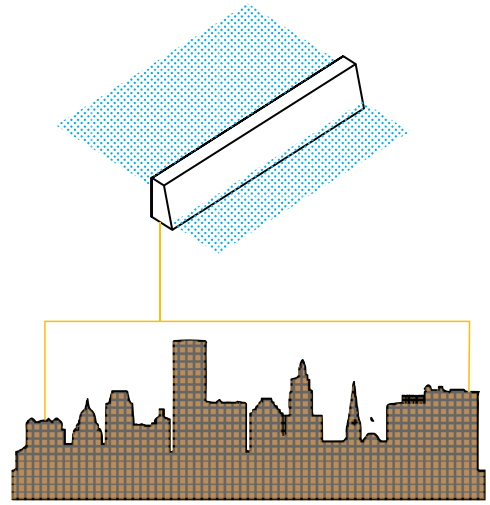
100 kw to 10 mw

Powers 2,800 homes or 1 town. Provides a significant amount of power to a community. Typical of early 20th century dams.

Large Hydropower

Infrastructure

5 Infrastructure



LARGE HYDRO

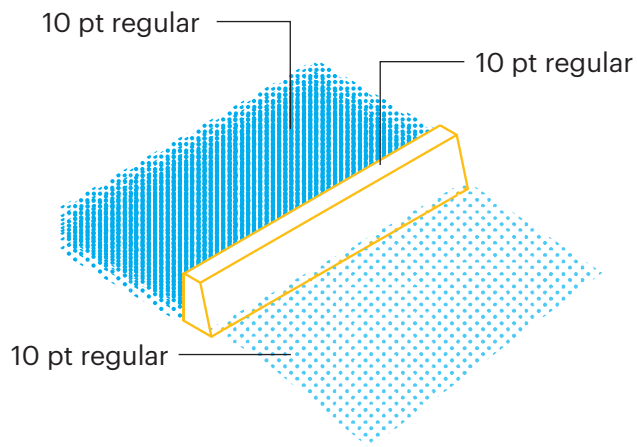
energy by impoundemnt

Power for 56,000 homes or 1 small city. A major infrastructural component to a region. Usually placed in major water ways.

Transportation

Infrastructure

6 Infrastructure



TRANSPORTATION

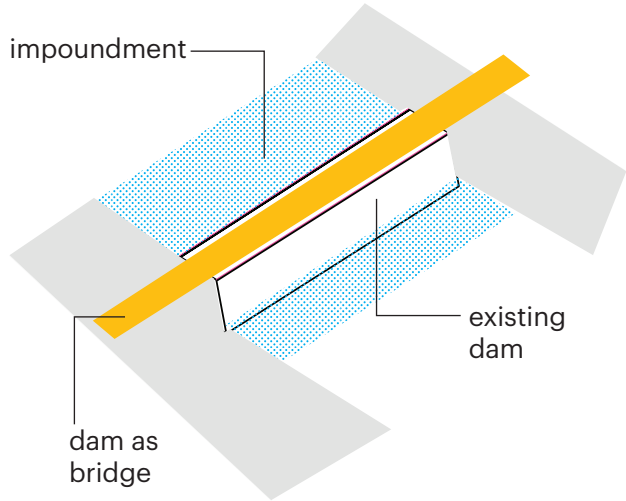
River Herring + American Eel

Dams obstruct diadromous (salt and fresh water dwelling) fish from migrating to spawning areas in rivers or coastal waters.

Road on Dam

Infrastructure

7 Infrastructure



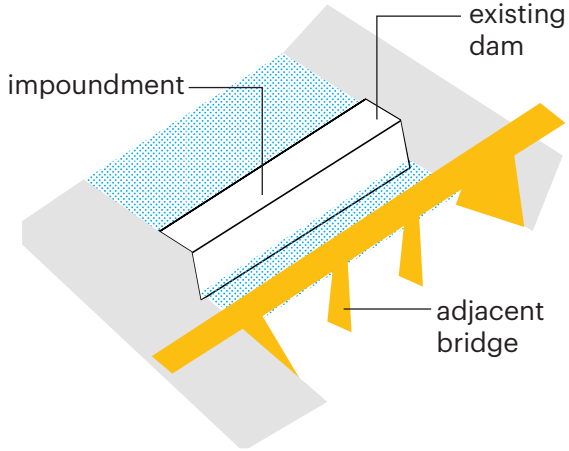
ROAD ON DAM

Dam as Bridge

At times, dams double as passageways for cars. This infrastructural coupling increases the value of the dam.

Adjacent Bridge

Infrastructure



ADJACENT BRIDGE

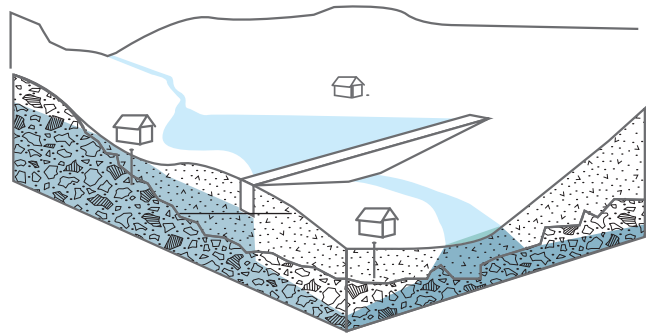
a bridge coupled with a dam

Bridges are often built next to dams and the stability of their structures often is tied to the dam infrastructure and the existing water flow regime.

Well Water

Infrastructure

1 Infrastructure



WELL WATER

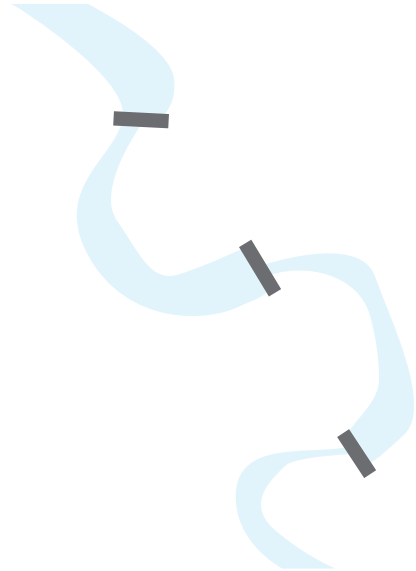
groundwater, water table

Dams can elevate the water table behind the dam. People reliant on well water may have to drill deeper in order to access groundwater

Flow Control

Infrastructure

1 Infrastructure



FLOW CONTROL

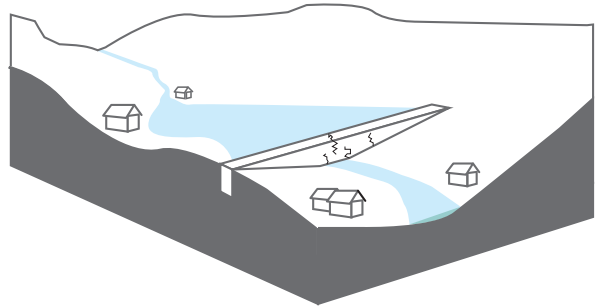
flow regime

Dams along river systems affect water flow in the entire river. Rather than allowing seasonal fluctuations, dams restrict water during high flow and ensure water during low flow.

Dam Breach

Infrastructure

1 Infrastructure



DAM BREACH

catastrophic failure

When the dam fails structurally, this can impact communities and infrastructure further downstream (including more dams).

Municipal Supply

Infrastructure

1 Infrastructure

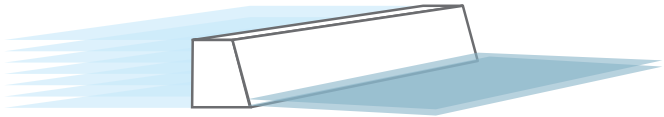
MUNICIPAL SUPPLY

water detention, potable water

Flood Mitigation

Infrastructure

1 Infrastructure



MITIGATION

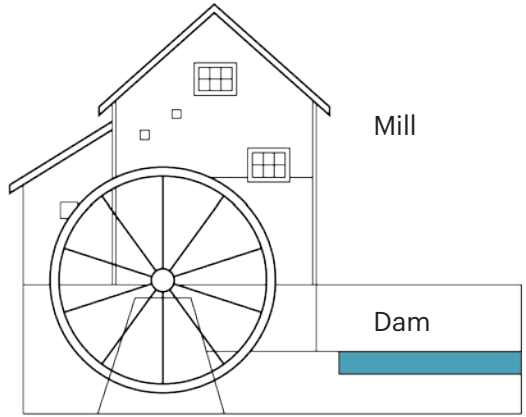
flow regime

Even if flood control is the objective of a project, dams have an effect on the flood cycle of the river.

Landmarks

Cultural

1 Cultural



LANDMARKS

Constructions

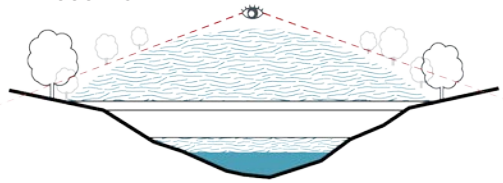
The constructions like old mills, dams and fish ladders can be significant landmarks for the native citizens and visitors.

Views

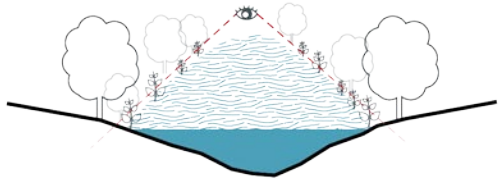
Cultural

2 Cultural

Reservoir



Free Flowing River



VIEWS

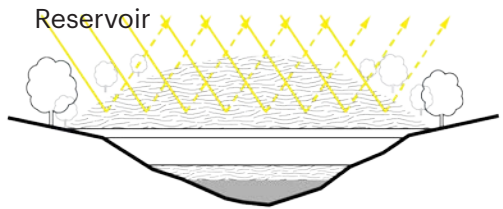
Broad & Narrow

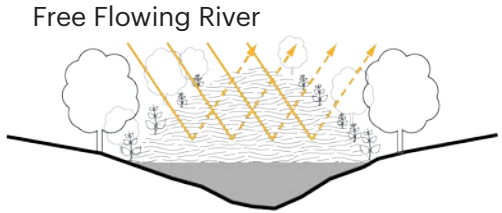
The reservoir behind the dam provides free field of view for people.
If without dam, riparian habitat for vegetation will form relatively narrow visual field.

Phenomena

Cultural

3 Cultural





PHENOMENA

Light

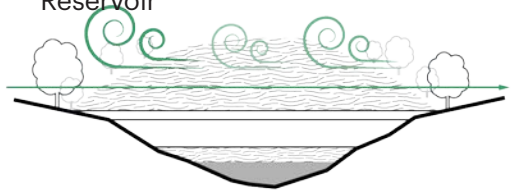
The reservoir receives more sunshine.
If without the dam, the river channel space will be more shady and cool with more vegetations

Phenomena

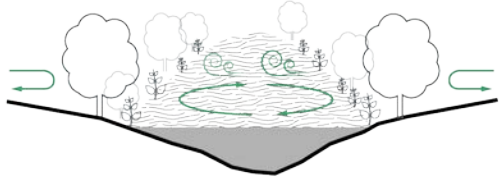
Cultural

4 Cultural

Reservoir



Free Flowing River



PHENOMENA

Wind

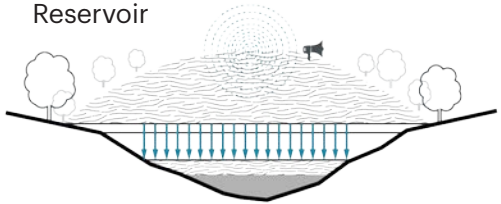
Wind can directly blow over the broad reservoir area. Vegetations at the bank of free flow river can block the wind and form more stable micro-environment.

Phenomena

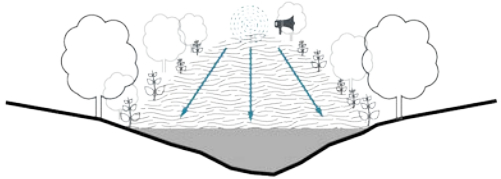
Cultural

5 Cultural

Reservoir



Free Flowing River



PHENOMENA

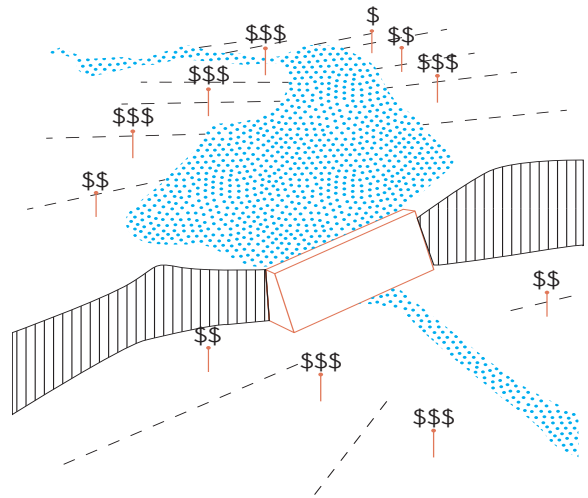
Sound

The waterfall on the dam makes loud sound.
If without the dam, it will be more quiet environment with sound of trickling water

Property Value

Cultural

6 Cultural



PROPERTY VALUE

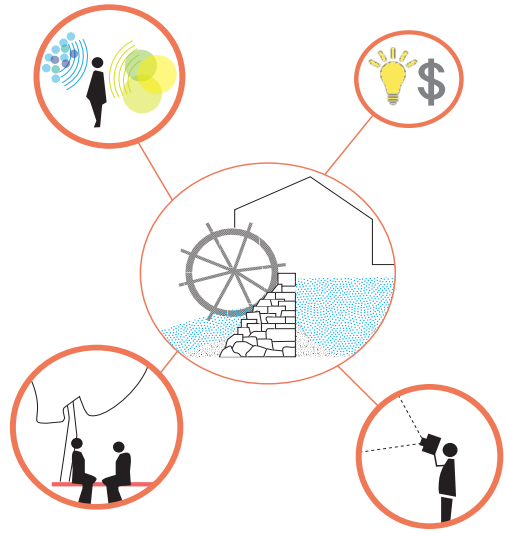
Land value with natural infrastructure

Property values vary according to different situations in relation with the proximity and acces to the natural infrastructure.

Sense of Place

Cultural

7 Cultural



SENSE OF PLACE

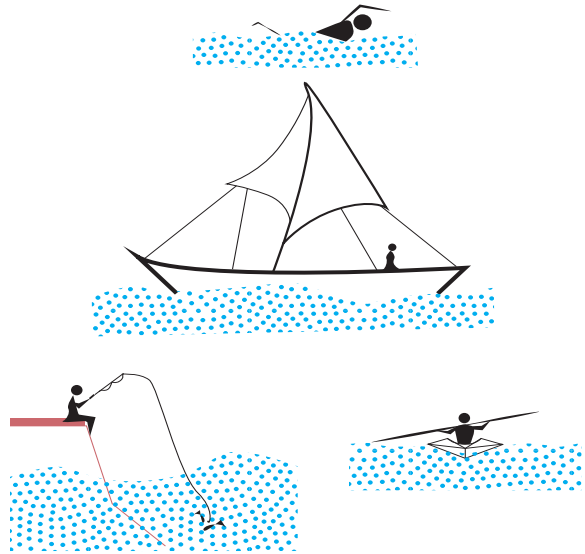
Memory

A Dam that has become an icon for the community, that through the passing of time has created an emotional bond between them and the landscape. The sense of place is defined by the people's experiences in them.

Recreation

Cultural

8 Cultural



RECREATION

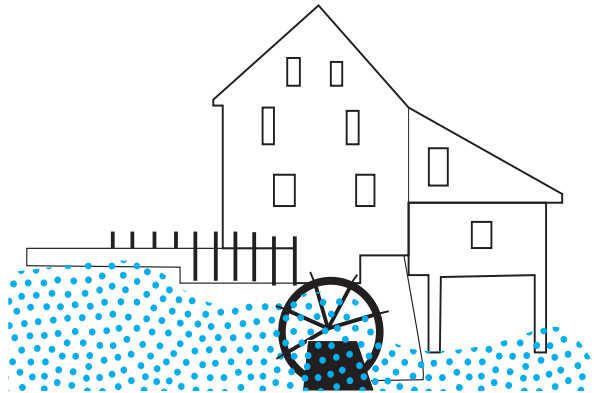
Water Sports

Activities in a dam are predominantly water related such as: rafting, kayaking, sailing, fishing, swimming among others.

Heritage

Cultural

9 Cultural



HERITAGE

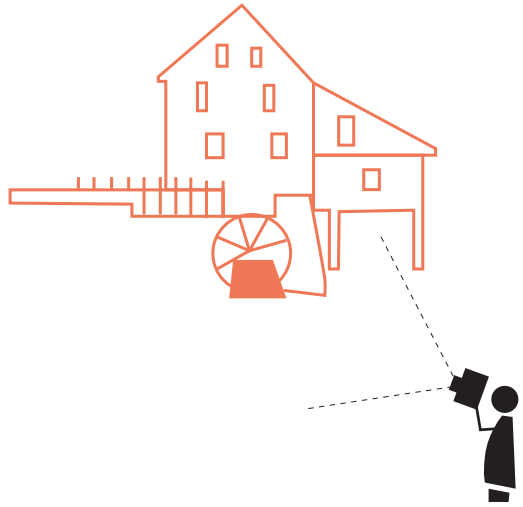
Historic Importance

A dam that displays the inherited legacy from past generations, crucial to the identity of the local costumes, as well as a key element of the landscape composition of the place.

Tourism

Cultural

10 Cultural



TOURISM

Economical Potential

According to the historic relevance or landmark importance, a dam can attract tourism activities that can be a potential for a different kind of economic development of the town or city. As well as a consideration if this already exists.