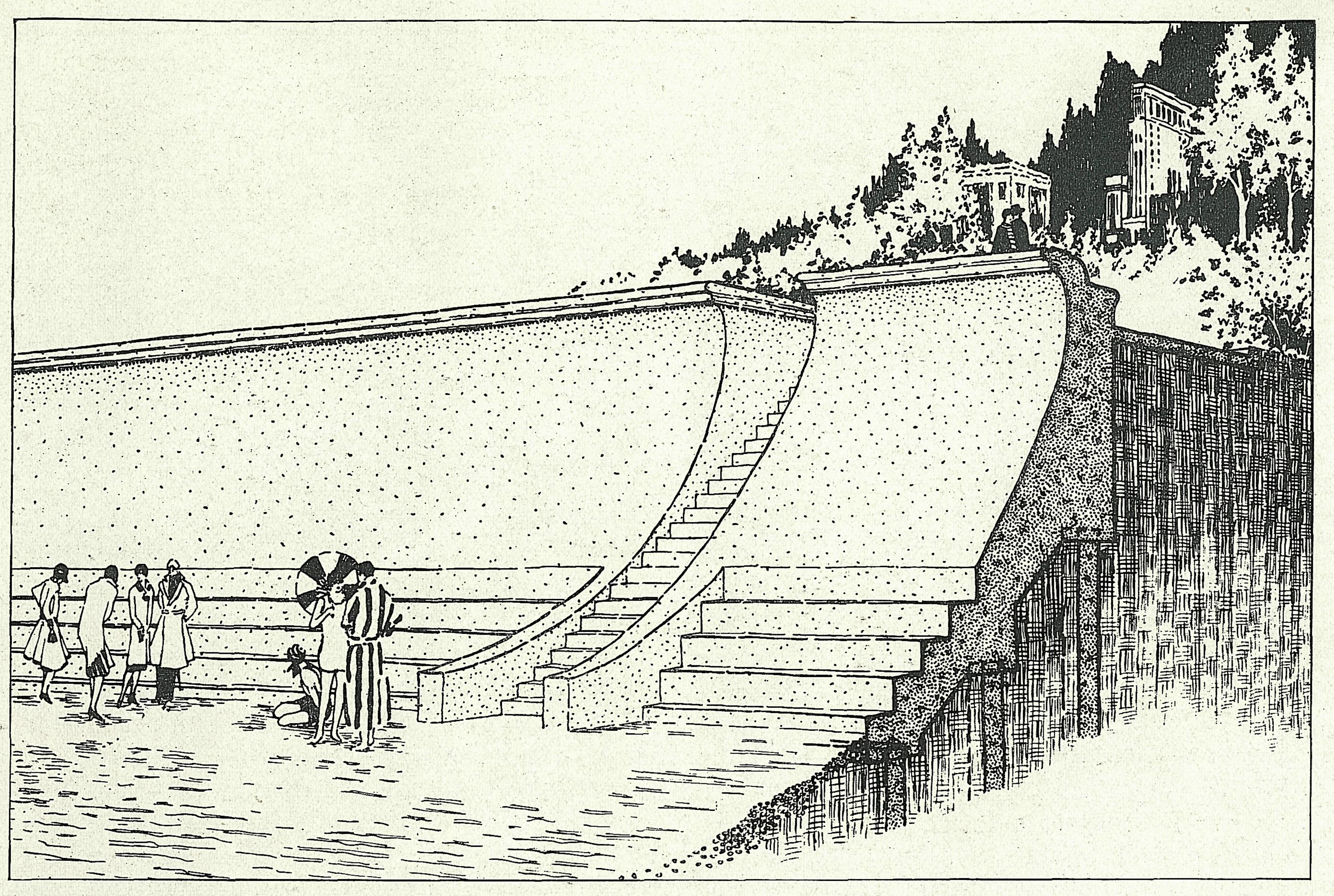


A suggested type for a monolithic concrete sea wall. With necessary modifications the wall may be artistically designed to conform to the general architectural scheme of the adjoining development. The top of the wall forming the parapet along a walkway may be appropriately treated with an ornamental coping on the water side, and cast-in-place seats on the land side. Access to the beach at frequent intervals may be obtained by steps as shown. Undermining should always be guarded against by a toe wall of concrete sheet piling.

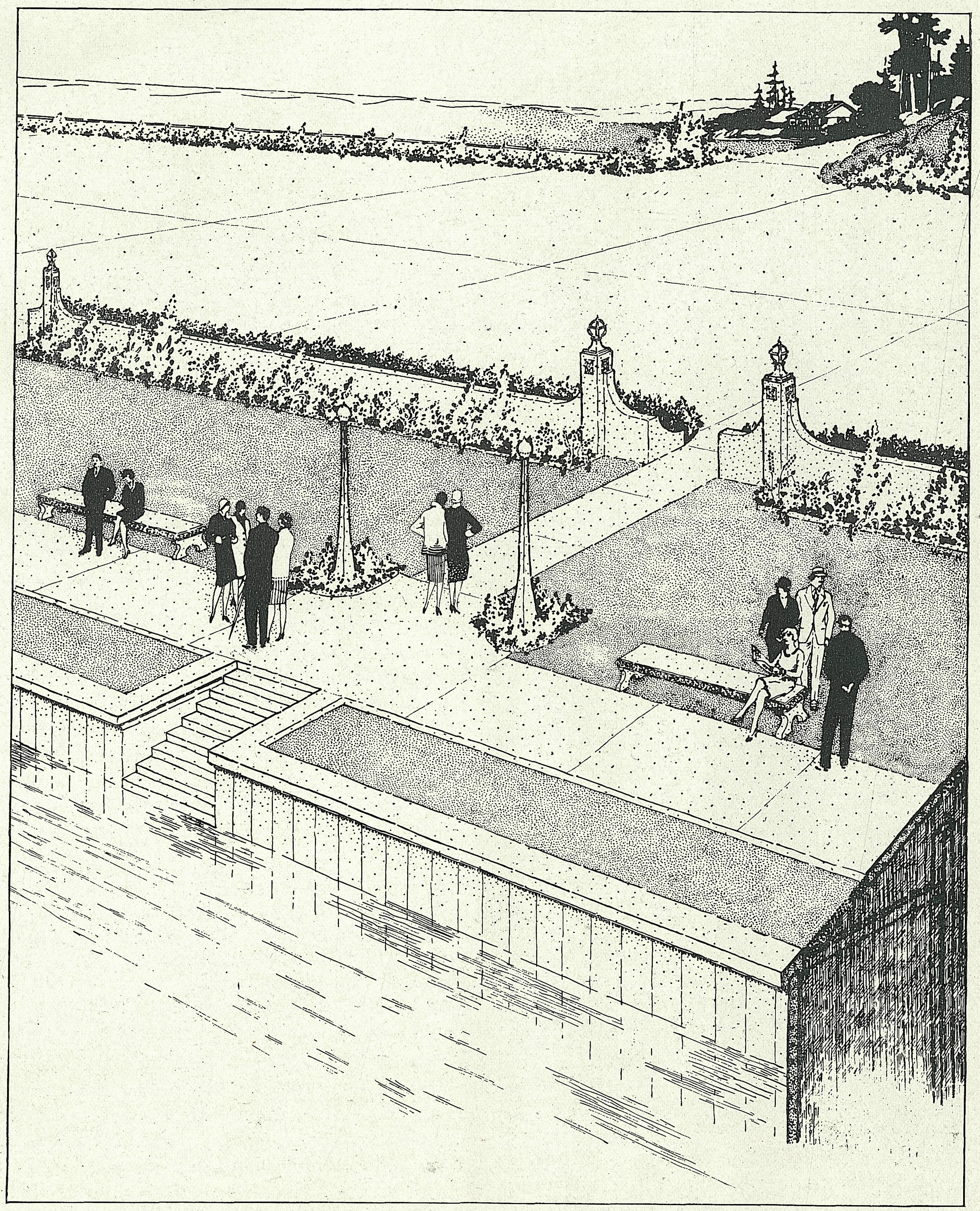
Principles of Making Concrete

The factors involved in designing concrete mixtures, particularly for shore protection structures where watertightness is an essential requirement, can be clarified greatly by thinking of concrete as an aggregate mass held together by a hardened paste of portland cement and water. With the use of sound and clean aggregates concrete derives its useful properties mostly from the hardened cement-water paste. If strong and watertight concrete is desired, the hardened paste must be strong and watertight.

When portland cement is mixed with enough water to form a paste, a reaction is started which develops the binding medium that gives concrete its useful properties. The relative proportion of cement and water greatly affects the quality of the paste. Complete hydration of cement can be accomplished by an amount of water ordinarily insufficient to produce a paste plastic enough to be handled. When aggregates are mixed with this paste to make concrete, it is necessary to use an additional amount of water to produce workability. In terms of hydration, this additional water may be called an excess, which is not needed to combine with the cement, but is needed to give the mass workability.

The excess water not used in the chemical process of hardening and which does not enter into combination with the cement remains within the paste, and the space it occupies will later be represented by voids as the water evaporates. These voids obviously may form channels through which moisture can percolate during the service life of the structure. It is also obvious that these voids must reduce the strength of the concrete.

Water regulation and limitation is important. As any destructive agent passing through or penetrating concrete must find its way between the aggregate particles and therefore through the



Landscaping behind a shore protection structure will add materially to the general appearance. Concrete sidewalks, benches, lighting standards, and a garden wall either cast in place, or of precast concrete masonry units are suggested in this sketch. The shore wall shown is of concrete sheet piling with monolithic coping. This is an ideal arrangement for protected harbors, river banks, or shores of small lakes.