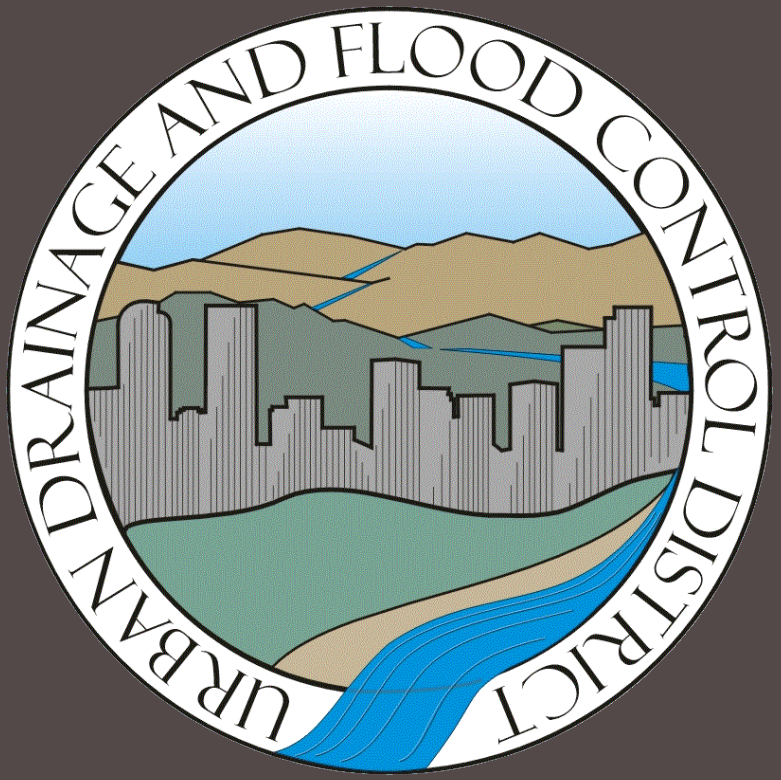
# Restoring to what?




Laura Kroeger, Urban Drainage and Flood Control District

The velocity in unlined canals must be limited to that which will not cause cutting or erosion of the canal bottom or sides. This limiting velocity usually is 2½ or 3½ ft. per second, depending on the size of the canal and the character of the material. On the other hand, concrete linings have been used satisfactorily in canals with velocities as high as 15 ft. per second. When velocities exceed about 8 ft. per second care should be taken to make the wetted surface as smooth and free from abrupt changes of grade or direction as possible, since irregularities or obstructions might cause turbulence and consequent overtopping of the lining. Somewhat greater than normal freeboards (see above) also should be provided, especially at turnouts and other structures.

## types of lining using portland cement

As early as 1880 the use of portland cement mortar for lining irrigation canals came into favor. Since that time use of various types of linings made with portland cement has increased until these types now are generally recognized as possessing more desirable qualities than any other lining material of comparable cost. These linings vary in first cost, construction procedures or the materials used in combination with cement. This permits selection of the type that, at the lowest possible cost, will most nearly fit the conditions encountered. The following terms are used to describe the several types:

**Concrete** is the term used for plastic concrete, either plain or reinforced, made with portland cement, separated and processed aggregates and water.

**Pit-run concrete** is plastic concrete made with portland cement and suitable unseparated pit-run sand and gravel of which not more than 12 per cent will pass the No. 100 sieve. If less than 15 per cent of the aggregate is retained on the ¼-in. sieve the resultant concrete is usually referred to as "cement mortar."

**Plastic soil-cement** is a mixture of portland cement, soil and just enough water to produce a plastic consistency similar to that of masonry mortar; it requires no mechanical consolidation.

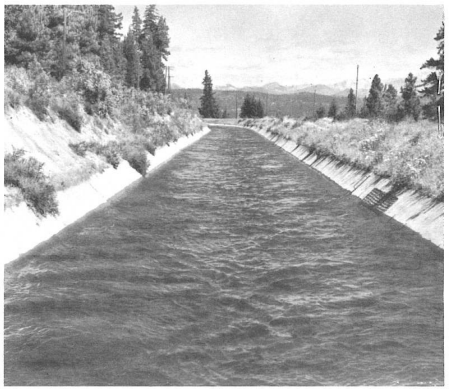
**Compacted soil-cement** is a mechanically compacted mixture of portland cement and soil with optimum water content to give maximum density.

**Shotcrete** is a pneumatically placed mortar made of portland cement, processed sand and water.

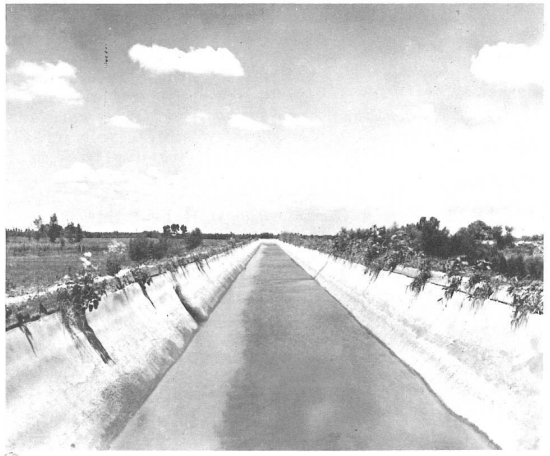
**Precast concrete** is a term applied to concrete units, usually interlocking, that are manufactured at a central plant and hauled to the job site.

All of these linings have certain advantages that make them desirable for use in irrigation canals. Their long life, low maintenance requirements, structural resistance to damage, and operating advantages make them particularly suitable as economical lining materials.

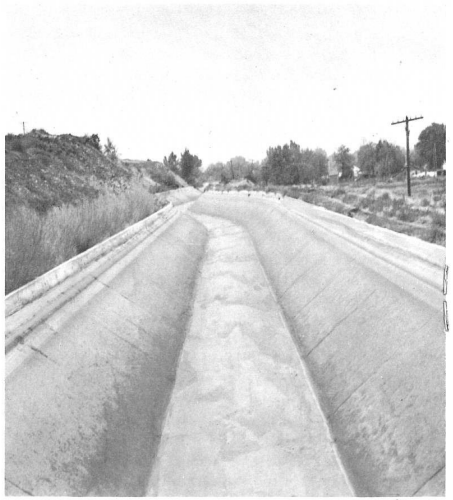
# Canal Linings...Years of Proven Service...Years of Service Ahead



**The Kittitas Main Canal, near Ellensburg, Wash., lined with concrete in 1926, has withstood satisfactorily the severe winter exposures in this area.**



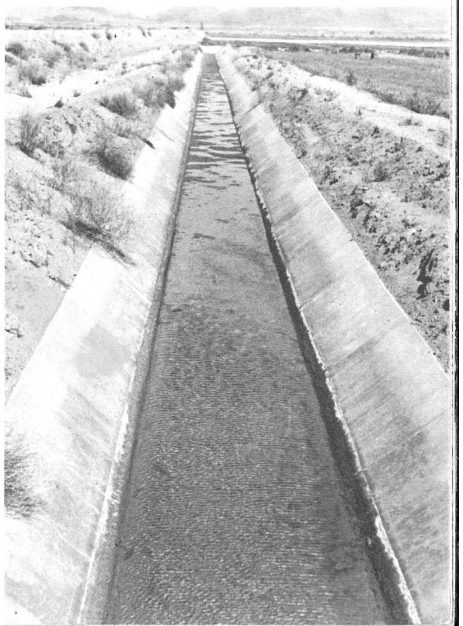
**This section is typical of over 200 miles of canals, lined with 1½-in. shotcrete in 1940, in the Willacy County, Texas, Water Control and Improvement District No. 1. All of the shotcrete-lined canals are in excellent condition and saving water every year.**



**Ridenbaugh Canal, near Boise, Idaho, lined in 1910 with unreinforced pit-run concrete, is still in excellent condition after 45 years of service.**

**ge Canal, near Loma Linda, Calif., was lined in 1886 with 1 in. of cement mortar. Much of the original lining is still in good condition.**

**The plastic soil-cement lining was placed in this canal near Yuma, Ariz., in 1945.**



# Urban Drainage and flood control district

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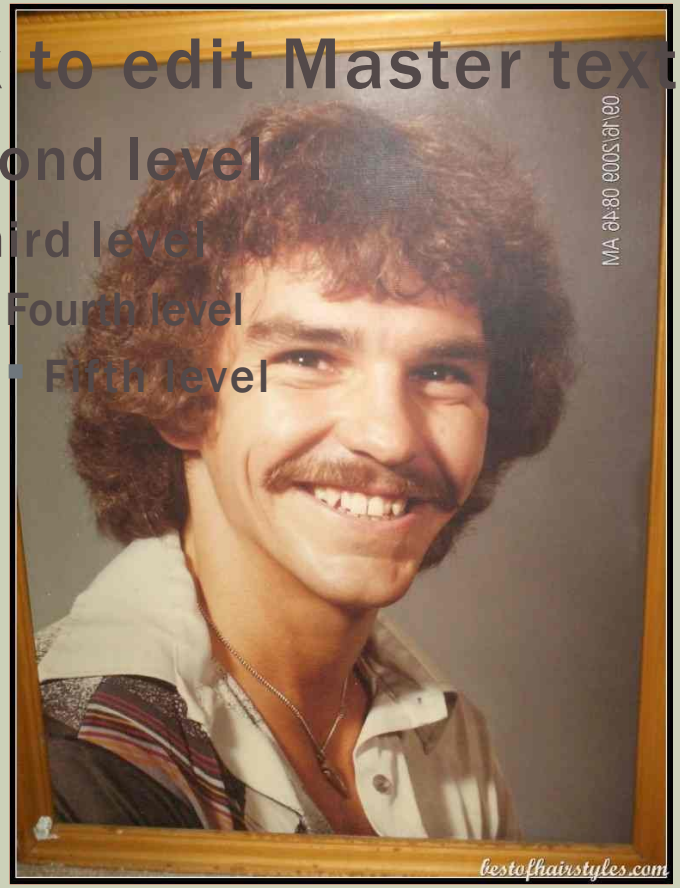


# Experimenting

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# Design, Construction, and maintenance Program


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# Design, Construction, and maintenance Program


# Design, Construction, and maintenance Program

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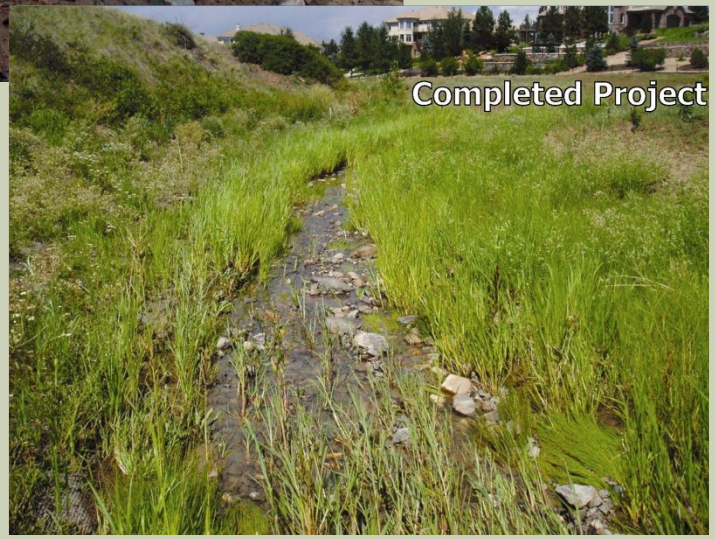
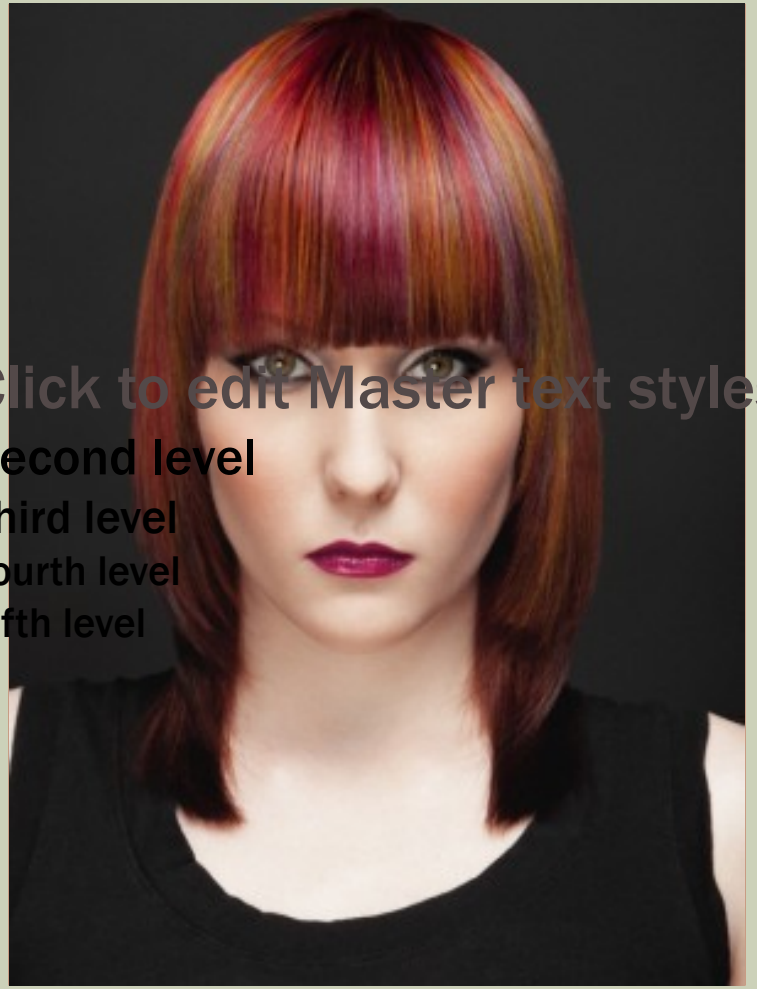


# Design, Construction, and maintenance Program



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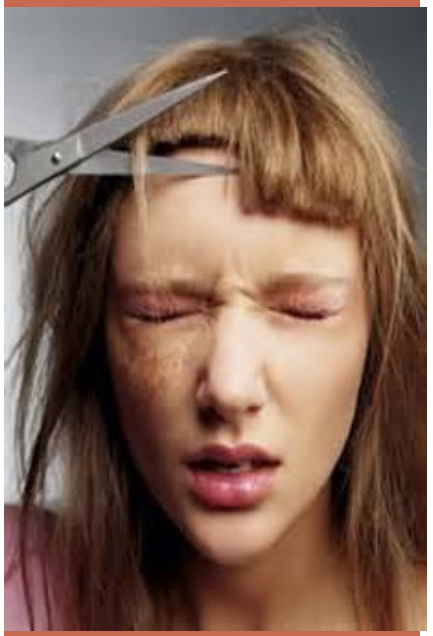
# Challenge



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Challenge

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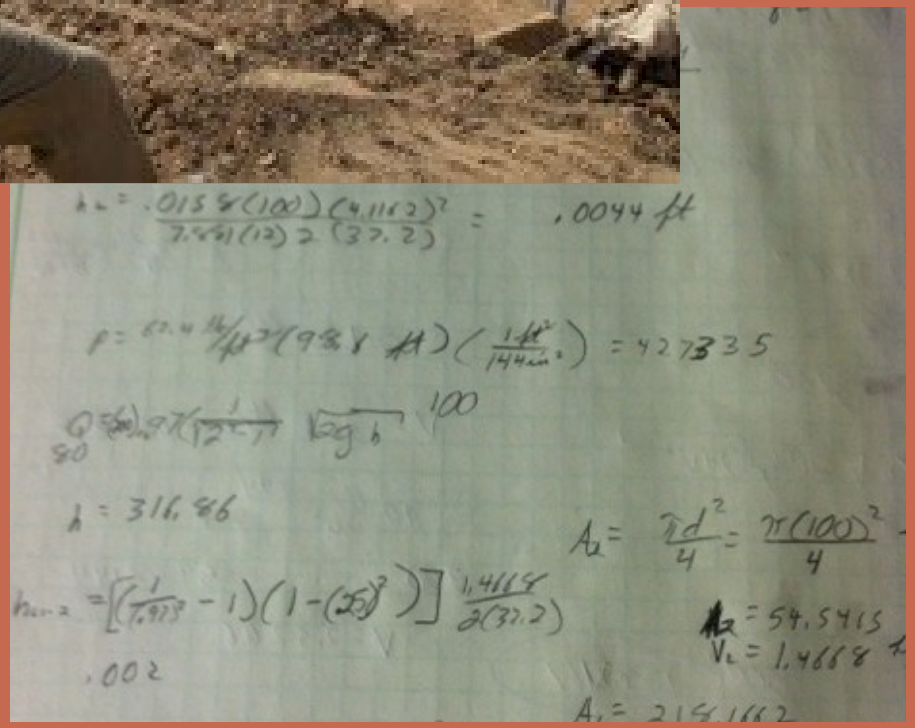

Challenge

Knowledge

COLORADO WATERSHED ASSEMBLY

Colorado Foundation for Water Educat

Your State. Your Water. Your Future.


How to get there?

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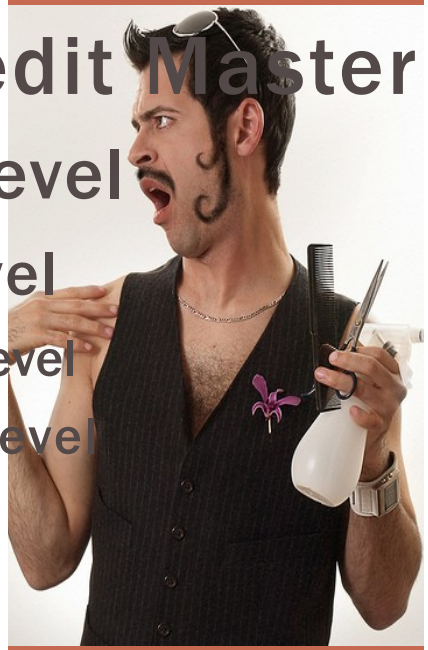
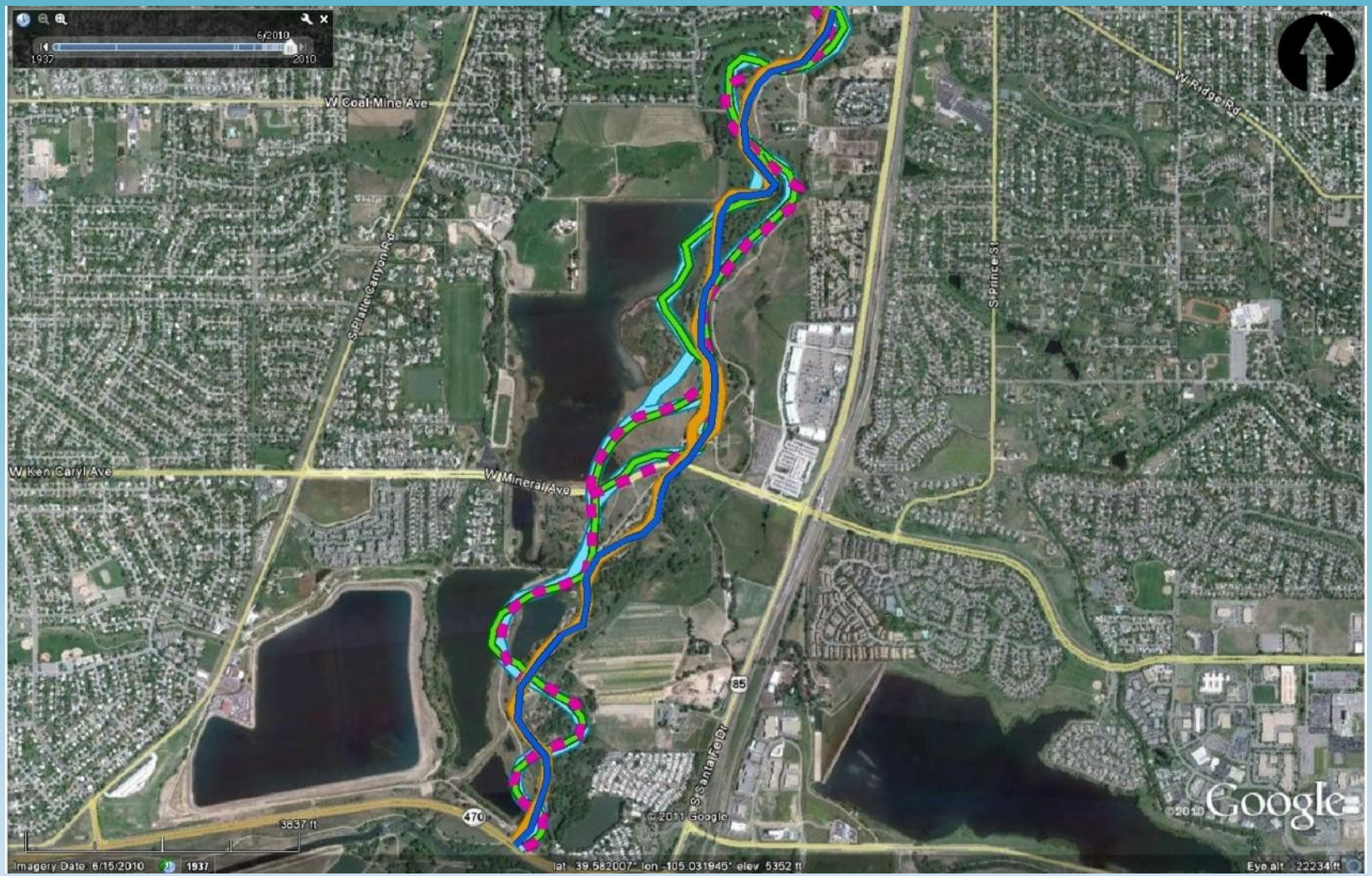



SOUTH PLATTE PARK
South Platte Ecological Restoration
Project
June 12, 2013

# South Platte Park Project Location

# Historic Condition - 1937 to 2010



**Challenges**

Reduced Flows

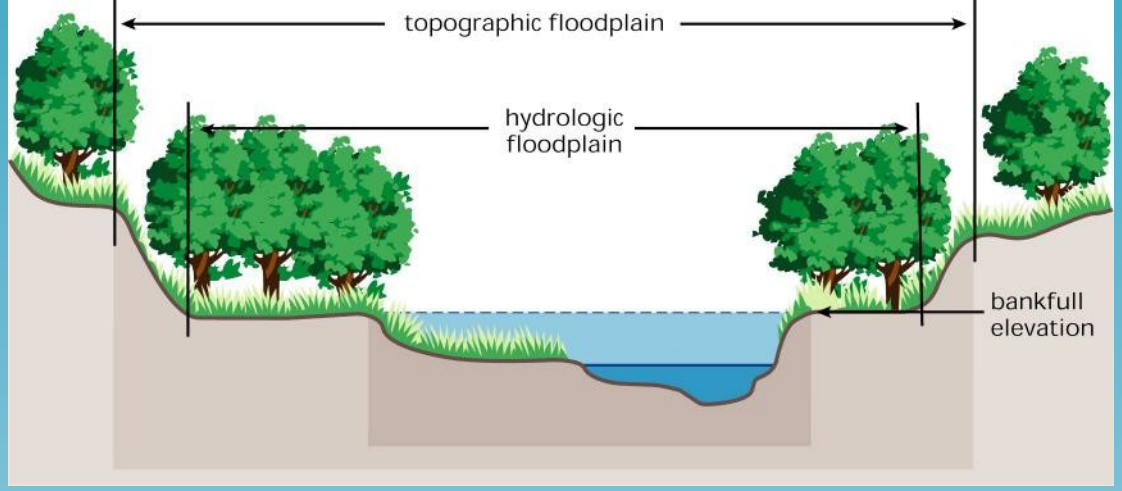
Loss of Sinuosity

Sediment Load Eliminated

Insufficient Depth @ Low Flow

Disconnected Riparian Habitat and Historic Floodplain

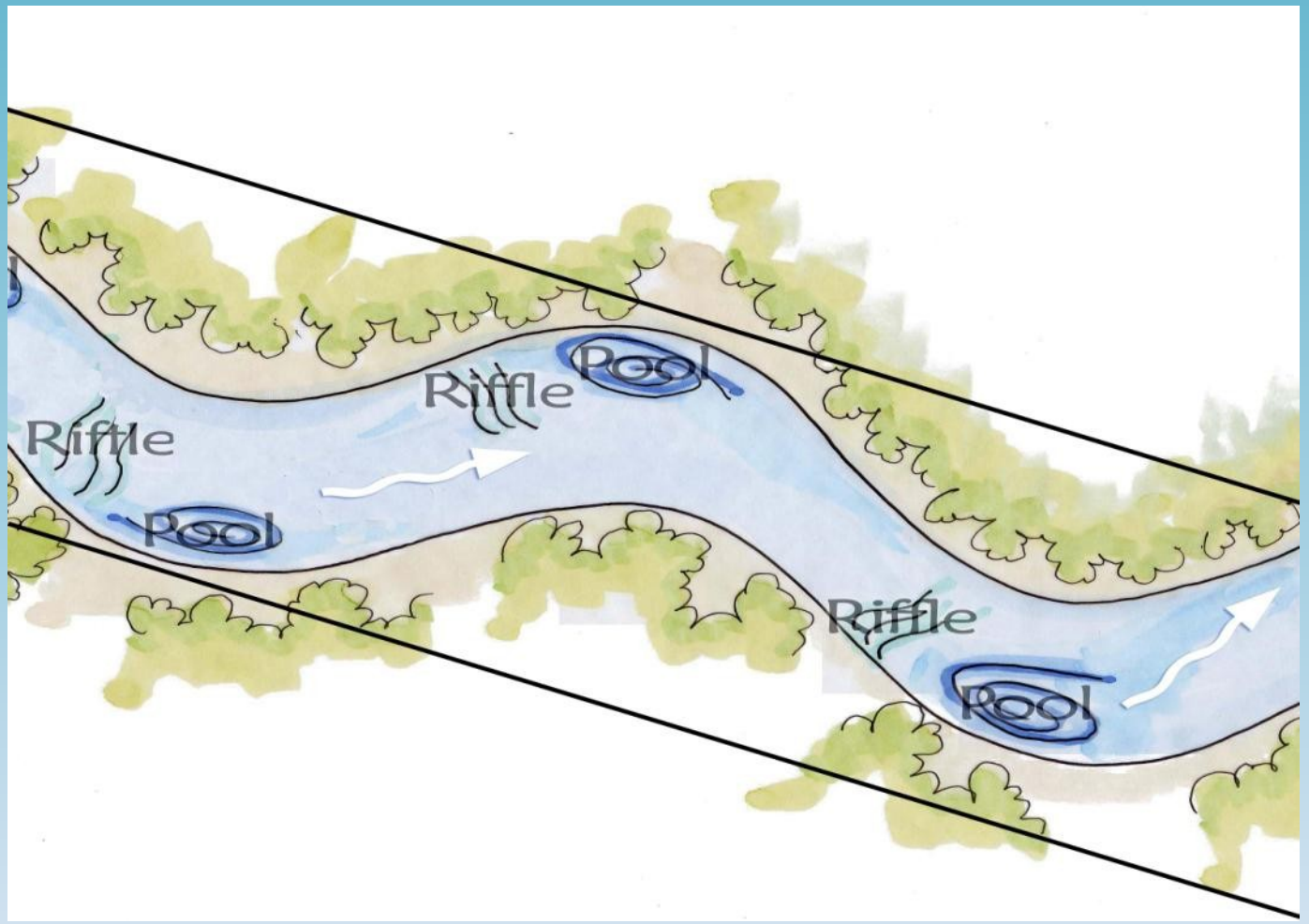
No Longer Functioning as a Natural System




- ✓ Mitigate impacts of channelization and flow reductions to create natural balance with current conditions.
- ✓ Enhance natural ecological function of aquatic and riparian environment.
- ✓ Establish river corridor, natural in appearance and function given limitations of flow releases from the dam and effects of historic land use.
- ✓ Improve low flow aquatic habitat through channel reshaping and construction of more natural riffle / pool / glide sequences.
- ✓ Stabilize and protect eroding banks.
- ✓ Develop and restore riparian habitat through construction of riparian terraces and plantings.
- ✓ Preserve existing quality habitat and ecosystems.

# Solution

Re-establish Low Flow Sinuosity and Riffle-Pool Sequence

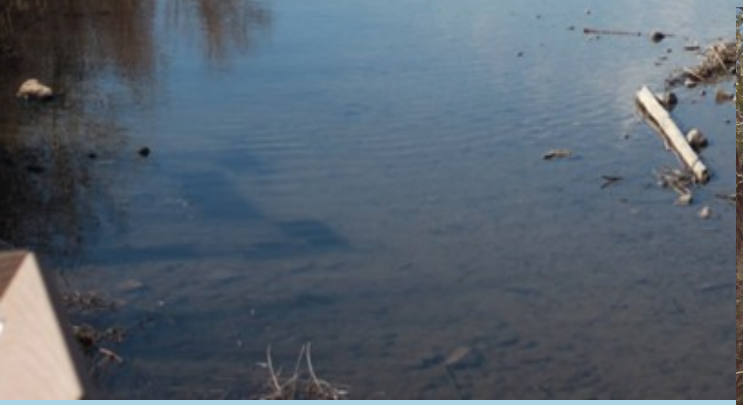


# Conceptual Design (30%) 2012

# Phase I Construction Project 2013

# River Terrace Construction

# Riffle, Pool and Glide Construction



# Riffle Construction, and Bank Protection

# Bank Restoration & Protection, River Terrace Construction

Imagine what we can do together

# Thank you!

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## Comments
## Questions