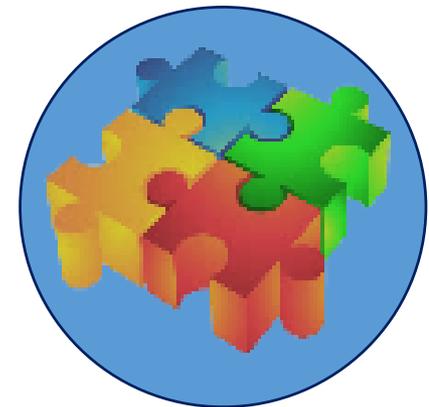


A Systems Thinking Approach to Protecting People, Property, & the Environment

2017 UDFCD Annual Seminar



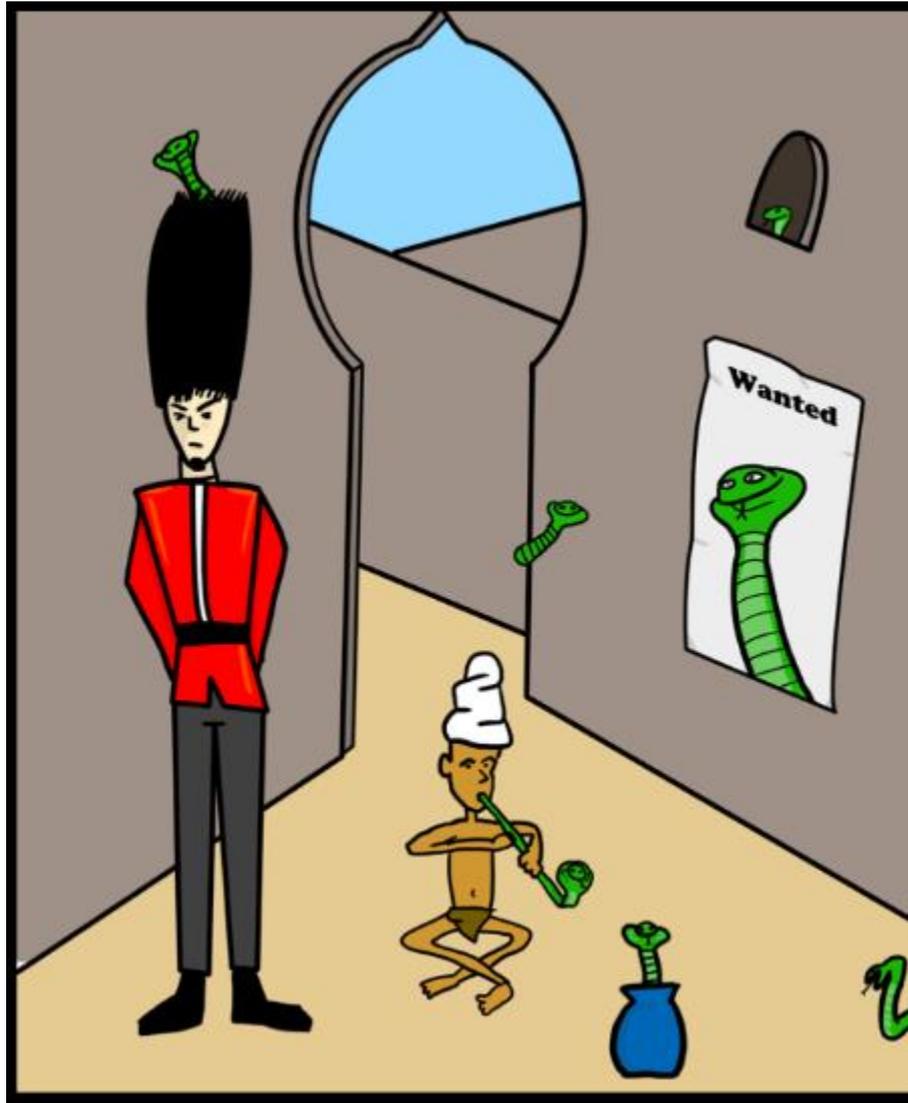
David J. Skuodas, PE
Project Manager
Stream Services



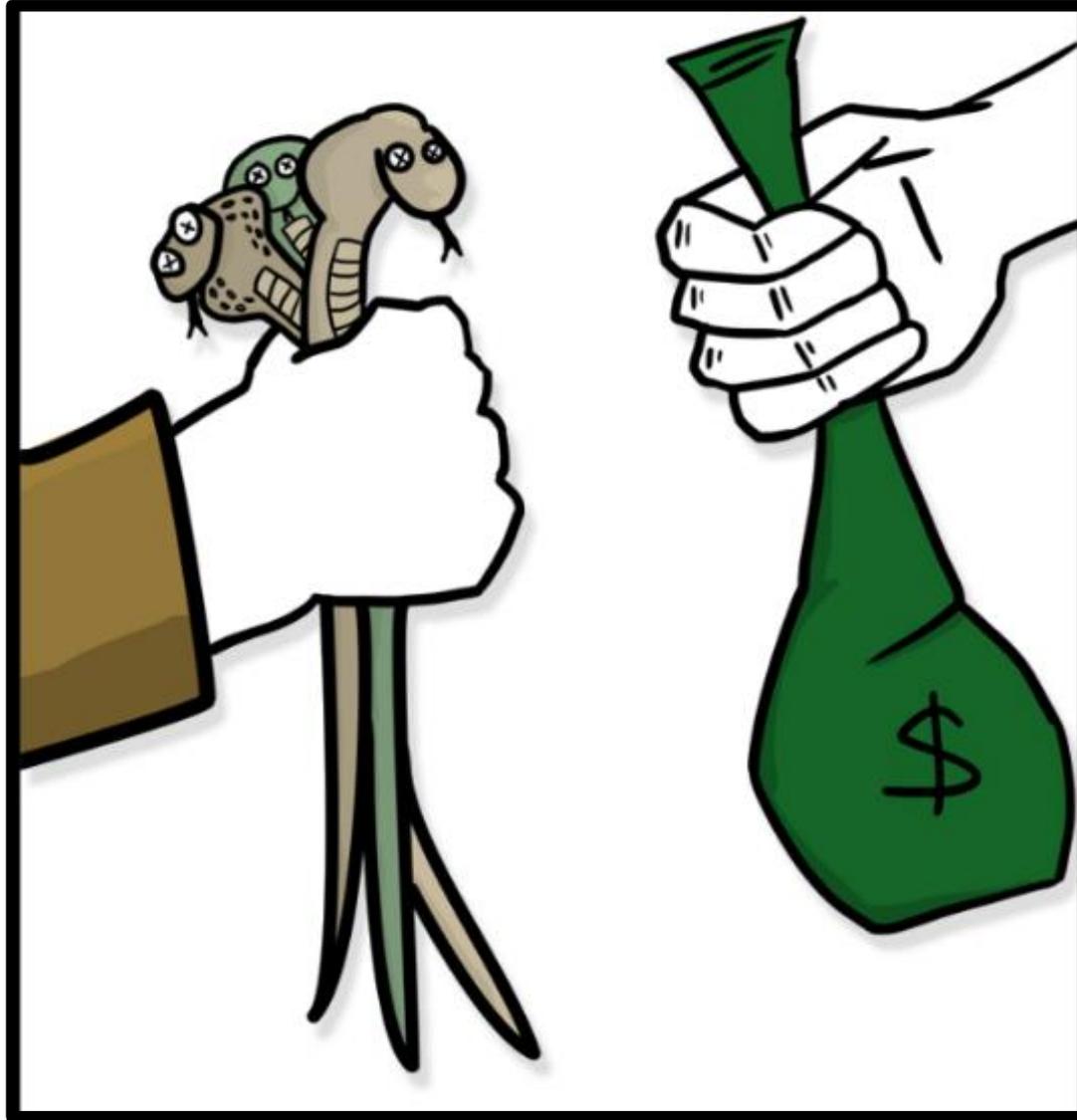
The Cobra Effect



The Cobra Effect



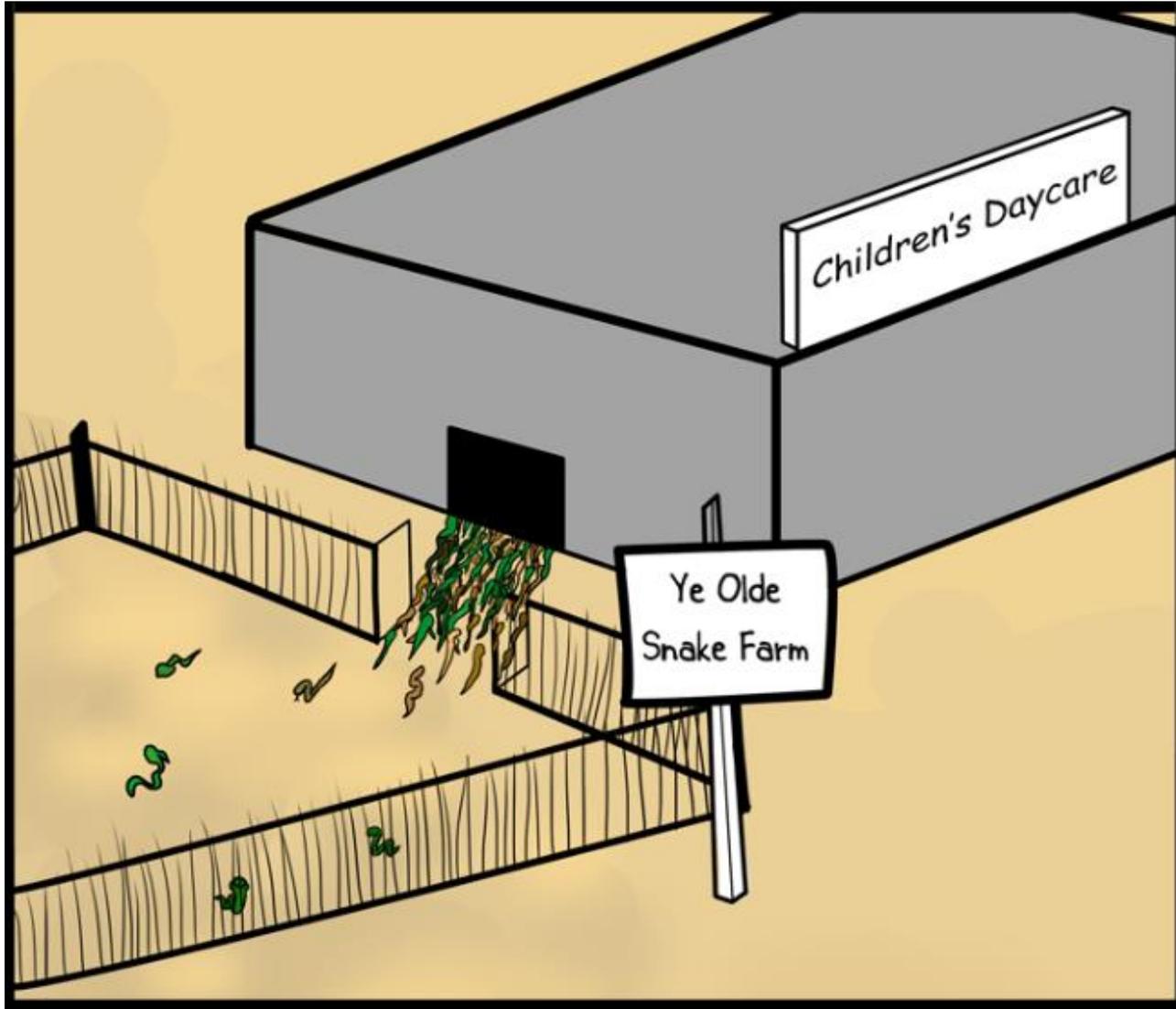
The Cobra Effect



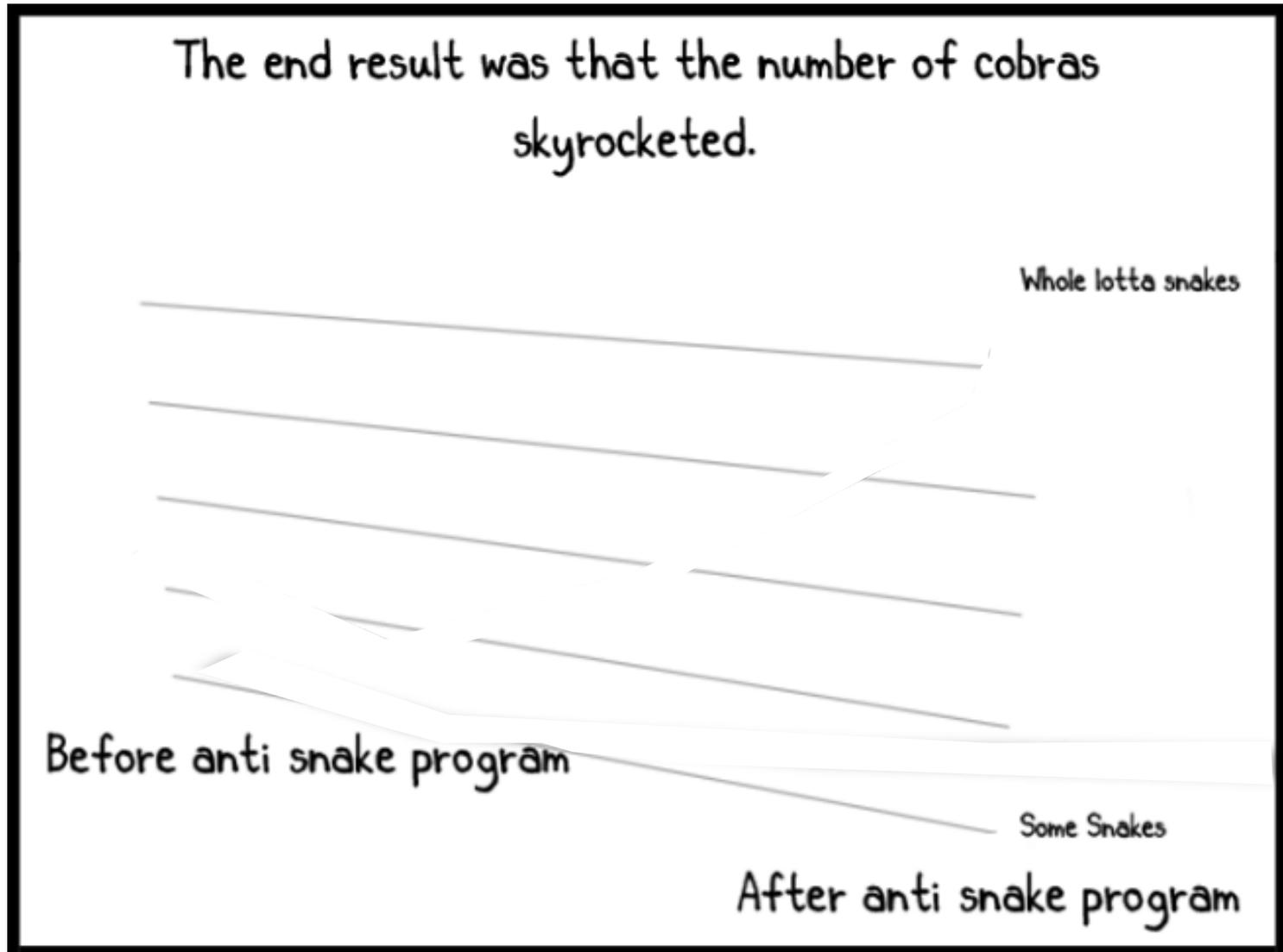
The Cobra Effect



The Cobra Effect



The Cobra Effect







40

Corporate Dr

© 2016 Google

Google earth



1. Stormwater = Bad

(move it away as quickly & efficiently as possible)

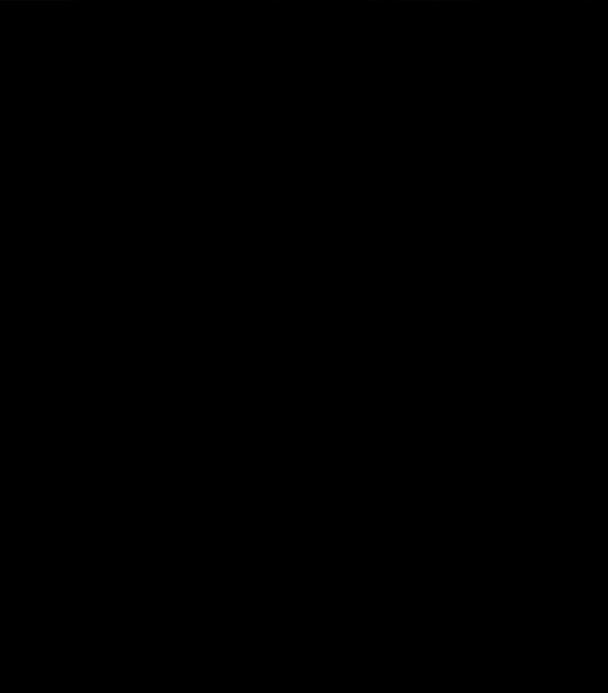
2. Any \$ from Development = Good

(regardless of long term maintenance cost)

**3. Developable Land > Floodplain
Preservation**

(regardless of stream impacts)







Complex Adaptive Systems

**Independent Agents Operating on
Simple Rules**

**Collective Dynamics Among the
Agents Produce Global Behavior or
Outcomes to Emerge**

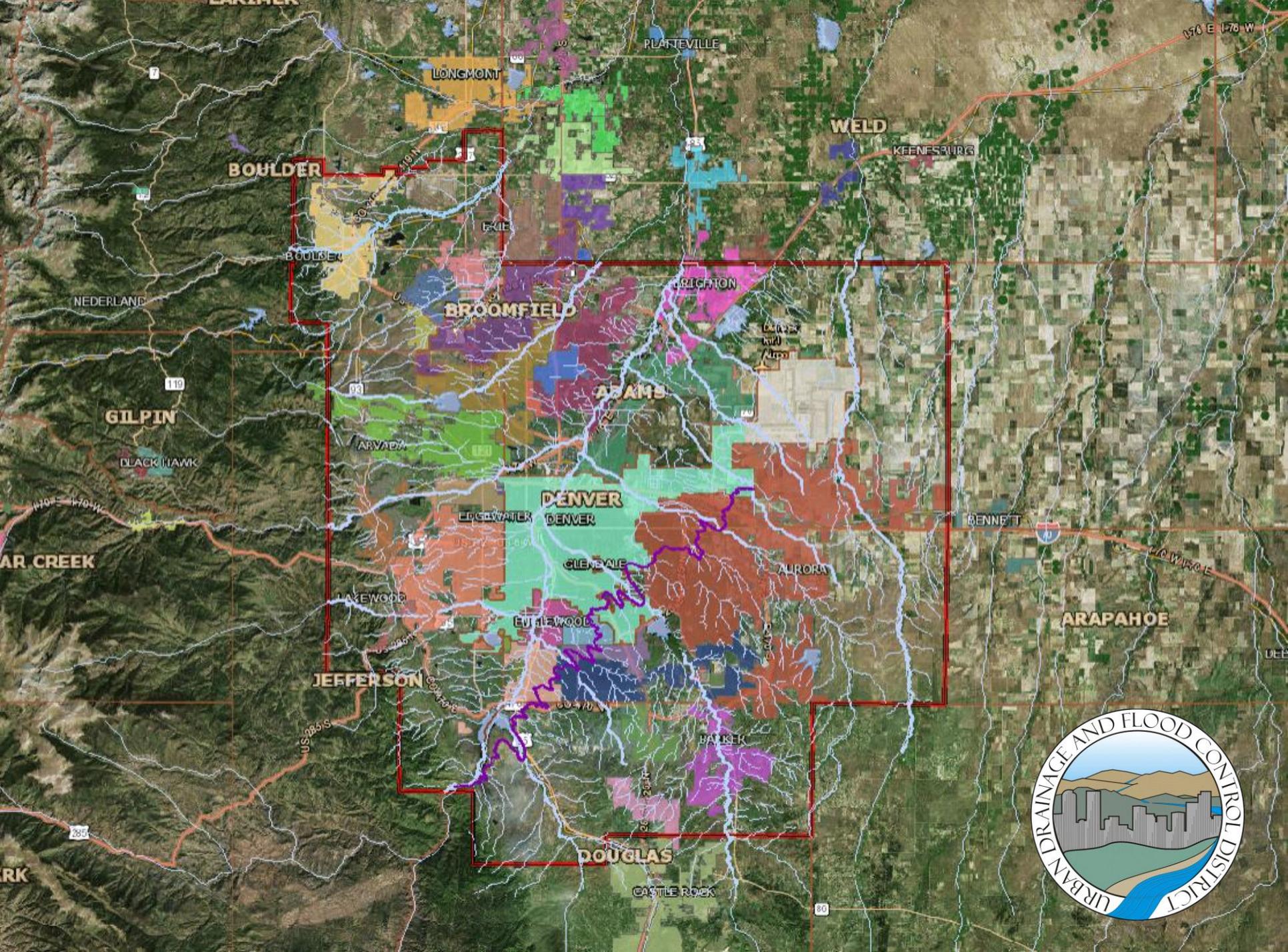
Complex Adaptive Systems



Complex Adaptive Systems



1. Stay Equidistant
2. Fly Towards the Center
3. Avoid Predators



BOULDER

LONGMONT

PLATEVILLE

WELD

KEENESBURG

NEDERLAND

BROOMFIELD

WRIGHT

110

GILPIN

BLACK HAWK

ARVADA

ARAHS

DENVER

EDGEMONT

GLENDALE

AURORA

BENNETT

STAR CREEK

LAYWOOD

EUREKA

ARAPAHOE

JEFFERSON

BARKER

DOUGLAS

CASTLE ROCK



Systems Thinking

Systems thinking is a vantage point from which you see a whole, a web of relationships & interconnectedness, rather than focusing only on the specific detail of any particular piece.

Systems Thinking



Systems Thinking



Systems Thinking

Systems thinking is a vantage point from which you see a whole, a web of relationships & interconnectedness, rather than focusing only on the specific detail of any particular piece.

Events are seen in the larger context of a pattern that is unfolding over time.

Systems Thinking

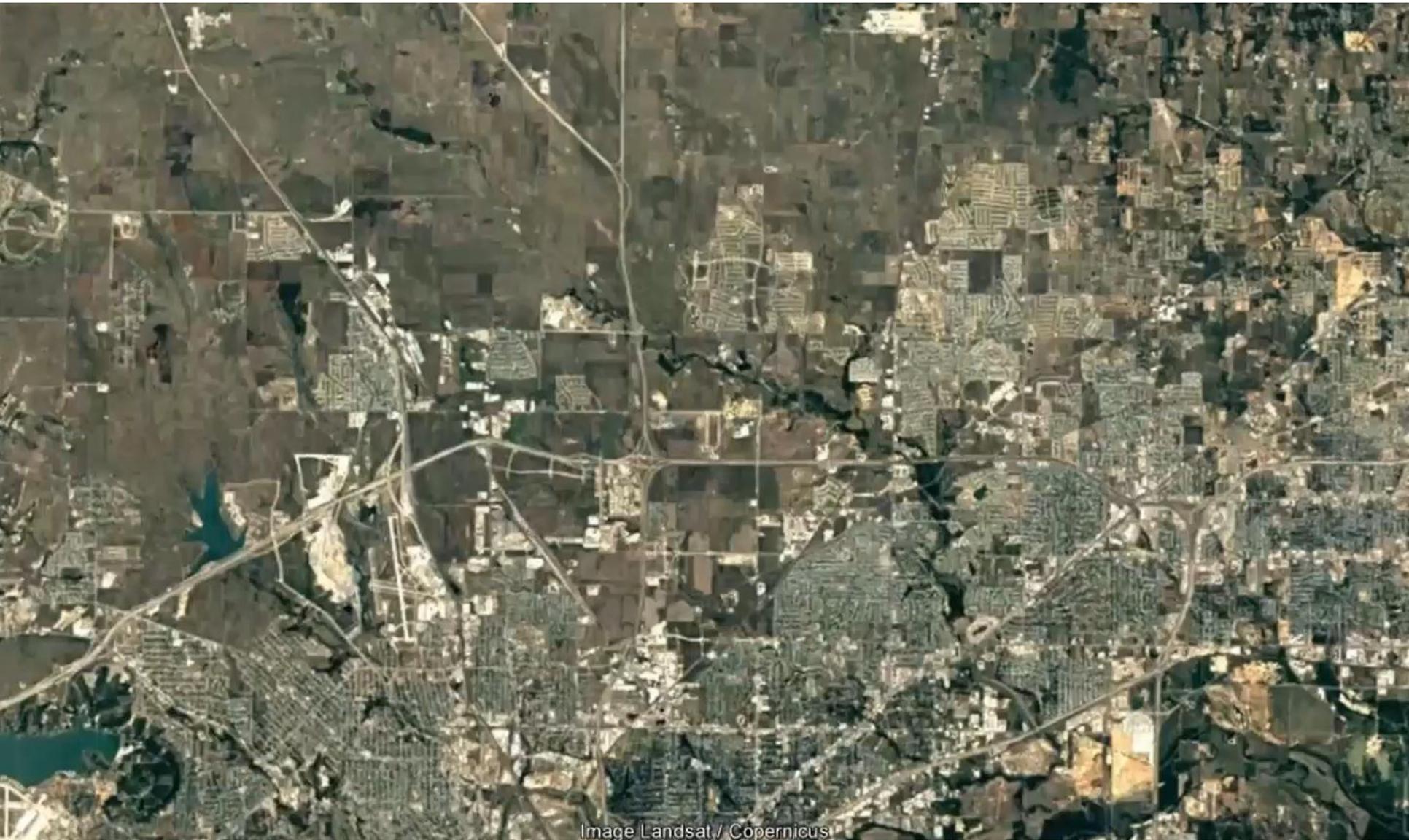


Image Landsat / Copernicus



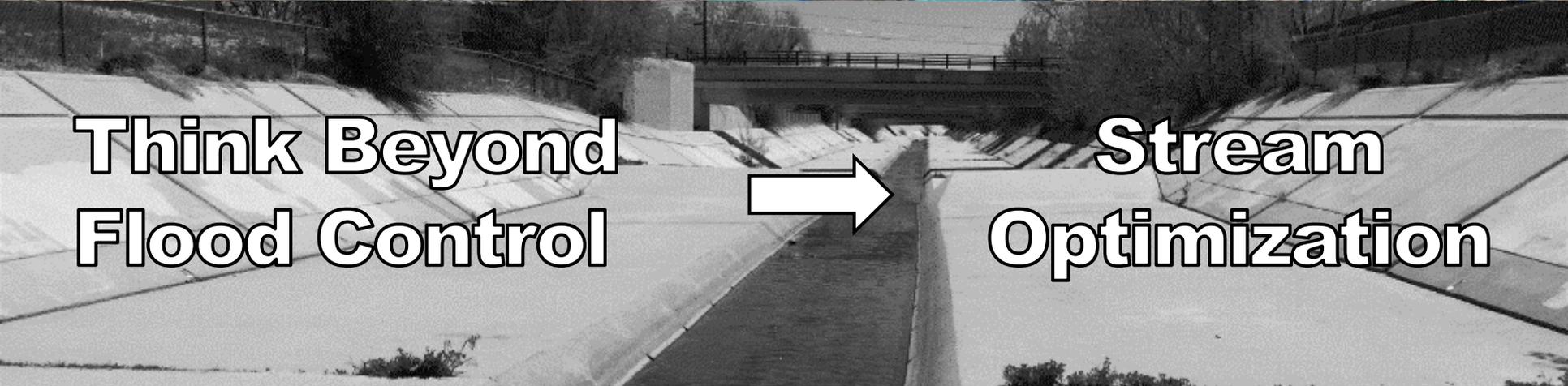
**Think Beyond Our
Project Location**

Image Landsat / Copernicus



**Time & \$\$\$
Efficiency**

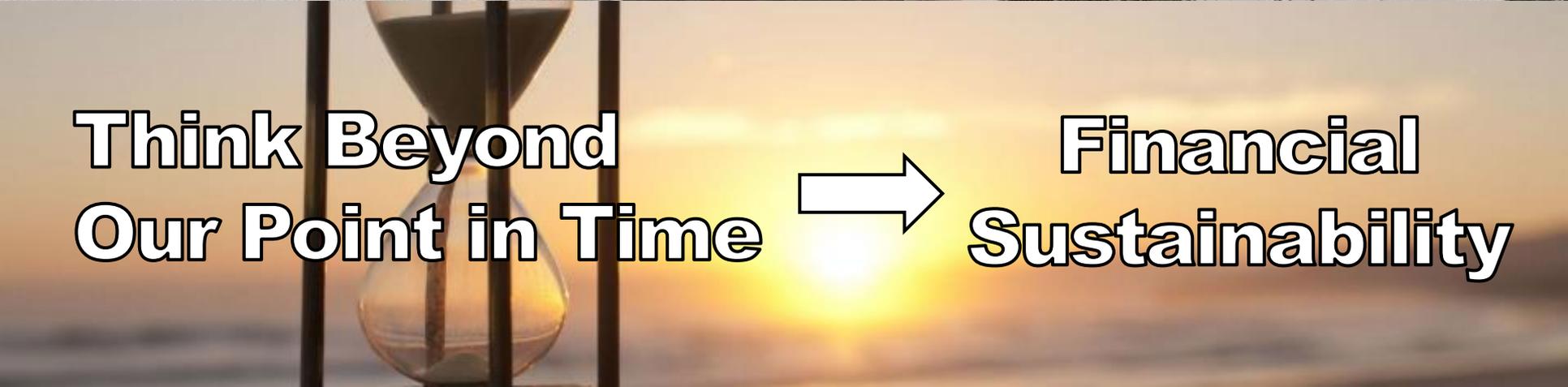
Google earth



**Think Beyond
Flood Control**



**Stream
Optimization**



**Think Beyond
Our Point in Time**



**Financial
Sustainability**

An aerial satellite view of a city and surrounding landscape. A complex network of blue lines is overlaid on the terrain, representing water flow paths or a hydrological model. The lines are thicker in some areas and thinner in others, following the natural contours and drainage patterns of the land. The background shows a mix of urban development, agricultural fields, and natural terrain.

**Think Beyond Our
Project Location**

Image Landsat / Copernicus

Google earth





Insect “A”



**More Pesticide =
Less Insects =
Higher Crop Yield**



Insect “A”



Insect "A"

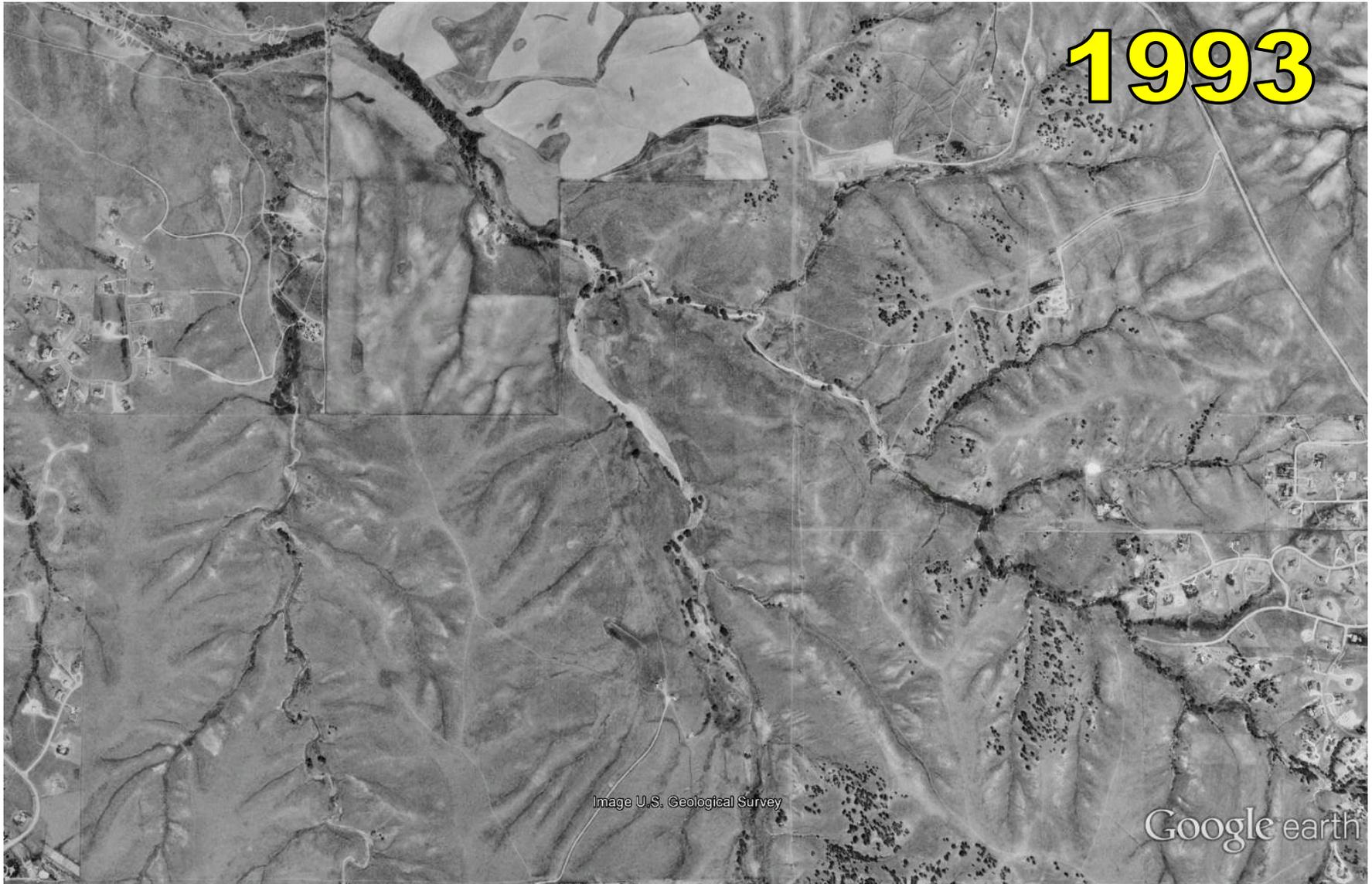
Insect "B"



Piney Creek Sediment Issues



Piney Creek Sediment Issues



Piney Creek Sediment Issues



Piney Creek Sediment Issues



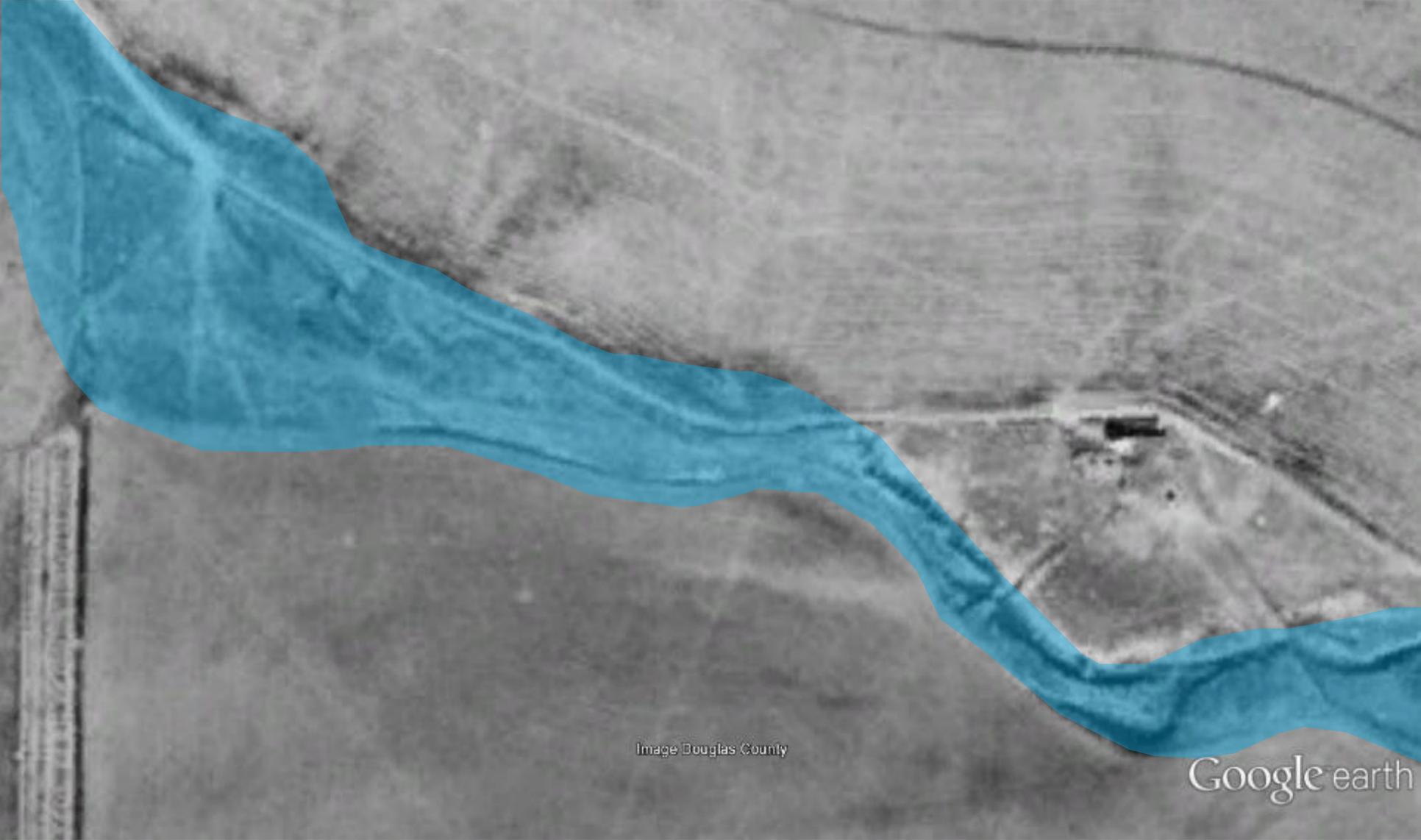
Piney Creek Sediment Issues



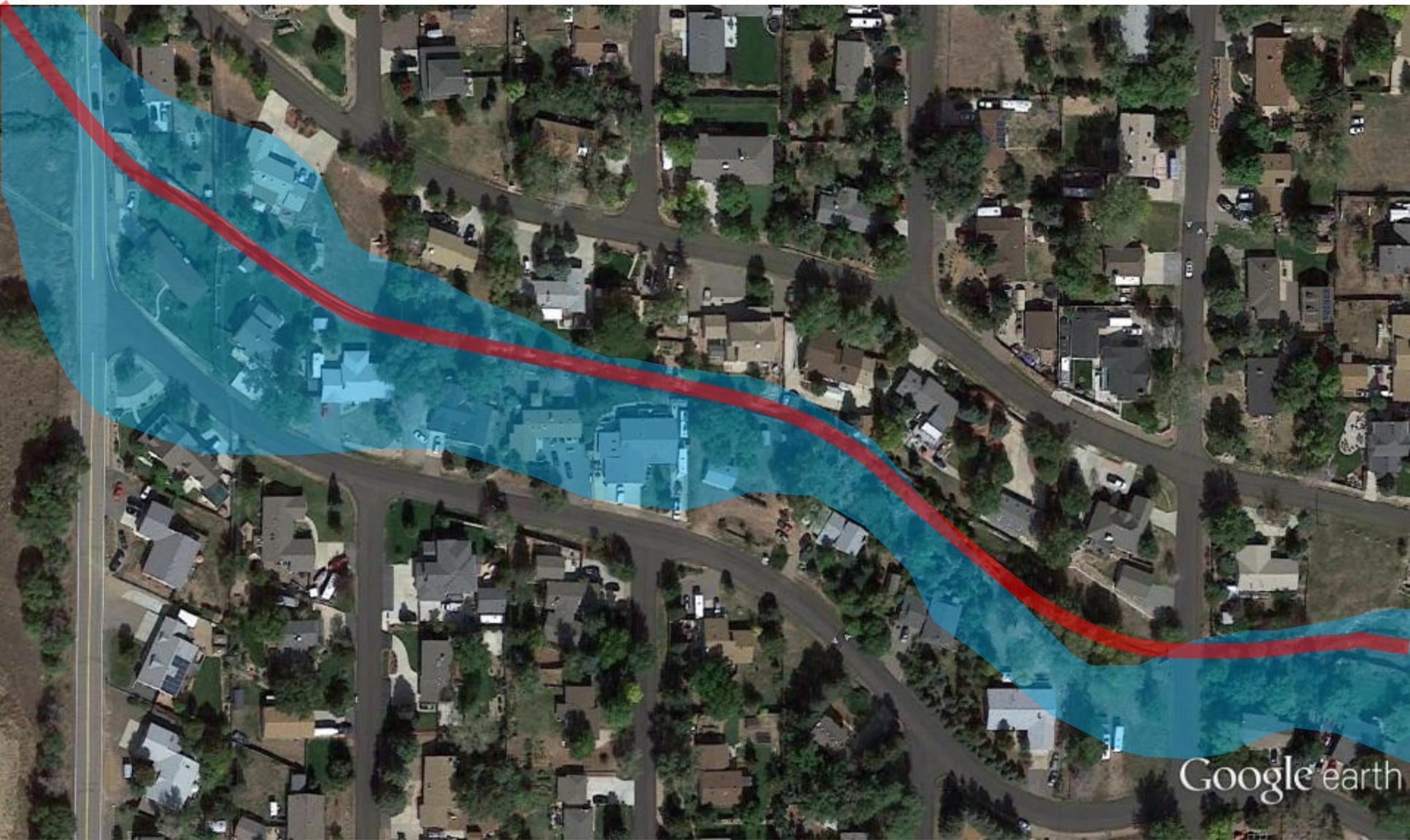




Developer Driven Projects



Developer Driven Projects

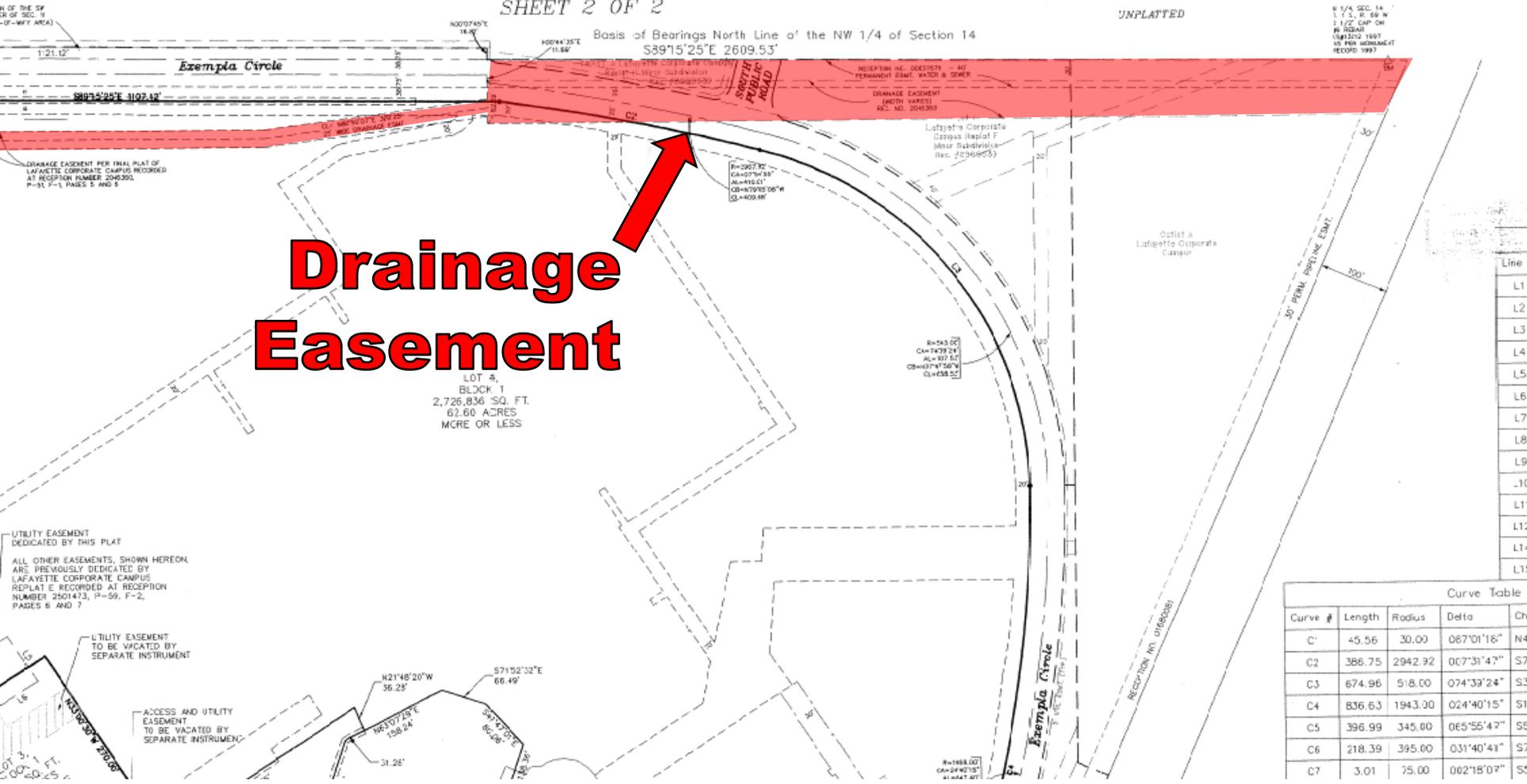


Developer Driven Projects



Developer Driven Projects

LOCATED IN THE NW 1/4 OF SECTION 14, TOWNSHIP 1 SOUTH, RANGE 69 WEST OF THE 6TH P.M.
CITY OF LAFAYETTE, BOULDER COUNTY, STATE OF COLORADO
SHEET 2 OF 2



Developer Driven Projects



Think Beyond Flood Control



AUTOCENTRIC STREET



COMPLETE STREET



FLOODCENTRIC STREAM



AUTOCENTRIC STREET



FLOODCENTRIC STREAM



FLOODCENTRIC STREAM



FLOODCENTRIC STREAM



FLOODCENTRIC STREAM



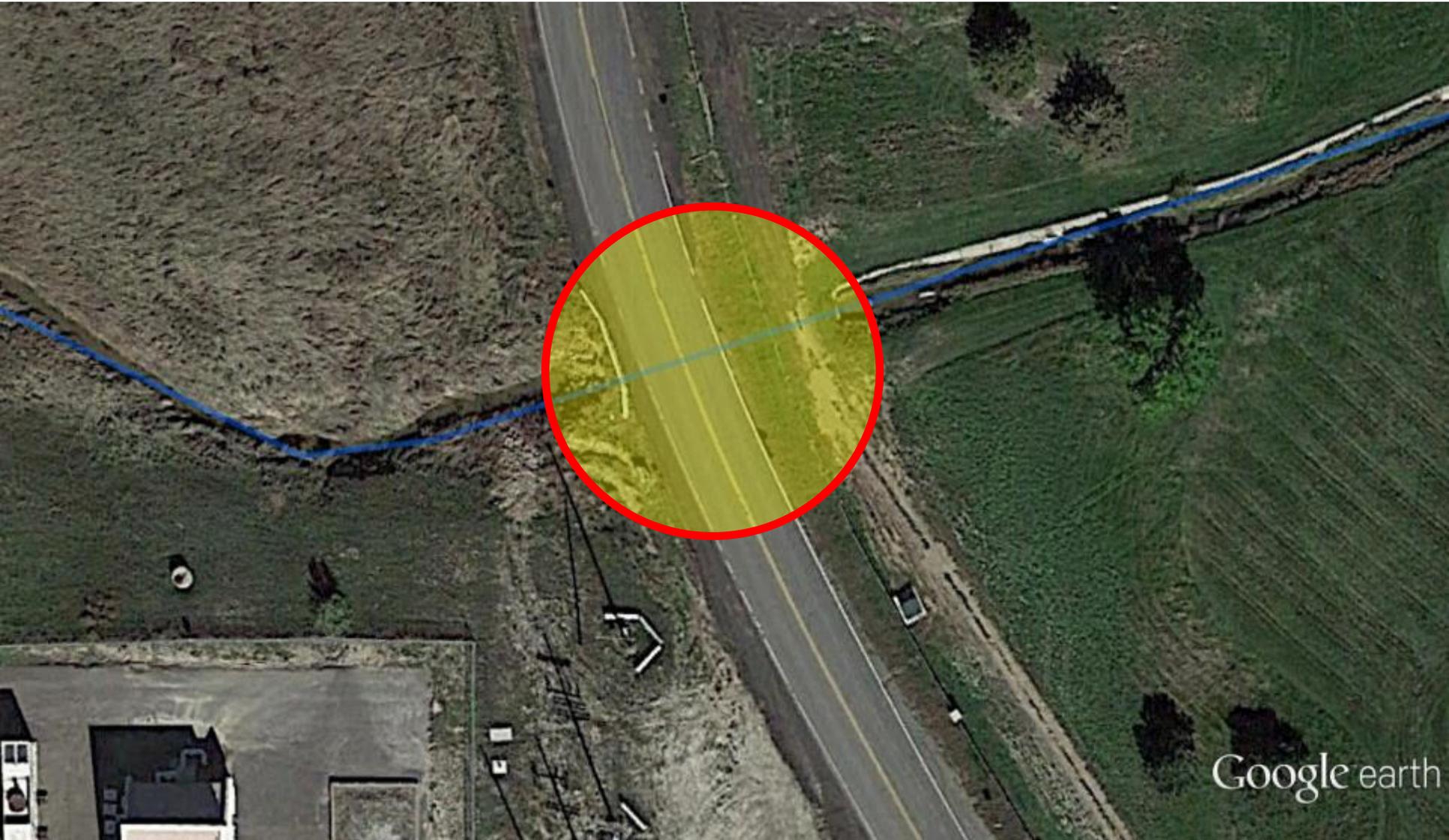
FLOODCENTRIC STREAM



FLOODCENTRIC STREAM



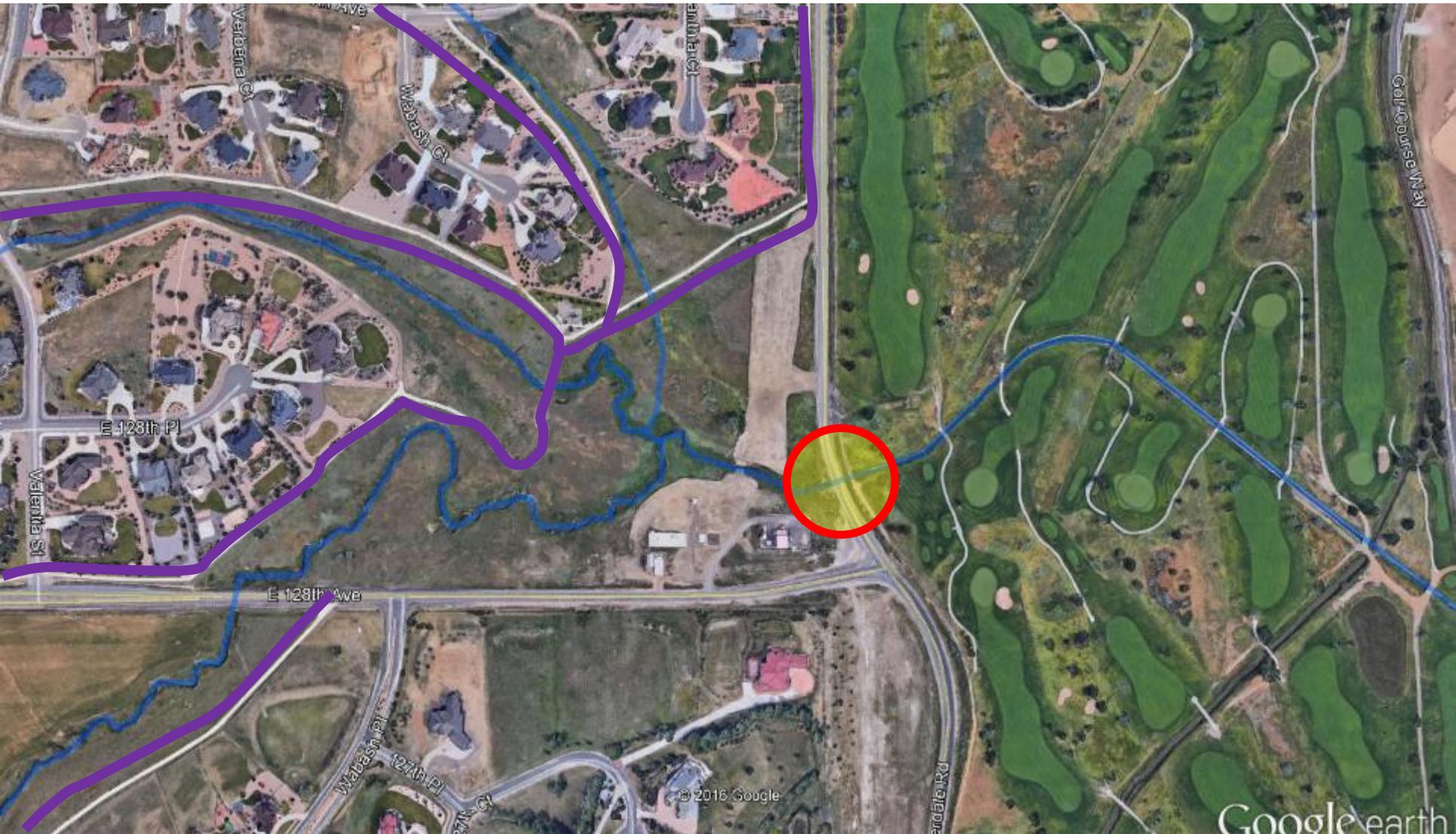
Brantner Gulch at Riverdale Road



Brantner Gulch at Riverdale Road



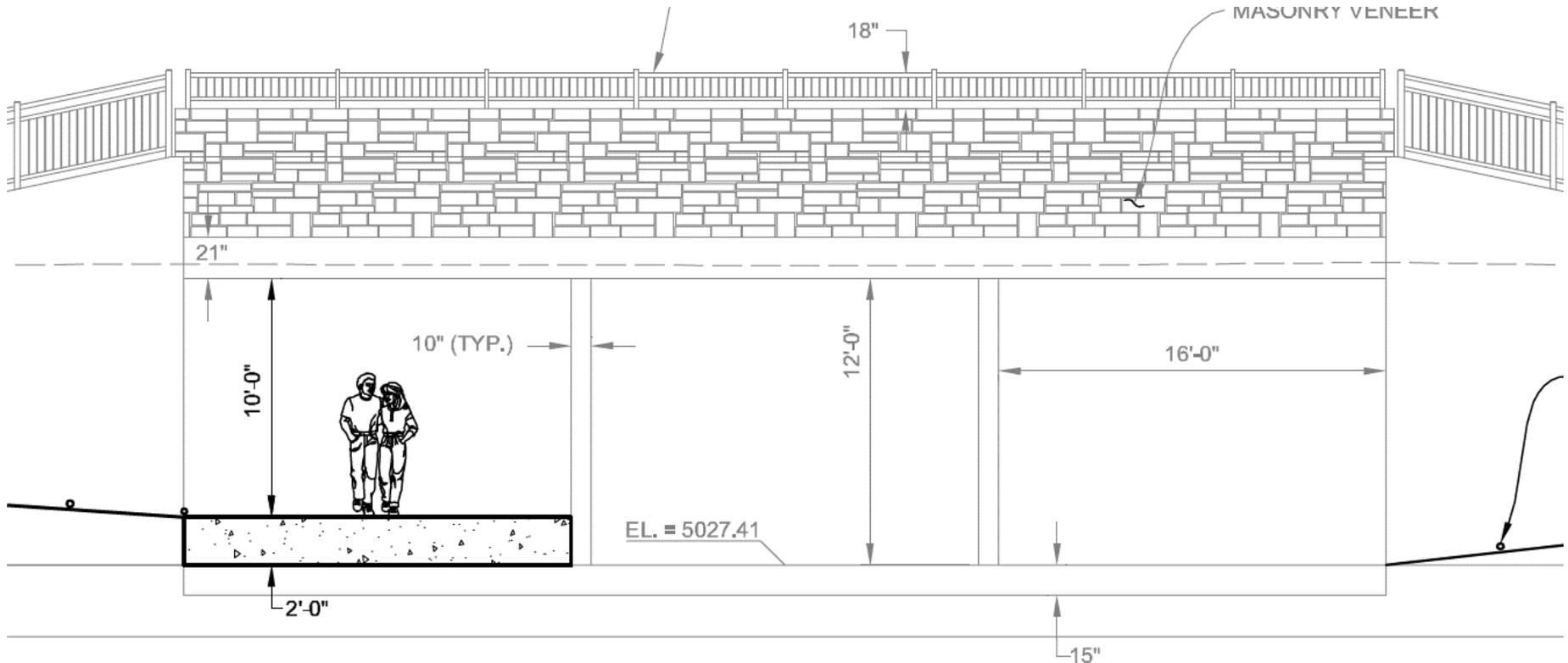
Brantner Gulch at Riverdale Road



Brantner Gulch at Riverdale Road



Brantner Gulch at Riverdale Road



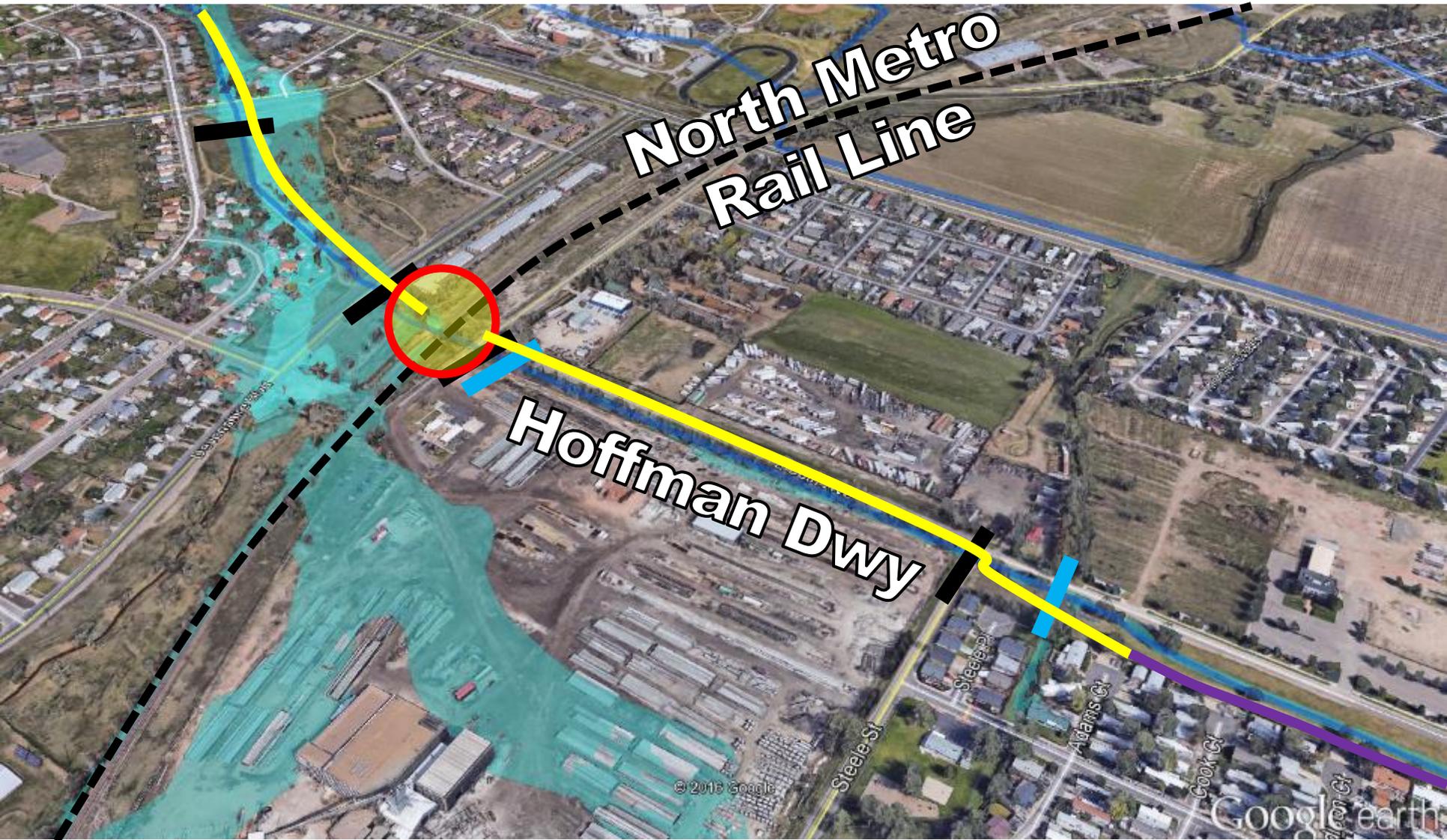
ACCOUNT FOR UP TO
THE NORTH OR
OF CONSTRUCTING
(VN).

WEST (UPSTREAM) FACE PROFILE

SCALE: 1" = 5'-0"

IS NOT INCLUDED

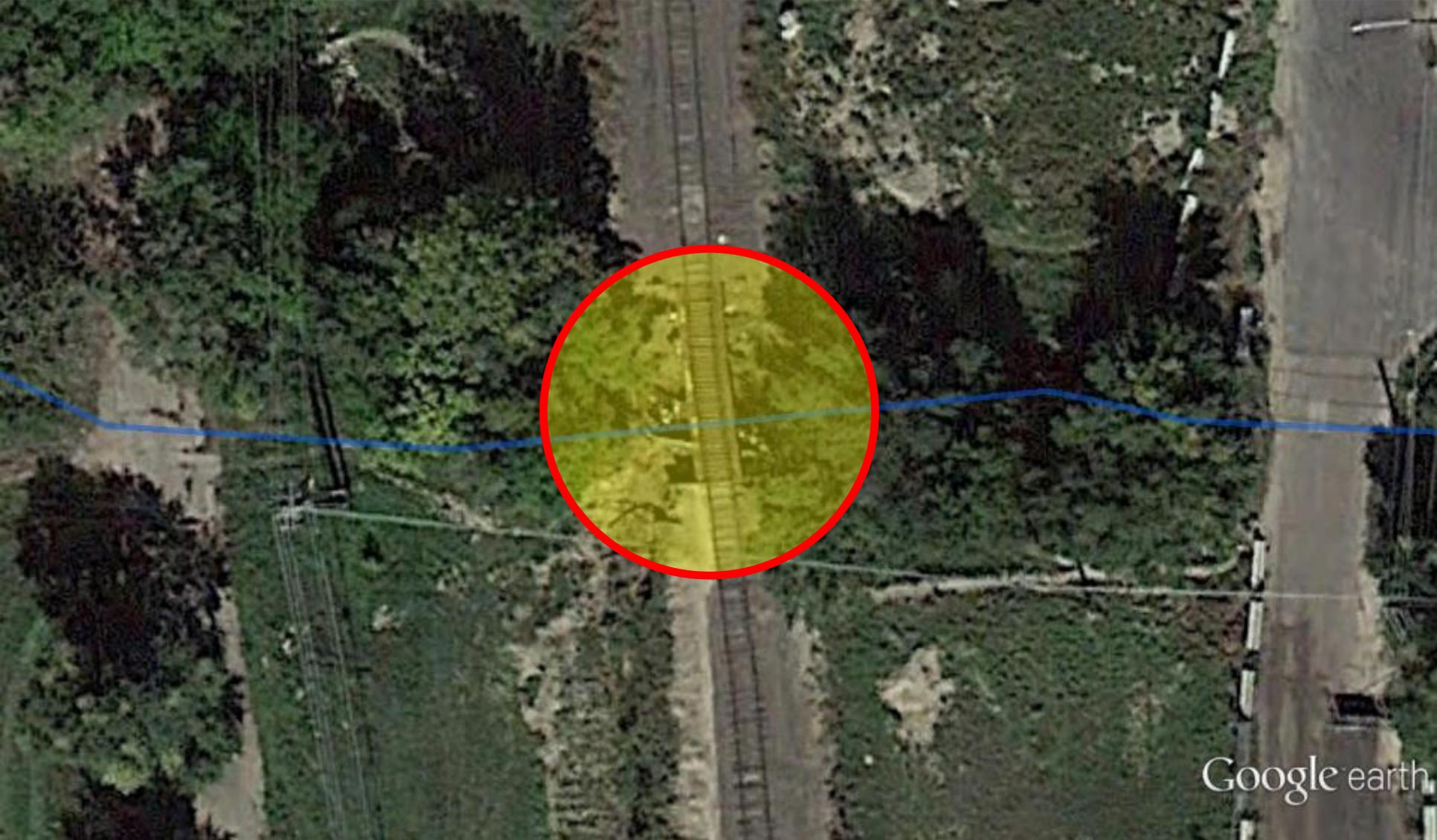
Hoffman Drainageway



Hoffman Drainageway



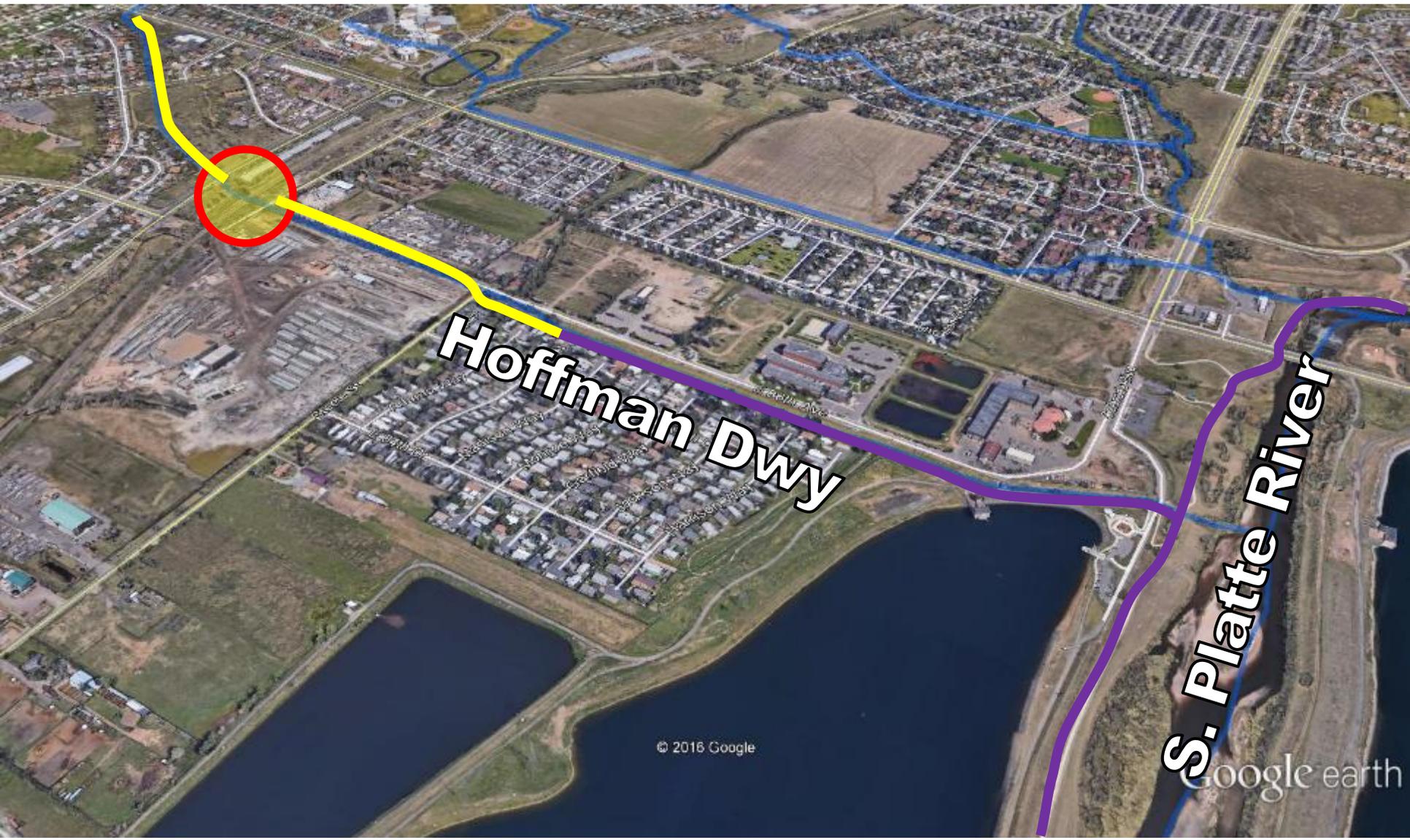
Hoffman Drainageway



Hoffman Drainageway



Hoffman Drainageway



An hourglass is positioned on the left side of the image, resting on a dark, textured surface that resembles a human brain. The hourglass is made of dark metal with two glass bulbs. The top bulb is partially filled with dark sand, while the bottom bulb is mostly empty. The background is a soft, out-of-focus sunset or sunrise over a body of water, with a bright sun low on the horizon creating a warm, golden glow. The overall mood is contemplative and philosophical.

**Think
Beyond Our
Point in Time**

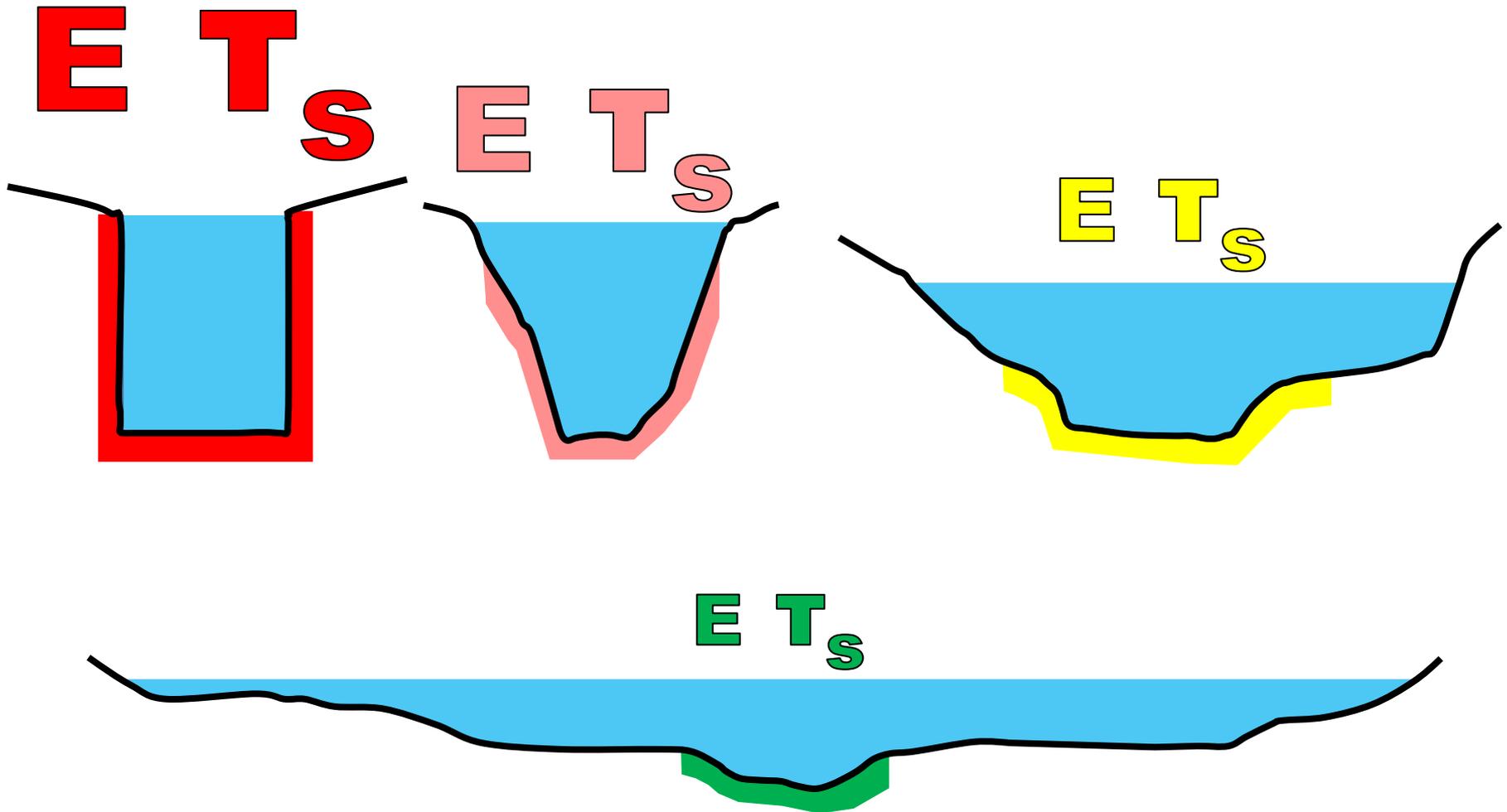
Think Beyond Our Point in Time



Think Beyond Our Point in Time



Natural Floodplain Preservation



Natural Floodplain Preservation



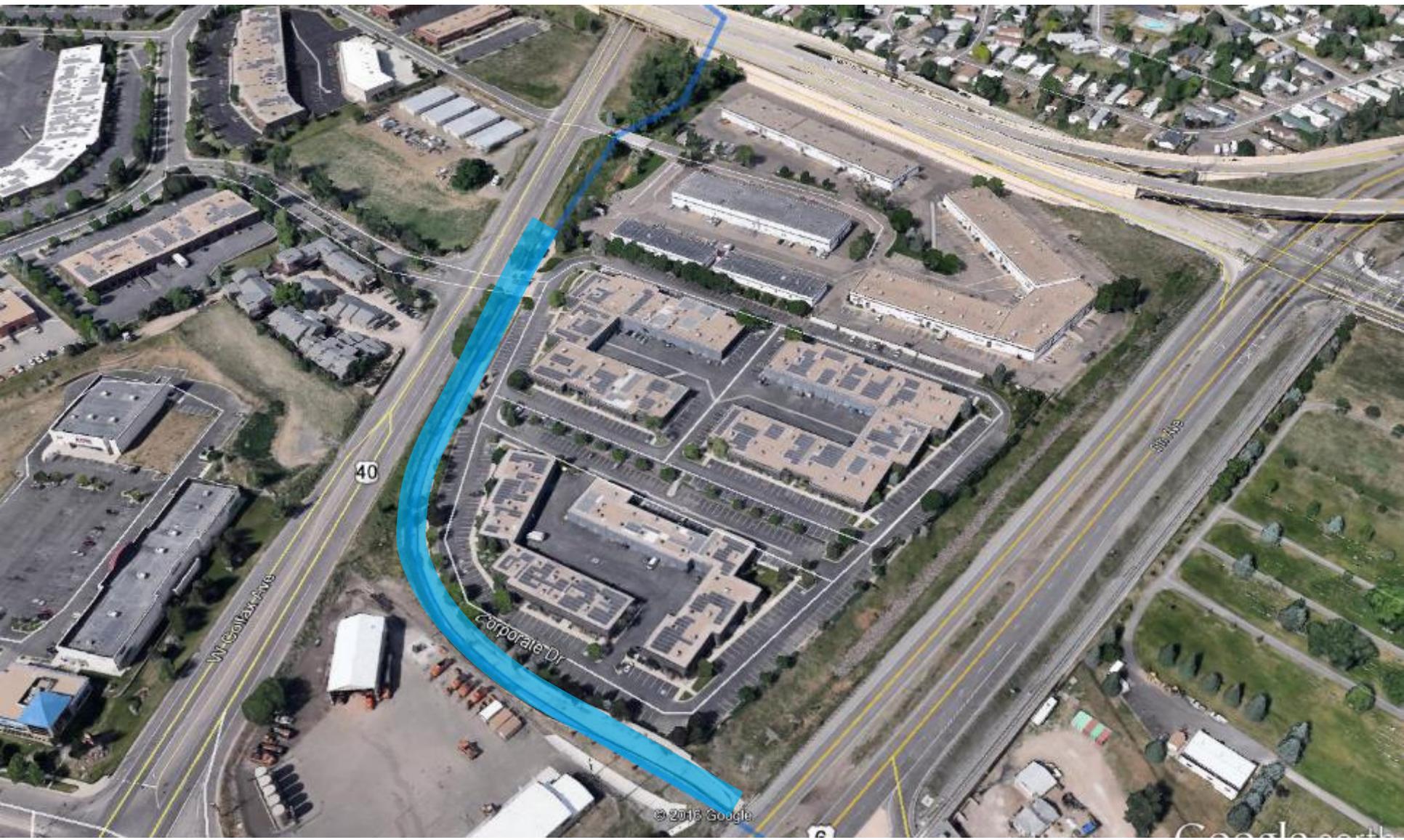
Think Beyond Our Point in Time



Lena Gulch



Lena Gulch



Lena Gulch



UDFCD Funding

Total \$268/yr

Maintenance \$97/yr

Lena Gulch

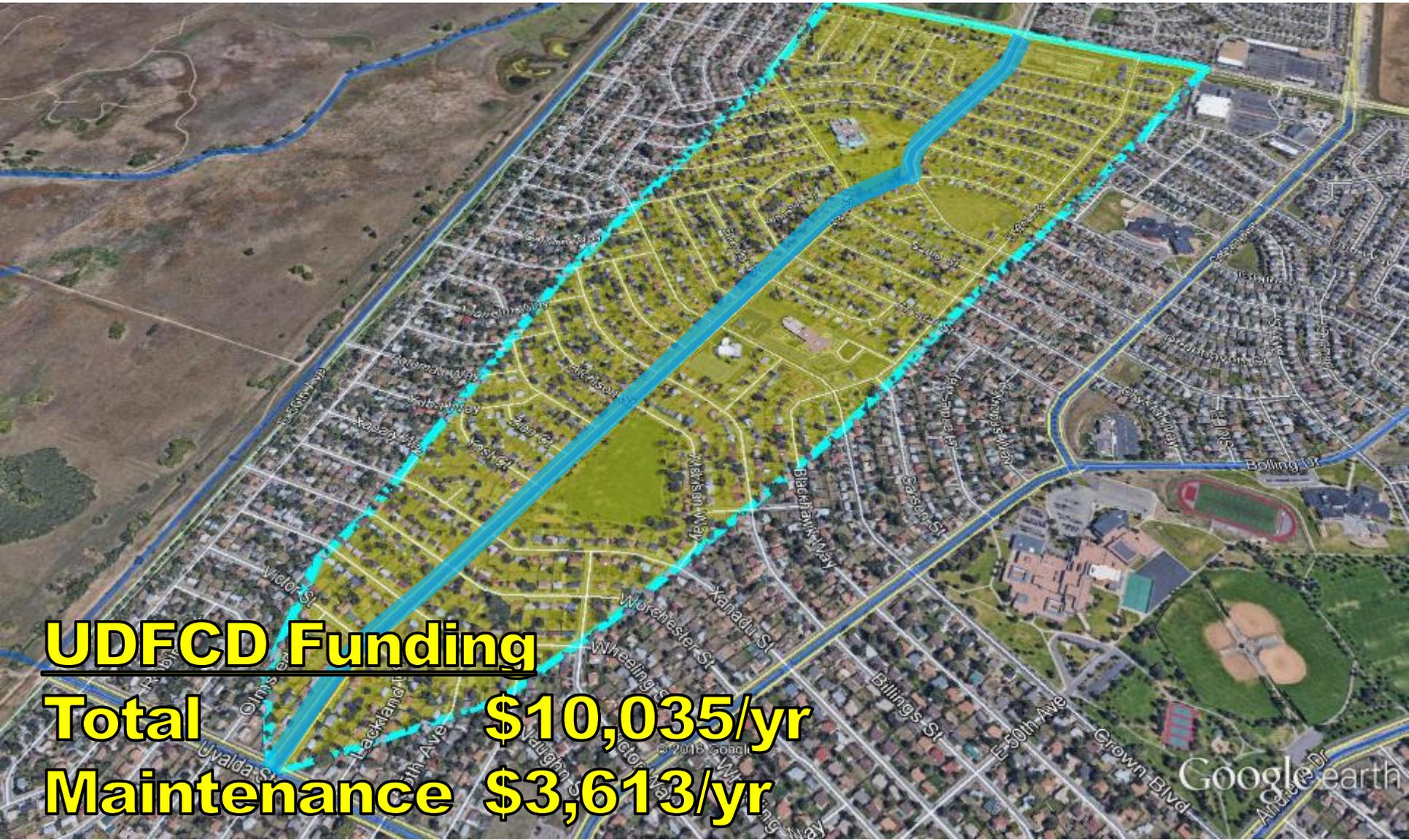


17,000 YEARS

Maxwell Tributary



Maxwell Tributary



UDFCD Funding

Total \$10,035/yr

Maintenance \$3,613/yr

Maxwell Tributary



Maxwell Tributary



750 YEARS

Newlin Gulch



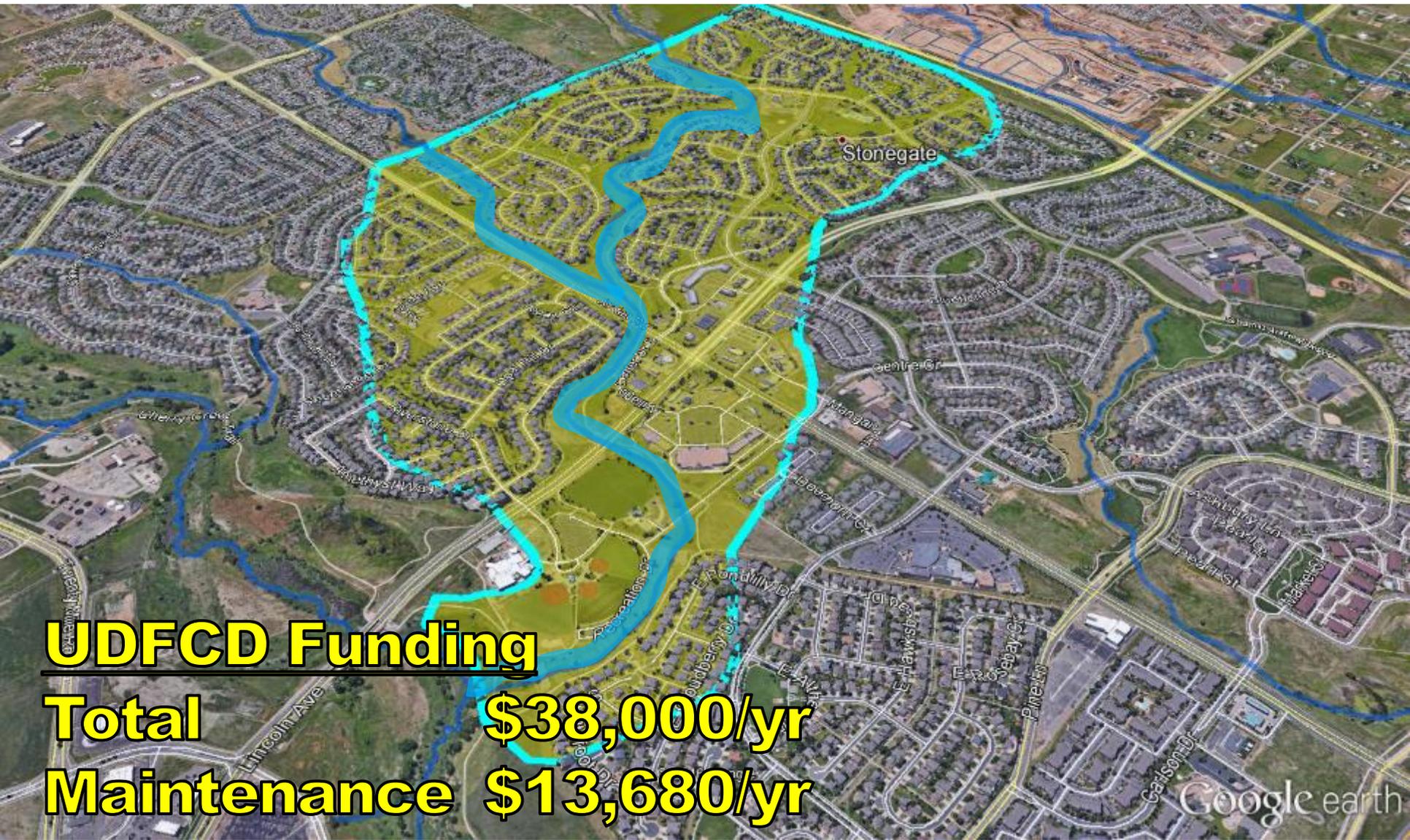
Newlin Gulch



Newlin Gulch



Newlin Gulch



UDFCD Funding

Total \$38,000/yr

Maintenance \$13,680/yr

Newlin Gulch



300 YEARS

Rock Creek



Rock Creek



Rock Creek



Rock Creek



UDFCFD Funding
Total \$7,460/yr
Maintenance \$2,685/yr

Rock Creek



200 YEARS

Rock Creek

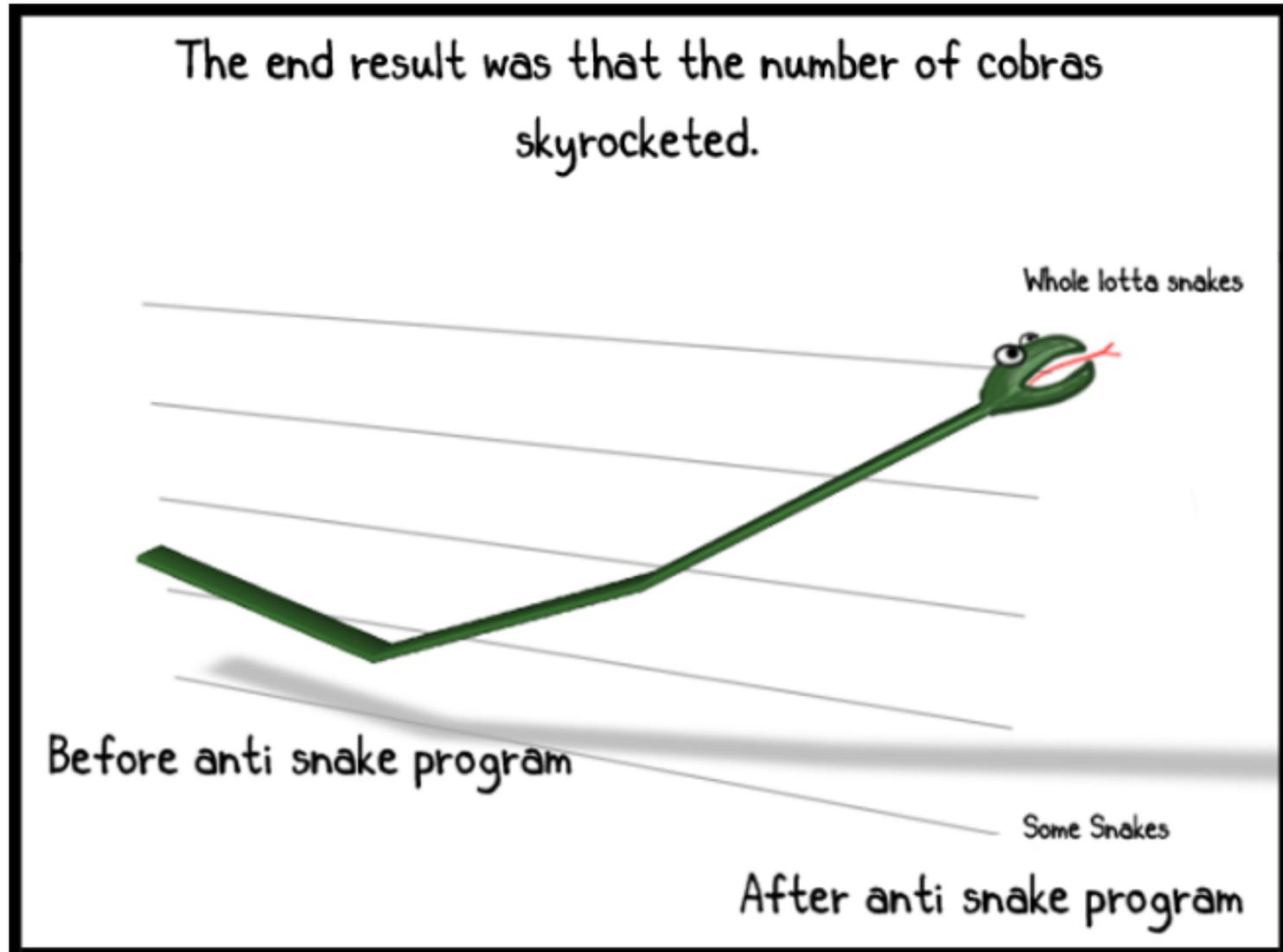


~~200 YEARS~~
70 YEARS

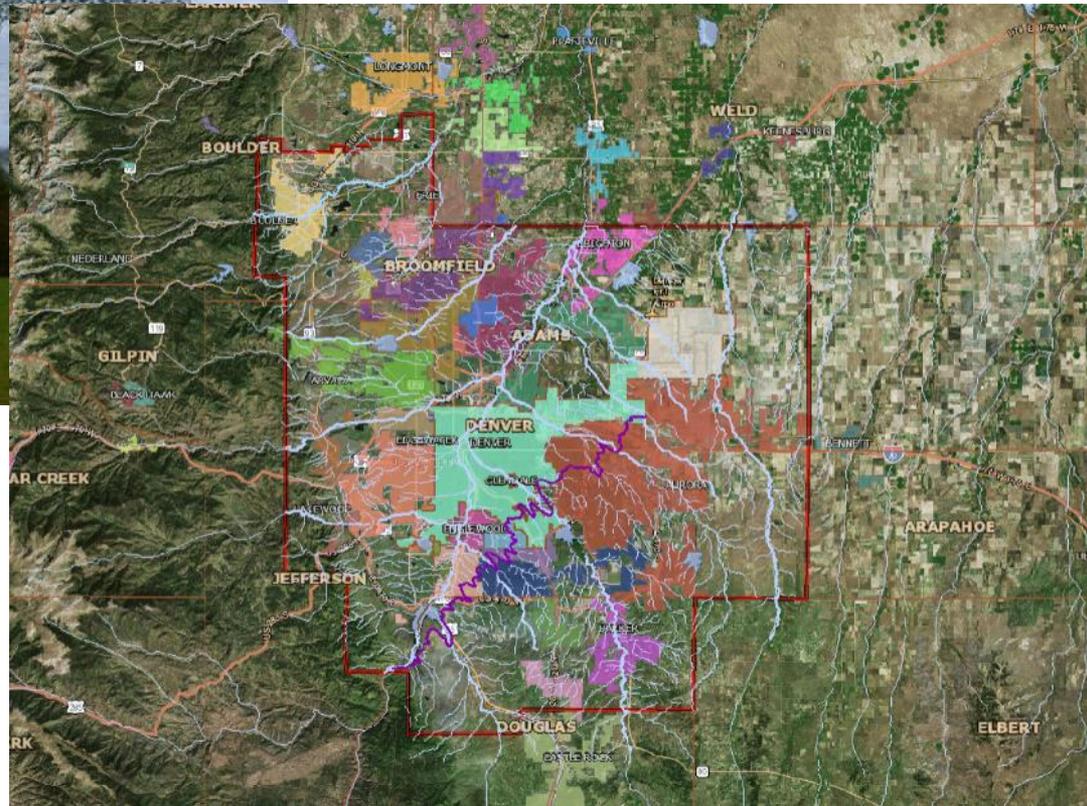
Natural Floodplain Preservation



Find Unintended Consequences



Recognize System Structure



Investigate Cause and Effect

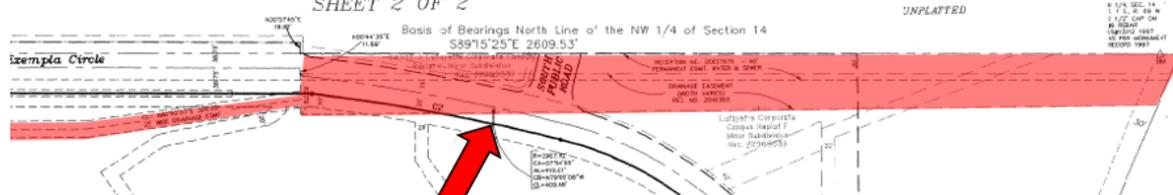


Change Perspective



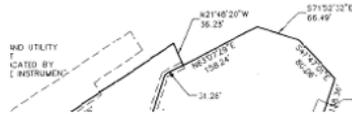
Look for Leverage

THE NW 1/4 OF SECTION 14, TOWNSHIP 1 SOUTH, RANGE 69 WEST OF THE 6TH P.M.
CITY OF LAFAYETTE, BOULDER COUNTY, STATE OF COLORADO
SHEET 2 OF 2



**Drainage
Easement**

LOT 8,
BLOCK 1
2,720,836 SQ. FT.
63.60 ACRES
MORE OR LESS



Seek to Understand the Big Picture



Use Feedback and Adjust





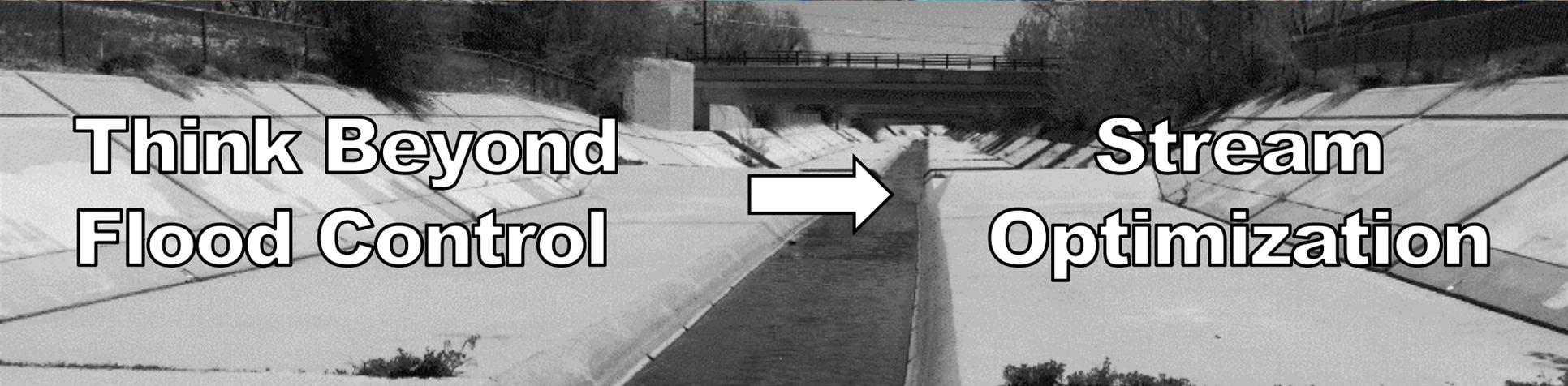
**Think Beyond Our
Project Location**

Image Landsat / Copernicus



**Time & \$\$\$
Efficiency**

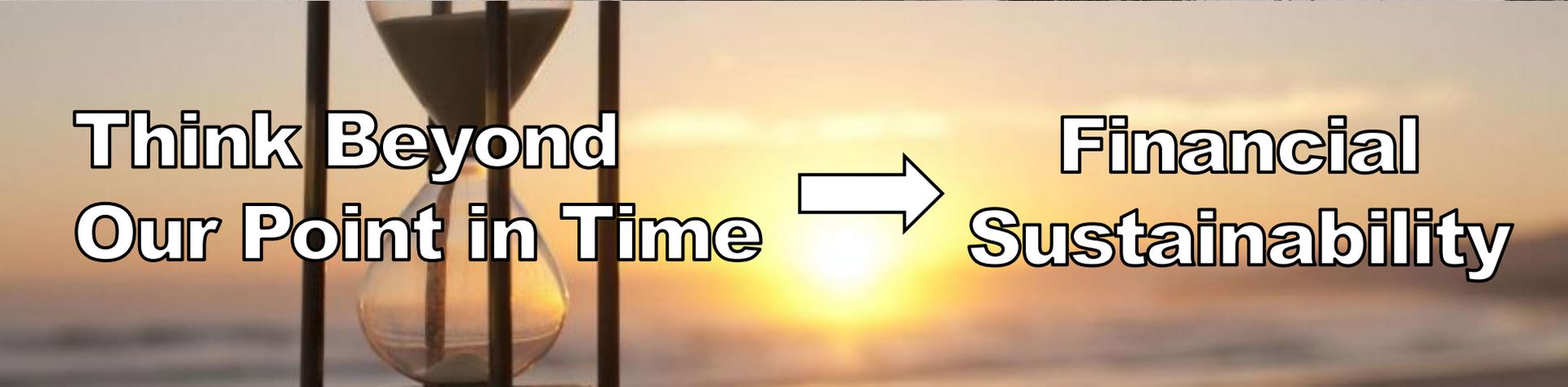
Google earth



**Think Beyond
Flood Control**



**Stream
Optimization**



**Think Beyond
Our Point in Time**



**Financial
Sustainability**