"Make It Rain" Gardens: A Contractor's Experiences in Green Stormwater Infrastructure

By Shannon Brown, Founder
Ecosystem Regeneration Artisans

Who?
What?
Why?

The Soil Sponge

Install

Plan

Rain Tested

ERAnativeland.com

Who? What? Why?

Rain gardens capture stormwater, transforming flooding liabilites into groundwater assets.

Since 2017, We've Built 300+ Rain Gardens!

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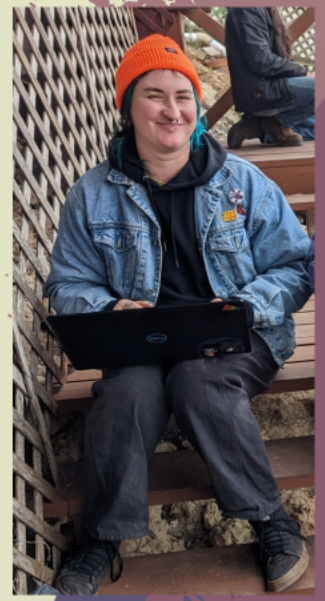
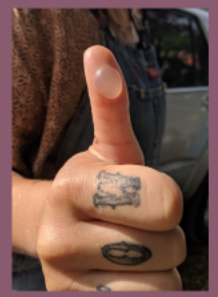
Creating Green Jobs with GSI!





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Rainscape Components

Dry Creek

conveys water between areas, elevations in channel must be exact for appropriate flow

Berm

downhill from basin, made by mounding soil excavated from basin area

December

June

Basin

excavated area where rainwater pools temporarily with inflow and outflow points

Don't forget the native plants!

Select species that can thrive with temporary inundation for basins, and dry-loving species for berms

ainscape
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for Water & Wildlife

- Filter runoff pollution
- Recharge local groundwater
- Conserve water
- Improve water quality
- Protect rivers and streams
- Reduce potential flooding
- Habitat for wildlife
- Drought hardy
- Low maintenance (compared to lawn)
- Enhance curb appeal
- Our desired future!

Choose Clean, Clear & Flowing!

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What can be done to manage water exclusively within our clients' property lines?

Watershed Analysis

Design

Lessons Learned:
Powerful tool
with some limitations:

- Often old data sets
- Shows normal patterns, not extreme events
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Delineate Micro-watershed Boundaries
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Detailed Topography
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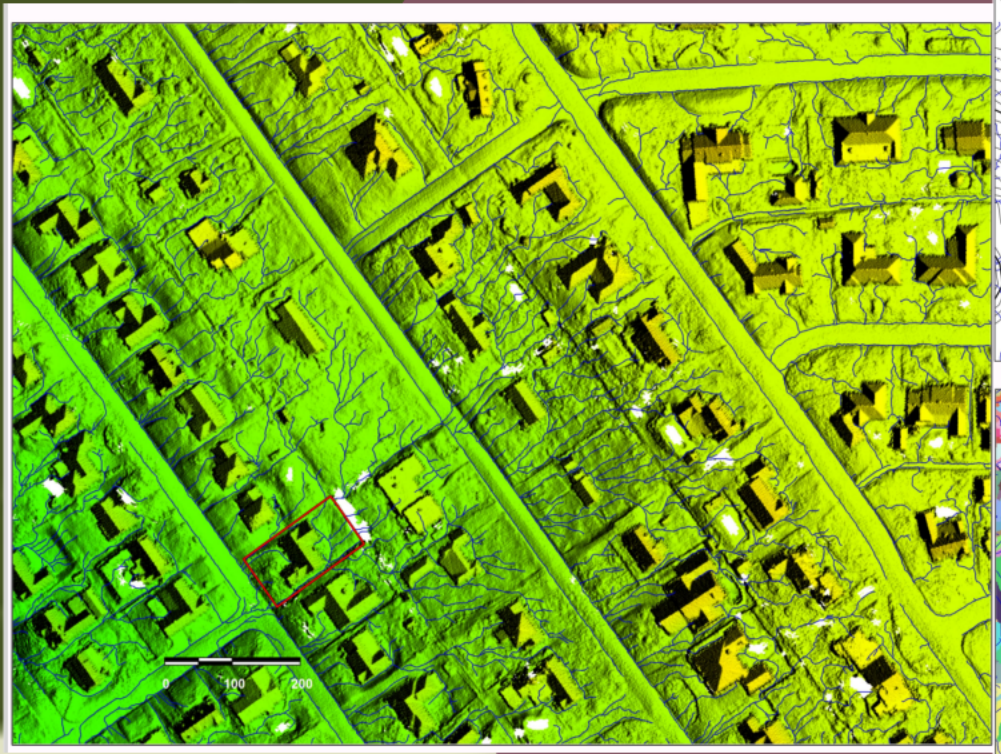
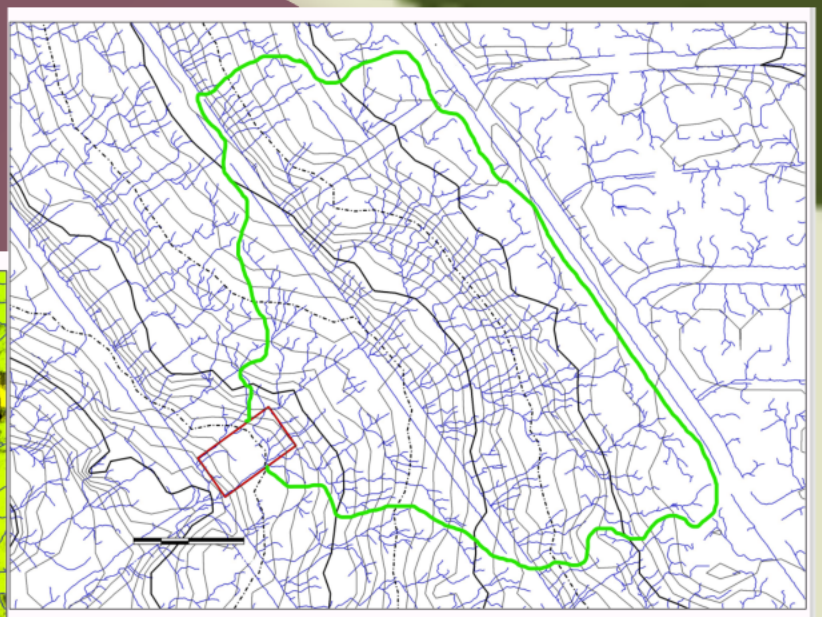
Story Time

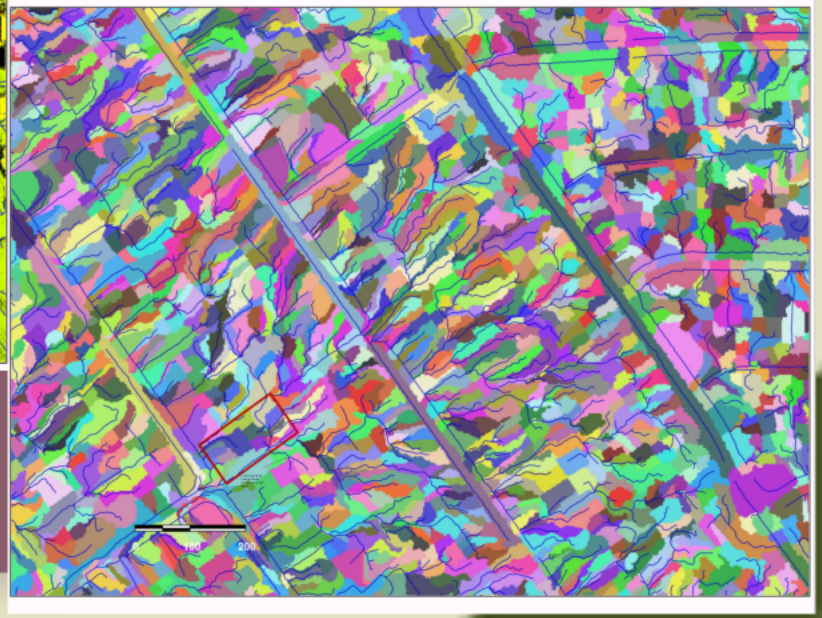
Missed Opportunity

"We live in an upland area but the back door floods and the French drain doesn't work!"

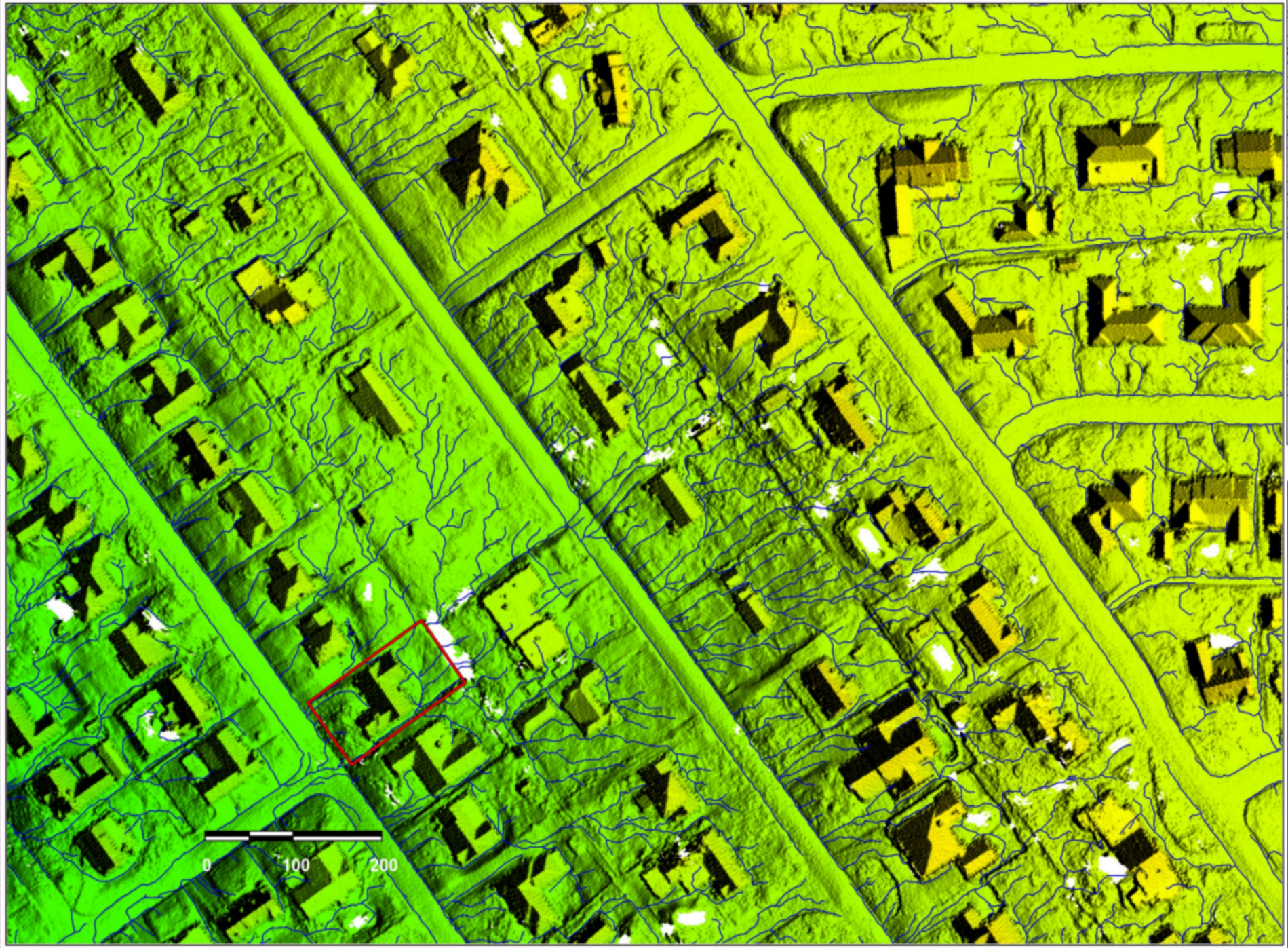
Why does flood water come through the backdoor?







Over 12 acres drains into this yard!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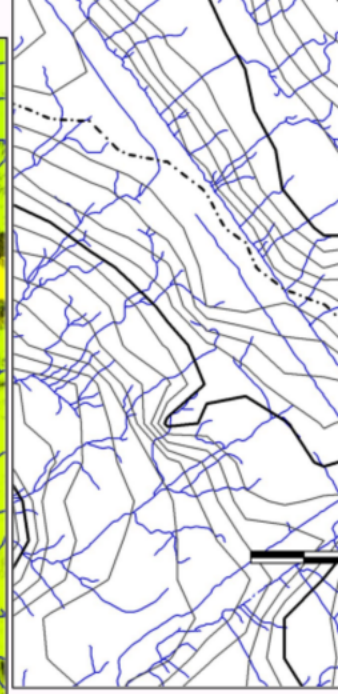

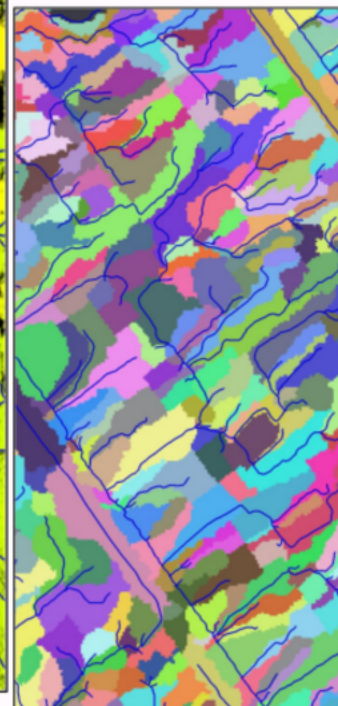

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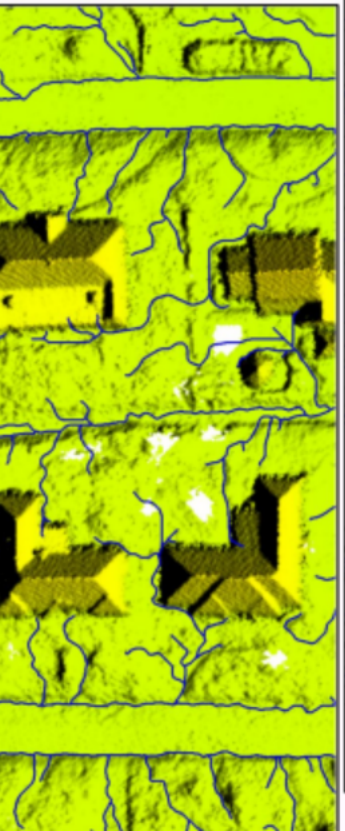

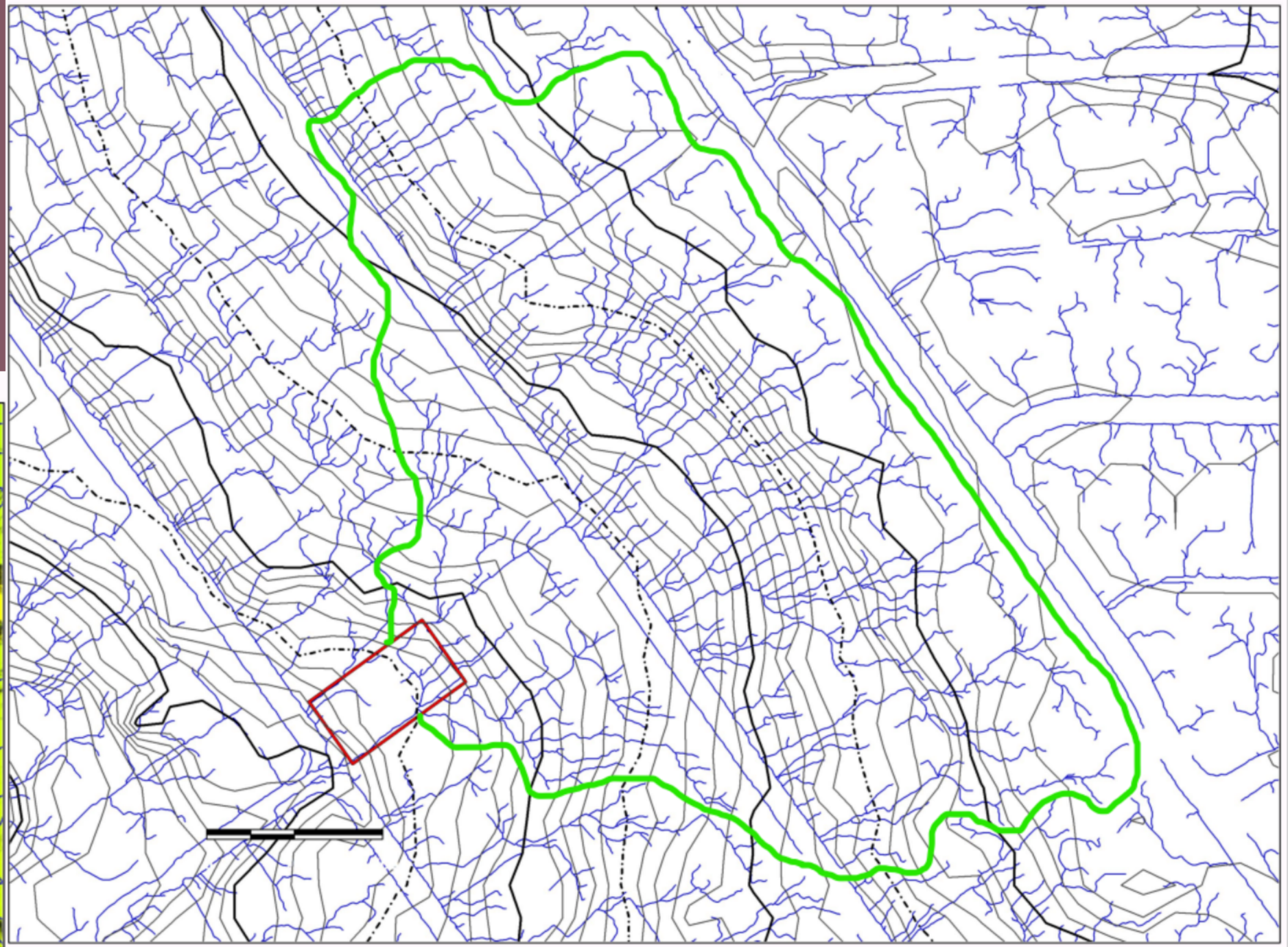

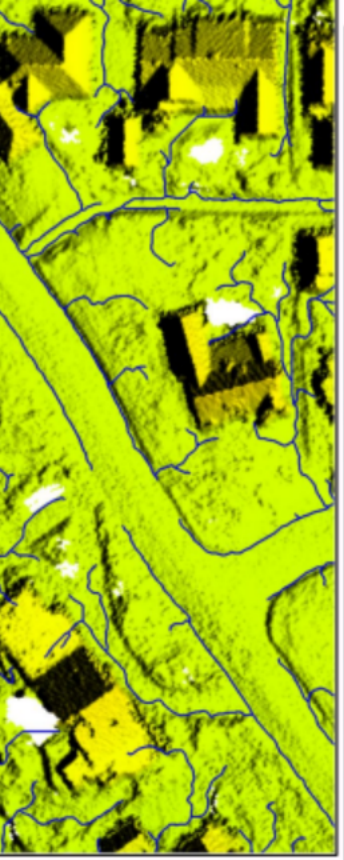

drains
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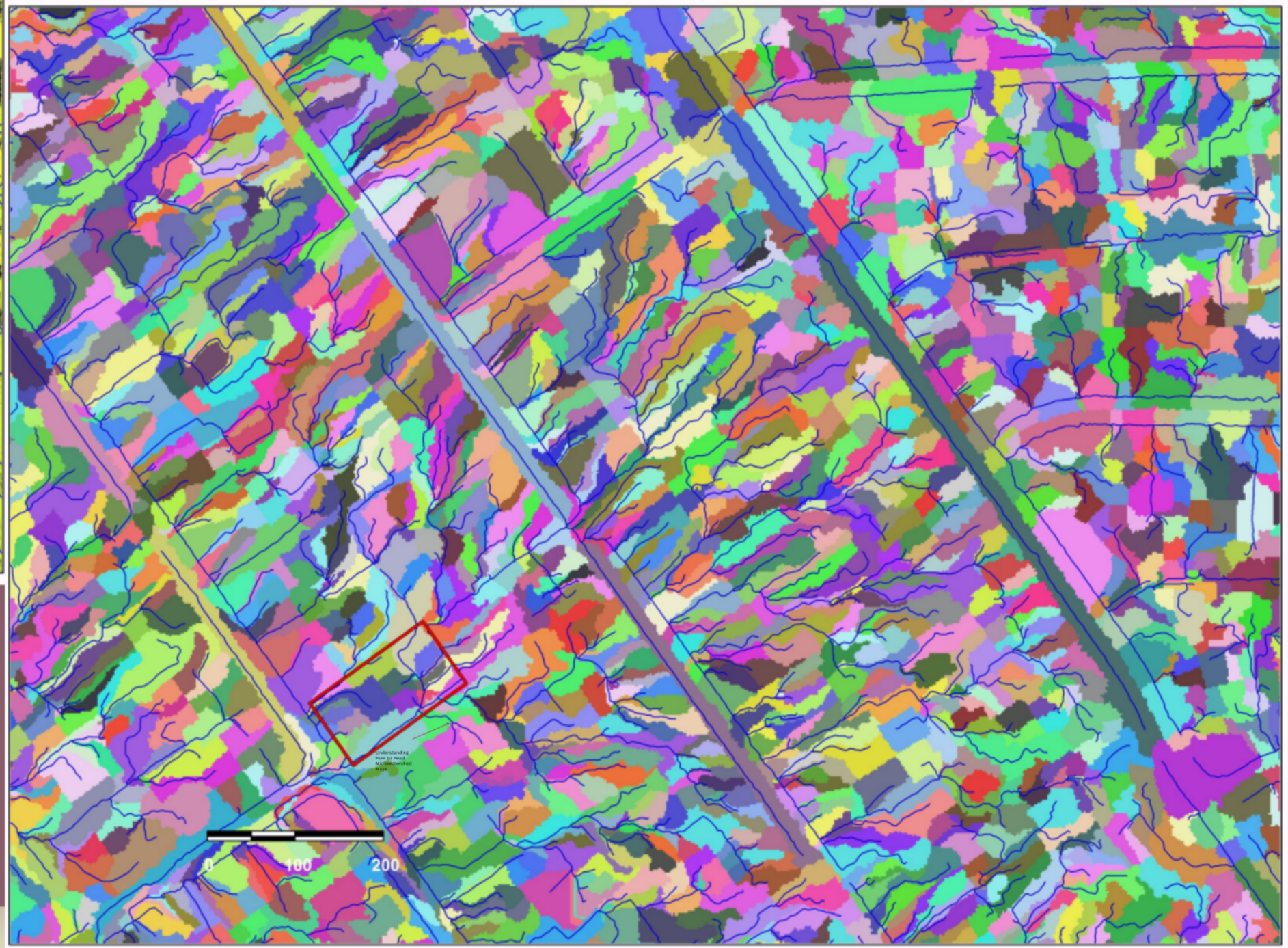

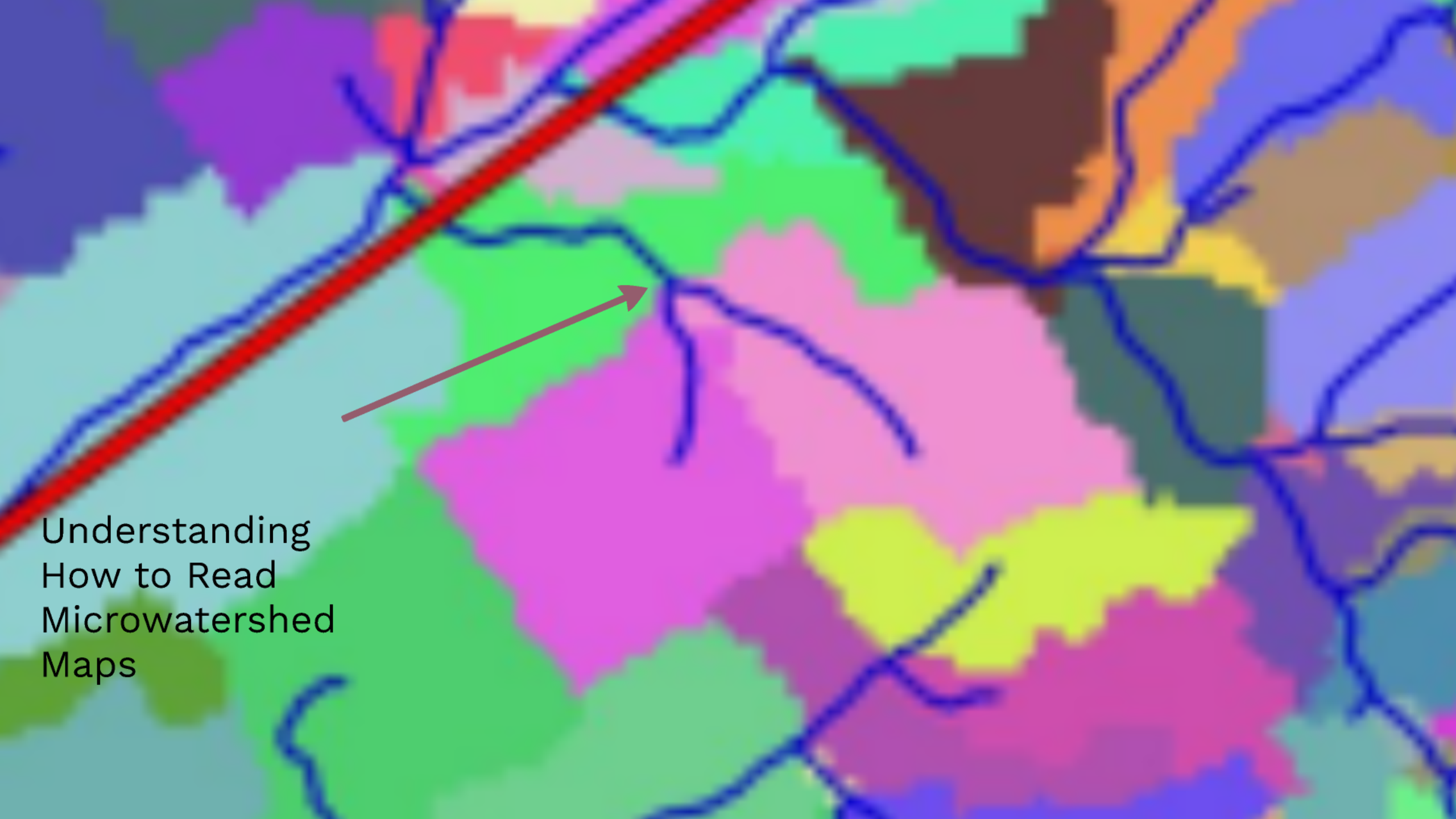
Understanding
How to Read
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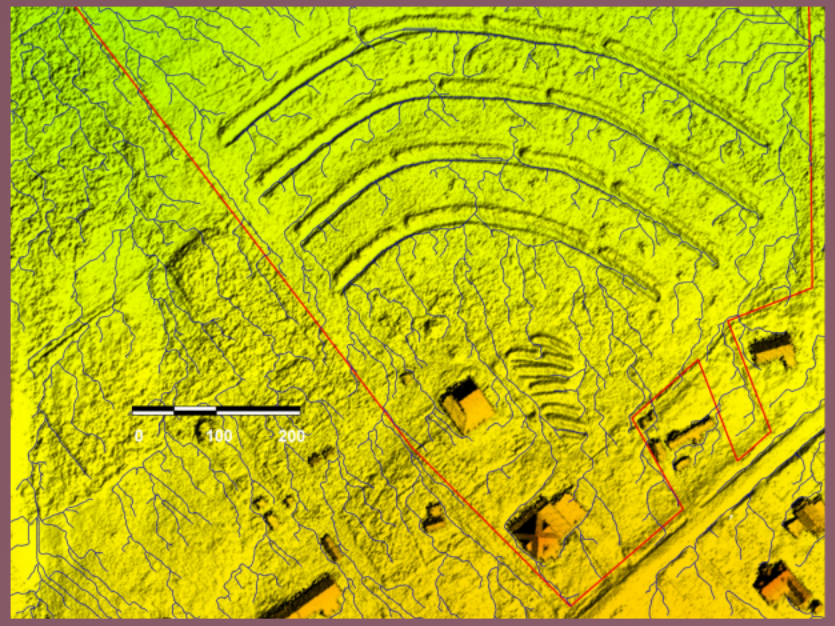
Missed Opportunity

Narrow Miss

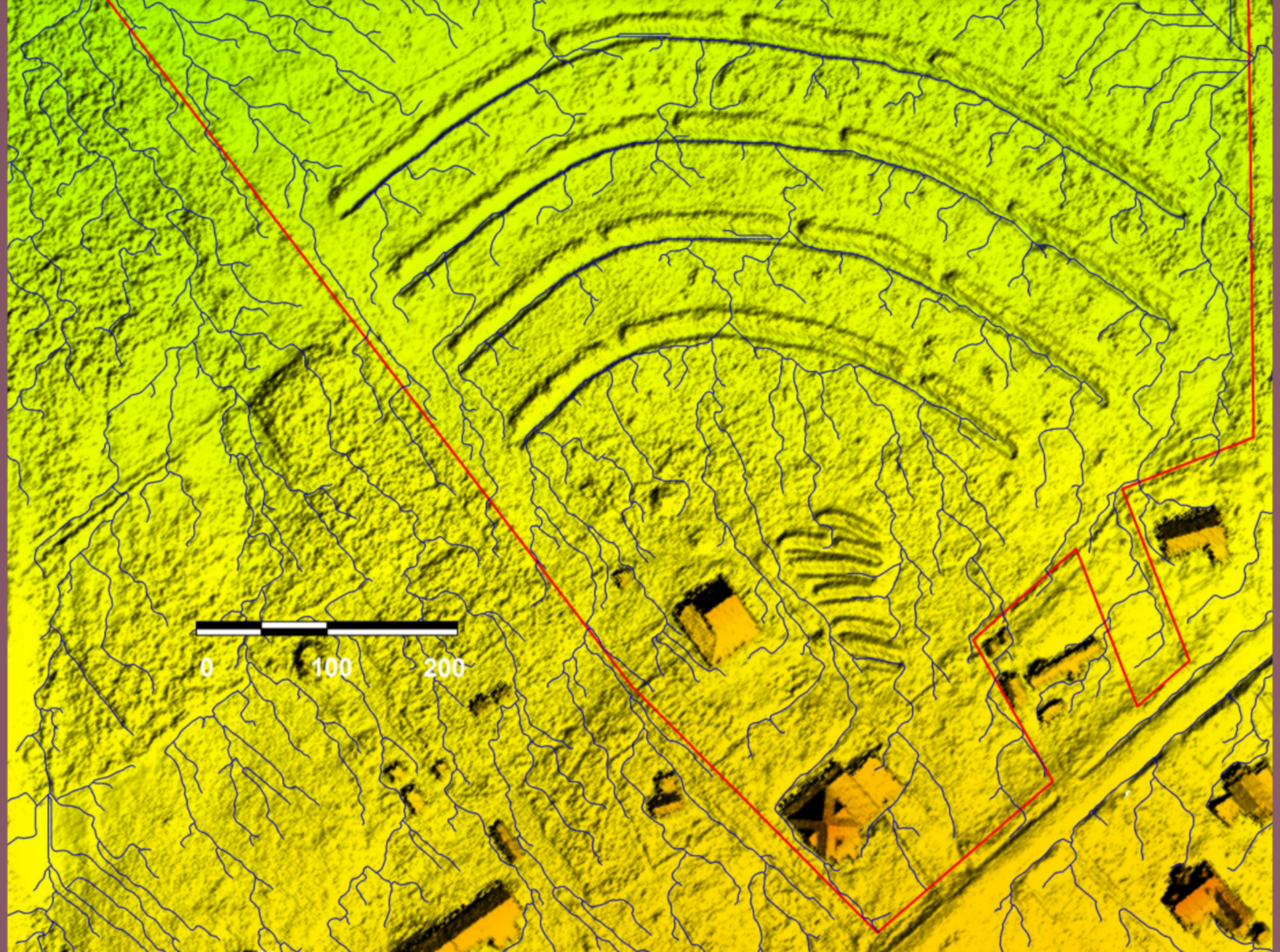
Designed and installed by one of my mentors without access to watershed analysis data



- Larger terraces downstream in the watershed
- Ideally best to catch the water at the top of the watershed
- Then, catch as many times as possible downstream

Lesson Learned:

- Data on existing site conditions informs design to allow maximum efficiency installations.
- Investing in Watershed Analysis at the start of a project is worthwhile and cost effective.
- This tool is critical for Green Stormwater Infrastructure project planning and is currently under-utilized in this field.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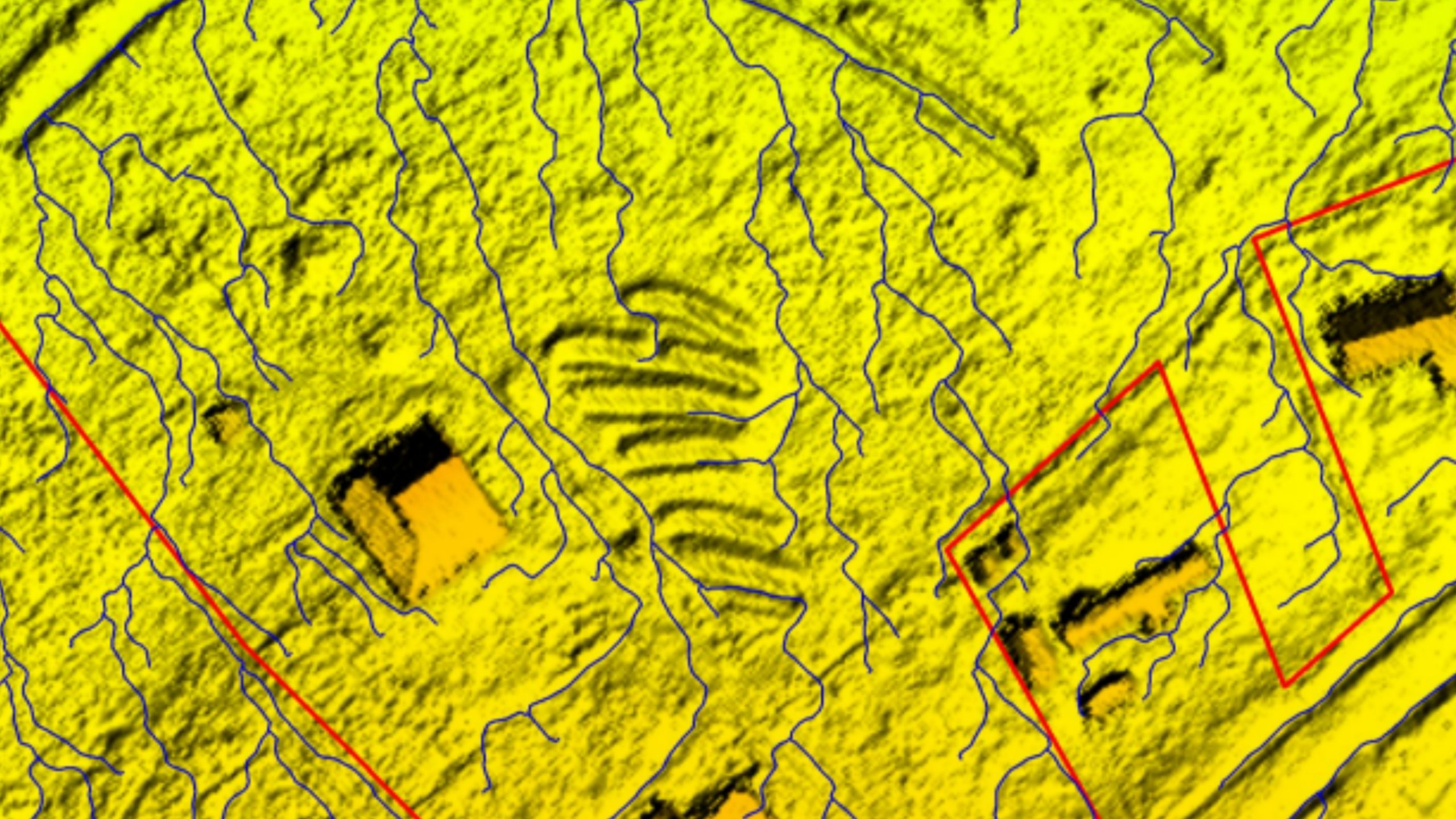

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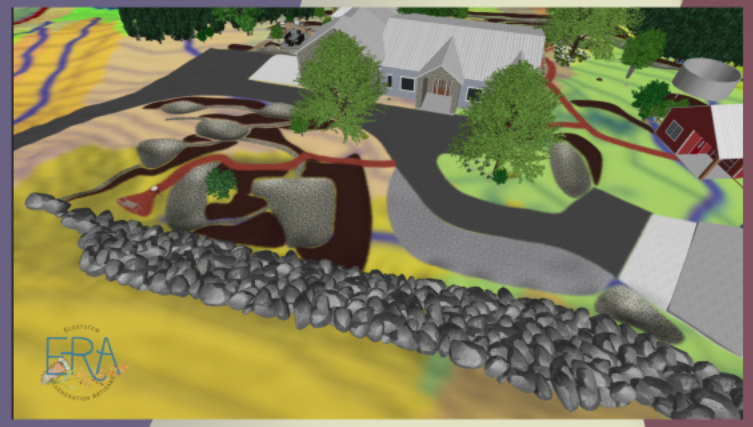
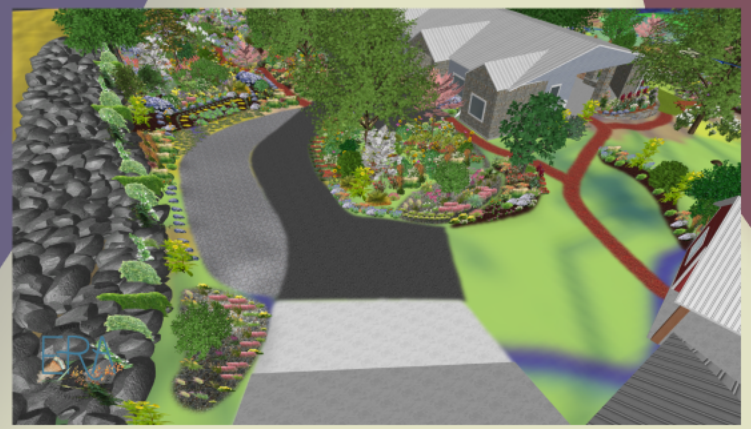




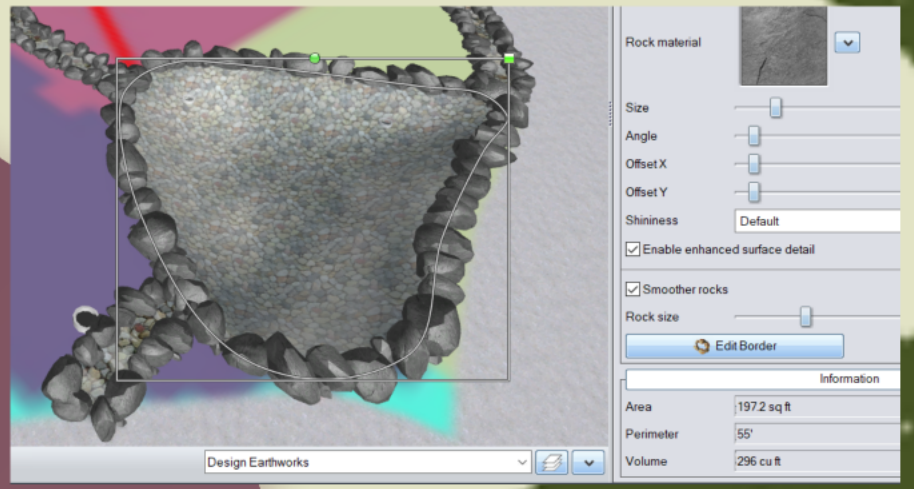
Design

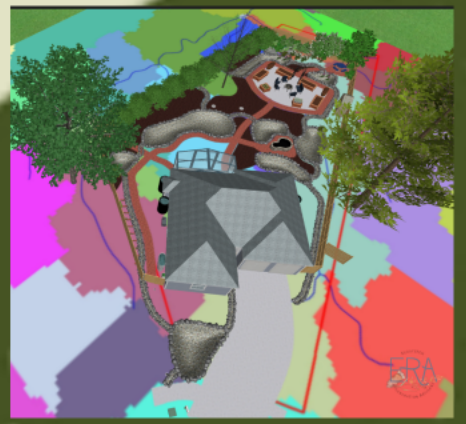
- Realtime Landscape Architect
- Measure and photograph site
- Model existing site features
- Earthworks plan
- Plant plan
- Optional videos for clients
- Output mulch and stone quantities
- Volume of each basins
- Calculated as lined like a pond
- Soil water storage capacity excluded

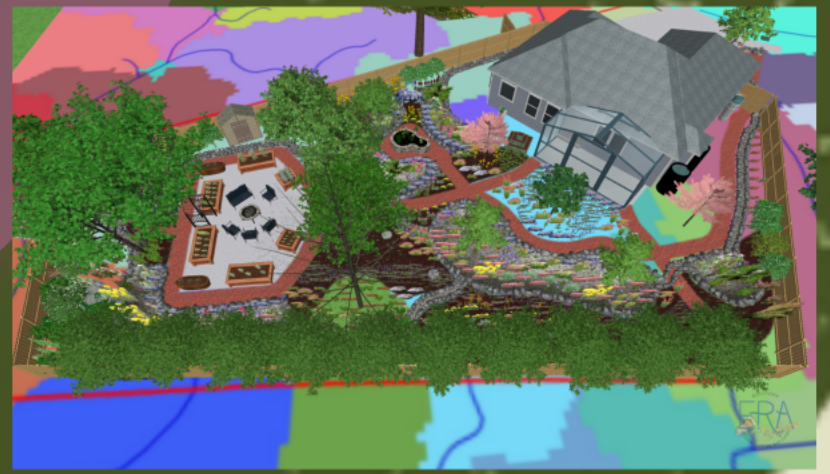
Lessons Learned:

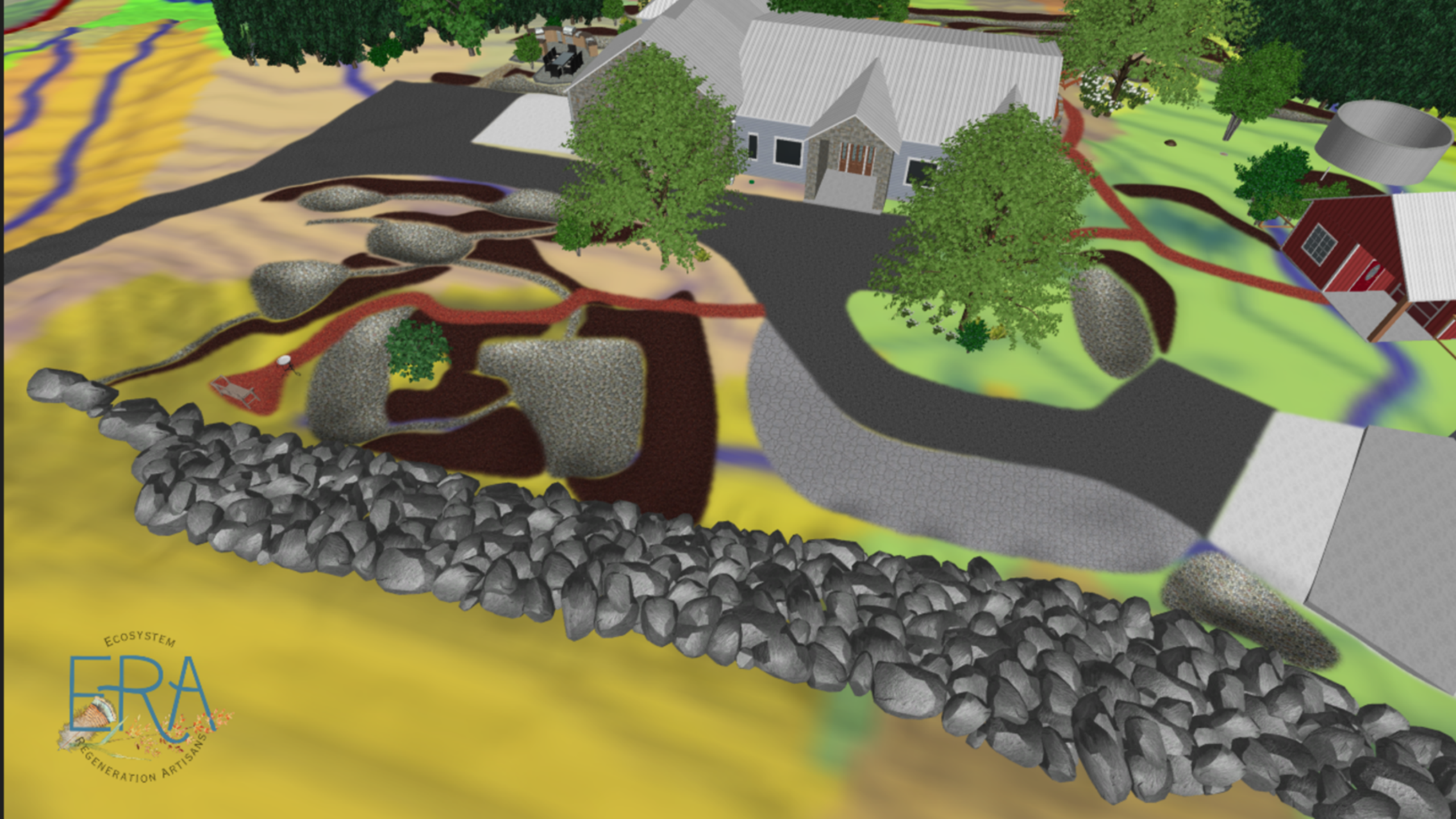
Digital design provides a more streamlined approach, which allows for easy editing and calculations.

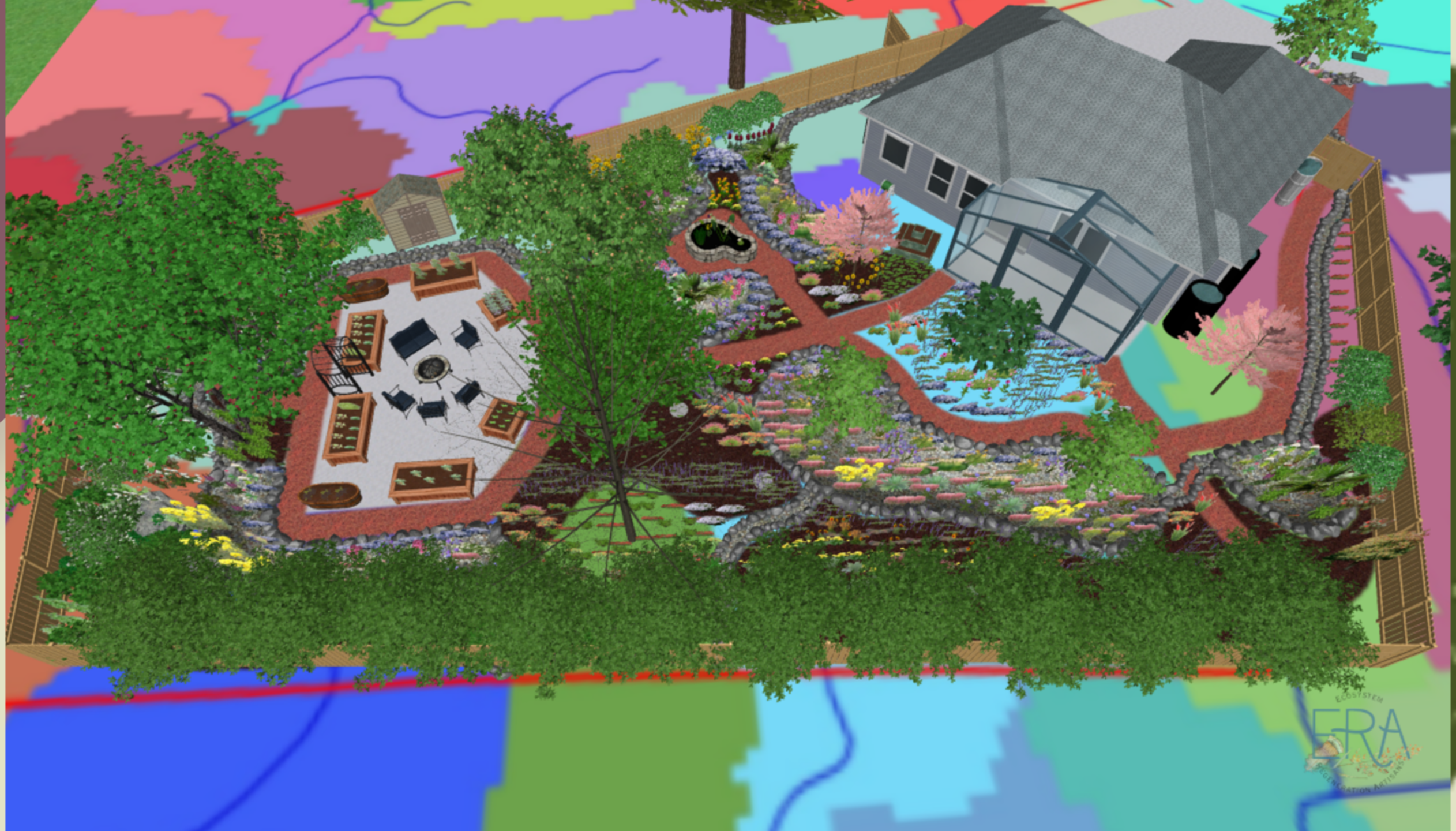
Clients enjoy "walkthrough mode" experience of walking throught their future gardens.








ECOSYSTEM
ERA
REGENERATION ARTISANS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Turning a Dream Oasis into Reality

Transforming a computer drawing into a functional living system is complicated!

Working with nature, people and any challenges thrown our way is just part of the process.

Planning minimizes, but doesn't eliminate complication from *"Unknown Unknowns."*

K.I.S.S.

Budget & Phases

Material Selection

Elevation Issues

Tools & Machinery

ROCKS! ROOTS!

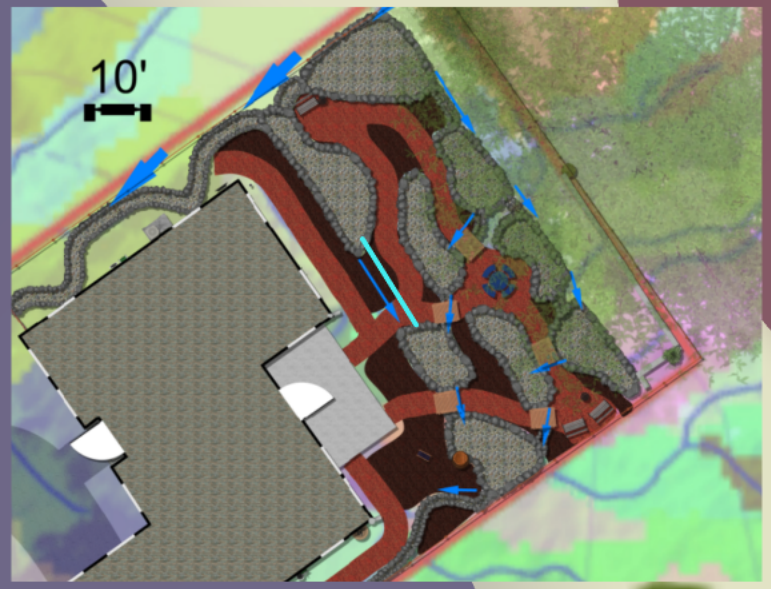
Lesson Learned:
Designer's involvement in construction can make or break a system.
Redesign based on new information during the build is sometimes necessary for system functionality.

"The Map is NOT the Terrain"

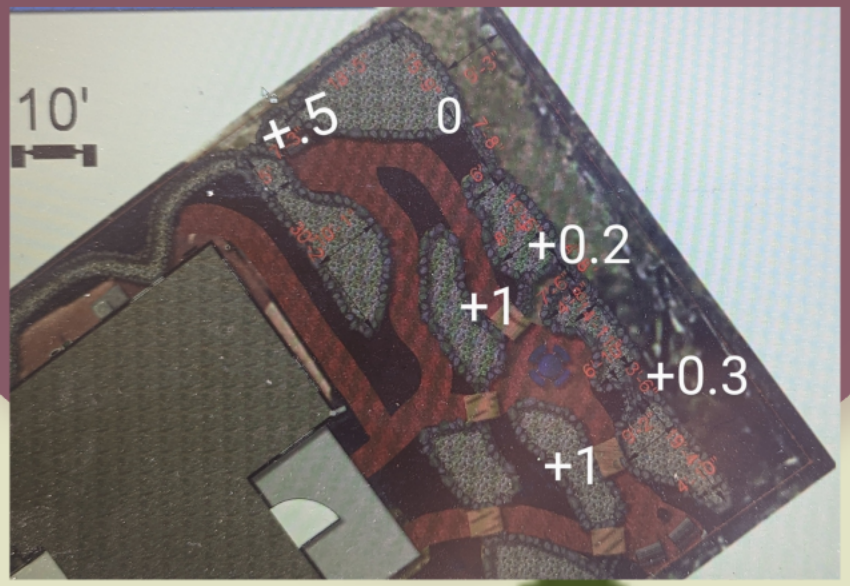
1/8-inch effects water flow.
Topography lines show 1-foot contours.
Therefore, installation doesn't always go according to plan.
Catch issues early!
Prepare for design revision in the field.
Crew lead must be aware of overall system function.

Lesson Learned:
Emergency Overflow Drains can allow flexiblity in water direction across the site and keep walkways open and accessible. **Plus in high flow events these features provide extra support with drainage.**

Original Earthworks Plan



Site Notes



As Built Revised Earthworks Plan

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Measure, Dig, Move

With Not An Inch To Spare!

Altimeter

- Dry Creek & Basin Depth Checks

1.5 Ton Mini-Excavator

- Retracts to 28 inches
- Fits through gates and other narrow spaces

Mini-Track Loader

- 35.6 inches wide

Hammer Drill

- Got to get through that limestone somehow!

Lesson Learned:

- 1 hr with a mini-excavator = 4 pick axers for 8 hours
- Machinery Multiplies Productivity, **IF** you can manueaver in the site.

Lesson Learned:
Altimeter makes finding contours and making accurate depth measurements (1/10th inch), fast and easy.

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Rocks & Roots

"Who Put That There!?!"

Working with Nature is often the best option. Leave room for inspiration based on unknown underground features.

- Large pecan roots? Heart shape!
- Karst features? Spiral accent!
- Rock too big? Rock island!
- Solid Shelf? Build up the berm.
- Oak roots? Preserve and create 3-tier effect!
- Rising and sinking root? Serpent scuplture!

Lesson Learned: Dig carefully with little scoops to **find what Nature provides to work with.**

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Lesson Learned:
Crushed Granite Paths tend to wash away if there's any slope or water flow. Plus, it's high maintenance to weed (even with weed barrier).
Cedar mulch is readily available and easy to maintain.

Mulch & Stone

Blended Organic Compost & Double Grind Aged Hardwood

- MUST BE ORGANIC
  - Herbicides move through system and kill plants
- Double Grind for smooth texture
- Microbiology for microbiome

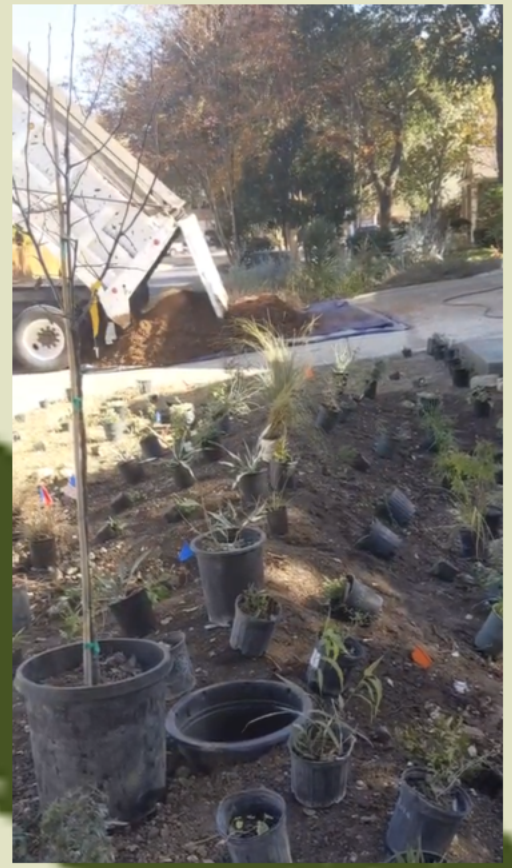
Paths

- Single Grind Cedar Mulch
  - Suppresses Plant Growth
  - Doesn't Wash Away

River Rocks

- 1" for basins and most dry creeks
- 2-3" in dry creeks with moderate flow
- 6-8" Cobbles mixed with 2-3" in high flow dry creeks

Lesson Learned:
Non-organic compost can kill whole installations! Luckily, we didn't learn this the hard way, because a mentor warned us to be extremely careful about it.
Always check with suppliers about organic status.



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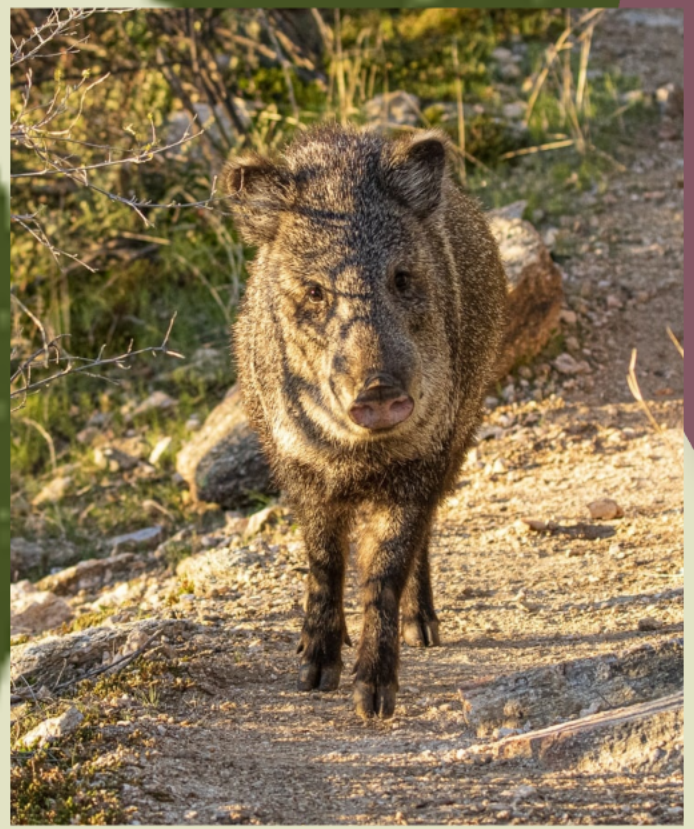
Lesson Learned:
Working with the seasons of finance and Nature. Discuss phases and priorities at design completion. Understand what the budget is before bidding out the whole job, & break the project up as needed. Itemize project costs to make budgeting choices more straightforward.



Budget & Phases

Homeowners Landscape Costs Budgets

-Native soil

-Relatively clean roof top/ lawn runoff

Municipal GSI Costs

-Extra excavation and engineered soil

-Parking lot pollutants

Large Ranch Installations

-Most cost effective as large projects based on delivery fees

-Lots to maintain in early garden stages

Phases

-*"Eat an Elephant, One Bite at a Time"*

Working with the Seasons

- Tree planting only between October 15- March 15th

Prioritizing Based on Watershed & Client Goals

-Value Engineering: Rock only in Dry Creeks, smaller plants, seeds

-Rebate timelines

DIY

-Homeowners Plant & Mulch

Lesson Learned:
Upfront knowledge of expected overall project costs are important for clients, since this isn't the standard landscape featured in "Home Advisor" articles.
Provide ballpark pricing packages based on standardized material quantities and square footage, so clients can budget for the full project even at Watershed Analysis and Design Stages.

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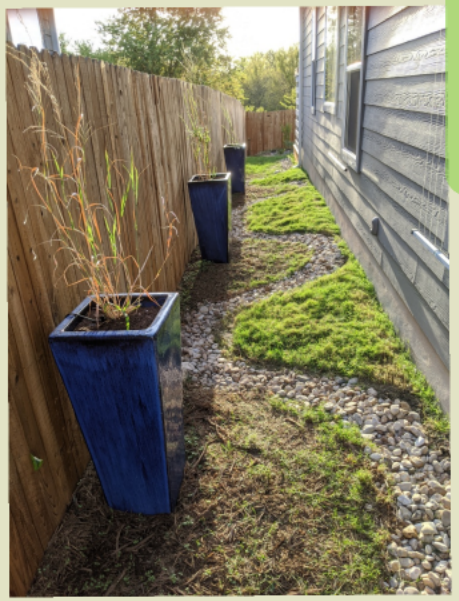


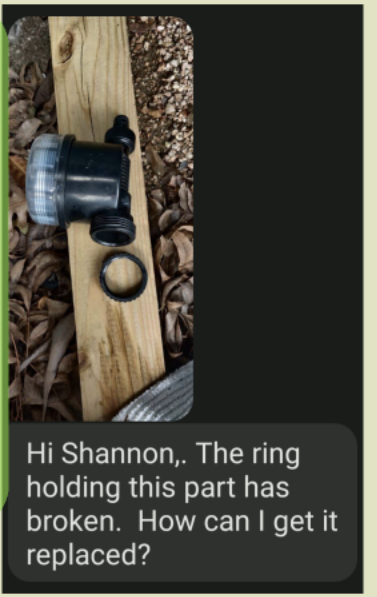
Lesson Learned:
Simple dry creeks with just a few curves work best in most scenarios.

Simple is Super!

- Additional components add maintenance
- More hardware means more points of failure especially in freezing weather
- Excessive meander in Dry Creeks complicates maintenance
- Don't over-excavate, steep sides are problematic
- Lots of little basins complicate order of operations for installation, based on access
  - **Driving heavy equipment in basins breaks infiltration, requiring extra aeration**
- Drains and grates can and will clog
  - Make it easy to clean them
    - Plan sediment catch points

Lesson Learned:
Complicated and tight arrangement of basins requires careful equipment operator planning.

Lesson Learned:
Hardware requires battery checks, extra freeze protection, and sometimes components fail. Be prepared to coach clients through replacing hardware, and how to check all components. Have spares on hand during maintenance days.



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When using rain tanks without pumps, use specific timers and "spaghetti" (1/4) drip line to reduce pressue loss and expand run length.

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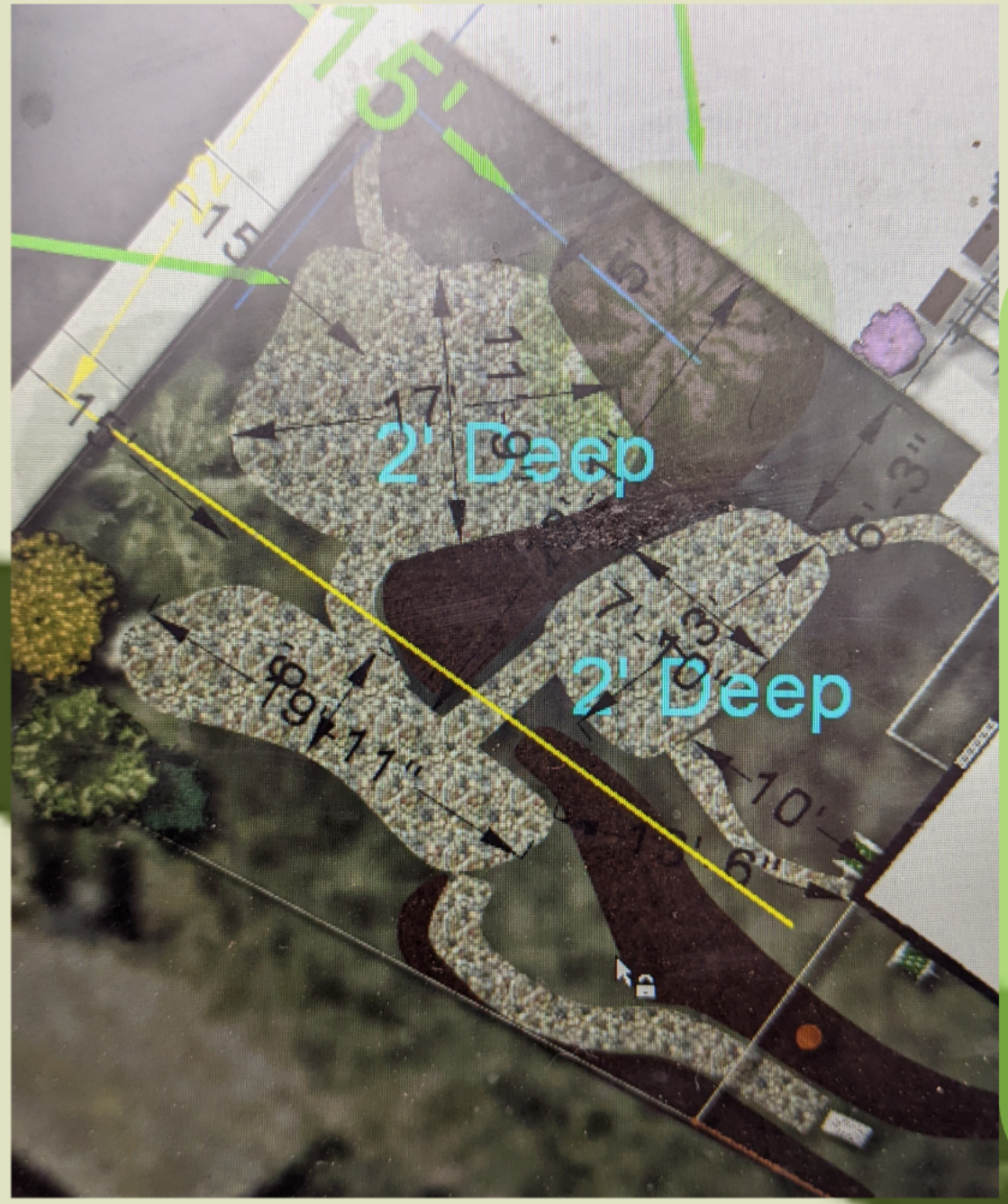

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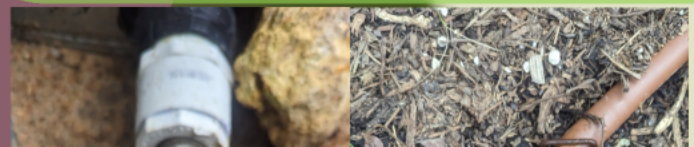


Hi Shannon,. The ring holding this part has broken. How can I get it replaced?

Turning a Dream Oasis into Reality

Transforming a computer drawing into a functional living system is complicated!

Working with nature, people and any challenges thrown our way is just part of the process.

Planning minimizes, but doesn't eliminate complication from *"Unknown Unknowns."*

K.I.S.S.

Budget & Phases

Material Selection

Elevation Issues

Tools & Machinery

ROCKS! ROOTS!

"Make It Rain" Gardens: A Contractor's Experiences in Green Stormwater Infrastructure

By Shannon Brown, Founder
Ecosystem Regeneration Artisans

Who?
What?
Why?

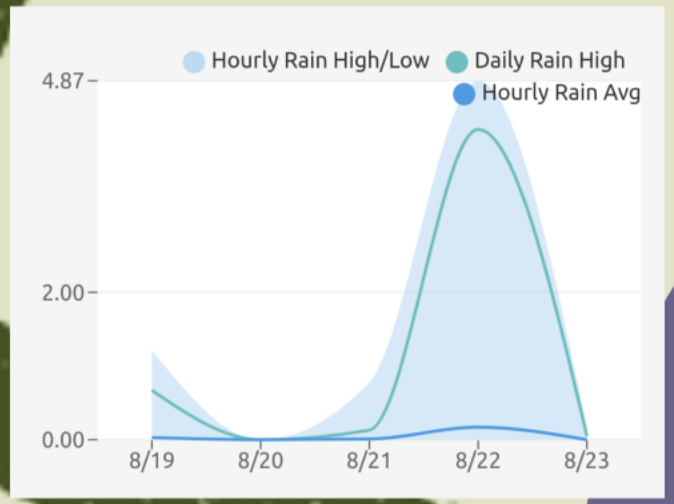
The Soil Sponge

Install

Plan

Rain Tested

ERAnativeland.com



Approved!

Rain Catcher Pilot Program
City of Austin in Partnership with Urban Patchwork

Design Parameters:
Catch 80% of runoff from impervious cover in 1.3" storm

August 22, 2022- Major Storm
Shoal Creek 0 cfs to 2000 cfs and 16ft

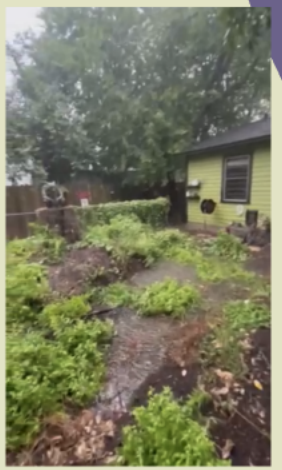
Checked Ambient Weather App for hyper-localized data near our RCPP clients (Skyview Neighborhood)

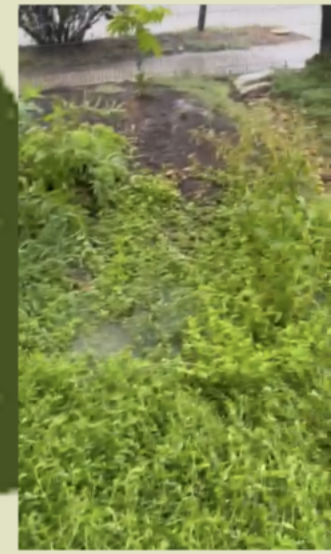
Client Check In:
Both sites reported that their systems were NOT overflowing

Possible Explainations:
Driveway cut grates unable to handle rate of flow led to water skipping over (Front yard)

But this doesn't explain the large rain gardens in the backyard...

Soil Sponge!





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This table reveals the potential to increase the project site's water storage capacity by using the soil as a sponge. Native grass roots penetrate deep into the soil, promoting increased soil organic matter deeper into the soil surface, which increases the infiltration rate and the capacity of all rain gardens and bioswales in this vegetated system.

Table 2. Water Wise and Soil Health Practices to Maximize Effective Water Utilization

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Cover Crops/ Native Reseeding	Nitrogen Fixation, Soil Structure Improvement, Increased Soil Carbon
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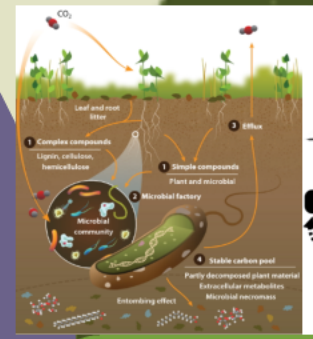

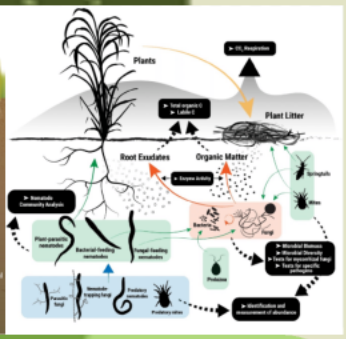

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TRWD Median Rainscape Water Storage Capacity

This table show the water holding capacity of each basin. Capacity of basins for bioswales and rain gardens excludes water holding capacity of soil. Water holding capacity of soil listed is based on the Natural Resources Conservation Service (NRCS) statistic that each 1% increase in soil organic matter (SOM) to a 6" depth produces an increase in water storage capacity of 21,669 gal/ acre. This number represents only the amount of change in capacity for each percentage point increase. In other words this table reveals the potential to increase the project site's water storage capacity by using the soil as a sponge. Historic SOM percentages for this area were 4%-7% (Hargrove & Luxmore 1988), with typical current turf grass areas containing less than 1% SOM. Soil testing can establish a current base line for SOM. Returning SOM to historic levels is possible over time. This table only represents a 4% increase which is attainable in 1-5 years after installation with restoration of healthy soil microbes. Native grass roots penetrate deep into the soil, promoting increased soil organic matter deeper into the soil surface, which increases the infiltration rate and the capacity of all rain gardens and bioswales in this vegetated system. Calculations for increased storage capacity based on 8- 12 foot grass root depth are not included in this table.

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Basin Totals	3464.6	5196	38869	17235	34470	51704	68939
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Prepared by Ecosystem Regeneration Artisans (ERA)

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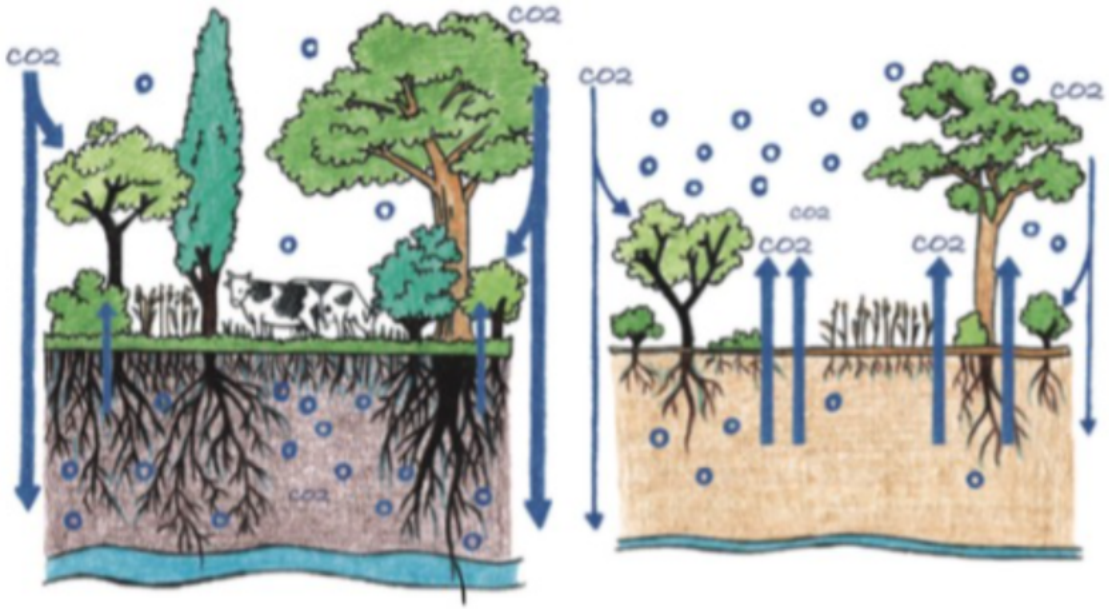
HOLISTIC LAND MANAGEMENT & OTHER TECHNIQUES OF REGENERATIVE AGRICULTURE

CONVENTIONAL LAND MANAGEMENT & INDUSTRIAL AGRICULTURE



Healthy soil as carbon sink

- More ground cover
- More roots
- More carbon stored in soil
- More water retention in top soil
- Recovering groundwater levels
- Less erosion
- More bioproductivity
- More diversity
- Less carbon in the atmosphere

Depleted soil as carbon source

- Less ground cover
- Fewer roots
- Less carbon stored in soil
- Less water retention in top soil
- Depleting groundwater
- More erosion
- Less bioproductivity
- Less diversity
- More carbon in the atmosphere

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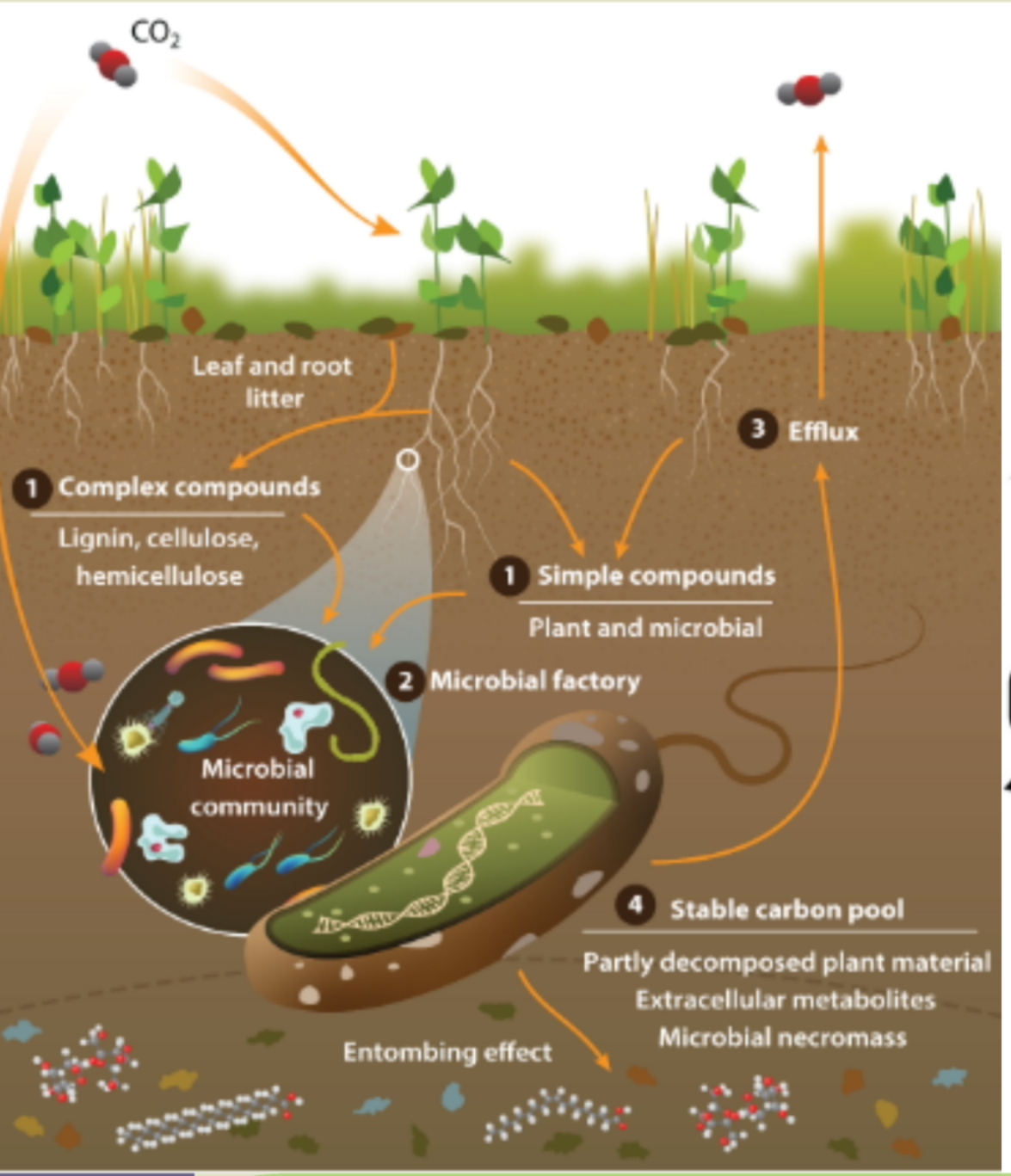
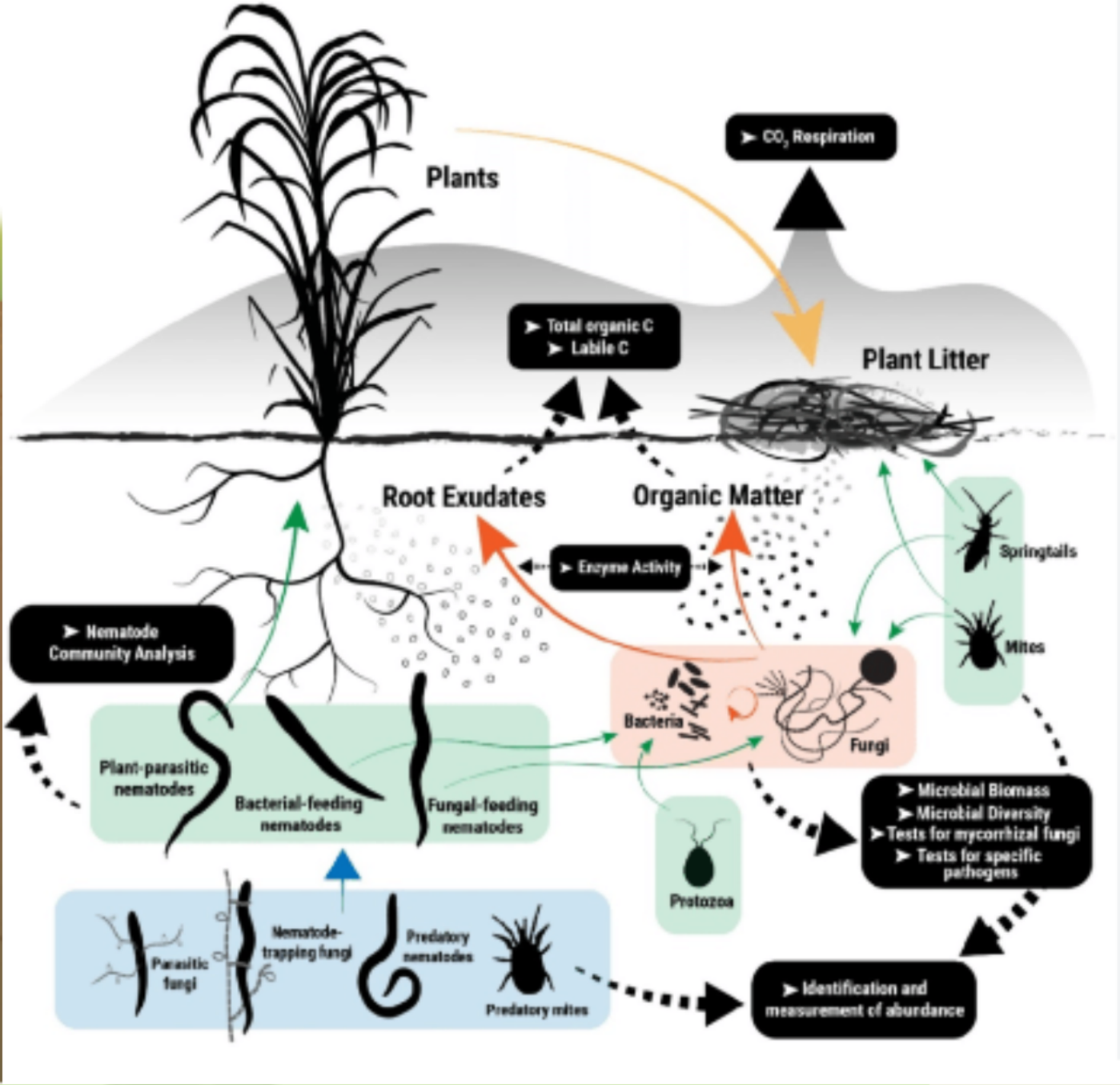

CO_2
Leaf and root litter
1 Complex compounds
Lignin, cellulose, hemicellulose
3 Efflux
1 Simple compounds
Plant and microbial
2 Microbial factory
Microbial community
4 Stable carbon pool
Partly decomposed plant material
Extracellular metabolites
Microbial necromass
Entombing effect


Plants
➤ CO_2 Respiration
➤ Total organic C
➤ Labile C
Plant Litter
Root Exudates
Organic Matter
➤ Enzyme Activity
➤ Nematode Community Analysis
Springtails
Mites
Bacteria
Fungi
Plant-parasitic nematodes
Bacterial-feeding nematodes
Fungal-feeding nematodes
Protozoa
➤ Microbial Biomass
➤ Microbial Diversity
➤ Tests for mycorrhizal fungi
➤ Tests for specific pathogens
Parasitic fungi
Nematode-trapping fungi
Predatory nematodes
Predatory mites
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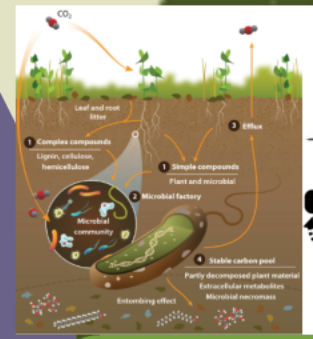

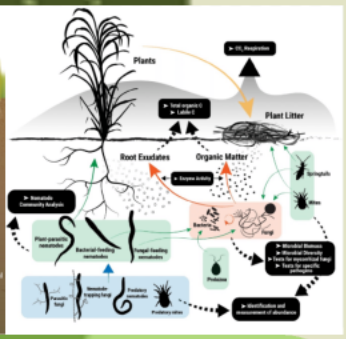

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Visit us & tour our rain gardens
and native plant nursery!
First Saturday, Every Month
10am-2pm (February 3rd)
946 Boulder Bluff, San Marcos Tx

Thank you for being here, and for
taking an active role in ecosystem
regeneration and water-wise living.

Shannon Brown, Founder

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