

# Managing to the Future

Adaptive Management in Left Hand Watershed

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Left Hand Watershed Center



**LEFT HAND**  
watershed center



# Left Hand Watershed Center



**We protect and restore watersheds for people and the environment using a collaborative, science based approach.**

St. Vrain Basin and Beyond



# Watershed Management Planning

Our goal in planning process:

- Create the most **resilient future possible** for people and environment.
  - Adapt to future stressors, drought and flood, while still meeting the needs of the community.

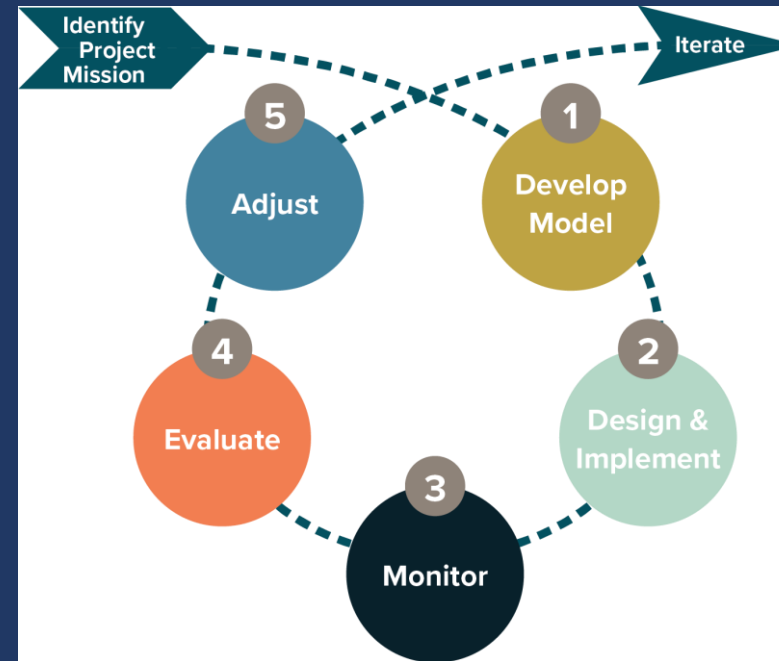


# How do we manage to the future?

## Adaptive Management!

### Iterative Process for:

- Adjusting management or monitoring actions based on what is learned.



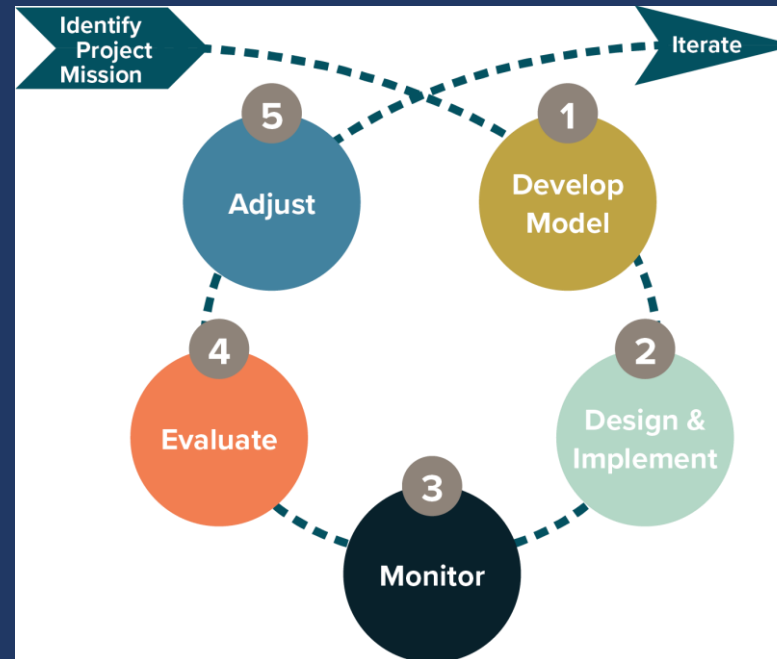
Allows us to plan for uncertainty associated with climate change and dynamic watershed processes.



# How do we manage to the future?

## Adaptive Management!

1. Conceptual model
2. Design & Implement
3. Monitor
4. Evaluate
5. Learning & Adjusting



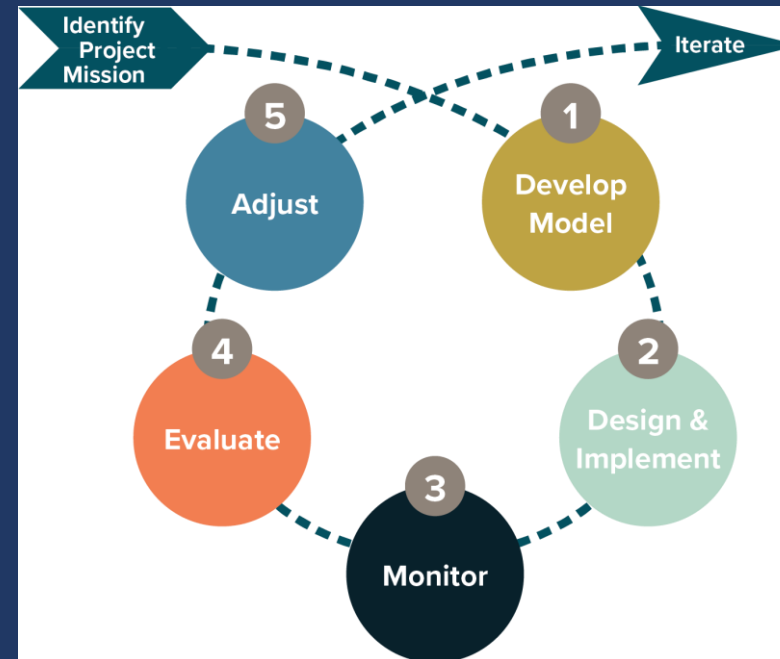
**A Core Value:** Learn from data and then adjust in response to new information, then iterate! Recognizes that don't have all the information.



# How do we manage to the future?

## Adaptive Management!

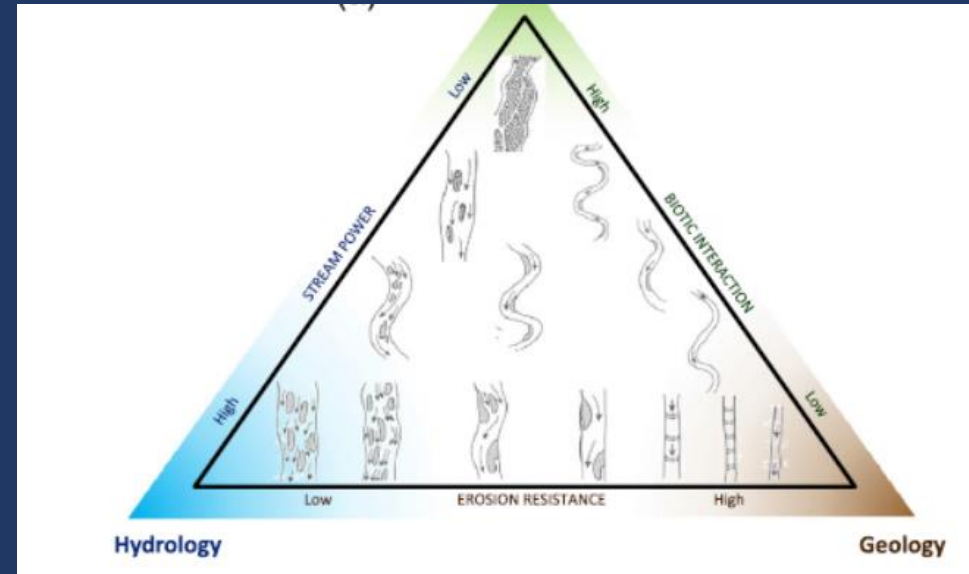
1. Conceptual model
2. Design & Implement
3. Monitor
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# Why Conceptual models?

- Conceptual models provide a space to help understand potential trajectories of change and scenarios for possible future conditions.
- Conceptual models are “**thinking tools,**” and the best outcome of a conceptual model is not a precise answer but deeper thinking.



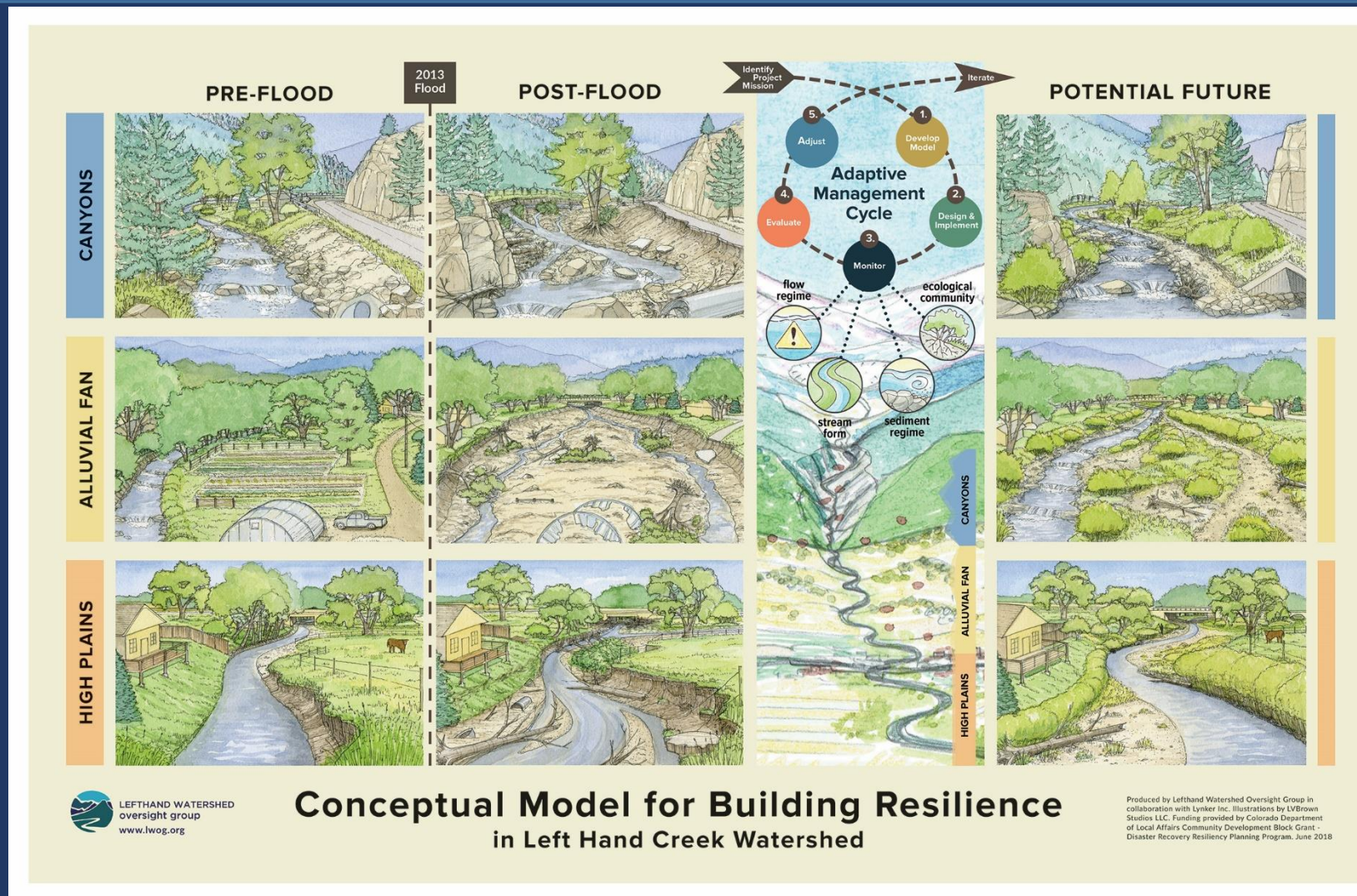
The stream evolution triangle: Integrating geology, hydrology, and biology

Janine M. Castro<sup>1</sup>  | Colin R. Thorne<sup>2</sup> 



# 1. Conceptual Model

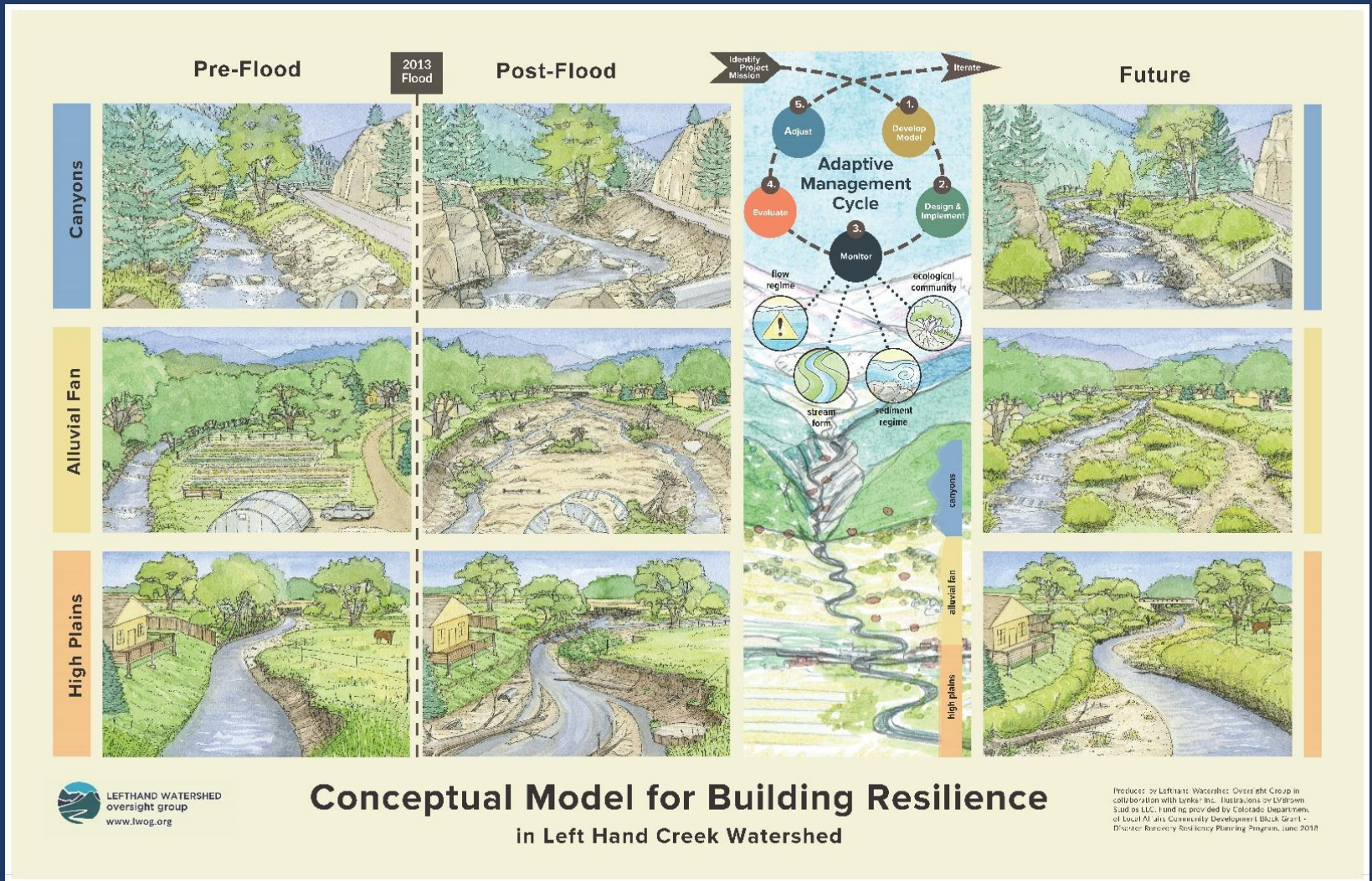
- Collaboratively developed by scientists & stakeholders.
- Purpose to inspire deep thinking about what is possible in the future, what worked and did not work in the past.





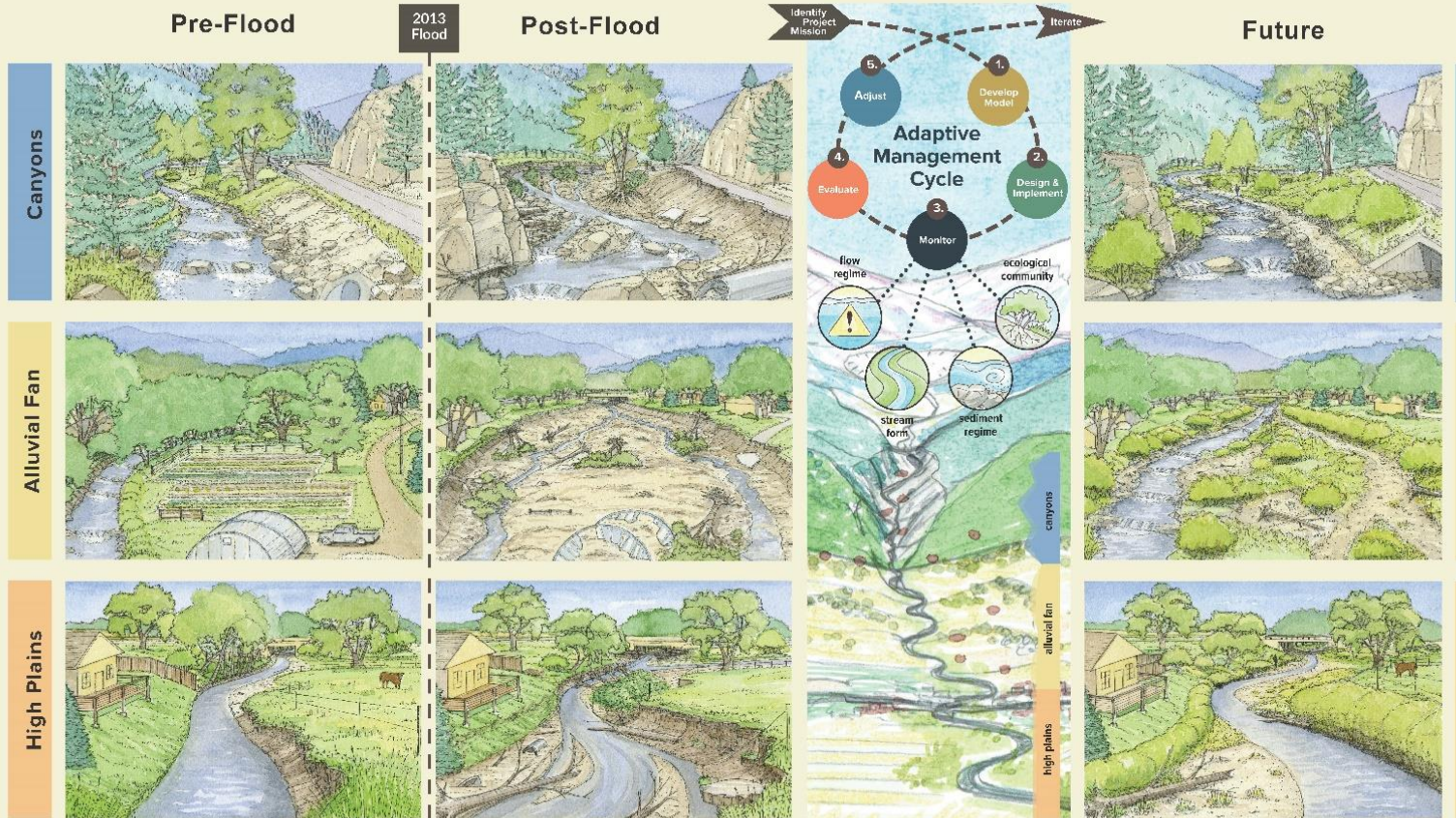
# 1. Conceptual model

- Conditions assessment that goes beyond a static snapshot of current conditions.
- Space and time represented
- Recognizes a shifting baseline.

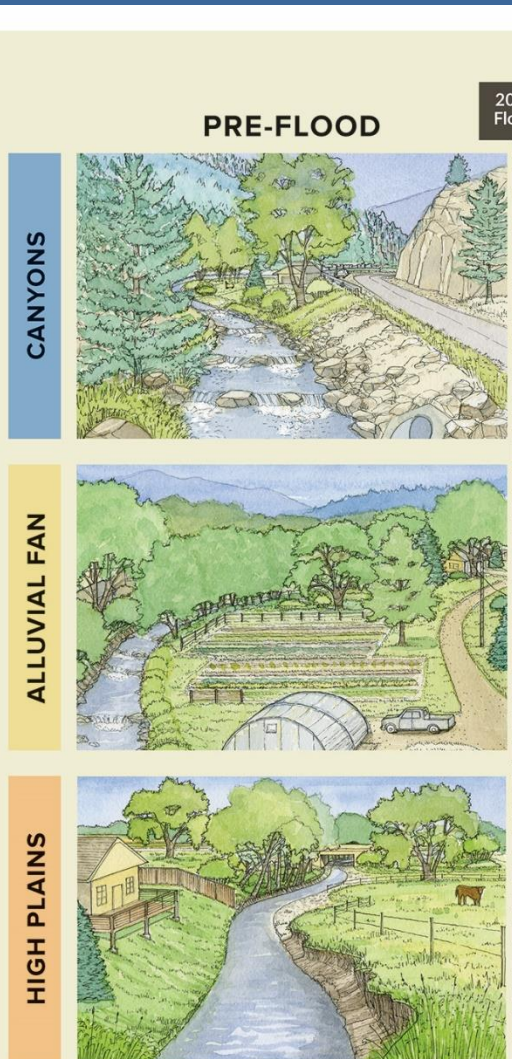




# 1. Conceptual model



# Concept Model: Pre-flood conditions



- Purpose of looking back is to give context to what might be possible, achievable, desirable in the future.
- **But** we're not restoring back to some historical point in time.
- While this concept model stops at pre-flood, looking further back in time gives additional important context

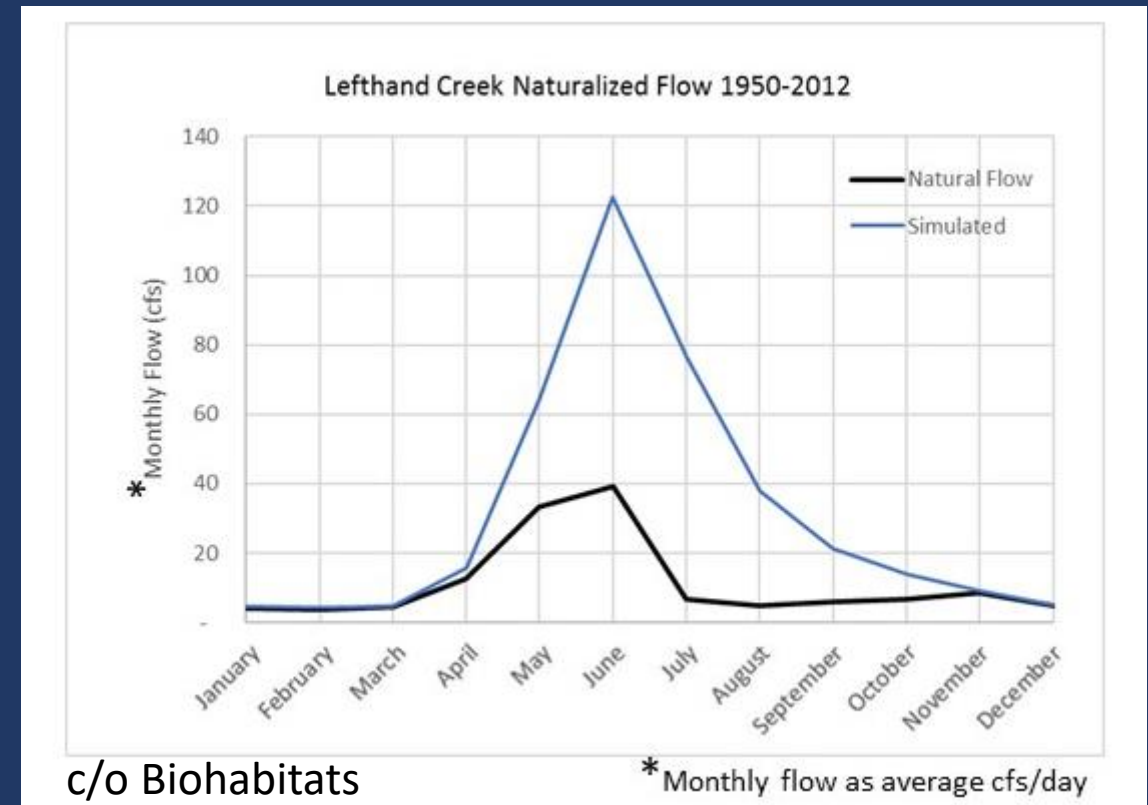


# Concept Model: Historical Context

1

Develop  
Model

- Pre-1879 Left Hand was a seasonal creek or wetland swale
- Historic court case Coffin vs. Left Hand allowed flows from St. Vrain to be diverted to Left Hand.
- Likely open canopy with occasional cottonwoods, wetland vegetation on margins.
- Current context: Left Hand is a “Working River”

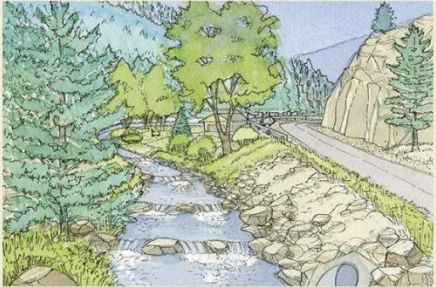


# Concept Model: Pre-flood conditions

## PRE-FLOOD

20  
Flo

CANYONS



ALLUVIAL FAN



HIGH PLAINS



## Methods:

- Photos & stakeholder & scientist interviews
- We found:
  - Mix of land use (roads, homes, ag crops, lawns grazing)
  - Often cultivated and used up to creek edge.
  - Vegetation tells a story

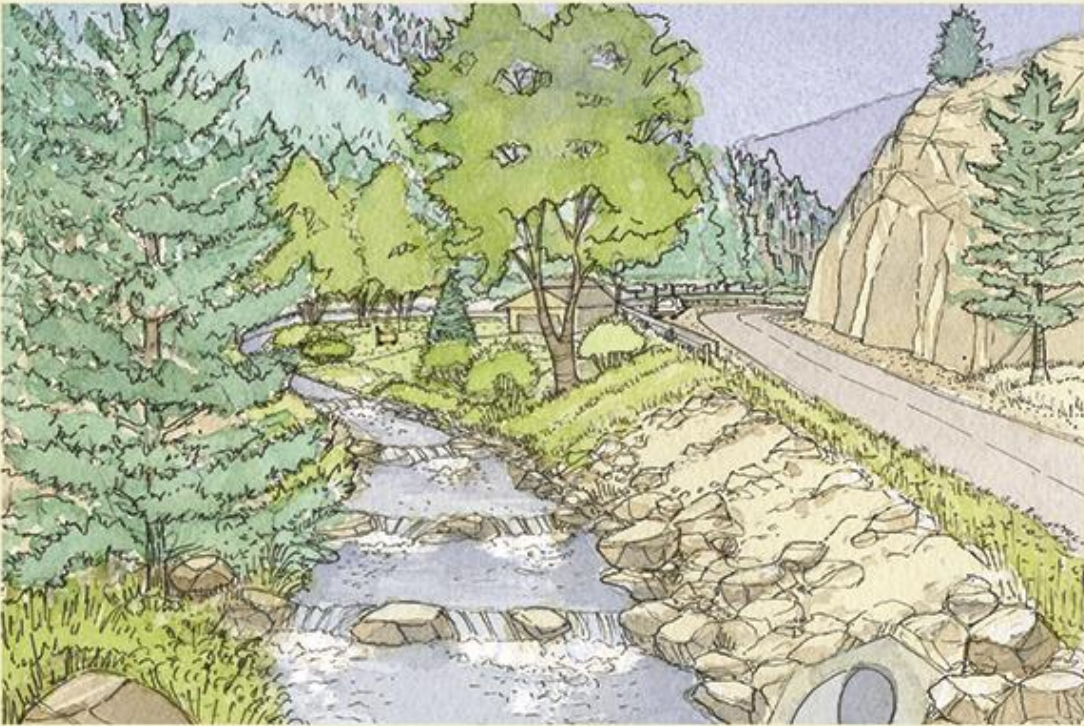


# Concept Model: Pre-flood conditions (Canyons)

## PRE-FLOOD

20.  
Flo

CANYONS



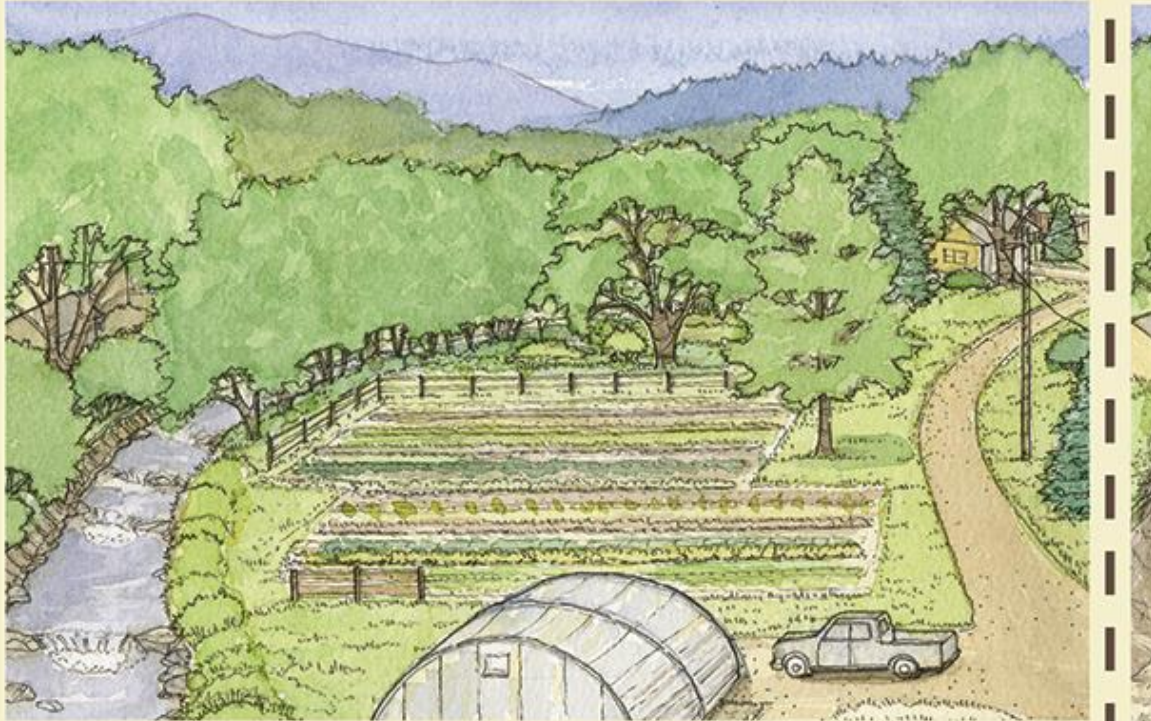


# Concept Model: Pre-flood conditions (Alluvial Fan)

1

Develop Model

ALLUVIAL FAN





# Concept Model: Pre-flood conditions (Plains)

1

Develop  
Model

HIGH PLAINS





# Concept Model: Pre-flood conditions



What did we see:

- Vegetation: non-native vegetation, encroaching
- Stream Form: “Locked it” banks, creek had limited access to floodplain
- Sediment Regime: little natural erosion/deposition processes

Why did we see it?:

Flows! Characteristic of the working river.  
Dry up points, Lack of flushing flows.



# Concept Model: Pre-flood conditions

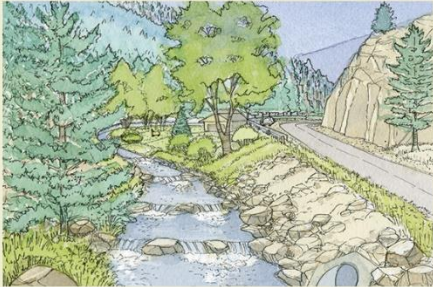
## What did we learn?

- Don't want crack willow dominated riparian corridor
- Want the stream to have access to the floodplain so natural deposition/erosional processes can occur
- Flushing flows are important.

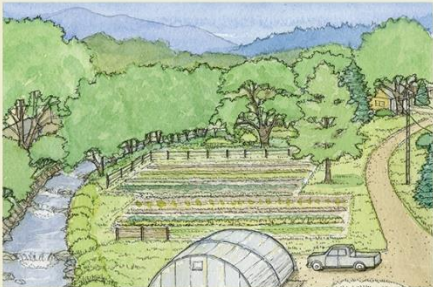
PRE-FLOOD

20  
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ALLUVIAL FAN



HIGH PLAINS

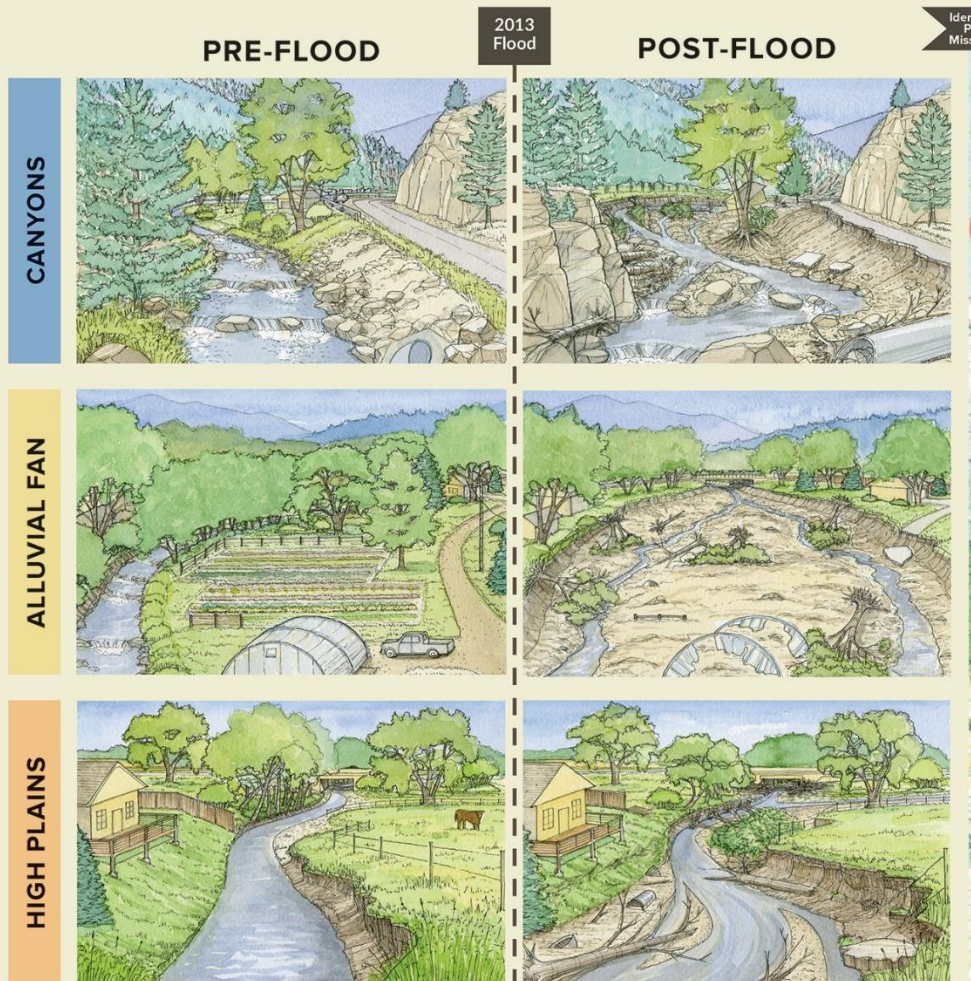




# Concept Model: Post-Flood conditions

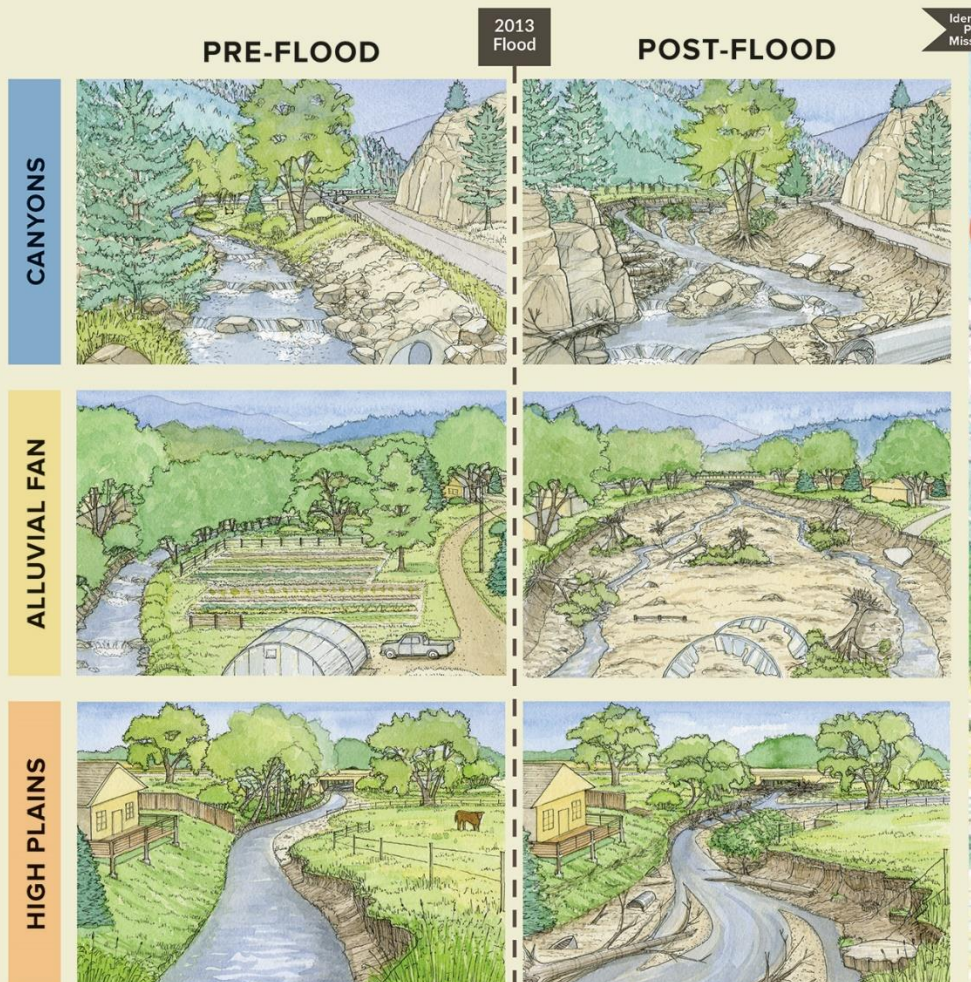
1

Develop Model





# Concept Model: Post-Flood conditions



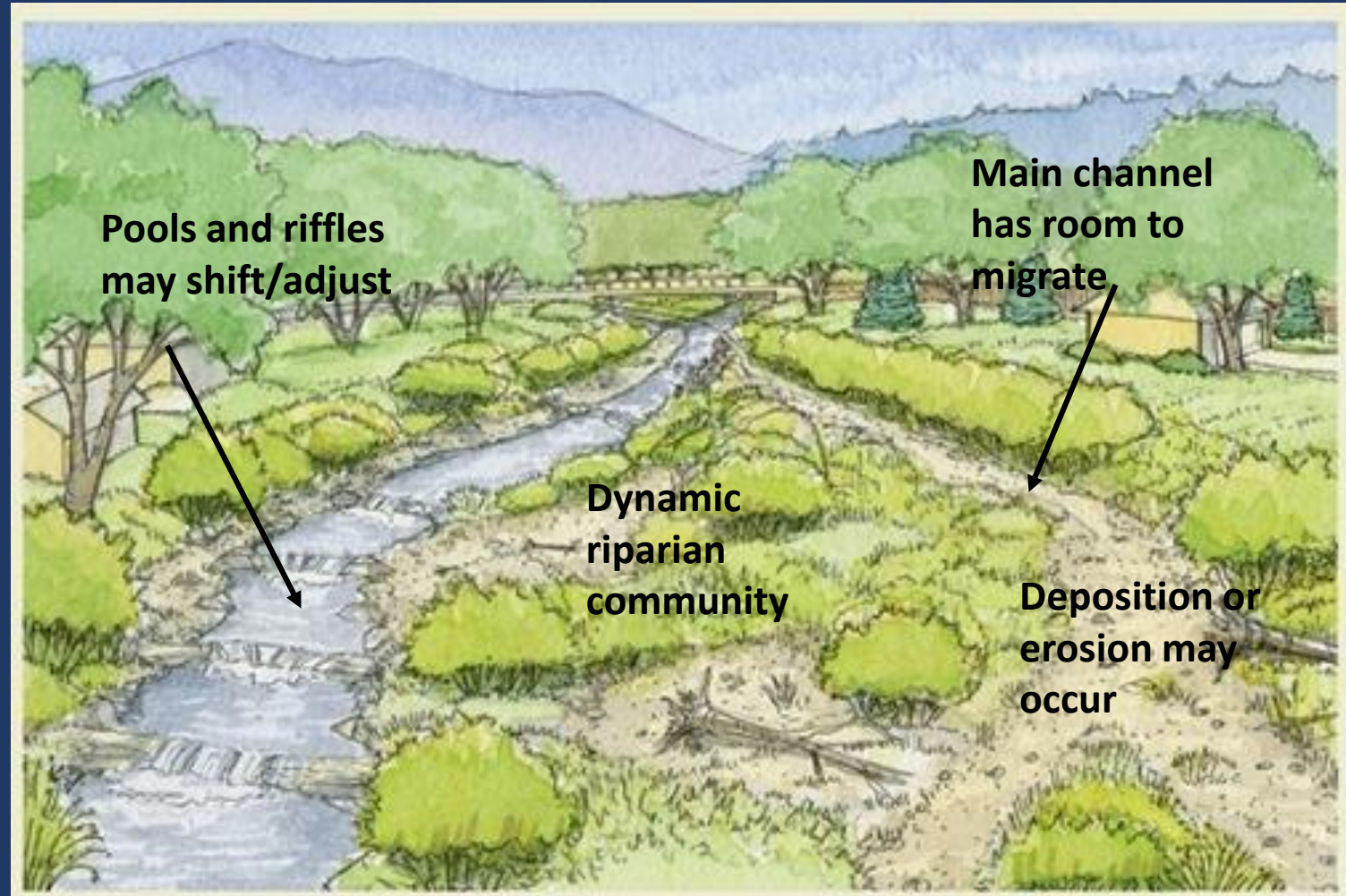
## KEY WATERSHED FUNCTIONS:

- Flows: Flushing flow!
- Form: Unstable (for surrounding land use)
- Sediment Regime: Unstable
- Ecology/Veg: Not much resilience..



# Concept Model: Potential Future

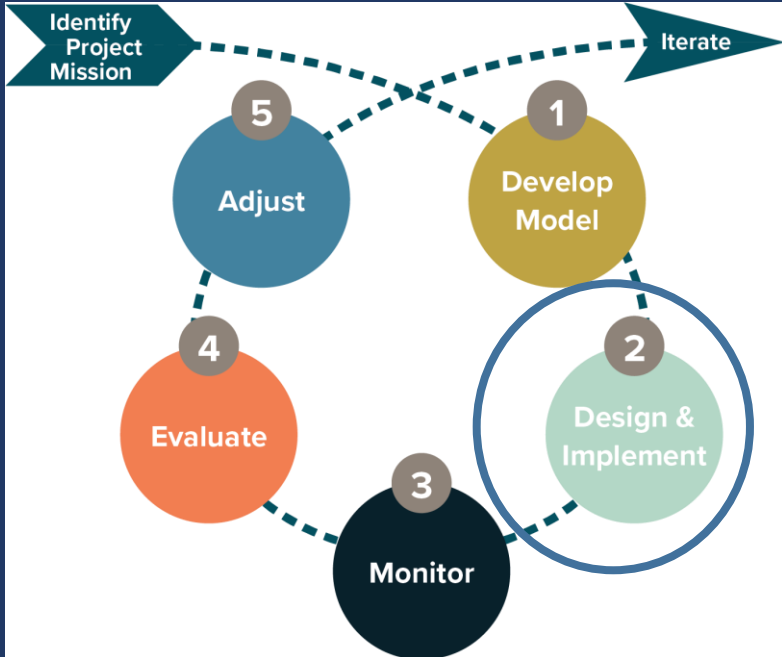
## POTENTIAL FUTURE





# 2. Design & Implement Projects

- Design and implement projects to achieve desire future condition as defined in concept model





## 2. Design & Implement Projects



Goal: Jump start process to ensure we are headed in right trajectory (toward desired future condition)





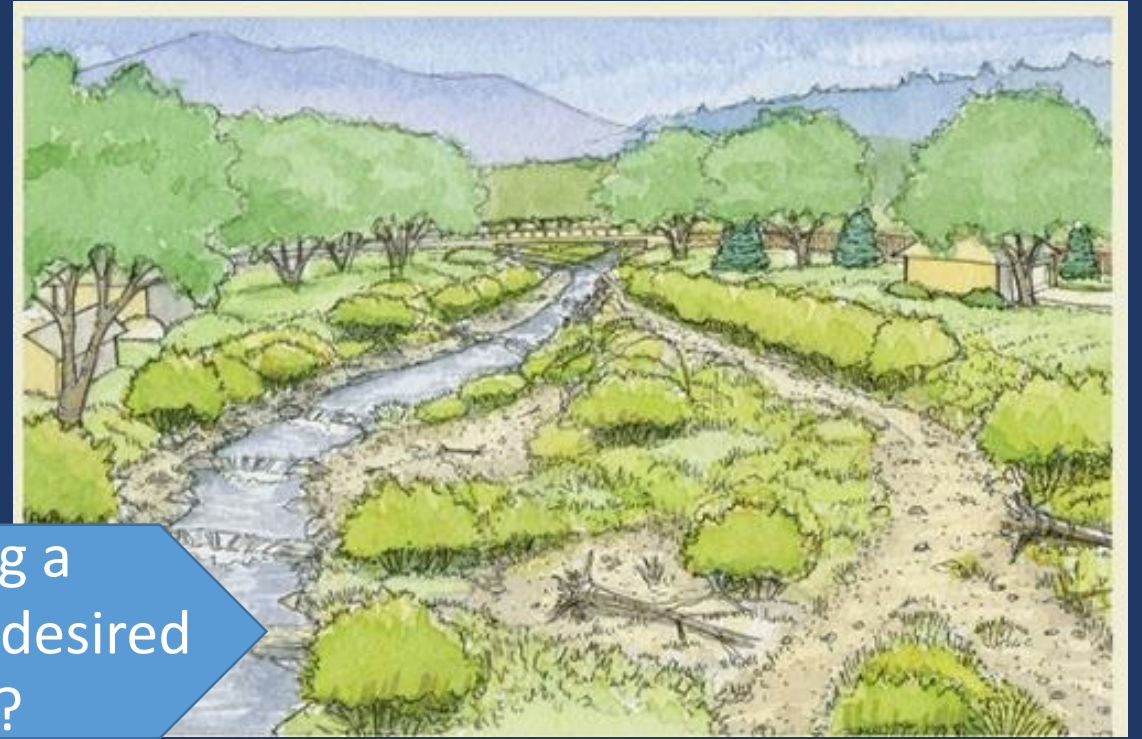
# 3. Monitor and Assess

- Restoration



Are we maintaining a trajectory towards our desired future condition?

- Desired Future Conditions



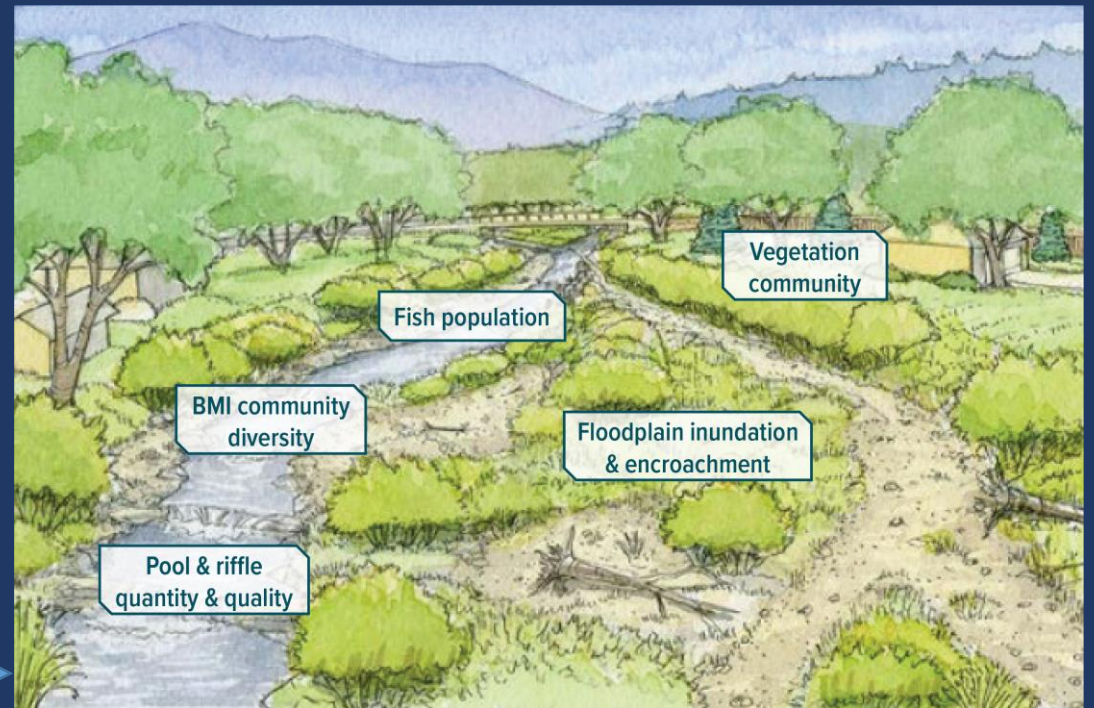


# Using an Adaptive Management Framework

## Connect project goals to desired future conditions

1. Maintain or improve floodplain and channel connectivity;
2. Maintain or improve channel morphology and physical habitat;
3. Maintain or improve native riparian condition and the native plant community;
4. Maintain or improve benthic macroinvertebrate community;
5. Maintain or improve water quality;
6. Maintain or improve fish community and condition;
7. Reduce hazards and increase flood safety.

## Desired Future Conditions





# Monitoring and Assessment Framework

## Example - Pools:

Related Management Goal: 2) Maintain or improve channel morphology and physical habitat.

### Hypothesis

Average residual pool depth will be maintained or increased to provide refugia for fish year to year.

### Performance Standard

At low flow, average residual pool depth per reach is maintained or increasing and greater than 1.0 feet in plains and foothills, or 0.8 feet in canyons.

### Management Trigger

At low flow, average residual pool depth per reach is declining or less than 1.0 feet in plains and foothills, or 0.8 feet in canyons.

### Suggested Action

Investigate functional driver(s) performance to assess impacts on the parameter

Relate average pool depth to pool area measurements

Actively manage flow and/or pool size





# Monitoring and Assessment Framework

## What Sets This Framework Apart?

### Holistic



It addresses ecological conditions but accounts for all watershed functions as drivers.

### Actionable



On-the-ground management actions are incorporated directly into the monitoring plan.

### Flexible

New datasets can be incorporated seamlessly by modifying hypotheses.

Performance standards or management triggers can also be modified to accommodate unique project goals.

Data collection methods can also be adjusted for different systems or watershed needs.



4

Evaluate

5

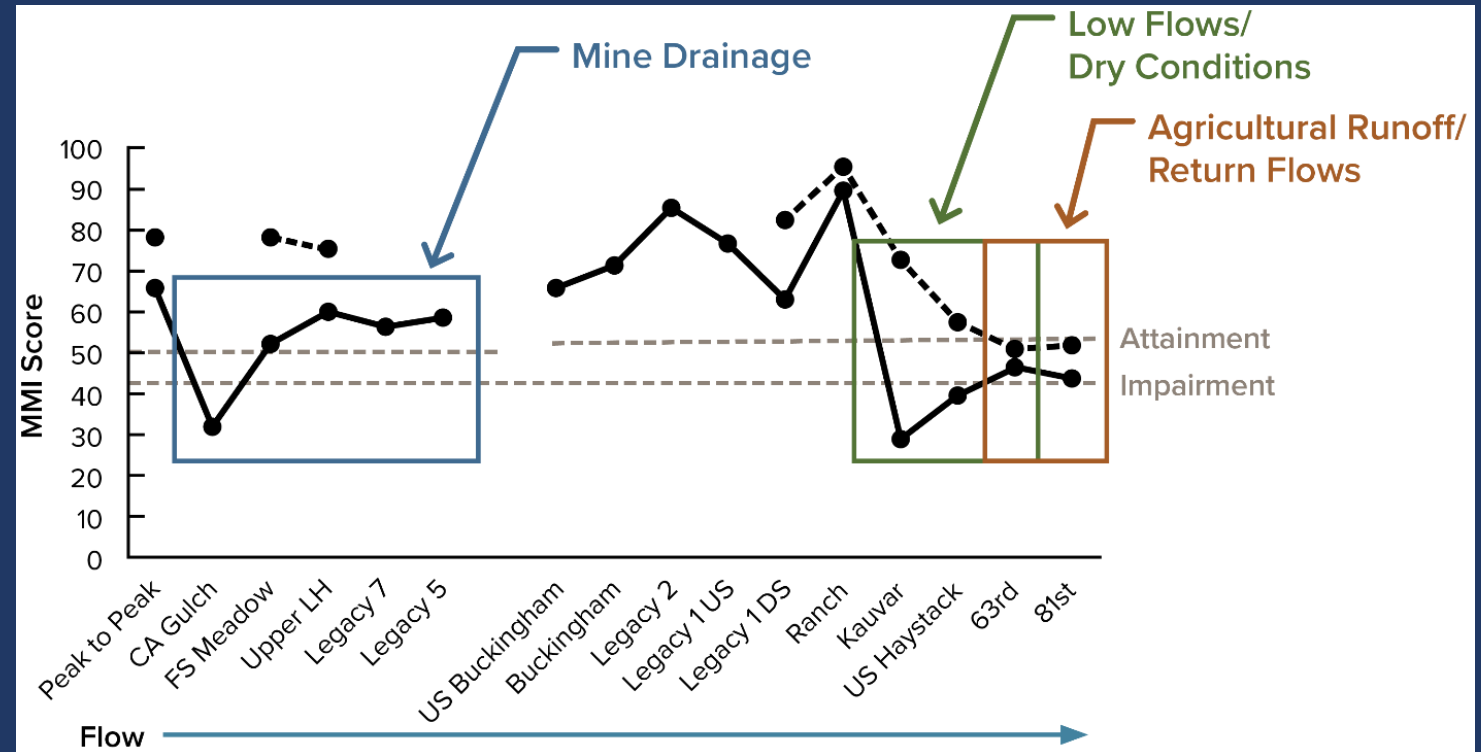
Adjust

# 4. and 5. Evaluating and Adjusting

## Water Quality Example:

### Year 1 Adjustments:

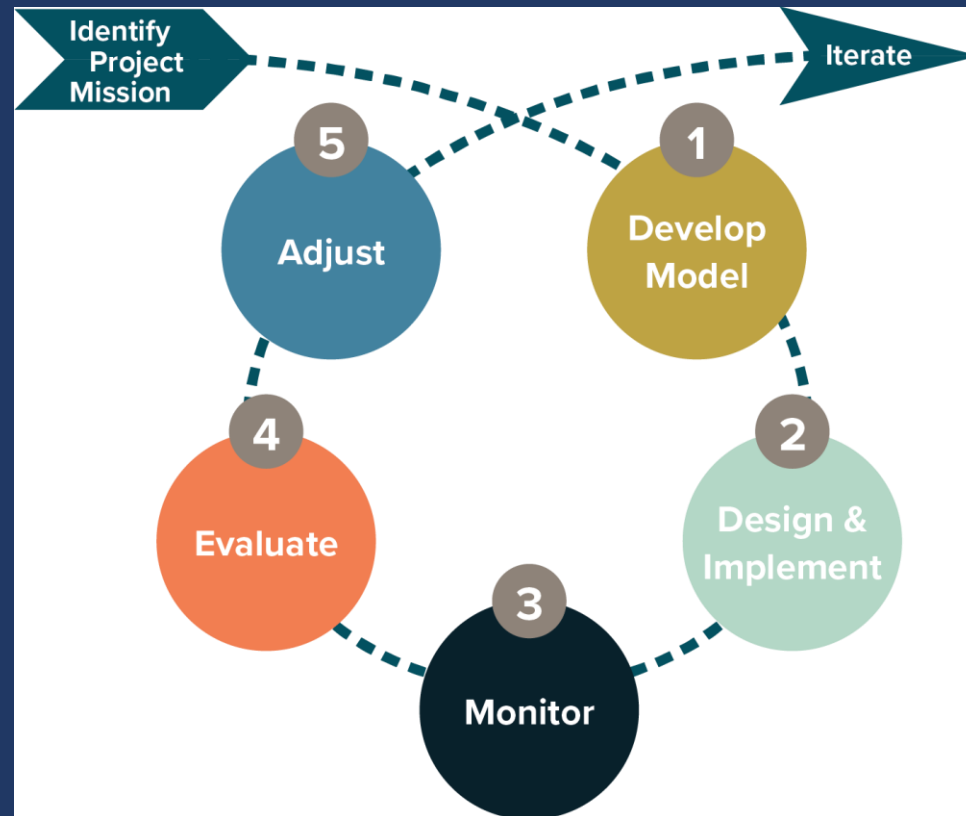
- Address water quality issues
- Prioritize restoration where water quality issues are not present





# The Future

- Continuing process to build our understanding of system, improve conceptual model on annual basis.
- Studies to improve that include fish population studies, barrier assessment, water quality studies, experimental restoration including stage zero project.





# Achieving Outcomes & Future Initiatives



- Considering Forests
- Engaging Community
- Extending Geography



Create the most **resilient future possible** for people and environment.





# THANK YOU

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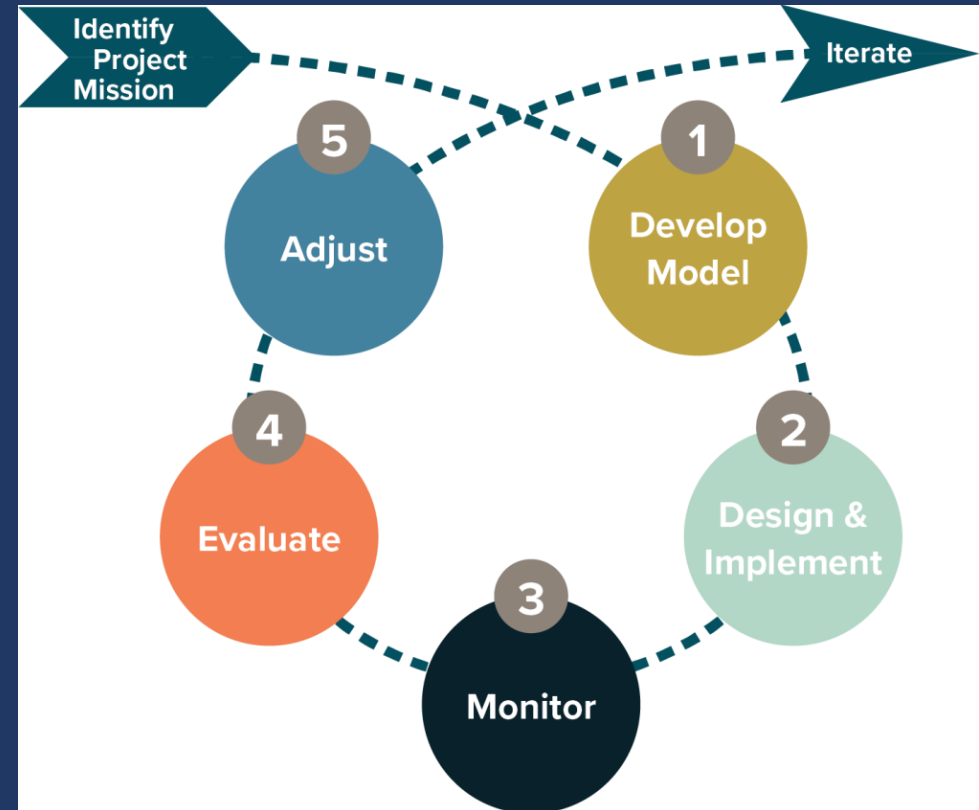
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# Key Takeaway 1

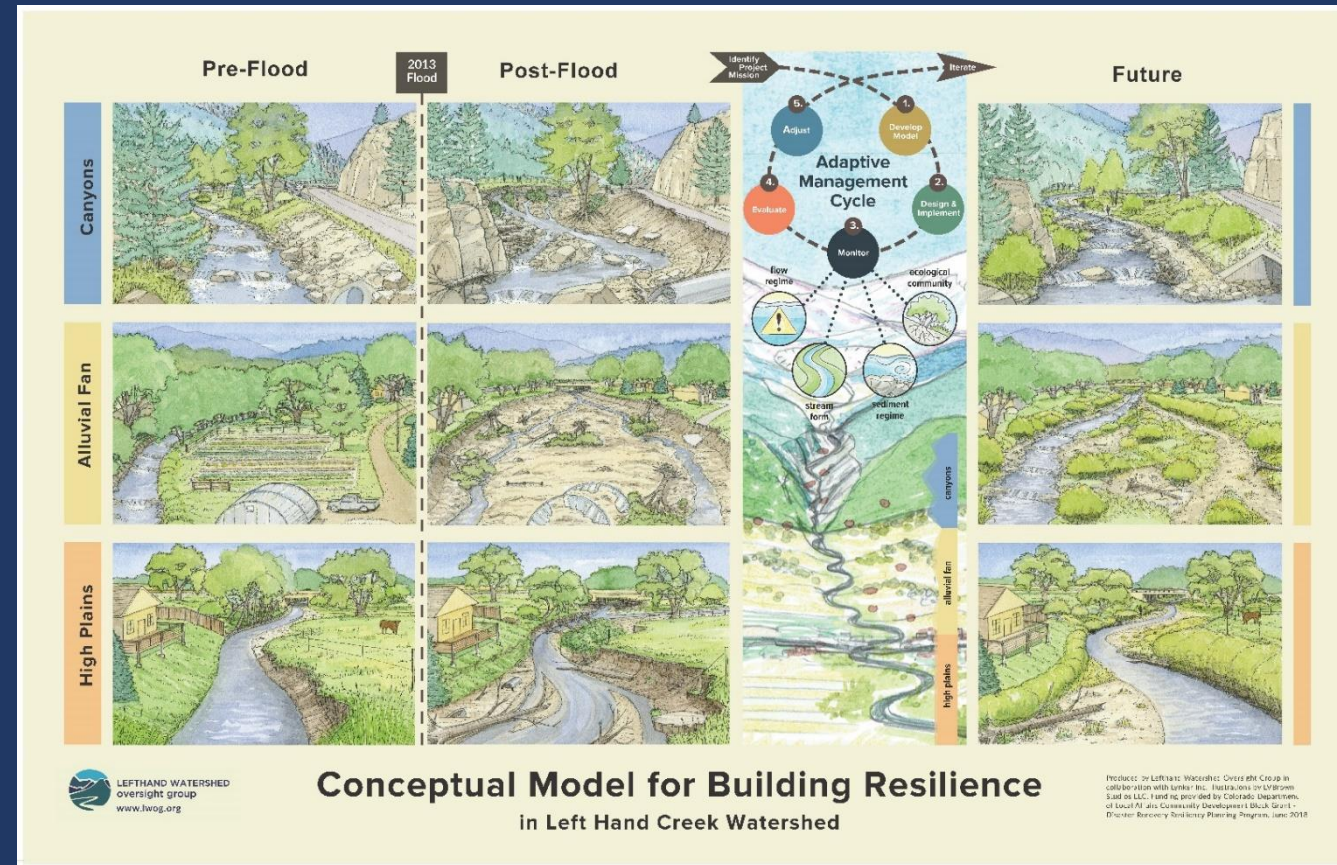
- Consider using an Adaptive Management approach in watershed planning!
  - Adaptive management is a flexible process that acknowledges we do not have all the information and cannot predict all outcomes.
  - But we document our current understanding, and make a plan to adjust along the way.





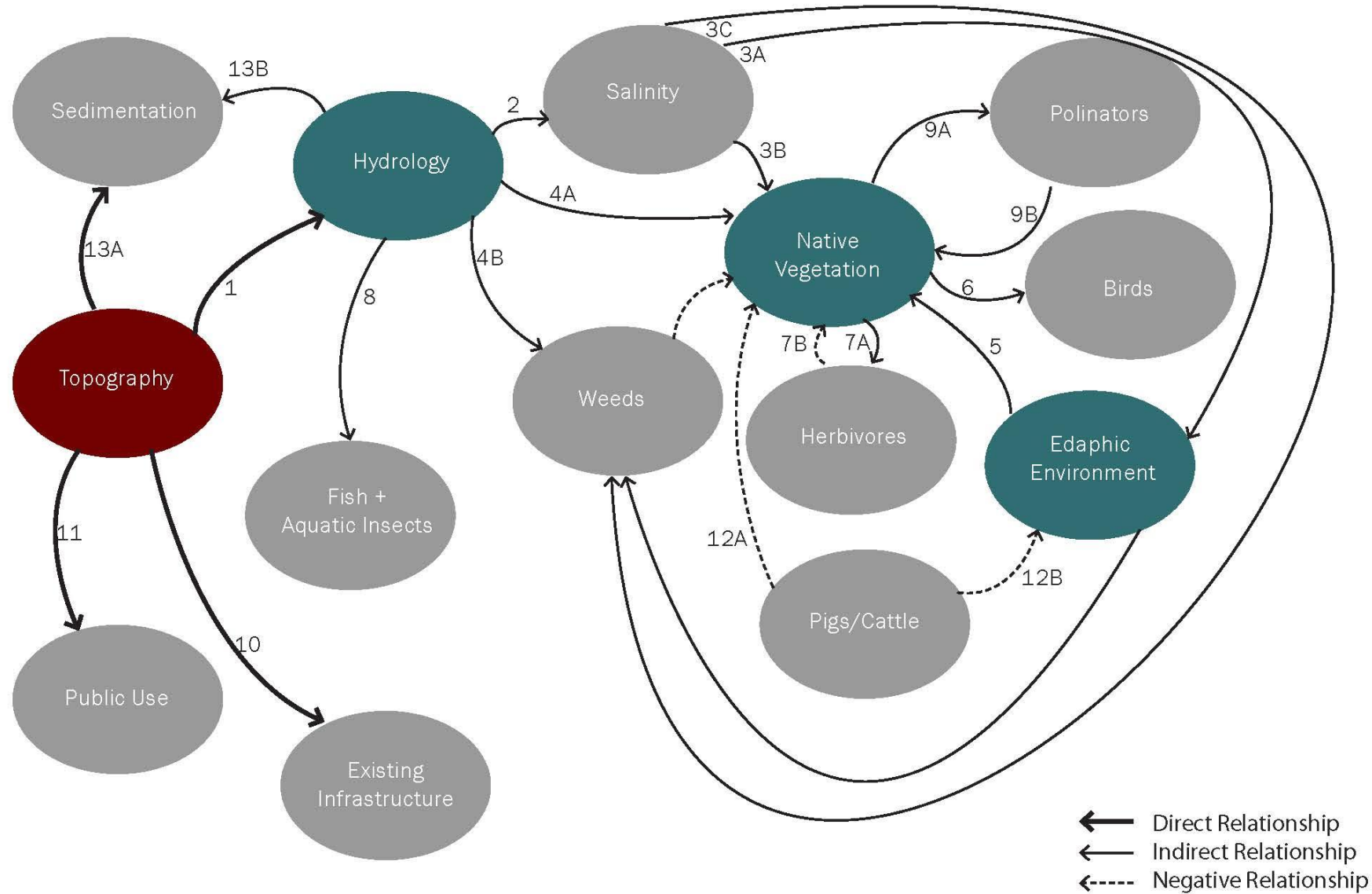
# Key Takeaway 2

- Consider using conceptual models to define past, present and potential future conditions and deepen your understanding!
  - Avoid “baseline” reports that describes the current conditions in extraordinary detail...
  - Thinking tools are best!





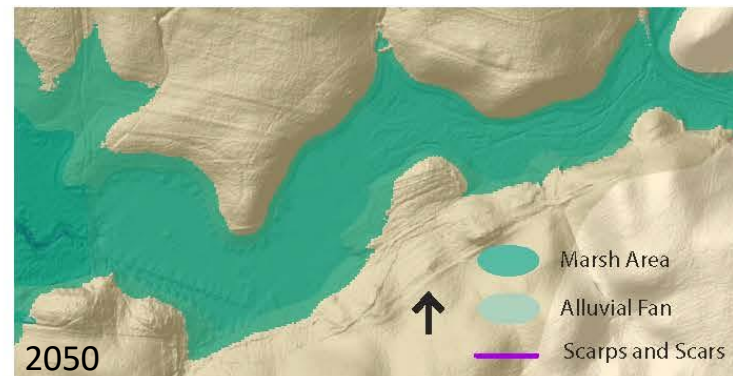
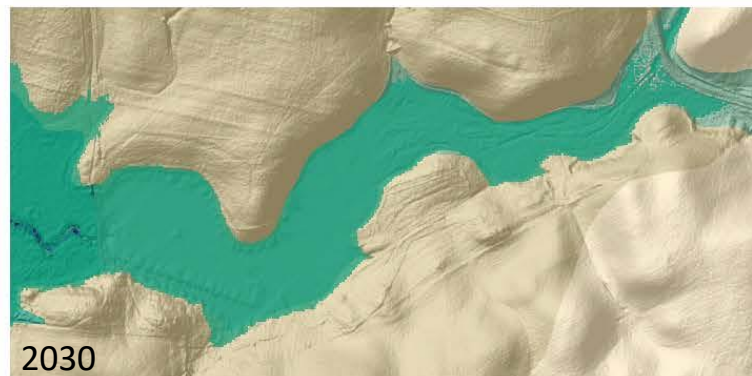
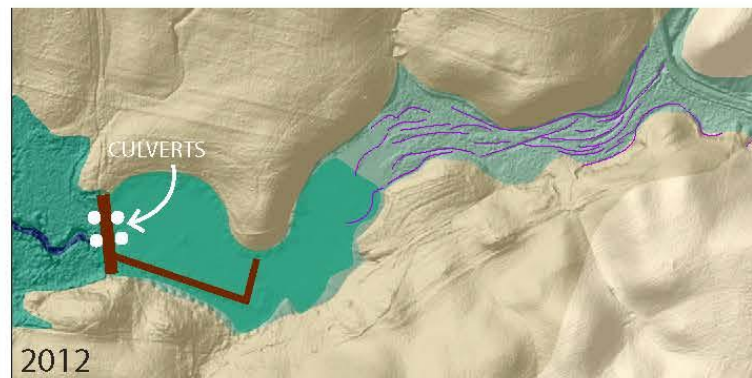
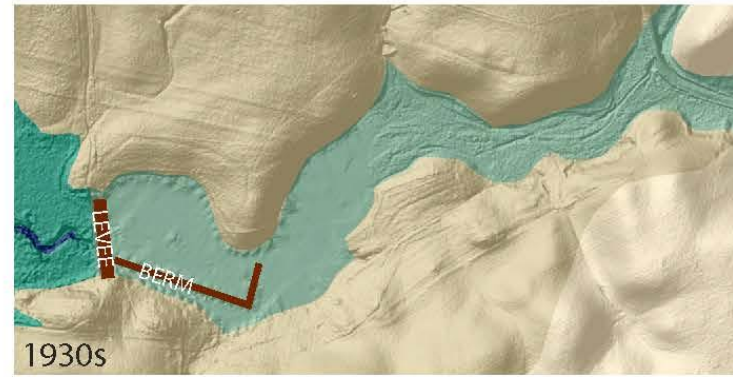
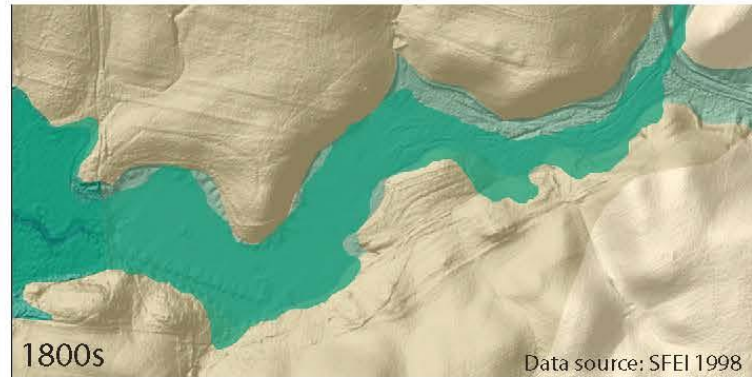
# SITE CONCEPTUAL MODEL example



How will the site respond following reconnection?



# SITE CONCEPTUAL MODEL example



Shifting baselines