AN EQUATION FOR FLOOD MITIGATION IN THE SPECIAL FLOOD HAZARD AREA AND BEYOND
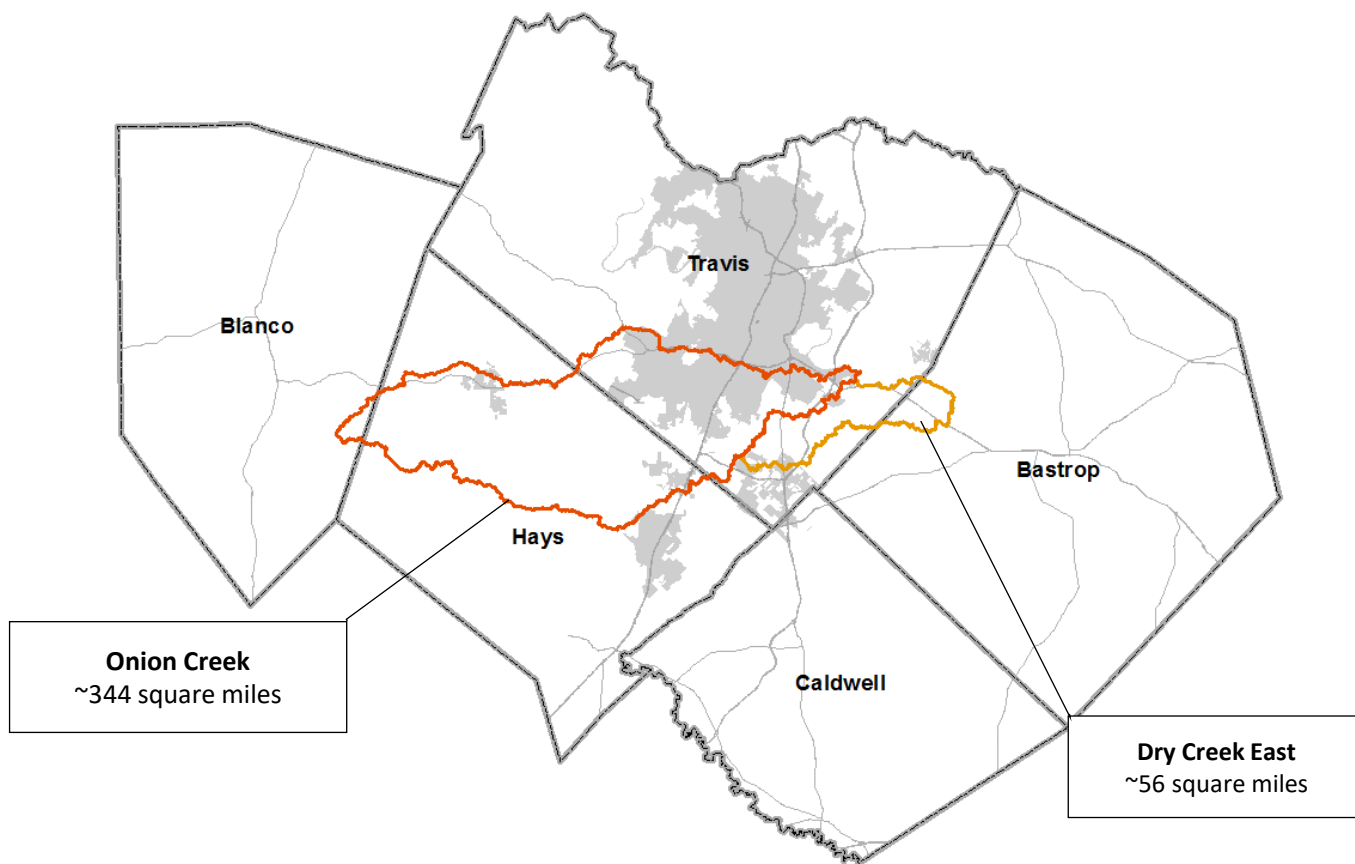
TEXAS FLOODPLAIN MANAGEMENT ASSOCIATION
Fall Technical Summit
August 30, 2017

Stacey Scheffel, CFM
Cindy Engelhardt, PE, CFM
Stephanie Castillo, EIT, CFM

HALFF®

Onion Creek
~344 square miles

Dry Creek East
~56 square miles

Blanco

Travis

Hays

Bastrop

Caldwell

OVERVIEW

UTILITY FUNCTION

CONCLUSION

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Cindy Engelhardt, PE, CFM
Stephanie Castillo, EIT, CFM

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Sept 2015, Onion Creek, 12711 Cholla Ln

May 2016, Citation & Man O War

May 2016, Citation & Ponder Ln

April 2017, Onion Creek, Turley Dr

May 2016, FM 973

Oct 2013, Onion Creek, 12711 Cholla Ln
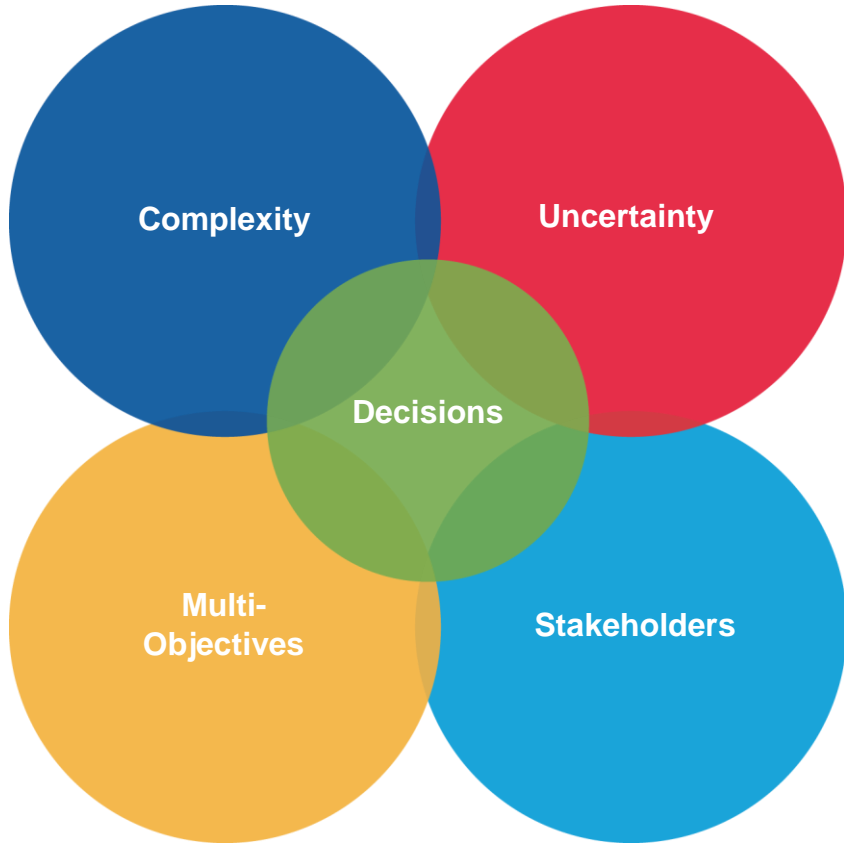
OVERVIEW

UTILITY FUNCTION

CONCLUSION

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DECISION-ANALYSIS PROCESS

Avoiding "ERROR OF THE THIRD KIND"

- Reject alternative for the **WRONG** reason
- Solve the **WRONG** problem

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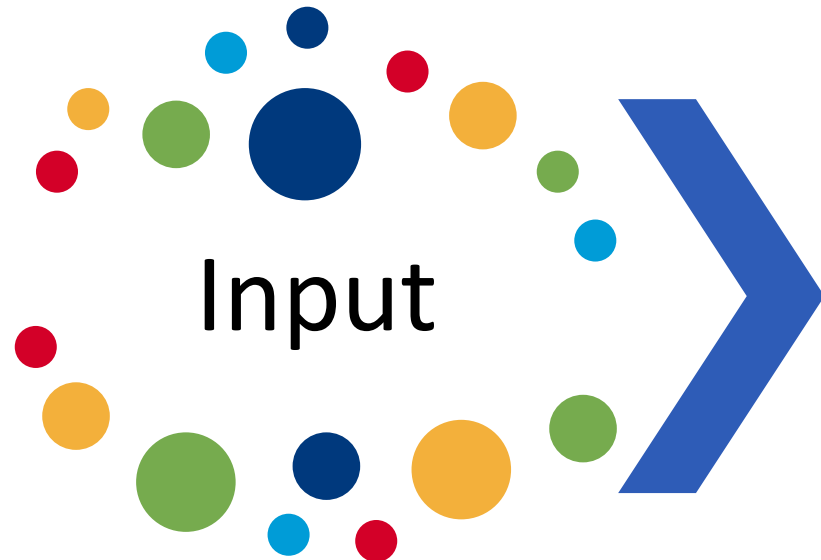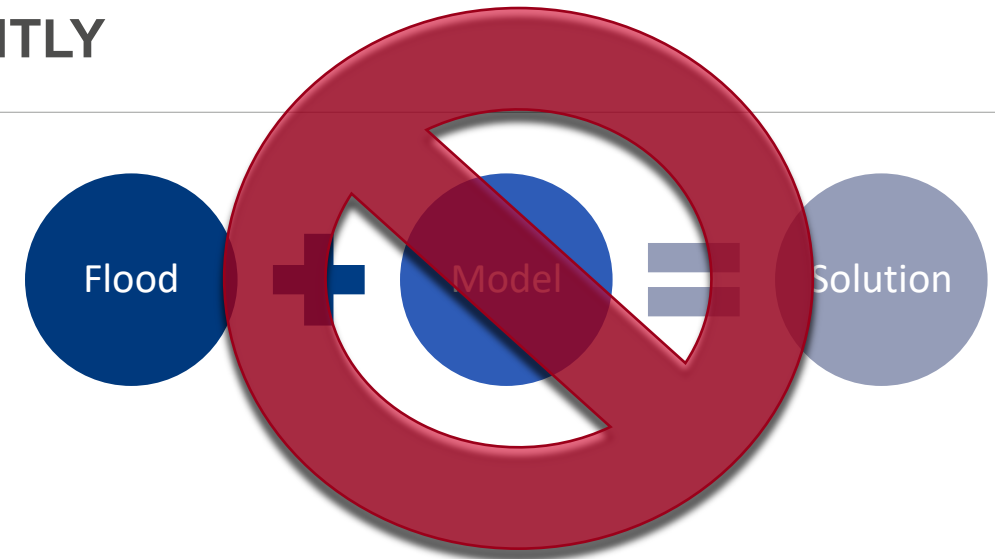**Cindy Engelhardt, PE, CFM**
Stephanie Castillo, EIT, CFM

DECISION-ANALYSIS PROCESS

Develop an equation that "TELLS" you what to do

Stacey Scheffel, CFM
Cindy Engelhardt, PE, CFM
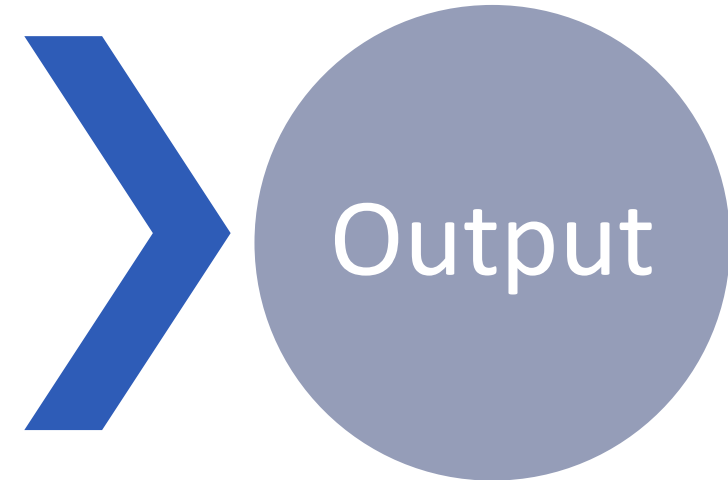**Stephanie Castillo, EIT, CFM**
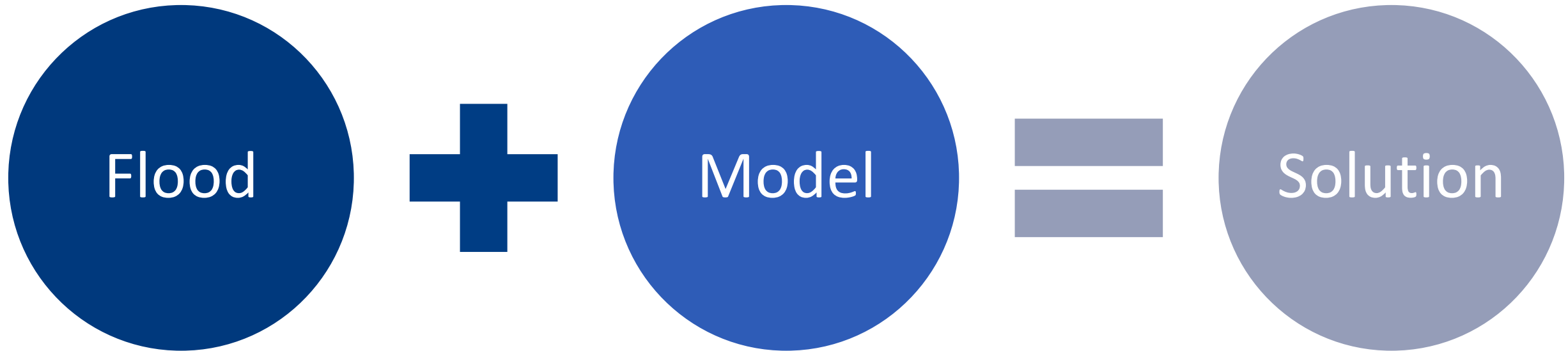
DECISION-ANALYSIS PROCESS

The **ALGORITHM** that leads to possible solutions

- Impossible to create an **UNBIASED-OBJECTIVE** output based on **SUBJECTIVE** inputs

Flood + Model = Solution

Input > Decision Analysis Process > Output

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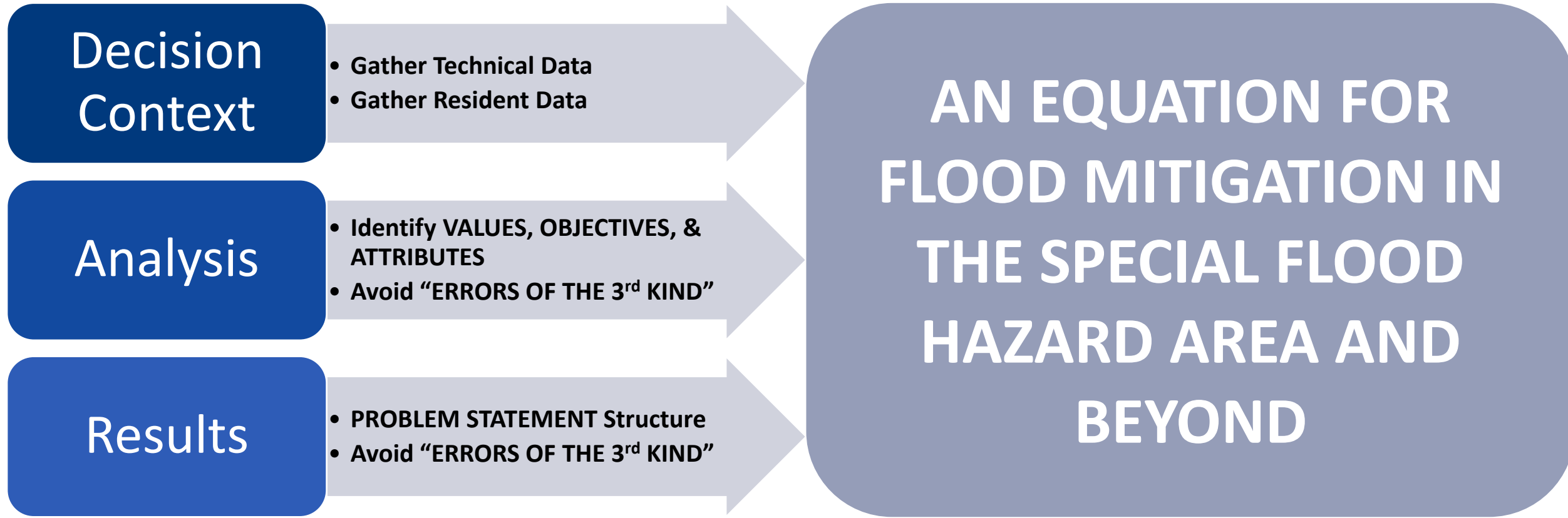
OVERVIEW

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Stephanie Castillo, EIT, CFM

WHAT IS A "UTILITY FUNCTION?"

An **"Apples-to-Apples"** comparison of **APPLES AND ORANGES**

Decision Context
- Gather Technical Data
- Gather Resident Data

Analysis
- Identify VALUES, OBJECTIVES, & ATTRIBUTES
- Avoid "ERRORS OF THE 3rd KIND"

Results
- PROBLEM STATEMENT Structure
- Avoid "ERRORS OF THE 3rd KIND"

AN EQUATION FOR FLOOD MITIGATION IN THE SPECIAL FLOOD HAZARD AREA AND BEYOND

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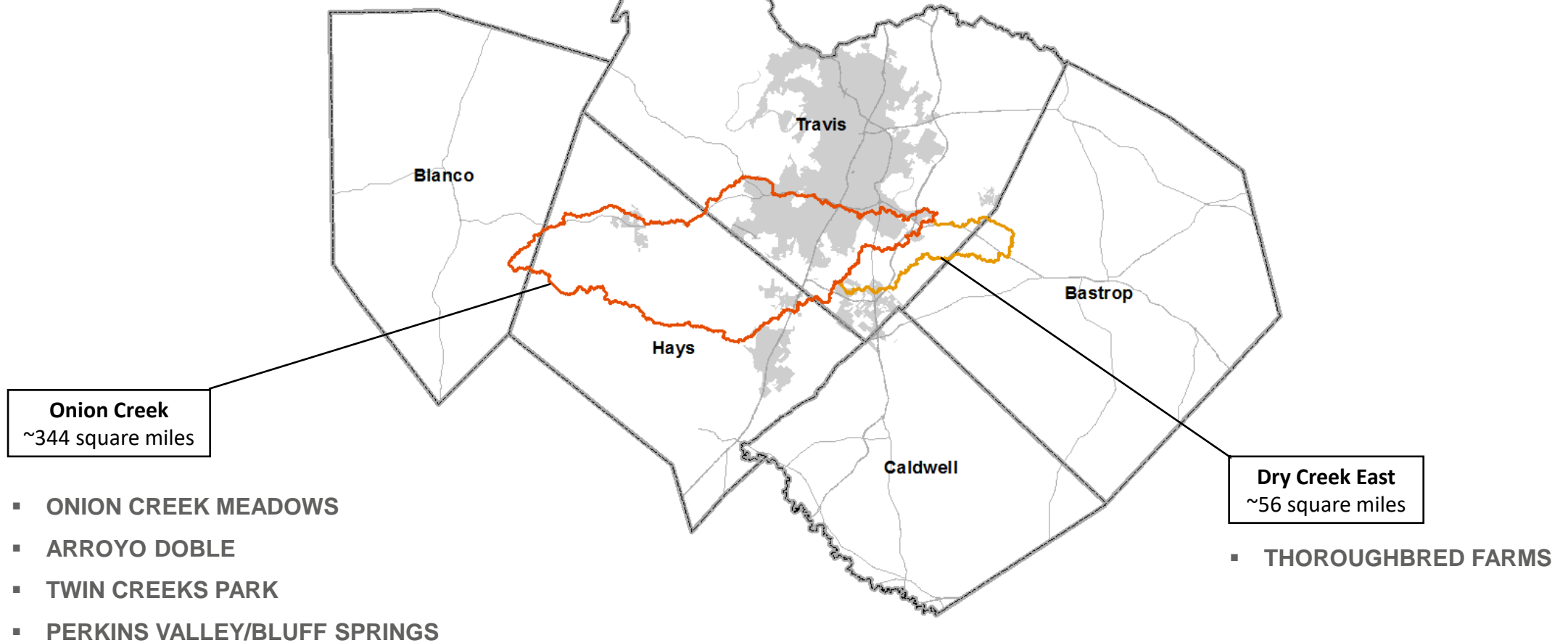
Decision Context
- Gather Technical Data
- Gather Resident Data

GATHER TECHNICAL DATA

DRY CREEK EAST

- Regulatory Effective Models
  - Hydrologic
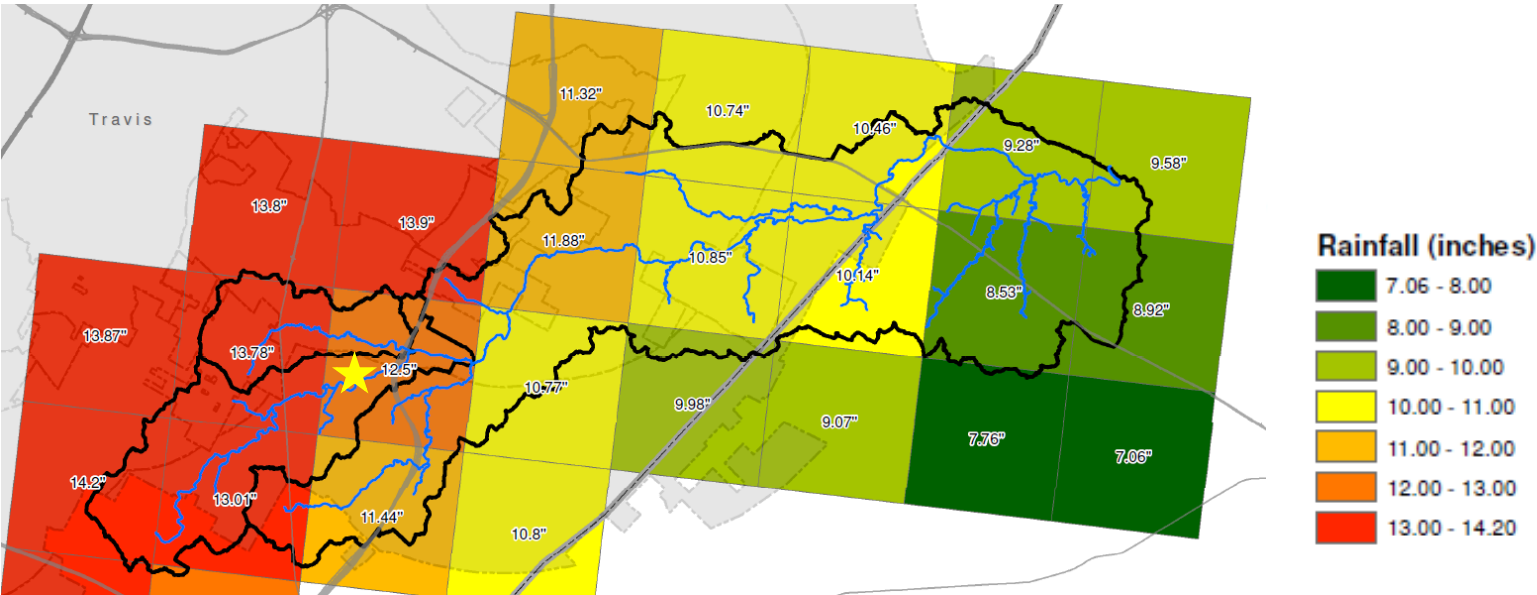 - Hydraulic
- LiDAR
- Rainfall
- Survey

	Rainfall (inches)			
	1 % ACE	0.2% ACE	Oct 30, 2015	May 26, 2016
South Fork of Dry Creek East at Thoroughbred Farms	6.5 (4 hr)	9.0 (4 hr)	11-14 (2 hr)	8-11 (4 hr)

	Flow (cubic feet per second)			
	1 % ACE	0.2% ACE	Oct 30, 2015	May 26, 2016
South Fork of Dry Creek East at Thoroughbred Farms	11,800 cfs	16,200 cfs	18,000 cfs*	16,200 cfs*

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Cindy Engelhardt, PE, CFM
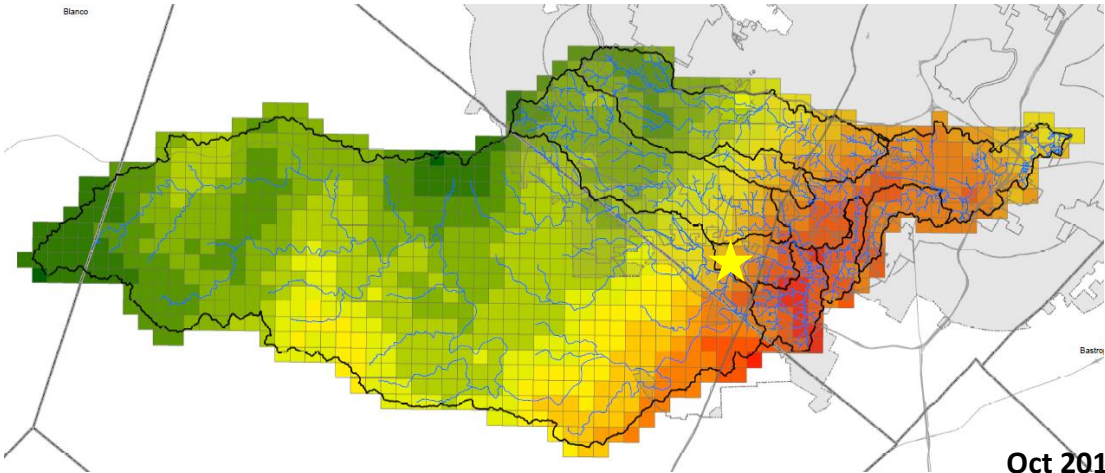Stephanie Castillo, EIT, CFM

Decision Context
- Gather Technical Data
- Gather Resident Data

GATHER TECHNICAL DATA

ONION CREEK

- 2016 Preliminary Models
  - Hydrologic
  - Hydraulic
- LiDAR
- Rainfall
- Survey

Oct 2015

Oct 2013
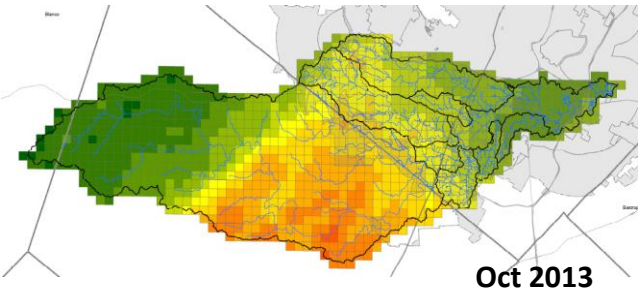
	Rainfall (inches)			
	1 % ACE	0.2% ACE	Oct 31, 2013	Oct 30, 2015
Onion Creek near confluence with Bear Creek	6.9 (6 hr)	9.5 (6 hr)	9-12 (6 hr)	11-15 (6 hr)

	Flow (cubic feet per second)			
	1 % ACE	0.2% ACE	Oct 31, 2013	Oct 30, 2015
Onion Creek near confluence with Bear Creek	11,800 cfs	16,200 cfs	18,000 cfs*	16,200 cfs*
Onion Creek at US 183	118,200 cfs	185,400 cfs	135,000 cfs8	120,000 cfs*

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Stephanie Castillo, EIT, CFM

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| Decision Context | • Gather Technical Data
• Gather Resident Data |

GATHER RESIDENT DATA

DRY CREEK EAST WATERSHED

■ Resident Testimony

  ☐ Floodplain Boundaries

  ☐ High Water Marks

  ☐ Flow Direction

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Decision Context
- Gather Technical Data
- Gather Resident Data

GATHER RESIDENT DATA

Onion Creek Watershed

■ Resident Testimony
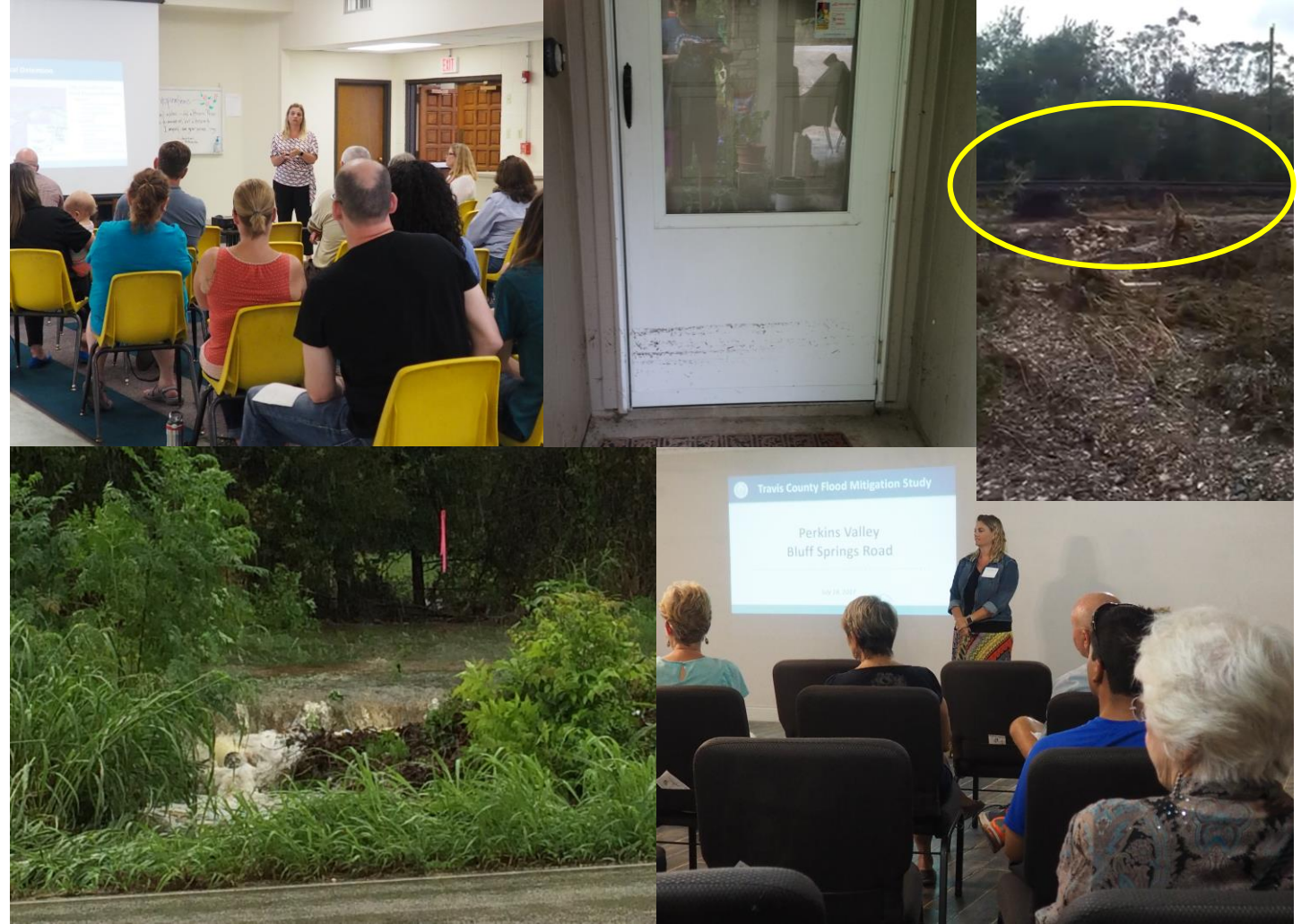
☐ Floodplain Boundaries

☐ High Water Marks

☐ Flow Direction

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OVERVIEW

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OBJECTIVES

Risk Reducing Alternative

Public Safety

Social

Economic

Environmental

Project Timing
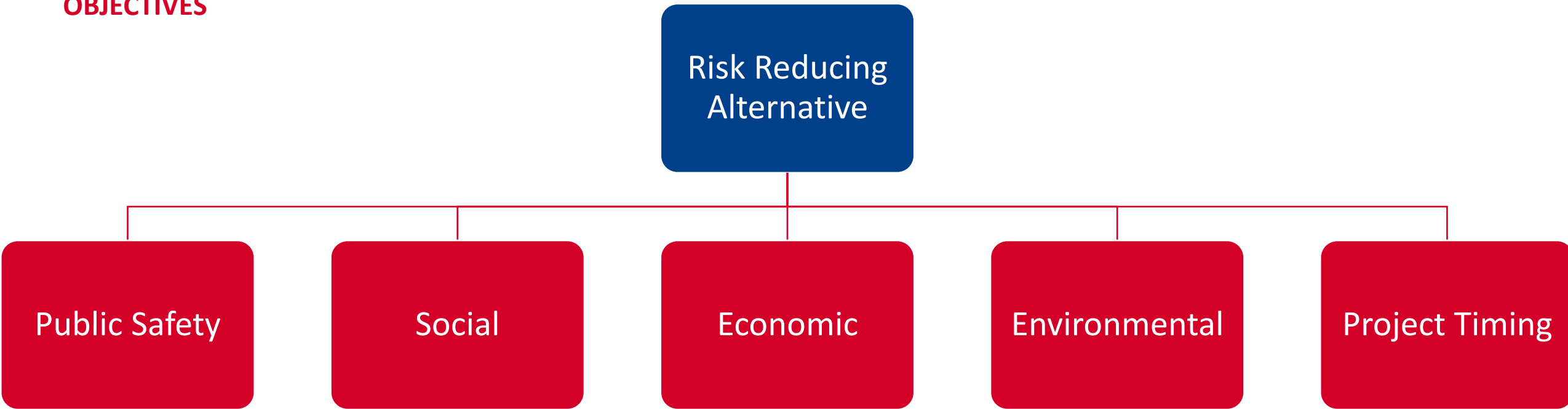
$$U_{TOTAL} = U_P + U_S + U_M + U_E + U_T$$

$$U_{TOTAL}(P, S, M, E, T) = C_1\left(U_p\right) + C_2(U_S) + C_3(U_M) + C_4(U_E) + C_5(U_T)$$

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CONCLUSION| BUILDING THE HIERARCHY

ATTRIBUTES

```
                                    Alternative
```

| Public Safety | Social | Economic | Environmental | Project Timing |

- **Public Safety**
  - Road Flooding and Mobility
  - Emergency Access
  - Property/ Infrastructure Flooding
  - Level of Service
  - Mitigation required for downstream impacts

- **Social**
  - Public Opinion
  - Element of a comprehensive Plan

- **Economic**
  - Benefit/Cost Relationship
  - Sustainability
  - Impact to County Tax Rolls
  - Funding Source

- **Environmental**
  - Water Quality Significance
  - Impact to existing environmental features

- **Project Timing**
  - Ease of Permitting
  - Land and Easement Acquisition

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UTILITY FUNCTIONS

Are just a "FANCY" Weighted Average
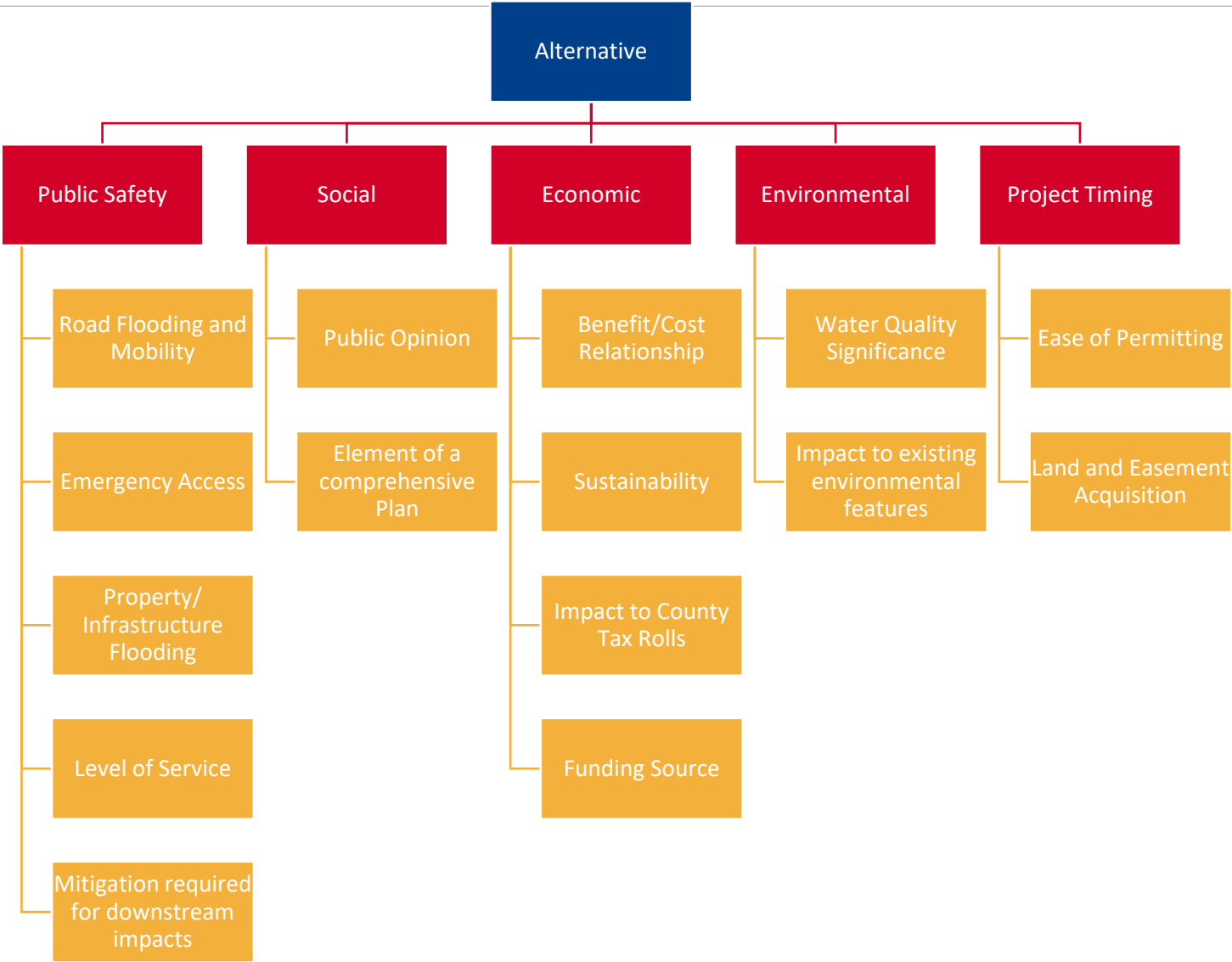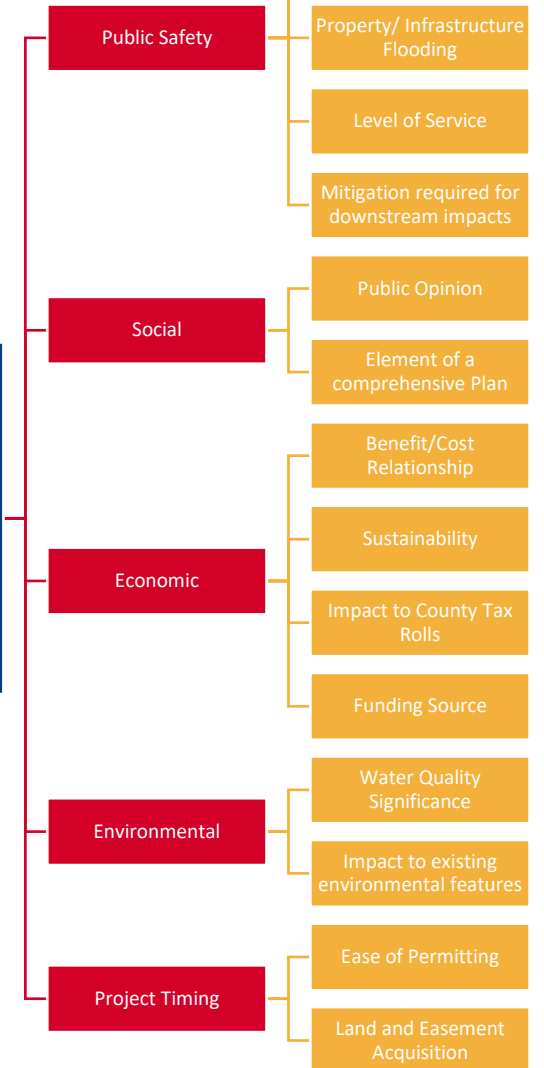
- Weights are not arbitrarily chosen

- Building the function is an iterative process

- Many different disciplines use this concept

- Applying this technique to everyday life makes people better rational decision makers

PRELIMINARY TRAVIS COUNTY UTILITY FUNCTION

$$U_{TOTAL} = U_P + U_S + U_M + U_E + U_T$$

Alternative

Public Safety
- Road Flooding and Mobility
- Emergency Access
- Property/ Infrastructure Flooding
- Level of Service
- Mitigation required for downstream impacts

Social
- Public Opinion
- Element of a comprehensive Plan

Economic
- Benefit/Cost Relationship
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Environmental
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Project Timing
- Ease of Permitting
- Land and Easement Acquisition

Stacey Scheffel, CFM
Cindy Engelhardt, PE, CFM
Stephanie Castillo, EIT, CFM

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QUESTIONS?

Contact:

- Stacey Scheffel, CFM | 512-854-7565

  Stacey.Scheffel@traviscountytx.gov

- Cindy J. Engelhardt, PE, CFM | 512-777-4552

  CEngelhardt@halff.com

- Stephanie Castillo, EIT, CFM | 512-777-4546

  SCastillo@halff.com

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**Stacey Scheffel, CFM
Cindy Engelhardt, PE, CFM
Stephanie Castillo, EIT, CFM**