

**KIOWA CREEK
MASTER DRAINAGE PLAN
PUBLIC MEETING
April 25, 2017**

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Project Objectives

▲ Introductions

- Arapahoe County staff
- BHI staff

Project Objectives

- ▲ Overall objective is to prepare a Master Drainage Plan (MDP) for Kiowa Creek and its tributaries within Arapahoe County

Project Description

- ▲ This project includes:
 - Topographic mapping of the Kiowa Creek watershed,
 - Field inventory of existing drainageway crossings,
 - Environmental assessment
 - Major drainageway baseline hydrology,
 - Floodplain delineation for Kiowa Creek and its tributaries

Project Description

- ▲ This project includes:
 - Alternative analysis to address potential flooding, drainage structure capacity, channel stability, and ecological issues, and
 - Planning-level conceptual design of recommended improvements
 - Preparation of Master Drainage Plan (MDP) Report

Study Area Description

- ▲ 275 square mile watershed
- ▲ Headwaters in El Paso County
- ▲ Flows through Elbert County to Arapahoe County
- ▲ Watershed area within Arapahoe County approximately 42 square miles

Study Area Description

- ▲ Several tributaries primarily to the west of Kiowa Creek
- ▲ Crossings of Brick Center Road (CR129), E. Quincy Road, and County Line Road (CR50)
- ▲ Kiowa Creek crossings of County Line Road (CR50), E. Quincy and Interstate 70

Study Area Description

- ▲ County Planning and Zoning indicates area north of 6th Avenue could develop as densely as one dwelling unit per acre.
- ▲ Area south of 6th Avenue to remain more rural with A-1 and A-E zoning with 19-acre and 35-acre sites respectively

Environmental Assessment

- ▲ Located in the Foothills Grassland ecoregion
 - Historically contained a mix of shortgrass and tallgrass prairie vegetation species
 - Historically the creek likely flooded frequently and contained a wide riparian zone
 - In several areas, the Creek is currently constrained to a narrow active stream channel, surrounded by dry grassy terraces
 - Grassland areas have been converted to agriculture and in some areas degraded the grassland

Environmental Assessment

- ▲ Approx. 200 acres of wetlands
 - Dominated by wetland grasses, rushes and seges
- ▲ Approx. 1,100 acres of riparian areas
 - Dominated by mature Plains cottonwoods with mostly grassy understory
 - Lack of a continuous riparian corridor
 - Riparian trees and shrubs provide important habitat for wildlife including: deer, migratory birds, small mammals, and predators

Hydrologic Analysis

- ▲ Existing and Future Conditions Models
- ▲ Used the Colorado Urban Hydrograph Procedure (CUHP)
- ▲ Modelled 2-, 5-, 10-, 25-, 50-, 100-, and 500-year rainfall events

Hydrologic Analysis

▲ Land Use

Land Uses and Percent Impervious Values

Land Use for Modeling	% Impervious
Greenbelts, agriculture	2%
Residential – Single family 0.25 acres or less	45%
Residential – Single family 1 acre	20%
Residential – Single family 2.5 acres or larger	12%
Mixed use	75%
Arapahoe County Planning Reserve	45%
Arapahoe County Tier 1	5%
Arapahoe County Tier 3	5%
Streets - Paved	100%
Industrial – Heavy Areas	90%
Industrial – Light Areas	80%
Suburban Area	75%

Hydrologic Analysis

▲ Rainfall

One-Hour and Six-Hour Point rainfall (inches)

Duration	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
1-Hour	0.97	1.38	1.65	2.05	2.32	2.67
6-Hour	1.4	1.9	2.2	2.80	3.0	3.4

Storm duration and area adjustment for CUHP modeling of Kiowa Creek

Watershed Area (Square Miles)	Storm Duration (hours)	Area Adjustment Needed?	Location of Area Adjustment
>50	6	Yes	Upper Kiowa Creek and Kiowa Creek
<15	2	No	Tributaries A, B, C, D, E and F

Hydrologic Analysis

▲ Hydrologic Results

- What is a 100-year storm event?
- 100-year event key flow rates
- Impacts of future development south of the County line - 70% increase in Kiowa Creek at the County line crossing

Hydraulic Analysis

▲ Evaluation of Existing Facilities

- Culvert Crossings
- Bridge Crossings
- 100-Year Floodplains
 - Kiowa Creek
 - Tributaries

Hydraulic Analysis

▲ Evaluation of Existing Facilities – Crossings

Crossing Structure Criteria

Jurisdiction	Maximum Culvert Headwater:Depth	Bridge Freeboard	Street Overtopping
Arapahoe County	≤ 1.2 arterial, ≤ 1.5 local/collector	3' (high debris), $0.1Q^{0.3} + 0.008v^2$ (low-moderate debris)	No Overtopping
CDOT	Rise/Diameter: $< 36'' - 2$ $36'' - 60'' - 1.7$ $> 60'' - < 84'' - 1.5$ $84'' - 120'' - 1.2$ $\geq 120'' - 1.0$	4' (high debris), $0.1Q^{0.3} + 0.008v^2$ (low-moderate debris)	No Overtopping

Hydraulic Analysis

▲ Evaluation of Existing Facilities

– 100-Year Floodplains

- Currently there are not any habitable structures within the FEMA 100-year floodplain
- FEMA study did not include the Tributaries to Kiowa Creek
- Tributaries assessed as part of this project
- 100-year floodplains delineated for the Tributaries for planning purposes
- No habitable structures are located within the Tributary floodplains

Alternative Analysis

▲ Goals:

- Maintain the existing Kiowa Creek floodplains
- Maintain the newly delineated Tributary floodplains
- Maintain the rural/agricultural characteristic of the watershed within Arapahoe County

Alternative Analysis

▲ Primary Alternatives:

- Maintaining the status quo
- Floodplain preservation w/channel stabilization
- Crossing structure improvements
- Detention ponds
- Channel lining

Alternative Analysis

Table 6-1 – Alternatives Pre-Screening Matrix

Reach	Status Quo	Floodplain Preservation with Channel Stabilization	Crossing Structure Improvements	Detention Ponds	Channel Lining
Kiowa Creek 1	X	X	X	X	
Kiowa Creek 2	X	X			
Kiowa Creek 3	X	X	X	X	
Kiowa Creek 4	X	X			
Kiowa Creek 5	X	X	X	X	
Tributary A	X	X			
Tributary A.1	X	X	X	X	
Tributary A.1.a	X	X			
Tributary A.1.a.1	X	X			
Tributary A.1.a.2	X	X			
Tributary A.1.b	X	X			
Tributary A.1.b.1	X	X			
Tributary A.1.b.2	X	X			
Tributary A.2	X	X			
Tributary B	X	X			
Tributary B.1	X	X			
Tributary B.2	X	X			
Tributary B.2.a	X	X	X	X	
Tributary B.2.b	X	X	X	X	
Tributary C	X	X	X	X	
Tributary C.1	X	X			
Tributary C.1.a	X	X			
Tributary C.1.b	X	X			
Tributary C.2	X	X	X	X	
Tributary D	X	X	X	X	
Tributary D.1	X	X			
Tributary D.2	X	X	X	X	
Tributary E	X	X			

Next Steps and Project Schedule

- ▲ Alternatives Analysis – completion
 - Cost estimates
 - Alternative Report
 - Selection of preferred Alternative by County
- ▲ Conceptual Design
 - Development of conceptual design of the Preferred Alternative
- ▲ Final MDP Report

Project Completion Schedule

- ▲ Alternatives Analysis Report – Early May 2017
- ▲ Conceptual Design – May – July 2017
- ▲ Final MDP Report – July 2017
- ▲ MDP Adoption

Questions