

## BHI Project Kickoff Meeting Minutes

**Date:** July 14, 2016

**BHI Project Name:** Kiowa Creek Master Drainage Plan (MDP)

### 1. Introduction of Meeting Participants & Project Team

#### a. Roles and Responsibilities

Project Team & Roles		*Attendance at Meeting:	
Name	Project Responsibilities	Name	Project Responsibilities
Cathleen Valencia	<input checked="" type="checkbox"/> County – Project Manager	Craig Hoover	<input checked="" type="checkbox"/> Project Manager/PIC
Chuck Haskins	<input checked="" type="checkbox"/> County – Engineering Division Manager	Jared Lee	<input checked="" type="checkbox"/> Assistant Project Manager
Brian Love	<input checked="" type="checkbox"/> County – CIP Program Manager	Rifka Wine	<input checked="" type="checkbox"/> Drainage Lead
Brian Weimer	<input checked="" type="checkbox"/> County – Transportation Division Manager	Andrea Lowery	<input type="checkbox"/> Project Engineer
Roger Harvey	<input type="checkbox"/> County – Open Space	Kareem Saint-Lot	<input type="checkbox"/> Project Engineer
	<input type="checkbox"/>	Brady Weingardt	<input type="checkbox"/> Engineering Tech
	<input type="checkbox"/>	Greg Maynard	<input type="checkbox"/> GIS
	<input type="checkbox"/>	Alan Benham	<input checked="" type="checkbox"/> Survey
	<input type="checkbox"/>	Dennis Sandin	<input checked="" type="checkbox"/> Mapping

b. Roles of Sub-consultants with Point(s) of Contact –  
 Aerial Surveys International – Aerial Mapping Acquisition  
 Pinyon Environmental – Environmental Assessment – Karin McShea

c. Client Contact Information and Protocol:  
 All contact with Arapahoe County should go through Cathy, cc: Chuck and Brian L.

### 2. Project Objectives and Goals

- Overall project objective: Produce a Master Drainage Plan (MDP) for Kiowa Creek within Arapahoe County
- Discussion on project goals, objectives and standards  
 Specific elements to address:
  - Arapahoe County will want to use the final product for land use management, encroachment management, development review.

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- This is Arapahoe County's first watershed east of UDFCD's jurisdictional boundary, and this will be Arapahoe County's first MDP effort without UDFCD's assistance. Want this study to be an example for future rural watersheds in the County
- Recommended improvements – put costs to them, to help develop fees to help Arapahoe County fund projects.
- Arapahoe County Open Spaces may have goals for Kiowa Creek, including trail connections, possibly parallel to the stream.
- Open Spaces should be contacted through Cathy, and they will be invited to meetings on the project.
- For the tributaries, Arapahoe County wants approximate floodplain delineations to keep development from encroaching onto the floodplains. Comparison to FEMA floodplains. With this project, they want to develop a threshold that they can apply to other projects (640 acres?)
- Other major focus is analysis of the existing roadway crossings. These crossings may be very shallow and very wide. Are narrower structures more cost effective?
- Existing Transportation Master Plan (2035). Planned road improvements:
  - 6<sup>th</sup> Ave Crossing
  - I-70 full interchange at Kiowa Bennett
  - Trail connection under I-70 along the creek

### 3. Scope Overview

- Project Administration
  - Attach Earned Value Form to invoices. County to provide BHI with example format.
- Project Development – Arapahoe County will get back to BHI on the schedule for public meetings (Wednesday or Thursday's preferred). May combine public meetings with other projects or items of interest to residents to increase public turn-out to meeting.
- Data Collection, Research, Inventory, Existing Conditions
  - right-of-entry may be a delay. BHI will provide a blank form to Arapahoe County. Arapahoe County will give BHI a no-fee traffic control permit for survey crews.
  - County to provide planning, land use information (no major developments currently planned).
  - Coordination agencies: CDOT Region I, Adams Co., Elbert Co., Property owners (County to provide information), Utilities - gas,

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water?, Excel power, fiber (county to research utility providers), Colorado Water Conservation Board, Rural Economic Advancement Board (REAP)

### d. Major Drainageway Planning – Phase 1: Baseline Hydrology

- i. If the FEMA floodplain is significantly different from what BHI delineates on this project, Arapahoe County will need to evaluate what to do with that information.
- ii. County to coordinate with County Planning regarding land use and provide information to BHI.

### e. Major Drainageway Planning – Phase 2: Alternative Analysis

### f. Major Drainageway Planning – Phase 3: Conceptual Design

### g. Findings, Recommendations, and Final Plan Report

## 4. Project Execution

- **Immediate action items**
    - Initial project meeting – today's meeting
    - Establish project review team – input from County
    - Prepare project work plan
    - Resource review
    - Design study criteria
      - Existing dams will be ignored; the watershed upstream of the Elbert County line will be divided into larger subbasins based on land use.
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- Rainfall IDF curves – BHI will send County summary of recommended approach for review.
- Obtain necessary entry permits
  - BHI will provide blank right-of-entry form to County
- Plan and arrange traffic control
  - BHI will put County on notice when TC permit is needed for survey crews. County to provide no-fee ROW permit
- Develop contact list – need input from County
  - BHI will start list and send to County
- **Action Items within next month**
  - Initiate Survey
  - Data Collection
  - Field Inventory
  - Environmental Assessment

## 5. Questions

None

## 6. Recap/Summary

Arapahoe County wants feedback throughout the process, as this is their first MDP without UDFCD support – include lessons learned as item in progress meetings  
Notice to Proceed issued, Contracts signed

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**MEETING MINUTES**

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** September 14, 2016  
**Location/Time:** Crested Butte, CO, 5:00 PM  
**Organizer:** Craig Hoover, BHI  
**Attendees:**

Charles Haskins, Arapahoe County  
Cathleen Valencia, Arapahoe County  
Sue Liu, Arapahoe County  
Craig Hoover, BHI  
Rifka Wine, BHI

**Progress Meeting**

**Meeting Purpose: Regular Progress Meeting**

**I. Data Collection**

**A. Survey**

1. Survey was completed between August 23 and August 30. Control points were set throughout the watershed on properties that responded positively to the right-of-entry letters.
2. The crossing structures were also surveyed. One structure that was included in the survey request was not found in the field, along County Line Road approximately 1,000 feet to the west of Antelope Drive. Water had clearly been overtopping the road in the area. Arapahoe County will check whether this portion of County Line Road is maintained by Arapahoe County or Elbert County.
3. Right-of-entry has delayed the mapping by about one week. BHI will review the schedule and provide an updated schedule to Arapahoe County. Overall, the project is still on track.

**B. Mapping**

1. Project was flown the week of September 5. Surface is currently being processed, and is expected to be completed by September 27. One complete LAS surface will be provided that integrates the 1' contours from the LiDAR mapping along the main stem of Kiowa Creek and 2' contours from the orthoimagery throughout the rest of the watershed. A LAS file is an industry-standard binary format for storing airborne LiDar data.

**C. Environmental Assessment**

1. Arapahoe County Engineering Services would like to talk to Arapahoe County Open Spaces before Pinyon goes out to perform the Environmental Assessment. Subsequent to the Project Status meeting on September 16, 2106, the County provided BHI with contact information for County Open Spaces and asked us to contact them directly.

**II. Major Drainageway Planning Baseline Hydrology**

**A. Zoning Data**

1. Land Use Plans for Arapahoe, Elbert, and El Paso Counties have been obtained and reviewed by BHI.
  2. BHI downloaded the zoning map for Elbert County from the link forwarded by Arapahoe County, and confirmed that map will work for the project hydrology.
- B. Upstream basins in Elbert and El Paso Counties have been delineated, and hydrologic parameters are currently being assigned for input into CUHP.**

**III. Other Discussion**

- A. Arapahoe County has a website for stakeholders and residents. A link to that website should be included in the public meeting mailout.**
- B. The date of the first public meeting was discussed. It was decided to keep the meeting scheduled for late October, to inform the residents of what is being done on this project.**
- C. Subsequent to the Project Status meeting on September 16, 2106, the County indicated to BHI that the County will send out postcards with project information including a link to the website. The County will then gage the response and determine the need and timing for a public meeting.**

**IV. Action Items**

1. Arapahoe County will check whether the portion of County Line Road west of Antelope Drive is maintained by Arapahoe County or Elbert County.
2. BHI will review the schedule and provide an updated schedule to Arapahoe County.
3. BHI will coordinate with Arapahoe County Open Spaces, Roger Harvey, before Pinyon goes out to perform the Environmental Assessment.

This represents our interpretation of the discussions and decisions made at the meeting. Please notify us if you have any additions or deletions to the minutes.



## MEETING MINUTES

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** November 15, 2016  
**Location/Time:** Arapahoe County Eastern Service Center, Bennet, CO – 5 PM

**Attendees:**

Cathleen Valencia, Arapahoe County  
Brian Love, Arapahoe County  
Craig Hoover, BHI  
Jared Lee, BHI  
Approx. 12 Resident Attendees – See sign in sheet

**Meeting Purpose: 1<sup>st</sup> Public Meeting (Open House)**

- I. **Presentation of project area, brief project description - BHI**
- II. **Discussion Topics or Questions raised by members of the public in attendance**
  - o “Proposed Project Schedule?”
    - Complete Summer 2017
    - 2<sup>nd</sup> Public Meeting – Late March, Early April
  - o “What will be process for Final Plans? County to Adopt Plan?”
    - Resolution to adopt plan as guidance, not necessarily adopt flood plans.
  - o “Area comprised of Pure Sand”
    - Observation important
  - o “Any Plans for Roads across Kiowa Creek?”
    - Future 6<sup>th</sup> St. crossing, +/-10yrs out
  - o “Any Open Space Plans?”
    - N./S. Ex Plans
    - Bike Lane along Creek? – Not preferred along/across properties by residents
    - Preserve wildlife habitats along creek
    - Antelope Hills Trail – “not very active”
  - o “Proposed Changes as part of project”
    - Analyze existing Flow Path? Floodplain? Open Space? Green Belt?
      - Results not yet determined
  - o “Impact to Existing Floodplain?”
    - To be determined - Residents concerned this is a land grab tactic
  - o “Environmental Assessment (EA) included, impact to property owner use of land?”
    - High level EA only as part of this project.
  - o “What is the purpose for study?”



- High level planning document, Roadway crossings capacity/guidance
- o “Existing Floodplain limits?”
  - Can be found online via Arapa-map website
- o “Future Scheduled Anticipated Field Visits?”
  - 3 more visits
    - Soil Investigation
    - Site Specific Field Engr.
    - Environmental
- o “Water across Kiowa - Bennet Rd impacting residence downstream”
- o “Recommended improvements on Private Property?”
  - Possible bank protection, erosion control recommendations; mostly examining public roadway crossing improvements
  - Do Residents have ability to deny recommended improvement?
    - Driven by insurance requirements, permit requests
- o “Any existing Flow gauges along Creek?”
  - Not Planned, Hydrology based on calibrated procedures.
- o Open house discussions continued.

**III. Next Meeting: Tentative Late March, Early April**

Public Meeting  
Kiowa Creek Master Drainage Plan  
November 15, 2016

**PROJECT DESCRIPTION**

Arapahoe County (County) has contracted with Bohannon Huston, Inc. (BHI) to produce a Master Drainage Plan (MDP) for Kiowa Creek and its tributaries within the County. This project includes the following:

- topographic mapping of the Kiowa Creek watershed
- field inventory of existing drainageway crossings
- major drainageway baseline hydrology (i.e., the relationship between rainfall, land cover, soils and streamflow)
- alternative analysis to address potential flooding, drainage structure capacity, channel stability, and ecological issues
- planning-level conceptual design of recommended improvements
- floodplain delineation for Kiowa Creek and its tributaries

**OBJECTIVES**

The following are the objectives of the Kiowa Creek MDP:

1. Produce and collect data to support development of the Kiowa Creek MDP.
2. Assess environmental impacts to inform the development of drainage alternatives to help minimize adverse environmental impacts.
3. Develop the baseline hydrology model for the Kiowa Creek MDP that will inform the project team regarding existing and future conditions runoff values.
4. Develop alternatives to address flooding, drainage, channel stability, and ecological issues, evaluate the alternatives, and recommend a preferred alternative for approval by the County.
5. Develop conceptual design plans adequate in detail to properly plan bridges and culvert crossings, plan for new drainageway facilities, permit the acquisition of needed right-of-way and enable the County to permit new subdivisions and buildings in the study area with full knowledge of the area stormwater infrastructure requirements.
6. Produce a MDP that will be used for land use management, encroachment management, and development review.
7. Create a MDP that will serve as an example for future rural watersheds in the County.
8. Develop costs for recommended improvements that will help the County fund projects.
9. Consider Open Spaces plans for trail connections.
10. Develop approximate floodplain delineations to keep development from encroaching onto the floodplains.
11. Analyze existing roadway crossings for the potential to reduce footprint and increase cost-effectiveness.
12. Consider planned road improvements included in the existing Transportation Master Plan in order to determine future bridge/structure sizing.



**MEETING MINUTES**

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** December 15, 2016  
**Location/Time:** Phone, 2:00 PM  
**Organizer:** Craig Hoover, BHI  
**Attendees:**

Cathleen Valencia, Arapahoe County  
Brian Love, Arapahoe County  
Craig Hoover, BHI  
Jared Lee, BHI  
Rifka Wine, BHI

**Project Review Meeting**

**Meeting Purpose: Project Review Meeting**

**I. Budget**

\$5,195 was moved from Phase 005 (Alternatives Analysis) to Phase 004 (Baseline Hydrology). We may need an approved addendum or revised invoices. Arapahoe County will get back to BHI on this.

**II. Schedule**

Progress meetings will be scheduled monthly on the 4<sup>th</sup> Thursday of the month at 3:00 PM. Craig will send out an invitation. The schedule remains the same as the last revision. Pinyon is finished with the EA. A meeting will be scheduled for 1/10 for the HEC-RAS cross section review at BHI's Denver Office. Cathy will check with Chuck and then send out an invitation.

**III. Hydrology Model Imperviousness**

Based on a cursory review of the model prior to the meeting, the revised imperviousness had approximately 12% impact on a basin basis, negligible impact overall. This model is much more sensitive to the soils than it is to the imperviousness for the 100-year event. Subsequent to the meeting, the tributaries were reviewed in more detail, and the tributary flows went down approximately 40-50% for the 100-year event.

**IV. Model Inputs and Assumptions**

Rifka walked through the assumptions for the models, which are documented in the report text that was submitted with the SWMM models.



**V. Public Meeting Follow-up**

It seemed like the residents showed up expecting a presentation. Next time, maybe don't provide seating, or prepare a short presentation. Jared and Craig will consolidate the feedback they received from the residents for the project file.



**MEETING MINUTES**

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** February 9, 2017  
**Location/Time:** Phone, 3:00 PM  
**Organizer:** Craig Hoover, BHI  
**Attendees:**

Charles Haskins, Arapahoe County  
Cathleen Valencia, Arapahoe County  
Brian Love, Arapahoe County  
Craig Hoover, BHI  
Jared Lee, BHI  
Rifka Wine, BHI

**Monthly Progress Meeting**

**Meeting Purpose: Monthly Progress Meeting**

**I. Floodplain Delineation**

The floodplain delineation shown in the KMZ provided to the County is based on the future flows. BHI will clean up the small islands throughout the floodplain delineation as the analysis is finalized. Cathy and Chuck will review the floodplain in more detail next week and provide any additional comments by next Thursday.

**II. Alternatives Pre-Screening Matrix**

Due to the rural nature of the watershed, BHI suggested only considering water quality ponds where maintenance has been or may become an issue. The County will think about this and check with the road and bridge maintenance personnel to see if there have been any maintenance issues related to sediment in the area.

Channel lining may only be recommended where necessary to protect existing structures that may be threatened by bank erosion.

**III. Alternatives Evaluation Matrix**

The alternatives evaluation matrix was discussed. The County will review the weighting and provide any comments by next Thursday.

**IV. Existing Crossing Structure Inventory**

While Quincy Ave in the Kiowa Creek watershed is technically classified in ARAPAMAP as a collector road, the County wants to consider it as an arterial because it functions as an arterial in more populated areas in western portions of the County. Additionally, the County





wants to add a column to this table indicating whether the crossing structure capacity is sufficient for existing flows and a column for whether the roadway is overtopping in existing conditions.

**V. Schedule**

The milestone review meeting is being moved to February 23, to coincide with the next regular progress meeting. Cathy and Craig will discuss after this meeting whether Craig will attend in person.

**VI. Next Public Meeting**

The next public meeting should be scheduled sometime around April 20, after the Alternatives Report has been reviewed by the County. Craig and Cathy will discuss the scheduling of this in more detail after this meeting.

**VII. Other Discussion Items**

None

**VIII. Action Items**

County will review the floodplains, discuss sediment issues with road and bridge maintenance personnel, and review the Alternatives Evaluation Matrix weighting, providing additional input and comments by next Thursday.



**MEETING MINUTES**

**Project Name:** Kiowa Creek MDP

**Meeting Date:** February 28, 2017

**Location/Time:** BHI, 10:30 AM

**Organizer:** Craig Hoover, BHI

**Attendees:**

Charles Haskins, Arapahoe County

Cathleen Valencia, Arapahoe County

Brian Love, Arapahoe County

Craig Hoover, BHI

Rifka Wine, BHI

Olin Brown, BHI

**Project Review Meeting**

**Meeting Purpose: Project Review Meeting**

**I. County's Questions from 2/16 e-mail**

The County's comments that were sent on February 16 via e-mail were discussed:

1. Table 4-2 Existing Structure Crossings – please add a column for “Capacity Sufficient for Existing Flows” and a column for depth of water if road is over-topped.

Response: These columns have been added to Table 4-2.

2. Table 5-1 - Alternatives Pre-Screening Matrix

- a. We don't think the column for water quality ponds will be necessary.

Response: This column has been deleted. Water quality will need to be addressed when development occurs, depending on the intensity of the development. A qualitative discussion of water quality and impacts of development will be included in the MDP.

- b. Please explain the type of channel lining that you are proposing.

Response: Potentially riprap. This lining is only proposed to include locations where the tributaries are flowing along the side of roadways, potentially threatening the roadways themselves, or at locations where existing structures are threatened by lateral migration of Kiowa Creek or its tributaries.

- c. Should we separate floodplain preservation and channel stabilization?



Response: Potentially. Floodplain preservation without channel stabilization would essentially be just dedicating a floodplain right-of-way or easement. It was decided at the meeting not to separate the two.

- d. What is the difference between channel lining and channel stabilization?

Response: Channel lining would be hard-lining the channel where roadways or structures may be in harm's way if lateral migration were to continue. Channel stabilization includes grade control structures to stabilize the channel in its current location.

- e. Detention Pond column – are we looking at whether it would be less expensive to put in a pond than to fix a crossing?

Response: -Yes, detention ponds may be the less expensive option in some areas.

3. Table 5-3 – What is Triple R Maintenance?

Response: Routine, restorative, and rehabilitative maintenance. This may include cleaning debris and sediment out of crossing structures, fixing erosion problems downstream of crossing structures, etc.

4. Road and Bridge gave the following comments regarding known erosion issues along the Creek:

- a. County Road 30 – Erosion under the bridge, performed a scour repair to fix it. The repair is performing well.
- b. Elbert County is responsible for County Road 50 crossing per IGA between Arapahoe and Elbert County.

5. Will you be submitting an overlay of the new floodplain with the A-Zone floodplain that we currently use in Arapahoe?

Response: Yes. With our next deliverable, an overlay comparison of the future conditions 100-yr floodplain we have delineated with the effective Zone A will be included.

6. Road and Bridge is responsible for crossings and roadside ditches. We do not have any funds for detention. When development occurs the developer will be responsible for addressing detention.

Response: Some of these regional detention ponds may be cheaper than the crossings, and they will be evaluated with this MDP. Since Arapahoe County does not currently have a mechanism to build or maintain detention ponds, they may not score well in the alternatives evaluation. However, they will still be documented as having been



evaluated in this MDP so that when the issue is revisited in the future, there will be a record of this evaluation.

7. Will there be analysis of what type of crossing would be required for the Kiowa-Bennett Interchange (Arapahoe County 2035 Transportation Plan)?

Response: This is just to the east of Kiowa Creek. Any proposed improvements to the I-70 bridges will need to consider the future interchange; however, the interchange itself does not cross Kiowa Creek. Arapahoe County has a more recent report related to this interchange and will review it to see if it shows potential layouts for the interchange.

8. Is the Environmental Assessment ready for review? It might be a good idea to have Open Spaces take a look at it and issues comments.

Response: The Environmental Assessment will be available in mid-March for the County's review.

9. For future submittals can we assume the County will have a 2 week review window?

Response: Yes. The schedule has been updated to include this.

## II. Preliminary Alternatives Hydraulic Analysis Results

Rifka walked through the existing and future floodplains with an overlay comparison with the effective Zone A floodplain. In general, the floodplains BHI has delineated are similar to but narrower than the effective Zone A. Several outbuildings, storage tanks and oil and gas pad sites are scattered throughout the watershed and are often within the limits of the 100-year floodplain. After BHI submits the drainage alternative elements, the County may go out into the field and identify whether the structures BHI has identified as being in the floodplain are houses, sheds, etc. It is not desirable to have oil and gas wells in the floodplain, and this will need to be considered from a floodplain management perspective.

Rifka walked through the existing and proposed bridges and culverts along Kiowa Creek and its tributaries. The bridges over the main stem of Kiowa Creek are proposed to be raised to meet the freeboard criteria for high-debris streams, which is three feet for Quincy Ave and County Line Rd, which are County arterial roads (although this section of County Line Rd is maintained by Elbert County) and four feet for I-70 (a CDOT road). Culverts are proposed to be upgraded where the roadways are overtopped. Where the headwater to depth criteria are violated for culverts but no roadways are overtopped, BHI has modeled upgraded structures that meet the criteria; however, the County also has the option of allowing a variance for these structures. BHI will evaluate a CBC option rather than 7 RCPs for Tributary C at Brick Center.

As an alternative to upsizing roadway culverts, BHI has evaluated four detention ponds, keeping them non-jurisdictional under the State of Colorado's Dam Safety Rules:

1. Tributary B.2.b upstream of Brick Center Road. This pond can be constructed on existing County property and can reduce the flows in Tributary B.2.b enough to meet the capacity constraints at both Brick Center Road and Quincy Avenue.





2. Tributary A.1 upstream of Brick Center Road. This pond can reduce flows in Tributary A.1 enough to meet the capacity constraint at Brick Center Road.
3. Two ponds on Tributary C were also evaluated; however, they could not attenuate the flow enough to meet the downstream constraints.

BHI will include a table in the MDP that summarizes the analysis of existing structures for existing and future flows, that includes the smaller storms and which ones overtop the structures. Additionally, BHI will include tables summarizing the analysis of upgraded structures and potential detention ponds.

### III. Schedule

The schedule has been updated to allow a two-week review time for the County. A new end date of July 11<sup>th</sup> was discussed based on the 2<sup>nd</sup> Public Meeting being held on April 18<sup>th</sup>. However, after discussion it was agreed to move the meeting to April 25<sup>th</sup> to avoid tax filing time and holidays. Moving the 2<sup>nd</sup> Public Meeting one week later results in an end date of July 18<sup>th</sup> to allow time to incorporate public input into the Alternatives report and subsequent tasks as appropriate. A revised schedule is included with these meeting minutes reflecting these dates..

### IV. Next Public Meeting

The next public meeting should be in late April, once the Alternatives Report is completed. It would be better as a formal presentation. The planned date for the public meeting is April 25<sup>th</sup> at 6:30 pm, with the meeting being held at the Arapahoe County Eastern Service Center - 4405 S. CR 129 Bennett, CO 80102.

### V. Plan for Rifka's FMLA

Olin Brown will be stepping in for Rifka when her FMLA begins. He's been with BHI for almost five years, and has similar experience working on alternatives analysis for drainage projects. He also worked for Arapahoe County on the Watkins Road/Muskrat Gulch project.

### VI. Other Discussion Items

The November invoice was discussed. Cathy will check on the status and call Kevin Marland with BHI.

### VII. Action Items

1. Arapahoe County will review reports related to the I-70/Kiowa Bennett interchange it to see if it shows potential layouts for the interchange.
2. Arapahoe County will go out and look at the structures BHI has identified in the floodplain and identify if they are houses or sheds, etc.
3. BHI will evaluate a CBC option rather than 7 RCPs for Tributary C at Brick Center.



4. BHI will send out a revised schedule (attached with these meeting minutes).
5. Cathy will check on the status of the November invoice.

**MEETING MINUTES**

**Project Name:** Kiowa Creek MDP

**Meeting Date:** March 21, 2017

**Location/Time:** BHI, 10:00 AM

**Organizer:** Craig Hoover, BHI

**Attendees:**

Charles Haskins, Arapahoe County

Cathleen Valencia, Arapahoe County

Brian Love, Arapahoe County

Craig Hoover, BHI

Jared Lee, BHI

Olin Brown, BHI

**Project Review Meeting**

**Meeting Purpose: Project Review Meeting**

**I. County's Comments on 3/7 deliverable**

County still reviewing documents, expected to provide comments week of March 27th, 2017.

**II. Trail Alignment Discussion**

Existing/Proposed trail alignments from I-70 south to the County's north open space.

County to coordinate with Open Space Dept. and provide ACAD/SHP files of the existing and proposed trail alignments as available.

BHI to incorporate provisions including costs for trails (underpass crossings) at Kiowa Creek roadway bridge crossings into the Report.

BHI to add the following text to the Report, "as development occurs County Open Space plans to incorporate trails along Kiowa Creek".

**III. Alternatives Evaluation Matrix – Criteria Weighting**

County in concurrence with current outline of scoring criteria categories and weighted values

**IV. Cost Estimates – Grade Control Structure Height Assumption/Channel Stabilization Alternatives**

Stabilization of streams based on two criteria: Froude numbers of 0.6 or less and velocities less than 5 feet per second

3 Alternatives: Grade Control Structures, Induced Meandering, and Channel Lining

Only the first two are suitable for this project

Craig reviewed preliminary grade control structure evaluations spreadsheet for the entire project – 220 total grade control structures included.

UDFCD guidelines were used as basis of evaluation – 5' assumed height

BHI to continue analysis and refine for upper tributary reaches where number of structures may be significantly over estimated

When overall structure count is confirmed, BHI will work to prioritize structures. Locate at crossing improvements and flow confluences, where possible.

Olin presented induced meandering alternative grade control option.

Conceptually, induced meandering lessens the stream bed slope by increasing the overall stream length through the encouragement of stream meandering.

Advantages include in-situ stabilization, avoiding large, expensive hardened grade control structures, can use local materials.

BHI to provide County with additional photos and examples of techniques used to induce meandering.

**V. Schedule**

The current project schedule was discussed in particular with respect to the potential impacts of County comments on the hydraulic submittal that have yet to be received. It was agreed that the project schedule we remain as is until the County comments are received. If the comments necessitate changes and re-work the schedule will likely need to be updated and extended.

**VI. Next Public Meeting**

The next public meeting is scheduled for Tuesday, April 25<sup>th</sup> at 6:30 pm, with the meeting being held at the Arapahoe County Eastern Service Center - 4405 S. CR 129 Bennett, CO 80102. BHI will prepare a PowerPoint presentation that will summarize, at a high level, the project work to date including:

1. Data Collection
2. Hydrology
3. Environmental Assessment
4. Alternatives Analysis

Emphasis will be made that the alternatives presented are only preliminary and only options that are under consideration and a final plan has not yet been developed and public input is welcome.



A conference call coordination meeting will be held the week prior (tentative April 18<sup>th</sup>) to review presentation materials.

**VII. Other Discussion Items**

Project invoicing was discussed. BHI Accounts receivable is current through February invoice. Retainage for Task 4 will be released upon receipt of Environmental Assessment Report.

BHI requested the County include invoice or pay request number as part of payments provided.

County performed site visit and confirmed structure inside floodplain is a large shed.

**VIII. Action Items**

1. Arapahoe County will complete review of hydraulic calculations and provide BHI with comments the week of March 28<sup>th</sup>
2. Arapahoe County to coordinate with Open Space Dept. and provide ACAD/SHP files of the existing and proposed trail alignments as available.
3. BHI to incorporate open space trail crossing locations and cost into the Report.
4. BHI will schedule follow-up meetings
  - a. County review comment meeting – week of March 28<sup>th</sup> (once the County has completed review of the hydraulic calculations)
  - b. Public Meeting coordination – April 18<sup>th</sup>
5. BHI will review Cathy's e-mail regarding the culvert crossing at Mexico to see if any changes to the hydraulic model are necessary
6. BHI will send the Environmental Assessment Report to the County once BHI receives it from Pinyon Environmental.



**MEETING AGENDA**

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** April 27 21, 2017  
**Location/Time:** BHI, 3:00 PM  
**Organizer:** Craig Hoover, BHI  
**Attendees:**

Charles Haskins, Arapahoe County  
Cathleen Valencia, Arapahoe County  
Brian Love, Arapahoe County  
Craig Hoover, BHI  
Olin Brown, BHI  
Jared Lee, BHI

**Project Progress Meeting**

**Meeting Purpose: Project Progress Meeting**

- I. **Response to County's Comments on 3/7 deliverable**
- II. **Debrief on 4/25 Public meeting**
  - a. **Revisions to maps/graphics**
  - b. **Revisions to PowerPoint presentation**
  - c. **Soils maps – need input from Chuck.**
  - d. **Decision on what get posted to the County's web site – County to provide list**
    - Floodplain maps
    - Soils – index and brief descriptor of soil groups
- III. **Additional culverts on E. Quincy – Tributary B.1 and Tributary B.2.a**
  - Add these, County will survey next week and provide data
  - County to provide contract amendment
- IV. **Alternatives Report status and submittal**
  - Due 5/2 – on schedule**
- V. **Update on Cost Estimates**

Using UD tool

**VI. Benefit Cost Analysis**

Benefits area based on floodplain extents and impacts to habitable structures.

County or UDFCD does the maintenance in the urban area – so use their numbers.

In terms of benefits – not necessary. The County will address hydraulic deficiency as part of the bridge/culvert rating.

Identify the risk in terms of what event “fails” the structure.

Higher traffic volume road would get higher priority.

County – don’t need a full blown cost benefit analysis.

O & M: What does this include?

We don’t have detention ponds, WQ ponds, etc. Only have the culverts and bridges.

Easements – as development occurs the County will obtain the easements and look for them to be donated by the developer at the time of development.

County to consider this further with review of the draft Alternatives Report and provide direction.

**VII. Schedule**

**VIII. Budget**

**a. Transferring budget between phases**

**b. Invoice #7 Status**

**IX. Other Discussion Items**

MDP approval and adoption – County to take to Board.

Study session with the Board – BHI to attend

May require another Planning Commission Meeting (more a formality and BHI wouldn’t need to attend)

Adopt at a Board study

Billing – Pay App 10 include retainage for Pinyon.

**X. Action Items**

County to provide list of items for web site, addendum and survey data

BHI provide draft Alternatives report 5/2

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

Bohannon ▲ Huston

## Contents/Agenda

- ▲ Introductions
- ▲ Project Objectives
- ▲ Project Description
- ▲ Study Area Description
- ▲ Environmental Study
- ▲ Hydrologic Analysis
- ▲ Hydraulic Analysis
- ▲ Alternative Analysis
- ▲ Next Steps and Project Schedule
- ▲ Questions



# Project Objectives

## ▲ Introductions

- Arapahoe County staff
- BHI staff

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# Project Objectives

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

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## 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

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## 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

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## 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

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## 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

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## Study Area Description

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

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## 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

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# 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

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# 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

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# 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%

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# 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

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# 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

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# Hydraulic Analysis

## ▲ Evaluation of Existing Facilities

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

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# 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 ≥120" – 1.0	4' (high debris), $0.1Q^{0.3} + 0.008v^2$ (low-moderate debris)	No Overtopping

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# 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

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# 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

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# Alternative Analysis

## ▲ Primary Alternatives:

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

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# 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			

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## 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

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# Project Completion Schedule

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

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# Questions

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## MEETING AGENDA

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** May 25, 2017  
**Location/Time:** BHI, 3:00 PM  
**Organizer:** Craig Hoover, BHI  
**Attendees:**  
Charles Haskins, Arapahoe County  
Cathleen Valencia, Arapahoe County  
Craig Hoover, BHI  
Olin Brown, BHI  
Jared Lee, BHI

### Project Progress Meeting

#### Meeting Purpose: Project Progress Meeting

- I. **Contract Addendum: Additional Culverts on E. Quincy – Tributary B.1 and Tributary B.2.a**
  - a. Craig will sign and return.
  - b. Survey provided to BHI has all the required information for inclusion into the analysis.
- II. **County Comments on Alternatives Report Submittal**
  - a. BHI and County reviewed comments and preliminary responses.
- III. **County Comments on Environmental Assessment**
  - a. Back check and send to County.
- IV. **Initiation of Task 6: Major Drainageway Planning Conceptual Design**
  - a. BHI to begin Task 6 after addressing Alternatives Analysis comments.
- V. **Schedule**
  - a. New end date 7/27/17.
- VI. **Other Discussion Items**
  - a. County Planning Department is looking at changing some land uses in the watershed.
    - i. 1 du/acre could be from Jewels north rather than 6th Avenue. (approx. 3 miles south of 6<sup>th</sup>)
    - ii. 3 options:
      1. Do nothing;



2. Revise everything – hydrology, hydraulics, alternatives etc.;
  3. Make a general qualitative recommendation.
- b. Discussion on retainage. It is an internal BHI accounting issue related to how the job was set up in our system.

#### VII. Action Items

- a. BHI to provide the scoring matrix in Excel.
  - i. County to score the alternatives.
- b. Discuss land use change and provide direction.
- c. BHI – sign and submit addendum.
- d. Send an updated schedule.

**MEETING MINUTES**

**Project Name:** Kiowa Creek MDP  
**Meeting Date:** July 20, 2017  
**Location/Time:** BHI, 11:00 AM  
**Organizer:** Craig Hoover, BHI  
**Attendees:**

Charles Haskins, Arapahoe County  
Cathleen Valencia, Arapahoe County  
Brian Love, Arapahoe County  
Craig Hoover, BHI  
Olin Brown, BHI  
Rifka Wine, BHI

**Project Progress Meeting**

**Meeting Purpose: Project Progress Meeting**

**I. Results of analysis of additional culverts on E. Quincy – Tributary B.1 and Tributary B.2.a**

Currently, the hydraulic models are showing that 6-42" pipes are needed at each location. The structure sizes could be reduced with a variance from the headwater depth criteria. The existing structure on B.2.a at Quincy includes a bend connected to a drop inlet. Olin will sketch this out for the County's information. On tributary B.2.a, there is a large proposal for a solar field. They have proposed the same culvert size for their proposed road as the existing culvert at Quincy Ave.

**II. Alternative Scoring Matrix**

The initial scoring was indicating that all alternatives were recommended. This was due to the minimum score threshold for "recommended" being set at 1.5. On a scale of 1 to 3, the minimum score for "recommended" improvements should be set at 2. This leads to the Status Quo and Detention Ponds categories falling out of the recommended alternatives. The completed matrix will be included in the final report.

**III. Review of plan and profile drawings for the Selected Plan**

Preliminary comments: show and label both existing and proposed bridge deck and low chord elevations and culvert inverts. Make grid lines lighter, and darken profiles. Additional comments will be provided after the County has had a chance to review the MDP in its entirety.

**IV. Draft MDP**

The County would like a three-week review, beginning Monday. Rifka noted that the HEC-RAS model output, SWMM model output, and SWMM model schematics were not included in the Draft MDP, but will be included in the final MDP. Additionally, the project correspondence (progress and project development meeting minutes) was not included in the draft MDP, but will be included in the final MDP. Preliminary comments: include the environmental assessment as an appendix. Put captions on photos. The County's Comprehensive Plan may have more intense development as far south as Jewell Ave. Add a discussion of consideration of this to the Land Use section of the report. Include future 6<sup>th</sup> Avenue bridge costs in the report.

**V. Schedule for Completion**

The County will provide comments on the Draft MDP by 8/24. BHI will finalize the report by 8/31.

**VI. Other Discussion Items**

None were discussed.

**VII. Action Items**

A. BHI

- a. Sketch out existing structure on tributary B.2.a at Quincy
- b. Add scoring matrix to Final MDP
- c. Address preliminary County comments on profiles
- d. Address preliminary County comments on draft MDP

B. County

- a. Provide additional comments on Draft MDP