



INFORMATION PACKET MEMORANDUM

To: Mayor Osborne and City Council

From: Jane S. Brautigam, City Manager
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Date: October 14, 2010

Subject: Information Item: South Boulder Creek Flood Mitigation Planning Study

EXECUTIVE SUMMARY

This memorandum provides an update on the South Boulder Creek (SBC) flood mitigation planning study. The study is focused on developing and evaluating alternatives designed to mitigate flood hazards affecting structures and areas along South Boulder Creek and the West Valley within the current incorporated city limits.

In 2007, the city completed the South Boulder Creek flood mapping study and submitted the study results to the Federal Emergency Management Agency (FEMA) for review and acceptance. The flood mitigation planning study began in early 2010 and two public meetings were held in March and September. Eight conceptual-level alternatives (a detailed description of each alternative is in the **ANALYSIS** section) were developed, as follows:

- Status quo
- High hazard and critical facility protection
- Regional flood detention facility (two alternatives)
- Containment in South Boulder Creek
- Large culverts and pipes (two alternatives)
- Nuisance-level flood improvement protection

The eight alternatives were presented to the public on Sept. 2, 2010. In response to feedback received about one of the alternatives (a flood detention pond alternative that used private property near Highway 93), staff is currently working to develop and evaluate a new alternative for a flood detention facility that uses city Open Space property or private property with owners willing to sell. A project status update will be provided to the WRAB in November or December 2010. Next steps will be discussed during this update that will likely include the suggestion that two to four alternatives (rather than nine alternatives) be more fully developed and analyzed prior to final review and recommendation. Information will also be provided to the Open Space Board of Trustees (OSBT). City Council will be provided with a project update following the update to the WRAB and OSBT. It is anticipated that a final recommendation on a flood mitigation plan will go to City Council for a decision in the second quarter of 2011.

FISCAL IMPACT

The Urban Drainage and Flood Control District (UD&FCD) is a co-sponsor of the mitigation study and is contributing half of the study contract amount of \$255,020. Concept-level alternatives, excluding the status quo alternative, range in estimated cost from approximately \$11 million to over \$46 million. The 2011 – 2016 CIP includes \$4.3 million (including a \$3 million revenue bond) in 2011 and 2012 to help fund the construction of flood mitigation measures.

COMMUNITY SUSTAINABILITY ASSESSMENTS AND IMPACTS

- **Economic:** Revised floodplain mapping of SBC was submitted to the Federal Emergency Management Agency (FEMA) and is anticipated to be adopted in late 2011. If the revised mapping is officially adopted by FEMA, 700 structures (with a total of approximately 1,200 dwelling units) will be located in the 100-year floodplain. Currently, there are approximately 460 structures (with approximately 500 total dwelling units) in the 100-year floodplain. Most structures within the existing regulatory mapping area are also affected under the new study results; therefore, approximately 240 additional structures (with approximately 700 total dwelling units) will be impacted. The majority of these structures are located within existing developed areas of the West Valley area. FEMA requires property owners located within the 100-year floodplain to purchase flood insurance if they have a federally backed mortgage. A risk assessment completed in June 2009 estimated a 100-year event would result in \$215 million in damages. A benefit cost analysis has been conducted for the conceptual-level flood mitigation alternatives.
- **Environmental:** One of the Boulder Valley Comprehensive Plan general policies states the city's commitment to open space preservation and the use of open space buffers to define the community. The regional detention alternatives located south of US 36 on City of Boulder Open Space and Mountain Parks property would impact land with high ecological resources, including an important occurrence of the federally threatened plant species, Ute ladies' tresses orchid; an important population of the federally threatened animal species, Preble's meadow jumping mouse; a population of an amphibian under status review by the US Fish and Wildlife Service for listing as a federally threatened species, northern leopard frog; a population of two native fish species believed to be in decline in Colorado, plains topminnow and orange-spotted sunfish; a population of a declining grassland nesting bird, Bobolink; an important remnant of the plains

cottonwood riparian ecosystem; relicts of the tallgrass prairie ecosystem; and wetlands that are considered to be among the best preserved and most ecologically significant in the Boulder Valley. Careful design and restoration would be required to minimize environmental impacts and mitigate for impacts should one of these alternatives be selected.

- Social: The flood hazards associated with SBC are a risk to life, property and business. Mitigating these hazards would serve important social goals of stability and sustainability. One of the regional flood detention alternatives would require the acquisition of an easement or purchase of private property from property owners who are not willing sellers. All alternatives would result in temporary disruption to local residents, businesses and transportation routes that would be impacted during construction.

BACKGROUND

In 1996, the University of Colorado commissioned a flood study as part of its due-diligence review to purchase the 315-acre CU-Boulder South Campus. This study identified significant flood spills would impact east Boulder areas in what has subsequently been called the “West Valley Overflow” area.

In 1997, the city, Boulder County, the UD&FCD and the Colorado Water Conservation Board, in cooperation with FEMA, commissioned another flood study (called the Taggart study) to verify the results of the CU study and to compare the results to the adopted floodplain mapping. Ultimately, the Taggart study was not approved and a new flood study, using more advanced hydraulic modeling and hydrology techniques, was commissioned by the city and the UD&FCD. This study was performed by HDR Engineering and included a Climatology and Hydrology Report with reviews by an independent review panel, citizen advisory group and a hydrology advisory panel. The HDR Engineering study was completed in 2007 and resulted in a new flood map and formally identified the flood hazard that would impact the West Valley neighborhoods west of South Boulder Creek and north of US 36.

On April 17, 2007, City Council approved a motion authorizing the submittal of the flood study to FEMA. The flood mapping study was submitted in August 2007 and is anticipated to be adopted late 2011. If the revised mapping is officially adopted by FEMA, there will be 700 structures (with a total of approximately 1,200 dwelling units) in the 100-year floodplain. Currently, there are approximately 460 structures (with approximately 500 total dwelling units) in the 100-year floodplain. Most structures within the existing regulatory mapping are also affected under the new study results; therefore, approximately 240 additional structures (with approximately 700 total dwelling units) will be impacted. The majority of these structures are located within existing developed areas of the city within the West Valley area. A Risk Assessment completed in June 2009 estimated a 100-year event would result in \$215 million in property damages.

The City of Boulder Multi-Hazard Mitigation Plan, adopted by council on Aug. 19, 2008, includes two action items relating to flood mitigation along SBC. Action item seven states the need to prepare a master plan to evaluate flood mitigation alternatives for SBC as a high priority. In addition, action item nine states the need to consider construction of a regional detention pond

to provide flood mitigation along SBC as a high priority. Two of the eight conceptual-level alternatives developed for consideration as part of the flood mitigation planning effort include a regional detention pond facility.

On Jan. 29, 2009, an informational memo to council provided an update on the SBC flood mapping study and the plan for new floodplain regulations. At that time, it was still anticipated that FEMA would accept the new flood study in early 2009. Current information is that this will not occur until late 2011.

On April 28, 2009, a study session about floodplain management was held with council. While some of the discussion was focused on the Fourmile Canyon Creek and Wonderland Creek mitigation plans, there was also discussion about all creeks and tributaries, including South Boulder Creek.

The South Boulder Creek Flood Mitigation Planning Study began in early 2010 and is being funded by the city and the UD&FCD. A consulting team from CH2MHill was selected to perform the study. The study is focused on developing and evaluating alternatives designed to mitigate flood hazards affecting structures and areas within the current incorporated city limits, primarily within the West Valley area (**Attachment A**). It is anticipated that the study will be completed in the second quarter of 2011.

A project workshop, held on Jan. 27, 2010, was attended by representatives from Open Space and Mountain Parks, Urban Drainage and Flood Control District, United States Army Corps of Engineers, Colorado Department of Transportation, University of Colorado, a representative from the Water Resources Advisory Board (WRAB), city staff and the consultant team. An overview of the study goals and timeline were offered along with a presentation and discussion of known constraints and potential conceptual solutions.

An initial public meeting was held on March 3, 2010 with approximately 50 people in attendance. A formal presentation was used to present an overview of the study purpose, need, goals and process. Staff answered questions following the presentation and provided area-specific information at four work stations.

An update on the flood mitigation study was presented to WRAB on June 21, 2010. Project progress and seven conceptual alternatives were presented for discussion and input.

A second public meeting was held on Sept. 2, 2010. A summary of the study progress to date and eight conceptual alternatives were presented for public comment. Concept-level costs along with estimated benefits for each alternative were also presented. Staff emphasized that none of the alternatives had been ranked and no alternative is currently being recommended. In addition to the standard methods used by the city to provide notification of public meetings, a newspaper advertisement was placed in the *Camera* and over 2,000 postcards were mailed to people affected by the SBC floodplain within the City of Boulder. More than 100 members of the public, many from the Marshall area, attended the meeting and 63 comment sheets were received.

ANALYSIS

The eight concept-level alternatives for flood mitigation were presented to the public on Sept. 2, 2010. **Attachment B** presents a summary comparison table of the conceptual alternatives.

Attachment C presents figures of each of the eight conceptual alternatives. The alternatives are detailed below:

- **Alternative 1: Status Quo.** This alternative would maintain the status quo within the watershed and therefore has no associated cost or corresponding benefit-to-cost ratio. Limits of the existing floodplain would not change under this alternative and all properties would remain in the 100-year floodplain.
- **Alternative 2: High Hazard and Critical Facility Protection.** Two multi-family structures are located within the high-hazard zone northwest of the intersection of Foothills Parkway and US 36 and 25 structures identified as critical facilities are located within the 100-year floodplain. This alternative would include earth work to eliminate the high-hazard risk and floodproof the critical facilities at an estimated cost of \$10.7 million. The estimated benefit-to-cost ratio of this alternative is 2.2. This alternative would not change the limits of the existing floodplain and there are questions regarding long-term reliability of floodproofing efforts.
- **Alternative 3: Regional Detention at US 36 with Downstream Improvements.** This alternative proposes to construct an approximately 40-acre regional flood detention facility to prevent overtopping of US 36 during a major storm event. The proposed location is on University of Colorado” South Campus land, but would inundate city Open Space lands during a major event. This alternative also includes downstream improvements including flood detention facilities near the intersection of Foothills Parkway and Baseline Road, at Manhattan Middle School, and at Flatirons Golf Course along with flow capacity upgrades to Dry Creek Ditch Number. 2. This alternative would provide 100-year flood protection within the West Valley area. The estimated cost of this alternative is approximately \$36 million and has a benefit-to-cost ratio of 2.15.
- **Alternative 4: Regional Detention near Hwy 93 with Downstream Improvements.** This alternative is identical to alternative three with the exception of the proposed location of the regional flood detention facility. This alternative proposes to construct the detention facility east of Highway 93 near Marshall Road. The location includes land owned by the University of Colorado, city Open Space and two privately owned parcels. The land owners have stated they are not willing sellers. This alternative would provide 100-year flood protection within the West Valley area. The estimated cost of this alternative is approximately \$31 million and has a benefit-to-cost ratio of 2.51.

In response to feedback that is opposed to Alternative 4, staff is currently working to develop and evaluate a new alternative for a flood detention facility that uses city Open Space property or private property with owners willing to sell. Both the city and the UD&FCD, a project co-sponsor, typically purchase property and easements through negotiations with private property owners. In limited and unusual circumstances, both the city and the UD&FCD have used the eminent domain process for flood mitigation

purposes. The UD&FCD has done this twice on projects outside of Boulder and the city has done this on two projects: the Goose Creek Phase III project (1998); and the Elmer's Two-mile Creek project (2008).

- **Alternative 5: Containment of Flood Flow in South Boulder Creek.** This alternative would construct a berm to force all flood flows through a main channel under the US 36 bridge. It would require use of Baseline Reservoir for storage of flood flows to avoid downstream impacts. Baseline Reservoir is a drinking water storage facility for the City of Lafayette and water quality concerns are an issue. In addition, there are concerns that the State Engineer may raise questions on dam safety relating to increased flow volume into the reservoir. This alternative would provide 100-year flood protection within the West Valley area. This alternative is estimated to cost approximately \$39 million, excluding any studies or improvements that would be required by the State Engineer. The estimated benefit-to-cost ratio is 0.6.
- **Alternative 6: Bear Canyon Creek Pipeline.** This alternative would provide 100-year flood protection within the West Valley area without using regional detention upstream of US 36. Flood flows would continue to overtop US 36, but would be collected downstream and conveyed through the West Valley via two, pipe systems with diameters ranging from 7.5 feet to 9 feet. One system would divert flow to Bear Canyon Creek and the other parallel to Dry Creek Ditch Number 2. This alternative includes flood detention on Flatirons Golf Course and would result in major neighborhood impacts during construction. The UD&FCD prefers open channel systems to pipe systems. The estimated cost of this alternative is approximately \$46 million and has a benefit-to-cost ratio of 1.25.
- **Alternative 7: Dry Creek Ditch No. 2 Pipeline.** This alternative is similar to alternative six, but would involve constructing one pipe system along Dry Creek Ditch No. 2 with pipe diameters in the range of 7.5 feet to 11 feet. This alternative also includes the detention storage at Flatirons Golf Course. Construction impacts would be similar in scale to alternative six. The estimated cost of this alternative is approximately \$46 million and has a benefit to cost ratio of 1.24.
- **Alternative 8: Nuisance-level Flood Improvement Protection.** This alternative would provide pipe system upgrades to prevent nuisance flooding during minor storm events at an estimated cost of approximately \$14 million and has a benefit-to-cost ratio of 0.1. Improvements would not effectively change the 100-year floodplain and most properties would remain in the floodplain.

NEXT STEPS

A project status update will be presented to the WRAB in November or December 2010. Next steps will be discussed during this update that will likely include the suggestion that two to four alternatives (rather than nine alternatives) be more fully developed and analyzed prior to final review and recommendation. Information will also be provided to the Open Space Board of Trustees (OSBT). City Council will be provided with a project update following the update to the WRAB and OSBT. It is anticipated that a final recommendation on a flood mitigation plan

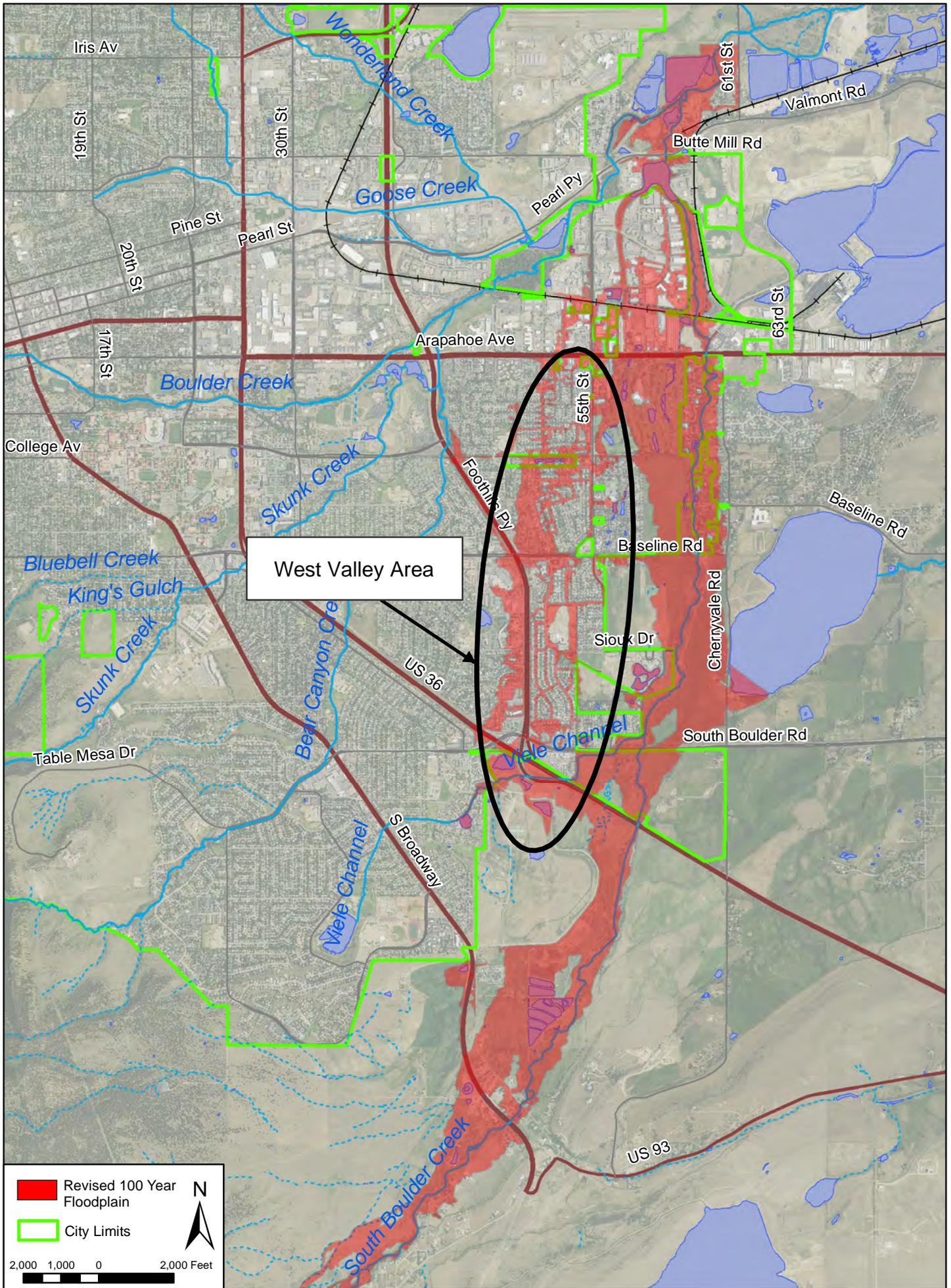
will go to City Council for a decision in the second quarter of 2011. The public will be notified of the board and council meetings via several methods and encouraged to present comments via the public hearing process.

For more information on this project, visit www.southbouldercreek.com or contact Kurt Bauer, project manager, at 303-441-4232 or bauerk@bouldercolorado.gov.

ATTACHMENTS

- A. Location Map
- B. Summary Comparison Table of Conceptual Alternatives Presented at Second Public Meeting
- C. Conceptual Alternatives Presented at Second Public Meeting

**ATTACHMENT A
LOCATION MAP**



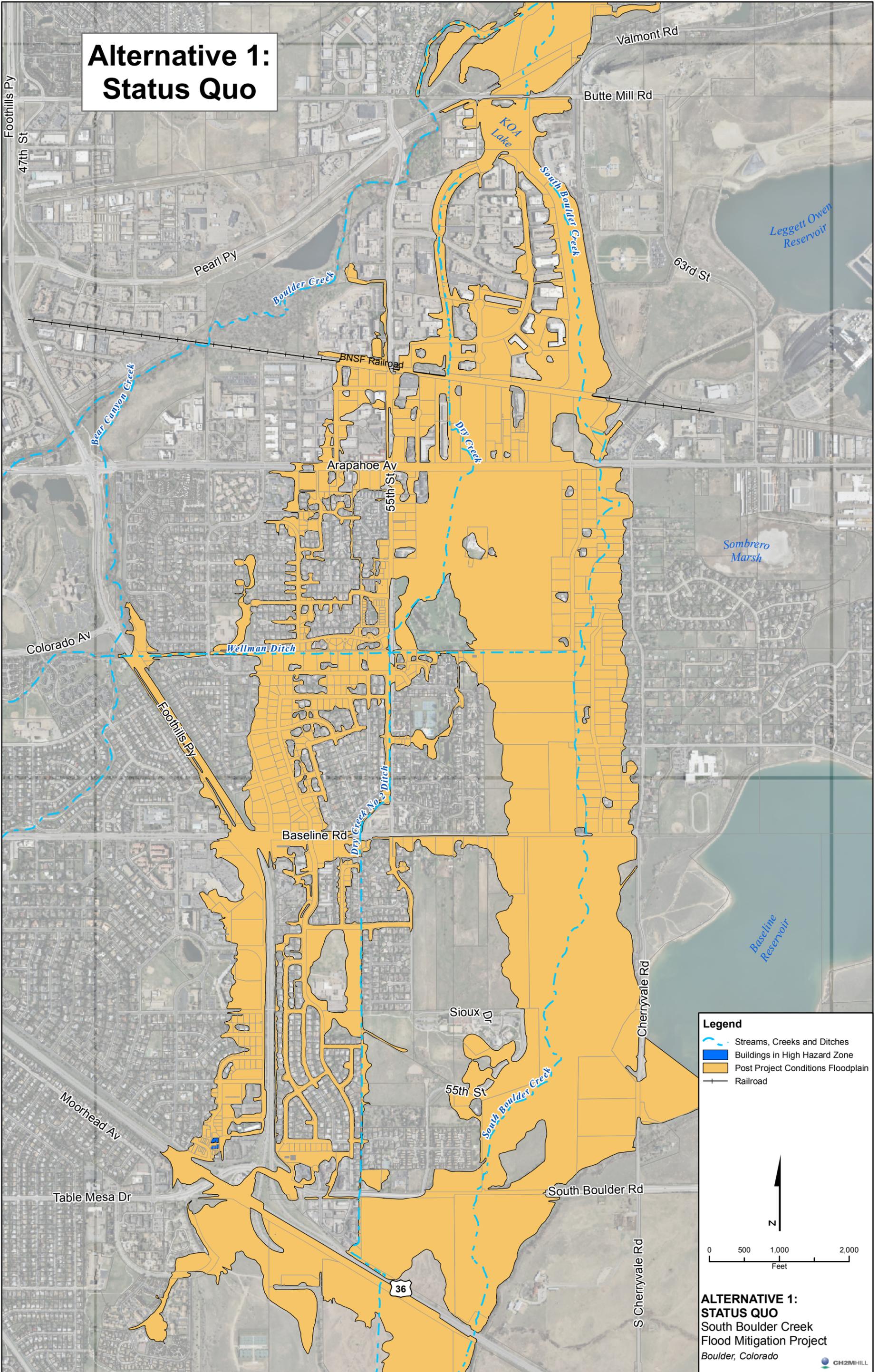
ATTACHMENT B
SUMMARY COMPARISON TABLE OF CONCEPTUAL ALTERNATIVES
PRESENTED AT SECOND PUBLIC MEETING

Summary Comparison of Conceptual Alternatives Presented at Second Public Meeting

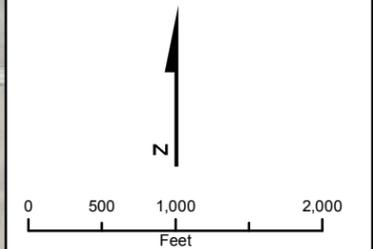
Alternative		Estimated Construction Cost	Benefit-to-Cost Ratio	Environmental Impacts	Social Impacts
1	Status Quo	\$0	0	<ul style="list-style-type: none"> • No impacts 	<ul style="list-style-type: none"> • Flood risk still remains
2	High Hazard and Critical Facility Protection	\$10,700,000	2.2	<ul style="list-style-type: none"> • Limited impacts 	<ul style="list-style-type: none"> • Flood limits do not change • Floodproofing reliability concerns
3	Regional Detention at US36 with Downstream Improvements	\$35,900,000	2.15	<ul style="list-style-type: none"> • Habitat and wetland impacts • Periodic inundation of Open Space Lands 	<ul style="list-style-type: none"> • Requires formal agreements with CU, BVSD, OSMP, CDOT, ditch companies and City Parks • Provides 100-year protection in West Valley Area
4	Regional Detention near HWY93 with Downstream Improvements	\$30,700,000	2.51	<ul style="list-style-type: none"> • Habitat and wetland impacts • Periodic inundation of Open Space Lands 	<ul style="list-style-type: none"> • Requires purchase of property from unwilling sellers • Requires formal agreements with CU, BVSD, OSMP, ditch companies and City Parks • Provides 100-year protection in West Valley Area
5	Mainstem Flow Containment	\$39,245,000	0.6	<ul style="list-style-type: none"> • Limited habitat and wetland impacts 	<ul style="list-style-type: none"> • Requires approval from State Engineers Office • Requires formal agreements with City of Lafayette, BVSD, CDOT, OSMP, ditch companies and City Parks • Provides 100-year protection in West Valley
6	Bear Canyon Creek Pipeline	\$46,286,000	1.25	<ul style="list-style-type: none"> • No water quality enhancement opportunities • Limited wetland impacts 	<ul style="list-style-type: none"> • Extensive disruption during construction • Requires easement coordination with ditch companies • Provides 100-year protection in West Valley Area
7	Dry Creek Ditch No. 2 Pipeline	\$45,661,000	1.24	<ul style="list-style-type: none"> • No water quality enhancement opportunities • Limited wetland impacts 	<ul style="list-style-type: none"> • Extensive disruption during construction • Requires easement coordination with ditch companies • Provides 100-year protection in West Valley Area
8	Nuisance Flood Improvements Only	\$13,976,000	0.1	<ul style="list-style-type: none"> • No impacts 	<ul style="list-style-type: none"> • Limited changes to 100-year floodplain limits or risk
9	New alternative to locate regional detention on Open Space property	TBD	TBD	<ul style="list-style-type: none"> • TBD 	<ul style="list-style-type: none"> • TBD – This new alternative is still being developed.

ATTACHMENT C
CONCEPTUAL ALTERNATIVES PRESENTED AT SECOND PUBLIC MEETING

Alternative 1: Status Quo

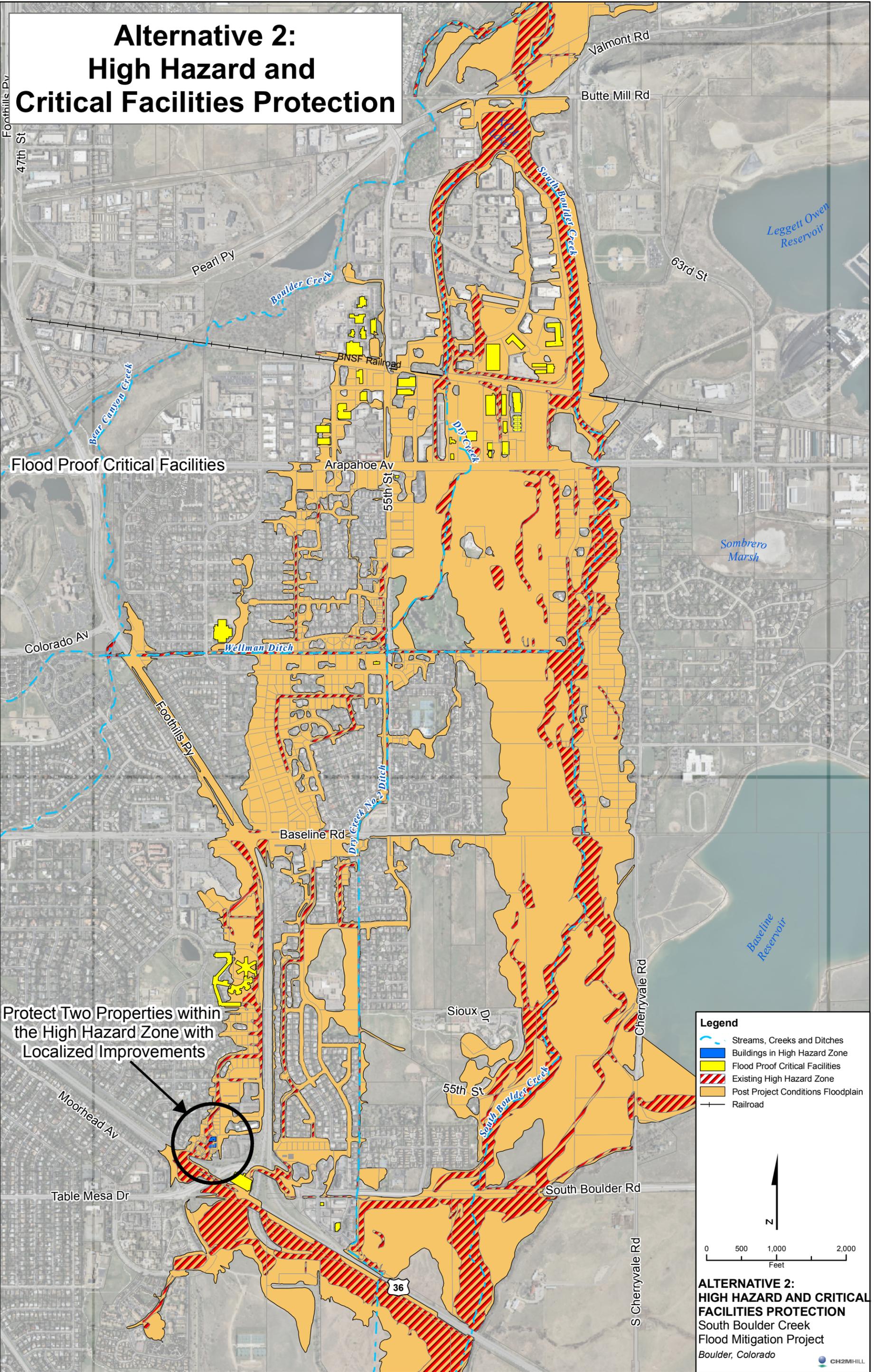


- Legend**
- Streams, Creeks and Ditches
 - Buildings in High Hazard Zone
 - Post Project Conditions Floodplain
 - Railroad



**ALTERNATIVE 1:
STATUS QUO**
South Boulder Creek
Flood Mitigation Project
Boulder, Colorado





Alternative 2: High Hazard and Critical Facilities Protection

Flood Proof Critical Facilities

Protect Two Properties within the High Hazard Zone with Localized Improvements

Legend

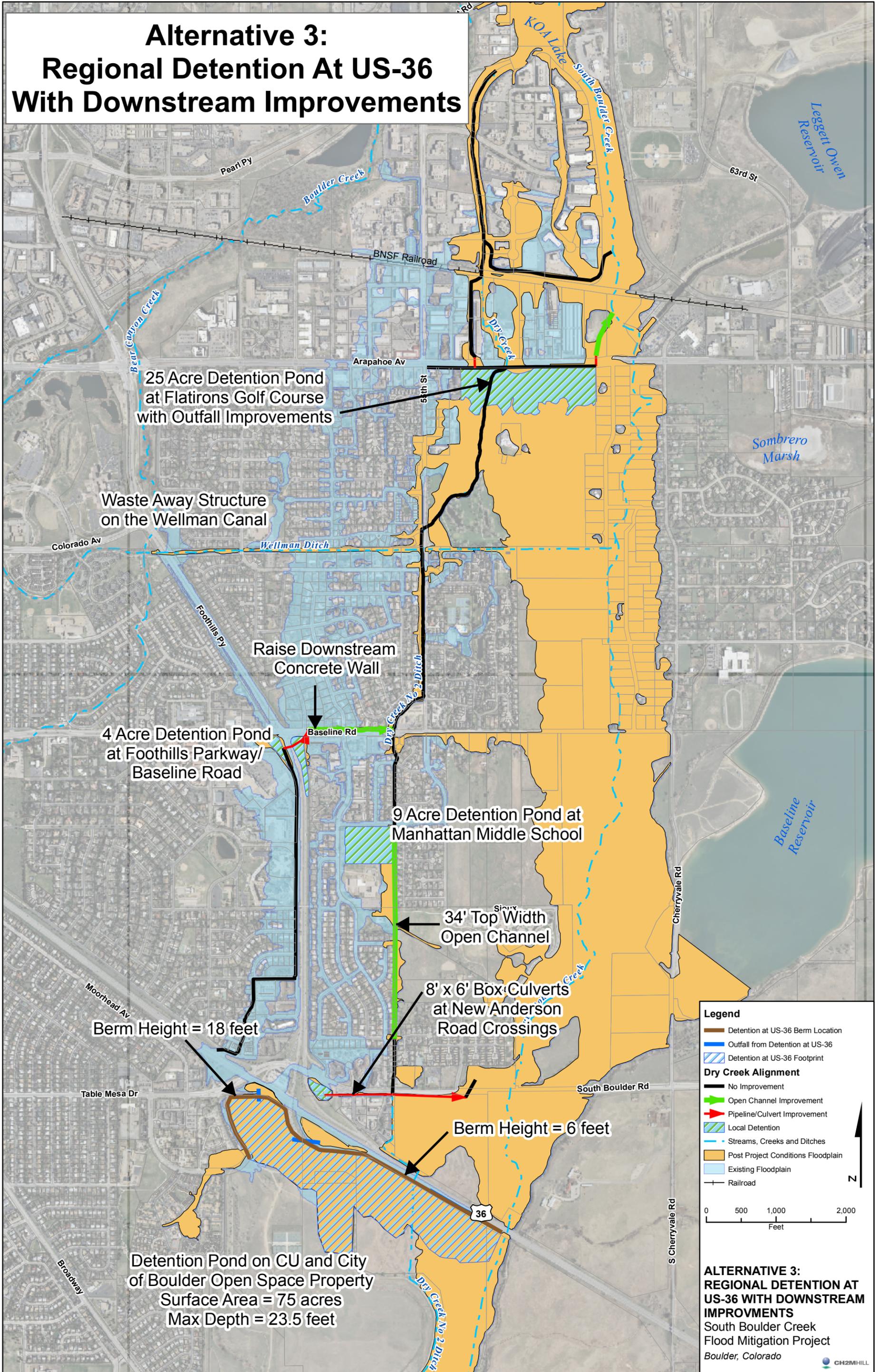
- Streams, Creeks and Ditches
- Buildings in High Hazard Zone
- Flood Proof Critical Facilities
- Existing High Hazard Zone
- Post Project Conditions Floodplain
- Railroad

N

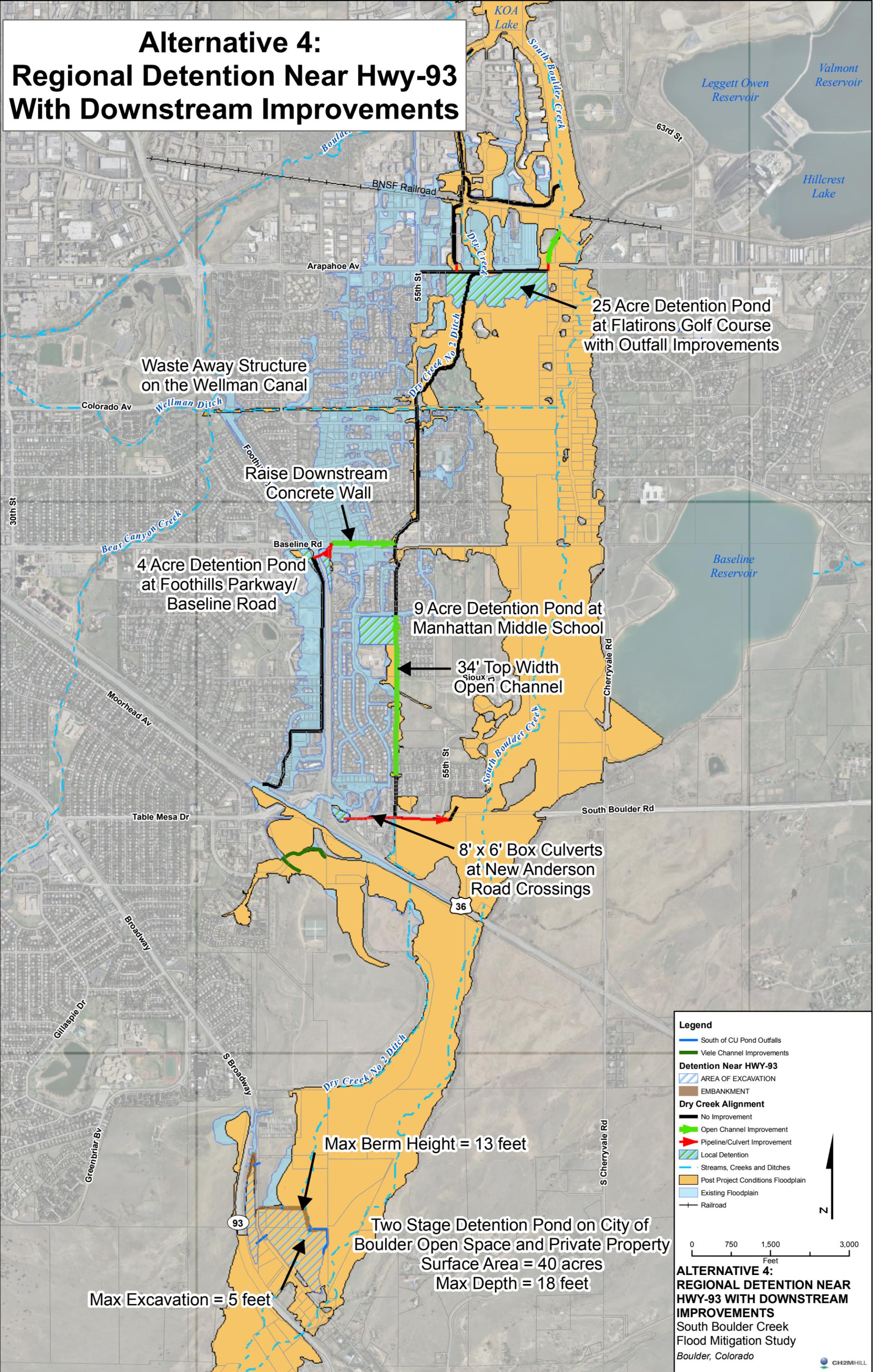
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**ALTERNATIVE 2:
HIGH HAZARD AND CRITICAL
FACILITIES PROTECTION**
South Boulder Creek
Flood Mitigation Project
Boulder, Colorado

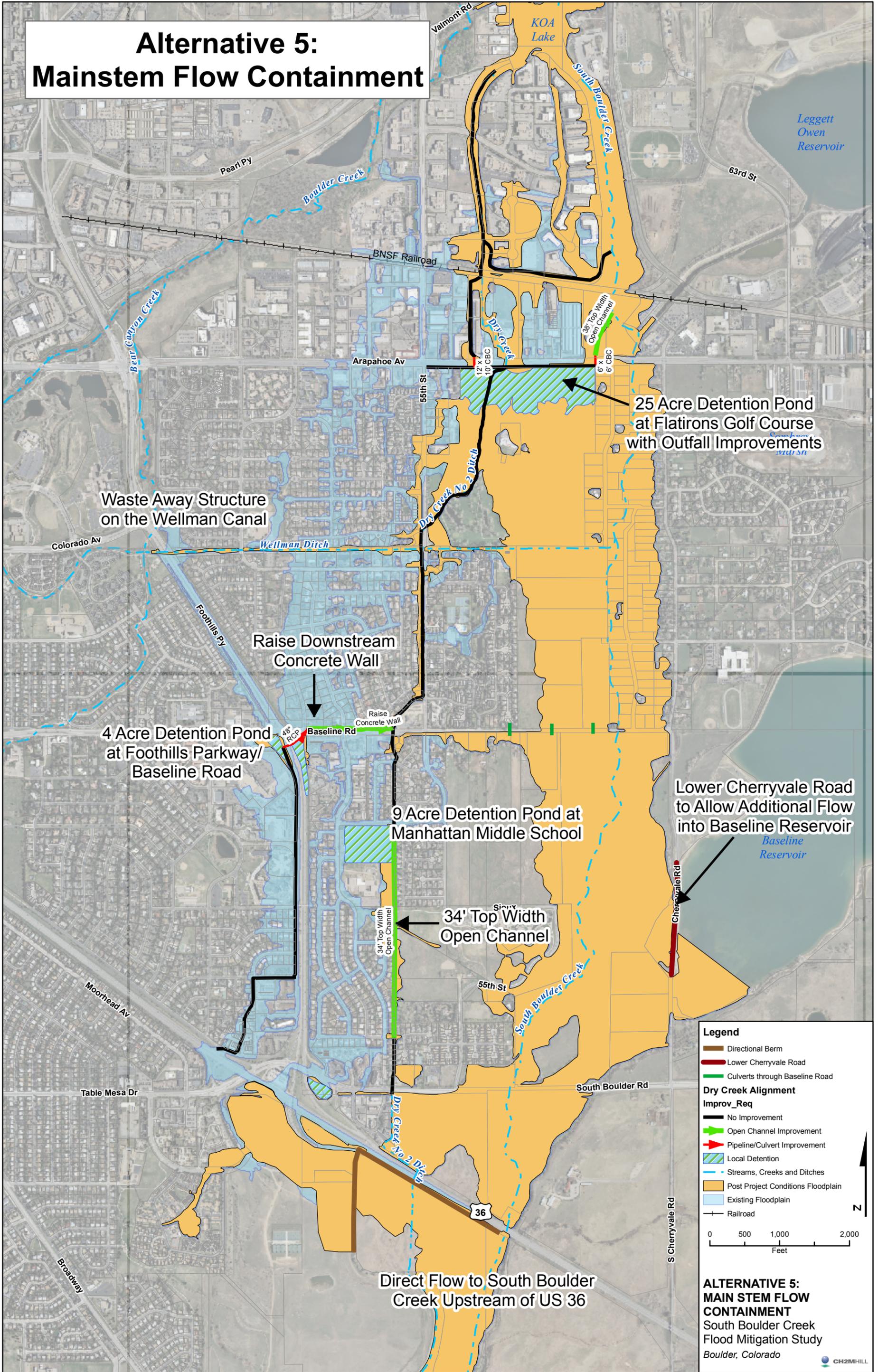
Alternative 3: Regional Detention At US-36 With Downstream Improvements



Alternative 4: Regional Detention Near Hwy-93 With Downstream Improvements



Alternative 5: Mainstem Flow Containment



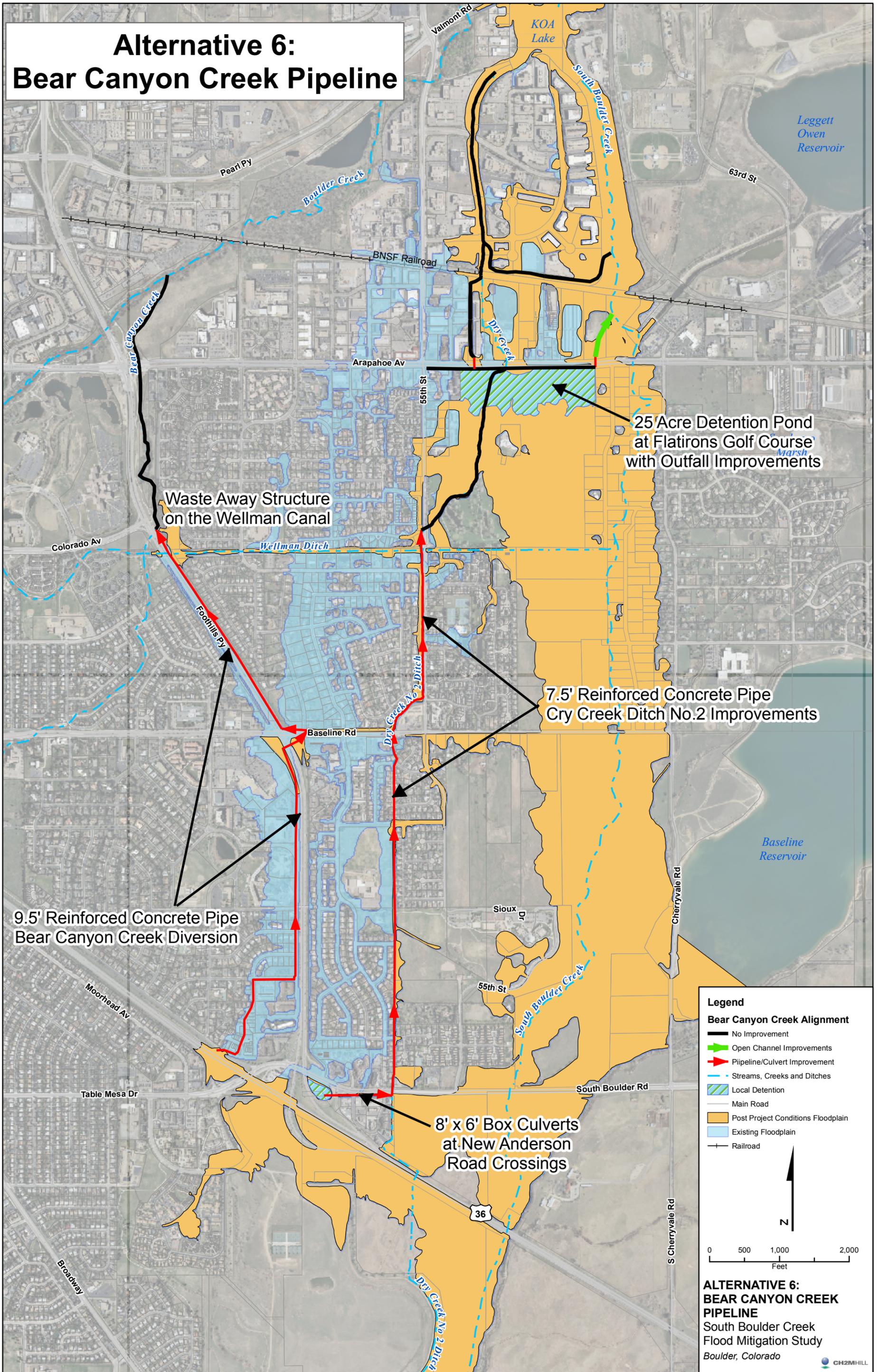
Legend

- Directional Berm
- Lower Cherryvale Road
- Culverts through Baseline Road
- Dry Creek Alignment Improv_Req**
- No Improvement
- Open Channel Improvement
- Pipeline/Culvert Improvement
- Local Detention
- Streams, Creeks and Ditches
- Post Project Conditions Floodplain
- Existing Floodplain
- Railroad

0 500 1,000 2,000
Feet

**ALTERNATIVE 5:
MAIN STEM FLOW
CONTAINMENT**
South Boulder Creek
Flood Mitigation Study
Boulder, Colorado

Alternative 6: Bear Canyon Creek Pipeline



Legend

Bear Canyon Creek Alignment

- No Improvement
- Open Channel Improvements
- Pipeline/Culvert Improvement
- Streams, Creeks and Ditches
- Local Detention
- Main Road
- Post Project Conditions Floodplain
- Existing Floodplain
- Railroad

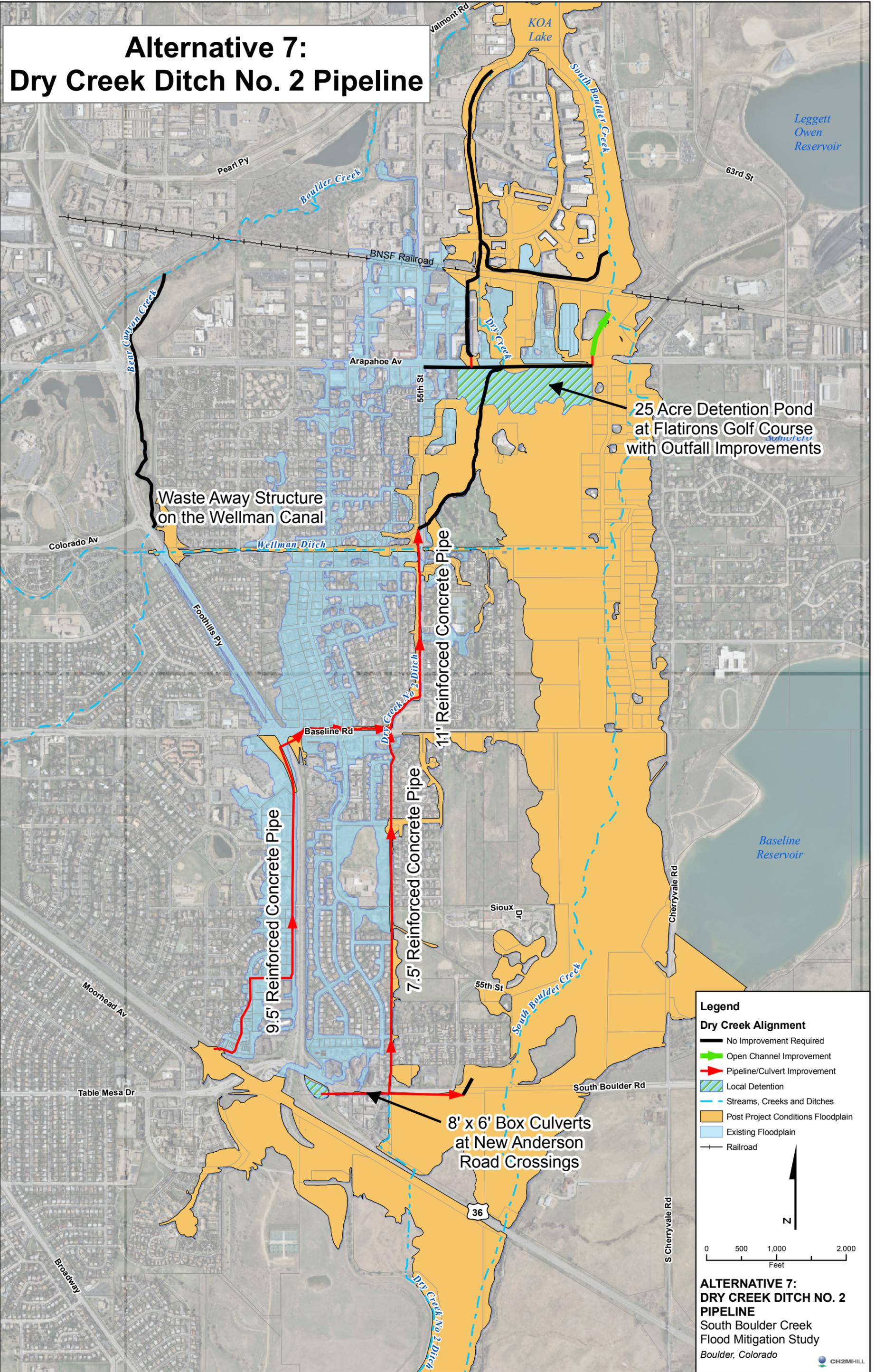
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**ALTERNATIVE 6:
BEAR CANYON CREEK
PIPELINE**
South Boulder Creek
Flood Mitigation Study
Boulder, Colorado

CH2M HILL

Alternative 7: Dry Creek Ditch No. 2 Pipeline



Legend

Dry Creek Alignment

- No Improvement Required
- Open Channel Improvement
- Pipeline/Culvert Improvement
- Local Detention
- Streams, Creeks and Ditches
- Post Project Conditions Floodplain
- Existing Floodplain
- Railroad

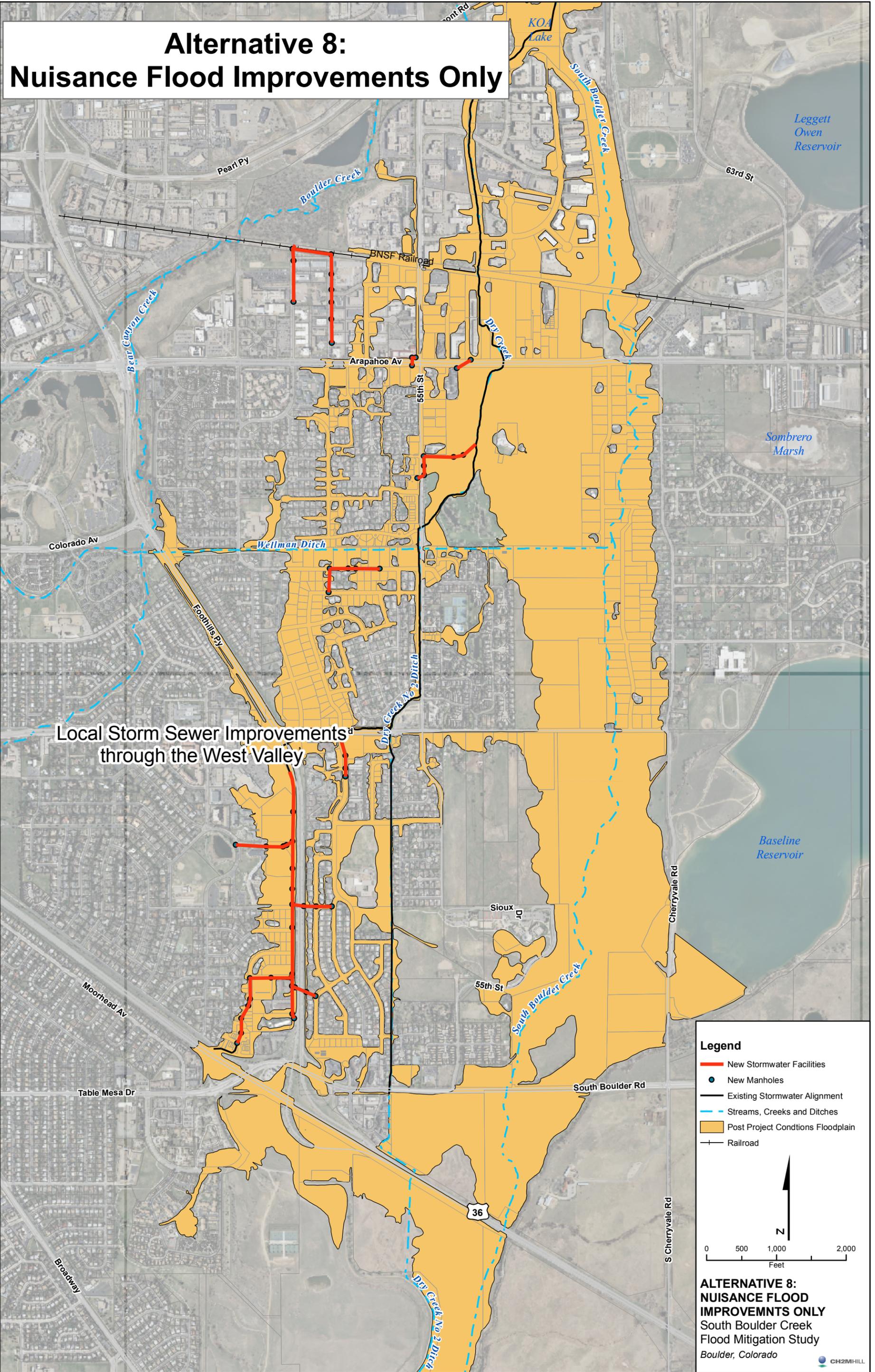
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**ALTERNATIVE 7:
DRY CREEK DITCH NO. 2
PIPELINE**
South Boulder Creek
Flood Mitigation Study
Boulder, Colorado

CH2M HILL

Alternative 8: Nuisance Flood Improvements Only



Local Storm Sewer Improvements^{at}
through the West Valley

Legend

- New Stormwater Facilities
- New Manholes
- Existing Stormwater Alignment
- - - Streams, Creeks and Ditches
- Post Project Conditions Floodplain
- +— Railroad

N

0 500 1,000 2,000
Feet

**ALTERNATIVE 8:
NUISANCE FLOOD
IMPROVEMNTS ONLY**
South Boulder Creek
Flood Mitigation Study
Boulder, Colorado

