CITY OF BOULDER
WATER RESOURCES ADVISORY BOARD
AGENDA ITEM

MEETING DATE: Dec. 14, 2010

AGENDA TITLE: Discussion about South Boulder Creek Flood Mitigation Plan Alternatives and selection of a short list of best alternatives for further evaluation and consideration.

PRESENTERS: Ned Williams, Director of Public Works for Utilities
Bob Harberg, Utilities Planning and Project Management Coordinator
Annie Noble, Greenways Coordinator
Kurt Bauer, Engineering Project Manager
Don D'Amico, Ecological Systems Supervisor, Open Space and Mountain Parks

PURPOSE:

The purpose of this memorandum is to present and discuss the South Boulder Creek flood mitigation alternatives, including a newly developed alternative and select a short list of best alternatives for further evaluation and consideration. Project alternatives range from maintaining the status quo to providing 100-year flood protection.

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 over US 36 that would impact east Boulder areas in what has subsequently been called the "West Valley Overflow" area.

In 1997, the city, Boulder County, the Urban Drainage and Flood Control District (UDFCD) and the Colorado Water Conservation Board, in cooperation with the Federal Emergency Management Agency (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 UDFCD. 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 that 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 a total of 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 South Boulder Creek 100-year floodplain. Most structures within the existing regulatory mapping will remain in the floodplain; therefore, approximately 240 additional structures (with approximately 700 total dwelling units) will be newly designated as 100-yr floodplain properties. 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 South Boulder Creek Flood Mitigation Planning Study began in early 2010 and is being funded by the city and the UDFCD. A consulting team from CH2MHill was selected to perform the study. The study is focused on developing and evaluating alternatives to mitigate flood impacts to 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, UDFCD, 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 included 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. Attendees were encouraged to identify problem areas and potential solutions for consideration during the planning process.

An update on the flood mitigation study was presented to WRAB on June 21, 2010. Project progress and seven conceptual alternatives and one status quo option (for a total of eight alternatives) were presented for discussion and input. Information about this WRAB agenda item may be found at the following Web site:
www.bouldercolorado.gov > Departments > Public Works, Utilities > Water Resources Advisory Board > Previous Agenda > Agenda for June 21, 2010
or
(http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id=13370&Itemid=1189)

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 was currently being recommended. More than 100 members of the public, mostly from the Marshall area, attended the meeting and 63 comment sheets were received. Most of the comments focused on concerns with the alternative that included the use of private property from unwilling sellers for flood detention near Highway 93.

WRAB members participated in a field trip on Oct. 7, 2010 to view the project area and several residents attended the Oct. 18, 2010 WRAB meeting and spoke during the *Public Participation* portion of the meeting.

PROGRESS TO DATE:

In response to feedback received at the second public meeting on Sept. 2, 2010, a new and ninth alternative (referred to below as Alternative 5: Distributed Regional Detention) for a flood detention facility that uses city Open Space property or private property with owners willing to sell was developed. **Attachment B** presents a summary comparison table of the nine conceptual alternatives. **Attachment C** presents figures of each of the nine 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. This alternative, along with all the other alternatives investigated, would include the continued enforcement of the city's floodplain management efforts to assure that new development does not exacerbate existing flood hazards and that measures such as flood warning and participation in the National Flood Insurance Program remain in place.

- **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 limited site work to eliminate the high-hazard risk and floodproof the critical facilities. The cost is estimated cost at $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 but would provide 100-year protection for critical facilities.

- **Alternative 3: Regional Detention at US 36 with Downstream Improvements**. This alternative proposes to construct an approximately 75-acre (560 acre-feet of storage) 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 approximately 37 acres of city Open Space lands during a major event. This alternative also includes downstream improvements including smaller 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 $29 million and has a benefit-to-cost ratio of 2.68.

- **Alternative 4**: **Regional Detention near Hwy 93 with Downstream Improvements**. This alternative proposes to construct an approximately 40-acre (422 acre-feet of storage) regional flood detention facility east of Highway 93 near Marshall Road, preventing the overtopping of US 36 during storms up to the 100-year event. The location includes land owned by the University of Colorado, city Open Space and two privately owned parcels. This alternative

would provide 100-year flood protection within the West Valley area. This alternative also includes downstream improvements including smaller 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. The estimated cost of this alternative is approximately $31 million and has a benefit-to-cost ratio of 2.52.

- **Alternative 5**: **Distributed Regional Detention**. This alternative was developed in response to feedback opposing Alternative 4. The objective of this alternative is to provide 100-year flood protection within the West Valley area using lands owned by the City Open Space and Mountain Parks Department (OSMP) or undeveloped private land that could be purchased from willing sellers. This alternative proposes a series of three regional detention facilities as follows:
  - Approximately 130 acre-feet of detention storage (38 acres surface area) at US36. Flood waters would be stored behind a berm constructed along the south side of US36 on the west side to South Boulder Creek. The berm would begin at the bridge, reach a maximum height of 13 feet near the Foothills Parkway interchange and be constructed entirely on OSMP lands, avoiding construction on CU property.
  - Approximately 130 acre-feet of detention storage (49 acres surface area) at South Boulder Road. Flood waters would be stored behind a berm constructed along the south side of South Boulder Road, have a maximum height of six feet above South Boulder Road and be constructed entirely on OSMP lands.
  - Approximately 295 acre-feet of detention storage (38 acres of surface area) at Baseline Road. The water would be stored behind a berm constructed along the south side of Baseline Road that would have a maximum height of approximately 13 feet above Baseline Road. The berm would be constructed on OSMP land but would also require the purchase of privately owned parcel. Construction of this detention facility would require relocating an OSMP trail head and access parking lot from the south side of Baseline Road likely to the west side of Cherryvale Road.

  All three of these detention facilities would require control structures to convey flood waters from South Boulder Creek to the detention sites. The control structures have not been designed but the current concept is to leave the existing capacity of the bridges intact and control the flood flows via control structures located upstream of the bridge. The structures could involve berms on both sides of the creek and buried grouted rock or concrete sill located at the existing creek invert to provide erosion protection.

  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. The estimated cost of this alternative is approximately $29.5 million and has a benefit-to-cost ratio of 2.57.

- **Alternative 6: Containment of Flood Flow in South Boulder Creek**. This alternative would construct a berm to force all flood flows through the main channel under the US 36 bridge. It proposes using Baseline Reservoir for storage of flood flows to avoid downstream impacts. Baseline Reservoir is a drinking water storage facility for the City of Lafayette. 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 1.94.

- **Alternative 7: 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. The estimated cost of this alternative is approximately $46 million and has a benefit-to-cost ratio of 1.25.

- **Alternative 8: 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. The estimated cost of this alternative is approximately $46 million and has a benefit to cost ratio of 1.24.

- **Alternative 9: 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.

STAFF RECOMMENDATION:

Staff recommends that a short list of five best alternatives be selected for further refinement and analysis. The five short list plans would be evaluated further to identify recommended construction phasing of each and further discussions would be conducted with the public and property owners to identify any additional issues related to construction of proposed improvements. This evaluation, along with a final recommended plan, would be presented to WRAB and OSMP Board of Trustees during first quarter of 2011, after which the final selection would go to City Council for consideration.

The staff recommends the following five alternatives to move forward onto the short list of best alternatives:

- **Alternative 1: Status Quo** – It is typical for planning studies to include a 'do nothing' alternative. This alternative does not require any funds for construction.

- **Alternative 2: High Hazard and Critical Facility Protection** – This alternative would remove the High Hazard Zone threat to existing structures and provide some level of protection to critical facilities during a major storm event at a relatively low cost and high benefit-to-cost ratio. Protection of the critical facilities also provides the benefit of enhanced protection to at-risk populations and reduces the potential of spills of hazardous materials during large flood events.

- **Alternative 3: Regional Detention at US 36 with Downstream Improvements** – This alternative would provide 100-year flood protection within the West Valley without requiring condemnation or major impacts to OSMP lands at a high benefit-to-cost ratio (2.68). This alternative also provides the additional benefit of enhanced emergency response and vehicular movement by preventing overtopping of US36 during a major storm event.

- **Alternative 5: Distributed Regional Detention** – This alternative would provide 100-year flood protection within the West Valley without requiring condemnation or the need to impact CU lands at a high benefit-to-cost ratio (2.6). Similar to Alternative 3, this alternative also provides the transportation and emergency response benefits of US36 protection.

- **Alternative 7**: **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. This alternative, though slightly higher in cost than the other pipeline alternative (Dry Creek Ditch No. 2 pipeline, Alternative 8), also has a slightly higher benefit-to-cost ratio than the other pipeline alternative and would have far less impacts to residential areas during construction. The estimated cost of this alternative is approximately $46 million and has a benefit-to-cost ratio of 1.25.

WRAB ACTION:

Staff is recommending that Alternatives 1, 2, 3, 5 and 7 be considered as the short list of best alternatives to be further evaluated and considered in the South Boulder Creek Flood Mitigation Plan process.

Staff is requesting a WRAB recommendation on the alternatives to be considered on the short list for best alternatives to be further evaluated.

NEXT STEPS:

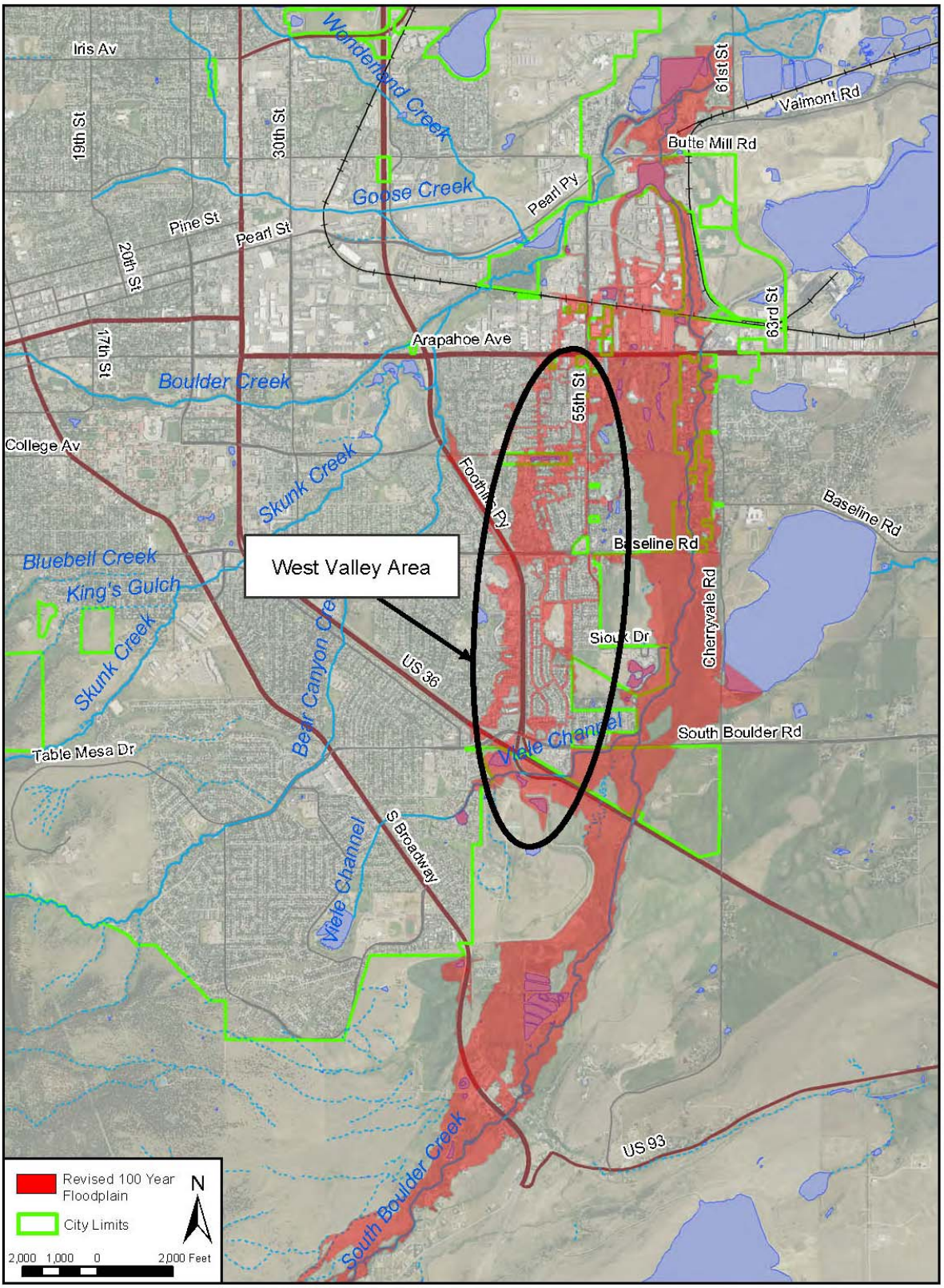
The following next steps are recommended for this planning process:

- Presentation to OSMP Board of Trustees in Jan. 2011 and recommendation of short list of best alternatives
- Inform City Council in Febuary 2011 about project status
- Further evaluation of the short list of best alternatives
- Presentation to WRAB and OSMP Board of Trustees in second quarter of 2011, including a recommended best alternative
- City Council decision about the best alternative to implement on South Boulder Creek in second or third quarter 2011

ATTACHMENTS:

Attachment A: Location Map
Attachment B: Summary Comparison Table of Conceptual Alternatives
Attachment C: Figures of the Nine Alternatives

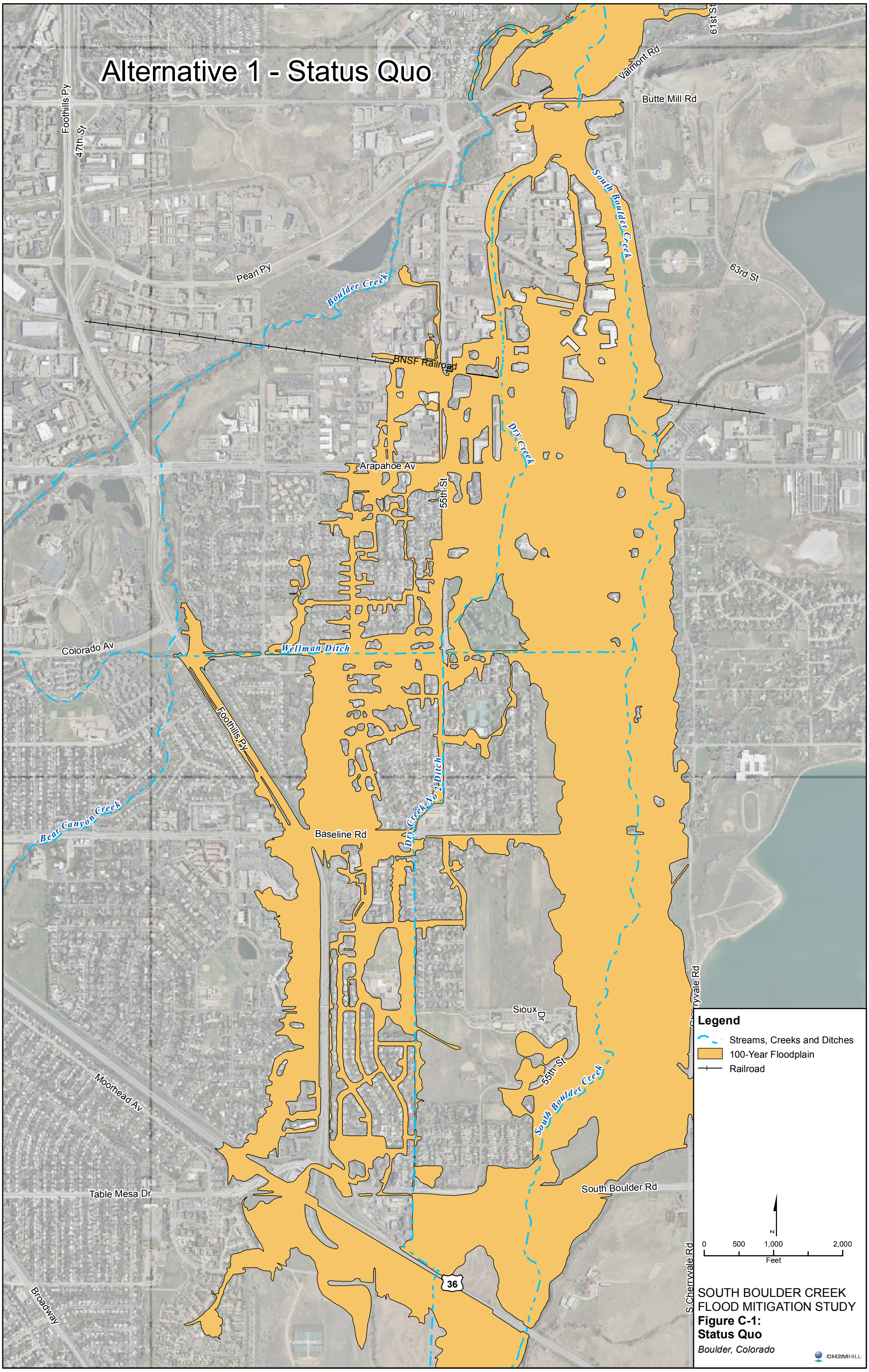
Attachment A: Location Map

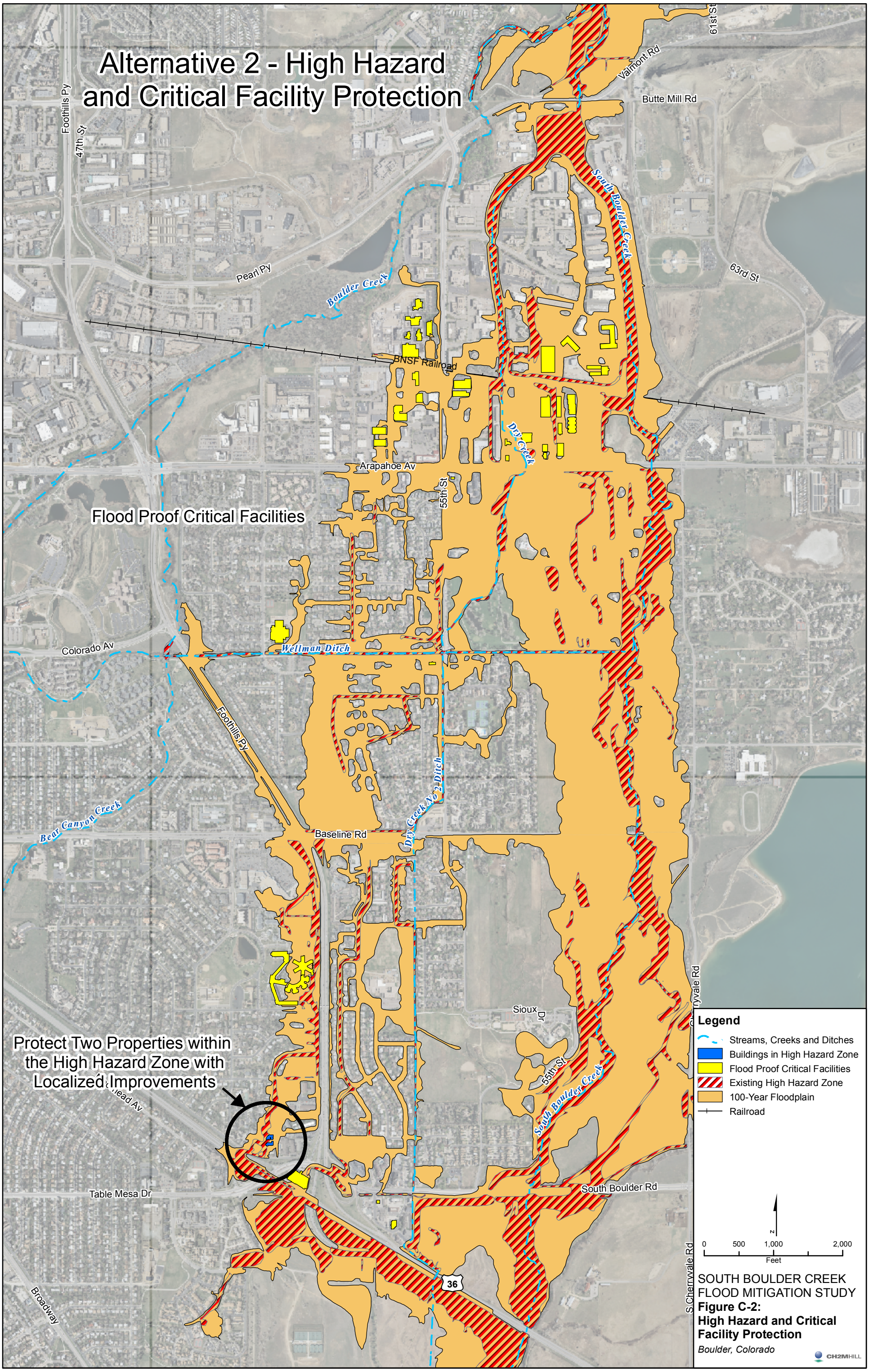


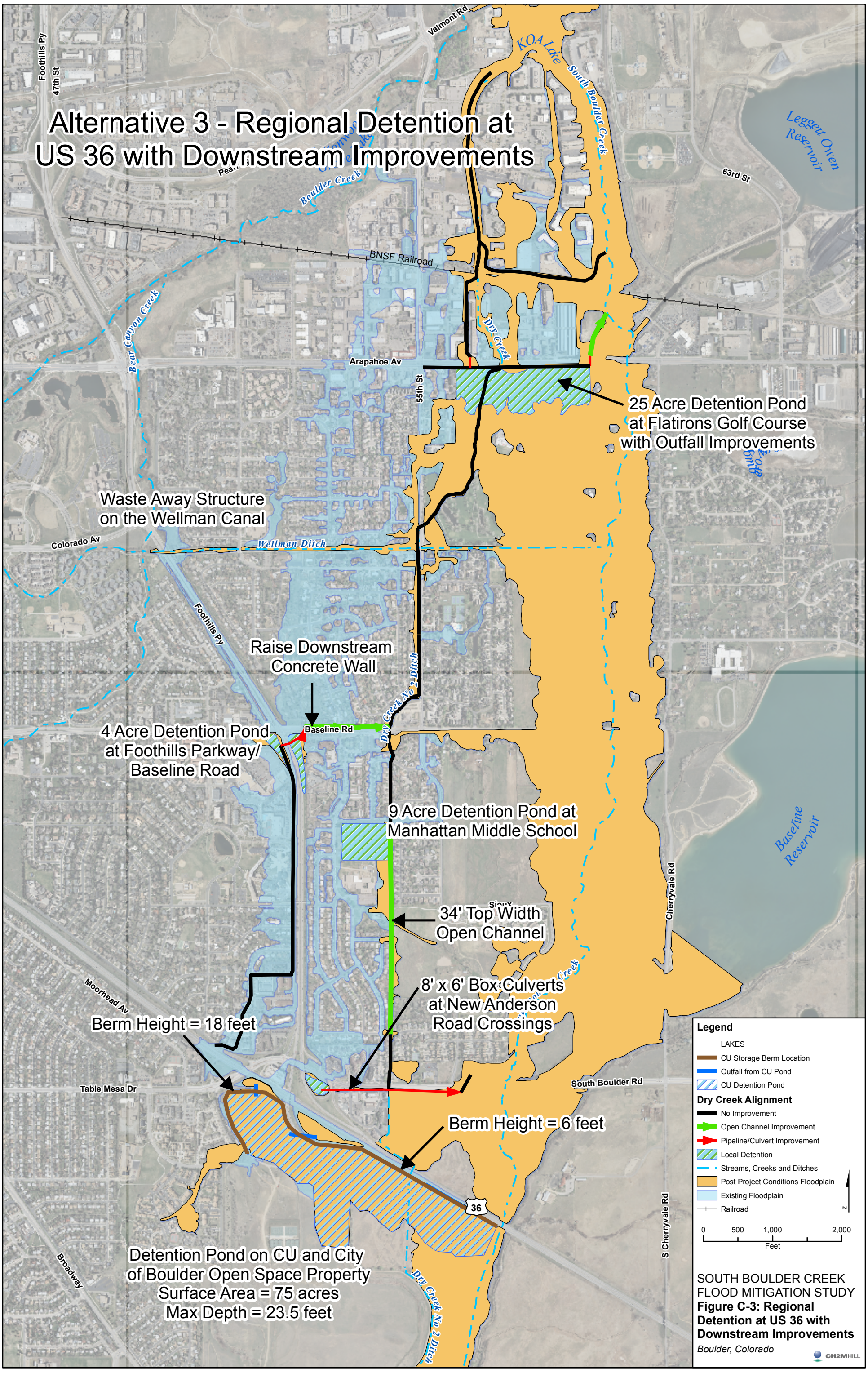
Attachment B: Summary Comparison of Conceptual Alternatives

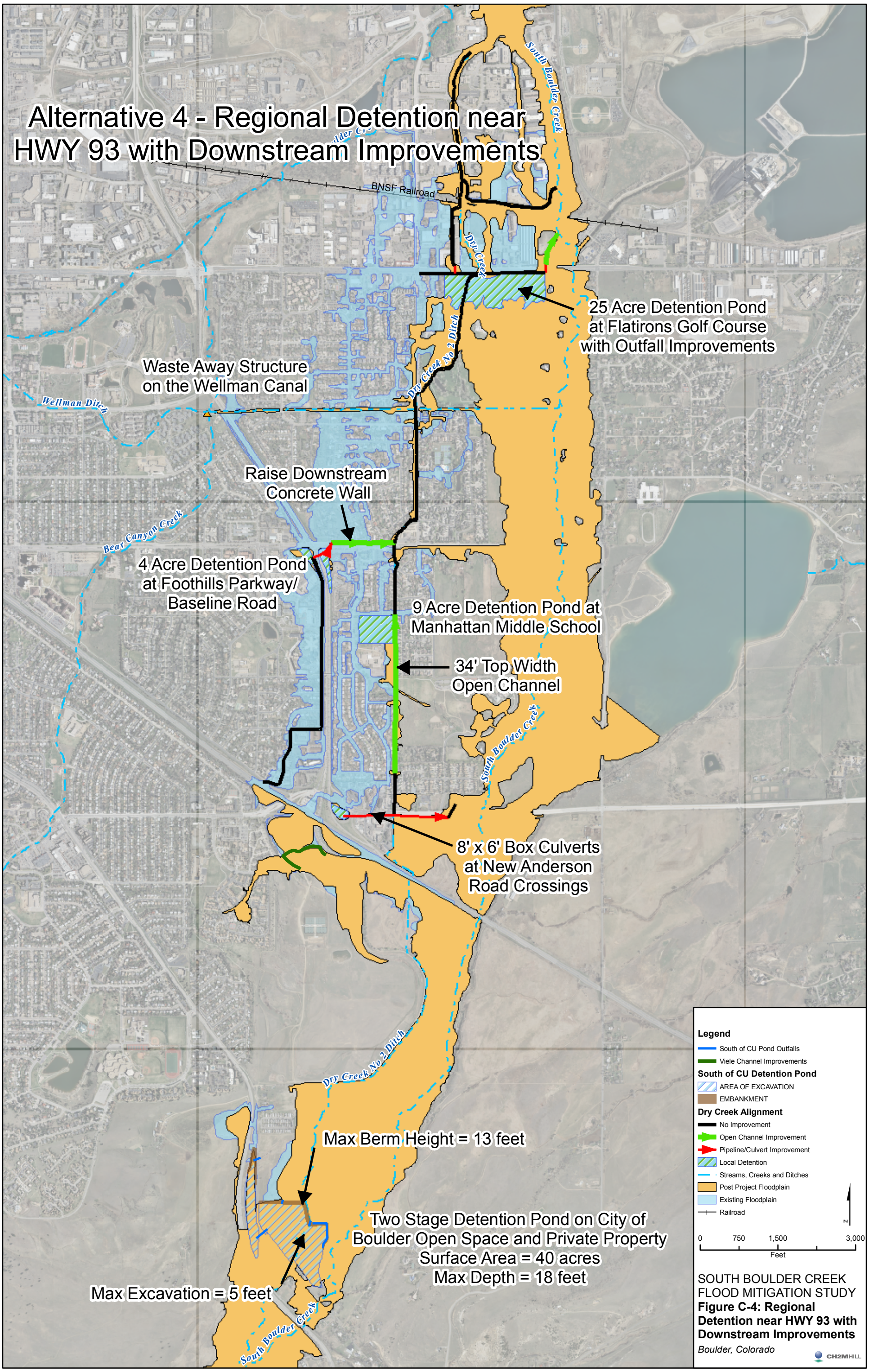
Alternative		Estimated Construction Cost	Benefit-to-Cost Ratio	Environmental Impacts	Social Impacts
1	Status Quo	$0	0	• No impacts	• Flood risk still remains
2	High Hazard and Critical Facility Protection	$10,700,000	2.2	• Limited impacts	• Flood limits do not change • Floodproofing reliability concerns
3	Regional Detention at US36 with Downstream Improvements	$28,800,000	2.68	• Habitat and wetland impacts • Periodic inundation of Open Space Lands	• 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	2.52	• Habitat and wetland impacts • Periodic inundation of Open Space Lands	• 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	Distributed Regional Detention	$29,500,000	2.57	• Habitat and wetland impacts (including Critical Wildlife Area near Baseline Road) • Periodic inundation of Open Space Lands • Requires hydraulic control structures along the creek	• Requires formal agreements with BVSD, OSMP, CDOT, ditch companies and City Parks and purchase of private property • Provides 100-year protection in West Valley Area
6	Containment of Flood Flow in South Boulder Creek	$39,200,000*	1.94*	• Limited habitat and wetland impacts	• 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
7	Bear Canyon Creek Pipeline	$46,300,000	1.25	• No water quality enhancement opportunities • Limited wetland impacts	• Extensive disruption during construction • Requires easement coordination with ditch companies • Provides 100-year protection in West Valley Area
8	Dry Creek Ditch No. 2 Pipeline	$45,700,000	1.24	• No water quality enhancement opportunities • Limited wetland impacts	• Extensive disruption during construction • Requires easement coordination with ditch companies • Provides 100-year protection in West Valley Area
9	Nuisance Flood Improvements Only	$14,000,000	0.1	• No impacts	• Limited changes to 100-year floodplain limits or risk

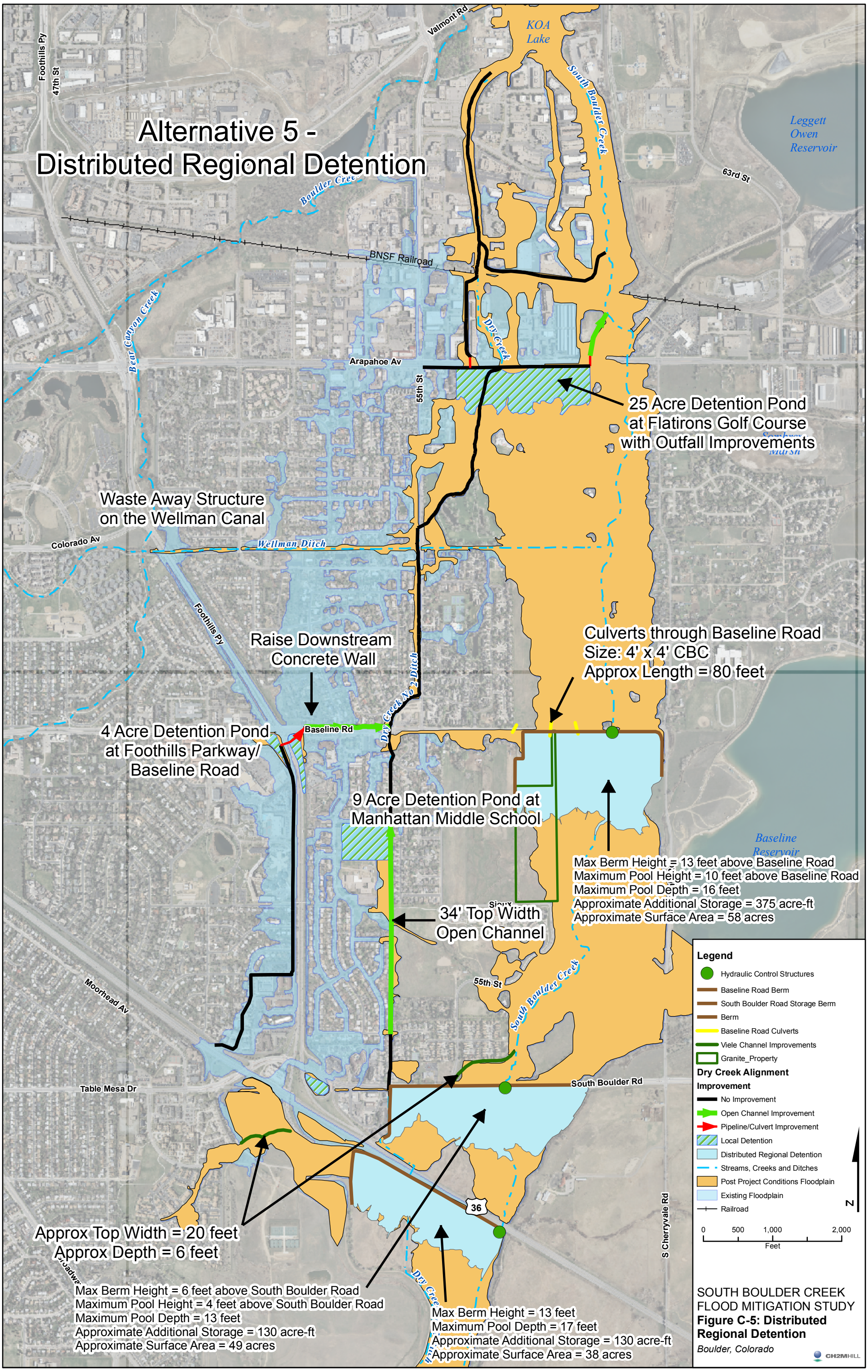
* Does not include any costs to upgrade Baseline Reservoir as may be required to store the additional flood water

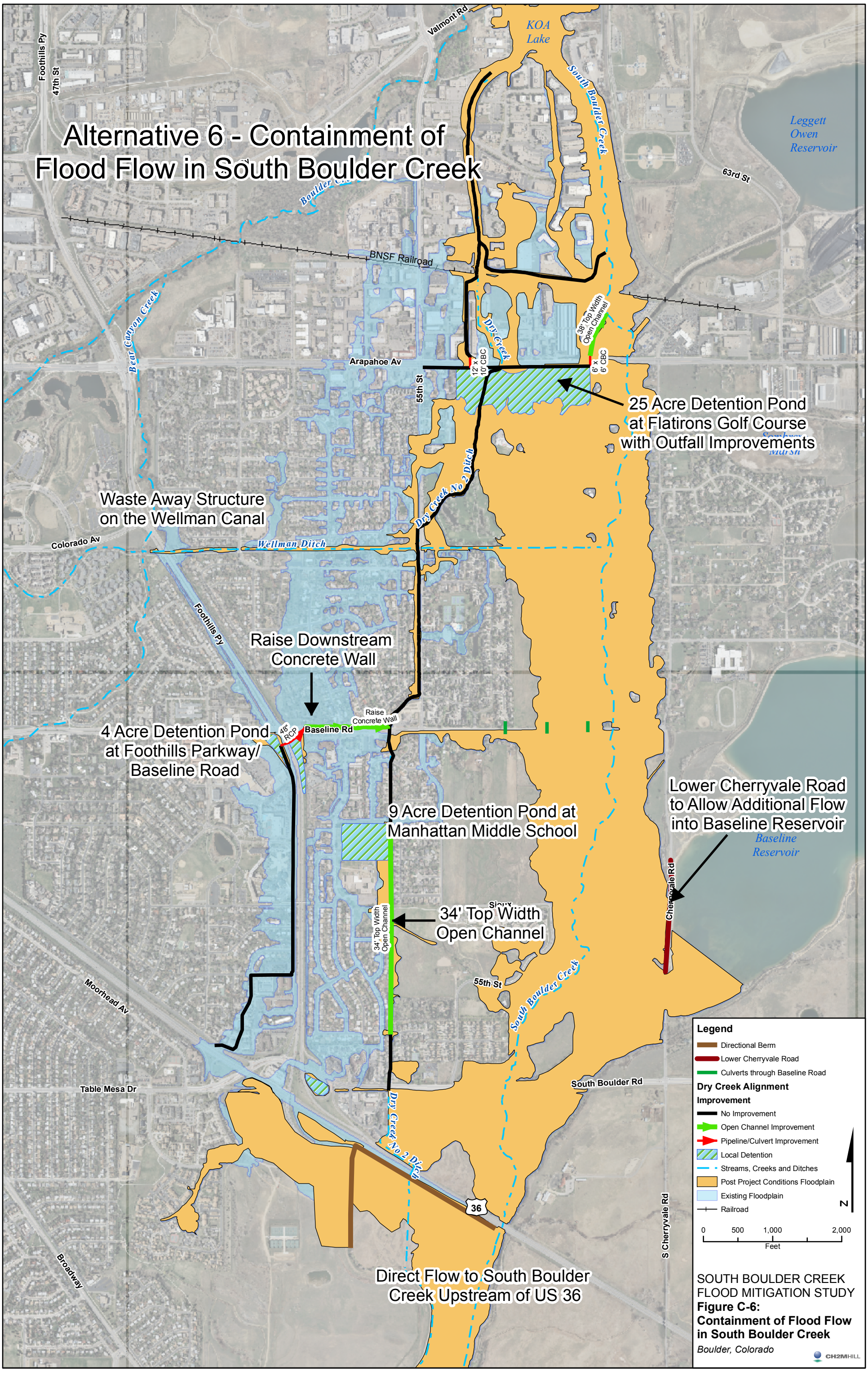

Alternative 1 - Status Quo
Foothills Py
47th St
Pearl Py
Boulder Creek
BNSF Railroad
Valmont Rd
Butte Mill Rd
61st St
South Boulder Creek
63rd St
Dry Creek
Arapahoe Av
55th St
Colorado Av
Wellman Ditch
Foothills Py
Dry Creek No 2 Ditch
Bear Canyon Creek
Baseline Rd
Sioux Dr
55th St
South Boulder Creek
South Boulder Rd
S Cherryvale Rd
Moorhead Av
Table Mesa Dr
36
Broadway
Legend
Streams, Creeks and Ditches
100-Year Floodplain
Railroad
N
0
500
1,000
2,000
Feet
SOUTH BOULDER CREEK
FLOOD MITIGATION STUDY
Figure C-1:
Status Quo
Boulder, Colorado
CH2MHILL

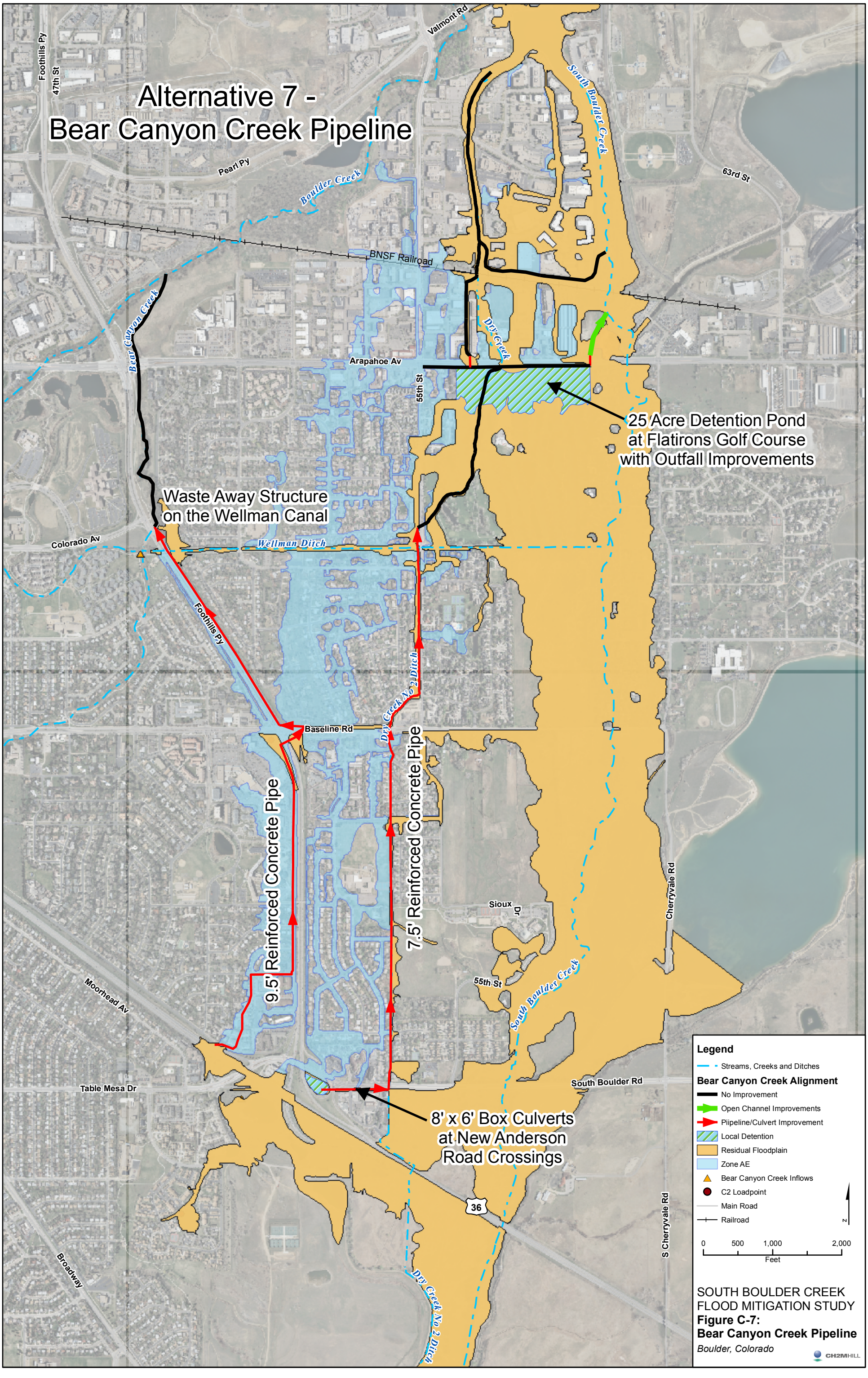

Alternative 2 - High Hazard and Critical Facility Protection
Flood Proof Critical Facilities
Protect Two Properties within the High Hazard Zone with Localized Improvements
Foothills Py
47th St
Pearl Py
Boulder Creek
BNSF Railroad
Arapahoe Av
55th St
Dry Creek
South Boulder Creek
Valmont Rd
Butte Mill Rd
61st St
63rd St
Colorado Av
Wellman Ditch
Foothills Py
Dry Creek No 2 Ditch
Bear Canyon Creek
Baseline Rd
Sioux Dr
55th St
South Boulder Rd
S Cherryvale Rd
Table Mesa Dr
Broadway
36
Legend
Streams, Creeks and Ditches
Buildings in High Hazard Zone
Flood Proof Critical Facilities
Existing High Hazard Zone
100-Year Floodplain
Railroad
N
0 500 1,000 2,000
Feet
SOUTH BOULDER CREEK FLOOD MITIGATION STUDY
Figure C-2:
High Hazard and Critical Facility Protection
Boulder, Colorado
CH2MHILL

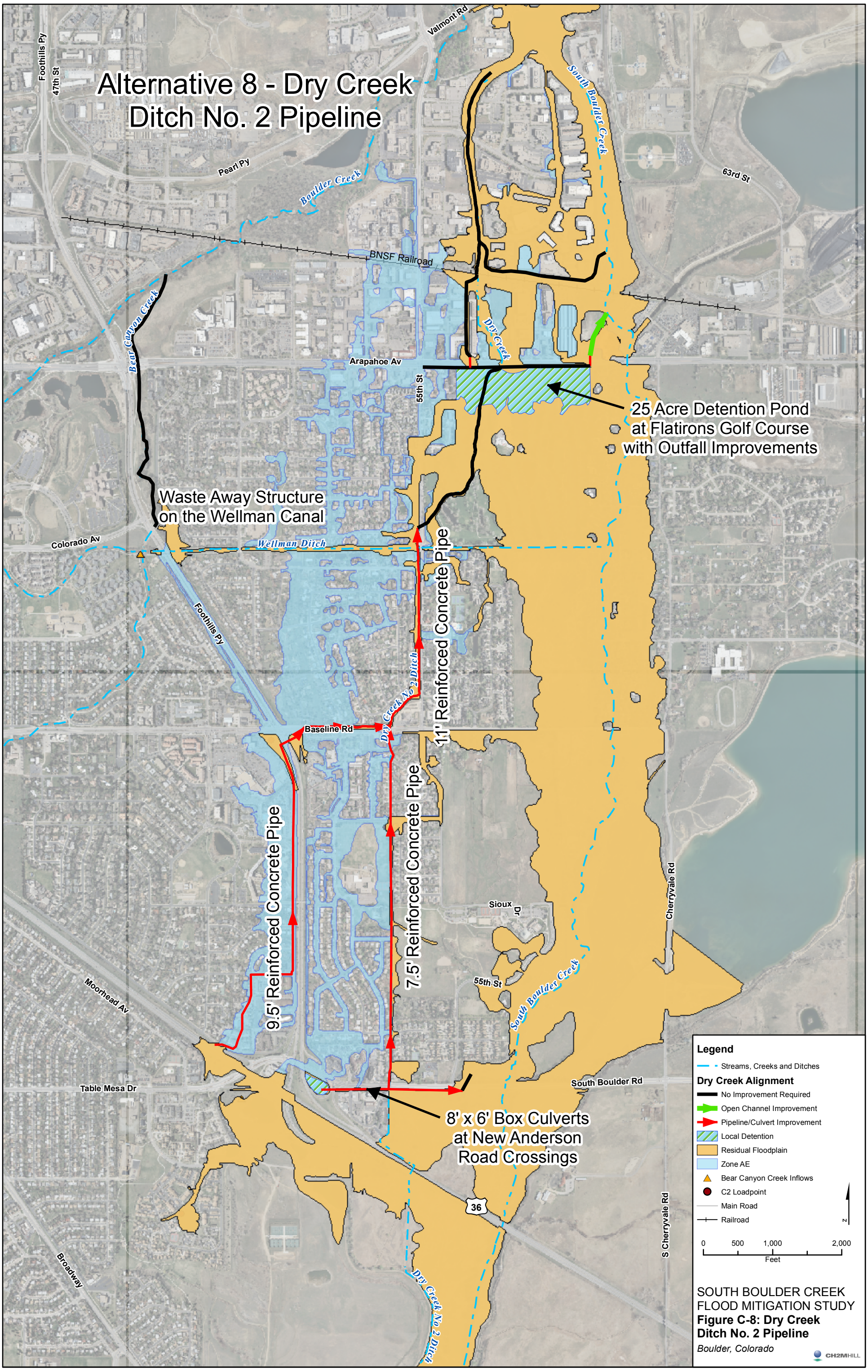

Alternative 3 - Regional Detention at US 36 with Downstream Improvements
Valmont Rd
KOA Lake
South Boulder Creek
Leggett Owen Reservoir
63rd St
Foothills Py
47th St
Boulder Creek
BNSF Railroad
Bear Canyon Creek
Dry Creek
Arapahoe Av
55th St
25 Acre Detention Pond at Flatirons Golf Course with Outfall Improvements
Waste Away Structure on the Wellman Canal
Colorado Av
Wellman Ditch
Foothills Py
Raise Downstream Concrete Wall
Dry Creek No 2 Ditch
4 Acre Detention Pond at Foothills Parkway/ Baseline Road
Baseline Rd
9 Acre Detention Pond at Manhattan Middle School
Baseline Reservoir
Cherryvale Rd
34' Top Width Open Channel
8' x 6' Box Culverts at New Anderson Road Crossings
Moorhead Av
Berm Height = 18 feet
Table Mesa Dr
South Boulder Rd
Berm Height = 6 feet
36
S Cherryvale Rd
Broadway
Detention Pond on CU and City of Boulder Open Space Property
Surface Area = 75 acres
Max Depth = 23.5 feet
Dry Creek No 2 Ditch
Legend
LAKES
CU Storage Berm Location
Outfall from CU Pond
CU Detention Pond
Dry Creek Alignment
No Improvement
Open Channel Improvement
Pipeline/Culvert Improvement
Local Detention
Streams, Creeks and Ditches
Post Project Conditions Floodplain
Existing Floodplain
Railroad
N
0 500 1,000 2,000
Feet
SOUTH BOULDER CREEK FLOOD MITIGATION STUDY
Figure C-3: Regional Detention at US 36 with Downstream Improvements
Boulder, Colorado
CH2MHILL

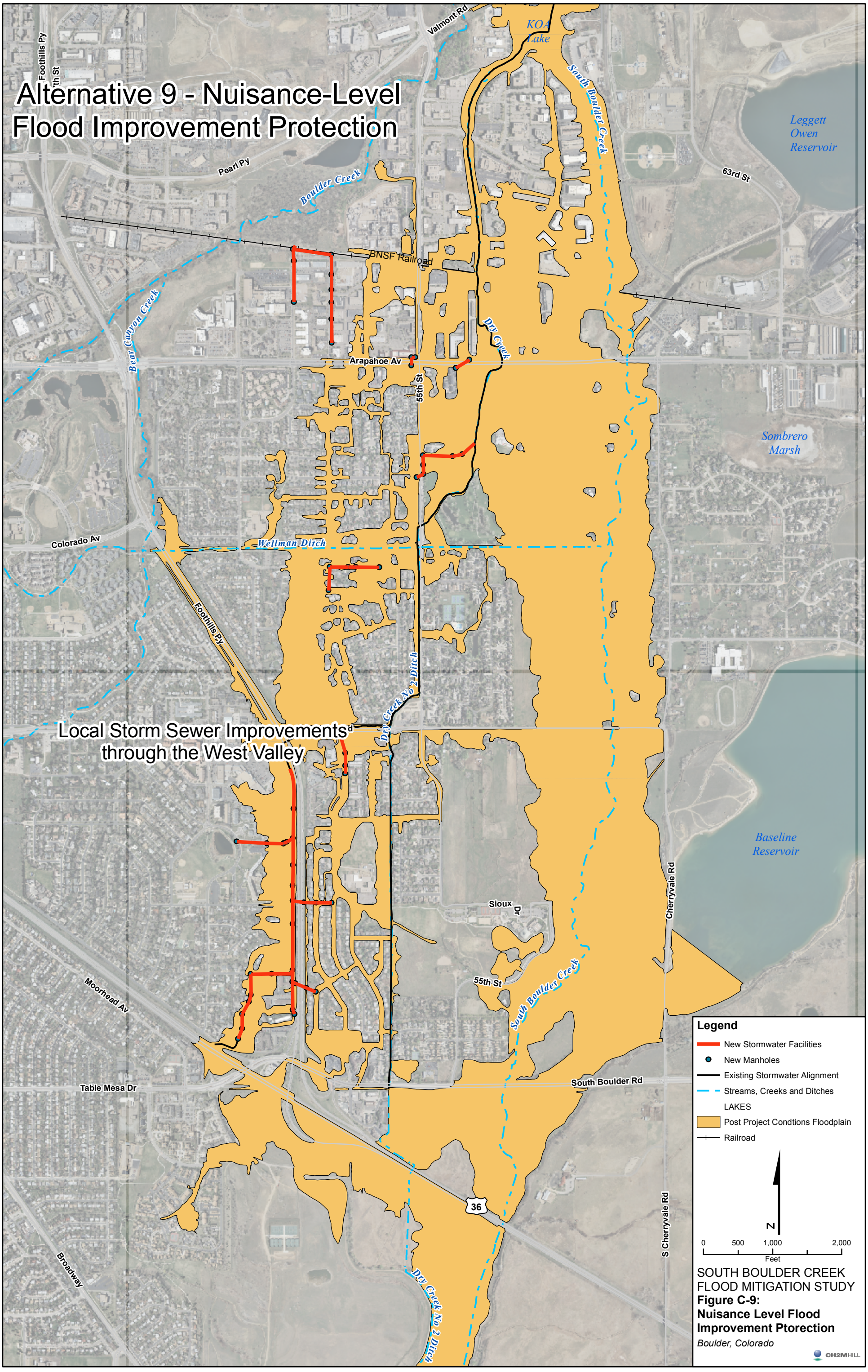

Alternative 4 - Regional Detention near HWY 93 with Downstream Improvements
BNSF Railroad
South Boulder Creek
Dry Creek
Dry Creek No 2 Ditch
25 Acre Detention Pond at Flatirons Golf Course with Outfall Improvements
Waste Away Structure on the Wellman Canal
Wellman Ditch
Raise Downstream Concrete Wall
Bear Canyon Creek
4 Acre Detention Pond at Foothills Parkway/ Baseline Road
9 Acre Detention Pond at Manhattan Middle School
34' Top Width Open Channel
8' x 6' Box Culverts at New Anderson Road Crossings
Max Berm Height = 13 feet
Two Stage Detention Pond on City of Boulder Open Space and Private Property
Surface Area = 40 acres
Max Depth = 18 feet
Max Excavation = 5 feet
Legend
South of CU Pond Outfalls
Viele Channel Improvements
South of CU Detention Pond
AREA OF EXCAVATION
EMBANKMENT
Dry Creek Alignment
No Improvement
Open Channel Improvement
Pipeline/Culvert Improvement
Local Detention
Streams, Creeks and Ditches
Post Project Floodplain
Existing Floodplain
Railroad
N
0 750 1,500 3,000
Feet
SOUTH BOULDER CREEK FLOOD MITIGATION STUDY
Figure C-4: Regional Detention near HWY 93 with Downstream Improvements
Boulder, Colorado
CH2MHILL


Alternative 5 -
Distributed Regional Detention
KOA Lake
South Boulder Creek
Leggett Owen Reservoir
63rd St
Valmont Rd
Foothills Py
47th St
Boulder Creek
BNSF Railroad
Bear Canyon Creek
Dry Creek
Arapahoe Av
55th St
25 Acre Detention Pond
at Flatirons Golf Course
with Outfall Improvements
Waste Away Structure
on the Wellman Canal
Colorado Av
Wellman Ditch
Foothills Py
Raise Downstream
Concrete Wall
Culverts through Baseline Road
Size: 4' x 4' CBC
Approx Length = 80 feet
Dry Creek No 2 Ditch
4 Acre Detention Pond
at Foothills Parkway/
Baseline Road
Baseline Rd
9 Acre Detention Pond at
Manhattan Middle School
Baseline Reservoir
Max Berm Height = 13 feet above Baseline Road
Maximum Pool Height = 10 feet above Baseline Road
Maximum Pool Depth = 16 feet
Approximate Additional Storage = 375 acre-ft
Approximate Surface Area = 58 acres
34' Top Width
Open Channel
Moorhead Av
55th St
South Boulder Creek
Table Mesa Dr
South Boulder Rd
36
S Cherryvale Rd
Approx Top Width = 20 feet
Approx Depth = 6 feet
Max Berm Height = 6 feet above South Boulder Road
Maximum Pool Height = 4 feet above South Boulder Road
Maximum Pool Depth = 13 feet
Approximate Additional Storage = 130 acre-ft
Approximate Surface Area = 49 acres
Max Berm Height = 13 feet
Maximum Pool Depth = 17 feet
Approximate Additional Storage = 130 acre-ft
Approximate Surface Area = 38 acres
Legend
Hydraulic Control Structures
Baseline Road Berm
South Boulder Road Storage Berm
Berm
Baseline Road Culverts
Viele Channel Improvements
Granite_Property
Dry Creek Alignment
Improvement
No Improvement
Open Channel Improvement
Pipeline/Culvert Improvement
Local Detention
Distributed Regional Detention
Streams, Creeks and Ditches
Post Project Conditions Floodplain
Existing Floodplain
Railroad
N
0 500 1,000 2,000
Feet
SOUTH BOULDER CREEK
FLOOD MITIGATION STUDY
Figure C-5: Distributed
Regional Detention
Boulder, Colorado
CH2MHILL


Alternative 6 - Containment of Flood Flow in South Boulder Creek
KOA Lake
South Boulder Creek
Leggett Owen Reservoir
63rd St
Valmont Rd
Foothills Py
47th St
BNSF Railroad
Bear Canyon Creek
Dry Creek
38' Top Width Open Channel
12' x 10' CBC
6' x 6' CBC
Arapahoe Av
55th St
25 Acre Detention Pond at Flatirons Golf Course with Outfall Improvements
Dry Creek No 2 Ditch
Waste Away Structure on the Wellman Canal
Colorado Av
Wellman Ditch
Raise Downstream Concrete Wall
Raise Concrete Wall
Baseline Rd
48" RCP
4 Acre Detention Pond at Foothills Parkway/ Baseline Road
9 Acre Detention Pond at Manhattan Middle School
Lower Cherryvale Road to Allow Additional Flow into Baseline Reservoir
Baseline Reservoir
Cherryvale Rd
34' Top Width Open Channel
Moorhead Av
South Boulder Rd
Table Mesa Dr
36
S Cherryvale Rd
Broadway
Direct Flow to South Boulder Creek Upstream of US 36
Legend
Directional Berm
Lower Cherryvale Road
Culverts through Baseline Road
Dry Creek Alignment Improvement
No Improvement
Open Channel Improvement
Pipeline/Culvert Improvement
Local Detention
Streams, Creeks and Ditches
Post Project Conditions Floodplain
Existing Floodplain
Railroad
N
0 500 1,000 2,000
Feet
SOUTH BOULDER CREEK FLOOD MITIGATION STUDY
Figure C-6:
Containment of Flood Flow in South Boulder Creek
Boulder, Colorado
CH2MHILL


Alternative 7 -
Bear Canyon Creek Pipeline
Foothills Py
47th St
Valmont Rd
South Boulder Creek
63rd St
Pearl Py
Boulder Creek
BNSF Railroad
Bear Canyon Creek
Dry Creek
Arapahoe Av
55th St
25 Acre Detention Pond
at Flatirons Golf Course
with Outfall Improvements
Waste Away Structure
on the Wellman Canal
Colorado Av
Wellman Ditch
Foothills Py
Dry Creek No 2 Ditch
Baseline Rd
9.5' Reinforced Concrete Pipe
7.5' Reinforced Concrete Pipe
Sioux Dr
Cherryvale Rd
55th St
South Boulder Creek
Moorhead Av
Table Mesa Dr
South Boulder Rd
8' x 6' Box Culverts
at New Anderson
Road Crossings
36
S Cherryvale Rd
Broadway
Dry Creek No 2 Ditch
Legend
Streams, Creeks and Ditches
Bear Canyon Creek Alignment
No Improvement
Open Channel Improvements
Piipeline/Culvert Improvement
Local Detention
Residual Floodplain
Zone AE
Bear Canyon Creek Inflows
C2 Loadpoint
Main Road
Railroad
N
0
500
1,000
2,000
Feet
SOUTH BOULDER CREEK
FLOOD MITIGATION STUDY
Figure C-7:
Bear Canyon Creek Pipeline
Boulder, Colorado
CH2MHILL


Alternative 8 - Dry Creek Ditch No. 2 Pipeline
Foothills Py
47th St
Valmont Rd
South Boulder Creek
Pearl Py
Boulder Creek
63rd St
BNSF Railroad
Bear Canyon Creek
Dry Creek
Arapahoe Av
55th St
25 Acre Detention Pond at Flatirons Golf Course with Outfall Improvements
Waste Away Structure on the Wellman Canal
Colorado Av
Wellman Ditch
11' Reinforced Concrete Pipe
Dry Creek No 2 Ditch
Baseline Rd
9.5' Reinforced Concrete Pipe
7.5' Reinforced Concrete Pipe
Sioux Dr
Cherryvale Rd
Moorhead Av
55th St
South Boulder Rd
Table Mesa Dr
8' x 6' Box Culverts at New Anderson Road Crossings
36
S Cherryvale Rd
Broadway
Legend
Streams, Creeks and Ditches
Dry Creek Alignment
No Improvement Required
Open Channel Improvement
Pipeline/Culvert Improvement
Local Detention
Residual Floodplain
Zone AE
Bear Canyon Creek Inflows
C2 Loadpoint
Main Road
Railroad
0 500 1,000 2,000
Feet
SOUTH BOULDER CREEK FLOOD MITIGATION STUDY
Figure C-8: Dry Creek Ditch No. 2 Pipeline
Boulder, Colorado
CH2MHILL


Alternative 9 - Nuisance-Level Flood Improvement Protection
Local Storm Sewer Improvements through the West Valley
Valmont Rd
KOA Lake
South Boulder Creek
Leggett Owen Reservoir
63rd St
Foothills Py
Pearl Py
Boulder Creek
BNSF Railroad
Bear Canyon Creek
Dry Creek
Arapahoe Av
55th St
Sombrero Marsh
Colorado Av
Wellman Ditch
Foothills Py
Dry Creek No 2 Ditch
Baseline Reservoir
Cherryvale Rd
Sioux Dr
55th St
South Boulder Creek
Moorhead Av
Table Mesa Dr
South Boulder Rd
36
S Cherryvale Rd
Broadway
Dry Creek No 2 Ditch
Legend
New Stormwater Facilities
New Manholes
Existing Stormwater Alignment
Streams, Creeks and Ditches
LAKES
Post Project Condtions Floodplain
Railroad
N
0 500 1,000 2,000
Feet
SOUTH BOULDER CREEK FLOOD MITIGATION STUDY
Figure C-9:
Nuisance Level Flood Improvement Ptorection
Boulder, Colorado
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