

# Rio de Flag Flood Control

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**COMMUNITY DEVELOPMENT  
DIVISION**

**JUNE 3, 2014**

# Background

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- 1. Lack of Progress with USACE**
  - Federal funding – not in USACE work program last 3 years
  - Schedule – too long
  - Cost – too expensive
  
- 2. Staff Presentation to Council February 26, 2013**
  - Option #1 – Stay the Course
  - Option #2 – Self Administration
  - Option #3 – City Project
  - Option #4 – Terminate the Project
  
- 3. Staff Presentation to Council April 2, 2013**
  - Council direction to prepare Design Concept Report (DCR)
  
- 4. Council approval of Design Contract December 3, 2013**

# Background

## FEMA vs. USACE Flood Protection

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### ➤ **USACE**

- Floodplains determined using 50 year build out with no mitigation

### ➤ **FEMA**

- Floodplains are from COF Flood Insurance Study and based on current conditions
- City of Flagstaff Storm Water requirements in place to mitigate future increases in flooding

### ➤ **Project Statement**

The project intent is to contain the 100 year event in the proposed flood control structures and eliminate the flood plain.

# Purpose

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## **Design Concept Report**

- Preliminary Project Design
- Feasibility
- Costs

## **Determine Strategy for Future Project Delivery**

- Continue Project With USACE
- City Delivery of Project

# Rio de Flag

## Flood Control Design Concept Project

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**PROJECT TEAM:  
BAKER INTERNATIONAL  
SHEPARD WESNITZER, INC.  
HUNTER CONTRACTING CO.**

# Project Purpose

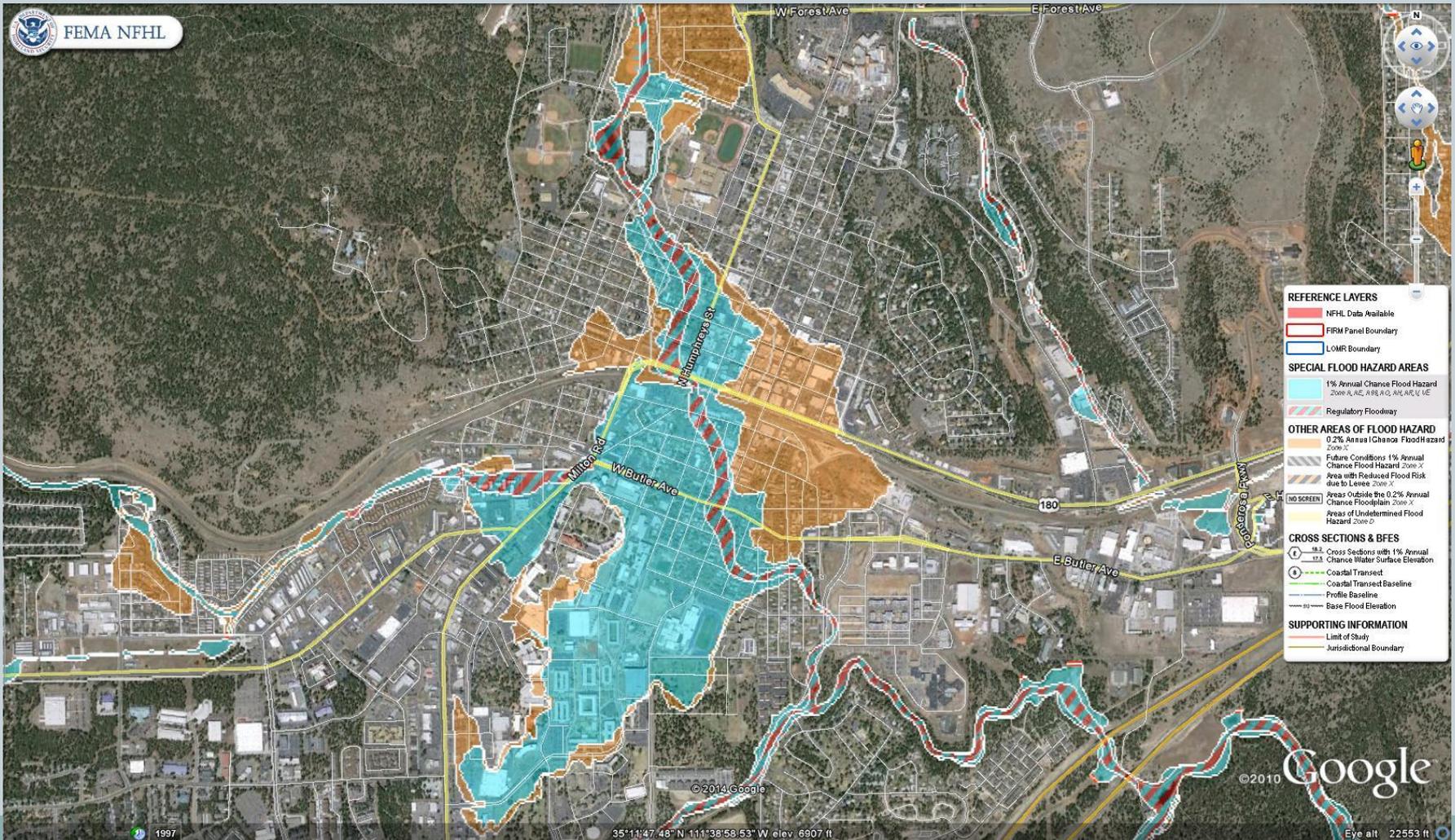
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Investigate feasibility and approximate cost of building flood control project using:

- FEMA 100-year flows vs. United States Army Corps of Engineers (USACE) 100-year flows
- Industry standard design and construction vs. USACE design and construction

# Existing Floodplain Impacts

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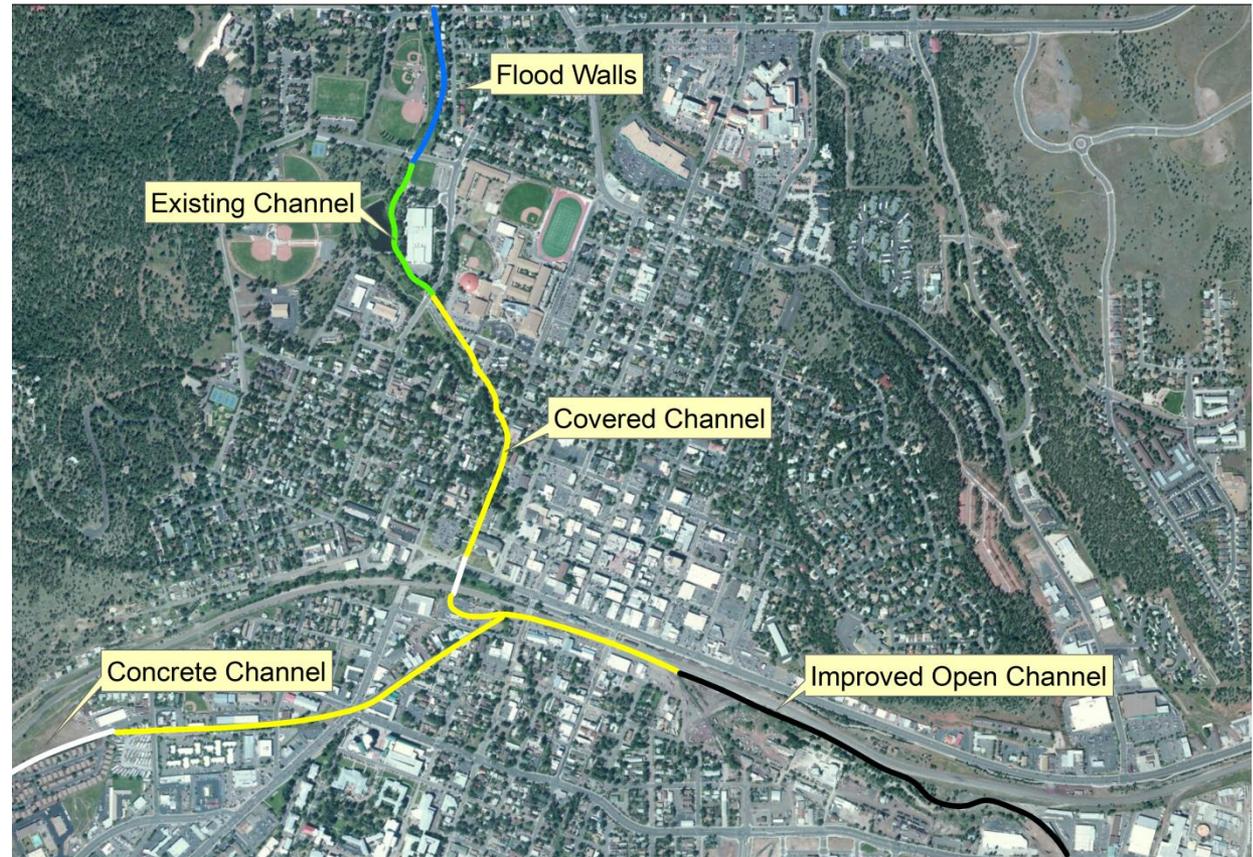


## Rio de Flag:

- ❑ Flood Walls Beal Road to Thorpe Road
- ❑ Existing Open Channel Thorpe Road to Bonito Street
- ❑ Covered Concrete Channel Bonito Street to RT 66
- ❑ Concrete Rectangular Channel through RT 66 and Railroad
- ❑ Covered Concrete Channel Along Railroad to Existing Open Channel Near End of Phoenix Avenue
- ❑ Improved Open Channel to Butler Avenue

## Clay Avenue Wash:

- ❑ Concrete Rectangular Channel to Chateau Drive
- ❑ Covered Concrete Channel to Confluence with Rio de Flag



# USACE Project Summary

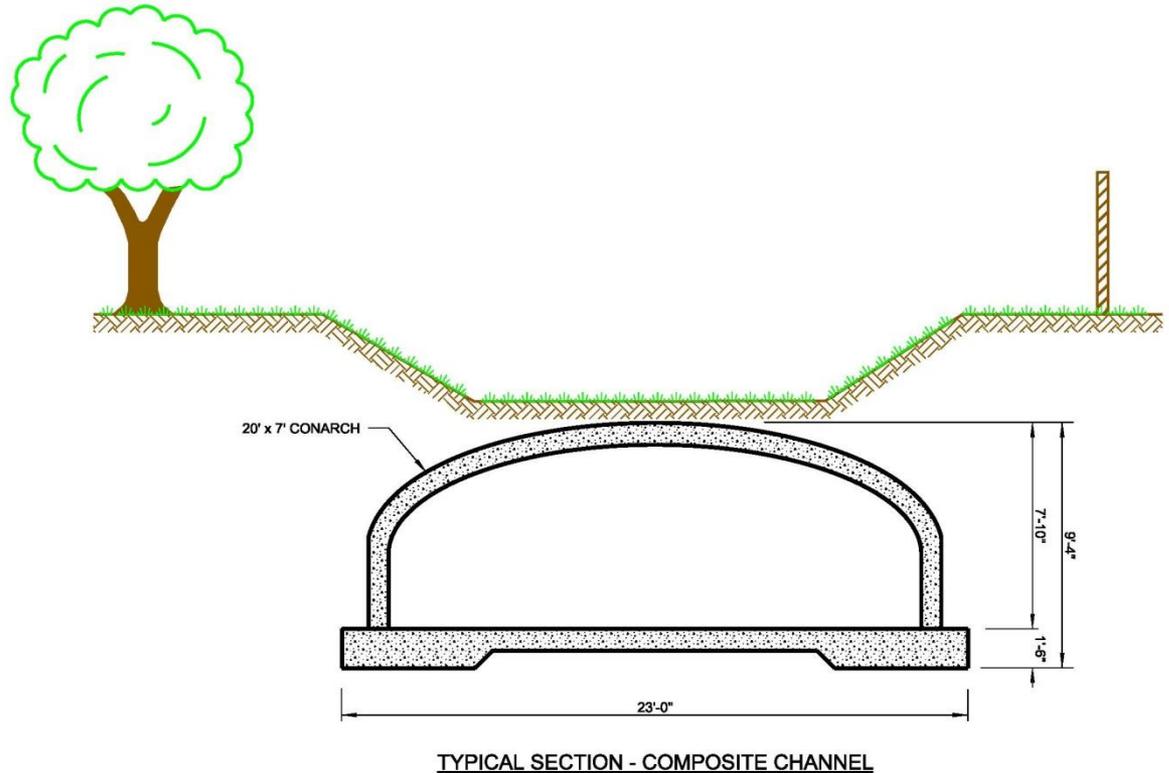
## Flood Control Project Summary

Develop four alternatives to convey 100-year FEMA flows through downtown Flagstaff, and return to the historic Rio de Flag channel upstream of I-40

- Alt 1 – USACE alignment using lower FEMA flows
- Alt 2 – Using existing channel alignment through RT 66 and BNSF Railroad
- Alt 3 – Using existing culvert in Butler Road to reduce structure size in Mike's Pike
- Alt 4 – Combination of Alt 2 for Rio de Flag and concrete circular pipes for Clay Avenue Wash

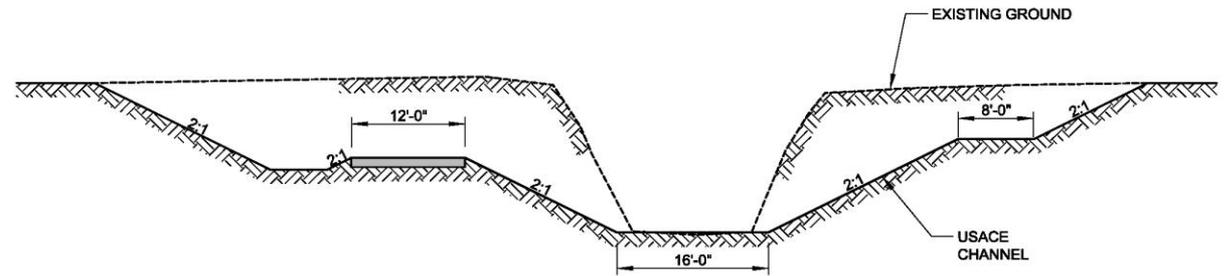
## Composite Channel – All Alternatives

- Low flow open channel
- Flood flows underground
- Full open channel requires property acquisition and significant improvements (floodwalls, hardened channel banks) that would change the character of the Rio de Flag



## Rio de Flag Lower Reach – All Alternatives

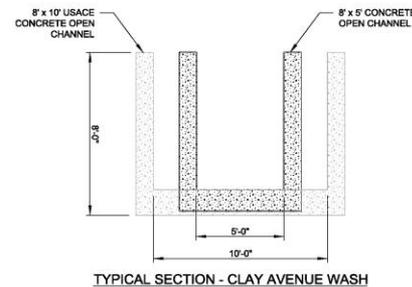
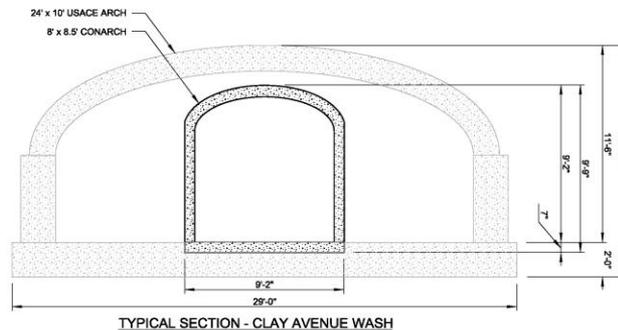
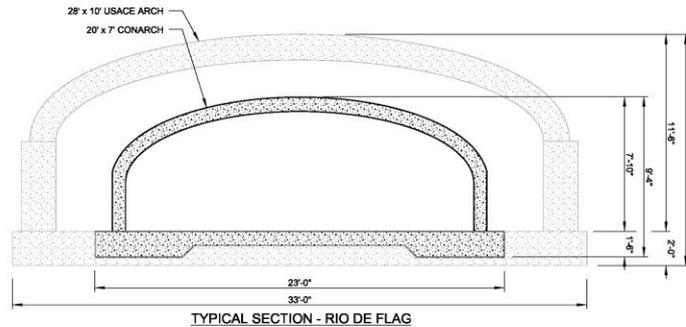
- Utilize existing channel where feasible
- Some grading required to remove obstructions and daylight covered channel



TYPICAL SECTION - RIO DE FLAG LOWER REACH

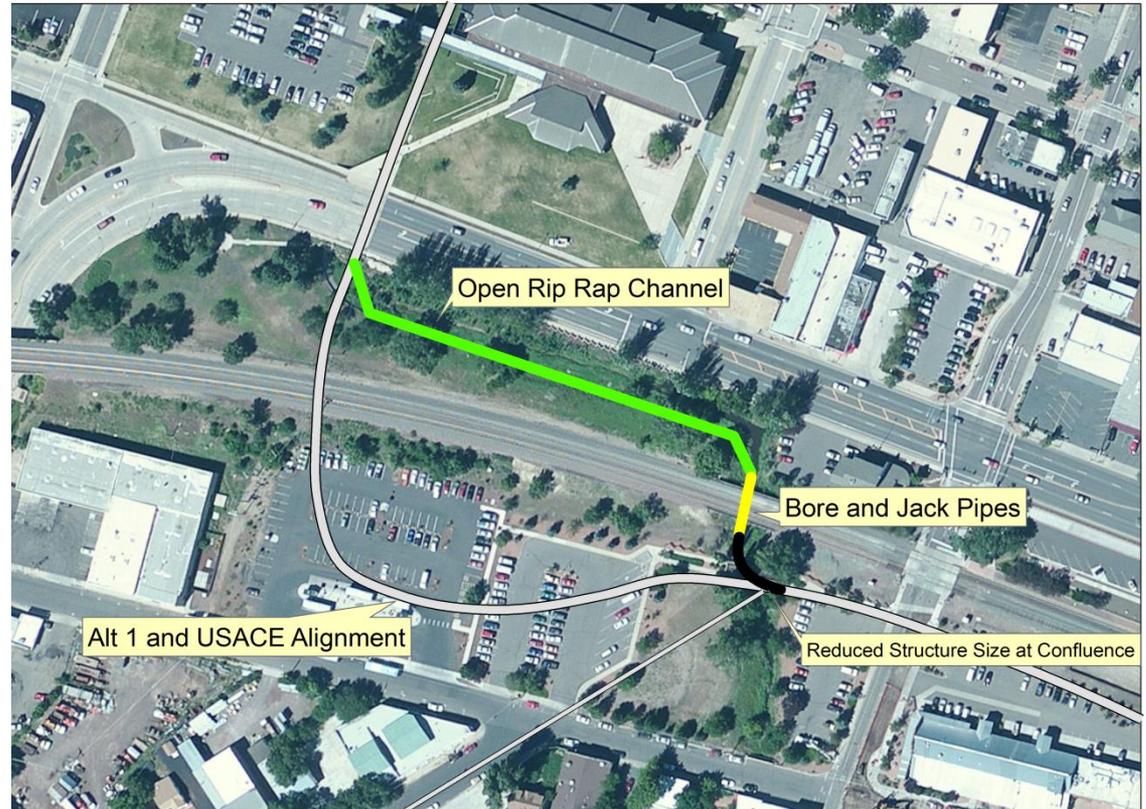
## Alt 1 Structure Size Comparison (USACE vs. Project)

- 20'x7' arch culvert for Rio de Flag
- 5' wide concrete rectangular channel for Clay Avenue Wash Upper
- 8'x8.5' arch culvert for Clay Avenue Wash Lower
- Utilizing existing open channel sections where feasible
- Jack and bore pipes under RT66/BNSF and five points intersection
- **Cost savings ~\$40M**

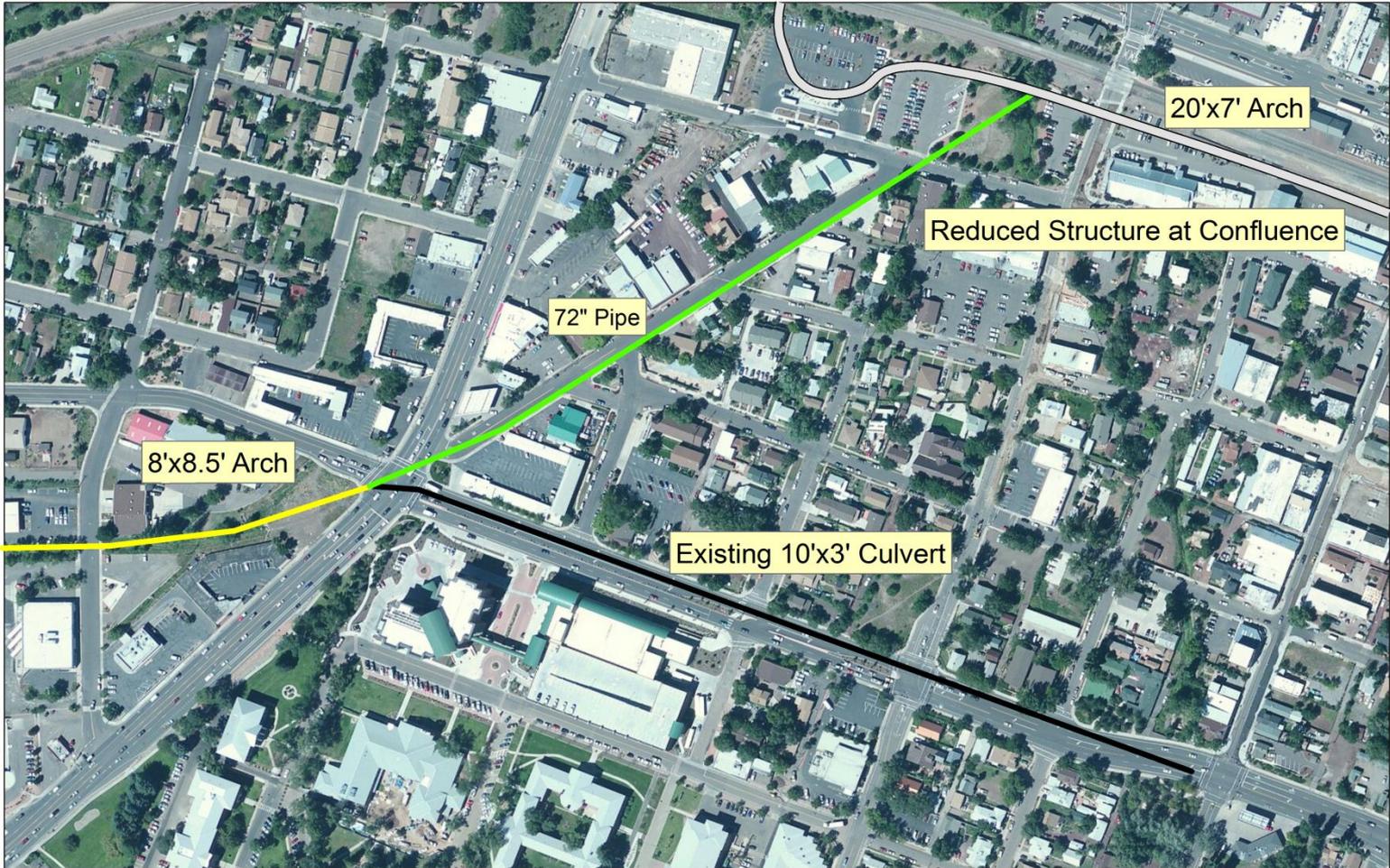


## Alternative 2 Plan

- Arch culvert through RT66
- Open rip rap channel along current alignment
- Jack and bore pipes under railroad
- Return to arch culvert and USACE alignment
- Cost saving  
~\$42M

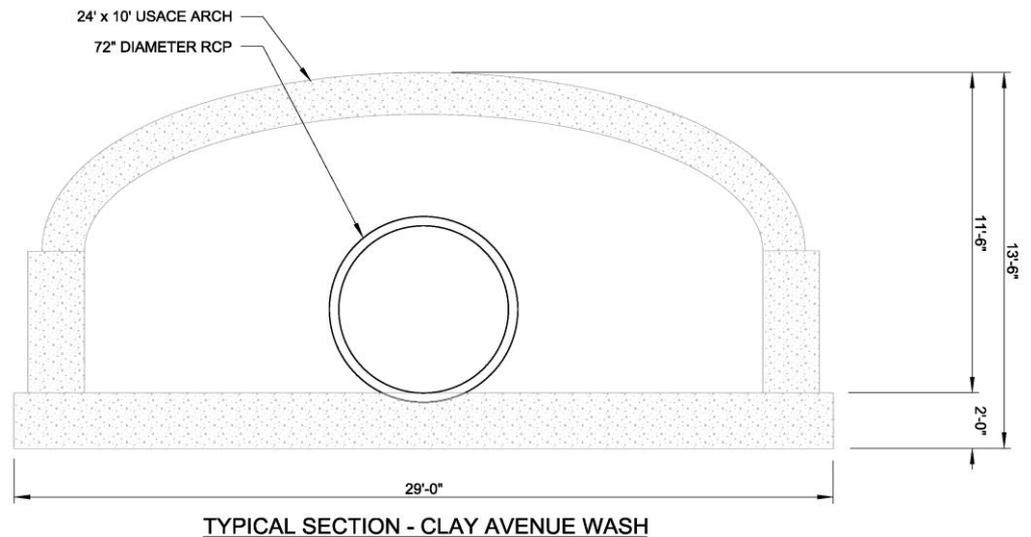


# Alternative 3 Plan



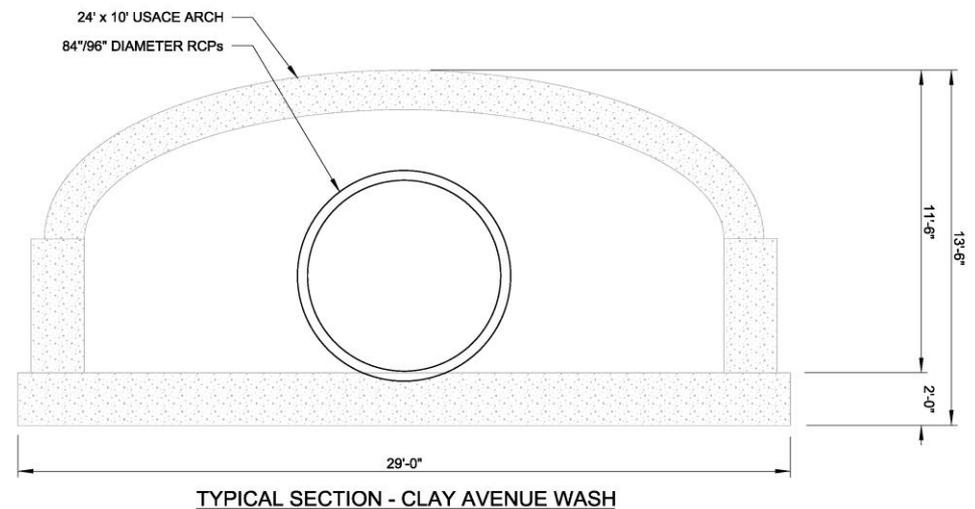
## Alt 3 Structure Size Comparison (USACE vs. Project)

- 72" Pipe in Mike's Pike
- Channel downstream of Butler needs significant maintenance
- Junction structure at five points to split flows
- Uncertainty in existing 10'x3' culvert excess capacity
- **Cost savings ~\$43M**



## Alternative 4

- Combination of Alt 2 for Rio de Flag and using pipes for Clay Avenue Wash
- 84" and 96" pipes required
- Still a cost savings over concrete arch culverts
- **Cost savings**  
~\$44M



# Cost Comparison

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- USACE Preferred Alternative - \$107M
- Alternative 1 - \$67M
- Alternative 2 - \$65M
- Alternative 3 - \$64M
- Alternative 4 - \$63M

# Cost Comparison

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## ➤ USACE

○ Total Project Cost	\$107M
○ City expended to date	\$15M
○ City share to complete	\$34M

## ➤ City FEMA Project

○ Total Project cost per DCR	\$63M
○ City expended towards project	\$5.6M
○ Cost to complete	\$57.4M

# Preferred Alternative (Alt 4) Benefits

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- Lowest cost alternative
- Reduced infrastructure impacts at transit center
- Jack and bore under five points and RT66/BNSF minimizes traffic impacts
- Ease of construction for Clay Avenue pipes
- No junction structure at five points to split flows
- Simplified junction structure at confluence

# Benefits vs. Corp Project

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- Eliminates sewer siphon at five points
- Minimizes environmental impacts with jack and bore
- Reduces scope of coordination with BNSF
- Minimizes traffic impacts with jack and bore
- Composite open channel through upper reach
- Project control
- Schedule control
- Lower overall project cost

# CONCLUSION

## Design Concept Report:

1. Develop design alternatives
2. Determine feasibility
3. Determine costs
4. Determine Strategy for Future Project Delivery
  - Option #1 – Stay the Course
  - Option #2 – Self Administration
  - Option #3 – City Project
  - Option #4 – Terminate the Project

# Questions and Discussion