



# Spring Creek

## Aquatic Ecosystem Restoration Study

Colorado Springs, CO

CONTINUING AUTHORITIES PROGRAM, SECTION 206

### APPENDIX I CIVIL ENGINEERING



US Army Corps  
of Engineers®  
Albuquerque District



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## TABLE OF CONTENTS

<b>1</b>	<b>General</b> .....	<b>1</b>
<b>2</b>	<b>Option Reach 1B</b> .....	<b>1</b>
<b>3</b>	<b>Option Reach 2B</b> .....	<b>2</b>
	<b>3.1 Existing Aerial Sanitary Sewer Line and Culverts</b> .....	<b>2</b>
	<b>3.2 Access to Staging Areas</b> .....	<b>3</b>
	<b>3.3 Rock Riffles</b> .....	<b>4</b>
<b>4</b>	<b>Option Reach 3B</b> .....	<b>5</b>
	<b>4.1 Existing Culvert</b> .....	<b>6</b>
	<b>4.2 Small Rock Riffles</b> .....	<b>7</b>
<b>5</b>	<b>Earthwork</b> .....	<b>7</b>
<b>6</b>	<b>Construction and Operations and Maintenance</b> .....	<b>8</b>
	<b>6.1 Construction Schedule</b> .....	<b>8</b>
	<b>6.2 Operations and Maintenance, Repair, Replacement, and Rehabilitation (O&amp;MRRR)</b> .....	<b>9</b>

## LIST OF FIGURES

Figure 1:	Spring Creek CAP 206 TSP (Alternative 24-2b1b3b) Reach 1b exhibit.....	1
Figure 2:	Spring Creek CAP 206 TSP (Alternative 24-2b1b3b) Reach 2b exhibit.....	2
Figure 3:	Location of aerial sanitary sewer line crossing Spring Creek.....	3
Figure 4:	Staging areas and construction route.....	4
Figure 5:	Spring Creek CAP 206 TSP (Alternative 24-2b1b3b) Reach 3b exhibit.....	6
Figure 6:	Location of fill areas and bank modification areas.....	8

## LIST OF TABLES

Table 1:	Earthwork quantities by reach.....	7
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# 1 General

The study area is located along the Spring Creek in Colorado Springs, Colorado. The Spring Creek basin is within the larger Fountain Creek Watershed (hydrologic unit code (HUC) 8: 11020003 - Fountain; HUC 4: 1102 - Upper Arkansas). Fountain Creek is a tributary to the greater Arkansas River system. Spring Creek's headwaters originate in urban Colorado Springs. The defined stream channel generally slopes from the northeast to the southwest and is approximately 4 miles long, from just under half a mile upstream of the project area to its confluence with Fountain Creek. For the purposes of this study, the area was divided into three reaches. Following guidance and due to overwhelming support from the PDT and the Sponsor, the recommended plan is ALT 24 – 1b 2b 3b. The measures in each Reach are described below.

## 2 Option Reach 1B

This alternative would involve stone toe protection on the west bank of Reach 1, riparian plantings behind the stone toe, boulder clusters within the channel, a new access road to a stewardship area, and removal of invasive species on the east bank.

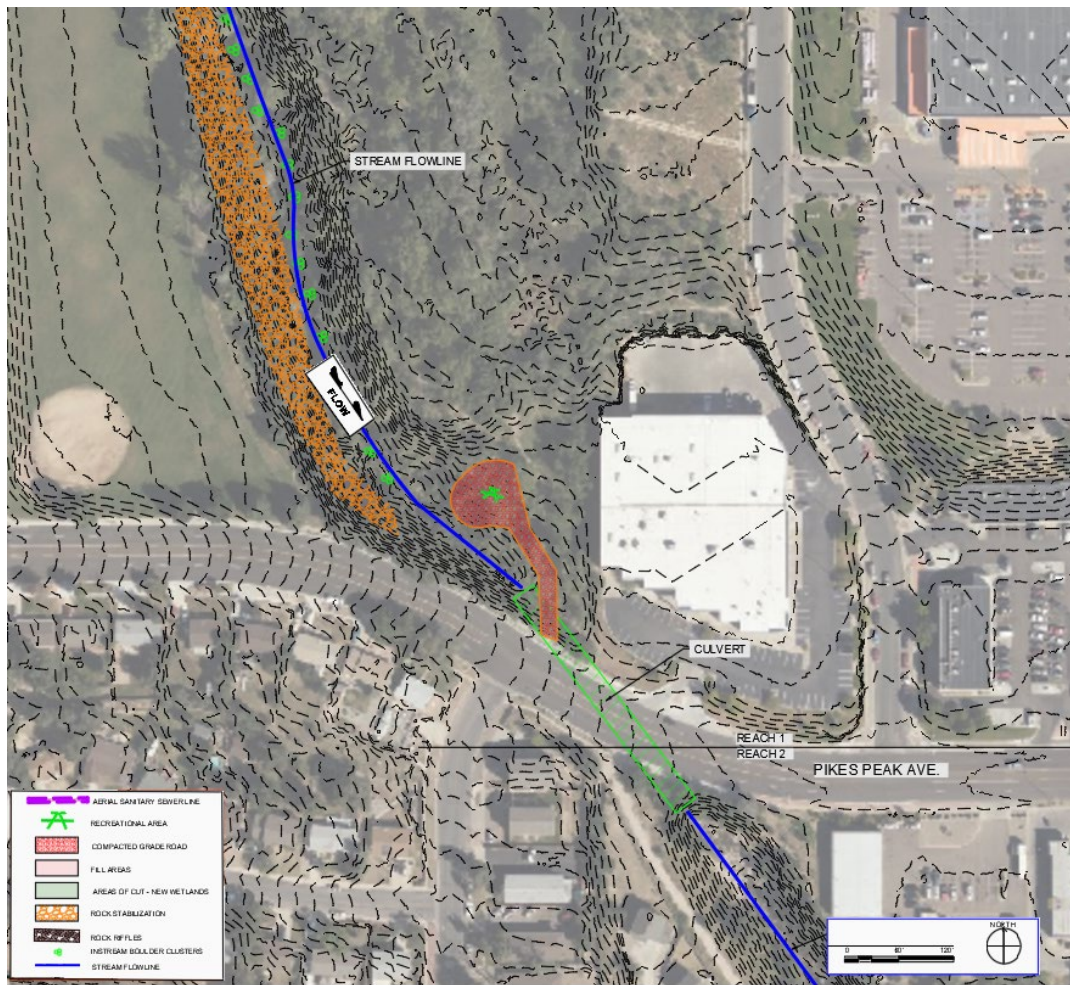


Figure 1: Spring Creek CAP 206 TSP (Alternative 24-2b1b3b) Reach 1b exhibit.

### 3 Option Reach 2B

This alternative would involve boulder clusters in the channel entering Reach 2, larger bank slope modification (including riparian bench creation) for wetland rehabilitation and plantings, two constructed rock riffles, stone bank stabilization at two key eroded outside bends, fill placement on-site, and designated trails to stewardship areas.

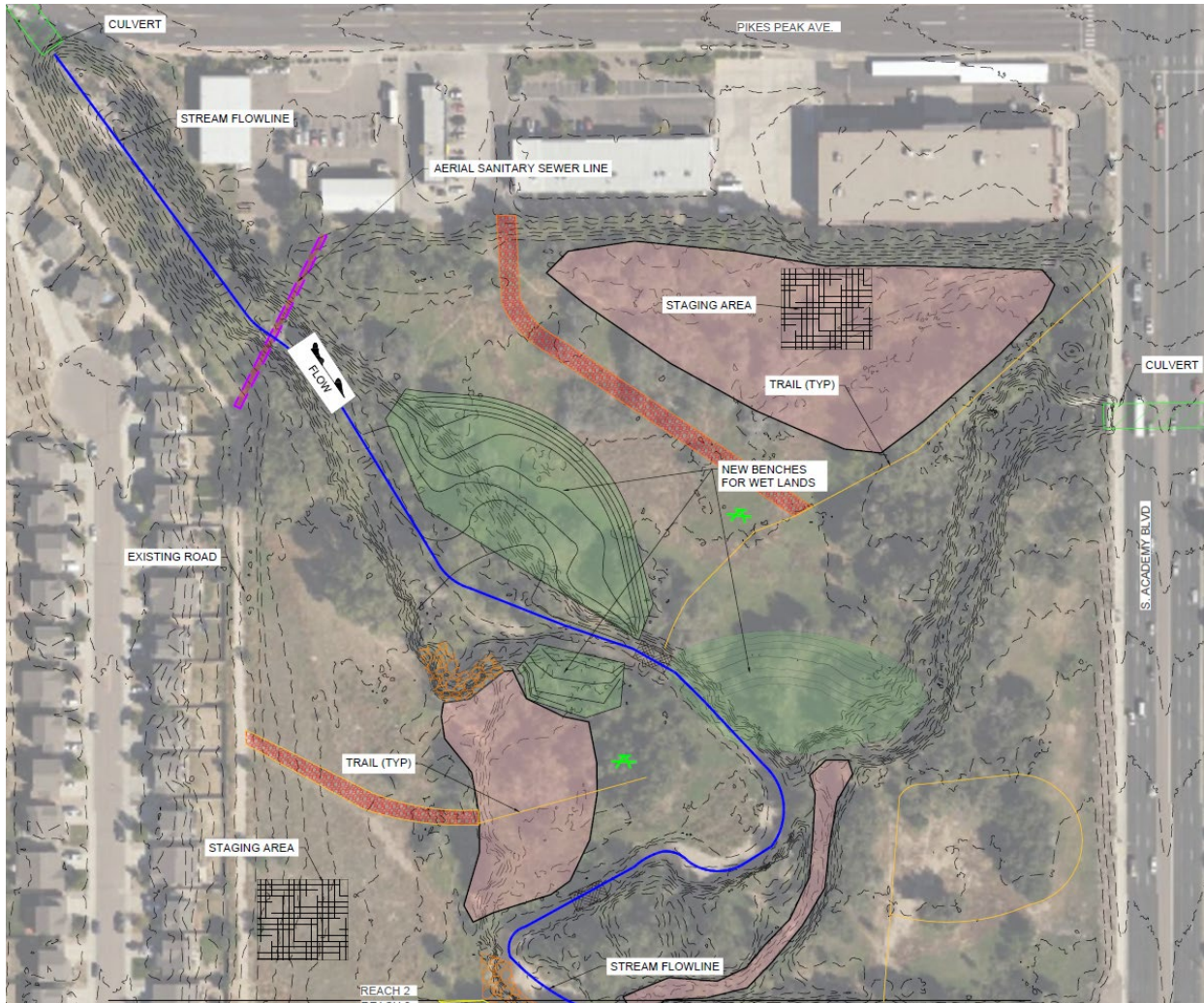


Figure 2: Spring Creek CAP 206 TSP (Alternative 24-2b1b3b) Reach 2b exhibit.

#### 3.1 Existing Aerial Sanitary Sewer Line and Culverts

The existing aerial sanitary sewer line crosses Spring Creek approximately 350 feet south of Pikes Peak Avenue (Figure 3). While this line is outside the immediate work area, its location should be noted and avoided. Utility clearances, including communication, electrical, and water lines, must be obtained prior to design and construction.

The three existing box culverts that feed Spring Creek will need to remain undisturbed.

These box culverts will be control points for the flow line of Spring Creek. Storm water drainage from the upstream areas contribute to the flows in these culverts, this could be a concern during the monsoon season. The northern most box culvert crosses Pikes Peak Ave. One culvert lies on the east side of Reach 2 at S Academy Blvd. Both culverts are shown in Figure 2.



Figure 3: Location of aerial sanitary sewer line crossing Spring Creek.

### 3.2 Access to Staging Areas

The southern staging area is accessible via an existing dirt road east of the residential development (Figure 4). Access to the northern staging area requires either crossing the river or utilizing the existing dirt road west of the staging area that connects to Pikes Peak Avenue. If the dirt road is the chosen access point, verification with appropriate personnel is required before use. Due to the proposed fill placement (maximum 1.5 feet) in the northern staging area, the southern staging area should be used initially. Once the fill is compacted, access from the north may be possible, pending dirt road use verification. All access routes will be clearly marked and maintained throughout the construction period. Dust control measures will be implemented as needed on the dirt roads. This emphasizes maintenance and environmental control.



Figure 4: Staging areas and construction route.

### 3.3 Rock Riffles

These are ramps or low weirs with long aprons made from riprap or small boulders that are constructed at intervals approaching natural riffle spacing. These structures are intended to provide limited grade control and habitat diversity. The two structures that are part of the Reach 2 alternatives are specifically placed based on natural riffle spacing and sufficiently within the riffle section of the stream’s natural pool-riffle-run sequence. The upstream slope of rock fill should be 4:1, steeper than the downstream slope that may be as gradual as 50:1 should be considered. Specific design considerations to be further developed in the design and implementation (D&I) phase. The peak crest height is recommended to be at least 2 ft, however the hydraulic jump should be drawn out during larger events. Specific design considerations to be further developed in the D&I phase. The riffle crest and downstream surface should be V-shaped to direct the flow towards the channel centerline, reducing bank scour along the riffle and maintaining depth for the downstream pool. Banks should be protected with riprap from the channel centerline up to the top of bank to prevent flanking and toe in at the downstream end to protect from scour. Geotextile may be used underneath the stone structures to prevent leaching of fine material. Stone for the structure should be well-graded and properly sized. Past applications have been successful even with stone up to 3.3 ft in diameter. Stone size recommendations have been made using the USACE riprap sizing guidelines. At low flows, structures should concentrate flows to maintain sufficient depth for habitat and

passage of aquatic organisms. At high flow, stability analysis should be conducted to ensure the structure will remain in place for flows up to a given recurrence interval. In this case, depths and velocities from the modeled 1% AEP scenario were used for design. The materials used for these structures are not intended to be mobile during higher flows like natural riffle materials. Dimension guidelines and ranges are recommended according to past applications and studies conducted in Tate (1988), Newbury and Gaboury (1993a), Wittler (1996), and Newbury et al., (1999).

#### Example Construction Sequence:

- Excavate trench in stream bed to a depth equal to the total thickness of the heading and footing rocks.
- Place footing rocks with no gaps in between the footings.
- Install filter fabric.
- Place select backfill behind the footing rocks.
- Install heading rocks on top of and slightly set back from the footing rocks, such that part of the heading rock is resting on the select backfill. Heading rocks should span the seams of the footing rocks, with no gaps between the rocks.
- Place select backfill behind heading rocks ensuring that any voids between the rocks are filled. Hand placement or “chinking” may be necessary to ensure voids are filled and there is no sub-surface flow in the structure.

## **4 Option Reach 3B**

This alternative would involve a small riffle at the top of Reach 3. This riffle would slow the water velocity coming into Reach 3. Boulder clusters in the channel would provide instream habitat diversity throughout Reach 3. The removal of concrete, and slope adjustment, rock placement, and plantings on the west bank slope would create a pervious and diverse riparian habitat area along this otherwise channelized section of stream.

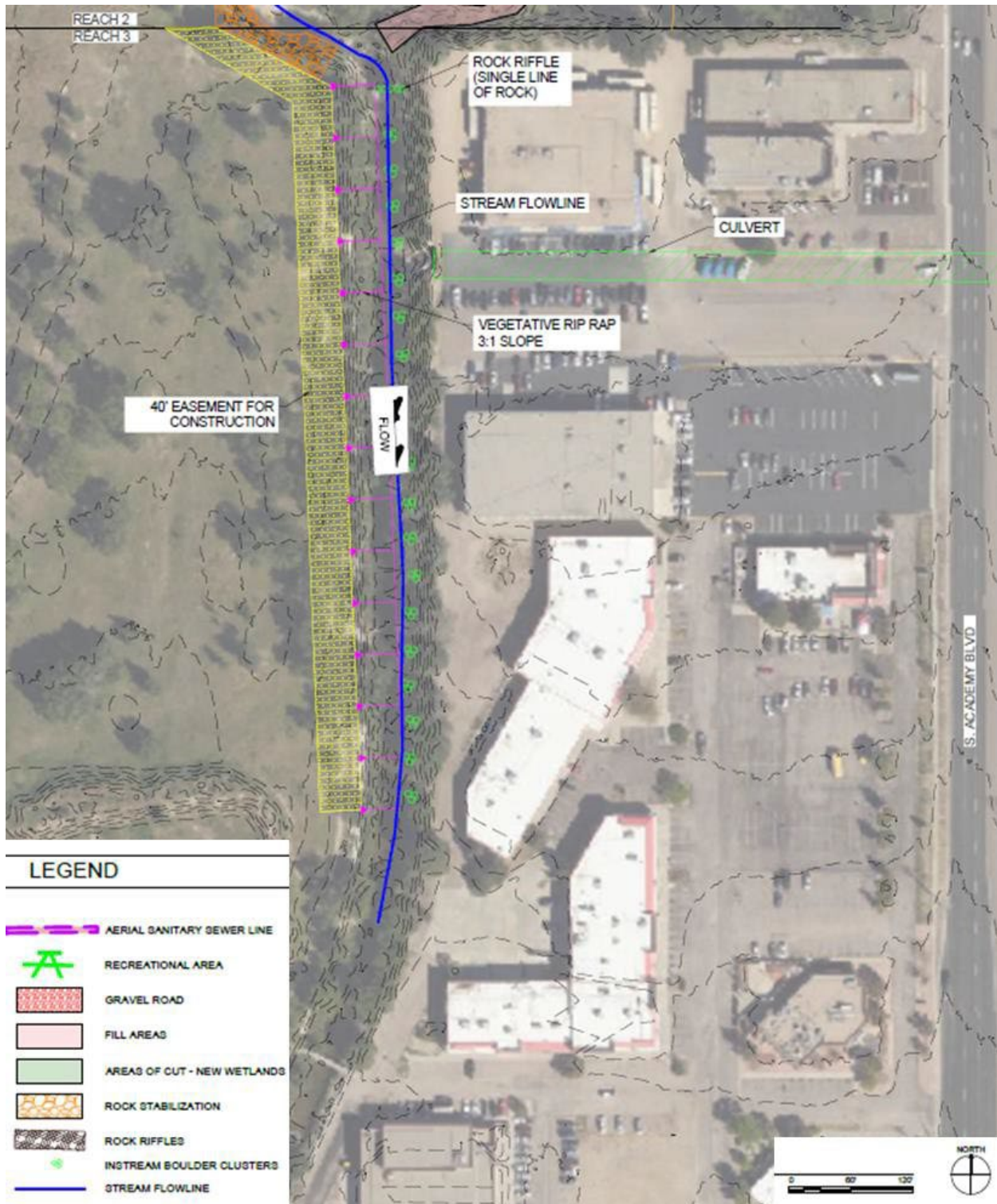


Figure 5: Spring Creek CAP 206 TSP (Alternative 24-2b1b3b) Reach 3b exhibit.

#### 4.1 Existing Culvert

The three existing box culverts that feed Spring Creek will need to remain undisturbed. These box culverts will be control points for the flow line of Spring Creek. Storm water

drainage from the upstream areas contribute to the flows in these culverts, this could be a concern during the monsoon season. The culvert that lies within Reach 3 is shown on Figure 5 at S Academy Blvd.

## 4.2 Small Rock Riffles

Stone for the structure should be well-graded and properly sized. Stone size recommendations have been made using the USACE riprap sizing guidelines. Banks should be protected with riprap from the channel centerline up to the top of bank to prevent flanking. At low flows, the structure should act as grade control for the flows to maintain sufficient depth upstream. At high flow, stability analysis should be conducted to ensure the structure will remain in place for flows up to a given recurrence interval. In this case, depths and velocities from the modeled 1% AEP scenario were used for design.

## 5 Earthwork

The project requires approximately 26,000 cubic yards (CY) of earthwork (Table 1). This fill will be used primarily in areas F1 and F2, with the remaining material (approximately 5 acre-feet) spread to a maximum depth of 1.5 feet across the 3.5-acre area designated F3 (Figure 3). Fill location F1 will address an old flow-way with steep, eroded banks, reducing extreme topography and preventing water from entering it, thus supporting bank modification area BM3. Fill location F2 will improve access for maintenance and adaptive management of the rock riffles and bank modification area BM2. Fill area F3, an upland area, will accommodate excess cut material from bank modification areas BM1-3, further reducing topography and minimizing upland erosion within Reach 2. By using F1-3 all earthworks will be contained onsite to minimize earthwork movement costs.

REACH AREA	CUT (CY)	CUT/FILL FACTOR	EQUIV. FILL (CY)		FILL F1 (CY)	FILL F2 (CY)		EXCESS FILL TO F3 (CY)
1A	0		0					
1B	0		0					
1C	0		0					
2A	7446	1.2	6205		5520	8065		N/A
2B	20936	1.2	17447		5520	8065		3862
3A	5100	1.2	4250					
3B	5100	1.2	4250					
2A + 3A	12546	1.2	10455		5520	8065		N/A
2A + 3B	12546	1.2	10455		5520	8065		N/A
2B + 3A	26036	1.2	21697		5520	8065		8112
2B + 3B	26036	1.2	21697		5520	8065		8112

Table 1: Earthwork quantities by reach.

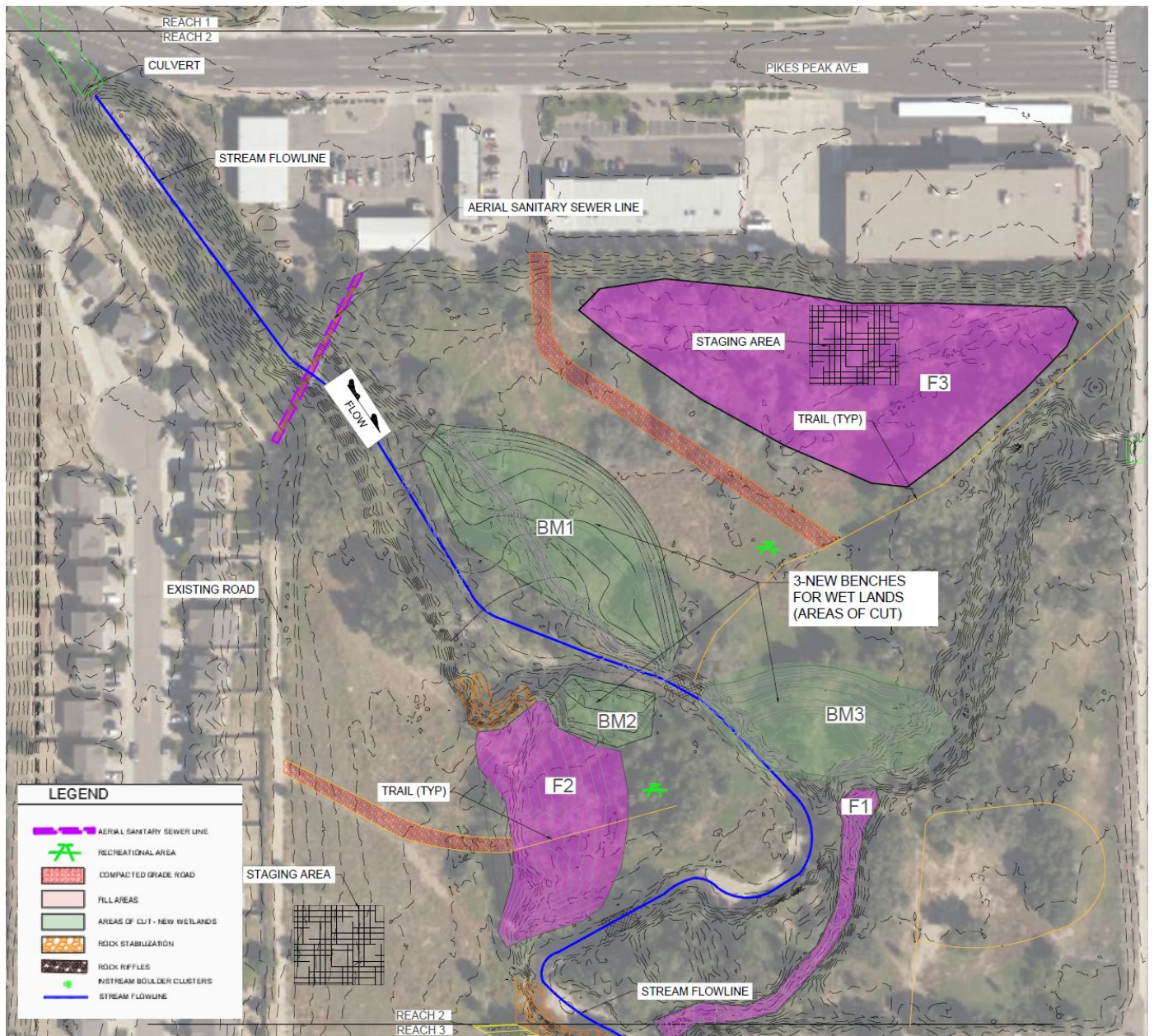


Figure 6: Location of fill areas and bank modification areas.

## 6 Construction and Operations and Maintenance

### 6.1 Construction Schedule

Construction of the project will be contingent upon availability of funds. Construction schedule could be impacted by the stages in Spring Creek. Construction completion is estimated at **XXX (XX)** months but subject to change as design is completed.

## **6.2 Operations and Maintenance, Repair, Replacement, and Rehabilitation (O&MRRR)**

the in-stream structures may require minor reshaping or material replacement if they are disturbed by high-water events. Some woody debris or sediments may accumulate on or around the in-stream structures, and if it is deemed to be causing impairments to the structural function, it should be removed to reduce the risk of failure. All OMRRR work including annual inspections will be performed by the NFS.