Spring Creek

Aquatic Ecosystem Restoration Study

Colorado Springs, CO

Continuing Authorities Program, Section 206
Appendix B – Habitat Evaluation & Modelling

September 2025

US Army Corps of Engineers
Albuquerque District

COLORADO SPRINGS
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Executive Summary

This integrated feasibility report and environmental assessment (IFR/EA) and related appendices present the results of a U.S. Army Corps of Engineers (USACE) feasibility study to identify and evaluate alternatives to restore degraded wetland and riparian ecosystems along Spring Creek in Colorado Springs, Colorado. USACE is undertaking this effort in partnership with the City of Colorado Springs, CO, the non-Federal sponsor (Sponsor). The study is being conducted under the authority of Section 206 of the Water Resources Development Act of 1996.

The project delivery team identified and implemented two models, the Functional Assessment of Colorado Wetlands (FACWet) and the Functional Assessment of Colorado Streams (FACStream) to quantify and evaluate the ecosystem benefits, in the form of Habitat Units (HUs) which would be realized by the Spring Creek aquatic ecosystem restoration project. There are no suitable potential habitat locations for wetland establishment in Reach 1 nor Reach 3 and therefore Reach 2 is the only reach where FACWet is applicable. For this reason, all analysis focused on the Cost Effectiveness and Incremental Cost Analysis (CE/ICA) assessment will focus on the FACStream results for an even comparison of between the reaches and the subsequent Alternatives. FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

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Abbreviations and Acronyms

EA	Environmental Assessment
IFR	Integrated Feasibility Report
Sponsor	The non-federal sponsor, City of Colorado Springs
USACE	U.S. Army Corps of Engineers
NEPA	National Environmental Policy Act
CWPP	Colorado Wetland Program Plan
Ave.	Avenue
ER	Engineer Regulation
CY	Cubic Yards

1 Introduction

This integrated feasibility report and environmental assessment (IFR/EA) documents the planning process for the Spring Creek Aquatic Ecosystem Restoration Study along Spring Creek in the City of Colorado Springs, Colorado, and demonstrates consistency with U.S. Army Corps of Engineers (USACE) planning policy and with the National Environmental Policy Act (NEPA). The following sections provide Environmental Resources background information regarding the basis for this study.

1.1 Project Location

The study area is located along the Spring Creek basin in the City of Colorado Springs, Colorado, USA (Figure 1). The Spring Creek basin is a tributary of the larger Fountain Creek watershed, with its headwaters originating in urban Colorado Springs. The defined stream channel gradually slopes in a northeast to southwest direction for approximately 4 miles, beginning just under half a mile upstream of the project area to its confluence with Fountain Creek. The study area was divided into three study Reaches: (1) Reach 1 was named "Pikes Peak North" and is bordered to the west by Wagner Park, to the south by Pike Peak Ave., to the north by a city Fire Station, and to the east by commercial businesses. (2) Reach 2 was named "Former Wetland" and is located southwest of Pikes Peak Ave. and S. Academy Blvd intersection and directly south of Reach 1. (3) Reach 3 was named "South Channel" and is located directly south of Reach 2 and is bordered to the west and south by private land and to the east by commercial businesses. In the early stages of this study, only Reach 2 was going to be considered, however the team recognized that hydrologic and ecologic processes in the reaches upstream and downstream of Reach 2 (Former Wetland) could influence the success of wetland restoration. Therefore Reach 1 and Reach 3 were incorporated into the study area. Rationale for developing the three study Reaches was to facilitate the formulation of measures suited to address the restoration goals of each Reach.

2 Procedure Overview

All method descriptions and variable descriptions of Section 2 *Procedure Overview* and its sub-headings are derived from Johnson et al., 2013 (FACWet Manual) or Johnson et al., 2016 (FACStream Manual).

2.1 Functional Assessment of Colorado Wetlands (FACWet)

The FACWet method is a weight-of-evidence approach based on hydrogeomorphic theory. In routine application, FACWet utilizes the best evidence available through desktop analysis and field verification within a rapid assessment timeframe to develop and support ratings for eight variables. Variables are rated based on the severity and extent that identified stressors cause departure from a reference standard condition. FACWet deconstructs the function of the assessed area through three primary attributes: 1) Buffer and Landscape Context, 2) Hydrology and 3) Abiotic and Biotic Habitat. These three primary attributes are quantified by stated variables (see Table 1) and in some cases, sub-variables. A weight has been assigned to each category and the resultant Functional Capacity Index (FCI) is produced on a 0.00 to 1.00 scale, with a 1.00 rating indicating a pristine/reference standard condition (Johnson et al., 2013).

Table 1 Summary of FACWet attributes, State Variables and Sub-variables. The final column provides that total weight assigned to the variable when calculating the overall site score, or composite FCI. Derived from Johnson et al. 2013.

Attribute	Variable Number	State Variable Name	Sub-Variable Name	Total Weight of Variable in Composite FCI
Buffer & Landscape Context	V1	Habitat Connectivity	SV 1.1 – Neighboring Wetland and Riparian Habitat Loss	0.04
			SV 1.2 – Barriers to Migration and Dispersal	
	V2	Contributing Area	SV 2.1 – Buffer Condition	0.11
			SV 2.2 – Buffer Extent	
			SV 2.3 – Buffer Width	
			SV 2.4 – Surrounding Land Use	
Hydrology	V3	Water Source	No sub-variables	0.13
	V4	Water Distribution		0.17
	V5	Water Outflow		0.17
Abiotic & Biotic Habitat	V6	Geomorphology	No sub-variables	0.15
	V7	Chemical Environment	SV 7.1 – Nutrient Enrichment	0.07
			SV 7.2 – Sedimentation/turbidity	
			SV 7.3 – Toxic Contamination	
			SV 7.4 – Temperature	
			SV 7.5 – Soil Chemistry and Redox	
	V8	Vegetation Structure and Complexity	SV 8.1 – Tree Stratum	0.15
			SV 8.2 – Shrub Stratum	
			SV 8.3 – Herb Stratum	
			SV 8.4 – Aquatic Stratum	

Variable scoring is calibrated to parallel the academic grading scale (Table 2) based upon a concise narrative description of the condition of the key driver of wetland health, rather than a measure of a process rate or unit. Specific instructions for scoring each variable are included on the individual FACWet datasheets but generally, a provided list of stressors are intended to capture the most common stressors that effect that variable. Based on the composite effect of all recorded stressors, an informal academic letter grade ("A" through "F" with a "+"/ "-" scale) would be assigned. Criteria for scoring is based on overall level of variable alteration which is provided on the FACWet datasheets (raw datasheets for FACWet Existing Conditions may be found in Sub-appendix I). Following the narrative descriptions assigned using the FACWet datasheets, a decimal value between 0.00 and 1.00[2, 3] would then be assigned to convert the letter

grade to numbers so arithmetic operations may be performed (Johnson et al., 2013). FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

Table 2 Scoring ranges and equivalents. Derived from Johnson et al. 2013.

Score Range	Letter Grade	Narrative Condition Category	Interpretation
1.0 – 0.9	A	Reference Standard	Pristine or nearly so. Supports highest level of sustainable functioning.
<0.9 – 0.8	B	Highly Functioning	Stressors detectably alter the variable's form in minor ways. The variable still retains its essential qualities and supports a high level of ecological function.
<0.8 – 0.7	C	Functioning	Obvious alteration and degradation of the variable, but it still supports basic, natural, passive wetland functioning.
<0.7 – 0.6	D	Functionally Impaired	Major ecologically harmful alterations to the variable. Active management commonly required to support maintenance of wetland characteristics.
<0.6	F	Non-Functioning	Massive deleterious alteration of the variable. The level of alteration generally results in an inability of the variable to support wetland conditions or it otherwise makes the area biologically-unsuitable.

2.1.1 Variable 1 – Habitat Connectivity

The Habitat Connectivity Variable (V1) in FACWet is described by the two sub-variables- Neighboring Wetland (SV1.1) and Riparian Habitat Loss and Barriers to Migration and Dispersal (SV1.2). SV1.1 measures how isolated from other naturally occurring wetlands or riparian area the assessed area (AA) has become as a result of habitat destruction within a 500-meter (m) zone called a Habitat Connectivity Envelope (HCE). SV1.2 rates the degree to which the AA has become isolated from existing neighboring wetlands and riparian habitat by artificial barriers that inhibit migration and dispersal of organisms within the HCE (Johnson et al., 2013).

2.1.2 Variable 2 – Contributing Area

The Contributing Area Variable (V2) is described by four sub-variables- Buffer Condition (SV2.1), Buffer Extent (SV2.2), Buffer Width (SV2.3) and Surrounding Land Use (SV2.4). These variables are measured within a 250m zone surrounding the AA. As land use intensifies around the AA, so does the potential that the landscape could make deleterious material contributions to the wetland, increase habitat isolation and/or generally elevate stress on biota, particularly fauna. SV2.1 measures the functionality and composition of the vegetative buffer. SV2.2 assigns a score based on the percentage of the AA that has a vegetative buffer and SV2.3 is scored by randomly measuring the width of eight areas and averaging the measurements together for a total average vegetative buffer width. SV2.4 assesses the severity of impairment based on the surrounding land use. The four sub-variables are than averaged to assign a final score to V2 (Johnson et al., 2013).

2.1.3 Variable 3 – Water Source

The Water Source Variable (V3) has no sub-variable and assesses the up-gradient hydrological connectivity. This is a measure of the integrity of the AA water source, including the quantity and timing of water delivery as well as the water source's ability to perform sediment transport, erosion and soil pore flushing. Stressors are impacted by augmentation, depletion or alteration of inflow timing and hydrodynamics (Johnson et al., 2013).

2.1.4 Variable 4 – Water Distribution

The Water Distribution Variable (V4) has no sub-variable and determines hydrologic connectivity within the AA. V4 measures the alteration of the spatial distribution of surface and groundwater within the AA. This variable is scored based on stressors that alter flow patterns, impact the hydrograph, and increase or decrease the depth and/or duration of the water table or surface (Johnson et al., 2013).

2.1.5 Variable 5 – Water Outflow

The Water Outflow Variable (V5) has no sub-variable and is concerned with the down-gradient hydrologic connectivity and flow of water and water-borne materials and energy moving out of the AA. V5 is a measure of impacts that affect the hydrologic outflow of water including the passage of water through its normal low- and high-flow periods, surface outlets, infiltration/groundwater recharge and energetic characteristics of water delivered to dependent habitats (Johnson et al., 2013).

2.1.6 Variable 6 – Geomorphology

The Geomorphology Variable (V6) has no sub-variable and is a measure to the degree to which the geomorphic setting within the AA has been altered. Such stressors may include fill, excavation, dikes, sedimentation, channelization, and hardened banks (Johnson et al., 2013).

2.1.7 Variable 7 – Water and Soil Chemistry

The Water and Soil Chemical Environment Variable (V7) is described through five sub-variables- Nutrient Enrichment (SV7.1), Sedimentation and Turbidity (SV7.2), Toxic Contamination (SV7.3), Temperature (SV7.4) and Soil Chemistry and Redox (SV7.5). These sub-variables measure the soil and water media within the AA, though the origin of stressors may occur outside the AA (*e.g.* non- point source pollution). These five sub-variables are averaged to produce a final score for V7 (Johnson et al., 2013).

2.1.8 Variable 8 – Vegetation Structure and Complexity

The Vegetation Structure and Complexity Variable (V8) is described through four sub-variables- Tree Stratum (SV8.1), Shrub Stratum (SV8.2), Herbaceous Stratum (SV8.3) and Aquatic Stratum (SV8.4). Each stratum coverage is recorded and compared to expected vegetation coverage of the reference standard. Additional stressors, such as exotic/invasive species, mowing and dewatering, are factored into each sub-variable score. The sub-variables are then averaged to produce a final score for V8 (Johnson et al., 2013).

2.1.9 FACWet Functional Capacity Indices

After each variable score is calculated, they are used to calculate the FCIs. FCI is a rating of the capacity of the AA to perform a function relative to its reference standard (Table 2).

FACWet considers seven key functions performed by wetlands:

1) Support of characteristic wildlife habitat
2) Support of characteristic fish/aquatic habitat
3) Flood attenuation
4) Short- and long-term water storage
5) Nutrient/toxicant removal
6) Sediment retention/shoreline stabilization
7) Production export/food chain support

Each of these seven functions is comprised of variables which have the preeminent control over the level of functioning. While additional variables may play a role in creating a given function, if they are not a primary driver, they are not included in the FCI calculation. Furthermore, variables that play a more prominent role in driving a function are subsequently weighted higher. Once total functional points are calculated by adding the relevant variable scores together (and their associated weights) these points are averaged to provide a resultant FCI. An overall composite FCI is also calculated by averaging all seven functional category FCIs together. Table 3 lists the interpretation of a FCI score (Johnson et al., 2013).

Table 3 Functional category classification and general interpretation, Derived from Johnson et al. 2013.

FCI Score	Functional Category	Interpretation
1.0 - 0.9	Reference Standard	AA is functioning at or near its Reference Standard capacity.
<0.9 - 0.8	Highly Functioning	AA retains all of its natural functions. While the capacity of some or all have been altered somewhat, the function of the wetland is still fundamentally sound.
<0.8 - 0.7	Functioning	The capacity of some or all of the AAs functions has been markedly altered, but the wetland still provides the types of functions associated with its habitat type.
<0.7 - 0.6	Functioning Impaired	The functioning of the wetland has been severely altered. Certain functions may be nearly extinguished or they may be grossly altered to be more representative of a different class of wetland (e.g., a fen converted to a depressional system). Despite the profound changes, the AA still supports wetland habitat.
<0.6	Non-functioning	AA no longer possesses the basic criteria necessary to support wetland conditions.

2.2 Functional Assessment of Colorado Streams (FACStream)

The FACStream method is a reach-scale functional assessment tool that rates functional condition based on the degree of impairment in comparison to a reference standard condition. Like FACWet, FACStream is a weight-of-evidence approach that utilizes the best evidence available through desktop analysis and field verification within a rapid assessment timeframe to develop and support ratings for 10 variables and their associated sub-variables (Johnson et al., 2016) (see Figure 2).

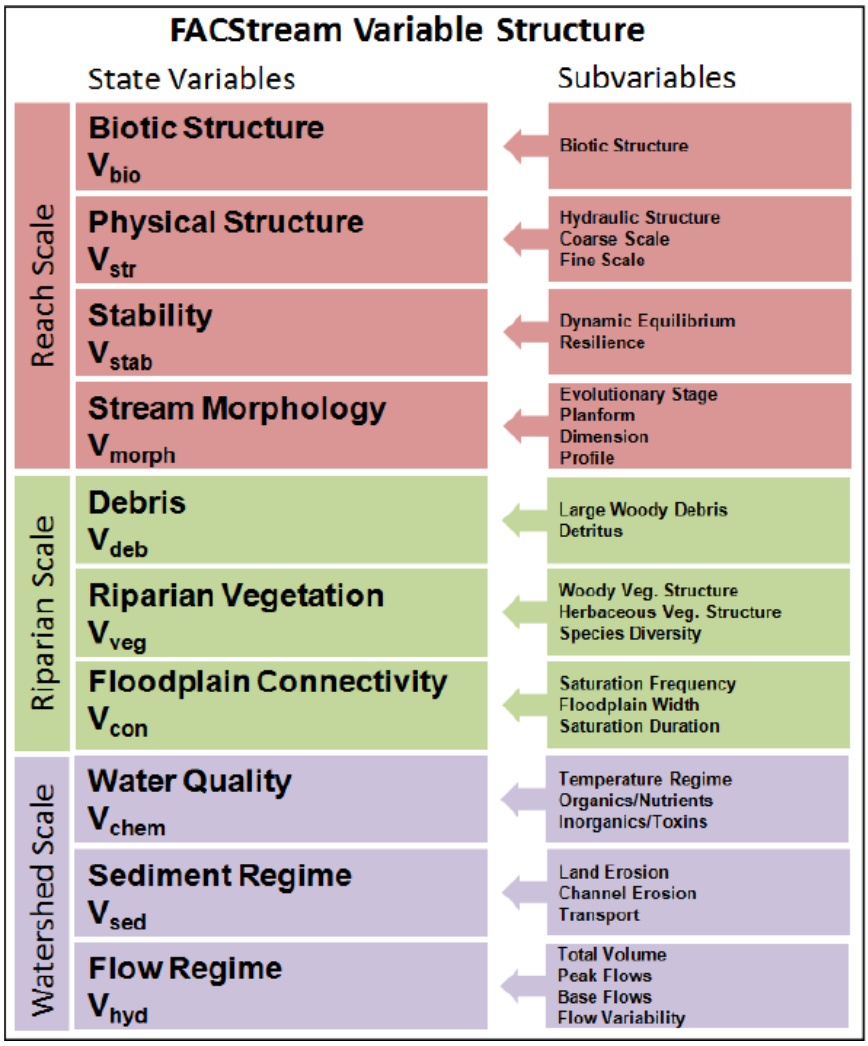


Figure 1 FACStream Variable Structure. Derived from Johnson et al. 2016

A FACStream assessment reads like a report card that represents the functional condition of a reach. Like FACWet, the overall condition score, variable and sub-variables are scored using a scale that parallels academic grading where letter grades ("A" through "F") correspond to numerical scores on a 100 to 50 scale. Criteria for scoring is based on overall level of variable

alteration which is provided on the FACStream datasheets (raw datasheets for FACStream Existing Conditions may be found in Sub-appendix I). Following the narrative descriptions assigned using the FACStream datasheets, an informal academic letter grade is assigned with a confidence rating to determine an overall accepted academic grade for each individual variable. A decimal value between 0.00 and 1.00 will then be assigned to convert the letter grade to numbers so arithmetic operations may be performed (Johnson et al., 2016) (Table 4).

Table 4 Scoring and degree of functional impairment. Derived from Johnson et al. 2016.

Score	Grade	Impairment
90-100	A	Negligible
80-89	B	Mild
70-79	C	Significant
60-69	D	Severe
50-59	F	Profound (or unsustainable)

2.2.1 Watershed Scale Variables

Three variables are assessed to determine conditions from a watershed scale, these are Flow Regime (Vhyd), Sediment Regime (Vsed) and Water Quality (Vchem). Vhyd is described by four sub- variables- Total Volume (Vhyd1), Peak Flows (Vhyd2), Base Flows (Vhyd3) and Flow Variability (Vhyd4). These sub-variables combined determine the structure and function of aquatic and riparian ecosystems for streams and rivers. Alterations to the watershed may affect total annual volume of water via depletions or augmentations, alter the pattern of the hydrograph by changing the magnitude and duration of peak flows, low flows, flow variability, timing, and

rates of change. These four sub-variables are scored and averaged to produce a total score for Vhyd (Johnson et al., 2016).

Vsed is described by three sub-variables- Land Erosion (Vsed1), Channel Erosion (Vsed2) and Transport (Vsed3). These three sub-variables help the assessor detect impacts to sediment supply by location and process. The Vsed variable is scored based on the net impact to the total annual amount and timing of sediment delivery to the reach combined from all sources (Johnson et al., 2016).

Vchem is described by three sub-variables- Temperature Regime (Vchem1), Organics/Nutrients (Vchem2) and Inorganics/Toxins (Vchem3). The physiographic properties of a stream reach are largely inherited from the contributing watershed. Biogeochemical processing by stream organisms as well as physical changes within channels and floodplains can alter these properties. Stressors include number of organic inputs, nutrients, shifts in pH, conductivity, turbidity, metals and other contaminants. The three sub-variables are scored and averaged to produce a total score for Vchem (Johnson et al., 2016).

2.2.2 Riparian Scale Variables

Three variables are assessed to determine conditions from a riparian scale, these are Floodplain Connectivity (Vcon), Riparian Vegetation (Vveg) and Debris (Vdeb). Vcon is described by three sub- variables- Saturation Frequency (Vcon1), Floodplain Width (Vcon2) and Saturation Duration (Vcon3). These sub-variables combined describes the degree to which water accesses and hydrates the floodplain.

The amount and timing of flow interacts with channel and floodplain morphology to create a pattern of frequency, lateral extent and duration and saturation of overbank flow and groundwater exchanged. These sub-variables are scored and averaged together to determine the final score for Vcon (Johnson et al., 2016).

Vveg is described by three sub-variables- Woody Vegetation Structure (Vveg1), Herbaceous Vegetation Structure (Vveg2) and Species Diversity (Vveg3). These sub- variables describe the

complexity and assemblage of the vegetative community. Riparian vegetation is critically important to supporting the stream reach. It provides root structure, hydraulic roughness in a way that it reduces flow velocity, stress on banks and structural complexity. Riparian vegetation can also be a source of woody debris and detritus that forms the basis of the aquatic food webs and provides cover and shading for species with terrestrial life stages (Johnson et al., 2016).

Vdeb is described by two sub-variables- Large Woody Debris (Vdeb1) and Detritus (Vdeb2). Both sub-variables assess organic inputs into the stream which impact the structural component of the aquatic habitat as well as secondarily providing nutrient and energy sources. Stressors that impact Vdeb include adjacent land uses that deplete wood sources (e.g. clearing/thinning, urbanization, agriculture and vegetation conversion), beaver (*Castor canadensis*) loss or extirpation from an area, poor floodplain connectivity or physical barriers between the stream and riparian area (Johnson et al., 2016).

2.2.3 Reach Scale Variables

Four variables are assessed to determine conditions from a reach scale; these are Stream Morphology (Vmorph), Stability (Vstab), Physical Structure (Vstr) and Biotic Structure (Vbio). Vmorph is described by four sub-variables- Evolutionary Stage (Vmorph1), Planform (Vmorph2), Dimension (Vmorp3) and Profile (Vmorph4). These sub-variables combined describe the characteristic patterns of stream morphology as a result of geomorphic processes. These sub-variables also take into account the dynamic equilibrium between hydrology and sediment, adaptions to natural disturbance and response to biotic agents such as vegetation and beaver. These sub-variables are scored and averaged together to determine the final score for Vmorph (Johnson et al., 2016).

Vstab is described by two sub-variables- Dynamic Equilibrium (Vstab1) and Resilience (Vstab2). These sub-variables determine the rate of probability that the stream would maintain its geomorphic structure over time. Vstab1 is based on stability of the channel bed and banks. On alluvial streams, such as the Spring Creek, the bed and banks should be mobile, and stability should be maintained in a complex state of dynamic equilibrium between sediment supply and

energy (known as Lane's Balance). Vstab2 rates the ability of the system to recover after a large disturbance, such as a flood or mass erosion event (Johnson et al., 2016).

Vstr is described by three sub-variables- Hydraulic Structure (Vstr1), Course Scale (Vstr2) and Fine Scale (Vstr3). These sub-variables describe the heterogeneity in the physical structure of the stream because of complex interactions between hydraulics and geomorphology. Biological drivers such as vegetation, wood and beavers may have a profound impact on structure and diversity. Stressors are assessed to determine the degree to which characteristic patterns of structural heterogeneity have been altered (Johnson et al., 2016). Vbio has no sub-variable but describes the biological component of the natural infrastructure of a stream. Biota supported by a stream is not only a category of stream function, but also an essential element of functional condition by carrying out biochemical processing through a characteristic trophic structure. Stressors measured include both direct and indirect impacts on community assemblage and biotic structure (Johnson et al., 2016).

2.2.4 FACStream Functional Condition Scores

Upon assigning each of the ten variables a score, a functional condition score is calculated using weighted averages (see Table 5). FACStream assess four functional categories:

1) Hydraulic
2) Geomorphic
3) Physiochemical
4) Biotic

Table 5 Variable weights used to calculate functional condition scores. Derived from Johnson et al., 2016

State Variable	Hydraulic Functions	Geo-morphic Functions	Physico-chemical Functions	Biotic Functions	Total Functions	
V_{hyd}	30%	15%	15%	20%	**20%**	35%
V_{sed}	0%	15%	5%	0%	**5%**	
V_{chem}	0%	0%	25%	15%	**10%**	
V_{con}	30%	10%	10%	10%	**15%**	30%
V_{veg}	5%	15%	10%	10%	**10%**	
V_{deb}	0%	10%	5%	5%	**5%**	
V_{morph}	10%	10%	0%	0%	**5%**	35%
V_{stab}	10%	15%	5%	10%	**10%**	
V_{str}	15%	10%	5%	10%	**10%**	
V_{bio}	0%	0%	20%	20%	**10%**	

An overall functional score takes the four separate functional category scores and average them together to produce a comprehensive FCI. Like FACWet, FCI is calculated by variables which have the preeminent control over the level of functioning. While additional variables may play a role in creating a given function, if they are not a primary driver, they are not included in the FCI calculation. Furthermore, variables that play a more prominent role in driving a function are subsequently weighted higher. Once total functional points are calculated by adding the relevant variable scores together (and their associated weights) these points are averaged to provide a resultant FCI on a 0.00 to 1.00[5] scale (Johnson et al., 2016).

3 Methods

The Both FACWet and FACStream require a reference standard condition to be used as a comparison to the Spring Creek project. An area approximately 1 mile downstream was selected for reference of relatively natural conditions (Figure 3. Map of Ref Wetland). This area was selected as a suitable reference standard as it reflects a more natural state of the creek system.

The reference area is comprised of meandering bends, in-stream point bar formations, oxbows, connectivity to its floodplain and a stable riparian corridor that is influenced by stream modifications and two grade-control structures. The scoring process of the model variables was based on the comparison between historical conditions and Future Without Project (FWOP). The study team also considered expert knowledge of natural headwaters stream conditions in Colorado Springs area provided by the City's Fountain Creek Watershed Project Manager (Berlemann, personal communication) when scoring stream variables. Additionally, aerial images (Google Earth) were used as a reference and evaluation tool by finding the reference site, identifying and delineating the assessment area, habitat connectivity and identification of stressors. It is important to note that the conditions at the reference standard location are not the goals for the Spring Creek project. The reference area is utilized only to identify the severity and extent that the identified stressors have influenced a departure of the project area from a reference standard or expected historical condition.

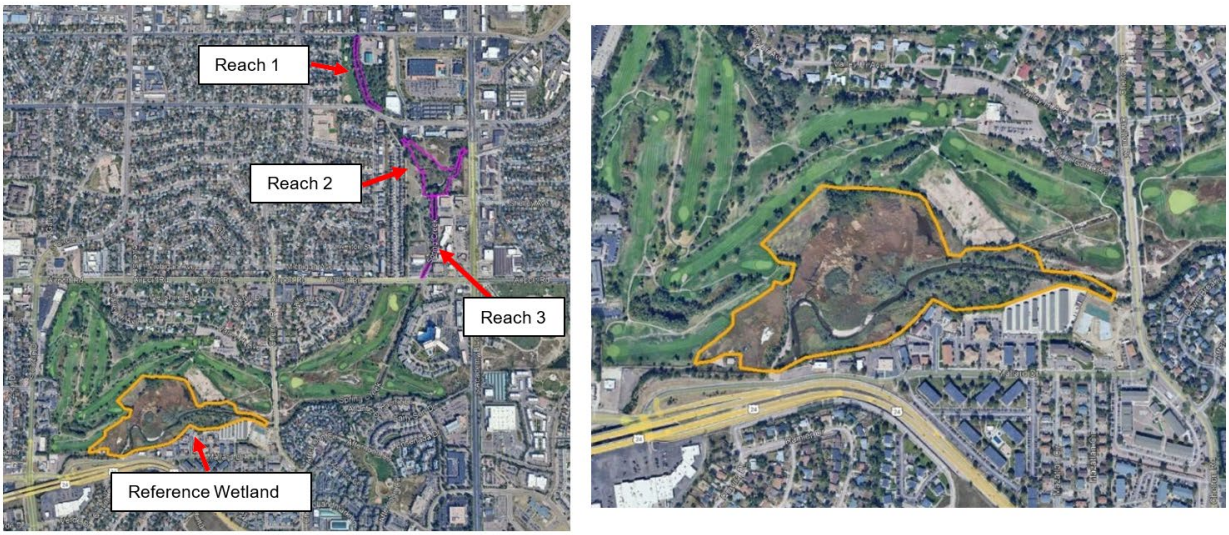


Figure 2 Left: Reference wetland (yellow outline) in relation to the Spring Creek Study Site (purple outline). Right: Reference Wetland (yellow outline),

To assess the ecosystem benefits of the Project Delivery Team (PDT) applied two quantitative assessment tools: the Functional Assessment of Colorado Wetlands (FACWet) and the Functional Assessment of Colorado Streams (FACStream). These models were used to estimate ecological improvements in terms of Habitat Units (HUs). Due to the lack of suitable conditions for wetland establishment in Reaches 1 and 3, the use of FACWet was limited exclusively to Reach 2, where wetland restoration is feasible. As a result, the Cost Effectiveness and Incremental Cost Analysis (CE/ICA) relied solely on FACStream outputs to ensure consistent and comparable evaluation across all reaches and alternatives. While FACWet was not included in the CE/ICA calculations, its results were taken into consideration during the internal comparison of Options 2a and 2b within Reach 2, providing additional insight into potential wetland function gains.

3.1 Habitat Unit Calculation

Model outputs, specifically the composite functional capacity index (FCI) which were calculated based on the departure of each site (reach) from the refence standard condition, were utilized to qualitatively assess the existing condition, the FWOP, and the future with project (FWP) condition. This qualitative output was then multiplied by the assessment area footprint, measured in acres. This value is a quantified measure of environmental output, known as a habitat unit (HU), where the difference between future habitat units without management measures (future without project) and future habitat units with management measurements (future with project) equals the habitat units produced by the alternative (USACE, 1995). The HUs are then annualized throughout the 50-year study period to provide an overall average annual HU, also known as average annualized habitat unit (AAHU). This value represents an average environmental functional output that the subject are contributes to in any given year for any FWP condition.

4 Existing Conditions – EC

Spring Creek is a perennial, alluvial waterbody located within the urban core of Colorado Springs, CO. Its Strahler stream order is classified as a "1", indicating its position as a "Headwater Stream" within the Spring Creek basin and acts as a tributary of the greater Fountain Creek watershed. The study area falls within the Colorado Piedmont physiographic region as determined through climate and topography. The defined Spring Creek channel is approximately 4 miles long, with headwaters beginning just under half a mile from the project area and flows south to its confluence with Fountain Creek. The delineation of the stream (for FACStream assessment in all 3 Reaches) and wetland extent (for FACWet assessment in Reach 2) was calculated during an initial site visit to Spring Creek on SEP 29, 2023. This was achieved by walking along the stream (for all 3 Reaches) and the wetland extent in Reach 2 and mapping the extent of the stream and the extent of the wetland using a handheld GPS unit. This involved in carefully and accurately identifying evidence of moist soils, existing wetland vegetation and other signs like watermarks or stains on nearby tree trunks, boulders and other fixed objects.

The existing condition of Spring Creek is a relatively straight, fully entrenched channel system with a low width-depth ratio and minimal variance in sinuosity. The channelization and entrenchment of stream dictates the stream's morphology and decreases the potential development of stream branching patterns and changes in stream cross-section such as stream enlargement or widening.

Additionally, portions of existing bank armoring/hardening also influences the natural variability of changes to the slope or gradient of the stream, ultimately driving the evolutionary stage of Spring Creek further away from a natural condition. The physical structure of the stream has been homogenized, resulting in poor distribution of water depth and velocity across the existing floodplain. The existing condition of the fine-scale structural diversity of Spring Creek is severely limited and profoundly lacks characteristics of heterogenous substate material such as size, type and packing that is the foundation for supporting aquatic organisms. Portions of the artificial streambeds have been scoured down to bedrock and have also contributed to the degradation of the geomorphic structure by limiting the process of fine sediment deposition and scour.

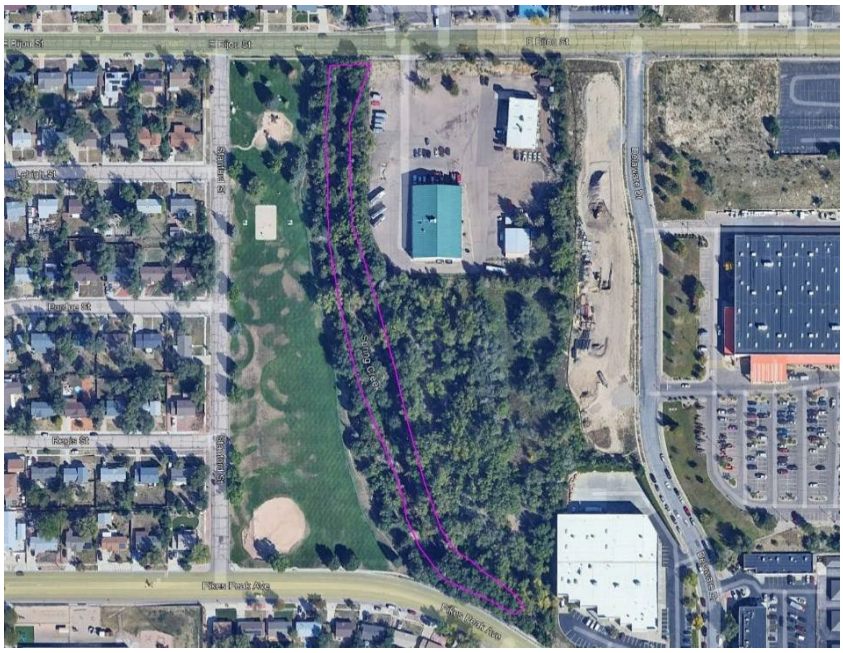
The surrounding urban landscape and runoff from impervious surfaces is a major stressor, altering the chemical environment through a supply of metabolic agents into the Spring Creek watershed. The existing hydrologic regime in combination with the existing physical structure, provide the periodic delivery of organic compounds and toxins. Peak flows exacerbate the transport of toxins from the urban watershed and other inputs of organic and inorganic compounds that ultimately produce unfavorable fluctuations in the water quality of the stream. The existing dynamic relationship between sediment supply and transport is not in sync, and this loss of equilibrium has resulted from the hardened channels. The stream's ability to move, adapt and adjust has been severely impaired due to a significant disconnect from its floodplain, producing a degraded riparian zone. The existing riparian zone is nearly absent and restricted to a narrow band on steeply sloped banks (at times near- vertical banks) that have altered the composition of complex assemblages of flora and fauna. Consequently, important functional guilds and trophic levels are absent, and the existing biotic structure is nonfunctional across the three Reaches.

The existing condition of the Spring Creek Ecosystem Restoration study site is typical of an urban stream. Existing water courses have been greatly modified, via channelization and rerouting of drainage with widespread conversion of native vegetation to residential and commercial tracts, invasive species establishing, increased debris and trash, increased impervious surface, and increased stream incision. Water quality has been maintained at a reasonably stable/good condition, despite runoff from the surrounding developed areas.

4.1 Reach 1 – EC

Reach 1, also referred to as "Pikes Peak North" and it extends from a City Fire Station in the north to the Pikes Peak Ave. to the south. The FACStream assessment area for Reach 1 is approximately 1.74 acres, representing the northern segment and the most upstream area of the project footprint (Figure 4). This is a linear-shaped site, measuring approximately 0.24 mi (0.39 km) long and 79 ft. (24 m) wide, with dense woodland on a steep 25-ft bank down to Spring Creek on the west side and a generally sloping bank to a natural bench with a continued slope up on the east side. Spring Creek flows north to south through a box culvert under Pikes Peak Avenue and then into Reach 2 – Former wetland. Reach 1 is classified as a stream type "G"

under the Rosgen Stream Classification (Rosgen, 1996) with a low width-to-depth ratio, fully entrenched channel on moderate gradients. The existing hydrologic regime of Reach 1 is severely impaired with a single incised channel that has facilitated flows with high velocity ultimately influencing the seasonal synchrony of water flow, in particular the magnitude and duration of peak flows. The distribution of water throughout the Reach has also been severely impacted, which over time has significantly limited the connectivity with its floodplain and has almost eliminated the potential for sediment production and transport. Currently, the physical



structure of the stream experiences damaging erosion process, from periodic high flow events that limit the formation of banks, and other natural substrate features. As a result, the chemical environment of the Reach has shifted from supporting a robust riparian vegetation zone to a degraded state characterized by a poor tree and shrub structure, a significant decrease in the spatial extent of herbaceous vegetation cover and an increase in the establishment of exotic vegetation.

Figure 3 FACStream Assessment Area for Reach 1 (1.74 ac) .

4.2 Reach 2 – EC

Reach 2, also referred to "Former Wetlands" where the. FACStream Area of Assessment was 8.65 ac and the FACWet Area of Assessment was 6.53 ac which represent the stream and wetland components respectively (Figure 5). This land was previously owned by the Audubon Society and has functioned as a wetlands bird sanctuary in the early 1980's, when it supported a former wetland dominated by sandbar willow, Baltic rush, three square and hairy sedge. This Reach is 535 m long, and it has experienced a significant amount of incision that has led to an environmental shift from an emergent wetland to a riparian grassland (Figure 5.). Reach 2 is classified as a stream type "E" under the Rosgen Stream Classification (Rosgen, 1996) as a low-gradient meandering riffle-pool stream with low width-to-depth ratio and little deposition. The existing condition within Reach 2 consists of a single incised channel with steep or nearly vertical banks, that are not connected to the former wetland and overbank areas. The box culvert at the northern end of the reach where the stream crosses under Pikes Peak Ave. acts as a grade control structure and a second box culvert located in the east deposits' urban wastewater from residential, municipal, and industrial parcels into the site. The quality, quantity, timing, and distribution of flows in Reach 2 have been severely impaired. This hydrologic regime has further driven the degradation of the stream's morphology and riparian zone's vegetative complexity. Overstory trees have persisted at the site and have become established in the former wetland area, with some large cottonwood trees and other loose branches occasionally falling into the channel. Reach 2 currently experiences a profound degree of floodplain disconnect that over time has eliminated the potential occurrence of normal hydroperiods and consequently the duration of saturation of soils throughout the floodplain. Hydroperiods are normally thought of as the length of time which soils are saturated, that is, days out of the year in which an area experiences inundation. Spring Creek's floodplain has experienced a decrease in hydroperiod frequency as well as a decrease in the area that experiences hydroperiods. This ecological effect has confined most riparian herbaceous and shrub species to the immediate streambank and has increased soil oxidation rates and other soil disturbances in the upland areas of the Reach from constant human activity and regular use of pedestrian trails. A former bog area northwest of the Reach persists

and is dominated by smooth brome (*Bromus inermis*) and scattered patches of licorice (*Glycyrrhiza lepidota*), showy milkweed (*Asclepias speciosa*) and dock (*Rumex spp.*).

*Figure 4 FACStream Assessment Area for Reach 2 (*Violet *line)(8.65 ac) overlayed with the FACWet Assessment Area for Reach 2 (*Blue *line)(6.53 ac).*

4.3 Reach 3 – EC

Reach 3, also referred to “South Channel”, is a narrow strip measuring 0.25 mi (395 m) long and 57 ft. (17.36 m) wide, consisting mainly of channelized stream dominated by shrub vegetation with sparse overstory trees. The Reach 3 FACStream Assessment Area is approximately 1.51 acres in size, beginning at the former confluence in the southern end of Reach 2, ending at the box culvert under Airport Rd, representing the stream components of Reach 3 (Figure 6). The banks along Reach 3 have been hardened with concrete, and in portions of the Reach these concrete structures have sloughed off into the channel. Reach 3 is classified as a stream type “G” under the Rosgen Stream Classification (Rosgen, 1996) with a low width-to-depth ratio, fully entrenched channel on moderate gradients. This Reach has 3 drop structures, an urban wastewater input into Spring Creek from the east through a box culvert and a pedestrian bridge that connects a commercial parking lot in the east to a pedestrian path located on the upland portion of Reach 3 on the west. Reach 3 is driven by a single incised and hardened channel that assists high velocity flows which over time, have degraded the hydrologic regime. Flows through this channel have homogenized the geomorphology of the Reach and thus have eliminated

natural sediment transport processes. This has caused adverse effects to the biogeochemical environment and thus the degree of the complexity with the existing vegetation.

Figure 5 FACStream Assessment Area for Reach 3 (1.51 ac)

4.4 FACWet Results – EC

Only Reach 2 was evaluated using FACWet, as this was the only reach that formerly supported

wetlands and could do so in the future if a project were implemented. Table 6 summarizes the eight variables and their associated scores for Reach 2 within the Spring Creek Section 206 study area as well as the scores for the seven FCIs. Sub- headings explore further detail and justification for scoring. For raw data sheets utilized to score all variables, functions and calculate overall composite FCIs, please see Section 9. Reach 2 received a composite FCI of 0.62, Functioning Impaired (D) for existing conditions. FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

Table 6 FACWet variable scores and associated functional capacity index scores for wetlands and riparian areas in Reach 2 along Spring Creek within the study area. Note that 1.00 to 0.90 is reference standard condition, <0.90 to 0.80 is high functioning, <0.80 to 0.70 is functioning, <0.70 to 0.60 is functioning impaired and <0.60 is considered non-functioning.

SCALE	VARIABLES	REACH 2
Buffer & Landscape Context	(V1) Habitat Connectivity	0.62
	(V2) Contributing Area	0.66
Hydrology	(V3) Water Source	0.61
	(V4) Water Distribution	0.61
	(V5) Water Outflow	0.61
Abiotic & Biotic Habitat	(V6) Geomorphology	0.60
	(V7) Chemical Environment	0.60
	(V8) Vegetation Structure & Complexity	0.66
FUNCTIONS		**REACH 2**
Support of Characteristic Wildlife Habitat		0.65
Support of Characteristic Aquatic Habitat		0.61
Flood Attenuation		0.62
Short- and Long-term Water Storage		0.61
Nutrient/Toxicant Removal		0.62
Sediment Retention/Shoreline Stabilization		0.64
Production Export/Food Chain Support		0.62
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		**0.62 (Functioning Impaired)**

4.4.1 Variable 1 – Habitat Connectivity

The V1 is described by the two sub-variables Neighboring Wetland (SV1.1) and Riparian Habitat Loss and Barriers to Migration and Dispersal (SV1.2). The calculation of this score results by

averaging the two sub-variables together. The Team could not score SV 1.1 because there is insufficient evidence of neighboring wetlands within the habitat connectivity envelope as defined in the model, and therefore SV1.2 provided the overall assigned score for V1 at 0.62 in Reach 2. The existing habitat connectivity conditions include barriers such as surrounding urban development, secondary and tertiary highways (Pikes Peak Ave. on the north & South Academy Blvd on the east), pedestrian trails and aquatic organism barriers (Figure 7). Such characteristics hinder the migration and dispersal of many organisms and propagules between the AA and up to 66% of the surrounding wetland/riparian habitat Additionally, up to 33% of surrounding wetland/riparian habitat is functionally isolated from the AA.

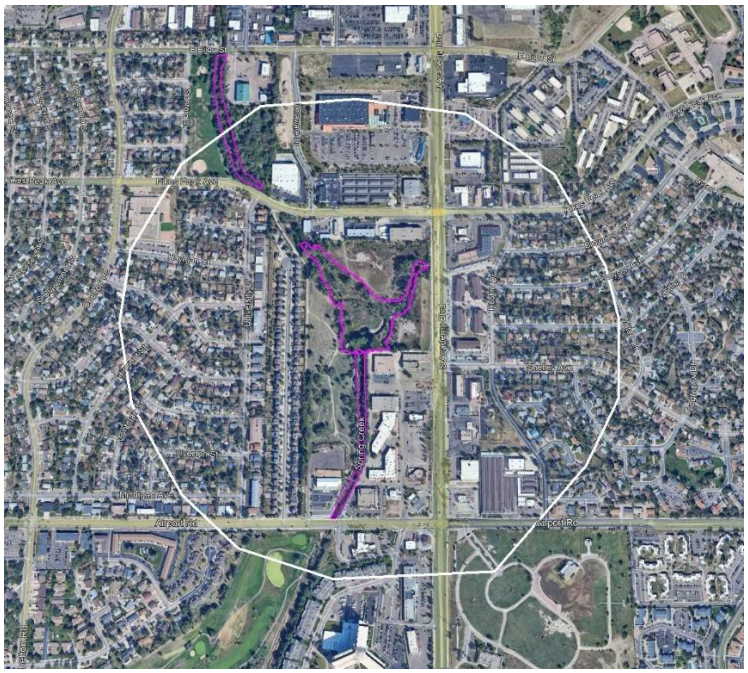


Figure 6 HCE for Reach 2

4.4.2 Variable 2 – Contributing Area

The overall assigned score for V2 was 0.66 (D) in Reach 2. This score was calculated by taking the lowest of the first three sub-variables which describe the riparian buffer and averaging that score with the sub-variable that considers land use. The overall buffer condition was rated as functioning- impaired, with the buffer's existing conditions that indicate significant alterations to the vegetative structure, with several brush clearings that have undergone complete removal of the vegetative layers, and the vegetation patches that remain are substantially composed of non-native species.

Additionally, there are significant substrate disturbances and other soil-structure alterations such as soil compaction and erosion, which are generally attributed to high levels of human visitation and use. The surrounding landscape has a substantial degree of impermeable surfaces from commercial and residential development and although the supporting capacity of the contributing area has been greatly diminished, it has not been totally extinguished.

4.4.3 Variable 3 – Water Source

The overall assigned score for V3 was 0.61 (-D) in Reach 2. As noted in section 2.1.3 this variable is concerned with the upstream impacts on the AA. The effect of in-flows from up-gradient hydrologic connectivity sources is considered non-functioning in Reach 2. The quantity and timing of water delivery, and the ability of these in-flows to support sediment transport, soil-pore flushing, and other hydrodynamic benefits have been significantly degraded. The water source's degradation can be attributed to a combination of urban/surface runoff and its interaction with constriction features on the landscape such as ditches, drains and culverts that dictate the timing and power of inflow as well as other components of hydrodynamics (e. g. depletion, augmentation, or alteration of inflow). Existing conditions indicate that the water source for Reach 2 experiences frequent and unnatural high-water events which over time alter the fundamental characteristics of the wetland.

4.4.4 Variable 4 – Water Distribution

The overall assigned score for V4 was 0.61 (-D) in Reach 2. The spatial distribution of surface and groundwater within the AA is considered non-functioning. Alteration of headwaters (currently a mall parking lot), in combination with channels and other entrenchment features including straightening and armoring (channel into Reach 2 under South Academy Blvd. and the channel into Reach 2 from Pikes Peak Ave.) alter seasonal flow patterns and impact the hydrologic regime of the AA. The existing conditions in Reach 2 concerned with water distribution are characterized by periodic and localized shifts in the water table that affect water-surface flow patterns altering the water depth and duration. Floodplain areas almost never experience periods of inundation or saturated soils from overbank flooding, producing shifts from a wetland system towards an upland condition. Although irrigated fields that surround Spring Creek slightly contribute to groundwater recharge and seepage, the urban effects surrounding the AA such as the abundance of impervious surfaces have impaired the effects of groundwater infiltration in the AA.

4.4.5 Variable 5 – Water Outflow

The overall assigned score for V5 was 0.61 (-D) in Reach 2. This variable is the converse of V3 and considers downstream effects. The down-gradient hydrologic regime and water outflow has been profoundly impaired and is considered non-functioning. The existing conditions restrict the natural patterns of low/high flow surface outlets including the energy and associated materials in the water column that are exported out of the AA. A combination of stressors affecting water outflows include bank incisions, channelization, bank hardening, and a confined outflow passages have severed the ability for groundwater recharge and the transfer of energy to down-gradient habitats through hydrologic connectivity and hydraulic mechanisms.

4.4.6 Variable 6 – Geomorphology

The overall assigned score for V6 was 0.60 (-D) in Reach 2. This variable is considered non- functioning since the AA's surface and natural topography has been altered with pervasive geomorphic stressors that have caused fundamental changes in site characteristics and system functioning. Such geomorphic alterations have produced channel instability leading to excessive bank erosion. Channel reconfiguration

including artificial banks have eliminated the shoreline vegetation community which hold sediment in place and help stabilize shorelines.

4.4.7 Variable 7 – Water and Soil Chemistry

The overall assigned score for V7 was 0.60 (-D) in Reach 2. This variable is concerned with the chemical environment of the soil and water within the AA and is calculated by averaging the five sub- variables together. The complete industrialization and urbanization of the Spring Creek watershed has been the main driver producing the existing conditions. The chemical environment is considered non-functioning with stressors such as toxic contamination from nearby industrial sites (former uncontained car wash on Pikes Peak Ave.) and eutrophication from urban runoff and excessive erosion contribute to the point and non-point sources of pollution. In addition, physical alterations have stimulated the unnatural desaturation of soils which decrease the potential for soil redox mechanisms that ultimately produce creek banks that are high and dry. Additionally, Reach 2 experiences a slight shift in the water temperature regime, mainly resulting from urban runoff and a slight diminished volume of available shade.

4.4.8 Variable 8 – Vegetation Structure and Complexity

The overall assigned score for V8 was 0.66 (D) in Reach 2. The structure, diversity, composition and cover of vegetation layers have been significantly altered relative to its natural state. The existing condition of the vegetative structure and complexity in Reach 2 is considered non-functioning since the percent coverage of vegetative strata is dominated with exotic species on other undesirable vegetation especially non-native trees like the Siberian elm (*Ulmus pumila*). Loss of zonation and an increase in ecological homogenization within the AA limit the wetland's ability to support higher-order functions such as wildlife populations. The wetland's ability to influence other primary functions such as flood-flow attenuation, channel stabilization and sediment retention has also been affected due to the alteration of the vegetative structure. An elevated degree of dewatering is occurring, and loss of wetland habitat has severely altered the presence, distribution and diversity of wetland vegetative structure and complexity.

4.4.9 FACWet Functional Capacity Indices

As previously noted, scored variables are variously combined and accordingly weighted to calculate a functional score rating to depict the capacity of an AA to perform a function relative to its reference standard.

1. Support of Characteristic Wildlife Habitat
This function is a combination of V1, V2 and V8 (weighted x2), and Reach 2 received an FCI of 0.65 (D), considered functionally impaired in supporting characteristics of wildlife habitat.

2. Support of Characteristic Fish/Aquatic Habitat
This function is a combination of V1, V2 and V8 (weighted x2), and Reach 2 received an FCI of 0.61 (D-), considered functionally impaired in supporting characteristics of aquatic organism habitat.

3. Flood Attenuation
This function combines V2, V3 (weighted x2), V4 (weighted x2), and V5 (weighted x2), V6 and V8. Reach 2 received an FCI of 0.62 (-D) and is considered functioning impaired in flood attenuation.

4. Short and Long-Term Water Storage
This function is a combination of V2 (weighted x2), V3, V4 (weighted x2), and V6. The short- and long- term water storage capacity in Reach 2 received an FCI of 0.61 (-D) and it is considered non- functioning.

5. Nutrient/Toxicant Removal
This function is a combination of the variables V2 (weighted x2), V4 (weighted x2), V6 and V7. The FCI score for Reach 2 is 0.62 (-D) and the AA's ability to remove nutrient/toxicants is considered functioning impaired.

6. Sediment Retention/Shoreline Stabilization
This function is calculated by combining V2, V6 (weighted x2), and V8 (weighted x2), producing a FCI score of 0.64 (D) for Reach 2. The AA's capacity in sediment retention and shoreline stabilization is considered functioning impaired.

7. Production Export/Food Chain Support
This function is a combination of V1, V5 (weighted x2), V6, V7, and V8 (weighted x2). Reach 2 received an FCI score of 0.62 (-D) and the AA's ability for trophic productivity and support of food chains is considered non-functioning.

4.5 FACStream Results – EC

Table 7 summarizes the 10 variables and their associated scores for Reach 1, 2, and 3. As noted in Section 2b, the watershed and stream scale variables comprise 35% each of the weighted score while the riparian scale variables account for 30% of the total weighted score. Hydraulic regime variables are the single greatest driver of the FCIs. Reaches 1, 2 and 3 are considered severely impaired, each with a composite index score of 0.34 for Reach 1, 0.36 for Reach 2 and 0.30 for Reach 3, with all Reaches corresponding to an "-F" letter grade.

Table 7 FACStream "Report Card" for the three reaches within the Spring Creek study area. Note that FCI scores are extrapolated to a 0.00 to 1.00 scale, with 1.00 being optimal and 0.00 being completely non-functional.

SCALE	VARIABLES	REACH 1	REACH 2	REACH 3
Watershed	(Vhyd) Flow Regime	C-	C-	C-
	(Vsed) Sediment Regime	D	F	D
	(Vchem) Water Quality	B	B	B
Riparian	(Vcon) Floodplain Connectivity	F+	D	F+
	(Vveg) Riparian Vegetation	D+	D	D-
	(Vdeb) Debris	C-	C-	C-
Stream	(Vmorph) Stream Morphology	D-	D+	F
	(Vstab) Stability	D	F+	F
	(Vstr) Physical Structure	F	D	F
	(Vbio) Biotic Structure	D	C-	D
OVERALL REACH CONDITION SCORE		**D**	**D+**	**D**
(Biology Functions FCI)		0.36	0.40	0.34
(Physiochemical Functions FCI)		0.42	0.44	0.38

(Geomorphology Functions FCI)	0.32	0.30	0.24
(Hydraulic Functions FCI)	0.28	0.34	0.22
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE	**0.34**	**0.36**	**0.30**
DEGREE OF IMPARIMENT	**Severe**	**Severe/Significant**	**Severe**

4.5.1 Watershed Scale Variables

Flow Regime (V_{hyd}) was calculated by averaging the total volume, peak and base flows, and flow variability sub-variables together to produce an overall calculated letter grade of C- for all three Reaches. This scoring is based on the flow regime's existing condition, with the total annual volume of water supplied for each Reach at a significant/severe degree of impairment. The frequency, timing, and rate of change of flow are not in seasonal synchrony, and the existing flow regime operates outside of its natural range of variability. Although the magnitude and duration of base flows have been only mildly impacted, the magnitude and duration of peak flows have been severely impacted due to the surrounding impervious surfaces (urban development) and widespread channel erosion, both which facilitate the degrading effects of focused urban stormwater inputs. The natural variation of peak and base flows, rates of change, and seasonal runoff processes have been significantly/severely altered.

Sediment Regime (V_{sed}) was calculated by averaging the three sub-variables together to produce an overall letter grade of "D" for Reach 1 and 3, and a letter grade of "F" for Reach 2. The rationale for this scoring was based on the existing characteristics of sediment supply from land and channel erosion location and sediment transport processes of the AA. Reach 2 scored lower relative to Reach 1 and Reach 3 due to a pronounced sediment imbalance. Unlike Reach 1 and Reach 3, where sediment transport process remains partially functional, Reach 2 receives minimal sediment input while experiencing disproportionately high sediment export, resulting in significant geomorphic stability. The existing linear concrete channels in combination with drop structures eliminate the potential for sediment production, creating an un-balanced sediment transport process, where the sediment input into Spring Creek is significantly low, and the sediment output is significantly high. The sediment delivery and continuity through all reaches has been profoundly impaired and have combined in degrading the watershed's sediment regime.

Water Quality (V_{chem}) was calculated by averaging temperature regime, organic and nutrients and inorganic and toxin sub-variables together to produce an overall letter grade "B" across all three Reaches. This scoring is based off the physicochemical properties of the AA, with focus on the biogeochemical processes by stream organisms and physical changes within channels and floodplain that can drive changes to the conditions within the stream. The existing stream temperature regime is mildly altered but still retains the abiotic habitat factors affected by temperature gradients that contribute to the diversity of organisms that inhabit all three Reaches. Urban runoff is the major stressor driving the existing supply of metabolic agents into the Spring Creek watershed. There are mild alterations to the volume of and timing of these inputs, which periodically deliver uncharacteristic levels of organic compounds, metals and toxins that bring fluctuations in pH, conductivity, and turbidity of the stream. The water quality standard from Colorado's Department of Public Health & Environment is not exceeded (5 CCR 102-32), however all Reaches display levels that are within the range of natural variability.

4.5.2 Riparian Scale Variables

Floodplain Connectivity (Vcon) was calculated by averaging saturation frequency and duration and floodplain width sub-variables together to produce an overall letter grade of "F+" for Reach 1 and Reach 3, and "D" for Reach 2. The rationale for this scoring is supported by direct observations of existing channel hardening, grade control and deep entrenchment that restrict the stream's access to its floodplain. In addition, existing migration barriers such as major roadways and crossing bridges (Pikes Peak Ave. on the north & South Academy Blvd on the east) further restrict natural fluvial movement as well as the upstream urbanization that has altered the natural hydrograph. The active floodplain is dry for most of the warmer productive months, and floodplain inundation depends on extreme flood events. The floodplain's spatial extent has significantly diminished (70-50%) and its saturation frequency and duration have been severely/profoundly affected.

Riparian Vegetation (Vveg) was calculated by averaging woody and herbaceous structure and species diversity sub-variables together to produce an overall letter grade of "D+" for Reach 1, "D" for Reach 2 and "D-" for Reach 3. This variable examines the riparian vegetation zone and its ability to support complex assemblages of flora that interact with each other and with other components of the riparian zone system of all Reaches. Existing conditions are driven by anthropogenic stressors that facilitate the establishment of exotic flora, and hydrologic alteration

of the Spring Creek watershed. As a result, the structural characteristics of trees, shrubs and other woody vegetation have been severely altered, the spatial extent of herbaceous vegetation cover has decreased up to 40% and the presence and diversity of riparian flora species has reached a severe degree of impairment.

Debris Supply (Vdeb) was calculated by averaging large woody debris (LWD) and detritus sub-variables to produce an overall letter grade of "C-" across all three Reaches. Scoring reflects the current management practices concerning LWD, which are characterized by routine removal conducted by local authorities. Additionally, the natural recruitment of LWD had mildly declined due to strategic forest clearing adjacent to the channel. A practice aimed at enhancing water conveyance.

The supply of detritus and other small organic material has decreased by up to 75% and has been severely impaired. The existing conditions across all Reaches rely on a narrow band of riparian vegetation supported by steep banks that hinder the input of debris supply into the stream.

4.5.3 Reach Scale Variables

Stream Morphology (V_{morph}) was calculated by averaging the sub-variables stream evolution, planform, dimension, and profile to produce an overall letter grade of "D-" in Reach 1, "D+" in Reach 2, and "F" in Reach 3. Rationale for this scoring includes direct observations of channelization and entrenchment that dictate the stream morphology and decrease the potential development of stream branching patterns and changes in stream cross-section such as stream enlargement or widening. Additionally, the existing bank armoring/hardening influences the natural variability of changes to the slope or gradient of the stream, ultimately driving the evolutionary stage of Spring Creek further away from the reference condition. As a consequence of anthropogenic stressors such as past channel manipulations to accommodate urban development, fills within the floodplain and loss of biotic influences such as presence of beaver has produced the existing condition of a severe/profound degree of impairment to the stream's geometry and morphology.

Stability and Resilience (V_{stab}) was calculated by averaging the dynamic equilibrium and resilience sub-variables together to produce an overall letter grade of "D" in Reach 1, "F+" in Reach 2, and "F" in Reach 3. The probability that the stream would maintain its geomorphic structure over time has been profoundly impaired and the stream's ability to recover after a large disturbance (i. e. large flood, wildfire, mass erosion event) has been severely impaired. The existing condition of the

dynamic balance between sediment supply and transport is not in equilibrium as a result of the hardened channels and the stream's inability to move, adapt and adjust due to a significant disconnect from its floodplain and poor riparian zone that support and enhance the resiliency of the stream.

Physical Structure (V_{str}) was calculated by averaging hydraulic structure, and coarse and fine substrate sub-variables together to produce an overall letter grade of "F" in Reach 1, "D" in Reach 2, and "F" in Reach 3. Determination of this score is based on the heterogeneity and structural diversity of the stream. The existing physical structure experiences a poor erosion process with limited formation of beds, banks, and substrates. The channelization in combination with the effects of channel armoring features have modified the complex process of hydraulic and geomorphic interactions towards a profoundly impaired state. At the floodplain scale, the physical structure of the stream has been homogenized, resulting in poor distribution of water depth and velocity across the existing floodplain. At the fine scale, Spring Creek is severely limited in fine-scale structural diversity, profoundly lacking characteristics of substate material such as size, type and packing. The hardened artificial streambeds within channels and other areas that have been scoured down to bedrock (portions of Reach 1) also contribute to the degradation of the geomorphic structure by limiting the process of fine sediment deposition and scour.

4.5.4 FACStream Functional Condition Scores

As noted above in Section 2b, variable scores are variously combined and accordingly weighted to calculate a functional score rating to depict the capacity of an AA to perform a function relative to its reference standard.

1. Biology Function
This function is a combination of V_{hyd} (weighted 20%), V_{chem} (15%), V_{con} (10%), V_{veg} (10%), V_{deb} (5%), V_{stab} (10%) V_{str} (10%) and V_{bio} (20%). This function received an FCI of 0.36 for Reach 1, 0.40 for Reach 2 and 0.34 in Reach 3. A major reason for variance in scoring between Reach 2 compared to Reach 1 and 3 stems from the slightly better variable score of Vbio, Vstr, Vmorph, Vcon and Vchem. Despite the variance, all the Reaches are severely impaired.

2. Physiochemical Function

The physiochemical function is a combination of V_{hyd} (weighted 15%), Vsed (5%), V_{chem} (25%), V_{con} (10%), V_{veg} (10%), V_{deb} (5%), V_{stab} (5%), V_{str} (5%) and V_{bio} (20%). The FCI for Reach 1 scored a 0.42, Reach 2 scored 0.44 and Reach 3 scored 0.38. The primary reason for variance originates from Vstab and Vveg.

3. Geomorphology Function

This function is a combination of V_{hyd} (weighted 15%), V_{sed} (15%), V_{con} (10%), V_{veg} (15%), V_{deb} (10%), V_{morph} (10%), V_{stab} (15%) and V_{str} (5%). This function received an FCI of 0.32 in Reach 1, 0.30 in Reach 2, and 0.24 in Reach 3. A major reason for variance is derived from Vstem, Vveg, Vmorph, and Vstab. All of the Reaches are severely impaired.

4. Hydraulic Function

This function is a combination of V_{hyd} (weighted 30%), V_{con} (30%), V_{veg} (5%), V_{morph} (10%), V_{stab} (10%) and V_{str} (15%). This function received and FCI score of 0.28 in Reach 1, 0.34 in Reach 2, and 0.22 in Reach 3. A main reason for this variance stems from Reach 2 having a higher degree of hydraulic capacity, and a better variable score in Vmorph, Vbio and Vcon. All the Reaches are severely impaired.

5. Composite Score

As depicted in Table 7, overall composite scores are the average of all four functional categories. Composite FCI score of 0.34 for Reach 1, 0.36 for Reach 2, and 0.30 for Reach 3. All reaches are severely impaired.

5 Future Without Project – FWOP

The FWOP assess the likely condition of the variables within the three reaches of the study area. In the next 50 years, riparian/wetland habitat is represented by FACWet and aquatic habitat is represented by FACStream. A 50-year period analysis was utilized, with incremental year at: Year 1, Year 5, Year 10 and Year 25.

5.1 Reach 1 – FWOP

In the Future Without Project condition, Reach 1, also referred to as "Pikes Peak North", is projected to experience continued and significant ecological and geomorphic decline over the next 50 years. This segment, approximately 1.74 acres in size and extending from the City Fire Station in the north to Pikes Peak Avenue in the south, will likely remain classified as a Rosgen "G" stream type: an entrenched, low width-to-depth ratio channel with limited access to its floodplain. Without intervention, ongoing incision is expected to worsen, deepening the channel and further disconnecting it from adjacent riparian zones. High-velocity flows will persist due to the entrenched nature of the channel, exacerbating bank erosion, scouring the bed, and reducing opportunities for sediment deposition and bar formation. The hydrologic regime will remain impaired, with reduced floodplain interaction and altered timing, magnitude, and duration of peak flows. This continued instability will limit recruitment and establishment of native riparian vegetation, while favoring the spread of invasive and disturbance-tolerant species. Over time, the structural diversity of the site is expected to decline, with further loss of herbaceous cover and canopy species. The chemical environment of the stream will also likely degrade, as the lack of sediment retention, vegetation filtering, and organic input limits nutrient cycling, exacerbates turbidity, and reduces overall water quality. If left unaddressed, Reach 1 is expected to remain in a severely degraded state, offering limited ecological function, poor habitat quality, and ongoing physical instability.

5.2 Reach 2 – FWOP

In the FWOP condition, Reach 2, also referred to as “Former Wetlands”, is expected to undergo significant and accelerating ecological degradation over the next 50 years. Once functioning as a wetlands bird sanctuary in the early 1980s, the reach has already transitioned from a diverse emergent wetland to a simplified riparian grassland system. Without intervention, the entrenched channel will continue to incise and erode, further lowering the streambed and intensifying the disconnection between the stream and its floodplain. As a result, the occurrence and duration of hydroperiods will continue to decline, eliminating the conditions necessary to support wetland vegetation and soil saturation processes. Riparian and herbaceous species will remain confined to the narrow streambank margins, while former wetland zones will continue to dry out, promoting the expansion of upland and invasive species such as smooth brome. Soil oxidation and compaction will increase across the site due to ongoing pedestrian activity and exposure, further degrading soil structure and biological function. The site’s hydrologic regime will remain severely impaired due to unregulated inputs from upstream urban culverts, sustaining flashy, unnatural flows with poor timing, distribution, and quality. These conditions will lead to increased sediment instability, a loss of vegetative complexity, and limited organic input into the aquatic system. Over time, Reach 2 will continue its departure from a wetland-dominated system and evolve into a fragmented, degraded floodplain corridor with limited habitat value, reduced biodiversity, and diminished capacity to support riparian and aquatic functions.

5.3 Reach 3 – FWOP

In the FWOP condition, Reach 3, referred to as the “South Channel”, is expected to undergo continued physical, hydrologic, and ecological decline over the next 50 years. The existing entrenched, hardened stream channel, classified as a Rosgen “G” type, will likely experience further incision and structural failure as portions of the concrete bank continue to degrade and slough into the channel. The three existing drop structures will persist as artificial grade controls, but without intervention, they are unlikely to prevent ongoing erosion and high-velocity flows

that characterize this reach. The continued input of urban wastewater through the eastern box culvert, combined with high-flow events funneled through the confined channel, will perpetuate a simplified flow regime, lacking the variability needed for sediment transport, deposition, and geomorphic recovery. Over time, these conditions will maintain a highly homogenized channel profile with little potential for pool-riffle formation or dynamic bed processes. The lack of floodplain connectivity and persistent bank hardening will inhibit recruitment of native vegetation and reduce opportunities for woody debris input, further limiting habitat structure and quality. Shrub-dominated riparian vegetation may persist in fragmented patches, but overall vegetative complexity and ecological resilience are expected to decline. Additionally, biogeochemical functions—such as nutrient cycling, organic matter retention, and water quality regulation—will continue to degrade due to poor substrate diversity and limited vegetative buffering. Without restoration, Reach 3 will remain a highly altered, disconnected stream corridor with diminishing ecological function and reduced capacity to support diverse aquatic and riparian communities.

5.4 FACWet Results – FWOP

Without future restoration, planning, and remediation efforts, it is likely that the watershed condition of Spring Creek would continue to degrade. Table 8 provides a summary of the FWOP results for FACWet. Future population growth would continue to place demands on watershed resources, and it seems likely that these demands would inevitably impair watershed health. Increases in population and higher intensity development would increase demand for water supply, likely driving hydrologic modifications that can shift the watershed hydrology towards a further altered state, more intensely impairing watershed condition and having impacts on organisms. For water quality, this increase in development suggests a subsequent increase in nonpoint source pollution throughout the watershed. In addition to continued pressure from population growth and urbanization, shifting climatic conditions at the planetary scale would also likely impact the water resources of the area. FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

Table 8 FACWet variable scores and associated functional capacity index scores for the FWOP in wetlands and riparian areas of Reach 2. Note that 1.00 to 0.90 is reference standard condition, <0.90 to 0.80 is high functioning, <0.80 to 0.70 is functioning, <0.70 to 0.60 is functioning impaired and <0.60 is considered non-functioning.

SCALE	VARIABLES	REACH 2 FWOP
Buffer & Landscape Context	(V1) Habitat Connectivity	0.55
	(V2) Contributing Area	0.64
Hydrology	(V3) Water Source	0.53
	(V4) Water Distribution	0.57
	(V5) Water Outflow	0.58
Abiotic & Biotic Habitat	(V6) Geomorphology	0.58
	(V7) Chemical Environment	0.59
	(V8) Vegetation Structure & Complexity	0.58
FUNCTIONS		**REACH 2**
Support of Characteristic Wildlife Habitat		0.59
Support of Characteristic Aquatic Habitat		0.56
Flood Attenuation		0.57
Short- and Long-term Water Storage		0.57
Nutrient/Toxicant Removal		0.60
Sediment Retention/Shoreline Stabilization		0.59

Production Export/Food Chain Support	0.58
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE	0.58 (Non-Functioning)

5.4.1 Variable 1 – Habitat Connectivity

The Habitat Connectivity (V1) is described by the two sub-variables- Neighboring Wetland (SV1.1) and Riparian Habitat Loss and Barriers to Migration and Dispersal (SV1.2). SV1.1 was not scored due to insufficient evidence of neighboring wetlands within the habitat connectivity envelope (within 500 m) as defined in the model. In a FWOP scenario, surrounding development pressures beyond the habitat connectivity envelope could shrink and degrade those nearby wetland and riparian habitats that exist past the 500 m. mark. These "islands" of habitat within the urban landscape are expected to experience a decrease in their riparian extent. Future development of the surrounding area could establish barriers that preclude the passage for wildlife movements to other surrounding suitable habitats. In a FWOP, barriers to organism migration and dispersal (SV2.1) could include bicycle paths, fencing, additional roads and additional or enhanced water management structures within the former wetland to support adjacent plans. The FWOP measurement for Habitat Connectivity (V1) decreased in score to 0.55 (-F) considering potential additions such as the above barriers could further restrict organism movement and advance the degree of impairment on their ability to migrate or disperse.

5.4.2 Variable 2 – Contributing Area

The Contributing Area (V2) is described by the four sub-variables, Buffer Condition (SV2.1), Buffer Extent (SV2.2), Buffer Width (SV2.3) and Surrounding Land Use (SV2.4). As land-use intensifies, so does the effects of urban encroachment into the former wetland. Future development within the contributing area would disrupt the condition of the surrounding buffer (SV2.1) and lead to the degradation of the buffer's extent (SV2.2) and

width (SV2.3). In a FWOP scenario, such development plans are estimated to contribute deleterious material into Reach 2, altering environmental conditions and elevating the stress of organisms. In addition, such future development plans could have strong implications on the surrounding land-use (SV2.4) since shifting the current vegetative condition of the contributing area towards characteristics of an urban landscape would eliminate the function and composition of a once vegetative buffer. The FWOP measure for the Contributing Area (V2) decreased in score to 0.66 (D) since future impairments the contributing area's capacity to support and maintain characteristic functions of a wetland condition.

5.4.3 Variable 3 – Water Source

The Water Source Variable (V3) has no sub-variables and assesses the up-gradient hydrological connectivity. The FWOP condition could present further impairments to the hydrology of Reach 2. The effects of shifting climatic conditions at the planetary scale in combination with the urban intensification pattern could drive Reach 2 towards unrealistic variations with in-flow and water distribution. Future hydrologic alterations to water sources (e. g. augmentation, depletion, timing) are expected to modify the quantity, and timing of the water source, and the water source's ability to perform sediment transport, erosion and soil pore flushing. The up-gradient FWOP condition of the constriction features, designed to route water sources into the Reach, will continue to promote channelization of Reach 2 through the effects of high-powered inflows and unnatural high-water events. This future estimate decreased the score to 0.53 (-F) for V3.

5.4.4 Variable 4 – Water Distribution

The Water Distribution Variable (V4) has no sub-variable and determines hydrologic connectivity by measuring the alteration of the spatial distribution of surface and groundwater in Reach 2. Future flow ways through Reach 2 will continue to remain confined to the channel and will continue to drive the severe disconnect between floodplain and stream. This effect is estimated to maintain the conditions that hinder floodplain inundation, including the chemical processes triggered when soils experience periods of inundation.

Although future water management impacts have the potential to alter flow patterns, these alterations are not expected to result in changes to the FWOP conditions which is estimated to remain the same at 0.57 (F).

5.4.5 Variable 5 – Water Outflow

The Water Outflow Variable (V5) has no sub-variables and is concerned with the down-gradient hydrologic connectivity and flow of water and water-borne materials and energy moving out of Reach 2. In the FWOP scenario, the outflow patterns will persist within the channel, maintaining current water outflow conditions. Despite the potential for future water management impacts to change outflow patterns, it is projected that the future condition will remain unchanged at 0.58 (F).

5.4.6 Variable 6 – Geomorphology

The Geomorphology Variable (V6) has no sub-variable and is a measure of degree to which the geomorphology of Reach 2 could be altered in the future. A FWOP scenario is projected to maintain the current sediment regime that produces excessive bank erosion and increases channel instability. Such future changes to the surface configuration and existing topography are estimated to change the geomorphic setting of Reach 2. The FWOP measurement decreased the score to 0.58 (F).

5.4.7 Variable 7 – Water and Soil Chemistry

The water and Soil Chemical Environment Variable (V7) is described through five sub-variables. Nutrient Enrichment (SV7.1), Sedimentation and Turbidity (SV7.2), Toxic Contamination (SV7.3), Temperature (SV7.4) and Soil Chemistry and Redox (SV7.5). In a future scenario the hydrology of Reach 2, largely unaffected, will sustain the present levels of erosion, sedimentation, and turbidity. Similarly, storm water runoff, in particular current road drainage runoff will maintain the same inputs of toxic contamination. Future estimates of shifting climatic conditions at the planetary scale project an increase in temperature,

potentially shifting the temperature regime of Reach 2, however a FWOP condition of the soils and water media will remain the same at 0.59 (F).

5.4.8 Variable 8 – Vegetation Structure and Complexity

The Vegetation Structure & Complexity Variable (V8) is described through four sub-variables. These are Tree Stratum (SV8.1), Shrub Stratum (SV8.2), Herbaceous Stratum (SV8.3) and Aquatic Stratum (V8.4). To estimate the percent coverage for each of the vegetation layers, the sub-variable weighing factor was determined using a reference wetland for Reach 2, a golf course wetland located approximately 1.25 miles downstream of Spring Creek (Figure 2). With future impairment to the hydrologic and sediment regime of Reach 2, the structure and complexity of the various vegetation layers could experience degradation, primarily from the effects of a shrinking riparian zone and the severe constriction of vegetation to the unstable banks of the channels within Reach 2. Additionally, a FWOP scenario would introduce vegetation management practices (e. g. tree removal, mowing, application of herbicide), including the opportunity for invasive species encroachment. The FWOP condition score for V8 decreased to 0.58 (-F) since it is estimated that the FWOP scenario would hinder the system's ability to support desirable riparian habitat composed of a robust tree, shrub, herbaceous and aquatic layer.

5.4.9 FACWet Functional Capacity Indices

As previously noted, scored variables are variously combined and accordingly weighted to calculate a functional score rating to depict the capacity of an AA to perform a function relative to its reference standard.

1. Support of Characteristic Wildlife Habitat
This function is a combination of V1, V2 and V8 (weighted x2), and Reach 2 received an FCI of 0.59 (F), considered functionally impaired in supporting characteristics of wildlife habitat.

2. Support of Characteristic Fish/Aquatic Habitat
This function is a combination of V3 (weighted x3), V4 (weighted x2) and V5 (weighted x2) and Reach 2 received an FCI of 0.56 (F), considered non-functioning in supporting characteristics in Fish/Aquatic habitat.

3. Flood Attenuation
This function combines V2, V3 (weighted x2), V4 (weighted x2), and V5 (weighted x2), V6 and V8. Reach 2 received an FCI of 0.57 (F) and is considered non-functioning in flood attenuation.

4. Short and Long-Term Water Storage
This function is a combination of V2 (weighted x2), V3, V4 (weighted x2), and V6. The short- and long- term water storage capacity in Reach 2 received an FCI of 0.57 (F) and it is considered non- functioning.

5. Nutrient/Toxicant Removal
This function is a combination of the variables V2 (weighted x2), V4 (weighted x2), V6 and V7. The FCI score for Reach 2 is 0.60 (D) and the AA's ability to remove nutrient/toxicants is considered non- functioning.

6. Sediment Retention/Shoreline Stabilization
This function is calculated by combining V2, V6 (weighted x2), and V8 (weighted x2), producing a FCI score of 0.59 (F) for Reach 2. The AA's capacity in sediment retention and shoreline stabilization is considered non-functioning.

7. Production Export/Food Chain Support
This function is a combination of V1, V5 (weighted x2), V6, V7, and V8 (weighted x2). Reach 2 received an FCI score of 0.58 (F) and the AA's ability for trophic productivity and support of food chains is considered non-functioning.

8. Composite Score
The overall composite scores are the average of all seven functional categories. The composite FCI for Reach 2 was 0.58 (F) and the functional capacity for the AA is considered non-functioning.

5.5 FACStream Results – FWOP

In the next 50 years, it is anticipated that some components of the aquatic system will continue to degrade and the overall acreage of the aquatic habitat is anticipated to decrease in reference to

existing conditions. In the FWOP condition, physiochemical properties of the aquatic environment would stem from the increased urbanization and development. Impervious surfaces would increase further leading to a slight increase in runoff of inorganic and organic matter into the Spring Creek system. Invasive and non-native species will continue to out-compete native species within the remaining habitat. Vegetation structure and complexity will decrease, and monocultures will continue to persist impacting the quality and functional value of the stream bank and riparian areas. the microhabitat of a typical cross section of the river will become almost entirely homogenized in depths and velocities without future restoration, planning, and remediation efforts. Table 9 summarized the scores for all Reaches based on a FWOP condition.

Table 9 FWOP FACStream "Report Card" for the three reaches within the Spring Creek study area. Note that FCI scores are extrapolated to a 0.00 to 1.00 scale, with 1.00 being optimal and 0.00 being completely non-functional.

SCALE	VARIABLES	Reach 1 FWOP	Reach 2 FWOP	Reach 3 FWOP
Watershed	(V_{hyd}) Flow Regime	D-	D-	D-
	(V_{sed}) Sediment Regime	F	F	D
	(V_{chem}) Water Quality	D	D	D
Riparian	(V_{con}) Floodplain Connectivity	F	F	F
	(V_{veg}) Riparian Vegetation	D-	D-	F
	(V_{deb}) Debris	D	D	D-
Stream	(V_{morph}) Stream Morphology	F+	D-	F
	(V_{stab}) Stability	F+	F+	F+
	(V_{str}) Physical Structure	F-	F	F-
	(V_{bio}) Biotic Structure	F	D-	F-

OVERALL REACH CONDITION SCORE	F+	D-	F+
(Biology Functions FCI)	0.18	0.22	0.14
(Physiochemical Functions FCI)	0.20	0.22	0.16
(Geomorphology Functions FCI)	0.16	0.18	0.16
(Hydraulic Functions FCI)	0.14	0.16	0.14
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE	**0.18**	**0.20**	**0.16**
DEGREE OF IMPARIMENT	**Profound**	**Severe**	**Profound**

5.5.1 Watershed Scale Variables

Flow Regime (Vhyd) was calculated by averaging the total volume, peak and base flows, and flow variability sub-variables together to produce an overall calculated letter grade of -D for all three Reaches. This scoring is based on the flow regime's existing condition, and the 50-year projection without implemented measures. In the FWOP, the higher demand for water would drive the total annual volume of water supplied for each Reach further into a significantly/severely degree of impairment. The FWOP conditions would drive the rate of change of flow including the frequency and timing of flow, to experience extreme variations from its existing range of variability. Such extreme variations in flow drive the peak flows and base flows into a state of severe impairment.

Sediment Regime (Vsed) was calculated by averaging the three sub-variables together to produce an overall letter grade of "F" for Reach 1, "F" for Reach 2 and "D" for Reach 3. The rationale for this scoring was based on the existing characteristics of sediment supply from land and channel erosion location and sediment transport processes of the AA. In a FWOP condition, the existing linear concrete channels in combination with drop structures would continue to eliminate the potential for sediment production, exacerbating the already un-balanced sediment transport process. The sediment regime would experience higher degrees of variation from its existing range. The input into Spring Creek is estimated to diminish, and the sediment output would increase significantly.

Water Quality (Vchem) was calculated by averaging temperature regime, organic and nutrients and inorganic and toxin sub-variables together to produce an overall letter grade "D" across all three Reaches. This scoring is based off the physicochemical properties of the AA in the 50-year condition, with focus on the biogeochemical processes by stream organisms and physical changes within channels and floodplain that can drive changes to the conditions within the stream. In the FWOP the existing stream temperature regime would shift towards warmer trends but still retains some form of abiotic habitat factors that support organisms in all three Reaches. Urban runoff would be the major stressor driving the existing supply of metabolic agents into the Spring Creek watershed in the 50- year condition. Unusual volumes and timing of these water inputs into Spring Creek would occur more frequently, increasing levels of organic compounds, metals and toxins that would impair the pH, conductivity, and turbidity of the stream.

5.5.2 Riparian Scale Variables

Floodplain Connectivity (Vcon) was calculated by averaging saturation frequency and duration and floodplain width sub-variables together to produce an overall letter grade of "F" for all Reaches. The rationale for this scoring is supported by the trend of the existing channel where the hardening, grade control and deep entrenchment would continue in a FWOP condition. This effect would disconnect the stream's access to its floodplain and further drive the natural hydrograph into profound impairment.

Riparian Vegetation (Vveg) was calculated by averaging woody and herbaceous structure and species diversity sub-variables together to produce and overall letter grade of "D-" for Reach 1, "D-" for Reach 2 and "F" for Reach 3. This variable examines the riparian vegetation zone and its ability to support complex assemblages of flora that interact with each other and with other components of the riparian zone system of all Reaches. In the FWOP condition, the establishment of exotic flora would increase in complexity, with more woody species encroachment into the aquatic zone driven by a steady hydrologic alteration of the Spring Creek watershed in the 50-year condition. This effect would decrease the quality of vegetation structure and would decrease the diversity of riparian vegetation.

Debris Supply (Vdeb) was calculated by averaging large woody debris (LWD) and detritus sub- variables to produce an overall letter grade of "D" for Reach 1 and 2, and a "D-" for Reach 3. Support for this scoring assumes that LWD would continue to be actively managed by local authorities. In a FWOP condition the supply of LWD would decrease in quality and quantity, since riparian vegetation is expected to decrease in density and diversity. The supply of detritus and other small organic material would also decrease since steep banks would restrict any vegetation from establishing near or over the stream. The active tree management from local authorities would also steadily contribute to the increase of debris supply into the stream.

5.5.3 Reach Scale Variables

Stream Morphology (Vmorph) was calculated by averaging the sub-variables stream evolution, planform, dimension, and profile to produce an overall letter grade of "F+" in Reach 1, "D-" in Reach 2, and "F" in Reach 3. Rationale for this scoring includes is driven by the ongoing trend in channelization and entrenchment of stream that would dictate the stream morphology towards an impaired state. In the FWOP condition the existing bank armoring/hardening would continue to dictate the slope or gradient of the stream, eliminating the formation of complex soil formations and alluvial processes.

Stability and Resilience (Vstab) was calculated by averaging the dynamic equilibrium and resilience sub-variables together to produce an overall letter grade of "F+" for all three Reaches. In the FWOP, the probability that the stream will maintain its geomorphic structure over time would decrease and a recovery after a large disturbance (i. e. large flood, wildfire, mass erosion event) would also decrease. In a FWOP condition, the dynamic balance between sediment supply and transport would be further away from a functional condition as result of the compounding effects of the hardened channels. The stream's inability to move, adapt and adjust would be eliminated, given that the floodplain and poor riparian zone would be completely disconnected from the stream.

Physical Structure (Vstr) was calculated by averaging hydraulic structure, and coarse and fine substrate sub-variables together to produce an overall letter grade of "F-" in Reach 1, "F" in Reach 2, and "F-" in Reach 3. Determination of this score is based on the

heterogeneity and structural diversity of the stream. In a FWOP condition, the physical structure would continue to experience unfavorable erosion process with no formation of beds, banks, and substrates. The channelization in combination with the effects of channel armoring features have shut-down the process of hydraulic and geomorphic interactions, driving the stream into a profoundly impaired state.

Biotic Structure (Vbio) takes into consideration the trophic interactions at the various levels of the biotic hierarchy to produce a letter grade of "F" in Reach 1, "-D" in Reach 2 and "F-" in Reach 3. The rationale for this is supported by the continued trends in the reduction of riparian buffer, and the elimination of floodplain. Other effects, such as from impervious surfaces, and other stressors from the surrounding urban environment, are anticipated to drive an increase in impairment of the stream's natural systems.

5.5.4 FACStream Functional Condition Scores

As noted earlier, all variable scores are variously combined and accordingly weighted to calculate a functional score rating to depict the capacity of an AA to perform a function relative to its reference standard.

1. Biology Function
This function is a combination of V_{hyd} (weighted 20%), V_{chem} (15%), V_{con} (10%), V_{veg} (10%), V_{deb} (5%), V_{stab} (10%) V_{str} (10%) and V_{bio} (20%). This function received an FCI of 0.18 for Reach 1, 0.22 for Reach 2 and 0.14 in Reach 3.

2. Physiochemical Function
The physiochemical function is a combination of V_{hyd} (weighted 15%), Vsed (5%), V_{chem} (25%), V_{con} (10%), V_{veg} (10%), V_{deb} (5%), V_{stab} (5%), V_{str} (5%) and V_{bio} (20%). The FCI for Reach 1 scored a 0.20, Reach 2 scored 0.22 and Reach 3 scored 0.16.

3. Geomorphology Function
This function is a combination of V_{hyd} (weighted 15%), V_{sed} (15%), V_{con} (10%), V_{veg} (15%), V_{deb}, (10%), V_{morph} (10%), V_{stab} (15%) and V_{str} (5%). This function received an FCI of 0.16 in Reach 1, 0.18 in Reach 2, and 0.16 in Reach 3. A major reason for variance is derived Vstem, Vveg, Vmorph, and Vstab.

4. Hydraulic Function

This function is a combination of V_{hyd} (weighted 30%), V_{con} (30%), V_{veg} (5%), V_{morph} (10%), V_{stab} (10%) and V_{str} (15%). This function received and FCI score of 0.14 in Reach 1, 0.16 in Reach 2, and 0.14 in Reach 3.

5. Composite Score

As depicted in Table 8, overall composite scores are the average of all four functional categories. Composite FCI score of 0.18 for Reach 1, 0.20 for Reach 2, and 0.16 for Reach 3.

6 Final Array of Alternatives

A combination of restoration measures or Action Alternatives were developed for each Reach of Spring Creek. For a more detailed description of each alternative, please see Section 4.4 of the IFR, titled Formulation of Alternatives. For Reach 1, action alternatives 1A, 1B and 1C underwent FACStream analysis (Table 10.), Reach 2 action alternatives 2A and 2B (Table 11.) and Reach 3 action alternatives 3A and 3B (Table 12xx.). Due to Reach 2 being a former wetland, FACWet analysis of 2A and 2B was also conducted (Table 14.). Table 13 summarizes the composite FCI scores for each Action Alternative and the FCI change from Existing Conditions. As discussed previously, the composite FCI scores are then translated into HUs which are then used in the CE/ICA. Twenty-five ALTs were developed from the Action Alternative combinations from all Reaches, including a 'No Action ALT' (Table 15.).

6.1 FACStream Report Cards

Table 10 FACStream Report Card for Reach 1 summarizing Existing Conditions, FWOP, and measures 1A, 1B, 1C

FACStream "Report Card" for Reach 1a, 1b and 1c. Note that Functional Capacity Index (FCI) scores are extrapolated to a 0.00 to 1.00 scale, with 1.00 being optimal and 0.00 being completely non-functional. Area of Assessment: 1.74 ac

SCALE	VARIABLES	REACH 1 Existing Conditions	REACH 1 FWOP	REACH 1 A	REACH 1 B	REACH 1 C
Watershed	(Vhyd) Flow Regime	C-	-D	C-	C-	C-
	(Vsed) Sediment Regime	D	F	C-	C	C
	(Vchem) Water Quality	B	D	B	B	B
Riparian	(Vcon) Floodplain Connectivity	F+	F	D	C-	C
	(Vveg) Riparian Vegetation	D+	-D	C-	C	B-
	(Vdeb) Debris	C-	D	C	C+	B-
Stream	(Vmorph) Stream Morphology	D-	+F	D	D	C-
	(Vstab) Stability	D	+F	D+	C	C
	(Vstr) Physical Structure	F	-F	D+	C-	C
	(Vbio) Biotic Structure	D	F	C	C+	B-
OVERALL REACH CONDITION SCORE		**D**	**+F**	**C-**	**C**	**C**
(Biology Functions FCI)		0.36	0.18	0.46	0.52	0.56
(Physiochemical Functions FCI)		0.42	0.20	0.50	0.54	0.60
(Geomorphology Functions FCI)		0.32	0.16	0.40	0.46	0.52
(Hydraulic Functions FCI)		0.28	0.14	0.36	0.44	0.48
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		**0.34**	**0.18**	**0.44**	**0.50**	**0.54**
DEGREE OF IMPARIMENT		**Severe**	**Profound/ Severe**	**Significant/ Severe**	**Significant**	**Significant**

Table 11 FACStream Report Card for Reach 2 measures 2A, 2B

FACStream "Report Card" for Reach 2a and 2b. Note that Functional Capacity Index (FCI) scores are extrapolated to a 0.00 to 1.00 scale, with 1.00 being optimal and 0.00 being completely non-functional. Area of Assessment: 8.65 ac

SCALE	VARIABLES	REACH 2 Existing Conditions	REACH 2 FWOP	REACH 2 A	REACH 2 B
Watershed	(Vhyd) Flow Regime	-C	-D	-C	-C
	(Vsed) Sediment Regime	F	F	D	+D
	(Vchem) Water Quality	B	D	B	B
Riparian	(Vcon) Floodplain Connectivity	D	F	+C	B
	(Vveg) Riparian Vegetation	D	-D	C	C
	(Vdeb) Debris	-C	D	C	+C
Stream	(Vmorph) Stream Morphology	+D	-D	-C	C
	(Vstab) Stability	+F	F	D	-C
	(Vstr) Physical Structure	D	F	C	C
	(Vbio) Biotic Structure	-C	-D	+C	-B
OVERALL REACH CONDITION SCORE		**+D**	**-D**	**C**	**C**
(Biology Functions FCI)		0.40	0.22	0.52	0.56
(Physiochemical Functions FCI)		0.44	0.22	0.54	0.58
(Geomorphology Functions FCI)		0.30	0.18	0.44	0.48
(Hydraulic Functions FCI)		0.34	0.16	0.48	0.54
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		**0.36**	**0.20**	**0.50**	**0.54**
DEGREE OF IMPARIMENT		**Severe**	**Severe**	**Significant**	**Significant**

Table 12 FACStream Report Card for Reach 3 measures 3A and 3B.

FACStream "Report Card" for Reach 3a and 3b. Note that Functional Capacity Index (FCI) scores are extrapolated to a 0.00 to 1.00 scale, with 1.00 being optimal and 0.00 being completely non-functional. Area of Assessment: 1.51 ac

SCALE	VARIABLES	REACH 3 Existing Conditions	REACH 3 FWOP	REACH 3 A	REACH 3 B
Watershed	(Vhyd) Flow Regime	-C	-D	C	C
	(Vsed) Sediment Regime	D	D	C	C
	(Vchem) Water Quality	B	D	B	B
Riparian	(Vcon) Floodplain Connectivity	+F	F	D	D
	(Vveg) Riparian Vegetation	-D	F	+D	+D
	(Vdeb) Debris	-C	-D	-C	-C
Stream	(Vmorph) Stream Morphology	F	F	+F	-D
	(Vstab) Stability	F	+F	-D	D
	(Vstr) Physical Structure	F	-F	D	D
	(Vbio) Biotic Structure	D	-F	-C	C
OVERALL REACH CONDITION SCORE		**D**	**+F**	**-C**	**-C**
(Biology Functions FCI)		0.34	0.14	0.44	0.46
(Physiochemical Functions FCI)		0.38	0.16	0.48	0.50
(Geomorphology Functions FCI)		0.24	0.16	0.36	0.38
(Hydraulic Functions FCI)		0.22	0.14	0.34	0.36
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		**0.30**	**0.16**	**0.40**	**0.42**
DEGREE OF IMPARIMENT		**Severe**	**Profound**	**Severe**	**Severe**

Table 13 Alternative Comparison

	Composite FCI Score			Change from FWOP		
	Reach 1	**Reach 2**	**Reach 3**	**Reach 1**	**Reach 2**	**Reach 3**
Existing Conditions	0.34	0.36	0.30	-0.16	-0.16	-0.14
FWOP / No-Action Alternative	0.18	0.20	0.16	-	-	-
Alternative A	0.44	0.50	0.40	0.26	0.30	0.24
Alternative B	0.50	0.54	0.42	0.32	0.34	0.26
Alternative C	0.54	--	--	0.36		

6.2 FACWet Report Card

Table 14 FACWet Report Card for Reach 2 measures 2A and 2B. FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

FACWet variable scores and associated functional capacity index scores (FCI) for Reach 2 scenarios. Note that 1.00 to 0.90 is reference standard condition, <0.90 to 0.80 is high functioning, <0.80 to 0.70 is functioning, <0.70 to 0.60 is functioning impaired and <0.60 is considered non-functioning. Area of Assessment: 6.53 ac.

SCALE	VARIABLES	Reach 2 Existing Conditions	Reach 2 FWOP	Reach 2A	Reach 2B
Buffer & Landscape Context	(V1) Habitat Connectivity	0.62	0.55	0.64	0.68
	(V2) Contributing Area	0.66	0.64	0.72	0.72
Hydrology	(V3) Water Source	0.61	0.53	0.68	0.68
	(V4) Water Distribution	0.61	0.57	0.73	0.78
	(V5) Water Outflow	0.61	0.58	0.72	0.74
Abiotic & Biotic Habitat	(V6) Geomorphology	0.60	0.58	0.74	0.86
	(V7) Chemical Environment	0.60	0.59	0.71	0.78
	(V8) Vegetation Structure and Complexity	0.66	0.58	0.71	0.81
FUNCTIONS					
F1 - Support of Characteristic Wildlife Habitat		0.65	0.59	0.69	0.75
F2 - Support of Characteristic Aquatic Habitat		0.61	0.56	0.71	0.75
F3 - Flood Attenuation		0.62	0.57	0.71	0.75
F4 - Short- and Long-term Water Storage		0.61	0.57	0.72	0.76
F5 - Nutrient/Toxicant Removal		0.62	0.60	0.72	0.77
F6 - Sediment Retention/Shoreline Stabilization		0.64	0.59	0.72	0.81
F7 - Production Export/Food Chain Support		0.62	0.58	0.71	0.77
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		0.62	0.58	0.71	0.77
Functional Category		**Functioning Impaired**	**Non-Functioning**	**Functioning**	**Functioning**

Table 15 Alternatives developed for HU calculation and CE/ICA

Alternatives developed for Habitat Unit (HU) calculation and Cost Equivalent / Incremental Cost Analysis (CE/ICA).	
Alt 1 - No Action	Alt 14 - 2a, 1a, 3a

Alt 2 - 2a	Alt 15 - 2a, 1b, 3a
Alt 3 - 2b	Alt 16 - 2a, 1c, 3a
Alt 4 - 2a, 1a	Alt 17 - 2b, 1a, 3a
Alt 5 - 2a, 1b	Alt 18 - 2b, 1b, 3a
Alt 6 - 2a, 1c	Alt 19 - 2b, 1c, 3a
Alt 7 - 2b, 1a	Alt 20 - 2a, 1a, 3b
Alt 8 - 2b, 1b	Alt 21 - 2a, 1b, 3b
Alt 9 - 2b, 1c	Alt 22 - 2a, 1c, 3b
Alt 10 - 2a, 3a	Alt 23 - 2b, 1a, 3b
Alt 11 - 2a, 3b	Alt 24 - 2b, 1b, 3b
Alt 12 - 2b, 3a	Alt 25 - 2b, 1c, 3b
Alt 13 - 2b, 3b	

7 Recommended Plan / Agency Preferred Alternative – FWP

The restored riparian zone would be planted with a transitional cottonwood-willow community, interspersed with mesic graminoid species, creating a dynamic, multi-layered habitat that supports a wide range of plant and urban wildlife species (Stanford & Ward, 1996). In addition, the construction of in-stream features and bank stabilization structures would enhance the aquatic environment. In Reach 2, two rock riffles, two stone-bank stabilization features and a series of boulder clusters would counter channel incision, erosion and would add variation in the hydrogeomorphology of the stream system.

The existing conditions of the former wetland in Reach 2 is considered low-quality habitat, and under the TSP the wetland would experience a significant increase in spatial extent, increasing

the riparian-wetland zones from 1.34 acres to 3.53 acres within Reach 2. In addition to an increase in spatial extent, Reach 2 would experience an ecological lift, restoring 2,355 ft of stream length with newly modified banks that offer gentle slopes which facilitate hydrological connectivity into the lateral floodplain that promotes natural habitat development.

Although, these restoration measures are designed to bolster wetland productivity and ecological resilience, the former wetland in Reach 2 remains a challenged system. Nestled in the core of Colorado Springs, disconnected and confined to a sub-urban conduit, the Spring Creek system would have to undergo major transformation to reach a functional score that is near its reference standard (Smith & Kuhn, 2015).

The measures implemented under the TSP would enhance the complexity and the functionality of the stream and riparian complex. The TSP would improve Reach 2 from a severely altered wetland with nearly extinguished wetland functions towards a functioning wetland that has increased significantly in production capacity and able to provide all natural wetland functions.

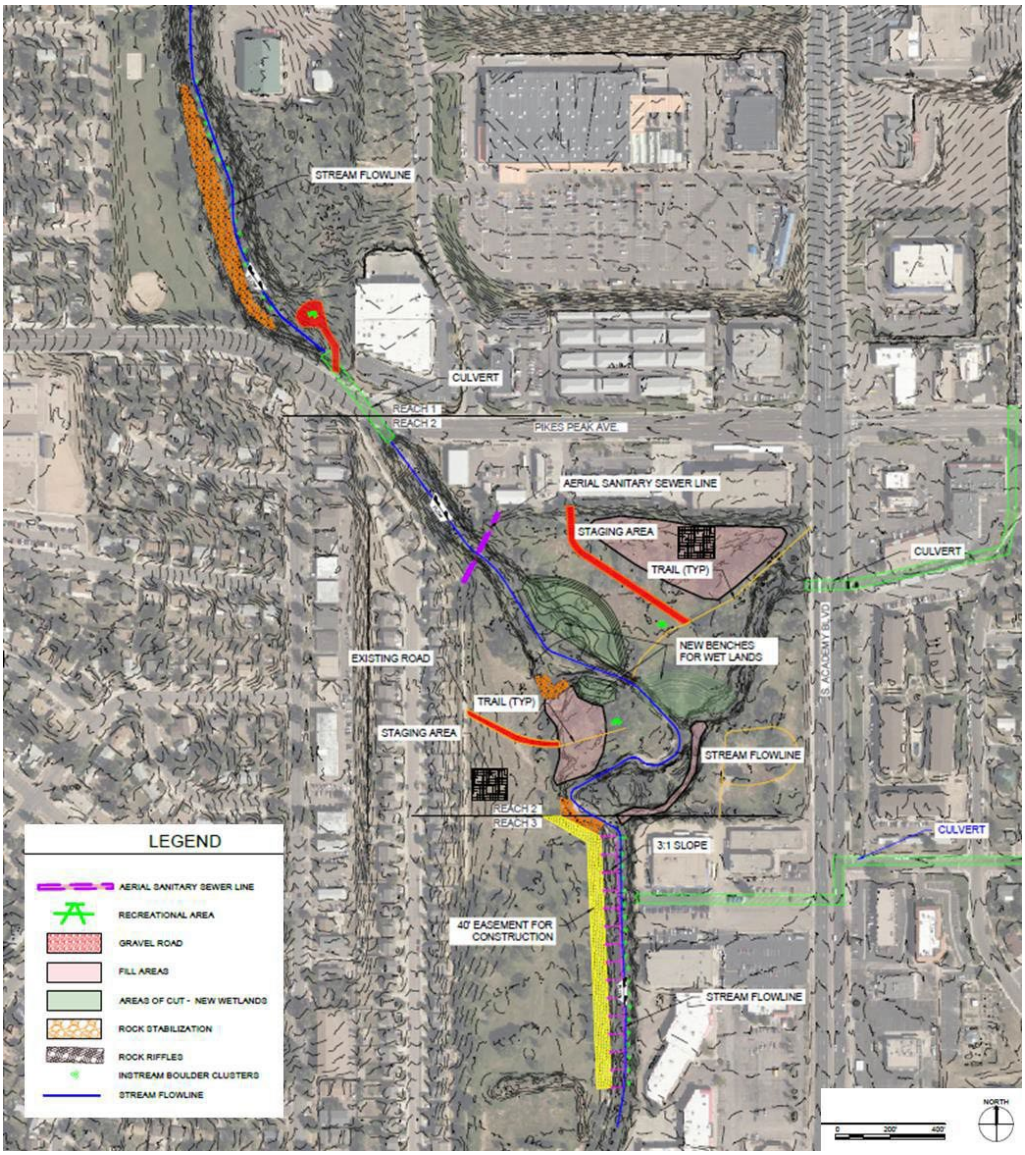


Figure 7 Summary of the Spring Creek CAP 206 TSP (Alternative 24 – 2b-1b-3b)

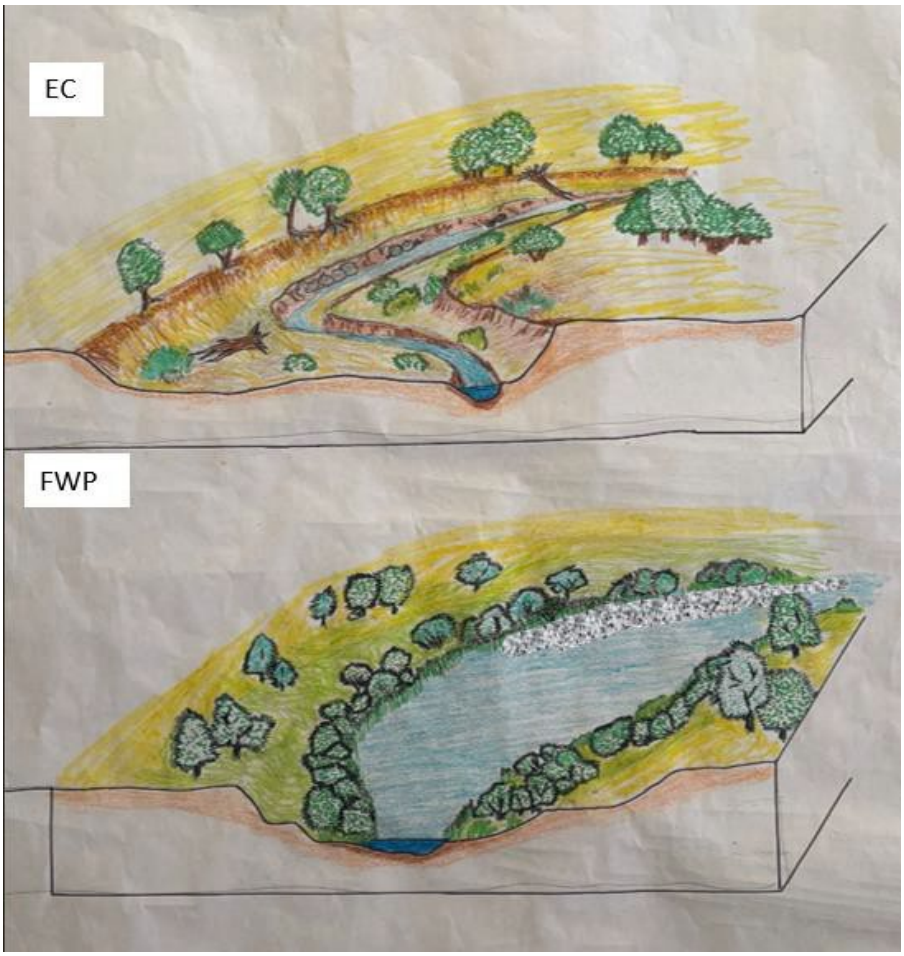


Figure 8 Artist interpretation of the Existing Conditions and Future with Project based on cross-sections from Figure 10.

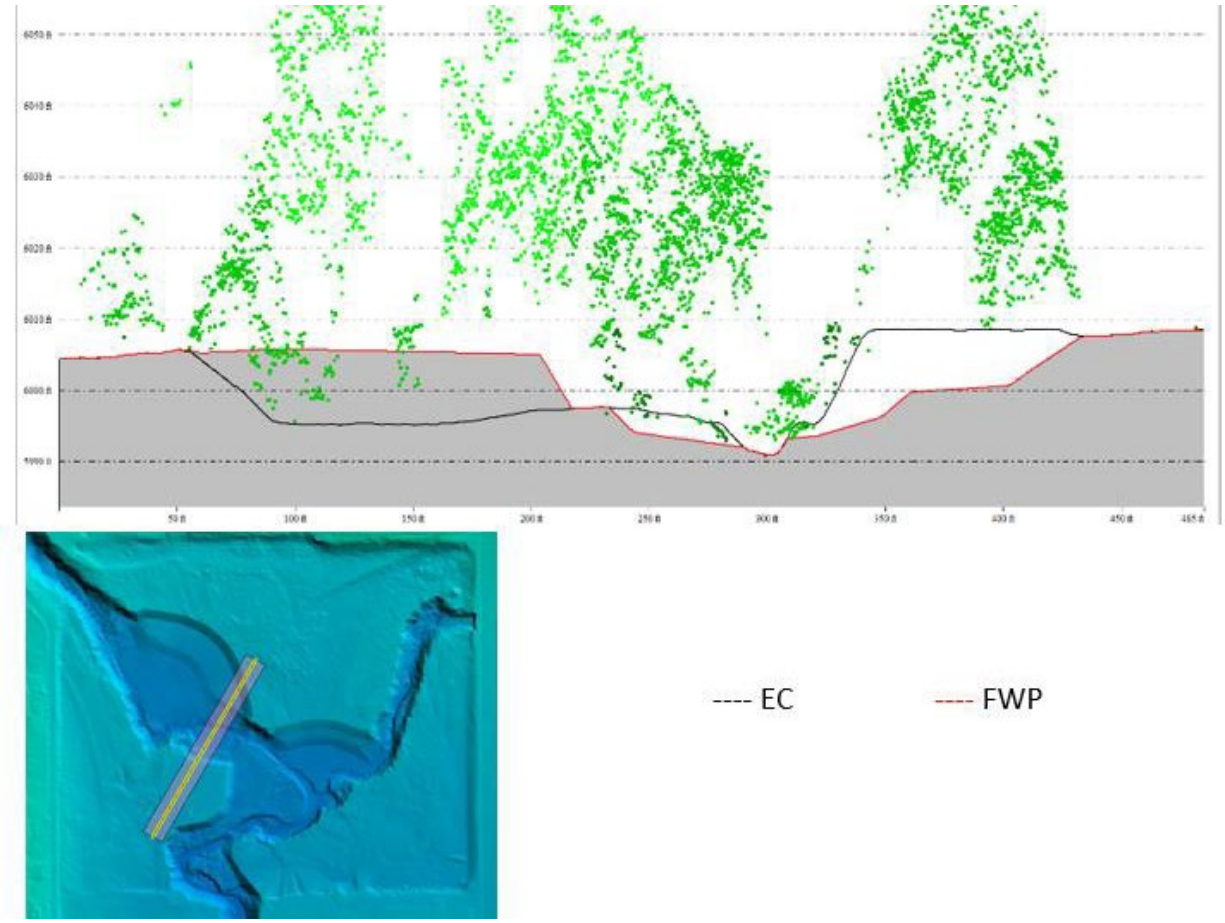


Figure 9 Overlaid cross-sections of Existing Conditions and Future with Project. Note that green marks correspond to trees and other vegetation.

7.1 Reach 1 – FWP

In the Future With Project (FWP) condition, Reach 1, also referred to as "Pikes Peak North", is anticipated to undergo substantial ecological and geomorphic improvement over the next 50

years as a result of the proposed FWP restoration measures. The integrated approach of installing a boulder toe along the west bank, planting native riparian vegetation, removing invasive species on the east bank, and enhancing in-stream complexity through boulder clusters is expected to reverse current degradation trends. Bank stabilization will reduce the rate of erosion and protect the integrity of the steep western slope, while plantings behind the boulder toe will promote the establishment of native vegetation and increase the structural complexity of riparian habitat. The removal of exotic flora on the east bank will relieve competitive pressure on native species, allowing for improved herbaceous and woody vegetation cover over time. In-stream boulder clusters will create flow variability, slow velocities, and promote sediment retention, all of which will enhance the stream's ability to form natural features such as bars and pools. These hydrologic improvements will gradually reestablish floodplain connectivity, particularly during peak flow events, and support the formation of moist parafluvial zones. Over time, these conditions are expected to stabilize the channel, improve water quality through increased organic matter filtering and nutrient cycling, and expand the site's ability to support diverse aquatic and riparian communities. As a result, Reach 1 will transition toward a more functional and resilient stream segment, with improved habitat quality, restored ecological processes, and increased capacity to withstand and recover from future disturbances.

7.2 Reach 2 – FWP

In the Future With Project condition, Reach 2, referred to as "Former Wetlands", is anticipated to recover substantial ecological and hydrologic function over the next 50 years through the implementation of targeted restoration measures. The construction of two rock riffles (CRR1 and CRR2) will act as grade control structures, stabilizing the incised channel and initiating sediment retention upstream. These features, combined with bank modifications and laid-back slopes, will promote floodplain reconnection and restore more natural hydroperiods, reintroducing the wetland conditions historically supported in the area. Periodically and permanently saturated zones will develop along the regraded banks, supporting the successful establishment of native wetland vegetation such as sandbar willow, Baltic rush, and three-square. Formerly disconnected overbank areas will begin to function hydrologically once more, improving soil saturation and reducing oxidation rates. The strategic use of excavated fill to reshape floodplain contours (Areas

F1, F2, and F3) will enhance topographic diversity and create suitable conditions for a gradual transition between stream, wetland, and upland zones. Stone armoring at erosion-prone bends (SBS1 and SBS2) will provide additional channel stability while maintaining habitat heterogeneity. Riparian replanting throughout the reach will increase vegetation cover and complexity, promoting habitat for a wider range of aquatic and terrestrial species. Over time, these combined measures are expected to improve the quality, timing, and distribution of flows, enhance sediment and organic matter dynamics, and reestablish the reach as a functioning riparian-wetland mosaic with increased biodiversity, resilience to disturbance, and long-term ecological integrity.

7.3 Reach 3 – FWP

In the FWP condition, Reach 3, referred to as the "South Channel", is anticipated to undergo substantial ecological and structural improvement over the next 50 years through targeted restoration measures. The removal of existing concrete slabs along the west bank and the regrading of the slope to a 3:1 ratio with the addition of a 10-foot-wide riparian bench will allow for the reestablishment of bank stability using a combination of riprap and native vegetation. This treatment will reduce erosion, improve soil-water interactions, and support the long-term establishment of riparian plant communities. Strategic riparian plantings within the riprap and along the bench will enhance vegetative structure, providing shade, organic input, and improved habitat complexity. A constructed rock riffle at the northern end of the reach will function as a grade control feature that promotes energy dissipation, sediment deposition, and flow variability. Instream boulders will further diversify hydraulic conditions, facilitating the development of riffle-pool sequences and promoting channel heterogeneity. Together, these measures will help reverse the long-term effects of channelization by restoring more natural sediment transport dynamics, reconnecting the stream with its immediate floodplain, and enhancing biogeochemical processes such as nutrient cycling and organic matter retention. Over time, Reach 3 is expected to evolve into a stable, resilient stream corridor that supports a higher diversity of aquatic and riparian species, improves water quality, and contributes to the overall ecological recovery of the Spring Creek system.

7.4 FACWet Results – FWP

The restored riparian zone would be planted with a transitional cottonwood-willow community, interspersed with mesic graminoid species, creating a dynamic, multi-layered habitat that supports a wide range of plant and urban wildlife species (Stanford & Ward, 1996). In addition, the construction of in-stream features and bank stabilization structures would enhance the aquatic environment. In Reach 2, two rock riffles, two stone-bank stabilization features and a series of boulder clusters would counter channel incision, erosion and would add variation in the hydrogeomorphology of the stream system (Figure 8). Please see Section 6.1 *Tentative Selected Plan Components* and Figure 24-29 of the Integrated Feasibility Report for more detail on the components that make up the TSP.

The FACWet assessment was applied to Reach 2 only since this reach was a former wetland (Table 16). The Tentative Selected Plan (TSP), improvements to the wetland habitat in Reach 2 increased the Composite FCI score (from 0.62 to 0.77) and improved from a 'Functioning Impaired' wetland to a 'Functioning' wetland per the FACWet functional category classification. The existing condition is currently characterized as a low-quality wetland habitat, and under the TSP, the riparian-wetland zones adjacent to the stream channel in Reach 2 are projected to increase in size by approximately 163%, expanding from 1.34 ac to 3.53 ac. In addition to a lateral increase in spatial extent of wetland characteristics, the TSP includes restoration of approximately 2,355 linear ft (717 m) of stream channel, incorporating bank regrading and the establishment of gentler slopes along the banks of the stream. The modifications included in the TSP are designed to improve hydrologic connectivity between the stream and adjacent floodplain, thereby supporting conditions conducive to the development and establishment of riparian and wetland conditions.

Although these restoration measures are designed to bolster wetland productivity and ecological resilience, the former wetland in Reach 2 would remain a challenged system. Nestled in the core of Colorado Springs, disconnected and confined to a sub-urban conduit, the Spring Creek system would have to undergo major transformation to reach a functional score that is near its reference standard (Smith & Kuhn, 2015).

The measures implemented under the TSP would enhance the complexity and the functionality of the stream and riparian complex. The TSP would improve Reach 2 from a severely altered wetland with nearly extinguished wetland functions towards a functioning wetland with significantly improved production capacity able to provide all natural wetland functions (Figure 8). FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

Table 16 Summary of the eight variables, their associated scores and the seven FCI scores for Reach 2 within the Spring Creek Section 206 study area. As the TSP, Reach 2b received a composite FCI score of 0.77 (an increase from 0.62 under existing conditions). FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

FACWet variable scores and associated functional capacity index scores (FCI) for Reach 2 scenarios. Note that 1.00 to 0.90 is reference standard condition, <0.90 to 0.80 is high functioning, <0.80 to 0.70 is functioning, <0.70 to 0.60 is functioning impaired and <0.60 is considered non-functioning. Area of Assessment: 6.53 ac.

SCALE	VARIABLES	Reach 2 Existing Conditions	Reach 2 FWOP	Reach 2B
Buffer & Landscape Context	(V1) Habitat Connectivity	0.62	0.55	0.68
	(V2) Contributing Area	0.66	0.64	0.72
Hydrology	(V3) Water Source	0.61	0.53	0.68
	(V4) Water Distribution	0.61	0.57	0.78
	(V5) Water Outflow	0.61	0.58	0.74
Abiotic & Biotic Habitat	(V6) Geomorphology	0.60	0.58	0.86
	(V7) Chemical Environment	0.60	0.59	0.78
	(V8) Vegetation Structure and Complexity	0.66	0.58	0.81
FUNCTIONS				
F1 - Support of Characteristic Wildlife Habitat		0.65	0.59	0.75
F2 - Support of Characteristic Aquatic Habitat		0.61	0.56	0.75
F3 - Flood Attenuation		0.62	0.57	0.75
F4 - Short- and Long-term Water Storage		0.61	0.57	0.76
F5 - Nutrient/Toxicant Removal		0.62	0.60	0.77
F6 - Sediment Retention/Shoreline Stabilization		0.64	0.59	0.81
F7 - Production Export/Food Chain Support		0.62	0.58	0.77
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		0.62	0.58	0.77
Functional Category		**Functioning Impaired**	**Non-Functioning**	**Functioning**

7.4.1 Variable 1 – Habitat Connectivity

Under the FWP, the assigned score for V1 in Reach 2 slightly increased from existing conditions (from 0.62 to 0.68), as a result of minor and localized additional habitat from the bank modifications and re-vegetation efforts that would create a wetland/riparian habitat complex. Since SV1.1 considers the connectivity potential to surrounding wetlands within 500 m. of the assessment area (see Habitat Connectivity Envelope, Section 2.1.1), increase in the habitat benefits score was insignificant when compared to the overall watershed due to the severe loss of wetlands. SV1.1 was not scored due to the lack of wetlands within the HCE. SV1.2 rates the degree to which the wetland has become isolated from existing neighboring wetland habitats by barriers that inhibit migration and dispersal of organisms. In the next 50 years, the surrounding urbanization will continue to present barriers that interfere with organism movements; however, a slight increase in connectivity is assumed as a result of improving connectivity in Reach 2.

7.4.2 Variable 2 – Contributing Area

The score for V2 increased from existing conditions (from 0.66 to 0.72), since portions of the surrounding contributing area, (a 250 m. zone surrounding the perimeter of the wetland) are projected to experience improvements. SV2.1 measures the functionality and composition of the buffer surrounding the wetland, and under the TSP, the surrounding buffer landscape

would be enhanced, using fill material that can contribute to the upland microtopography and supplemented by seeding and plantings. Although the immediate surrounding land use and buffer extent will experience improvements, the TSP will not exceed greater than 25% of the designated 250 m. zone (contributing area) and thus the designated score for V2 is only a slight improvement.

7.4.3 Variable 3 – Water Source

The assigned score for V3 increased from existing conditions (from 0.61 to 0.68). Under the TSP, the restoration measures implemented in Reach 1 are projected to produce benefits to the quantity, quality, timing and distribution of flows into Reach 2. However, stressors, particularly stormwater runoff from impervious surfaces and other point and non-point source pollution, in combination with water management will continue to impact the conditions of V3 in the next 50 years. Therefore, the assigned score reflects a slight improvement.

7.4.4 Variable 4 – Water Distribution

The score for V4 increased from existing conditions (from 0.61 to 0.78), due to the augmentation of in-stream complexity and enhancements to the stream banks. The TSP is projected to improve the distribution of water through Reach 2 by influencing the hydrology (e. g. water depth, water flow-path, water speed) through the implementation of rock riffles, boulder clusters and bank modification techniques. These are anticipated to produce some heterogeneity throughout the aquatic environment and generate occasional periods of drying and flooding of stream adjacent areas.

7.4.5 Variable 5 – Water Outflow

The designated score for V5 increased from existing conditions (from 0.61 to 0.74). This variable is the converse of V3 and considers the downstream effects. Under the TSP, the outflow regime would improve, with in-stream structures and bank modifications of Reach 2 anticipated to produce suitable variations in the down-gradient hydrology. The biotic and abiotic enhancements within Reach 2 aim to improve the export of water and water-borne

materials as well as the transport of energy out of the wetland supporting dependent habitats located downstream in Reach 3.

7.4.6 Variable 6 – Geomorphology

The score for V6 increased from existing conditions (from 0.60 to 0.86). The TSP's enhancements in Reach 2 would combine to improve the overall fluvial process, generating benefits to the microtopography of the wetland and improving the function and composition of the stream bed, banks, and adjacent floodplain. The modified stream banks would provide gentler, vegetative slopes that can improve the width and depth ratio of the stream itself and boost the sediment transport process thus boosting the condition of bed and bank substrates and other near-surface soil properties. In addition, the in-stream enhancements in combination with bank modifications are projected to decrease stream instability, bank erosion and ultimately improve the redox process that supports saturated soils that maintain a chemical environment suitable for wetlands.

7.4.7 Variable 7 – Water and Soil Chemistry

The designated score for V7 increased from existing conditions (from 0.60 to 0.78) since under the TSP, the quality and quantity of biochemical interactions between wetland-riparian-upland zones are estimated to experience an increase. The establishment of saturated soils would support biogeochemical processes (i. e. nutrient enrichment, sediment transport, pH, temperature), and increase the exchange of matter and energy between upland and wetland zones, enhancing the soil chemistry potential.

7.4.8 Variable 8 – Vegetation Structure and Complexity

The score for V8 increased from existing conditions (from 0.66 to 0.81). As part of the TSP, the effects from the modified banks and the re-vegetation of the gradual slopes are anticipated to directly benefit the stream's vegetative community. These effects also generate potential for an ecological lift of Reach 2, the native plantings and vegetation layers of the extended floodplain can provide habitat

availability for resident and transient wildlife (Stanford & Ward, 1996). The vegetation components of the TSP would support other system functions such as channel stabilization, sediment retention and high-flow attenuation.

7.4.9 FACWet Functional Capacity Indices

As part of the FACWet assessment method the variables are combined and accordingly weighted to calculate a functional score rating that depicts the capacity of a wetland area to perform a function relative to its reference standard (see Section 2.1.9).

1. Support of Characteristic Wildlife Habitats
The wildlife habitat characteristics FCI score increased from existing conditions (from 0.65 to 0.75). The TSP would increase the spatial extent of habitat availability. Although considered relatively small at the landscape scale, the score reflects benefits to the potential for habitat connectivity throughout the watershed and overall urban landscape. Post-construction improvements to the wetland's buffer through fill, seeding and planting methods would enhance the quality of the contributing area. These improvements in combination with a boost in hydrology would support complex vegetation communities and other key habitat requirements for wildlife use in an urban setting.

2. Support of Characteristic Fish/Aquatic Habitat
The FCI score for fish/aquatic habitat characteristics increased from existing conditions (from 0.61 to 0.75). The restoration measures implemented in Reach 1 would generate abatements to stressors such as depletion, augmentation or alteration to the quantity and timing of water delivery into Reach 2. In-stream structures together working in synergy with the re-vegetated banks can facilitate the distribution of flow through the constructed wetland and produce quality outflow into Reach 3, with the export of water and stream material towards downstream habitats. Improvements to the channel's geomorphology would also generate improvements to the chemical environment of the water column and saturated banks that are filtered through the newly constructed wetland.

3. Flood Attenuation
The FCI score for flood attenuation increased from existing conditions (from 0.62 to 0.75) as improvements in the water source and the buffer can enhance the quality of the contributing

area. With the TSP, the in-stream structures, bank modifications and upland fill would reform the geomorphology and improve the distribution of water and outflow into Reach 3 during flood events (Thomas *et al.* 2000). Additionally, the vegetation plantings and other established communities would produce conditions for flood attenuation processes that unfold in floodplains.

4. Short – and Long – Term Water Storage

The FCI score for water storage capacity increased from existing conditions (from 0.61 to 0.76). The improved conditions in Reach 1 together with a revamped contributing area would support water storage functions. In addition, in-stream structures, and improved banks, would reshape the landscape and optimize water flow towards downstream regions and for storage during high-water events. The wetland and riparian vegetation along the banks would create favorable conditions (e. g. intercepting rainfall, slowing down water flow, groundwater recharge) effectively acting as a natural sponge that gradually releases water and benefits Reach 2's capacity to store water.

5. Nutrient Toxicant Removal

The FCI score for the wetland's capacity to remove nutrient and toxicant improved from existing conditions (from 0.62 to 0.77), since the TSP is projected to increase the spatial extent of wetlands, improve the quality of the contributing area and the in-stream environment. The restoration measures of the TSP would activate filtration by vegetation, sediment trapping, chemical absorption onto soil particles and other processes that boost the mechanisms required to remove nutrients and toxins from a wetland system. Significant improvements to the geomorphology of Reach 2 would enhance the chemical conditions of the aquatic system as the fluvial system filters nutrient and toxins through the new constructed wetland.

6. Sediment Retention/Shoreline Stabilization

The FCI score for sediment retention/shoreline stabilization increased from existing conditions (from 0.64 to 0.81). Under the TSP, upgrading the geomorphology and vegetation complexity improves the formation of active para-fluvial zones which lead to long-term bank stabilization through sediment retention and vegetation establishment. On the upland side of the system, the newly revamped buffer zones surrounding the wetland would

contribute matter and energy into the stream system, boosting the input of material and the formation of sediment-heavy banks.

7. Production Export/Food Chain Support
The FCI score for the production export/food chain support increased from existing conditions (from 0.62 to 0.77). Under the TSP, the function and composition of the Spring Creek corridor would experience a degree of improvement which generates some benefit to the habitat connectivity potential between neighboring wetlands within the watershed. The increase in habitat availability under the TSP would boost the productivity of the riparian corridor and support the integrity of the system's trophic complexity.

8. Composite Score
The overall composite score corresponds to the average of all seven functional categories. Under the TSP, the Composite FCI score of the former wetland in Reach 2, increased (from 0.62 to 0.77) and improved from a 'Functioning Impaired' aquatic system to a 'Functioning' system per the FACWet functional category classification.

7.5 FACStream Results – FWP

The TSP design is to improve the ecological resilience and boost the overall health of the stream system, its associated riparian corridor and to a certain extent the surrounding area that contributes to the stream-riparian system. Under the TSP, improvements to riparian and stream habitat in Spring Creek would occur under ALT (2b, 1b, 3b). Table 11 provides a summary of the 10 variables and their associated scores. As noted in Section 2b, the watershed and stream scale variables comprise 35% each of the weighted score while the riparian scale variables account for 30% of the total weighted score. The variables associated with the hydraulic regime are the single greatest driver of the FCIs. Reach 1 FCI scored 0.50 (an increase from existing conditions FCI score of 0.34 Existing Conditions) and received a letter grade of "C" (an increase from a "D" letter grade). Reach 2 FWP FCI scored a 0.54 (an increase from existing conditions FCI of 0.36) and received a letter "C" (an increase from a "- D" letter grade). Reach 3 FWP FCI scored 0.42 (an increase from existing conditions FCI of 0.30) and received a letter grade of "C-" (an increase from a "D" letter grade).

Table 17 FACStream "Report Card" for the three reaches within the Spring Creek study area. Note that FCI scores are extrapolated to a 0.00 to 1.00 scale, with 1.00 being optimal and 0.00 being completely non-functional.

SCALE	VARIABLES	REACH 1b	REACH 2b	REACH 3b
Watershed	(Vhyd) Flow Regime	C-	C-	C
	(Vsed) Sediment Regime	C	D+	C
	(Vchem) Water Quality	B	B	B
Riparian	(Vcon) Floodplain Connectivity	C-	B	D
	(Vveg) Riparian Vegetation	C	C	D+
	(Vdeb) Debris	C+	C+	C-
Stream	(Vmorph) Stream Morphology	D	C	D-
	(Vstab) Stability	C	C-	D
	(Vstr) Physical Structure	C-	C	D
	(Vbio) Biotic Structure	C+	B-	C
OVERALL REACH CONDITION SCORE		**C**	**C**	**C-**
(Biology Functions FCI)		0.52	0.56	0.46
(Physiochemical Functions FCI)		0.54	0.58	0.50
(Geomorphology Functions FCI)		0.46	0.48	0.38
(Hydraulic Functions FCI)		0.44	0.54	0.36
COMPOSITE FUNCTIONAL CAPACITY INDEX SCORE		**0.50**	**0.54**	**0.42**
DEGREE OF IMPARIMENT		**Significant**	**Significant**	**Severe**

The Plan aims to enhance riparian habitat by restoring and re-vegetating the stream banks, transforming previously degraded or low-quality areas towards an improved and significantly suitable condition. This process involves removing non-native or unsuitable vegetation and replanting the area with a diverse mix of native species, including cottonwood and willow trees, shrubs, and herbaceous plants adapted to the local environment. Notably, the targeted areas for re-vegetation were not previously considered viable habitat, making this effort a significant contribution to increasing habitat availability and ecological function. An enhancement of the

Spring Creek corridor can generate and increase various forms of value (Jepson *et al.* 2017), establishing a public asset for the City of Colorado Springs.

In Reach 1, the focus is on bank stabilization, using boulders and plantings to prevent erosion, as well as removing invasive species and creating a scenic sitting area with a picnic table. Moving downstream, Reach 2 (the former wetland) involves the construction of two rock riffles to counter incision, as well as the creation of wetland areas through bank modifications and replanting of riparian zones. Additionally, an incised former channel will be filled, and access paths will be created to facilitate maintenance and visitor access. In Reach 3, the west bank will undergo significant modifications, including the removal of a concrete slab, slope modification, and the addition of riprap and plantings to stabilize the stream and enhance habitat. The project also includes the installation of a constructed rock riffle and instream habitat boulders to further support ecosystem function. Ultimately, these restoration measures aim to improve stream and riparian zone function as part of the Fountain watershed corridor system but also provide numerous benefits to the surrounding communities, highlighting the importance of collaborative conservation efforts.

7.5.1 Watershed Scale Variables

The Flow Regime (Vhyd) was calculated by averaging the total volume, peak flows, base flows and flow variability sub-variables to produce an overall calculated letter grade of "C-" for Reaches 1, 2, and a "C" for Reach 3. Under the TSP, Vhyd remains generally consistent with Existing Conditions since stressors are expected to continue impacting the greater watershed and affecting the total volume of water delivery into Spring Creek. The variation of flow depletions and augmentations would remain between 5-15% of the total annual volume and base flows to remain decreased by 10-20%. Under the TSP, flow variability in Reach 2 and Reach 3 would improve, produced by the enhancements in flow-patterns from Reach 1.

The Sediment Regime (Vsed) was calculated by averaging the three sub-variables together to produce an overall letter grade "C-" for Reach 1, "D+" for Reach 2 and "D+" for Reach 3 (an increase from Existing Conditions for all 3 reaches). Under the TSP, the combination of measures would improve the rate of land erosion, channel erosion and the mechanisms that

sustain a balanced sediment regime (Thomas *et al.* 2000). Although the highest areas of the project's footprint would continue to experience some form of land erosion, excavated material will be strategically placed as fill on these upland areas. This is anticipated to improve the rate of surface erosion, by boosting the soil conditions and improving land-surface erosion. The current degree of channel erosion would experience significant improvement from the bank stabilization techniques, which are anticipated to reduce high amounts of sediment input from severe erosion events.

In addition, the TSP is anticipated to reduce human-caused erosion by discouraging displaced-people from occupying/camping on the high slopes and banks. This would allow for the natural re-vegetation of previously disturbed patches and regeneration of bank soils and other para-fluvial elements. Such forms of ground stabilization in stream systems are often a prerequisite for a healthy sediment regime (Stanley *et al.* 1991; Hauer *et al.* 2016). Although the majority of the contributing watershed is urbanized, and impediments will continue to obstruct the sediment transport process that feed into Spring Creek the continuity of sediment through all Reaches is expected to improve at the Reach scale, supported by the in-stream boulder clusters that create diversity in flow paths/speed which can also be translated to the creation of sediment deposition/transport patches within the stream.

The Water Quality (Vchem) did not change from Existing Conditions and all three reaches maintained a score of "B" letter grade. Under the TSP, water quality would not significantly improve from Existing Conditions, but would maintain a score of "B", instead of continued degradation of FWOP. Although the TSP's hydrologic enhancements in combination with a boost in the riparian zone would improve the stream's temperature regime and the input of metabolic agents (i. e. organic carbon, dissolved O), the surrounding urban runoff (aka "urban drool) would inhibit a significant improvement to the stream's water quality.

7.5.2 Riparian Scale Variables

The Floodplain connectivity (Vcon) scored a letter grade of "C-" for Reach 1, "B" for Reach 2, and "D" for Reach 3. Under the TSP, the floodplain's width would increase by 35-40%, enhancing the rate of saturation frequency and saturation duration for all three Reaches. With an improved bank-height ratio, the floodplain would experience saturation every 1.0-1.5 year,

instead of a return interval of 5-10 years that occurs under Existing Conditions. Floodplain hydroperiods (days per year of soil saturation) are anticipated to exceed the 14 consecutive days per year during growing conditions, however watershed stressors from the surrounding urban core could continue to exacerbate periods of uncharacteristic dry conditions.

The Riparian Vegetation (Vveg) scored "C" in Reach 1, "C" in Reach 2 and a "D+" in Reach 3. The TSP would significantly increase the woody and herbaceous vegetation cover (i. e. 90% increase in woody and 40% increase in herbaceous), but stressors from the surrounding urban environment would continue to influence one or two structural characteristics of the outer riparian perimeter. The improvement in riparian vegetation, would establish a root structure and roughness, which stabilizes banks and generates conditions that are suitable for the productivity of organisms. The TSP is anticipated to establish a robust assemblage of riparian flora that interact with each other and with elements of the floodplain environment and would boost plant species diversity by 20%.

The Debris Supply (Vdeb) was calclulated by averaging (LWD) and detritus sub-variables to produce a letter grade of "C+" for Reach 1 and Reach 2, and "C-" for Reach 3. Under the TSP, an abundance of vegetation would increase the input of organic debris into the stream, with the potential for the in- stream structures to capture woody complexes. The effects of measures are anticipated to increase the volume of detritus and LWD by 60%, thus influencing the stream's structure (e. g. cover, shading, water velocity) and creating foundations for an aquatic food-web.

7.5.3 Reach Scale Variables

The stream's Morphology (Vmorph) was calculated by averaging the sub-variables stream evolution, planform, dimension, and profile to produce an overall letter grade of "D" for Reach 1, "C" for Reach 2, and "D" for Reach 3. Under TSP, the width-depth ratio is anticipated to improve and favor conditions of increase stability. The effects of stability would enhance the dynamics and equilibrium between hydraulics and sediment (Thomas *et al.* 2000), and the stream's response to biologic agents such as the establishment of vegetation and habitat use by wildlife. However, Spring Creek occurs in an urban setting, which inhibits anastomosis of the stream and eliminates the potential for high degree of meanders, significant stream widening or drastic changes in the stream's slope or gradient.

Stream Stability (Vstab) was calculated by averaging the dynamic equilibrium and resilience sub- variables together to produce an overall letter grade of "C" for Reach 1, "C-" for Reach 2 and "D" for Reach 3. Under the TSP, the channel bed and banks would be stronger than the forces that could act upon them. Although stressors will persist from the surrounding environment, the patterns of deposition, scour, and sediment transport will be highly improved under the TSP, indicating that the geomorphology of Spring Creek would be maintained over time.

The stream's Physical Structure (Vstr) was calculated by averaging hydraulic structure, and coarse/fine substrate scale sub-variables together to produce an overall letter grade of "C" for Reach 1, "C" for Reach 2 and "D" for Reach 3. Under the TSP, a 50% increase in heterogeneity of the stream's physical structure is anticipated. The effects of heterogeneity create diverse velocities and depths and can produce patches of both coarse and fine scale stream beds that support a healthy water column. A diversity in sediment gradation can provide healthy substrates required for organism establishment such as aquatic invertebrates.

The overall letter grade for Biotic Structure (Vbio) was "C-" for Reach 1, "B+" for Reach 2, and "C" for Reach 3. Under the TSP, an improved geomorphic condition in combination with an increase in riparian vegetation is anticipated to provide a 25% boost in the taxonomic groups that make up the stream's biotic structure. Although significant stressors persist and encroach from the surrounding urban core, the TSP would provide an increase in overall biomass, species diversity, the distribution of age and population structure and the development of functional guilds. The newly improved landscape produces topographic diversity that favors the development of ecological niches that attract key stream and riparian organisms (Stanford & Ward, 1996).

7.5.4 FACStream Functional Condition Scores

Biology Function
The function is a combination fo Vhyd (weighted 20%), Vchem (15%), Vcon (10%), Vveg (10%), Vdeb (5%), Vstab (10%) Vstr (10%) and Vbio (20%). This function scored 0.52 for Reach 1, 0.56 for Reach 2 and 0.46 for Reach 3 (existing conditions were 0.36, 0.18 and 0.28, respectively). The increase in score under the TSP, reflects effects of improvement in the

stream's hydrologic regime over a wider and revamped floodplain, producing benefits to the habitat structure, encouraging wildlife use and the potential for trophic interactions.

Physiochemical Function

The physiochemical function is a combination of Vhyd (weighted 15%), Vsed (5%), Vchem (25%), Vcon (10%), Vveg (10%), Vdeb (5%), Vstab (5%), Vstr (5%) and Vbio (20%). This function scored 0.54 for Reach 1, 0.58 for Reach 2 and 0.50 for Reach 3 (existing conditions were 0.42, 0.44 and 0.38, respectively). The score reflects the effect of the TSP that improvement in the transfer of matter and energy within the Spring Creek ecosystem.

Geomorphology Function

The geomorphology function is a combination of Vhyd (weighted 15%), Vsed (15%), Vcon (10%), Vveg (15%), Vdeb (10%), Vmorph (10%), Vstab (15%) and Vstr (5%). This function scored 0.46 for Reach 1, 0.48 for Reach 2 and 0.38 for Reach 3 (existing conditions were 0.32, 0.30 and 0.24, respectively). The TSP would produce effects that reinforce the interactions between hydraulics sediment and biota, fostering equilibrium in the stream's profile and setting trends towards a stable condition.

Hydraulic Function

This function is a combination of Vhyd (weighted 30%), Vcon (30%), Vveg (5%), Vmorph (10%), Vstab (10%) and Vstr (15%). This function scored 0.44 for Reach 1, 0.54 for Reach 2 and 0.36 for Reach 3 (existing conditions were 0.28, 0.34 and 0.22, respectively). Under the TSP, the flow regime and connectivity to the floodplain would improve and would create hydraulic potential over a larger area. This would allow water into areas that are currently dry to interact and influence biotic/abiotic components of the floodplain that have been previously lost.

Composite Score

Composite FCIs for Reaches 1, 2 and 3 were 0.50, 0.54 and 0.42. Under the TSP, the total ecological lift of the project would improve by nearly 20% in the FWP condition at year 50,

compared to today's existing condition. The FWP-year 50 compared to FWOP-year 50 would improve by 34%. A total of 17.6 acres of wetland and riparian habitat would be restored along the Spring Creek corridor and nearly 0.75 miles of stream length of degraded aquatic habitat would experience improvement.

8 Habitat Unit Calculation – FWP

The composite FCI may be multiplied by the existing habitat within the reach to provide a baseline quantifiable HU. HUs were calculated by multiplying the area of existing riparian habitat acreages by the composite FCI. It is these baseline HUs with which the Corps will try to improve upon with-project conditions. Model outputs like the composite FCI, which were calculated based on the departure from the refence standard condition, were utilized to qualitatively assess the various ALTs. This qualitative output was then multiplied by an alternative's project footprint, measured in acres. This value is a quantified measure of environmental output, known as a HU, where the difference between future HUs without management measures (FWOP) and future habitat units with management measurements (FWP/TSP) equals the habitat units produced by the alternative (USACE, 1995). The HUs are annualized over the 50-year period of analysis to calculate the AAHUs. This metric represents the mean annual ecological output or functional gain that the project area is expected to contribute under each FWP condition scenario, serving as a standardized measure of environmental benefit over time.

Using the FACStream, current existing conditions for Reach 1 contain 0.59 HUs, Reach 2 contains 3.11 HUs and Reach 3 contains 0.45 HUs. The 50-year FWP/TSP life period assumes Reach 1 to improve to contain 0.87 HUs (+0.28 HUs, a 47% increase), Reach 2 to improve to contain 4.67 HUs (+1.56 HUs, a 50% increase), and Reach 3 to improve to contain 0.63 HUs (+0.18 HUs, a 40% increase) as a result of implementing the TSP. Table 18 and Table 19 summarize the FACStream model output and its corresponding HUs. Using the FACWet, current conditions for Reach 2 contain 4.04 HUs. The 50-year FWP/TSP life period assumes Reach 2 to improve to contain 5.02 HUs (+0.98 HUs, a 24% increase). Table 20 summarizes the FACWet model output and its corresponding HUs. FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

*Table 18 Summary of FACStream model output (Composite FCI) with corresponding HUs for Reaches 1, 2 and 3. HUs are calculated by multiplying area by FCI (Area*FCI= HU).*

FACStream						
REACH	REACH Existing Conditions		REACH FWOP		REACH FWP/TSP	
	Composite FCI	Area*FCI = (HU)	Composite FCI	Area*FCI = (HU)	Composite FCI	Area*FCI = (HU)
Reach 1 Assessment Area (1.74 ac)	0.34	**0.59**	0.18	**0.31**	0.50	**0.87**
Reach 2 Assessment Area (8.65 ac)	0.36	**3.11**	0.20	**1.73**	0.54	**4.67**
Reach 3 Assessment Area (1.51 ac)	0.30	**0.45**	0.16	**0.24**	0.42	**0.63**

Table 19 Habitat Unit Calculation for FWP/TSP and difference compared to Existing Conditions for the Spring Creek Riparian Corridor using FACStream.

FACStream Alternative Comparison				
Spring Creek Reach (Assessment Area)	**Alternatives (ALTs)**	**Habitat Units (HU)**	**HU difference compared to FWOP**	**% increase compared to FWOP**
Reach 1 (1.74 ac)	Existing Conditions (EO)	0.59	+ 0.28	+ 47%
	FWOP / No-Action Alternative	0.31	N/A	N/A
	Reach 1B (FWP/TSP)	0.87	+ 0.56	+ 64%
Reach 2 (8.65 ac)	Existing Conditions (EO)	3.11	+ 1.38	+ 44%
	FWOP / No-Action Alternative	1.73	N/A	N/A
	Reach 2B (FWP/TSP)	4.67	+ 2.94	+ 63%
Reach 3 (1.51 ac)	Existing Conditions (EO)	0.45	+ 0.21	+ 48%
	FWOP / No-Action Alternative	0.24	N/A	N/A
	Reach 3B (FWO/TSP)	0.63	+ 0.39	+ 62%

Table 20 Habitat Unit Calculation for Reach 2 (Former Wetland) using FACWet. FACWet is not used during the CE/ICA but it is considered during the option-comparison process for Reach 2 (between Options 2a and 2b).

FACWet Alternative Comparison				
Spring Creek (Assessment Area)	**Alternatives (ALTs)**	**Habitat Units (HU)**	**HU difference compared to FWOP**	**% increase compared to FWOP**
Reach 2 (6.53 ac)	Existing Conditions (EO)	4.04	+ 0.26	+ 5%
	FWOP / No-Action Alternative	3.78	N/A	N/A

	Reach 2B (FWP/TSP)	5.02	+ 1.24	+ 25%

Table 21. Summary of HUs per each alternative, including the incremental years and corresponding AAHU.

Alternative	Existing Conditions HU (2024)	FWOP HU	HU Year 1 (2025)	HU Year 10 (2034)	HU Year 20 (2044)	HU 50 Year (2074)	AAHU
No Action	4.15	2.28	4.12	3.62	3.14	2.28	3.040
Alt 1 - 2a	4.15	2.28	4.19	4.2	4.22	4.23	4.174
Alt 2 - 2b	4.15	2.28	4.3	4.4	4.5	4.67	4.467
Alt 3 - 2a, 1a	4.15	2.28	4.27	4.48	4.6	5.09	4.645

Alt 4 - 2a, 1b	4.15	2.28	4.28	4.5	4.64	5.19	4.697
Alt 5 - 2a, 1c	4.15	2.28	4.3	4.56	4.71	5.25	4.755
Alt 6 - 2b, 1a	4.15	2.28	4.34	4.64	4.85	5.44	4.887
Alt 7 - 2b, 1b	4.15	2.28	4.34	4.66	4.87	5.54	4.929
Alt 8 - 2b, 1c	4.15	2.28	4.36	4.66	4.88	5.60	4.953
Alt 9 - 2a, 3a	4.15	2.28	4.28	4.56	4.64	4.92	4.626
Alt 10 - 2a, 3b	4.15	2.28	4.28	4.58	4.67	4.95	4.647
Alt 11 - 2b, 3a	4.15	2.28	4.34	4.64	4.81	5.27	4.821
Alt 12 - 2b, 3b	4.15	2.28	4.34	4.62	4.87	5.30	4.850
Alt 13 - 2a, 1a, 3a	4.15	2.28	4.3	4.6	4.76	5.69	4.915
Alt 14 - 2a, 1b, 3a	4.15	2.28	4.3	4.61	4.78	5.79	4.955
Alt 15 - 2a, 1c, 3a	4.15	2.28	4.3	4.61	4.8	5.85	4.982
Alt 16 - 2b, 1a, 3a	4.15	2.28	4.37	4.67	4.92	6.04	5.105
Alt 17 - 2b, 1b, 3a	4.15	2.28	4.36	4.68	4.92	6.14	5.135
Alt 18 - 2b, 1c, 3a	4.15	2.28	4.37	4.68	4.93	6.20	5.159

Alt 19 - 2a, 1a, 3b	4.15	2.28	4.31	4.6	4.87	5.72	4.969
Alt 20 - 2a, 1b, 3b	4.15	2.28	4.31	4.61	4.88	5.82	5.005
Alt 21 - 2a, 1c, 3b	4.15	2.28	4.33	4.61	4.88	5.88	5.025
Alt 22 - 2b, 1a, 3b	4.15	2.28	4.37	4.67	4.93	6.07	5.117
Alt 23 - 2b, 1b, 3b	4.15	2.28	4.37	4.7	4.98	6.17	5.173
Alt 24 - 2b, 1c, 3b	4.15	2.28	4.41	4.74	5.06	6.23	5.234

Table 22. Summary of acres, FCI, HUs and AAHU for each alternative and each scenario.

Alternative	Acres	FCI	EC HU	FWOP HU	FWP HU	AAHU
No Action	11.90	0.54	4.15	2.28	N/A	3.040
Alt 1 - 2a	8.65	0.50	4.15	2.28	4.87	4.174
Alt 2 - 2b	8.65	0.54	4.15	2.28	5.22	4.467
Alt 3 - 2a, 1a	10.39	0.94	4.15	2.28	5.32	4.645
Alt 4 - 2a, 1b	10.39	1.0	4.15	2.28	5.43	4.697
Alt 5 - 2a, 1c	10.39	1.04	4.15	2.28	5.49	4.755
Alt 6 - 2b, 1a	10.39	0.98	4.15	2.28	5.67	4.887
Alt 7 - 2b, 1b	10.39	1.04	4.15	2.28	5.78	4.929
Alt 8 - 2b, 1c	10.39	1.08	4.15	2.28	5.84	4.953
Alt 9 - 2a, 3a	10.16	0.90	4.15	2.28	5.23	4.626
Alt 10 - 2a, 3b	10.16	0.92	4.15	2.28	5.26	4.647
Alt 11 - 2b, 3a	10.16	0.94	4.15	2.28	5.58	4.821
Alt 12 - 2b, 3b	10.16	0.96	4.15	2.28	5.61	4.850
Alt 13 - 2a, 1a, 3a	11.90	1.34	4.15	2.28	5.68	4.915
Alt 14 - 2a, 1b, 3a	11.90	1.40	4.15	2.28	5.79	4.955
Alt 15 - 2a, 1c, 3a	11.90	1.44	4.15	2.28	5.85	4.982

Alt 16 - 2b, 1a, 3a	11.90	1.38	4.15	2.28	6.03	5.105
Alt 17 - 2b, 1b, 3a	11.90	1.44	4.15	2.28	6.14	5.135
Alt 18 - 2b, 1c, 3a	11.90	1.48	4.15	2.28	6.20	5.159
Alt 19 - 2a, 1a, 3b	11.90	1.36	4.15	2.28	5.71	4.969
Alt 20 - 2a, 1b, 3b	11.90	1.42	4.15	2.28	5.82	5.005
Alt 21 - 2a, 1c, 3b	11.90	1.46	4.15	2.28	5.88	5.025
Alt 22 - 2b, 1a, 3b	11.90	1.40	4.15	2.28	6.06	5.117
Alt 23 - 2b, 1b, 3b	11.90	1.46	4.15	2.28	6.17	5.173
Alt 24 - 2b, 1c, 3b	11.90	1.50	4.15	2.28	6.23	5.234

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