

The Functional Assessment of Floodplain Health: A Regulatory Tool to Protect the Natural and Traditional Character of Waterways



Natural and Traditional Character

Chapter 25-7 - Drainage

§ 25-7-61 - CRITERIA FOR APPROVAL OF DEVELOPMENT APPLICATIONS

(5) the proposed development:

- a) will not result in additional adverse flooding impact on other property;
- b) To the greatest extent feasible, preserves the natural and traditional character of the land and the waterway located within the 100-year floodplain;
- c) except as provided by Subsection (B), includes on-site control of the two-year peak flow, as determined under the Drainage Criteria Manual and the Environmental Criteria Manual;
- d) will not result in additional erosion impacts on other property; and
- e) locates all proposed improvements outside the erosion hazard zone, unless protective works are provided as prescribed in the Drainage Criteria Manual.



Natural and Traditional Character



CITY OF AUSTIN

WATERSHED PROTECTION DEPARTMENT



Natural and Traditional Character



CITY OF AUSTIN

WATERSHED PROTECTION DEPARTMENT



2013 Watershed Protection Ordinance

§ 25-8-364 - FLOODPLAIN MODIFICATION.

(A) Floodplain modification within a critical water quality zone is prohibited except as allowed under Section 25-8-261 (Critical Water Quality Zone).

(B) Floodpl...

(C) Floodpl...

(1) is

(2) wo

(3) is

(4) is

(D) Floodpl...

(1) be

(2) en

(3) re

(4) co

(E) If mitigat...

(1) pa

(2) tra

(a)

(b)

(c)

1.7.0 - FLOODPLAIN MODIFICATION CRITERIA

1.7.1 - Introduction

These guidelines s...

- preservin
- encourag
- preventin
- encourag
- restoring

The guidelines ap... Whenever a mod... development perm... ordinances, inclu... Development Cod... no adverse floodin...

Naturally functioni... pollutants, and pro... riparian corridors... of floodplains area... quality. Also, by p... aquatic habitats, in...

Source: [Rule No. R...](#)

1.7.2 - Code Require

A. Critical Wate

The Critical Wate... Development Cod

A Critical Water Q

Appendix X: Functional Assessment of Floodplain Health

Introduction: The Functional Assessment was developed by a cross-discipline team of ecologists, engineers, statisticians, and po... provide a simple, accurate, and locally-derived tool to assess specific functional characteristics of three discrete units: the floodpl... Quality Zone (CWQZ), the Critical Water Quality Zone, and the active channel. For more detail on the regulatory requirements fo... 1.7.0 (*Floodplain Modification Criteria*) of this manual.

A 100 meter transect length will be the base unit for this assessment, which is consistent with other stream assessment tools. H... the area being modified, the heterogeneity of the system, and other variables, the measurement unit can vary, as long as the ra... defined in the application process. These tools will be utilized to assess floodplains with modifications proposed as well as to ass... Zone and/or the active channel before they are restored. These tools will also be used post-restoration to assess the successful... required in the Critical Water Quality Zone and/or the active channel.

The measures selected for the Zone 1 assessment tool are based primarily on riparian vegetation, but also include soil compacti... of a City of Austin-developed tool called the Riparian Functional Assessment (RFA), which is currently used by the Watershed Pr... riparian zone assessments citywide. The Zone 1 assessment will require a tape measure, a soil compaction meter, and some exp... assessment methods. For a 100 meter transect, the assessment should take about 1 hour, but ultimately will depend on the age... The more degraded the site, the faster the assessment will go. If the assessment needs to be performed between November and... be performed by staff from the Watershed Protection Department, due to a seasonal lack of vegetation.

The measures selected for the Zone 2 assessment are also taken from the Riparian Functional Assessment and are intended to r... characteristics of riparian vegetation plus a measure of soil compaction. The Zone 2 assessment will use the same field instrume... approximately 1.5 hours for a 100 meter reach of a stream. Again, this will depend on the age and structure of the riparian com... to be performed between November and February, the assessment may be performed by staff from the Watershed Protection... lack of vegetation.

The Zone 3 assessment includes riparian measures along the immediate banks and overbank, geomorphic characteristics includ... characteristics, and in-stream aquatic habitat characteristics. The majority of the measures for the Zone 3 assessment were deri... tools developed by the U.S. Forest Service (Pfankuch 1975) and the Environmental Protection Agency (Barbour et al. 1999), but... from the Riparian Functional Assessment and geomorphic measures developed by the EPA (Harman et al. 2012) and the Waters... Zone 3 assessment may be performed by staff from the Watershed Protection Department and is required when a proposed sit...



25-8-364 - Floodplain Modification

Floodplain modification is prohibited unless –

- 1) Necessary to protect public health and safety



Unsafe



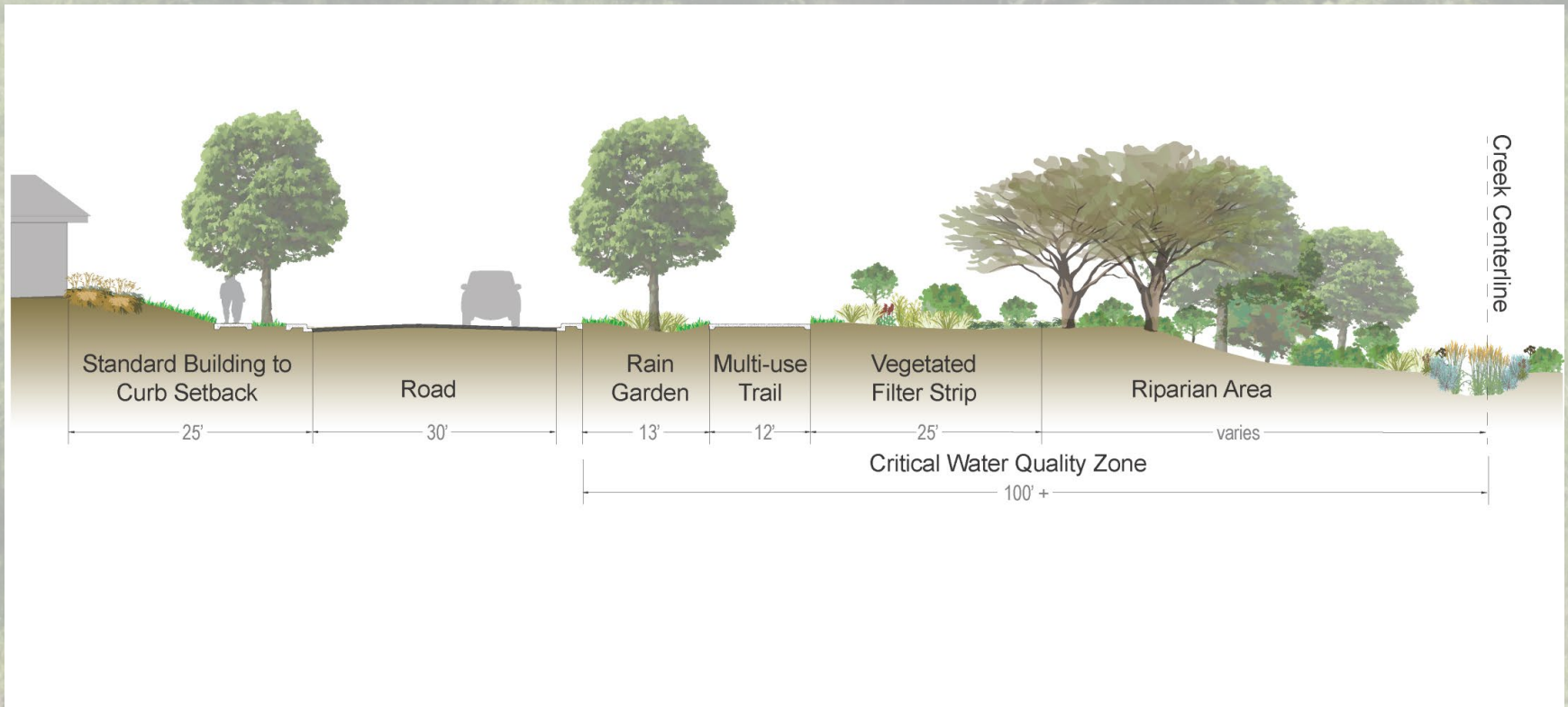
Safe



25-8-364 - Floodplain Modification

Floodplain modification is prohibited unless –

- 2) Necessary for development permitted in the Critical Water Quality Zone



25-8-364 - Floodplain Modification

Floodplain modification is prohibited unless –

- 3) Provides significant, demonstrable environmental benefit



Poor Condition



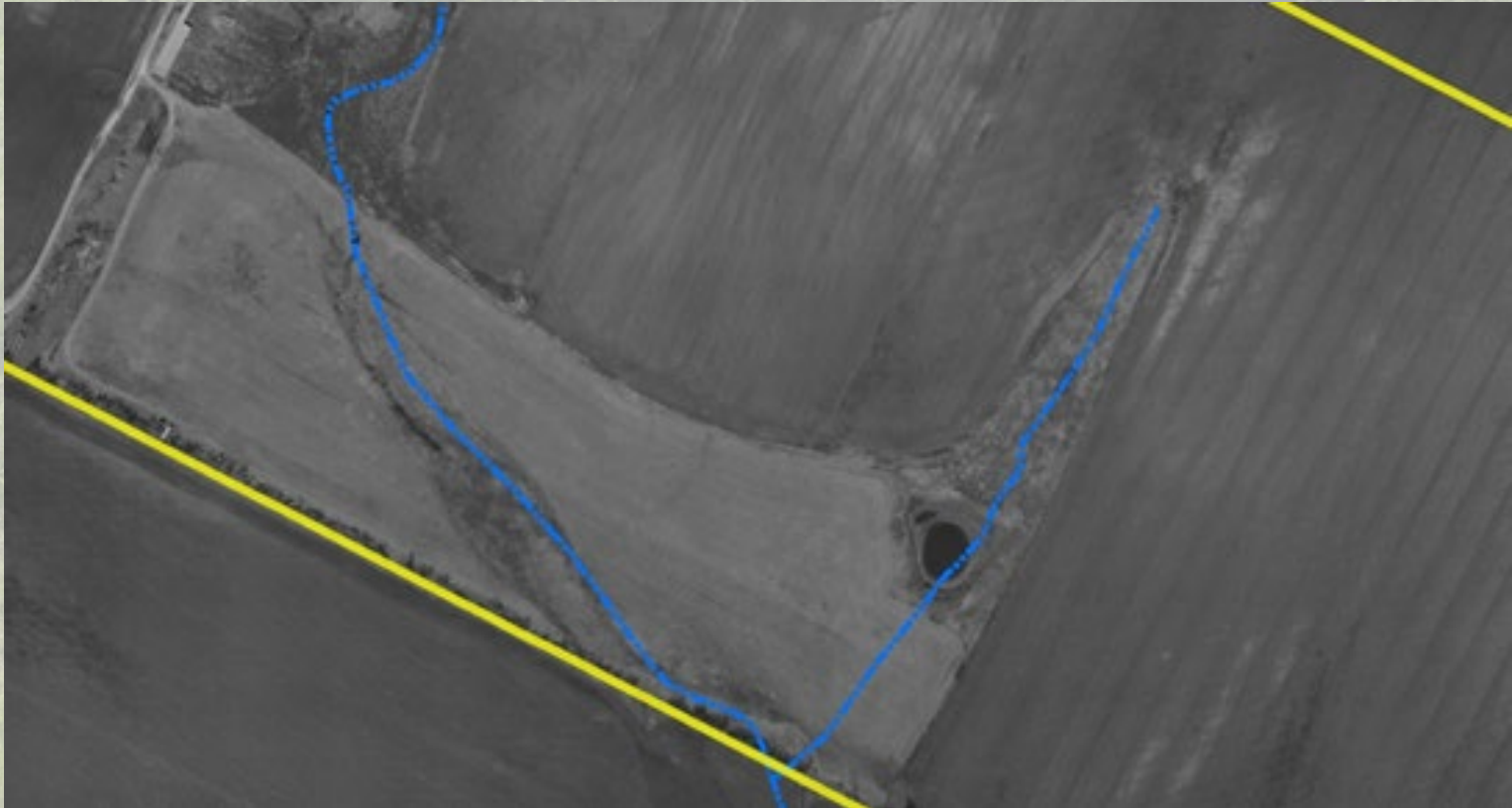
Restored - Good Condition



25-8-364 - Floodplain Modification

Floodplain modification is prohibited unless –

- 4) Floodplain is outside of the Critical Water Quality Zone and in FAIR or POOR condition.



ECM Appendix X Functional Assessment of Floodplain Health

Zone 1

Zone 2

Zone 3

100-yr outside
of CWQZ

Critical Water
Quality Zone

Active
Channel

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Functional Assessment of Floodplain Health

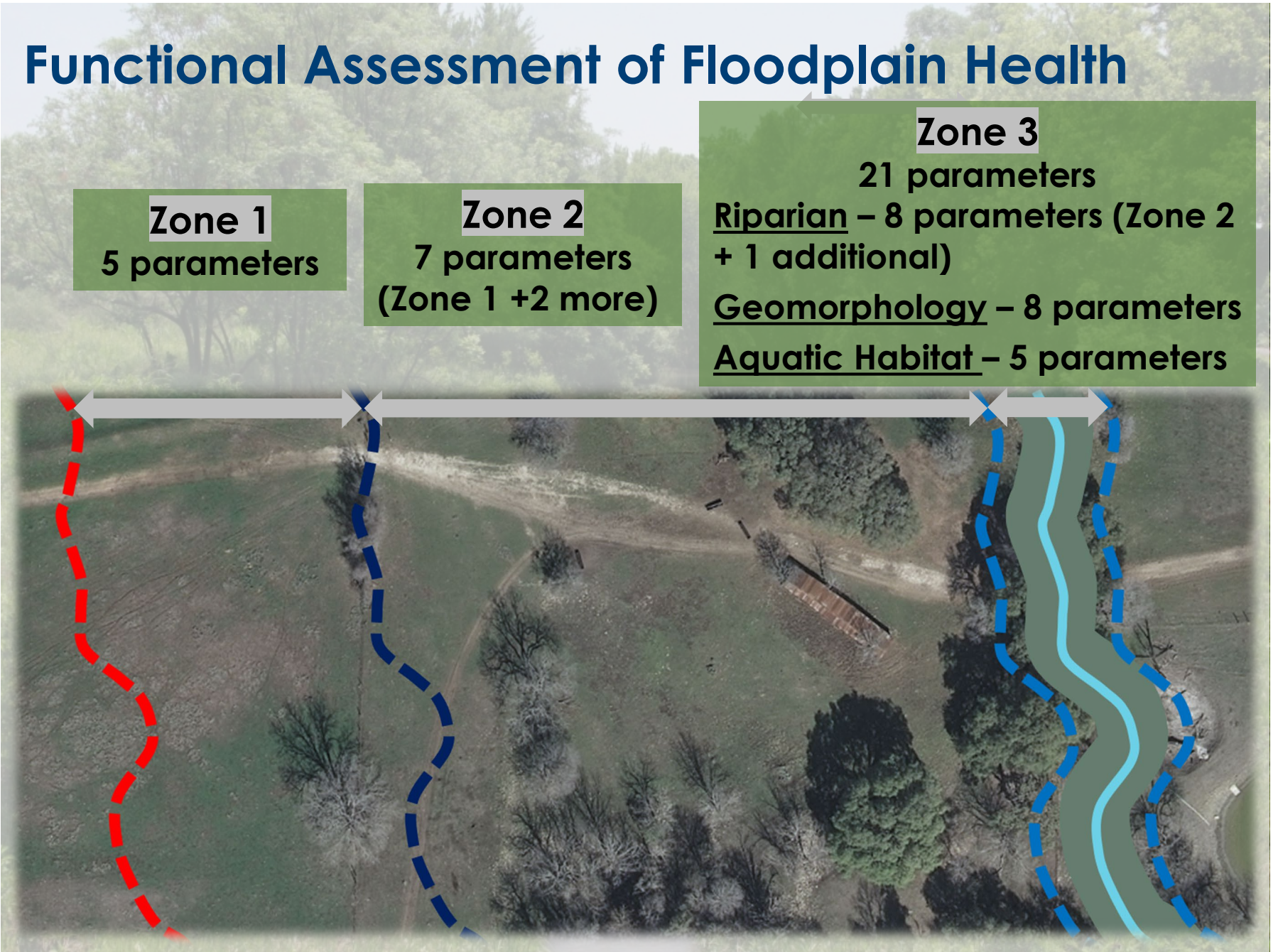
Zone 1
5 parameters

Zone 2
7 parameters
(Zone 1 + 2 more)

Zone 3
21 parameters
Riparian – 8 parameters (Zone 2 + 1 additional)
Geomorphology – 8 parameters
Aquatic Habitat – 5 parameters

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Zone 1 – Floodplain

Scoring: Zone 1 – Floodplain Health

Site/Project Name: _____

Date: _____ Time: _____

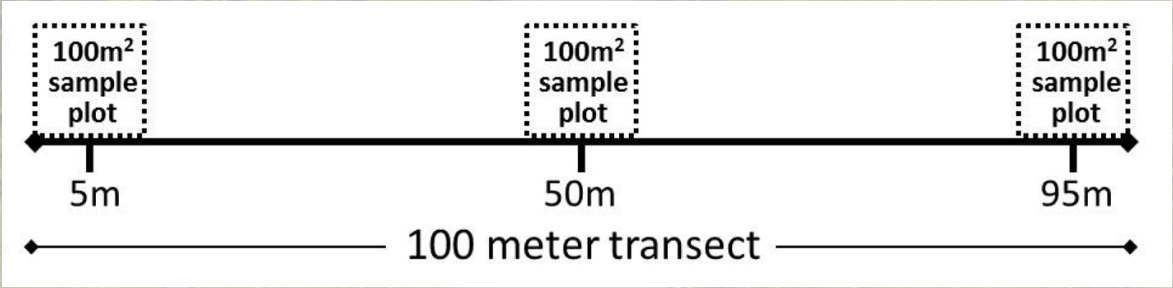
Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Gap Frequency <i>A visual assessment of the number of gaps in vegetation.</i>	0 - 20% of area has visual gaps in vegetation	20% - 40% of area has visual gaps in vegetation	40 - 60% of area has visual gaps in vegetation	> 60% of area has visual gaps in vegetation	
Large Woody Debris <i>An evaluation of the amount of large woody debris.</i>	7 or more pieces of large woody debris	5 - 6 pieces of large woody debris	3 - 4 pieces of large woody debris	2 or less pieces of large woody debris	
Soil Compaction <i>An assessment of the bulk density of the soil.</i>	0 - 125 pounds per square inch	126 - 175 pounds per square inch	176 - 225 pounds per square inch	> 225 pounds per square inch	
Structural Diversity <i>An evaluation of the canopy and understory vegetation.</i>	> 65% canopy; or > 50% canopy and > 50% understory	51 - 65% canopy; or 0 - 50% canopy and > 40% understory	31 - 50% canopy; or 0 - 30% canopy and > 30% understory	0 - 30% canopy; or 0 - 15% canopy and 0 - 30% understory	
Tree Demography <i>An assessment of the age class distribution of all canopy tree species.</i>	Canopy tree species are present in all 4 age classes	Canopy tree species are present in 3 of 4 age classes	Canopy tree species are present in 2 of 4 age classes	Canopy tree species are present in only 1 age class or no trees	

Assessed Condition (Circle One) **Excellent: 18 - 20** **Good: 13 - 17** **Fair: 8 - 12** **Poor: 5 - 7**

Zone 1 Score: _____



Zone 2 – CWQZ

Scoring: Zone 2 – Critical Water Quality Zone

Site/Project Name: _____

Date: _____ Time: _____

Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Gap Frequency <i>A visual assessment of the number of gaps in vegetation.</i>	0 - 20% of riparian area has visual gaps in vegetation	20% - 40% of riparian area has visual gaps in vegetation	40 - 60% of riparian area has visual gaps in vegetation	> 60% of riparian area has visual gaps in vegetation	
Large Woody Debris <i>An evaluation of the amount of large woody debris.</i>	7 or more pieces of large woody debris	5 - 6 pieces of large woody debris	3 - 4 pieces of large woody debris	2 or less pieces of large woody debris	
Soil Compaction <i>An assessment of the bulk density of the soil.</i>	0 - 125 pounds per square inch	126 - 175 pounds per square inch	176 - 225 pounds per square inch	> 225 pounds per square inch	
Structural Diversity <i>An evaluation of the canopy and understory vegetation.</i>	> 65% canopy; or > 50% canopy and > 50% understory	51 - 65% canopy; or 0 - 50% canopy and > 40% understory	31 - 50% canopy; or 0 - 30% canopy and > 30% understory	0 - 30% canopy; or 0 - 15% canopy and 0 - 30% understory	
Tree Demography <i>An assessment of the age class distribution of all canopy tree species.</i>	Canopy tree species are present in all 4 age classes	Canopy tree species are present in 3 of 4 age classes	Canopy tree species are present in 2 of 4 age classes	Canopy tree species are present in only 1 age class or no trees	
Wetland Tree Status <i>Percent of total trees that are defined as FAC+ or greater with respect to wetland status.</i>	> 65% of trees are FAC+ or greater	50 - 65% of trees are FAC+ or greater	25 - 49% of trees are FAC+ or greater	< 25% of trees are FAC+ or greater	
Riparian Zone Width <i>A measure of the width of the undisturbed riparian zone.</i>	> 18 meters or > 75% of the CWQZ	12 - 18 meters or 50 - 75% of the CWQZ	6 - 12 meters or 25 - 49% of the CWQZ	< 6 meters or < 25% of the CWQZ	

Zone 2 Score: _____

Assessed Condition (Circle One)

Excellent: 25 - 28

Good: 18 - 24

Fair: 11 - 17

Poor: 7 - 10



Zone 3 – Active Channel (Riparian)

Scoring: Zone 3 – Active Channel

Riparian Zone

Site/Project Name: _____

Date: _____

Time: _____

Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Gap Frequency <i>A visual assessment of the number of gaps in vegetation.</i>	0 - 20% of riparian area has visual gaps in vegetation	20% - 40% of riparian area has visual gaps in vegetation	40 - 60% of riparian area has visual gaps in vegetation	> 60% of riparian area has visual gaps in vegetation	
Large Woody Debris <i>An evaluation of the amount of large woody debris.</i>	7 or more pieces of large woody debris	5 - 6 pieces of large woody debris	3 - 4 pieces of large woody debris	2 or less pieces of large woody debris	
Soil Compaction <i>An assessment of the bulk density of the soil.</i>	0 - 125 pounds per square inch	126 - 175 pounds per square inch	176 - 225 pounds per square inch	> 225 pounds per square inch	
Structural Diversity <i>An evaluation of the canopy and understory vegetation.</i>	> 65% canopy; or > 50% canopy and > 50% understory	51 - 65% canopy; or 0 - 50% canopy and > 40% understory	31 - 50% canopy; or 0 - 30% canopy and > 30% understory	0 - 30% canopy; or 0 - 15% canopy and 0 - 30% understory	
Tree Demography <i>An assessment of the age class distribution of all canopy tree species.</i>	Canopy tree species are present in all 4 age classes	Canopy tree species are present in 3 of 4 age classes	Canopy tree species are present in 2 of 4 age classes	Canopy tree species are present in only 1 age class or no trees	
Wetland Tree Status <i>Percent of total trees that are defined as FAC+ or greater with respect to wetland status.</i>	> 65% of trees are FAC+ or greater	50 - 65% of trees are FAC+ or greater	25 - 49% of trees are FAC+ or greater	< 25% of trees are FAC+ or greater	
Riparian Zone Width <i>A measure of the width of the undisturbed riparian zone.</i>	> 18 meters or > 75% of the CWQZ	12 - 18 meters or 50 - 75% of the CWQZ	6 - 12 meters or 25 - 49% of the CWQZ	< 6 meters or < 25% of the CWQZ	
In-Stream Canopy Cover <i>An assessment of the amount of canopy cover extending over the stream banks.</i>	> 75% canopy cover	50 - 75% canopy cover	25 - 49% canopy cover	< 25% canopy cover	

Riparian Zone Score: _____

Assessed Condition (Circle One)

Excellent: 29 - 32

Good: 21 - 28

Fair: 13 - 20

Poor: 8 - 12



Zone 3 – Active Channel (Geomorphology)

Scoring: Zone 3 – Active Channel

Geomorphology

Site/Project Name: _____

Date: _____

Time: _____

Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Mass Wasting <i>An evaluation of the existing and the potential for future major bank sloughing within the reach.</i>	No evidence of past or any potential for future mass wasting into channel.	Infrequent and/or very small. Mostly healed over. Low future potential.	Moderate frequency and size, with some raw spots eroded by water during high flows.	Frequent or large, causing sediment nearly yearlong or imminent danger of same.	
Vegetative Bank Protection <i>An evaluation of the amount and variety of vegetation covering the channel banks within the stream reach.</i>	> 90% plant density. Vigor and variety suggests a deep, dense, soil binding root mass.	70 - 90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	50 - 70% density. Lower vigor and species form a somewhat shallow and discontinuous root mass.	< 50% density plus fewer species and vigor indicate discontinuous and shallow root mass.	
Obstructions, Deflectors, Sediment Traps <i>An evaluation of the presence of obstructions, deflectors, and sediment traps within the reach and of its relative permanence in the channel.</i>	Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable.	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	Moderately frequent, unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	Frequent obstructions and deflectors cause bank erosion. Sediment traps' full channel migration occurring.	
Undercutting <i>An assessment of the prevalence and the height of cut and raw banks along the channel reach.</i>	Little or none evident. Infrequent, raw banks < 15 cm high.	Some, intermittently at outcurves and constrictions. Raw banks < 30 cm.	Significant. Cuts 30 - 60 cm high. Root mat overhangs and sloughing evident.	Almost continuous cuts, some > 60 cm high. Failure of overhangs.	



Zone 3 – Active Channel (Geomorphology)

Scoring: Zone 3 – Active Channel

Geomorphology

Site/Project Name: _____

Date: _____

Time: _____

Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Consolidation or Particle Packing <i>An analysis of the degree to which stream bed particles are stabilized in the bed, either due to embeddedness or the orientation of the particles.</i>	Assorted sizes tightly packed and/or overlapping.	Moderately packed with some overlapping.	Mostly a loose assortment with no apparent overlap.	No packing evident. Loose, easily moved.	
Scouring and Deposition <i>An analysis of the extent of bed material mobilization within the reach, evidenced by scouring and/or deposition.</i>	< 5% of the bottom affected by scouring and deposition.	5 - 30% affected. Scour at constrictions and where steep. Pool deposition.	30 - 50% affected. Deposits and scour at obstructions, constrictions, and bends.	> 50% of bed in a state of flux or change nearly year-long.	
Entrenchment Ratio <i>An assessment of how entrenched the stream is.</i>	Little or no entrenchment. Ratio > 2.5	Minimal entrenchment. Ratio of 2.0 - 2.5	Moderate entrenchment. Ratio of 1.2 - 2.0	Highly entrenched. Ratio < 1.2	
Floodplain Connectivity/ Bank Height Ratio <i>An assessment of how easily storm flows inundate the floodplain.</i>	Functioning floodplain. Ratio of 1.0 - 1.2	Floodplain functioning but at risk. Ratio of 1.3 - 1.5	Floodplain not functioning. Ratio of 1.5 - 1.7	Severely degraded floodplain function. Ratio > 1.7	

Subtract up to 4 points for **Exposed Infrastructure** (2 pts.) and **Evidence of Headcuts** (2 pts.) **Deductions:** _____

Geomorphology Score: _____

Assessed Condition (Circle One) **Excellent: 29 - 32** **Good: 21 - 28** **Fair: 13 - 20** **Poor: 4 - 12**



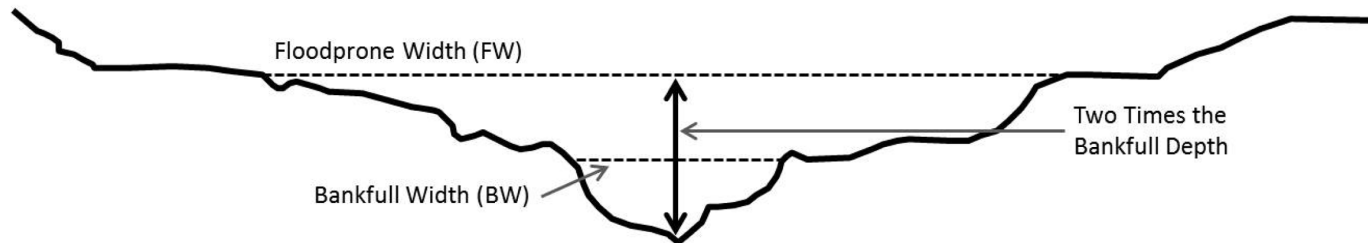
Zone 3 – Active Channel (Geomorphology)

Methodology: Zone 3 – Active Channel

Entrenchment Ratio: At a reference site along each 100 meter transect, measure the width of the floodprone area, bankfull channel width, and bankfull depth. Calculate the entrenchment ratio by dividing the floodprone width (channel width at 2 times the bankfull depth) by the width of the bankfull channel.

Measurement of Entrenchment Ratio (ER) at a Cross Section

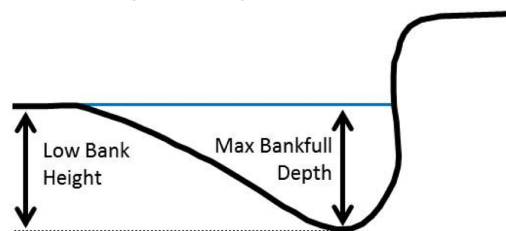
$$ER = \text{Floodprone Width (FW)} / \text{Bankfull Width (BW)}$$



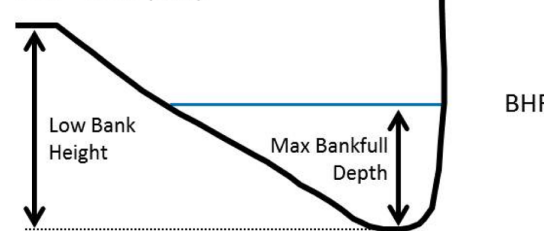
Floodplain Connectivity/Bank Height Ratio: Within each 100 meter transect, measure the bankfull depth and topographic low bank height. Estimate the bank height ratio by dividing the height of the low bank by the bankfull depth.

Measurement of Bank Height Ratio (BHR) at a Cross Section

BHR = 1.0 (Excellent)



BHR = 1.63 (Fair)



$$BHR = \frac{\text{Low Bank Height}}{\text{Max Bankfull Depth}}$$

Exposed Infrastructure: Along each 100 meter transect, perform a visual observation that determines if exposed infrastructure such as footings or pipes is evident.

Evidence of Headcuts: Along each 100 meter transect, perform a visual observation that determines if headcuts are evident. A headcut (also known as a knickpoint) is an erosional feature where an abrupt vertical drop in the stream bed occurs.



Zone 3 – Active Channel (Aquatic Habitat)

Scoring: Zone 3 – Active Channel

Aquatic Habitat

Site/Project Name: _____

Date: _____

Time: _____

Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Epifaunal Substrate and Available Cover <i>An evaluation of the channel substrate, snags, submerged logs, and other stable habitat features to determine the amount of habitat available for epifaunal community colonization.</i>	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40 - 70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization.	20 - 40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
Embeddedness <i>An evaluation of the degree to which gravel, cobble, and boulder particles are surrounded by fine sediments.</i>	Gravel, cobble, and boulder particles are 0 - 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25 - 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50 - 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	
Velocity/Depth Regimes <i>An evaluation of the presence of four categories of regimes: slow-deep, slow-shallow, fast-deep, and fast-shallow. Highest scores are assigned to reaches with all four velocity/depth regimes.</i>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). Slow is < 0.3 m/s, deep is > 0.5 m.	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).	



Zone 3 – Active Channel (Aquatic Habitat)

Scoring: Zone 3 – Active Channel

Aquatic Habitat

Site/Project Name: _____

Date: _____

Time: _____

Transect Number: _____

Staff (if applicable): _____

Parameter	Excellent (4)	Good (3)	Fair (2)	Poor (1)	Score
Frequency of Riffles <i>An analysis of the occurrence of riffles, with reaches in which the average distance between riffles is less than seven times the channel's bankfull width receiving the highest scores.</i>	Riffles relatively frequent; ratio of distance between riffles divided by width of the stream < 7:1 (generally 5 to 7); variety of habitat is key.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of > 25.	
Flow Permanence Score <i>A statistical assessment of the degree of perennial flow for a stream reach, based on historical site visit and gage data.</i>	Flow permanence score from proximate EII reach > 85	Flow permanence score from proximate EII reach between 75 - 85	Flow permanence score from proximate EII reach between 45 - 74	Flow permanence score from proximate EII reach < 45	

Aquatic Habitat Score: _____

Assessed Condition (Circle One)

Excellent: 18 - 20

Good: 13 - 17

Fair: 8 - 12

Poor: 5 - 7

Scoring: Zone 3 – Active Channel

Total Score

Site/Project Name: _____

Date: _____

Time: _____

Transect Number: _____

Staff (if applicable): _____

Final Scoring

Riparian Zone Score: _____

+ Geomorphology Score: _____

+ Aquatic Habitat Score: _____

Total Zone 3 Score: _____

Assessed Condition (Circle One)

Excellent: 75 - 84

Good: 54 - 74

Fair: 33 - 53

Poor: 17 - 32

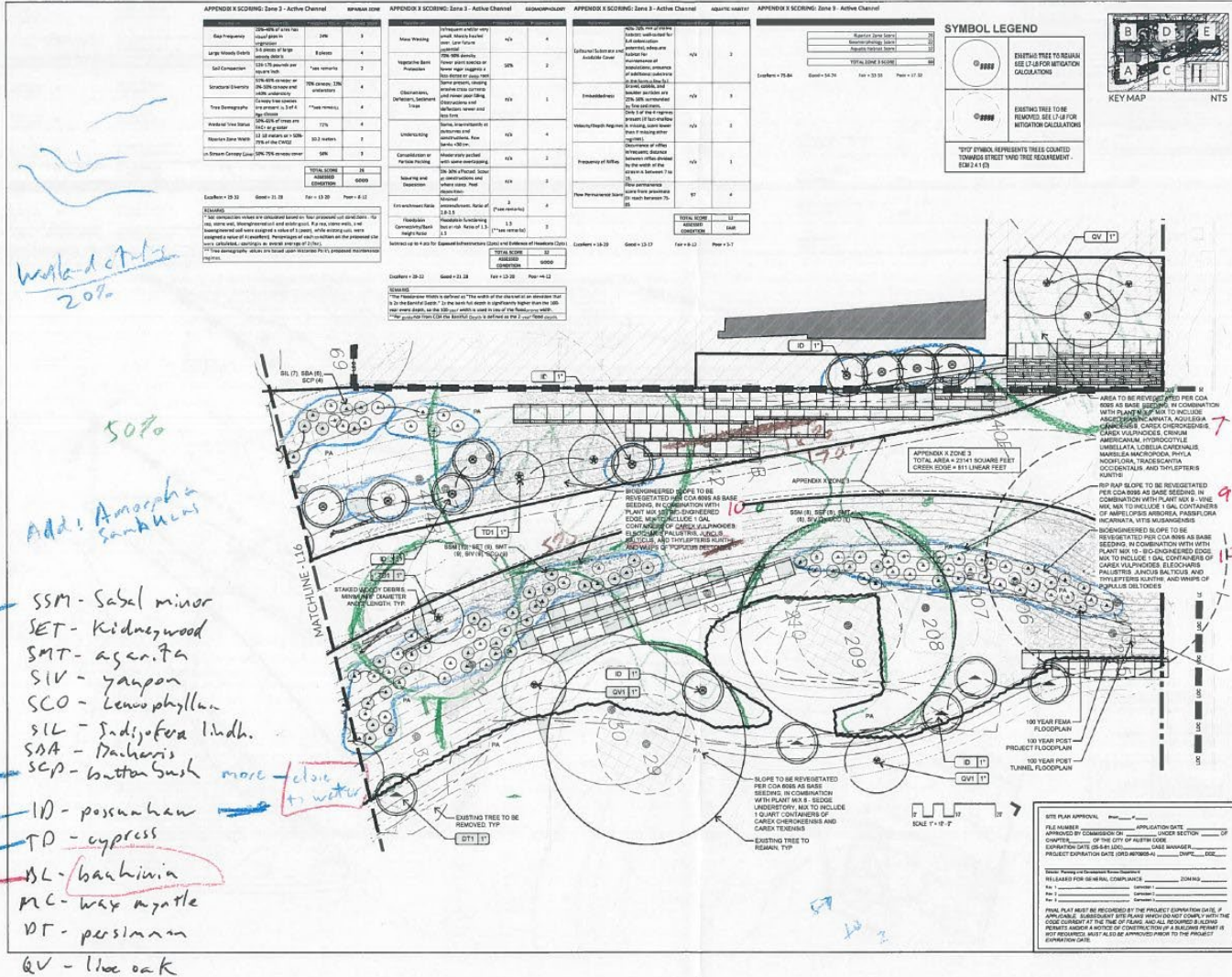


Assessing Proposed Condition

- “The floodplain modifications proposed would provide a significant, demonstrable environmental benefit...”
- “Restoration of floodplain health as prescribed by this section is required...”



Assessing Proposed Condition



work details
20%

50%

Add: Amorpha
Sambucus

- SSM - Sabal minor
- SET - Kidneywood
- SMT - agave 7ft
- SIV - yucca
- SCO - Lemnophyllan
- SIL - Indigofera lindh.
- SBA - Palmetto
- SCP - button bush
- ID - possumhaw
- TD - cypress
- BL - baccharis
- MC - wax myrtle
- DT - persimmon
- QV - live oak

more close to water

57
10 2

Assessing Proposed Condition

