Appendix 3.3.1 Riparian and instream habitat condition

This appendix summarizes instream and riparian habitat conditions based on parameters quantified by Stream Health Initiative (SHI) field observations. Values of these parameters were added together to calculate an overall index of riparian habitat quality and instream habitat quality for each stream reach assessed. Each stream reach was then placed into one of four habitat quality categories based on the habitat quality index values. For the reaches assessed in each sub-watershed, habitat quality is shown on the habitat quality maps in Chapter 4's sub-watershed sections.

Instream Habitat Quality. SHI used the habitat characterization matrix in EPA's Rapid Bioassessment Protocol for use in Streams and Wadeable Rivers (RBP) as a means of evaluating and documenting habitat quality of each reach. EPA's RBP for habitat assessment evaluates the structure of the surrounding physical habitat that influences the aquatic life and potentially limits biological community potential. Each parameter was evaluated at each designated reach and rated on a scale of 0 (worst) to 20 (best). The scores were totaled and then compared to a regional reference site to provide an assessment of habitat quality. Stream habitat condition, as determined by the RBP Habitat Assessment score, was assigned to each reach.

Riparian Habitat Quality. SHI used the Natural Resource Conservation Service's (NRCS) Riparian Assessment method to assess sustainability of riparian ecosystems. The NRCS evaluates riparian habitat condition and functionality by characterizing eleven parameters. Parameters encompass amount, condition and type of riparian cover with regard to stabilizing ability, and stability of the stream channel. Field-based visual assessments over each entire reach were made of riparian, flood-prone and upland vegetation, and of the condition of stream banks and the channel. Parameters were evaluated and scored in the field. Scores were totaled and compared against a regional reference reach. Riparian habitat condition, as determined by the NRCS assessment score, was assigned to each reach.

Summary of Results

EPA and NRCS scores were combined to arrive at an overall score of instream and riparian habitat quality. Reach by reach stream and riparian habitat quality scores are available by sub-watershed in Chapter 4. Figures 3.3.1 and 3.4.3 provide a summary of results. In table 1 EPA and NRCS parameters were organized into six functional groups: channel condition, stream balance, aquatic wildlife potential, riparian potential, riparian quality and terrestrial wildlife potential. Scores for each parameter in a functional group were totaled for each reach. Reach score totals were assigned to a quality category, optimal, sub-optimal marginal or poor. Numbers of stream miles in each quality category were summed to arrive at a percentage of stream miles in each quality category. The following is a list of functional groups and characteristics of quality categories:

Roaring Fork Watershed Instream and Riparian Habitat Condition

Channel Condition: Channel Alteration, Riffle Frequency, Sinuosity, Energy Dissipation					
Sub-watershed		**Optimal:** Natural channel; Riffle frequency optimal; Natural meander pattern; Adequate energy dissipation, with active overflow channels and little to no excessive erosion. Percent (miles)	**Suboptimal:** Past channelization evident but with significant recovery, no recent channelization; Riffle frequency & sinuosity slightly reduced; Slight limitations in energy dissipating habitat characteristics. Percent (miles)	**Marginal:** Channelization Extensive with shoring structures common; Only occasional riffles or bends; Inadequate habitat characteristics such as woody debris, and/or riparian vegetation for energy dissipation with occasional erosion and headcuts. Percent (miles)	**Poor:** >80% of stream channelized and disrupted; All flat water or shallow riffles, channel straight, poor habitat; Floodplain limited or not present and inadequate to dissipate energy, woody debris and riparian vegetation inadequate to dissipate stream energy and erosion common. Percent (miles)
Upper Roaring Fork		70% (15.75)	14% (3.28)	16% (3.50)	0.00%
Upper Middle Roaring Fork	RF	33% (6.11)	67% (12.60)	0.00%	0.00%
	Brush Ck.	0.00%	60% (7.63)	39.72% (5.03)	0.00%
Lower Middle Roaring Fork		7% (0.88)	91% (11.89)	2% (0.29)	0.00%
Lower Roaring Fork	RF	32% (4.05)	68%(8.05)	0.00%	0.00%
	Fourmile Ck.	29% (3.5)	71% (8.65)	0.00%	0.00%
Maroon/Castle	Maroon	63% (3.15)	37% (1.84)	0.00%	0.00%
	Castle	65% (9.86)	9% (1.33)	26% (3.96)	0.00%
Snowmass/Capitol		35% (4.9)	65% (9.21)		0.00%
Fryingpan		13% (1.84)	67% (9.22)	19% (2.4)	0.00%
Crystal		6.85 (2.13)	74.15% (23.06)	18.99% (5.91)	0.00%
Cattle		21.58% (4.2)	14.71% (2.86)	42.12% (8.19)	21.58% (4.2)

Stream Balance: Bank stability, Channel downcutting and lateral cutting, Sediment deposition					
Sub-watershed		**Optimal:** Banks stable; Channel stable, no active downcutting; Lateral erosion balanced with stream setting; Width/depth ratio appropriate to stream type and deep pools are common. Percent (miles)	**Suboptimal:** Banks moderately stable with only small, infrequent areas of erosion; Channel has evidence of old downcutting that is stabilizing; Excessive active lateral erosion is minimal; Channel has widened & become shallower, some increase in point bars and islands from gravel, sand or silt and slight deposition in pools. Percent (miles)	**Marginal:** Banks moderately unstable with erosion common; Active downcutting with bank failure common; Accelerated lateral erosion on either or both banks; Width/depth ratio excessively high for stream type, moderate deposition of gravel, sand and silt on old and new point bars and islands, and pools filling with sediment. Percent (miles)	**Poor:** Banks unstable with erosional scars on >60% of area; Channel downcut and unstable; Lateral erosion extensive on both inside and outside banks; Heavy sediment deposits of sand and silt, pools absent due to sediment deposition. Percent (miles)
Upper Roaring Fork		58% (13.10)	33% (7.37)	9% (2.04)	0.00%
Upper Middle Roaring Fork	RF	7% (1.31)	58% (10.88)	34% (6.52)	0.00%
	Brush Ck.	0.00%	45%(5.70)	55% (6.97)	0.00%
Lower Middle Roaring Fork		0.00%	56%(7.29)	44% (5.78)	0.00%
Lower Roaring Fork	RF	0.00%	35% (4.41)	65% (8.14)	0.00%
	Fourmile Ck	0.00%	82% (9.99)	18% (2.15)	0.00%
Maroon/Castle	Maroon	44% (2.21)	56% (2.78)	0.00%	0.00%
	Castle	60% (9.09))	40% (6.06)	0.00%	0.00%
Snowmass/Capitol		5.49% (0.77)	94.51% (13.29)		
Fryingpan		0.00%	100% (13.72)		
Crystal		0.00%	61.75% (19.21)	38.25%(11.89)	0.00%
Cattle		0.00%	36.30% (11.77)	42.12% (8.19)	21.58% (4.2)

Aquatic Wildlife Potential: Channel substrate, Velocity-depth regime/pool variability, Embeddedness, Flow status and Beaver activity.					
Sub-watershed		**Optimal:** >70% of channel substrate stable with abundant availability, quantity and variety of natural structures for aquatic wildlife; All 4 velocity/depth regimes present; Cobble & gravel <25% embedded; Water reaches base of both banks & minimal substrate exposed. Beaver activity abundant with resulting major flow modification.	**Suboptimal:** 40-70% of channel substrate stable and suitable for use by aquatic wildlife; 3 of 4 regimes present; Cobble and gravel >25<50% embedded; Water fills >75% of channel and some riffle substrate exposed. Beaver activity common with some flow modification.	**Marginal:** 20-40% of channel substrate stable and suitable for aquatic wildlife, habitat frequently disturbed or removed; 2 of 4 regimes present; Cobble and gravel >50<75% embedded; Water fills 25-75% of channel with riffle substrate mostly exposed. Beaver activity rare with little or no flow modification.	**Poor:** <20% of habitat stable; suitable habitat unstable or lacking; 1 flow regime dominates; Cobble and gravel >75% embedded; Very little water in channel & occurs mostly as standing pools. Beaver activity and flow modification absent.
		Percent (miles)	**Percent (miles)**	**Percent (miles)**	**Percent (miles)**
Upper Roaring Fork		42% (9.53)	41% (9.18)	17% (3.82)	0.00%
Upper Middle Roaring Fork	RF	24% (4.43)	68% (12.73)	8% (1.56)	0.00%
	Brush Ck.	0.00%	49% (3.69)	51% (3.91)	0.00%
Lower Middle Roaring Fork		0.00%	100% (13.07)	0.00% (	0.00%
Lower Roaring Fork	RF	0.00%	100% (20.93)	0.00%	0.00%
	Fourmile Ck.	0.00%	29% (3.48)	71% (8.65)	0.00%
Maroon/Castle	Maroon	48% (3.97)	52% (4.35)	0.00%	0.00%
	Castle	63% (9.74)	37% (5.68)	0.00%	0.00%
Snowmass/Capitol		5.49% (0.77)	74.35% (10.46)	20.16% (2.84)	0.00%
Fryingpan		0.00%	95.63% (13.12)	4.37% (0.6)	0.00%
Crystal		2.95% (0.92)	82.72% (25.73)	14.33% (4.46)	0.00%
Cattle		0.00%	36.30% (7.06)	63.70% (12.39)	0.00%

Riparian Potential: Riparian zone width, Protective vegetative cover, Soil condition					
Sub-watershed		**Optimal:** Riparian zone width appropriate to landscape and unimpacted by human activity; >90% of streambanks covered by native riparian vegetation; >85% of area with sufficient soil to hold water and enable rooting. Percent (miles)	**Suboptimal:** Zone width reduced by <30% and slightly impacted by human activities; 70-90% of streambanks covered by native riparian vegetation; >65<85% of area with sufficient soil. Percent (miles)	**Marginal:** Zone width reduced 30-60% and impacted a great deal by human activities; 50-70% of streambanks covered with native riparian vegetation with bare soil or closely cropped vegetation common; >35<65% of area with sufficient soil. Percent (miles)	**Poor:** Riparian zone width reduced by >60% with little or no native vegetation due to human activities; <50% of streambank covered by vegetation & disruption of bank vegetation very high; <35% of area with sufficient soil to hold water and enable rooting. Percent (miles)
Upper Roaring Fork		55.60% (12.52)	21.72% (4.89)	17.34% (3.91)	5.33% (1.20)
Upper Middle Roaring Fork	RF	7.01% (1.31)	43.94% (8.22)	49.04% (9.18)	0.00%
	Brush Ck.	9.43% (0.72)	35.56% (2.70)	55.03% (4.18)	0.00%
Lower Middle Roaring Fork		0.00%	27.95% (3.65)	69.78% (9.13)	2.25% (0.29)
Lower Roaring Fork	RF	0.00%	13% (1.59)	87% (10.96)	0.00%
	Fourmile	0.00%	100% (20.24)	0.00%	0.00%
Maroon/Castle	Maroon	48% (2.38)	52% (2.61)	0.00%	0.00%
	Castle	63% (9.47)	15% (2.25)	23% (3.43)	0.00%
Snowmass/Capitol		22.27% (3.13)	73.55% (10.34)	4.18% (0.59)	0.00%
Fryingpan		0.00%	55.91% (7.67)	44.09% (6.05)	0.00%
Crystal		6.85% (2.13)	27.51% (8.56)	65.63% (20.41)	0.00%
Cattle		21.58% (4.2)	14.71% (2.86)	42.12% (8.19)	21.58% (4.2)

Riparian quality: Vegetation quality, Vegetative vigor, Woody species' age class distribution, Noxious weeds					
Sub-watershed		**Optimal:** Riparian area has at least 4 native plant species with deep, binding root masses; 0-5% woody plant stems browsed; All age classes of habitat appropriate native woody plants present; No noxious weeds present. Percent (miles)	**Suboptimal:** Riparian area has at least 3 native plant species with deep, binding root masses; 5-25% woody plant stems browsed – lightly; One age class of woody species absent, all other age classes well represented; Noxious weeds <5% (rare). Percent (miles)	**Marginal:** Riparian area has at least 2 plant species with deep, binding root masses; 25-50% woody stems browsed – moderately; Two age classes absent, all others well represented, or the stand is comprised mainly of mature species; Noxious weeds 5 to <10% (common). Percent (miles)	**Poor:** Riparian area has one or no plant species present with deep, binding root masses; >50% pf woody stems browsed - heavily; Disturbance induced or non-riparian species dominate, woody species consist of decadent/dying individuals; Noxious weeds >10% (abundant). Percent (miles)
Upper Roaring Fork		69.01% (15.54)	15.48% (3.49)	15.50% (3.49)	0.00%
Upper Middle Roaring Fork	RF	43.68% (8.17)	56.32% (10.54)	0.00%	0.00%
	Brush Ck.	26.65% (2.02)	73.37% (5.57)	0.00%	0.00%
Lower Middle Roaring Fork		5.12% (0.67)	79.09% (10.34)	15.76% (2.06)	0.00%
Lower Roaring Fork	RF	0.00%	35% (4.41)	65% (8.14)	0.00%
	Fourmile Ck.	29% (3.48)	71% (8.65)	0.00%	0.00%
Maroon/Castle	Maroon	100% (4.99)	0.00%	0.00%	0.00%
	Castle	98% (14.86)	2% (0.29)	0.00%	0.00%
Snowmass/Capitol		32.76% (4.61)	67.23% (9.46)	0.00%	0.00%
Fryingpan		31.41% (4.31)	68.59% (9.41)	0.00%	0.00%
Crystal		59.16% (18.39)	40.84% (12.70)	0.00%	0.00%
Cattle		14.71% (2.86)	21.58% (4.2)	63.71% (12.39)	0.00

Riparian Wildlife Potential: Riparian potential, Riparian Quality, Human activities & disturbances observed.					
Sub-watershed		**Optimal:** Optimal riparian potential and habitat quality; Little to no human disturbances or activities. Wildlife access to riparian habitat unimpeded by roads, trails or development. Percent (miles)	**Suboptimal:** Riparian potential and habitat quality only slightly diminished; Human disturbances and activities minimal. Wildlife access to riparian habitat only slightly restricted by roads, trails or development. Percent (miles)	**Marginal:** Riparian potential and habitat quality marginal; Human disturbance and activities common and extensively distributed throughout riparian area. Roads and development render wildlife access to riparian habitat difficult and potentially lethal. Percent (miles)	**Poor:** Riparian potential and habitat quality not sustainable; Human disturbance and activities dominate area. Wildlife access to riparian habitat inhibited by roads and development. Percent (miles)
Upper Roaring Fork		56.25% (12.67)	19.60% (4.41)	18.82% (4.24)	5.33% (1.20)
Upper Middle Roaring Fork	RF	7.01% (1.31)	61.40% (11.49)	31.58% (5.91)	0.00% (0.00)
	Brush Ck.	9.43% (0.72)	35.56% (2.70)	55.03% (4.18)	0.00% (0.00)
Lower Middle Roaring Fork		0.00%	27.95% (3.65)	69.78% (9.13)	2.25% (0.29)
Lower Roaring Fork	RF	0.00%	13% (1.59)	87% (10.96)	0.00%
	Fourmile Ck.	0.00%	52% (6.26)	48% (6.26)	0.00%
Maroon/Castle	Maroon	85% (4.23)	15% (0.76)	0.00%	0.00%
	Castle	63% (9.47)	37% (5.68)	0.00%	0.00%
Snowmass/Capitol		22.27% (3.13)	73.55% (10.34)	4.18% (0.59)	0.00%
Fryingpan		0.00%	66.84% (9.17)	33.16% (4.55)	0.00%
Crystal		2.95% (0.92)	31.15% (9.69)	65.90% (20.49)	0.00%
Cattle		0.00%	36.30% (7.06)	42.12% (8.19)	21.58% (4.2)