Appendix 5A
Focus Reach Selection Process

May 2015

5A Focus Reach Selection Process

Because issues pertaining to environmental and recreational resources are inherently site-specific (for example, necessary minimum flows to safely raft a river reach) but can also be broader in scale (for example, the recovery of endangered species), the Environmental and Recreational Flows Workgroup (Workgroup) approach investigated both specific sites and the Colorado River Basin (Basin) more holistically. Because detailed assessments of all river reaches in the Basin were not feasible, the Workgroup decided to select several "focus reaches" to understand specific ecological and recreational issues and the programs already in place to help address these issues. A customized focus reach selection process was undertaken to help the Workgroup come to a consensus on several reaches to use as focus reaches.[1] For the river reach selection process, the Workgroup completed four main steps:

1. Developed a list of rivers in the Upper and Lower Basins that could be suitable for Phase 1 of the *Moving Forward* effort and divided them into reaches.
2. Identified five goals for reach selection and developed specific criteria supporting each goal.
3. Characterized each river reach on the initial list based on the selection criteria.
4. Used the reach characterizations to narrow the initial list of reaches to the final list of focus reaches.

The following sections provide further explanation of each step.

5A.1 River Reach Identification

The process of selecting focus reaches was initiated by developing a list of major rivers and tributaries in the Upper and Lower Basins. A few rivers (for example, the Colorado River through the Grand Canyon) were not included on this list because of existing ongoing planning or legal processes. Table 5A-1 presents the list of rivers considered in the focus reach selection process.

Each river shown in Table 5A-1 was divided into reaches based on the following attributes:

- Major river/tributary confluences
- Breakpoints between warmwater and coldwater fisheries
- Locations of dams, major diversions, and fish passage or barrier structures
- Major recreation reaches (such as whitewater boating and high-use areas)
- Exclusion of the impounded waters located upstream of dams

The delineation process resulted in an initial list of 37 river reaches to be considered in the reach selection process, including 29 reaches in the Upper Basin and eight reaches in the Lower Basin.

Headwater river reaches were defined as a separate category to represent river reaches that are in the uppermost parts of a watershed and typically above any dams or other major water control facilities. Five headwater areas were considered with the goal of selecting one as an additional focus reach.

Table 5A-2 lists the river and headwater reaches delineated for each river. Figure 5A-1 shows the locations of the reaches.

[1] The focus reach selection process was undertaken to assist with the specific Workgroup goals and may not be appropriate for use in other settings.

TABLE 5A-1
Initial List of Rivers

Upper Basin Rivers		Lower Basin Rivers
Colorado mainstem above Lake Powell	San Miguel	Virgin
Gunnison	Duchesne	Colorado mainstem below Lake Mead in the U.S.
Dolores	San Rafael	Bill Williams
Green	Dirty Devil	
Yampa	Escalante	
Little Snake	San Juan	
White	Paria	

5A.2 River Reach Selection Criteria

The Workgroup aimed to select focus reaches that would represent a diverse range of river reaches in terms of current river health, recreational value, geographic location, regional significance, and potential tradeoffs with other water uses. To accomplish this, reach selection criteria (Figure 5A-2 and Table 5A-3) were developed based on five distinct goals in order to narrow down the initial list (Table 5A-2) to two to six focus reaches. The following five goals were used to develop the selection criteria:

1. Protect or improve river ecological health.
2. Protect or improve river recreational experiences.
3. Limit or manage tradeoffs with other water uses.
4. Consider geographic location and regional importance.
5. Consider constraints limiting flexibility of solutions.

Criteria were developed to support each of the five selection goals, as shown on Figure 5A-2. Each criterion was defined and a rating was determined according to three characterization categories: A, B, or C. Table 5A-3 lists the River Reach Selection Criteria, along with the basis for rating and definitions of A, B, and C categories for each.

5A.3 River Reach Characterization

River reach characterization for each criterion was based on a series of information-gathering efforts. First, readily quantitative data, when available, were compiled for the criterion by reach. For criteria having no readily available data, Workgroup members with expertise in the area assigned ratings based on professional knowledge. Characterization ratings of A, B, or C were assigned based on the available information and Workgroup consensus. The sections below describe the quantitative and qualitative characterization processes in more detail. The headwater reaches were not characterized because a manageable number of reaches from which to select were already available.

5A.3.1 Quantitative Criteria Characterization

Readily available quantitative data were collected, compiled, and used to characterize the reaches as appropriate. The quantitative methods used to characterize the reaches for each applicable criterion are described below.

Criterion 1A: Native Fish Species of Conservation Interest

Native fish data for each reach was collected from several sources. Lower Colorado River Multi-Species Conservation Program (LCR MSCP) data

TABLE 5A-2
River Reach Delineations

			Reach Number (downstream limit of the reach[1])			
No.	**River**	**River Code**	**1**	**2**	**3**	**4**
Upper Basin						
1	Green River	GRR	Colorado River Confluence	White River Confluence	Yampa River	Flaming Gorge Dam (to TP at Fontenelle Dam)
2	Yampa	YAR	Green River Confluence	Little Snake Confluence (to TP at Stagecoach Dam)		
3	Little Snake	LSR	Yampa River Confluence (to TP at Battle Creek, Wyoming)			
4	Duchesne	DUR	Green River Confluence (to TP at Starvation Dam)			
5	White	WHR	Green River Confluence	Taylor Draw Dam (to TP at Confluence of N and S Forks)		
6	San Rafael	SRR	Green River Confluence (to TP at Ferron Creek)			
7	Gunnison	GUR	Colorado River Confluence	North Fork Confluence (to TP1 at Crystal Dam)	Blue Mesa Dam	East River and Taylor River Confluence (to TP2 at Taylor Dam)
8	Dolores	DOR	Colorado River Confluence	San Miguel Confluence	McPhee Dam (to TP at West Fork of Dolores)	
9	San Miguel	SMR	Dolores River Confluence (to TP at Specie Creek)			
10	Dirty Devil	DDR	Lake Powell (to TP at Confluence of N and S Forks)			
11	Escalante	ESR	Lake Powell (to TP at Sweetwater Creek)			
12	San Juan	SJR	Lake Powell	Animas River Confluence	Navajo Dam (to TP at West Fork Confluence)	

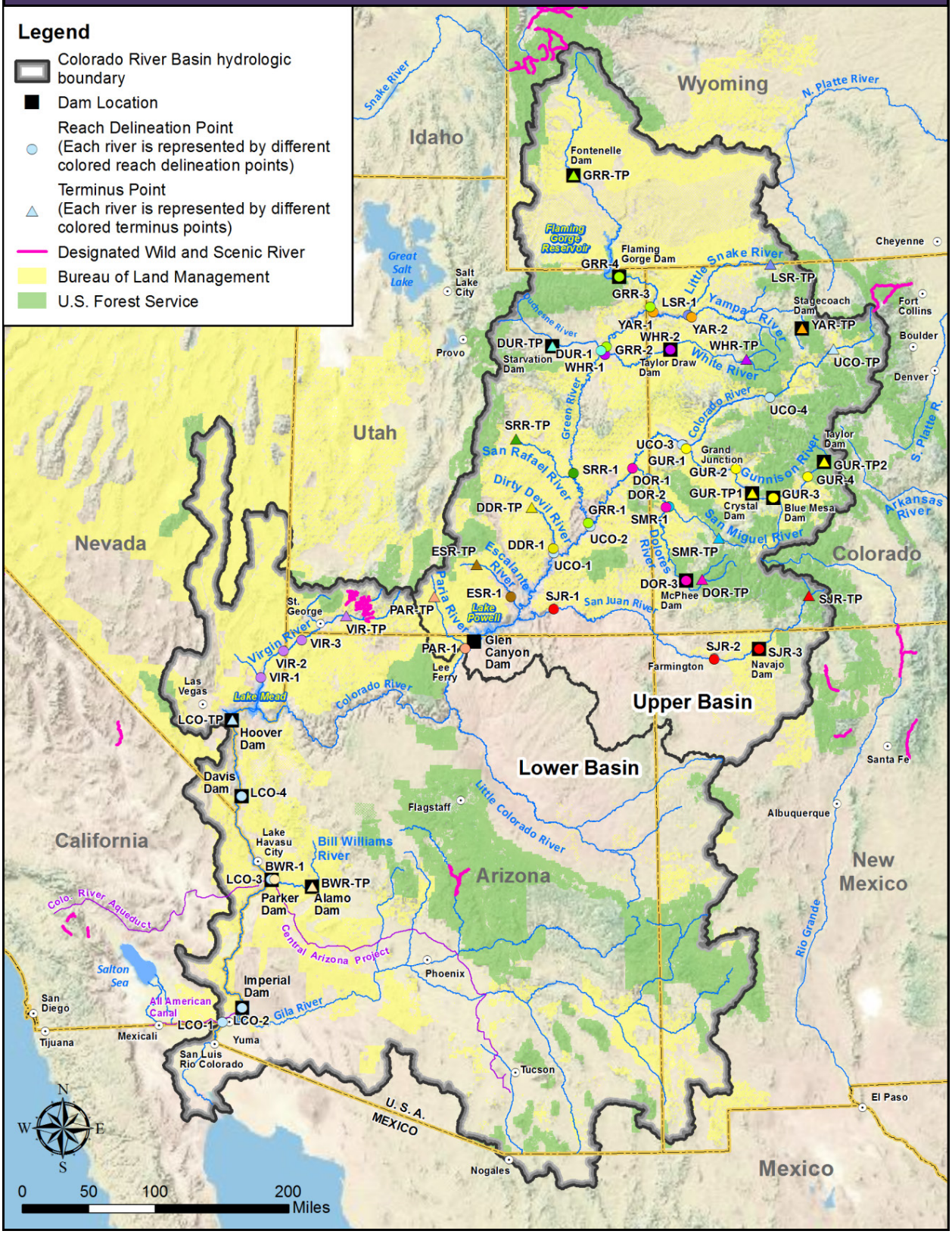
TABLE 5A-2
River Reach Delineations

			Reach Number (downstream limit of the reach[1])			
No.	**River**	**River Code**	**1**	**2**	**3**	**4**
13	Paria River	PAR	Colorado River Confluence (to TP at Sheep Creek)			
14	Upper CO Mainstem above Lake Powell	UCO	Lake Powell	Green River Confluence	Gunnison River Confluence	Roaring Fork River (to TP at Blue River Confluence)
15	Virgin	VIR	Lake Mead	Mesquite Diversion	Narrows Fish Control Structure (to TP at Quail Creek Diversion)	
16	Bill Williams	BWR	Lake Havasu (to TP at Alamo Dam)			
17	Lower CO Mainstem to NIB	LCO	NIB with Mexico	Imperial Dam	Parker Dam	Davis Dam (to TP at Hoover Dam)
18	Henry's Fork					
19	Muddy Creek (Black Fork)					
20	Little Snake					
21	Escalante					
22	Upper Muddy Creek					

Colorado (CO); North (N); Northerly International Boundary (NIB); South (S); Terminus Point (TP)

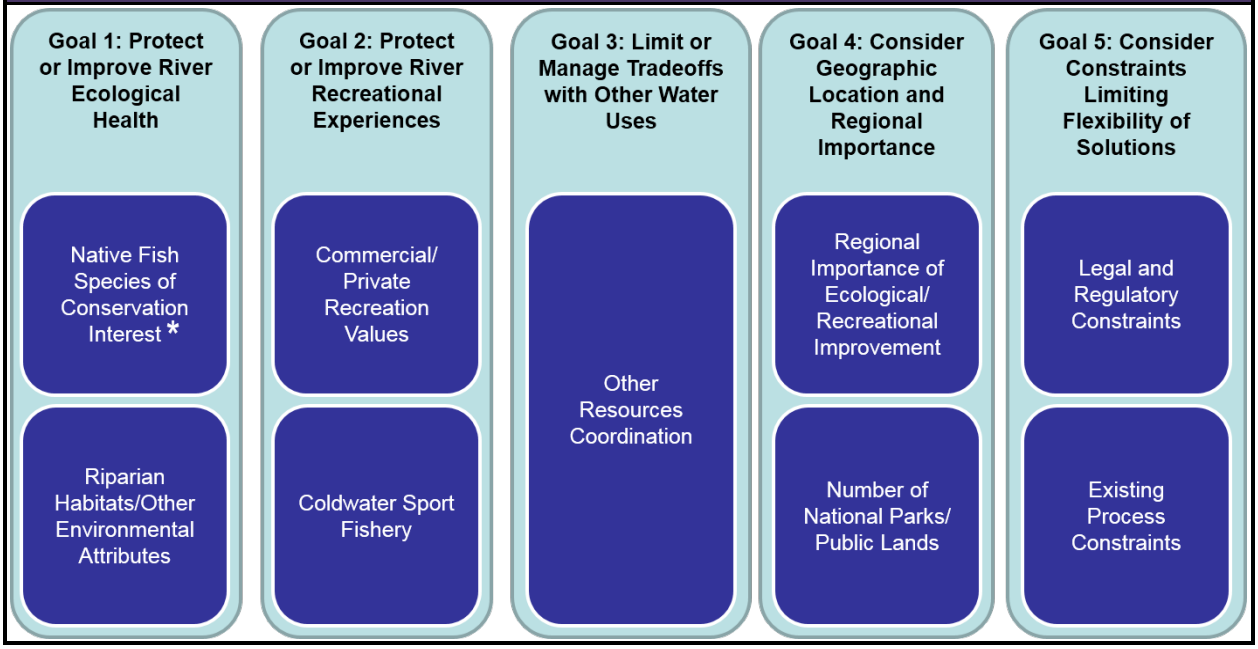
[1] Reaches do not include the impounded waters located upstream of dams.

FIGURE 5A-1
River Reach Delineations



Notes:
1. Reaches do not include the impounded waters located upstream of dams.
2. Similar to the Basin Study, the scope of the *Moving Forward* effort is limited to the portion of the Basin within the U.S.

FIGURE 5A-2
River Reach Selection Goals and Criteria



* The phrase "of conservation interest" was developed by the Workgroup to be a general term, and is not intended to correspond to specific regulatory or conservation definitions.

include fish species ranges, and the number of species within a given reach was counted to obtain the number of fish species used for characterization for the Lower Basin mainstem reaches (LCR MSCP, 2013b). The number of fish species for the Bill Williams River was obtained from Shafroth and Beauchamp (2006). The Nature Conservancy (TNC) (2009a) data are expressed as a range of values for the number of "imperiled" species, so the highest number in the range was used. The numbers from TNC (2009a) were combined with other sources to result in a total number of fish species of conservation interest for each reach. A characterization of A was assigned for reaches with no fish species of conservation interest, a B was assigned for reaches with one to three fish species of conservation interest, and a C was assigned for reaches with four or more fish species of conservation interest.

Criterion 1B: Riparian Habitats and Other Environmental Attributes

Reach characterization for this criterion was based on a "riparian index" that was calculated based on two factors: the number of non-fish species of conservation interest present on the reach (TNC, 2009b; LCR MSCP 2013a) and the relative amount of woody wetlands and tamarisk estimated to be present on a reach.

The quality of riparian vegetation was estimated on each reach by estimating both the amount of tamarisk present on the reach and the amount of woody wetlands. The approximate coverage of tamarisk was estimated based on Tamarisk Coalition data (2009). Woody wetlands coverage was estimated using data from the National Land Cover Database 2006 (Fry et al., 2011). For both tamarisk and woody wetlands coverage, the following designations were used: dense, partial, sparse or none. Based on these designations, a reach scored 0 or 1 for riparian vegetation based on the combinations shown in Table 5A-4.

The riparian vegetation score and the number of non-fish species of conservation concern were totaled to calculate the riparian index. A characterization of A was assigned for reaches with a riparian index of 0, a B was assigned for reaches with a riparian index of 1-2, and a C was assigned for reaches with a riparian index of 3 or more.

TABLE 5A-3
River Reach Selection Criteria

Criterion No.	Criterion Title	Selection Criteria	Definition of Criterion	Basis for Rating: Data or Lead(s) for Qualitative Rating[1]	Characterization Rating		
					A	B	C
Goal 1: Protect or Improve River Ecological Health							
1A	Native Fish Species of Conservation Interest[2]	Are fish species of conservation interest located in this reach?	Reaches with fish species of conservation interest are considered to be of higher priority for protection or improvement and thus are characterized more favorably than those that have no species of concern. Such species are expected to likely benefit from any potential solutions to improve ecological conditions in this reach.	Number of native fish species of conservation interest – threatened, endangered, species of concern, and other related categorizations.	0 fish species	1 to 3 fish species	4 or more fish species
1B	Riparian Habitats and Other Environ-mental Attributes	Is a native riparian vegetation and riparian-dependent native species of conservation interest located in this reach or other environmental attributes that are unique or important that are not captured in criterion 1A for native fish located in this reach?	Reaches with native riparian vegetation and associated riparian-dependent native species, including those with unique or important environmental attributes (e.g., high biodiversity of river-dependent species) that are not captured in criterion 1A are considered to be of higher priority for protection or improvement and thus are assigned higher scores than those that do not have such resources. Such species or environmental attributes are expected to likely benefit from any potential solutions to improve ecological conditions in this reach. Reaches with invasive plants such as tamarisk are also assigned lower scores than reaches with no invasive vegetation.	A riparian index scoring system was developed based on presence and density of tamarisk and associated riparian vegetation, as well as counts of associated riparian-dependent non-fish species of conservation interest.[2]	Poor riparian habitat/ other important attributes (Riparian Index of 0)	Moderate riparian habitat/ other important attributes (Riparian Index of 1-2)	Good riparian habitat/ other important attributes (Riparian Index of 3 or more)

TABLE 5A-3
River Reach Selection Criteria

Criterion No.	Criterion Title	Selection Criteria	Definition of Criterion	Basis for Rating: Data or Lead(s) for Qualitative Rating[1]	Characterization Rating		
					A	B	C
Goal 2: Protect or Improve River Recreational Experiences							
2A	Commercial/ Private Recreation Values	Are commercial/ private recreational values associated with this reach?	Commercial/private recreation is an indicator of the level of use and economic impact. Managing flows that support recreational uses is a high priority.	Based on known popularity of the reach. Recreation use can include the following: • Whitewater boating • Float fishing • Other related activities	Low popularity/ use	Moderate popularity/ use	High popularity/ use
2B	Coldwater Sport Fishery	Is a significant coldwater sport fishery in this reach?	Reaches with significant coldwater sport fisheries are considered to be of higher priority for protection or improvement and thus are assigned higher scores than those that have no coldwater sport fish populations. Coldwater sport fishery species are expected to likely benefit from any potential solutions to improve ecological conditions in this reach. It is realized that coldwater sport fishery and native fishery habitats may conflict.	Based on: • General knowledge of the river reaches • Coordination and discussions with Trout Unlimited staff • Research on guide, angler, and state agency websites, including reports and fish/use data	Low quality/ popularity	Moderate quality/ popularity	High quality/ popularity
Goal 3: Limit or Manage Tradeoffs with Other Water Uses							
3A	Other Resources Coordination	How many resources, other than recreational and ecological (e.g., lake elevations, hydropower, etc.) are associated with this reach?	Managing tradeoffs with other water users is a key factor when considering which potential solutions are practical for implementation. As the number of users, stakeholders, and other resources increase, so does the complexity of implementing solutions.	Number of other resources for coordination and magnitude of use: • Hydropower • Regional municipal water supply diversion/intake • Regional agricultural water supply intake/diversion • Energy	Significant other resources	Moderate other resources	Minimal other resources

TABLE 5A-3
River Reach Selection Criteria

Criterion No.	Criterion Title	Selection Criteria	Definition of Criterion	Basis for Rating: Data or Lead(s) for Qualitative Rating[1]	Characterization Rating		
					A	B	C
4A	Ecological/ Recreational Improvement: Regional Importance	Would improvements in flow or non-flow ecological or recreational conditions in this reach benefit more than one reach (as opposed to only one reach)?	If improvement in a particular reach could benefit multiple other reaches, then that reach would have greater potential regional ecological or recreational significance and would have a higher priority compared to isolated reaches where improvements may have only local benefits. For example, dams are considered operational control points related to flow management. If reoperation at one dam can benefit multiple reaches in addition to the targeted reach in question, that reach will score higher.	Reach count between upstream and downstream dams (dams are considered to be operational control points). Count all reaches starting from first dam upstream of target reach to first dam downstream of target reach. If more than one dam is upstream (on any tributary), include separate count starting from each. If no dam upstream, count = 0.	No upstream dam to allow flow control	1 to 2 connected reaches between dams	3 or more connected reaches between dams
4B	Number of National Parks/Public Lands	How many national park lands or other significant public land values are adjacent to the reach?	The number of national parks or other significant lands represent the existing value of the land. These lands are considered higher priority for protection or improvement through potential solutions.	Count one point for each of the following: • National or State Park • National or State Refuge • Wilderness Area • Reach considered Eligible for Wild and Scenic Designation	None	1 to 2	3 or more

TABLE 5A-3
River Reach Selection Criteria

Criterion No.	Criterion Title	Selection Criteria	Definition of Criterion	Basis for Rating: Data or Lead(s) for Qualitative Rating[1]	Characterization Rating		
					A	B	C
Goal 5: Consider Constraints Limiting Flexibility of Solutions							
5A	Legal and Regulatory Constraints	Do legal or regulatory constraints in this reach leave sufficient flexibility for development of alternate solutions?	Legal or regulatory constraints may limit the flexibility or practicality of potential solutions. Regulatory constraints could be associated with existing or future federal, state, or significant local permits, Records of Decision, hydropower constraints, private land ownership, pending litigation, etc.	Significant legal or regulatory constraints, which may include: • Settled court cases • Ongoing litigation • Regulated flow management programs • Other related items	Significant legal or regulatory constraints	Moderate legal or regulatory constraints	Minimal legal or regulatory constraints
5B	Existing Process Constraints	Are existing process constraints related to this reach that could inhibit the development of solutions?	Process constraints may limit the flexibility or practicality of potential solutions. Process constraints could be associated with existing or future flow management programs, species recovery programs, or similar commitments or programs.	Process constraints, which may include: • Recreation programs • Recovery programs (e.g., species, habitat, ecology, etc.) • Other related items	Significant process constraints	Moderate process constraints	Minimal process constraints

[1] Quantitative and qualitative characterization methodologies for each criterion are described in more detail in Section 5A.3.
[2] The phrase "of conservation interest" was developed by the Workgroup to be a general term and is not intended to correspond to specific regulatory or conservation definitions.

TABLE 5A-4
Designations Used for Tamarisk and Woody Wetlands

Tamarisk Designation	Woody Wetlands Designation	Riparian Vegetation Score (0/1)
Dense	Dense	1
Dense	Partial/sparse	0
Partial/sparse/none	Dense/partial/sparse	1
Any	None	0

Criterion 4A: Ecological/Recreational Improvement: Regional Importance

Characterization for this criterion was based on the number of reaches that would be affected if flows were modified on a given reach. To determine this, the number of contiguous reaches, based on the reach delineation of this process, was counted from the first dam upstream of the target reach to the first dam downstream of the target reach. Only the dams included in Figure 5A-1 were used, which does not account for other, smaller dams. If more than one dam was located upstream from a reach, a separate count was included starting from each, and the highest total was used for the characterization. For reaches with no dam located upstream, the count was 0. A characterization of A was assigned for reaches with a count of 0, a B was assigned for reaches with a count of 1 to 2, and a C was assigned for reaches with a count of 3 or more contiguous reaches between dams.

Criterion 4B: Number of National Parks/Public Lands

This criterion was scored by summing the total number of surrounding National Parks and wilderness areas along the reach (National Park Service, 2013; University of Montana, 2013). If the reach has been designated eligible as a Wild and Scenic River[2], then the total score was increased by one (American Whitewater, 2013; National Wild and Scenic Rivers System, 2013). A characterization of A was assigned for reaches with a count of 0, a B was assigned for reaches with a count of 1 to 2, and a C was assigned for reaches with a count of 3 or more.

[2] The source includes only lands managed by the U.S. Forest Service that have been designated eligible as a Wild and Scenic River; lands managed by the U.S. Bureau of Land Management were not included.

5A.3.2 Qualitative and Consensus-Based Criteria Characterization

After the quantitative data were collected and reviewed, it was determined that sufficient data were not available for some criteria or that collection of the data would require a level of effort that could not be completed during Phase 1 of the *Moving Forward* effort. For the criteria listed below, the Workgroup determined consensus-based characterizations for the river reaches based on their expert knowledge and judgment. Criterion 2B used information prepared by Colorado, New Mexico, Utah, and Arizona; this information includes the Colorado Fishing Network (2014), Colorado Parks and Wildlife (2014), the Utah Division of Wildlife Resources (2014), New Mexico Game and Fish (Castell, 2009), and the Arizona Game and Fish Department (2008), but was ultimately a qualitative characterization based on Workgroup members' knowledge.

- Criterion 2A: Commercial/Private Recreation Values
- Criterion 2B: Coldwater Sport Fishery
- Criterion 3A: Other Resources Coordination
- Criterion 5A: Legal and Regulatory Constraints
- Criterion 5B: Existing Process Constraints

5A.4 River Reach Selection

After the river reach characterization was complete, focus reaches were selected using a two-step process. First, a filtering process, based on the characterizations, was used to narrow the initial list of reaches. The Workgroup then selected the focus reaches from the narrowed list to be assessed during Phase 1 of the *Moving Forward* effort. The headwater reaches were not filtered and the focus reach was selected solely using the qualitative selection step.

5A.4.1 Step 1: Reach Selection Process

To identify focus reaches, a filtering process was used that identified a "decision point" for each criterion above which a reach would be retained and below which it would be dropped, for that criterion. For example, a filter could be applied that retained all reaches with a rating of A or B in the "native fish species of conservation interest" criteria.

Four filtering scenarios were developed to represent a range of decision points that reflected different Workgroup viewpoints. The scenarios used the following decision points:

- Scenario 1: For each criterion, retain only reaches that scored a C.
- Scenario 2: For each criterion, retain only reaches that scored a C, except for criterion 3A and criterion 5B, where only reaches that scored an A are retained.
- Scenario 3: For each criterion, retain only reaches that scored a B or a C.
- Scenario 4: For each criterion, retain only reaches that scored a B or a C, except criterion 3A and criterion 5B, where only reaches that scored an A are retained.

Once filtering was completed, the total number of criteria for which a reach had been retained was summed for each scenario, and an average across all scenarios was calculated. For example, if a reach was retained for 4 criteria in the first scenario, 5 criteria in the second scenario, and 6 criteria in the third and fourth scenarios, its average score would be 5.25. The reaches were then ranked in order of their average score across all scenarios, with Upper Basin and Lower Basin reaches ranked separately. The top 12 scoring reaches in the Upper Basin were closely grouped with averages between 5 and 6, and in the Lower Basin, the top six reaches had averages between 4 and 5. This filtering process resulted in reducing the number of reaches under active consideration from 37 to 18; these top scoring reaches for each basin are shown in Table 5A-5.

5A.4.2 Step 2: Reach Selection Process

The Workgroup then selected focus reaches from the filtered list of reaches (Table 5A-5). During this step, while adhering to the Guiding Principles, Workgroup members discussed qualitative factors, such as political feasibility of working on a particular reach and diversity of reaches, based on their collective knowledge and best professional judgment to arrive at the list of focus reaches on a consensus basis. A similar qualitative process was used to select one headwater focus reach, to represent upper headwater coldwater streams that are above dams and have primarily natural hydrology and runoff patterns.

Using this process, the following reaches, including two Upper Basin reaches, one Lower Basin reach, and one headwater reach, were selected as focus reaches:

- The Upper Colorado River Focus Reach (Upper Basin) – mainstem of the Colorado River between the confluence with the Gunnison River and the confluence with the Green River (Reach UCO-2)
- The White River Focus Reach (Upper Basin) – White River between Taylor Draw Dam and the confluence with the Green River (Reach WHR-1)
- Bill Williams River Focus Reach (Lower Basin) – Bill Williams River from Alamo Dam to the confluence with the Colorado River at Lake Havasu (Reach BWR-1)
- The Henry's Fork Headwaters Focus Reach

TABLE 5A-5
Top Scoring Reaches in the Upper and Lower Basins

Upper Basin Reach	Average Score	Lower Basin Reach	Average Score
Green (GRR 2)	6.00	Bill Williams (BWR 1)	5.25
Green (GRR 3)	5.75	Lower Colorado Mainstem (LCO 4)	4.75
Green (GRR 1)	5.50	Virgin (VIR 1)	4.25
Yampa (YAR 2)	5.50	Virgin (VIR 2)	4.25
Gunnison (GUR1)	5.50	Lower Colorado Mainstem (LCO2)	4.25
Gunnison (GUR 2)	5.50	Virgin (VIR 3)	4.00
Yampa (YAR 1)	5.25		
Upper Colorado Mainstem (UCO 1)	5.25		
Upper Colorado Mainstem (UCO 2)	5.25		
White (WHR 1)	5.00		
Gunnison (GUR 4)	5.00		
Dolores (DOR 3)	5.00		

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