Range-Wide Status of Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*): 2010

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Executive Summary

The Colorado River cutthroat trout (CRCT) Conservation Team completed the first range-wide status assessment of the species in 2006. This document is a revision of the original that updates the status of the species as of 2010. This document presents an updated description of the historic and current range of Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*), which is the result of an intensive effort within each Geographic Management Unit (GMU) to refine the baseline historic and current range presented in the 2005 assessment. In addition to changes in the current range of CRCT, the document includes data describing population size, genetic status, and characteristics of habitat occupied by CRCT conservation populations. Conservation populations are those having a minimum level of genetic purity or other unique traits that make them a priority for conservation. In response to feedback from the CRCT Conservation Team, this assessment focuses almost exclusively on conservation populations.

A variety of land management agencies engaged in active conservation of CRCT through surveys, monitoring, genetic sampling and testing, habitat improvements, and the creation of new populations through chemical treatment and stocking of water bodies. From 2007 to 2010 genetic testing was completed on 131 stream and nine lake populations. This information resulted in considerable changes in the known distribution of conservation populations. Changes included the reclassification of some populations with unknown genetic status, as well as the identification of previously unknown populations that qualified as conservation populations. In the same time period, 13 barriers were constructed to protect conservation populations from non-natives, chemical treatments were performed in six water bodies, habitat improvement projects were completed for 60 conservation populations, and a variety of monitoring was performed on population status and habitat conditions.

Following the completion of the 2005 assessment each GMU embarked on revising their portion of the historic and current range of CRCT. Systematic reviews by local experts of the map presented in the 2005 assessment frequently resulted in reductions to the historic range of the species. The current estimate of historic range is 32,328 km, over 2,000 km less than that presented in the 2005 assessment. Changes in historic range were variable across states and GMUs. For example, the amount of historic range in Arizona, New Mexico, and Utah increased while historic range decreased in Colorado and Wyoming. Similarly, there were increases in three GMUs and decreases in the remaining five. The amount of habitat occupied by CRCT conservation populations is proportionally greater than it was in 2005.

There are 361 CRCT conservation populations that occupy 3,403 km of stream habitat, about 11% of the estimated historic range. The percentage of historic habitat occupied by CRCT conservation populations changed since 2005. At that time conservation populations occupied 8% of the estimated historic range. Conservation populations occur in all GMUs and in 37 of the 51 4th-level HUCs that constitute the historic range of the species. The large increase in the number of conservation populations between 2005 (when there were 285) and 2010 is due to the documentation of previously unknown populations through genetic analysis and the creation of new populations.

The analysis and inclusion of information on CRCT conservation populations in lakes is a significant change in the 2010 assessment. Lake populations, while rare relative to CRCT conservation populations in streams, often represent unique opportunities for life-history diversity that are typically lacking in small, isolated patches of stream habitat. The 2010 assessment includes information on the distribution of lake populations.

There have been a variety of changes in population distribution and connectivity to the surrounding watershed. The assessment presents updated information on population size, connectivity, life history diversity, population density, and habitat quality. In addition to these, this assessment includes a detailed discussion of the potential for climate change to affect CRCT, drawing on recent peer-reviewed publications. Changes were variable across the current range; however, CRCT typically inhabit small (< 10 km), isolated, high-elevation habitat patches that are often affected by land management activities and other human uses. This pattern is consistent with that documented for a variety of inland salmonid species native to western North America.

There have been numerous changes in our knowledge of the genetic status of conservation populations since 2005. Genetic testing was completed on 140 CRCT populations. Information on the genetic status of known and previously undocumented conservation populations resulted in many changes in estimates of habitat occupied by conservation populations. This assessment includes a synopsis of the results of scientific research on the genetic history of CRCT that has been published since 2005 (Appendix A). Much energy has been devoted to attempting to clarify the genetic history of CRCT and its close cousin, the greenback cutthroat trout (*O. c. stomias*). At the time of this writing the effect this research will have on CRCT management and conservation remains uncertain.

Many state and federal agencies, their partners and other stakeholders completed a tremendous amount of work toward increasing CRCT distribution and improve habitat conditions within their current range. While not a project-by-project narrative of conservation actions, this assessment documents the work of signatory agencies to the CRCT Conservation Agreement and their partners. Increasing the accuracy of the estimate of historic range, the baseline upon which agencies can document the efficacy of their actions to preserve and protect CRCT, was a major achievement. The conservation agreement for CRCT requires a status assessment be completed every five years, meaning the next assessment would document changes in status of CRCT conservation populations that occurred from 2011 through 2015. It is possible the next assessment will include revisions to the historic range; however, it is unlikely any changes will be significant. Therefore, the 2015 assessment will focus exclusively on progress made in conserving CRCT.

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Introduction

The Colorado River Cutthroat Trout Conservation Team completed the first range-wide status assessment for the species in 2006 (Hirsch et al. 2006). The initial assessment involved the synthesis of data collected by state and federal natural resource management agencies in Colorado, New Mexico, Utah, and Wyoming. The resulting document established a baseline upon which future conservation activities for Colorado River cutthroat trout (CRCT) could build.

In the wake of the original assessment much work has been done within each of the eight Geographical Management Units (GMU) that make up the current range of CRCT. Specific activities included surveys to monitor known populations and identify previously unknown conservation populations, genetic analysis of conservation or suspected conservation populations, and field validation of current distributions. The goal of these activities was to refine distribution maps, population estimates, and genetic status of populations reported in the 2006 status assessment. Concurrent to those activities, natural resource agencies from across the range of CRCT embarked on projects including habitat improvements, non-native species control, and translocation to restore or create new conservation populations. Changes to CRCT distribution within each GMU reflect the work by stakeholders to identify and evaluate the status of extant populations as well as the results of activities designed to expand their range.

Information from the range-wide database maintained by signatories to the CRCT Conservation Agreement (CRCT Conservation Team 2006a and b) was the basis for this assessment. The job of the CRCT Conservation Team in revising and updating the status assessment for 2012 was simplified greatly by the fact each GMU conducted annual updates of CRCT status. Additionally, the CRCT Conservation Team meets annually to discuss the status of populations across the species range and to share challenges and successes in conservation activities. This document presents the results of these and other activities and is an accurate description of the status of CRCT conservation populations throughout their range as of December 2010.

A recent publication exploring the molecular composition of museum specimens collected prior to the advent of large-scale stocking activities has helped refine our view of the phylogenetic history of cutthroat trout in the southern Rocky Mountains, including CRCT (Metcalf et al. 2012). While an earlier publication suggested that greenback cutthroat trout could be found west of the Continental Divide (Metcalf et al. 2007), subsequent work maintained that the molecular fingerprint attributed to greenback cutthroat trout actually represented a second lineage found within the range of CRCT (Rogers 2010, Metcalf et al. 2012). Whether this second lineage (dubbed Lineage GB for its connection to what were thought to be greenback cutthroat trout east of the Divide) simply represents distinct diversity within CRCT, or whether it should be elevated to subspecies status is currently being evaluated. The U. S. Fish and Wildlife Service is embarking on a scientific review of these findings along with another study that compares phenotypic characteristics between the clades identified in the museum study (Metcalf et al. 2012) to see if visual differences between the lineages are apparent. It could be years before a final determination is made (Leslie Elwood, USFWS, personal communication). Additional information regarding the evolutionary history of CRCT can be found in Appendix A.

In addition to discussions of non-native species, habitat degradation, and disease, this assessment also includes a discussion of the potential effects of climate change on the long-term viability of CRCT populations. In the last five years, much energy has been spent evaluating how climate change may affect fish species in western North America (Rieman et al. 2008; Meyers et al. 2010; Rieman et al. 2010; Wenger et al. 2011; Haak et al. 2012). There are many unknowns; however, the same approaches outlined in the conservation strategy (2006b) are also the ones that will best protect CRCT in the face of a changing climate.

Methods

The same Inland Cutthroat Protocol and GIS database used to complete the 2005 status assessment lies at the foundation of this 2010 assessment as well. A detailed discussion of the protocol can be found in Appendix B. The GIS database was maintained and refined through annual meetings held by each GMU specifically for the purpose of updating the raw data upon which the assessment is based. In addition to incorporating population and genetic survey results from the previous field season, these annual updates served as a venue to document changes in the current range of CRCT resulting from restoration work or the identification of previously unknown populations. These changes to the current range included adding lake populations of CRCT to the database as outlined in Appendix B. Historical range was also adjusted if new information regarding natural barriers or water temperatures suggested that CRCT would not have inhabited specific waters prior to European settlement.

Unlike the 2005 assessment, we focused our efforts on describing the status of CRCT conservation populations in this 2010 assessment, since they have the greatest conservation significance across the species' current range. Indeed, the USFWS considered conservation populations only when they arrived at a "not warranted" listing for CRCT in 2007 (USFWS 2007) and a "warranted but precluded" finding for Rio Grande cutthroat trout in 2008 (USFWS 2008). A detailed description of the "currently occupied" habitats which includes the remaining CRCT populations consistent with the 2005 assessment is presented in Appendix C.

Results and Discussion

Accomplishments: 2007 – 2010

The 2006 Conservation Agreement and Conservation Strategy are companion documents that provide direction for the implementation of future restoration and conservation efforts. Both documents list this goal:

> *To assure the long-term viability of CRCT throughout their historic range. Areas that currently support CRCT will be maintained, while other areas will be managed for increased abundance. New populations will be established where ecologically and economically feasible, while the genetic diversity of the species is maintained. The cooperators envision a future where threats to wild CRCT are either eliminated or reduced to the greatest extent possible.*

The Conservation Agreement was designed to "expedite the implementation of conservation measures for CRCT in Colorado, Utah, and Wyoming as a collaborative and cooperative effort among resource agencies." The Conservation Strategy then directs the implementation of conservation measures through the identification of 11 Strategies, discussed in more detail below.

In 2007 the CRCT Conservation Team developed a process to annually quantify the teams' accomplishments for each strategy. This section summarizes the accomplishments during the four year period from 2007 to 2010. Similar conservation actions also occurred in 2006 but were not reported in a way that could be readily integrated with the subsequent structure. Accomplishments are summarized first by strategy and then by conservation action within that strategy. Some conservation actions are further separated into stream and lake populations. Accomplishments were first summarized by GMU and then combined for the entire range of CRCT.

Strategy 1 addresses population monitoring, the survey of new waters, and genetic analysis.

Monitor: Abundance monitoring of conservation populations provides information on the number of individuals, size structure, and age composition. Population monitoring is expected to occur periodically to monitor changes in these attributes through time. One hundred and sixty-one stream and 34 lake conservation populations were monitored between 2007 and 2010. Many of these sites had been previously sampled providing information on changes in the population structure and new sites will serve as baseline information for future monitoring.

Survey: The conservation action directed cooperators to "seek out undiscovered waters that have the potential to support CRCT populations until all remnant populations and potential habitats have been identified". A total of 131 streams were assessed resulting in the discovery of nine new conservations populations and 42.5 additional miles of occupied habitat. Twelve lakes were assessed with no new populations recorded.

Genetics: The third conservation action called for the complete genetic analyses of known or potential populations of CRCT. Fish tissue was collected and analyzed for 131 known stream conservation populations and nine lakes. Similarly, genetic results were obtained for 52 streams that had the potential to contain CRCT.

Strategy 2 focuses on efforts to reduce threats to population persistence. Efforts including the prevention of introduction of non-native fishes, disease, invasive species, as well as angling regulations have been addressed through policy and the enforcement of these policies by state agencies.

Disease Testing: Whirling disease is the primary disease tested for within conservation populations with 24 stream and four lake populations tested. Brood sources are routinely tested for a wide range of diseases.

Barriers Constructed: Existing natural or anthropogenic in-channel barriers eliminate the risk of invasion by non-native fish species or hybridized cutthroat for many conservation populations. Barriers should be constructed if not present and all barriers should be routinely assessed and maintained. Thirteen barriers were constructed, maintenance occurred on 16 barriers, and barrier effectiveness was monitored at 10 sites.

Strategy 3 focuses on the removal on non-native fishes to create new and expand existing populations. Many conservation populations coexist with non-native fishes in all or part of their occupied habitat. Electrofishing was used to reduce the number of non-native fishes in 34 stream conservation populations and in four lakes. In addition, non-native fishes were completely removed from two stream conservation populations. Four streams were chemically treated to remove all non-native fish resulting in the creation of new conservation populations. Similar, two lakes were reclaimed. An additional 25 watersheds were reviewed for future reclamation projects.

Strategies 4 and 5 address the need to maintain sources of genetically pure Colorado River cutthroat trout. There are 12 genetically pure brood sources for CRCT. Forty-nine stream and 23 lake populations are stocked with progeny from these brood sources.

Strategies 6 and 11 involve monitoring watershed conditions and land management actions to detect changes in habitat conditions.

Habitat: Habitat conditions were monitored within 71 stream and one lake conservation populations. Monitoring questions and techniques varied and addressed livestock impacts, stream banks and riparian vegetation, aquatic passage at diversions and culverts, overall habitat quality assessments, recreation use, travel management, stream substrate, photo points, and effects of water level fluctuations.

Water Quality: Water quality was monitored at 70 stream and 11 lake populations. Water temperature monitoring was most common but monitoring also included stream flows, macroinvertebrates, and various parameters in lakes

Strategy 7 is focused on improving habitat conditions for CRCT.

Watershed Improvement: Watershed improvement actions were implemented for eight conservation populations. Actions include road decommissioning, travel management, prescribed burning, invasive species control, and livestock management including fencing, reduced numbers, and temporary removal

Habitat Improvement: Habitat improvement actions were conducted at 54 stream and 6 lake populations. Actions include construction and maintenance of riparian fencing, off-stream water development, stream bank stabilization, new channel construction, culvert replacement/removal for aquatic passage, fish screens on diversions, and riparian vegetation planting.

Water Quantity: Additional water was acquired for two conservation populations.

Strategy 8 focuses on interpretive and education programs to increase public awareness of CRCT conservation efforts. Twenty five interpretive and education programs have been conducted that address conservation and restoration of CRCT. Programs include discussions at public meetings, watershed councils, town councils, interest groups, and classrooms, interviews with media, documentaries, interpretive signs, volunteer help on projects, and field trips.

Strategy 9 and 10 focus on the need to continue fostering a cooperative interagency work environment and maintain the CRCT database. These accomplishments were discussed in the introduction.

Historic Range

The status update is based on habitat believed to be inhabited when early European explorers entered western North America (ca. 1800). In general, streams capable of supporting trout now were assumed to have been occupied if they were not above a barrier. Conversely, streams which cannot currently support trout were excluded from our estimate of historic range unless they are known to have been degraded in the last 200 years by water withdrawals, channel alterations, human-caused barriers, or chemical contamination. There was a thorough review of the original estimate of historic distribution and many corrections were made before the 2010 update. Our current estimate of historic range of CRCT is 32,328 kilometers (Table 1, Figure 1). The 2010 estimate is over 2,000 km less than that made in 2005. Most changes are the result of refinements made in consultation with local experts and are not indicative of habitat lost in the last five years.

Table 1. Estimates of historic range (km) of CRCT in five western states in 2005 and 2010. 2010 State totals are rounded and therefore do not sum to the total listed.

State	2005	2010
Arizona	-	177
Colorado	22,014	19,778
New Mexico	88	181
Utah	5,608	5,660
Wyoming	6,754	6,533
Total	**34,417**	**32,328**

While the overall estimate of historic range decreased by over 2,000 km, there was not a reduction in historic range in every GMU (Table 2). Historic range increased in the Lower Colorado, Lower Green, and San Juan GMUs. Nearly 1,000 km of historic range was removed from the Gunnison GMU. Differences in interpretation by individual biologists also contributed to variable changes in historic range among fourth-level HUCs within each GMU (Table 2).

Current Range

Conservation populations are those known (genetic testing complete) or suspected to be at least 90% genetically pure or were otherwise determined to be important for CRCT conservation. There are 361 conservation populations occupying 3,403 km of stream habitat in Colorado, Utah, and Wyoming (Table 3, Figure 3), which includes 291 km outside of historic habitat. Conservation populations currently occupy 11% of the historic range, up from 8% in 2005. Changes in the number and distribution of conservation populations relative to 2005 were due to an increase in the amount of stream known to be occupied by conservation populations, and the decrease in estimated historic habitat (see above). Conservation populations occur in all eight GMU's and in 37 of 51 4th-level HUCs which contain historic habitat. Ten conservation populations are known to straddle state boundaries, up from eight in 2005.

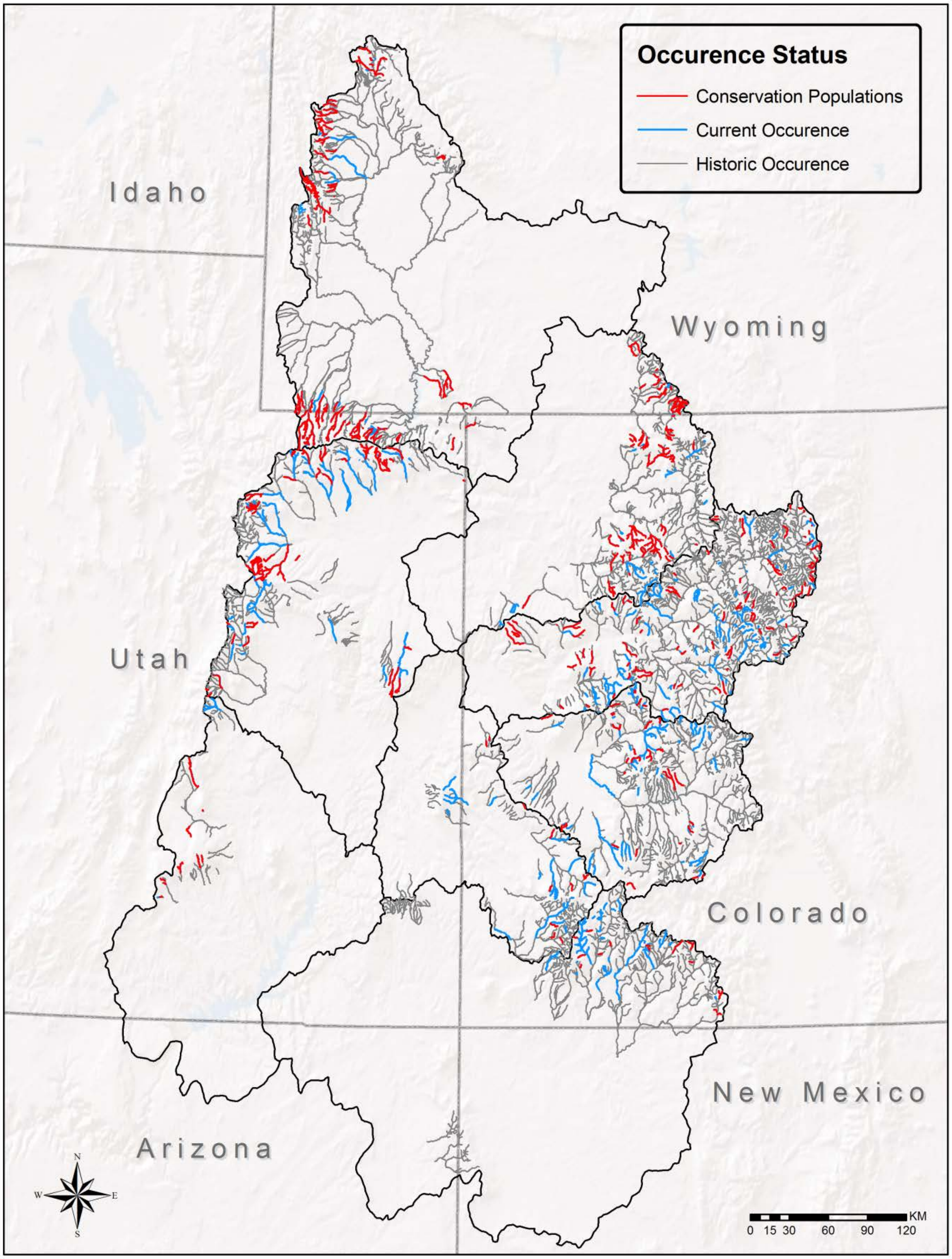

Figure 1. Historic and current range of CRCT as of 2010.

Table 2. Estimates of historic range (km) of CRCT in eight Geographical Management Units (GMU) in 2005 and 2010. Fourth-level HUCs within each GMU are listed in italics. The values in this table have been rounded to the nearest whole number for presentation; therefore, summing the data presented here results in overestimates of CRCT historic distribution. Readers are instructed to the use the data presented in Table 1 when defining the size of CRCT historic distribution.

GMU; *HUC-4*	2005	2010
Dolores	**2,002**	**1,795**
Lower Dolores	211	229
San Miguel	508	473
Upper Colorado-Kane Springs	130	133
Upper Dolores	1,113	918
Westwater Canyon	40	43
Gunnison	**5,506**	**4,636**
East-Taylor	884	768
Lower Gunnison	602	476
North Fork Gunnison	773	663
Uncompahgre	367	271
Upper Gunnison	2,042	1,747
Tomichi	837	711
Lower Colorado	**560**	**590**
Escalante	172	177
Fremont	250	267
Muddy	1,387	146
Lower Green	**3,572**	**3,577**
Ashley-Brush	257	256
Duchesne	987	914
Lower Green-Desolation Canyon	243	242
Lower Green-Diamond	41	41
Price	640	632
San Rafael	591	634
Strawberry	648	697
Willow	166	161
Upper Colorado	**7,585**	**7,272**
Blue	732	759
Colorado Headwaters	3,401	3,353
Colorado Headwaters-Plateau	984	944
Eagle	1,012	945
Parachute-Roan	231	241
Roaring Fork	1,225	1,031
Upper Green	**7,081**	**6,850**
Big Sandy	575	491
Blacks Fork	1,389	1,356
Muddy	538	537
New Fork	626	587
Upper Green	2,608	2,472
Upper Green-Flaming Gorge Reservoir	1,143	1,203
Upper Green-Slate	113	113
Vermillion	89	91
San Juan	**3,211**	**3,414**
Animas	790	730
Chinle	-	268
Lower San Juan-Four Corners	241	258
Mancos	179	191
Middle San Juan	332	252
Montezuma	32	35
Piedra	595	601
Upper San Juan	1,042	1,079
Yampa	**4,948**	**4,194**
Little Snake	786	830
Lower Yampa	65	82
Lower White	132	143
Muddy	98	105
Piceance-Yellow	100	106
Upper Yampa	2,742	2,080
Upper White	1,024	848

The current range of all CRCT, both conservation populations and those populations without conservation population designation, includes about 5,679 km of stream habitat (Figure 1) and 1,162 ha of lake habitat. Of currently occupied CRCT stream habitat, 509 km occur outside delineated, historic CRCT stream habitat. This additional stream habitat is typically located upstream of natural barriers in stream segments not believed to have been occupied historically. CRCT were most likely introduced into these habitats by humans. In most cases these stream segments are adjacent to the historic range. CRCT populations in lakes were not tracked as part of the 2005 assessment so no comparisons are possible. The current range of CRCT is 16% of the historic range. In 2005 we estimated CRCT occupied about 14% of their historic range. Changes are attributable to revision of the estimated historic habitat, an increase in known occupied habitat, discovery of previously unknown populations, and expansion or establishment of new populations through management actions. For a thorough discussion of characteristics of all CRCT (conservation populations and undesignated populations), see Appendix C. The rest of the main body of this text refers to designated conservation populations only unless noted.

Characteristics of Conservation Populations

Since 2005 additional conservation populations have been identified, which translate to additional stream kilometers and percentage of state's historic habitat occupied (Table 3). Colorado continues to have the greatest number of conservation populations and the most occupied habitat. However, Colorado also has the lowest percentage of occupied historical habitat and the shortest average occupied patch length (Table 3). Utah has the fewest conservation populations. However, Utah has the second most stream length occupied, the highest percentage of occupied historical habitat, and longest average occupied patch length. The greatest increase in both number of conservation populations and occupied stream kilometers was in Colorado. Wyoming was the only state where the average length of occupied patches increased since 2005, which was due to restoration efforts in the Upper Green GMU.

Within GMUs, the current range of conservation populations was as low as 3% of historic range in the Delores and Gunnison GMUs to 16% of historic range in the Upper Green and Yampa GMUs. The Dolores and Gunnison GMUs comprise nearly 20% of the species' historic range but only 6.4% of the current range of conservation populations is located in these GMUs. In contrast, the Upper Green and Yampa GMUs comprise 34.2% of the species historic range and they contain 55.9% of the current range of conservation populations (Table 4). While the current range of conservation populations is dramatically reduced relative to the historic range, it is important to point out that conservation populations are present in 37 of the 51 HUCs that comprise the species' historic range. In four of these, extant conservation populations are the result of human introduction outside the species historic range (Table 4).

Table 3. Characteristics of CRCT conservation populations in Colorado, Wyoming, and Utah. CRCT populations in lakes were not evaluated in 2005. Populations which cross state lines (8 in 2005 and 10 in 2010) are counted twice in this table.

	2005	2010
Colorado		
Conservation populations	145	198
Current range	1,141	1,432
Historic range %	5	7
Average patch length	4.9	7.4
Lake area occupied	-	60
Utah		
Conservation populations	63	86
Current range	933	1,105
Historic range %	17	20
Average patch length	9.2	13.8
Lake area occupied	-	327
Wyoming		
Conservation populations	85	87
Current range	816	866
Historic range %	12	13
Average patch length	6.0	12.7
Lake area occupied	-	242.4
Total		
Conservation populations	285	361
Current range	2,891	3,403
Historic range %	8	11
Average patch length	6.1	9.4
Lake area occupied	-	629

Habitat patch size

The size of occupied habitat patches varies considerably across the current range of conservation populations (Table 5). The majority of the current range of conservation populations is composed of habitat patches less than 10 km long (Table 5). While 249 conservation populations are located in these smaller patches only 18 are found in habitat patches over 30 km long. The pattern of CRCT distribution on the landscape is consistent with that of other inland cutthroat trout sub-species (Dunhan et al. 1997; Dunham et al. 1999; Haak et al. 2010).

Habitat connectivity

Connectedness to surrounding watersheds varies considerably for conservation populations (Table 7). Most conservation populations are located upstream of a barrier. As previously undocumented conservation populations have been identified, additional barriers have been documented as well (Table 7). This update identifies additional complete barriers in seven GMUs. There are 17 conservation populations for which barrier status is not known; however, it is likely future surveys will clarify the status of these.

Although barriers are often necessary to ensure persistence of CRCT populations, there is clear evidence that barriers are fragmenting watersheds that support conservation populations. The current average patch size of stream-dwelling conservation populations upstream from complete barriers is 7.3 km. The average patch size of stream-dwelling conservation populations upstream from partial barriers is 11.1 km. The average patch size of conservation populations having no known downstream barrier is 12.8 km. The difference between isolated and un-isolated average patch length is 5.5 km.

Between 2005 and 2010, six additional populations with strong network connectivity were identified (Table 8). Additionally, strongly connected populations are now found in four GMUs, including the Dolores GMU. The inclusion of lake habitat in this assessment resulted in the documentation of lake populations in two GMUs that are strongly connected to the surrounding watershed. The majority of populations in both 2005 and 2010 were classified as isolated from the surrounding watershed.

Table 4. Stream length (km) of historic range within each GMU and 4th-level HUC. Proportion of historic range occupied currently, rounded to the nearest whole number, in parentheses. Additional habitat occupied (km) are populations resulting from human introduction outside the species' historic range. Current range (km) is the sum of all occupied habitat.

	Historic range, km	Historic occupied, km (%)	Additional, km	Current range, km
Dolores	**1,795**	**52.0 (3)**	**3.8**	**55.8**
Lower Dolores	229	-	-	-
San Miguel	473	27.3 (6)	3.8	31.1
Upper Colorado-Kane Springs	133	-	-	-
Upper Dolores	918	17.1 (2)	-	17.1
Westwater Canyon	43	7.6 (18)	-	7.6
Gunnison	**4,636**	**147.0 (3)**	**49.2**	**196.2**
East-Taylor	768	-	-	-
Lower Gunnison	476	-	8.9	8.9
North Fork Gunnison	663	69.6 (11)	7.7	77.3
Uncompahgre	271	15.0 (6)	-	15.0
Upper Gunnison	1,747	62.4 (4)	25.1	87.5
Tomichi	711	-	7.4	7.4
Lower Colorado	**590**	**77.0 (13)**	**6.8**	**83.8**
Escalante	177	33.4 (19)	5.7	39.1
Fremont	267	43.6 (16)	1.1	44.7
Muddy	146	-	-	-
Lower Green	**3,577**	**525.9 (15)**	**112.1**	**638.0**
Ashley-Brush	256	96.0 (38)	-	96.0
Duchesne	914	151.2 (17)	-	151.2
Lower Green-Desolation Canyon	242	-	-	-
Lower Green-Diamond	41	-	1.4	1.4
Price	632	110.4 (18)	21.8	132.2
San Rafael	634	43.0 (7)	-	43.0
Strawberry	697	125.3 (18)	5.5	130.8
Willow	161	-	83.4	83.4
Upper Colorado	**7,272**	**524.1 (7)**	**80.9**	**605.0**
Blue	759	37.7 (5)	10.2	47.9
Colorado Headwaters	3,353	195.3 (6)	26.1	221.4
Colorado Headwaters-Plateau	944	104.1 (11)	4.6	108.7
Eagle	945	49.5 (5)	7.3	56.8
Parachute-Roan	241	74.5 (31)	17.4	91.9
Roaring Fork	1,031	63.1 (6)	15.2	78.3
Upper Green	**6,850**	**1,068.6 (16)**	**4.5**	**1,073.1**
Big Sandy	491	-	-	-
Blacks Fork	1,356	222.3 (16)	-	222.3
Muddy	537	57.6 (11)	-	57.6
New Fork	587	14.5 (3)	-	14.5
Upper Green	2,472	447.0 (18)	4.5	451.5
Upper Green-Flaming Gorge Res.	1,203	327.3 (27)	-	327.3
Upper Green-Slate	113	-	-	-
Vermillion	91	-	-	-
San Juan	**3,414**	**46.6 (1)**	**33.7**	**80.3**
Animas	730	3.0 (< 1)	22.4	25.4
Chinle	268	-	-	-
Lower San Juan-Four Corners	258	-	-	-
Mancos	191	-	-	-
Middle San Juan	252	-	-	-
Montezuma	35	-	-	-
Piedra	601	19.8 (3)	-	19.8
Upper San Juan	1,079	23.8 (2)	11.3	35.1
Yampa	**4,194**	**670.8 (16)**	**-**	**670.8**
Little Snake	830	242.1 (29)	-	242.1
Lower Yampa	82	17.9 (22)	-	17.9
Lower White	143	-	-	-
Muddy	105	32.9 (31)	-	32.9
Piceance-Yellow	106	13.1 (12)	-	13.1
Upper Yampa	2,080	280.9 (14)	-	280.9
Upper White	848	83.9 (10)	-	83.9

Table 5. Distribution of habitat patch lengths (km) occupied by 348 stream-dwelling CRCT conservation populations. Lake populations were not included in this analysis.

Habitat patch length class, km	Conservation populations
0.0 – 1.0	17
1.1 – 2.0	36
2.1 – 4.0	79
4.1 – 10.0	117
10.1 – 20.0	62
20.1 – 30.0	19
30.1 – 40.0	6
40.1 – 50.0	1
50.1 – 70.0	6
70.1 – 90.0	3
90.1 – 110.0	2

Table 6. Characteristics of CRCT conservation populations in 2005 and 2010. N is the number of conservation populations, stream habitat occupied is presented in km, lake habitat occupied is presented in ha. Median patch length is for stream populations only. Information on lake occupancy was not available in 2005.

GMU	N	Stream habitat occupied, km	Lake habitat occupied, ha	Median patch length, km (range)
		2005		
Dolores	4	23	-	5.8(3.6-7.7)
Gunnison	25	149	-	5.3 (0.2-19.6)
Lower Colorado	14	80	-	4.7 (0.5-21.7)
Lower Green	26	495	-	11.1 (0.7-95.6)
San Juan	12	67	-	4.2 (1.3-13.8)
Upper Colorado	75	485	-	5.0 (0.3-28.6)
Upper Green	76	1,047	-	9.0 (0.03-105.6)
Yampa	53	545	-	5.5 (0.7-60.4)
Total	*285*	*2,891*	-	*6.0 (0.03-105.6)*
		2010		
Dolores	10	56	0	5.2 (2.7-8.1)
Gunnison	36	196	6	4.4 (0.2-20.2)
Lower Colorado	21	84	7	2.0 (0.5-23.5)
Lower Green	39	638	146	10.1 (1.4-96.4)
San Juan	15	80	1	3.7 (1.3-14.2)
Upper Colorado	101	605	35	5.0 (0.12-26.0)
Upper Green	75	1,073	417	9.0 (0.03-101.7)
Yampa	64	671	17	5.1 (0.3-78.1)
Total	*361*	*3,403*	*629*	*5.7 (0.03-101.7)*

Table 7. Distribution of barriers among CRCT conservation populations by GMU in 2005 and 2010.

	Barrier type					Barrier type		
	Complete	Partial	None	Unknown		Complete	Partial	None	Unknown
	2005					**2010**		
Dolores	2	0	2	0	**Dolores**	5	1	4	0
Gunnison	9	2	14	0	**Gunnison**	13	6	14	3
Lower Colorado	13	0	1	0	**Lower Colorado**	16	1	4	0
Lower Green	15	4	7	0	**Lower Green**	17	5	17	0
San Juan	11	0	0	1	**San Juan**	13	0	1	1
Upper Colorado	38	15	22	6	**Upper Colorado**	43	11	41	6
Upper Green	25	4	52	2	**Upper Green**	24	6	42	3
Yampa	26	2	26	1	**Yampa**	27	7	26	4
Total	*139*	*27*	*124*	*10*	*Total*	*158*	*37*	*149*	*17*

Table 8. Connectivity of CRCT conservation populations for each GMU. For each connectivity level data are presented as *number of populations; stream km; lake ha*. There are no lake data for 2005.

		Network connectivity			
GMU	N	Isolated, N; km; ha	Weak, N; km; ha	Moderate, N; km; ha	Strong, N; km; ha
		2005			
Dolores	4	4; 23	-	-	-
Gunnison	25	19; 89	5; 53	1; 7	-
Lower Colorado	14	12; 56	2; 24	-	-
Lower Green	26	15; 110	7; 119	1; 49	3; 217
San Juan	12	11; 57	1; 11	-	-
Upper Colorado	75	59; 345	15; 112	1; 29	-
Upper Green	76	32; 276	33; 401	7; 137	4; 233
Yampa	53	36; 234	9; 106	7; 205	1; 0.9
Total	*284*	*188; 1,190*	*72; 826*	*17; 427*	*7; 450*
		2010			
Dolores	10	9; 49; 0	-	-	1; 7; 0
Gunnison	36	29; 131; 6	5; 43; 0	2; 22; 0	-
Lower Colorado	21	18; 54; 7	3; 30; 0	-	-
Lower Green	39	21; 160; 118	12; 170; 7	2; 81; 0	4; 227; 21
San Juan	15	14; 69; 1	1; 11; 0	-	-
Upper Colorado	101	82; 441; 29	16; 116; 7	1; 25; 0	2; 23; 0
Upper Green	75	35; 306; 62	31; 403; 39	3; 53; 1	6; 311; 314
Yampa	64	47; 301; 17	9; 90; 0	7; 280; 0	-
Total	*361*	*256; 1,511; 240*	*76; 1,063; 53*	*15; 461; 1*	*13; 561; 335*

Conservation populations in sympatry with non-natives

In 2005, 60% of conservation populations occurred with non-native trout or had records of stocking. By 2010, this number was reduced slightly to 58%. While the number of allopatric conservation populations increased from 115 to 152 by 2010, occupied stream kilometers declined from 935 to 795 (Table 9). This is a result of survey work refining distributions of known populations as well as documenting new populations occupying relatively short stream segments. Data reporting for 2005 and 2010 differ slightly; in 2010 we separated instances where non-native were known to be present and sites having a historic stocking record (Table 9).

Life history diversity

Life history diversity was evaluated for each conservation population (Table 10). Life history strategies that have been documented in CRCT populations include adfluvial (migrating between lakes and streams), fluvial (migrating between larger and smaller streams), and stream resident. Throughout the current range of CRCT migratory life histories are rare reflecting the fact most conservation populations are isolated from the surrounding watershed. There are no documented migratory life histories in the Dolores and San Juan GMUs.

Table 9. Conservation populations in allopatry and sympatry within GMUs in 2005 and 2010. A valid stocking record indicates there is the potential for hybridization. In 2005, conservation populations having either a historic stocking record or confirmed non-native presence were pooled. Within each column data are formatted as *number of populations; stream km; lake ha*. There are no lake data for 2005.

GMU	Populations	Stream km	Lake ha
Non-natives absent, 2005			
Dolores	1	13	-
Gunnison	13	73	-
Lower Colorado	8	46	-
Lower Green	8	253	-
San Juan	7	54	-
Upper Colorado	32	280	-
Upper Green	24	362	-
Yampa	22	275	-
Non-natives present, 2005			
Dolores	3	13	-
Gunnison	12	131	-
Lower Colorado	6	68	-
Lower Green	18	401	-
San Juan	5	26	-
Upper Colorado	43	424	-
Upper Green	52	1,224	-
Yampa	31	550	-
Non-natives absent, no stocking record, 2010			
Dolores	4	25	0
Gunnison	14	45	6
Lower Colorado	12	44	1
Lower Green	14	128	13
San Juan	8	43	1
Upper Colorado	40	181	18
Upper Green	27	171	15
Yampa	33	0	0
Historic stocking record, non-natives absent, 2010			
Dolores	1	5	0
Gunnison	6	40	0
Lower Colorado	3	7	0
Lower Green	3	117	0
San Juan	3	18	0
Upper Colorado	17	99	14
Upper Green	12	161	0
Yampa	11	90	0
Non-natives present, 2010			
Dolores	5	27	0
Gunnison	16	112	0
Lower Colorado	6	33	6
Lower Green	22	392	133
San Juan	4	19	0
Upper Colorado	44	326	3
Upper Green	36	741	402
Yampa	20	420	17

Table 10. Life history diversity of CRCT conservation populations within each GMU.

	Life-history strategy					
	Resident (R)	Fluvial (F)	Adfluvial (A)	A, R	F, R	A, F, R
Dolores	10					
Gunnison	35		1			
Lower Colorado	19		1	1		
Lower Green	35		2		1	1
San Juan	15					
Upper Colorado	97	1	2		1	
Upper Green	69		2	2	2	
Yampa	61	1		2		
Total	*341*	*2*	*8*	*5*	*4*	*1*

Genetic status

The genetic purity of conservation populations is variable across current range (Table 11). Most changes in genetic status since 2005 are populations that were characterized as “suspected unaltered” and “potentially hybridized.” Surveys conducted since 2005 have resolved the genetic status of these populations resulting in dramatic decreases in populations classified as suspected unaltered or potentially hybridized, accompanied by increases in other categories. For example, in the Upper Colorado GMU, populations classified in these two categories occupy about 115 km less stream habitat in 2010 than they did in 2005. In the same time period, the Upper Colorado GMU added over 200 km of habitat occupied by populations with at least 90% genetic purity (Table 11).

In 2010, 1,426 stream km were occupied by populations having unaltered genetics, 14% more than was reported in 2005. Habitat occupied by unaltered populations increased in most GMUs, with the largest increase in the Lower Green and Upper Green GMUs (Table 11).

The amount of stream habitat occupied by populations displaying 90-99% genetic purity increased since 2005. Conservation populations having 90-99% purity occupy 798 stream km, which is an increase of 514.5 km since 2005 (Table 11). Most of this positive change is the result of genetic surveys conducted after 2005 and the reclassification of populations with previously unknown genetic status.

Table 11. Genetic status of CRCT conservation populations in 2005 and 2010 by GMU. Data are presented as stream km occupied by populations of each genetic status. Populations were classified either with molecular data or based on their past stocking history such that the resulting population is likely pure (Suspected unaltered, SusUn), hybridized (Potentially hybridized, PotHyb), or composed of mixed stock of native and nonnative species (Mixed).

		Genetic status							
		Unaltered	90-99%	80-89%	< 80%	SusUn	PotHyb	Mixed	Total
Dolores	2005	8.7	6.6			4.6		3.7	23.5
	2010	29.8	21.7			0.0		4.3	55.9
	Change	21.1	15.1			*-4.6*		0.6	32.2
Gunnison	2005	90.5	18.0			10.1	31.1	0.0	149.7
	2010	76.1	64.9	6.5		15.5	39.7	10.1	212.8
	Change	*-14.4*	46.9	6.5		5.4	8.6	10.1	63.1
Lower Colorado	2005	75.9					5.0		80.9
	2010	78.5					5.2		83.7
	Change	2.6					0.2		2.8
Lower Green	2005	317.9				129.2	47.4		494.5
	2010	404.7	64.6		23.9	92.9	51.8		637.9
	Change	86.8	64.6		23.9	*-36.3*	4.4		143.4
San Juan	2005	46.9	12.7			4.6	3.0		67.2
	2010	51.8	19.1			6.4	3.1		80.3
	Change	*-4.9*	6.4			1.8	0.1		13.1
Upper Colorado	2005	144.0	55.2		8.6	91.0	186.8		485.5
	2010	242.0	128.3	0.1	28.5	81.9	124.3		605.0
	Change	98.0	73.1	0.1	19.9	*-9.1*	*-62.5*		119.5
Upper Green	2005	244.8	120.2	25.8	11.2	234.0	311.3	104.9	1,052.1
	2010	320.3	128.3	36.4	20.8	242.1	229.5	95.8	1,073.1
	Change	75.5	8.1	10.6	9.6	8.1	*-81.8*	9.1	21.0
Yampa	2005	300.0	70.5	5.2	5.8	62.6	104.6		548.7
	2010	312.9	240.8	4.0	0.0	56.4	56.8		670.8
	Change	12.9	170.3	*-1.2*	*-5.8*	*-6.2*	*-47.8*		122.1

As with stream populations, the genetic status of CRCT populations in lakes is variable (Table 12). Seven of eight GMU's contain a lentic conservation population; however, most of these populations are located in the Lower Green, Upper Green, and Yampa GMUs. Many of these populations have an unknown genetic status. Genetic testing of these populations will resolve this uncertainty. Because lake size is highly variable, comparison of hectares occupied does not relate as well to numbers of populations as streams do.

Table 12. Genetic status of lake populations of CRCT in 2010 by GMU. Data are presented as hectares occupied by populations of each genetic status. Populations were classified either with molecular data or based on their past stocking history such that the resulting population is likely pure (Suspected unaltered, SusUn), hybridized (Potentially hybridized, PotHyb), or composed of mixed stock of native and nonnative species (Mixed).

	Genetic status							
	Unaltered	90-99%	80-89%	< 80%	SusUn	PotHyb	Mixed	**Total**
Dolores								
Gunnison	6							**6**
Lower Colorado	7							**7**
Lower Green	48	12			62	24		**146**
San Juan		1						**1**
Upper Colorado	29	1			6	10		**35**
Upper Green	26	25			118	248		**417**
Yampa	2				16			**18**

<u>CRCT density</u>

Adult CRCT density estimates were based on number of fish ≥ 150 mm TL and calculated as adults per kilometer for each conservation population. Densities were summarized into density ranges by state (Table 13) and GMU (Table 14). In 2005 and 2010, 622 km and 660 km, respectively of occupied habitat supported populations identified within the 0-50 per mile range. In 2010, nearly 100 additional stream kilometers are occupied by populations having adult densities of 51-150 fish per mile. The pattern was similar for populations having densities of 151-440 and > 400 fish per mile.

Table 13. Density categories, reported in units of sexually mature CRCT per mile, of conservation population-occupied stream habitat (km) by state for reporting periods 2005 and 2010 are shown in addition change since 2005.

Density	2005 (km)	2010 (km)	Change (km)
Colorado			
0 – 50	163.1	254.4	91.3
51 – 150	266.3	456.4	190.1
151 – 400	379.3	296.4	-82.9
> 400	64.8	166.9	102.1
Unknown density	272.4	157.4	-115.0
Total	1,145.9	1,431.7	185.6
Utah			
0 – 50	251.8	253.6	1.8
51 – 150	159.4	233.0	73.6
151 – 400	175.4	258.3	82.9
> 400	116.8	186.1	69.3
Unknown density	235.9	174.2	-61.7
Total	939.3	1,105.3	166.0

Density	2005 (km)	2010 (km)	Change (km)
		Wyoming	
0 – 50	207.0	151.6	-55.4
51 – 150	209.1	242.2	33.1
151 – 400	189.8	187.7	-2.1
> 400	119.8	102.5	-17.3
Unknown density	91.2	182.0	90.8
Total	816.9	865.9	49.0

There were large increases in the amount of current range for which adult density is known in most GMUs (Table 14). Surveys have revealed populations with very high adult density in some GMUs. For example, in 2005 the current range in the Gunnison GMU contained no populations having an adult density > 400 adults per mile. In 2010, the Gunnison GMU contained 21.7 km of current range supporting more than 400 adults per mile. The increase was even greater in the Lower Green GMU, which contains an additional 40 km of current range supporting adult density > 400 fish per mile (Table 14).

Habitat Quality

Quality ratings for habitat occupied by conservation populations were based on natural characteristics and anthropogenic influences (see Appendix B). There was substantially more excellent and good habitat in 2010 in all three states. Unfortunately it is not possible to clarify how much of these changes are due to management actions as opposed to the discovery of additional occupied habitat since 2005.

Survey work since 2005 has documented changes in known habitat quality in all GMUs (Table 16). The amount of poor and unknown quality habitat decreased since 2005 in most GMUs. The exceptions to this were the Lower and Upper Green GMUs where the amount of poor quality habitat increased. However, this does not suggest habitat degradation has occurred in the Lower and Upper Green GMUs. In the same time period the amount of habitat rated as excellent and good increased for those GMUs (Table 16).

Occupied Stream Width

The average width of occupied stream segments was assessed for all occupied habitat. Despite increases in total stream kilometers occupying the various stream width categories, the proportion of surveyed stream kilometers within each of the different categories remained relatively constant. Sixty-three percent of occupied stream habitat was less than 15 ft wide (Table 17). Changes in the distribution of stream widths occupied by CRCT conservation populations are accounted for by refined distribution surveys with particular emphasis on small, headwater tributaries.

Table 14. Density categories, reported in units of adult CRCT per mile, of conservation population-occupied stream habitat (km) by GMU for 2005 and 2010.

Density	2005 (km)	2010 (km)	Change (km)
Dolores			
0 – 50	5.3	4.9	-0.4
51 – 150	3.7	31.9	28.2
151 – 400	6.6	19.1	12.5
> 400	-	-	-
Unknown density	7.9	0.0	-7.9
Total	*23.5*	*55.9*	*32.4*
Gunnison			
0 – 50	30.0	61.0	31.0
51 – 150	42.2	46.5	4.3
151 – 400	47.3	53.6	6.3
> 400	0.0	21.7	21.7
Unknown density	30.2	13.3	-16.9
Total	*149.7*	*196.2*	*46.5*
Lower Colorado			
0 – 50	16.5	5.7	-10.8
51 – 150	30.8	28.4	-2.4
151 – 400	10.4	17.5	7.1
> 400	22.5	29.8	7.3
Unknown density	0.7	2.3	1.4
Total	*80.9*	*83.7*	*2.8*
Lower Green			
0 – 50	222.8	224.9	2.1
51 – 150	81.9	146.1	64.2
151 – 400	80.1	104.1	24.0
> 400	7.1	49.7	42.6
Unknown density	102.6	113.2	10.6
Total	*494.5*	*637.9*	*143.4*
San Juan			
0 – 50	-	-	-
51 – 150	32.0	30.4	-1.6
151 – 400	18.8	18.1	-0.7
> 400	16.4	25.8	9.4
Unknown density	0.0	6.0	6.0
Total	*67.2*	*80.3*	*13.1*
Upper Colorado			
0 – 50	77.0	92.4	15.4
51 – 150	97.8	177.3	79.5
151 – 400	171.4	126.7	-44.7
> 400	11.5	111.3	99.8
Unknown density	127.8	97.3	-30.5
Total	*485.5*	*605.0*	*119.5*
Upper Green			
0 – 50	171.2	128.8	-42.4
51 – 150	192.1	231.7	39.6
151 – 400	278.2	291.9	13.7
> 400	187.0	197.7	10.7
Unknown density	223.7	223.0	-0.7
Total	*1,052.1*	*1,073.1*	*21.0*
Yampa			
0 – 50	99.1	141.9	42.8
51 – 150	154.2	239.6	85.4
151 – 400	131.7	211.5	79.8
> 400	57.1	19.4	-37.7
Unknown density	106.6	58.5	-48.1
Total	*548.7*	*670.8*	*122.1*

Table 15. Quality of habitat patches occupied by conservation populations in Colorado, Utah, and Wyoming in 2005 and 2010.

Habitat quality rating	2005 (km)	2010 (km)	Change (km)
Colorado			
Excellent	150.1	243.0	92.9
Good	642.8	783.1	140.3
Fair	234.5	324.7	90.2
Poor	77.6	62.6	-15.0
Unknown	40.8	18.3	-22.5
Total	*1,145.9*	*1,431.7*	*285.8*
Utah			
Excellent	210.0	270.1	60.1
Good	374.5	447.9	73.4
Fair	249.7	253.2	3.5
Poor	57.4	85.1	27.7
Unknown	47.7	49.1	1.4
Total	*939.3*	*1,105.3*	*166.0*
Wyoming			
Excellent	63.5	76.5	13.0
Good	294.8	356.1	61.3
Fair	357.8	331.4	-26.4
Poor	64.1	76.7	12.6
Unknown	36.7	25.2	-11.5
Total	*816.9*	*865.9*	*49.0*

Table 16. Habitat quality of habitat (km) occupied by CRCT conservation populations in 2005 and 2010 by GMU.

GMU	2005 (km)	2010 (km)	Change (km)
Dolores	**23.5**	**55.9**	**32.4**
Excellent	-	-	-
Good	7.9	39.3	31.4
Fair	15.6	16.6	1.0
Poor	-	-	-
Unknown	-	-	-
Gunnison	**149.7**	**196.2**	**46.5**
Excellent	18.4	34.3	15.9
Good	103.8	124.2	20.4
Fair	26.5	36.6	10.1
Poor	1.0	1.0	0.0
Unknown	-	-	-
Lower Colorado	**80.9**	**83.7**	**2.8**
Excellent	19.3	19.2	-0.1
Good	30.1	35.6	5.5
Fair	21.4	21.2	-0.2
Poor	10.1	7.7	-2.4
Unknown	-	-	-
Lower Green	**494.5**	**637.9**	**143.4**
Excellent	3.5	5.8	2.3
Good	176.1	304.5	128.4
Fair	220.4	215.3	-5.1
Poor	47.3	65.6	18.3
Unknown	47.3	46.7	-0.6
Upper Colorado	**485.5**	**605.0**	**119.5**
Excellent	76.4	134.9	58.5
Good	253.2	283.6	30.4
Fair	90.9	157.1	66.2
Poor	32.7	19.9	-12.8
Unknown	32.4	9.5	-22.9
Upper Green	**1,052.1**	**1,073.1**	**21.0**
Excellent	201.1	255.4	54.3
Good	422.3	411.6	-10.7
Fair	328.8	290.2	-38.6
Poor	62.7	88.5	25.8
Unknown	37.1	27.5	-9.6
San Juan	**67.2**	**80.3**	**13.1**
Excellent	23.1	24.0	0.9
Good	35.4	46.7	11.3
Fair	8.7	9.6	0.9
Poor	-	-	-
Unknown	-	-	-
Yampa	**548.7**	**670.8**	**122.1**
Excellent	82.0	116.0	32.0
Good	283.4	341.5	58.1
Fair	129.7	162.9	32.2
Poor	45.2	41.7	-3.5
Unknown	8.4	8.8	0.4

Table 17. Width (ft) of stream habitat occupied by CRCT conservation populations by GMU.

Stream width (ft)	2005 (km)	2010 (km)	Change (km)
Dolores			
< 5	9.1	14.8	5.7
5-10	14.5	32.3	17.8
10-15	0.0	8.8	8.8
15-20	-	-	-
20-25	-	-	-
> 25	-	-	-
Unknown	-	-	-
Total	*23.5*	*55.9*	*32.4*
Gunnison			
< 5	35.1	28.7	-6.4
5-10	80.1	106.3	26.2
10-15	33.8	48.1	14.3
15-20	0.0	13.0	13.0
20-25	-	-	-
> 25	-	-	-
Unknown	0.7	0.0	-0.7
Total	*149.7*	*196.2*	*46.5*
Lower Colorado			
< 5	7.0	8.2	1.2
5-10	37.6	38.0	0.4
10-15	30.3	31.6	1.3
15-20	1.0	0.8	-0.2
20-25	5.0	5.2	0.2
> 25	-	-	-
Unknown	-	-	-
Total	*80.9*	*83.7*	*2.8*
Lower Green			
< 5	80.8	129.8	49.0
5-10	190.1	266.7	76.6
10-15	118.9	119.8	0.9
15-20	11.6	23.2	11.6
20-25	29.2	35.1	5.9
> 25	3.9	3.9	0.0
Unknown	59.9	59.5	-0.4
Total	*494.5*	*637.9*	*143.4*
San Juan			
< 5	-	-	-
5-10	33.1	39.4	6.3
10-15	0.0	5.6	5.6
15-20	20.2	21.1	0.9
20-25	13.9	14.2	0.3
> 25	-	-	-
Unknown	-	-	-
Total	*67.2*	*80.3*	*13.1*
Upper Colorado			
< 5	21.7	54.3	32.6
5-10	249.2	310.2	61.0
10-15	97.4	144.5	47.1
15-20	53.1	47.7	5.4
20-25	31.4	29.5	-1.9
> 25	54.1	7.6	-46.5
Unknown	32.7	11.2	21.5
Total	*539.6*	*605.0*	*65.4*
Upper Green			
< 5	185.8	246.1	60.3
5-10	439.8	398.5	-41.3
10-15	171.5	133.5	38.0
15-20	119.6	158.4	38.8
20-25	33.5	44.8	11.3
> 25	0.0	55.4	55.4
Unknown	47.8	36.4	-11.4
Total	*998.0*	*1,173.1*	*151.1*
Yampa			
< 5	47.4	81.5	34.1
5-10	259.9	300.8	40.9
10-15	127.3	152.7	25.4
15-20	62.5	79.4	16.9
20-25	24.2	35.5	13.3
> 25	2.3	2.4	0.1
Unknown	25.1	18.5	-6.6
Total	*548.7*	*670.8*	*122.1*

Conservation Population Occurrence by Land Status

Surveys have identified about 330 km of additional occupied stream habitat since 2005. Sixty percent of additional stream kilometers are on National Forest (USFS) lands (24% within designated Wilderness Areas), 25% occurred on state lands, and 15% were on private land. Increases in occupied stream habitat on Bureau of Land Management (BLM) and tribal lands were negligible and there was a decrease in the amount of occupied stream habitat on National Park Service (NPS) lands (Table 18). As current reporting marks the first inventory of standing water occupied by CRCT, there are no listings for occupied hectares in 2005 (Table 18). The majority of occupied lake habitat occurred on USFS Wilderness lands (44%), followed by NPS (36%), USFS non-Wilderness (14%), BLM (2%), and State Lands (2%).

While overall stream kilometers within the various land status designations (save NPS lands) have increased since 2005, state lands was the only land status category that saw proportional increases in occupied stream kilometers. Of the 3,403 kilometers of habitats currently occupied by CRCT, 2,621 kilometers or 77% are located on Federal lands. This number is down from approximately 84% of currently occupied habitats associated with Federal lands in 2005.

Approximately two-thirds of all occupied habitats occurred on USFS lands. The proportion of currently occupied habitats occurring on non-wilderness USFS lands has decreased between reporting periods, while the proportion of those occurring within wilderness boundaries has not changed. See Appendix C for a map of all CRCT, including populations not designated as conservation populations, by land ownership.

Table 18. Land management status of occupied habitat by conservation populations in 2005 and 2010.

	2005 (km)	2010 (km/ha)	Change (km)
Bureau of Land Management			
Colorado	137	131/2	-6
Utah	4	12/0	8
Wyoming	123	123/0	0
Forest Service, non-Wilderness			
Colorado	606	672/8	66
Utah	637	667/202	30
Wyoming	473	500/242	27
Forest Service, Wilderness			
Colorado	234	273/26	39
Utah	157	189/114	32
Wyoming	35	43/0	8
National Park Service			
Colorado	18	12/21	-6
Utah	1	1/0	0
Wyoming	-	-	-
Private			
Colorado	279	309/2	40
Utah	100	120/12	20
Wyoming	148	148/0	0
State			
Colorado	20	35/0	15
Utah	25	78/0	53
Wyoming	38	53/0	15
Ute (tribal)			
Colorado	-	-	-
Utah	9	38/0	29
Wyoming	-	-	-

Risks to Conservation Populations

We considered three risks to conservation populations: 1) genetic contamination; 2) disease; and 3) climate change.

Genetic Contamination

Risk of genetic contamination was evaluated by determining the proximity and accessibility of hybridizing species. A total of 182 conservation populations (51%) were ranked as being at no risk of genetic contamination due to the presence of a secure barrier preventing immigration of hybridizing species. Thirty-four (9%) and 123 (34%) populations were at low or moderate risk, respectively. Twenty-two populations (6%) were rated as being at high genetic risk (Table 19). Low genetic risk was defined as hybridizing species being greater than 10 km away from the population, moderate risk was defined as hybridizing species being within 10 km of the population, and high genetic risk was defined as hybridizing species being sympatric with the population. Genetic risks to the 361 CRCT conservation populations by population numbers and kilometers of habitat occupied also varied by GMU (Table 19).

Degree of connectivity of conservation populations was evaluated against the degree of genetic risk (Table 20). Of the 182 populations considered as having no risk of genetic contamination 176 (97%) were identified as being isolated or weakly connected (Table 20). Only six (3%) conservation populations viewed to be at no risk had either moderate or strongly networked within population connectivity. In general, populations having limited connectivity had a lower risk of genetic contamination relative to more-connected and larger populations. Also, across levels of connectivity, the “no risk” populations (those protected by a barrier) were smaller than populations with higher levels of risk as seen in Table 20 where the percentage of "no risk" populations is always greater than the percentage of "no risk" stream kilometers.

Table 19. Risk of genetic contamination for 361 CRCT conservation populations by GMU.

Genetic contamination risk	Populations	Stream habitat (km)	Lake habitat (ha)
Dolores			
No risk	1	4	-
Low risk	1	6	-
Moderate risk	7	43	-
High risk	1	3	-
Gunnison			
No risk	12	60	6
Low risk	2	14	-
Moderate risk	21	102	-
High risk	1	20	-
Lower Colorado			
No risk	15	69	7
Low risk	-	-	-
Moderate risk	5	9	-
High risk	1	5	-
Lower Green			
No risk	22	305	97
Low risk	2	9	-
Moderate risk	12	286	28
High risk	3	39	21
San Juan			
No risk	13	66	1
Low risk	-	-	-
Moderate risk	2	15	-
High risk	-	-	-
Upper Colorado			
No risk	64	349	32
Low risk	8	49	-
Moderate risk	28	200	4
High risk	1	8	-
Upper Green			
No risk	24	126	43
Low risk	12	154	105
Moderate risk	28	464	40
High risk	12	330	228
Yampa			
No risk	31	190	17
Low risk	9	91	-
Moderate risk	21	336	-
High risk	3	53	-
TOTAL			
No risk	182	1,169	203
Low risk	34	323	105
Moderate risk	123	1,455	72
High risk	22	458	249

Table 20. Risks of genetic contamination for 361 CRCT conservation populations by degree of within population connectivity.

	Populations	Stream habitat (km)	Lake habitat (ha)
Population isolated			
No risk	145	759	196
Low risk	22	124	20
Moderate risk	77	484	4
High risk	11	144	21
Weakly connected			
No risk	31	271	7
Low risk	9	121	46
Moderate risk	30	339	-
High risk	7	132	-
Moderately connected			
No risk	2	20	-
Low risk	2	17	-
Moderate risk	8	343	1
High risk	3	80	-
Strongly connected			
No risk	4	119	-
Low risk	1	61	86
Moderate risk	8	289	21
High risk	1	102	229
TOTAL			
No risk	182	1,169	203
Low risk	34	323	152
Moderate risk	123	1,455	26
High risk	22	458	250

Disease

Disease risk was assessed based on proximity and accessibility of disease-causing pathogens. The diseases of concern are those that cause severe and significant impacts to population health and include but are not limited to whirling disease, furunculosis, and infectious pancreatic necrosis virus.

Two hundred fifteen populations (59%) were judged to have very limited risk from disease because disease and pathogens are not known to exist in the watershed or a barrier provides complete blockage to upstream fish movement. Ninety-three populations (26%) are at minimal disease risk because they are either farther than 10 kilometers from significant diseases or pathogens or they are protected by a barrier, but the barrier may be at risk of failure. Thirty-eight populations (11%) were at moderate risk because disease or pathogens have been identified within 10 kilometers of the conservation population, but not within the same stream segment. Seven populations (2%) are at high risk because disease or pathogens are sympatric with the cutthroat population. Eight populations (2%) are known to be infected with a significant disease (Table 21).

Table 21. Ranked risks associated with catastrophic diseases for the 361 conservation populations by GMU. Values reflect number of populations and kilometers occupied.

Disease risk	Populations	Stream habitat (km)	Lake habitat (ha)
Dolores			
Limited risk	1	4	-
Minimal risk	5	32	-
Moderate risk	4	19	-
High risk	-	-	-
Infected	-	-	-
Gunnison			
Limited risk	16	71	-
Minimal risk	11	85	-
Moderate risk	9	40	6
High risk	-	-	-
Infected	-	-	-
Lower Colorado			
Limited risk	16	39	6
Minimal risk	2	13	1
Moderate risk	1	6	-
High risk	-	-	-
Infected	2	26	-
Lower Green			
Limited risk	31	540	146
Minimal risk	3	53	-
Moderate risk	1	9	-
High risk	1	2	-
Infected	3	34	-
San Juan			
Limited risk	10	59	1
Minimal risk	5	22	-
Moderate risk	-	-	-
High risk	-	-	-
Infected	-	-	-
Upper Colorado			
Limited risk	58	311	29
Minimal risk	29	169	6
Moderate risk	11	87	-
High risk	2	26	-
Infected	1	12	-
Upper Green			
Limited risk	47	552	47
Minimal risk	19	384	242
Moderate risk	7	75	-
High risk	2	61	128
Infected	-	-	-
Yampa			
Limited risk	36	255	2
Minimal risk	19	311	16
Moderate risk	5	61	-
High risk	2	1	-
Infected	2	42	-
TOTAL			
Limited risk	215	1,832	230
Minimal risk	93	1,069	265
Moderate risk	38	397	6
High risk	7	90	128
Infected	8	114	-

We compared the degree of connectivity of each conservation population with disease risk (Table 22). Of the 215 populations considered as having a limited risk of catastrophic disease 43% were identified as being non-networked independent or isolated entities. In general, populations having limited connectivity were at somewhat lower levels of risk from diseases when compared to populations with greater degrees of within population connectivity and larger networks.

Table 22. Ranked risks associated with diseases for the 361conservation populations by degree of within population connectivity (networks). Values reflect number of populations and kilometers occupied.

Disease risk	Populations	Stream habitat (km)	Lake habitat (ha)
Population isolated			
Limited risk	154	813	156
Minimal risk	69	482	35
Moderate risk	29	203	6
High risk	1	0.5	43
Infected	2	11	-
Weakly connected			
Limited risk	48	556	53
Minimal risk	15	188	-
Moderate risk	4	25	-
High risk	5	29	-
Infected	5	63	-
Moderately connected			
Limited risk	6	186	-
Minimal risk	5	190	1
Moderate risk	3	46	-
High risk	-	-	-
Infected	1	39	-
Strongly connected			
Limited risk	7	276	21
Minimal risk	4	210	229
Moderate risk	2	23	-
High risk	1	61	86
Infected	-	-	-
TOTAL			
Limited risk	215	1,832	230
Minimal risk	93	1,069	265
Moderate risk	38	297	6
High risk	7	90.5	128
Infected	8	113	-

Climate Change

The impact of climate change on stream environments is an emerging risk to salmonid populations in the western U. S. While the potential effects to CRCT populations are well known (reductions in available habitat and increased exposure to stochastic disturbance events) there is no definitive protocol for determining how climate change could affect the species across its current range. The recent USGS publication *The Potential Influence of Changing Climate on the Persistence of Salmonids of the Inland West* (Haak et al. 2010) describes a coarse filter analysis conducted using GIS. Across the historic range of CRCT risk scores were aggregated by subwatershed to determine an area-weighted average score within historic and current range. Four factors were assessed: 1) increased summer temperature, 2) increased winter flooding, 3) increased wildfire risk, and 4) protracted drought (Haak et al. 2010).

Summer Temperature

Lower elevation populations may be at risk due to increased summer temperatures above tolerance levels for the species. However, across the range the overall risk resulting from increased summer temperature is low (Figure 4, upper left panel). These results are supported by others who have studied the effects of climate change on inland cutthroat trout populations (Wenger et al. 2011; Roberts and Fausch 2012). It is also possible that conditions for populations in higher elevations may improve, leading to increased recruitment and population density as mean summer temperatures increase. In addition, higher elevation streams and stream segments currently too cold to sustain CRCT may warm enough to provide suitable habitat in the future. Upslope range expansion could offset the predicted loss of lower elevation habitat. Conversely, high elevation stream segments experience stochastic disturbance, such as wild fire and debris flows, more frequently than low elevation areas. It is possible upslope range expansion of CRCT could be impacted by heightened risk of disturbances such as wild fire and post-wild fire debris flows (Roberts and Fausch 2012).

Drought

Protracted drought is a possible outcome of climate change and the factor that poses the highest risk for Colorado River cutthroat trout (Haak et al. 2010). Drought was modeled with respect to changes in stream flow using the Palmer Drought Severity Index (PDSI). Twenty percent of conservation populations identified in the 2005 assessment were ranked as being at high risk from drought. However, most populations were rated as having low to moderate drought risk. The upper right panel of Figure 4 depicts those portions of the range where drought poses the greatest risk.

Wildfire

Increased wildfire activity poses a risk to a number of watersheds. In fact increased wildfire activity has been presented as one of the most prominent effects of changing climate in western North America (Westerling et al. 2006). Across the analysis area, risk was determined to be low to moderate. Extensive acreage of beetle-killed lodgepole pine (*Pinus contorta*) exists in portions of northern and central Colorado and southern Wyoming. Populations occurring in these areas could be at increased risk. Recent research; however, suggests fire intensity and severity may not be increased in beetle-killed forests (Simard et al. 2011). It is uncertain whether the on-going bark beetle epidemic will contribute to risks posed by wildfires. The lower left panel of Figure 4 depicts those portions of the range most at risk from catastrophic wildfire.

Winter flooding

USGS modeling predicts that some streams will be at higher risk of uncharacteristic winter flooding as a direct result of warmer winter temperatures associated with climate change. Increased air temperatures during winter may result in a greater proportion of precipitation occurring as rain. Winter rain events would result in a flashier winter hydrograph and greater frequency of rain-on-snow events that lead to flooding. However, across the range the risk posed by winter flooding is low. The lower right panel of Figure 4 depicts those portions of the range most at risk from winter flooding.

Climate change summary

Considering the unknowns associated with global and regional climate change, the results of vulnerability assessments such as Haak et al. (2010) and Roberts and Fausch (2012) cannot be considered explicit definitions of where the physical effects of climate change will hurt CRCT populations. However, in defining the vectors by which CRCT populations could be affected they provide a template for regional and local biologists to identify populations most at risk. In particular the Bayesian Belief Network tool developed by Roberts and Fausch (2012) is readily available to resource managers and provides a simple platform to evaluate risks to conservation populations.

A simple GIS-based analysis in which the maps in Figure 4 are overlaid onto a map of CRCT current range can provide a coarse-filter of extant populations most at risk. For example, populations in sub-watersheds colored red for 3 or 4 of the factors defined in Haak et al. (2010) would be considered at greater risk than those colored red for 1 or 2. Local biologists could use this information when planning future conservation actions. For example, it may be unwise to attempt a translocation into a sub-watershed considered at risk from multiple factors defined in Figure 4.

It is nearly certain that the effects of climate change on CRCT populations will be variable: habitat losses associated with disturbance in one area may be offset by range expansion in another (Wenger et al. 2011). At this time it appears ongoing climate change has resulted in minimal changes to the current range of CRCT but it is possible changes could accelerate in the future. Wholesale losses of cutthroat trout populations are unlikely for at least the next several decades (Roberts and Fausch 2012); however, well-defined monitoring programs for both stream temperature and cutthroat trout distribution are necessary to determine where and how cutthroat trout are responding to a warming environment.

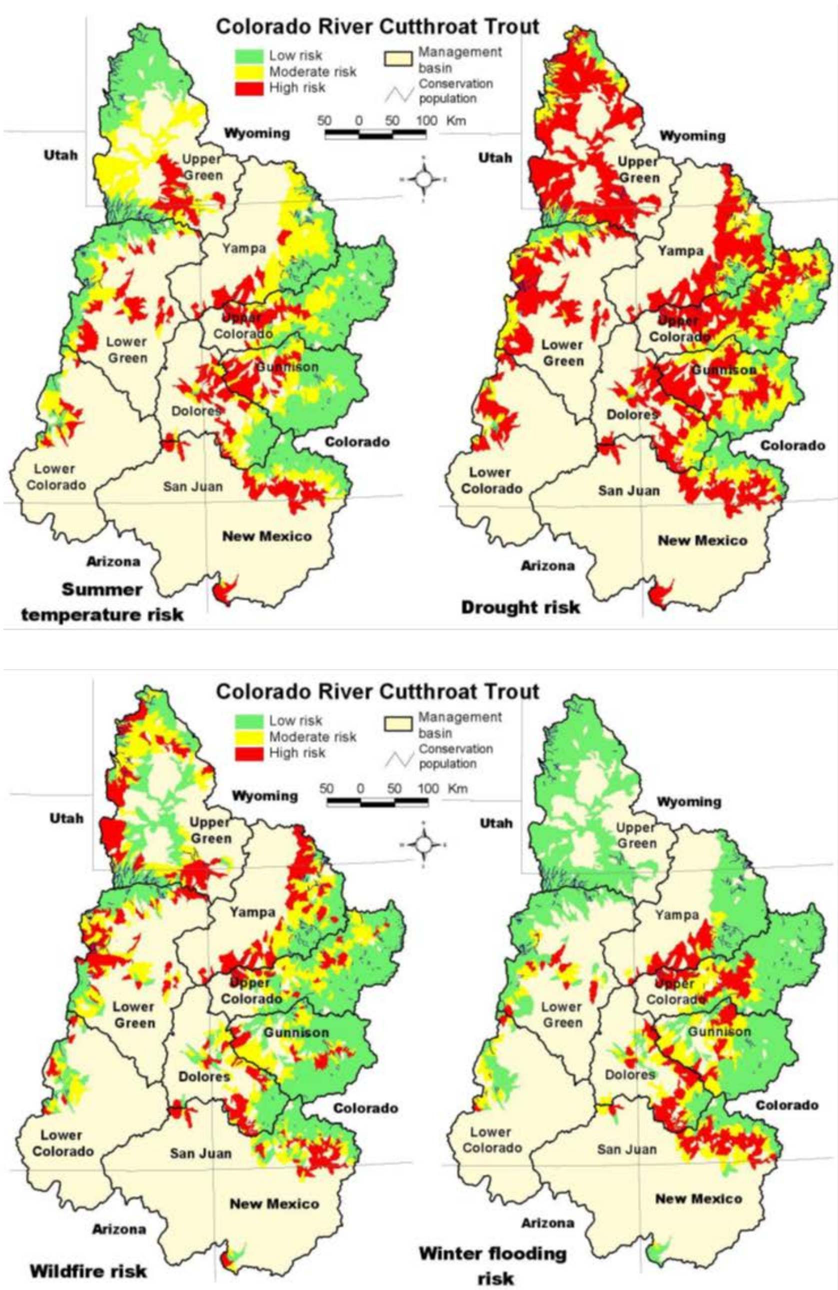

Figure 4. Risks posed by climate change to watersheds comprising the current range of CRCT. Source: Haak et al., (2010).

General Population Health

A generalized population health evaluation based on four indicators of health was completed for each conservation population. Components of the health evaluation included
1) **Temporal variability** associated the amount of occupied habitat as an indicator of patch size and resiliency;
2) **Population size** of adults as an estimator of effective population size;
3) **Population demographics** (growth and survival) estimator based on habitat quality, presence of non-native fish and disease, and consideration of land use influences;
4) **Degree of within-population connectivity**.

These indicators of relative health were analyzed individually and as a composite based on a weighted formula (Table 23). It is important to note that individual health indicators and the composite of these indicators are merely a relative indicator of general health. These indicators are based on stream characteristics only, therefore lake only populations are not included.

Temporal variability information contained in Table 23 indicates the majority (245) of conservation populations (70%) occupied habitats that were less than 9.7 kilometers in length. Twenty-five percent of the populations (87) occupied between 9.7 and 30.6 kilometers of habitat. There were 16 populations that had either high (2 populations, at least 80 kilometers) or moderately high (14 populations, 32 to 79 kilometers) ratings for the amount of habitat occupied.

Population size information presented in Table 23 indicates 11% of the populations had at least 2,000 adults. Thirty-two percent of the populations had between 500 and 2,000 adults and 38% had 50 to 500 adults. Sixty-five of the 348 stream-dwelling conservation populations (19%) were classified as having “low” population size: less than 50 adults (see Appendix C, Box C).

Production potential (growth and survival): There were no conservation populations with a production potential demographics rating of low. Most of the conservation populations (93%) were judged to have a moderately high health condition related to quality factors associated with production potential. Twenty populations (6%) were judged to have moderately low production potential. Six populations (just under 2%) were judged to have high population potential. Habitat quality, presence of non-native trout species, presence or proximity of catastrophic diseases, land uses, and recovery actions were included in this metric.

Population connectivity: Assessment of within population connectivity or networks indicated that 70% exist as non-networked (i.e., single streams) entities. There were 76 weakly connected populations (22%) in which movement into the population is possible. Fifteen populations were considered moderately connected, having migratory forms present but only occasional genetic exchange possible. Fourteen populations were considered strongly connected, with migratory forms present and open migration corridors.

Table 23. Population health ratings for 348 stream-dwelling CRCT conservation populations.

Health indicator ranking	Populations	Stream habitat (km)
Temporal variability		
High	2	198
Moderate-high	14	769
Moderate-low	87	1,412
Low	245	1,024
Population size		
High	40	1,224
Moderate-high	112	1,215
Moderate-low	131	656
Low	65	308
Production potential		
High	6	46
Moderate-high	322	2,902
Moderate-low	20	454
Low	-	-
Population connectivity		
High	14	570
Moderate-high	15	461
Moderate-low	76	863
Low	243	1,509
Composite rating		
High	9	497
Moderate-high	100	1,701
Moderate-low	196	1,065
Low	43	140

Composite scores of general population health for the 348 stream-dwelling conservation populations (Table 24) allowed for a more balanced or tempered review of general health conditions associated with CRCT conservation populations. Only 9 conservation populations (3%) were judged to have a high degree of general health. One hundred CRCT conservation populations (29%) were judged to have a moderately high degree of general health. Of the remaining populations, 196 (56%) were judged to have a moderately low level of general health and 43 (12%) had a low level of general health. Sixty-nine percent of the stream-dwelling conservation populations had a low to moderately low composite health determination. The small population sizes and isolated condition of Colorado River cutthroat trout conservation populations appear to be the factors most contributing to their general persistence risks. However, this reduces the population's risk of genetic or disease contamination, bringing most populations into a "moderate" category. Combined health ratings for each GMU are presented in Table 24.

Table 24. Composite population health rating for 348 CRCT conservation populations by GMU.

Health indicator ranking	Populations	Stream habitat (km)
Dolores		
High	-	-
Moderate-high	-	-
Moderate-low	10	56
Low	-	-
Gunnison		
High	-	-
Moderate-high	4	52
Moderate-low	28	138
Low	3	7
Lower Colorado		
High	-	-
Moderate-high	5	50
Moderate-low	14	31
Low	1	2
Lower Green		
High	3	173
Moderate-high	14	308
Moderate-low	17	146
Low	4	11
San Juan		
High	-	-
Moderate-high	5	47
Moderate-low	9	29
Low	1	3
Upper Colorado		
High	-	29
Moderate-high	5	258
Moderate-low	14	270
Low	1	48
Upper Green		
High	-	224
Moderate-high	31	617
Moderate-low	28	182
Low	11	49
Yampa		
High	-	71
Moderate-high	16	368
Moderate-low	36	212
Low	10	20
Total		
High	9	497
Moderate-high	100	1,701
Moderate-low	196	1,065
Low	43	140

The influence of within population connectivity on general population health was more obvious than the relationships associated with genetic or disease risks (Table 25), indicating that general CRCT population health was positively influenced by expanded within population connectivity associated with larger networks. Again, it is important to note that individual health indicators and the composite ratings of these indicators do not represent existing problems, but summarize risk factors relating to overall population health.

Table 25. Composite population health rating for 348 CRCT conservation populations by level of connectivity.

Health indicator ranking	Populations	Stream habitat (km)
Population isolated		
High	-	-
Moderate-high	46	569
Moderate-low	158	823
Low	39	117
Weakly connected		
High	2	53
Moderate-high	36	585
Moderate-low	34	201
Low	4	23
Moderately connected		
High	1	71
Moderate-high	13	378
Moderate-low	1	12
Low	-	-
Strongly connected		
High	6	372
Moderate-high	5	169
Moderate-low	3	29
Low	-	-
Total		
High	9	497
Moderate-high	100	1,701
Moderate-low	196	1,065
Low	43	140

Land Uses Associated with Conservation Populations

Land uses and human activity have the potential influence the quality and quantity of habitat available to CRCT populations. We identified the number of conservation populations for which one or more of 11 land uses and activities were present within their influence zone (Table 26). No attempt was made to address significance of these activities, either on a specific CRCT population or with regard to conservation in general. The relative significance of these activities may be addressed in subsequent assessments. Ninety-seven percent of conservation populations had one or more land uses or human activities (e.g., angling, roads, recreation, etc.) occurring within the influence zone of the population. Nine of the 361 populations included in the analysis had no land use activities within the population influence zone. Common land use activities include angling (60%), livestock grazing (66%), non-angling recreation (68%), roads (37%), and timber harvest (21%).

Table 26. Number and percentage (of the 285 conservation populations evaluated) of designated CRCT conservation populations where various land uses were identified. Multiple land uses may be associated with a single conservation population.

	2005		2010	
Land use activity	Populations	Percentage	Populations	Percentage
Recreation (non-angling)	207	73	246	68
Angling	202	71	216	60
Range (Livestock grazing)	195	68	237	66
Roads	120	42	132	37
Timber harvest	67	24	74	21
De-watering	45	16	54	15
Fish stocking (e.g., non-native fish)	12	4	17	5
Mining	12	4	12	3
Hydroelectric, water storage and/or flood control	3	1	3	1
Other	36	13	37	10
None	4	1	9	3
Unknown	3	1	10	3

Restoration Activities Implemented for Conservation Populations

Restoration, conservation, and management activities that had been implemented to conserve designated conservation populations were evaluated for 361 conservation populations (Table 27). In 2005 agencies reported 589 conservation, restoration, or management actions for CRCT populations (Table 27). As of 2010 the number of reported conservation actions increased by nearly 40% to 823 (Table 27). There are commonalities in the types and frequency of conservation actions between 2005 and 2010; however, there were substantial increases in the frequency of a number of actions. These include population restoration and expansion, spawning habitat improvement, riparian restoration, public outreach, and culvert replacement (Table 27). For this status update there was no attempt to address the significance of the conservation actions, either on a specific CRCT population or with regard to conservation in general. Relative significance will have to be addressed in subsequent assessments conducted by the coordinated conservation effort. Common activities include special fishing regulations, barrier construction, founding a pure population, land-use mitigation or protections, and removal of competing or hybridizing species by chemical means or physical means.

Table 27. Number of CRCT conservation populations that have had various types of conservation, restoration, and management actions implemented to conserve them as of 2005. Multiple actions may be associated with a single conservation population.

Conservation action	2005	2010
Special angling regulations	140	143
Land-use mitigation direction and requirements (e.g., Forest Plan direction, regulation, permit requirement, coordination stipulations, etc.)	60	96
Re-founding pure population	54	62
Barrier construction	51	65
Physical removal of competing/hybridizing species	41	54
Chemical removal of competing/hybridizing species	35	51
Population covered by special protective management emphasis (e.g., National Park, wilderness, special management area, conservation easement, etc.)	32	43
Population Restoration/Expansion	24	59
Water lease/In-stream flow enhancement	20	27
Riparian fencing	17	26
Bank stabilization	12	13
Pool development	10	11
Channel restoration	9	13
In-stream cover habitat	8	8
Spawning habitat enhancement	8	14
Riparian restoration	7	20
Public outreach efforts at site (Interpretative site)	6	16
Diversion modification	5	8
Culvert replacement	4	27
Barrier removal	3	10
Grade control	3	4
Installation of fish screens to prevent loss	3	4
Woody debris placement	3	8
Fish ladders to provide access	1	1
Increase irrigation efficiency	1	1
Other	32	39
None	80	96

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Appendix A.

Recent developments in cutthroat trout taxonomy: implications for Colorado River cutthroat trout

Kevin Rogers CPW

Despite a long history of taxonomic work, and an established paradigm charting the phylogeny of cutthroat trout in the southern Rocky Mountains (Behnke 2002, Trotter 2008), an article appearing in Molecular Ecology in 2007 (Metcalf et al. 2007) spawned renewed interest in the field. Most of the uproar in the popular media surrounding the 2007 publication focused on their assertion that roughly half of greenback cutthroat trout (*O. c. stomias*) populations east of the Continental Divide were in fact Colorado River cutthroat trout (*O. c. pleuriticus*) established in the early 1900s. While that finding did not negatively affect management of Colorado River cutthroat trout directly, that same manuscript reported finding a greenback cutthroat trout population west of the Divide in Antelope Creek near Gunnison. The authors suggestion that the Antelope Creek population was founded from an east slope source and therefore not native, was more troubling - particularly since concurrent testing in 2007 with the same amplified fragment length polymorphism (AFLP) test used in the Metcalf study had revealed that cutthroat trout populations with similar molecular signatures were fairly common in Colorado River cutthroat trout waters west of the Continental Divide (Rogers 2008).

Extensive genetic testing conducted by CRCT Conservation Team members over the last five years using AFLPs and mitochondrial DNA sequence data (Rogers 2010, Rogers et al. 2011, Rogers 2012a) continues to suggest the presence of two distinct clades within Colorado River cutthroat trout (Figure 1), mirroring the two discussed in the University of Colorado study (Metcalf et al. 2007).

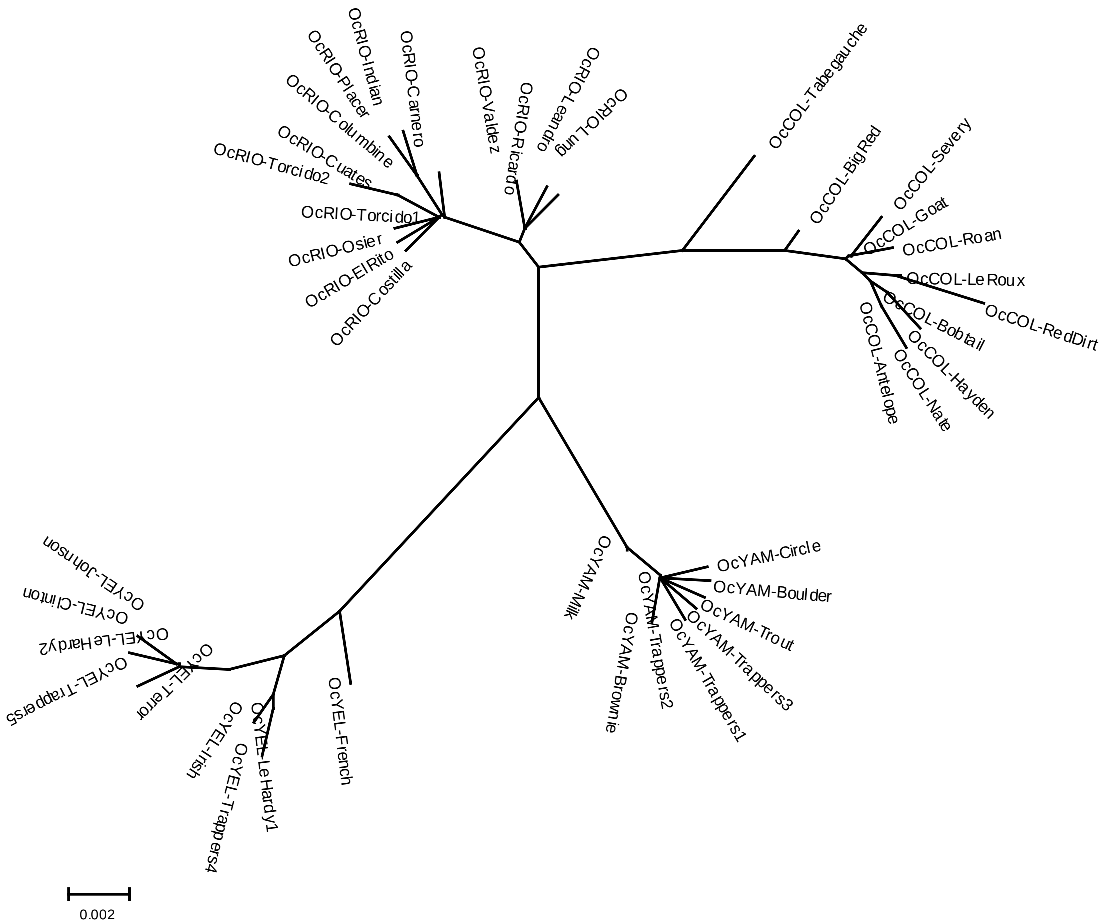

FIGURE 1: 648 bp of the ND2 mitochondrial gene were isolated and aligned with ClustalW (Rogers et al. 2011). Evolutionary history was inferred using the Neighbor-Joining approach. The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. The evolutionary distances were computed using the Maximum Composite Likelihood method. Labels for haplotypes of Rio Grande cutthroat trout are prefaced with OcRIO, Yellowstone cutthroat trout haplotypes with OcYEL, and the two lineages of Colorado River cutthroat trout with OcCOL (predominantly from the Gunnison, Dolores, and Colorado River basins) and OcYAM (from the White and Yampa River basins).

Evidence for these two clades within Colorado River cutthroat trout was actually apparent in earlier molecular trees developed with allozyme data (Kanda et al. 2000), but not formally described until Shiozawa and Evans labeled them as “archaic” and “main basin” (Evans and Shiozawa 2000). It is these “main basin” forms that match what Metcalf et al. (2007) referred to as “greenback” cutthroat trout as those populations shared the molecular signature of remaining greenback cutthroat trout east of the Continental Divide. Recognizing that this “greenback” fingerprint was much more widespread on the West Slope than anticipated by researchers at the University of Colorado, the CRCT Conservation Team adopted the name

Lineage GB to reflect that indeed, while it shared a molecular signature with greenbacks on the east side of the Divide, these fish were likely aboriginal to the west slope at a minimum (Rogers 2010) being widely distributed across 15 counties in western Colorado and one in Utah (Figure 2). Sixty populations have been identified to date (Rogers 2012b), and they are broadly distributed across the Upper Colorado, Gunnison, and Dolores GMUs.

The remaining Colorado River cutthroat trout populations reflect a genotype that Shiozawa and Evans referred to as "archaic" for its more basal position on molecular trees (Evans and Shiozawa 2001) and its prevalence in headwater habitats throughout the range of Colorado River cutthroat trout (Evans and Shiozawa 2002, Evans and Shiozawa 2004). This latter trait appears to be an artifact of extensive stocking in fishless waters above barriers in the early 1900s (Rogers 2008). The majority of Lineage CR populations can be found in the White and Yampa River basins within the Yampa GMU (Figure 2). Trappers Lake lies at the headwaters of the White River, and it is here that early fish culturists collected wild eggs for use in the state hatchery system. From 1903-1938 these culturists produced millions of pure Colorado River cutthroat trout that were then distributed across the state of Colorado (Rogers 2008).

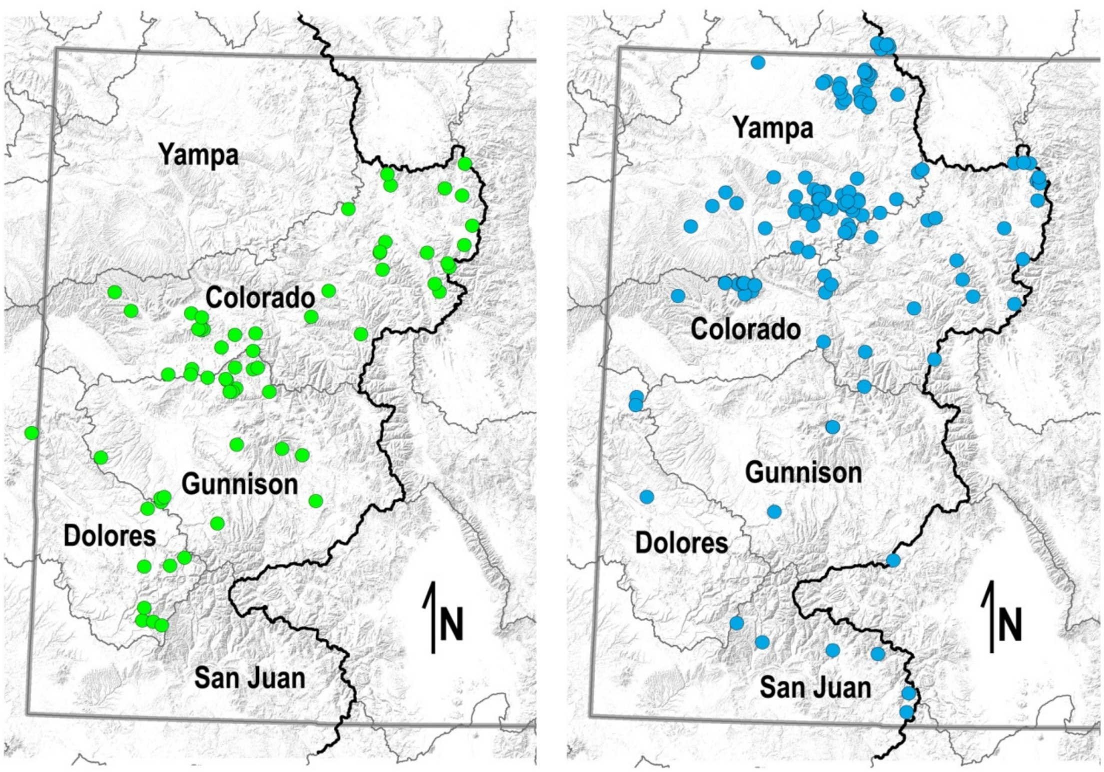

FIGURE 2: Distribution of Lineage GB cutthroat trout populations (left in green) and Lineage CR populations (right in blue) identified west of the Continental Divide as of December 2012 (base figures courtesy of Grant Wilcox, CPW)

Interestingly, no Lineage GB populations have been discovered in the White and Yampa River basins despite extensive testing. This area appears to be a stronghold for Lineage CR cutthroat trout and coincides with the native range of Colorado's only other native salmonid – the mountain whitefish (*Prosopium williamsoni*). Perhaps Lineage GB fish were already present in southwestern Colorado when Lineage CR invaded the state from the Green River drainage to the north along with mountain whitefish and a suite of other species that currently call the White and Yampa Rivers home (Rogers 2010).

Until the taxonomy of these fish is resolved, the U. S. Fish and Wildlife Service is urging land management agencies to treat Lineage GB cutthroat trout as if they were greenback cutthroat trout, and conduct Section 7 consultations under the Endangered Species Act where appropriate (USFWS 2009). The Service also believes that implementation of the CRCT conservation strategies that are in place to preserve and protect Colorado River cutthroat trout (CRCT Coordination Team 2006) will adequately protect any that represent the Lineage GB clade as well.

Colorado's illustrious stocking history (Wiltzius 1985) has made it challenging to resolve the native distribution of these lineages. Fortunately, not only did trout attract the attention of several notable naturalists in the late 1800s, but these individuals did not yet have access to formalin, instead preserving their specimens in ethanol which does a much better job preserving DNA. Although degraded, modern molecular methods have allowed us to explore the distribution of cutthroat trout diversity across Colorado prior to the bulk of fish culture activity in the state through those specimens. Recent findings from these museum collections corroborate the notion that Lineage GB was native west of the Continental Divide (Metcalf et al. 2012), with specimens collected in 1889 near Glenwood and Gunnison carrying Lineage GB haplotypes.

While there appears to be a molecular basis for separating two distinct clades of Colorado River cutthroat trout, interest remains in determining if these genotypic differences translate into phenotypic differences that would then warrant description as discrete taxa. It is possible that previous meristic studies were unable to isolate consistent differences even under recognized subspecies, simply because historic stocking had occluded the native distribution of these fish. This mixing may have amplified the variation within a subspecies, and erased differences between them, suggesting geographic range might be a poor metric for classifying subspecies. In collaboration with the Larval Fish Lab at Colorado State University, a meristics study was launched to determine if discrete cutthroat trout lineages identified by these new molecular methods do possess unique phenotypic traits. Four state agencies have worked together with four Federal agencies to gather specimens from across the range of greenback, Colorado River, and Rio Grande cutthroat trout. These samples have been collected using a spatially balanced random design to ensure representative coverage across their respective ranges. Researchers will then use these specimens to determine if differences implied by the DNA lineages are reflected in the physical characteristics of the populations they represent. This work will form the foundation for determining whether these distinct genetic lineages deserve subspecies designation or whether Colorado's native trout should be synonymized.

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Appendix B. Assessment Protocol

The range-wide assessment for CRCT included: 1) estimating range that was historically occupied; 2) determining current distribution and identifying specific attributes associated with current distribution; 3) identifying the various conservation populations and assessing relative population health using a ranking system approach similar to that proposed by Rieman et al. (1993); and 4) evaluating the potential for further expansion and restoration of conservation populations. The group recognized that such an assessment would be based primarily on expert opinion supported more or less by existing empirical data and in some cases, particularly when historically occupied range was assessed, the assessment would be more qualitative. However, where field data were available these data were used and referenced. The protocol detailed below represents a modified version of the protocols developed for the westslope (Shepard et al. 2003), Yellowstone (May et al. 2003), and Bonneville (May et al. 2005) cutthroat trout subspecies.

Geographic Information System

This assessment used the National Hydrography Dataset (NHD) as the base for the effort (see **http://nhd.usgs.gov/** for more information on NHD). We used the 1:24,000 scale of NHD as available. Some watershed areas required using the 1:100,000 scale. **An effort will be made to correct the information to as it becomes available.** The USFS Natural Resource Information System (NRIS) provided ArcGIS tools that greatly assisted with this process. An event creation tool, developed the NRIS team, was used to geo-reference CRCT population segments. The tool uses a "point–and-click" user interface to reference these population segments against the NHD stream network. To increase continuity and consistency, only streams identified on the stream layer as being perennial had information entered into the database. We recognize that intermittent and ephemeral streams may provide habitat that is used by CRCT during specific periods when sufficient flows occur. We also fully anticipate that some perennial streams that support CRCT will not be shown on the stream layer and therefore they will not be included in this assessment. It is anticipated that these streams will be added in the future during subsequent efforts to improve NHD.

Data Quality Control and Assurance

When constructing the dataset, identification of the source of information and linking the sources to an anticipated reliability was conducted. This assessment identified sources of information entered into the database as a means for providing a relative determination of reliability and accuracy. Data Source Tables were created to track how the information was derived (Table 1). Information associated with judgment calls and anecdotal sources, in general, may be viewed as being less reliable and/or accurate than information developed as part of detailed surveys and studies that has undergone substantial analysis and review.

In the logistics of data generation, entering the data and ensuring data entry accuracy was handled by making the effort a "real time" exercise. In order to assure consistency and completeness a specific work group (team) completed the assessment of a given 4th level hydrologic unit code (HUC, 8-digit EPA designation) before moving to another HUC. There were 60 4th level HUCs within the historical range of CRCT. During the completion of the assessment for each HUC, the teams were asked to employ a systematic approach starting with the main stream from mouth and proceeding to the headwaters of that stream. Then each tributary system beginning in a clockwise fashion and starting at the lower most portion of the main stream was completed using the same orderly process. The use of 4^{th} level HUCs was for accounting purposes only. The actual stream layers, either as cutthroat mapping segments or when used to identify discrete populations, were attributed through a database with the specific information developed during the status update using fishery biologists and a GIS-data entry person as a critical members of the team.

Table 1. Example look-up table for data sources with a relative index for information reliability and accuracy.

Information ‘Source	Relative Degree of Reliability
Professional Judgment	Lower
Anecdotal Information	Lower
Letter	Lower
News Account	Lower
Data Files	Moderate
Agency Report	Moderate
Published Paper	Higher
Thesis or Dissertation	Higher

The assessment protocol was partitioned into four primary components for conducting this assessment. First, the historical range that was occupied by CRCT at the time of the first European exploration (approximately 1800) of the Northern Rocky Mountains was estimated. Second, the current distribution with density, genetic status and habitat information for CRCT was developed and displayed on a mapping segment basis. Third, conservation populations were identified, either as isolated and meta-populations (networked or connected populations – e.g., interbreeding populations) and relative health was evaluated for each population identified. Relative health was assessed based on three aspects: 1) influences associated with genetic introgression, 2) influences associated with disease, and 3) a general population health determination. Health determinations represented relative determinations indicating a higher or lower level of concern. The mapping and population health determinations were completed for all conservation populations including those associated with lakes (adfluvial) that are maintained by natural reproduction. **The actual location of lakes will not be shown on the initial maps but can be added at a later date**. CRCT populations supported entirely by annual or routine stocking were not included as part of this assessment. Exceptions would be those populations serving as a wild broods that require periodic stocking to bring in new genetic material as part of the brood maintenance plan. Genetic, disease and population risk assessments will be done for each conservation population. Fourth and finally, the assessment included evaluation of the potential for restoration of conservation populations within the historical boundary and for the expansion of existing conservation populations.

Definition of Terms

Definitions of terms used for this protocol are provided in italics as they are first used.

Population mapping unit (segment) *– each stream, or occupied segment of stream, will be treated as a separate population (stock) mapping unit or segment and connectivity between these segments will determine whether these segments function in terms of an isolated population or as a "metapopulation (connected)".*

Conservation Populations – *those cutthroat populations existing in a genetically unaltered condition (core conservation populations with genetic analysis indicating greater than 99% purity) and/or populations having unique ecological, genetic and behavioral attribute of significance that maybe genetically introgressed (See Cutthroat Trout Management: A Position Paper – Genetic Considerations Associated with Cutthroat Trout Management). Conservation populations may exist as isolated populations or networks of subpopulations.*

Meta-population *– infers that interbreeding between subpopulations (population mapping segments) can occur within a few generations (3-15 years). Also referred to as a connected or networked population.*

Sub-Population – *A discrete component of a meta-population or networked population. Usually associated with individual streams and/or stream segments.*

Isolated Population *– populations that occupy isolated habitat fragments and these populations exist independently from connected groups of subpopulations.*

Genetic Risk *– risk of initial or on-going genetic introgression (hybridization) with introduced species or subspecies.*

Population Risk – *risk of deterministic or stochastic declines in a population that could lead to a reduced probability of viability for that population. Linked to temporal, population size, production considerations and degree of isolation.*

Significant Disease (Pathogens) Risk *– Those diseases and the associated pathogens that have the potential to cause significant detrimental influences on population health. Including but not limited to the following: whirling disease, furunculosis, infectious pancreatic necrosis virus, etc.*

Competing Species *– Those species that compete with cutthroat trout for food and space. Can be salmonid and non-salmonid. Generally, non-natives that have been introduced within cutthroat trout habitats. Certain competing species (i.e., brown trout) are predatory on cutthroat trout. Introduced rainbow and brook trout can be viewed as both a competitive and hybridizing species.*

Hybridizing Species *– Those species or subspecies of trout that readily hybridize with cutthroat trout, primarily introduced rainbow trout. Can also include subspecies of cutthroat trout that have been introduced to habitats outside of their respective historical range.*

Barriers

Barrier identification was the first action taken in parts 1 and 2 of the assessment. Barriers to fish movement (either long-term geologic, natural short-term, or anthropogenic barriers) were used to assess whether individual stream segments were likely historically occupied by CRCT, assess potential influences of genetic introgression or disease to existing CRCT populations, and determine whether existing subpopulations were connected with other subpopulations. The identification of barrier location and distinguishing characters was very important. During the effort to describe the historical distribution of the subspecies, we identified those barriers that represent long-term geologic features that may have influenced historical distributions. These barrier locations were located (as points in ArcGIS) on the population mapping segments. Before mapping current distribution, we identified other significant barriers (e.g., natural short-term and/or anthropogenic barriers), their locations (as points in ArcGIS), and other relevant features, including barrier type (Table 2), blockage extent (Table 3), and barrier significance (Table 4). Only those barriers believed to have a significant influence on cutthroat distribution or population integrity (life history expression, spawning, competition and hybridization) were identified. Data sources for barriers were also identified (Table 5). If the barrier extended over an extended distance (e.g., temperature or chemical barrier) the downstream point of the barrier was marked on the map.

Table 2. Types of barriers to upstream fish movement (Check the <u>one</u> that best applies to each barrier)..

Code	Barrier Type
1	Water diversion
2	Fish culture facility/research facility
3	Temperature
4	Bedrock
5	Culvert
6	Debris
7	Insufficient flow
8	Manmade Dam
9	Manmade temporary restoration barrier
10	Pollution
11	Beaver dams
12	Velocity barrier
13	Waterfall
14	Unknown

Table 3. Extent of blockage caused by barriers (Check the <u>one</u> that best applies).

Code	Blockage Extent
1	Complete
2	Partial
3	Unknown

Table 4. Barrier significance (Check all that apply for each barrier).

Code	Barrier Significance
1	Prevents or limits introgression
2	Prevents ingress of competing species
3	Temporary, but presently prevents introgression or ingress of competing species
4	Confines population to small area of usable habitat
5	Limits or precludes opportunity for population re-founding
6	Limits expression of life history characteristics
7	Unknown

Table 5. Information sources associated with barrier (Check one that best applies).

Code	Barrier Information Source
1	Judgment - Anecdotal and/or extrapolated information from other streams
2	Judgment - Ocular Reconnaissance
3	Minor Sampling
4	Major Sampling

Determining Historical Distribution

The historically occupied range of CRCT was assessed based on the believed distribution at the time Europeans first entered the Rocky Mountain West (approximately 1800). This assessment was done at a relatively coarse level. There was an initial effort to adjust the base stream layer by identifying the lower extremes of historical distribution based on the lowest probable elevation limits (6000 feet in elevation or 5500 feet on north-facing slopes). Fishery professionals familiar with each major drainage basin (4^{th} code HUC) defined historical distribution for the remaining stream mapping segments within each 4^{th} code HUC by identifying the historical range based on their personal knowledge of the area, known anecdotal information, known habitat restrictions, known geologic barriers, and historical fisheries data and reports. This information was used to edit CRCT historical range maps. CRCT were assumed to have occupied all stream segments within the adjusted base stream layer of their broad known historical distribution unless information or professional judgment indicated CRCT likely did not occupy specific mapping segments of stream.

Determining Current Distribution, Genetic Status, Densities and Habitat Conditions

The lower and upper bounds of all stream segments presently occupied by naturally self-sustaining populations of CRCT were located and data and data sources associated with the individual characteristics of the occupied segments were identified. Each 4^{th} level HUC working group made initial determinations on occupied habitat based on viewing the map and referring to available information. Specific information associated with current occupancy was tracked on a stream segment basis. Barrier locations were important in these determinations, as was the information associated with Tables 8 to 18. Each identified stream segment must have all attributes in common. If one or more attributes changed, a new segment was created. Table 8 identifies fish stocking associated with the occupied stream segments. Genetic information and status was identified for each CRCT mapping unit in Tables 9 and 10. For Table 9, the category determination was based on information from the largest sample and/or the most recent sample. Only naturally occurring, self-sustaining populations (i.e., no routine augmentation with hatchery fish) of CRCT were addressed in this status review. Relative density based on a projected number per kilometer of sexually mature adults (set at 15 cm and larger) for each CRCT mapping segment was also identified (Tables 11 and 12). It was assumed that both trend and detailed population sampling could be supported by a level of statistical review (Table 12). The information in Table 12 was used to provide specific density values for Table 11. Habitat information was identified for each CRCT mapping unit (Table 14 and 15). Tables 17 and 18 related presence of non-native fish sympatric with CRCT in the mapping segment.

Table 6. Fish stocking associated with the occupied stream segment (Check all that apply).

Code	Fish Stocking Status
1	No Record of fish stocking
2	Record of rainbow stocking
3	Record of brown trout stocking
4	Record of brook trout stocking
5	Record of Lake trout stocking
6	Record of fine-spotted YCT stocking
7	Record of large –spotted YCT stocking
8	Record of CRCT stocking
9	Record of other cutthroat trout subspecies being stocked. Specify:
10	Other non-native fish stocked. Specify:

Table 7. Genetic status of CRCT within a mapping segment (Check one that best applies).

Code	Genetic Status
1	Genetically unaltered (>99.0%) as a result of introduced species interaction– tested via electrophoresis or DNA
2	Introgressed (hybridized) with introduced species – tested and found to be 90% to 99% CRCT genetic material in individual fish throughout population
3	Introgressed (hybridized) with introduced species – tested and found to be 80% to 89% CRCT genetic material in individual fish throughout the population
4	Introgressed (hybridized) with introduced species– tested and found to be less than 80% CRCT genetic material in individual fish throughout population
5	Not Tested -- Suspected unaltered with no record of stocking or contaminating species present
6	Not Tested -- Potentially hybridized with records of introduced hybridizing species being stocked or occurring in stream
7	Hybridized and Pure populations co-exist (sympatric) in stream (use only if reproductive isolation is suspected and/or testing has been completed)

Table 8. Specify the specific information associated with genetic sampling and analysis. More than one entry can be made for a mapping segment. (Add the specific genetic information in this table)**(<u>This Table will not be specifically included in status update as a separate entity</u>)**

Sample Number	Collection Date	Collection ID	Number of Fish Sampled	Analysis Date	Analysis Code	% CRCT

Analysis Code	Genetic Analysis
1	Allozymes
2	PINES
3	Microsatellites
4	DNA

Table 9. Population density (numbers per mile) of sexually mature adults (15 cm and larger) within the mapping segment (Check the <u>one</u> that best applies).

Code	Mapping Segment Standing
1	0 to 50 fish per mile (Specific density within this range if available__________)
2	50 to 150 fish per mile (Specific density within this range if available__________)
3	151 to 400 fish per mile (Specific density within this range if available__________)
4	Over 400 fish per mile (Specific density within this range if available__________)
5	Unknown

Table 10. **<u>(This Table is for informational purposes to support Table 11)</u>** Population estimates of CRCT 15 cm and larger) expressed as number per mile (Complete with specific sample information that applies).

Sample ID	Sample Date	Estimated fish/mile	Coefficient of Variation %	95% Confidence Interval	Estimate Type Code

Code	Population Estimate Type
	3 pass removal
	2 pass removal
	1 pass removal
	Mark-recapture
	Single pass removal

Table 11. Source of population density information (Check <u>one</u> that best applies).

Code	Source of CRCT density information
1	Judgment-extrapolated information from other areas
2	Judgment - Ocular Reconnaissance
3	Spot Sampling
4	Trend Sampling
5	Detailed Population Sampling
6	Unknown

Table 12. Relative quality of occupied habitat (Check <u>one</u> that best applies). Refer to Box B (pages 26-29) for desired habitat reference conditions.

Code	Habitat Quality Determination
1	Excellent habitat quality (e.g., ample pool environment, low sediment levels, optimal temperatures, quality riparian habitat, etc.)
2	Good habitat quality (may have some habitat attributes that are slightly less than ideal)
3	Fair habitat quality (has a greater number of attributes that are less than ideal)
4	Poor habitat quality (most habitat attributes reflect inferior conditions
5	Unknown

Table 13. Relative of width of occupied stream segment (Check one that best applies).

Code	Average width of occupied stream segment
1	< 5 feet
2	5 to 10 feet
3	10 to 15 feet
4	15 to 20 feet
5	20 to 25 feet
6	Over 25 feet
7	Unknown

Table 14. Source of habitat quality and stream width information Check **one** that best applies).

Code	Source of habitat information
1	Judgment-extrapolated information from other streams
2	Judgment - Ocular Reconnaissance
3	Spot Habitat Sampling
4	Trend Habitat Sampling
5	Detailed Habitat Sampling

Table 15. Presence of non native fish sympatric with CRCT in the mapping segment (Check all that apply).

Code	Presence of Non-Native Fish
1	No non-native fish present
2	Rainbow trout
3	Brown trout
4	Brook trout
5	Lake trout
6	Fine-spotted YCT
7	Large-spotted YCT
8	Other cutthroat trout subspecies. Specify:
9	Other trout. Specify:
10	Other fish. Specify:
11	Unknown

Table 16. Source information associated with presence of non-native fish (Check one that best applies).

Code	Source of non-native fish information
1	Judgment-information extrapolated from other streams
2	Judgment -- Ocular Reconnaissance
3	Spot Sampling
4	Trend Sampling
5	Detailed Sampling
6	Unknown

Identification of Individual Conservation Populations and Application of Relative Health Evaluations for each Population

For this stage of assessment the focus changed from CRCT occupied mapping segments to conservation populations and the factors that have the potential to influence the well-being of the identified populations. Determinations were made relative to which occupied mapping units were combined into a specific conservation population with conservation being the primary management objective. Conservation populations were further sub-divided based on connectedness into meta-populations or as isolated populations (Table 19). To be considered connected in a meta-population, a total barrier cannot be present within the meta-population's stream network. Both meta-populations and isolated populations were identified as conservation populations. Conservation populations were categorized as genetically unaltered (i.e., core conservation populations) or displaying unique life history traits and ecological characteristics in the presence of hybridization (i.e., conservation populations) (Table 20). Life history attributes of the population (Table 21) and status of the conservation population as a source or a sink (Table 22) were identified. Information on conservation activities, land-use and fishery management were identified for each conservation population (Tables 23 and 24). No degree of significance was (or should be) attributed to the conservation activities or the land uses that were identified as being associated with each conservation population. The significance of the conservation activities and/or land uses to each specific conservation population will have to be addressed in subsequent specific assessments.

Table 17. Degree of connectedness associated with the conservation population (Check one that best applies).

Code	Degree of Connectedness
1	Strongly connected. Migratory forms (fluvial/ad-fluvial) must be present and migration corridors must be open (significant connectivity). Occupied habitat consists of numerous (> 5) individual streams w/ sub-populations.
2	Moderately connected. Migratory forms are present but connection periodically disrupted. Genetic exchange limited at times. Occupied habitat consists of a few (4-5) individual streams w/ sub-populations.
3	Weakly connected. Questionable whether migratory forms exist within connected habitat; however possible infrequent straying of adults within occupied connected habitat. Occupied habitats consists of 3 to 4 streams w/ sub-populations.
4	Population not networked or connected. Population functions as an isolated entity with no interaction with other populations or sub-populations. Passage barrier may be present.

Table 18. Conservation Population Qualifier (Check one that best applies)

Code	Conservation Population Qualifier
1	Core Conservation Population (must be genetically unaltered – greater than 99% CRCT genes)
2	Known or Probable Unique Life History (fluvial, ad-fluvial, or resident) May include populations that represent the last, best CRCT population within a given watershed or drainage basin.
3	Known or Probable Ecological Adaptation to extreme environmental condition (e.g. temperature, alkalinity, pH, sediment)
4	Known or Probable Predisposition for large size or unique coloration
5	Other – Population occupies habitat that is likely to become part of the CRCT conservation focus

Table 19. Life history attributes associated with the conservation population (Check all that apply).

Code	Life History Attributes
1	Resident Life History (e.g. Resides in one stream or a network of smaller streams for entire life)
2	Fluvial Life History (e.g. Resides primarily in a larger stream or river but migrates to other streams to spawn)
3	Ad-fluvial Life History (e.g. Resides primarily in a lake environment but migrates to riverine environments to spawn)

Table 20. Is the population a source of a sink (Check one that best applies)

Code	Is Conservation Population a Source or Sink
1	Conservation population is a source to other populations downstream
2	Conservation population is a sink from upstream population sources.
3	Not Applicable

Table 21. Conservation activities associated with the conservation population (Check all that apply).

Code	Conservation Actions
1	Water lease/In-stream flow enhancement
2	Channel restoration
3	Bank stabilization
4	Riparian restoration
5	Diversion modification
6	Barrier removal
7	Barrier construction
8	Culvert replacement
9	Installation of fish screens to prevent loss
10	Fish ladders to provide access
11	Spawning habitat enhancement
12	Woody debris placement
13	Pool development
14	Increase irrigation efficiency
15	Grade control
16	In-stream cover habitat
17	Re-founding pure population
18	Riparian fencing
19	Physical removal of competing/hybridizing species
20	Chemical removal of competing/hybridizing species
21	Public outreach efforts at site (Interpretative site)
22	Population Restoration/Expansion
23	Special Angling Regulations
24	Land-use mitigation direction and requirements (e.g., Forest Plan direction, regulation, permit req., coordination stipulations, etc.)
25	Population covered by special protective mgt emphasis (e.g., Nat'l Park, wilderness, special mgt area, conservation easement, etc.
26	Other:
27	None:

Table 22. Land-use and fishery management activities associated with conservation population (Check all that apply).

Code	Activity
1	Timber Harvest
2	Range (Livestock grazing)
3	Mining
4	Recreation (non-angling)
5	Angling
6	Roads
7	De-watering
8	Fish Stocking (e.g., non-native fish)
9	Hydroelectric, water storage and/or flood control
10	Other
11	Unknown
12	None

Conservation Population Health Evaluations

Only conservation populations were evaluated for relative genetic and disease influences and general population health. It is important to note that these evaluations did not and should not define inherent probability of persistence or exclusion but rather identified index conditions that put a population at greater or lesser risk based on certain attributes.

Genetic Stability Assessment A genetic stability index was made for each conservation population (e.g., Network- or isolate) using a index ranking of 1 to 4 to indicate low to progressively higher levels of possible risk (Table 25). The index was not and should not be viewed as an absolute but rather as an indicator of possible or potential genetic influences.

Table 23. Genetic index ranking (Check one that best applies).

Rank	Risk Characterization
1	Introduced hybridizing species **cannot interact** with existing CRCT population. **Barrier provides complete blockage to upstream fish movement**.
2	Introduced hybridizing species are in same stream and/or drainage **further than 10 km** from CRCT population, but not in same stream segment as CRCT, **or within 10 km where existing barriers exist, but may be at risk of failure.**
3	Introduced hybridizing species are in same stream and/or drainage **within 10 km of CRCT population and no barriers exist** between introduced species and CRCT population. However, introduced hybridizing species have not yet been found in same stream segment as CRCT population.
4	Introduced hybridizing species are **sympatric** with CRCT in same stream segment.

Significant Disease Influence Assessment A significant disease influence assessment was made for each meta- (networked) or isolate population using a ranking of 1 to 5 to indicate low to progressively higher levels of risk associated with the possible or potential influence of significant diseases (Table 26). Population isolation and security were important considerations but were not viewed as absolutes. The diseases of concern are those that cause severe and significant impacts to population health and include but are not limited to whirling disease, furunculosis, infectious pancreatic necrosis virus, etc. The assessment was completed and/or reviewed by fish health professional. The level of influence was not and should not be viewed as an absolute but rather as an indicator of possible or potential disease influences.

Table 24. Significant diseases risk influence index (Check one that best applies).

Rank	Risk Characterization
1	Significant diseases and the pathogens that cause these diseases **have very limited opportunity to interact** with existing CRCT population. Significant disease and pathogens are not known to exist stream or watershed associated with CRCT population. **Barrier provides complete blockage to upstream fish movement**. Stocking of fish from other sources does not occur.
2	Significant diseases and/or pathogens have been introduced and/or identified in same stream and/or drainage **further than 10 km** from CRCT population, but not in same stream segment as CRCT, **or within 10 km where existing barriers exist, but may be at risk of failure.** Stocking of fish from others source areas requires fish health screening and pathogen free clearance.
3	Significant diseases and/or pathogens have been introduced and/or have been identified in same stream and/or drainage **within 10 km of CRCT population and no barriers exist** between disease and/or pathogens and diseased fish species and the CRCT population. However, diseases and/or pathogens have not yet been found in same stream segment as CRCT population.
4	Significant disease and/or pathogens and disease carrying species are **sympatric** with CRCT in same stream segment but CRCT have not tested positive.
5	CRCT population is known to be positive for significant disease and/or pathogens are present. CRCT population has a history of impacts from significant diseases. Environmental and/or biological conditions may have intensified disease impact.

Conservation Population General Health Assessment

A generalized population health assessment was completed for each meta- or isolate population using an index ranking that includes consideration of four factors (See attachment A). General population health was indexed from low to high by using a 1 to 4 ranking system based on four variables identified by Rieman et al. (1993) (Table 27). The ranking for temporal variability was derived as a cumulative length total of stream segments identified as being part of the conservation population. Population size of CRCT that are sexually mature (15 cm and larger) were derived from the density information associated with the stream segments identified for each conservation population (Tables 11). This size range was felt to reasonably reflect that component of a CRCT population that can be viewed as sexually active (e.g. approximating an effective population). Population production ranking was derived from stream segment

Table 25. Ranks of various types of risk to conservation populations. Individual variable rankings to be generated from the information associated with currently occupied habitat data and specific conservation population information.

Variable	Description	Rank	Criteria
Temporal Variability – **Influence of stochastic catastrophic events on a whole population**	Habitat Quantity -- Stream length occupied will be used to index temporal variability. Assumption is that larger habitat patch sizes will be less likely to be in synchrony with regard to stochastic events and, to a degree, with deterministic influences. Ranking for temporal variability will be derived as a cumulative total of stream segments identified as being part of the conservation population.	1	At least 50 miles of occupied habitat
		2	20 to 49 miles of occupied habitat
		3	6 to 19 miles of occupied habitat
		4	< 6 miles of occupied habitat
Population Size – Associated with the potentially sexually reproductive component of the CRCT population.	Defined as the number of fish greater than 15 cm (refer to density determinations and/or specific population survey information … Tables 11 and 12). Population size will be derived from expanding the density information associated with the stream segments identified for each conservation population and adjusting the total to reflect the amount of occupied habitat. Although it is recognized that a 15 cm cutoff in low elevation streams will not exclude all immature fish, most CRCT conservation populations are restricted to high elevations where the cutoff will yield a conservative estimate of sexually mature fish. .	1	> 2,000 Adults
		2	500 – 2,000 Adults
		3	50 – 500 Adults
		4	< 50 Adults
Population Production (Growth/ Survival) **-** **Influence of deterministic demographic factors on whole population** **See Box C (pages 30-32)**	Factors that influence population production include habitat quality, disease, competition, and predation. Important considerations include land-use influence on habitat that could be influencing a population's potential. As important would be the application of enhancement actions targeted to improve population condition.	1	Greater than 50% of habitat in excellent condition; No non-native competitive species present. No catastrophic diseases present; No land uses identified; Substantial enhancement (>5 enhancement types) efforts have been undertaken.
		2	Greater than 50% of habitat in good and excellent condition; Non-native competitive species maybe present; Catastrophic diseases present in close proximity; One to two land uses associated with population; Three to 5 enhancement efforts have been undertaken

Variable	Description	Rank	Criteria
		3	Greater than 50% of habitat in fair, good and excellent condition; Non-native competitive species may be present; Catastrophic diseases present in close proximity; Three to four land uses associated with population; One or two enhancement efforts have been undertaken
		4	Greater than 50% of habitat in poor condition Population associated with poor quality habitat; Non-native competitive species maybe present; Catastrophic diseases sympatric with population; Greater than 5 land uses associated with population; No enhancement .
Population Connectivity	Relates to how isolated or connected is the conservation population from other conservation populations or sub-populations? Select from information in Table 19.	1	Strongly connected. Migratory forms must be present and migration corridors must be open (connected)
		2	Moderately connected. Migratory forms are present, but connection with migratory populations disrupted at a frequency that allows only occasional genetic exchange.
		3	Weakly connected. Questionable whether migratory form exists within connected habitat; however, possible infrequent straying of adults into area occupied by population
		4	Population not connected. Population is isolated from any other population segment, usually due to a barrier, but possibly due to lack of movement.

information associated with habitat quality, presence of non-native fish, potential for disease and the level of land use interaction with the population (See Box C). The degree of connectedness was taken from Table 19. These four main factors were weighted to derive a final index as follows: Temporal Variability = 0.7; Population Size = 1.2; Population Productivity (Growth/Survival) = 1.6; and Isolation = 0.5. The index value for general population health was not and should not be viewed as an absolute but rather as an indicator of possible or potential health.

The population assessment identified source/sink relationships that may exist between headwater CRCT conservation populations and those conservation populations lower in the drainage, especially where barriers to upstream movement might exist. While headwater CRCT populations may include those isolated by impassible barriers to upstream fish movement (and thus could not be re-founded or receive external genetic material without human intervention), these headwater populations may be important sources for re-founding and augmenting lower populations. This was handled by a simple identifier indicating that a given population operates as a source. The most downstream population would automatically become a "sink" recipient.

Evaluation of Potential CRCT Population Restoration and Expansion Opportunities.
This evaluation was based on an initial range-wide review of stream segments not currently associated with conservation populations. This mapping exercise facilitated assessment of potential restoration and/or expansion opportunities. Similar to the mapping exercise associated with currently occupied stream segments, lower and upper bounds of all stream segments viewed as having the potential to support CRCT were identified and evaluated. Using the base hydrography layer within each 4^{th} level HUC overlaid with current CRCT occupied habitat, conservation population and barrier locations, each team systematically identified and evaluated CRCT restoration and expansion potentials on a stream segment basis.

The information for these segments can be treated as a block of segments or can be developed for each NHD segment. The assessment teams identified segments as large as possible. The specific information was tracked on a stream segment basis. Again, considering barrier locations was important as was the information associated with Tables 28 to 31. Each identified stream segment had all attributes in common or, if one or more attributes changed, a new segment was created. Fish stocking and/or fish presence (Table 28), habitat attribute (Table 29), significance of any fishery (Table 30), associated with the stream segment was identified. The relative complexity of removal (chemical and/or physical removals) of any existing fish within the potential restoration or expansion segment was also identified (Table 31).

Table 26. Fish stocking and/or presence of fish associated with the restoration or expansion stream segment. (Check the one that best applies)

Code	Non-native Fish Stocking and/or Presence Status
1	No Record of fish stocking and the segment is barren
2	Record of stocking and/or hybridized CRCT are the only trout present but they are not part of a conservation population.
3	Record of non-native trout stocking and/or the presence of non-native trout in low numbers. Includes all non-native trout: rainbow, brown, Brook, Lake, and other cutthroat. Hybridized CRCT may or may not be present.
4	Record of non-native trout stocking and/or the presence of non-native trout being present in high numbers. Includes all non-native trout: rainbow, brown, Brook Lake, and other cutthroat. Hybridized CRCT may or may not be present
5	Unknown presence or stocking record of non-native trout.

Table 27. Relative habitat quality of the potential restoration or expansion segment. (Check the one that best applies)

Code	Habitat Quality Determination
1	Excellent habitat quality (e.g., ample pool environment, low sediment levels, optimal temperatures, quality riparian habitat, etc.)
2	Good habitat quality (may have some habitat attributes that are slightly less than ideal)
3	Fair habitat quality (has a greater number of attributes that are less than ideal)
4	Poor habitat quality (most habitat attributes reflect inferior conditions)
5	Habitat Quality Unknown

Table 28. Relative significance of any fishery associated with the potential restoration or expansion segment. (Check the one that best applies)

Code	Relative Significance of a Fishery
1	No fishery present
2	Minor fishery (i.e., minimal use)
3	Moderate fishery
4	Major fishery (i.e., significant level of use)
5	Significance Unknown

Table 29. Relative complexity associated with removal of any fish associated with the potential restoration or expansion segment. (Check the one that best applies)

Code	Relative Complexity of Non-native Fish Removal=
1	No fish present
2	Minor complexity (e.g., simple drainage, few fish, low flows, simple habitats, etc.)
3	Moderate complexity
4	Major complexity (e.g., significant flows, multiple channels, many fish, complex habitats, etc.)
5	Unknown complexity

Table 30. Source information for the potential CRCT restoration or expansion segment. (Check the one that best applies)

Code	Description
1	Judgment-information extrapolated from other streams
2	Ocular Reconnaissance
3	Spot Sampling
4	Trend Sampling
5	Detailed Sampling
	Unknown

A generalized restoration opportunity assessment for each potential restoration stream segment was performed by rating the information contained in Tables 28 through Table 31. Restoration potentials were ranked using a 1 to 4 ranking system for each of the four variables identified above (Table 33). The ranking for each restoration variable was derived from the information and judgment of the working group doing the assessment. The ranks assigned to each of the variables were combined into a rating of overall restoration potential for each stream segment. The four variables were weighted equally to derive the overall restoration ranking. The overall score was divided into logical rankings associated with restoration potential (High Restoration Potential = 4 to 6; Intermediate Restoration Potential = 7 to 9; Low Restoration Potential = 10 to 13; and, Very Low Restoration Potential = 14 to 16). If a complete barrier occurred in the lower portion of a segment, the ranking was elevated to the next higher restoration or expansion rank. The identification of one or more unknown conditions associated with the restoration variables resulted in labeling that segment as having unknown restoration potential.

Table 31. Ranking of the various restoration potential factors for each stream segment.

Variable	Description	Rank	Criteria
Biological Considerations Associated with CRCT Restoration Opportunities	Specifically addresses the biological considerations associated the presence of other trout in potential restoration segments (Table 28).	1	No record of fish stocking and the segment is barren
		2	Hybridized CRCT are present in the absence of other trout and segment is not part of a conservation population.
		3	CRCT maybe present and there are non-native trout present in low numbers. Segment not part of conservation population.
		4	CRCT maybe present and there are non-native trout present in high numbers. Segment not part of conservation population
Habitat Considerations Associated with CRCT Restoration Opportunities	Specifically addresses habitat quality of potential restoration segments. See habitat quality ranking in Table 29	1	Excellent habitat quality
		2	Good habitat quality
		3	Fair habitat quality
		4	Poor habitat quality
Social and Political Considerations Associated with CRCT Restoration Opportunities	Specifically addresses the relative significance of an existing fishery (Table 30).	1	No fishery present.
		2	Minor fishery (i.e. minimal use)
		3	Moderate fishery
		4	Major fishery (i.e. significant use level)
Relative Complexity Considerations Associated with CRCT Restoration Opportunities	Specifically addresses the complexity of non-native trout or hybrid CRCT removals (chemical or physical) (Table 31).	1	No fish present
		2	Minor complexity.
		3	Moderate complexity.
		4	Major complexity.

Box C - Generalized Population Health Evaluations

As indicated in the status update protocol each conservation population will receive a generalized population health assessment (Table 27) based on four (4) variables identified by Rieman et.al. (1993). Each of these variables with be ranked based on information contained in the status update database. The variables are related to both deterministic (e.g. changes that are predictable) and/or stochastic (e.g. changes due to chance events) processes that could influence the well-being of a population of CRCT. It should be noted that this generalized health evaluation should not be viewed as an absolute but rather as a relative index of possible or potential health influences associated with the population.

Temporal Variability As used in this health evaluation, temporal variability is linked the population's ability to withstand stochastic influences to the occupied habitat. As such, the amount of occupied habitat becomes a significant indicator of how influential environmental (e.g. fire or drought) or hydrologic (e.g. flooding) events are likely to be to the population. The assumption is that increased habitat provides a greater opportunity for increased habitat complexity and a greater resistance to catastrophic events that could influence the entire population. To receive a low temporal risk ranking we are calling for at least 50 miles of occupied habitat to be present. On the other end of the scale, a very high temporal risk ranking would be associated with occupied habitat of less than 6 miles. The temporal risk ranking will be derived as a cumulative total of stream segments identified as being part of the specific conservation population.

Population Size Variability of Individuals Larger than 15 cm As used in this risk evaluation, this is the population size based on the number of individuals larger than 15 cm in the conservation population. This size threshold is viewed as a reasonable length associated with CRCT that would be sexually active (e.g. related to the effective population). The concept of effective population size plays an important role in the long-term conservation scenario of a population by being related to genetic drift, loss of genetic diversity and population inbreeding. Effective population size is also important in maintaining "critical population mass" needed for adjustments from migration and natural selective influences. A larger sexually active population size, in general, reflects conditions were all life stages are represented in the population. The population size will be derived from the density information associated with Tables 11 and 12. To receive a low adult population size risk ranking we are calling for an adult population size of greater than 2000 individuals. At the other end of the risk scale, a very high risk ranking would be associated with an adult population size of less than 50 adults.

Population Production (Growth/Survival) Variability Factors that influence population production include habitat quality, disease, competition and predation. Land uses that influence habitat quality as well as efforts to enhance habitat are also important. To a significant degree population production factors reflect deterministic processes. The development of a ranking for population production will include consideration of the database information associated with habitat condition, presence of competitive fish, presence of catastrophic disease, the nature of land uses associated with the conservation population and the number of conservation actions taken to improve conditions associated with the conservation population (Table A1). For the purposes of developing an initial ranked score associated with population production, the habitat quality, presence of disease, land uses and implementation of conservation actions will be weighted equally. The final population production score assigned to the conservation population will be increased by one level if non-native fish are sympatric with the population. The composite scores for population production variable ranking can range from 4 to 16 with a 4 being the best production ranking and 16 being the worst ranking. Partitioning of the initial ranked scores for population production follows: High Population Production = 4 to 6; Intermediate Population Production = 7 to 10; Low Population Production = 11 to 13; and, Very Low Population Production = 14 to 16. The final ranked score will reflect an adjustment to reflect the presence of non-native fish competition and predation. If non-native fish are sympatric with the conservation population, the ranked score should be adjusted to the next higher population production level (i.e. Example: If the initial ranked score falls within the intermediate population production range (score or 7 to 10) and non-native fish are present; the final ranked score will automatically be changed to the low population production level. The final ranking will be inserted as the population production potential ranking in Table 27.

Population Connectivity Variable Populations of CRCT exist as either isolated populations or networks. Isolate populations operate as a discrete entity usually within a single stream. A population network (often referred to as a meta-population) consists of several local sub-populations operating with a level of movement and genetic exchange. Most often population networks represent several local sub-populations each occupying a specific component (e.g. specific streams) of a drainage network. In general, the diversity of local sub-populations and the nature of connectivity within the population network contribute to the stability of the population, especially in terms of how stochastic events might influence population performance through time. The basis for ranking population connectivity will be taken directly from the database (Table 19).

These four main factors will be weighted to derive a final index value using the following weighting criteria: Temporal Variability = 0.7; Population Size = 1.2; Population Productivity (Growth/Survival) = 1.6; and Isolation = 0.5. The individual factors and the final composite index scores represent only a relative indicator of population health. They should not be viewed as absolutes but rather as indicators of possible or potential health influences associated with each population.

Box C-Table 1. Ranks of the various types of population production factors

Variable	Description	Rank	Criteria
Habitat Quality –	Habitat Quantity – Derived from the occupied stream segment habitat quality information contained in the database (Table 14).	1	> 50% of occupied stream segment judged to have an excellent habitat rating.
		2	> 50% of occupied stream segments judged to have excellent and good habitat ratings.
		3	> 50% of occupied stream segments judged to have excellent, good and fair habitat ratings.
		4	> 50% of occupied stream segments judged to be in poor habitat condition.
Presence of catastrophic disease	Developed from the risk assessment associated with significant disease (Table 26).	1	Significant diseases not known to exist and/or complete barrier to fish migration present.
		2	Significant diseases not in close proximity and/or barriers at risk of failure.
		3	Disease in close proximity and no barrier exists.
		4	Disease sympatric with population and/or known to be infected.
Presence of land uses	Ranking gauged on the number of land uses associated with the conservation population. This variable is associated with the information contained in Table 24.	1	Population occurs within wilderness or land with management that precludes extractive or detrimental land uses.
		2	Population associated with on 1 to 2 land uses.
		3	Population associated with 3 to 4 land uses.
		4	Population associated with five (5) or more land uses.
Implementation of Conservation Actions	This variable is associated with the conservation actions identified in Table 23.	1	A substantial (>5 actions) number of conservation actions have been implemented.
		2	Three (3) to 5 conservation actions have been implemented.
		3	Only 1 to 2 conservation actions have been implemented.
		4	No conservation actions have been implemented.

Appendix C. Population and habitat data for all CRCT populations regardless of conservation status

Current range

CRCT currently occupy about 5,679 kilometers (km) of stream habitat and 1,163 hectares (ha) of lake habitat (Figure 1). Of currently occupied CRCT stream habitat, 509 km occur outside historic CRCT stream habitat. This additional stream habitat is typically located upstream of natural barriers in stream segments not estimated to have been occupied historically, but which still occur within the historic CRCT range. Overall, these 509 km account for approximately 1.6% of the total historic CRCT stream habitat. 2010 is the first year lake populations were tracked as part of the status assessment; therefore, no comparisons to 2005 can be made for lake populations.

Sixteen percent of designated CRCT historic stream habitat is currently occupied: an increase of 3% from the 2005 CRCT status assessment. This increase in occupied, historic stream habitat is attributable to refinement of the estimated historic CRCT habitat, and an overall increase in known occupied CRCT habitat. Currently, CRCT are known to occupy 16% more stream habitat (5,679 km) than was reported in 2005. Discovering additional, existing CRCT populations and expanding/establishing CRCT populations have contributed to the increase in occupied stream habitat of CRCT.

CRCT persist in three of the five states containing historic habitat. In Colorado, CRCT currently occupy 2,633 km of stream habitat, nearly a 20% increase in occupied stream habitat in this state since 2005. In Utah, 1,991 km of stream habitat is currently occupied by CRCT, which is about 35% of all occupied habitat in the CRCT range and 11% more than was reported in 2005. Wyoming's CRCT population currently occupies 1,055 km of stream habitat, which is nearly a 19% increase when compared to 2005. Utah has the greatest number of 640 ha of occupied lake habitat. CRCT are believed to be extirpated from the subspecies' historic range in New Mexico and Arizona.

Current range varied among GMUs (Table 1). The two Green River GMUs contain the largest amount of currently occupied CRCT habitat: 1,390 km in the Lower Green and 1,297 km in the Upper Green (Table 1). CRCT currently occupy 1,039 km in the Upper Colorado GMU, followed by the Yampa GMU (787 km occupied), Gunnison GMU (601 km occupied), San Juan GMU (255 km occupied), Dolores GMU (191 km occupied), and Lower Colorado GMU (120 km occupied). Of these GMUs, the greatest amount of change from the 2005 CRCT status assessment was observed within the Dolores GMU, a 98% increase in occupied CRCT stream habitat. We documented increases in current range of CRCT in all other GMUs, ranging from 7 to 33 %.

The percentage of historic habitat occupied by extant CRCT populations varied by state, with 35% of Utah's historic range occupied, 16% of Wyoming's occupied, and 13% of Colorado's occupied. CRCT have been extirpated from New Mexico and Arizona. The percentage of historic habitat still occupied varied by GMU, ranging from nearly 8 % in the San Juan GMU to 39% in the Lower Green GMU (Table 1). Interestingly, CRCT have managed to persist in 20%

of the historic stream habitat of the Lower Colorado GMU, despite this GMU contributing the least overall historic CRCT stream habitat (590 km). Persistence of CRCT is lowest in the San Juan GMU, where CRCT occupy only 8% of the historic range. Extant populations can be found 42 of the 51 fourth-level HUCs within the historic range (Table 1), which represents no change since 2005. CRCT are believed to be extirpated from the following nine fourth-level HUCs: Upper Colorado-Kane Springs, Upper Green-Slate, Big Sandy, Vermillion, Middle San Juan, Mancos, Lower San Juan-Four Corners, Montezuma, and Chinle.

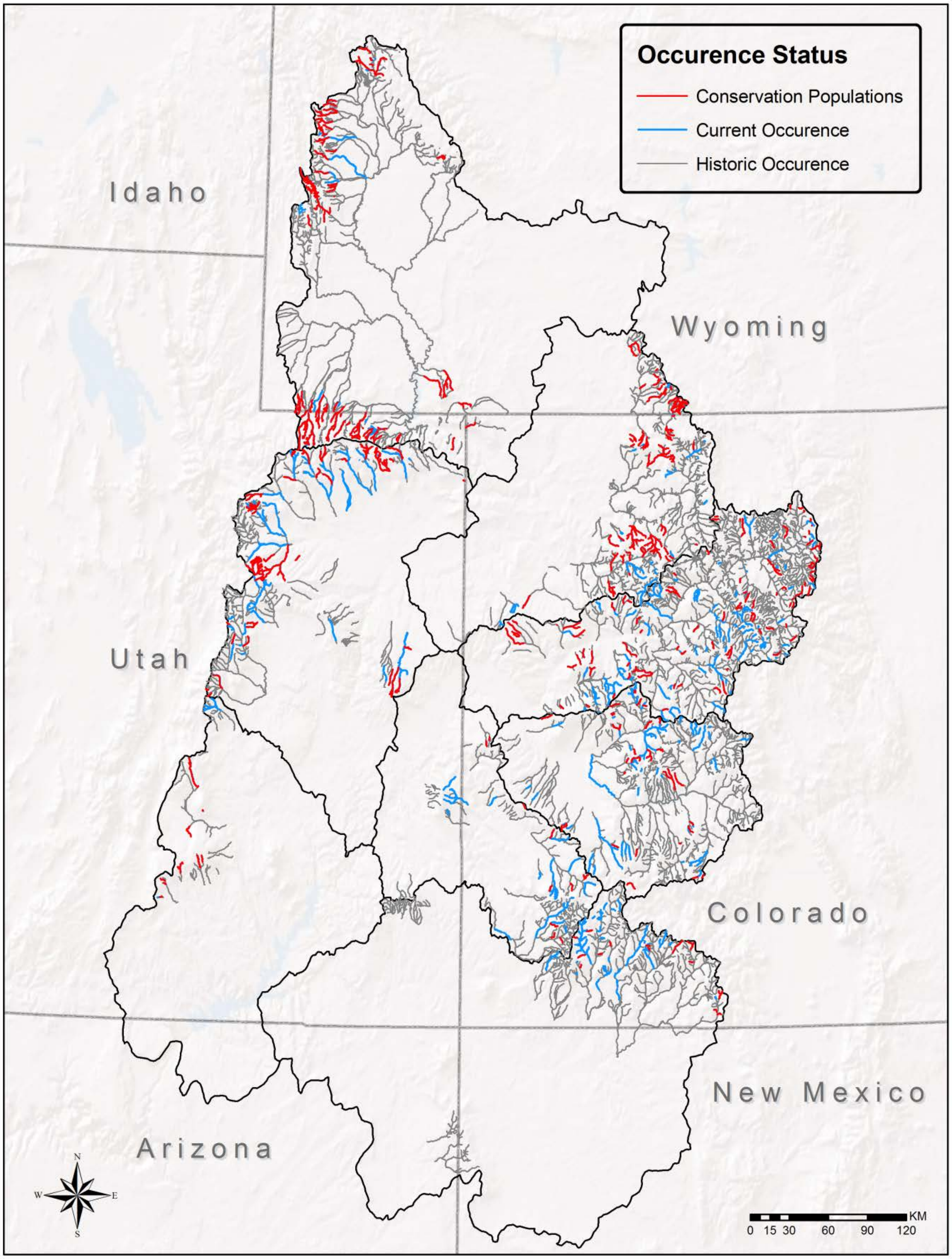

Figure 1. Current range (blue) and historic range (gray) of CRCT. Conservation populations are also shown in red.

Table 1. Historic and currently occupied CRCT stream habitat (km) by GMU and fourth-level Hydrologic Unit Code (HUC). Percentage of historic range occupied is overestimated in several HUCs where CRCT have been introduced outside their historic range.

GMU, ***HUC***	**Historic range**	**Current range**	**Percentage occupied**
Dolores	1,795	191	10.6
Lower Dolores	229	77	33.4
San Miguel	473	66	13.9
Upper Colorado-Kane Springs	133	0	0
Upper Dolores	918	41	4.5
Westwater Canyon	43	8	17.6
Gunnison	4,636	601	13.0
East-Taylor	768	58	7.5
Lower Gunnison	476	34	7.1
North Fork Gunnison	663	223	33.6
Uncompahgre	271	74	27.4
Upper Gunnison	1,747	168	9.6
Tomichi	711	44	6.2
Lower Colorado	590	120	20.3
Escalante	177	41	23.2
Fremont	267	45	16.7
Muddy	146	34	23.1
Lower Green	3,577	1,390	38.8
Ashley-Brush	256	137	53.5
Duchesne	914	465	50.8
Lower Green-Desolation Canyon	242	20	8.4
Lower Green-Diamond	41	1	3.5
Price	632	225	35.6
San Rafael	634	87	13.6
Strawberry	697	396	42.5
Willow	161	159	98.6
Upper Colorado	7,272	1,039	14.3
Blue	759	94	12.4
Colorado Headwaters	3,353	366	10.9
Colorado Headwaters-Plateau	944	260	27.6
Eagle	945	98	10.3
Parachute-Roan	241	92	38.2
Roaring Fork	1,031	129	12.5
Upper Green	6,850	1,297	18.9
Big Sandy	491	0	0
Blacks Fork	1,356	266	19.6
Muddy	537	58	10.7
New Fork	587	14	2.5
Upper Green	2,472	597	24.2
Upper Green-Flaming Gorge Reservoir	1,203	361	30.1
Upper Green-Slate	113	0	0
Vermillion	91	0	0
San Juan	3,414	255	7.5
Animas	730	173	23.7
Chinle	268	0	0
Lower San Juan-Four Corners	258	0	0
Mancos	191	0	0
Middle San Juan	252	0	0
Montezuma	35	0	0
Piedra	601	40	6.6
Upper San Juan	1,079	43	4.0
Yampa	4,194	787	18.8

Little Snake	830	248	29.9
Lower Yampa	82	18	21.9
Lower White	143	30	21.0
Muddy	105	33	31.2
Piceance-Yellow	106	13	12.3
Upper Yampa	2,080	321	15.4
Upper White	848	125	14.7

Genetic Status of Colorado River Cutthroat Trout (CRCT)

Genetic analysis has been completed for CRCT in 2,925 km (52%) of occupied stream habitat, and within 447 ha (39%) of occupied lake habitat (Table 3; Figure 5). Genetic samples were equal to or greater than 99% genetically pure in CRCT currently occupying 1,522 km of stream habitat. This "unaltered" genetic status accounts for 52% of the stream habitat analyzed for genetic samples, 27% of occupied CRCT stream habitat, and 5% of the historic range of CRCT. Genetic samples from CRCT currently occupying 961 km of stream habitat (17% of occupied CRCT stream habitat and 3% of the historic range of CRCT) indicated 90%-99% genetic purity (conservation population criteria). Genetic samples were identified as "genetically altered" or hybridized (less than 90% purity) in CRCT currently occupying 443 km of stream habitat (8% of occupied CRCT stream habitat). Genetic analysis revealed at least 99% purity in CRCT currently occupying 197 ha of lake habitat (44% of the lake habitat analyzed for genetic samples and 17% of the occupied CRCT lake habitat). Nearly half of the lake habitat analyzed found these population to be less than 80% pure.

Investigators also estimated presumptive genetic status of CRCT without formal genetic analysis (Table 2). Observers noted that CRCT within 647 km (24%) of stream habitat and CRCT within 30% of lake habitat (215 ha) investigated may be genetically pure based upon the absence and/or non-stocking of hybridizing fishes, meristic characteristics, and/or the location of CRCT to a nearby genetically pure CRCT population. This "suspected unaltered" genetic status represents 11% of occupied CRCT stream habitat (2% of CRCT historic range), and 19% of occupied CRCT lake habitat. Alternatively, surveyors observed that CRCT may be genetically altered due to the presence, or past stocking of hybridizing, non-native fishes. This "potentially altered" genetic status represents 34% of occupied CRCT stream habitat and 43% of occupied CRCT lake habitat.

Genetic status was also evaluated in stream (Table 3) and lake habitat (Table 4) in each of the eight GMUs . The majority of CRCT stream habitat genetically analyzed by GMU showed CRCT with 90% or greater genetic purity. The Yampa and Upper Colorado GMUs had the highest percentages of CRCT stream habitat qualify as CRCT conservation populations (90% or greater genetic purity), at 92% (518 km) and 89% (441 km), respectively. The Lower Green GMU had the most CRCT lake habitat genetically analyzed (118 ha) when compared to all other GMUs, while the Dolores GMU had no CRCT lake habitat genetically analyzed. Ninety percent of CRCT lake habitat analyzed within the Lower Green GMU qualifies as CRCT core conservation waters (99% or greater genetic purity). Nearly all CRCT lake habitat analyzed within the Yampa GMU (138 km) was found to be hybridized. Observers within each GMU classified the majority of stream habitat occupied by CRCT as presumptively hybridized (without formal genetic analysis). Surveyors also estimated 68% and 77% of the CRCT lake habitat evaluated within the Upper and Lower Green GMUs, respectively, may be genetically altered.

Table 2. Genetic status of CRCT summarized as stream km within each genetic status category. SusUn – suspected unaltered, not tested; PotUn – potentially unaltered, not tested; Mixed – mixed stock of altered and unaltered genetics. Current range and 2005 Current range are stream km. % Current range is the percentage of the total CRCT current range included in each genetic category. % Historic range is the percentage of the total CRCT historic range included in each genetic category and includes current range that is outside estimated historic range. % Historic range and 2005 Current range not available for lake populations.

Genetic status	Current range	% Current range	% Historic range	2005 Current range
		Stream habitat		
Unaltered	1,522	26.8	4.7	1,261
90-99% pure	961	16.9	3.0	351
80-89% pure	135	2.4	0.4	134
< 80 % pure	308	5.4	1.0	108
SusUn	647	11.4	2.0	761
PotUn	1,926	33.9	6.0	2,165
Mixed	181	3.2	0.6	110
Total	5,679	100.0	17.6	4,890
		Lake habitat		
Unaltered	197	16.9	-	-
90-99%	40	3.4	-	-
80-89%	1	0.1	-	-
< 80 %	209	18.0	-	-
SusUn	215	18.5	-	-
PotUn	501	43.1	-	-
Mixed	0	0.0	-	-
Total	1,163	100.0	-	-

Table 3. CRCT genetic status for populations within each GMU in 2005 and 2010. Data are summarized as stream km within each genetic status category. SusUn – suspected unaltered, not tested; PotUn – potentially unaltered, not tested; Mixed – mixed stock of altered and unaltered genetics.

		Genetic status							
		Unaltered	90-99%	80-89%	< 80%	SusUn	PotUn	Mixed	Total
Dolores	2005	8.7	6.6	7.4	6.5	13.2	50.5	3.7	96.5
	2010	34.7	21.7	15.0	29.3	0.0	85.9	4.4	191.1
	Change	26.0	15.1	7.6	22.8	*-13.2*	35.4	0.7	94.6
Gunnison	2005	90.5	34.7	11.8	29.2	69.1	237.9	0.0	473.1
	2010	85.5	75.8	8.5	54.7	68.8	307.4	29.6	630.2
	Change	*-5.0*	41.1	*-3.3*	25.5	*-0.3*	69.5	29.6	157.1
Lower Colorado	2005	75.9	-	-	0.0	10.0	17.6	-	103.5
	2010	80.6	-	-	17.9	10.5	10.5	-	119.5
	Change	4.7	-	-	17.9	0.5	*-7.1*	-	16.0
Lower Green	2005	319.6	0.0	20.1	33.2	164.9	742.0	-	1,279.8
	2010	411.2	89.1	11.7	100.6	155.4	621.7	-	1,389.7
	Change	91.6	89.1	*-8.4*	67.4	*-9.5*	*-120.3*	-	109.9
San Juan	2005	46.9	13.4	-	0.0	14.0	117.9	0.0	192.1
	2010	106.6	19.7	-	4.5	16.5	112.6	2.7	262.7
	Change	59.7	6.3	-	4.5	2.5	-5.3	2.7	70.6
Upper Colorado	2005	144.0	78.5	35.1	22.0	168.4	523.9	0.0	971.8
	2010	242.9	197.9	11.3	42.7	145.9	398.4	37.2	1,076.2
	Change	98.9	119.4	*-23.8*	20.7	*-22.5*	*-125.5*	37.2	104.4
Upper Green	2005	244.8	147.6	25.8	11.2	237.6	345.7	105.8	1,118.4
	2010	320.3	141.2	36.4	93.1	264.4	344.6	96.7	1,296.7
	Change	75.5	*-6.4*	10.6	81.9	26.8	*-1.1*	*-9.1*	178.3
Yampa	2005	330.8	70.5	33.9	5.8	84.0	129.6	0.0	645.5
	2010	397.3	120.9	38.3	5.2	94.9	130.8	4.5	791.8
	Change	66.5	50.4	4.4	*-0.6*	10.9	1.2	4.5	146.3

Table 4. Genetic status of lake populations of CRCT. Data are summarized as lake ha within each genetic status category. SusUn – suspected unaltered, not tested; PotUn – potentially unaltered, not tested; Mixed – mixed stock of altered and unaltered genetics.

Unaltered	**90-99%**	**80-89%**	**< 80%**	**SusUn**	**PotUn**	**Mixed**	**Total**
Dolores							
0	0	0	0	0	0	0	0
Gunnison							
15	0	0	0	5	3	97	119
Lower Colorado							
7	0	0	0	0	0	0	7
Lower Green							
106	12	0	0	70	239	0	427
San Juan							
1	1	0	0	0	0	0	2
Upper Colorado							
41	2	0	39	6	10	0	99
Upper Green							
26	25	0	32	118	248	0	449
Yampa							
2	0	1	138	16	1	0	157

Figure 2. Genetic status of currently occupied Colorado River cutthroat trout (CRCT) stream segments. Waters designated as "Other" are comprised of all genetic results less than 90% pure, untested and suspected hybridized, and mixed stocks of unaltered and hybridized CRCT.

Elevation of Colorado River Cutthroat Trout (CRCT) Occurrence
Current CRCT populations occur in streams at elevations ranging from approximately 1,400 m (nearly 4,600 feet) to more than 3,800 m (nearly12,500 feet) (Figure 3; Table 6). Historically, stream populations were found across a wider range of elevations, particularly at elevations less than 1,800. Seventy-five percent of the current occupied stream habitat (3,856 km), which is also within historic CRCT habitat, occurs between 2,200 and 3,000 m. Although this elevation range represents only 61% of historic, occupied stream habitat, the same range in elevation corresponds to nearly 80% (2,459 km) of stream conservation population habitat. CRCT persistence within historic habitat appears to be the greatest (17%-27%) at elevations between 2,200 and 3,400 m. CRCT occupy less than 2 % of their historic range below 1,800 m. Interestingly, 12% of historic habitat currently occupied by CRCT is 3,600 m or greater in elevation. The 2005 Assessment evaluated an interesting trend in the 4th level watersheds, where CRCT persistence was greatest. Generally, watersheds with the lowest amount of historical habitat had higher persistence, most likely related to the reduced likelihood of non-native trout stocking in the more marginal habitat. This may also explain the observed trend of greater persistence in higher elevation streams with habitat that is marginal for the introduced trout species, along with barriers to upstream fish movement. Furthermore, competition and hybridization with non-native trout at lower elevations have impacted CRCT persistence in these streams.

In contrast to stream populations, extant lake populations are present down to 2,000 m (6,562 feet; Figure 4; Table 6). Most current occupied lake habitat (97%; 1,133 ha) occurs between 2,600 and 3,400 m. This same range in elevation also corresponds to nearly all (97%; 611 ha) of lake conservation population habitat. Persistence of CRCT within historic lake habitat cannot be calculated, as historic lake habitat is unknown. Several existing lake populations have been established by stocking, and are self-sustaining. In these situations, lakes were likely historically fishless due to natural fish migration barriers and/or the propensity of these waters to winter-kill.

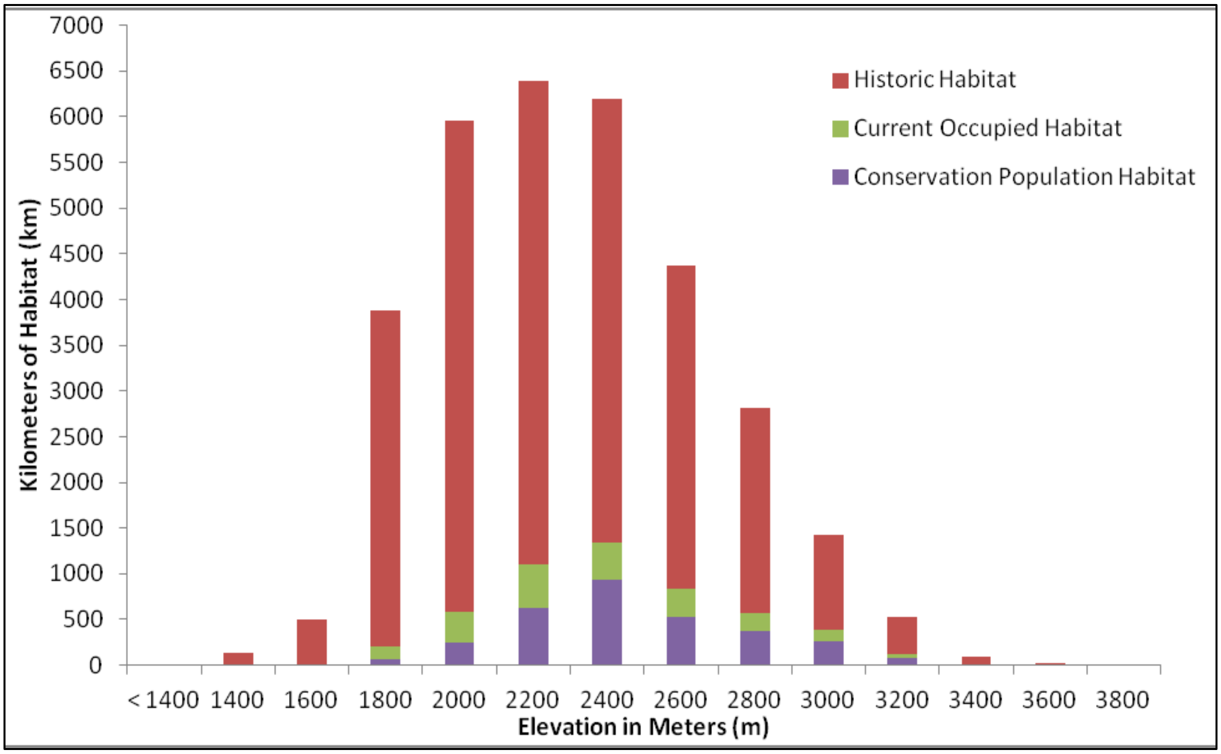

Figure 3. Kilometers (km) of stream habitat occupied by Colorado River cutthroat trout (CRCT) historically (red), currently (green), and by conservation populations (≥90% genetic purity) (purple) in relation to elevation range (meters). Habitats are presented as a fraction of total historic stream habitat (km).

Table 5. Kilometers (km) of stream habitat currently occupied by Colorado River cutthroat trout (CRCT) within historic habitat, and hectares (ha) of lake habitat currently occupied by CRCT in relation to elevation range (meters, m). Estimated historic habitat, percentage of historic habitat currently occupied, and habitat for current stream and lake conservation populations (≥90% genetic purity) are also provided.

Elevation Range (m)	Current Occupied Stream Habitat within Historic Habitat (km)	Historic Stream Habitat (km)	Historic Stream Habitat Currently Occupied (%)	Stream Conservation Population Habitat within Historic Habitat (km)	Current Occupied Lake Habitat (ha)	Lake Conservation Population Habitat (ha)
< 1,400	0	5	0.0	0	0	**0**
1,400-1,600	2	140	1.4	0	0	**0**
1,600-1,800	13	505	2.0	3	0	**0**
1,800-2,000	239	3,882	5.3	78	0	**0**
2,000-2,200	662	5,962	9.8	295	12	**12**
2,200-2,400	1,180	6,387	17.2	705	3	**3**
2,400-2,600	1,415	6,198	21.7	958	0	**0**
2,600-2,800	887	4,374	19.1	566	300	**300**
2,800-3,000	662	2,813	20.5	405	203	**68**
3,000-3,200	435	1,422	26.9	276	290	**78**
3,200-3,400	166	523	23.3	105	340	**165**

3,400-3,600	16	99	6.1	9	11	**3**
3,600-3,800	2	17	11.8	2	1	**1**
>3,800	0	2	15.0	0	3	**0**
TOTAL	**5,679**	**32,328**	**16.0**	**3,403**	**1,162**	**629**

CRCT (≥ 15 cm) were based on number of adults per mile for each steam segment. Density estimates are not available for lakes. Densities were summarized into density ranges by state (Table 7) and included all occupied streams regardless of genetic purity. In general, occupied stream habitat increased across Colorado, Utah, and Wyoming from the 2005 status assessment for adult CRCT densities greater than 51 fish per mile (Table 7). Two exceptions occurred in Wyoming where stream habitat declined for adult CRCT densities greater than 151 fish per mile. Decreases in stream habitat for adult CRCT density ranges in Wyoming may have been offset by increases in other density ranges (51% for adult CRCT in the 51-150 fish/mile range and 96% for adult CRCT in the unknown category). The large increase in unknown adult population density for Wyoming may be related to new populations that were observed, but in which densities were not quantified. In Colorado and Utah, the amount of stream habitat with unknown CRCT densities decreased over time, likely due to the collection of more detailed population information from these waters. This presumption may explain the 61% increase of stream habitat for small CRCT populations (<50 fish/mile) in Colorado. Declines in CRCT stream habitat in Utah (3%) and Wyoming (2%) for the same density of adult CRCT previously identified may be attributable to loss of CRCT populations as a result of degraded suitable habitat or non-native fish removal with subsequent establishment of CRCT populations. Overall, the three states evaluated more stream habitat for adult CRCT densities from 2005 to 2010 as a result of an overall increase in occupied CRCT stream habitat.

Adult CRCT density ranges were also evaluated within each GMU for occupied stream habitat and compared from 2005 to 2010 (Table 8). Investigators in four the Upper Colorado, Gunnison, Lower Green, and Yampa GMUs became more familiar with adult densities over time as evidenced by reductions in the amount of CRCT stream habitat in which densities were "unknown." Conversely, a large increase in unknown adult population density in nearly 30 km of stream habitat within the San Juan GMU may be attributed to discoveries of new populations but for which investigators were unable to quantify CRCT densities. Stream habitat for small CRCT populations (<50 fish/mile) decreased in the Lower Colorado and Lower Green GMUs, potentially being offset by increases in other adult CRCT density ranges, as opposed to actual loss of CRCT populations. The greatest change in adult densities across all known categories (0 to >400 fish/mile) from 2005 to 2010 occurred within the Dolores (118%) and Gunnison (107%) GMUs. Changes translated to an additional 86 km and 224 km of occupied stream habitat with known adult CRCT population densities per GMU, respectively. In 2005, the Dolores GMU had no known stream populations having densities greater than 400 fish/mile. New CRCT populations were either discovered or established within the Dolores GMU by 2010, resulting in an additional 12 km occupied by adult CRCT (>400 fish/mile). This is of particular interest since the Dolores GMU has the lowest amount of historic habitat still occupied by CRCT. More occupied stream habitat was evaluated from 2005 to 2010, and this corresponded to an overall increase in CRCT stream habitat assessed for adult CRCT densities in each GMU across the same time period.

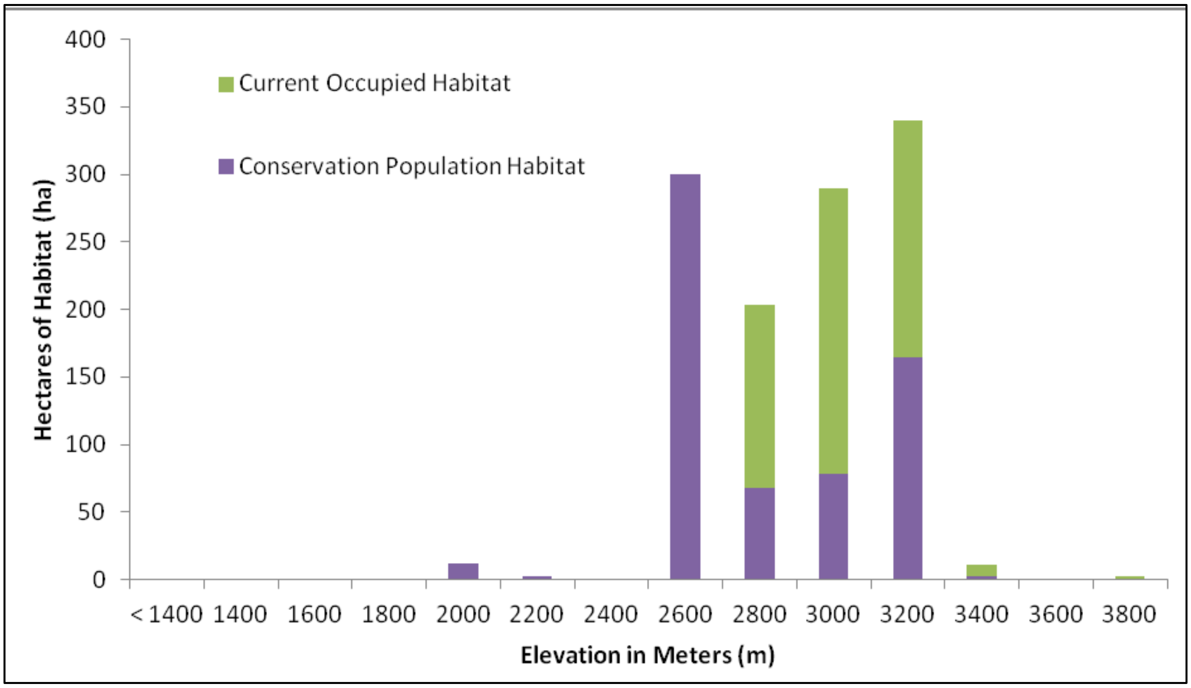

Figure 4. Elevation range (meters, m) of current occupied lake habitat (in hectares, ha) (green) of Colorado River cutthroat trout (CRCT) and identified conservation populations ($\geq$90% genetic purity) (purple). Conservation population habitat is a fraction of total current occupied lake habitat. Hectares of current occupied habitat at 2600 - 2800 feet of elevation was entirely occupied by conservation populations of CRCT.

Densities of Colorado River Cutthroat Trout (CRCT)

Densities of adult

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Table 6. Density (number of fish/mile) of sexually mature ($\geq$ 15 centimeters in total length) Colorado River cutthroat trout (CRCT) occupying stream habitat (length in kilometers, km) compared by state between 2005 and 2010, including percentage change in stream length over time.

Density Range (# of fish/mile)	**Colorado**			**Utah**			**Wyoming**		
	2010 (km)	**2005 (km)**	**% Change**	**2010 (km)**	**2005 (km)**	**% Change**	**2010 (km)**	**2005 (km)**	**% Change**
0 to 50	618.6	384.9	61%	687.4	704.6	-2.4%	224	228.6	-2%
51 to 150	687.4	412.5	67%	333.9	253.7	32%	323.9	214.1	51%
151 to 400	581.7	445.9	31%	323.2	237.4	36%	220.3	228	-3.4%
>400	200.2	93.9	113%	268.7	171.1	57%	102.5	125.5	-18%
Unknown	544.9	863.5	-37%	378.6	432.1	-12%	184.4	93.9	96%
TOTAL	**2632.8**	**2200.7**	**20%**	**1991.9**	**1798.9**	**11%**	**1055**	**890.1**	**19%**

Table 7. Density (number of fish/mile) of sexually mature (≥15 centimeters in total length) Colorado River cutthroat trout (CRCT) occupying stream habitat (length in kilometers, km) for each Geographic Management Unit (GMU) compared between 2005 and 2010, including percent change in stream length over time.

Density Range (# of fish/mile)	Upper Colorado			Lower Colorado		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
0 to 50	217.7	125	74%	19.6	29.9	-35%
51 to 150	258.8	186.5	39%	28.4	30.8	-7.7%
151 to 400	173.1	191.4	-9.5%	18.4	10.4	77%
>400	119.8	24	399%	50.6	30.6	65%
Unknown	269.2	445	-40%	3.4	1.7	99%
TOTAL	**1038.6**	**971.8**	**6.9%**	**120.4**	**103.5**	**16.3%**

Density Range (# of fish/mile)	Dolores			Gunnison		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
0 to 50	37.5	35.2	6.7%	141.9	83.4	70%
51 to 150	48.2	19.1	153%	134.2	63.3	112%
151 to 400	61.3	19.2	220%	118.3	52.1	127%
>400	11.9	0	100%	39.8	12.3	225%
Unknown	32.2	23.1	39%	166.4	262.1	-37%
TOTAL	**191.1**	**96.5**	**98%**	**600.6**	**473.1**	**26.9%**

Density Range (# of fish/mile)	Upper Green			Lower Green		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
0 to 50	203.3	175.5	16%	620.3	637.7	-2.7%
51 to 150	313.4	195.3	61%	247	176.2	40%
151 to 400	326.4	307.5	6.2%	162	141.5	15%
>400	202.1	189.9	6.4%	95.1	50.3	89%
Unknown	251.4	250.3	0.5%	265.2	274.1	-3.2%
TOTAL	**1296.7**	**1118.4**	**15.9%**	**1389.7**	**1279.8**	**8.6%**

Density Range (# of fish/mile)	San Juan			Yampa		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
0 to 50	102.4	97.1	5.4%	187.3	134.3	40%
51 to 150	50.7	34.5	47%	264.7	174.8	51%
151 to 400	33.4	30.3	10%	232.3	158.8	46%
>400	25.8	16.4	58%	26.2	67.1	-61%
Unknown	43.2	13.9	211%	76.9	119.5	-36%
TOTAL	**255.4**	**192.1**	**33%**	**787.3**	**654.5**	**20.3%**

Habitat Quality of Colorado River Cutthroat Trout (CRCT)

Habitat quality was subjectively evaluated as excellent, good, fair, poor, or unknown by accounting for natural characteristics (e.g., gradient, stream size, habitat diversity) and human disturbance (e.g., adjacent roads, grazing, development; Table 9). Overall, quality of occupied stream habitat across Colorado, Utah, and Wyoming appeared to be at least "fair," and in some cases, was "good" or even "excellent" (Table 9). Nearly half of all known occupied stream habitat across the sub-species' range was considered good quality, while approximately 15% (816 km) of known occupied stream habitat was excellent. The number of stream kilometers rated as fair, good, and excellent habitat quality improved from 2005 for Colorado and Utah. This trend was also observed for Wyoming, with the exception of excellent stream habitat, in which a 4% decrease in quality stream habitat was noted. The amount of poor stream habitat quality increased in Utah and Wyoming from 2005, by 31% and 20%, respectively. In general, investigators became more familiar with characterizing habitat quality over time as evidenced by either no change or reductions in the amount of occupied CRCT stream habitat in which quality was "unknown." Overall, the three states evaluated more CRCT stream habitat quality from 2005 to 2010 as a result of an overall increase in occupied CRCT stream habitat.

Habitat quality was also evaluated by each of the eight GMUs for occupied CRCT stream habitat and compared from 2005 to 2010 (Table 10). Habitat quality was either improved through stream improvement projects or investigators became more familiar with CRCT stream habitat over time, in three of the GMUs (Upper Colorado, Lower Green, and Yampa). An additional 554 km (19%) of stream habitat were considered of "good" or better quality in 2010 when compared to 2005. More than half of the known habitat evaluated in 2010 per GMU was categorized as good and/or excellent for seven of the eight GMUs. The amount of poor quality stream habitat increased since 2005 for the Upper Green and Lower Green GMUs. The greatest change in occupied stream habitat quality across all known habitat categories (Excellent to Poor) from 2005 to 2010 occurred within the Dolores GMU (99%). This change translated to an additional 95 km of CRCT occupied stream habitat that were categorized as fair and good quality. The Lower Green GMU, with slightly less than 10%, had the least amount of change in CRCT occupied stream habitat quality across all known habitat over time. More occupied CRCT stream habitat was evaluated from 2005 to 2010, and this corresponded to an overall increase in CRCT occupied stream habitat quality assessed for each GMU across the same time period.

Table 8. Habitat quality for Colorado River cutthroat trout (CRCT) occupying stream habitat (length in kilometers, km) compared by state between 2005 and 2010, including percent change in stream length over time.

Habitat Quality Category	Colorado			Utah			Wyoming		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
Excellent	400.8	273.7	46%	336.9	268.8	25%	78.2	80.7	-3.1%
Good	1419.9	1173.9	21%	851.1	789.1	7.9%	379.6	324.3	17%
Fair	613.4	465.2	32%	615.5	577.5	6.6%	483.6	384.3	26%
Poor	77.8	106.2	-27%	138.2	105.4	31%	76.7	64.1	20%
Unknown	120.9	181.7	-33%	50.3	58.1	-13%	37	36.7	0.7%
TOTAL	**2632.8**	**2200.7**	**20%**	**1991.9**	**1798.9**	**11%**	**1055**	**890.1**	**19%**

Table 9. Habitat quality for Colorado River cutthroat trout (CRCT) occupied stream habitat (length in kilometers, km) for each Geographic Management Unit (GMU) compared between 2005 and 2010, including percent change of stream length over time.

Habitat Quality Category	Upper Colorado			Lower Colorado		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
Excellent	196.1	124.6	57%	21.7	21.7	-0.1%
Good	455.9	426.9	6.8%	67.7	50.2	35%
Fair	275.8	230.5	20%	23.3	21.4	8.6%
Poor	29.3	55.6	-47%	7.7	10.1	-24%
Unknown	81.5	134.3	-39%			
TOTAL	**1038.6**	**971.8**	**6.9%**	**120.4**	**103.5**	**16.3%**

Habitat Quality Category	Dolores			Gunnison		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
Excellent				77.7	42.2	84%
Good	88.4	43.4	104%	376.6	321.5	17%
Fair	102.7	53.1	93%	121.7	84.9	43%
Poor				6.8	6.7	1.5%
Unknown				17.8	17.8	-0.2%
TOTAL	**191.1**	**96.5**	**98%**	**600.6**	**473.1**	**26.9%**

Habitat Quality Category	Upper Green			Lower Green		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
Excellent	288.3	228.8	26%	37.9	32.5	17%
Good	435.1	436.2	-0.2%	663.8	570.5	16%
Fair	445.5	353.6	26%	521.4	523.8	-0.5%
Poor	88.5	62.7	41%	118.7	95.3	25%
Unknown	39.3	37.1	5.8%	47.9	57.7	-17%
TOTAL	**1296.7**	**1118.4**	**15.9%**	**1389.7**	**1279.8**	**8.6%**

Habitat Quality Category	San Juan			Yampa		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
Excellent	74.9	74.6	0.5%	119.2	98.8	21%
Good	132.9	104.2	28%	430.3	334.4	29%
Fair	47.6	13.3	258%	174.5	146.4	19%
Poor				41.7	45.2	-7.9%
Unknown				21.6	29.6	-27%
TOTAL	**255.4**	**192.1**	**33%**	**787.3**	**654.5**	**20.3%**

Width of Streams supporting Colorado River Cutthroat Trout

More than 75% (4,097 km) of occupied stream habitat across Colorado, Utah, and Wyoming was 15 feet (ft) or less in width (Table 11). Slightly more than half of these 4,097 km were attributable to occupied stream habitat with widths ranging from 5 to 10 ft. Wyoming had both the greatest increase and decrease in CRCT occupied stream habitat by known stream width category over time, with a seven-fold increase for stream widths ranging from 20 to 25 ft and a 31% decrease for stream widths ranging from 10 to 15 ft. In general, investigators became more familiar with characterizing stream widths over time as evidenced by either no change (Wyoming) or reductions in the amount of occupied CRCT stream habitat in which stream width was "unknown." Overall, the three states evaluated more stream habitat from 2005 to 2010 as a result of an overall increase in occupied stream habitat.

Stream width was also evaluated in each GMU (Table 12). The Lower Colorado, Dolores, and Yampa GMUs were the only GMUs in which occupied stream habitat either increased or remained the same for known stream width categories from 2005 to 2010. The other five GMUs had both increases and decreases in stream habitat by known stream width categories across the same time period. Investigators must have become more familiar over time with occupied stream habitat as reductions in unknown stream widths were observed in four of the GMUs (Upper Colorado, Gunnison, Lower Green, and Yampa), while the unknown stream width category remained unchanged for the other four GMUs. The Upper Green and Lower Green GMUs had the most occupied stream habitat for both the smallest streams (< 5 ft width) 268 km and 291 km, respectively, and the largest streams (> 25 ft width) 225 km and 206 km, respectively, when compared to all other GMUs. The greatest change in occupied stream habitat across all known stream width categories (< 5 ft to > 25 ft) from 2005 to 2010 occurred within the Dolores GMU (97%). This change translated to an additional 94 km of occupied stream habitat 15 ft and smaller. The Lower Green GMU, with slightly less than 10%, had the least change in occupied stream habitat across all known stream width categories over time. More occupied stream habitat was evaluated from 2005 to 2010, resulting in increase in occupied stream habitat for which widths have been assessed.

Table 10. Stream width (feet, ft) for Colorado River cutthroat trout (CRCT) occupied stream habitat (length in kilometers, km) compared by state between 2005 and 2010, including percent change in stream length over time.

Stream Width (ft)	Colorado			Utah			Wyoming		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change in Stream Length	2010 (km)	2005 (km)	% Change
< 5	267.7	213.5	25%	388.7	297.3	31%	233.8	192.2	22%
5 to 10	1149.1	1021.0	13%	709.8	668.5	6.2%	393.2	380.2	3.4%
10 to 15	584.7	407.0	44%	269.6	254.3	6.0%	99.3	143.9	-31%
15 to 20	273.8	196.2	40%	264.6	228.7	16%	88.0	57.8	52%
20 to 25	201.5	165.6	22%	186.1	171.2	8.7%	141.8	17.0	733%
> 25	23.2	0	100%	68.6	66.8	3%	50.7	51.3	-1.1%
Unknown	133.2	197.4	-33%	103.6	112.1	-7.6%	48.2	47.8	0.9%
TOTAL	**2633.2**	**2200.7**	**20%**	**1991**	**1798.9**	**11%**	**1055**	**890.1**	**19%**

Table 11. Stream width for Colorado River cutthroat trout (CRCT) occupied stream habitat (length in kilometers, km) for each Geographic Management Unit (GMU) compared between 2005 and 2010, including percent change in stream length over time.

Stream Width (feet)	Upper Colorado			Lower Colorado		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
< 5	131.6	98.6	33%	10.2	7.0	46%
5 to 10	486.9	467.2	4.2%	48.5	46.7	3.8%
10 to 15	195.6	148.8	31%	48.1	36.2	33%
15 to 20	92.9	90.5	2.6%	0.8	1.0	-21%
20 to 25	29.5	31.4	-6.1%	12.8	12.5	2.6%
> 25	23.2	0.0	100%			
Unknown	79.1	135.2	-42%			
TOTAL	**1038.6**	**971.8**	**6.9%**	**120.4**	**103.5**	**16.3%**

Stream Width (feet)	Dolores			Gunnison		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
< 5	32.9	17.7	86%	53.5	53.5	-0.1%
5 to 10	105.7	59.3	78%	211.3	201.2	5.0%
10 to 15	39.3	6.9	470%	159.3	122.6	30%
15 to 20	13.2	12.6	4.8%	82.2	26.0	216%
20 to 25				75.6	50.1	51%
> 25						
Unknown				18.9	19.6	-3.7%
TOTAL	**191.1**	**96.5**	**98%**	**600.6**	**473.1**	**26.9%**

Stream Width (feet)	Upper Green			Lower Green		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
< 5	268.4	195.4	37%	290.8	246.6	18%
5 to 10	462.0	495.9	-6.8%	455.2	401.2	13%
10 to 15	134.6	172.1	-22%	161.1	171.6	-6.1%
15 to 20	158.4	119.6	32%	172.2	144.6	19%
20 to 25	169.7	33.5	407%	145.4	142.2	2.3%
> 25	55.4	54.1	2.4%	61.4	61.6	-0.3%
Unknown	48.2	47.8	0.9%	103.6	112.1	-7.6%
TOTAL	**1296.7**	**1118.4**	**15.9%**	**1389.7**	**1279.8**	**8.6%**

Table 11. (continued)

Stream Width (feet)	San Juan			Yampa		
	2010 (km)	2005 (km)	% Change	2010 (km)	2005 (km)	% Change
< 5	8.4	0	100%	94.4	84.1	12%
5 to 10	134.0	99.7	34%	349.5	298.6	17%
10 to 15	26.8	6.8	291%	188.7	140.1	35%
15 to 20	25.3	25.8	-1.9%	81.5	62.5	30%
20 to 25	61.0	59.8	1.9%	35.5	24.2	47%
> 25				2.4	2.3	3.8%
Unknown				35.2	42.5	-17%
TOTAL	**255.4**	**192.1**	**33%**	**787.3**	**654.5**	**20.3%**

Stocking and Presence of Non-Native Trout Species-

Within currently occupied habitat approximately 2,639 kilometers (46%) have no record of non-native fish stocking. The remaining 3,041 kilometers of occupied habitat have at least one record of stocking of non-native fish. Between 2005 and 2010, 790 km of occupied stream habitat was identified. Within this the proportion of habitat for which there is a stocking record is identical to previous data. The Dolores and San Juan GMUs had increases in un-stocked occupied stream habitat. Areas with records of non-native trout stocking by state and GMU are presented in Tables 13 and 14.

Table 12. Currently-occupied CRCT stream (length in kilometers, km) and lake habitat (area in hectares, ha) by state for which records of stocking with non-native salmonids has not (no record) or has (non-native stocking) occurred and comparison to 2005 data. Lake data was not available in 2005. Include NA

Non-native Fish Stocking Category	Colorado			Utah			Wyoming		
	2010 (km or ha)	2005 (km or ha)	% Change	2010 (km or ha)	2005 (km or ha)	% Change	2010 (km or ha)	2005 (km or ha)	% Change
No record – streams	1,164	955	21.9%	1,019	838	21.7%	456	405	12.6%
Non-native stocking – streams	1,469	1,246	17.9%	972	961	1.2%	599	485	23.5%
No record – lakes	82	NA	NA	75	NA	NA	242	NA	NA
Non-native stocking – lakes	198	NA	NA	565	NA	NA	0	NA	NA
TOTAL	**2,633 km 280 ha**	**2200.7 km**	**19.6% (streams)**	**1,992 km 640 ha**	**1,799 km**	**10.7% (streams)**	**1,055 km 242 ha**	**890 km**	**18.5% (streams)**

Table 13. Currently-occupied CRCT stream (length in kilometers, km) and lake (area in hectares, ha) habitat by Geographic Management Unit (GMU) for which records of stocking with non-native salmonids has not (no record) or has (non-native stocking) occurred and comparison to 2005 data.

Non-native Fish Stocking Category	Upper Colorado			Lower Colorado		
	2010 (km or ha)	2005 (km or ha)	% Change	2010 (km or ha)	2005 (km or ha)	% Change
No record – streams	444	441	0.8%	62	59	5.6%
Non-native stocking – streams	595	531	12.0%	58	44	30.7%
No record – lakes	43	NA	NA	0	NA	NA
Non-native stocking - lakes	56	NA	NA	7	NA	NA
TOTAL	**1,039 km 99 ha**	**972 km**	**6.9% (streams)**	**120 km 7 ha**	**103 km**	**16.3% (streams)**

Non-native Fish Stocking Category	Dolores			Gunnison		
	2010 (km or ha)	2005 (km or ha)	% Change	2010 (km or ha)	2005 (km or ha)	% Change
No record – streams	111	39	183%	199	180	10.6%
Non-native stocking – streams	80	57	39.7%	402	293	37.0%
No record – lakes	0	NA	NA	14	NA	NA
Non-native stocking - lakes	0	NA	NA	8	NA	NA
TOTAL	**191 km 0 ha**	**96 km**	**98.0% (streams)**	**601 km 23 ha**	**473 km**	**26.9% (streams)**

Non-native Fish Stocking Category	Upper Green			Lower Green		
	2010 (km or ha)	2005 (km or ha)	% Change	2010 (km or ha)	2005 (km or ha)	% Change
No record – streams	615	560	9.9%	640	523	22.2%
Non-native stocking – streams	682	559	22.0%	750	756	-0.8%
No record – lakes	307	NA	NA	10	NA	NA
Non-native stocking - lakes	141	NA	NA	416	NA	NA
TOTAL	**1,297 km 448 ha**	**1,118 km**	**15.9% (streams)**	**1,390 km 427 ha**	**1,280 km**	**8.6% (streams)**

Non-native Fish Stocking Category	San Juan			Yampa		
	2010 (km or ha)	2005 (km or ha)	% Change	2010 (km or ha)	2005 (km or ha)	% Change
No record – streams	131	66	100.2%	438	330	32.6%
Non-native stocking – streams	124	127	-1.9%	350	324	7.8%
No record – lakes	0.5	NA	NA	24	NA	NA
Non-native stocking - lakes	1.2	NA	NA	133	NA	NA
TOTAL	**255 km 1.7 ha**	**192km**	**33% (streams)**	**787 km 157 ha**	**654 km**	**20.3% (streams)**

Within currently occupied habitat there were 2,367 kilometers (42%) identified as having no non-native trout present. A total of 3,313 kilometers of occupied habitat contain sympatric CRCT and non-native trout. Wyoming continued to have the highest percent of occupied habitat without non-native trout (48%), followed by Colorado (41%) and Utah (39%, see Table 15) by 2010. There was an increase of 26%, 46%, and 28% of cutthroat stream kilometers without non-native trout in Colorado, Utah, and Wyoming, respectively. Colorado and Wyoming identified increases in occupied stream habitat containing non-natives (16% and 11%, respectively). There was 4% decline in sympatric CRCT and non-natives in Utah.

The Yampa, Lower Colorado, and Upper Colorado GMU's had the lowest percentage of CRCT in sympatry with non-native trout while the Gunnison and Lower Green GMU's had the highest percentage (Table 16).All GMU's, except the Upper Colorado, increased or maintained the percent of occupied stream length with no non-native trout. The San Juan GMU had the most dramatic increase in the percent of occupied stream length without non-native trout (Table 16).

In most areas, there are more miles of stream with non-native trout than there are miles with records of stocking, implying that there has been either invasion or unrecorded stocking in significant parts of the occupied range. In Utah, 519 miles of occupied habitat (47%) do not have any stocking records associated with them; however, only 327 miles (29%) remain free of non-native trout. The Gunnison, Upper Green, and Lower Green GMUs contain large amounts of stream habitat for which there are no stocking records but contain non-natives. Conversely, the Yampa and Upper Colorado GMUs contain slightly less habitat in which non-natives are present outside the areas for which there are stocking records.

Table 14. Currently-occupied CRCT stream (length in kilometers, km) and lake habitat (area in hectares, ha) by state for which non-native salmonids have or have not been documented sympatric with CRCT and comparison to 2005 data. 2005 lake data is not available. % Change column is the comparison of the kilometers of stream with or without non-natives compared to 2005. The percentage in the 2010 and 2005 columns is the percent of the occupied habitat with or without non-natives at that time.

Presence of non-native trout	Colorado			Utah			Wyoming		
	2010	2005	% change	2010	2005	% change	2010	2005	% change
Non-natives absent – streams	1084 (41.2%)	863 (39.2%)	25.6%	773 (38.9%)	529 (29.4%)	46.2%	509 (48.3%)	397 (44.6%)	28.2%
Non-natives present – streams	1549 (58.8%)	1337 (60.8%)	15.8%	1218 (61.1%)	1270 (70.6%)	-4.1%	546 (51.7%)	493 (55.4%)	10.7%
Non-natives absent – lakes	124 (44.5%)	n/a	n/a	71 (11%)	n/a	n/a	14 (5.7%)	n/a	n/a
Non-natives present - lakes	155 (55.5%)	n/a	n/a	569 (89%)	n/a	n/a	229 (94.3%)	n/a	n/a
Totals	**2633 km 280 ha**	**2201 km**	**20% (streams)**	**1991 km 640 ha**	**1799 km**	**11% (streams)**	**1055 km 242 ha**	**890 km**	**19% (streams)**

[Utah had a reduction in the amount of stream with non-natives present. Need to compare to accomplishments to see what's going on.]

Table 15. Colorado River cutthroat trout (CRCT) occupied stream (length in kilometers, km) and lake habitat (area in hectares, ha) by Geographic Management Unit (GMU) for which non-native salmonids have or have not been documented sympatric. Lake data for 2005 is not available (NA). Comparisons made between 2010 and 2005 for stream length only.

Record of non-native stocking	Upper Colorado			Lower Colorado		
	2010	2005	% change	2010	2005	% change
Non-natives absent – streams	429.5 (41.4%)	457.1 (47%)	-6.0%	65.1 (54.1%)	53.2 (51.5%)	22.4%
Non-natives present – streams	609.2 (58.6%)	514.7 (53%)	18.3%	55.3 (45.9%)	50.2 (48.5%)	10.0%
Non-natives absent – lakes	84.3 (85.3%)	NA	NA	1.2 (17.8%)	NA	NA
Non-natives present - lakes	14.5 (14.7%)	NA	NA	5.7 (82.2%)	NA	NA
Total	**1039 km 99 ha**	**971.8 km**	**6.9% (streams)**	**120.4 km 7 ha**	**103.5 km**	**16.3% (streams)**

Record of non-native stocking	Dolores			Gunnison		
	2010	2005	% change	2010	2005	% change
Non-natives absent – streams	78 (40.8%)	34.4 (35.7%)	126.7%	139.9 (23.3%)	109.7 (23.2%)	27.5%
Non-natives present – streams	113.1 (59.2%)	62.1 (64.3%)	82.1%	460.8 (76.7%)	363.4 (76.8%)	26.8%
Non-natives absent – lakes	0	NA	NA	19.5 (86.6%)	NA	NA
Non-natives present - lakes	0	NA	NA	3 (13.4%)	NA	NA
Total	**191.1 km 0 ha**	**96.5 km**	**98% (streams)**	**600.7 km 23 ha**	**473.1 km**	**26.9% (streams)**

Record of non-native stocking	Upper Green			Lower Green		
	2010	2005	% change	2010	2005	% change
Non-natives absent – streams	549.2 (42.4%)	368.9 (33%)	48.9%	489.4 (35.2%)	349.8 (27.3%)	39.9%
Non-natives present – streams	747.5 (57.6%)	749.6 (67%)	-0.3%	900.3 (64.8%)	930 (72.7%)	-3.2%
Non-natives absent – lakes	67.3 (15%)	NA	NA	15.8 (3.7%)	NA	NA
Non-natives present - lakes	381.4 (85%)	NA	NA	410.9 (96.3%)	NA	NA
Total	**1296.7 km 449 ha**	**1118.4 km**	**15.9% (streams)**	**1389.7 km 427 ha**	**1279.8 km**	**8.6% (streams)**

Record of non-native stocking	San Juan			Yampa		
	2010	2005	% change	2010	2005	% change
Non-natives absent – streams	133.7 (52.3%)	66.2 (34.5%)	101.8%	483.1 (61.3%)	349.8 (53.4%)	38.1%
Non-natives present – streams	121.8 (47.7%)	125.9 (65.5%)	-3.3%	304.3 (38.7%)	304.7 (46.6%)	-0.1%
Non-natives absent – lakes	1.7	NA	NA	19 (12.1%)	NA	NA
Non-natives present - lakes	0	NA	NA	137.9 (87.9%)	NA	NA
Total	**255.4 km 2 ha**	**192.1 km**	**33% (streams)**	**787.3 km 157 ha**	**654.5 km**	**20.3% (streams)**

CRCT Occurrence by Land Status

In 2005 CRCT occupied 5,679 kilometers of habitat on federal, state, and privately owned lands in Colorado, Utah, and Wyoming. Of the 790 additional kilometers of occupied stream habitat identified between 2005 and 2010, just over half is on National Forest lands (11% within designated Wilderness) and 30% is on private land (Table 17). Small increases were identified on BLM, state, and tribal lands. There was a small decrease in the amount of occupied stream on National Park Service lands due to segregation of lake populations, which were originally quantified as stream segments in the prior assessment.

Of the lake habitat occupied by CRCT, 93% is found on National Forest lands (Table 17). High elevation lakes, many of which contain aboriginal or introduced cutthroat trout populations are found on National Forest system lands. These lakes offer excellent habitat and are often protected by barriers (either natural or human-made) to invasive species and land use activities (through restrictions to land use or natural topography).

Table 16. Colorado River cutthroat trout (CRCT) occupied stream (length in kilometers, km) and lake (area in hectare, ha) habitat within the various land ownership boundaries by Geographic Management Unit (GMU) in 2010. Percentage represent amount of CRCT habitat occupied by land ownership.

GMU	NPS	USFS Wilderness	USFS Non-Wilderness	BLM	Tribal	State	PVT
Upper Colorado	30.6 km 25.6 ha	210.0 km 23.4 ha	451.6 km 8.2 ha	130.9 km 3 ha	--	18.6 km	197.2 km
Lower Colorado	--	--	106.6 km 6.9 ha	4.1 km	--	--	8.8 km
Dolores	--	3.4 km	113.9 km	11.1 km	--	23.6 km	39.1 km
Upper Green	--	149.6 km 106.5 ha	667.1 km 342.2 ha	143.8 km	--	48.9 km	287.2 km
Lower Green	1.4 km	156.1 km 216.6 ha	667.1 km 198.5 h	21.5 km	174.7 km	141.3 km	324.7 km 11.7 ha
Gunnison	--	194.9 km 5 ha	287.4 km 14.5 ha	37 km* 3 ha	--	3.2 km	78.2 km
San Juan	--	44.9 km	177.7 km	3.9 km	--	--	28.9 km 1.7 ha
Yampa	--	83.3 km	446.4 km 157 ha	52.1 km	--	31.3 km	174.2 km
Total Stream (km)	**32 (0.6%)**	**842.4 (14.8%)**	**2,820.4 (49.7%)**	**404.4 (7.1%)**	**174.7 (3%)**	**267.1 (4.7%)**	**1138.3 (20%)**
Total Lake (ha)	**25.6 (2.2%)**	**508.4 (43.7%)**	**570.3 (49.1%)**	**6 (0.5%)**	**--**	**--**	**51.9 (4.5%)**

** Gunnison GMU BLM land – 1.7 km wilderness, 35.3 km non-wilderness.*

Table 17. Change in Colorado River cutthroat trout (CRCT) occupied stream habitat (length in kilometers, km) within land ownership boundaries by Geographic Management Unit (GMU) between 2005 and 2010.

GMU	NPS	USFS Wilderness	USFS Non-Wilderness	BLM	Tribal	State	PVT
Upper Colorado	-5.2	31.7	3.9	18.6	--	1.9	22
Lower Colorado	--	--	15.2	0.3	--	--	0.8
Dolores	--	0.2	50.3	10.3	--	15.4	19.2
Upper Green	--	5.5	35	17.6	--	13.7	112.2
Lower Green	0	4.4	28.3	1.6	16.3	30	35.4
Gunnison	--	25.9	67.8	8.8*	--	1	24.5
San Juan	--	9.3	47.2	0	--	--	7.4
Yampa	--	15.8	78	11.5	--	10.3	21.3
Total	**-5.2 (-4.4%)**	**92.7 (11.4%)**	**325.7 (39.9%)**	**68.5 (8.4%)**	**16.3 (2%)**	**72.4 (8.9%)**	**245.6 (30.1%)**

** Gunnison GMU BLM land – 1.7 km wilderness, 35.3 km non-wilderness.*

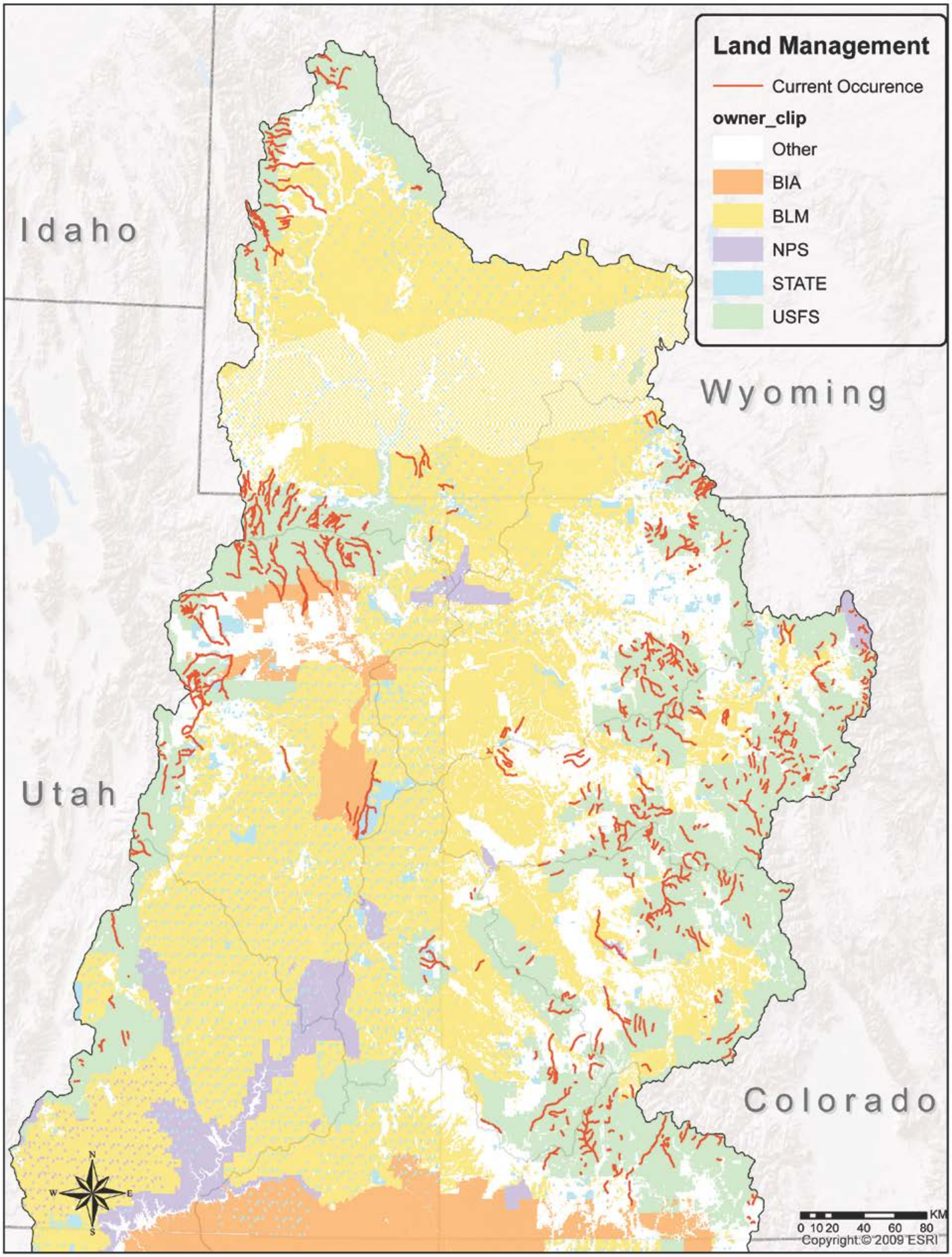
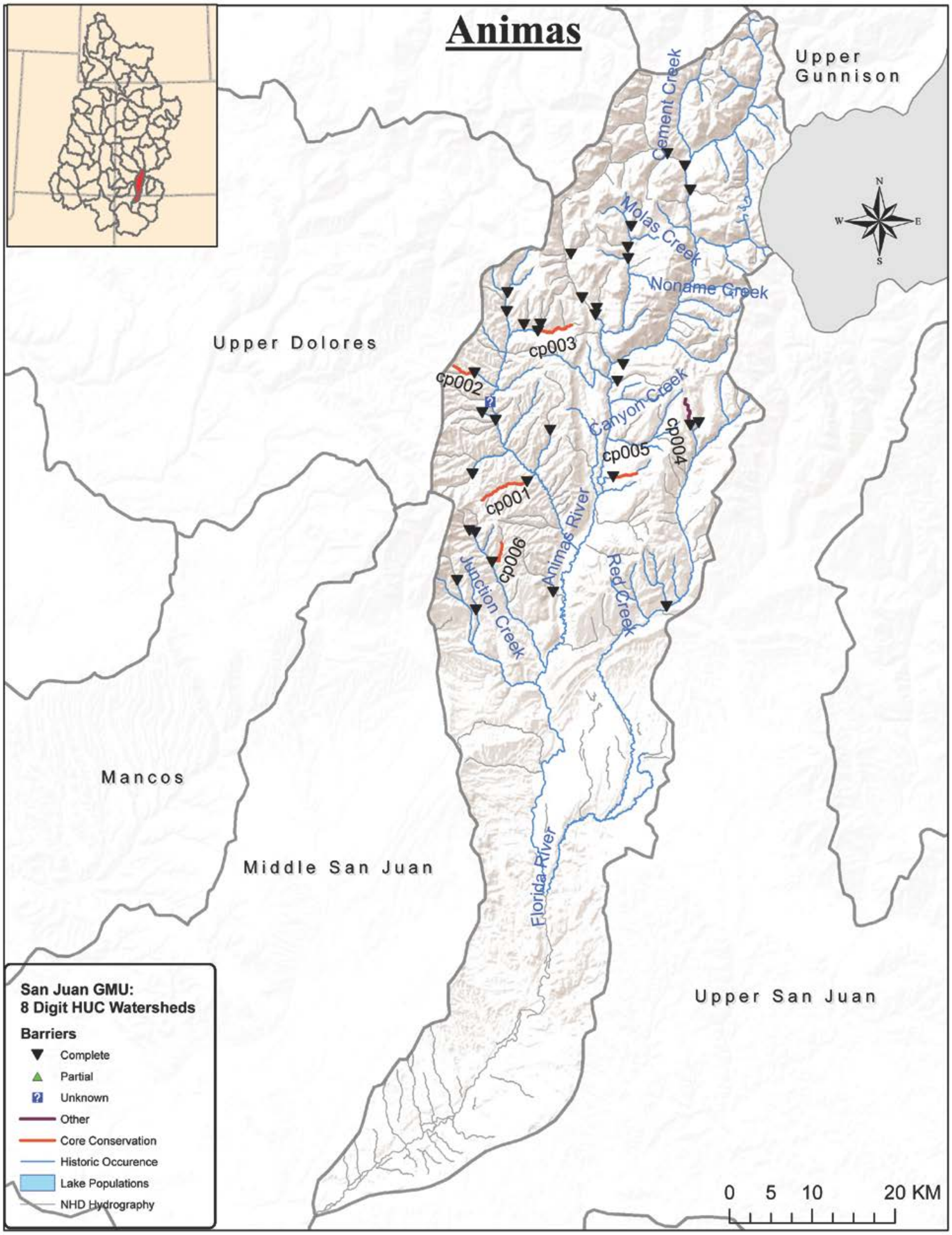
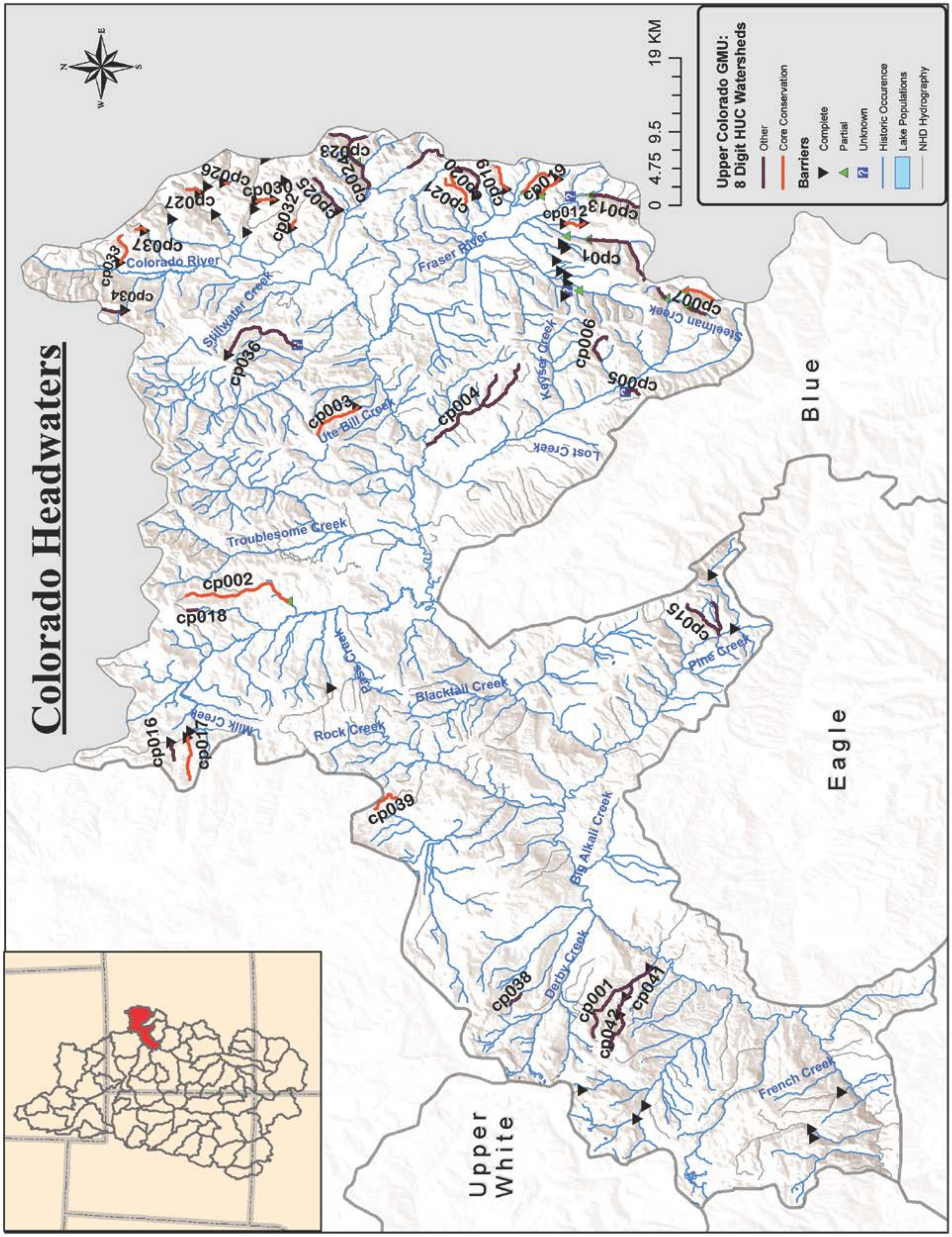


Figure 4. Currently occupied CRCT habitat associated with the primary agencies (USFS, BLM, NPS, State, and Tribal).

Appendix D. Maps of each 4th level HUC containing historic habitat and each conservation population.


Animas
Upper Gunnison
Upper Dolores
Mancos
Middle San Juan
Upper San Juan
Cement Creek
Molas Creek
Noname Creek
Canyon Creek
Animas River
Red Creek
Junction Creek
Florida River
cp001
cp002
cp003
cp004
cp005
cp006
San Juan GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 5 10 20 KM


Colorado Headwaters
Upper Colorado GMU:
8 Digit HUC Watersheds
Other
Core Conservation
Barriers
Complete
Partial
Unknown
Historic Occurence
Lake Populations
NHD Hydrography
0 4.75 9.5 19 KM
Colorado River
Stillwater Creek
Fraser River
Keyser Creek
Steelman Creek
Ute Bill Creek
Lost Creek
Troublesome Creek
Pass Creek
Blacktail Creek
Rock Creek
Milk Creek
Pine Creek
Big Alkali Creek
Derby Creek
French Creek
Blue
Eagle
Upper White
cp001
cp002
cp003
cp004
cp005
cp006
cp007
cp012
cp013
cp015
cp016
cp017
cp018
cp019
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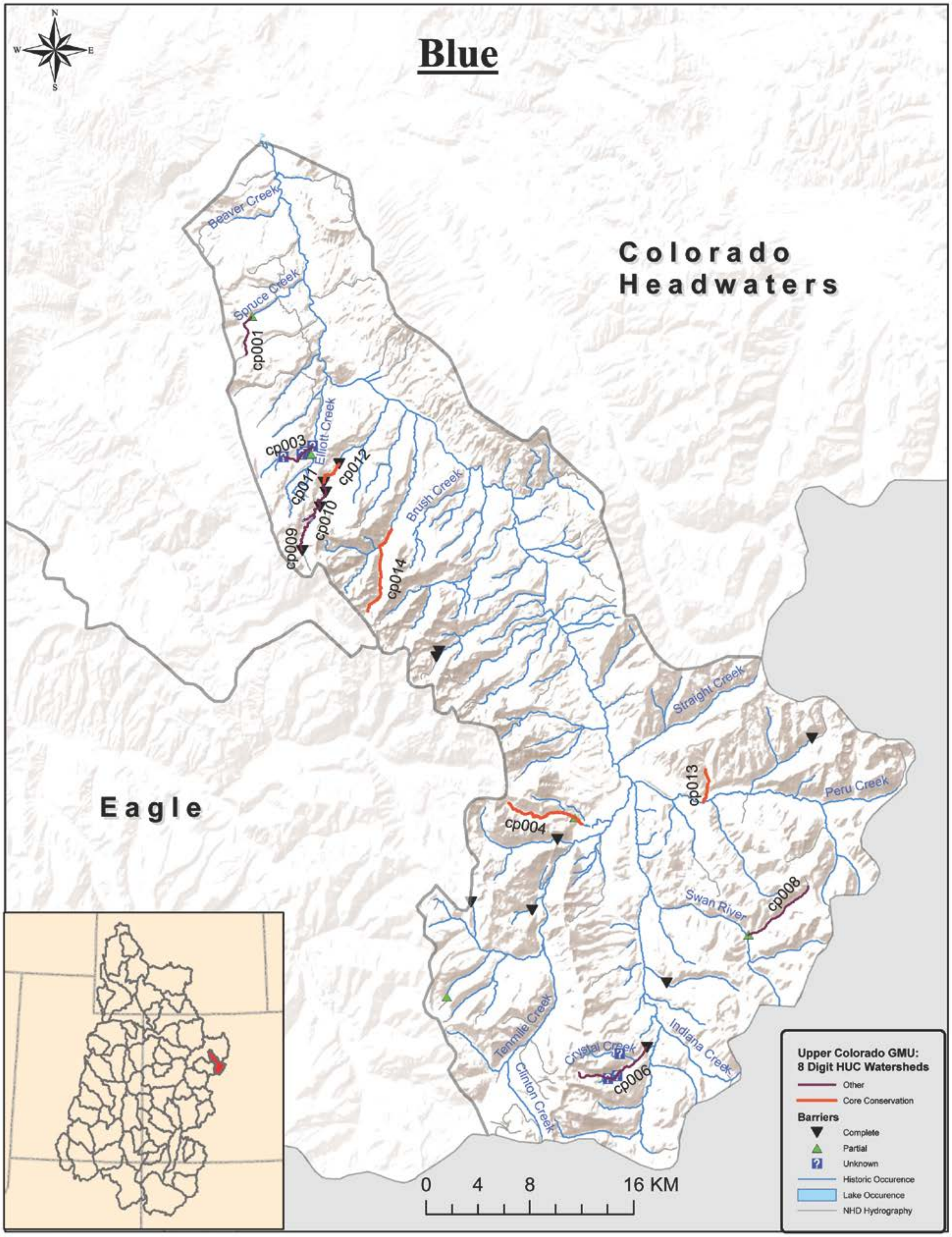
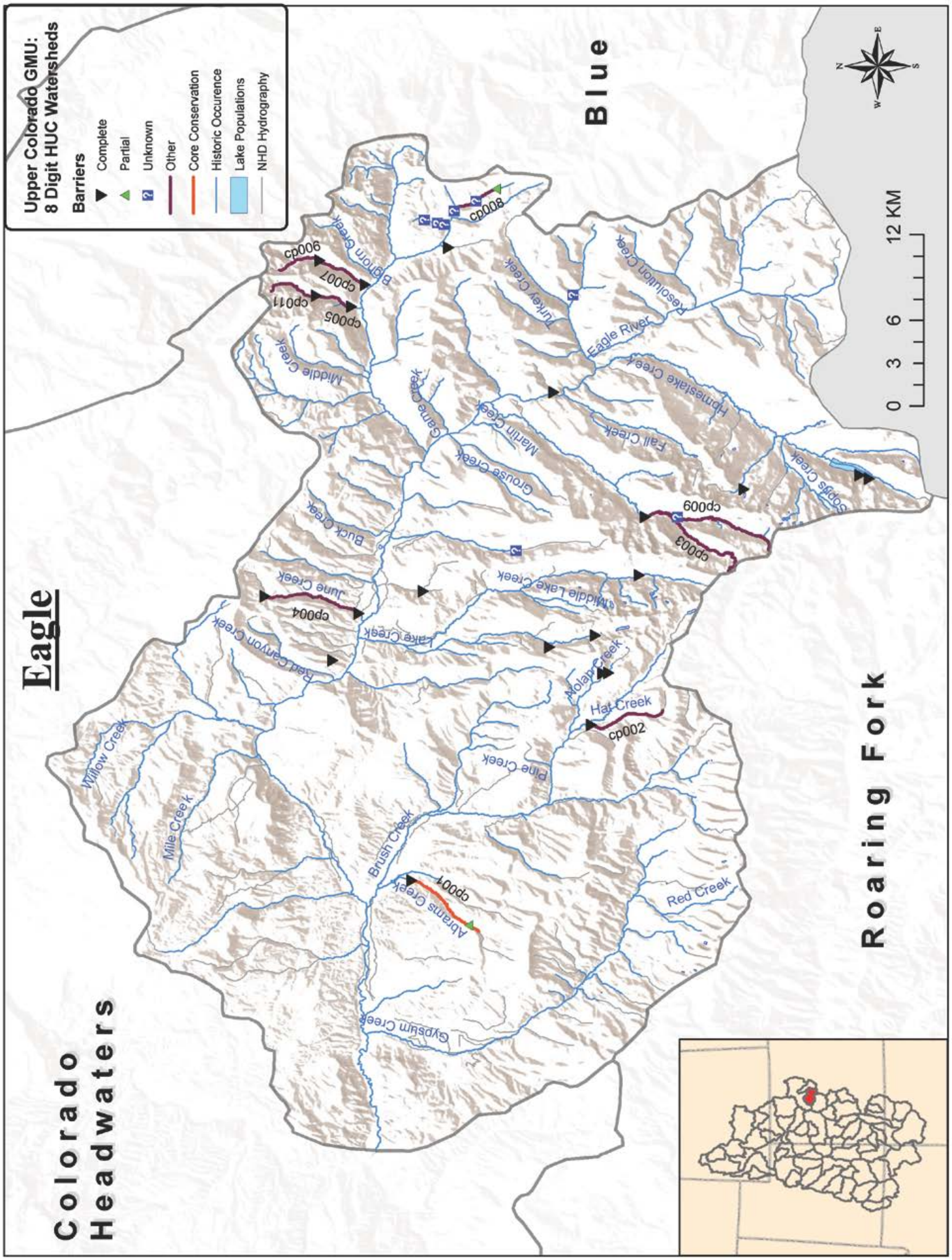
cp042


Blue
Colorado Headwaters
Eagle
Beaver Creek
Spruce Creek
cp001
Elliott Creek
cp003
cp012
cp011
cp010
cp009
Brush Creek
cp014
Straight Creek
cp013
Peru Creek
cp004
Swan River
cp008
Tenmile Creek
Crystal Creek
cp006
Indiana Creek
Clinton Creek
0 4 8 16 KM
Upper Colorado GMU: 8 Digit HUC Watersheds
Other
Core Conservation
Barriers
Complete
Partial
Unknown
Historic Occurence
Lake Occurence
NHD Hydrography


Eagle
Upper Colorado GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Blue
Roaring Fork
Colorado Headwaters
0 3 6 12 KM
cp001
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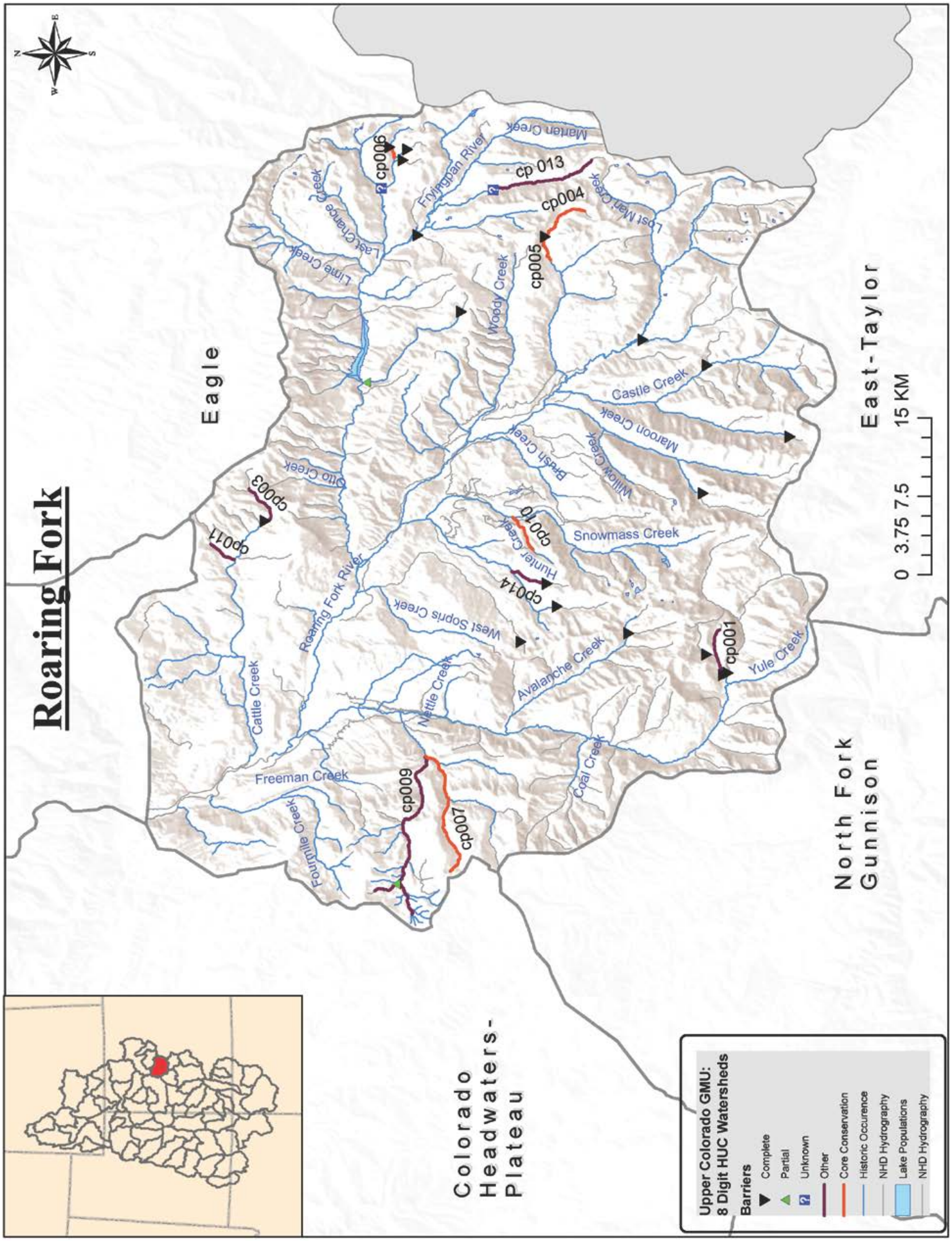
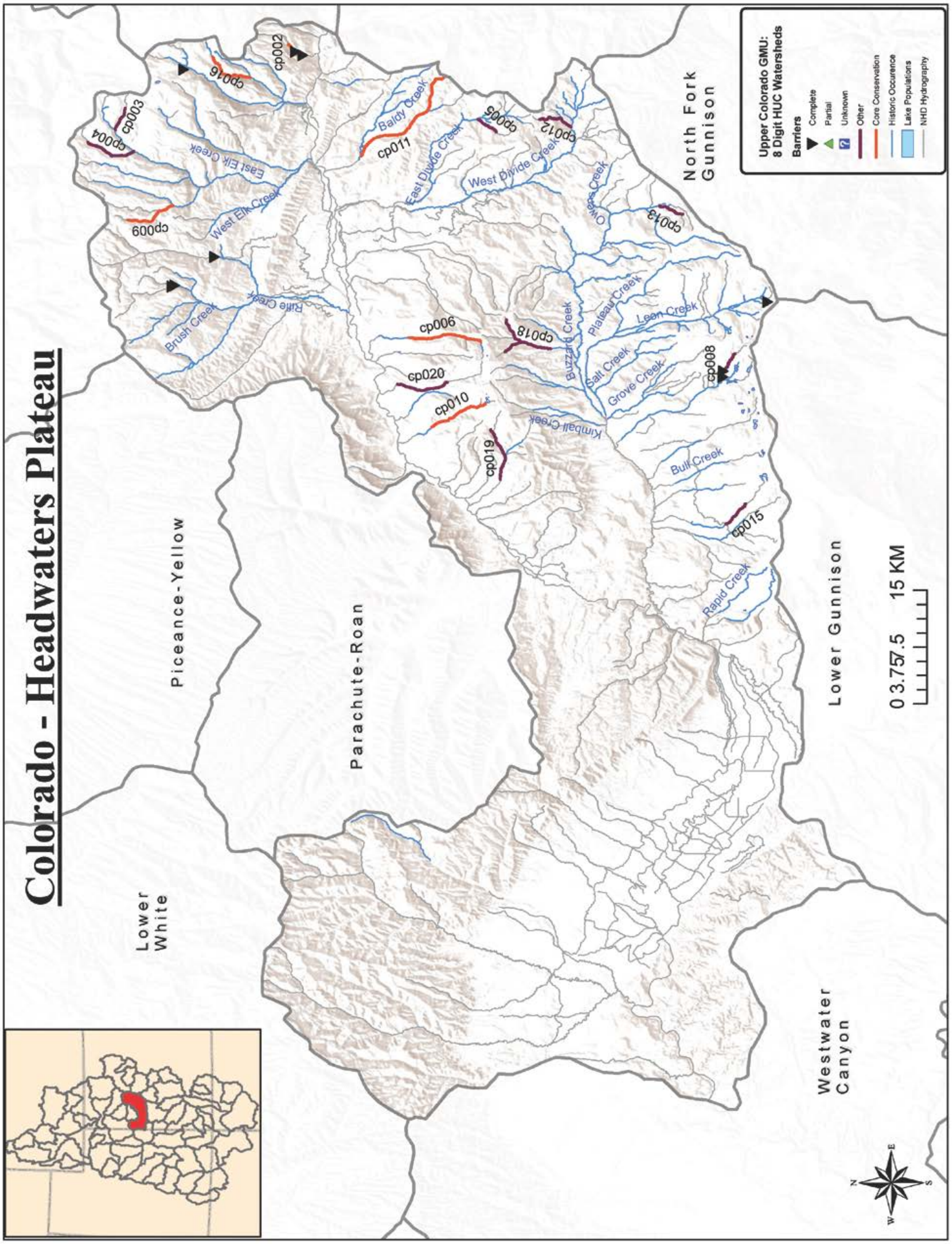
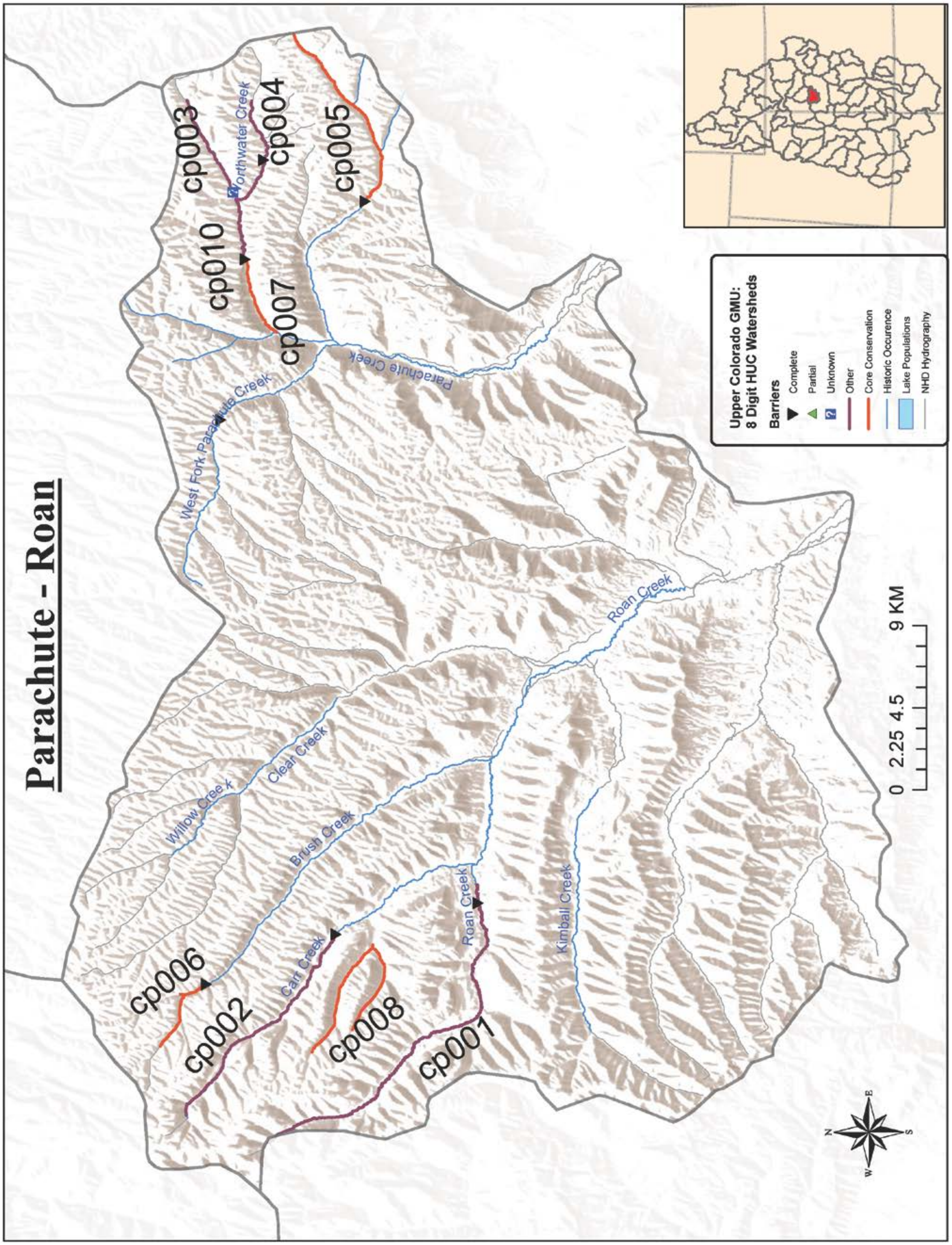
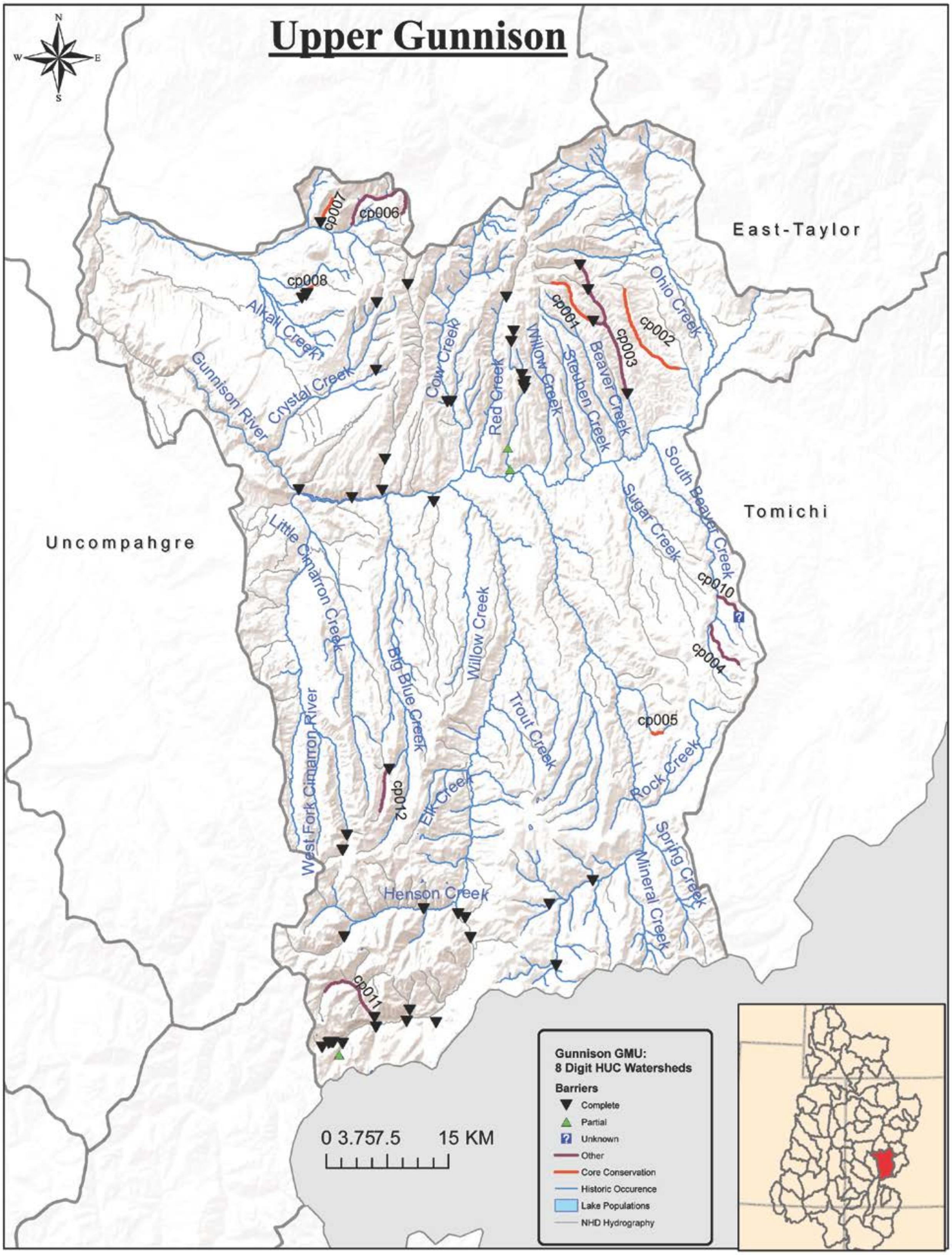
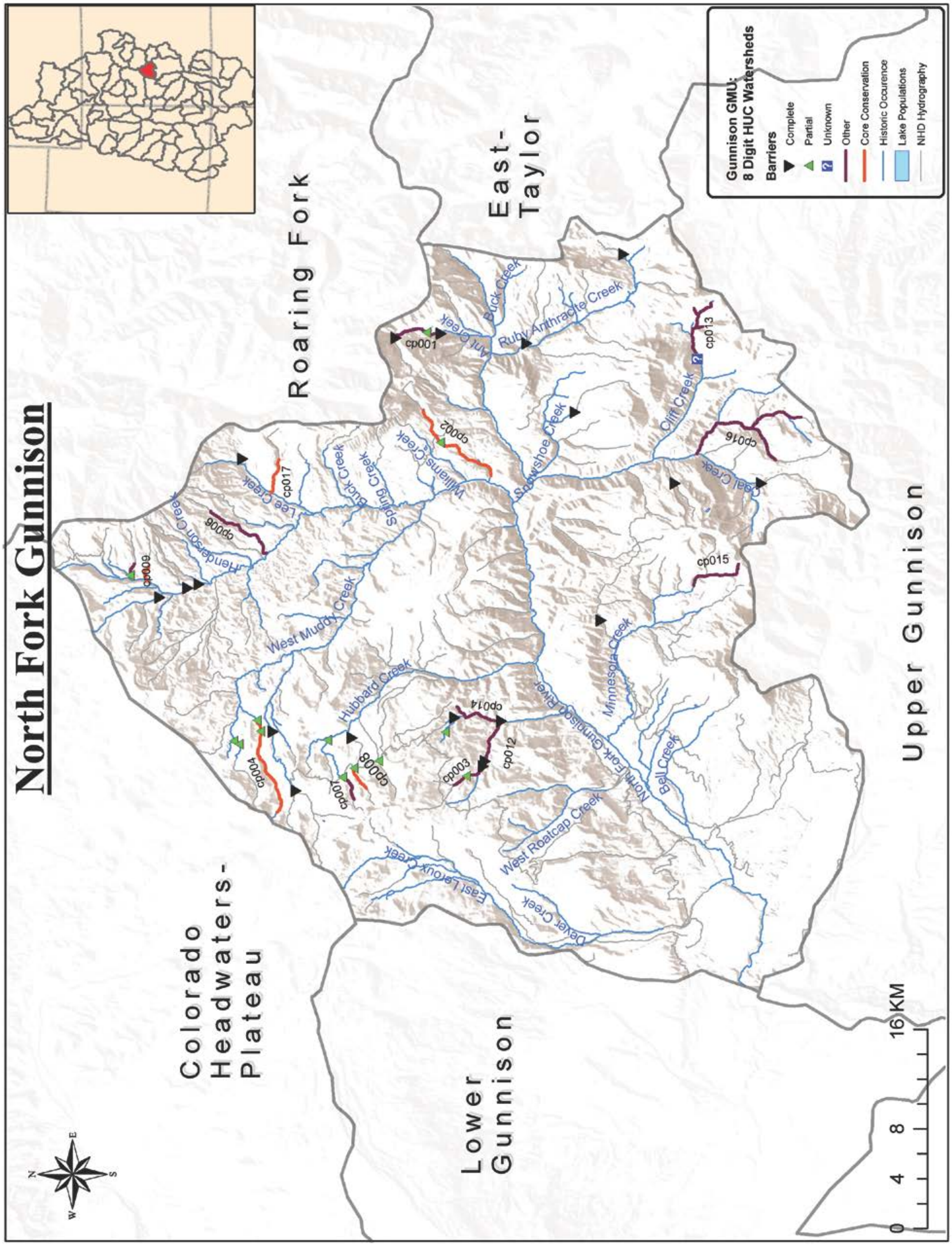
cp003
cp004
cp005
cp006
cp007
cp008
cp009
cp011
Eagle River
Brush Creek
Gypsum Creek
Abrams Creek
Red Creek
Pine Creek
Hat Creek
Nolan Creek
Lake Creek
Middle Lake Creek
June Creek
Red Canyon Creek
Buck Creek
Grouse Creek
Martin Creek
Game Creek
Middle Creek
Bighorn Creek
Turkey Creek
Resolution Creek
Homestake Creek
Fall Creek
Cross Creek
Willow Creek
Mile Creek

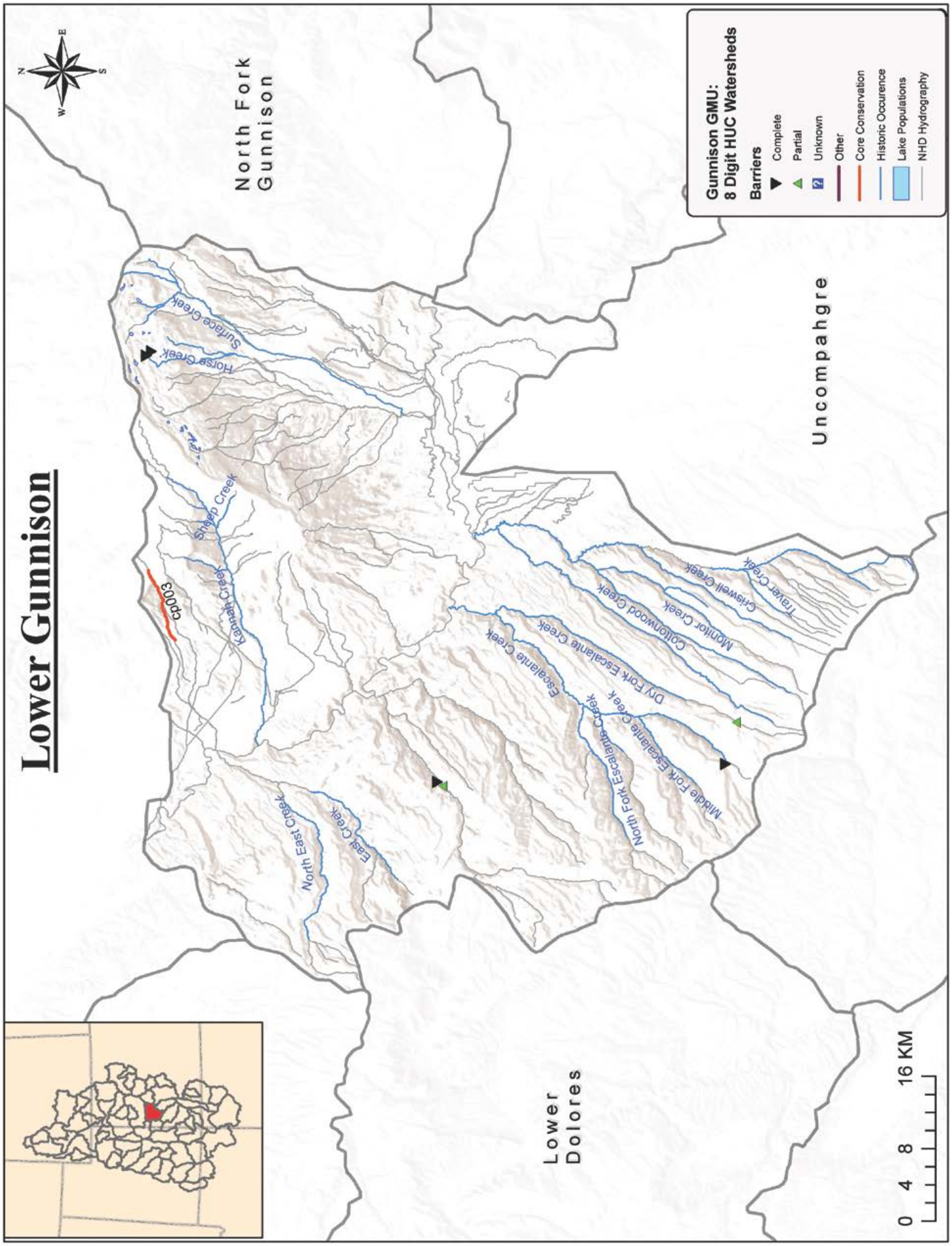

Roaring Fork
Eagle
East-Taylor
North Fork Gunnison
Colorado Headwaters-Plateau
0 3.75 7.5 15 KM
Upper Colorado GMU: 8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
NHD Hydrography
Lake Populations
NHD Hydrography
Marten Creek
Fryingpan River
Last Chance Creek
Lime Creek
Woody Creek
Lost Man Creek
Castle Creek
Maroon Creek
Willow Creek
Brush Creek
Snowmass Creek
Hunter Creek
Otto Creek
Roaring Fork River
West Sopris Creek
Avalanche Creek
Yule Creek
Cattle Creek
Nettle Creek
Coal Creek
Freeman Creek
Fourmile Creek
cp006
cp 013
cp004
cp005
cp003
cp011
cp010
cp014
cp001
cp009
cp007

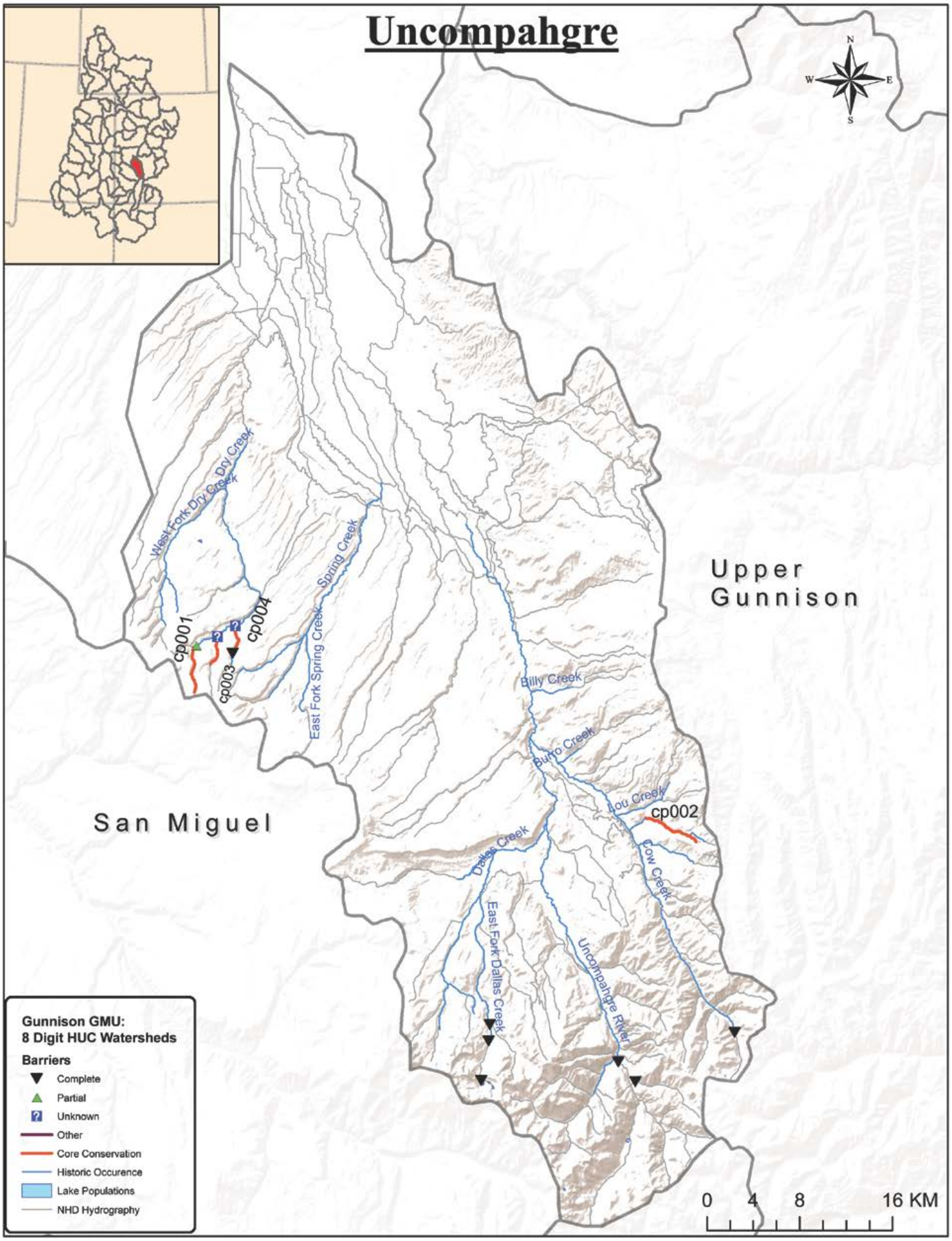

Colorado - Headwaters Plateau
Lower White
Piceance-Yellow
Parachute-Roan
North Fork Gunnison
Lower Gunnison
Westwater Canyon
Upper Colorado GMU: 8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 3.75 7.5 15 KM
cp002
cp016
cp003
cp004
cp009
cp011
cp005
cp012
cp013
cp006
cp018
cp020
cp010
cp019
cp008
cp015
East Elk Creek
West Elk Creek
Brush Creek
Rifle Creek
Baldy Creek
East Divide Creek
West Divide Creek
Owens Creek
Plateau Creek
Leon Creek
Buzzard Creek
Salt Creek
Grove Creek
Kimball Creek
Bull Creek
Rapid Creek


Parachute - Roan
cp003
cp004
cp005
cp010
cp007
cp006
cp002
cp008
cp001
Northwater Creek
Parachute Creek
West Fork Parachute Creek
Roan Creek
Willow Creek
Clear Creek
Brush Creek
Carr Creek
Kimball Creek
Upper Colorado GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 2.25 4.5 9 KM

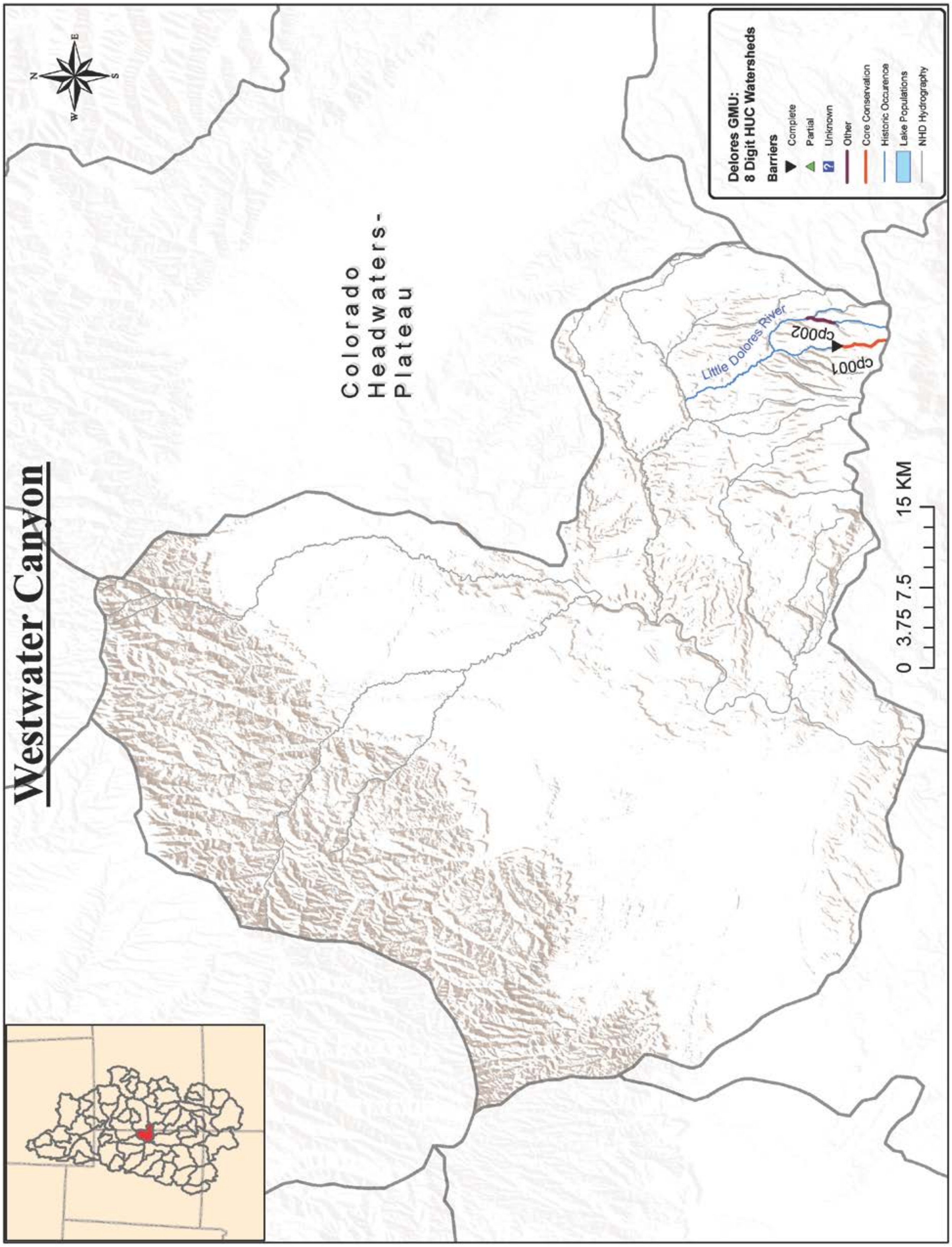

Upper Gunnison
N
S
E
W
East-Taylor
Tomichi
Uncompahgre
cp001
cp002
cp003
cp004
cp005
cp006
cp007
cp008
cp010
cp011
cp012
Ohio Creek
Beaver Creek
Steuben Creek
Willow Creek
Red Creek
Cow Creek
Crystal Creek
Alkali Creek
Gunnison River
South Beaver Creek
Sugar Creek
Little Cimarron Creek
Big Blue Creek
Willow Creek
Trout Creek
West Fork Cimarron River
Elk Creek
Rock Creek
Spring Creek
Mineral Creek
Henson Creek
0 3.757.5 15 KM
Gunnison GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography

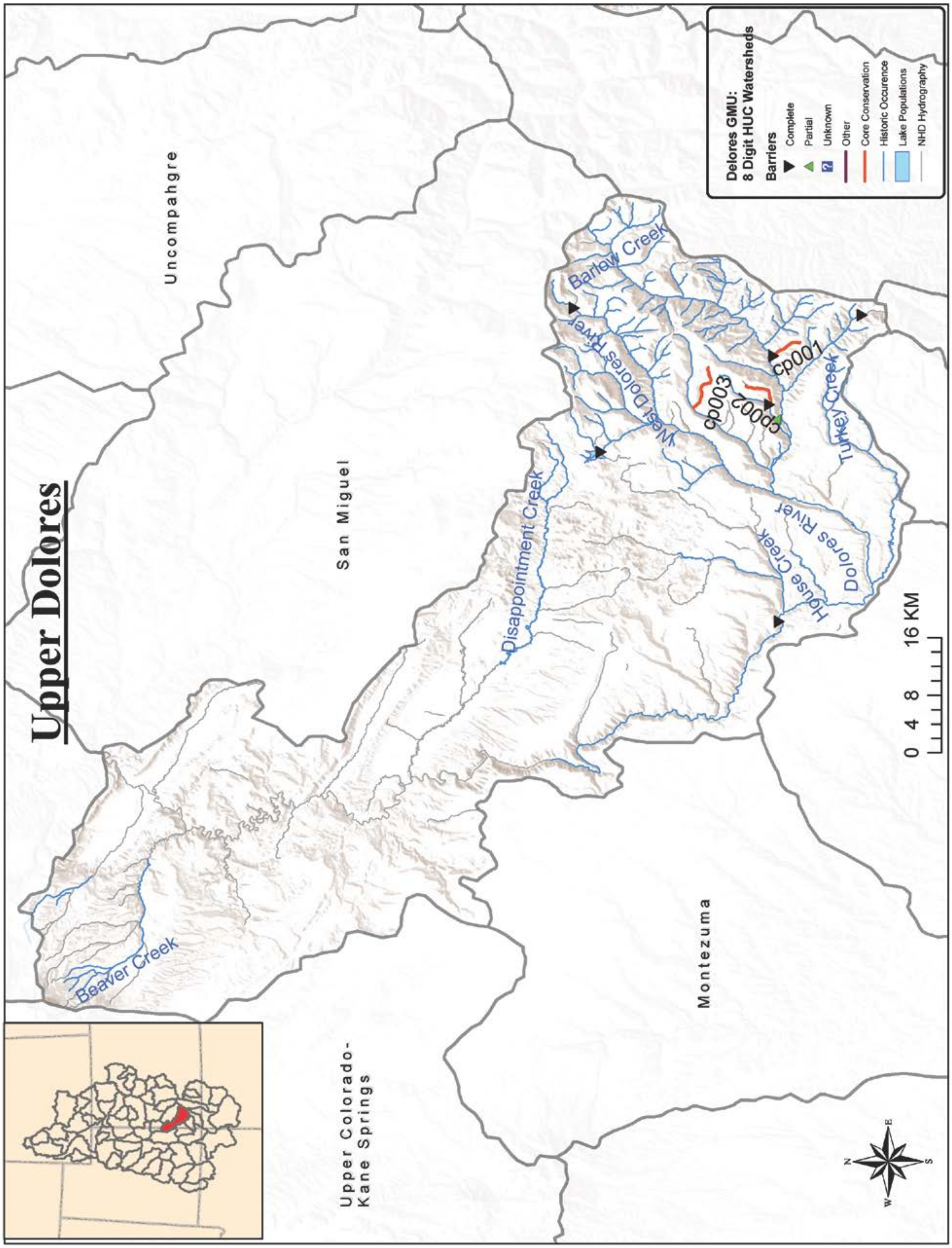

North Fork Gunnison
Gunnison GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Roaring Fork
East-
Taylor
Colorado
Headwaters-
Plateau
Lower
Gunnison
Upper Gunnison
Buck Creek
Ruby Anthracite Creek
Anthracite Creek
Cliff Creek
Coal Creek
Snowshoe Creek
Williams Creek
Spring Creek
Lee Creek
Henderson Creek
West Muddy Creek
Hubbard Creek
North Fork Gunnison River
Minnesota Creek
Bell Creek
West Roatcap Creek
East Leroux Creek
Dever Creek
cp001
cp002
cp003
cp004
cp006
cp007
cp008
cp009
cp012
cp013
cp014
cp015
cp016
cp017
0 4 8 16 KM

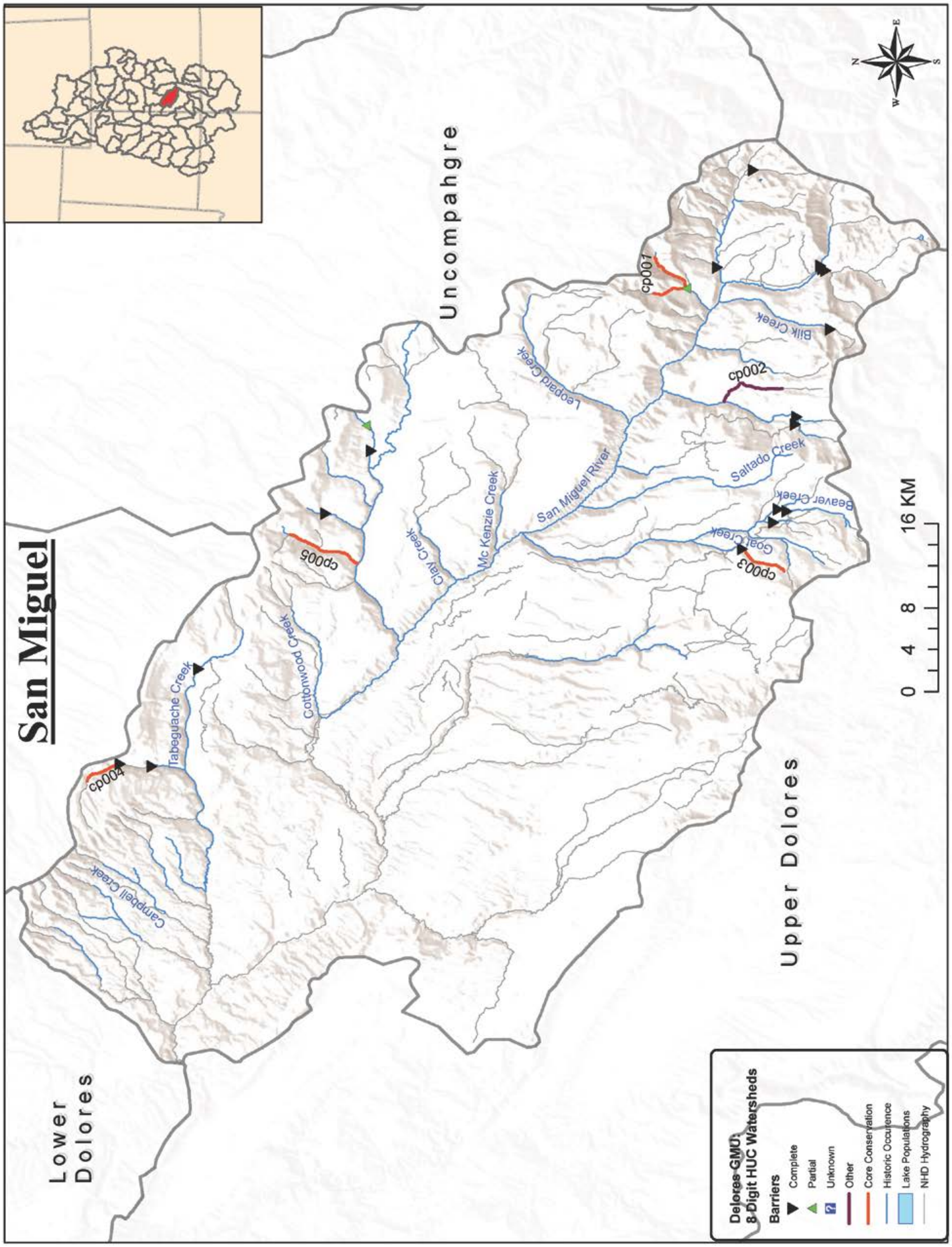

Lower Gunnison
North Fork Gunnison
Uncompahgre
Lower Dolores
Gunnison GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Surface Creek
Horse Creek
Sheep Creek
Kannah Creek
cp003
Traver Creek
Criswell Creek
Monitor Creek
Cottonwood Creek
Dry Fork Escalante Creek
Escalante Creek
North Fork Escalante Creek
Middle Fork Escalante Creek
North East Creek
East Creek
0 4 8 16 KM

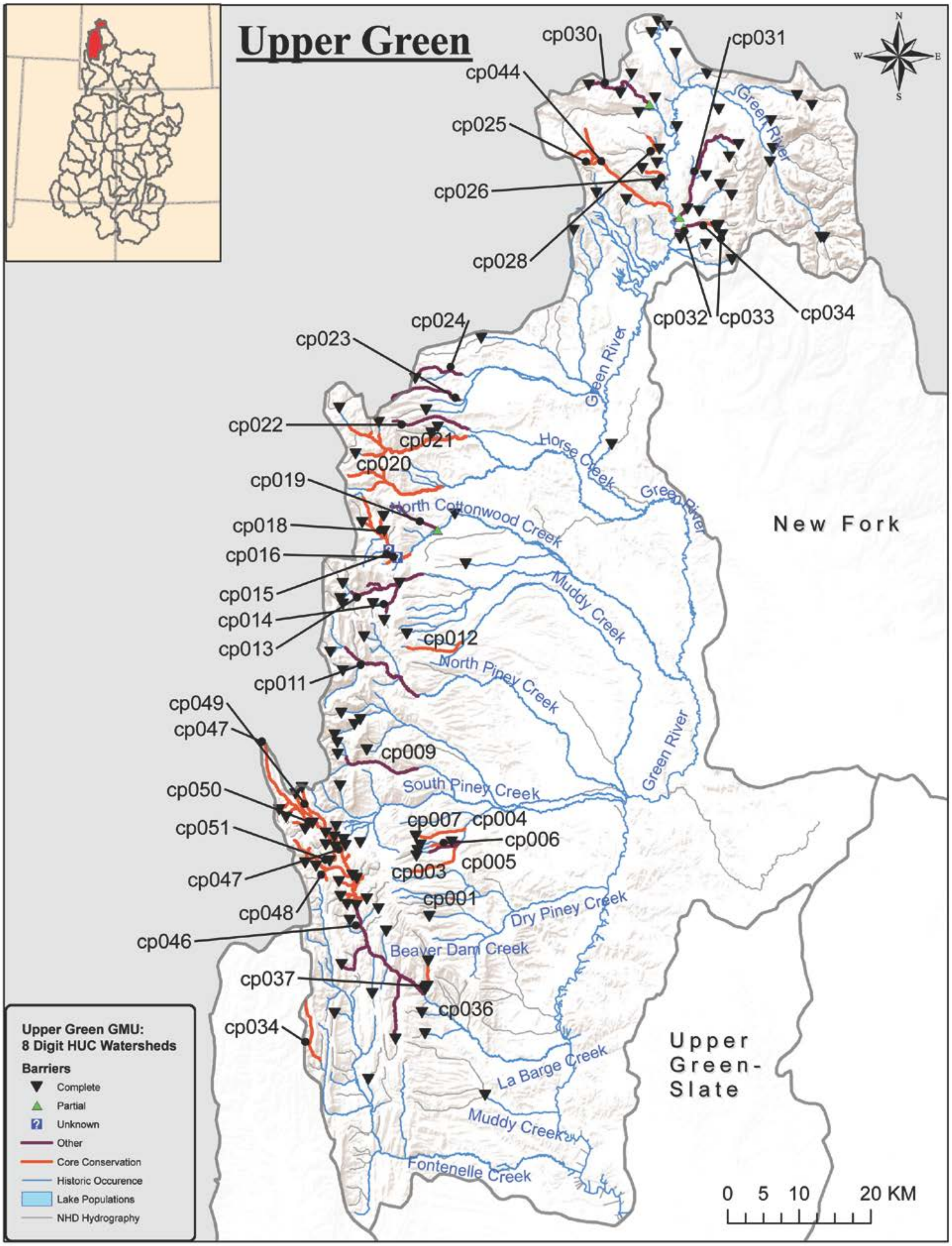


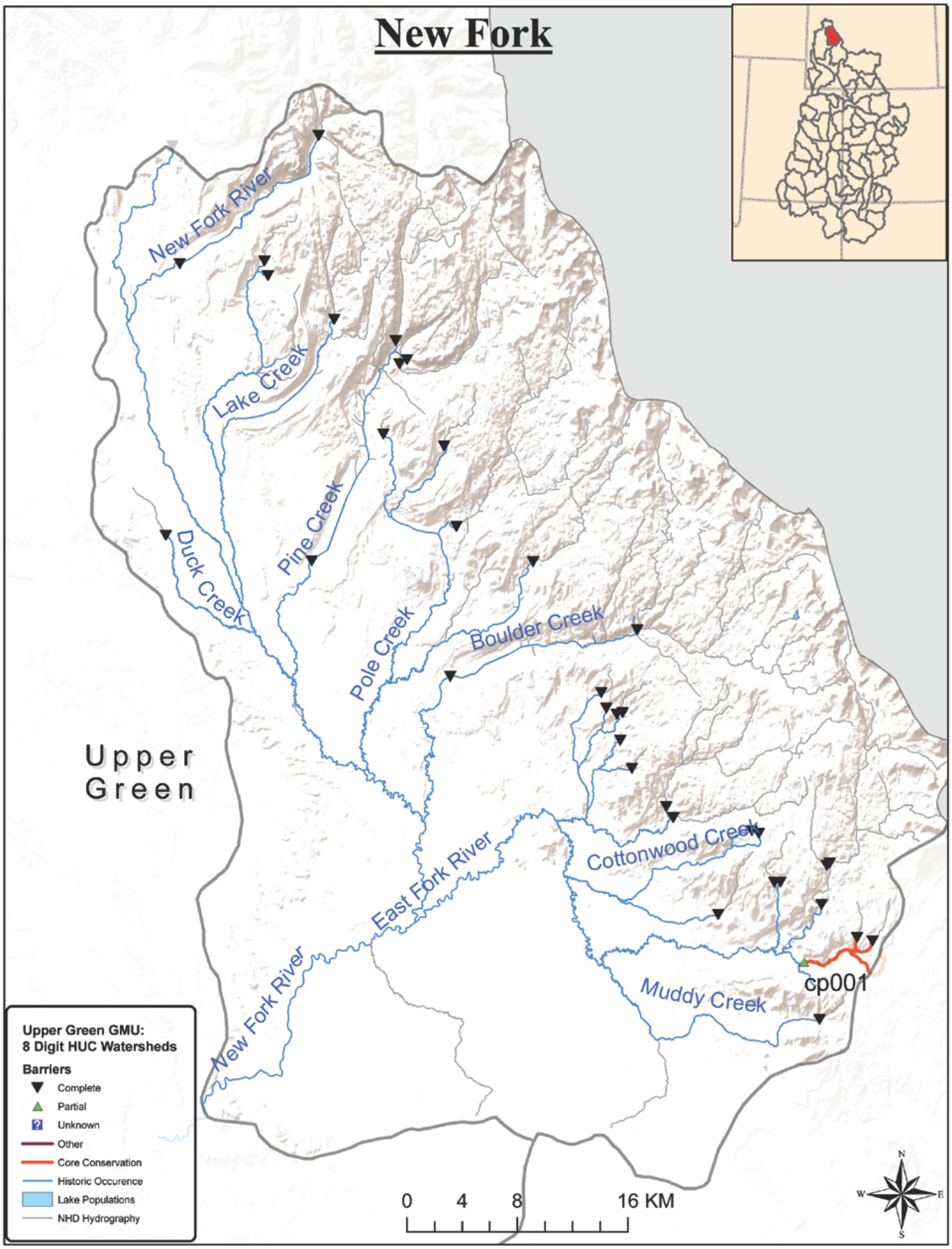
Uncompahgre
Upper Gunnison
San Miguel
West Fork Dry Creek
Dry Creek
Spring Creek
East Fork Spring Creek
cp001
cp003
cp004
cp002
Billy Creek
Burro Creek
Lou Creek
Cow Creek
Dallas Creek
East Fork Dallas Creek
Uncompahgre River
Gunnison GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 4 8 16 KM

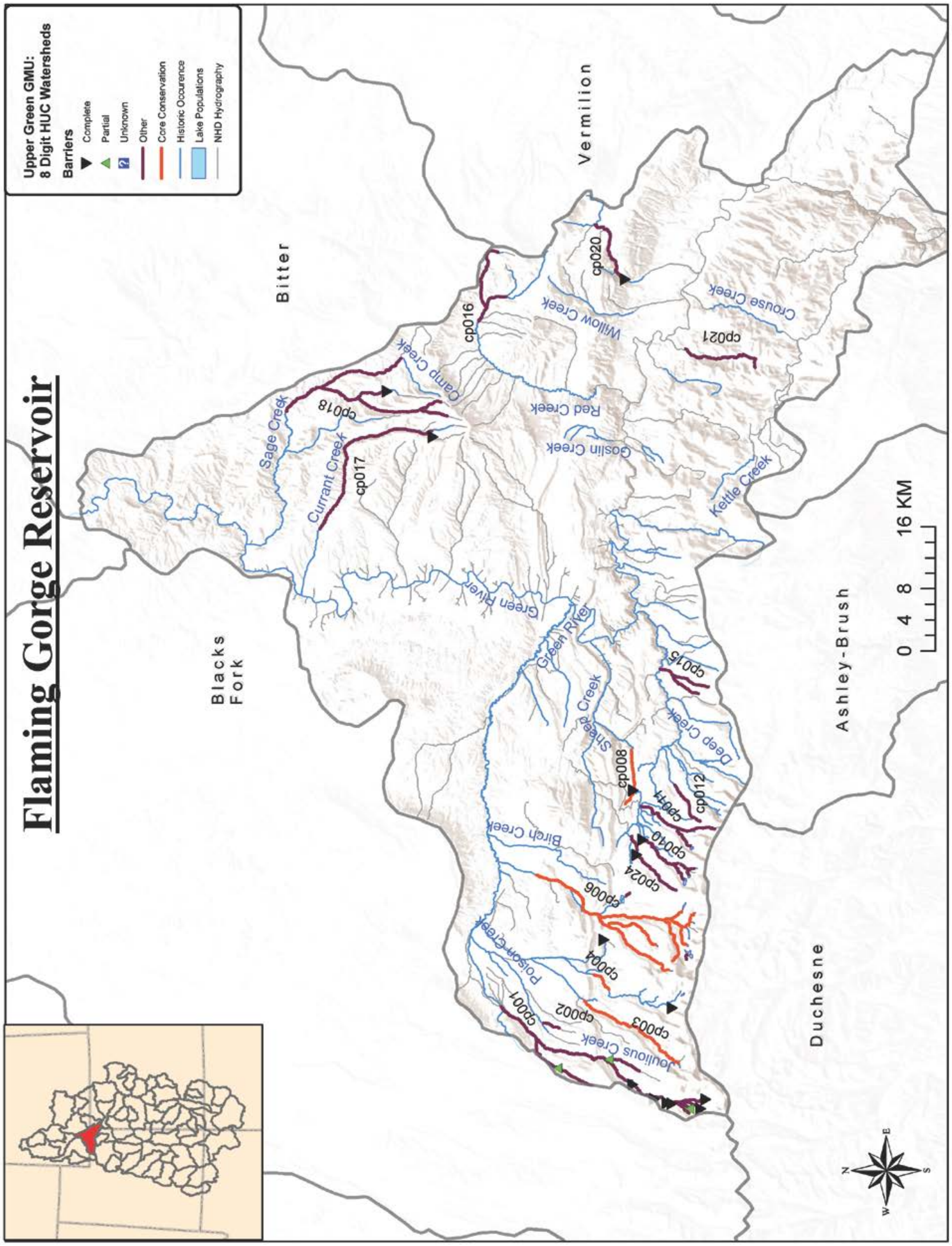

Westwater Canyon
Colorado Headwaters-Plateau
Little Dolores River
cp001
cp002
Delores GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 3.75 7.5 15 KM

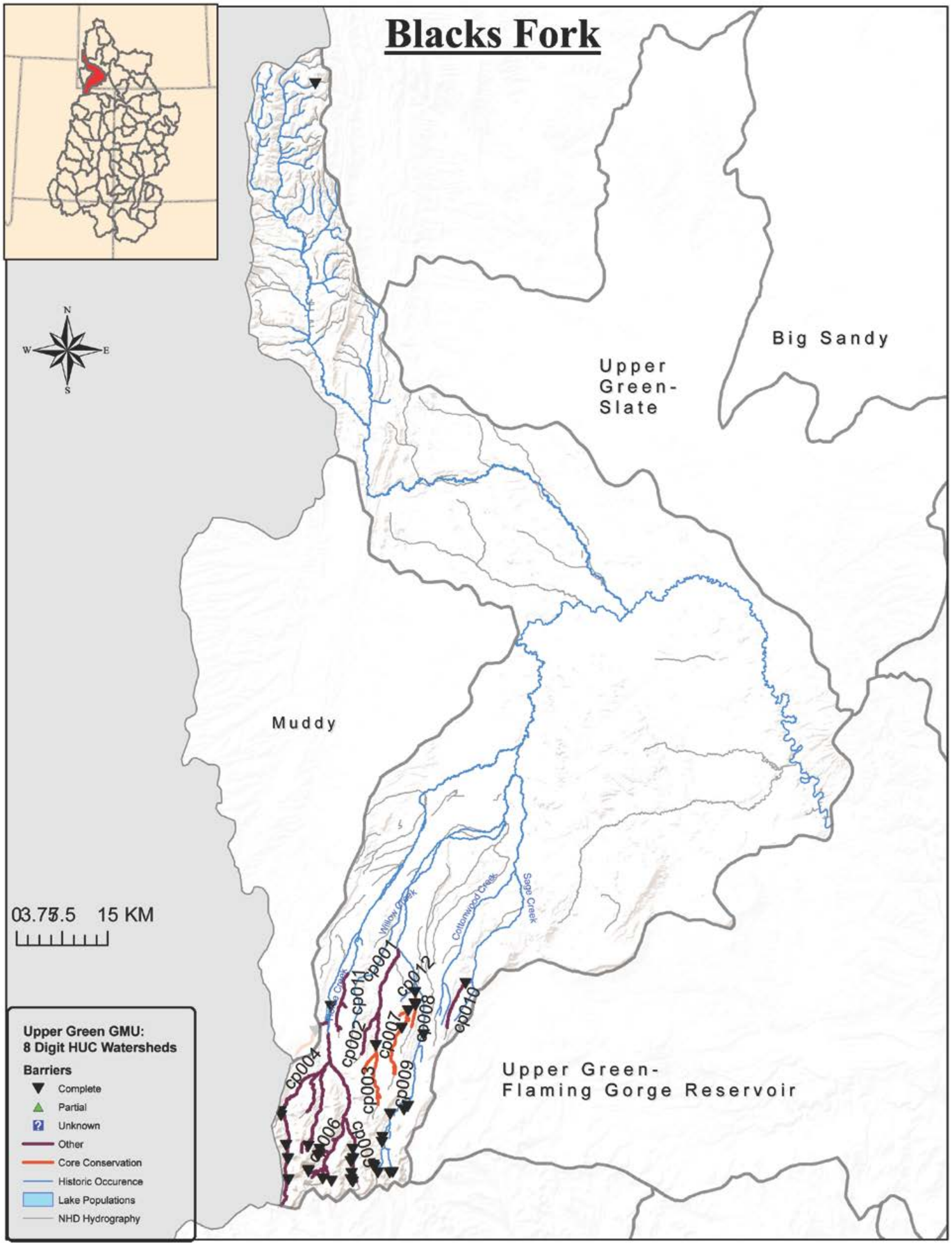

Upper Dolores
Uncompahgre
San Miguel
Montezuma
Upper Colorado-
Kane Springs
Barlow Creek
West Dolores River
cp001
cp002
cp003
Turkey Creek
Dolores River
House Creek
Disappointment Creek
Beaver Creek
0 4 8 16 KM
Delores GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography

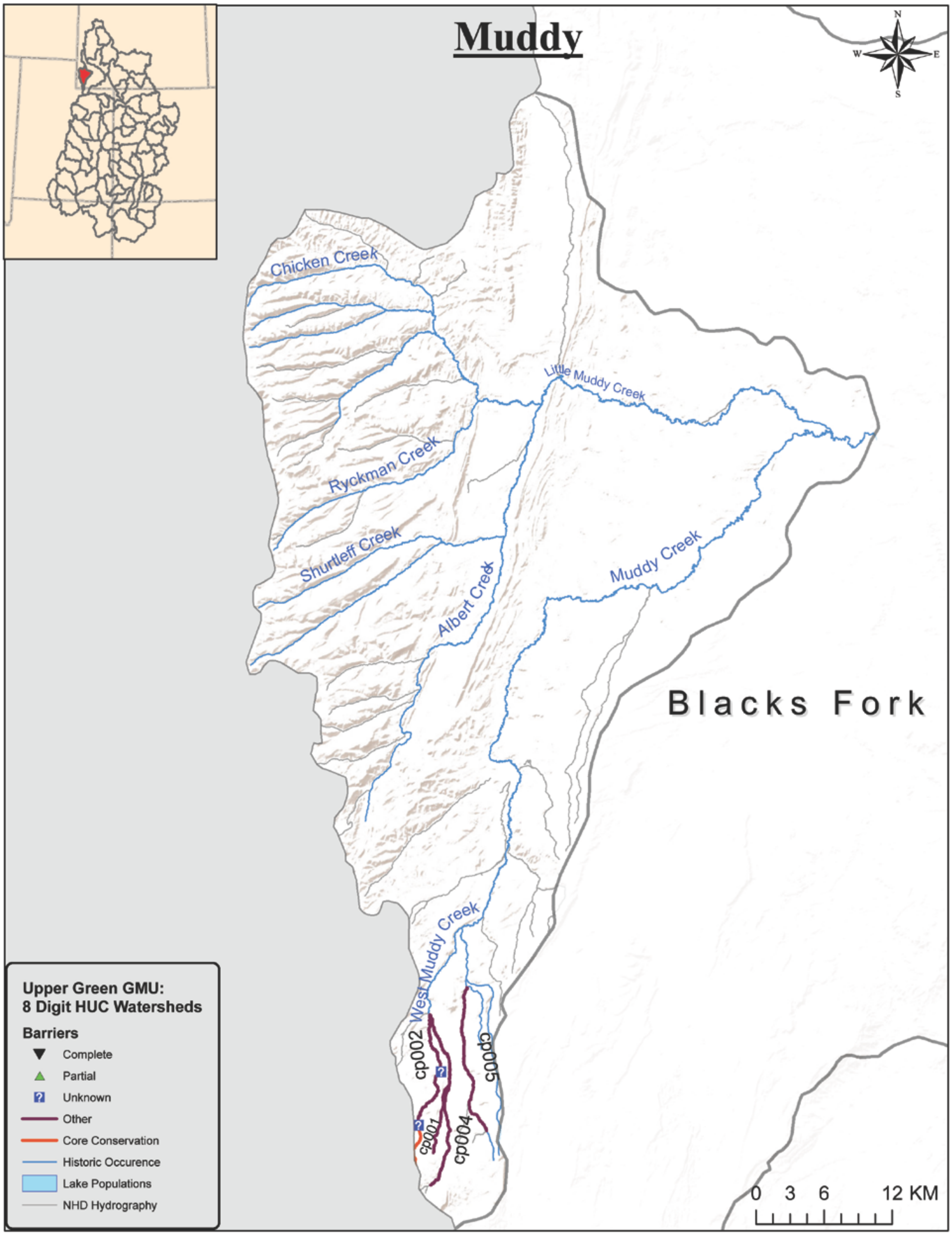

San Miguel
Uncompahgre
Upper Dolores
Lower Dolores
Leopard Creek
Bilk Creek
San Miguel River
Saltado Creek
Beaver Creek
Goat Creek
Mc Kenzie Creek
Clay Creek
Cottonwood Creek
Tabeguache Creek
Campbell Creek
cp001
cp002
cp003
cp004
cp005
0 4 8 16 KM
Dolores GMU:
8-Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography

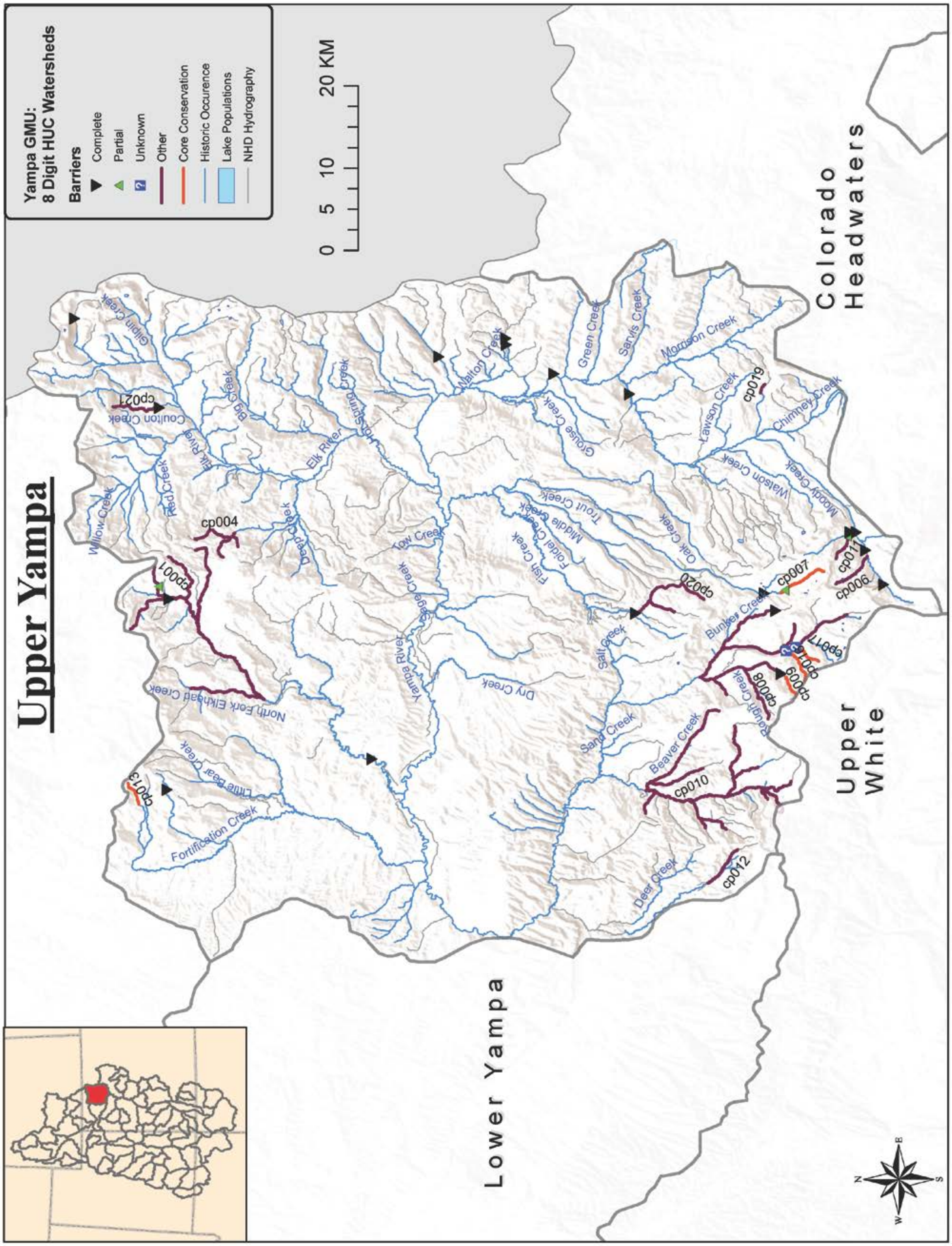

Upper Green
cp030
cp031
cp044
cp025
cp026
cp028
cp032
cp033
cp034
cp024
cp023
cp022
cp021
cp020
cp019
cp018
cp016
cp015
cp014
cp013
cp012
cp011
cp049
cp047
cp009
cp050
cp051
cp047
cp048
cp046
cp007
cp004
cp006
cp003
cp005
cp001
cp037
cp036
cp034
Green River
Horse Creek
North Cottonwood Creek
Muddy Creek
North Piney Creek
South Piney Creek
Dry Piney Creek
Beaver Dam Creek
La Barge Creek
Muddy Creek
Fontenelle Creek
New Fork
Upper Green-Slate
Upper Green GMU: 8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 5 10 20 KM

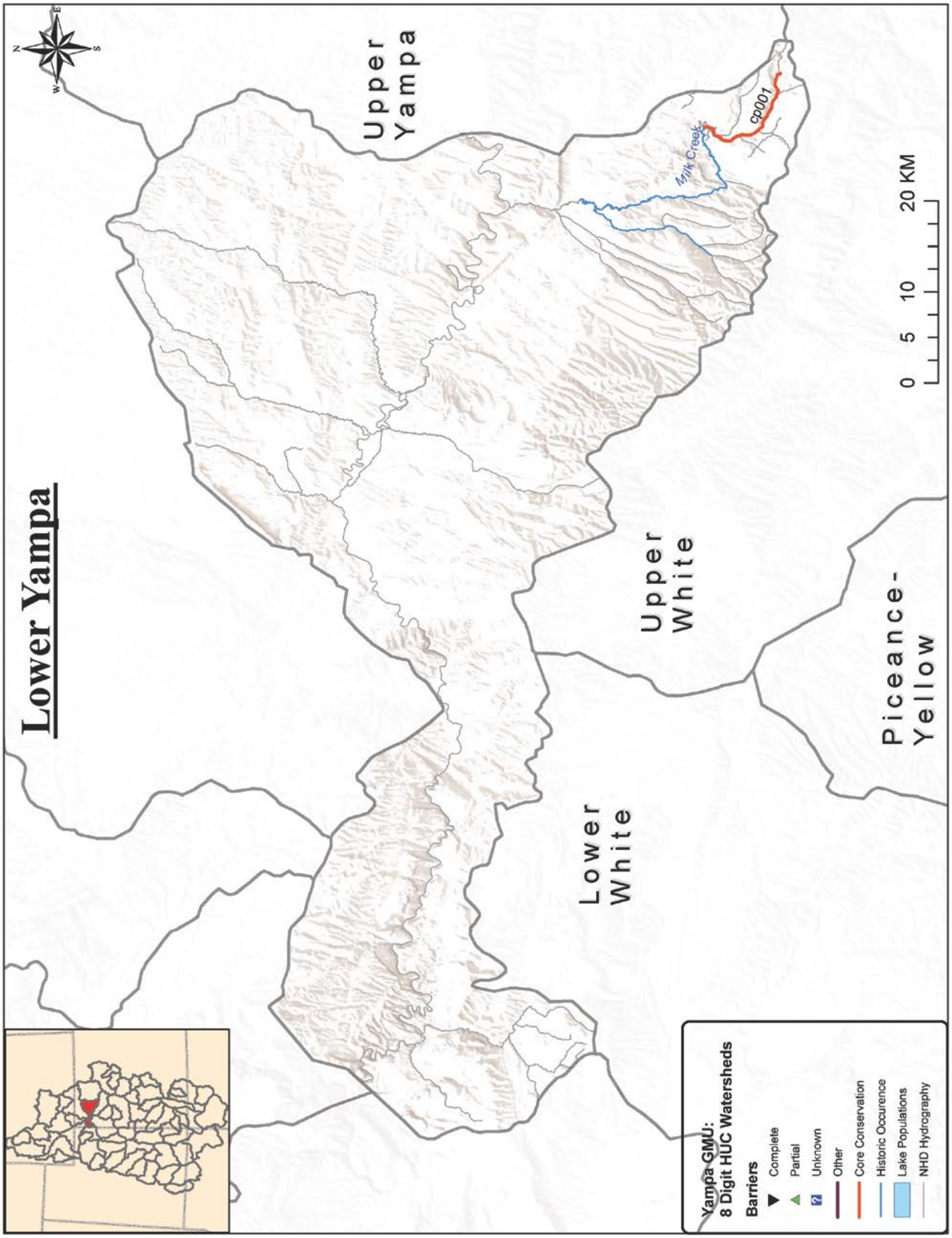

New Fork
New Fork River
Lake Creek
Pine Creek
Duck Creek
Pole Creek
Boulder Creek
Cottonwood Creek
East Fork River
New Fork River
Muddy Creek
cp001
Upper Green
Upper Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 4 8 16 KM
N
E
S
W

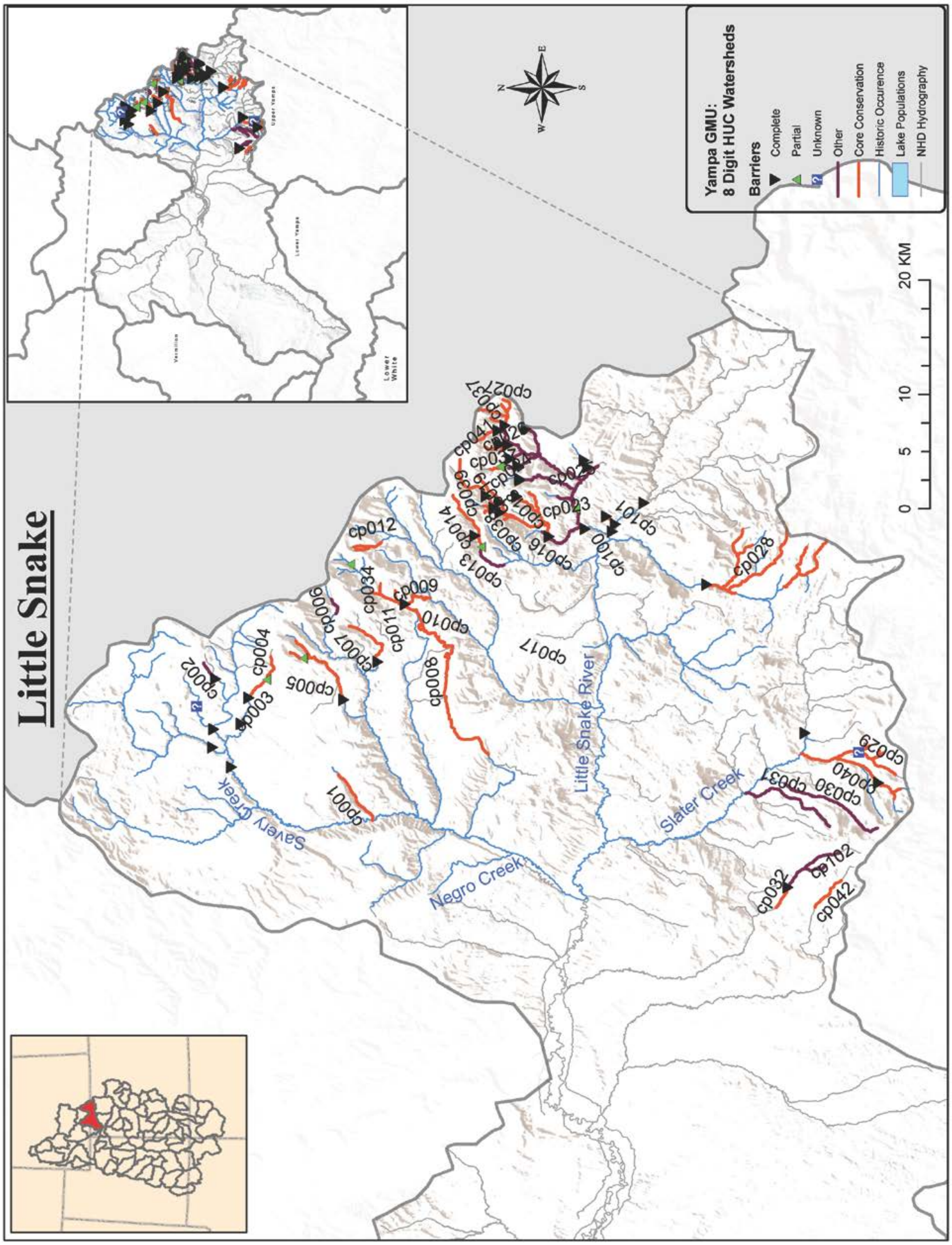

Flaming Gorge Reservoir
Upper Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Vermilion
Bitter
Blacks Fork
Ashley-Brush
Duchesne
0 4 8 16 KM
Green River
Sage Creek
Currant Creek
Camp Creek
Red Creek
Goslin Creek
Willow Creek
Crouse Creek
Kettle Creek
Sheep Creek
Deep Creek
Birch Creek
Poison Creek
Jouilous Creek
cp001
cp002
cp003
cp004
cp006
cp008
cp010
cp011
cp012
cp015
cp016
cp017
cp018
cp020
cp021
cp024


Blacks Fork
Big Sandy
Upper Green-Slate
Muddy
Upper Green-Flaming Gorge Reservoir
N
S
E
W
03.757.5 15 KM
Willow Creek
Cottonwood Creek
Sage Creek
cp001
cp002
cp003
cp004
cp005
cp006
cp007
cp008
cp009
cp010
cp011
cp012
Upper Green GMU: 8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography


Muddy
N
W
E
S
Chicken Creek
Little Muddy Creek
Ryckman Creek
Shurtleff Creek
Albert Creek
Muddy Creek
Blacks Fork
West Muddy Creek
cp002
cp001
cp004
cp005
Upper Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 3 6 12 KM


Upper Yampa
Yampa GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 5 10 20 KM
Colorado Headwaters
Upper White
Lower Yampa
Gilpin Creek
Coulton Creek
Elk River
Big Creek
Red Creek
Willow Creek
Elk River
Deep Creek
Hot Spring Creek
Walton Creek
Green Creek
Sarvis Creek
Morrison Creek
Grouse Creek
Lawson Creek
Chimney Creek
Watson Creek
Moody Creek
Trout Creek
Middle Creek
Foidel Creek
Fish Creek
Oak Creek
Tow Creek
Sage Creek
Yampa River
Dry Creek
Salt Creek
Bunker Creek
Sand Creek
Beaver Creek
Rough Creek
Deer Creek
North Fork Elkhead Creek
Little Bear Creek
Fortification Creek
cp001
cp004
cp006
cp007
cp008
cp009
cp010
cp011
cp012
cp013
cp016
cp017
cp019
cp020
cp021


Lower Yampa
Upper Yampa
Upper White
Lower White
Piceance-Yellow
Milk Creek
cp001
0 5 10 20 KM
Yampa GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography



Little Snake
Yampa GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 5 10 20 KM
Upper Yampa
Lower Yampa
Vermillion
Lower White
Savery Creek
Negro Creek
Little Snake River
Slater Creek
cp001
cp002
cp003
cp004
cp005
cp006
cp007
cp008
cp009
cp010
cp011
cp012
cp013
cp014
cp016
cp017
cp023
cp027
cp028
cp029
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cp042
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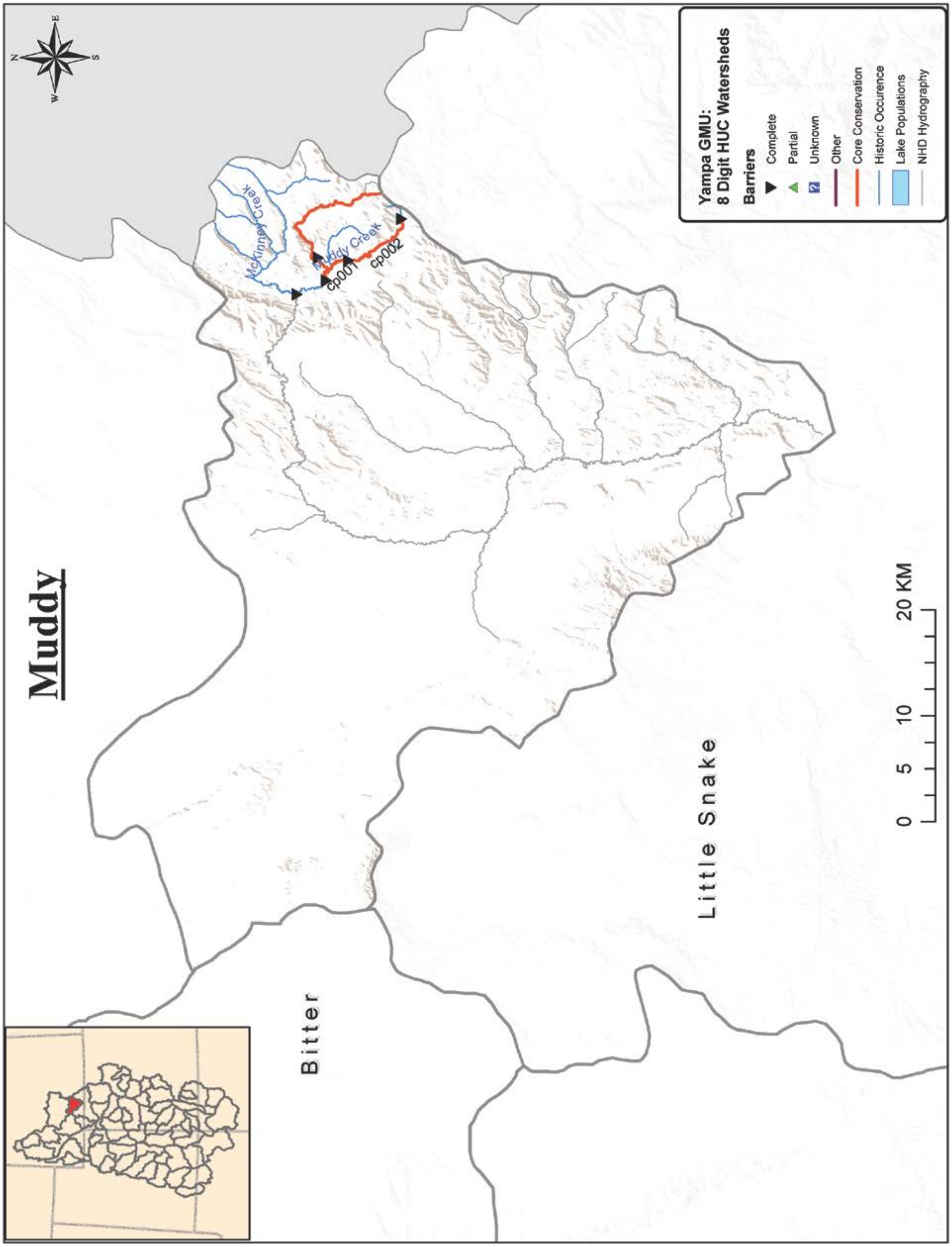
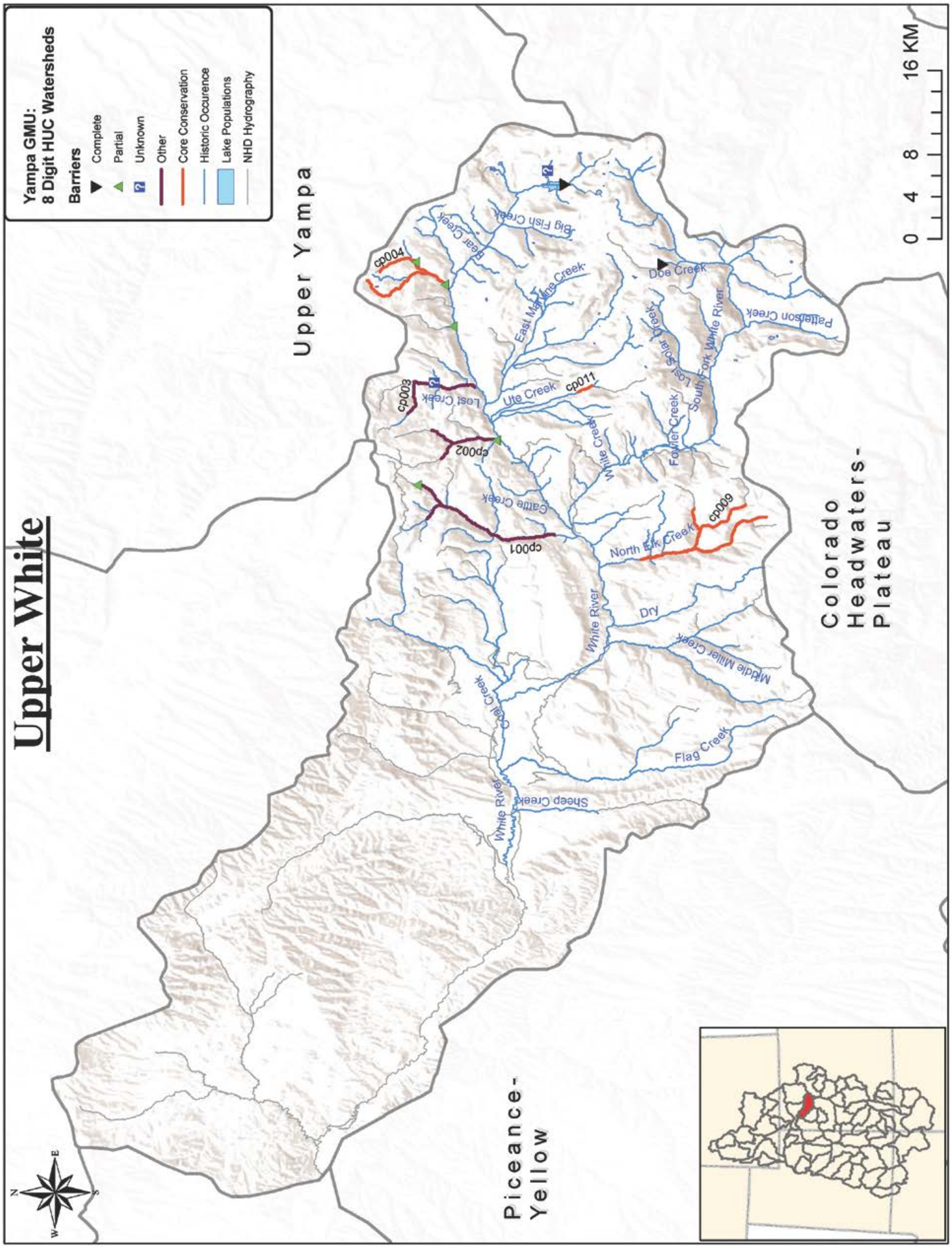
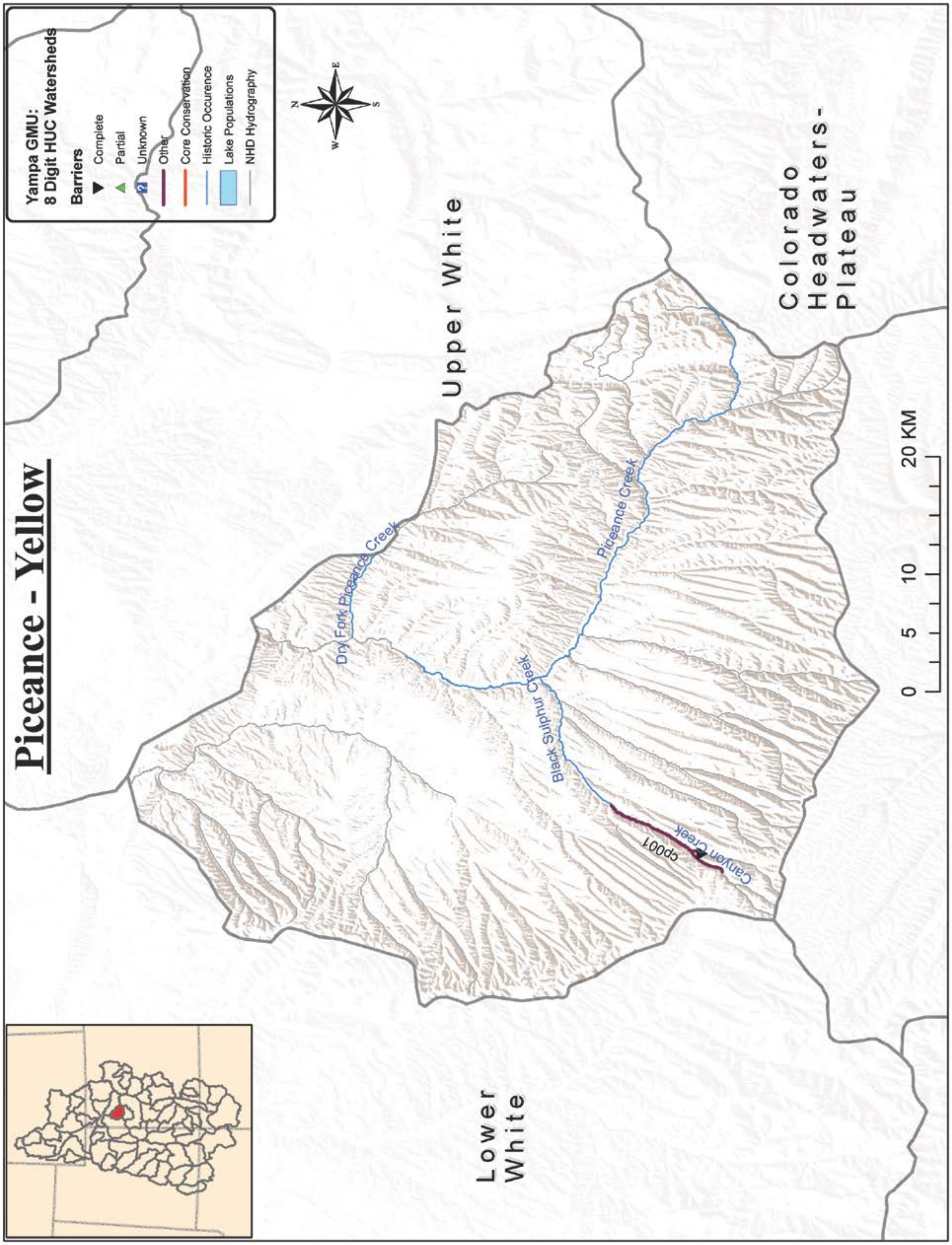
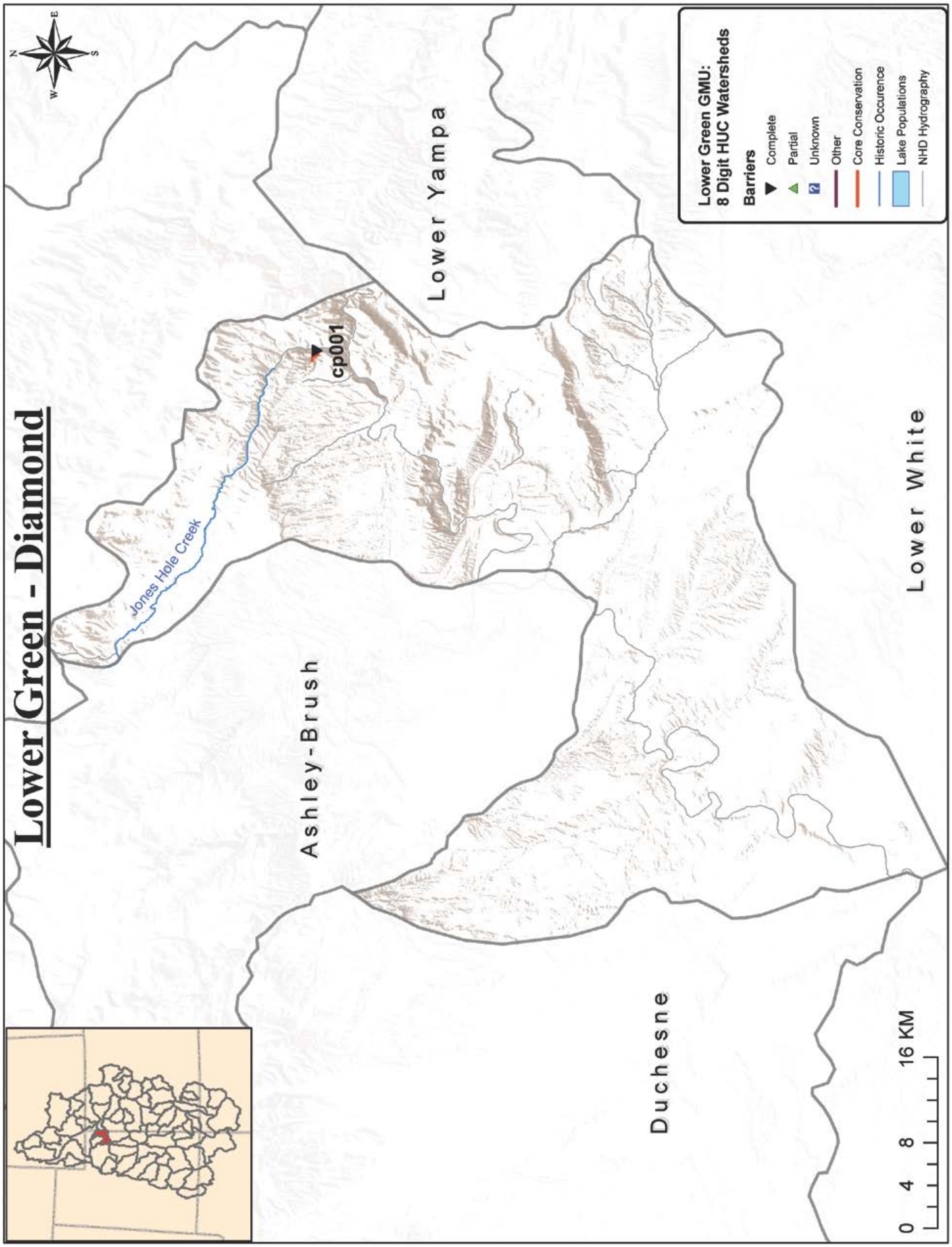
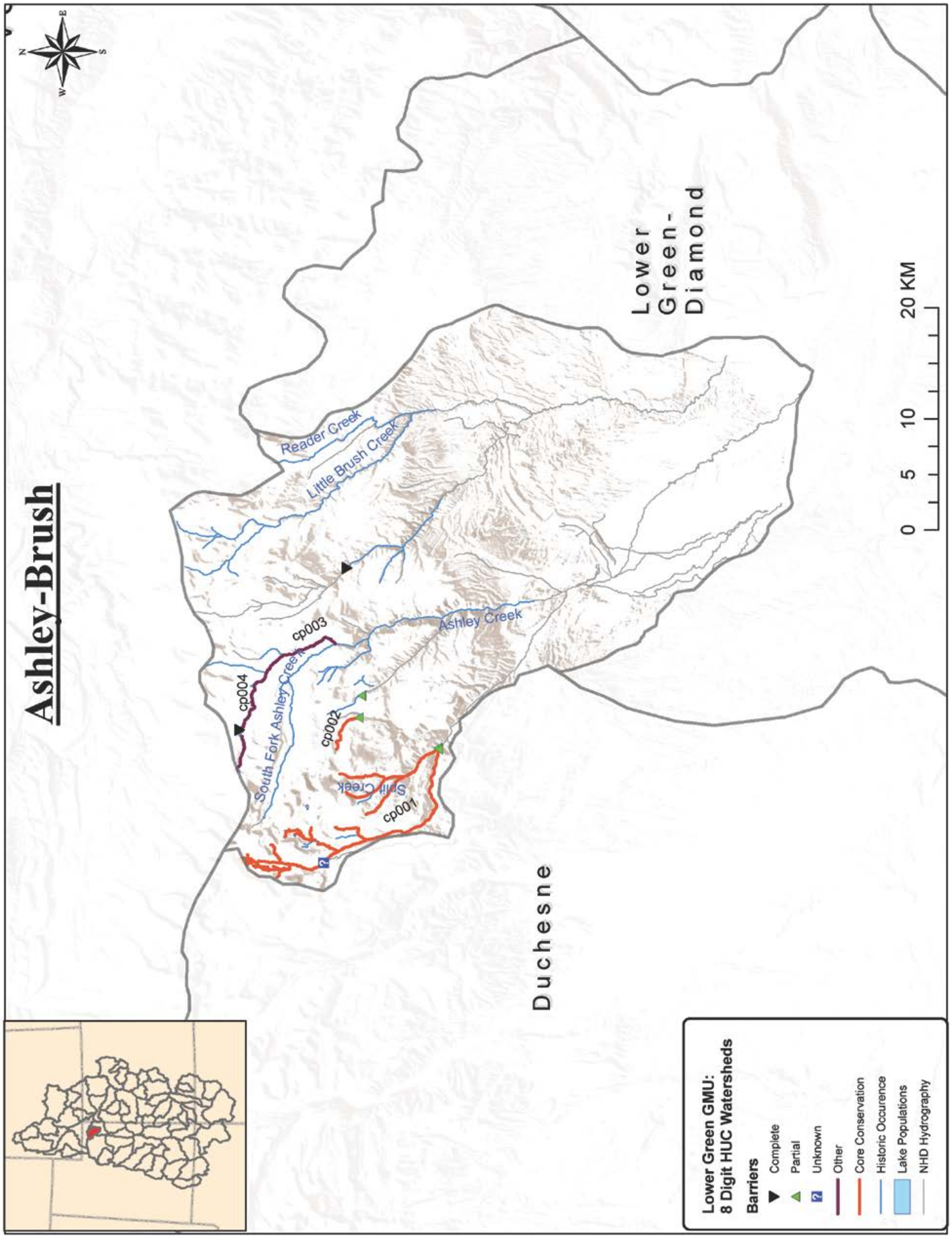
cp101
cp102

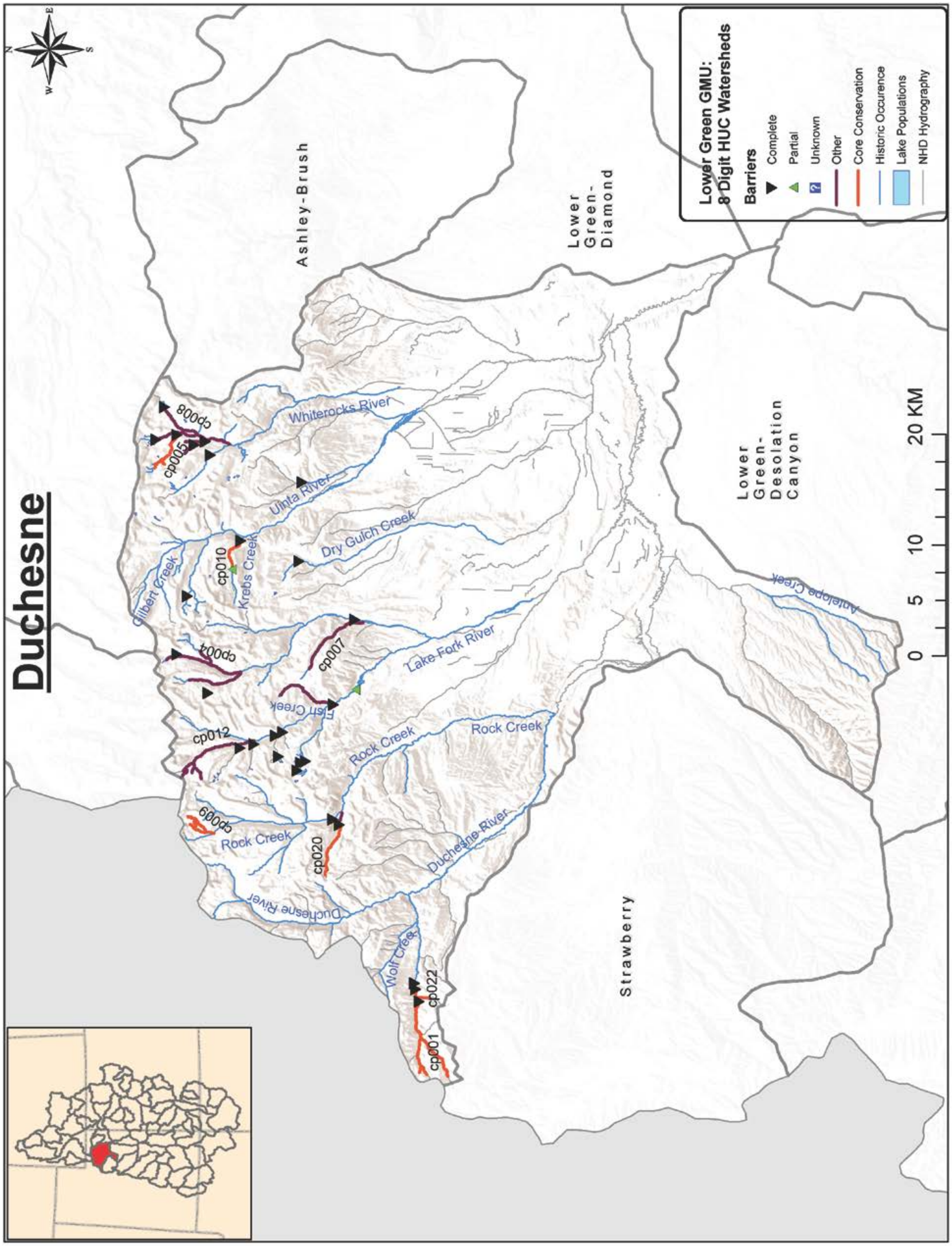

Muddy
Yampa GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Mckinney Creek
Muddy Creek
cp001
cp002
Little Snake
Bitter
0
5
10
20 KM
N
E
S
W

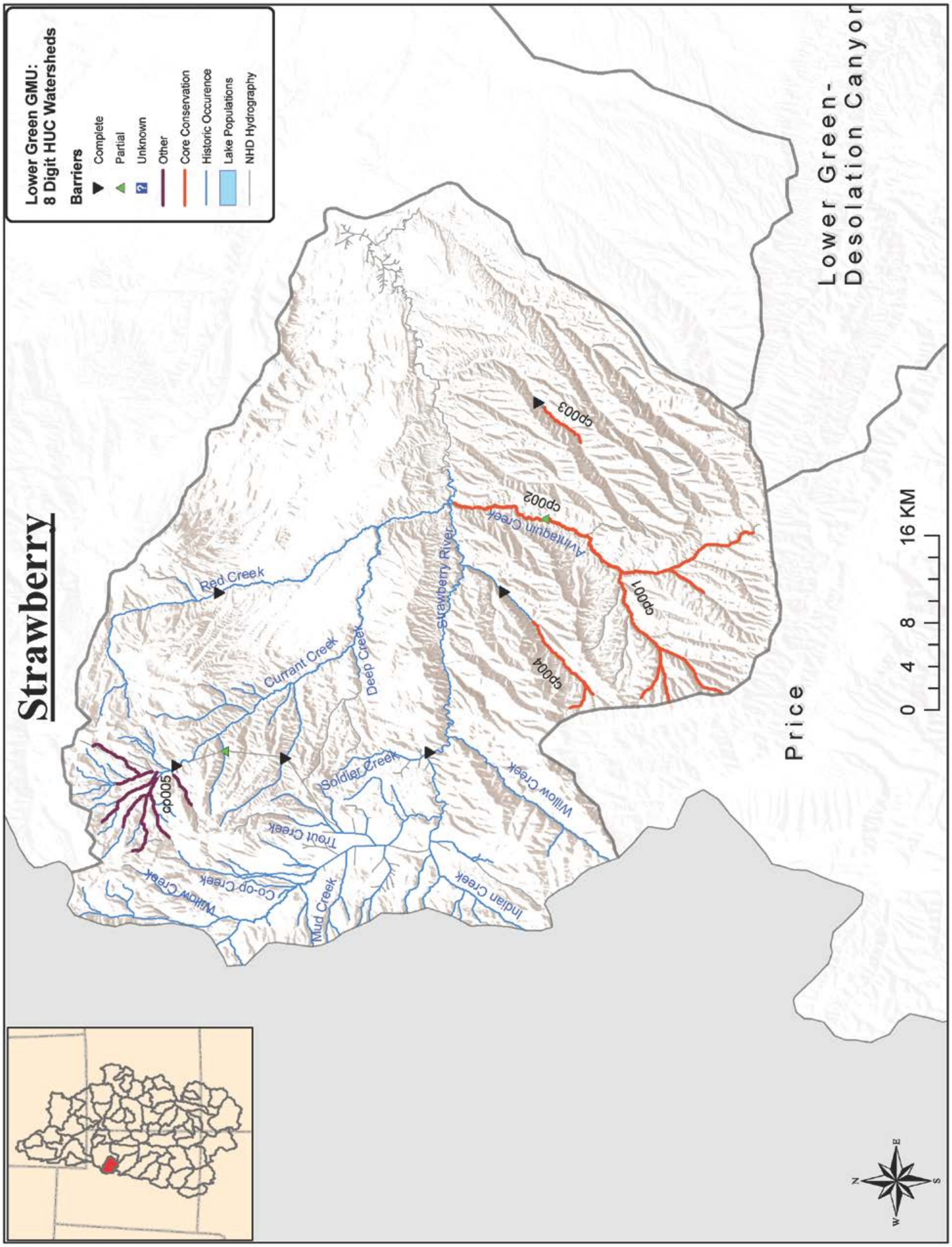

Upper White
Yampa GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Upper Yampa
Colorado Headwaters-Plateau
Piceance-Yellow
0 4 8 16 KM
cp001
cp002
cp003
cp004
cp009
cp011
Big Fish Creek
Bear Creek
East Marvine Creek
Doe Creek
Lost Solar Creek
South Fork White River
Patterson Creek
Lost Creek
Ute Creek
White Creek
Fowler Creek
Cattle Creek
North Elk Creek
White River
Dry
Middle Miller Creek
Coal Creek
Flag Creek
Sheep Creek

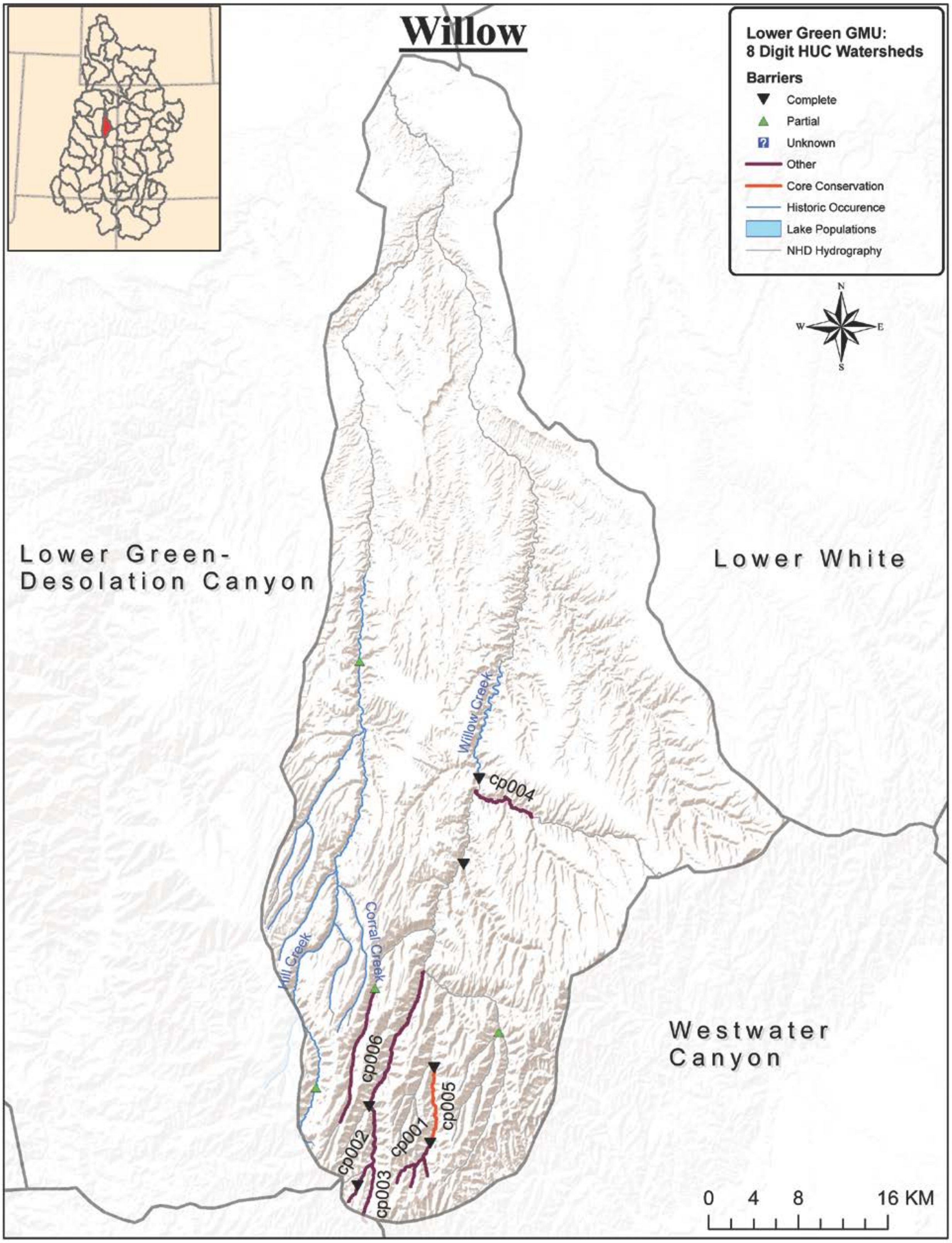

Piceance - Yellow
Yampa GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
N
E
S
W
Upper White
Lower White
Colorado Headwaters - Plateau
Dry Fork Piceance Creek
Piceance Creek
Black Sulphur Creek
Canyon Creek
cp001
0
5
10
20 KM


Lower Green - Diamond
Lower Yampa
Lower White
Ashley-Brush
Duchesne
Jones Hole Creek
cp001
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 4 8 16 KM

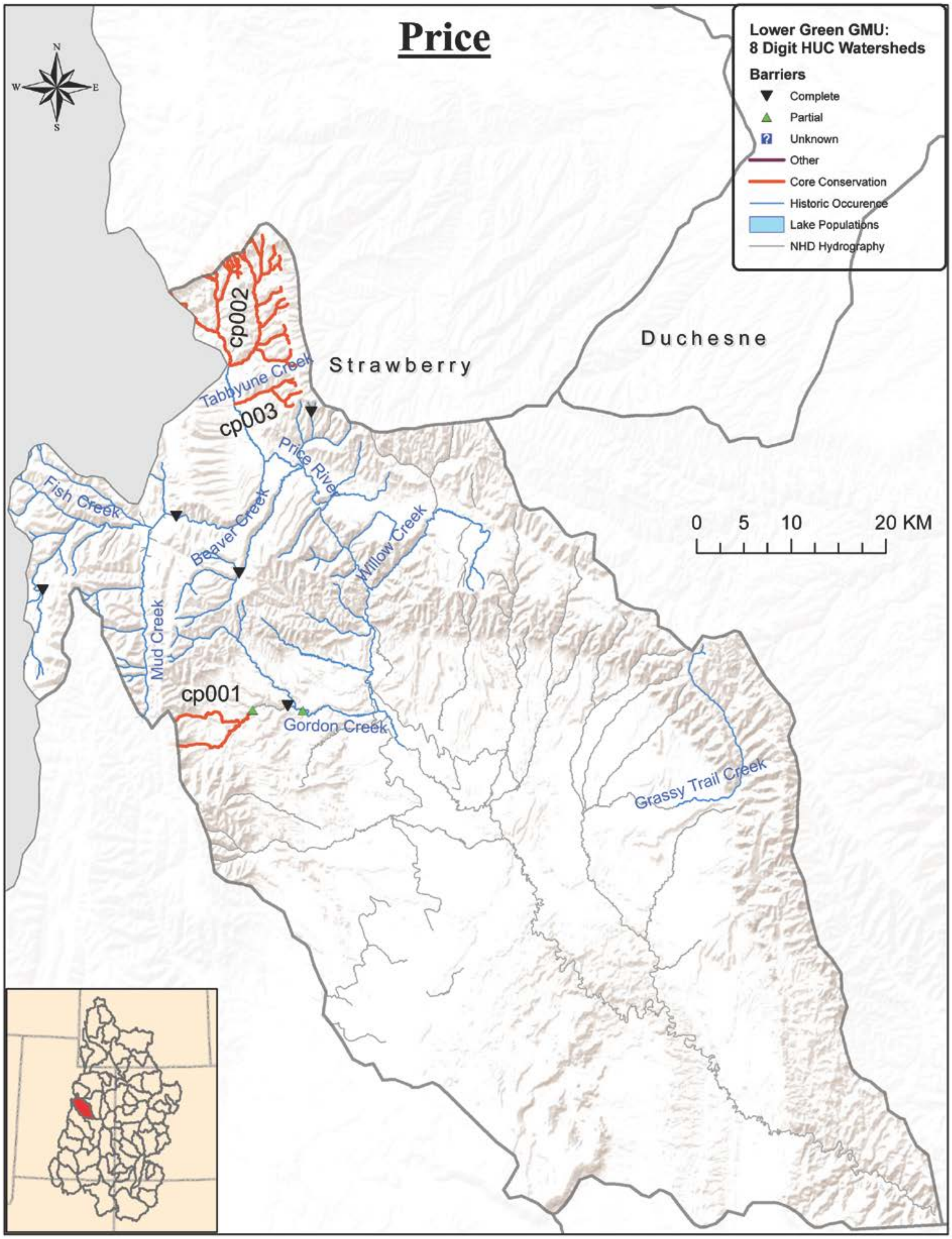

Ashley-Brush
Lower Green-Diamond
Duchesne
Reader Creek
Little Brush Creek
Ashley Creek
South Fork Ashley Creek
Split Creek
cp001
cp002
cp003
cp004
0 5 10 20 KM
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography

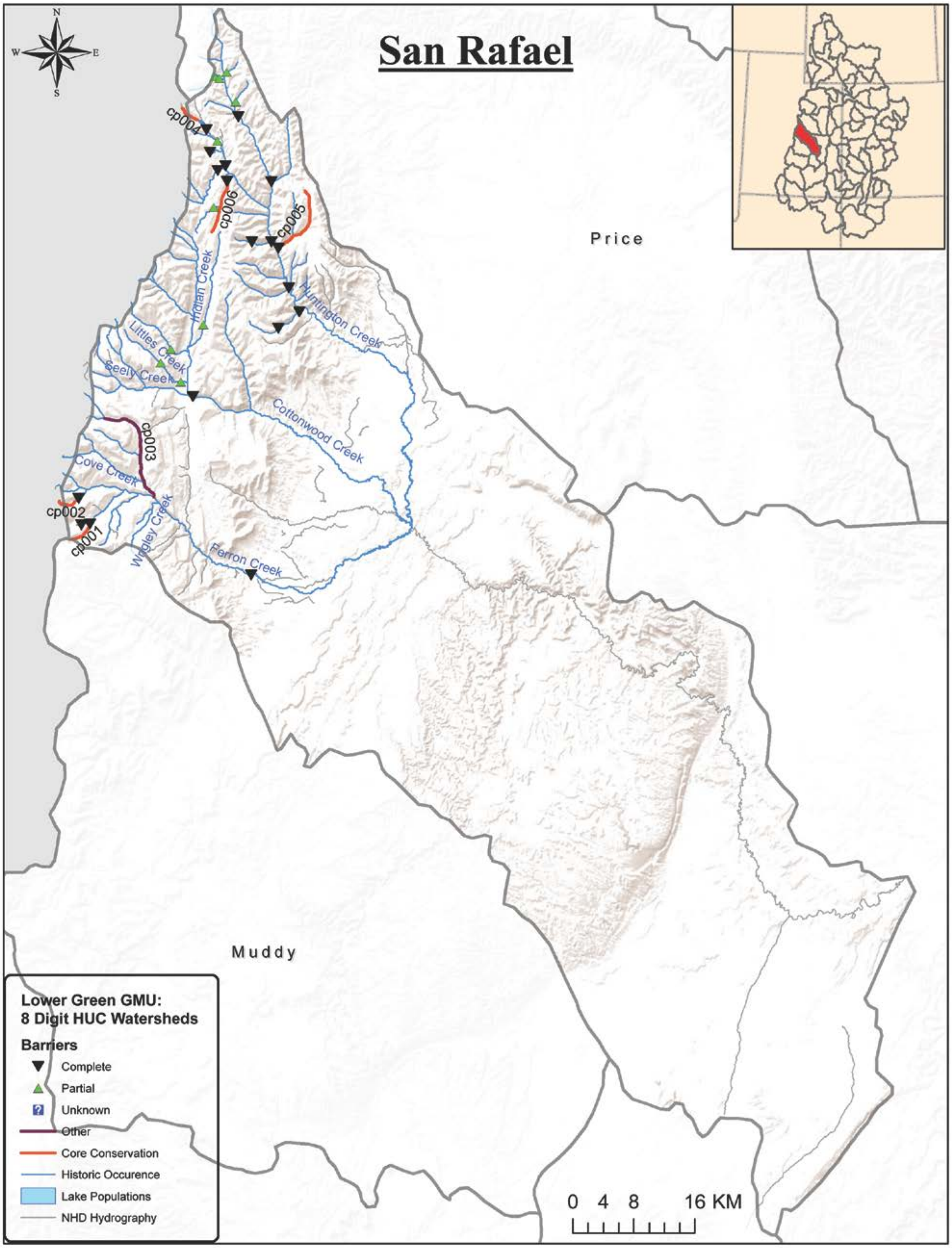

Duchesne
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Ashley-Brush
Lower Green-Diamond
Lower Green-Desolation Canyon
Strawberry
Whiterocks River
Uinta River
Dry Gulch Creek
Gilbert Creek
Krebs Creek
Lake Fork River
Fish Creek
Rock Creek
Duchesne River
Wolf Creek
Antelope Creek
cp008
cp005
cp010
cp004
cp007
cp012
cp009
cp020
cp022
cp001
0 5 10 20 KM

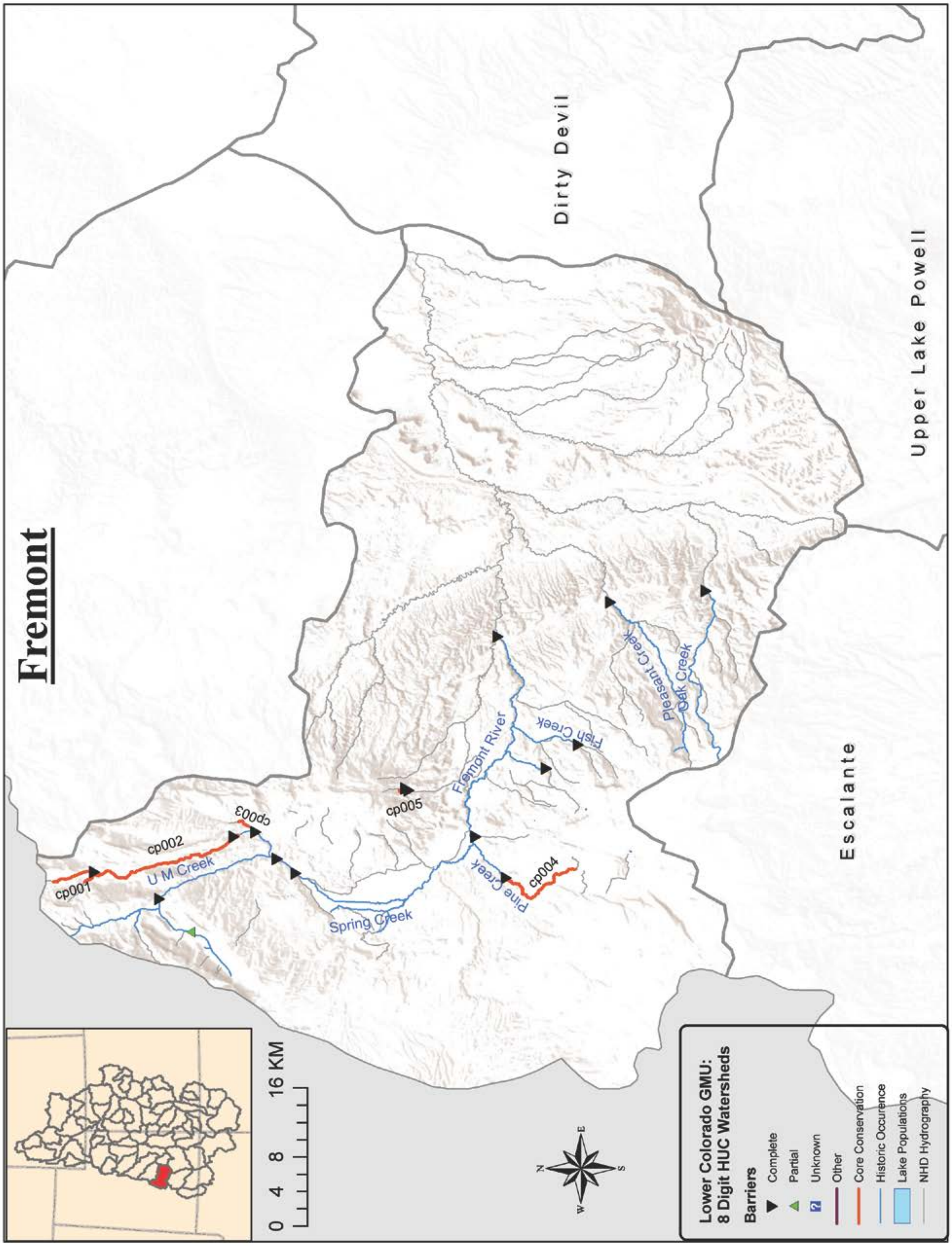

Strawberry
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Lower Green-
Desolation Canyon
Price
0 4 8 16 KM
Red Creek
Currant Creek
Deep Creek
Strawberry River
Avintaquin Creek
Soldier Creek
Willow Creek
Trout Creek
Co-op Creek
Mud Creek
Indian Creek
cp001
cp002
cp003
cp004
cp005

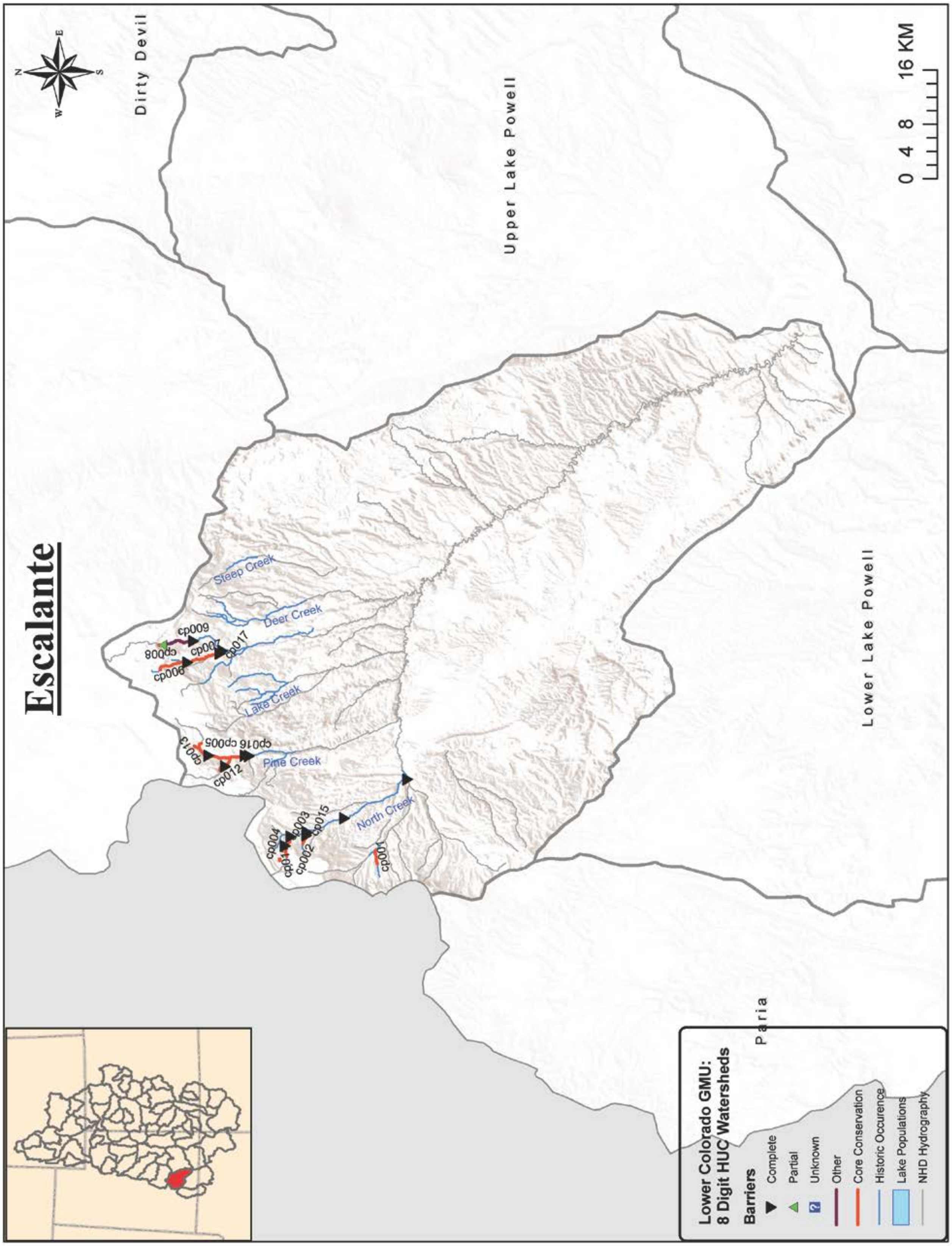


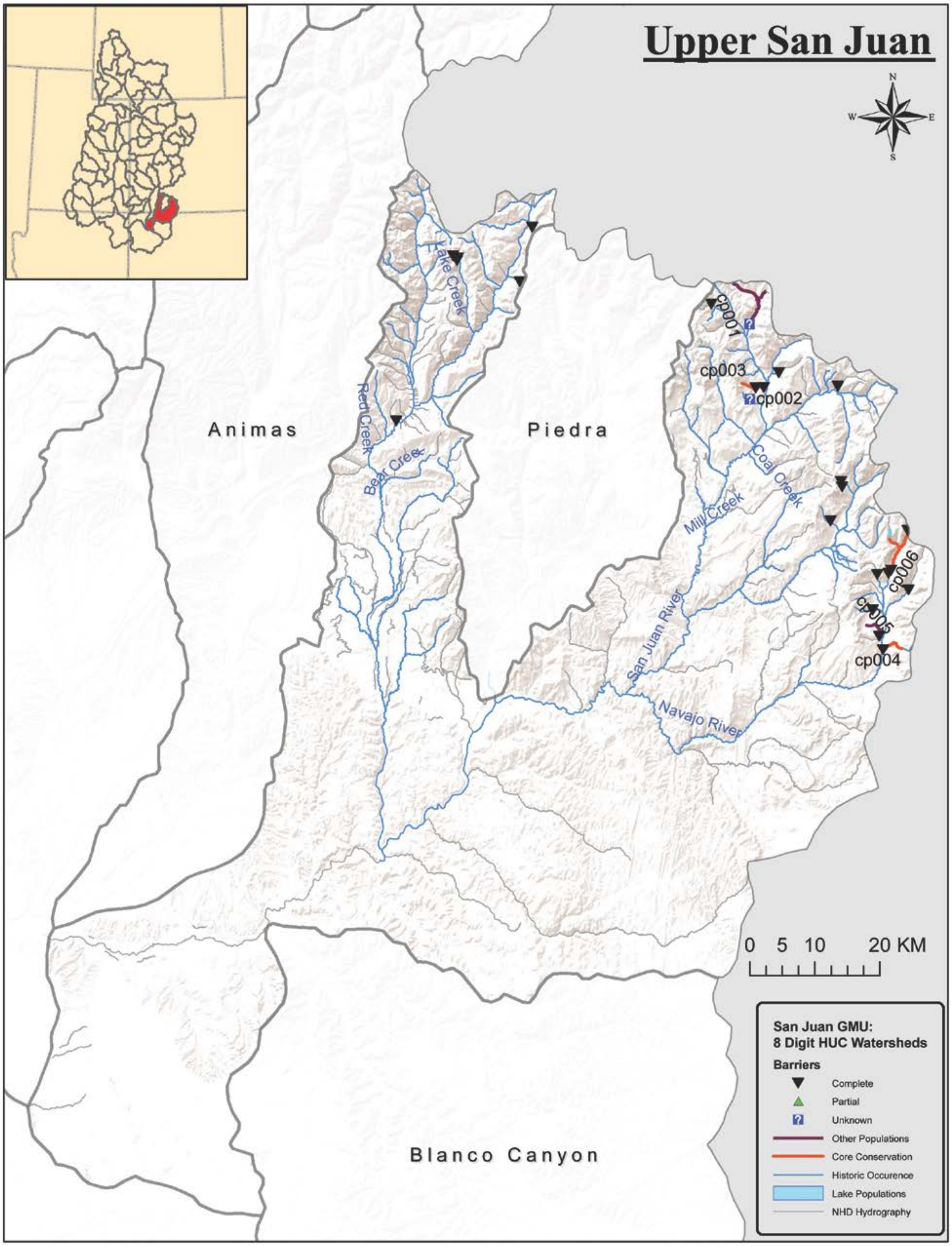
Willow
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
N
W
E
S
Lower Green-
Desolation Canyon
Lower White
Westwater
Canyon
Willow Creek
Corral Creek
Hill Creek
cp001
cp002
cp003
cp004
cp005
cp006
0 4 8 16 KM

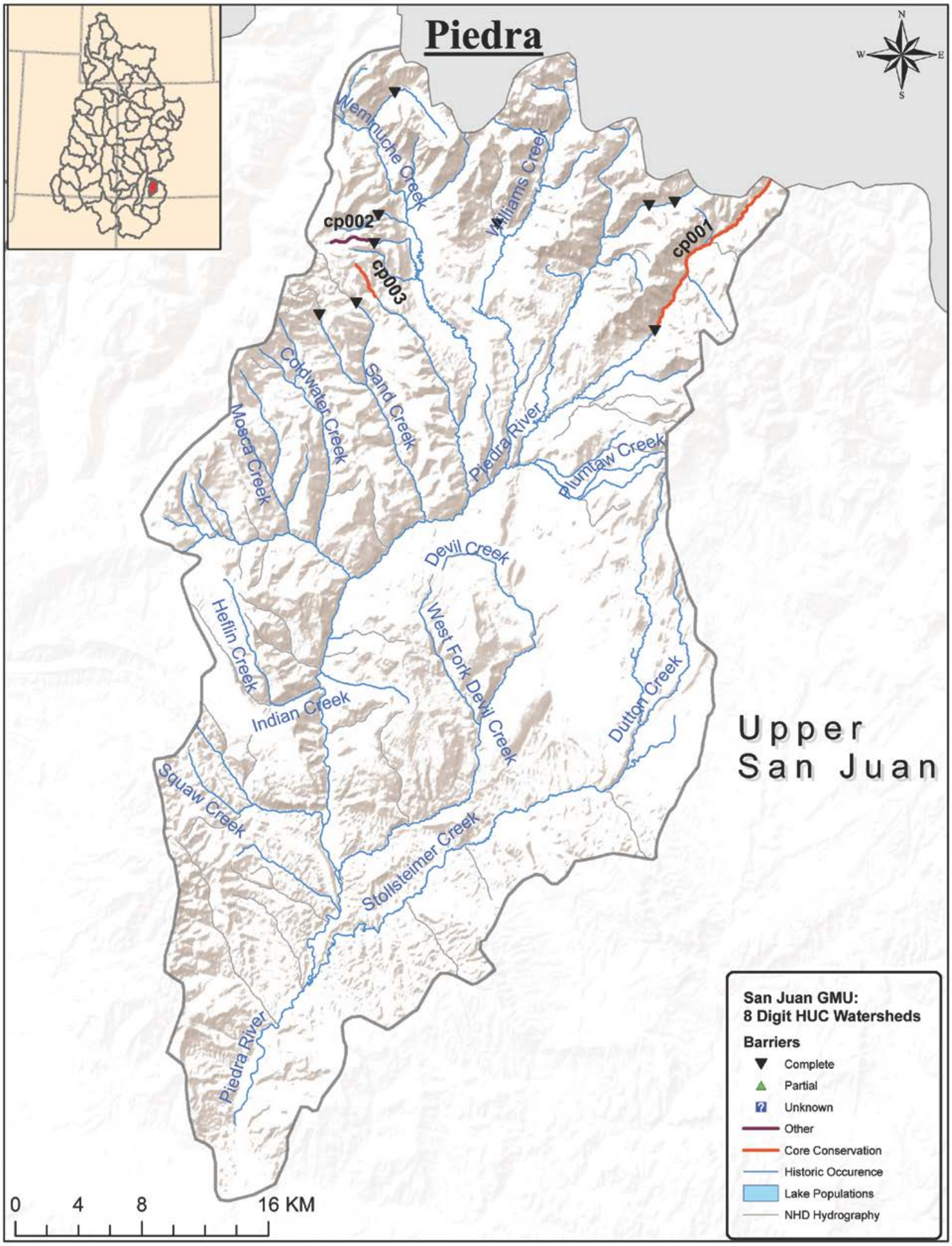

Price
N
S
E
W
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Duchesne
Strawberry
cp002
cp003
cp001
Tabbyune Creek
Price River
Fish Creek
Beaver Creek
Willow Creek
Mud Creek
Gordon Creek
Grassy Trail Creek
0 5 10 20 KM


San Rafael
N
S
E
W
Price
Muddy
cp004
cp006
cp005
cp003
cp002
cp001
Indian Creek
Huntington Creek
Littles Creek
Seely Creek
Cottonwood Creek
Cove Creek
Wrigley Creek
Ferron Creek
Lower Green GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
0 4 8 16 KM


Fremont
Dirty Devil
Upper Lake Powell
Escalante
U M Creek
Spring Creek
Fremont River
Fish Creek
Pleasant Creek
Oak Creek
Pine Creek
cp001
cp002
cp003
cp004
cp005
0 4 8 16 KM
Lower Colorado GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography


Escalante
Dirty Devil
Upper Lake Powell
Lower Lake Powell
Paria
0 4 8 16 KM
Steep Creek
Deer Creek
Lake Creek
Pine Creek
North Creek
cp001
cp002
cp003
cp004
cp005
cp006
cp007
cp008
cp009
cp012
cp013
cp015
cp016
cp017
Lower Colorado GMU: 8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography

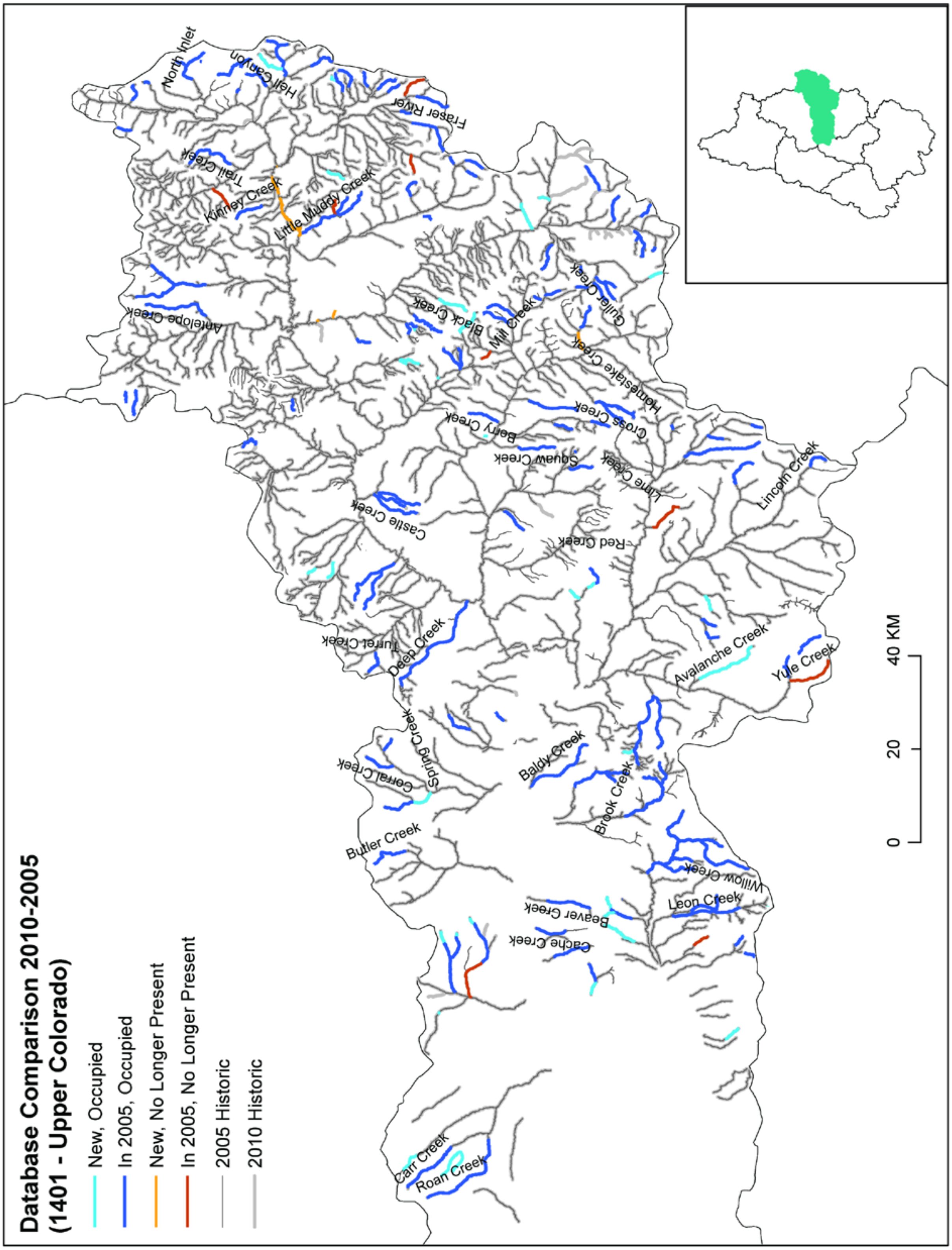

Upper San Juan
N
W
E
S
Animas
Piedra
Lake Creek
Red Creek
Bear Creek
cp001
cp003
cp002
Coal Creek
Mill Creek
San Juan River
cp006
cp005
cp004
Navajo River
0 5 10 20 KM
San Juan GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other Populations
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography
Blanco Canyon

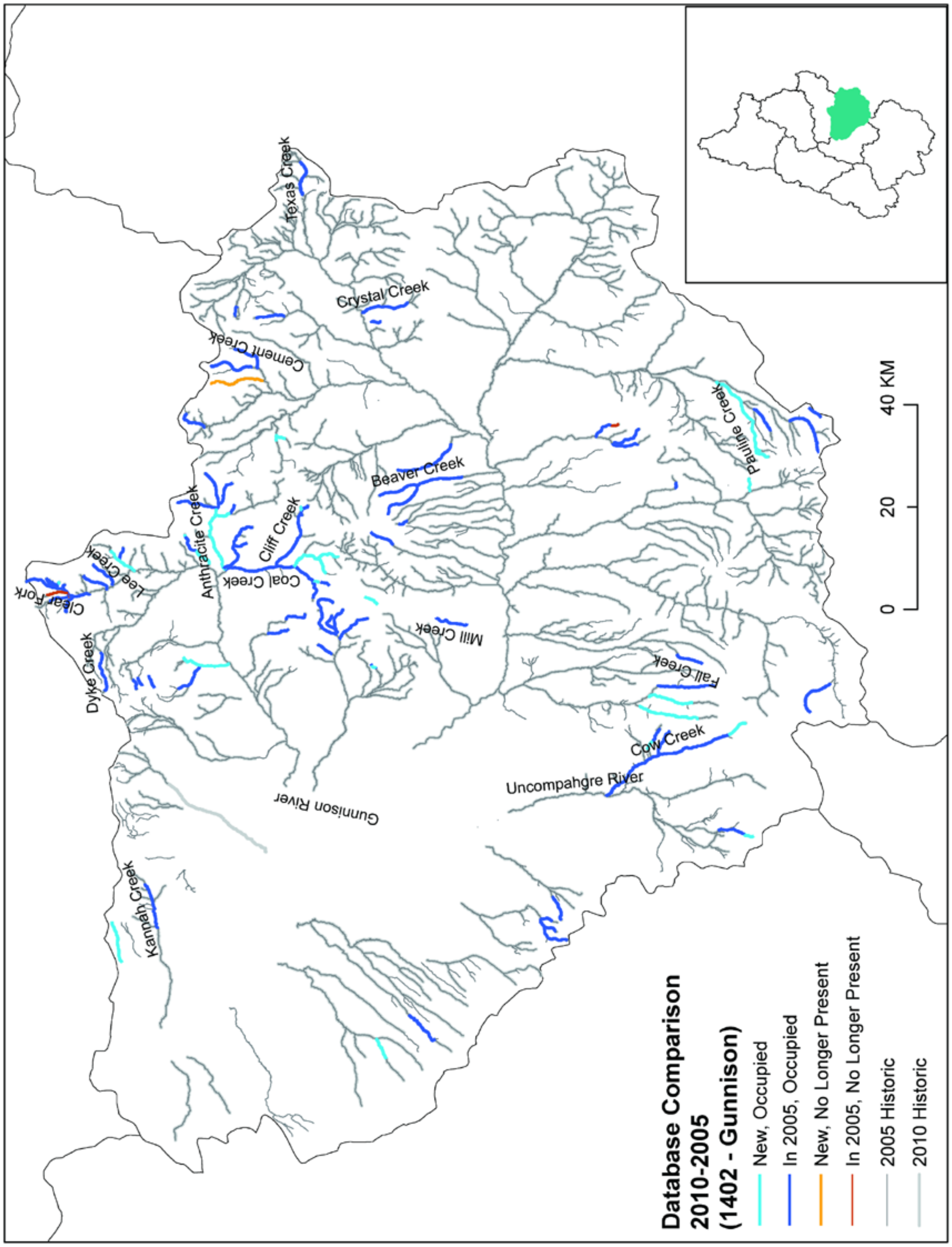

Piedra
N
S
W
E
Nemnuche Creek
Williams Creek
cp002
cp003
cp001
Coldwater Creek
Sand Creek
Mosca Creek
Piedra River
Plumtaw Creek
Devil Creek
West Fork Devil Creek
Heflin Creek
Indian Creek
Dutton Creek
Squaw Creek
Stollsteimer Creek
Piedra River
Upper San Juan
0 4 8 16 KM
San Juan GMU:
8 Digit HUC Watersheds
Barriers
Complete
Partial
Unknown
Other
Core Conservation
Historic Occurence
Lake Populations
NHD Hydrography

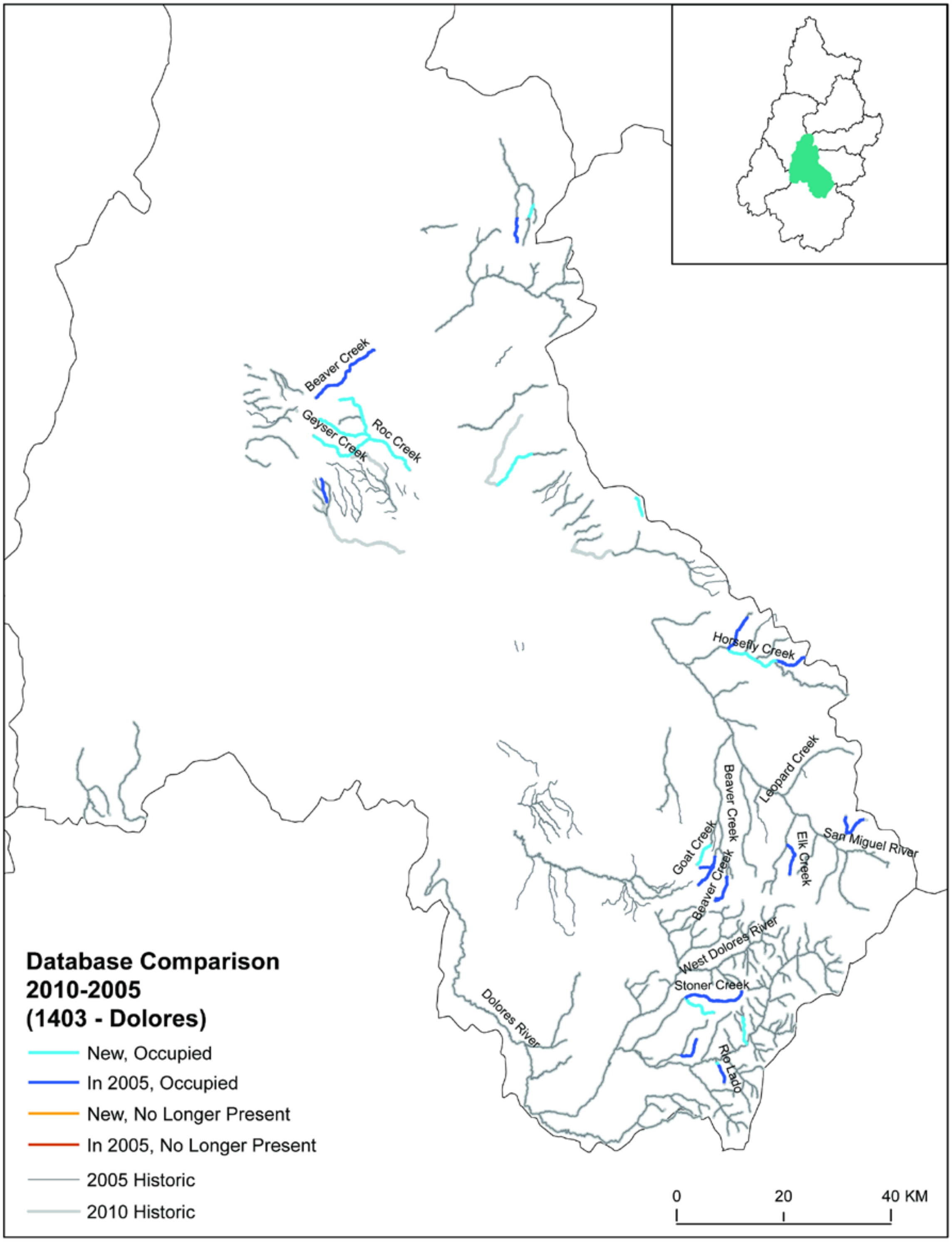
Appendix E. Comparison maps showing changes in the database to the *currently occupied* layer, historic habitat, and populations designated as no longer present.

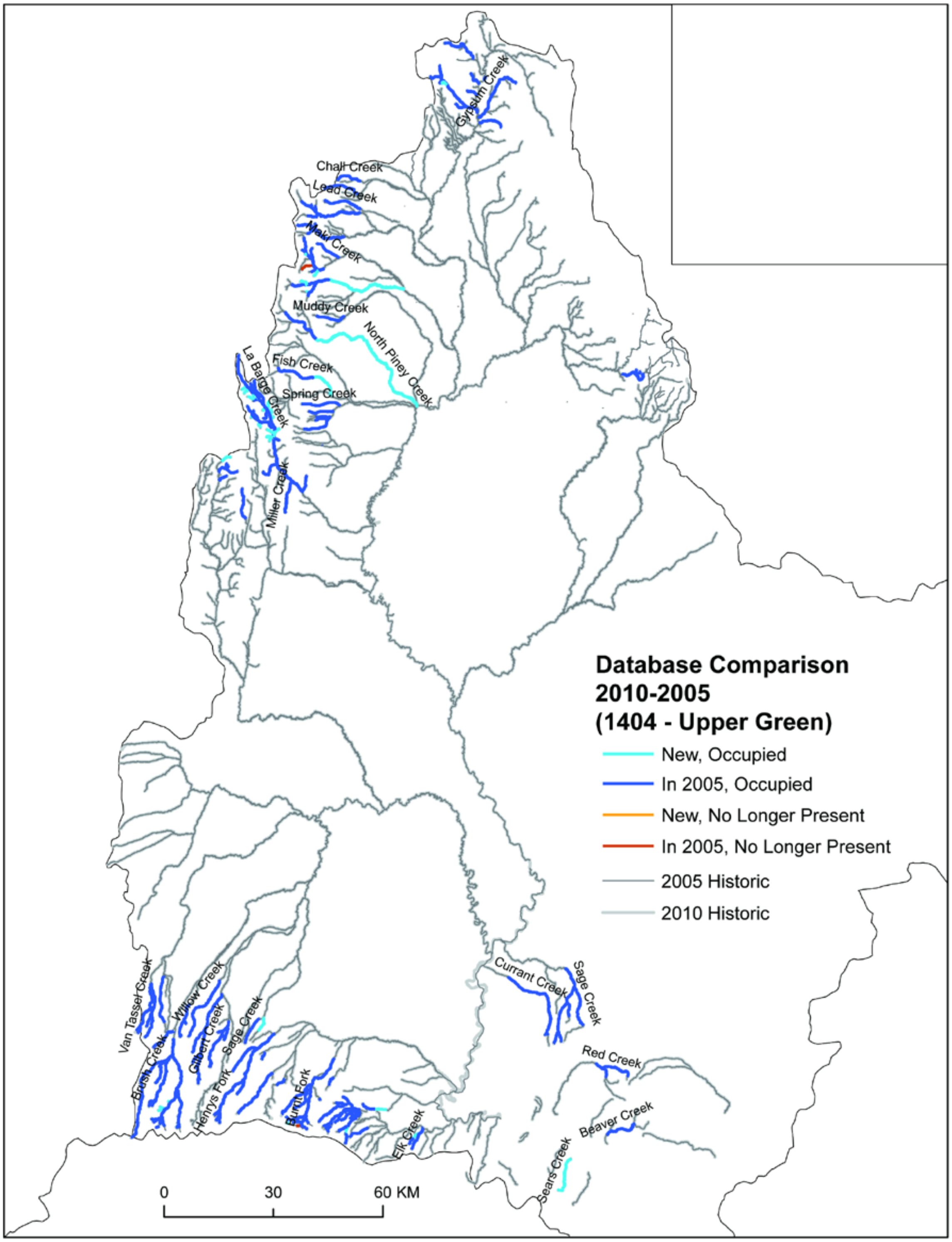
Populations designated as in the database in 2005 Current and No Longer Present are present in the 2010 database. (Maps are currently draft – specifically we will change the 2005 and 2010 historic to be more differentiated and correct the Yampa locator map)

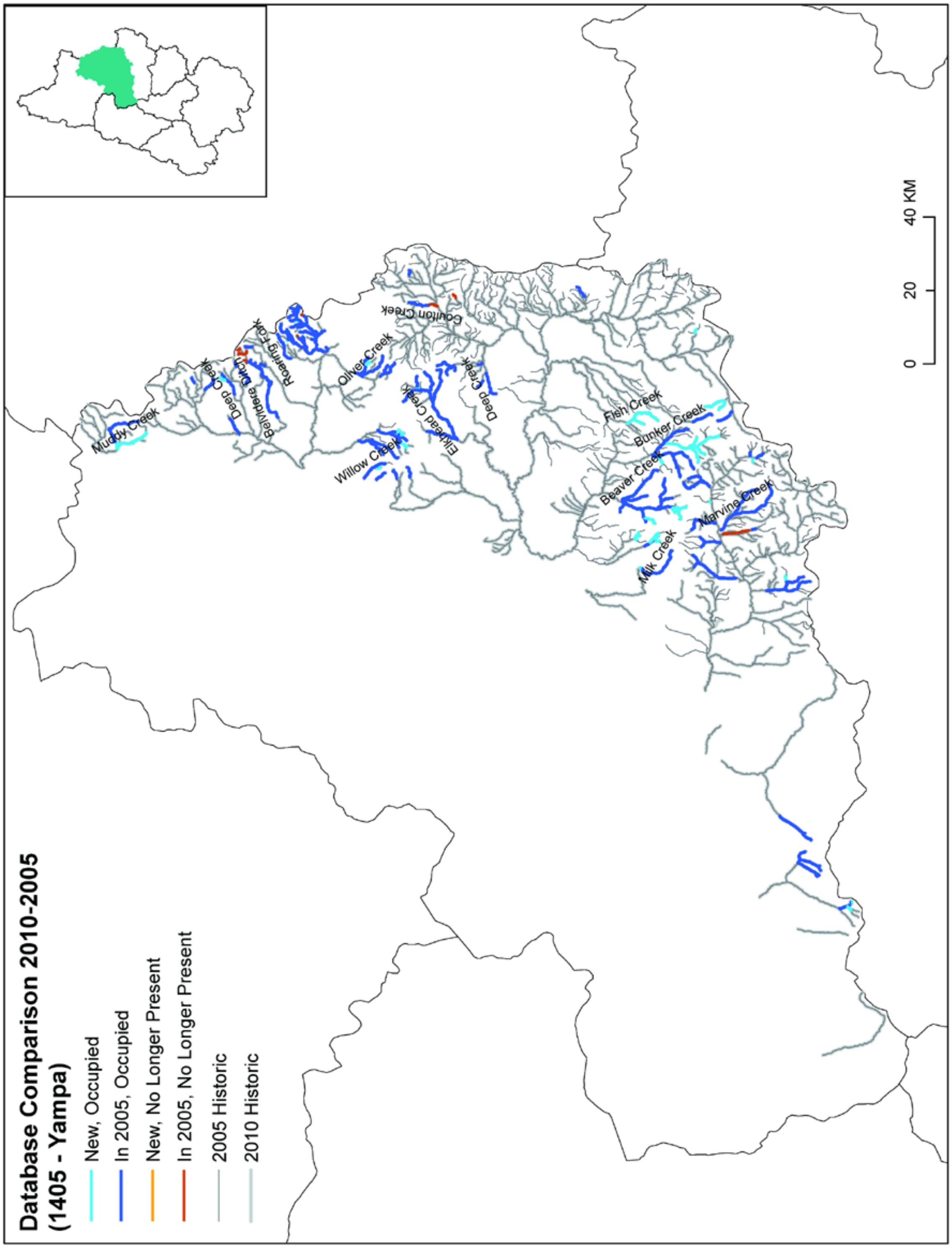
Maps are presented in order:
1401 – Upper Colorado
1402 – Gunnison
1403 – Dolores
1404 – Upper Green
1405 – Yampa
1406 – Lower Green
1407 – Lower Colorado
1408 – San Juan

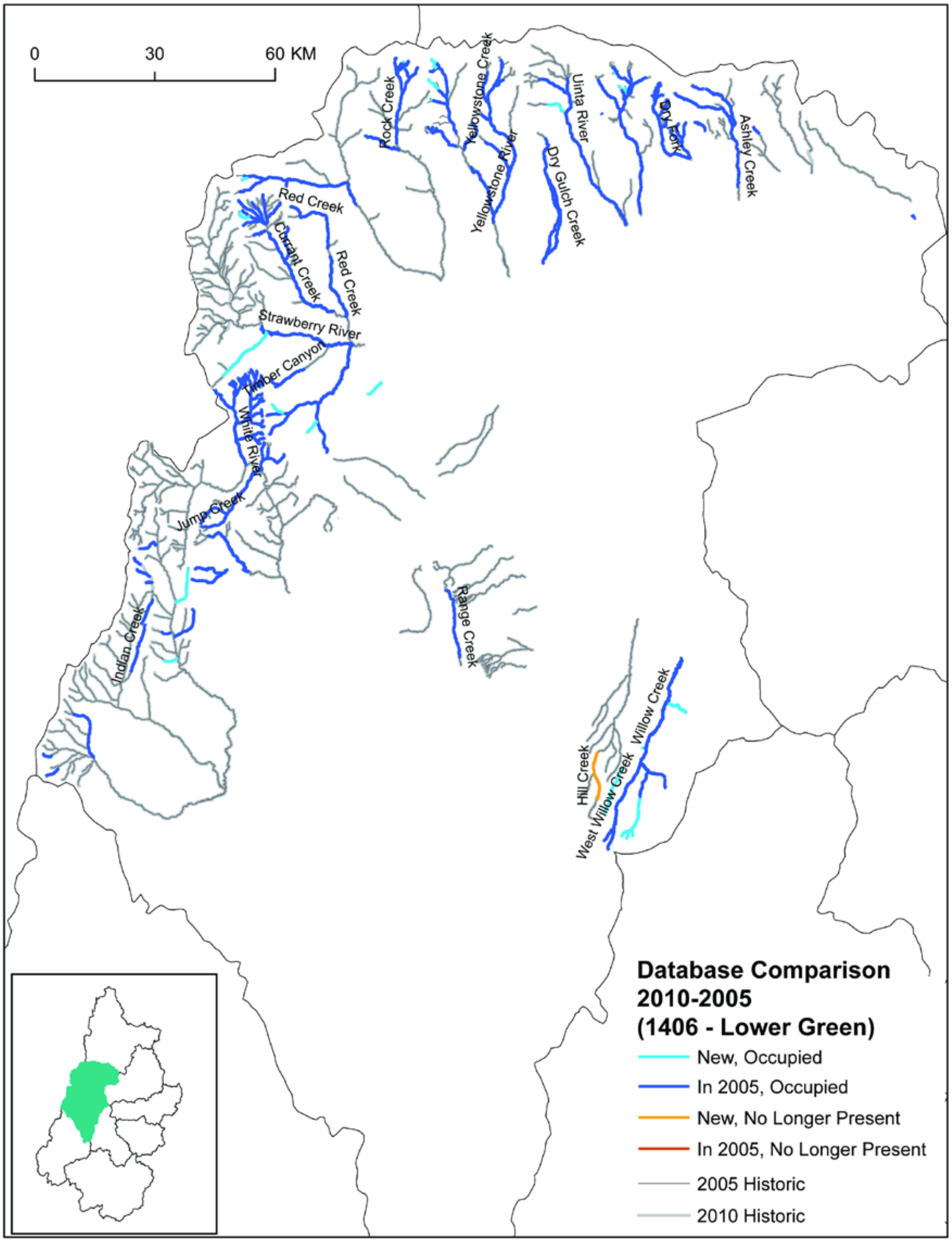

Database Comparison 2010-2005
(1401 - Upper Colorado)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
0
20
40 KM
North Inlet
Hell Canyon
Fraser River
Trail Creek
Kinney Creek
Little Muddy Creek
Antelope Creek
Black Creek
Mill Creek
Gulier Creek
Homestake Creek
Cross Creek
Berry Creek
Squaw Creek
Lime Creek
Lincoln Creek
Castle Creek
Red Creek
Deep Creek
Tunel Creek
Avalanche Creek
Yule Creek
Spring Creek
Corral Creek
Baldy Creek
Brook Creek
Butler Creek
Willow Creek
Leon Creek
Beaver Creek
Cache Creek
Carr Creek
Roan Creek

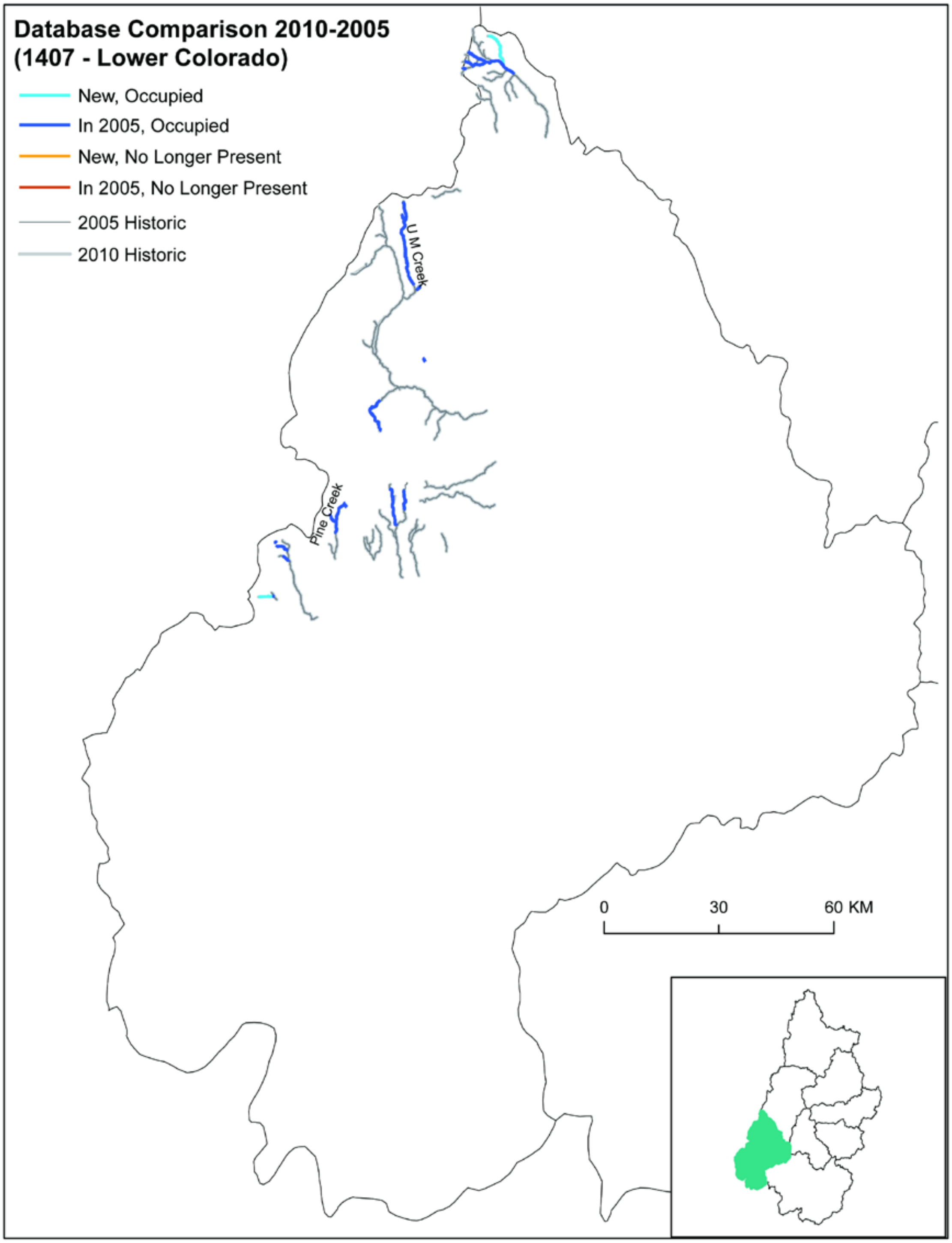

Database Comparison
2010-2005
(1402 - Gunnison)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
0
20
40 KM
Texas Creek
Crystal Creek
Cement Creek
Beaver Creek
Pauline Creek
Anthracite Creek
Cliff Creek
Coal Creek
Lee Creek
Clear Fork
Mill Creek
Dyke Creek
Fall Creek
Cow Creek
Uncompahgre River
Gunnison River
Kannah Creek

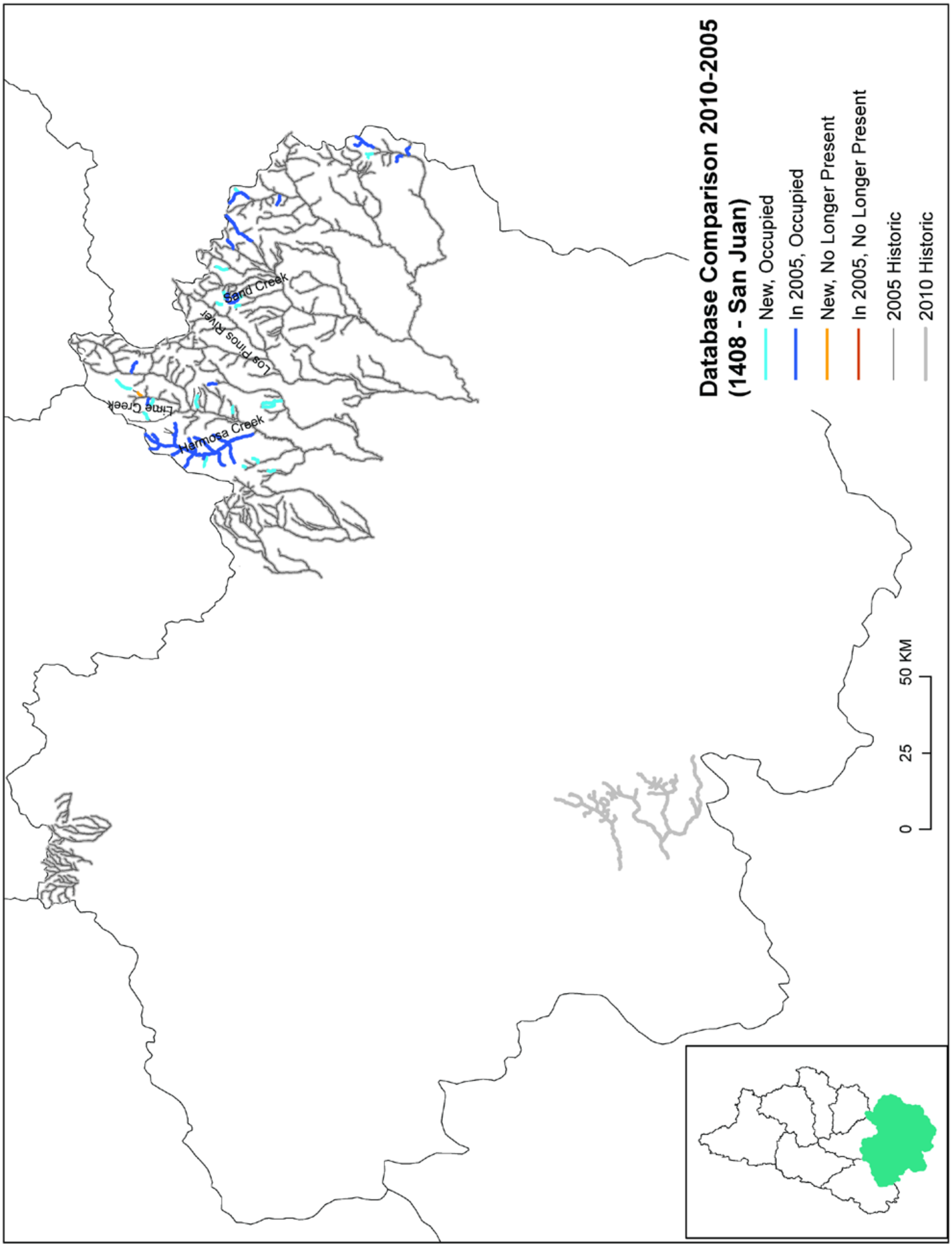

Beaver Creek
Geyser Creek
Roc Creek
Horsefly Creek
Leopard Creek
Beaver Creek
San Miguel River
Elk Creek
Goat Creek
Beaver Creek
West Dolores River
Stoner Creek
Dolores River
Rio Lado
Database Comparison
2010-2005
(1403 - Dolores)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
0
20
40 KM


Database Comparison
2010-2005
(1404 - Upper Green)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
Gypsum Creek
Chall Creek
Lead Creek
Mau Creek
Muddy Creek
North Piney Creek
Fish Creek
La Barge Creek
Spring Creek
Miller Creek
Van Tassel Creek
Willow Creek
Gilbert Creek
Sage Creek
Bush Creek
Henrys Fork
Burnt Fork
Elk Creek
Currant Creek
Sage Creek
Red Creek
Beaver Creek
Sears Creek
0
30
60 KM


Database Comparison 2010-2005
(1405 - Yampa)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
0
20
40 KM
Muddy Creek
Deep Creek
Belvidere Ditch
Roaring Fork
Oliver Creek
Coulton Creek
Elkhead Creek
Deep Creek
Willow Creek
Fish Creek
Bunker Creek
Beaver Creek
Marvine Creek
Milk Creek


0
30
60 KM
Rock Creek
Yellowstone Creek
Yellowstone River
Uinta River
Dry Fork
Ashley Creek
Dry Gulch Creek
Red Creek
Current Creek
Red Creek
Strawberry River
Timber Canyon
White River
Jump Creek
Indian Creek
Range Creek
Willow Creek
Hill Creek
West Willow Creek
Database Comparison
2010-2005
(1406 - Lower Green)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic


Database Comparison 2010-2005
(1407 - Lower Colorado)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
U M Creek
Pine Creek
0
30
60 KM


Database Comparison 2010-2005
(1408 - San Juan)
New, Occupied
In 2005, Occupied
New, No Longer Present
In 2005, No Longer Present
2005 Historic
2010 Historic
Sand Creek
Los Pinos River
Lime Creek
Hermosa Creek
0
25
50 KM