Integrated Water Quality Monitoring and Assessment Report

State of Colorado

Prepared Pursuant to Section 303(d) and Section 305(b) of the Clean Water Act

2012 Update to the 2010 305(b) Report

Prepared by: Water Quality Control Division, Colorado Department of Public Health and Environment

Executive Summary

The Colorado 2012 Integrated Water Quality Monitoring and Assessment Report summarizes water quality conditions in the State of Colorado. This report fulfills Clean Water Act (CWA) Section 305(b) which requires all states to assess and report on the quality of waters within their State. This report fulfills Colorado's obligation under the Clean Water Act, and covers the 2010-2011 two-year period.

This report provides the State's assessments of water quality that were conducted during the past five years. Specifically, it compares the classified uses of all surface waters within the State to the corresponding standards in order to assess the degree to which waters are in attainment of those standards. The Integrated Report (IR) provides the attainment status of all surface waters according to the 5 reporting categories, defined in detail within. This report also includes a description of groundwater quality activity and links to agencies involved with groundwater monitoring.

The last full comprehensive report for Colorado was written in 2002. Biennial updates were provided for 2004, 2006, and 2008. A newly designed report was written for the 2010 submittal to provide a more useful, informative tool for the public and other state and federal agencies. This 2012 submittal is an updated version of the 2010 report.

2012 Report Highlights

- New wetlands section
- Summaries by basin changed from hydrologic basin to Water Quality Standards Basins
- New Aquatic Life MMI tool and listings
- Change from FCA (fish consumption advisories) to newly adopted methods
- More in-depth coverage of Water Quality Control Division's (WQCD) programs

From the highest sand dunes in North America to 54 mountain peaks over 14,000 feet, Colorado has one of the most unique and varied natural landscapes in the entire nation. Throughout the state, there exist lush green forests, fields of vibrant wildflowers, picturesque mountain lakes, abundant grasslands and rich red rock formations. There are many places to enjoy Colorado's vast natural beauty, with four national parks, five national monuments and 41 state parks waiting to be explored. Colorado is also home to 25 scenic and historic byways, noted for their distinct qualities. They include ghost towns, ancient ruins, alpine tundra, some of the oldest trains in the West and much more.

Oh Be Joyful Creek

What's Changed from the 2010 305(b) Report Update?

New Wetlands Section	• The WQCD contracted with the Colorado National Heritage Program to compile a section covering Colorado's wetlands.
Hg Listings	• 303(d) listings for fish tissue mercury are no longer linked to the issuance of an FCA. New assessment methods have been adopted for both 303(d) listing waterbodies as well as for issuing FCAs.
MMI Tool and Bioassessments	• First time use of the WQCC's approved Multimetric Index (MMI) tool.
Basin Summaries	• Reporting by basin is now summarized by WQCC standards basins, rather than hydrologic basins.
Greater Accuracy in Waterbody Sizes	• Great improvements in National Hydrography Dataset (NHD)/Geographical Information System (GIS) layers have improved the accuracy of waterbody sizes for Colorado.

Fun Fact: *Antero is derived from the Spanish word "first", as it was the first dam on the South Platte River near the river's origin and first in storage capacity at the time of its construction. Built in 1909, the Antero Dam is an earth-filled dam. Green Lake lies submerged within the Antero Reservoir.*

C3. Colorado's Wetland Resources

This section is new to the 2012 report and provides an overview of selected U.S. Environmental Protection Agency (EPA) funded wetland projects in Colorado, primarily focused on inventory and condition assessment. This section includes seven sub-sections:

1. EPA's Core Elements Framework for a Comprehensive Wetlands Program
2. Wetland Standards and Classification
3. Wetland Inventory and Mapping
4. Rotating Basin Wetland Condition Assessments
5. Participation in the National Wetland Condition Assessment
6. Watershed Approach to Wetland Mitigation
7. Additional Wetland Resources

Many of the efforts described in this section are being conducted by agencies and organizations outside the Water Quality Control Division (WQCD). Participating agencies are specifically noted where applicable.

EPA's Core Elements Framework for a Comprehensive Wetlands Program

Wetlands are an integral component of a state's aquatic resources. They provide valuable services including storm water retention, nutrient uptake, and wildlife habitat. In 2008, EPA's National Wetlands Division developed the Core Elements Framework (CEF),[1] which includes four core elements of a comprehensive state or tribal wetlands program. The four elements are: 1) monitoring and assessment, 2) regulation, 3) voluntary restoration and protection, and 4) water quality standards for wetlands.

In Colorado, no single agency or organization oversees work on all four of the core elements, nor is there an official coalition or council that facilitates joint work on all four elements. Instead, individual state agencies or organizations focus on particular aspects.

Inventory, monitoring and assessment of Colorado's wetlands (Core Element #1) has largely been led by the Colorado Natural Heritage Program (CNHP; www.cnhp.colostate.edu), a research unit of Colorado State University (CSU). Through partnerships with other agencies and organization, data generated through monitoring and assessment informs the other three elements.

[1] Further information on the CEF can be found at: water.epa.gov/grants_funding/wetlands/cefintro.cfm.

Regulation of wetland impacts in Colorado (Core Element #2) is primarily the jurisdiction of the U.S. Army Corps of Engineers (USACOE), under Section 404 of the federal Clean Water Act (CWA) (www.nwo.usace.army.mil/html/od-tl/coloreg-home.htm). USACOE works in conjunction with EPA and numerous state agencies to process Section 404 permit applications. The WQCD provides input on Section 404 permits through the Section 401 Certification Program.

Voluntary restoration of wetland and riparian habitat (Core Element #3) is an active goal of many agencies and organizations in Colorado. The main state agency involved in this work is Colorado Parks and Wildlife (CPW), through the Wetland Wildlife Conservation Program (wildlife.state.co.us/LandWater/WetlandsProgram/), a voluntary, incentive-based program whose mission is to protect wetlands and wetland-dependent wildlife on public and private land. Each year, the CPW Wetlands Program provides ~$1.5 million in funding for direct on-the-ground wetland restoration and enhancement. In addition to CPW, numerous federal agencies and non-profits encourage the restoration and conservation of wetland habitat through direct funding, landowner education, tax incentives, and many other initiatives.

Water quality standards for wetlands (Core Element #4) were developed for Colorado by the Water Quality Control Commission in 1993. See below for more details.

Wetlands Standards and Classification

The State of Colorado recognizes wetlands under the definition of "state waters" and therefore they are subject to basic standards for water quality. Under Colorado state law, wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." This is the same definition used by both the EPA and USACOE under the federal CWA.

In 1993, the Water Quality Control Commission (WQCC or the Commission) convened a hearing to develop classifications and water quality standards for wetlands in Colorado. Fewer than 20 states across the country have taken this step. The statement of basis and purpose from this hearing is contained in WQCC Regulation 31.27.

In the hearing, a series of definitions were added to Regulation 31.5 to specify how water quality standards would apply to various kinds of wetlands (Table 13). The definitions, which include "constructed wetlands," "compensatory wetlands," "created wetlands," and "tributary wetlands," emphasize a wetland's origin and landscape position relative to other surface waterbodies. The Commission recognized that many wetlands are created by human actions, either intentional or unintentional, and that water quality may differ depending on origin. With the exception of wetlands constructed for the primary purpose of wastewater or stormwater treatment, all wetlands within Colorado are considered state waters, but applicable classifications and standards differ.

Fun Fact: *Leadville is the highest incorporated city in the United States at 10,430 feet elevation. Because there were lots of "silver" named towns at the time, the founding fathers suggested Leadville.*

Table 13. Definitions applied to wetlands in Colorado for the purpose of state water quality regulation.

Name	Definition	Applicable Classifications and Standards
Constructed Wetlands	Wetlands intentionally designed, constructed and operated for the primary purpose of wastewater or stormwater treatment or environmental remediation.	Excluded from state waters and therefore not subject to classification and standards. All applicable permits must be obtained, however, if a constructed wetland is built on a previously existing wetland.
Compensatory Wetlands	Wetlands developed for mitigation of adverse impacts to other wetlands (e.g. wetlands developed pursuant to section 404 of the federal Act).	Included within state waters and subject to, at a minimum, the classification and standards of the segments in which they are located.
Created Wetlands	Wetlands other than compensatory wetlands created in areas which would not otherwise be wetlands in the absence of human modifications. Created wetlands include, but are not limited to, wetlands created inadvertently by human activities such as mining, channelization of highway runoff, irrigation, and leakage from manmade water conveyance or storage facilities.	Included in state waters and initially subject only to narrative standards for wetlands: Reg. 31.11(1)(b).
Tributary Wetlands	Wetlands that are the head waters of surface waters or wetlands within the floodplain that are hydrologically connected to surface waters via either surface or groundwater flows. Tributary wetlands do not include constructed or created wetlands.	Included in state waters and initially subject to interim classification and numeric standards: Reg. 31.7(1)(b)(iv).
Isolated Wetlands	Wetlands that are not tributary wetlands or created wetlands. (Definition not listed within Reg. 31.5, but included in Reg. 31.27).	Included in state waters and initially subject only to narrative standards for wetlands: Reg. 31.11(1)(b).

To protect Colorado's wetland resources while minimizing disruption to the current standards, the Commission adopted a two-step process for the classification and standards application for wetlands. All tributary wetlands (except created wetlands) were initially subject to either a) standards set by baseline ambient quality, if known, or b) the classification and standards of the segment into which the wetland falls. As wetlands are not likely to be used directly as a drinking water source, the Commission exempted wetlands from the water supply classification and all standards specific to that classification. The second step would be the development and adoption of site-specific standards, potentially based on the functions of the wetland in question. For created wetlands and isolated (non-tributary) wetlands, only the narrative standards for wetlands initially apply, though site-specific standards may be adopted in the future. At the time of the hearing, the Commission specifically decided not to adopt biological criteria

as water quality standards for wetlands. The Commission also specified that wetland water quality standards should not be interpreted or applied in a manner that restricts the lawful exercise of water rights.

The Commission acknowledged in 1993 that the need to apply these standards was not expected to arise very frequently, and that has indeed been the case. The Commission did anticipate that the Division would occasionally develop site-specific standards for certain wetlands and stipulated that these would be reviewed during the Commission's triennial review of the basin in which the wetlands were located. To date, no site-specific standards have been developed and there are no plans to develop standards in the near future.

Wetland Inventory and Mapping

Total acreage of wetlands in Colorado is currently unknown. Estimates place the extent at roughly 1,000,000 acres or ~1.5% of Colorado's land area (Dahl 1990). Historically, Colorado's landscape likely supported twice the wetland acreage that exists today. It is estimated that 50% of Colorado's original wetlands have been drained and converted to farmland or urban development, or lost as a result of water diversion and storage.

In the mid-1970s, the U.S. Fish and Wildlife Service (USFWS) created the National Wetlands Inventory (NWI) to map and classify wetlands across the United States. NWI mapping protocols and classification system (Cowardin et al. 1979) are now recognized as the federal standard for wetland mapping. Colorado was one of the first states to be mapped through the NWI program. However, the state was mapped between the late 1970s and early 1980s, before widespread use of computer driven geographic information systems (GIS), when the NWI produced hard copy paper maps. Though useful on a project-by-project basis, paper maps cannot be used to calculate total acreage of wetlands or summarize wetland acreage by class. While many states have subsequently converted paper maps to a digital, geospatially rectified format, the availability of digital spatial data for wetlands in Colorado is limited.

Riparian vegetation along Saguache Creek

Since 2008, the Colorado Natural Heritage Program (CNHP) and Colorado Parks and Wildlife (CPW) have partnered with the NWI program to convert paper NWI maps into digital data that can be used in GIS analyses. This partnership began with an EPA Region 8 Wetland Program Development Grant (WPDG) and has been augmented with funding from numerous additional partners. Prior to 2008, digital wetlands data existed for <15% of the state. From 2008–2011, CNHP and CPW converted 458 quads from paper maps to digital data, bringing the total area of mapping available in 2012 to >40% of the state (Figure 1). In addition, CNHP created 62 quads of newly updated NWI mapping based on photo interpretation of 2009 color infrared imagery from the National Agricultural Imagery Program (NAIP). Updated mapping includes portions of the northern Front Range corridor and all of Park County.

There are 944,275 acres of wetlands and waterbodies mapped (Table 14) within the portion of the state that contains digital NWI data (Figure 1, areas shown as digital data or submitted). Along with wetlands, NWI mapping also includes waterbodies such as lakes, reservoirs, rivers, streams, and canals. Of the acres mapped by NWI, 10% are

lakes and reservoirs and 9% are rivers, streams, and canals. The remaining 81% (764,769 acres) are wetlands. Herbaceous wetlands comprise 69% of all wetland acres and shrub wetlands comprise 21%.

It is important to note that the definition of wetlands used by the NWI program differs slightly from the definition used by EPA and USACOE under the federal CWA and by the State of Colorado for water quality standards. The NWI definition is broader and more ecologically based than the regulatory definition. This difference is due in part to the limitations of aerial photo interpretation and in part to USFWS' interest in wetland habitat for wildlife species. The extent of wetland acreage based on NWI mapping, therefore, may differ from the extent of wetlands considered state waters.

Digital wetland mapping is available to the public through two online mapping tools. USFWS supports the NWI Wetlands Mapper (www.fws.gov/wetlands/Data/Mapper.html), where users can view and download all official NWI data. In addition, CNHP and CPW recently developed the Colorado Wetlands Inventory (www.cnhp.colostate.edu/wetlandinventory), an online mapping tool that displays Colorado NWI data plus data from several non-NWI wetland mapping projects, such as playa wetlands mapped on the eastern plains or fen wetlands mapped in the mountains.

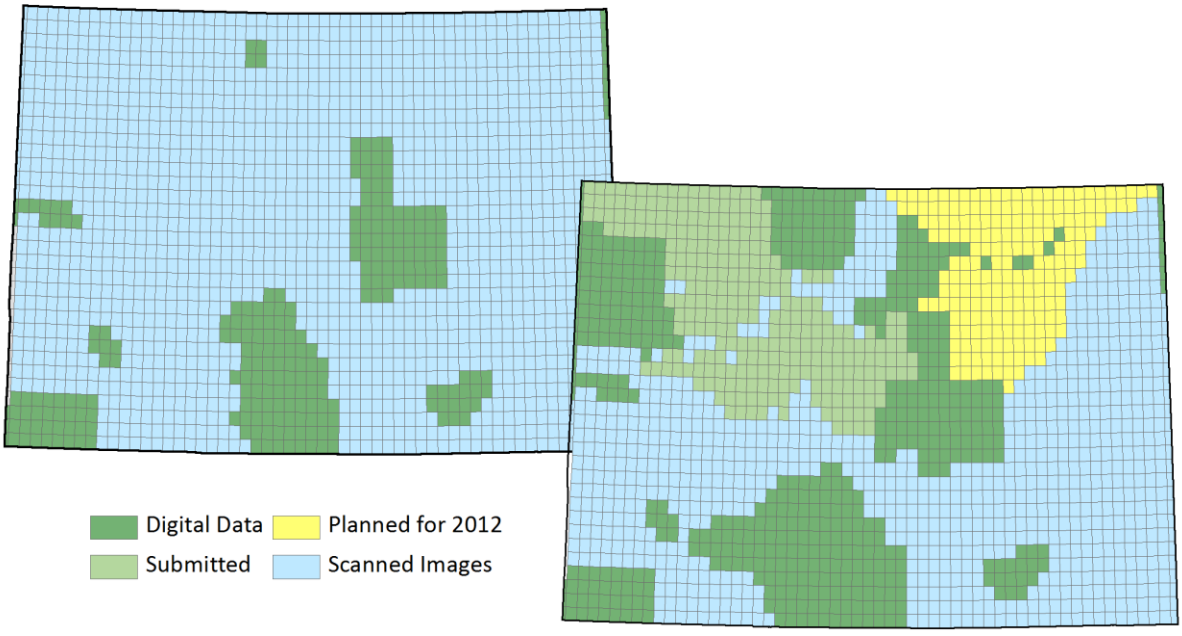

Figure 5. Status of NWI mapping for Colorado by quad. Map in upper left shows the availability of digital NWI mapping prior to 2008. Map in lower right shows current availability of digital NWI mapping, including quads recently submitted to NWI and quads planned for mapping in 2012.

Table 14. Acres of wetlands in Colorado mapped by NWI. Acreage represents wetlands only within areas of the state with digital mapping.

NWI Code	NWI System / Class	Common Name	Acres	% of Wetlands & Waterbodies	% of Wetlands (excl. Lakes & Rivers)
L1/2	Lacustrine	Lakes	95,898	10%	NA
R2/3/4	Riverine	Rivers	83,607	9%	NA
PUB/US	Palustrine Unconsolidated Bottom/Shore	Unvegetated Ponds/Shores	24,362	3%	3%
PAB	Palustrine Aquatic Bed	Vegetated Ponds	30,281	3%	4%
PEM	Palustrine Emergent	Herbaceous Wetlands	530,348	56%	69%
PSS	Palustrine Scrub-Shrub	Shrub Wetlands	164,105	17%	21%
PFO	Palustrine Forested	Forested Wetlands	15,260	2%	2%
Pf	Palustrine Farmed	Farmed Wetlands	413	<1%	<1%
Total Wetlands & Waterbodies			**944,275**	**100%**	**NA**
Total Wetlands (excl. Lakes & Rivers)			**764,769**	**NA**	**100%**

Rotating Basin Wetland Condition Assessments

EPA strongly recommends that each state monitor aquatic resources, including wetlands, using a probabilistic random sample design to make statistically valid statements about the condition of its resources. Funded by EPA Region 8 WPDGs, CNHP and CPW have partnered on a series of river basin scale wetland condition assessment projects. The objective of these projects is to provide quantitative information on the types, abundance, distribution, and condition of wetlands across Colorado. This information will be used to prioritize conservation funding through CPW's Wetlands Program, in accordance with their newly updated strategic plan (Sullivan 2011). The first project was a pilot wetland condition assessment in the Rio Grande Headwaters River Basin, which took place from 2008–2011. The second was conducted in the North Platte River Basin from 2009–2011. The third will be conducted in the lower half of the South Platte River Basin from 2011–2013. Results from the Rio Grande Headwaters and North Platte River Basins are summarized here. Details can be found in final reports on CNHP's website (www.cnhp.colostate.edu/download/reports.aspx).

CNHP and CPW plan to implement a rotating basin strategy for wetland condition assessments, beginning a new river basin study every one to two years depending on resource availability. For the purpose of these assessments, CNHP and CPW have defined ten major river basins within Colorado (Figure 5). The major river basins are modified from U.S. Geological Survey 6-digit hydrologic unit code (HUC6) basins, with smaller HUC6 basins merged with larger HUC6 basins where practical. These major river basins are similar, but not identical, to the major river basins used by WQCD for water quality reporting. For future surveys, CNHP and CPW will select river basins to study depending on partner agency interest.

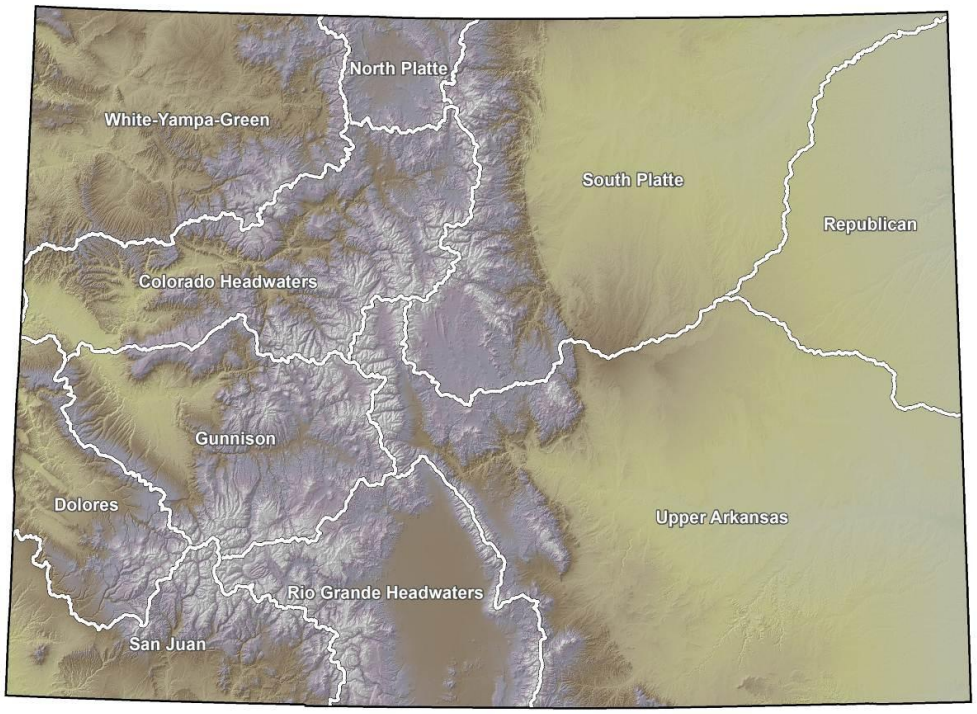

Figure 6. Major river basins used by CNHP and CPW for wetland condition assessment projects.

Protocols used in the rotating basin surveys have been developed by CNHP over the past 10 years with funding from EPA and CPW. The protocols follow EPA's Level 1-2-3 framework[2] for wetland assessment and the Ecological Integrity Assessment (EIA) framework.[3] Within EPA's Level 1-2-3 framework, Level 1 assessments are broad in geographic scope, rely on GIS or remotely sense data, and are used to characterize resources across an entire landscape. Level 2 assessments are rapid, field-based assessments that evaluate the general condition of wetlands using a suite of easily collected and interpreted metrics. Level 3 assessments involve the most intensive, field-based protocols and are the most accurate measure of wetland condition.

The EIA Framework evaluates wetland condition based on a multi-metric index. Biotic and abiotic metrics were selected to measure the integrity of key wetland attributes (Table 15). Using field and GIS data, each metric is rated according to deviation from its natural range of variability, which is defined based on the current understanding of how wetlands function under reference conditions absent human disturbance. The farther a metric deviates from its natural range of variability, the lower the rating it receives. Numeric and narrative criteria define rating thresholds for each metric. Once metrics are rated, scores are rolled up into four major categories: 1) landscape context, 2) biotic condition, 3) hydrologic condition, and 4) physiochemical condition (Table 15). Ratings for these four categories are then rolled up into an overall EIA score. For ease of communication, category scores and the overall EIA score are converted to four ranks following the ranges shown in Table 16. See detailed reports for further explanation of data collection protocols and scoring formulas.

[2] For more information on EPA's Level 1-2-3 framework, see www.epa.gov/owow/wetlands/pdf/techfram.pdf.
[3] For more information on the EIA framework, see: www.natureserve.org/publications/EPA-Wetland-Mitigation.jsp.

EIA scores should not be interpreted as water quality standards and the results presented here are not analogous to WQCD's classified use attainment categories. The current EIA protocols do not include numeric criteria for any water quality parameters. EIA metrics related to water quality (sediment/turbidity and algal growth) are based on narrative criteria that have not been reviewed or approved by WQCD or the WQCC. Any establishment of biological or ecological water quality standards for wetlands would be coordinated through WQCD, with opportunity for public comment and approval by the WQCC. The results presented here describe wetland condition in a broad, ecological context and are useful for wetland conservation and management.

Similarly, the EIA method is not a functional assessment that measures the capacity of a wetland to perform specific functions (flood abatement, nutrient uptake, sediment retention, etc.). The EIA method is an ecologically based condition assessment that evaluates key biotic and abiotic attributes to indicate overall integrity. Condition assessments assume that a wetland with excellent integrity will perform all functions expected for its class or type at the full level, but do not measure those functions explicitly. Functional assessments, in contrast, evaluate structural attributes important to the delivery functions (e.g. measuring volume to determine potential for stormwater retention).

WETLAND, BASE OF BLANCA PEAK

Table 15. EIA metrics used for the Rio Grande Headwaters and North Platte River Basin wetland assessments.

Major Categories	Key Wetland Attributes	Metrics
Landscape Context	Buffer	Average Buffer Width and Extent Buffer Condition
	Landscape Connectivity	Percent Unfragmented Landscape Riparian Corridor Continuity[1]
Biotic Condition	Community Composition	Relative Cover Native Plant Species Absolute Cover Noxious Weeds Absolute Cover Aggressive Native Species Mean C[2]
	Community structure	Regeneration of Native Woody Species[3] Interspersion of Structural Patches
Hydrologic Condition	Hydrology	Hydrologic Alteration[4] Upstream Water Retention[1] Water Diversions / Additions[1] Floodplain Interaction[1] Bank Stability[1] Beaver Activity[1,5]
Physiochemical Condition	Physiochemistry	Sediment / Turbidity Algal Growth Substrate / Soil Disturbance

[1] Metric recorded in Riverine HGM wetlands only.
[2] Mean C is a metric related to the floristic composition of the wetland. For more information, see Rocchio (2007).
[3] Only applied to sites where woody species are naturally common.
[4] Metric recorded in Non-Riverine HGM wetlands only.
[5] Only applied to sites where beaver activity is expected.

Fun Fact: *American Rivers once named the Animas River in southwestern Colorado one of the "most endangered rivers" in the United States and named La Poudre Pass Creek near Rocky Mountain National park one of the "most threatened rivers" in the United States.*

Table 16. EIA score to rank conversion and interpretation.

EIA Score Range	EIA Rank	Interpretation of Score and Rank
4.5 – 5.0	A	**Reference Condition (No or Minimal Human Impact):** Wetland functions within the bounds of natural disturbance regimes. The surrounding landscape contains natural habitats that are essentially unfragmented with little to no stressors; vegetation structure and composition are within the natural range of variation, nonnative species are essentially absent, and a comprehensive set of key species are present; soil properties and hydrological functions are intact. Management should focus on preservation and protection.
3.5 – <4.5	B	**Slight Deviation from Reference:** Wetland predominantly functions within the bounds of natural disturbance regimes. The surrounding landscape contains largely natural habitats that are minimally fragmented with few stressors; vegetation structure and composition deviate slightly from the natural range of variation, nonnative species and noxious weeds are present in minor amounts, and most key species are present; soils properties and hydrology are only slightly altered. Management should focus on the prevention of further alteration.
2.5 – <3.5	C	**Moderate Deviation from Reference:** Wetland has a number of unfavorable characteristics. The surrounding landscape is moderately fragmented with several stressors; the vegetation structure and composition is somewhat outside the natural range of variation, nonnative species and noxious weeds may have a sizeable presence or moderately negative impacts, and many key species are absent; soil properties and hydrology are altered. Management would be needed to maintain or restore certain ecological attributes.
1.0 – <2.5	D	**Significant Deviation from Reference:** Wetland has severely altered characteristics. The surrounding landscape contains little natural habitat and is very fragmented; the vegetation structure and composition are well beyond their natural range of variation, nonnative species and noxious weeds exert a strong negative impact, and most key species are absent; soil properties and hydrology are severely altered. There may be little long term conservation value without restoration, and such restoration may be difficult or uncertain.

Prior to conducting field based assessments, all paper NWI maps were converted to digital data for both the Rio Grande Headwaters and North Platte River Basins. To efficiently sample wetlands across each study area, spatially balanced, probabilistic survey designs were developed. The Rio Grande Headwaters project employed a two-stage survey design. Target watersheds were selected in the first stage and target wetland sites were selected from NWI mapping within the target watersheds in the second. To stratify sampling across the basin, watersheds were grouped into six watershed strata (labeled A–F) based on a cluster analysis of environmental variables. Watershed strata were labeled from west to east across the basin, generally following the elevation gradient from the high San Juan Mountains (A) to the San Luis Valley (D and E), with the F stratum covering the Sangre de Cristo Mountains and foothills (Figure 7). Target watersheds were selected from these strata. The North Platte project, in contrast, used a one-stage survey design stratified by ecoregion (Figure 4; Omernik 1987). In the North Platte, wetland sites were randomly selected from NWI mapping within each ecoregion, proportional to the area of the basin occupied by that ecoregion. For the North Platte basin, where flood irrigated hay production occurs across a significant portion of the landscape, wetlands mapped as irrigated lands were removed from the survey design to focus the assessment on wetlands not actively managed as hay fields. In total, 137 wetland sites were sampled in the Rio Grande Headwaters (Figure 7) and 95 were sampled in the North Platte (Figure 8a).

For Level 1 assessments, detailed profiles of wetland acreage by type, water regime, ecoregion, and land ownership were prepared for each basin. For Level 2, wetlands were assessed in the field using the EIA protocol. For Level 3, a subset of sites in both basins was surveyed with intensive vegetation protocols. In the Rio Grande Headwaters pilot

project, not all target sites were visited, which limited the statistical inference that can be drawn from the results. However, EIA scores summarized by watershed strata, paired with the proportion of wetland acres each stratum contains, illustrate the range of wetland condition within the basin. For the North Platte project, survey design-based parameters were used to estimate the range of condition across all wetland acres within the basin.

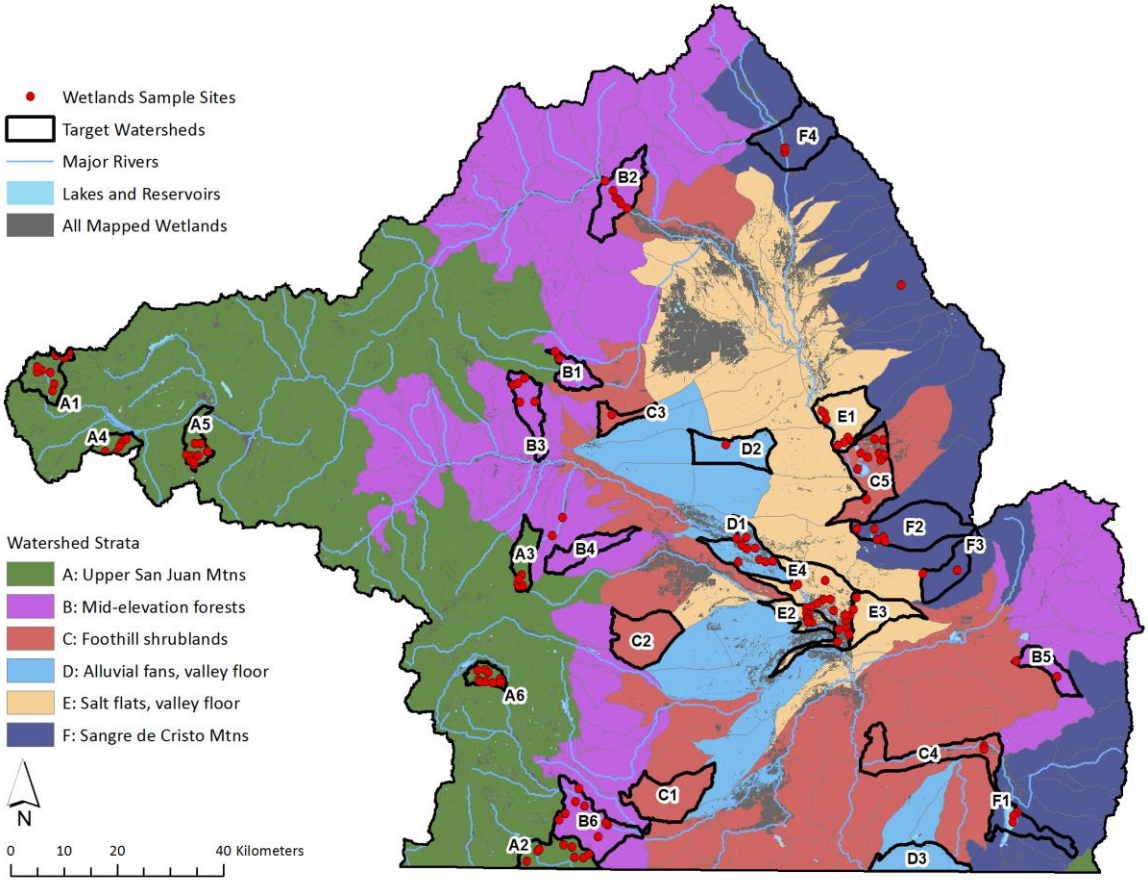

Figure 7. Watershed strata and randomly selected wetland sites sampled in the Rio Grande Headwaters River Basin

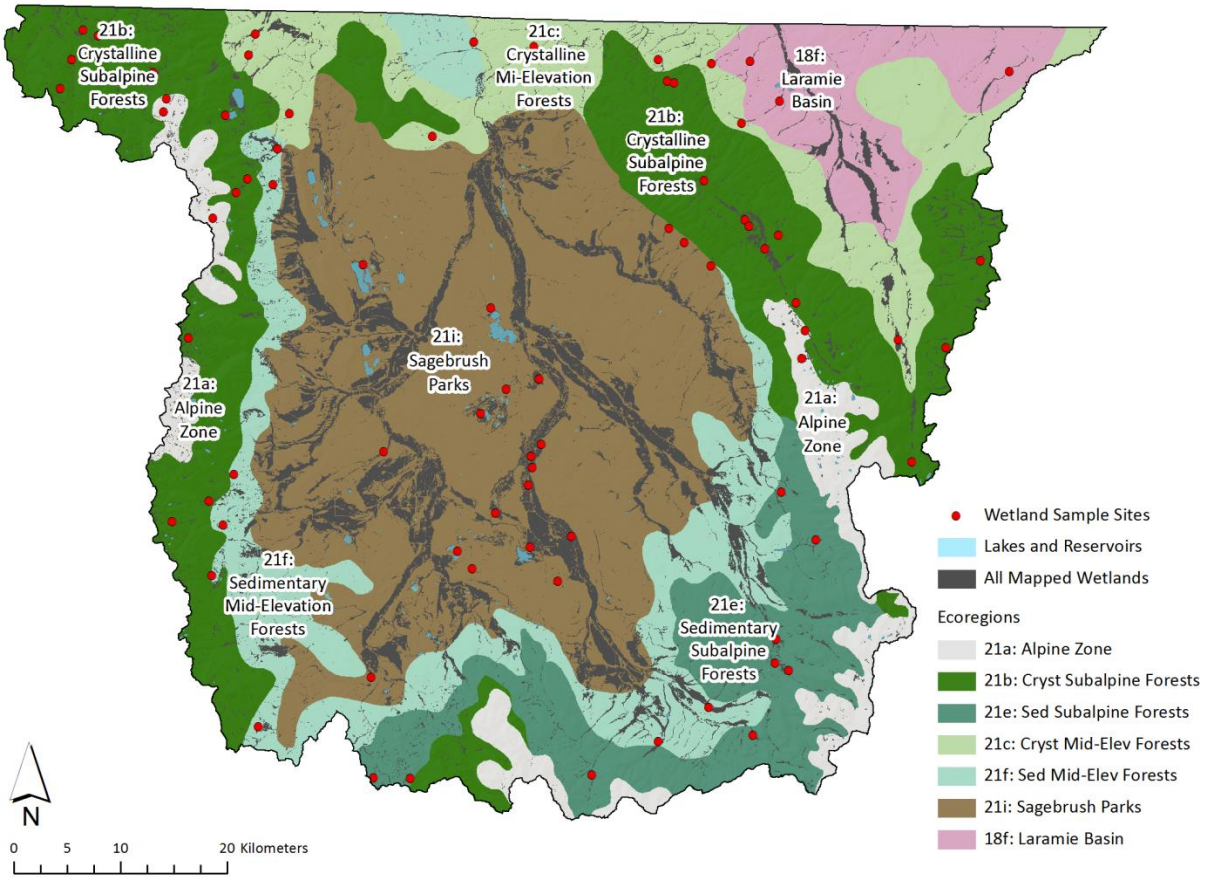

Figure 8a. Ecoregions and randomly selected wetland sites sampled in the North Platte River Basin. Eighteen sites sampled on private lands not shown.

Based on NWI mapping, there are 282,804 acres of wetlands and waterbodies in the Rio Grande Headwaters River Basin and 138,043 acres in the North Platte River Basin (Table 17). Excluding lakes and rivers, wetlands represent 6% of the land area in the Rio Grande and 10% of the North Platte. Wetland assessments were conducted in these basins because they are known to contain major wetland complexes and high priority wildlife habitat. Though mapping is not complete across the state, it is likely that wetlands comprise a smaller proportion of land area in other basins. Roughly one-third of the wetland area in the Rio Grande is mapped as irrigated lands, while over half the wetland area in North Platte is mapped as irrigated. Irrigated wetlands in active hay production were included in the Rio Grande Headwaters field assessment, but excluded from the North Platte field assessment.

NWI Wetland Type	Acres Mapped	
	Rio Grande Headwaters	North Platte
Lakes	11,607	5,046
Rivers	5,826	1,355
Unvegetated Ponds/Shores	1,738	991
Vegetated Ponds	5,490	3,321
Herbaceous Wetlands	236,553	100,880
Shrub Wetlands	20,111	26,171
Forested Wetlands	1,478	280
Total Acres of Wetlands and Waterbodies	282,804	138,043
Total Acres of Wetlands (excl. Lakes & Rivers)	265,371	131,642
Total Acres within the Basin	4,830,001	1,289,532
Percent of the Basin Mapped as Wetland	6%	10%
Percent of Wetlands Mapped as Irrigated[1]	33%	57%

[1] Irrigated lands from Colorado Decision Support System (CDSS 2009).

From field survey results, 19% of wetlands sampled in the Rio Grande received an overall EIA rank of A, 30% received a B, 41% received a C, and 10% received a D (Table 18; Figure 8). A strong elevation and geographic trend is evident in the ranks. The highest EIA ranks occurred in the mountains (A and B watersheds), with lower scores in the foothills and on the valley floor (C, D, and E watersheds). The elevation gradient is also strongly tied to land use patterns in the basin, as is the case throughout Colorado. Proportional to the wetland area they contain, the A and B watersheds were oversampled. If sampling had been proportional, EIA ranks for all wetland area across the basin would likely include more low scores.

Table 17. EIA ranks for sampled wetlands in the Rio Grande Headwaters River Basin by watershed strata. See Figure 3 for watershed strata definitions.

Watershed Strata	A	B	C	D	Total	% of Wetlands Sampled	% of Mapped Wetland Area
A	25	16	4	-	45	33%	18%
B	1	15	7	2	25	18%	6%
C	-	5	7	1	13	9%	20%
D	-	1	8	1	10	7%	11%
E	-	1	22	8	31	23%	37%
F	-	3	8	2	13	9%	7%
Total	26	41	56	14	137	100%	100%
% of Sites	19%	30%	41%	10%	100%	NA	NA

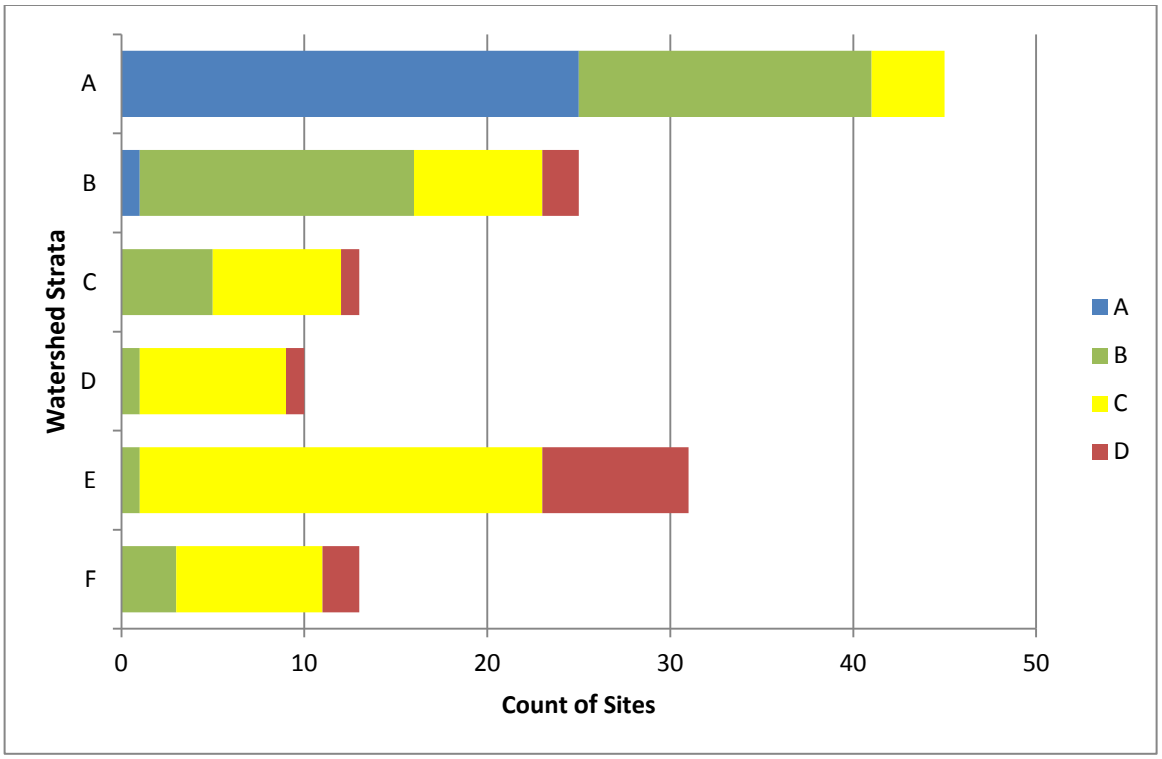

Figure 8b. EIA ranks for sampled wetlands in the Rio Grande Headwaters River Basin by watershed strata. See Figure 7 for watershed strata definitions.

In the North Platte, 45% of sites received an A rank, 42% received a B, 13% received a C and no wetlands received a D (Table 19; Figure 9). Overall scores were higher in the North Platte River Basin, which is less populated and has less intensive land use than the Rio Grande. However, the same elevation and land use gradient is evident in the North Platte. Sites in the alpine and subalpine ecoregions scored higher than sites in the central North Park valley. In the North Platte study, survey design parameters were used to extrapolate results to all non-irrigated wetland area in the basin with 95% confidence. Extrapolated results indicate that 34% of all wetland area in the basin would receive an A rank, 48% would receive a B, and 17% would receive a C (Figure 10).

Table 18. EIA ranks for sampled wetlands in the North Platte River Basin by ecoregion. See Figure 8 for ecoregion definitions.

Ecoregion	A	B	C	D	Total	% of Wetlands Sampled	% of Mapped Non-Irrigated Wetland Area
21a	5	-	-	-	5	5%	3%
21b	21	1	-	-	22	23%	19%
21e	6	3	-	-	9	9%	6%
21c	5	5	-	-	10	11%	7%
21f	5	7	-	-	12	13%	16%
21i	-	21	11	-	32	34%	44%
18f	1	3	1	-	5	5%	5%
Total	43	40	12	0	95	100%	100%
% of Sites	45%	42%	13%	0%	100%	NA	NA

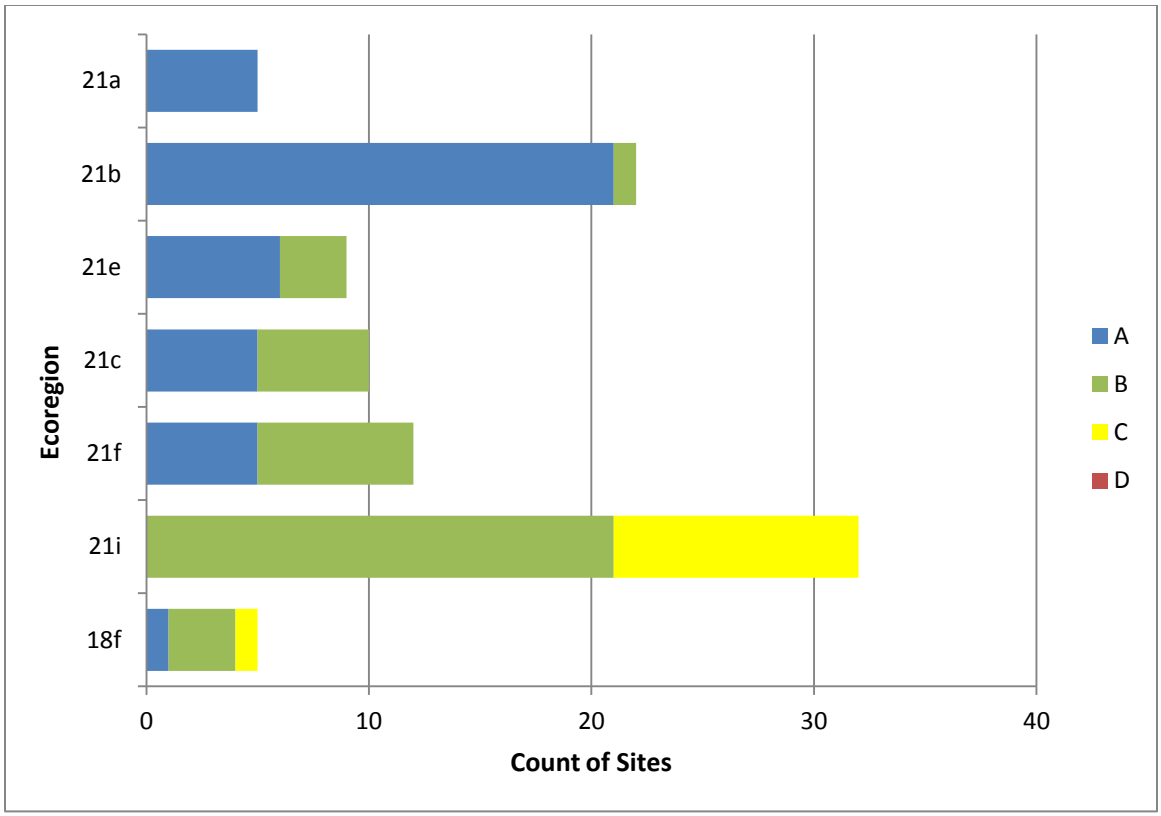

Figure 9. EIA ranks for sampled wetlands in the North Platte River Basin by ecoregion. See Figure 8 for ecoregion definitions.

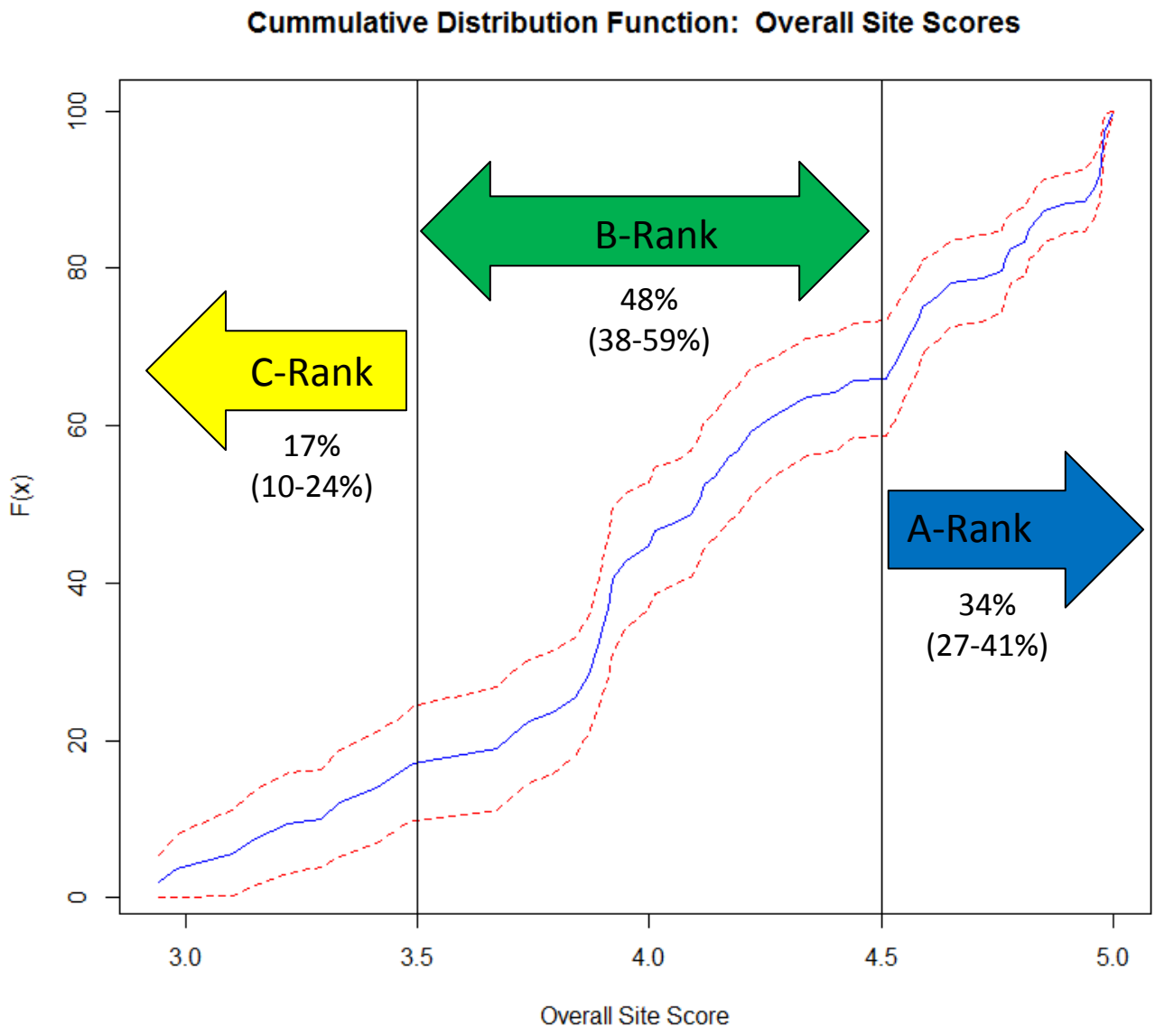

Figure 10. Cumulative distribution function of overall EIA scores and ranks for wetlands in the North Platte River Basin. Graph shows the cumulative proportion of wetland area (y axis) at or below a given EIA score (x axis). Blue solid line represents the estimate; red dashed lines represent the upper and lower 95% confidence limits.

Overall EIA scores and ranks were derived from category scores for landscape context, biotic condition, hydrologic condition, and physiochemical condition (Table 15). In general, scores were lower in the Rio Grande Headwaters than the North Platte River Basin. Most notable were differences in biotic and hydrology scores. The biotic condition category includes metrics related to vegetation composition, such as relative cover of native species, presence and cover of noxious weeds, and dominance of aggressive native species (cattails, red canary grass, etc.). In the Rio Grande, 30% of sites had no nonnative species at all and 59% of sites had less than 5% cover of nonnative species. In the North Platte, 36% had no nonnative species and 66% had less than 5% cover. Noxious weeds (as listed by the Colorado Department of Agriculture) were present in 34% of Rio Grande sites but only 21% of North Platte sites.

Twelve different noxious weed species were encountered in the Rio Grande study, while only four were encountered in the North Platte. Canada thistle was the most common noxious weed in both surveys. Aggressive native species, which can take over wetlands when high nutrient levels are present, dominated 8% of sites in the Rio Grande, but only 1% of sites in North Platte.

The hydrology category includes metrics related to water source, connectivity of water flow, and alteration of hydroperiod (frequency and duration of saturation). Water management is prevalent in both basins, as it is throughout Colorado. In the Rio Grande Headwaters, major diversions and canals move large quantities of water throughout the basin and groundwater pumping is extensive. In the North Platte, water management is more localized; smaller ditches and canals move water shorter distances for flood irrigation. Water management impacts on wetland hydrology are therefore less significant in the North Platte than the Rio Grande Headwaters.

Table19. EIA category ranks assigned to wetlands in the Rio Grande Headwaters and North Platte River Basins, shown as the percent of all wetlands sampled in each basin.

	A	B	C	D
Landscape Context Rank				
Rio Grande	22%	47%	20%	12%
North Platte	56%	39%	4%	1%
Biotic Condition Rank				
Rio Grande	21%	15%	36%	27%
North Platte	37%	28%	28%	6%
Hydrology Rank				
Rio Grande	23%	26%	31%	20%
North Platte	48%	40%	9%	2%
Physiochemistry Rank				
Rio Grande	36%	56%	8%	-
North Platte	77%	22%	-	1%

Though scores and ranks were generally lower in the Rio Grande Headwaters River Basin than the North Platte River Basin, numerous wetlands in both basins received very high scores and are in nearly pristine condition. While CNHP and CPW continue to conduct river basin scale assessments, including the upcoming study of the lower South Platte River Basin, these results will be viewed in the context of the entire state of Colorado. Results from these and subsequent surveys will help CPW prioritize restoration and conservation funding

Participation in the National Wetland Condition Assessment

With the participation of numerous state agencies, tribes, and cooperators, EPA conducted field sampling for the first National Wetland Condition Assessment (NWCA) during the summer of 2011.[4] NWCA was the fifth National Aquatic Resource Survey conducted by EPA to assess the condition of the nation's waters. Prior to NWCA, EPA carried out similar surveys of the nation's rivers, streams, lakes, and coastal areas. The purpose of NWCA was to assess the condition of the Nation's wetlands by collecting data from 900 randomly selected wetlands within the

[4] For more information on the NWCA, see: water.epa.gov/type/wetlands/assessment/survey/index.cfm.

lower 48 states. Data were collected on vegetation, soils, water quality, hydrology, and buffers within each targeted wetland. The survey employed a probabilistic random survey design that will allow the results to be extrapolated to all wetlands within the contiguous U.S.

The target population for NWCA included all tidal and nontidal wetlands of the contiguous U.S. with rooted vegetation and, when present, open water less than one meter deep. Certain farmed wetlands not currently in crop production were also sampled. The study used the broader USFWS definition of wetlands and, therefore, a wetland's jurisdictional status under state and federal regulatory programs did not affect a site's status as target.

Out of 900 randomly selected wetlands across the country, twelve were located in Colorado. A list of potential sample locations, including twelve primary sites and 36 oversample sites, was provided by EPA. Prior to field sampling, all potential sample sites were evaluated through a desktop screen and/or field reconnaissance to determine if the site met the study's target population. If a primary site did not fit within the target population, the site was replaced by the first site in the oversample list. For all sites on private property, landowner permission was obtained prior to sampling. If permission was not granted, the site was replaced by an oversample site. Applicable permits were also obtained for all sites located on public property. In addition to the random sites, four reference sites were selected in Colorado. Reference sites were handpicked wetlands known to be in good condition. Data from reference sites will help set condition thresholds for the randomly selected sites.

CNHP was contracted to carry out all site evaluation and field sampling due to its experience conducting wetland condition assessment projects. EPA provided field training in May 2011 and all members of the CNHP field team participated. Field work took place between June and September 2011 and followed EPA protocols. The four reference sites and all twelve randomly selected sites were sample at least once during the summer (Figure 11). Two random sites were sampled twice to determine intra-annual variability. All field samples were shipped to cooperating laboratories for analysis and all data have been submitted to the EPA for processing. Data analysis will take place in 2012–2013, with a final report by 2014.

SAMPLING WETLAND VEGETATION, SAN LUIS VALLEY

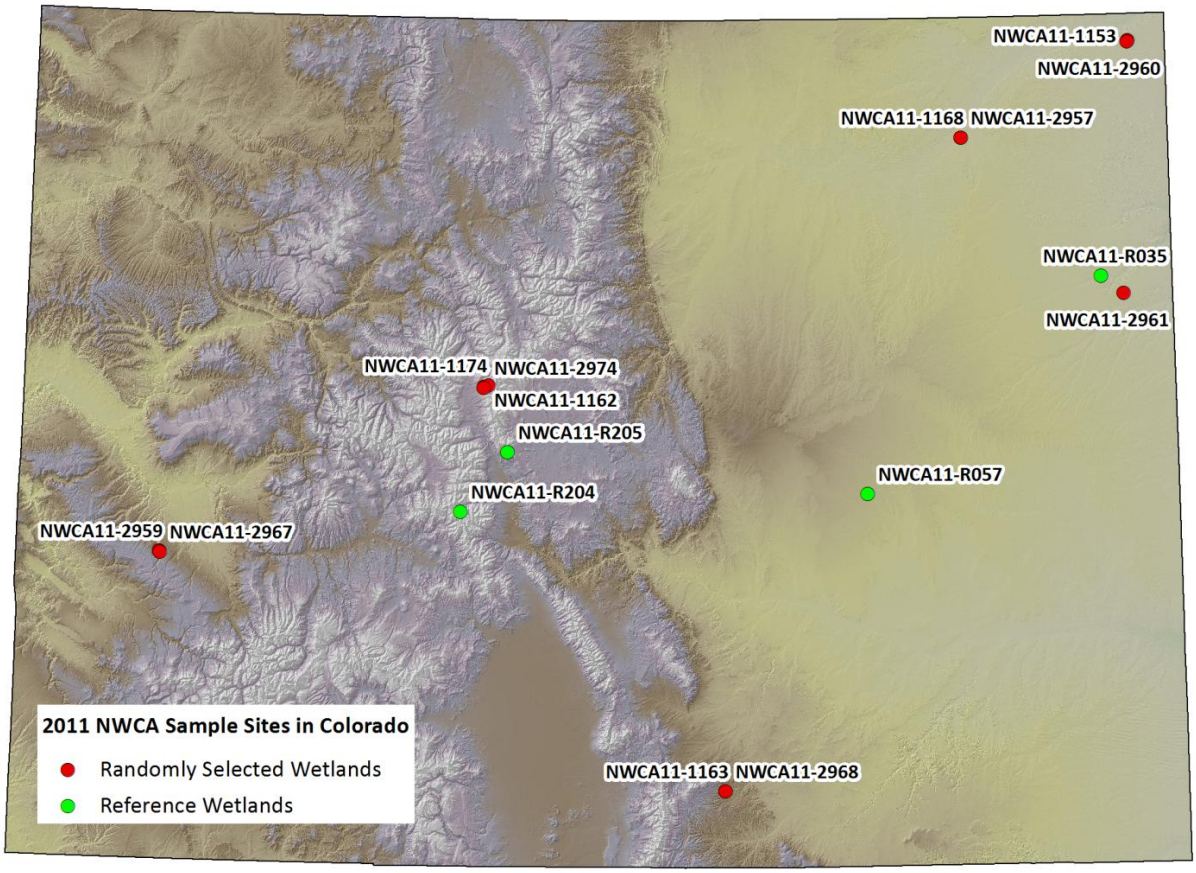

Figure 11: Wetlands sampled in Colorado through the NWCA. Several target sites occurred in neighboring pairs and appear as one site at the state scale.

Watershed Approach to Wetland Mitigation

Compensatory mitigation is required to offset wetland impacts permitted under Section 404 of the federal CWA. Out of concern that current mitigation practices are not sufficient to meet the national goal of no net loss of wetland acreage or function, the USACOE and EPA issued a federal rule to increase the effectiveness of mitigation (USACOE & EPA 2008). One of the key recommendations within the rule is for mitigation decisions to be made using a "watershed approach." Several facets of the rule allow for interpretation at the USACOE district level, but the general approach involves: (a) building program partnerships, (b) setting watershed goals, and (c) using monitoring and assessment to inform decision-making based on the established goals.

Although it requires a watershed approach to mitigation, the rule does not provide guidance on how this should be implemented. Individual states and USACOE district offices are currently defining the watershed approach within their jurisdictions. Beginning in 2008, EPA convened a working group of interested parties to outline the use of a watershed approach in Colorado. The working group was comprised of staff from USACOE's Omaha District, EPA Region 8 and Office of Research and Development (ORD), Colorado Department of Transportation (CDOT), CNHP, and Colorado State University (CSU). The working group prepared a training syllabus that describes an

assessment framework for compensatory mitigation and a series of factors that should be reviewed for a permit application under CWA Section 404. T The syllabus was formally transmitted from EPA ORD to the Omaha District in June as a proposed approach. The review factors help determine whether the location and type of proposed mitigation is in line with policy directives under the watershed approach.

Stemming from the EPA-facilitated working group, CNHP and CSU were awarded a 2009 EPA Region 8 WPDG to continue developing Colorado's watershed approach. CDOT provided matching funds. Through the WPDG, CNHP and CSU are developing a detailed manual for applying the watershed approach in Colorado. This manual fully fleshes out the permit review factors and will be available by the end of 2012 for both regulators and developers to better plan mitigation projects that advance watershed goals.

Along with the manual, the CNHP and CSU team are carrying out a pilot project along the northern Front Range corridor to demonstrate how inventory and assessment data can be used to plan better mitigation projects (Figure 9). First and foremost, the watershed approach relies on an accounting of the current wetland extent within a project's watershed. However, Colorado lacks digital wetlands data for more than half the state. Within the pilot project area, CNHP updated NWI maps using 2009 aerial photography in order to calculate the current extent and distribution of wetlands and provide a baseline for watershed-level planning. In addition to wetland mapping, the condition of 34 randomly selected wetland sites was assessed during the summer of 2011 using two separate methods, CNHP's EIA method and the Functional Assessment of Colorado Wetlands (FACWet), which is now required for use with permit applications by the USACOE's Denver Office of the Omaha District. The results of these assessments will provide a detailed accounting of wetland resources along the Front Range and will help inform future mitigation decisions.

Additional Wetland Resources

In addition to the projects described above, CNHP and partners have received EPA Region 8 WPDGs for over 15 years. Many of these grants have funded surveys to document and monitor biologically significant wetland communities and populations of uncommon wetland plants and animals, most often at the county level. Data collected through these surveys are housed in CNHP's database, which contains thousands of records throughout Colorado and allows CNHP to track areas of high biodiversity significance.[5]

CNHP is also a leading resource of information on the identification and classification of wetlands in Colorado. In 2003, with EPA funding, CNHP produced the *Field Guide to the Wetland and Riparian Plant Associations of Colorado* (Carsey et al. 2003). This 466-page publication was based on field data collected by numerous wetland scientists over more than 10 years and describes 184 plant associations found across the state. CNHP is currently in the process of developing the *Field Guide to Wetland Plants of Colorado.* This full-color field resource will include botanical descriptions of ~500 wetlands plant species found across the state. In addition to descriptions, the guide will include photographs and line illustrations, diagnostic characteristics, tips for distinguishing between similar species, and information pertaining to wildlife use.

[5] A map of counties surveyed by CNHP is available at: www.cnhp.colostate.edu/download/maps.asp#county_inventory.

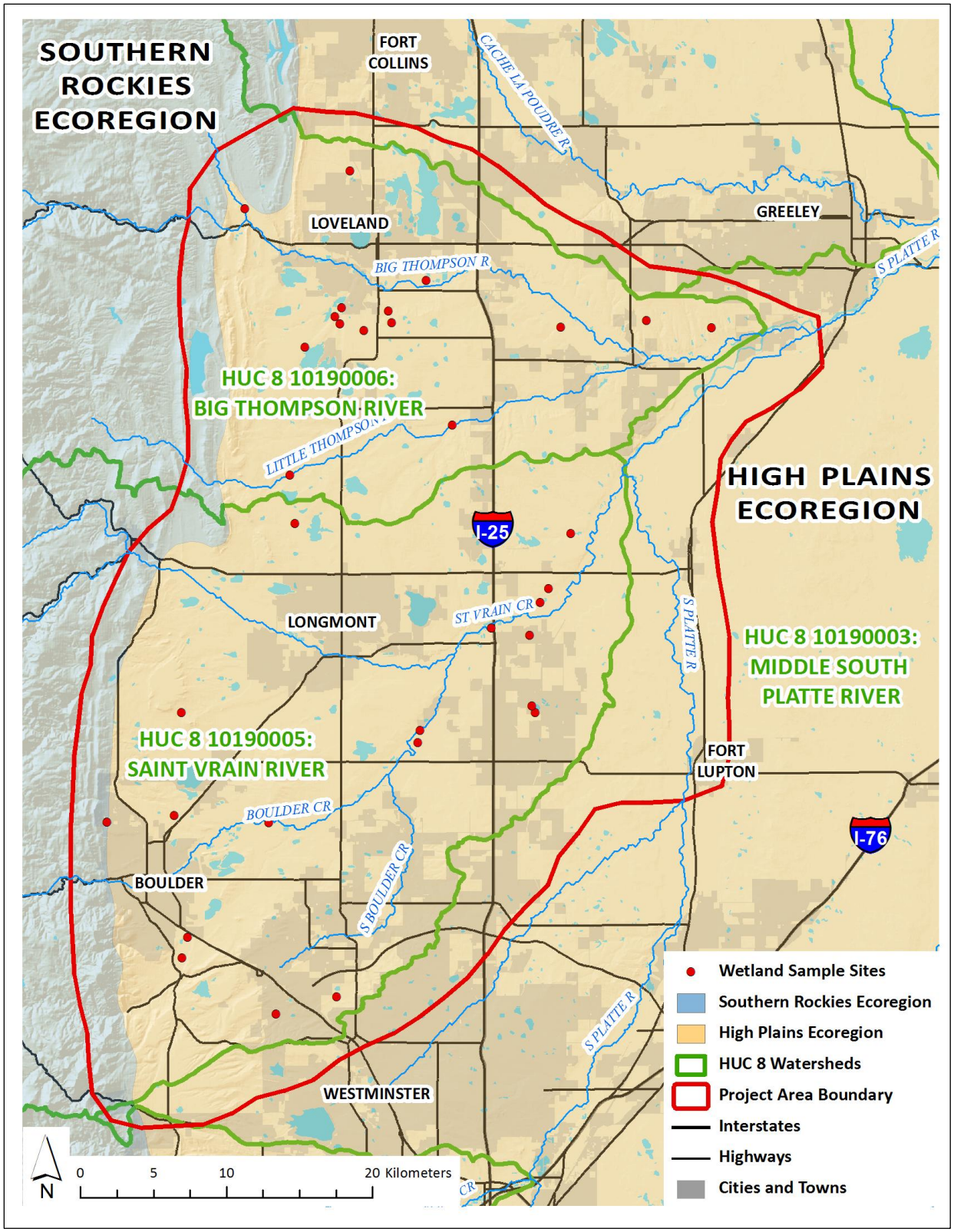

Figure 12. Front Range pilot project study area and location of wetland sites surveyed. The study area is bound to the west by the edge of the High Plains Ecoregion, to the south by HUC 8 10190005 (Saint Vrain River), to the north by HUC 8 10190006 (Big Thompson River), and to the east by Hwy 85 from Fort Lupton to Greeley.

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