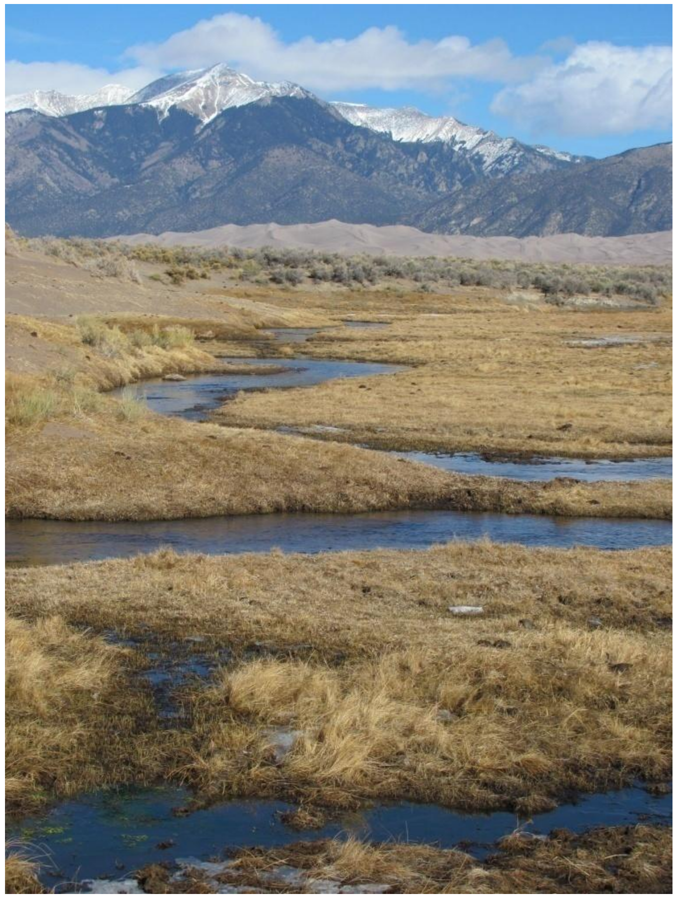
Evaluation of Big Spring Creek

Saguache County, Colorado



For its Merit in Meeting National Significance Criteria as a
National Natural Landmark

in Representing

Streams

in the Southern Rocky Mountains Province

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EXECUTIVE SUMMARY

Big Spring Creek, in Saguache County, Colorado is recommended for designation as a National Natural Landmark in the Southern Rocky Mountains biophysiographic province. The primary features of the 440 acre site represent the Streams ecological theme and Spring-fed streams sub-theme. Big Spring Creek, at its source, is an example of a perennial, spring-fed creek that flows through a sparsely-vegetated, stabilized eolian sand sheet. The site boundary encompasses Indian Spring at the creek's origin, the emergent seeps and springs that generate the surface flow of Big Spring Creek, and one mile of the creek and associated emergent wetlands. Along its course, Big Spring Creek supports an aquatic dependent wetland ecosystem in an otherwise arid landscape. The wetlands are part of a much larger complex in the larger San Luis Lakes drainage. Few spring-fed creeks exist in the area, but most are altered for irrigation. The Big Spring Creek site maintains a natural flow pattern. The surrounding uplands represent the secondary geologic theme of sand dunes. Taken together, the meandering creek and surrounding eolian landforms provide an excellent example of natural geologic and hydrologic patterns.

INTRODUCTION

Source of Site Proposal

This area was originally identified by Maar et al. (1980) as part of a comprehensive survey of potential national natural landmarks in the Southern Rocky Mountain Region. The original proposal included 2,560 acres and was titled 'Indian Springs'. This evaluation focuses on the seeps and springs that form the creek, including Indian Spring, but also includes approximately one mile of stream and the collection of characteristics associated with a spring-fed stream (Figure 4). Thus, to be more reflective of the full suite of natural features under evaluation, Big Spring Creek is the proposed site name.

Evaluator(s)

The evaluation presented here was conducted by the Colorado Natural Heritage Program (CNHP).

Scope of Evaluation

Research materials used to complete this evaluation include academic journal articles and primary literature on the stream hydrology, the geology and natural history of sand dunes, and the history of the San Luis Valley area. The statewide database maintained by CNHP, in addition to reports authored by CNHP ecologists, provided information on the biological components of the site. A site visit was conducted by the author and the Regional National Natural Landmarks [NNL] coordinator on January 19, 2012 to verify biological information and to discuss current management with Great Sand Dunes National Park and Preserve (GRSA) resource manager Fred Bunch and geologist Andrew Valdez.

PNNL SITE DESCRIPTION

Brief Overview

Big Spring Creek site is located in Saguache County, Colorado, approximately 48 kilometers (30 miles) north of the town of Alamosa (Figure 6). Although the stream is located largely within Alamosa County, the portion evaluated here is within Saguache County. The site, which includes a one-mile stretch of its course from its origination at Indian Spring, is within Great Sand Dunes National Park and Preserve, managed by the National Park Service (NPS) (Figures 4 and 5). The site is open to the public; however, it falls within the park's "Guided Learning Zone" (NPS 2007), thus visitors must be accompanied by an NPS staff member due to sensitive cultural resources present at the site. Access to the site is through the Medano/Zapata Ranch owned by The Nature Conservancy. At this time, the Ranch contains a bison herd that could pose safety concerns for unaccompanied visitors.

Natural History Themes Represented

Primary natural features of the Big Spring Creek site fit into the following themes and subthemes:

- Ecological natural history themes, Group 4, Aquatic Ecosystems:
  Theme: Streams

Sub-theme: Spring-fed streams

Primary Natural Features

Big Spring Creek is a perennial, spring-fed stream located on the western edge of the Great Sand Dunes National Park and Preserve (Figure 5). Big Spring Creek originates at Indian Spring, an emergent spring on the sand sheet west of the main dune field. At its origin, water flows from an unconfined aquifer where the water table intersects the ground surface, creating a line of seeps and springs (Rupert and Plummer 2004; Price 1996). Big Spring Creek is classified as a 'gaining stream', where groundwater discharges into the surface stream (Kresic and Stevanovic 2010). The gaining system of Big Spring Creek is unique to the area, as nearly all of the drainages in the San Luis Valley are ephemeral, or losing (Harte 2004; Neu 2005; NPS 2007). The flowpath of groundwater that forms the seeps and springs starts in the Sangre de Cristo Mountains, where two major creeks, Sand and Medano, recharge groundwater in the unconfined aquifer (Figure 5). The groundwater then flows underneath the dune field, and finally discharges to Big Spring Creek- a process that is estimated to take more than 60 years (Rupert and Plummer 2004).

Figure 1. Amphitheater head along Big Spring Creek, as a result of groundwater sapping. Photo by NPS.

This lateral emergence of groundwater out of a bank or hillslope as seeps and springs results in erosion of the surface material. This process, known as groundwater sapping, is more common on the Colorado Plateau and is the predominant mechanism of growth in the Glen Canyon region. Landforms characteristic of groundwater sapping include U-shaped stream cross-sections and amphitheater (theater-shaped) heads (Laity and Malin 1985), both are which are predominant along the upper reaches of Big Spring Creek (Figure 1).

Big Spring Creek supports an aquatic dependent wetland ecosystem. Freshwater floodplain wetlands form a band no more than 60 feet wide along the creek (Figure 3) (Sarr and Sanderson 1998). Slender spiderflower (*Cleome multicaulis*), ranked as critically imperiled by NatureServe (2012), occurs along the margin of Big Spring Creek (CNHP 1999). The occurrence is ranked by CNHP as having excellent viability (A-ranked), and estimates from field surveys range from hundreds to over one million individuals (CNHP 1999; Sarr and Sanderson 1998). Two emergent wetland plant communities tracked by the Colorado Natural Heritage Program dominate the site: Analogue sedge (*Carex simulata*) Herbaceous Vegetation and Clustered sedge (*Carex praegracilis*) Wetland. Common associate species include Nebraska sedge (*Carex nebrascensis*), roundleaf monkeyflower (*Mimulus glabratus*), water knotweed (*Polygonum amphibium*), and chairmaker's bulrush (*Schoenoplectus* *americanus*). Six state or globally rare bird species are known to visit the site: short-eared owl (*Asio flammeus*), western snowy plover (*Charadrius alexandrines*), long-billed curlew (*Numenius americanus*), black-crowned night heron (*Nycticorax nycticorax*), white-faced ibis (*Plegadis chihi*), and Forster's tern (*Sterna forsteri*) (CNHP 1999).

The sand sheet uplands above the creek are sparsely vegetated, often displaying large stretches of barren sand. Dominant shrub species are greasewood (*Sarcobatus vermiculatus*), fourwing saltbush (*Atriplex canescens*), rubber rabbitbrush (*Ericameria nauseosa*), Green's rabbitbrush (*Chrysothamnus greenei*) (Salas et al. 2010). Indian ricegrass (*Achnatherum hymenoides*) and dune scurfpea (*Psoralidium lanceolatum*) are common associates. Finally, the Big Spring Creek area is inhabited by a diverse array of arthropods: Pineda (2002) reported 1,034 arthropod species, including six endemics.

The natural features of the Big Spring Creek area are well recognized in the scientific community. A section of land around Indian Spring has also been designated the Indian Spring State Natural Area by the Colorado Natural Areas Program. It is also included within the San Luis Lakes Potential Conservation Site (PCS), a designation given by the Colorado Natural Heritage Program to identify areas and ecological processes that are necessary to support the continued existence of elements of natural heritage significance. The San Luis Lakes PCS has a biodiversity ranking of B2 (very high significance) (CNHP 1999). This rank is primarily due to the extensive wetlands found within the PCS boundary. Big Spring Creek, one of the major water sources for two natural lakes in the PCS, is critical to the viability of these wetland habitats. The San Luis Valley contains the most extensive wetland complex in Colorado, and the San Luis Lakes PCS (including Big Spring Creek), is a critical component within this ecological system.

From an ecological perspective, the groundwater/surface water interface found at spring-fed streams supports greater species diversity than the surrounding landscape (Grimm et al. 1997; Winter et al. 1998). In the arid Southern Rockies, the wetlands that occur at this interface function as critical oases for plants and animals (Grimm et al. 1997). Although a complete inventory of spring-fed creeks for the Southern Rocky Mountains biophysiographic province is not available, there are likely thousands. However, most are diverted for irrigation, public water supply, industrial, livestock, and mining. The portion of Big Spring Creek under evaluation does not contain any diversions. While Indian Springs contains a pool that was likely excavated, this modification has not degraded the quality of habitat at the site, nor the associated hydrogeologic processes. Downstream, outside the site boundaries, the water is diverted by TNC to irrigate hay meadows.

Spring-fed, perennial streams that flow through eolian sand sheets are relatively rare within the Southern Rocky Mountains. Numerous examples exist in the Great Plains (Nebraska Sandhills, including Middle Loup, Dismal, North Loup and Calamus rivers). No perennial streams exist in the following dune fields in the Intermountain West: North Sand Hills (Colorado), Killpecker Dunes (Wyoming), and White Sands (New Mexico). Most of the streams in GRSA are ephemeral, and fed by snowmelt. The following streams, however, are perennial and spring-fed: Big Spring Creek, Buck Creek, and Little Spring Creek (Figure 5). Little Spring Creek, located adjacent to Big Spring Creek, is part of the greater San Luis Lakes wetland complex. Similar site characteristics are found between Big and Little Spring creeks, however, a greater depth of ecological information is available for the former.

Figure 2. Bison skull on banks of Big Spring Creek. Photo by NPS.

Figure 3. View of Big Spring Creek and associated wetlands in winter. The rolling waves of the main dune field form a band between the creek and Mount Herard (13, 340 ft). Photo by NPS.

Secondary Natural Features

- Geological Natural History themes, Group 1, Land Forms of the Present
  Theme: Eolian Landforms
  Sub-theme: Sand dunes

Big Spring Creek flows through an eolian sand sheet located on the western edge of the Sangre de Cristo Mountains (Wurster et al. 2003). Quartz and rhyolite sand grains accumulate to form the sand dune depositional setting, and are mostly derived from the weathering of Middle Tertiary volcanic rocks of the San Juan Mountains (Johnson 1971). Sediments from the Sangre de Cristo Mountains accumulate here in smaller amounts, and are derived from gneiss, granite, and granodirorite of Precambrian Age (Johnson 1971). The sand sheet forms low-relief dunes that are stabilized by grass species such as Indian ricegrass (*Achnatherum hymendoides*) and shrubs (*Sarcobatus vermiculatus* and *Atriplex canescens*). The sheet, with an average thickness of 136 feet, consists of flat bedded sand deposits with scattered groups of parabolic dunes (NPS 2007). The prominent dunefield, located east of Big Spring Creek, contains the tallest sand dunes in North

America, some of which rise 700 feet above the valley floor (CNHP 1999; NPS 2007). The dunefield is composed of reversing dunes, transverse dunes, star dunes, and a few barchan dunes. It is estimated to contain over 5 billion cubic meters of sand (NPS 2007).

Physical Setting

Big Spring Creek is located in south-central Colorado, in Great Sand Dunes National Park and Preserve (Figures 5 and 6). The Park is situated along the eastern edge of the San Luis Valley. The valley is located toward the southern edge of the Southern Rocky Mountains biophysiographic province, as defined in the Potential NNL guidelines (NPS 2007).

The San Luis Valley is part of the downfaulted block that forms the Rio Grande Rift. Adjacent to the valley, and bounded by the Sangre de Cristo fault, the Sangre de Cristo Range represents the upfaulted block or horst that borders the rift valley. During rift formation, the San Luis and Wet Mountain Valleys dropped down as the crust arched upward, stretched, and collapsed, leaving the Sangre de Cristo Range as a remnant of this uplift (Lindsey 2010). Geophysical surveys indicate the original downfaulted block of the San Luis Valley is now topped by more than 3 miles of sediment fill.

The seeps and springs that form Big Spring Creek occur on an eolian sand sheet. The sheet originated when sand from dry lakebeds in the valley was blown by prevailing southwest winds toward a low curve in the Sangre de Cristo Mountains. Here, the wind funnels toward three mountain passes, and the sand accumulates in this natural pocket. The winds generally blow from the valley floor toward the mountains, but during storms the winds blow back toward the valley, and these opposing wind directions cause the dunes to grow vertically. Runoff from creeks draining the mountain watershed above the dunes captures and returns sand that has blown from the valley floor, carrying it around the edge of the dune field and depositing it where it can again be picked up by the wind and carried into the main dune field. This recycling action of water and wind contributes to the great height of the main dune field. The active dune field is stabilized by opposing wind directions (southwestly and northeasterly), creeks that recycle sand back into it, and a 7% moisture content below the dry surface. The base of the sand sheet is marked by a gradual change to clay-rich fluvial-lacustrine sediments of the Alamosa Formation (HRS Water Consultants 1999). Two aquifers exist in the unconsolidated layers of gravel, sand and clay that comprise the Alamosa Formation at GRSA. One is shallow and unconfined, the other deeper and confined. Big Spring Creek is fed by groundwater from the unconfined aquifer.

The San Luis Valley is Colorado's largest and driest mountain park. Perennial water sources, such as Big Spring Creek, are therefore ecologically significant (Essington 1996). Average annual precipitation at the GRSA headquarters (elevation 8,170 ft) is 11.18 inches (NPS 2010). Convective thunderstorms associated with southwest monsoonal flow between July and September supply approximately 60% of the total annual precipitation to the San Luis Valley (Huntley 1976). Bitter cold winters and cool summers characterize the climate of the GRSA. Summer temperatures average 65°F, and winter temperatures average 19°F (Fryberger 1990). The highest and lowest recorded temperatures, 96°F and -25°F, were recorded on June 29, 1982 and January 13, 1963, respectively (NPS 2010).

Land Use and Condition

The dynamic, shifting sands in the Big Spring Creek area have revealed an incredibly rich concentration of archaeological resources. Artifacts from nearby dig sites indicate the area was first inhabited by Clovis and Folsom peoples from 10,500 to 11,000 years before present (Wolf 1995). Successive cultural groups from Paleoindian, Archaic, and Late Prehistoric cultural stages were primarily big-game hunters that supplemented their diets with small game and wild plants (Geary 1997; Martorano et al. 1999). More recently (500-2,000 years ago), Ute and Jicarilla Apache people were present in the area on a seasonal basis. Northern Pueblo, Navajo, and Comanche people also hunted in the valley.

Spanish explorers first visited the San Luis Valley in the late 16th century, likely passing near present-day San Luis Lakes- the endpoint for Big Spring Creek (Geary 1997). First settlements, called plazas, were not established until 1849 (Trujillo 1976). The Spanish settlers relied on subsistence agriculture, irrigation, and sheep grazing. In 1912, the 27,000 acre Medano Ranch was acquired by George W. Linger (Gulliford 2005). The Big Spring Creek site was leased from the state of Colorado as a cattle ranch by the Linger family until 1948 (pers. comm. to Bob Linger). Successive lessees grazed cattle at the site, until the GRSA gained ownership in 2009 through a land exchange with the State of Colorado (State of Colorado 2009). Great Sand Dunes National Monument was established in 1932. The Great Sand Dunes Wilderness Area was established in 1976, and includes most of the original monument. The Great Sand Dunes National Park and Preserve Act was signed in 2000, officially designating the lands as a National Park. At present, no bison or cattle use the site, and elk visit the site in large numbers.

The site is located within a Guided Learning Management Zone within GRSA. The focus of this zone is protecting sensitive resources; therefore, on-site opportunities for learning about the resources are through guided interpretive and educational tours (NPS 2007). Thus visitation and use of the area is relatively low and regulated.

Threats

Hydrological alteration is the primary threat to the groundwater, creek, and associated wetlands at Big Spring Creek. The Closed Basin Project, located immediately northwest of the site, began pumping groundwater from the unconfined aquifer and transporting it to the Rio Grande in the late 1980s (CNHP 1999). Currently, there is a network of over 132 wells that are used by the Rio Grande Water Conservation District to measure water level or pressure data from both the confined and unconfined aquifers (Rio Grande Water Conservation District 2012). The data that are retrieved from these measurements are used to operate the Closed Basin Project within the limits that are prescribed by the authorizing legislation. The Project maintains a senior water right to GRSA, but is limited to 83,000 acre feet per year (Rio Grande Water Conservation District 2012).

On August 4, 2008, a decree was signed entitling the National Park Service to an absolute water right to appropriate in-place all unappropriated groundwater in the unconfined aquifer beneath the Park (Harte 2011). The water right entitles NPS to specific water levels at 10 monitoring wells located near the western boundary, including one at Big Spring Creek. This action allows the park to challenge any changed or expanded use of an existing water right and new rights junior to the

Park, thereby offering protection of groundwater levels important to maintaining the hydrologic conditions at Big Spring Creek (Harte 2011).

Sensitive or Hazardous Resources

The Big Spring Creek area has a very long and rich human history, dating from the Folsom around 10,500 years (Martorano et al. 1999). Sensitive archaeological resources are present at the site. However, the incidence of unintentional or incidental damage is likely low, as the access to the site is through a locked gate, and all visitors must be accompanied by an NPS staff member (NPS 2007). The site is defined by the Park as a "Guided Learning Zone" (NPS 2007).

The unpaved access road to the creek is owned by The Nature Conservancy [TNC]. At this time, a bison herd managed by TNC grazes along the road, which could pose a safety threat to visitors if the "Guided Learning Zone" restrictions are lifted.

COMPARATIVE ASSESSMENT

Regional Site Inventory

There are no known sites within the Southern Rocky Mountains biophysiographic province that share all of the features of Big Spring Creek, i.e., a spring-fed, perennial, gaining creek associated with eolian sand dunes. Similar eolian systems found within the Southern Rocky Mountains biophysiographic region include the North Sand Hills (Colorado) and the Killpecker Dunes (Wyoming); however, there are no perennial streams present. In GRSA, several creeks are charged, at least in part, by groundwater, and flow over the eolian sand sheet (Table 1; Figure 5) and thus are considered in the comparative analysis.

Table 1. Spring-fed (groundwater-fed) streams that flow over an eolian sand sheet in the Southern Rocky Mountains biophysiographic province.

Rank	Name	County, State	Comments
1	Big Spring Creek	Saguache, CO	Federal NPS Groundwater fed, gaining, perennial. Found on eolian sand sheet. Not diverted at source.
2	Buck Creek	Alamosa, Saguache, CO	Federal USFS, NPS Groundwater fed, gaining, perennial. Major seeps and spring not located on eolian sand sheet, empties

			into Medano Creek at sand sheet. Not diverted at source.
Rank	**Name**	**County, State**	**Comments**
3	Deadman Creek	Saguache, CO	Federal NPS, USFS, Private Dependent on groundwater and surface water, losing, ephemeral. Irrigation diversions along creek. Source is not on eolian sand sheet.
4	Medano Creek	Alamosa, Saguache, CO	Federal NPS Dependent on groundwater and surface water. Losing, ephemeral. Irrigation diversions along creek. Found on eolian sand sheet.
5	Sand Creek	Alamosa, Saguache, CO	Federal NPS Dependent on groundwater and surface water. Irrigation diversions along creek. Losing, ephemeral. Found on eolian sand sheet.

Site Descriptions

Buck Creek

Buck Creek straddles the Alamosa, Saguache county line in southern Colorado. It originates in the Sangre de Cristo Mountains, and flows through the Rio Grande National Forest [RGNF] and GRSA. Buck Creek, like Big Spring Creek, is a gaining, perennial stream, which is unusual in the region (Table 1). Groundwater discharged as fault springs is responsible for the flow of the creek. Hydrologic studies at Buck Creek show that the water table is sloping opposite to the surface allowing the groundwater to resurface as springs on the hill side. This groundwater is feeding the lower portion of Buck Creek, which allows the stream to flow year round (Neu 2005). No emergent wetlands have been documented at Buck Creek. Forested wetlands are present at the site, and are classified as Narrowleaf Cottonwood Temporarily Flooded Wetlands (Salas et al. 2010). Only a small stretch of Buck Creek reaches the eolian sand sheet at GRSA (Neu 2005). No diversions are present on Buck Creek (Colorado Water Conservation Board 2012).

Deadman Creek

Deadman Creek is located in Saguache County in southern Colorado. It originates in the Sangre de Cristo Mountains, and flows west through the RGNF, GRSA, and private lands. Seepage investigations of measured reaches upstream to downstream have classified Deadman Creek as a losing stream (Harte 2004). The creek is ephemeral, and depends largely on snowmelt from the mountains, although groundwater contributes a small portion of the flow. Although the creek flows over the eolian sand sheet at GRSA, no emergent wetlands have been documented at the site (CNHP 1999). Diversions are present on the upper and lower reaches of Deadman Creek (Colorado Water Conservation Board 2012).

Medano Creek

Fed by numerous tributaries, Medano Creek flows from the Sangre de Cristo Mountains and around the dunefield along the eastern and southeastern borders of GRSA. It disappears beneath the sand in the southern portion of the sand sheet where it deposits its load of sediment (NPS 2007). The water-borne transport of sand by Medano Creek is a key part of the eolian/hydrologic process that forms and maintains the Great Sand Dunes. Classified as a losing stream, it relies on spring runoff from snow melt in the Sangre de Cristo Mountains, although groundwater contributes a small portion of the flow (Harte 2004). In dry years, the stream is ephemeral. Forested wetlands are present at the site, and are classified as Narrowleaf Cottonwood Temporarily Flooded Wetlands (Salas et al. 2010). Two irrigation ditches exist in the headwaters of Medano Creek (NPS 2007).

Sand Creek

Sand Creek flows out of the Sangre de Cristo Mountains onto the sand sheet, bisecting the GRSA. The instream flow of the creek is charged largely by snowmelt from the mountains, although groundwater contributes a small portion of the flow (Harte 2004). Results from a seepage investigation study indicate that from upstream to downstream in measured reaches, Sand Creek is a losing stream (Harte 2004). All the water in Sand Creek, except what is lost to evapotranspiration, infiltrates into the shallow unconfined aquifer (Rupert and Plummer 2004). Several wetland plant communities have been classified along Sand Creek, including Coyote Willow Temporarily Flooded Shrublands, Interdunal Swale Wetlands, and Narrowleaf Cottonwood Temporarily Flooded Wetlands (Salas et al. 2010). Diversions are present on the upper and lower reaches of Sand Creek (Colorado Water Conservation Board 2012).

Comparative Analysis and Discussion

Big Spring Creek, and the four sites described above provide examples of streams that are, at least in part, fed by groundwater (spring-fed). The following provides a comparative assessment of these sites in respect to the five NNL Program significance criteria (Illustrative Character, Present Condition, Diversity, Rarity and Value for Science and Education.)

Big Spring Creek, Buck Creek, Deadman Creek, Medano Creek, and Sand Creek all receive varying amounts of flow from the unconfined aquifer in the area. At Buck Creek, groundwater is forced to discharge as fault springs midway down Buck Creek's drainage basin (Neu 2005). Deadman, Medano, and Sand Creeks receive some amount of groundwater, but are largely fed by runoff from higher elevation snowmelt in the Sangre de Cristo Mountains. Conversely, Big Spring Creek is almost entirely spring-fed, from its origins around Indian Springs, down through the one-mile stretch covered in this evaluation. Results from 2010 flow data report steady flows, with an average daily discharge of approx. 6 cubic feet per second at the site (Colorado Division of Water Resources 2012). Furthermore, Big Spring Creek's constant source results in a non-flooding creek with regular, year-round flow. This combination of well-developed components, make Big Spring Creek particularly illustrative of the characteristics associated with spring-fed streams.

Present condition varies among the five streams. Deadman, Medano, and Sand Creeks receive groundwater flow, but are still ephemeral, losing streams. In dry years, these creeks recede toward the Sangre de Cristo Mountains. Diversions are present on all three of these streams (Colorado Water Conservation Board 2012). Buck Creek, classified as a perennial, gaining stream, is relatively unaltered and maintains a natural flow with no diversions. Thus Big Spring Creek and Buck Creek are fairly similar with regards to their present condition. However, the long-term protection of the hydrologic processes of Big Spring Creek, and thus is continued natural conditions, are well secured given that appropriation of all groundwater in the unconfined aquifer beneath the park and upstream from Big Spring Creek now belong to GRSA.

In a comparison of the secondary criteria (Diversity, Rarity and Value for Science and Education), all of the creeks listed in Table 1 occur on the same eolian sand sheet within GRSA. Large stretches of Deadman, Medano, and Sand Creek flow over the sand sheet, creating a diverse life zone on the otherwise arid landscape. Buck Creek, however, empties into Medano Creek just as it reaches the sand sheet. Few studies have been conducted on the ecological significance of Buck Creek. Narrowleaf Cottonwood Temporarily Flooded Wetlands occur at the site, but no other information exists on rare plants, animals, or plant communities at the site. The unique life zones created by the sand sheet wetlands present at Big Spring Creek are not found on Buck Creek.

Sand Creek and Big Spring Creek both contain emergent wetlands. The wetlands at Sand Creek are very limited, and cover an estimated area of three acres. The Big Spring Creek emergent wetlands extend miles downstream from the source, forming a complex of wetlands with Little Spring Creek in the greater San Luis Lakes area. The freshwater floodplain wetlands of Big Spring Creek support one critically-imperiled plant species, and provide important habitat for six state or globally rare bird species and a diverse array of arthropods, six of which are endemics.

The unique geological and hydrological conditions at this site are well recognized by the scientific and conservation communities as evidenced by the existing biodiversity and natural area designations of the site. It is a well studied system and receives much attention from researchers.

In summary, the primary natural feature of spring-fed stream is best represented by Big Spring Creek. Buck Creek is a high quality, undiverted, spring-fed stream within GRSA; however, it does not support the high quality emergent wetlands found at Big Spring Creek. More studies are needed to determine the biological resources at Buck Creek. The secondary feature of eolian landform (sand dunes) is present at all but one of the comparison creeks (Table 1). Buck Creek reaches the sand sheet, but empties into Medano Creek. The diverse and rare features found along Big Spring Creek, all set within the context of an active dune system, make the area valuable for science and education. Additionally, the protections afforded to the site from its location within the park and the recent acquisition of the groundwater rights, provide for the long-term protection of these resources.

EVALUATION RECOMMENDATIONS

The Big Spring Creek site qualifies for designation as a National Natural Landmark.

Summary Significance Statement

Big Spring Creek is unique in the Southern Rocky Mountains biophysiographic province as a spring-fed, gaining stream formed by groundwater discharging from an unconfined aquifer. The stream flows out over an eolian sand sheet, forming emergent wetlands that support a diversity of rare species and plant communities in an otherwise arid landscape. No diversions are present within the site boundaries, and the creek maintains a natural flow pattern within the site boundaries. The meandering creek provides an excellent example of natural geologic and hydrologic patterns.

Proposed Landmark Boundary and Ownership Maps

The proposed landmark boundary (Figure 4) is drawn along quarter section lines encompassing Big Spring Creek, from its origin at Indian Spring, downstream approximately one mile to the Alamosa County line. The following is a description of the Township, Range, Section, Quarter Sections of Quarter Sections:

- T41N, R12E, S34, SE¼ of NE ¼
- T41N, R12E, S34, NE¼ of SE¼
- T41N, R12E, S34, SE ¼ of SE¼
- T41N, R12E, S34, SW¼ of SE¼
- T41N, R12E, S35, NE¼ of NW¼
- T41N, R12E, S35, NW¼ of NW¼
- T41N, R12E, S35, SW¼ of NW¼
- T41N, R12E, S35, NW¼ of SW¼
- T41N, R12E, S35, NW¼ of NE¼
- T41N, R12E, S26, SW¼ of SE¼
- T41N, R12E, S26, SE¼ of SW¼

The boundary encompasses 440 acres, and is located entirely within the Great Sand Dunes National Park and Preserve.

Natural Landmark Brief

Name: Big Spring Creek

Location: Saguache County, Colorado

Description:

Big Spring Creek, located on the western edge of the Great Sand Dunes National Park and Preserve, is an example of a perennial, spring-fed stream (Figure 5). Big Spring Creek originates at Indian Spring, an emergent spring on the sand sheet west of the main dune field. At its origin, water flows from an unconfined aquifer where the water table intersects the ground surface, creating a line of seeps and springs (Rupert and Plummer 2004; Price 1996). Big Spring Creek is classified as a 'gaining stream', where groundwater discharges into the surface stream (Kresic and Stevanovic 2010). The gaining system of Big Spring Creek is unique to the area, as nearly all of the drainages in the San Luis Valley are ephemeral, or losing (Harte 2004; Neu 2005; NPS 2007). Groundwater sapping, a geomorphic process in which groundwater laterally emerges out of a bank as seeps and springs eroding the surface material, occurs along Big Spring Creek. Amphitheater heads, more common in the Colorado Plateau region, form as a result (Figure 1). The stream flows out over an eolian sand sheet, forming emergent wetlands that support a diversity of rare species and plant communities in an otherwise arid landscape.

Big Spring Creek supports two emergent wetland plant communities tracked by the Colorado Natural Heritage Program dominate the site: Analogue sedge (*Carex simulata*) Herbaceous Vegetation and Clustered sedge (*Carex praegracilis*) Wetland. These plant communities form a band no more than 60 feet wide along the creek (Sarr and Sanderson 1998). Slender spiderflower (*Cleome multicaulis*), ranked as critically imperiled by NatureServe (2012), occurs along the margin of Big Spring Creek (CNHP 1999). Six state or globally rare bird species are known to visit the site: short-eared owl (*Asio flammeus*), western snowy plover (*Charadrius alexandrines*), long-billed curlew (*Numenius americanus*), black-crowned night heron (*Nycticorax nycticorax*), white-faced ibis (*Plegadis chihi*), and Forster's tern (*Sterna forsteri*) (CNHP 1999).

Significance:

Big Spring Creek is unique in the Southern Rocky Mountains biophysiographic province as a spring-fed, gaining stream formed by groundwater discharging from an unconfined aquifer. The stream flows out over an eolian sand sheet, forming emergent wetlands that support a diversity of rare species and plant communities in an otherwise arid landscape. No diversions are present within the site boundaries, and the creek maintains a natural flow pattern within the site boundaries. The meandering creek provides an excellent example of natural geologic and hydrologic patterns.

Ownership: Federal

Designation:

Evaluation: Bernadette Kuhn, Colorado Natural Heritage Program

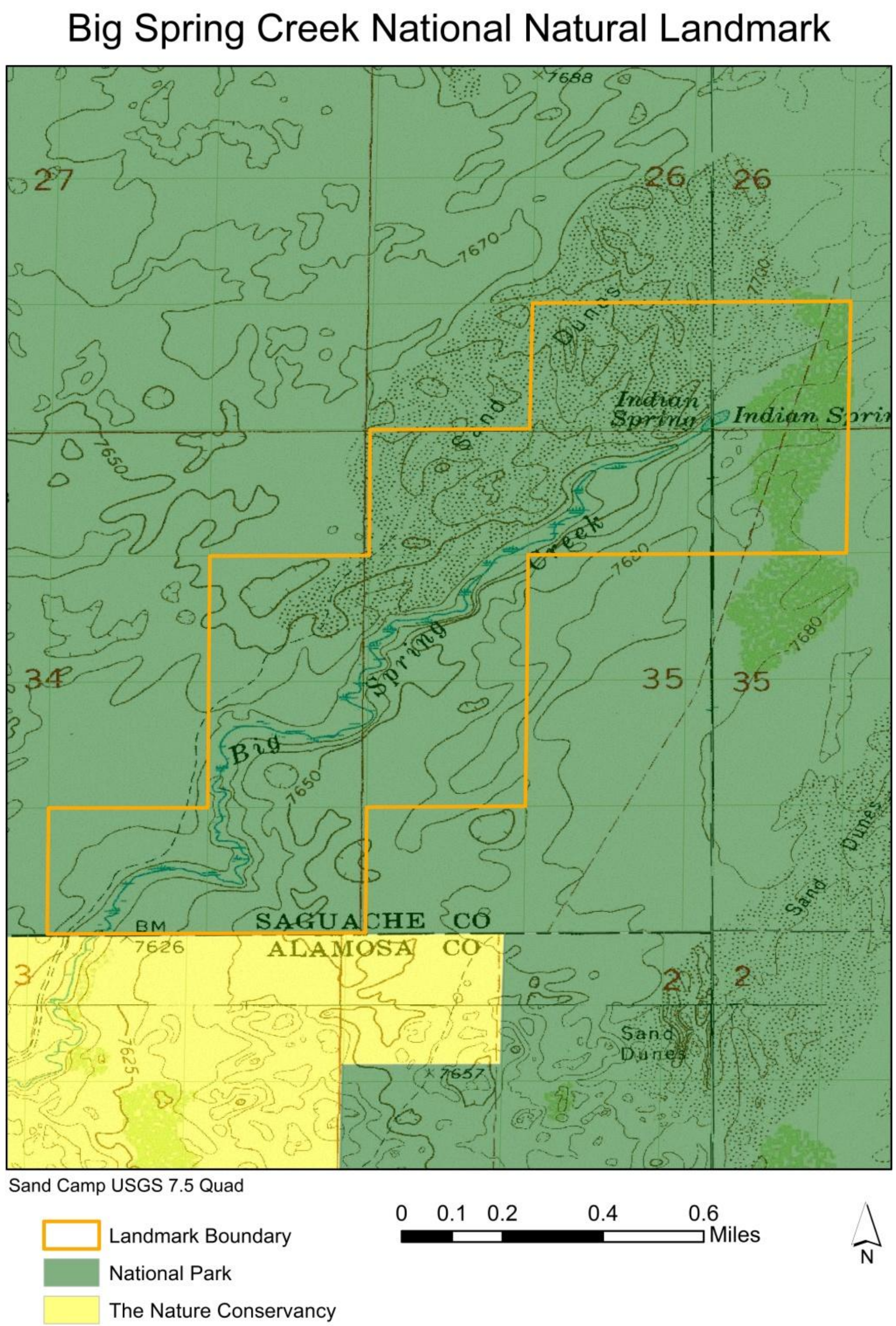

Figure 4. Proposed boundary and land ownership of Big Spring Creek site.

Great Sand Dunes National Park and Preserve

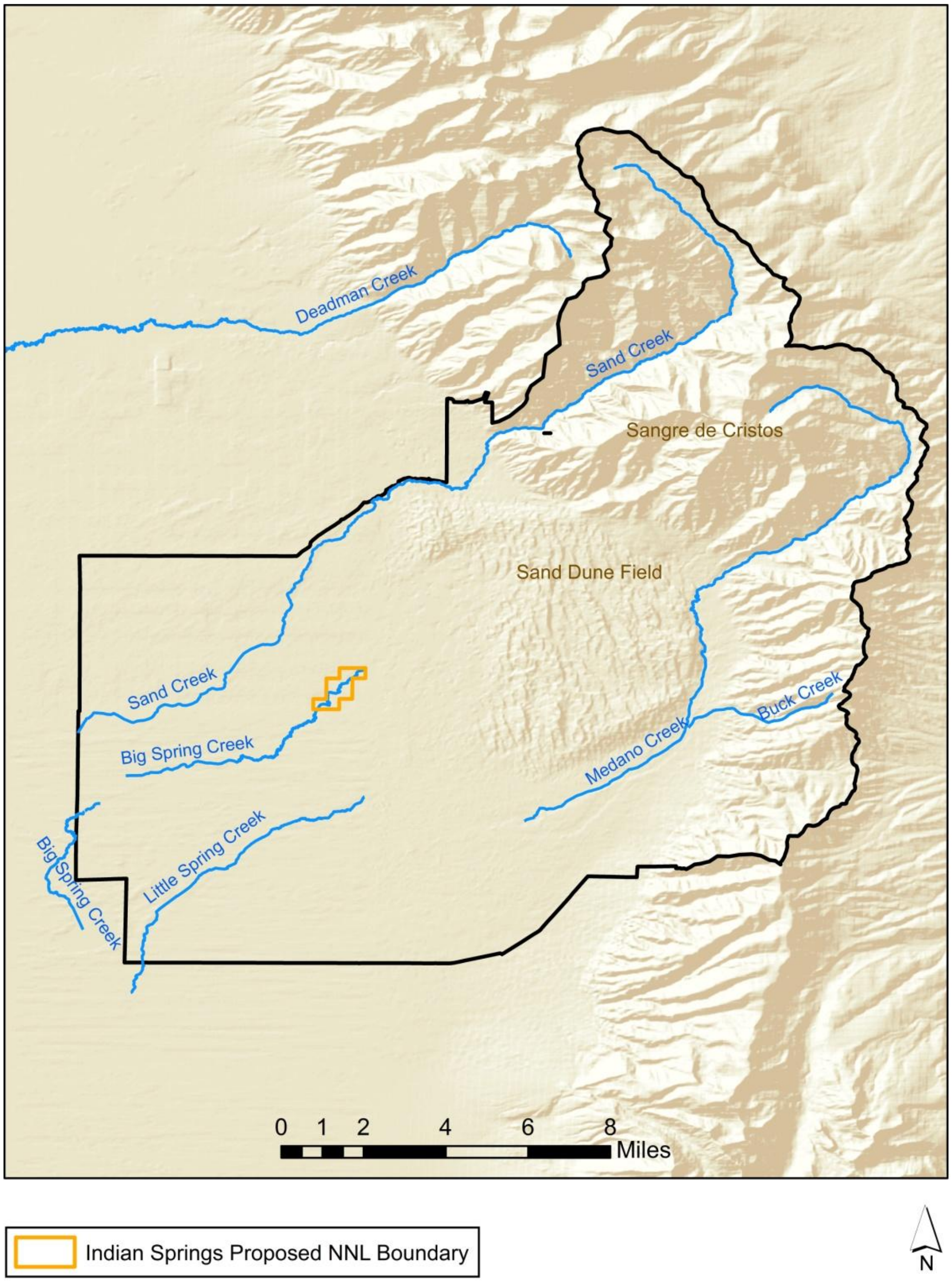

Figure 5. Great Sand Dunes National Park and Preserve.

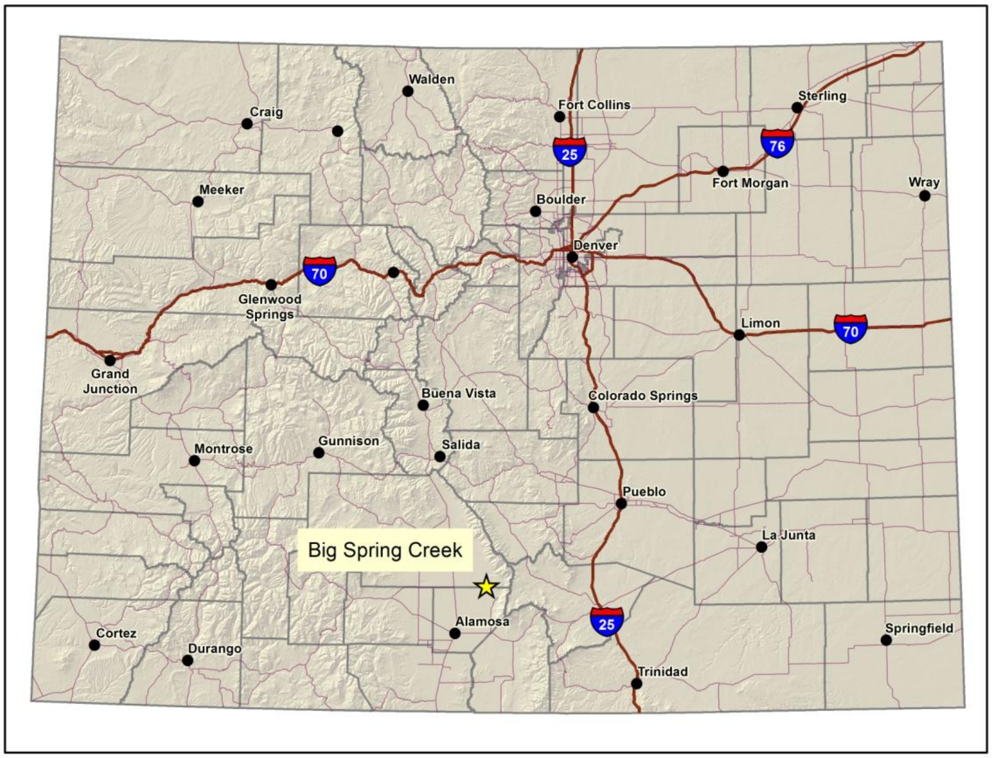

Figure 6. Location of Big Spring Creek in Colorado.

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