FWS National Wildlife Refuge System Wilderness Fellows

Report on Wilderness Character Monitoring

Salt Creek Wilderness

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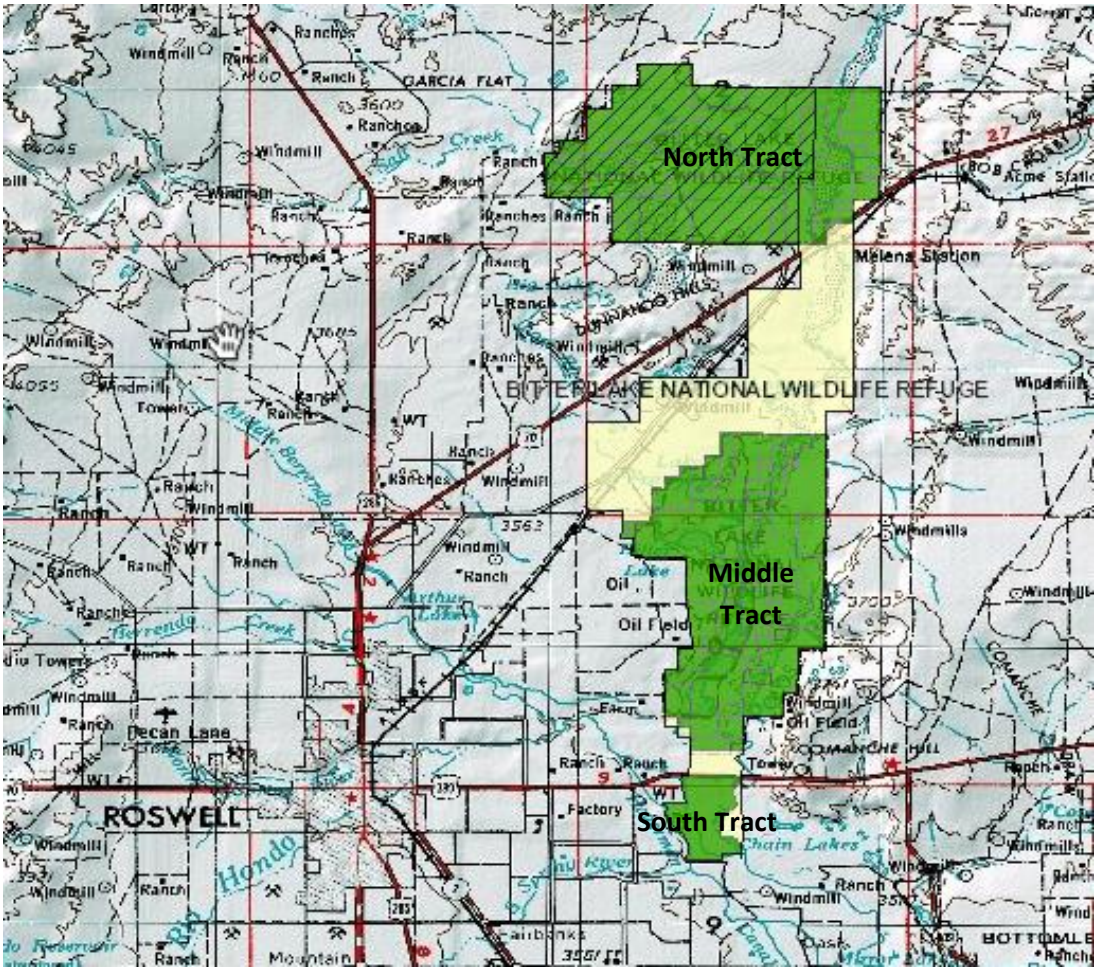
Table of Contents

Setting and Background of Refuge Wilderness

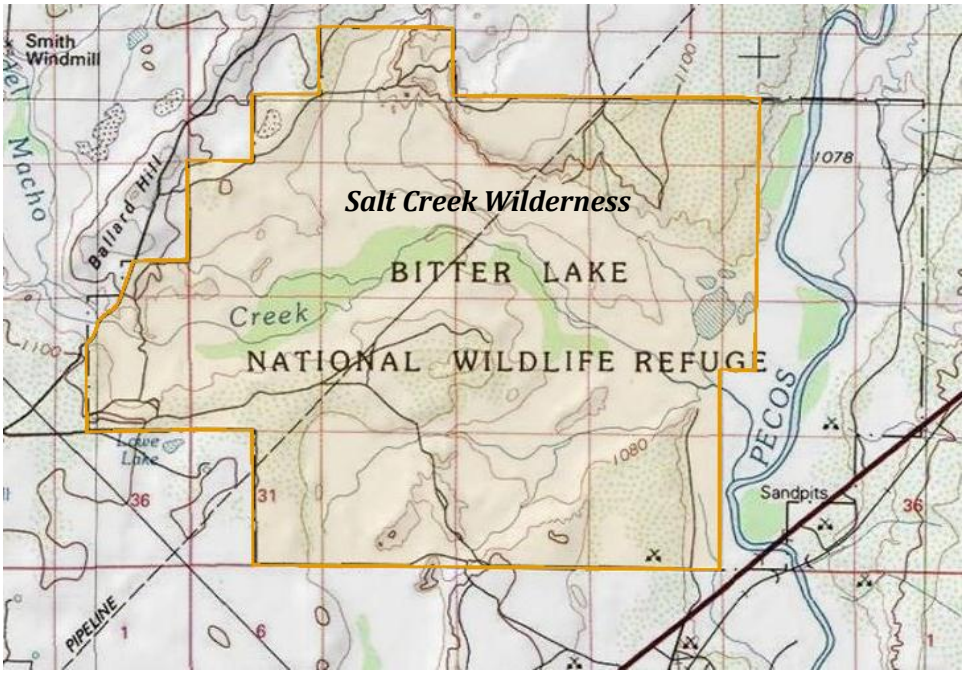
Geographic Setting

Bitter Lake National Wildlife Refuge (NWR) consists of 24,536 acres spread across three distinct management tracts (The North Tract, Middle Tract, and South Tract) along the Pecos River, just northeast of Roswell, Chaves County, New Mexico. The North Tract is comprised of approximately 12,160 acres, and encompasses the Salt Creek Wilderness, which accounts for 9,620 of the total acres.



Map of Bitter Lake NWR

Legend: Refuge land Wilderness



Map of Salt Creek Wilderness

Ecological Setting

The Salt Creek Wilderness occupies a unique transitional zone between the Chihuahuan Desert and short-grass prairies of the Southern Plains. This predominantly arid, sandy environment rests upon the Roswell artesian aquifer, which, in combination with the abundance of dissolvable gypsum substrate, has created peculiar, spring-fed sinkholes across the wilderness. Each sinkhole is physically and chemically unique, and provides rare aquatic habitat in an otherwise dry, desert ecosystem. The Salt Creek Wilderness also embodies a natural grassland system, representing an ecosystem that has become increasingly rare across the nation, and providing crucial habitat for unique and sensitive species.

Amongst the aforementioned features, however, the Salt Creek Wilderness also harbors a highly invasive, non-native plant—salt cedar, or tamarisk (*Tamarix*). Salt Cedar can be found throughout the wilderness area, and, more broadly, the rest of the refuge. Unlike the rest of the refuge, however, the salt cedar occurring within the wilderness has not undergone any type of active management or control, due to perceived restrictions created by the Wilderness Act, as well as (more recently) financial limitations. Thus, at present time, salt cedar continues to be a prominent feature, detrimental as it may be, of the ecological setting of the Salt Creek Wilderness.

History of Establishing the Wilderness

The Salt Creek area underwent consideration for wilderness designation beginning in 1967. Agency, organization, and citizen assessment of the Salt Creek Wilderness proposal culminated in a public hearing to comment on the possible incorporation of the area into the National Wilderness Preservation System. The majority of contributors, spanning from large organizations, such as the Sierra Club, to

individual, local citizens, supported the designation of the Salt Creek area as wilderness on the following basis:

Such designation would provide for…

- the preservation of an increasingly rare natural grassland system
- the preservation of suitable habitat for associated wildlife
- experiential and recreational opportunities
- maintenance of current (as of 1967), relatively minimal levels of development and active management
- the preservation of cultural history, especially in the context of Native Americans and early explorers/settlers
- opportunities for scientific research, particularly regarding the functioning of healthy grassland systems

However, despite the overwhelming support, there was some notable opposition to the Salt Creek Wilderness proposal, led in particular by the Bureau of Sport Fisheries and Wildlife (BSFW). This agency, and those supporting its opposition to the wilderness proposal, based its case on a short list of arguments primarily focused on the presence and implications of salt cedar. This non-native, invasive plant was prevalent within the proposed wilderness area at the time of review, and consumed a significant portion of the already limited water resources available to the native grasses. The critical concern voiced by the Bureau of Sport Fisheries and Wildlife was that designation of the Salt Creek area as wilderness would interfere with the ability to carry out the desired removal of salt cedar, offering the invasive plant the same protection as the rest of the land under the Wilderness Act. This, however, is a misinterpretation of the language and prescriptions of the act, and ultimately did not hold up under congressional review. On October 23, 1970, the proposed 9,620 acres received official wilderness designation, and became known as the Salt Creek Wilderness.

Refuge Purposes

Bitter Lake NWR was initially established to preserve and manage critical wetland habitat vital to the protection and perpetuation of migratory birds (particularly waterfowl). However, since its designation in 1937, Bitter Lake NWR has been recognized for its capacity to provide crucial habitat for a number of unique species, some of which are threatened or endangered, including: Pecos sunflower (*Helianthus paradoxus*), Pecos gambusia (*Gambusia nobilis*), Interior least tern (*Sternula antillarum athalassos*), Noel's amphipod (*Gammarus desperatus*), and Roswell springsnail (*Pyrgulopsis roswellensis*). Purpose duties of the refuge were also further expanded in 1970 with the designation of the Salt Creek Wilderness. This being said, the management agenda of the refuge is multidimensional, focusing on: the maintenance and improvement of wintering crane, waterfowl, and neotropical passerine habitat; the protection and enhancement of habitat for threatened, endangered, and federal candidate species; and the monitoring and management of wilderness so as to maintain its natural ecosystem, and the values and opportunities it represents. Excerpts from formal establishing and purpose documents are provided below for reference.

Bitter Lake NWR was established on October 8, 1937, by Executive Order 7724:

"…as a refuge and breeding ground for migratory birds and other wildlife."

The Migratory Bird Conservation Act (16 U.S.C. 715d) identifies the refuge:

"…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds."

The Refuge Recreation Act (16 U.S.C. 460-1) identifies the refuge as being:

"…suitable for incidental fish and wildlife-oriented recreational development, the protection of natural resources, and the conservation of endangered species or threatened species."

The Wilderness Act of 1964 (P.L. 88-577) directs the Service to:

"…maintain wilderness as a naturally functioning ecosystem" on portions of the refuge.

Introduction to Wilderness Character Monitoring

This wilderness character monitoring program represents an interagency initiative designed to provide a standardized, yet dynamic, means of assessing current conditions, and monitoring progressive trends in wilderness—both locally at individual wilderness areas, and broadly across the National Wilderness Preservation System. Drawing substance from the words of the Wilderness Act of 1964, this program creates a hierarchical monitoring framework (outlined below) charged with feeding four "qualities" of wilderness (described below), which serve as a collective representation of wilderness character. Monitoring measures represent nuts and bolts manifestations of specificity and significance for each individual wilderness area, and affords a balance of pertinence between local and regional/national scales. Further explanation of conceptual and technical details of this monitoring program can be found in *Keeping It Wild: An Interagency Strategy to Monitor Trends Across the National Wilderness Preservation System*. The measures selected and discussed in the following report serve the aforementioned purposes in the context of the Salt Creek Wilderness. Baseline assessment of conditions of the Salt Creek Wilderness will be completed by the end of 2014.

Hierarchical Monitoring Framework of Wilderness Character Monitoring

Qualities

Primary elements of wilderness character that link directly to the statutory language of the Wilderness Act of 1964. In this framework, all four qualities are necessary to assess trends in wilderness character. Trends in qualities contribute to the computation of the overall trend in wilderness character.

Monitoring Questions

Major elements under each quality that are significantly different from one another. Monitoring questions direct this monitoring so as to answer particular management questions. Trends in monitoring questions contribute to the computation of trends in qualities.

Indicators

Distinct and important elements within each monitoring question. Trends in indicators contribute to the computation of trends in monitoring questions.

Measures

Specific aspects of wilderness, determined by the unique context of each individual wilderness, on which data are collected. Trends in measures contribute to the computation of trends in indicators. At least one measure is required for each indicator.

Qualities of Wilderness Character

Untrammeled

"…an area where the earth and its community of life are untrammeled by man…" and "…generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable" –Wilderness Act of 1964

Wilderness is essentially unhindered and free from [the actions of] modern human control or manipulation

Natural

"…is protected and managed so as to preserve its natural conditions" –Wilderness Act of 1964

Wilderness ecological systems are substantially free from the effects of modern civilization

Undeveloped

"…an area of undeveloped Federal land…without permanent improvement or human habitation…" and "…where man himself is a visitor who does not remain" –Wilderness Act of 1964

Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation

Solitude or Primitive and Unconfined Recreation

"…has outstanding opportunities for solitude or a primitive and unconfined type of recreation" – Wilderness Act of 1964

Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation

Documents Consulted

Organizational Legend

Building/Location:

File No. (if applicable) File Title
→ Sub-file/folder
- "Title of Specific Document"

Visitor Center:

Final Comprehensive Conservation Plan and Environmental Assessment: Bitter Lake National Wildlife Refuge. (1998). Prepared by: Research Management Consultants Inc.

13.10 Salt Creek Wilderness: Wilderness Management Plan. (1981). Prepared by: Jerry D. French.

13.11 Salt Creek Wilderness: Original Study (1967).

10.006 Roads & Trails
→ North Tract Roads/Trails: Historic Documents 1941

10.020 North Tract Well RA-3134A

10.109 River Crossing Fence Structures SAMMA #'s 10051021 & 10051022

10.113 North Dike & Water Control Structure Oxbow 2 SAMMS 10040676

20.005 Fire Mgt. Plan
- "Cooperative of Mutual Aid Agreement Between the Berrendo Volunteer Fire Department and the United States Department of the Interior Fish and Wildlife Service"
- "Dispatch Plan"
- "U.S. Fish & Wildlife Service Regional Fire Dispatch Plan Region 2, Albuquerque, NM Fiscal Year 1995"

20.006 Correspondence—Fire Mgt. Plan
→ 20.006a Fire Budget F4-91; 92; 93
- "Survey for Database Elements for Fish and Wildlife Service Fire Management Program"

20.100 Ecosystem Management Plan
- "Reintroduction of Cyorinodon Pecosensis with Analysis of Salinity Tolerance Variations Between Populations"—1995 (Fax Cover)

20.002 Wilderness Plan
- "Wilderness Area Management Questionnaire"—2003
- "[Email] Subject: UTM/long-lat of wilderness boundaries"

- "Wilderness Watch" Correspondence—1999
- Correspondence with "Margaret G. Ottum of Johnson State College"—1983

18.005 Trespass Livestock
- "Memorandum: Subject: Trespass Cows on North Tract"—1988
- "Resolution No. R-69-67: Order to Prohibit Animals Running at Large within the Pecos Valley Artesian Conservancy District"—1981
- "Memorandum: Subject: Cattle Trespass"—1985

20.003 Water Management Plan
→ Bitter Lake National Wildlife Refuge Water Management Plan—1959
- "Bitter Lake National Wildlife Refuge Supplement to Refuge Water Plan"

Annual Narrative Report—1970

Annual Narrative Report—2002

Annual Narrative Report—2003

Biology Building:

14.001B Sinkhole Water Quality
→ H_20 Quality Sinkholes
- "Table XX. Water Quality in Refuge Sinkholes—Summer 1999"
- "Sinkhole Water Quality—1997"
- "Sinkhole Water Quality—Winter 1998"
- "Sinkhole Water Quality—Winter 2000"
- "Summary of Summer Sinkhole Water Quality Monitoring Jul/Aug 1998"
- "Bitter Lake NWR: Lake Saint Francis—Jan 95' Records (01/01/97-thru-01/31/97)" and "Bitter Lake NWR: Lake Saint Francis—CY 1999 Records"
- "Sinkhole Water Quality—Summer 2002"
- "Sinkhole Water Quality [2001]"
- "Table Sinkhole Water Quality"—Summer 2001
- Map of North Tract with sinkholes W1-16 indicated
- "Sinkhole Water Quality—Summer 2001"
- Memo: Re: Sinkhole maps
- "2003 North tract"
- "Sinkhole Water Quality—Summer 2001"

14.014a Habitat Restoration
→ Saltcedar Removal North Tract + Nest Searchers 2009-present
- Maps indicating removal areas for salt cedar on North Tract
- Scope of Work: Bitter Lake NWR: "Pecos River Restoration: North Tract Salt Cedar Control Project"

24.007 Transwestern Pipeline ROW
- "Final Inspection: Gas Pipeline Across North Tract"

24.016 Yates Petroleum Corporation
→ Chaves UY State No. 1 (Salt Creek Wilderness) Permit (G-3)
- "Record of Decision"

24.004 Right-of-Way U.S. 70

24.008 Central Valley Electric ROW

Fire Management Plan: Bitter Lake National Wildlife Refuge & Dexter National Fish Hatchery—2001

Other Resources

Landres et al. (2008). *Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System*. USDA Forest Service.

Landres et al. (2009). *Technical Guide for Monitoring Selected Conditions Related to Wilderness Character*. USDA Forest Service.

Staff Consulted

Floyd Truetken *Refuge Manager*
Jeff Sanchez *Refuge Biologist*
Rick Ozbun *Maintenance Helper*
Milton Harper *Fire Management Specialist*

Process to Identify Measures

The process of identifying measures capable of providing both localized insight to refuge staff, and national comment to the greater Fish and Wildlife Service, Division of Inventory & Monitoring, and all parties that may be concerned with the state of the National Wilderness Preservation System, began with an exhaustive review of all archived materials within the refuge's files system. At the time of this report, there were virtually no electronic resources pertaining to the wilderness area, so the majority of this work consisted of combing through hard copy documents and maps. While conducting this initial research, staff were consulted on a casual basis for informal information, suggestions, and impressions based on their time and experience working at the refuge, which helped provide an increased sense of local context, and in turn, some guidance for honing in on aspects of particular significance. While reading through all major documents, which included the *Salt Creek Wilderness: Original Study*, *Salt Creek Wilderness: Management Plan*, and *Final Comprehensive Conservation Plan and Environmental Assessment—Bitter Lake National Wildlife Refuge*, a brief 1-2 pg. summary of contents was created to allow for quick and convenient future reference. For perusing the large files systems made of up less cohesive documents, a "File Search" reference collection was maintained, indicating the title of a particular document of interest, its file name and number, and the building/file collection in which it is housed. This provided another means of organizing relevant information, and allowing for easy future reference.

After completing the thorough review of all available files and resources, the Xcel document *Potential Measures for WCM—2012*, part of the electronic resources provided to Wilderness Fellows at training in Fort Collins, was accessed and reviewed. Based on the information obtained from the file search, measures deemed potentially significant to the refuge, and relevant to the assessment of wilderness character, from the perspective of the Wilderness Fellow, were selected from the Xcel document. Separate meetings were then conducted with the Refuge Manager and Biologist in which they were provided with a copy of the Xcel document, and asked to select the measures they felt were appropriate. During this selection process, an open discussion was facilitated to entertain ideas, clarify objectives and terminology, and keep the analysis that went into selecting potential measures in the context of the wilderness area (as opposed to the non-wilderness portion of the refuge, which has historically been the focus of Bitter Lake NWR's management and operation). Notes regarding selection and exclusion/elimination of potential measures according to each of these staff members were taken during these meetings, and compiled afterwards for analysis. The resulting compilation indicated differing perspectives and disagreement across a number of measures, which, in addition to the associated notes taken during the previous measure selection meetings, served as talking points for a following meeting with all parties present. With a common outlet for the Refuge Manager, Biologist, and Wilderness Fellow to discuss their differing interpretations of the various measures, functional debate and ultimate resolutions were realized.

The aforementioned selection process served as an efficient means of paring down the list of potential measures provided within the Xcel document, and yielded a prescreened, manageable list of potential measures to be further considered through the prioritization process. The Word document *FWS Wilderness Fellows, Prioritizing Measures Worksheet*, part of the electronic resources provided to Wilderness Fellows at training in Fort Collins, was used at a following meeting with both the Refuge Manager and Biologist in which the prescribed numerical ranking system was employed to provide further comment on the relevance and feasibility of selected potential measures, and to further refine the list of selected measures. This process ultimately culminated in a semi-finalized list of monitoring measures for wilderness character.

The absolute, finalized measures presented in this report represent the efforts of a perpetual process of reevaluation and refinement. As further conceptual and technical-oriented thought was applied to the list of measures through the drafting of this report, and the specific measure definitions contained within, tweaking on both broad and fine scales occurred. Entire measures were added to and removed from the selected list, and the specific definitions and protocols of these measures were held in a highly malleable state until they found a form capable of adequately representing their associated aspects of wilderness character, and acknowledging the staffing and resource limitations of the refuge. The *Technical Guide for Monitoring Selected Conditions Related to Wilderness Character*, *Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System*, and the reports of past Wilderness Fellows served as valuable resources throughout this process.

Preface Note

The Salt Creek Wilderness presents somewhat of an atypical scenario in the context of this wilderness character monitoring program. Monitoring measures are ideally determined and developed, and their baseline year assessment data entered into the database, from existing programs and information files of the refuge. This strategy allows for the fulfillment of the wilderness character monitoring program, while minimizing the extent of additional work created for refuge staff (as compared to the development and initiation of a host of brand new monitoring protocols and initiatives). In the case of Bitter Lake NWR, however, existing current and historical data and monitoring resources pertaining to the wilderness (at the time of this report) were minimal. This situation required the development of a monitoring program for which the majority of measures represent entirely new programs and initiatives on the part of the refuge. This being said, there are a great number of archival resources that helped to establish the context of the Salt Creek Wilderness, and in turn, identify underlying explanations for the lack of information and monitoring.

A significant contributing factor to the lack of information and program resources devoted to this particular wilderness relates to the establishing purpose of Bitter Lake NWR. In 1937, the refuge was established primarily to provide wintering habitat for migratory birds—particularly waterfowl. Despite being made up of three distinct management tracts (North Tract—containing the Salt Creek Wilderness, Middle Tract, and South Tract), the Middle Tract has historically received the overwhelming majority of refuge resources, as it contains both a natural "cienega" spring/seep system, and an extensive artificial wetland system most capable of supporting waterfowl and other migrants (not to mention additional sensitive flora and fauna). This precious water resource requires continual, strategic management over the course of the year to ensure its viability for fulfilling the establishing purpose of the refuge. Additionally, since its establishment some 75 years ago, the refuge has become recognized as a home for a number of threatened and endangered species, many of which occur on the Middle Tract. The presence of these species has likewise fueled the initiation and perpetuation of monitoring initiatives, including bird, mammal, fish, and invertebrate surveying programs, which focus on the Middle Tract. This overwhelming emphasis on the functioning of the Middle Tract (and, more generally, the non-wilderness portions of the refuge), has likely caused the Salt Creek Wilderness to be placed on the backburner.

A historically deep-rooted misinterpretation of the Wilderness Act, both on the part of refuge staff and management, as well as parties involved in the original discussion of wilderness designation, represents another particularly significant factor contributing to the lack of resources pertaining to the Salt Creek Wilderness. The Wilderness Act of 1964, and areas of land which it, through congress's approval, designates as wilderness, provides management and visitor/user conduct guidelines that are often more restrictive than those of a typical wildlife refuge, park, or forest. This being said, the Wilderness Act does not remove all managing authority/ability from an agency/staff. Management actions to aid in the protection and maintenance of the natural and experiential/social resources of wilderness are acceptable, as are actions taken as a measure of safety or other valid concern, so long as the proper protocol is followed (i.e.: minimum tool analysis, and consideration of effects on wilderness character). The misinterpretation of the Wilderness Act affecting the Salt Creek Wilderness began in 1967, when a public hearing was held as an outlet for comment on the potential designation of the Salt Creek area as wilderness. Those opposed to the designation, led by the Bureau of Sport Fisheries and Wildlife, based their argument on the notion that the implications of wilderness status would conflict with and make impossible the proposed removal of invasive salt cedar. This argument did not hold up under congressional review, and was the invalid product of legislative misinterpretation, yet the notion that

wilderness ties the hands of management persisted. Throughout nearly all refuge documents discussing salt cedar in the Salt Creek Wilderness (post official designation in 1970), comment is made suggesting the Wilderness Act will not allow for removal of this invasive species, and, as was stated in the 1981 *Wilderness Management Plan*, "these stands of salt cedar are now afforded complete Wilderness Act protection" (pg. 6). As a result, even relatively recent management and staff have been hesitant to engage in substantial wilderness management, even where such initiatives would serve to improve wilderness character (such as the removal of salt cedar). Thus, under the misconception that wilderness is essentially off limits to management, there has historically been little incentive for, or manifestation of, programs and monitoring capable of serving as resources for wilderness character monitoring. While current management and staff have a better understanding of wilderness than their predecessors, removal of salt cedar within the wilderness has yet to manifest itself beyond a proposal (which has thus far proved cost prohibitive).

Finally, a simple factor, yet one which may serve to contribute to and exacerbate the significance of those previously discussed, is associated with the physical constraints of the Salt Creek Wilderness. The North Tract, which encompasses the Salt Creek Wilderness, is located approximately 8 miles north of the Middle Tract, which contains all refuge headquarters, offices, personnel, and resources. Additionally, the Salt Creek Wilderness provides no authorized, let alone public, travel roads within the wilderness, meaning any access to the interior of the wilderness must be accomplished by hiking or horseback. As the refuge itself has no horses at its disposal, hiking is currently the only option, which makes visiting and working within the Salt Creek Wilderness a rather time consuming and labor intensive process. Thus, in addition to the more deep-rooted contextual hindrances to working in the Salt Creek Wilderness, there is also a very simple, yet pertinent stumbling block presented by the physical separation and nature of accessibility of the area.

Bearing the above discussion in mind, the approach of this report will be slightly different than originally intended. In the absence of data capable of satisfying the needs of the wilderness character monitoring baseline assessment, the development of a monitoring program for which the majority of selected measures represent entirely new initiatives on the part of the refuge was unavoidable. Likewise, without the existence of previously established monitoring initiatives and associated data resources, the majority of measures incorporated into this wilderness character monitoring program lack data capable of serving as the baseline value at the time of this report/initial assessment. Those measures for which data could be determined before the departure of the Wilderness Fellow are displayed, along with their associated baseline year, in the measure definitions below, as well as in the wilderness character monitoring database. Those measures for which baseline data is still required (due to either an inability to collect it before the departure of the Wilderness Fellow [Measures: 1.3, 2.1, 2.2, 2.3, 2.4, 3.3, 4.1], or an impression that the data value for a given measure is likely to change during the remainder of its baseline year [Measures: 1.2, 3.4]) will be indicated as such—Baseline Data Value [YEAR]: TBD—throughout the report. Refuge staff will be responsible for collecting this data, and will enter the appropriate values into the database as they are determined. The year during which the initial data collection occurs for a given measure will represent the baseline year for said measure, and will likewise be entered into the database. The baseline year for the Salt Creek Wilderness (as a whole) will correspond to the first year in which data for all measures is available, and will be entered into the database under the "Select Wilderness" menu. The initial baseline assessment, and all associated data collection and entry, will be completed by refuge staff no later than the end of the 2014 fiscal year.

In order to facilitate the process of satisfying all measures, and fully establishing this wilderness character monitoring program, the focus of the following portion of the report is on the development

and effective communication of clear and comprehensive measure definitions/protocols. Clarity and specificity, in conjunction with a design that exhibits local relevance, and an acknowledgement of staff/resource limitations, serves to ensure no lingering questions remain or arise as to how the Salt Creek Wilderness is to be monitored, or what is required to determine the data value of a given measure, after the departure of the Wilderness Fellow.

Measures Used

Untrammeled Quality *Wilderness is essentially unhindered and free from modern human control or manipulation*				
Monitoring Question	Indicator	Measure	Data Source(s)	Frequency (yr.)
What are the trends in actions that control or manipulate the "earth and its community of life" inside wilderness?	Actions authorized by the Federal land manager that manipulate the biophysical environment	1.1 Number of actions to manage vegetation; fish, wildlife, and insects; soil and water; and fire	Refuge Manager Refuge Biologist Wilderness file system	1
		1.2 Number of research, survey, and monitoring projects that manipulate plants or wildlife	Refuge Biologist Wilderness file system	1
	Actions not authorized by the Federal land manager that manipulate the biophysical environment	1.3 Number of observed and reported incidents of cattle/livestock trespass on wilderness	LE Officer Refuge Manager Incident reports Wilderness file system	1

[Measure 1.1]—Number of actions to manage vegetation; fish, wildlife, insects, and disease; soil and water; and fire

Baseline Data Value [2012]: 0

Frequency: 1 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Manager; Refuge Biologist; Wilderness file system

Data Collection Protocol: The Refuge Manager and Biologist will be aware of all actions taken to manage natural aspects of the wilderness, including: vegetation, fish, wildlife, insects, disease, soil, water, and fire. The total number of such actions taken in a given monitoring period shall serve as the data value. Examples of actions to manage the aforementioned aspects of the natural components of wilderness are given below, as well as a guiding table (Table 1) indicating general rules for counting and reporting the number of actions for this measure. The examples found below are purely for conceptual reference, and are not intended to be all inclusive, nor representative of the management actions likely to occur within this particular wilderness.

The following examples illustrate possible assignment of many different actions into the four components:

1. Actions that manage vegetation include:
    - Spraying herbicide to control populations of invasive plants
    - Removal of invasive plants by mechanical means
    - Spreading seed to rehabilitate an area that burned
    - Spreading fertilizer
    - Planting vegetation
2. Actions that manage fish, wildlife, insects, and disease include:
    - Introducing biological control agents
    - Manipulating wildlife habitat (ex: installing guzzlers, creating fish barriers)
    - Removing animals
    - Introducing or supplementing animals
    - Using management-ignited fire to improve forage
3. Actions that manage soil and water include:
    - Burned Area Emergency Response projects, including actions that fell trees to reduce soil erosion
    - Diverting water for irrigation
    - Spreading lime to buffer acid deposition
    - Restoration of a mine site
4. Actions that manage fire include:
    - Suppressing human-caused fire
    - Mechanical fuel reduction to reduce accumulated fuels
    - Using management-ignited prescribed fire to reduce accumulated fuels

Table 1: Guidelines for counting and reporting management actions

Type of Action	Example	Counting Rule	Reporting
Single action at a single location	Salt cedar treated at a single location	Count as one action	Report one action
Single action at multiple locations	Salt cedar treated with herbicide at several locations	Count as one action	Report one action for the single species regardless of the number of locations
Multiple actions at a single location	Herbicide is used to treat Salt cedar and phragmites at the same location	Count as multiple actions	Report one action for each species (i.e.: one treatment on two species = two actions)
Multiple actions at multiple locations	Mechanical treatment used in addition to herbicides	Count as multiple actions	Report one action for each treatment on each species (i.e.: two treatments on two species = four actions)
Action occurs within a single fiscal year	Salt cedar is treated with herbicide between June and July 2007	Count as one action	Report one action
Action spans multiple fiscal years without interruption	Herbicide treatment initiated in August 2007 ends in November 2007	Count as one actions	Report as one action in fiscal year 2007
Action spans multiple fiscal years with interruption	Herbicide treatment initiated in August 2007 ends in November 2007, and is reinitiated in August 2008	Count as multiple actions	Report as one action in fiscal year 2007 and one action in fiscal year 2008

Context and Relevance: Historically, there has been a lack of management actions targeting the Salt Creek Wilderness (a trend that has continued to present day). This being said, with the implications and importance of wilderness discussed with the staff of Bitter Lake NWR, and the initiation of this wilderness character monitoring program, a more active and involved approach to managing the Salt Creek Wilderness may likely ensue. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses authorized actions that manipulate the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of wilderness. An increase in the number of management actions indicates a degrading trend in the context of this measure and associated indicator, monitoring question, and quality, while a decrease in management actions indicates an improving trend. Due to the historical lack of management actions within the Salt Creek Wilderness, this measure may likely indicate a degrading trend (initially), as management actions result from the implementation and derived information of this wilderness character monitoring initiative.

[Measure 1.2]—Number of research, survey, and monitoring projects that manipulate plants or wildlife

Baseline Data Value [YEAR]: TBD

Frequency: 1 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Biologist; Wilderness file system

Data Collection Protocol: The Refuge Biologist will be aware of all research, survey, and monitoring projects, both those initiated and performed by refuge staff, as well as outside researchers. The Refuge Biologist will be consulted for this information, and the total number of all research, survey, and monitoring projects in a given monitoring period that manipulate plants or wildlife will serve as the data value for this measure.

Context and Relevance: To date, the refuge has performed little to no research or monitoring in the Salt Creek Wilderness. As this wilderness character monitoring program becomes implemented, various research, survey, and monitoring work will be initiated within the wilderness. This measure will serve to track the number of programs which manipulate plants or wildlife. This measure is relevant to the associated indicator, monitoring question, and quality, in that it addresses actions authorized by the federal land manager that manipulate the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of wilderness. An increase in the number of authorized research, survey, and monitoring projects that manipulate plants or wildlife habitat indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of projects indicates an improving trend. Formal determination of the official baseline data value will be postponed until data for all other measures has been collected, as the implementation of this wilderness character monitoring initiative may likely result in the creation and implementation of such research, survey, and monitoring projects as a product of other measures. Likewise, as the refuge gradually transitions to a more inquisitive and involved relationship with the Salt Creek Wilderness, a degrading trend for the measure may likely be seen before it stabilizes.

[Measure 1.3]—Number of observed and reported incidents of cattle/livestock trespass on wilderness

Baseline Data Value [YEAR]: TBD

Frequency: 1 yr.

Significant Change: 2 incident reports

Data Adequacy: Moderate—Due to logistical constraints, it will not be possible to constantly monitor the entirety of the wilderness on a regular basis for cattle trespass. This being said, the scope of this measure is more concerned with providing refuge management with a relative impression of the frequency of cattle trespass in the wilderness, rather than an absolute count of all incidents. The data collected, while perhaps not being capable of producing the same

degree of accuracy as other measures of higher data adequacy, is still viewed as providing the refuge with valuable information.

Data Source(s): LE Officer; Refuge Manager; Incident reports; Wilderness file system

Data Collection Protocol: At the time of this report, there is only one LE Officer on staff, and he also serves as the refuge's Recreational Planner. As such, the LE unit rarely patrols the wilderness area. This being said, with other monitoring measures being implemented, other staff members will be spending time in the wilderness on a more regular (relatively speaking) basis. Therefore, refuge staff will report any observed presence of cattle/livestock trespass within the Salt Creek Wilderness to the LE Officer and Refuge Manager, and an appropriate incident report will be filed to document the occurrence. Valid observations of trespass will include sightings of actual animals, as well as "cow pies" (refuge staff have indicated the ability to distinguish between cow pies of various ages). All incident reports should include some sort of geographic reference, but this is particularly important when cow pies are used as evidence of cattle trespass, so as to avoid recounting the same evidence. The total number of documented, observed incidents of cattle trespass during a given monitoring period will serve as the data value for this measure.

Context and Relevance: Historical records of the refuge reference a number of instances of cattle and livestock trespass occurring within the North Tract (none of these reports specify whether the trespass occurred on the actual wilderness portion of the tract). Many of these instances have been traced to a small number of adjacent land owners, who frequently took advantage of the situation by removing areas of refuge boundary fencing in order to obtain free grazing for their cattle. These records are currently not being maintained, but refuge staff are informally aware of some of the incidents that occur (including incidents occurring within the Salt Creek Wilderness). This measure reinstates the keeping of records and reports regarding cattle/livestock trespass, and is relevant to its associated indicator, monitoring question, and quality in that it addresses an unauthorized action that serves to manipulate the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of wilderness. An increase in the number of documented incidents of cattle/livestock trespass indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of documented incidents indicates an improving trend.

Natural Quality *Wilderness ecological systems are substantially free from the effects of modern civilization*				
Monitoring Question	Indicator	Measure	Data Source(s)	Frequency (yr.)
What are the trends in terrestrial, aquatic, and atmospheric natural resources inside wilderness?	Plant and animal species and communities	2.1 Population dynamics of selected non-native species: Salt cedar/Tamarisk (*Tamarix*)	Refuge Biologist Wilderness file system	1
		2.2 Status of habitat for selected species: Pecos pupfish (*Cyprinodon pecosensis*)	Refuge Biologist Wilderness file system	3
		2.3 Status of species of particular concern or interest: Pecos pupfish (*Cyprinodon pecosensis*)	Refuge Biologist Wilderness file system	3
	Physical resources	2.4 Air quality	FWS Division of Inventory & Monitoring	1
	Biophysical processes	2.5 Pathways for invasives as a function of annual precipitation	Refuge Biologist Eight Mile Draw RAWS data Wilderness file system	1

[Measure 2.1]—Population dynamics of select non-native species: Salt cedar/Tamarisk (*Tamarix*)

Baseline Data Value [YEAR]: TBD

Frequency: 1 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Biologist; Wilderness file system

Data Collection Protocol: The Refuge Biologist will use professional judgment and expertise to consider the following three primary factors: annual precipitation, occurrence and extent of removal/treatment of salt cedar, and presence and impact of the tamarisk leaf beetle. Based on the Refuge Biologist's interpretation of these factors, the population dynamics of salt cedar will be scored according to the following scoring system: 0 = salt cedar population is stable or decreasing; 1 = salt cedar population is increasing/expanding. This score will serve as the data value.

Context and Relevance: Salt cedar has proven to be a highly invasive and resilient species within the Salt Creek Wilderness since before its official designation, and serves to take acreage and valuable water resources away from natives of the natural grassland system. This being said, salt cedar is a nonnative species of particular concern to refuge staff. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses effects of and on a plant species, and contributes to an evaluation and understanding of the natural quality of wilderness. A population dynamics score of 1 indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, whereas a population dynamics score of 0 must be interpreted by the Refuge Biologist, and assigned the appropriate trend of either degrading or stable based on the aforementioned professional judgment criteria.

[Measure 2.2]—Status of habitat for selected species: Pecos pupfish (*Cyprinodon pecosensis*)

Baseline Data Value [YEAR]: TBD

Frequency: 3 yr.

Significant Change: To be determined by Refuge Biologist after collection of baseline data

Data Adequacy High

Data Source(s): Refuge Biologist; Wilderness file system

Data Collection Protocol: For the purposes of establishing the initial baseline, all sinkholes in the Salt Creek Wilderness will be subjected to a water quality analysis. The key parameters of water quality that pertain to habitat evaluation for Pecos pupfish are salinity and conductivity, dissolved oxygen, temperature, and pH. Based on this data, the Refuge Biologist will use professional judgment and expertise to determine which sinkholes in the wilderness provide suitable habitat for Pecos pupfish, regardless of whether or not fish are actually known/confirmed to be present in a given sinkhole. Each sinkhole will then be scored for

habitat quality (0 = inadequate for Pecos pupfish; 1 = adequate for Pecos pupfish). The sum of all scores, representing the number of sinkholes determined to provide suitable habitat, will serve as the baseline data value for the measure. Data collection for all subsequent monitoring periods will entail the same water quality analysis and professional interpretation by the Refuge Biologist, but only those sinkholes originally determined to be suitable habitat for Pecos pupfish will be monitored and scored. The sum of all scores in a given monitoring period will serve as the respective, subsequent data value.

Context and Relevance: The Pecos pupfish is a species of particular concern and interest to refuge staff, as it is listed as threatened in New Mexico, a species of concern by the American Fisheries Society, and a federal candidate species. This being said, the status of habitat provided by the sinkholes in the Salt Creek Wilderness is also of particular interest to refuge staff. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses effects on an animal species (via habitat), and contributes to an evaluation and understanding of the natural quality of wilderness. An increase in the number of sinkholes providing suitable habitat for Pecos pupfish indicates an improving trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of sinkholes providing suitable habitat for Pecos pupfish indicates a degrading trend.

Comments: Due to logistical constraints, it will not be possible to survey all sinkholes within the Salt Creek Wilderness for every monitoring period. This is why only those sinkholes determined to provide suitable habitat through the baseline assessment will be monitored in subsequent monitoring periods. Bearing this in mind, the number of sinkholes providing suitable habitat for Pecos pupfish will never (barring an increase in available time, staff, and resources) increase above the initial baseline number. The measure itself still possesses the potential to create an improving trend, as sinkholes are known to undergo physical and chemical fluctuations, and thus an increase in the number of suitable sinkholes back up to the baseline value is possible following a preceding decrease, but the ideal trend for this measure will be stable at the baseline value.

[Measure 2.3]—Status of species of particular concern or interest: Pecos pupfish (*Cyprinodon pecosensis*)

Baseline Data Value [YEAR]: TBD

Frequency: 3 yr.

Significant Change: To be determined by Refuge Biologist after collection of baseline data

Data Adequacy: High

Data Source(s): Refuge Biologist; Wilderness file system

Data Collection Protocol: Monitoring of Pecos pupfish in the Salt Creek Wilderness represents an entirely new initiative for refuge staff, and will therefore require some extra work to establish the baseline for the measure. Staff will survey all sinkholes in the wilderness for water quality, which will allow the Refuge Biologist to determine which sinkholes provide suitable habitat for Pecos pupfish (see Measure 2.2—Status of habitat for selected species: Pecos pupfish). Fish traps will then be set in all sinkholes determined to provide suitable habitat for Pecos pupfish to determine in which sinkholes, out of those deemed to provide adequate

habitat, the species is actually present (the exception being sinkholes in which a positive identification of Pecos pupfish can be made from the surface by a trained eye—in which case trapping will not be needed to determine presence/absence of the species). These sinkholes will then be scored according to presence/absence of the species (0 = absent; 1 = present). The sum of all scores, representing the number of sinkholes in which Pecos pupfish are confirmed to be present, will serve as the baseline data value. With the baseline established, future data collection for the measure will entail trapping (again, if a positive identification is not first made via visual inspection by a trained eye) at all sinkholes determined through the baseline study (of Measure 2.2) to provide suitable habitat for Pecos pupfish. The sum of all resulting presence/absence scores in a given monitoring period will serve as the respective, subsequent data value.

Context and Relevance: The Pecos pupfish is a species of particular concern and interest to refuge staff, as it is listed as threatened in New Mexico, a species of concern by the American Fisheries Society, and a federal candidate species. The refuge has studied Pecos pupfish on the Middle Tract, but never before (in any appreciable manner) within the Salt Creek Wilderness. This particular species, and the measure it is associated with, has the potential to become increasingly important should the Pecos pupfish receive federal listing/protection. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses effects on an animal species, and contributes to an evaluation and understanding of the natural quality of wilderness. An increase in the number of sinkholes with Pecos pupfish present indicates an improving trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of sinkholes with Pecos pupfish present indicates a degrading trend.

[Measure 2.4]—Air Quality

Baseline Data Value [YEAR]: TBD

Frequency: 1 yr.

Significant Change:

Data Adequacy:

Data Source(s): FWS Division of Inventory & Monitoring

Data Collection Protocol: All data required for monitoring of the air quality measure, which will likely be composed of a series of defined metrics, will be provided by the FWS Division of Inventory & Monitoring. At the time of this report, protocol dictating the specific metrics and interpretation was unavailable, but will be accompanying the data provided to the refuge.

Context and Relevance: Air quality, while largely beyond the control of refuge management, is an important and ever present aspect of wilderness character. Due to its geo-climatic setting, the Salt Creek Wilderness is occasionally exposed to, directly or indirectly, smoke from wildfires. This smoke increases the density of particulate matter within the air, and can significantly reduce the natural viewshed. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses effects on a physical resource, and contributes to an evaluation and understanding of the

natural quality of wilderness. Guidelines for interpreting trends from data values for this measure will be provided by the FWS Division of Inventory & Monitoring.

Comments: Other aspects of this measure's definition, such as significant change and data adequacy, will be determined by the Refuge Manager and Biologist after data and further protocol information have been received from I&M.

[Measure 2.5]—Pathways for invasives as a function of annual precipitation

Baseline Data Value [1986]: 1

Frequency: 1 yr.

Significant Change: ANY increase above a score of 2; ANY decrease from a score above 2

Data Adequacy: Moderate—the quality of the data collected for this measure is determined to be satisfactory for the purpose of satisfying the indicator, and providing a level of accuracy capable of expressing realistic trends regarding pathways for invasives, and their effect on the natural quality of wilderness character. The reason the data adequacy for this measure is expressed as moderate, rather than high, stems from the highly localized nature of precipitation events typical of the region (rain for Roswell, NM does not always mean rain for the Salt Creek Wilderness). The Eight Mile Draw Remote Automatic Weather Station (RAWS) represents the closest weather station to the wilderness, and according to the Refuge Biologist, will provide the most accurate representation of the weather conditions experienced, as rain typically tracks from the direction of the Eight Mile Draw RAWS to the Salt Creek Wilderness, while rain tracking through Roswell has a tendency to bypass the wilderness. However, all precipitation experienced by the Eight Mile Draw RAWS is not guaranteed to be realized within the Salt Creek Wilderness, and vice versa. Therefore, while accurate enough for the purposes of this wilderness character monitoring initiative (conveying general trends), the data itself may not possess the same degree of accuracy found in other measures of higher data adequacy.

Data Source(s): Refuge Biologist; Eight Mile Draw RAWS; Wilderness file system

Data Collection Protocol: A historic average annual precipitation value of 13.18 inches was calculated from the past 26 years of archived precipitation data from the Eight Mile Draw RAWS (representing data from the station's first full year of data collection beginning January 1986, to December 2011), and will serve as the scoring threshold for the measure. Data from the Eight Mile Draw RAWS will be consulted (at the end of each year) for annual precipitation figures (calculated from monthly figures), and will serve as a best available representation of the weather conditions experienced by the Salt Creek Wilderness. If the annual precipitation in a given year does not exceed (i.e.: is less than or equal to) the historic average (13.18 inches), it will receive a score of 0. If the annual precipitation exceeds the historic average, it will receive a score of 1. Computing the final data value for the measure goes a step further. If the score for a given year's precipitation is 0, the data value is 0. However, if the score for a given year's precipitation is 1, it will be summed with the preceding year's data value, and this total score will serve as the data value for the year in question. Interpreting significant change is similarly two-fold. A decrease in the data value is only significant if the preceding data value is greater than 2 (i.e.: 3 or above), whereas any increase exceeding a score of 2 is significant. An example

of this computational process is illustrated below in Table 2 (Note: all data is purely hypothetical for the purpose of the example, and does not represent the data for the Salt Creek Wilderness obtained from the RAWS).

Table 2: Computational process for determining significant change in annual precipitation/pathways for invasives

Year	Annual Precip. Score	Data Value	Significant Change?
1998	0	0	—
1999	1	1	NO
2000	1	2	NO
2001	0	0	NO
2002	1	1	NO
2003	1	2	NO
2004	1	3	YES
2005	1	4	YES
2006	0	0	YES

Context and Relevance: In an arid, desert habitat, such as that found in the Salt Creek Wilderness, water is a limiting resource. Even invasive species such as salt cedar (*Tamarix*), Johnson grass (*Sorghum halepense*), and Russian knapweed (*Acroptilon repens*), which have demonstrated their ability to take advantage of what the climate has to offer, require generous amounts of water to significantly expand their range, and increase their abundance. Therefore, consistent exceedances of historic annual precipitation provide perhaps the most significant pathway for establishment and expansion of invasive plants within the Salt Creek Wilderness. Based on the Refuge Biologist's professional judgment and expertise, it was determined that 3 consecutive years of above average precipitation are required in order to produce a significant change capable of allowing for establishment and expansion of invasive plant species. Any further consecutive year(s) of above average precipitation similarly produces a significant change in the context of pathways for invasives, whereas any break in the (significant) consecutive pattern of above average precipitation serves as a significant change, and essentially sets the expansion potential of the plants back to square one. This is the rationale that led to the development of the scoring and interpretation guidelines of the measure (featured above). This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses effects on the biophysical environment, and contributes to an evaluation and understanding of the natural quality of wilderness. An increase in the total score/data value indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the total score/data value indicates an improving trend. As with all other measures, any numerical increase or decrease in the data value that fails to meet the criteria of significant change (described above) indicates a stable trend.

Comments: The historic average annual precipitation value used as the scoring threshold for the measure is based on 26 years of data. In discussions with the Refuge Biologist, it was expressed that a greater sample of precipitation data would perhaps yield a more accurate/significant historic value, as it would capture and average out longer-term fluctuations in observed weather conditions, which can be especially relevant to a region that experiences periodic long-term droughts. This being said, while other weather stations exist in the area, notably in Roswell, and on the Middle Tract, it was determined that these stations are likely not capable of providing an accurate reflection of the precipitation actually experienced by the Salt Creek Wilderness. Thus, while possessing a greater amount of historical data, a historic average annual precipitation value obtained from these sites would likewise be the product of less accurate (in the context of the local conditions of the Salt Creek Wilderness) data. This ultimately contributed to the selection of the Eight Mile Draw RAWS station as the data source for the calculation of the measure's scoring threshold/historic average annual precipitation value.

In calculating the historical average annual precipitation value for this measure, an extreme outlier data value was removed. Total precipitation recorded by the Eight Mile Draw RAWS for October 1960 was 253.5 inches, indicating an obvious error. Daily precipitation records for October 1960 were examined, and the source of abnormality was traced to a single date (October 3, 1960) in which a precipitation value of 251.60 inches was recorded. This error would significantly alter the historical average annual precipitation value, and was thus removed from the total precipitation amount recorded for October 1960 (253.50 [total precip.] - 251.60 [error precip.] = 1.9 inches total precipitation for October 1960) before calculating the official historical value.

Undeveloped Quality *Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation*				
Monitoring Question	Indicator	Measure	Data Source(s)	Frequency (yr.)
What are the trends in non-recreational development inside wilderness?	Non-recreational structures, installations, and developments	3.1 Miles of active, administrative travel routes and access roads within wilderness	Refuge Manager Wilderness file system	5
	Inholdings	3.2 Acres of inholdings within wilderness	Refuge Manager Wilderness file system	5
What are the trends in mechanization inside wilderness?	Use of motor vehicles, motorized equipment, or mechanical transport	3.3 Unauthorized vehicle intrusions	LE Officer Refuge Manager Incident reports Wilderness files system	1
		3.4 Number of user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport	Refuge Manager Refuge Biologist Wilderness file system	1

[Measure 3.1]—Miles of active, administrative travel routes and access roads within wilderness

Baseline Data Value [2012]: 5.35 miles

Frequency: 5 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Manager; Wilderness file system

Data Collection Protocol: The Refuge Manager will be aware of all active, administrative travel routes and access roads within the wilderness area, and will be consulted for data. The sum of all miles of active, administrative travel routes and access roads within the wilderness during a given monitoring period will serve as the data value.

Context and Relevance: There are currently no active travel routes or access roads used by refuge staff to enter and navigate the Salt Creek Wilderness. There are, however, 2 administrative travel routes that are maintained as a stipulation of the inholdings present within the wilderness. The Transwestern Pipeline Company's natural gas line is made accessible for maintenance and inspection via a 3.8 mile right-of-way travel route, and the Central Valley Electric Cooperative's transmission line is made accessible via a 1.55 mile right-of-way travel route. The extent of active, administrative travel routes and access roads is not likely to change, but is nonetheless an aspect of the Salt Creek Wilderness which refuge management would like to see kept in check. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses the presence of non-recreational structures, installations, and developments within the wilderness, and contributes to an evaluation and understanding of the undeveloped quality of wilderness. An increase in the number of miles of active, administrative travel routes and access roads indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of miles of active, administrative travel routes and access roads indicates an improving trend.

[Measure 3.2]—Acres of inholdings within wilderness

Baseline Data Value [1970]: 988.6

Frequency: 5 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Manager; Wilderness file system

Data Collection Protocol: The Refuge Manager will be aware of all existing inholdings within the wilderness area, and will be consulted for acreage data. The sum of all inholding acres present during a given monitoring period will serve as the data value.

Context and Relevance: The Salt Creek Wilderness inherited 3 inholdings upon its designation. It is unlikely that the amount of acres tied up in inholdings will change in the future, but the expanse of

inholdings within the wilderness nonetheless embodies an aspect of interest and concern for refuge management. Table 3 indicates all present inholdings and associated acreages within the Salt Creek Wilderness at the time of this report, which also happens to match the original acreage inherited in 1970. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses the presence of inholdings, and contributes to an evaluation and understanding of the undeveloped quality of wilderness. An increase in the number of acres of inholdings indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of acres of inholdings indicates an improving trend.

Table 3: Inholdings and associated acreages within the Salt Creek Wilderness (as of 2012)

Inholdings within Salt Creek Wilderness		
Owner	Description	Acres
State of New Mexico	Mineral rights	960
Transwestern Pipeline Company	Natural gas pipeline and right-of-way	23
Central Valley Electric Cooperative	Transmission line and right-of-way	5.6
	Total Acreage	988.6

[Measure 3.3]—Unauthorized vehicle intrusions

Baseline Data Value [YEAR]: TBD

Frequency: 1 yr.

Significant Change: ANY

Data Adequacy: Moderate—Due to logistical constraints, it will not be possible to constantly monitor the entirety of the wilderness on a regular basis for intrusions of unauthorized vehicles. Similarly, incidents of unauthorized vehicle intrusion uses will likely not be caught in the act, but rather, determined from remaining evidence, such as tire tracks. This being said, the scope of this measure is more concerned with providing refuge management with a relative impression of the frequency and patterns of unauthorized vehicle intrusions in the wilderness, rather than an absolute count of all incidents. The data collected, while perhaps not being capable of producing the same degree of accuracy as other measures of higher data adequacy, represents information of high interest to refuge management.

Data Source(s): LE Officer; Refuge Manager; Incident reports; Wilderness file system

Data Collection Protocol: At the time of this report, there is only one LE Officer on staff, who also serves as the refuge's Recreational Planner. As such, the LE unit rarely patrols the wilderness area. This being said, with other monitoring measures being implemented, other staff members will be spending time in the wilderness on a more regular (relatively speaking) basis. Therefore, refuge staff will report any observed signs or instances of unauthorized vehicle intrusion within the Salt Creek Wilderness to the LE Officer and Refuge Manager, and an

appropriate incident report will be filed to document the occurrence. The total number of documented incidents of unauthorized vehicle intrusions during a given monitoring period will serve as the data value for this measure.

Context and Relevance: Refuge policy governing the Salt Creek Wilderness strictly prohibits the use of unauthorized motorized vehicles. The only permissible means of transport within the wilderness at present are by foot and horseback. There have been ongoing problems with visitors to the North Tract driving up the Pecos River, which, although not part of the Salt Creek Wilderness, is still an unauthorized activity, and there are concerns that this activity may well be expanding into the wilderness. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses the use of motorized vehicles in the wilderness, and further contributes to an evaluation and understanding of the undeveloped quality of wilderness. An increase in the number of reports documenting unauthorized vehicle intrusions indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of reports indicates an improving trend.

[Measure 3.4]—Number of user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport within wilderness

Baseline Data Value [YEAR]: TBD

Frequency: 1 yr.

Significant Change: 28 days

Data Adequacy: High

Data Source(s): Refuge Manager; Refuge Biologist; Wilderness file system

Data Collection Protocol: The Refuge Manager will be aware of all user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport within the wilderness, as all such activities will require the Manager's approval. The Refuge Biologist will also be aware of many (if not all) of these user days, as such activities will likely require coordination with the Biologist. These sources will be consulted for user days data. The sum of all days in which refuge staff used motorized transport, motorized equipment, and/or mechanical transport within the wilderness (excluding emergency purposes) during a given monitoring period will serve as the data value. Definitions of motorized and mechanical, as pertaining to this measure of wilderness character, have been sourced from the Forest Service's *Technical Guide for Monitoring Selected Conditions Related to Wilderness Character*, and are provided below.

> "Mechanical Transport. Any contrivance for moving people or material in or over land, water, or air, having moving parts, that provides a mechanical advantage to the user, and that is powered by a living or nonliving power source. This includes, but is not limited to, sailboats, hand gliders, parachutes, bicycles, game carts, and wagons. It does not include wheelchairs when uses as necessary medical appliances. It also does not include skis, snow shoes, rafts, canoes, sleds, travois, or similar primitive devices without moving parts."

> "Motorized Equipment. Machines that use a motor, engine, or other nonliving power sources. This includes, but is not limited to, such machines as chain saws, aircraft, snow mobiles, generators, motorboats, and motor vehicles. It does not include small battery or gas powered hand carried devices such as shavers, wristwatches, flashlights, cameras, stoves, or other similar small equipment."

Context and Relevance: Historically, there has been a lack of active management and monitoring within the Salt Creek Wilderness. Additionally, there is currently no authorized use of motorized vehicles permitted within the wilderness by refuge management. Formal determination of the official baseline data value will be postponed until data for all other measures has been collected, as the implementation of this wilderness character monitoring initiative may result in such uses as a product of other measures. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses the use of motor vehicles, motorized equipment, and mechanical transport within wilderness, and contributes to an evaluation and understanding of the undeveloped quality of wilderness. An increase in the number of user days of nonemergency, administrative use of motorized transport, motorized equipment, or mechanical transport indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of user days indicates an improving trend. Due to the historical lack of active management and monitoring within the Salt Creek Wilderness, this measure may indicate a degrading trend (initially), as the refuge gradually develops a more involved relationship with the wilderness.

Solitude or Primitive and Unconfined Recreation Quality *Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation*				
Monitoring Question	Indicator	Measure	Data Source(s)	Frequency (yr.)
What are the trends for outstanding opportunities for solitude within wilderness?	Remoteness from sights and sounds of people inside the wilderness	4.1 Audio/Visual contacts of visitors within the wilderness	Refuge Biologist Wilderness file system	3
	Remoteness from occupied and modified areas outside the wilderness	4.2 Area of wilderness affected by adjacent travel routes and development	Refuge Manager Refuge Biologist Wilderness file system	5
What are the trends in outstanding opportunities for primitive and unconfined recreation inside wilderness?	Facilities that decrease self-reliant recreation	4.3 Agency provided recreation facilities	Refuge Manager Maintenance Staff Wilderness file system	5
	Management restrictions on visitor behavior	4.4 Management restrictions on visitor behavior	Refuge Manager Wilderness file system	5

[Measure 4.1]—Audio/Visual contacts of visitors within wilderness

Baseline Data Value [YEAR]: TBD

Frequency: 3 yr.

Significant Change: ANY

Data Adequacy: Low—Due to logistical constraints, it will not be possible for refuge staff to conduct regular audio/visual sampling for visitor contacts within the wilderness. At the time of this report, the Refuge Manager and Biologist only foresee the ability to conduct sampling for this measure once per monitoring period. Thus, the data obtained is not going to be capable of producing the same degree of accuracy as measures with a higher degree of data adequacy. This being said, the current impression of refuge staff is that the Salt Creek Wilderness receives very few visitors annually, and, as the scope of this measure is to provide refuge management with a general impression of the extent of visitor contacts within the wilderness, the data collected for this measure is viewed as satisfactory for the purposes of this wilderness character monitoring initiative.

Data Source(s): Refuge Biologist; Wilderness file system

Data Collection Protocol: Audio/visual sampling will be conducted at 3 sampling locations across the Salt Creek Wilderness. The surveyor(s) will stop at each designated location, and spend 10 minutes looking and listening for visitor contacts. Each contact is made up of 2 components: audio and visual, and therefore receives 2 scores. The audio component (sound) of the contact will be scored as such: 0 = none, 1 = faint, 2 = variable, 3 = easily heard. The visual component (sight) of the contact will be scored as such: 0 = none, 1 = distant, 3 = clearly visible. These components will then be added up for each contact observed during the 10 minute sampling period, and yield a total score for the sampling location. The total scores of all sampling locations will then be summed to determine the total audio/visual contact score for the wilderness, and this number will serve as the data value. An example of this scoring protocol is provided below in Table 4.

Table 4: Scoring protocol for audio/visual contact sampling

Sampling Location	**Audio Score**				**Visual Score**				**Total Score**
	Contact No.				*Contact No.*				
	1	*2*	*3*	*4*	*1*	*2*	*3*	*4*	
Point 1	2				0				2
Point 2	3	1			2	0			6
Point 3	0				1				1
Total Score									9

Context and Relevance: There is currently no means for refuge management to estimate or assess the magnitude of users visiting the Salt Creek Wilderness. This being said, based on the experience and

derived perceptions of refuge staff, the wilderness area is thought to receive very little in the way of visitors. This measure, while incapable of providing an accurate count of visitors, will at least provide for a means of periodically reassessing this general impression. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses remoteness from sights and sounds of people inside the wilderness, and contributes to an evaluation and understanding of the solitude or primitive and unconfined recreation quality of wilderness. An increase in the total audio/visual contact score indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the total audio/visual contact score indicates an improving trend.

[Measure 4.2]—Area of wilderness affected by adjacent travel routes and development

Baseline Data Value [2012]: 4772 acres

Frequency: 5 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Manager; Refuge Biologist; Wilderness file system

Data Collection Protocol: Proximity of surrounding travel routes and developments were assessed through the use of a combination of mapping programs, including Google Earth, Google Maps, and FWS Lands Mapper. Based on the findings, the Refuge Manager and Biologist used their professional judgment to determine the buffer distance representative of the area of wilderness impacted by adjacent travel routes and development—a half mile in the case of the baseline assessment. The FWS Lands Mapper program was then used to calculate the acreage occupied by the buffer, and this acreage figure will serve as the data value. For subsequent monitoring periods, mapping programs and the professional judgment of the Refuge Manager and Biologist will be consulted for reassessment of the area of wilderness affected by adjacent travel routes and development.

Context and Relevance: The Salt Creek Wilderness currently has a number of small roads, main highways, and scattered developments surrounding it. While the size of the majority of these roads and developments, with the exception of the main highways, are relatively small, the nature of the landscape (flat with very little in the way of visual or audio buffers), can serve to increase the magnitude of the impacts such developments have on the wilderness (relative to, say, a dense forest system). This being said, this measure is of particular interest to refuge management, as new travel routes and development have the potential to impose serious consequences on the character of the Salt Creek Wilderness. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses remoteness from occupied and modified areas outside the wilderness, and contributes to an evaluation and understanding of the solitude or primitive and unconfined recreation quality of wilderness. An increase in the number of acres of wilderness affected by adjacent travel routes and development indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the number of acres of wilderness affected by adjacent travel routes and development indicates an improving trend.

[Measure 4.3]—Agency provided recreation facilities

Baseline Data Value [2012]: 0

Frequency: 5 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Manager; Maintenance Staff; Wilderness file system

Data Collection Protocol: The Refuge Manager and Maintenance Staff will be aware of all authorized recreational structures and facilities. These sources will be consulted, and counts of all facilities representing authorized recreational development (indicated below in Table 5) will be collected and totaled. The total count of all facilities present within a given monitoring period will serve as the data value.

Context and Relevance: The data value produced by this measure serves to quantify the presence and magnitude of recreational facilities within the wilderness. As indicated in Table 5, the Salt Creek Wilderness currently has no recreational facilities within it, and therefore makes an ideal contribution to the quality of solitude or primitive and unconfined recreation. This characteristic of the Salt Creek Wilderness, while unlikely to change in the near future, is one refuge management and staff would like to see preserved. Monitoring this measure therefore provides a means of communicating the implications of recreational facilities within wilderness to both present and future refuge staff. This measure is relevant to the associated indicator, monitoring question, and quality in that it addresses facilities that decrease self-reliant recreation, and contributes to an evaluation and understanding of the solitude or primitive and unconfined recreation quality of wilderness. An increase in the total number of recreation facilities indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the total number of recreation facilities indicates an improving trend.

Table 5: List of facilities representative of recreational development, and their count within the Salt Creek Wilderness (as of 2012)

Facilities	**Number**
Toilets	0
Constructed tent pads or sleeping platforms	0
Picnic tables	0
Bear poles/food storage structures	0
Developed/permanent fire rings/grates	0
Shelters	0
Developed water sources	0

Corrals	0
Large bridges	0
Total	0

[Measure 4.4]—Management restrictions on visitor behavior

Baseline Data Value [2012]: 16

Frequency: 5 yr.

Significant Change: ANY

Data Adequacy: High

Data Source(s): Refuge Manager; Wilderness file system

Data Collection Protocol: Table 6, sourced from the Forest Service's *Technical Guide for Monitoring Selected Conditions Related to Wilderness Character*, contains a list of management restrictions placed on visitor behavior, as well as scores assigned based on the degree of restriction, and the significance of their impact on opportunities for primitive and unconfined recreation. When scoring the restrictions of a given wilderness, a geographical weight is also applied: 1 = restriction applies only to a portion of the wilderness; 2 = restriction applies throughout entire wilderness. Based on the stipulations of management policy within a given monitoring period, the wilderness will be scored, and the total score will serve as the data value. Table 7 illustrates this scoring process for the Salt Creek Wilderness based on management restrictions in place at the time of this report.

Table 6: Index of management restrictions

Category	Score	Type of Restriction
Campfires	0	No regulation
	1	Designated site, above designated elevation, or mandatory setback
	2	Total prohibition
Camping	0	No restriction
	1	Any mandatory setback; designated sites
	2	Assigned sites
	3	Total prohibition
Fees	0	No fees
	1	Fees charged of selected user type

	2	Fees charged of all visitors
Permits	0	No permit or registration
	1	Voluntary self-registration
	2	Mandatory, nonlimiting permit or registration
	3	Mandatory; use limited
Human waste	0	No regulation
	3	Pack out required
Length of stay	0	No restriction on length of stay
	1	Length of stay limited
Stock use	0	No restriction
	1	Mandatory setbacks; no hitching, tethering
	2	Grazing prohibited or feed restricted
	3	No camping with stock; area closures to all stock
Swimming/bathing	0	No restrictions
	2	Prohibited
Area closure	0	No restriction
	3	Area closed to use
Group size limits	0	No restriction
	1	Group size limits in place
Dogs	0	No restrictions
	1	Required to be on leash
	2	Prohibited

Context and Relevance: Based on the Wilderness Act of 1964, and reinforced through the operational definitions proposed by this monitoring program, outlets for primitive and unconfined recreation represent a major contributing quality to the overall character of wilderness. Management of wilderness includes the creation and enforcement of visitor use/behavior restrictions, which ultimately affect the quality of a visitor's recreational experience. Table 7 indicates the extent of management restrictions associated with the Salt Creek Wilderness at the time of this report (according to the above scoring system). The data value of this measure is not likely to change in the near future, and will therefore likely display a consistent, stable trend. This measure is relevant to the associated indicator,

monitoring question, and quality in that it addresses management restrictions on visitor behavior, and contributes to an evaluation and understanding of the solitude or primitive and unconfined recreation quality of wilderness. An increase in the management restrictions index score indicates a degrading trend in the context of the measure and associated indicator, monitoring question, and quality, while a decrease in the management restrictions index score indicates an improving trend.

Table 7: Management restrictions score for Salt Creek Wilderness (2012)

Category	**Score**	**Geographic Weight**	**Total Score**
Campfires	2	2	4
Camping	3	2	4
Fees	0	—	0
Permits	0	—	0
Human waste	0	—	0
Length of stay	1	2	2
Stock use	0	—	0
Swimming/bathing	2	2	4
Area closure	0	—	0
Group size limits	0	—	0
Dogs	1	2	2
		Total Score	16

Dropped Measures

Untrammeled Quality	
Measure	Reason(s) measure was dropped
Acreage of wilderness burned due to human ignited fires	Debate about how possible and practical it would be to investigate the cause of every single fire. Not a part of current practices, and not likely something refuge personnel, time, and resources are going to be spent on in the future.
Number of actions to manage fire (natural ignitions and human caused)	Data from this measure captured under the more inclusive measure "Number of actions to manage vegetation; fish, wildlife, and insects; soil and water; and fire"
Natural Quality	
Measure	Reason(s) measure was dropped
Population dynamics of selected native species	Seen as a redundancy since "Status of species of particular concern or interest" is being used as a measure, and likewise communicates similar information
Watershed function	The only "watershed" within the wilderness would be associated with Salt Creek, but that is usually dry most of the year as a result of damming the Pecos River, which occurred pre-wilderness designation. This being said, Salt Creek, and its associated watershed, was not an existing characteristic of the wilderness area when it was designated. Additionally, the likelihood of the state of Salt Creek ever changing is minimal, as it would require the removal of up-river dams over which the refuge has no jurisdiction.
Change in natural fire regime	Low scoring for significance, vulnerability, and reliability, and determined to have low feasibility for monitoring
Water Quality	Logistical issues with communicating the multiple variables tied to this measure in a functional manner. Water quality is only relevant to the Salt Creek Wilderness in the context of its potential to provide habitat for species of particular interest/concern, which is already being addressed via the measure "Status of habitat for selected species: Pecos pupfish (*Cyprinodon pecosensis*)".
Climate change parameters	Lack of confidence in accuracy of ascertainable data and trends given the resources and time at the refuge's disposal, as well as the nature of climate change itself
Undeveloped Quality	
Measure	Reason(s) measure was dropped
Index of authorized physical structures, installations, or developments	Low scoring for significance and vulnerability. Authorized structures of high significance are inholdings, for which there is a more specific measure, "Acres of inholdings within wilderness".
Miles of roads associated with inholdings	Seen as a redundancy since "Acres of inholdings within wilderness" is being used as a measure, and the right-of-ways for these inholdings (which represent the only associated roads) are included in the acreage values.
Authorized administrative uses	No authorized vehicular access is allowed in the wilderness, with the exception of case-by-case emergency situations. While it was initially thought this could be a positive attribute of this particular

	wilderness to highlight, the fact that the situation is highly unlikely to change eventually lead to the exclusion of this measure.
Authorized emergency uses	In the context of the undeveloped quality of the Salt Creek Wilderness, authorized emergency uses of motorized or mechanical transportation and equipment are not seen as a significant source of impact. Due to low levels of visitor use, and the fact that the wilderness area is small enough to hike across in a single day (if need be), with major roads visible even at a distance, emergencies are extremely rare.
Solitude of Primitive and Unconfined Recreation Quality	
Measure	Reason(s) measure was dropped
Visitors to wilderness area	While this information would be very insightful and useful in the context of this wilderness character monitoring initiative, as well as the local operations of the refuge, it would not be possible to accurately determine the number of visitors to the Salt Creek Wilderness. There are a number of off-refuge property access points used by the public (particularly hunters, which make up a large portion of the visitor demographic), and the wilderness area is separated from refuge headquarters by about 8 miles, making monitoring of visitor use on that portion of the refuge very difficult.
Other Features Quality	
Measure	Reason(s) measure was dropped
Cultural resources	Although initially discussed as a valuable aspect of this particular wilderness, based on mention of Native American and early settler/homestead artifacts in some of the older annual narratives and documents, a measure dealing with cultural resources was found to be infeasible to monitor on a regular basis, let alone in time for the baseline year. Framing the measure in terms of loss, such as the suggested “Number of unauthorized removals of cultural resources” would be impossible to keep track of, and while perhaps something akin to a cultural inventory could be beneficial, the process required to complete the necessary data collection goes far beyond the timeframe for this baseline assessment.

Conclusion

The above compilation of selected measures provides for an accurate representation of the Salt Creek Wilderness, and contributes to a greater functional understanding of wilderness character and its management. Through careful design and consideration, the finalized list of monitoring measures manages to strike a critical balance between local and national pertinence, thereby exhibiting relevance for both refuge management and staff, and the FWS Division of Inventory & Monitoring. The common absence of current and historical data and monitoring resources pertaining to the Salt Creek Wilderness presented a unique (relative to previous installations of this program at other refuges/wilderness areas) challenge, and required the development of measures which, for the most part, represent entirely new programs and initiatives on the part of the refuge. This contradicts the ideal protocol presented to Wilderness Fellows at training in Fort Collins—to minimize the creation of additional work for refuge staff by using already existing data and monitoring initiatives to design and satisfy the measures of this wilderness character monitoring program—, and created some initial concerns about accountability and follow through on the part of refuge staff. However, I feel as though these concerns have been adequately addressed through the procedural and conceptual approaches taken during the process of designing and establishing this wilderness character monitoring program.

I worked very closely with the Refuge Manager and Biologist (those that will be charged with maintaining the program in the future—at least initially) to ensure not only the highest degree of local relevance possible, but that the sum total of the work required to gather and interpret data for each measure did not impose unreasonable, additional burdens on refuge staff as well. This involved frequent, significant discussions about the availability of staff and additional resources, as well as further logistical considerations (ex: What time of year will data collection for a given measure likely occur? For what measures can data be collected together to maximize the efficiency of time spent in the wilderness? Who will likely be responsible for collecting the data? What equipment will be needed? How long will data collection take for a given measure? Are there any particular conflicts with current refuge duties that may interfere with the collection of data for a given measure at a given time? Etc.) not explicitly captured in, but highly influencing, the text of this report. Drawing on this process of detailed procedural discussions, and addressing the absence of data and current programs from which measures could be adapted, and baseline data values determined, this final report places an emphasis on the development of highly refined and specific measure definitions and data collection protocols, so as to leave no lingering questions or doubts as to what needs to be done to satisfy each measure, or the goals of the greater monitoring program, after the departure of the Wilderness Fellow.

The deliberate pursuit of local relevance, emphasis on procedural practicality, acknowledgement of limitations of staff and additional resources, and clear, detailed communication of protocol and purpose, contribute to a final report and program design capable of guiding the staff of Bitter Lake NWR to full implementation, and, ultimately, realization of both local and national goals.

Dramatic changes in wilderness character are not foreseen, at least in the immediate future, for the Salt Creek Wilderness. This being said, as this monitoring program becomes established, and produces valuable insight for refuge management and staff, a potential change within the four qualities may become most pronounced in the form of interactions associated with the natural quality. This wilderness character monitoring program represents the beginning of a more active and inquisitive relationship between refuge staff and the Salt Creek Wilderness, and has the potential to present and incentivize opportunities to improve aspects of the natural quality of the wilderness (ex: salt cedar removal, additional plant and wildlife monitoring/management programs, etc.), which may incidentally

impact the other qualities (ex: increased monitoring and management programs would degrade the untrammeled quality; salt cedar removal, should it be performed through the use of motorized or mechanical means, would degrade the undeveloped quality; and increased activity within the wilderness, in general, could contribute to the degradation of the solitude or primitive and unconfined recreation quality). The potential magnitude of such interactions and impacts may be more accurately inferred after the completion of the initial baseline assessment for the Salt Creek Wilderness.

Appendix A: Prioritizing Measures of Wilderness Character—priority ranking of all measures considered

(*Excluding those eliminated via the initial prescreening process)*

The criteria and ranking guide below is used to create an overall score for each measure. If the combined score for criteria A and B is ≤ 2, STOP and do not score criteria C and D. Those measures with the highest overall scores should be the highest priority for assessing trends in wilderness character

A. Level of significance (the measure is highly relevant to the quality and indicator of wilderness character, and is highly useful for managing the wilderness): High = 3, Medium = 2, Low = 1

B. Level of vulnerability (measures an attribute of wilderness character that is currently at risk, or may likely be at risk over 10-15 years): High = 3, Medium = 2, Low = 1

C. Degree of reliability (the measure can be monitored accurately with a high degree of confidence, and would yield the same result if measured by different people at different times): High = 3, Medium = 2, Low = 1

D. Degree of feasibility (the measure is related to an existing effort or could be monitored without significant additional effort): High = 1, Low = 0 (if 0 is given, do not use)

POTENTIAL MEASURE	Criteria for Prioritizing Potential Measures				OVERALL SCORE
	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	
UNTRAMMELED QUALITY					
Indicator: Authorized actions that manipulate the biophysical environment **Measure:** Number of actions to manage fire (natural ignitions and human-caused)	2	1	3	1	7
Indicator: Authorized actions that manipulate the biophysical environment **Measure**: Number of actions to manage vegetation; fish, wildlife, and insects; soil and water; and fire	3	3	3	1	10
Indicator: Authorized actions that manipulate the biophysical environment **Measure**: Number of research, survey, and monitoring projects that manipulate plants or wildlife habitat	3	2	3	1	9
Indicator: Unauthorized actions that manipulate the biophysical environment **Measure:** Number of observed and reported incidents of cattle/livestock trespass on wilderness	2	2	2	1	7

POTENTIAL MEASURE	Criteria for Prioritizing Potential Measures				OVERALL SCORE
	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	
NATURAL QUALITY					
Indicator: Plant and animal species and communities **Measure:** Population dynamics of selected native species	3	3	2	1	9
Indicator: Plant and animal species and communities **Measure:** Population dynamics of selected non-native species	3	3	2	1	9
Indicator: Plant and animal species and communities **Measure:** Status of habitat for selected species	3	3	2	1	9
Indicator: Plant and animal species and communities **Measure:** Status of species of particular concern or interest	3	3	2	1	9
Indicator: Physical resources **Measure:** Air quality	3	3	1	1	8
Indicator: Physical resources **Measure:** Water quality	3	3	2	1	9
Indicator: Biophysical processes **Measure:** Change in natural fire regime	1	2	1	0	X
Indicator: Biophysical processes **Measure:** Pathways for invasives	3	3	3	1	10

POTENTIAL MEASURE	Criteria for Prioritizing Potential Measures				OVERALL SCORE
	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	
UNDEVELOPED QUALITY					
Indicator: Non-recreational structures, installations, or developments **Measure:** Index of authorized physical structures, installations, or developments	1	1			X
Indicator: Non-recreational structures, installations, or developments **Measure:** Miles of active, administrative travel routes and access roads	2	1	3	1	7
Indicator: Inholdings **Measure:** Acres of inholdings within wilderness	2	2	3	1	8
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport **Measure:** Unauthorized vehicle intrusions	2	2	2	1	7
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport **Measure:** Number of user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport	3	3	3	1	10

POTENTIAL MEASURE	Criteria for Prioritizing Potential Measures				OVERALL SCORE
	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	
SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY					
Indicator: Remoteness from sights and sounds of people inside the wilderness **Measure:** Audio/Visual contacts of visitors within the wilderness	2	1	2	1	6
Indicator: Remoteness from occupied and modified areas outside the wilderness **Measure:** Area of wilderness affected by adjacent travel routes and development	2	2	2	1	7
Indicator: Facilities that decrease self-reliant recreation **Measure:** Agency provided recreation facilities	3	1	3	1	8
Indicator: Management restrictions on visitor behavior **Measure:** Management restrictions on visitor behavior	3	1	3	1	8

Appendix B: Summary of Effort Required for Wilderness Character Monitoring

Comment: The following table has been adapted from the original materials provided, and differs from that featured in reports of past Wilderness Fellows. This adapted design serves to communicate an estimated indication of time required to collect data for each measure in the absence of more concrete temporal figures (due to the lack of data available to collect for the Salt Creek Wilderness).

Quality	Indicator	Measure	Index of estimated time required to gather and interpret data for each measure (1 = minimal, 2 = moderate, 3 = high)	Comments
Untrammeled	Actions authorized by the Federal land manager that manipulate the biophysical environment	1.1 Number of actions to manage vegetation; fish, wildlife, and insects; soil and water; and fire	1	
Untrammeled	Actions authorized by the Federal land manager that manipulate the biophysical environment	1.2 Number of research, survey, and monitoring projects that manipulate plants or wildlife	1	
Untrammeled	Actions not authorized by the Federal land manager that manipulate the biophysical environment	1.3 Number of observed and reported incidents of cattle/livestock trespass on wilderness	1	
Natural	Plant and animal species and communities	2.1 Population dynamics of selected non-native species: Salt cedar/Tamarisk (*Tamarix*)	2	Data for multiple variables needed; requires professional judgment

Natural	Plant and animal species and communities	2.2 Status of habitat for selected species: Pecos pupfish (*Cyprinodon pecosensis*)	3	Requires fieldwork
Natural	Plant and animal species and communities	2.3 Status of species of particular concern or interest: Pecos pupfish (*Cyprinodon pecosensis*)	3	Requires fieldwork
Natural	Physical resources	2.4 Air quality	1	All data provided by I&M
Natural	Biophysical processes	2.5 Pathways for invasives as a function of annual precipitation	1	
Undeveloped	Non-recreational structures, installations, and developments	3.1 Miles of active, administrative travel routes and access roads within wilderness	1	
Undeveloped	Inholdings	3.2 Acres of inholdings within wilderness	1	
Undeveloped	Use of motor vehicles, motorized equipment, or mechanical transport	3.3 Unauthorized vehicle intrusions	1	
Undeveloped	Use of motor vehicles, motorized equipment, or mechanical transport	3.4 Number of user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport	1	

Solitude or Primitive and Unconfined Recreation	Remoteness from sights and sounds of people inside the wilderness	4.1 Audio/Visual contacts of visitors within the wilderness	3	Requires fieldwork
Solitude or Primitive and Unconfined Recreation	Remoteness from occupied and modified areas outside the wilderness	4.2 Area of wilderness affected by adjacent travel routes and development	1	
Solitude or Primitive and Unconfined Recreation	Facilities that decrease self-reliant recreation	4.3 Agency provided recreation facilities	1	
Solitude or Primitive and Unconfined Recreation	Management restrictions on visitor behavior	4.4 Management restrictions on visitor behavior	1	

Title of staff involved in identifying, prioritizing, and selecting measures	Staff time to identify, prioritize, and select measures (hours)	Comments
Refuge Manager	20	consulted in formal meetings for identification, prioritization, and ultimate selection and definition of measures
Biologist	20	consulted in formal meetings for identification, prioritization, and ultimate selection and definition of measures
Maintenance Worker	2	informal discussions over the first couple weeks that helped establish context, and direct my research
Fire Officer	2	informal discussions over the first couple weeks that helped establish context, and direct my research

Time you spent to identify, prioritize, and select all the measures (in whole hours)	Time you spent to learn how to enter data into the WCM database application (in whole hours)	Time you spent to enter all data into the WCM database application (in whole hours)	Time you spent on other tasks directly related to WCM (e.g., reading CCP, giving presentations, talking with staff) (in whole hours)	Time you spent doing <u>other</u> Refuge tasks not directly related to WCM (in whole hours)
225	8	8	145	210

Appendix C: Summary of Priority, Data Source(s), and Data Collection Protocols for All Measures

Measure	Priority (H, M, L)	Data Source(s) and Collection Protocol
Untrammeled Quality		
1.1 Number of actions to manage vegetation; fish, wildlife, and insects; soil and water; and fire	H	Source(s): Refuge Manager; Refuge Biologist; Wilderness file system Protocol: The Refuge Manager and Biologist will be aware of all actions taken to manage natural aspects of the wilderness, including: vegetation, fish, wildlife, insects, disease, soil, water, and fire. The total number of such actions taken in a given monitoring period shall serve as the data value. See Table 1 for general rules of counting and reporting the number of actions for this measure.
1.2 Number of research, survey, and monitoring projects that manipulate plants or wildlife	H	Source(s): Refuge Biologist; Wilderness file system Protocol: The Refuge Biologist will be aware of all research, survey, and monitoring projects, both those initiated and performed by refuge staff, as well as outside researchers. The Refuge Biologist will be consulted for this information, and the total number of all research, survey, and monitoring projects in a given monitoring period that manipulate plants or wildlife will serve as the data value for this measure.
1.3 Number of observed and reported incidents of cattle/livestock trespass on wilderness	M	Source(s): LE Officer; Refuge Manager; Incident reports; Wilderness file system Protocol: At the time of this report, there is only one LE Officer on staff, and he also serves as the refuge's Recreational Planner. As such, the LE unit rarely patrols the wilderness area. This being said, with other monitoring measures being implemented, other staff members will be spending time in the wilderness on a more regular (relatively speaking) basis. Therefore, refuge staff will report any observed presence of cattle/livestock trespass within the Salt Creek Wilderness to the LE Officer and Refuge Manager, and an appropriate incident report will be filed to document the occurrence. Valid observations of trespass will include sighting of actual animals, as well as "cow pies" (refuge staff have indicated the ability to distinguish between cow pies of various ages). All incident reports should include some sort of geographic reference, but this is particularly important when cow pies are used as evidence of cattle trespass, so as to avoid recounting the same evidence. The total number of documented, observed incidents of cattle trespass during the given monitoring period (frequency) will constitute the data value for this measure.

Natural Quality		
2.1 Population dynamics of selected non-native species: Salt cedar/Tamarisk (*Tamarix*)	H	Source(s): Refuge Biologist; Wilderness file system Protocol: The Refuge Biologist will use professional judgment and expertise to consider the following three primary factors: annual precipitation, occurrence and extent of removal/treatment of salt cedar, and presence and impact of the tamarisk leaf beetle. Based on the Refuge Biologist's interpretation of these factors, the population dynamics of salt cedar will be scored according to the following scoring system: 0 = salt cedar population is stable or decreasing; 1 = salt cedar population is increasing/expanding. This score will serve as the data value.
2.2 Status of habitat for selected species: Pecos pupfish (*Cyprinodon pecosensis*)	H	Source(s): Refuge Biologist; Wilderness file system Protocol: For the purposes of establishing the initial baseline, all sinkholes in the Salt Creek Wilderness will be subjected to a water quality analysis. The key parameters of water quality that pertain to habitat evaluation for Pecos pupfish are salinity and conductivity, dissolved oxygen, temperature, and pH. Based on this data, the Refuge Biologist will use professional judgment and expertise to determine which sinkholes in the wilderness provide suitable habitat for Pecos pupfish, regardless of whether or not fish are actually known/confirmed to be present in a given sinkhole. Each sinkhole will then be scored for habitat quality (0 = inadequate for Pecos pupfish; 1 = adequate for Pecos pupfish). The sum of all scores, representing the number of sinkholes determined to provide suitable habitat, will serve as the baseline data value for the measure. Data collection for all subsequent monitoring periods will entail the same water quality analysis and professional interpretation by the Refuge Biologist, but only those sinkholes originally determined to be suitable habitat for Pecos pupfish will be monitored and scored. The sum of all scores in a given monitoring period will serve as the respective, subsequent data value.
2.3 Status of species of particular concern or interest: Pecos pupfish (*Cyprinodon pecosensis*)	H	Source(s): Refuge Biologist; Wilderness file system Protocol: Monitoring of Pecos pupfish in the Salt Creek Wilderness represents an entirely new initiative for refuge staff, and will therefore require some extra work to establish the baseline for the measure. Staff will survey all sinkholes in the wilderness for water quality, which will allow the Refuge Biologist to determine which sinkholes provide suitable habitat for Pecos pupfish (see Measure 2.2—Status of habitat for selected species: Pecos pupfish). Fish traps will then be set in all sinkholes determined to provide suitable habitat for Pecos pupfish to determine in which sinkholes, out of those deemed

		to provide adequate habitat, the species is actually present (the exception being sinkholes in which a positive identification of Pecos pupfish can be made from the surface by a trained eye—in which case trapping will not be needed to determine presence/absence of the species). These sinkholes will then be scored according to presence/absence of the species (0 = absent; 1 = present). The sum of all scores, representing the number of sinkholes in which Pecos pupfish are confirmed to be present, will serve as the baseline data value. With the baseline established, future data collection for the measure will entail trapping (again, if a positive identification is not first made via visual inspection by a trained eye) at all sinkholes determined through the baseline study (of Measure 2.2) to provide suitable habitat for Pecos pupfish. The sum of all resulting presence/absence scores in a given monitoring period will serve as the respective, subsequent data value.
2.4 Air quality	M	Source(s): FWS Division of Inventory & Monitoring Protocol: All data required for monitoring of the air quality measure, which will likely be composed of a series of defined metrics, will be provided by the FWS Division of Inventory & Monitoring. At the time of this report, protocol dictating the specific metrics and interpretation was unavailable, but will be accompanying the data provided to the refuge.
2.5 Pathways for invasives as a function of annual precipitation	H	Source(s): Refuge Biologist; Eight Mile Draw RAWS data; Wilderness file system Protocol: A historic average annual precipitation value of 13.18 inches was calculated from the past 26 years of archived precipitation data from the Eight Mile Draw Remote Automatic Weather Station (RAWS) (representing data from the station's first full year of data collection beginning January 1986, to December 2011), and will serve as the scoring threshold for the measure. Annual precipitation data from the Eight Mile Draw Remote Automatic Weather Station (RAWS) will be consulted for annual precipitation figures (calculated from monthly figures), and will serve as a best available representation of the weather conditions experienced by the Salt Creek Wilderness. If the annual precipitation in a given year does not exceed (i.e.: is less than or equal to) the historic average (13.18 inches), it will receive a score of 0. If the annual precipitation exceeds the historic average, it will receive a score of 1. Computing the final data value for the measure goes a step further. If the score for a given year's precipitation is 0, the data value is 0. However, if the score for a given year's precipitation is 1, it will be summed with the preceding year's data value, and this total score will serve as the data value for the year in question. Interpreting significant change is similarly two-fold. A decrease in the data

		value is only significant if the preceding data value is greater than 2, whereas any increase exceeding a score of 2 is significant. See Table 2 for an example of this computational process.
Undeveloped Quality		
3.1 Miles of active, administrative travel routes and access roads within wilderness	M	Source(s): Refuge Manager; Wilderness file system Protocol: The Refuge Manager will be aware of all active administrative travel routes and access roads within the wilderness area, and will be consulted for data. The sum of all miles of active, administrative travel routes and access roads within the wilderness during a given monitoring period will serve as the data value.
3.2 Acres of inholdings within wilderness	M	Source(s): Refuge Manager; Wilderness file system Protocol: The Refuge Manager will be aware of all existing inholdings within the wilderness area, and will be consulted for acreage data. The sum of all inholding acres present during a given monitoring period will serve as the data value.
3.3 Unauthorized vehicle intrusions	M	Source(s): LE Officer; Refuge Manager; Incident reports; Wilderness file system Protocol: At the time of this report, there is only one LE Officer on staff, and he also serves as the refuge's Recreational Planner. As such, the LE unit rarely patrols the wilderness area. This being said, with other monitoring measures being implemented, other staff members will be spending time in the wilderness on a more regular (relatively speaking) basis. Therefore, refuge staff will report any observed signs or instances of unauthorized vehicle intrusion within the Salt Creek Wilderness to the LE Officer and Refuge Manager, and an appropriate incident report will be filed to document the occurrence. The total number of documented incidents of unauthorized vehicle intrusions during the given monitoring period (frequency) will constitute the data value for this measure.
3.4 Number of user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport	H	Source(s): Refuge Manager; Refuge Biologist; Wilderness file system Protocol: The Refuge Manager will be aware of all user days of nonemergency, administrative use of motorized transport, motorized equipment, and mechanical transport within the wilderness, as all such activities will require the Manager's approval. The Refuge Biologist will also be aware of many (if not all) of these user days, as such activities will likely require coordination with the Biologist. These sources will be consulted for user days data. The sum of all days in which

		refuge staff used motorized transport, motorized equipment, and/or mechanical transport within the wilderness (excluding emergency purposes) during a given monitoring period, will serve as the data value.
Solitude or Primitive and Unconfined Quality		
4.1 Audio/Visual contacts of visitors within the wilderness	L	Source(s): Refuge Biologist; Wilderness file system Protocol: Audio/visual sampling will be conducted at 3 sampling locations across the Salt Creek Wilderness. The surveyor(s) will stop at each designated location, and spend 10 minutes looking and listening for visitor contacts. Each contact is made up of 2 components: audio and visual, and therefore receives 2 scores. The audio component (sound) of the contact will be scored as such: 0 = none, 1 = faint, 2 = variable, 3 = easily heard. The visual component (sight) of the contact will be scored as such: 0 = none, 1 = distant, 3 = clearly visible. These components will then be added up for each contact observed during the 10 minute sampling period, and yield a total score for the sampling location. The total score of all sampling locations will then be summed to determine the total audio/visual contact score for the wilderness, and this number will serve as the data value. See Table 4 for an example of this scoring protocol.
4.2 Area of wilderness affected by adjacent travel routes and development	M	Source(s): Refuge Manager; Refuge Biologist; Wilderness file system Protocol: Proximity of surrounding travel routes and developments were assessed through the use of a combination of mapping programs, including Google Earth, Google Maps, and FWS Lands Mapper. Based on the findings, the Refuge Manager and Biologist used their professional judgment to determine the buffer distance representative of the area of wilderness impacted by adjacent travel routes and development—a half mile in the case of the baseline assessment. The FWS Lands Mapper program was then used to calculate the acreage occupied by the buffer, and this acreage figure will serve as the data value. For subsequent monitoring periods, mapping programs and the professional judgment of the Refuge Manager and Biologist will be consulted for reassessment of the area of wilderness affected by adjacent travel routes and development.
4.3 Agency provided recreation facilities	M	Source(s): Refuge Manager; Maintenance Staff; Wilderness file system Protocol: The Refuge Manager and Maintenance Staff will be aware of all authorized recreational structures and facilities. These sources will be consulted, and counts of all facilities representing authorized recreational development (indicated in

		Table 5) will be collected and totaled. The total count of all facilities will serve as a quantitative representation of agency provided recreational facilities within the wilderness.
4.4 Management restrictions on visitor behavior	M	Source(s): Refuge Manager; Wilderness file system Protocol: Table 6, sourced from the Forest Service's *Technical Guide for Monitoring Selected Conditions Related to Wilderness Character*, contains a list of management restrictions placed on visitor behavior, as well as scores assigned based on the degree of restriction, and the significance of their impact on opportunities for primitive and unconfined recreation. When scoring the restrictions of a given wilderness, a geographical weight is also applied (1 = restriction applies only to a portion of the wilderness; 2 = restriction applies throughout entire wilderness). Based on the stipulations of management policy at the time of evaluation, the wilderness is scored. This total number represents an indexed representation of management restrictions placed on visitors to the wilderness.