Information Sheet on Ramsar Wetlands (RIS)

1. Date this sheet was completed/updated:

August 6, 2001

2. Country:

United States of America

3. Name of wetland:

Quivira National Wildlife Refuge

4. Geographical coordinates:

38°05'N and 98°29'W

7. Altitude:

1720 - 1790 feet mean sea level

6. Area:

8957.7 hectares (22,135 acres)

7. Overview:

Quivira National Wildlife Refuge (NWR) is a freshwater and inland salt marsh complex which includes 3023 ha of wetlands, 5261 ha of grasslands, and 526 ha of croplands. The Refuge serves as a migration stop and wintering area for migratory waterfowl and other water dependent species. The area is critical habitat for the endangered interior least terns and whooping cranes. Thousands of shorebirds use the Refuge salt flats as feeding, nesting and migration habitat.

8. Wetland Type:

Marine-Coastal: A B C D E F G H I J K Zk(a)

Inland: L M **N** O P Q **R** **Sp** **Ss** Tp
Ts U Va Vt W Xf Xp Y Zg Zk(b)

Man-Made: 1 2 3 **4** 5 **6** 7 8 **9** Zk(c)

Please now rank these wetland types by listing them from the most to the least dominant :

Sp, Ss, R, N, 6, 4, 9

9. Ramsar Criteria:

1 2 3 4 5 6

Please specify the most significant criterion applicable to the site:

1

10. Map of site included? Please tick X YES or NO

11. Name and address of the compiler of this form:

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12. Justification of the criteria selected under point 9:

1. Quivira National Wildlife Refuge (NWR) is a excellent example of an inland salt marsh, a rare habitat type within this region. The wetlands on Quivira NWR provide over 3,023 ha of habitat ranging from high salinity to almost fresh, depending on the precipitation and flow in Rattlesnake Creek, the main source of Refuge water. The salt marshes provide critical nesting, migration, and wintering habitat for over 311 bird species and literally millions of individuals.

The salt marshes of Quivira NWR are rare and unique for this region, where most wetlands are freshwater hydrologic regimes. The fresh groundwater in this portion of Kansas is perched atop a layer of salt water, which has resulted from the subsurface flow over bedrock salt formations deep within the earth. An upthrust in the bedrock, which extends almost to the land surface along the western boundary of Quivira NWR, forces this salt laden groundwater to enter Rattlesnake Creek or to emerge in springs that carry the salinity to the wetlands. This unique geologic process creates a variety of salinity levels as the groundwater flow mixes with runoff, precipitation, or is diluted by existing wetland levels. Natural evaporation can at times concentrate the salt as during the 1991 drought when the salinity level of the last remaining water in the Big Salt Marsh was recorded as three times that of ocean water.

Because of the salt rich environment, the resulting vegetative cover is determined by it's salt

tolerance. This has been an ecological factor in keeping some areas of the Refuge almost vegetation free, providing ideal habitat for a variety of shorebirds, and a nesting colony of endangered interior least terns.

2. Quivira NWR provides habitat for three federally listed endangered and two federally listed threatened species. The threatened bald eagle (*Haliaeetus leucocephalus*) uses the Refuge during fall, winter and early spring, feeding on the large flocks of waterfowl on Quivira. In 1999, a record of 142 bald eagles were counted, wintering on Quivira NWR. The endangered peregrine falcon (*Falco peregrinus*) has been recorded in all seasons, but is most evident during the spring and fall, when it is usually seen feeding on the migrating shorebirds.

The marshes of Quivira NWR provide critical habitat for endangered whooping cranes (*Grus americana*) during both the fall and spring migrations. In recent years up to 40 individual whooping cranes have been recorded using Quivira NWR during one fall migration period. Whooping cranes may stay for up to 5-6 weeks in the fall, but the spring migration stops are usually shorter, as the cranes are eager to reach the breeding grounds.

The extensive salt flats around the Big Salt Marsh provide critical nesting habitat for the endangered interior least tern (*Sterna antillarum*). Quivira NWR contains one of only two persistent nesting colonies of interior least terns in Kansas , usually with 30-40 pairs. A predator exclusion, electric fence and elevated artificial nesting structures have been added to the site to reduce flooding and predation. Production has been as high as 36-40 young least terns, raised to flight stage, from the Quivira NWR nesting colony.

The piping plover (*Charadrius melodus*), a federally designated threatened species, uses Quivira NWR during it's spring and fall migrations, often observed on the salt flats.

Two Kansas State listed threatened species also use Quivira as nesting sites; snowy plovers (*Charadrius alexandrinus*) and white-faced ibis (*Plegadis chihi*). Thompson and Ely (1989) consider Quivira NWR as the "main breeding area" for the snowy plover in Kansas. White-faced ibis are increasing as a breeding species on Quivira NWR and flocks over one hundred are common. Additionally, several free flowing springs adjacent to the Big Salt Marsh contain breeding populations of the Arkansas darter (*Etheostoma cragini*), a Kansas State threatened fish.

3. Quivira National Wildlife Refuge provides a diversity of wildlife habitat through the native grass uplands, fresh and saltwater marshes and salt flats on the site. Large wetland complexes are rare in Kansas, as throughout most of the southern Great Plains, most having been destroyed by agricultural development. Quivira NWR and the nearby state owned Cheyenne Bottoms Wildlife Management Area (WMA), which is already designated a RAMSAR site, comprise the major wetland sites for a variety of wildlife moving across Kansas, along the Central flyway.

Because of the 30 mile distance between Cheyenne Bottoms WMA and Quivira NWR, these two units are often not subjected to the same precipitation patterns. Seldom during rare drought conditions are both Quivira and Cheyenne Bottoms dry, so when one area cannot provide the wetland habitat needed, the other site can generally fill the needs of the migrating wildlife. Scattered thunderstorms can produce too much precipitation on either area, flooding the shallow water areas to a depth that prevents use by shorebirds. Because of the sporadic nature of prairie thunderstorms, this seldom happens at both Quivira and Cheyenne Bottoms, so the shorebirds just move from one site to the other.

Quivira and Cheyenne Bottoms, because of the sharing of habitat, often host over 90% of the worlds population of such species as stilt sandpipers (*Calidris himantopus*) and white-rumped sandpipers (*Calidris fuscicollis*).

Because of Quivira NWR's location near the 100th meridian, there is an overlap of eastern and western bird species and the central U.S. location results in northern and southern species intermingling. As an example, both the eastern meadowlark (*Sturnella magna*) and the western meadowlark (*Sturnella neglecta*) can be found using the habitat on Quivira NWR, at the same time.

4. Quivira NWR supports large assemblages of fauna, many for their entire life cycle and others for only critical portions. Quivira NWR was established in May, 1955, as a migration stop and a wintering area for migratory birds. The establishing legislation, stated the purpose as "use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act).

Quivira wetlands provide migration and wintering habitat for large populations of Canada geese (*Branta canadensis*), greater white-fronted geese (*Anser albifrons*) and increasingly in recent years, snow geese (*Chen caerulescens*). Based on bi-monthly surveys conducted during the fall migration, 2000-2001, Quivira supported over 600,000 Canada geese, 229,000 white-fronted geese and over 155,000 snow geese, which represented 42%, 51%and 32% (respectively) of the Statewide populations (KDWP Waterfowl Migration Report, 2000 Season). In addition, during this same period, Quivira NWR supported over 119,000 sandhill cranes (*Grus canadensis*) or 81% of the statewide population. Sandhill crane peak populations, during the fall migration, have reached over 180,000 individuals, in recent years. Almost 8000 American white pelicans (*Pelecanus erythrorhynchos*), 18% of the Statewide population, were also using the Refuge during this same period.

In addition to migration and wintering habitat, the wetlands on Quivira NWR provide nesting habitat for a variety of species. Over 45 species of water birds have been recorded nesting on Quivira NWR. In 1996-97, a mixed colony of over 10,000 snowy egrets (*Egretta thula*), cattle egrets (*Bubulcus ibis*) and great egrets (*Ardea alba*) used the Big Salt Marsh as a nesting site. Other nesting waterbird species include snowy plovers, white-faced ibis, Wilson's phalaropes (*Phalaropus tricolor*), Virginia rails (*Rallus limicola*), black rails (*Laterallus jamaicensis*), and American avocets (*Recurvirostra americana*). Black-necked stilts (*Himantopus mexicanus*) are known only to breed at Cheyenne Bottoms and Quivira NWR in Kansas (Thompson and Ely).

Historically, the marshes of Quivira provided food, cover, nesting sites and resting places for ducks, geese, and shorebirds migrating through the Central Plains. Native Americans used the area for hunting as well as early settlers and later market hunters. These wetlands have proven their value to endemic animals such as shorebird species like the American avocet, stilt sandpiper, long-billed dowitcher (*Limnodromus scolopaceus*), and white-rumped sandpipers. Quivira NWR is one of the major stopping points for sandhill cranes between the southern coasts and northern breeding grounds.

5. Waterfowl surveys for Quivira NWR regularly find the wetlands supporting over 20,000 individuals of several species. During the 2000-2001 fall, bi-monthly, surveys, over 40,000 mallards (*Anas platyrhynchos*), 290,000 Canada geese, 87,000 white-fronted geese and 107,000 snow geese were recorded on individual survey dates. In addition, sandhill crane numbers were recorded as over 50,000 on the survey dates, but actually peaked at over 180,000 between the survey periods. (KDWP Waterfowl Migration Report, 2000 Season).

Shorebird numbers frequently exceed 20,000 during the migration. A July 30, 2001 survey by State and Federal biologists found 30-40,000 shorebirds, mainly stilt sandpipers, using the late summer shallow water habitat on the Big Salt Marsh (Suzanne Fellows, FWS-Pers. Comm.).

6. Studies at Cheyenne Bottoms have indicated that the area supports over 90% of the world's population of stilt sandpipers and white-rumped sandpipers. Because of the close proximity of Quivira NWR to this State area, these birds, and other species as well, often move from one area to the other during their migration feeding activities. Precipitation events may occur at one site making the habitat too deep or the vegetation may become too thick, and the shorebirds will temporarily move to the other site. Sandhill cranes, ducks and geese, as well as the endangered whooping cranes, fly off the areas to feed in surrounding agricultural fields and the site they return to is often determined by the wind direction more than site preference.

In a recent article in the New York Times, Sebastian Patti, Illinois State Judge and author of "A Guide to Bird Finding in Kansas and Western Missouri" stated when speaking of Quivira and Cheyenne Bottoms that "Individually they are nationally important; collectively they have worldwide importance" (NY TIMES, 6/12/01).

Surveys have indicated that the wetlands on Quivira NWR regularly support over 1% of the

world populations of stilt sandpipers, white-rumped sandpipers, snowy plovers, Wilson's phalaropes, and Central flyway sandhill cranes. This is probably true as well for many other species for which we do not have adequate population figures.

With a world population of approximately 300 endangered whooping cranes, and a wild population near 200, Quivira NWR has provided fall migration habitat for over 40 individuals in recent years. As many as 22 endangered whooping cranes have been recorded using the marshes on Quivira NWR, on a single survey.

13. General Location:

Quivira National Wildlife Refuge is located in Stafford, Rice, and Reno Counties of south central Kansas. The Refuge is approximately 28 miles west of Hutchinson (population 39,100) and 30 miles southeast of Great Bend (14,600). Nearby smaller communities include Stafford (1461), 13 miles SW, Sterling (2112), 20 miles NE, and St. John (1357), 22 miles SW.

14. Physical Features:

Quivira NWR is a complex of wetlands, ranging from fresh to saline, interspersed with mixed grass prairie and agricultural fields. Grasslands are native and re-seeded native species, dominated by big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), switchgrass (*Panicum virgatum*), indian grass (*Sorghastrum nutans*), and prairie sandreed (*Calamovilfa longifolia*). A total of 526 ha of croplands exist on Quivira NWR, farmed by cooperative farmers, to provide feed for the migrating waterfowl and resident species of wildlife. Agricultural crops are rotated and are produced with no irrigation or regularly applied herbicides.

Wetlands on Quivira are both natural and enhanced by the addition of dikes and canals to better manage the water. A total of 2618 surface ha of wetlands are managed in 34 separate units, connected by over 34 km of water distribution canals and utilizing over 100 water control structures. These wetlands range in size from 3.3 ha to 694.8 ha. In addition, another approximate 404 ha of wetlands exist on Quivira that are not within the established units or connected to the water distribution system. These scattered wetlands get their water from direct precipitation runoff or from groundwater inflow.

Wetland habitat types vary from south to north on the Refuge. Southern marshes are lower in salinity, due to inflow from Rattlesnake Creek and the flushing action of more fresh water. These marshes are dominated by cattail (*Typha* spp.), common reed (*Phragmites australis)* and bullrush (*Scirpus* spp.). Salinity increases traveling northward and the deeper marshes become mixed with shallow wet meadow areas, dominated by inland saltgrass (*Distichlis stricta*), due to the more saline nature of the sites. The high salinity, especially north of the Big Salt Marsh, prevents any vegetative growth and results in the bare salt flats habitat, preferred by nesting endangered least terns, and snowy plovers, as well as migrating shorebirds.

Quivira NWR is located in the physiographic region of Kansas known as the Arkansas River Lowlands. This region follows the Arkansas River, which is 4 km northeast of Quivira, from the Colorado to the Oklahoma borders. Soils on Quivira NWR vary from nearly level, salt affected loamy soils to undulating and hilly sandy soils (USDA, Soil Survey of Stafford County). Drainage in the hummocky or undulating landscape is slow and many low, wetland areas are formed, which are very valuable to wildlife.

Quivira NWR is within some of the State's most intensively farmed regions. The grassland that once covered the surrounding land have been replaced with cultivated agriculture and now center pivot irrigation is used to grow crops, such as corn (*Zea mays*), that require more moisture than is provided by rainfall. The area has experienced a lowering of the water table and a extensive loss of wetlands due to this irrigated agricultural development (Busby and Zimmerman, 2001). Quivira NWR is an island of wetland habitat in a sea of agricultural land, increasing it's importance to migrating wildlife.

Large seasonal variations in temperature are common with cold winters and hot, dry summers. Quivira is near the boundary between the dry portion of western Kansas and the moist eastern regions of the State. Long term precipitation averages for Quivira NWR are about 609mm of precipitation, and the annual evaporation rate often exceeds 1270 mm. This condition has a direct impact on the flow of Rattlesnake Creek and the levels of the wetlands on Quivira NWR. Within the last 12 years, the Refuge has experienced two droughts sufficient to dry completely most wetlands, as well as experienced two 100-year floods, one month apart in 1993. This is truly a land of extremes.

15. Hydrological values:

The marshes of Quivira NWR have historically provided a very productive wetland habitat for both migratory and resident wildlife. Originally, these wetlands provided hunting sites for Native Americans, seeking ducks and geese on the marshes and the bison grazing the adjacent grasslands. Early settlers used these same resources and large cattle ranches sprang up around the area. The abundant wildlife on the marshes attracted market hunters, who harvested the ducks, geese, and shorebirds, packed them in the readily available salt, and shipped them to eastern restaurants. In the early 1900's, wealthy hunters purchased portions of the marshes and established private waterfowl hunting clubs for themselves and their guests. Records indicate over 17 such hunting clubs covered the area that is now Quivira NWR. In May, 1955, at the urging of local supporters, these marshes were protected by the establishment of Quivira NWR.

Rattlesnake Creek is the main source of water for the wetlands on Quivira. This stream starts near Greensburg, KS., approximately 160 km west of the Refuge. Rattlesnake Creek flows into the Little Salt Marsh, the main storage basin, on the southern end of the Refuge. Man-made canals and water control structures distribute this water to the other wetlands before releasing it into Salt Creek, which discharges any outflow into the Arkansas River.

Quivira NWR has a senior water right, through the Kansas Division of Water Resources, that

allows diversion of 14,632 acre feet of water from Rattlesnake Creek.

The flow in Rattlesnake Creek is often silt-laden, following a heavy precipitation event, and the Refuge marshes serve to trap this sediment. The marshes also provide some flood control as they slow the flow of water and allow it's seepage into the sandy soil, thereby reducing the impact of downstream flooding.

The main hydrologic value of this large marsh complex is that it slows runoff into the Arkansas River and allows the moisture to percolate into and recharge the groundwater surrounding the Refuge. In this area, where the groundwater is perched atop a salt water layer, withdrawing too much of this freshwater layer, by irrigation or domestic wells, can result in pumping salt water to the surface. This can destroy agricultural crops and present a human and livestock health hazard. Without the groundwater recharge provided by large wetlands on Quivira, this situation would become increasingly difficult to handle.

16. Ecological Features:

Main habitat types on Quivira NWR include wetlands that range in size from 3.3 ha to over 694 ha. Marshes are fresher on the southern end of the Refuge due to inflow from Rattlesnake Creek, but the salinity of the wetlands increases as you travel northward, until it climaxes on the barren salt flats north of the Big Salt Marsh. The deeper parts of the marshes contain aquatics such as sago pondweed (*Potomogeton pectinatus*) and coontail (*Ceratophyllum demersum*). Shallower, small marshes and large marsh edges are dominated by emergent aquatic vegetation such as cattail (*Typha* spp.), common reed (*Phragmites australis*) and bulrush (*Scirpus* spp.). Inland salt grass (*Distichlis stricta*), and various sedges (*Carex* spp., and *Juncus* spp.) dominate the wet meadow habitat type, their abundance depending on the site salinity. On the bare salt flats, only very salt tolerant species such as saltwort (*Salicornia rubra*) and (*Suaeda calceoliformis*) can exist.

The aquatic environments found on Quivira NWR are very productive and host a tremendous variety of micro and macro invertebrates. These invertebrates form the first link of the food chain, falling victim to the small fish species, which in turn fall prey to the thousands of waders and marsh birds. These invertebrates also form the major food for the thousands of shorebirds and ducks that nest or migrate through Quivira NWR. These birds in turn provide a food source for the bald eagles and peregrine falcons.

Upland habitats are classified as mixed grass native prairie dominated by prairie sandreed (*Calamovilfa longifolia*), big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*) and on the more saline sites inland salt grass. On Quivira NWR the majority of the grasses are warm season natives, either native prairie, re-seeded natives or go-back, which is land that has been allowed to revert to the natural grassland following the end of any cultivation.

The only major native tree was the cottonwood (*Populus deltoides*) when the early settlers came

to this area. They planted more trees to allow them to claim more land and as time progressed shelterbelts were planted to control wind erosion. Cottonwood trees, well over 100 years old, still exist where the early settlers planted them. Shelterbelts with a variety of native and exotic species still provide protection from the strong prairie winds. Some shelterbelt trees, such as Russian olives (*Elaeagnus angustifolia*) and eastern red cedar (*Juniperus virginiana*), have pioneered out into the grasslands and require control to prevent taking over the prairie. Brush species, such as the native sandhill plum (*Prunus angustifolia*), also have increased into the grasslands and require control to halt their spread.

17. Noteworthy Flora:

The most noteworthy flora on Quivira may be the salt tolerant plants associated with the high salinity of this area. The hostile environment on the Refuge salt flats prevents vegetative growth by all but the hardiest of species. Salt tolerant succulents, such a red saltwort (*Salicornia rubra*) are common in coastal areas but are found in Kansas only in salt marshes such as Quivira.

One annual succulent halopyhte, sea blite (*Suaeda calceoliformis*) has even adapted another growth-form to help it tolerate the conditions on the salt flats. An "erect" growth-form is more common and widespread over the Big Salt Marsh but a "prostrate" form has adapted to tolerate the strong winds, blowing salt crystals and harsher conditions on the salt flats (Youngman, 1989).

18. Noteworthy Fauna:

The most obvious fauna on Quivira NWR, and the main viewing target for most Refuge visitors, are the thousands of geese, ducks and sandhill cranes (*Grus canadensis*) present during spring and fall migrations. Over 500,000 geese, 180,000 sandhill cranes and thousands of ducks of all species, are noteworthy anytime they congregate into an area accessible by the public. A close second would be the over 30 varieties of shorebirds, constituting thousands of individuals, that use Quivira as a stopping point on their travels along the Central Flyway.

During one survey 22 endangered whooping cranes (*Grus americana*) were recorded using the Quivira marshes and this large a portion of an endangered population, in one location, is always noteworthy. The same is true when 142 threatened bald eagles (*Haliaeetus leucocephalus*) are recorded using one area during a single time period.

The Big Salt Marsh nesting colony of endangered interior least terns (*Sterna antillarum athalassos*) is one of only two main breeding areas for this species in Kansas (Busby and Zimmerman, 2001).

Aquatic mammals such as muskrats and beaver are common on the Refuge, as are furbearers such as coyotes, badgers and striped skunks. The small mammal population is rich in numbers

and variety, to provide a prey base for predatory species. Both white-tailed and mule deer are present on Quivira NWR, but the white-tailed deer is more prevalent.

19. Social and Cultural Values:

Historically, the marshes of what is now Quivira NWR, were used by Native Americans as a hunting site. The name "Quivira" means " raccoon eyes" and refers to the dark tattoos around the eyes of the Native American tribe using this area when the Spanish explorer Coronado visited in 1541. The Comanche Archeological Site, located on the western edge of Quivira NWR, is listed in the National Register of Historic Places. This is a multiple component site, having the remains of more than one cultural group represented, which shows the use of the area over a long time period.

Almost 60,000 visitors come to Quivira NWR each year and the number is growing, as more people discover the wildlife viewing opportunities on the Refuge. The fall migration of 500,000 geese and over 180,000 sandhill cranes creates a spectacle that is both a feast for the eyes and for the ears. The spring and fall migration of thousands of shorebirds is much quieter, but no less spectacular. Quivira NWR had been placed in the top 40 birding hot spots in North America by WildBirds magazine and our status has risen as more people visit the Refuge (WildBird, September, 1996). WildBird magazine now lists Quivira NWR and Cheyenne Bottoms WMA, jointly, as number 8 out of the top 15 best birding locations in North America (WildBird, September/October, 2001).

The State of Kansas has the smallest amount of public-owned land in the United States. This fact makes public-owned wildlife areas, such as Quivira NWR, even more important for providing outdoor recreation opportunities. All of the waters on Quivira NWR are open to fishing in accordance with Kansas regulations. Refuge specific regulations prevent the use of boats or unattended fishing lines, to protect fish-eating and over-water nesting birds.

Public hunting is allowed, for specific waterfowl and upland game species, on 3,238 ha of Quivira NWR. The Refuge hunting program follows Kansas regulations, seasons and bag limits. If the endangered whooping cranes are observed using the Refuge, all hunting is closed until they continue their southward migration.

Quivira NWR is a valuable social asset to the local communities, both in improving the quality of life and as an economic benefit. In 1993-94, Dr. Paul Kerlinger conducted a survey of only the birders visiting Quivira NWR. Of the 17,400 birders, out of almost 28,000 Refuge visitors during this period, they spent $636,000 on the local economy and their travels to and from the Refuge brought in $6.84 million to the national economy (Kerlinger, 1995). This study was conducted prior to the opening of the Quivira Visitors Center and new public use facilities, which have increased Refuge visitation to almost 60,000, so the impact would be far greater now.

A second study by Laughland and Caudill in 1995 looked at the total impact of Quivira NWR on

the local economy, not just from visiting birders. By this time Refuge visitation had increased to over 38,000, due to new public use facilities. Local economic effects associated with Refuge visitation were estimated at $1,046,000 , with 24 jobs, worth $361,600, generated by visitor demand. For every $1.00 spent on the budget for Quivira NWR, a $3.99 return was realized by the local economy (Laughland and Caudill, 1997).

20. Land Tenure/Ownership of: (a) Site (b) Surrounding Area

(a) The Quivira National Wildlife Refuge is managed by the U.S. Fish and Wildlife Service (FWS), Department of the Interior, as one of over 500 refuges in the National Wildlife Refuge System. Quivira NWR personnel are also responsible for the oversight of the Great Plains Nature Center, an environmental educational facility supported by a partnership between the FWS, the City of Wichita and the Kansas Department of Wildlife and Parks. This facility, owned in fee title, is located in Wichita, KS, 113 km from Quivira NWR.

(b)The majority of the land surrounding Quivira NWR is owned by private individuals or agricultural corporations. Because of the waterfowl hunting opportunities created by the management of the Quivira wetlands, a portion of the surrounding land is owned by hunting groups or clubs. These hunting groups often protect and manage their lands for wildlife conservation as a result of the opportunities created by Quivira NWR.

21. Current Land Use: (a) Site (b) Surrounding Area

(a) Quivira NWR was established as a migration stop and wintering area for migratory birds moving up and down the Central Flyway. Early management included season long grazing, few prescribed burns and more fire suppression, planting of feed crops, extensive annual haying, prevention of trespass and strict control of public visitation (Quivira NWR Narrative Reports 1956-Pres.).

Current management includes extensive water level manipulations to encourage growth of wildlife food plants and discourage excessive vegetative growth by cattails or exotic species. Historically, the grasslands of the Great Plains were subjected to the ecological impacts of lightening caused wild fires and extensive herds of grazing herbivores, primarily bison (*Bison bison*). Current management attempts to duplicate these historic impacts that shaped the Refuge landscape. Over 2,023 ha of prescribed burns are now conducted each year, on both wetland and grassland habitat. A high intensity/short duration grazing program puts a lot of cattle on a very small area for a very short period of time, then they are moved. This duplicates the bison grazing pattern whereby they would graze an area and then move on, often not returning to that area again until the next season. By using local rancher's cattle, we are able to duplicate this grazing impact without the problems and danger associated with managing bison.

Agricultural crops planted for wildlife feed have been reduced to only those areas with the best production for the least input. Haying is now conducted on an as needed basis, only when the

timing and resulting conditions can be beneficial to wildlife.

(b) Surrounding land use is generally agricultural production. Small grain and row crop production are predominate, along with rotated forage production crops such as alfalfa. Because of the sandy soil in this region, some areas are better suited to pasture for livestock operations, mainly cattle. A large portion of the lands surrounding the Refuge are in the Conservation Reserve Program, a government supported set aside where the landowners are paid to take the field out of crop production, reseed it and provide a grass cover for up to ten years.

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects: (a) at the site (b) around the site

(a) When Quivira NWR was established in 1955, there was very little water diverted from the Rattlesnake Creek basin, except for some small plots of irrigation, domestic use and for hunting clubs to flood their leases. The Quivira NWR water right has a priority date of 1957, for 14,632 acre feet of water to be diverted into the Refuge marshes. However, during the 1970's, interest in the development of irrigated agriculture exploded, as the number of permitted irrigation wells within the watershed grew from 177 in 1960, to over 1,500 by 1984, to over 2000 today.

In 1984, the U.S. Fish and Wildlife Service identified declining stream flows into Quivira NWR from Rattlesnake Creek. Because of the sandy soils in this region, the groundwater withdrawals for irrigation were suspected of drawing water down and reducing Rattlesnake Creek's flow. Because of a desire to work with the community in a cooperative manner, instead of opening litigation on this suspected water right infringement, Quivira NWR entered into a partnership to find solutions. The Quivira/Rattlesnake Creek Partnership consisted of the Kansas Division of Water Resources, Groundwater Management District #5, the Water Protection Association of Central Kansas (private agricultural producers and irrigators) and Quivira NWR. The Partnership formed in 1994, met regularly and worked out a long term management plan for the entire Rattlesnake Creek basin, which was signed by the State Water Engineer in January, 2000. The objective was to find solutions to the declining streamflows through incentive programs rather than regulation, and to improve the quality of life for all water users within the basin.

Presently, the Quivira/Rattlesnake Creek Partnership is working on getting policy written and funding secured through the Kansas State Legislature, to implement the programs within the long term management plan.

(b) The greatest impact to the ecological character of Quivira NWR, from the surrounding area, has and will be the participation of the private water users in the long term management plan developed by the Quivira/Rattlesnake Creek Partnership. By participating in the incentive based programs for water conservation outlined in this plan, the savings in water will allow more stream flow in Rattlesnake Creek and improve the delivery of water to the Quivira wetlands. Agricultural producers will become more efficient in the application of water to their crops, reducing their costs of production and increasing their profits and sustainability.

23. Conservation measures taken:

The Quivira National Wildlife Refuge was established under authority of the Migratory Bird Conservation Act ".....for use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act, 16 U.S.C. & 715d). The Refuge was established at the request of local supporters and interested conservationists, both within and outside Kansas, to preserve the marshes and uplands for wildlife.

Quivira NWR is owned in fee title by the U.S. Fish and Wildlife Service, Department of Interior, and is managed as one of over 500 such sites within the National Wildlife Refuge System. The mission of the National Wildlife Refuge System is "....to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Improvement Act, 1997).

Various management plans exist, such as the Rangeland Management plan, Water Management plan, Public Use plan, and Farm plan, that provide guidance for the management of the habitats and people on Quivira. Step down plans, usually less formal and more specific, are developed under these major plans, to help guide the day to day operations on the Refuge.

National and International recognition of the value of Quivira NWR, to migrating waterfowl and shorebirds, has been strengthened by inclusion in the Western Hemisphere Shorebird Reserve Network in the early 1990's. This network is a program of Manomet Observatory and Wetlands International, to recognize important shorebird staging sites throughout North America.

In 2001, Quivira NWR was also recognized by the American Bird Conservancy, a national conservation organization based in Washington D.C., as one of 100 "Globally Important Bird Areas". The American Bird Conservancy states that "directing protection and management efforts towards these sites is critical if viable populations of many species are to survive".

24. Conservation measures proposed but not yet implemented:

Within the next few years, as a result of the National Wildlife Refuge System Improvement Act of 1997, Quivira NWR will undergo a comprehensive conservation planning effort to develop updated goals, objectives and priorities. This Comprehensive Conservation Plan (CCP) will be developed in compliance with the National Environmental Policy Act (NEPA); it will include extensive public involvement; and it will be completed according to a procedure developed for all unit of the National Wildlife Refuge System.

25. Current scientific research and facilities:

Recent scientific research on Quivira NWR has been conducted on malformed amphibians, nesting bobolinks (*Dolichonyx oryzivorus*), black rail (*Laterallus jamaicensis*)distribution and

production and continuing research on the endangered interior least tern (*Sterna antillarum athalassos*) nesting colony. Past studies have investigated various aspects of the biology of black- tailed prairie dogs (*Cynomys ludovicianus*), northern grasshopper mice (*Onychomys leucogaster*), tiger beetles (*Cicindela* sp.), common grackles (*Quiscalus quiscula*), brown-headed cowbirds (*Molothrus ater*), diatoms and *Odonata* species.

Studies on the Refuge have been conducted by graduate level students, both MS and Ph.D., and by professional researchers from the USFWS and the U.S. Geological Survey, and by professors from Wichita State University, Ft. Hays State University, University of Manitoba, Oklahoma State University, and Kansas State University.

Because of the value of the Quivira marshes to migrating shorebirds, these species have received a great deal of investigation on the Refuge. Aspects of shorebird biology such as estimations of lipids and lean mass, dietary flexibility, residency patterns, habitat dynamics, response to prescribed burns and general conservation recommendations have all been researched on Quivira NWR.

26. Current conservation education:

Conservation education is a major program of the Quivira National Wildlife Refuge. Refuge facilities have been developed over the past 10 years to aid in educating the public, school groups and educators that use Quivira as an outdoor learning site. A Visitors Center, with interactive wildlife exhibits and classroom space, was constructed in 1995, along with two wheelchair accessible interpretive trails. The old Refuge Administrative building has been converted to a bunkhouse for visiting school groups, to allow overnight stays, and to a second classroom, with sinks and facilities for wetlands education.

The " Quivira NWR Educator's Guide" is a book that has been developed as a curriculum guide for teacher's workshops and to assist educators in using the Refuge with their classes. The Educator's Guide was published with the assistance of a local energy company and is distributed free to teachers wanting to use Quivira NWR. A second guide has been written and is in the development stage, specifically to interpret the largest of the two nature trails on the Refuge.

Special educational events are sponsored throughout the year by our Refuge support group, the Friends of Quivira. This group, formed in 1997, has over 200 members which have as their main objective to seek recognition and support for Quivira NWR. A sample of the events the Friends of Quivira annually sponsor would include: Peeps and Pastries, a early morning birding tour; Fathers Day Out, a father/child nature activity day; the Kid's Fishing Clinic, a family event; Monarch Mania, a butterfly tagging event; and Step Back in Time, a historic event to celebrate

National Wildlife Refuge Week. In addition, the Friends also sponsor kid's photo contests, hunter education programs and classroom activities at local schools.

Quivira NWR's connection to the Great Plains Nature Center, through the partnership agreement with the City of Wichita and Kansas Department of Wildlife and Parks, allows for expanded environmental education opportunities. This Center, which has Quivira NWR staff permanently assigned, gives 1600 programs to over 47,000 visitors per year. These programs often include educational messages about Quivira NWR and the value of wetlands.

27. Current recreation and tourism:

Current recreation programs on Quivira NWR include waterfowl hunting, upland game hunting, fishing, wildlife photography, environmental education and wildlife observation. Public use facilities have been developed to enhance the visitor's experience when participating in any of these activities.

A Kid's Fishing Pond, restricted to children 14 years or younger, has been developed, with an accessible pier, to encourage adults to take young people fishing. A second accessible fishing pier is located on the Little Salt Marsh, for use by all ages. A waterfowl hunting blind, accessible by persons with disabilities, is located on one of the Refuge wetlands, to provide hunting opportunities to all visitors.

For wildlife viewing, an accessible spotting scope has been placed at one of the premier viewing sites on the Refuge. Two wildlife photography blinds, one of which is accessible, have been located on wetlands that provide opportunities to photograph waterfowl, cranes and shorebirds.

Almost 60,000 visitors use Quivira NWR each year and this number is increasing as the national reputation for the area continues to grow. Recent newspaper and magazine articles have focused on the birding opportunities at Quivira and have resulted in a large influx of visitors. Local communities see this as an opportunity for economic development and the Refuge has been working with local agencies to promote eco-tourism in this area. In May, 2001, Quivira NWR and Cheyenne Bottoms were featured in a "Wings and Wetlands" weekend sponsored by the Great Bend Visitors and Convention Bureau. Quivira has also worked with the Stafford and St. John Chambers of Commerce on programs centered on the Refuge's connection to these towns.

28. Jurisdiction:

Quivira National Wildlife Refuge is under the jurisdiction of the Department of Interior, U.S. Fish and Wildlife Service, an agency of the United States federal government. This constitutes "federal" jurisdiction and the refuge staff are classified as civilian (non-military) government employees . The territorial and the functional jurisdictions are the same in this case.

29. Management authority:

Quivira National Wildlife Refuge is managed entirely under the authority of the U.S. Fish and Wildlife Service, Department of the Interior. The address is:

Quivira National Wildlife Refuge
RR# 3, Box 48A
Stafford, Kansas 67578
Phone: 620/486-2393
FAX: 620/486-2315
E-Mail: r6rw_qvr@fws.gov
WEBSITE: http://quivira.fws.gov

Management responsibilities for Quivira NWR are authorized and promulgated through the National Wildlife Refuge System Improvement Act of 1997, passed by the Congress of the United States, and by other Congressional Acts and Presidential Executive Orders.

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