Waterfowl Conservation Strategy
for the
Playa Lakes Joint Venture

(draft 08 Jun 2005)

"To sustain abundant waterfowl populations by conserving landscapes, through partnerships that are guided by sound science"

A Contribution to the
North American Waterfowl Management Plan
and the
Playa Lakes Joint Venture Implementation Plan

by the Playa Lakes Joint Venture
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North American Waterfowl Management Plan
Plan nord-américain de gestion de la sauvagine
Plan de Manejo de Aves Acuáticas de Norteamérica

PLAYA LAKES
JOINT VENTURE

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Background, Purpose, and Intended Audience

North American Waterfowl Management Plan

The purpose of the North American Waterfowl Management Plan (NAWMP) is to sustain abundant waterfowl populations by conserving landscapes, through partnerships that are guided by sound science (USFWS 2004). Originally signed in 1986, the NAWMP guides waterfowl conservation by developing continental population objectives, identifying geographic regions of North America that contain habitat critical to sustaining waterfowl populations, and forming "Joint Ventures" in these areas to facilitate achieving Plan objectives. Joint Ventures are coalitions of governmental and nongovernmental wildlife conservation agencies and organizations that pool expertise and resources to conserve wetlands and associated habitats important to waterfowl and other birds.

The original 1986 NAWMP was updated in 1994, 1998, and 2004 to address changing biological, sociological, and economic conditions influencing waterfowl status cooperative habitat conservation. The theme of the 2004 update is "*Strengthening the Biological Foundation*" to increase stakeholder confidence in Plan actions (USFWS 2004).

Playa Lakes Joint Venture

The Playa Lakes Joint Venture (PLJV) was formed in 1989 to implement the NAWMP in the Playa Lakes Region (PLR). The original PLR included northwestern Texas and portions of southeastern Colorado, southwestern Kansas, eastern New Mexico, and western Oklahoma. The PLJV originally developed waterfowl population and habitat objectives in 1994 for its Implementation Plan (PLJV 1994).

Since 1994 the PLJV has expanded geographically to include most of the Short-grass and Mixed-grass Bird Conservation Regions (BCRs) (Fig. 1), and expanded its focus to include all birds (PLJV 2004a). The PLJV updated its Implementation Plan in 2004 (PLJV 2004b); the adaptive approach to planning used by the PLJV requires maintaining up-to-date waterfowl population and habitat objectives.

PLJV Waterfowl Team

The PLJV Monitoring, Evaluation, and Research Team (MERT) formed a 12-member working group (Waterfowl Team; hereafter referenced as "team") in 2003 to update and maintain its waterfowl population and habitat objectives. The team is comprised of waterfowl experts from all 6 PLJV states, USFWS Regions 2 and 6, Ducks Unlimited, Inc., and PLJV staff. State and federal members have migratory game bird regulatory and monitoring responsibilities for their respective agencies, and are affiliated with the Central Flyway Technical Committee. Two team members are members of the NAWMP Science Support Team (NSST), and 6 team members also serve on the PLJV's MERT.

Goal, Purpose, and Intended Audience

Our goal was to improve the biological foundation for PLJV waterfowl conservation actions by developing waterfowl objectives in a manner consistent with the guidance and needs of the NAWMP and the PLJV. Specifically, we developed (1) regional waterfowl *population* objectives that are stepped-down from continental objectives in the NAWMP, and (2) regional waterfowl *habitat* objectives that are linked biologically to continental population objectives.

The purpose of this report is to provide detailed documentation of the procedures used to develop these objectives. The intended audience is biologists with technical orientation that are interested in the scientific underpinnings of PLJV waterfowl conservation objectives.

This report serves as a technical companion document to the PLJV's Implementation Plan (PLJV 2004b). The PLJV's *HABS (Hierarchical All Bird System) database* stores the biological data used to model the current carrying capacity of the PLJV for waterfowl (see Appendices A-I). Waterfowl habitat objectives developed herein are included in the PLJV's *Area Implementation Plans*.

The PLJV in the Context of North American Waterfowl and Wetlands

The PLJV region lies entirely within the Central Flyway, and largely corresponds to BCRs 18 (Shortgrass Prairie) and 19 (Mixed-grass Prairie) in the Southern Great Plains region of the continent (Fig. 1). Most waterfowl species common to the Central Flyway use the region (e.g., see Bolen et al. 1989, Ringelman et al. 1989, Smith 2003). Waterfowl in the PLJV use a wide range of natural and man-made wetlands and upland, agricultural habitats for foraging and roosting. Importance of the various habitats is discussed later in this report.

Within the PLJV, the NAWMP has identified 2 *areas of continental significance* to North American waterfowl: the playa lakes in the Texas panhandle and surrounding regions (largely corresponding to the original PLJV boundary), and the central Kansas marshes (USFWS 2004:15). The Cheyenne Bottoms and Quivera wetlands of central Kansas also are designated as *wetlands of international importance* under the RAMSAR convention.

Based on available waterfowl migration chronology data (see below), the PLJV region is important to waterfowl primarily as a migration area, and secondarily as a wintering area (especially for Mallards and Canada Geese). Many waterfowl species also breed in the region, but at low densities compared to primary breeding areas (Ray et al. 2003).

Given the importance of the region primarily as a migration and wintering area, our understanding of the annual life cycle needs of waterfowl suggest that the ability to acquire sufficient food to (1) meet daily energy requirements, and (2) gain body mass (i.e., acquire fat reserves) for migration, is of paramount importance for waterfowl in the PLJV (also see Limiting Factors section below).

Approach for Developing Habitat Objectives

We used a bioenergetics approach to develop nonbreeding waterfowl habitat objectives, explained in detail in the sections below:

1. Determine planning scale (geographic areas).
2. Determine priority species and seasons.
3. Develop population (abundance) objectives:
    a) midwinter abundance objectives
    b) bi-weekly abundance objectives for entire (fall – spring) nonbreeding season
4. Develop vital rate (i.e., population performance) objectives.
5. Determine limiting factors for #3-4.
6. Develop habitat objectives:
    a) estimate energetic demands for nonbreeding waterfowl (total use-days & duck use-day equivalents)
    b) determine important habitats and energetic carrying capacities per acre (i.e., define relationships between waterfowl abundance/vital rates and habitat characteristics)
    c) measure habitats to determine current quantity
    d) model current landscape carrying capacity for nonbreeding waterfowl and determine if habitat shortfalls exist
    e) describe conservation strategy to increase or maintain landscape carrying capacity for waterfowl
7. Develop criteria for measuring success.

Step 1: Geographic Planning Areas

Geographic planning areas for this strategy are the BCR portions of states (e.g., BCR18-Texas) (n=9; see Fig. 1). Planning and implementation for waterfowl at this scale ensures (1) that the desired distribution of waterfowl and their habitats throughout the states and BCRs within the PLJV is achieved; (2) consistency with NAWMP geographic prioritization regions (i.e., BCRs – see Step 2 below); and (3) consistency with planning boundaries for other bird conservation initiatives.

Step 2: Priority Species and Seasons

The 2004 NAWMP update prioritizes waterfowl species for conservation action for each BCR (USFWS 2004). For the PLJV (BCRs 18 and 19), highest priority duck species are Northern Pintails and Mallards, and highest priority goose species are Canada geese (Shortgrass Prairie, Hi-line, and Western Prairie/Great Plains Populations), Snow Geese (Western Central Flyway and Midcontinent Populations), and Greater White-fronted Geese (Midcontinent Population) (Table 1). In the PLJV, these goose populations are of concern due to overabundance, declining populations, or high regional responsibility, whereas duck species are of concern due to declining populations or societal importance (see USFWS 2004).

The only NAWMP breeding season priority for the PLJV was Canada Goose (Western Prairie/Great Plains Population). However, this goose population was a priority for the nonbreeding season also. As explained in other sections, we believe the PLJV region is far more important for nonbreeding than for breeding waterfowl, and we focus exclusively on the nonbreeding season for this planning initiative.

Although the NAWMP did not indicate swans as a priority, both trumpeter and tundra swans likely are well below historical numbers in the PLJV. Of the 6 PLJV states, only Nebraska consistently hosts swans (nonbreeding trumpeters). We did not include swans in this iteration of PLJV waterfowl conservation planning, but may do so in the future.

As described in the sections below, we sought to develop PLJV waterfowl objectives largely consistent with NAWMP guidance for species, population, and seasonal priorities. The bioenergetics approach we used allowed us to determine nonbreeding habitat needs and objectives not only for priority species, but also for non-priority species that obtain food resources from the same habitats.

Step 3: Population Objectives

Step 3a - Midwinter abundance objectives

Ducks

To assist Joint Ventures with waterfowl conservation planning for the nonbreeding season, the NSST developed midwinter (early January) waterfowl population objectives (Koneff undated). For each species, county-level objectives were established by multiplying the average proportion of the total continental midwinter count in each state (1970s midwinter waterfowl survey data), by the average proportion of the statewide harvest occurring in each county (1970s waterfowl harvest survey data). This proportion was multiplied by the continental breeding population objective in the NAWMP, and then divided by 0.85 to account for winter-spring mortality. Counties were aggregated by BCRs and Joint Ventures to facilitate development of regional midwinter objectives.

To develop PLJV midwinter objectives, we obtained county-level objectives from the NSST and aggregated them by BCRs and states, conforming to PLJV planning areas. PLJV midwinter duck population objectives for these planning units are shown in Table 2. This approach had limitations, likely due to anomalies in the midwinter survey and/or harvest data. For example, some species are missing (Blue-winged Teal, Common Goldeneye, Bufflehead). However, taken over all species and all planning areas, we believe these objectives are reasonable starting points for developing habitat objectives.

The PLJV midwinter duck population objective is 2.1 million birds (Table 2), and is dominated by dabbling ducks, especially Mallards and Northern Pintails. Diving duck objectives represented a small ($\leq$10%) portion of total duck objectives (Tables 2, 3).

Geese

NAWMP objectives for geese are presented by population, as defined in flyway management plans. However, population-specific winter survey and harvest data were not readily available to the NSST, which precluded developing population-specific midwinter goose objectives. Because we had access to population-specific winter survey data for the PLJV states, we did not use NSST midwinter goose objectives, but rather developed an alternative approach that did not rely on harvest data. We believe our approach is consistent with the NSST intent of developing regional objectives that are stepped-down from continental objectives, and better utilizes existing goose population objectives (from Central Flyway goose management plans) and monitoring data.

For each goose population, we calculated the average proportion of the total population counted in each PLJV state during winter surveys (10-year averages of the midwinter waterfowl survey and the historical December goose survey). Data used corresponded to the decade in which the flyway management plan was written (generally 1980s or 1990s). This proportion was multiplied by the continental winter objective from the NAWMP, resulting in state-specific objectives for each goose population. State-specific objectives were allocated to BCRs 18 and 19 by the proportion of total state counts from each BCR (estimates provided by state biologists). This allowed us to develop winter objectives for each goose population for each geographic planning area (Table 2).

The PLJV midwinter goose population objective is 386,000 birds (Table 2). Goose population objectives generally were lower than for dabbling ducks, but higher than for diving ducks (Tables 2, 3).

Step 3b – Biweekly abundance objectives for the entire nonbreeding season

Because the PLJV region is important to waterfowl during fall and spring migration, in planning for waterfowl habitat conservation it is important to understand how many waterfowl would be expected during other times of the nonbreeding season relative to the midwinter period. Therefore, in conjunction with midwinter objectives, we used available waterfowl migration chronology data to develop bi-weekly population objectives for September through April.

For September through March, we used migration chronology data collected during aerial surveys of public lands and waters in the PLJV region of Kansas during 1973 – 2002. For most species we consider these data to be the best available for the region. For each species, we took the average count for each bi-weekly period, and divided the result by the average count for the midwinter (early January) period. This proportion was multiplied by the midwinter objective to obtain period objectives. Kansas data were not available for April, so for that month we used regional migration chronology data presented in Bellrose (1980).

We sought to use the best available local migration chronology data for developing these period objectives. Therefore, for white-fronted geese in the BCR19 portion of Texas, we used migration chronology data from sightings of neck-banded birds presented in Anderson and Haukos (2003).

For brevity, bi-weekly population abundance objectives are not presented in this report. These are maintained by the PLJV for each planning area, and are available upon request.

Step 4: Vital Rate Objectives

To address the question of how should waterfowl populations "perform" or "be influenced" while in the PLJV, we believe waterfowl abundance objectives should be complemented by vital rate objectives (survival, body condition, etc.). For example, it would not be prudent for managers to attract large numbers of birds to the PLJV region if survival rates are below levels needed to sustain continental population objectives.

Ideally, regional vital rate objectives for nonbreeding waterfowl in the PLJV would be developed as part of broader, continental strategies, but no such strategy currently exists for any species under the NAWMP. Therefore, we elected to defer developing *survival rate* objectives. A *body condition objective* "to maintain body condition of waterfowl while in the PLJV" is established as part of the bioenergetics approach to developing habitat objectives (see Section 6 below).

Step 5: Limiting Factors

Given the population abundance objectives described above, and our desire to develop meaningful vital rate objectives, we considered a range of factors thought to influence the abundance, survival, and body condition of nonbreeding waterfowl in the PLJV. Each factor was ranked according to perceived importance, and to the potential for management control (Table 4).

These results, based on the expert opinion of the team, suggest that habitat (both for foraging and roosting) is the major factor limiting waterfowl abundance and vital rates in the PLJV. Team members felt there was a large gap in importance between the top 2 limiting factors (foraging and roosting habitat), and the third-ranked factor (disease; Table 4).

We note that limiting factors previously considered of high importance by the PLJV, such as disease and contaminants (PLJV 1994), now are considered of lower importance. In large part this is thanks to research (e.g., Samuel et al. 2004) and management actions undertaken by PLJV partners.

Waterfowl studies from the Texas PLR support the team's conclusions. Waterfowl abundance (TPW unpubl. data) and Northern Pintail survival and body condition (Moon 2004) are higher during winters with more flooded playas. Guthery et al. 1984 demonstrated that the amount water on the landscape was the primary determinant of duck abundance.

Step 6: Habitat Objectives

Given our understanding of the importance of food energy to nonbreeding waterfowl, and our opinion that foraging habitat is a primary factor limiting waterfowl abundance, survival, and

body condition in the PLJV, we used a bioenergetics approach to developing waterfowl habitat objectives.

Step 6a - Estimate energetic demands for nonbreeding waterfowl (use-days & duck use-day equivalents)

To estimate energetic demands of nonbreeding waterfowl in the PLJV, we first developed use-day objectives for each species and biweekly period. Period population objectives were simply multiplied by the number of days in the period.

Next, because energetic carrying capacity (ECC) of waterfowl habitats often is expressed in units of energy sufficient to meet daily energy requirements of a Mallard-sized duck during winter (292 kcal/day; Prince 1979), we adjusted period use-days for each species based on the body size of the species relative to Mallards. Body mass of each species was divided by the body mass of Mallards (adult male data from Bellrose 1980). This factor was multiplied by the period use-day objective for each species to obtain "Duck Use-Day Equivalents" (DUDEs). E. g., American Green-winged Teal are 0.25 times as large as Mallards, so 100 American Green-winged Teal use-days become 25 DUDEs for bioenergetics planning. DUDEs were summed over all periods to give total nonbreeding (September – April) DUDE objectives (Table 3).

For brevity, biweekly use-day objectives are not presented in this report. These are maintained by the PLJV for each planning area, and are available upon request.

Step 6b - Determine important habitats and energetic carrying capacities per acre (i.e., define relationships between waterfowl abundance/vital rates and habitat characteristics)

We listed habitats believed to be important for foraging and/or roosting waterfowl in the PLJV. We associated these habitats with applicable waterfowl guilds (dabbling ducks, diving ducks, and geese), and categorized them by importance based on the expert opinion of the team (Table 5).

This exercise reinforced the importance of upland, agricultural habitats to foraging waterfowl in the PLJV in addition to wetlands, as demonstrated by several previous studies (e.g., Baldassarre and Bolen 1984). It also raised questions about the importance of juxtaposition of foraging and roosting habitats (see Guthery et al. 1984, Moon 2004).

We selected a subset of these habitats for modeling the ECC of each planning area (Table 6). Selection criteria included foraging habitats of high or moderate importance to ducks and geese (Table 5). Only major habitats prevalent in large portions of the PLJV were considered. Minor habitats, or those of local importance, were not considered.

In Table 6 we present the ECC of each habitat, and cite our sources of information. ECC is expressed as DUDEs/acre, and is based on (1) the energy requirement of a Mallard-sized duck for maintaining body condition during winter (292 kcal/day; Prince 1979), (2) the mass of seeds, leafy plant material, and invertebrates available for foraging birds in the habitat (as measured from field studies), and (3) the energy content of those foods (as measured from laboratory

studies). ECC studies for some habitats are lacking, especially habitats containing important leafy plant material (e.g., pondweeds, winter wheat), so we made assumptions on ECC for some habitats. We also present threats and trends of these habitats, again based on the expert opinion of the team (Table 6).

Step 6c - Measure habitats to determine current quantity

Using available spatial data, agricultural statistics, and assumptions, we estimated the acreage of important waterfowl foraging habitats (described in Table 6) in each planning area. Habitat assessment procedures are described in detail in a companion technical document (PLJV 2004c).

For some deepwater habitats (e.g., reservoirs, freshwater lakes, stock ponds, lagoons) we made assumptions on the proportion of the total habitat acreage that would be suitable depth for waterfowl foraging (see Table 6 and Appendices A-I).

Mapping techniques used for playas (see PLJV 2004c) delineated acreage for the entire basins or "hydric footprints", so we made assumptions the percentage of this acreage that would be available (wet), both within pits only and outside pits (littoral acreage), under average environmental conditions (average precipitation; see Appendices A-I). For all other habitats we assumed the acreage measured represented average environmental conditions, and would be fully available to foraging waterfowl. For example, we assumed National Wetlands Inventory maps for emergent marsh represent acreage during years of average precipitation and not abnormally dry or wet conditions.

Step 6d - Model current landscape carrying capacity for nonbreeding waterfowl and determine if habitat shortfalls exist

For this step we multiplied the acreage of each foraging habitat (adjusted for suitability and availability as described above) by the ECC per acre of the habitat, and summed over all habitats in a planning area. This figure was divided by the total energetic demands for waterfowl (total DUDEs) in the area to portray current "percent of goal" for carrying capacity. This can be interpreted as the amount of food energy available in the area, compared to the amount needed to support NAWMP population objectives.

This analysis suggested that sufficient food resources are available to support NAWMP population objectives in 6 of the 9 planning areas. Apparently, food resources are substantially deficient in the southern portion of the PLJV (BCR18-NM, BCR18-TX, and BCR19-TX), where only approximately 15-30% of waterfowl energy demands could be supported. Food resources apparently are sufficient in the remainder of the PLJV; most areas in Colorado, Kansas, Nebraska, and Oklahoma can support approximately 110-150% of energy demands. The BCR18 portion of Oklahoma is the exception, where 558% of energy demands can be supported. For the 3 planning areas in New Mexico and Texas where foraging habitat was insufficient, we calculated food energy shortfall (expressed as DUDEs).

Details of this analysis for each planning area are presented in Appendices A-I and summarized in Table 7.

Step 6e - Describe conservation strategy to increase or maintain landscape carrying capacity for waterfowl

We recommend moist-soil management of wetlands (playas where possible) to alleviate foraging habitat shortfalls in New Mexico and Texas. Playa acreage in BCR19-Texas is insufficient to meet needs for additional managed habitat, so management of other wetland types will be needed. We justify this strategy as follows:

1. Moist-soil managed wetlands (including playas) can support more foraging use-days per acre than any other foraging habitat (Table 6), so emphasis on moist-soil management minimizes the number of wetland acres under management.
2. Moist-soil management of playas does not require expensive water control structures.
3. Due to the prevalence of groundwater pumping for cropland irrigation in the region, many groundwater wells are located near playas and other wetlands.
4. Moist-soil managed wetlands will provide stable, predictable foraging habitat in most years, which is desirable in the PLJV where wetlands often are unpredictable and ephemeral.

This strategy is consistent with recommendations of researchers who have advocated moist-soil management of wetlands for nonbreeding waterfowl in the PLJV (e.g., Anderson and Smith 1998, 1999; Moon 2004).

Further, we recommend a 30-year implementation horizon for alleviating the foraging habitat deficits in New Mexico and Texas. Annual acreage objectives for new moist-soil habitat are provided in Table 7.

For other planning areas in Colorado, Kansas, Nebraska, and Oklahoma where sufficient foraging habitat currently exists, we emphasize that habitat surpluses are not large (10-50% above objectives) and that we believe several important habitats are declining (Table 5). In these areas, conservation actions directed at long-term protection, restoration, and enhancement of important foraging habitats are strongly encouraged.

Step 7: Measuring Success

<to be completed>……But here is a thought:

"When habitat in all PLJV planning areas is not limiting waterfowl from reaching NAWMP objective levels, and is not expected to be limiting in the future, because PLJV conservation actions are sufficient to offset any negative trends in important habitats."

Monitoring and Evaluation

<to be completed>
Appendix J – Assumptions?
Appendix K – Research Priorities?

Updating the Conservation Strategy

This report represents the PLJV's first attempt to step down waterfowl population objectives from continental objectives in the NAWMP, and its first attempt to incorporate habitat objectives that are linked biologically to population objectives. Numerous information gaps and uncertainties arose during this planning process, which required us to make assumptions and subjective decisions in developing waterfowl conservation objectives. Some of these information gaps likely will be addressed in future research (see previous sections), which will allow future improvements in PLJV waterfowl conservation planning. Also, further critical thinking and discussion about habitat conservation strategies will create a desire to revise these objectives.

The PLJV's biological planning is an ongoing initiative (see PLJV 2004a, b). Waterfowl conservation objectives should be updated and revised as new information becomes available, and as desired by partners.

Finally, we encourage critical review of these objectives, and welcome suggestions for improving them. Please send comments to:

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Afterword

Waterfowl population and habitat objectives in this report are intended to guide the PLJV in implementing the NAWMP. Achieving these objectives within the next 30 years will be a major undertaking, requiring greater commitments of human and fiscal resources in the future than has occurred in the past. We hope and expect that by adopting these objectives, PLJV partners are inspired to redouble their efforts towards waterfowl and wetlands conservation and management.

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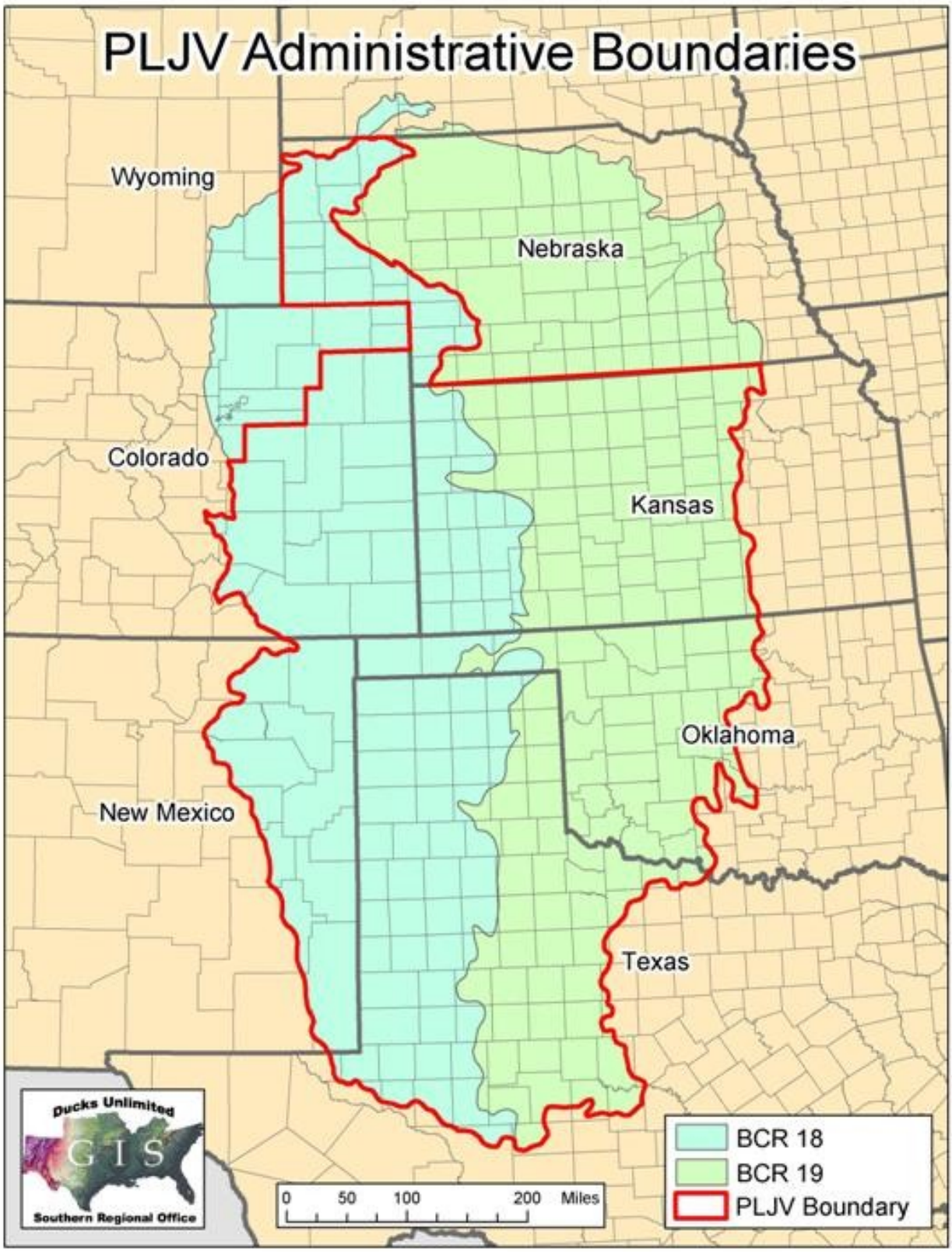

Figure 1. PLJV Administrative Boundaries.

Table 1. Highest priority waterfowl species, populations, and seasons for the PLJV, as designated in the North American Waterfowl Management Plan (2004 Update).

Species/Population	Season	BCR* 18	BCR* 19
Northern Pintail	Nonbreeding	X	X
Mallard	Nonbreeding	X	X
Canada Goose - Shortgrass Prairie Population	Nonbreeding	X	
Canada Goose – Hi-line Population	Nonbreeding	X	
Canada Goose – W. Prairie/Great Plains Population	Breeding		X
Canada Goose – W. Prairie/Great Plains Population	Nonbreeding		X
Snow Goose – Midcontinent Population	Nonbreeding		X
Snow Goose – Western Central Flyway Population	Nonbreeding	X	
Greater White-fronted Goose – Midcontinent Population	Nonbreeding		X

*Bird Conservation Region.

Table 2. PLJV midwinter (early January) waterfowl population objectives.

	CO	KS			NE	NM	OK			TX			PLJV		
Species	**18**	**18**	**19**	**KS Total**	**18**	**18**	**18**	**19**	**OK Total**	**18**	**19**	**TX Total**	**18 Total**	**19 Total**	**PLJV Tot.**
MALL	93,400	90,612	512,969	603,581	78,181	24,942	5,115	159,491	164,606	149,825	116,078	265,903	442,075	788,537	1,230,612
GADW	76	30	383	414	22	2,621	54	2,288	2,343	30,886	44,382	75,268	33,689	47,054	80,743
AMWI	281	641	3,511	4,152	61	11,104	195	10,571	10,766	49,372	37,397	86,768	61,653	51,479	113,132
AGWT	267	252	2,049	2,300	1	4,931	144	2,721	2,865	86,479	84,706	171,185	92,073	89,476	181,548
NSHO	170	0	3	3	0	1,769	7	185	192	19,763	9,037	28,800	21,710	9,225	30,936
NOPI	445	75	515	590	6	8,353	28	622	650	146,763	153,694	300,457	155,671	154,830	310,501
WODU	0	0	0	0	0	0	846	26,566	27,412	5,354	5,372	10,726	6,200	31,938	38,138
Dabblers	**94,639**	**91,610**	**519,429**	**611,039**	**78,270**	**53,721**	**6,390**	**202,444**	**208,834**	**488,441**	**450,666**	**939,107**	**813,071**	**1,172,539**	**1,985,610**
REDH	8	3	28	31	3	380	6	591	597	60,910	23,773	84,682	61,311	24,392	85,702
CANV	0	0	3	4	4	1,136	3	191	194	6,897	3,330	10,227	8,040	3,524	11,565
LESC	0	5	48	54	58	433	18	1,805	1,824	18,871	18,868	37,739	19,386	20,722	40,108
RNDU	1	49	1,142	1,191	3	1,333	0	2,153	2,153	438	3,000	3,438	1,823	6,295	8,118
RUDU	0	0	1	1	0	396	0	62	62	2,407	188	2,594	2,802	251	3,054
Divers	**10**	**58**	**1,224**	**1,281**	**69**	**3,677**	**28**	**4,802**	**4,830**	**89,522**	**49,159**	**138,680**	**93,363**	**55,184**	**148,547**
Tot. Ducks	**94,648**	**91,668**	**520,653**	**612,321**	**78,339**	**57,397**	**6,418**	**207,246**	**213,664**	**577,963**	**499,825**	**1,077,788**	**906,433**	**1,227,723**	**2,134,157**
CAGO - HL	10,981	0	0	0	6,127	0	0	0	0	0	0	0	17,107	0	17,107
CAGO-WP/GP	0	780	31,212	31,993	24,370	0	0	5,926	5,926	0	0	0	25,151	37,138	62,289
CAGO - SGP	27,879	0	0	0	698	15,329	1,588	14,294	15,882	79,493	14,028	93,521	124,988	28,322	153,310
CAGO - TGP	0	378	34,030	34,408	0	0	0	25,440	25,440	0	32,422	32,422	378	91,891	92,270
CAGO - Tot.	***38,860***	***1,158***	***65,242***	***66,401***	***31,195***	***15,329***	***1,588***	***45,660***	***47,248***	***79,493***	***46,450***	***125,943***	***167,624***	***157,352***	***324,976***
LESG - WCF	4,386	0	0	0	0	3,728	0	0	0	620	0	620	8,734	0	8,734
LESG - MC	0	153	1,986	2,139	0	0	0	8,774	8,774	0	0	0	153	10,761	10,914
LESG - Tot.	***4,386***	***153***	***1,986***	***2,139***	***0***	***3,728***	***0***	***8,774***	***8,774***	***620***	***0***	***620***	***8,886***	***10,761***	***19,647***
GWFG - MC	0	0	30,045	30,045	0	0	0	6,082	6,082	0	5,725	5,725	0	41,852	41,852
Tot. Geese	**43,246**	**1,311**	**97,274**	**98,585**	**31,195**	**19,057**	**1,588**	**60,516**	**62,104**	**80,113**	**52,175**	**132,288**	**176,510**	**209,964**	**386,475**
Tot. WF	**137,894**	**92,979**	**617,927**	**710,906**	**109,534**	**76,454**	**8,006**	**267,762**	**275,768**	**658,076**	**551,999**	**1,210,076**	**1,082,943**	**1,437,688**	**2,520,631**

Table 3. PLJV nonbreeding (Sep – Apr) duck use-day equivalent (DUDE) objectives (in thousands). See text for explanation.

	CO	KS			NE	NM	OK			TX			PLJV		
Species	**18**	**18**	**19**	**KS Tot.**	**18**	**18**	**18**	**19**	**OK Total**	**18**	**19**	**TX Total**	**18 Total**	**19 Total**	**PLJV Total**
MALL	12,905	12,520	70,876	83,395	10,802	3,446	707	22,037	22,743	20,701	16,038	36,739	61,080	108,950	170,031
GADW	121	48	610	658	35	4,174	86	3,644	3,730	49,186	70,679	119,865	53,650	74,932	128,582
AMWI	386	882	4,829	5,710	84	15,272	268	14,539	14,807	67,903	51,433	119,336	84,794	70,800	155,595
AGWT	149	140	1,140	1,280	1	2,744	80	1,514	1,594	48,121	47,135	95,256	51,235	49,789	101,024
NSHO	511	-	9	9	-	5,319	21	556	577	59,426	27,174	86,600	65,277	27,739	93,016
NOPI	1,755	296	2,031	2,327	24	32,939	110	2,453	2,563	578,750	606,082	1,184,831	613,874	610,565	1,224,439
WODU	0	0	0	0	0	0	1,375	43,175	44,550	8,701	8,730	17,432	10,076	51,905	61,981
Dabblers	**15,827**	**13,885**	**79,495**	**93,380**	**10,945**	**63,894**	**2,647**	**87,917**	**90,564**	**832,788**	**827,270**	**1,660,058**	**939,987**	**994,682**	**1,934,668**
REDH	12	5	43	47	5	578	9	900	909	92,720	36,188	128,908	93,329	37,131	130,459
CANV	-	-	1	1	1	290	1	49	50	1,763	851	2,614	2,055	901	2,955
LESC	0	5	52	57	62	465	19	1,937	1,956	20,250	20,247	40,496	20,801	22,235	43,036
RNDU	0	19	448	467	1	523	0	844	844	172	1,176	1,348	1,890	2,468	4,358
RUDU	0	0	1	1	0	492	0	77	77	2,991	234	3,225	495,140	312	495,452
Divers	**13**	**29**	**544**	**573**	**69**	**2,348**	**29**	**3,807**	**3,836**	**117,895**	**58,696**	**176,591**	**613,215**	**63,046**	**676,261**
Tot. Ducks	**15,840**	**13,914**	**80,038**	**93,953**	**11,014**	**66,243**	**2,677**	**91,723**	**94,400**	**950,683**	**885,966**	**1,836,649**	**1,553,202**	**1,057,728**	**2,610,929**
CAGO - HL	6,038	0	0	0	3,369	0	0	0	0	0	0	0	9,407	0	9,407
CAGO - WP/GP	0	314	12,577	12,891	9,820	0	0	2,388	2,388	0	0	0	10,134	14,965	25,099
CAGO - SGP	9,451	0	0	0	237	5,194	538	4,843	5,381	14,285	0	14,285	29,704	4,843	34,547
CAGO - TGP	0	77	6,941	7,018	0	0	0	5,189	5,189	0	11,288	11,288	77	23,417	23,495
CAGO - Tot.	***15,489***	***391***	***19,518***	***19,909***	***13,426***	***5,194***	***538***	***12,420***	***12,958***	***14,285***	***11,288***	***25,572***	***49,323***	***43,225***	***92,548***
LESG - WCF	1,242	0	0	0	0	1,055	0	0	0	171	0	171	2,468	0	2,468
LESG - MC	0	46	591	637	0	0	0	2,611	2,611	0	6,961	6,961	46	10,163	10,209
LESG - Tot.	***1,242***	***46***	***591***	***637***	***0***	***1,055***	***0***	***2,611***	***2,611***	***171***	***6,961***	***7,131***	***2,513***	***10,163***	***12,676***
GWFG - MC	0	0	6,581	6,581	0	0	0	1,332	1,332	0	2,508	2,508	0	10,422	10,422
Tot. Geese	**16,731**	**437**	**26,690**	**27,127**	**13,426**	**6,249**	**538**	**16,363**	**16,901**	**14,455**	**20,757**	**35,212**	**51,836**	**63,810**	**115,646**
Tot. WF	**32,571**	**14,351**	**106,729**	**121,080**	**24,440**	**72,492**	**3,215**	**108,086**	**111,301**	**965,139**	**906,723**	**1,871,861**	**1,605,038**	**1,121,538**	**2,726,576**

Table 4. Importance assessment of limiting factors for waterfowl in the PLJV, degree of management control, and priority level for management actions (H=high; M=moderate; L=low).

	Response Variable				
Limiting Factor	**Bird Numbers**	**Survival**	**Body Condition**	**Management Control**	**Priority**
Foraging habitat - wetland	H	H-M	H	H	1
Roosting habitat (water)	H	H-M	H	M	1
Foraging habitat - agricultural	H	H-M	H	H	2
Disease	L	M	L	M-L	3
Disturbance - hunting	M-H[A]	L	L	M	4
Contaminants	L	M-L	L	L	5
Predation[B]	*N/A*	L	L	L	5
Disturbance - nonhunting	L-M[C]	L	L	L	5
Inter-specific competition	L	L	L	L	5
Weather[D]	H	M	M	*N/A*	*N/A*

[A]M for ducks, H for geese.
[B]Predation includes disturbance by predators.
[C]L for ducks, M for geese.
[D]Seasonal ice and snow cover.

Table 5. Importance assessment for waterfowl foraging and roosting habitats in the PLJV (H=high; M=moderate; L=low).

	Guild				
	Dabbling Ducks		Diving Ducks	Geese	
Habitat	**Foraging Value**	**Roost Value**	**Foraging/Roost Value**	**Foraging Value**	**Roost Value**
Playas[A]	H	H	M	H	H
Saline Lakes	L	0	0	0	0
Reservoirs	H - L	H	H - M[B]	L	H
Marsh	H	H	H	H	H
Stock Tanks	H - L	H	H - M	L	H
Rivers	L	M	M	L	H
Sewage Lagoon	M	H	H	0	H
Moist Soil[C]	H	H	L	M - L	H
Wet Meadow	L	0	0	0	0
Gravel Pits	L	L	L	0	M
Sheet Water	H	M	0	H	L
Canals/Ditches	L	L	L	0	0
Grazing/Pasture	0	0	0	M - L	0
Corn[D]	H	0	0	H	0
Sorghum	H	0	0	H	0
Peanuts	H	0	0	H	0
Winter Wheat	L[E]	0	0	H	0
Cotton	0	0	0	0	0
Sunflowers	0	0	0	L	0
Soybeans	M	0	0	H - M	0
Alfalfa	0[F]	0	0	M - L	0

[A]Wet but unmanaged.
[B]H for mergansers, M for other divers.
[C]Includes managed playas.
[D]Does not include corn harvested for silage, which has zero foraging value (assumed).
[E]H for American Wigeon.
[F]L for American Wigeon.

Table 6. Important waterfowl foraging habitats, energetic carrying capacity (ECC), threats, and trends.

Habitat	ECC (DUDEs/Acre)	References	Applicable Guilds	Threats	Trends
Res., Lakes & Ponds					
Reservoirs	4,223 (for 5% of total area)	Assumption; consistent w/ LMVJV.	Dabbling ducks, Diving ducks	Decreased inflows, sedimentation.	Declining or stable.
Freshwater Lakes	4,223 (for 5% of total area)	Assumption; consistent w/ LMVJV.	Dabbling ducks, Diving ducks	Declining groundwater.	Stable.
Stock Ponds	225 (for 40% of total area0	Assumption; consistent w/ LMVJV.	Dabbling ducks, Diving ducks	Overgrazing.	Stable in BCR18; increasing in BCR19.
Lagoons	428	Assumed same as unmanaged playas.	Dabbling ducks, Diving ducks	Contaminants.	Stable or increasing.
Playas					
Wet Outside Pit	428	Haukos & Smith 1993, Anderson & Smith 1998; 1999	Dabbling ducks, Diving ducks, Geese	Siltation, tillage, overgrazing, modification (pits, roads, etc.). Decreasing irrigation tailwater.	Decreasing in many areas; stable in NM.
Wet Pit Only	849	Gray & Bolen 1987	Dabbling ducks, Diving ducks, Geese	Siltation is filling in existing pits; new pits generally are not being created.	Decreasing.
Other Wetlands					
Emergent Marsh	1,336	Assumption.	Dabbling ducks, Diving ducks, Geese	None.	Stable.
Saline Marsh	1,336	Assumption	Dabbling ducks, Diving ducks, Geese	None.	Stable.
Moist-Soil Units*	4,223	Haukos & Smith 1993, Anderson & Smith 1998; 1999	Dabbling ducks, Geese	Undesirable and exotic vegetation.	Increasing.
Riverine					
River channels	225	Assumption.	Dabbling ducks, Diving ducks	Reduced flows caused by aquifer depletion, reservoir development, exotic shrub invasion.	Declining.
Warmwater Sloughs	428	Assumption.	Dabbling ducks	Reduced river flows, sedimentation.	Declining.
Floodplain Marshes	1,336	Assumption	Dabbling ducks	Declining river flows and groundwater.	Declining.
Cropland					
Corn	1,336	Baldassarre & Bolen 1984; Reinecke & Loesch 1996	Dabbling ducks, Geese		Not assessed.
Sorghum	849	Reinecke & Loesch 1996	Dabbling ducks Geese		Not assessed.
Peanuts	849	Assumption.	Dabbling ducks, Geese		Not assessed.
Winter Wheat	1,336	Assumption.	Geese		Not assessed.

*Includes moist-soil managed playas.

Table 7. Current energetic carrying capacity (ECC) of PLJV planning areas for waterfowl relative to goals, and habitat objectives.

	Planning Area								
	BCR-18						BCR-19		
	CO	KS	NE	NM	OK	TX	KS	OK	TX
ECC Goal (DUDEs)	32,570,531	14,351,091	24,439,744	72,491,588	3,214,666	965,138,689	106,728,704	108,086,411	706,722,667
Current ECC of Area (DUDEs)	48,502,629	21,145,129	27,135,520	21,228,654	17,956,214	283,890,539	145,233,170	157,730,600	99,172,372
DUDE Surplus/(Deficit)	15,932,098	6,794,038	2,695,776	(51,262,934)	14,741,548	(681,248,150)	38,504,466	49,644,189	(607,550,295)
Current ECC of Area Relative to Goal (%)	148.5%	146.9%	109.6%	29.0%	558.2%	28.9%	135.8%	145.5%	13.5%
Moist-soil Habitat Acres Needed to Erase Deficit (@4,223 DUDEs/acre)	N/A	N/A	N/A	12,139	N/A	161,319	N/A	N/A	143,867
Annual Moist-soil Habitat Acreage Goal (30 years)	N/A	N/A	N/A	405	N/A	5,377	N/A	N/A	4,796

APPENDIX A: Waterfowl Carrying Capacity Model for BCR18 Colorado

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	10,345,029	Corn	713,807	0.06900	0.00	1,336	0	32,570,531	0.0000
Cropland	10,345,029	Peanuts	-	0.00000	0.00	849	0	32,570,531	0.0000
Cropland	10,345,029	Sorghum	331,041	0.03200	0.00	849	0	32,570,531	0.0000
Cropland	10,345,029	Wheat	1,468,994	0.14200	0.00	1,336	0	32,570,531	0.0000
Other Wetlands	1,761	Emergent marsh	1,761	1.00000	1.00	1,336	2,352,696	32,570,531	0.0720
Other Wetlands	1,761	Moist-soil unit	-	0.00000	1.00	4,223	0	32,570,531	0.0000
Other Wetlands	1,761	Saline	-	0.00000	1.00	1,336	0	32,570,531	0.0000
Playa	22,321	Wet	2,009	0.09000	1.00	428	859,805	32,570,531	0.0260
Playa	22,321	Wet pit only	1,339	0.06000	0.40	849	454,813	32,570,531	0.0130
Reservoirs Lakes Ponds	190,099	Freshwater lake	52,848	0.27800	0.05	4,223	11,158,754	32,570,531	0.3420
Reservoirs Lakes Ponds	190,099	Lagoon	3,802	0.02000	0.40	428	650,899	32,570,531	0.0190
Reservoirs Lakes Ponds	190,099	Reservoir	58,170	0.30600	0.05	4,223	12,282,658	32,570,531	0.3770
Reservoirs Lakes Ponds	190,099	Stock pond	71,477	0.37600	0.40	225	6,432,950	32,570,531	0.1970
Riverine Systems	495,329	Floodplain marsh	4,953	0.01000	1.00	1,336	6,617,595	32,570,531	0.2030
Riverine Systems	495,329	River channel	24,766	0.05000	1.00	225	5,572,451	32,570,531	0.1710
Riverine Systems	495,329	Warmwater slough	4,953	0.01000	1.00	428	2,120,008	32,570,531	0.0650
Totals							**48,502,629**		**1.4850**

*Goal is for the PLJV portion of BCR18-CO only (see Fig. 1); therefore carrying capacity shown here is too high. This inconsistency will be rectified following decisions on the JV orientation of the South Platte River corridor of Colorado.

APPENDIX B: Waterfowl Carrying Capacity Model for BCR18 Kansas

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	6,682,273	Corn	962,247	0.14400	0.00	1,336	0	14,351,091	0.0000
Cropland	6,682,273	Peanuts	-	0.00000	0.00	849	0	14,351,091	0.0000
Cropland	6,682,273	Sorghum	1,002,341	0.15000	0.00	849	0	14,351,091	0.0000
Cropland	6,682,273	Wheat	2,258,608	0.33800	0.00	1,336	0	14,351,091	0.0000
Other Wetlands	2,946	Emergent marsh	2,905	0.98600	1.00	1,336	3,880,754	14,351,091	0.2700
Other Wetlands	2,946	Moist-soil unit	41	0.01400	1.00	4,223	174,173	14,351,091	0.0120
Other Wetlands	2,946	Saline	-	0.00000	1.00	1,336	0	14,351,091	0.0000
Playa	90,724	Wet	8,165	0.09000	1.00	428	3,494,688	14,351,091	0.2430
Playa	90,724	Wet pit only	5,443	0.06000	0.40	849	1,848,592	14,351,091	0.1280
Reservoirs Lakes Ponds	8,448	Freshwater lake	6,412	0.75900	0.05	4,223	1,353,901	14,351,091	0.0940
Reservoirs Lakes Ponds	8,448	Lagoon	169	0.02000	0.40	428	28,926	14,351,091	0.0020
Reservoirs Lakes Ponds	8,448	Reservoir	118	0.01400	0.05	4,223	24,973	14,351,091	0.0010
Reservoirs Lakes Ponds	8,448	Stock pond	1,580	0.18700	0.40	225	142,180	14,351,091	0.0090
Riverine Systems	350,290	Floodplain marsh	3,503	0.01000	1.00	1,336	4,679,874	14,351,091	0.3260
Riverine Systems	350,290	River channel	24,520	0.07000	1.00	225	5,517,068	14,351,091	0.3840
Riverine Systems	350,290	Warmwater slough	-	0.00000	1.00	428	0	14,351,091	0.0000
Totals							**21,145,129**		**1.4690**

APPENDIX C: Waterfowl Carrying Capacity Model for BCR18 Nebraska

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	3,903,811	Corn	897,877	0.23000	0.00	1,336	0	24,439,744	0.0000
Cropland	3,903,811	Peanuts	-	0.00000	0.00	849	0	24,439,744	0.0000
Cropland	3,903,811	Sorghum	35,134	0.00900	0.00	849	0	24,439,744	0.0000
Cropland	3,903,811	Wheat	995,472	0.25500	0.00	1,336	0	24,439,744	0.0000
Other Wetlands	10,657	Emergent marsh	10,273	0.96400	1.00	1,336	13,725,193	24,439,744	0.5610
Other Wetlands	10,657	Moist-soil unit	32	0.00300	1.00	4,223	135,014	24,439,744	0.0050
Other Wetlands	10,657	Saline	352	0.03300	1.00	1,336	469,846	24,439,744	0.0190
Playa	103,026	Wet	9,272	0.09000	1.00	428	3,968,562	24,439,744	0.1620
Playa	103,026	Wet pit only	6,182	0.06000	0.40	849	2,099,258	24,439,744	0.0850
Reservoirs Lakes Ponds	34,479	Freshwater lake	310	0.00900	0.05	4,223	65,522	24,439,744	0.0020
Reservoirs Lakes Ponds	34,479	Lagoon	690	0.02000	0.40	428	118,056	24,439,744	0.0040
Reservoirs Lakes Ponds	34,479	Reservoir	21,860	0.63400	0.05	4,223	4,615,673	24,439,744	0.1880
Reservoirs Lakes Ponds	34,479	Stock pond	6,689	0.19400	0.40	225	602,003	24,439,744	0.0240
Riverine Systems	46,258	Floodplain marsh	463	0.01000	1.00	1,336	618,007	24,439,744	0.0250
Riverine Systems	46,258	River channel	2,313	0.05000	1.00	225	520,402	24,439,744	0.0210
Riverine Systems	46,258	Warmwater slough	463	0.01000	1.00	428	197,984	24,439,744	0.0000
Totals							**27,135,520**		**1.0960**

APPENDIX D: Waterfowl Carrying Capacity Model for BCR18 New Mexico

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	947,453	Corn	70,112	0.07400	0.00	1,336	0	72,491,588	0.0000
Cropland	947,453	Peanuts	18,002	0.01900	0.00	849	0	72,491,588	0.0000
Cropland	947,453	Sorghum	157,277	0.16600	0.00	849	0	72,491,588	0.0000
Cropland	947,453	Wheat	442,461	0.46700	0.00	1,336	0	72,491,588	0.0000
Other Wetlands	5,243	Emergent marsh	5,243	1.00000	1.00	1,336	7,004,648	72,491,588	0.0960
Other Wetlands	5,243	Moist-soil unit	-	0.00000	1.00	4,223	0	72,491,588	0.0000
Other Wetlands	5,243	Saline	-	0.00000	1.00	1,336	0	72,491,588	0.0000
Playa	14,843	Wet	1,781	0.12000	1.00	428	762,336	72,491,588	0.0100
Playa	14,843	Wet pit only	1,187	0.08000	0.40	849	403,255	72,491,588	0.0050
Reservoirs Lakes Ponds	66,180	Freshwater lake	32,759	0.49500	0.05	4,223	6,917,084	72,491,588	0.0950
Reservoirs Lakes Ponds	66,180	Lagoon	1,324	0.02000	0.40	428	226,600	72,491,588	0.0030
Reservoirs Lakes Ponds	66,180	Reservoir	19,258	0.29100	0.05	4,223	4,066,407	72,491,588	0.0560
Reservoirs Lakes Ponds	66,180	Stock pond	5,758	0.08700	0.40	225	518,189	72,491,588	0.0070
Riverine Systems	49,521	Floodplain marsh	495	0.01000	1.00	1,336	661,601	72,491,588	0.0090
Riverine Systems	49,521	River channel	2,971	0.06000	1.00	225	668,534	72,491,588	0.0090
Riverine Systems	49,521	Warmwater slough	-	0.00000	1.00	428	0	72,491,588	0.0000
Totals							**21,228,654**		**0.2900**

APPENDIX E: Waterfowl Carrying Capacity Model for BCR18 Oklahoma

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	1,087,673	Corn	118,556	0.10900	0.00	1,336	0	3,214,666	0.0000
Cropland	1,087,673	Peanuts	-		0.00	849		3,214,666	0.0000
Cropland	1,087,673	Sorghum	233,850	0.21500	0.00	849	0	3,214,666	0.0000
Cropland	1,087,673	Wheat	532,960	0.49000	0.00	1,336	0	3,214,666	0.0000
Other Wetlands	14	Emergent marsh	-	0.00000	1.00	1,336	0	3,214,666	0.0000
Other Wetlands	14	Moist-soil unit	14	1.00000	1.00	4,223	59,122	3,214,666	0.0180
Other Wetlands	14	Saline	-	0.00000	1.00	1,336	0	3,214,666	0.0000
Playa	3,307	Wet	661	0.20000	1.00	428	283,079	3,214,666	0.0880
Playa	3,307	Wet pit only	165	0.05000	0.40	849	56,153	3,214,666	0.0170
Reservoirs Lakes Ponds	3,944	Freshwater lake	3,873	0.98200	0.05	4,223	817,786	3,214,666	0.2540
Reservoirs Lakes Ponds	3,944	Lagoon	-	0.00000	0.40	428	0	3,214,666	0.0000
Reservoirs Lakes Ponds	3,944	Reservoir	-	0.00000	0.05	4,223	0	3,214,666	0.0000
Reservoirs Lakes Ponds	3,944	Stock pond	71	0.01800	0.40	225	6,389	3,214,666	0.0010
Riverine Systems	298,230	Floodplain marsh	2,982	0.01000	1.00	1,336	3,984,353	3,214,666	1.2390
Riverine Systems	298,230	River channel	56,664	0.19000	1.00	225	12,749,332	3,214,666	3.9650
Riverine Systems	298,230	Warmwater slough	-	0.00000	1.00	428	0	3,214,666	0.0000
Totals							**17,956,214**		**5.5820**

APPENDIX F: Waterfowl Carrying Capacity Model for BCR18 Texas

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	6,487,233	Corn	661,698	0.10200	0.00	1,336	0	965,138,689	0.0000
Cropland	6,487,233	Peanuts	162,181	0.02500	0.00	849	0	965,138,689	0.0000
Cropland	6,487,233	Sorghum	1,459,627	0.22500	0.00	849	0	965,138,689	0.0000
Cropland	6,487,233	Wheat	2,834,921	0.43700	0.00	1,336	0	965,138,689	0.0000
Other Wetlands	98,716	Emergent marsh	98,617	0.99900	1.00	1,336	131,752,691	965,138,689	0.1360
Other Wetlands	98,716	Moist-soil unit	99	0.00100	1.00	4,223	416,878	965,138,689	0.0000
Other Wetlands	98,716	Saline	-	0.00000	1.00	1,336	0	965,138,689	0.0000
Playa	497,543	Wet	99,509	0.20000	1.00	428	42,589,681	965,138,689	0.0440
Playa	497,543	Wet pit only	24,877	0.05000	0.40	849	8,448,280	965,138,689	0.0080
Reservoirs Lakes Ponds	132,319	Freshwater lake	57,294	0.43300	0.05	4,223	12,097,655	965,138,689	0.0120
Reservoirs Lakes Ponds	132,319	Lagoon	2,646	0.02000	0.40	428	453,060	965,138,689	0.0000
Reservoirs Lakes Ponds	132,319	Reservoir	20,509	0.15500	0.05	4,223	4,330,569	965,138,689	0.0040
Reservoirs Lakes Ponds	132,319	Stock pond	24,479	0.18500	0.40	225	2,203,111	965,138,689	0.0020
Riverine Systems	3,315,669	Floodplain marsh	33,157	0.01000	1.00	1,336	44,297,338	965,138,689	0.0450
Riverine Systems	3,315,669	River channel	165,783	0.05000	1.00	225	37,301,276	965,138,689	0.0380
Riverine Systems	3,315,669	Warmwater slough	-	0.00000	1.00	428	0	965,138,689	0.0000
Totals							**283,890,539**		**0.2890**

APPENDIX G: Waterfowl Carrying Capacity Model for BCR19 Kansas

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	17,947,545	Corn	1,238,381	0.06900	0.00	1,336	0	106,728,704	0.0000
Cropland	17,947,545	Peanuts	-	0.00000	0.00	849	0	106,728,704	0.0000
Cropland	17,947,545	Sorghum	2,243,443	0.12500	0.00	849	0	106,728,704	0.0000
Cropland	17,947,545	Wheat	6,371,378	0.35500	0.00	1,336	0	106,728,704	0.0000
Other Wetlands	16,234	Emergent marsh	-	0.00000	1.00	1,336	0	106,728,704	0.0000
Other Wetlands	16,234	Moist-soil unit	16,234	1.00000	1.00	4,223	68,556,182	106,728,704	0.6420
Other Wetlands	16,234	Saline	-	0.00000	1.00	1,336	0	106,728,704	0.0000
Playa	97,135	Wet	8,742	0.09000	1.00	428	3,741,640	106,728,704	0.0350
Playa	97,135	Wet pit only	5,828	0.06000	0.40	849	1,979,223	106,728,704	0.0180
Reservoirs Lakes Ponds	124,980	Freshwater lake	32,495	0.26000	0.05	4,223	6,861,277	106,728,704	0.0640
Reservoirs Lakes Ponds	124,980	Lagoon	2,500	0.02000	0.40	428	427,932	106,728,704	0.0040
Reservoirs Lakes Ponds	124,980	Reservoir	56,616	0.45300	0.05	4,223	11,954,456	106,728,704	0.1120
Reservoirs Lakes Ponds	124,980	Stock pond	30,870	0.24700	0.40	225	2,778,305	106,728,704	0.0260
Riverine Systems	1,988,385	Floodplain marsh	19,884	0.01000	1.00	1,336	26,564,824	106,728,704	0.2480
Riverine Systems	1,988,385	River channel	99,419	0.05000	1.00	225	22,369,331	106,728,704	0.2090
Riverine Systems	1,988,385	Warmwater slough	-	0.00000	1.00	428	0	106,728,704	0.0000
Totals							**145,233,170**		**1.3580**

APPENDIX H: Waterfowl Carrying Capacity Model for BCR19 Oklahoma

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	9,055,869	Corn	54,335	0.00600	0.00	1,336	0	108,086,411	0.0000
Cropland	9,055,869	Peanuts	54,335	0.00600	0.00	849	0	108,086,411	0.0000
Cropland	9,055,869	Sorghum	172,062	0.01900	0.00	849	0	108,086,411	0.0000
Cropland	9,055,869	Wheat	5,388,242	0.59500	0.00	1,336	0	108,086,411	0.0000
Other Wetlands	24,080	Emergent marsh	16,856	0.70000	1.00	1,336	22,519,616	108,086,411	0.2080
Other Wetlands	24,080	Moist-soil unit	7,224	0.30000	1.00	4,223	30,506,952	108,086,411	0.2820
Other Wetlands	24,080	Saline	-	0.00000	1.00	1,336	0	108,086,411	0.0000
Playa	51,527	Wet	10,305	0.20000	1.00	428	4,410,711	108,086,411	0.0400
Playa	51,527	Wet pit only	2,576	0.05000	0.40	849	874,928	108,086,411	0.0080
Reservoirs Lakes Ponds	104,695	Freshwater lake	45,647	0.43600	0.05	4,223	9,638,368	108,086,411	0.0890
Reservoirs Lakes Ponds	104,695	Lagoon	2,094	0.02000	0.40	428	358,476	108,086,411	0.0030
Reservoirs Lakes Ponds	104,695	Reservoir	53,394	0.51000	0.05	4,223	11,274,238	108,086,411	0.1040
Reservoirs Lakes Ponds	104,695	Stock pond	1,570	0.01500	0.40	225	141,338	108,086,411	0.0010
Riverine Systems	3,169,686	Floodplain marsh	31,697	0.01000	1.00	1,336	42,347,005	108,086,411	0.3910
Riverine Systems	3,169,686	River channel	158,484	0.05000	1.00	225	35,658,968	108,086,411	0.3290
Riverine Systems	3,169,686	Warmwater slough	-	0.00000	1.00	428	0	108,086,411	0.0000
Totals							**157,730,600**		**1.4550**

APPENDIX I: Waterfowl Carrying Capacity Model for BCR19 Texas

Association Name	Assoc. Acres	Condition Name	Cond. Acres	% of Assoc	% Suitability	ECC (DUDEs)	CC Current	Goal (DUDEs)	% of Goal
Cropland	2,986,127	Corn	8,958	0.00300	0.00	1,336	0	706,722,667	0.0000
Cropland	2,986,127	Peanuts	101,528	0.03400	0.00	849	0	706,722,667	0.0000
Cropland	2,986,127	Sorghum	176,181	0.05900	0.00	849	0	706,722,667	0.0000
Cropland	2,986,127	Wheat	1,940,983	0.65000	0.00	1,336	0	706,722,667	0.0000
Other Wetlands	45,858	Emergent marsh	45,766	0.99800	1.00	1,336	61,143,755	706,722,667	0.0860
Other Wetlands	45,858	Moist-soil unit	92	0.00200	1.00	4,223	387,317	706,722,667	0.0000
Other Wetlands	45,858	Saline	-	0.00000	1.00	1,336	0	706,722,667	0.0000
Playa	46,729	Wet	9,346	0.20000	1.00	428	4,000,002	706,722,667	0.0050
Playa	46,729	Wet pit only	2,336	0.05000	0.40	849	793,458	706,722,667	0.0010
Reservoirs Lakes Ponds	120,677	Freshwater lake	52,736	0.43700	0.05	4,223	11,135,175	706,722,667	0.0150
Reservoirs Lakes Ponds	120,677	Lagoon	2,414	0.02000	0.40	428	413,198	706,722,667	0.0000
Reservoirs Lakes Ponds	120,677	Reservoir	44,047	0.36500	0.05	4,223	9,300,546	706,722,667	0.0130
Reservoirs Lakes Ponds	120,677	Stock pond	19,067	0.15800	0.40	225	1,716,027	706,722,667	0.0020
Riverine Systems	417,834	Floodplain marsh	4,178	0.01000	1.00	1,336	5,582,262	706,722,667	0.0070
Riverine Systems	417,834	River channel	20,892	0.05000	1.00	225	4,700,632	706,722,667	0.0060
Riverine Systems	417,834	Warmwater slough	-	0.00000	1.00	428	0	706,722,667	0.0000
Totals							**99,172,372**		**0.1350**

APPENDIX J: Assumptions Made in Developing This Conservation Strategy

<to be completed?>

APPENDIX K: PLJV Waterfowl Research Priorities

(updated June 2004)

High Priority:

- Foraging value (energy per unit area)/carrying capacity of priority habitats[A] for waterfowl and sandhill cranes.
- Grazing impacts on foraging value of priority habitats[A].
- Annual and seasonal availability of priority foraging habitats[A].
- Effects of playa restoration techniques (buffers, filling pits, sediment removal) on foraging value.
- Migration chronology of waterfowl and sandhill cranes.
- Playa hydroperiod in cropland vs. rangeland vs. CRP.

Medium Priority:

- Trends in quantity/quality of priority habitats[A].
- Annual and seasonal variation in vital rates (survival, body condition) of priority species[B] in relation to habitat conditions.
- Habitat use and diets of priority species[B], esp. the importance of non-seed, non-invertebrate foods to northern pintails and mallards, and use of dry playas by sandhill cranes.
- Effects of hunting disturbance on waterfowl use of moist-soil managed areas.

Low Priority:

- Contaminant levels in waterfowl and food items in wastewater lagoons.

[A]**Priority Habitats** = Managed moist-soil units, impoundments (reservoirs, stock ponds, lagoons), playas, emergent marsh, rivers (channels and warmwater sloughs), wet meadows, and cropland (corn, sorghum, peanuts, winter wheat).

[B]**Priority Species** = Northern Pintail, Mallard, Sandhill Crane.

BDS note June 2005: add food depletion to research list? (see p. 937 LMV planning paper)