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12 **BEFORE THE**
13 **CALIFORNIA STATE WATER RESOURCES CONTROL BOARD**

14 HEARING IN THE MATTER OF
15 CALIFORNIA DEPARTMENT OF WATER
16 RESOURCES AND UNITED STATES
17 BUREAU OF RECLAMATION
18 REQUEST FOR A CHANGE IN POINT OF
19 DIVERSION FOR CALIFORNIA WATER FIX

20 **TESTIMONY OF GARY IVEY, Ph.D.**
21 **FRIENDS OF STONE LAKES NATIONAL**
22 **WILDLIFE REFUGE**

1 **I. INTRODUCTION**

2 I have worked as a Research Associate with the International Crane Foundation since
3 2007, focusing on the conservation needs of Sandhill Cranes (*Grus canadensis*; recently
4 considered *Antigone canadensis*; family *Gruidae*) in the western U.S. I received my doctorate
5 and master's degrees in Wildlife Science, both from Oregon State University in 2007 and 2015.
6 For my Master's Thesis I studied Greater Sandhill Crane (*G. canadensis tabida*) nesting
7 ecology, and for my doctoral dissertation, I studied wintering ecology of Greater and Lesser
8 Sandhill Cranes (*G. c. canadensis*) in the Sacramento-San Joaquin Delta. I received two
9 bachelor's degrees (Wildlife Management and Biology) from Humboldt State University (1977,
10 1978). I began studying Greater Sandhill Cranes in 1979 while I worked as a technician on a
11 nesting study at Malheur National Wildlife Refuge ("NWR") in SE Oregon and furthered
12 studying them while I worked as a Refuge Biologist at Sacramento NWR Complex (1 year),
13 Kern NWR (2 years), and Malheur NWR (15 years). I served as a consultant on California's
14 Draft Recovery Plan for Greater Sandhill Cranes (1998-2001) and also as a subconsultant to
15 assist with development of Greater Sandhill Crane conservation and mitigation measures for
16 the Bay Delta Conservation Plan ("BDCP"). I also carried out several field research projects for
17 The Nature Conservancy ("TNC") relating to management of Staten Island for Sandhill Crane
18 benefits.

19 **II. BACKGROUND**

20 Greater Sandhill Cranes were exploited by unregulated hunting by American settlers
21 and for the meat markets in the late 19th and early 20th centuries. They also suffered severe
22 historic habitat losses due to drainage and conversion of wetland habitats on both breeding
23 and wintering areas throughout the western U.S. While once a common breeding species
24 throughout the mountains in California, Walkinshaw (1949) (FSL-38) estimated only three to
25 five nesting pairs remained in 1944.

26 With the passage of section 3511 of the Fish and Game Code in 1970, the Greater
27 Sandhill Crane was designated a fully-protected species meaning no take can be authorized
28 for this project. (FSL-28) Subsequently in 1983, the California Fish and Game Commission

1 voted unanimously to add the Greater Sandhill Crane to the List of Rare Animals (Cal. Code
2 Regs., tit. 14, § 670.5). The California Endangered Species Act (1984) classifies the Greater
3 Sandhill Crane as a State Threatened species. (See SWRCB-102, FEIR/S, pp. 12-1243 [take
4 prohibited], Appendix 12A-24 [listing status].) Additionally, the Lesser Sandhill Crane (*G. c.*
5 *canadensis*) is classified as a “Bird Species of Conservation Concern” (Shuford and Gardali
6 2008). (FSL-34)

7 As a whole, the family Gruidae is one of the world's most endangered bird families, with
8 cranes often serving as "keystone" species for conserving grasslands, wetlands and
9 associated agricultural landscapes around the world. Cranes are long-lived birds (one species
10 lived to 83 years in a zoo) and they exhibit very low productivity and recruitment which makes
11 it difficult for them to rapidly recover from population-level effects of habitat losses or unnatural
12 causes of mortality such as from transmission line collisions. Their adaptation to forage in
13 agricultural grain fields has helped to allow the species to come-back from near historic
14 extinction; however, they have not fully recovered their historic breeding range and aren't likely
15 to ever recover to their pre-settlement population levels.

16 Sandhill Cranes are a very popular species that catch the public's interest more than
17 most other wildlife because their elegance and charisma is appealing to people; plus, they are
18 an important economic asset. An economic study of the spring Sandhill Crane staging area
19 along the Platte River in Nebraska estimated that over 90,000 visitors who travel there each
20 spring add about \$30 million to the local economy (FSL-31, Case and Sanders 2009). It is
21 likely that cranes wintering in the Central Valley generate much higher financial benefits to
22 local economies there, as they are present for over 6 months during winter and thousands of
23 visitors enjoy them at several NWRs, State Wildlife areas and Nature Preserves in the
24 Sacramento Valley, the Delta, and the San Joaquin Valley. Several Central Valley birding
25 festivals include tours to see Sandhill Cranes in their activities, including the Lodi Sandhill
26 Crane Festival, the Galt Winter Bird Festival, the Marysville Swan Festival and the Chico Snow
27 Goose Festival.

28

1 Approximately 20% of the Central Valley Population of Greater Sandhill Cranes, and
2 approximately 33% of the Pacific Coast Population of Lesser Sandhill Cranes winter in the
3 Delta Region (Ivey, unpublished data). Sandhill Cranes are found in some numbers
4 throughout the Delta; primarily in Sacramento and San Joaquin counties, but also in east Yolo,
5 Solano and Contra Costa counties. The wintering area includes both the Central Delta and
6 Cosumnes and Stone Lakes areas, and is approximately 1,500 km², bounded on the west by
7 the Sacramento River and the Deep Water Ship Channel, on the north by Elk Grove and South
8 Sacramento, on the south by Highway 4 to Stockton and on the east by Lodi, Galt and rural
9 communities of Herald and Wilton. This area includes the Cosumnes River floodplain (below
10 Wilton), the Mokelumne River floodplain (below Galt), the Sacramento River floodplain (below
11 Freeport), and the Delta tracts and islands which lie east of the Deep Water Ship Channel,
12 east of the Sacramento River channel between Rio Vista and Antioch, north of Highway 4, and
13 west of Interstate Highway 5 (FSL-36 Figure 2A.19-2).

14 Because of the importance of the Delta region for wintering Sandhill Cranes, agencies
15 and conservation groups have acquired, enhanced, and managed lands for use by wintering
16 Sandhill Cranes. Most of this activity has centered on 5 major roost complexes in the Delta
17 region; the Isenberg Sandhill Crane Reserve owned by California Department of Fish and
18 Wildlife, Stone Lakes NWR owned by U.S. Fish and Wildlife Service, Cosumnes River
19 Preserve, established by TNC in partnership with the Bureau of Land Management and with
20 multiple ownerships, and the more recent acquisition of Staten Island by TNC. All these
21 properties include a portion of habitat managed to provide winter roost sites for Sandhill
22 Cranes; however, most of Sandhill Crane foraging occurs on private lands in close proximity to
23 these managed roost sites. The highest densities of Greater Sandhill Cranes occur in the
24 east-central Delta on Staten Island and adjacent tracts and islands (including Brack Tract and
25 Isenberg Sandhill Crane Reserve), followed by Stone Lakes NWR and Cosumnes River
26 Preserve. Other Delta roost sites (on private lands) support much lower numbers of Sandhill
27 Cranes. Loss of foraging habitat on these private lands appears to be the biggest threat to the
28 future welfare of the Central Valley Population of Greater Sandhill Cranes. Habitat losses are

1 primarily due to conversion to incompatible crop types (e.g., vineyards and orchards) as well
2 as expanding urbanization and other developments. Habitat losses that occur within the daily
3 flight radius of a Sandhill Crane may change crane abundance at a roost, regardless of
4 management actions at the roost site itself (Ivey et al. 2015, SOSC-16). Capacities of existing
5 wintering sites to support Sandhill Cranes are threatened by habitat loss, which is occurring
6 throughout the Central Valley. The Delta is certainly under the greatest threat due to
7 pressures from expanding urban areas and is losing habitat (grain fields) to incompatible
8 permanent crops faster than other regions (estimated at 18.3% by 2040; Central Valley Joint
9 Venture 2006:79, FSL-32), which could contribute to a reduction of the population. In
10 summary, the Delta Greater Sandhill Cranes are already stressed by such habitat losses and
11 so the effects of the Delta Tunnels construction and operations will add additional stress and
12 risk to the population's future viability. This issue of cumulative impacts was not discussed or
13 evaluated in Chapter 12 of the FEIR/S.

14 **III. TESTIMONY**

15 1. Transmission Line Take of Greater Sandhill Cranes is Likely

16 Any new transmission lines within the Delta Sandhill Crane use area will pose a
17 mortality risk to Greater Sandhill Cranes and result in take of this fully-protected and
18 threatened subspecies under state law. As a subconsultant working on the BDCP in the 2010
19 to 2015 timeframe, I developed a model to estimate take of Greater Sandhill Cranes from
20 proposed project transmission lines and used the same model to identify potential mitigation
21 options to compensate for the take by reducing collision risk from existing powerlines. In the
22 context of the BDCP, take of Greater Sandhill Crane could be permitted under certain
23 conditions since the BDCP was a Habitat Conservation Plan/Natural Communities
24 Conservation Plan. (See Fish & Game Code, § 3511, citing Fish & Game Code, § 2835,
25 FSL-28.) It is my understanding that the currently petitioned project, Alternative 4A in the
26 FEIR/S, is no longer a NCCP.

27 In order to estimate annual take in the 2013 BDCP, I estimated how many individual
28 Greater Sandhill Crane flights cross the proposed project lines during a wintering season. One

1 study of Greater Sandhill Crane transmission line collisions provides estimates of mortality
2 rates per crossing (Brown and Drewien 1995, SOSC-35) and I used their estimated mortality
3 rates to estimate take of the subspecies. To estimate the number of crossings, my model used
4 data collected during surveys of Greater Sandhill Cranes conducted during the winters of
5 2006–2007, 2007–2008, and 2008–2009 by automobile, aircraft, and on foot (Ivey et al. 2014,
6 SOSC-13), and birds outfitted with transmitters were tracked to identify roosting and foraging
7 areas. These efforts quantify the approximate number of night-roosting Greater Sandhill
8 Cranes, with estimates in a roost site complex ranging from 10 to 1,500 birds (Staten Island,
9 FSL-35). Data from 33 Greater Sandhill Cranes outfitted with radio transmitters were used to
10 determine the distances they flew from roost sites to foraging areas as well as the proportion of
11 birds that foraged within different distance intervals from their roost. In other words, my study
12 determined the proportion of the roosting population that can be expected to forage within 1, 2,
13 and 3.7 miles (2, 4, and 6 kilometers) of the roost. Results indicated that all Greater Sandhill
14 Cranes (100%) forage within 1.2 miles (2 kilometers) of the roost site, 18% between 1.2 and
15 2.5 miles (2 and 4 kilometers) of the roost, 9% between 4 and 5 kilometers, and 5% between 3
16 and 3.7 miles (5 and 6 kilometers) (Ivey et al. 2015, SOSC-16). In order to weight collision risk
17 relative to the size of a given roosting site, the number of birds at each roost was divided by
18 1,500 (the maximum number of greater sandhill crane at a roost-site complex). Using this
19 method, the largest roost site would be standardized to a value of 1 and the smallest roost site
20 (10 birds) would be assigned a value of 0.0067 (10/1500) (see FSL-37 [Collision Risk Index
21 Map for Greater Sandhill Crane]). This value was then multiplied by the percentages derived
22 above to determine the relative risk in a given area based on roost size and distance from the
23 roost. This final number is the collision risk index value. Results were made spatially explicit in
24 ArcGIS, where each cluster of roost sites was buffered by a radius of 1, 2, 3, and 3.7 miles (2,
25 4, 5, and 6 kilometers), and collision risk index values were mapped within those distance
26 categories. In cases where the roost-site buffers overlapped, the values were added together
27 (i.e., risk in that polygon increased).

28

1 Using this approach, an average population size was determined for each line segment
2 crossing each polygon, which was then multiplied by 130 days (the mean number of days that
3 greater sandhill crane spend in the Delta wintering area) and by four flights per day (birds
4 going between foraging areas and roost sites twice a day, crossing the lines twice in the
5 morning and twice in the evening). Based on the assumption that the probability of flying out of
6 the roost in a given cardinal direction is 25%, this number was then divided by four, resulting in
7 a crossing estimate for each segment and for the total line. The number of crossings was then
8 multiplied by collision mortality rates that were calculated for greater sandhill crane in the
9 Rocky Mountains of Colorado (Brown and Drewien 1995, SOSC-35) to estimate annual take of
10 Greater Sandhill Cranes using their highest estimate (30.4×10^{-5} collisions per crossing) to be
11 conservative in favor of the subspecies in the estimate. Using this analysis of the previously
12 proposed BDCP project's original transmission line configuration, I estimated that the project
13 would result in 48 Greater Sandhill Crane deaths per year. (BDCP Appendix 5J, FSL-30)

14 According to adopted AMM20: *"Prior to powerline construction, the wildlife agency-*
15 *approved, qualified crane biologist familiar with crane biology will coordinate with DWR to*
16 *develop a plan for achieving the performance standard (no take of greater sandhill crane*
17 *associated with the new facilities) using one or a combination of the measures described*
18 *above. The plan will include an analysis, using the method described in BDCP Appendix 5.J,*
19 *Attachment 5.J.C, Analysis of Potential Bird Collisions at Proposed BDCP Powerlines, of the*
20 *2013 Public Draft BDCP to demonstrate that this standard has been met for the final*
21 *transmission line alignment. The best available science will be used to estimate bird strike*
22 *reduction associated with powerline diverters installed on existing lines in highest risk zones*
23 *for the species and to design and implement roost site surveys as described in Section*
24 *3B.4.20.6 of the 2013 Public Draft BDCP, Surveys to Inform Avoidance and Minimization."*
25 (SWRCB-111, p. 4-33 [Mitigation, Monitoring and Reporting Program])

26 The effects analysis referenced as *BDCP Appendix 5.J, Attachment 5.J.C* (FSL-30) also
27 considered an estimated growth rate of the Central Valley Population (estimated at 1.4%) and
28 the estimated annual take from implementing the BDCP project, which also included the same

1 tunnels project component as analyzed in the currently proposed project known as California
2 WaterFix or Alternative 4A as a percentage of the population. In the BDCP analysis, if the
3 percentage of take was lower than the growth rate, the population was assumed to continue to
4 increase or to be stable. However, the analysis did not consider the effects of transmission line
5 losses on the much smaller local Delta Greater Sandhill Crane population, that might reach a
6 level to result in a reduction of these local birds. I would be concerned that take of the local
7 subspecies would slow their recovery. Therefore, it is critical that the final project include
8 transmission line choices that prevent take of this species.

9 The FEIR/S discusses options for altering existing transmission lines to reduce take of
10 Greater Sandhill Cranes (SWRCB-105, FEIR/S, pp.12-3549-12-3550); however, DWR does
11 not own those existing lines and thus implementation of those measures would rely on
12 cooperation with the utility companies, adding uncertainty that the measure can be
13 implemented. To be effective, the final strategy for such mitigation would need to be developed
14 with approval of cooperating utility companies before project construction begins. In any case,
15 actions to reduce take at existing lines would not do anything to prevent unpermittable take
16 (FSL-28) of Greater Sandhill Cranes the new transmission lines included in the project. (See
17 SWRCB-105, FEIR/S Figure 3-25; see also FSL-33, LAND-3 and LAND-120 [figures showing
18 proposed transmission lines].)

19 The analysis to estimate Greater Sandhill Crane take which I developed, described in
20 BDCP *Appendix 5.J., Attachment 5.J.C* (FSL-30), is less than perfect and relied primarily on
21 Sandhill Crane studies conducted in other regions and during other seasons with differences in
22 night-time hours, weather conditions and landscapes. These factors could bias Delta Greater
23 Sandhill Crane mortality estimates. Ideally, a more thorough study of transmission line impacts
24 to Sandhill Cranes should be conducted in the Delta prior to project approval or construction to
25 better inform the model and provide more accurate estimates of take.

26 A study by Murphy et al. (2016a) (SOSC-44) in Nebraska that combined searches for
27 carcasses along lines with the use of electronic detectors of collisions and monitoring with
28 night-vision spotting scopes showed that previous studies likely underestimated crane collision

1 rates. Total mortality, including crippling and nocturnal (lack of observations at night) biases,
2 was 2.8 to 3.7 times higher than indicated by a traditional corrected-count mortality estimator,
3 because neither crippling bias nor nocturnal bias were adequately considered in those studies.
4 This suggests that the population effects of the losses of Greater Sandhill Cranes were
5 underestimated by the model.

6 A recent study suggested that glow-in-the-dark markers and smaller gaps between
7 markers reduced collision risk by Sandhill Cranes (Murphy et al. 2016b, SOSC-45). Therefore,
8 I suggest that marking standards for the project include glow-in-the-dark markers and smaller
9 gaps between markers to be incorporated into the transmission line design. I suggest DWR
10 consult with the above authors on spacing recommendations. Likely even more effective would
11 be solar-charged lights affixed to markers to make them even more visible in poor light. Such
12 technology should be relatively easy to attach to some existing marker styles. Also, it is very
13 important that the project maintain markers on lines designated to be marked for the life of the
14 lines, as indicated in AMM 20.

15 Chapter 12, page 12-3550; line 46; page 12-3551; lines 1-3 states: "*Considering that*
16 *the temporary lines would be removed within the first 10–14 years of Alternative 4A*
17 *implementation, and with the implementation **of one** or a combination of the measures*
18 *described under AMM20 Greater Sandhill Crane, there would be no take of greater sandhill*
19 *crane from the project pursuant to California Fish and Game Code Section 86."* Some
20 measures listed in AMM20 Greater Sandhill Crane would not result in fully mitigating take if
21 implemented alone. For example, only marking project lines, siting new transmission lines in
22 lower bird strike risk zones, or shifting locations of flooded areas that provide crane roosts to
23 lower risk areas if implemented as stand-alone measures, would not lead to no net take of
24 Greater Sandhill Cranes.

1 2. Project disturbance contributions to take of Greater Sandhill Cranes was not
2 adequately addressed

3 The project would substantially increase traffic and other activities related to
4 construction and ongoing monitoring and maintenance, which will lead to increased take of
5 Greater Sandhill Cranes which has not been accounted for in the model described above.
6 Murphy et al. (2016a) (SOSC-44) showed that cranes are at particular risk when flushed at
7 night; however, any time they are flushed and cross transmission lines in flight, there is a risk
8 of collision, particularly given the foggy conditions that often occur in this region. (See
9 SWRCB-5, BDCP Appendix 5JC.) Alternative 4A fails to account for the effects of construction
10 disturbance that would cause Greater Sandhill Cranes to flush over both new project lines and
11 existing transmission lines, increasing the number of transmission line crossings, leading to
12 some level of increased take of the subspecies. One way to reduce this additional take would
13 be to complete construction in crane use areas outside the Greater Sandhill Crane wintering
14 period; however, there would still be disturbance from project operations activities for the future
15 of the project which could result in take.

16 3. Mitigation of Greater Sandhill Crane Habitat Losses is Insufficient

17 FEIR/S Chapter 12, page 12-3549; lines 6-8 states: *“However, the project proponents*
18 *have committed to habitat protection, restoration, management, and enhancement associated*
19 *with Environmental Commitment 3 and Environmental Commitment 10 that are greater than*
20 *the mitigation ratios described above.”* (See SWRCB-111, MMRP, p. 4-32) Although the
21 commitments in EC 3 and EC 10 include more acres of habitat than the Greater Sandhill
22 Crane habitat that is directly impacted by the project, unless the habitat conservation of EC 3
23 and EC 10 is implemented within the crane use landscapes, they won't contribute to crane
24 objectives. (See FSL-35 [crane use map].)

25 4. Further Restricting Timing of Construction Activities Could Help Avoid Crane
26 Disturbance

27 According to AMM20 page 4-32; lines 15-18: *“To the extent feasible, construction that*
28 *cannot be completed prior to commencement of the wintering season will be started before*

1 *September 15 or after March 15, such that no new sources of noise or other major disturbance*
2 *that could affect cranes will be introduced after the cranes arrive at their wintering grounds.”*
3 (SWRCB-111, MMRP, p. 4-32.) This measure may allow most cranes to avoid disturbance by
4 selecting habitats away from construction sites. However, I would recommend that if a new
5 above ground project must be started after September 15 and before March 15, that the
6 project disturbance begin towards the mid-day period, between 11AM and 3PM so that
7 foraging birds or night roosting birds don't get exposed to sudden changes in disturbance while
8 they are using important habitats.

9 5. Lesser Sandhill Crane was not Adequately Addressed as a Covered Species

10 This subspecies is common in the Delta and is a California Bird Species of Special
11 Concern (Shuford and Gardali 2008, FSL-34). I believe that the BDCP was remiss in not
12 including this subspecies as a “*Covered Species*” and addressing its conservation needs in
13 *Appendix 2A, Covered Species Accounts*. Other Bird Species of Special Concern (Suisun
14 Song Sparrow, Tricolored Blackbird, Western Burrowing Owl, and Yellow-breasted Chat), and
15 additionally, the White-tailed Kite were addressed in Appendix 2A. Additionally, this subspecies
16 is also highly vulnerable to take from transmission line collisions and such take should be
17 avoided. I suggest a model similar to the model described in BDCP *Appendix 5.J., Attachment*
18 *5.J.C* (FSL-30) should be derived for this subspecies to mitigate the impacts of take. Such a
19 model would use similar parameters; however, the flight distances to foraging sites are about
20 2.5 miles longer, which means that such a model would extend to a much larger impact
21 landscape.

22 6. Salinity effects on future Greater Sandhill Crane foraging habitat should have been
23 considered

24 According to testimony presented in Part 1 of this proceeding, project diversions will
25 cause reduced flows into the Delta, leading to increased salinity in irrigation water. Specifically,
26 “by taking the flow from the north, less flow is available for salinity control from the point of
27 diversion to the south, and less freshwater from the Sacramento River is drawn into the Delta
28 in general. This allows the brackish water to radiate inward into the Delta, but also provides

1 less flushing within the Delta to remove accumulated salts from irrigation, wetlands and wildlife
2 management. That accumulation works in concert with reduced outflow salinity control by the
3 Sacramento River to increase salinity throughout the Delta.” (Exhibit II-24; see also II-13 and
4 LAND-78 [testimony detailing the effects of increased soil salinity on plant growth].) Increases
5 in salinity would likely lead to reduced yield and extent of grain crops important to Greater
6 Sandhill Crane foraging habitat in the Delta, further degrading their foraging landscape which
7 is already stressed by continual reductions in grain crops in their Delta wintering region. These
8 impacts to Greater Sandhill Crane foraging habitat were not assessed in the Bay Delta
9 Conservation Plan, Chapter 12, or the Avoidance and Minimization Measures for the Greater
10 Sandhill Crane, and are unmitigated impacts in the Petition.

11 **CONCLUSION**

12 In summary, in regards to the State Fully-Protected and Threatened Greater Sandhill
13 Crane, I find that take of this subspecies from project implementation will occur, and since the
14 petitioned project, Alternative 4A in the FEIR/S, is no longer a HCP/NCCP, such take would be
15 illegal, unless the final project should only consider transmission line options that prevent take
16 of the subspecies. Actions to reduce take at existing lines would not do anything to prevent
17 unpermissible take of Greater Sandhill Cranes on the new lines required.

18 I also find the FEIR/S lacking in respect to Greater Sandhill Cranes as it failed to
19 consider project disturbance effects which would result in additional take of the subspecies. It
20 also failed to address the cumulative impacts contributing to habitat loss for this subspecies in
21 the Delta, which will be compounded by the project, and to adequately address the project
22 effects on salinity increases in Delta irrigation supplies which will indirectly contribute to
23 foraging habitat loss as increased salinity will reduce the availability of crane forage crops such
24 as corn and rice. Additionally, although the FEIR/S included other Species of Conservation
25 Concern, it failed to address the Lesser Sandhill Crane which will be significantly impacted by
26 take and habitat losses from the project.

1 In its current form, the petitioned project would result in unreasonable effect on both
2 Greater and Lesser Sandhill Cranes and is contrary to the public's interest.

3
4 Executed on the 28th day of November, 2017, at Bend, Oregon.

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7 _____
8 Gary L. Ivey

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