July 6, 2015

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State Water Resources Control Board
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RE: June 8, 2015 Temporary Urgency Change Petition Concerning SWP/CVP and Water Deliveries, in relation to the April 6, 2015 TUCO

Thank you for the opportunity to comment on this important issue.

In January 2015, the California Department of Water Resources and the U.S. Bureau of Reclamation requested that the State Water Resources Control Board (SWRCB) consider a Temporary Urgency Change Petition (TUCP) regarding permits of the State Water Project (SWP) and the Central Valley Project (CVP). The SWRCB approved these requests, with modifications and conditions, in Temporary Urgency Change Orders (TUCOs) dated February 3, March 5, and April 6 of 2015. The April 6, 2015 TUCO provided legal authority for the continued reduction of freshwater flows into the Delta and the transfer of freshwater supplies to agricultural growers in the Sacramento and San Joaquin River valleys. The CA DWR and USBR have recently proposed a new TUCP (June 8, 2015), which, if approved by the SWRCB, would function as an extension of the previous TUCOs.

We argued earlier in a June 19, 2015 comment to the SWRCB that the use of irrigated water for livestock feed crop production is both wasteful and unreasonable during this time of drought in California; use of irrigated water for livestock feed production during this time of drought in California conflicts with the "waste or unreasonable use" section of the California Constitution. (See Article 10, Section 2, which declares that "the waste or unreasonable use … of water be prevented … The right to water or to the use or flow of water ... does not and shall not extend to the waste or unreasonable use … of water."[1])

[1] See Appendix A for more on this and beneficial uses.

We also argued that the wasteful, unreasonable use of irrigation water for livestock feed production has been manifest within four areas of California water use and policy: hay exports, continued flood irrigation of alfalfa and irrigated pasture, the April 6, 2015, Temporary Urgency Change Order (TUCO), and the extreme groundwater depletion within the San Joaquin Valley.

We assert in this new comment that our previous claims and evidence, which are included herein in their entirety by reference, are equally applicable to the June 8, 2015 SWP/CVP TUCP, which would function as an extension of the April 6, 2015 Temporary Urgency Change Order if approved by the SWRCB.

Again, the wasteful, unreasonable use of irrigation water for livestock feed production has become widespread and now imposes severe, adverse impacts upon the human and non-human residents of California.

**The Rule of Reasonableness**

To start, we present an overview of the "rule of reasonableness," which constitutes the core mandatory legal authority that both animates our arguments and requires the State Water Resources Control Board (SWRCB) to act "reasonably." This overview is quoted from a recent summary of this doctrine by the First District Court of Appeal, in *Light v. SWRCB* (2014) 226 Cal.App.4th 1463, 1479–80:

> Water use by both riparian users and appropriators is constrained by the rule of reasonableness, which has been preserved in the state Constitution since 1928. (Cal. Const., art. X, § 2; hereafter Article X, Section 2.) … As the Supreme Court recognized soon after Article X, Section 2 was added, the rule limiting water use to that reasonably necessary "appl[ies] to the use of all water, under whatever right the use may be enjoyed." (*Peabody v. City of Vallejo* (1935) 2 Cal.2d 351, 367–68 (*Peabody*).) The rule of reasonableness is now "the overriding principle governing the use of water in California." (*People ex rel. State Water Resources Control Bd. v. Forni* (1976) 54 Cal.App.3d 743, 750 (*Forni*).)
>
> California courts have never defined, nor as far as we have been able to determine, even attempted to define what constitutes an unreasonable use of water, perhaps because the reasonableness of any particular use depends largely on the circumstances. (*Peabody, supra*, 2 Cal.2d at p. 368.) "What may be a reasonable beneficial use, where water is present in excess of all needs, would not be a reasonable beneficial use in an area of great scarcity and great need. What is a beneficial use at one time may, because of changed conditions, become a waste of water at a later time." (*Tulare Dist. v. Lindsay–Strathmore Dist.* (1935) 3 Cal.2d 489, 567.) In this regard, the *Joslin* court commented, "Although, as we have said, what is a reasonable use of water depends on the circumstances of each case, such an inquiry cannot be resolved *in vacuo* isolated from statewide considerations of transcendent importance. Paramount among these, we see the ever increasing need for the conservation of water in this state, an inescapable reality of life quite apart from its express recognition in [Article X, Section 2]." ([*Joslin v. Marin Municipal Water District* (1967) 67 Cal.2d 132, 140 (*Joslin*)];

> see similarly *In re Waters of Long Valley Creek Stream System* (1979) 25 Cal.3d 339, 354 ["it appears self-evident that the reasonableness of a riparian use cannot be determined without considering the effect of such use on all the needs of those in the stream system [citation], nor can it be made 'in vacuo isolated from statewide considerations of transcendent importance'"].) Few decisions have ruled on the reasonableness of a specific use of water, but in separate cases the Supreme Court has concluded, essentially as self-evident, that the use of water for the sole purpose of flooding the land to kill gophers and squirrels is unreasonable (*Tulare Dist*., at p. 568), as is the use of floodwaters solely to deposit sand and gravel on flooded land (*Joslin*, at p. 141.)

(*Light v. SWRCB*, 226 Cal.App.4th at 1479–80.)

> The Board's authority to prevent unreasonable or wasteful use of water extends to all users, regardless of the basis under which the users' water rights are held. ([*California Farm Bureau Federation vs. State Water Resources Control Board* (2011) 51 Cal.4th 421, 429].)

(*Light v. SWRCB* 226 Cal.App.4th at 1482.)

**Livestock Feed Crops**

Crops such as alfalfa, other hay, irrigated pasture, corn, oats, and sorghum are grown primarily to provide feedstock for livestock. Other crops, such as almonds, are not grown to provide livestock feed; nonetheless, agricultural by-products from these agricultural commodities often produce marketable livestock feed. Almonds hulls, which compose over 50% of the mass of the almond fruit/nut structure, are used primarily as livestock feed for dairy cows in California.

In California, these crops require the application of immense quantities of water. During 2012, alfalfa, irrigated pasture, and corn production required the application of nearly 11 million acre feet of water (10.809 MAF), which constituted over 37% of all water applied to California agriculture (28.961 MAF). If half of the water applied to almond orchard acreage that bears fruit is associated with almond hull production, and half of all water applied to "bearing" almond acreage is then added to the previous *combined* water application value for alfalfa, irrigated pasture, and corn production, the application of approximately 12 million acre feet of water (12.207 MAF) resulted in the production of these four livestock feed crops in 2012. This "applied water" value *for these four livestock feed crops alone* constituted just over 42% of all water applied in California agriculture in 2012. (See Appendix D.)

**Wasteful Use**

Water used by farmers during this time of drought for the irrigation of livestock feed crops is wasteful. Livestock are notoriously inefficient at converting water and other natural resources into protein available for human consumption, relative to plant-based sources of protein. With regard to water alone, the production of one pound of animal protein has been estimated to require nearly 100 times more water than the amount needed to produce one pound of plant-based grain protein, according to a **study from researchers associated with Cornell University**.

A more conservative, recent estimate has been provided by Mekonnen and Hoekstra (2010). They document that pulses (legumes), such as pinto beans, kidney beans, navy beans, dry peas, and lentils, have dramatically lower water footprints per unit protein than pig, sheep, goat, and bovine meat. Pulses use only one-sixth of the water that bovine meat requires to produce a comparable gram of protein (19 liters compared to 112 liters.) Pulses also require substantially less water to produce a gram of protein than milk (19 liters compared to 31 liters.)

Simply put, it is wasteful for California irrigation water to be used to grow feed resources for a very inefficient protein/fat/carbohydrate production system when a fraction of that irrigated water could be used to grow equivalent amounts of plant-based protein and carbohydrates. In our view, this judgment of "waste" resonates with great strength in this current time of severe drought and water-scarcity.

**Unreasonable Use**

Water used to irrigate livestock feed crops constitutes an unreasonable use of California water during this time of drought in California, especially in the context of climate change where California will only become even drier and warmer in the future. Livestock feed crops produced from California water are fed to livestock. Livestock then generate methane through enteric fermentation and emit methane into the atmosphere. Methane in the atmosphere is a highly potent greenhouse gas (GHG) that has contributed to the overall warming of the planet and the rapid heating of the Arctic. Both global warming and rapid Arctic heating have now been strongly linked to the severe four-year drought in California that has adversely impacted the state's water supplies.

Three recent studies have documented linkage between heightened greenhouse gas emission levels, increased atmospheric heat, and the high pressure ridge that has formed and persisted in the Pacific Ocean, known colloquially as the "Ridiculously Resilient Ridge" (RRR). This RRR high pressure ridge has been responsible for re-routing Pacific storm activity well to the north of California over the last few years. [i, ii, iii] (Of the three studies noted above, one has also linked these three phenomena with rapid Arctic heating and decline in Arctic sea ice.) The Wang study, which did not assert a link to rapid Arctic warming, noted that "there is a traceable anthropogenic warming footprint in the enormous intensity of the anomalous ridge during winter 2013–2014 and the associated drought.") Finally, John P. Holdren, President Obama's senior science director, has argued powerfully that climate change should be considered one of the drought's major contributors.[2]

These findings were predicted in peer-reviewed scientific literature over ten years ago by Sewall and Sloan (2004). (For a full explanation and some thoughts on Sewall and Sloan's theory from prominent climatologists, see this **2014 article**.) Moreover, anthropogenic climate change has already increased the probability that more megadroughts will occur in California. Ault et al. (2014) conclude:

[2] Available at https://www.whitehouse.gov/sites/default/files/microsites/ostp/critique_of_pielke_jr_statements_on_drought.pdf.

> In the current generation of global climate models, the risk of a decade-scale drought occurring this century is at least 50% for most of the greater southwestern United States and may indeed be closer to 80% ... The probability of multidecadal megadrought is also high: the likelihood of a 35-yr event is between 10% and 50% depending on how much climate change is realized during the coming century. The probability of even longer events (50-yr, or "permanent," megadrought) is non-negligible (5%–10%) for the most intense warming scenario (p. 7545).

Such megadroughts, if they occur, will undoubtedly exacerbate the water shortages and species extinction that are already afflicting California. (Cook, 2015; Diffenbaugh et al. 2015).

This assessment is also consistent with the argument presented in the recently-published study by Kevin Trenberth et al. (2015), which emphasizes how the impact of human-induced warming has affected the climate system's thermodynamic state and consequently intensified major climatic events in recent years. Trenberth et al. also summarize the Diffenbaugh et al. (2015) study in a manner that highlights how anthropogenic warming has already increased the odds of increased drought risk and drought risk severity:

> Another very recent example is the California drought beginning in 2012. Whereas one study found no significant trends in winter precipitation in recent decades, another [the Diffenbaugh et al. 2015 study] pointed out the critical role of the record high annual mean temperatures in combination with record low annual mean precipitation for 2013 which led to increased evapotranspiration and more intense drought. The combination of these had impacts on water shortages, vegetation and agriculture, and increased wildfire risk. The odds of this combination have increased with human-induced climate change and anthropogenic warming has increased drought risk (footnote numbers removed). (Kevin Trenberth et al. (2015))

We also note for the record that the U.S. Geological Survey just released a study: "Temperature Impacts on the Water Year 2014 Drought in California" by Shraddhanand Shukla, et al. (http://onlinelibrary.wiley.com/wol1/doi/10.1002/2015GL063666/abstract), which finds that high heat has multiple damaging effects during drought, increasing the vulnerability of California's water resources and agricultural industry. Not only does high heat intensify evaporative stress on soil, it has a powerful effect in reducing snowpack, a key to reliable water supply for the state. In addition to decreased snowpack, higher temperatures can cause the snowpack to melt earlier, dramatically decreasing the amount of water available for agriculture in summer when it is most needed. "If average temperatures keep rising, we will be looking at more serious droughts, even if the historical variability of precipitation stays the same," Shukla said. "The importance of temperature in drought prediction is likely to become only more significant in the future."

Thus, the best available science demonstrates that continued GHG emissions in the present and near future are likely to further accelerate the warming of the planet generally and heating of the Arctic in particular. Such heating will likely increase the probability that more high pressure ridges will form in the Pacific. These high pressure ridges will then likely continue steering Pacific storm activity around (but not through) California in the future, thus aggravating the California drought. This best available science also indicates that GHG-associated global

warming is likely to intensify the duration and severity of such future droughts and the adverse impacts associated with such projected future droughts.

In short, it is profoundly unreasonable—indeed, intensely irrational—for the SWRCB to continue to allow California water to be used during this time of drought for activities (such as alfalfa-related livestock production) that are likely to generate even more water scarcity in California, both for the short and long term future.

**Hay Exports and Wasteful, Unreasonable Use**

In spite of the continuing, severe drought, California continues to export its water in virtual form through significant international exports of alfalfa and other hay. During the April 4–May 1, 2015 period, California hay growers sold over 16% of California-produced hay for export. Such exports amounted to nearly 11,000 tons of hay (mostly alfalfa) sold to foreign countries.[3] Moreover, the amount of water required to grow this amount of hay was approximately ten thousand acre feet (10,000 acre feet, or 10 TAF), as the exported hay originated from southeast California, where alfalfa production requires just under one acre-foot of water to produce one ton of alfalfa.[4]

In short, California essentially exported nearly 10 TAF to other countries in virtual form over this 27 day period! Moreover, this export occurred at a time when San Joaquin Valley dairy operations were actively trying to secure livestock feed supplies to sustain dairy operations in the San Joaquin Valley. (Hay exports were also substantial during the May 9–15, 2015 period, with 13.3% [1900 tons] of total CA hay tonnage [14,309 tons] being sold for export. All hay sold for export was alfalfa, with most of it being "premium" grade alfalfa. For the May 16–22 period, the export value as a share of the total remained around 13%, though most of the hay exported was rye grass from the Sacramento River Valley area. For the week of May 31–June 5, 2015 1,080 tons of alfalfa [from southeast California] were sold for export (5.7% of the total).

Most recently, sales of hay for export from southeast California have again exploded. For the week ending June 19, 2015, 14.32% (2100 tons) of total CA hay tonnage sold was for the international export market. **For the week ending June 26, 2015, 71.41% of all California hay tonnage was sold for export. 24,650 tons of hay, which likely required the application of nearly 20 TAF of water to grow, were sold to international buyers and will now be unavailable for domestic California livestock consumption.** We assert that it is the export of water internationally in virtual form (through alfalfa and "other" hay exports) during a time of severe drought and water scarcity that generates resource shortages that adversely impact California-based businesses, workers, and communities. California water used to grow California

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[3] See the weekly California Hay Report, ML_GR311, for the weeks of 04/10, 04/17, 04/24, 05/01 in YR 2015, USDA-CO Dept. of Ag Market News. http://www.ams.usda.gov/mnreports/gl_gr311.txt

[4] See CA DWR "Irrigated Crop Acres and Water Use" spreadsheets that provide applied water coefficients by crop for all California counties [http://www.water.ca.gov/landwateruse/anaglwu.cfm#], in combination with alfalfa crop acre yield information provided at http://www.nass.usda.gov/Statistics_by_State/California/Historical_Data/Hay-Alf.pdf and the Imperial County Agricultural Crop and Livestock Report, 2013.

hay needs to be available for California or U.S.-based businesses in severe drought, not consumed by Chinese or Japanese or United Arab Emirate businesses.

While hay prices are down significantly since peaking in 2014, it is likely that continuing drought and the need to import hay from other states will impact California's dairies. **After the week of June 20-June 26, nearly 25,000 tons of California-grown hay are now no longer available to feed drought-impacted California dairy cows or other California livestock this year.**

**Flood Irrigation, Alfalfa, Irrigated Pasture, and Wasteful, Unreasonable Use**

We believe that additional water cuts concerning the use of irrigation water to produce alfalfa and irrigated pasture are warranted. In 2010, nearly two million acres of land in California were devoted to the irrigation of alfalfa and pasture (1,038,582 acres for alfalfa, and 829,570 acres for pasture [CA DWR]). The most recent projection from the Federal government is that California producers intend to harvest hay (much of which will likely be alfalfa) from 1.23 million acres this year, down only 11% from last year. (See CALIFORNIA AND NEVADA PROSPECTIVE PLANTINGS FOR 2015, March 31, 2015, USDA, NASS, Pacific Region Farm News, http://www.nass.usda.gov/ca.)

Alfalfa and irrigated pasture have very high, "applied water" coefficients relative to other crops, primarily due to the use of flooding as the primary method of irrigation. (The 2010 AFA [Acre Feet Annually] alfalfa coefficient was 5.05, while the 2010 AFA coefficient for irrigated pasture was 4.05. [CA DWR].) Clearly, continued irrigation of these crops using traditional flooding methods appears wasteful and inconsistent with the California Constitution.

In 2011, Craig M. Wilson, the first Delta Watermaster and former Chief Counsel to State Water Board authored a report to the State Water Resources Control Board and the Delta Stewardship Council, titled, "THE REASONABLE USE DOCTRINE & AGRICULTURAL WATER USE EFFICIENCY." In this report, Wilson evaluated a key section of the California Constitution that constitutes mandatory legal authority concerning SWRCB regulatory powers. Wilson's report also evaluated the prior implementation of the Reasonable Use Doctrine by the SWRCB, as well as the SWRCB-related water code sections and case law that authorize implementation of the Reasonable Use Doctrine by the SWRCB. (See http://www.waterboards.ca.gov/board_info/agendas/2011/jan/011911_12_reasonableusedoctrine_v010611.pdf)

Wilson writes that the "underlying premise of this report is that the inefficient use of water is an unreasonable use of water. Accordingly, the Reasonable Use Doctrine is available prospectively to prevent general practices of inefficient water use."

Wilson then states that "[e]fficient agricultural water use and delivery practices include: weather-based and deficit irrigation scheduling, water distribution systems that can supply water to farmers "on-demand", and improved irrigation methods, such as substituting drip and sprinkler irrigation for flood irrigation."

We agree with Wilson, though we believe that the flood irrigation technique used to grow most alfalfa and irrigated pasture in California is also an "unreasonable *method* of use ... of water" (See Article 10, Section 2 of the California Constitution.)

The Wilson report clearly documents that the State Water Board has ample authority to issue Orders to implement the Reasonable Use Doctrine concerning the inefficient (and hence, "unreasonable") methods of water use such as flood irrigation devoted to alfalfa or irrigated pasture production. We encourage the SWRCB to condemn the wasteful, unreasonable use (and method of use) of water currently devoted to alfalfa and irrigated pasture production.

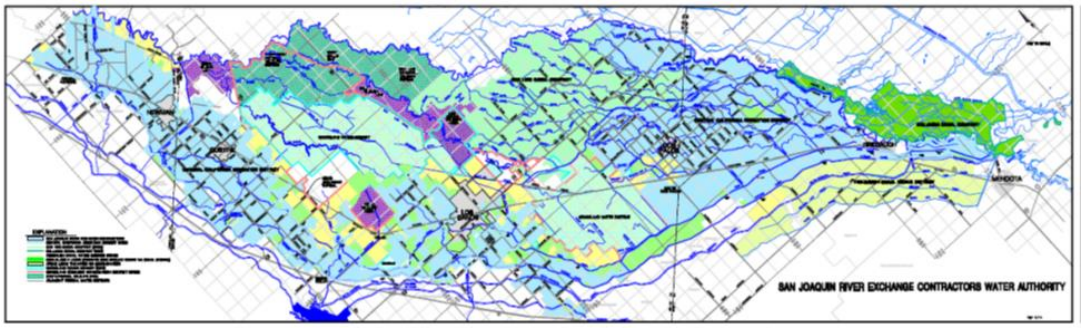
California Water Code Section 100.5 is controlling as to any SWRCB Division of Water Rights assessment of this matter. Section 100.5 states: "It is hereby declared to be the established policy of this state that conformity of a use, method of use, or method of diversion of water with local custom shall not be solely determinative of its reasonableness, but shall be considered as one factor to be weighed in the determination of the reasonableness of the use, method of use, or method of diversion of water, within the meaning of Section 2 of Article X of the California Constitution."

## April 6 2015 TUCO: The SJRECWA and Wasteful, Unreasonable Use

In January 2015, the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) requested that the SWRCB consider a Temporary Urgency Change Petition (TUCP) regarding permits of the State Water Project (SWP) and the Central Valley Project (CVP). The SWRCB approved these requests, with modifications and conditions, in Temporary Urgency Change Orders (TUCOs) dated February 3, March 5, and April 6 of 2015. The April 6 TUCO has provided legal authority for the continued reduction of freshwater flows into the Delta and the transfer of freshwater supplies to agricultural growers who hold senior water rights.

Based on the analysis provided above and below, we assert that the April 6, 2015, TUCO has likely promoted the wasteful and unreasonable use of irrigation water to produce livestock feed crops. (This analysis is germane to the June 8, 2015 TUCP submitted by DWR and USBR.)

The April 6, 2015 TUCO has reduced freshwater flows to the Delta and enabled delivery of freshwater to senior water rights holders in California. CVP Sacramento River Deliveries (most likely to the Sacramento River Settlement Contractors [SRSCs]) amounted to 330 TAF through May 2015, plus another 36.3 TAF for the CVP Tehama-Colusa Canal Deliveries. (SWP Deliveries For the "North of Delta Agricultural Contract Deliveries" added another 150 TAF to the area through May 2015 (CVP June 2015 Monthly Balance Sheet). For the January through May 2015 period, 131,540 AF were delivered to the Exchange Contractors in the San Joaquin and Mendota Pools and the Delta-Mendota Canal areas (see map), a value which exceeds the volume of water delivery to the San Joaquin River Exchange Contractors Water Authority (SJRECWA) during the Jan-May 2014 period by more than 13,000 acre-feet (see CVP Monthly Delivery Tables 24 and 25).

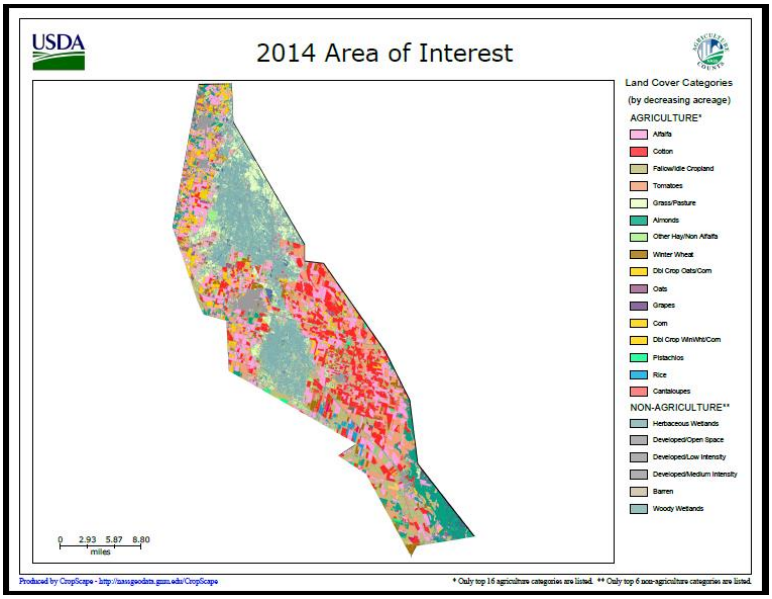



To what will this CVP water be applied, and how much is likely to be devoted to the production of livestock feed crops? Based on an approximation analysis for year 2014, we assumed that most of the acreage cultivated in 2015 by those associated with the largest SRSCs is devoted to rice production, with significantly smaller acreages devoted to walnuts, tomatoes, sunflowers, almonds, alfalfa, and winter wheat, in descending order of magnitude.

For the analysis below concerning the San Joaquin River Exchange Contractors Water Authority (SJRECWA) [iv], we also assume that the probable 2015 numerical values would likely be similar to estimated 2014 numerical values that we have derived and summarized below. (We note for the record that the analysis below was completed before news was released on May 14, 2015 concerning an arrangement in which the SJRECWA agreed to make available 60,000 AF to Friant Division Class 1 contractors. This deal will likely reduce annual 2015 CVP water deliveries to SJRECWA from an assumed 504,000 AF to 444,000 AF. A consequence of the deal is that additional crop acreage in the SJRECWA area will likely be fallowed. If the acreage to be fallowed is acreage previously intended for cotton, then up to 20,000 acres could be fallowed. If the acreage to be fallowed is acreage previously intended for alfalfa, then up to 13,000 acres could be fallowed. These estimates are based on the cotton and alfalfa "applied water" coefficients of 3 AFA and 4.65 AFA (respectively) for Merced County (CA DWR). We note further that a recent SJRECWA projection of acreage that could be fallowed in response to a proposed Salmon Temperature Management Plan Revision would constitute over 65 percent of the average annual total acreage farmed in the SJRECWA service area for the 2006-2010 period. We find such a projection to be not credible, at least until further information concerning the derivation of this projection [and the associated economic impact projection] is made publicly available for scrutiny. As noted above, 2015 USDA projections of decreases in livestock feed crop acreages in California were 11 percent for hay and 17 percent for corn. Winter wheat acreage was projected to decline 7 percent, and rice acreage was projected to decline 6 percent.)

Based on an approximation analysis of crop acreage data taken from the USDA CropScape website (http://nassgeodata.gmu.edu/CropScape/), we conclude that nearly half (49%) of the crop acreage in the SJRECWA area produced livestock feed in 2014. (See Appendix B.) This includes the acreage of those crops intended as livestock feed, half of the almond crop acreage (to account for the almond hull crop by-product), and one quarter of the overall pasture acreage that was assumed to receive irrigation water. Nearly 30% of all SJRECWA acreage was planted with alfalfa in 2014. After applying DWR's "Applied Water" coefficients, we have concluded that the water used to grow crops that resulted in livestock feed commodities in the SJRECWA area amounted to approximately 368 TAF in 2014—an amount that is nearly three-quarters (73%) of the amount of CVP water received by the SJRECWA last year!

Even if our approximation analysis has yielded numbers that are too large by 20%, the amount of acreage and applied water that yielded livestock feed crops in the SJRECWA area would still be substantial. Nearly 40% of total SJRECWA acreage and nearly 300,000 AF would have been used to produce crops that resulted in livestock feed—commodities that were ultimately consumed by livestock and converted, in part, to methane that was then emitted into the atmosphere. (Below is a map of Crop Acreage, estimated for SJRECWA, 2014.)




How many cows eat that feed in the SJRECWA? How much methane is then emitted by those dairy cows? What is the CO2 equivalency of such methane emissions, in terms of CO2, pounds of coal burned, and CO2 parts per million added to the atmosphere? A 2012 report commissioned by the SJRECWA indicated that most of the livestock feed grown in the SJRECWA was used to feed the 65 dairy operations within the SJRECWA service area, which housed nearly 83,000 dairy cows (i.e., milking cows and "other dairy cows").

The annual methane emission value for this number of dairy cattle is 17.51 million lb. per year methane. In terms of CO2 equivalents, this methane mass value converts to either approximately 1.471 billion lb. of CO2 (if using Methane GWP=84, 20-year interval) or 490 million lb. of CO2 (if using Methane GWP=28, 100-year interval). The milking cows alone (61,015 individual milking cows in these dairies) collectively produce a CO2 equivalency comparable to either 600 million lb. of coal burned (if using Methane GWP=84) or 200 million lb. of coal burned (if using Methane GWP=28). The methane CO2 equivalency contribution to the atmosphere in parts per million by volume (ppmv) is comparable to either 0.00853458 ppmv of CO2 (Methane GWP=84) or 0.0028445 ppmv of CO2 (Methane GWP=28). (See Part 3, Appendix B.)

Methane emissions from these dairy cows is far from trivial: the SJRECWA is part of a broader area that emits the second largest methane concentration "hot spot" plume in the United State.[5] We also note for the record that the 1.81 million dairy cows and 583,000 beef cows in California (CA Beef Council, Jan 1, 2014, http://www.cfaitc.org/factsheets/pdf/Beef.pdf) release annual

[5] See https://www.nasa.gov/press/2014/october/satellite-data-shows-us-methane-hot-spot-bigger-than-expected/#.VT0HgZMfrUX .

methane emissions into the atmosphere that have the CO2 equivalency of nearly 43 billion pounds of CO2 in the atmosphere [Methane GWP 84] over a 20-year period. This methane/CO2 equivalency [at Methane GWP 84, over a 20-year interval] is also equivalent to CO2 emissions associated with the burning of nearly 21 billion pounds of coal, or the collective annual CO2 emissions from five 2010 coal-burning power plants. (See Part 4, Appendix B.)

In short, 2014 CVP water deliveries to the SJRECWA ultimately contributed to substantial greenhouse gas emissions that likely promoted a further warming of our planet, which will likely fuel California drought conditions in the future. Without a change in the April 6 TUCO, CVP water deliveries to the SJRECWA are likely to contribute substantially to further warming our planet in 2015. We find both the past and prospective results to be unconstitutionally wasteful, unreasonable, and ethically untenable.

**Groundwater Depletion and Wasteful, Unreasonable Use**

Groundwater depletion in the San Joaquin Valley is a huge problem. We intend to address this issue more thoroughly in the future. Nonetheless, a quick review of groundwater supply issues in Tulare County provides illumination of yet another water policy sphere currently impacted by livestock feed production and an associated, wasteful and unreasonable use of water.

Groundwater storage may be significantly declining as a result of excessive groundwater pumping from the groundwater storage system of Tulare County. The USGS Continuous GPS Subsidence Station Data in Tulare County, California has documented a dramatic increase in subsidence in the past 14 months. (See http://ca.water.usgs.gov/projects/central-valley/central-valley-subsidence-data.html)

Land use changes have exacerbated this threat to groundwater storage by encouraging the planting of higher dollar crops, which has resulted in more groundwater pumping for tree irrigation. A major consequence of this pumping is that water levels in wells have reached historic lows, with draconian consequences.

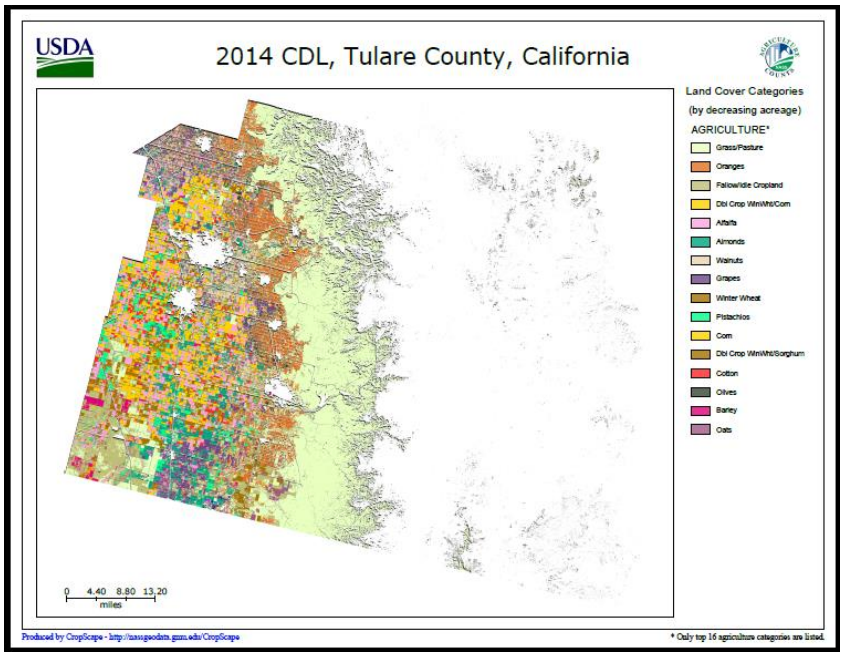
Groundwater wells have been drying up completely over the last year in Tulare County, especially in East Porterville. A total of 1244 wells have failed throughout Tulare County over this time, with 30–50 wells going dry per week, on average.[6] Eight hundred thirty two of these well failures were reported between September 2014 and May 18, 2015, alone. Still, much acreage has continued to be devoted to livestock feed production throughout Tulare County—acreage that has been irrigated largely through the use of pumped groundwater over the last few years!

A connection may exist between these two phenomena. A recent, preliminary examination of the causes of well failures in the Tule River sub basin of the Tulare Lake Basin suggests that high groundwater use for irrigation of high-water-use field crops (including alfalfa, cotton, corn, and sorghum) has been a contributing factor in triggering these well failures. (See Drought Impacts Briefing—Tulare Lake Region Tule River Sub basin, including East Porterville and Porterville—

[6] See http://tularecounty.ca.gov/emergencies/index.cfm/drought/drought-effects-status-updates/2015/may-2015/week-of-may-18-2015/.

*Preliminary*, Pages 3 and 10. Author: Deirdre Des Jardins, California Water Research, March 5, 2015)

For the following analysis, we focus on alfalfa, "other hay," corn, oats, sorghum, almond hulls, and irrigated pasture production in Tulare County, using 2014 numbers generated by CropScape.




To start, we must specify our assumptions. Some crop acreage categories list two different crops like winter wheat/corn or winter wheat/sorghum.

For these "double crops" acres, we assume that one crop is grown for half the year, and the other crop is grown for the other half of the year. We then assume that "double crop" acres can be equally represented as one crop being grown on half of the total acreage for the whole year, and the other crop being grown on the other half of the total acreage for the whole year. We assume that the 2014 value for Tulare County irrigated pasture acreage is 50% of the 2013 value provided in the Tulare County Agriculture Report. We assume that half of the total water applied and half of the total almond acreage irrigated is a reasonable estimate of the amount of water and almond tree acreage that produces almond hulls (which constitute 50% of the mass of the total almond nut complex). We use the CA DWR Tulare County "Applied Water" coefficients for these crops, respectively—5.13 for alfalfa, 1.65 for other hay, 3.16 for corn, 1.65 for oats, 2.81 for sorghum, 3.89 for almonds, and 4.96 for irrigated pasture. We multiply these coefficients times total crop acreages to produce water use estimates by crop. Total crop acreage and applied water that resulted in livestock feed crops in Tulare County in 2014 is as follows:

80,046 acres and 410.6 TAF were used for alfalfa production.
1,579 acres and 2.6 TAF were used for "other hay" production.
60,638 acres and 191.6 TAF were used for corn production.
8,613 acres and 14.2 TAF were used for oat production.
11,281 acres and 31.69 TAF were used for sorghum production.

33,894 acres and 131.85 TAF resulted in the production of almond hulls.[7]
46,500 acres and 230 TAF were likely used for the production of irrigated pasture. (See Appendix C.) (See Appendix F for Tulare County crop acreage raw data.)

The value for total acreage is 242,554 acres and the value for likely applied water is 1,012,910 acre feet. Production of livestock feed crops in Tulare County in 2014 likely used over one million acre feet of water, distributed on nearly 250,000 acres of land!

Again, it is likely that most of the water used to grow these livestock feed crops came from groundwater sources, as Tulare County received little precipitation and almost no surface water from CVP Friant Dam releases in 2014. Moreover, much of this pumped groundwater used to grow these livestock feed crops has not likely been replaced by natural recharge in either 2014 or 2015, due to extremely limited precipitation.

The use of pumped groundwater from already-depleted groundwater aquifers to produce livestock feed is a wasteful, unreasonable use of water. A small fraction of that water could have been used to grow drought-tolerant beans that humans could have directly consumed. It was not. Water was, instead, wasted on flood irrigation of crops that will be partially converted into significant amounts of methane and then emitted by livestock into the atmosphere. Such emissions will likely contribute to a long-term reduction in precipitation that will limit groundwater aquifer recharge in the future.

Again, we argue that it is unreasonable to use scarce and dwindling water supplies to produce crops that are likely to contribute to the generation of further water scarcity in the future. Groundwater use for livestock feed production in Tulare County appears especially (and

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[7] If the almond acreage value is derived from the "bearing almond acreage standing" value provided in the 2014 California Almond Acreage Report* instead of CropScape, the estimated 2014 Tulare County almond orchard acreage and associated applied water values (in TAF) that resulted in the production of almond hulls decline significantly—from approximately 34,000 acres to approximately 12,000 acres and nearly 132 TAF to 46 TAF. The total estimated amount of acreage and applied water that resulted in the production of livestock feed crops in Tulare County in 2014 then drops from just over 242,000 acres to just over 220,000 acres, and the amount of water applied that resulted in the production of livestock feed crops drops from just under 1,015 TAF to just under 930 TAF.* (California Department of Food and Agriculture, California Agriculture Statistics Service Cooperating with the USDA, National Agricultural Statistics Service, Pacific Region Office, http://www.nass.usda.gov/ca, April 29, 2015) The following is how the bottom of the chart in Appendix C looks using the almond acreage and associated acre feet values derived from the 2014 California Almond Acreage Report:

| | | | | |
|---|---|---|---|---|
| 75 | Almonds (1/2 for Hulls) | 11,832* | 3.89 | 46.02 |
| Total | | 220,391.4 acres | | 927.35 TAF |

egregiously) unreasonable to us, due to the recently-established link between livestock-feed crop-related groundwater use and the large number of well failures in the nearby areas associated with East Porterville.

**Imbalance and Unreasonable Water Use**

The conservation of the waters of the state is of paramount importance. We believe that we have presented sufficient evidence in this comment to establish that water used to grow livestock feed crops is, on its face, wasteful and unreasonable, and the consequences of such use adversely impact California society and natural ecosystems across a number of different yet inter-related economic, political, social, and ecological spheres. The cumulative impact of all these effects has now created in California a phenomenon of "transcendent importance" (*Joslin v. Marin Mun. Water Dist., 67 Cal.2d 132, [1967]).* What is this phenomenon? California is out of balance, and the use of water to produce livestock feed crops promotes further imbalance between the human species and California's native ecosystems. The path to balance requires actions that reduce and/or eliminate these wasteful and unreasonable uses that have been contributing to the imbalance between the human species and California's native ecosystems.

We believe that the SWRCB is required to act on the matter of wasteful, unreasonable use of water being used to produce livestock feed. The mandatory legal authority to buttress SWRCB action has three components. First, the SWRCB and the courts can nullify "beneficial" use of water, if such use is wasteful and/or unreasonable *(Joslin, 1967, Forni, 1976, Light v. SWRCB, 2014).* Second, the SWRCB can reduce and/or eliminate wasteful, unreasonable water use to rebalance an unbalanced situation *(U.S. v. SWRCB, 1986).* Third, the SWRCB is *required* to re-balance imbalanced situations *(Audubon, 1983, Cal Trout II.).*

Concerning our first point, we rely primarily on *Joslin (1967),* but also *Forni (1976).* In *Joslin,* the CA Supreme Court commented about the plaintiffs' claim:

[5] In essence their position is that such use is a [67 Cal.2d 143] beneficial one encompassed within their riparian rights and that all beneficial uses are reasonable uses. Such a position ignores rather than observes the constitutional mandate. Article XIV, section 3, does not equate "beneficial use" with "reasonable use."... the mere fact that a use may be beneficial to a riparian's lands is not sufficient if the use is not also reasonable within the meaning of section 3 of article XIV and, as indicated ... use must be deemed unreasonable. *(Joslin v. Marin Mun. Water Dist., (1967))*

Concerning *Forni (1976),* Littleworth and Garner (2007) note, "*Forni* followed *Joslin* in holding that a beneficial use could nonetheless be unreasonable (p. 111)." Finally, *Light v. SWRCB* (which the CA Supreme Court declined to review on Oct 1, 2014) appears to also reinforce the previous holdings of the court in both *Joslin* and *Forni.*

Concerning our second point, we rely primarily on *U.S. v. SWRCB (1986).* In this case, the court upheld a decision in which the SWRCB made an "implicit finding" of unreasonable use to justify a curtailment of CVP and SWP project activities that resulted in a reduction of water storage and a reduction in water exports. The SWRCB made this decision on the basis of new information

documenting "adverse impacts of the projects upon the Delta." We assert that it is reasonable to interpret the SWRCB's decision as an act of "balancing": the SWRCB discerned an imbalance in the relationship between human activities and the Delta ecosystem and curtailed the unreasonable use of water that was generating the imbalance. By reducing an unreasonable use of water, the SWRCB promoted balance in the relationship between humans and the natural world.

As for our last point, we rely upon *Audubon (1983)* and *Cal Trout II (1990).* In both of these cases, the SWRCB had refused, over extended periods, to take actions that would compel a re-balancing of the severely imbalanced relationships between the City of Los Angeles, the Mono Lake ecosystem, and the fisheries of Mono Lake's feeder streams. While neither of these cases focused on Article X, Section 2 of the California Constitution, the courts in both of these cases clearly ruled that the SWRCB had a legal duty to re-balance relationships between human institutions and natural ecosystems that had been clearly unbalanced for significant periods of time. In both of these cases, the court stepped in to "re-balance" when the SWRCB failed to meet its legal duty to "re-balance" an unbalanced situation. [v]

**Drought and Balance**

If the SWRCB does not designate the use of irrigation water to grow livestock feed as wasteful and unreasonable, it would be taking an action that is likely to promote further drought conditions in California. Such a refusal to designate the use of irrigation water to grow livestock feed as wasteful and unreasonable would be inconsistent with—and be in conflict with—the California Constitution

We also are obliged to comment further upon the concept of "balancing." The SWRCB and the courts continue to use an anachronistic concept of "balancing" in relation to drought. Drought appears to be viewed as a stressor that pits the needs of the environment against the "needs" of the economy/jobs/business, which must then be "rebalanced" by the SWRCB and the courts. In this view, the drought supposedly creates the pressure that results in imbalance between society and the environment.

We disagree. Human societies and natural ecosystems have frequently changed, adapted, and evolved to past drought conditions in ways that sacrificed neither. The present is different. Our current, dominant political-economic system still requires that natural ecosystems bear much of the burden of adaptation. As the escalating rise in extinction rates and decline in native flora and fauna viability suggest, meaningful adaptation by such natural ecosystems (at least what remains of them) is becoming exceedingly difficult. Drought is not the fundamental cause of this sad state. Our hybrid state/industrial, growth-based society has been the vector that has generated this terrible imbalance in our relationship between our society and the natural world.

We believe that it is our responsibility to change the way we live, such that we no longer drive the rest of the species of the natural world toward extinction. One way we can start to make such a change is to shift our production and consumption patterns such that these no longer aggravate and intensify the current imbalance that threatens native biodiversity on planet Earth. Reducing the production of livestock feed crops in California is one of the important, albeit difficult, steps

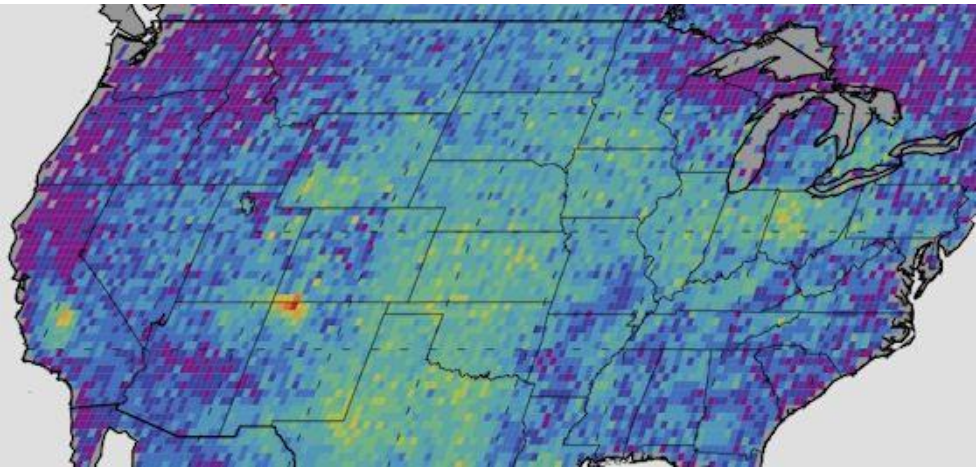
that we must take. (Appendix E includes pertinent words of Pope Francis and a list of possible remedies that would enable us to take some of these steps.)

**Climate Change Impacts on Public Lands Forest Health**

The world's climate is changing. Increased temperatures and levels of atmospheric carbon dioxide as well as changes in precipitation and in the frequency and severity of extreme climatic events are just some of the changes occurring. As we have argued above, these changes are being aggravated by significant methane emissions from livestock. These changes are having notable impacts on the world's forests and the forest sector through longer growing seasons, expansion of insect species ranges, low snowpack, and increased frequency of forest fires.

Smog from the Central Valley has settled in Sequoia and Kings Canyon National Parks, home of the giant Sequoias. Smog from the neighboring Central Valley is making it tougher for seedlings from the giants to take hold, and the needles of surrounding Jeffrey and Ponderosa pines are yellowing, symptoms of ozone toxicity. Smog is created when the sun's rays hit pollutants such as oxides of nitrogen and volatile organic compounds that are in motor vehicle exhaust, solvents, pesticides, gasoline vapors and decaying dairy manure. (See air pollution and drought effects Sierra ecosystems http://treephys.oxfordjournals.org/content/24/9/1001.full.pdf and http://www.sfgate.com/science/article/Sequoia-National-Park-Worst-air-pollution-3591161.php)

The impacts to federal public forestlands is not just from ozone. Methane emissions in the Central Valley (presumably from high livestock emissions) are the second largest methane concentration "hot spot" plume in the United States. (http://science.nasa.gov/science-news/science-at-nasa/2014/09oct_methanehotspot/) Methane, as we have noted above, is very efficient at trapping heat in the atmosphere and, like carbon dioxide, it contributes to global warming.



The Four Corners area (red) is the major U.S. hot spot for methane emissions while the Central Valley is the second largest concentration based on data from 2003–2009 (dark colors are lower than average; lighter colors are higher). Image Credit: NASA/JPL-Caltech/U. of Michigan.

This Central Valley methane "hot spot" has possibly contributed to the increased forest temperatures and reduced snow pack that are reducing available water flow to the valley and also stress-

ing public lands forests in California's Sierra Nevada. Federal public forestland management issues are intensified by increasing temperatures, loss of moisture, increased insect activity, and greater chance of wildfires that may, in part, be attributed to the heat-absorbing effects of methane on the forest.

As climate change conditions fluctuate from drought to high-intensity, warm rainfall, mountainous western watersheds are expected to experience more frequent winter and early spring flood events, runoff, and soil erosion.[8, 9] The continued unreasonable use of water for livestock feed crops that produce methane will only further exacerbate climate change and the impacts to forests and downstream communities.

**Epitaph for Delta Smelt**

While we have not provided an analysis concerning the impact of the April 6 TUCO on Bay-Delta fisheries in this document, we are familiar with recent analyses of this subject that have been developed and submitted to the SWRCB by the California Sportfishing Protection Alliance (CSPA), Restore the Delta, the Bay Institute, the Natural Resources Defense Council, and others. We note first that SWRCB-ordered curtailment of irrigation-related water exports, in order to protect Delta Smelt, has ***not*** occurred in over two years. The previous and current outflows of Sacramento and San Joaquin River water through the Delta have been facilitated primarily to promote salinity control in the Delta. Second, we concur with the argument made by CSPA that "[t]he Board's weakening of Bay-Delta standards has resulted in a population collapse of Delta species that exceeds the Pelagic Organism Decline that followed adoption of D-1641 in 2000." (Source: California Sportfishing Protection Alliance PowerPoint Presentation, Slide 2, SWRCB, 20 May 2015 Workshop, http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/workshops/cspa_pres_jennings.pdf.)

Based on these analyses, we assert that the April 6 TUCO has been, and remains, inconsistent with the Public Trust legal doctrine that the SWRCB is required to enforce. The April 6 TUCO has deprived the Bay-Delta of freshwater outflows needed to promote ecosystem sustainability and endangered fish species viability. This deprivation has likely generated damage to the seven

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8 "Global warming is expected to lead to a more vigorous hydrological cycle, including more total rainfall and more frequent high intensity rainfall events. Rainfall amounts and intensities increased on average in the United States during the 20th century, and according to climate change models they are expected to continue to increase during the 21st century. These rainfall changes, along with expected changes in temperature, solar radiation, and atmospheric C02 concentrations, will have significant impacts on soil erosion rates." (Expected climate change impacts on soil erosion rates: A review by MA Nearing, et al., 2004) http://www.jswconline.org/content/59/1/43.short

9 "Possible changes in runoff patterns, coupled with apparent recent trends in societal vulnerability to floods in parts of North America, suggest that flood risks may increase as a result of anthropogenic climate change (see Section 15.2.5). Changes in snowpack accumulation and the timing of melt-off are likely to affect the seasonal distribution and characteristics of flood events in some areas. For example, in mountainous western watersheds, winter and early spring flood events may become more frequent (Melack et al., 1997; Lettenmaier et al., 1999)." (Climate Change 2001: Impacts, Adaptation, and Vulnerability, by James J. McCarthy, Co-Chair of IPCC Working Group II, et al.) http://treconservice.com/onep/wp-content/uploads/2015/01/Impacts-Adaptation-and-Vulnerability.pdf

fish species that are likely candidates for Endangered Species Act protection, as well as the remaining wild Delta Smelt (which currently flicker on the very edge of extinction). Thus, the April 6 TUCO is not only legally untenable but its implementation by the SWRCB also constitutes a sin of the highest order.

We do not issue such an accusation lightly; rather, we form our judgement from the spiritual wisdom of Ecumenical Patriarch Bartholomew I of the Eastern Orthodox Communion, who said in 1997: "It follows that to commit a crime against the natural world is a sin. For humans to cause species to become extinct and to destroy the biological diversity of God's creation, for humans to degrade the integrity of Earth by causing changes in its climate, by stripping the Earth of its natural forests or destroying its wetlands ... for humans to contaminate the Earth's waters, its land, its air, and its life with poisonous substances—these are sins. [vi]"

Sincerely,

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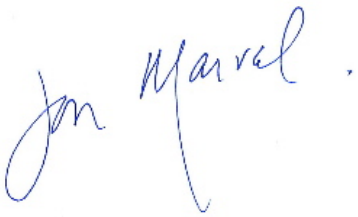

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End Notes

i: The first study demonstrating this linkage was published by Stanford University researchers on September 29, 2014 (co-authors Diffenbaugh, Swain, Rajaratnam, et alia) in a supplement to the Bulletin of American Meteorological Society. The study was summarized extensively in the Stanford Report issue of September 30, 2014. http://news.stanford.edu/news/2014/september/drought-climate-change-092914.html **Return to Text**

ii: The second study demonstrating this linkage was published in Environmental Research Letters, Jan 6, 2015, and coauthored by Rutgers Professor Jennifer Francis and Stephen Vavrus. The title of the study is "Evidence for a wavier jet stream in response to rapid Arctic warming." (Source: http://iopscience.iop.org/1748-9326/10/1/014005). **Return to Text**

iii: The third study was authored by Wang, S.-Y. (Simon Wang), Larry Hipps, Robert Gillies, and Jin-Ho Yoon, and is summarized in *Fire and Ice—California Drought and "Polar Vortex" in a Changing Climate*, Science and Technology Infusion Climate Bulletin NOAA's National Weather Service, 39th NOAA Annual Climate Diagnostics and Prediction Workshop St. Louis, MO, 20–23 October 2014. **Return to Text**

iv: The current Board Members of the SJRECWA are James O'Banion, Roy Catania, James L. Nickel, Mike Stearns, and Steve Chedester.

James O'Banion, Chairman of the Board of the SJRECWA, is also the Board Chairman of the Central California Irrigation District, one of the constituent organizations of the SJRECA (and by far the largest). He is a primary owner of O'Banion Ranches, which received 2.783 million dollars in USDA farm subsidies between 1995 and 2012 ($709,000 between 2009 and 2012, $241,000 between 2011 and 2012), mostly for rice and cotton, but also including $233,000 in dairy program subsidies. (See http://farm.ewg.org/persondetail.php?custnumber=A09429636) O'Banion Ranches farms on 2,492 acres (alfalfa, cotton, corn, wheat, wheat grass, and permanent pasture) and maintains a 475 head dairy herd.

Roy Catania is ranch manager for Paramount Farms, which is completely owned by Stuart and Lynda Resnick, (whose collective wealth has been reported to exceed $4 billion.) Roy is also President of the Columbia Canal Company, which is one of the constituent organizations of the SJRECWA.

The Environmental Working Group (EWG) has estimated the 2002 CVP-associated subsidy to the Stuart and Lynda Resnick-owned Paramount Citrus (which is associated with the Paramount Ranch that Roy Catania, Board Member of the SJRECWA, manages) as ranging from $13,000 to $1.1 million, depending upon the set of assumptions used. See the report on Paramount Citrus at
http://web.archive.org/web/20060927191459/http://www.ewg.org/reports/watersubsidies/top_recipients.php?top

James L Nickel is President of the San Luis Canal Company, one of the constituent organizations of the SJRECWA. He is a descendent of Henry Miller (see http://exiledonline.com/california-class-war-history-meet-the-oligarch-family-thats-been-scamming-taxpayers-for-150-years-and-counting/), who was, for a time during the 1850–1917 period, the largest landowner in the United States. He is a son of George W. Nickel, who pioneered water trading in California in the 1960s. James is part of the Nickel Family Trust (Nickel Family LLC), which received $3,641,246 in USDA subsidies (mostly for cotton) between 1998 and 2009. (See http://farm.ewg.org/persondetail.php?custnumber=A09780209) The James Nickel Trust received $326,355 in USDA subsidies between 2003 and 2007. (See http://farm.ewg.org/persondetail.php?custnumber=A08950476)

His relative, George W. Nickel III, wrote recently, in a letter to the SWRCB, that his family "farms close to 8,000 acres in California." (See April 10, 2015 letter to the SWRCB.) Nickel is President of the San Luis Canal Company.

The largest of the constituent organizations of the SJRECWA is the Central California Irrigation District (CCID). One of the board members of the CCID is Eric Fontana. Eric is a co-owner of Brinkley Farms. Brinkley Farms received $3,029,915 in USDA subsidies (mostly for cotton) between 1995 and 2012 ($280.657 from 2009 to 2012). (See http://farm.ewg.org/persondetail.php?custnumber=A09426694)

A Director of the Columbia Canal Company is Joseph MacIlvane, who is the president of Stewart and Lynda Resnick-owned Paramount Farms. He is president of the board of directors of the Dudley Ranch Water District, a private water district that owns 9.62% the Kern Water Bank Authority. (48.06% of the KWBA is owned by the Paramount Farms-owned Westside Mutual Water Company.) He is also the President of the Board of Directors for the Berrenda Mesa Water District.

A director of San Luis Canal Company is Cannon Michael, who manages Bowles Farming Co. Bowles Farming Company, based in Los Banos, produces crops on 10,500 acres of crop land. Cannon is reported to be a great-great-great grandson of Henry Miller. (See http://www.bloombergview.com/articles/2015-05-26/why-they-grow-thirsty-alfalfa-in-parched-california) Bowles Farming Company received $11,522,058 in USDA subsidies from 1995–2012, mostly for cotton. (In 2009, it received over $1.4 million in USDA subsidies, and just under $22,000 over the 2010–2012 period. Source: EWG.)

A number of other farm-related corporations that have central offices in Los Banos, Dos Palos, and Firebaugh (all located within the geographic boundaries of the SJRECWA) have received extensive USDA subsidies between 1995 and 2012. The top nine (in terms of subsidy value accumulated) each received more than $5 million in USDA subsidies between 1995 and 2012. The largest recipient (SJR Farming, based in Los Banos), received over $14 million in USDA subsidies (mostly for cotton). (See http://farm.ewg.org/persondetail.php?custnumber=A11892035)

In 2014, California farmers and ranchers received 3721 Livestock Forage Disaster Program (LFP-USDA) payments collectively worth $68,625,296. For 2015 (as of May 1), current USDA information indicates that California farmers and ranchers have received 364 payments collectively worth $5,367,861. The LFP program enables farmers and ranchers to receive up to $125,000 per year in assistance for grazing losses due to drought (60% of monthly feed cost for either three or five months, depending on forage type). The magnitude of LFP payments that farmers and ranchers can receive is based primarily on herd size, pasture type, and county drought condition. All other factors being equal, the rancher with a greater number of cattle is eligible to receive larger payments than the rancher with fewer cattle, up to $125,000 per year. (See http://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/index)

The broader federal subsidy provided to a California farmers by the CVP has been noted in a recent Bloomberg, April 27, 2015, article by Daniel Beard, the former Commissioner of the United States Bureau of Reclamation,[1][2] and the fourth Chief Administrative Officer of the United States House of Representatives.[3][4] Beard makes the following six claims selected from the article and treated as independent quotations:

"The federal Central Valley Project has delivered subsidized water to a group of California farmers for more than 60 years."

"Only 15% of what it cost to do this has been repaid more than six decades after water was first delivered."

"In a 2004 study, the Environmental Working Group estimated that the total subsidies for the Central Valley Project added up to roughly $600 million a year."

"All over the West, farmers served by federal projects have benefited from 50-year zero-interest loans, with generous repayment rates, plus low-cost power."

"By one estimate, the yearly water subsidy to Westlands of up to $110 million was the most profitable arrangement for any water district in the U.S., until the current drought forced cutoffs in the supply. A big part of that amount came from the difference in the price farmers paid for the water and the price the taxpayers could receive if it was sold on the open market."

"The Bureau of Reclamation doesn't question the rights of the water nobility in the West, or even calculate the total subsidy from the agency's programs (The last time the subsidy was calculated, more than 25 years ago, the figure was $116 billion.)" http://www.bloombergview.com/articles/2015-04-27/save-california-farmers-from-themselves

For a broader discussion of CVP subsidies to Central Valley farmers, see http://www.ewg.org/research/california-water-subsidies.

"At a time when California water is scarce and expensive, taxpayers guarantee Central Valley farms an abundant and cheap supply through a subsidy worth up to $416 million a year, according to an Environmental Working Group (EWG) investigation that calculated, for the first time, federal water subsidies to each of more than 6,800 farms in the Central Valley Project (CVP)."

"EWG found that water subsidies in the CVP are overwhelmingly controlled by the largest farms. In 2002, the largest 10% of the farms got 67% of the water, for an average subsidy worth up to $349,000 each at market rates for replacement water. Twenty-seven large farms received subsidies each worth $1 million or more at market rates, compared to a median subsidy for all recipients of $7,076. One farm—Woolf Enterprises of Huron, Fresno County—received more water by itself than 70 CVP water user districts, for a subsidy worth up to $4.2 million at market rates."

"CVP farmers get about one-fifth of all the water used in California, at rates that by any measure are far below market value. In 2002, the average price for irrigation water from the CVP was less than 2% what Los Angeles residents pay for drinking water, one-tenth the estimated cost of replacement water supplies, and about one-eighth what the public pays to buy its own water back to restore the San Francisco Bay and Delta." **Return to Text**

v: A recent discussion of reasonable use law (California Water Law Symposium: Harrison "Hap" Dunning and John Leshy on California's Reasonable Use Law, April 7, 2015 Maven Best of the Notebook, http://mavensnotebook.com/2015/04/07/california-water-law-symposium-harrison-hap-dunning-and-john-leshy-on-californias-reasonable-use-law/) is germane to the discussion above. In this recent symposium, other relevant reasonable use cases were explored, most notably *Erickson v. Queen Valley Ranch Company* (California Court of Appeals, 1971), and *State Water Board Resolution 7578* (1975), as well as relevant language in the Sustainable Groundwater Management Act of 2014. Even earlier, pre-1928 cases, as well as federal water law language and cases, were explored concerning this particular area of law. In sum, the legal guidance from these cases complements the holdings of the courts in *Audubon* and *Cal Trout II* in that it provides legal authority for "reasonable use law being used as a sword."

Professor Paul Kibel elaborated further: "By sword, I mean appealing directly to the courts to impose restrictions on water use or water diversion in the absence of agency action. The Erickson case involved a court ruling that the five-sixth losses during transmission were unreasonable; they weren't upholding anything that Fish and Game or the State Water Board said. They were relying directly on their authority for the court." **Return to Text**

vi: Ecumenical Patriarch Bartholomew, "To Commit a Crime Against the Natural World Is a Sin," Environmental Symposium, Saint Barbara Greek Orthodox Church, Santa Barbara, California, 8 November 1997. (Ecumenical Patriarch Bartholomew I has been the Patriarch of Constantinople, and thus "first among equals" in the Eastern Orthodox Communion, since 1991. He is the spiritual leader of 300 million Orthodox Christians around the world and has earned the title "Green Patriarch" for his efforts to raise environmental awareness. In 2008 he published *Encountering the Mystery: Understanding Orthodox Christianity Today*.) **Return to Text**

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## Appendix A

**California Constitution**
ARTICLE 10 WATER
"SEC. 2. It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the beneficial use thereof in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or water course in this State is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water. Riparian rights in a stream or water course attach to, but to no more than so much of the flow thereof as may be required or used consistently with this section, for the purposes for which such lands are, or may be made adaptable, in view of such reasonable and beneficial uses; provided, however, that nothing herein contained shall be construed as depriving any riparian owner of the reasonable use of water of the stream to which the owner's land is riparian under reasonable methods of diversion and use, or as depriving any appropriator of water to which the appropriator is lawfully entitled. This section shall be self-executing, and the Legislature may also enact laws in the furtherance of the policy in this section contained."

**SWRCB Beneficial Uses**

The Water Board must broadly consider how farmstead uses (Agricultural Supply [AGR]) are undermining the protection of municipal and domestic supply and human health. The Board must consider the relationship between water used to grow livestock feed crops, water freely drunk by livestock, and the climate-changing greenhouse gases generated by livestock production. Recent research implicates these gases in significantly increasing the probability of Pacific Ocean high pressure ridge formation that is deeply associated with California's four-year-long drought.

The SWRCB cannot effectively protect long-term human health by increasing water diversions to farmers who grow alfalfa, corn, and other feed for methane-emitting livestock. Water diversions for this particular use should no longer be considered a "beneficial use" as defined by the California Constitution.

"2.1.1 AGRICULTURAL SUPPLY (AGR)
Uses of water for farming, horticulture, or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

The criteria discussed under municipal and domestic water supply (MUN) also effectively protect farmstead uses. To establish water quality criteria for livestock water supply, the Water Board must consider the relationship of water to the total diet, including water freely drunk, moisture content of feed, and interactions between irrigation water quality and feed quality. The University of California Cooperative Extension has developed threshold and limiting

concentrations for livestock and irrigation water. Continued irrigation often leads to one or more of four types of hazards related to water quality and the nature of soils and crops. These hazards are (1) soluble salt accumulations, (2) chemical changes in the soil, (3) toxicity to crops, and (4) potential disease transmission to humans through reclaimed water use. Irrigation water classification systems, arable soil classification systems, and public health criteria related to reuse of wastewater have been developed with consideration given to these hazards."
http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/planningtmdls/basinplan/web/bp_ch2.shtml

The Water Board addresses in CHAPTER 2: BENEFICIAL USES the need for "protection of public health" (discussed under "municipal and domestic water supply (MUN)"): "The health aspects broadly relate to: direct disease transmission, toxic effects, and increased susceptibility to disease, such as links between halogenated organic compounds and cancer."

Condition 1e of the March 5, 2015 Modified Order states: "2. DWR and Reclamation shall consult on a regular basis with designated representatives from the State Water Board, Department of Fish and Wildlife, National Marine Fisheries Service and U.S Fish and Wildlife Service (fisheries agencies) concerning current conditions and potential changes to SWP and CVP operations **to meet health and safety requirements and to reasonably protect all beneficial uses of water**."
http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/tucp/tucp_order030515.pdf

## Appendix B

***SJRECWA 2014 Analysis***, Todd Shuman, April 30, 2015, 805.987.8203, tshublu@yahoo.com

**1: Crop Acreage, estimated for SJRECWA, 2014**

Below is a comparison of the largest values from two CropScape map/spreadsheet approximation sets of the SJRECWA created by Todd Shuman in April 2015.

The first numbers in the parentheses are from the S+M+N set (total of the 3 segments). The second numbers are from the single map/spreadsheet set. The former are generally lower and more conservative than the latter. (The S+M+N set and associated spreadsheets are available upon request. The raw data for the single map spreadsheet set is in Appendix F.)

The acreage numbers for the two sets are similar for alfalfa (58.7 K v. 59.9 K), cotton (38.86 K v. 39.3 K), fallow/idle (31.4 K v. 31.99 K), tomatoes (27.4 K v. 27.7 K), grass/pasture (25.86 K v. 25.4 K), other hay (9.9 K v. 9.8 K), oats (5.1 K v.5.55 K), double crop code 226 [oats/corn] (5.2 K v.5.6 K), corn (4.96 K v. 4.94 K), grapes (4.87 v.5.46 K), double crop code 225 [winter wheat/corn] (4.48 K v. 4.59 K), , and pistachios (2.06 K v. 1.83 K). The two largest discrepancies are the S+M+N set combined values that are *lower* for almonds (17.2 K v. 19.87 K) but *higher* for winter wheat (9.65 K v.8.06 K)

Livestock feed crops assumed to be receiving **irrigation** water are alfalfa (ALF), other hay (OH), oats (OA), corn (CN), the oats/corn double crop (OA/CN DBL CROP), half of the winter wheat/corn double crop (WNTR WHT/CN DBL CROP), half of the almond crop (assuming hulls are 50% of fruiting mass structure, hulls ultimately incorporate 50% of all the water that is incorporated into the fruiting mass structure, and hulls are fed to livestock—ALM HU), and one quarter of grass/pasture (assuming similarity to the 2010 number for irrigated pasture [cited in the SJRECWA 2012 report*], which was 7.36 K—IRR PAST).

Below is the sum of the combined acreage values above that presumably received irrigation water and which ultimately produced livestock feed in 2014, using the low values from the two sets. Values are in thousands (K): 58.7 (ALF) + 9.8 (OH) + 5.1 (OA) + 4.94 (CN) + 5.2 (OA/CN DBL CROP) + 2.24 (WNTR WHT/CN DBL CROP ½) + 8.6 (ALM HULL ½) + 6.35 (IRR PAST ¼) = **100.93 K, or 100,930 acres received irrigation water in 2014 and produced livestock feed.**

The total assumed **irrigated** acreage for 2014 using the whole-SJRECWA map/spreadsheet is 206.07 K acres (206,070 acres). This value is derived by subtracting the many non-agricultural row values from the total sum of all row values, including the subtraction of 75% of grass/pasture acreage (19.05 K), which Todd Shuman assumed earlier was not irrigated (see above). This total acreage value is likely larger than the other total irrigated acreage value for the S+M+N set, as the total summed acreage for all the whole-map-associated spreadsheet row values is 3,882.9 acres greater than the total summed acreage for all the S+M+N set spreadsheet row values combined. I will use the presumably higher-summed overall irrigated acreage value from the whole-SJRECWA map/spreadsheet to instill a conservative bias into any comparative evaluation of water used to grow livestock feed crops relative to water used to grow non-livestock feed crops.

Total livestock feed acreage and alfalfa acreage as a share of estimated total irrigated acreage (in thousands, or K): **100.93/206.07 = 48.98%; 58.7/206.07 = 28.48%**

100.93 K is nearly 49% of the total, **so nearly half of all SJRECWA acreage planted in 2014 (49%) produced livestock feed crops**.

58.7 K is 28.48% of the total. **Nearly 30% of all SJRECWA acreage planted in 2014 produced alfalfa, which is a livestock feed crop.**

## 2: Applied Water by Crop, estimated for SJRECWA, 2014

Water use by crop is calculated by multiplying estimated crop acreage by applied water coefficients for each crop. Estimated 2014 SJRECWA crop acreage values are the lowest values from the two 2014 CropScape map/spreadsheet approximation sets produced by Todd Shuman in April, 2015. Acre-Feet/Acre/yr ***applied water*** coefficients are taken from the Merced and Fresno County rows of the CA DWR Ag_County_2010 spreadsheet—AW WA sub-spreadsheet [Applied Water]. The lowest value AW coefficients were used in calculations concerning livestock feed crops (alfalfa, other hay, oats, corn, oats/corn double crop, half of the winter wheat/corn double crop, half of the almond crop related to almond hull production, and one quarter of total pasture assumed to be irrigated). The highest value AW coefficients were used in calculations concerning non-livestock feed crops (cotton, tomatoes, and wheat) to instill conservative bias into any comparative evaluation of water used to grow livestock feed crops relative to water used to grow non-livestock feed crops.

| Livestock Feed Crops | Acreage | AF Coefficient [AF/Acre] | Acre-Feet Applied |
|---|---|---|---|
| Alfalfa | 58.7 K | 4.59 | 269.433 K |
| Pasture | 6.35 K | 4.57 | 29.0195 K |
| Almond Hulls | 8.6 K | 3.24 | 27.864 K |
| Oats/Other Hay | 14.9 K | 0.97 | 14.453 K |
| Corn | 4.94 K | 2.56 | 12.6464 K |
| Oat/Corn Dble Crp | 5.2 K | 0.97/2.56 | 9.178 K |
| Wht/Corn Dble Crp | 2.24 K | 2.56 | 5.7344 K |
| Total LFC | (100.93 K) | | (368.3283 K) |

| Other Select Crops | Acreage | AF Coefficient | Acre-Feet Applied |
|---|---|---|---|
| Cotton | 38.86 K | 3.0 | 116.58 K |
| Tomatoes | 27.4 K | 2.45 | 67.13 K |
| Almond Kernels | 8.6 K | 3.52 | 30.272 K |
| Wheat | 10.3 K | 1.26 | 12.978 K |
| Total OSC | (85.16 K) | | (226.96 K) |
| Other Crops | (19.98 K) | | n/a |

| Total Estimated Crop Acreage SJRECWA 2014 | CVP AF Delivered to SJRECWA 2014* |
|---|---|
| (206.070 K) | (503,905 K) |

***Applied Water to crops that resulted in the production of livestock feed commodities as a share of total CVP AF Delivered to SJRECWA in 2014:***

**368.3283 K / 503.905 K = 73.0948%**

*Table 24, Table 25, CVO, USBR, downloaded from USBR CVO website (Monthly Deliveries in AF, San Joaquin and Mendota Pool, Delta-Mendota Canal)

*Applied Water for Other Select Crops as a share of total CVP AF Delivered to SJRECWA in 2014:*
226.96 K / 503.905 K = 45.04%

*Ratio of Applied Water for Livestock Feed Crops to Applied Water for Other Select Crops:*
368.3283: 226.93 = 1.623

## 3: Estimated Methane Emissions, CO2 Equivalents, and Equivalent Pounds of Coal Burned – SJRECWA Livestock, 2010/2011, (by Mike Hudak and Todd Shuman)

*Number of SJRECWA milking dairy cows, 2010/2011: 61,015**

Each cow emits CH4: 109 kg/cow/yr**
61,015 cows x 109 kg/cow/yr **= 6,650,635 kg/yr CH4**

Calculate using methane GWP of 84 and 28.
GWP 84: **558,653,340 kg CO2/yr**
GWP 28: **186,217,780 kg CO2/yr**
Calculate CO2 equivalents in pounds.
1 kg = 2.2 lb.
GWP 84: 2.2 lb./kg x 558,653,340 kg CO2/yr = **1,229,037,348 lb. CO2/yr**
GWP 28: 2.2 lb./kg x 186,217,780 kg CO2/yr = **409,679,116 lb. CO2/yr**
From epa.gov/cleanenergy/energy-resources/refs.html, calculate the equivalent pounds of coal burned.
9.31 x .0001 metric tons CO2/pound of coal = .000931 metric tons CO2/pound of coal
1 metric ton = 2,204.6 pounds
.000931 metric tons x 2,204.6 lb./metric ton = 2.05 lb. CO2/lb. coal
GWP 84: 1,229,037,348 lb. CO2/yr ÷ 2.05 lb. CO2/lb coal = **599,530,413 lb. of coal**
GWP 28: 599,530,413 ÷ 3 = **199,843,471 lb. of coal**

*Number of SJRECWA non-milking dairy cows, 2010/2011: 21,805*

21,805 cows x 60 kg (CH4)/cow/yr* = **1,308,300 kg/yr CH4**
GWP 84: 109,897,200 kg CO2/yr = **241,773,840 lb. CO2/yr**

*Number of SJRECWA dairy cows, 2010/2011, total: 82,820*

Add result for 21,805 non-milking cows (**241,773,840 lb. CO2/yr)** to the result for the 61,015 milking cows (**1,229,037,348 lb. CO2/yr**)

Total CO2 equivalents emitted by all SJRECWA dairy livestock using methane GWP 84 for 2010/2011: **1,470,811,188 lb. CO2 equivalence**. (If methane GWP 28 is used instead, then 490.27 million lb. of CO2 equivalence were emitted by all SJRECWA-associated dairy livestock for 2010/2011.)

The 1.471 billion pound amount of CO2 equivalency corresponds to **the addition of 0.008534587% of 1ppmv of CO2 to the atmosphere annually** from SJRECWA livestock (using a GWP methane coefficient of 84.)

*Role and Value of Agriculture San Joaquin River Exchange Contractors Water Authority Service Area, January 2012, Prepared for San Joaquin River Exchange Contractors Water Authority 541 H Street, Los Banos, CA, 93635 Tel 209-827-8616 Fax 209-827-9703 Prepared by Cardno ENTRIX 701 University Avenue, Suite 200, Sacramento, CA 95825 Tel 925 935 9920 Fax 925 935 5368 Toll-free 800 368 7511, pages 4.6 and 4.7, Agricultural Production, Table 4.4

**The annual methane emission values from livestock used in these calculations are documented in K. A. Johnson and D. E. Johnson, "Methane Emissions from Cattle," *Journal of Animal Science* 73(8) (1995): 2483–92.

**4: Methane Emissions from California Milking Cows and Beef Cows, Jan 1, 2014**

For the overall California livestock-associated methane emission numbers provided above, we use a conversion factor of 184.8 to convert kilograms of atmospheric methane emission into pounds (lb.) of CO2 equivalency (Methane GWP 84 over a 20 year interval). We use a conversion factor of 90.146 to convert kg of methane emission into the" pounds of coal burned" emission equivalency (Methane GWP 84 – twenty year interval).

The EPA website above documents that a 2010 coal-burning power plant produced, on average, CO2 emissions of approximately 8.4 billion pounds of CO2 (equivalent to 3,808,651 metric tons of CO2).

CA dairy cows are estimated to produce 1.9729 X $10^8$ kg CH4/yr, while CA beef cows produce 3.498 X $10^7$ kg CH4/yr, given the values of 1.81 million milking dairy cows and 583,000 beef cows.

**Appendix C**

| Tulare County, Livestock Feed Crops, and Water Usage in 2014 | | | | |
|---|---|---|---|---|
| | | | | |
| | | | **AW Co** | |
| **Code** | **Crop** | **Acres** | **(AFA)** | **TAF** |
| | | | | |
| 36 | Alfalfa | 80,046.50 | 5.13 | 410.60 |
| 37 | Other Hay | 1,579.20 | 1.65 | 2.60 |
| ***Hay Total*** | | **81,625.70** | | **413.20** |
| | | | | |
| 1 | Corn | 19,682.40 | 3.16 | 62.19 |
| 225 | ½ of WWheat/Corn | 40,476.40 | | 127.90 |
| 226 | ½ of Oats/Corn | 149.25 | | 0.47 |
| 237 | ½ of Barley/Corn | 330.50 | | 1.04 |
| ***Corn Total*** | | **60,638.55** | | **191.60** |
| | | | | |
| 28 | Oats | 8,463.90 | 1.65 | 13.96 |
| 226 | ½ of Oats/Corn | 149.25 | | 0.24 |
| ***Oats Total*** | | **8,613.15** | | **14.20** |
| | | | | |
| 4 | Sorghum | 2,146.60 | 2.81 | 6.03 |
| 236 | ½ of WWheat/Sorghum | 9,135.20 | | 25.66 |
| ***Sorghum Total*** | | **11,281.80** | | **31.69** |
| | | | | |
| **Alfalfa, Corn, Oats, Sorghum** | | **162,159.20** | | **650.69** |
| | | | | |
| n/a | **Irrigated Pasture** | | | |
| | (1/2 of 2013 Value) | **46,500.00** | 4.96 | **230.64** |
| | | | | |
| 75 | **Almonds** | | | |
| | (1/2 for Hulls) | **33,894.85** | 3.89 | **131.58** |
| | | | | |
| **Total** | | **242,554.05** | | **1,012.91** |
| | | **acres** | | **TAF** |

**Sources: CropScape (USDA) and CA DWR**

## Appendix D

**California Sportfishing Protection Alliance PowerPoint Presentation, Slide 16, State Water Resources Control Board, 20 May 2015 Workshop**
http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/docs/workshops/cspa_pres_jennings.pdf

**The Top Revenue Producing and Job Creating Commodities Use the Least Water**

| Crop Group | Area (1000 acres) | Gross Water (TAF)* | Net Water (TAF) | Gross Revenue ($1 M) | Rev/Net Water | Direct Jobs | Contract Labor | Total Jobs | Jobs/$1M | Jobs/Net Water (TAF) |
|---|---|---|---|---|---|---|---|---|---|---|
| Vegetables, horticulture, non-tree fruits | 857 | 1,298 | 899 | 12,875 | 14,318 | 67,227 | 63,484 | 130,711 | 10.2 | 74.76 |
| Cucurbits | 116 | 205 | 138 | 874 | 6,343 | 9,675 | 9,136 | 18,811 | 21.5 | 70.20 |
| Fresh tomatos | 42 | 77 | 55 | 310 | 5,621 | 3,427 | 3,236 | 6,664 | 21.5 | 62.21 |
| Subtropical fruits | 452 | 1,411 | 1,049 | 4,404 | 4,199 | 5,686 | 6,645 | 12,331 | 2.8 | 5.42 |
| Vine | 850 | 1,581 | 1,183 | 3,701 | 3,129 | 26,008 | 30,395 | 56,404 | 15.2 | 21.99 |
| Deciduous fruits | 671 | 2,210 | 1,655 | 3,910 | 2,362 | 17,383 | 20,315 | 37,699 | 9.6 | 10.50 |
| Onion, garlic | 80 | 225 | 161 | 330 | 2,046 | 3,647 | 3,444 | 7,092 | 21.5 | 22.65 |
| Potato | 28 | 66 | 45 | 91 | 2,046 | 1,011 | 954 | 1,965 | 21.5 | 22.64 |
| Almonds, pistachios | 1,080 | 3,820 | 2,892 | 4,199 | 1,452 | 13,383 | 7,006 | 20,389 | 4.9 | 4.63 |
| Processing tomatos | 304 | 742 | 548 | 742 | 1,355 | 8,214 | 7,756 | 15,970 | 21.5 | 14.99 |
| Cotton | 300 | 927 | 726 | 502 | 692 | 2,875 | 2,891 | 5,766 | 11.5 | 3.96 |
| Sugar beets | 27 | 138 | 87 | 60 | 685 | 895 | 103 | 999 | 16.7 | 10.27 |
| Other field crops | 647 | 1,691 | 1,096 | 710 | 648 | 6,114 | 5,557 | 11,671 | 16.4 | 5.58 |
| Grains | 576 | 802 | 545 | 342 | 628 | 928 | 189 | 1,117 | 3.3 | 1.70 |
| Corn | 781 | 2,206 | 1,507 | 918 | 609 | 454 | 92 | 546 | 0.6 | 0.30 |
| Dry beans | 85 | 199 | 140 | 74 | 526 | 119 | 24 | 143 | 1.9 | 0.85 |
| Rice | 592 | 2,700 | 1,517 | 796 | 524 | 1,573 | 320 | 1,893 | 2.4 | 1.04 |
| Safflower | 43 | 59 | 51 | 23 | 460 | 126 | 25 | 151 | 6.5 | 2.48 |
| Alfalfa | 1,039 | 5,241 | 3,652 | 1,303 | 357 | 2,801 | 2,546 | 5,347 | 4.1 | 0.77 |
| Irrigated pasture | 830 | 3,362 | 2,270 | 206 | 91 | 588 | 534 | 1,122 | 5.4 | 0.26 |
| **Grand Total** | **9,398** | **28,961** | **20,216** | **36,370** | **N/A** | **172,134** | **164,654** | **336,788** | **N/A** | **N/A** |

*TAF = Thousand acre-feet

**Sources:** Irrigated crop area, applied and net water use from California Department of Water Resources'(DWR) 2013 update of the California Water Plan for 2010
Revenue information from Statewide Agricultural Production Model Version 6 (http://swap.ucdavis.edu), adjusted to 2012
Jobs estimated from reconciling data from various sources including the California Employment and Development Department and the IMPLAN economic model
Prepared by Josue Medellin-Azuara, Research Scientist, UC Davis Center for Watershed Sciences. jmedellin@ucdavis.edu
**Crop Groups** defined by DWR. **Grains** = wheat, barley, oats, hay; **Other field crops** = flax, hops, sunflowers, sudan grass, millet, castor beans
**Vegetables, horticulture, non-tree fruits** = Artichokes, asparagus, green beans, carrots, celery, lettuce, peas, spinach, flowers nursery and tree farms, bush berries strawberries, peppers, broccoli, cabbage, cauliflower, brussel sprouts. **Cucurbits** = melons, squash, cucumbers. **Deciduous fruits** = apples, apricots, cherries, peaches, figs nectarines, pears, plums, prunes, walnuts. **Subtropical** = grapefruit, lemons, oranges, dates, avocados, olives, kiwis, jojoba, eucalyptus. **Vine** = table, wine and raisin grapes

*Prepared by Josue Medellin-Azuara with the assistance of Nadya Alexander, UC Davis Center for Watershed Sciences. Contact: jmedellin@ucdavis.edu*

The 2012 estimate of applied water that resulted in almond hull production is derived from CA DWR (2010) and the 2012 California Almond Acreage Report, California Department of Food and Agriculture, California Agriculture Statistics Service Cooperating with the USDA, National Agricultural Statistics Service, Pacific Region Office, http://www.nass.usda.gov/ca, April 25, 2013. Acreage devoted to sweet corn production was 5.7 percent of all harvested corn acreage in California in 2013. (California Agricultural Statistics 2013 Crop Year, USDA, NASS, April 2015, http://www.nass.usda.gov/ca)

The 2010 CA DWR State-wide Applied Water Coefficient for Almonds/ Pistachios was 3.54 AFA. The "bearing" almond acreage for 2012 was 790,000 acres. Total water applied to "bearing" almond acreage was 2.7966 MAF. Half of that amount (which we associate with almond hull production) is 1.3983 MAF. 1.3983 MAF added to 10.809 MAF equals 12.2073 MAF. 12.2073 MAF divided by 28.961 MAF equals 42.15%.

**Appendix E**

**<u>The Wisdom of Pope Francis on the Environment and Proposed Remedies</u>**

A much broader and deeper formulation of the argument in the Drought and Balance section above is presented by Pope Francis, in ENCYCLICAL LETTER *LAUDATO SI'* OF THE HOLY FATHER FRANCIS ON CARE FOR OUR COMMON HOME, June 18, 2015, Vatican Press." We share the following wisdom from Pope Francis concerning the adverse impacts of climate change on the planet.

> The climate is a common good, belonging to all and meant for all. At the global level, it is a complex system linked to many of the essential conditions for human life. A very solid scientific consensus indicates that we are presently witnessing a disturbing warming of the climatic system. In recent decades this warming has been accompanied by a constant rise in the sea level and, it would appear, by an increase of extreme weather events, even if a scientifically determinable cause cannot be assigned to each particular phenomenon. Humanity is called to recognize the need for changes of lifestyle, production and consumption, in order to combat this warming or at least the human causes which produce or aggravate it. It is true that there are other factors (such as volcanic activity, variations in the earth's orbit and axis, the solar cycle), yet a number of scientific studies indicate that most global warming in recent decades is due to the great concentration of greenhouse gases (carbon dioxide, methane, nitrogen oxides and others) released mainly as a result of human activity. Concentrated in the atmosphere, these gases do not allow the warmth of the sun's rays reflected by the earth to be dispersed in space. The problem is aggravated by a model of development based on the intensive use of fossil fuels, which is at the heart of the worldwide energy system. Another determining factor has been an increase in changed uses of the soil, principally deforestation for agricultural purposes.
>
> Warming has effects on the carbon cycle. It creates a vicious circle which aggravates the situation even more, affecting the availability of essential resources like drinking water, energy and agricultural production in warmer regions, and leading to the extinction of part of the planet's biodiversity. The melting in the polar ice caps and in high altitude plains can lead to the dangerous release of methane gas, while the decomposition of frozen organic material can further increase the emission of carbon dioxide. Things are made worse by the loss of tropical forests which would otherwise help to mitigate climate change. Carbon dioxide pollution increases the acidification of the oceans and compromises the marine food chain. If present trends continue, this century may well witness extraordinary climate change and an unprecedented destruction of ecosystems, with serious consequences for all of us. A rise in the sea level, for example, can create extremely serious situations, if we consider that a quarter of the world's population lives on the coast or nearby, and that the majority of our megacities are situated in coastal areas.

Pope Francis (April, 18 2015, Climate as a common good, passages 23 and 24)
http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html

Please correct us, if we have erred in observations or calculations. Based on our observation and calculations, we believe our suggested remedies could help to reduce the duration of California's drought and help counteract global climate change.

First, SWRCB could designate the flood irrigation method typically used to grow alfalfa and irrigated pasture as a wasteful and unreasonable method of water use during this time of drought in California.

Second, SWRCB could designate any future delivery of SWP or CVP water for livestock feed crop irrigation as wasteful and unreasonable during this time of drought in California.

Third, SWRCB could order DWR and USBR to cut back water deliveries to senior water rights holders who refuse to contractually commit to the agricultural production of non-livestock feed crops during this time of drought in California.

Over the longer term, farmers receiving SWP or CVP water could be contractually prohibited from growing livestock feed crops, regardless of drought condition.

Fourth, international exports of California alfalfa and hay could be prohibited by executive order (and/or legislation if necessary) during this time of drought. This action could prevent the export of virtual water to other countries and help ensure that hay commodities currently produced using California water are more readily available to help sustain California businesses and workers during this time of drought. A more complete market absorption of California-produced hay by California-located businesses could also reduce the presumed (and hotly-disputed) economic need to divert Sacramento River and San Joaquin River flows away from the Bay-Delta.

Finally, any and all California water (including groundwater) used to grow livestock feed crops could be declared as wasteful and unreasonable, by California state executive, legislative, and judicial authorities, including the SWRCB.

To facilitate the implementation of this final, ultimate remedy, transition payments could be used to promote a conversion of dairy operations into vegetable-protein production facilities and livestock feed farms into vegetable-protein farm businesses.

We are not averse to market-based remedies that would generate comparable outcomes.

## Appendix F

SJRECWA 2014 “Whole” Map-Associated Spreadsheet, from CropScape/USDA

| | Category | Acreage |
|---|---|---|
| 1 | Corn | 4941.4 |
| 2 | Cotton | 39317.1 |
| 3 | Rice | 1485.8 |
| 4 | Sorghum | 4.2 |
| 6 | Sunflowers | 1.3 |
| 21 | Barley | 518.8 |
| 22 | Durum Wheat | 166.4 |
| 23 | Spring Wheat | 74.9 |
| 24 | Winter Wheat | 8056.9 |
| 27 | Rye | 0.7 |
| 28 | Oats | 5546.7 |
| 33 | Safflower | 679.4 |
| 36 | Alfalfa | 59927.6 |
| 37 | Other Hay/Non Alfalfa | 9825.6 |
| 42 | Dry Beans | 3.8 |
| 44 | Other Crops | 91.6 |
| 46 | Sweet Potatoes | 4.7 |
| 48 | Watermelons | 52 |
| 49 | Onions | 487.5 |
| 53 | Peas | 9.8 |
| 54 | Tomatoes | 27738.8 |
| 57 | Herbs | 2.7 |
| 58 | Clover/Wildflowers | 30 |
| 61 | Fallow/Idle Cropland | 31988.1 |
| 66 | Cherries | 40 |
| 67 | Peaches | 9.6 |
| 68 | Apples | 0.2 |
| 69 | Grapes | 5457.6 |
| 71 | Other Tree Crops | 1.8 |
| 74 | Pecans | 31.8 |
| 75 | Almonds | 19867.4 |
| 76 | Walnuts | 323.1 |
| 111 | Open Water | 2062.3 |
| 121 | Developed/Open Space | 11822.5 |
| 122 | Developed/Low Intensity | 6396.3 |
| 123 | Developed/Medium Intensity | 5413.5 |
| 124 | Developed/High Intensity | 650.7 |
| 131 | Barren | 3336.8 |

| | | |
|---|---|---|
| 142 | Evergreen Forest | 1.1 |
| 143 | Mixed Forest | 4 |
| 152 | Shrubland | 51.8 |
| 176 | Grass/Pasture | 25413 |
| 190 | Woody Wetlands | 2248.6 |
| 195 | Herbaceous Wetlands | 59066 |
| 204 | Pistachios | 1832.3 |
| 205 | Triticale | 40.7 |
| 207 | Asparagus | 74.5 |
| 208 | Garlic | 5.3 |
| 209 | Cantaloupes | 1386.2 |
| 211 | Olives | 2.2 |
| 213 | Honeydew Melons | 182.1 |
| 217 | Pomegranates | 759.3 |
| 220 | Plums | 78.1 |
| 223 | Apricots | 68.5 |
| 225 | Dbl Crop WinWht/Corn | 4592.7 |
| 226 | Dbl Crop Oats/Corn | 5601.5 |
| 227 | Lettuce | 234.2 |
| 235 | Dbl Crop Barley/Sorghum | 0.7 |
| 236 | Dbl Crop WinWht/Sorghum | 159.7 |

Tulare County 2014 Map-Associated Spreadsheet, from CropScape/USDA

| | Category | Acreage |
|---|---|---|
| 1 | Corn | 19682.4 |
| 2 | Cotton | 17564.7 |
| 3 | Rice | 24 |
| 4 | Sorghum | 2146.6 |
| 21 | Barley | 9227.4 |
| 22 | Durum Wheat | 172.6 |
| 24 | Winter Wheat | 44969.1 |
| 27 | Rye | 4.4 |
| 28 | Oats | 8463.9 |
| 33 | Safflower | 837.3 |

| | | |
|---|---|---|
| 36 | Alfalfa | 80046.5 |
| 37 | Other Hay/Non Alfalfa | 1579.2 |
| 41 | Sugarbeets | 35.6 |
| 42 | Dry Beans | 1.6 |
| 43 | Potatoes | 22.7 |
| 44 | Other Crops | 72.1 |
| 47 | Misc Vegs & Fruits | 309.4 |
| 48 | Watermelons | 5.1 |
| 49 | Onions | 98.7 |
| 53 | Peas | 1409.5 |
| 54 | Tomatoes | 538.4 |
| 58 | Clover/Wildflowers | 0.9 |
| 59 | Sod/Grass Seed | 0.4 |
| 61 | Fallow/Idle Cropland | 88017.6 |
| 66 | Cherries | 1133.3 |
| 67 | Peaches | 1399.8 |
| 68 | Apples | 33.1 |
| 69 | Grapes | 54563 |
| 71 | Other Tree Crops | 2882.5 |
| 72 | Citrus | 4734.3 |
| 74 | Pecans | 849.3 |
| 75 | Almonds | 67789.7 |
| 76 | Walnuts | 55553.7 |
| 77 | Pears | 105.6 |
| 111 | Open Water | 7135.8 |
| 112 | Perennial Ice/Snow | 39.4 |
| 121 | Developed/Open Space | 50481.8 |
| 122 | Developed/Low Intensity | 21656.8 |
| 123 | Developed/Medium Intensity | 27360.8 |
| 124 | Developed/High Intensity | 4627.1 |
| 131 | Barren | 147758.6 |
| 141 | Deciduous Forest | 24278.8 |
| 142 | Evergreen Forest | 869182.6 |
| 143 | Mixed Forest | 1181.8 |
| 152 | Shrubland | 660297.3 |
| 176 | Grass/Pasture | 539347.3 |
| 190 | Woody Wetlands | 2306.7 |
| 195 | Herbaceous Wetlands | 1444.9 |
| 204 | Pistachios | 37101.7 |
| 205 | Triticale | 2390.5 |
| 206 | Carrots | 63.4 |
| 207 | Asparagus | 0.9 |
| 208 | Garlic | 44.9 |

| | | |
|---|---|---|
| 209 | Cantaloupes | 66.7 |
| 211 | Olives | 9909 |
| 212 | Oranges | 111064.6 |
| 214 | Broccoli | 342.9 |
| 216 | Peppers | 1.3 |
| 217 | Pomegranates | 4042.7 |
| 218 | Nectarines | 1631.3 |
| 219 | Greens | 255.1 |
| 220 | Plums | 6684.1 |
| 223 | Apricots | 111.6 |
| 224 | Vetch | 39.1 |
| 225 | Dbl Crop WinWht/Corn | 80952.8 |
| 226 | Dbl Crop Oats/Corn | 298.5 |
| 227 | Lettuce | 0.2 |
| 234 | Dbl Crop Durum Wht/Sorghum | 29.6 |
| 235 | Dbl Crop Barley/Sorghum | 1049.9 |
| 236 | Dbl Crop WinWht/Sorghum | 18270.4 |
| 237 | Dbl Crop Barley/Corn | 661 |
| 238 | Dbl Crop WinWht/Cotton | 40.5 |
| 242 | Blueberries | 286.7 |