

Technical Memorandum

Subject: Economic Review of Central Coast Water Board Ag Order 4.0 and Draft Environmental Impact Report

By: ERA Economics LLC

To: Kahn, Soares & Conway LLP

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Purpose and Background

ERA Economics (ERA) was engaged to review the economic analysis developed for the Central Coast Agricultural Order 4.0 (Ag Order 4.0, or just “Order”) and Draft Environmental Impact Report (DEIR). ERA reviewed the analysis completed by the Central Coast Regional Water Quality Control Board (CCWB) and its consultants. This memorandum summarizes the following components of ERA’s technical review:

1. Comment on the appropriateness and completeness of the economic analysis developed in the Ag Order 4.0 DEIR and associated documents supporting the Order determination
2. Compare the CCWB analysis to the analysis developed for the Central Valley Regional Water Quality Control Board’s (CVWB) 2012 Long-Term Irrigated Lands Regulatory Program and other comparable economic impact analysis
3. Summary scope of work describing the timeline and approach for an appropriate economic impact analysis

The following section summarizes conclusions, deficiencies, and recommendations based on ERA’s initial review of the Ag Order 4.0 documents. Short resumes and bios for each team member are included as an attachment.

Summary of Findings

The economic analysis developed by the CCWB and its consultants is limited and fails to capture important, quantifiable economic and associated impacts of the proposed Order. Agriculture is fundamentally an economic activity that makes use of, and affects, many aspects of the physical environment. Therefore, understanding the environmental impact of the Order requires that its economic effect on agricultural operations play an important role in the analysis. The DEIR analysis, significance determination, and associated findings for the Order did not quantify important economic impacts that can be reasonably quantified. As a result, the analysis was unable to assess potential effects of the economic impacts on the physical environment and could not incorporate these linkages into

significance determinations. The Order increases monitoring and reporting requirements (e.g., Annual Compliance Forms, Total Nitrogen Applied, Riparian Area Management Plans, Irrigation Nutrient Management Plans, etc.), and would impose significant management costs for growers to comply with riparian management areas, pesticide, surface runoff, and net nitrogen targets/limits. The DEIR and Order describe the accounting cost of some example management practices, but do not evaluate how growers, the agricultural industry, and linked economy (socioeconomic impacts) would adjust in response to these substantial regulatory costs. In other words, the DEIR does not prepare any economic analysis.

The DEIR Environmental Setting for the economic analysis section (DEIR Section 3.5) is also inadequate. It does not provide an accurate overview of crop production throughout the Central Coast region or the economic factors that affect planting decisions, land retirement, and jobs, and income opportunities for communities in the region, especially disadvantaged communities. There is no discussion of how implementation of the Order would impact standard rotations and cultural practices in the Central Coast Region, and thus would significantly affect the costs of implementing the Order. The summary of current regulatory costs is based on a review of three studies that are described incorrectly in the DEIR. The reader is left with the impression that that ability to absorb additional regulatory costs depends only on whether those additional costs are less than the net return over operating (or cash) costs for a representative crop. This accounting perspective is misleading and inconsistent with the competitive market for most Central Coast crops (as stated in the studies referenced in the DEIR). This emphasizes the importance of completing an economic impact analysis.

The DEIR determinations of the significance of physical outcomes are not supported by the analysis in the DEIR. The DEIR suggests that costs of implementing the Order are “speculative” or that the DEIR does not need to consider them because the Order does not “mandate” any specific management action. The former is simply not true; there is a well-established literature/method for assessing the effect of regulatory costs and other policy changes on producers and related businesses. The Order states that it does not mandate any specific management action, but by setting limits, targets, and imposing reporting requirements it will create costs that would be imposed on growers. Further, the inclusion of mandatory operational and/or riparian setbacks are arguably requirements that mandate a specific management action. These implementation costs, including costs associated with mandated operational and riparian setbacks, can affect land use, land retirement, and jobs in the Central Coast. However, the existing analysis did not evaluate these factors. Notably, employment and income impacts from these requirements are likely to fall disproportionately on disadvantaged communities.

Summary findings are as follows:

The Draft Environmental Impact Report (DEIR) does not evaluate the economic impact and resulting effects on jobs, land use, and agricultural resources of the Order, and therefore it is not possible to assess whether impacts are likely to be significant.

- There is a clear and well-established link between increasing production costs and changes in agricultural production, crop mix, and land retirement that can be evaluated using standard economic methods. The DEIR fails to include any economic analysis of these effects.
- The DEIR states at various points that the additional management actions that may be required to comply with the Order would not result in environmental impacts (see page 2-35, first paragraph). The DEIR did not provide analysis or any form of evidence to support this conclusion. Based on our experience and our professional opinion, we believe that economic impacts would potentially or likely lead to other significant environmental impacts. The Order includes several implementation costs and requirements that would almost certainly result in changes in the physical environment. For example, meeting the nitrogen discharge limits in the Order would require reducing applied nitrogen and/or incurring additional management costs. This would result in potential changes to yield, quality, and costs that affect the mix (or number) of crops that can be grown in the region and lead to land being idled and permanently removed from production. In another example, implementation of the operational and riparian setbacks will automatically result in land-retirement because commercial crop production is prohibited in such areas. There is a well-established economic literature, including a report commissioned by the CVWB, that documents analysis that can assess this impact.
- Appendix A to Ag Order 4.0 qualitatively describes high-level cost estimates for compliance with various reporting requirements. It is clear that the Order will impose direct implementation costs on Central Coast growers and linked industries. DEIR “Table 3.5-9. Selected Example Management Practice (MP) Implementation Cost” summarizes the range of management costs that a grower may incur, showing that implementation costs could exceed several thousand dollars per acre. Importantly, costs of nitrogen discharge requirements, compliance with surface water discharge limits, riparian setback areas, and other key substantive provisions are *not* estimated.
- The DEIR appears to have developed some of the baseline data required to prepare an economic impact analysis that would inform estimates of changes in agricultural land use, other socioeconomic effects, and their associated potential impacts, but inexplicably stops short of completing that analysis. Instead, the DEIR presents some example accounting costs but does not use those costs to quantify potential economic impacts to growers, linked industries (processing, shipping, etc.), communities and the region as a whole.

The DEIR Economics Chapter (3.5) fails to provide an adequate description of the environmental setting.

- The DEIR summarizes a crop production budget for romaine hearts and states that “*Production/harvest costs vary by commodity and potentially other factors, and thus it is difficult to generalize across the central coast region.*” (p. 3.5-4). Costs for one crop are not sufficient to characterize production costs or returns in the Central Coast region. The UC Cooperative Extension, the source of the romaine hearts budget, also provides production budgets for blackberries, broccoli,

iceberg lettuce, raspberries, spinach, strawberries, apples, and avocados. Other budgets could easily be obtained from other reports and grower interviews.

- As written, the DEIR implies that the static accounting measure of net return over operating or total costs is indicative of the economic response of the industry to changes in production costs. In practice, the industry supply curve, which acknowledges the variability in production practices, governs the aggregate industry response. An economic analysis of how the industry would respond to the requirements of the Order should: (i) account for risk in addition static operating costs, and (ii) evaluate the effect of implementation costs on aggregate industry supply.
- The section summarizing “Costs of Regulatory Compliance for Growers” mischaracterizes the studies that it cites and implies that regulatory costs of 5-10% of cash operating costs are not significant. The report by McCullough et al. (2017) emphasizes the importance of risk and market conditions (supply and demand) as the key economic drivers of how an industry responds to additional regulatory costs. It quantified regulatory costs for San Joaquin Valley growers and included those costs in an economic model that was used to evaluate the potential impacts of new off-road vehicle emission regulations. The DEIR incorrectly implies that a simple profit and loss accounting captures the effect of regulatory costs. This is not adequate. In fact, the McCullough study used the regulatory costs discussed in the EIR to populate a calibrated economic model of Central Valley agriculture plus a linked input-output model to calculate the direct, indirect, and induced regulatory costs. This is exactly the type of approach that the CCWB should complete for its proposed Order determinations and associated DEIR. The DEIR cherry-picked the first component of the study only and omitted all of the subsequent and relevant economic analysis.

Economic impacts felt by agriculture and other businesses reliant on the agricultural sector in this region, are likely to have a disproportionate impact on jobs that are performed by those that reside in economically disadvantaged communities, raising important environmental justice considerations that were not evaluated in the DEIR.

- Impacts of changes in crop mix (i.e., impacts to labor intensive crops) and land retirement or fewer crop rotations per year will be felt by all of agriculture, and likely will be disproportionately felt by farmworkers, packing house, cooler, and processing plant employees. Workers filling positions in packing houses and picking crops often reside in economically disadvantaged communities in the region, or in other regions within driving distance to the Central Coast.
- Quantifying the effect of the proposed regulation on jobs can be done using standard economic models (see summary comments below).

Ag Order 4.0 Appendix A described potential reporting compliance costs (e.g. filing forms and paperwork) but does not consider the more significant costs of meeting receiving water limits, discharge limits, targets, and setback areas.

- These are potentially significant economic costs that are likely to far exceed the costs of management and paperwork.
- Appendix A applies an opportunity cost of management time of \$45 per hour. This value is not supported in Attachment A or the DEIR and seems to be low.

The CVWB developed an economic impact analysis for the Central Valley using a standard approach that was available to the CCWB.

- The CVWB developed an economic impact analysis of alternatives for its 2012 Long Term Irrigated Lands Regulatory Program¹ that was included as an attachment to its EIR and relied upon to develop the waste discharge requirements order that was adopted by the CVWB.
- The components in the CVWB ILRP are different than those proposed for the CCWB's proposed Order, so the magnitude of economic impacts would not be comparable. However, the CVWB clearly shows that there are methods available for quantifying potential economic impacts.
- Example implementation costs were developed for management actions that may or may not apply to the Central Coast. However, these costs were not refined for producers in the Central Coast and incorporated into in a meaningful economic impact analysis.
- The CVWB economic analysis did not evaluate the impacts on forward linked industries. However, it did evaluate the direct economic and indirect and induced effects on backward-linked industries of baseline conditions and five (5) regulatory alternatives.

The DEIR states, in general, that economic effects were not estimated because the market and regulatory environment is complicated and/or because management practices are speculative. In fact, there is a well-established approach to quantify the economic impact of Ag Order 4.0.

- Page 3.5-35 of the DEIR states the following in asserting that impact ECON-1 is less than significant: *“Even assuming that growers may need to take areas of land out of production, along with the potentially increased costs of compliance associated with additional management practice implementation and new or expanded monitoring and reporting requirements from Agricultural Order 4.0, the question of whether these increased costs could impact growers in the central coast region to such a degree as to cause them to go out of business or sell their lands is essentially speculative.”*
- Analyzing economic impacts of increasing regulatory costs does not require knowing what management practice would be adopted by any given grower. If this was the standard, there would never be any economic impact assessment developed. The purpose of an economic impact analysis

¹ The draft version is still available on the SWRCB website here:
https://www.waterboards.ca.gov/centralvalley/board_decisions/tentative_orders/1612/18_kurnosoff/34_kurnosoff_pte_exh_1_4.pdf

is to establish likely impacts, disclose those impacts, and inform development of the regulations based on those impacts. Moreover, besides the economic impact requirements associated with CEQA, the California Water Code mandates that the CCWB consider economics in adoption of the Order. (See Water Code sections 13263 and 13241.)

- The potential costs of compliance are not speculative and have been (partially) defined in Appendix A to the Ag Order 4.0. The analysis needs to be expanded to evaluate the costs of setbacks, nitrogen discharge targets and limits, surface water discharge limits, and receiving water limits. With respect to the nitrogen discharge limits, the analysis should consider whether such limits would make it economically or agronomically infeasible to rotate multiple crops per year. This alone would have substantial economic impacts resulting in a drop in land values and lease rates. Combined with impacts from other provisions, there could be significant impacts to overall economic activity in the region.
- There is a well-established economic approach for analyzing such impacts. An increase in cost affects the supply for agricultural products produced in the Central Coast. This has a resulting effect on the relative profitability of crops, land use decisions, ability to continue farming, and employment and other input purchases. In addition, the economic analysis should evaluate effects on farming risk and competitiveness of the Central Coast industries.
- Simply stated, we disagree with the assertion that the effect of these implementation costs on Central Coast farming operations is speculative. Several economic frameworks are available to evaluate this exact question. In fact, the CVWB applied one such framework. We assembled a (partial) list of over 15 studies (see section “Central Valley Water Board and Other Example Analyses,” below in this memorandum) prepared by the following state agencies:
 - California Department of Food and Agriculture
 - State Water Resources Control Board
 - Central Valley Regional Water Quality Control Board
 - California Department of Water Resources
 - U.S. Bureau of Reclamation
 - U.S. Army Corps of Engineers
 - California Air Resources Board

A standard economic impact analysis approach can be readily developed to address the deficiencies in the Ag Order 4.0 analysis and DEIR.

- In this memorandum, we outline a standard economic impact analysis. The general steps include:

1. Develop the incremental compliance costs for each water quality management action, including hardware/equipment, operations, monitoring and record-keeping, land use change, administration, and all opportunity costs.
2. Assess how those implementation costs would apply to different crop types, rotation systems, regions, and alternatives.
3. Use an agricultural economic model to evaluate how the implementation costs imposed by each alternative would affect agricultural production, returns, and land use (crop mix, acreage, and land retirement). Prepare a geospatial analysis to overlay changes in crop mix and land retirement on Farmland Mapping and Monitoring Program data.
4. Use results from the agricultural economic model to evaluate direct effects on agricultural income, output, and jobs. Link these results to an input-output model, such as IMPLAN, to estimate impacts on the broader regional economy, especially on jobs and income for backward-linked industries. Develop additional analysis to quantify the distribution of impacts (particularly for disadvantaged communities) and consider the impact to economically important forward-linked industries.
5. Use the results of (1) – (4) to evaluate the effects of the proposed Order and assess significance of socioeconomic, agriculture resource, land use, environmental justice, and other associated impacts.

The economic impacts of the Order are likely to result in broader policy implications.

- Regulatory costs affect competitiveness of the California agriculture industry. This can push industries out of the state or to other countries, and with it jobs and income for the state and region.
- Impacts disproportionately fall on disadvantaged or severely disadvantaged communities (DAC/SDAC) because these communities are where people that work the fields, coolers, processing facilities, and equipment often reside.
- Regulatory costs are cumulative. In addition to the Order, the Central Coast is managing implementation of other regulations. For example, implementation of the Sustainable Groundwater Management Act will result in changes in the availability and cost of groundwater in Central Coast subbasins. Wages are increasing due to competition in the labor market (labor scarcity) and changes in overtime and minimum wage requirements under SB 3 and AB 1066. In addition, the study by Hamilton and McCullough (2018) identifies other regulatory compliance costs that are increasing over time. These costs should be appropriately considered in any economic impact analysis of additional regulations specified under the proposed Order.

Review of Central Coast Ag Order 4.0 DEIR and Findings

This section provides a summary of the review of the analysis described in the DEIR. Comments are structured following the outline in the DEIR (focusing on Sections 3.1 and 3.5)

The key elements of the Order include phasing, quantifiable milestones/requirements (targets, limits, time schedules), and monitoring and reporting requirements. Requirements are spatially defined by groundwater and surface water priority areas. The Order significantly expands requirements including:

1. Expanded requirements for irrigation and nutrient management for groundwater, including targets and prescriptive nitrogen discharge limits
2. Expanded requirements for irrigation and nutrient management for surface water, including targets and prescriptive limits
3. Expanded pesticide management for surface water and groundwater, including specified surface water monitoring and threshold limits
4. Expanded riparian habitat management requirements that would require retiring productive farmland and developing setback areas
5. Expanded sediment and erosion management for surface water
6. Increased reporting requirements in surface water and groundwater reporting areas in the form of ACF, RAMPs, TNA, and INMPs.

Each component would impose significant costs on Central Coast growers. Some regulatory components, such as proposed nitrogen discharge limits, may make current rotation systems economically or agronomically infeasible. This would result in substantial economic impacts (e.g., large reductions in land values and lease rates) that were not quantified or discussed in the DEIR. The following subsections summarize ERA's initial review of the DEIR and Order findings.

Sections Eliminated from Further Analysis (Section 3.0.5)

The DEIR does not develop an economic analysis to evaluate how Central Coast agriculture would respond to the costs imposed by the Order, and the associated potential land use and job impacts. As noted in the comments below, regulatory costs to growers affect the market supply of crops, which results in land use change, land retirement (removal from agriculture), and impacts to labor, and the regional economy. We note that socioeconomic impacts would likely fall on lower income sectors of the economy (disadvantaged communities or severely disadvantaged communities). In this case there would be an additional environmental justice impact that should be evaluated (see methods discussed in subsequent sections) and included in the DEIR.

Agricultural Resources (Section 3.1)

The agricultural resources section summarizes potential land retirement or land use change impacts disclosed in the DEIR. The reader is referred to Section 3.5 (economics) for a discussion of how

economics would cause conversion of agricultural lands. However, as noted in the review of Section 3.5 below, the DEIR does not in fact estimate these impacts.

The environmental setting relies primarily on Farmland Mapping and Monitoring Program (FMMP) data to describe general trends in total agricultural lands. The DEIR asserts that a trend analysis using FMMP data shows that prior Ag Orders did not cause conversion of agricultural land in the Central Coast. The DEIR states: “*Additionally, the results of the analysis shown in Figure 3.1-3 suggest that increasing the regulation of irrigated agricultural lands (e.g., from Agricultural Order 1.0 and 2.0) are not causing irrigated farmland to go out of production or be converted to non-agricultural uses.*” (p. 3.1-4). A trend analysis using FMMP data is not sufficient to establish that there is no causal effect of the prior Ag Orders on agricultural land use in the Central Coast. An appropriate method would apply, at minimum, a basic statistical/econometric regression model that isolates the effect of prior Ag Orders from other factors that drive changes in agricultural land in the Central Coast². Moreover, Ag Order 4.0 is dramatically different than previous orders, and thus impacts from previous orders here are not applicable.

The DEIR acknowledges that the Order would result in higher production costs for Central Coast growers, but asserts that these costs, the response by Central Coast agriculture, and associated impacts to agricultural resources are speculative and/or the CCWB does not need to consider these impacts because it does not require a specific management method. Putting aside that arguably there are some provisions that do equate to a specific management method (i.e., setbacks), we respond here to the DEIR’s claim that implementation costs are speculative. Page 3.1-26 of the DEIR states: “*CCWB and its consultants analyzed potential increased costs associated with the proposed Agricultural Order 4.0, as documented in Section 3.5, Economics. As described in Section 3.5, Agricultural Order 4.0 would result in increased costs for growers due to additional requirements relative to Agricultural Order 3.0. The additional costs of management practice implementation are speculative because it is unknown which management practices will be implemented by which growers, as Agricultural Order 4.0 would not prescribe specific methods of compliance.*” As discussed under comments on Section 3.5, below, the Order would increase costs, this would affect agriculture, land use, and socioeconomics in the Central Coast. There are well-established methods available to quantify these impacts. The CVWB has applied such methods in its earlier regulatory processes.

The conclusion that Impact AG-5 (conversion of farmland to other uses) is less than significant is not supported by the analysis in the DEIR. Conversion of farmland to non-agricultural uses (e.g., land

² See, for example, methodological/conceptual discussion in: Michael J. Roberts and Ruben N. Lubowski, Enduring Impacts of Land Retirement Policies: Evidence from the Conservation Reserve Program *Land Economics*, Vol. 83, No. 4 (Nov., 2007), pp. 516-538.

JunJie Wu, Slippage Effects of the Conservation Reserve Program, *American Journal of Agricultural Economics*, Vol. 82, No. 4 (Nov., 2000), pp. 979-992.

retirement) would result in additional socioeconomic impacts that are not disclosed in the DEIR. These impacts would be likely to fall disproportionately on disadvantaged communities in the Central Coast.

Economics (Section 3.5)

Section 3.5 fails to adequately describe the environmental setting in the Central Coast, quantify economic impacts of the Order, show how those impacts would result in physical changes, or discuss other socioeconomic impacts including employment and impacts to disadvantaged communities. As noted in the DEIR (p. 3.5-1): “...*economic effects of a project may be considered to the extent that they may result in adverse physical effects on the environment.*” The DEIR significance criteria related to agriculture include:

1. Increase costs for growers to such a degree that it would cause or result in growers going out of business, such that agricultural lands would be converted to nonagricultural uses; or
2. Disproportionately affect small farms or ranches due to increased implementation, monitoring, or reporting costs, such that these farms would be forced to go out of business, resulting in conversion of agricultural lands to non-agricultural uses.

The DEIR does not develop any economic analysis to evaluate these criteria. They are only addressed in an inadequate and cursory manner. An economic analysis using standard methods that have been applied by state agencies for several decades (see the section below, Central Valley Water Board and Other Analyses) would show the impacts needed to assess the significance of items 1- and -2-.

Environmental Setting (Regional Agricultural Economic Production and Cost of Production for Growers in the Central Coast)

The environmental setting is partially based on old data and fails to convey the important features of Central Coast agriculture that are relevant for assessing the economic impact of the Order.

DEIR Table 3.5-1 summarizes the Central Coast region agriculture industry. The source is a 2009 Agricultural Issues Center (AIC) report developed using 2002 baseline data. This data needs to be updated to current conditions. Cropping patterns and values have changed significantly since 2002 (or 2009 when the study was published). For example, the 2009 fruit and vegetable gross value (not including costs of production) in Monterey, Santa Barbara, and Santa Cruz was \$5,037 million dollars. The 2018 gross value was \$8,348 million dollars, up more than 66% between 2009 to 2018 (Monterey, Santa Barbara, and Santa Cruz Agricultural Commissioners’ 2009 and 2018 crop reports). An updated table would provide a more accurate measure of the current direct and total effect agricultural production has on the Central Coast economy. This data is readily available from USDA, CDFR, and local county agricultural commissioner offices.

The DEIR presents a production budget for a single crop, romaine hearts, to illustrate example production costs and returns in the Central Coast (Table 3.5-3). This is misleading and omits key information that would be relevant for assessing whether impacts of the Order are significant:

1. Romaine hearts are not in any way representative of the diverse mix of crops produced across the Central Coast. Production, cost, market, and economic data are readily available for other Central Coast crops including berries, grapes, other leafy greens, and other vegetables.
2. Summarizing a single production budget for a single crop misses the critical feature of Central Coast agriculture that is relevant for assessing the economic impacts of the Order: multiple (2-3) crops per year are produced in a carefully managed rotations system. Central Coast farmland values, lease rates, and the regional economy are a direct result of highly productive farmland. Several requirements in the Order, including nitrogen discharge limits, could make it impossible to produce multiple crops per year. This alone would cause substantial economic impacts (drop in land values and lease rates, among other impacts).
3. The static accounting measure of net return over operating (or total) costs shown in the UC budget does not indicate how growers would respond to the Order. That is, the static measure of net return over operating costs does not indicate whether the industry (or any individual grower) would stay in business with higher regulatory costs. In practice, the industry supply curve, which encompasses the variability in production practices and costs across many growers, governs the aggregate industry response. An economic analysis that accounts for this factor and grower risk preferences (which are explicitly not included in any UC production budget) is the appropriate way to estimate how the industry would respond to additional regulatory costs.
4. Important assumptions in the UC budget are not described (e.g., information on the ranch such as crop mix and crop rotations, fertilizer, and soil amendments, and yields).

The DEIR fails to provide a useful or relevant overview of agricultural economics in the Central Coast. There is no discussion of markets, competition, risk, or related economic factors that actually drive farming decisions. This is the critical information required for assessing the economic effect of increased regulatory costs on physical changes in the Central Coast.

Environmental Setting (Cost of Regulatory Compliance for Growers)

The summary of regulatory compliance costs in the DEIR relies on three studies. The studies are not accurately represented in the DEIR and other relevant studies are omitted. Importantly, the DEIR again fails to include any discussion of economics (i.e., how agriculture would respond to additional regulatory costs and associated physical changes), focusing instead on misleading accounting measures of regulatory costs or static estimates of net income.

It is important to note all of the regulatory cost studies references in the DEIR are date specific. The Hurley et al. study was published in 2006 but the actual data used in the study was obtained through a 2005 mail survey. The Paggi study was published in 2009 but the data acquisition for the study was done in 2008. The regulatory cost information was obtained from a panel of orange growers in the San Joaquin Valley. The risk analysis was done in early 2009. These studies provide an accounting summary snapshot of example regulatory costs for a sample of farms at that time. In addition, these studies are accounting measures of standard production costs and regulatory costs. Neither study

estimates the economic effect (how the industry would be likely to respond) of increasing regulatory costs on the Central Coast industries.

A more recent regulatory cost study that was not mentioned in the DEIR was by Hamilton and McCullough, “A Decade of Change: A Case Study of Regulatory Compliance Costs in the Produce Industry” (2018). A lettuce producer in the Salinas Valley had been interviewed in 2006 and again in 2017 concerning regulatory costs. Table 1 of that study illustrates changing regulatory costs. Total regulatory costs in 2006 were \$109.19/acre and by 2017 they were \$977.30/acre. Significant changes were: water quality regulatory costs went from \$4.30/acre in 2006 to \$18.57/acre in 2017; food safety regulatory costs went from \$0.68/acre to \$181.48/acre; and air quality costs went from a minimal cost to \$5.26/acre. Selecting accounting studies that were based on 10 – 15-year-old surveys omits important increases in regulatory costs that currently affect Central Coast growers. Two important observations can be made from the Hamilton and McCullough study: (i) costs can change (increase) over time, and (ii) regulatory costs are cumulative over time.

The McCullough et al. study referenced in the DEIR was first published in 2017 based on surveys conducted in late 2015. The DEIR misrepresents the results of that study by implying that a simple profit and loss accounting captures the effect of regulatory costs. In fact, the McCullough study goes beyond a simple accounting of regulatory costs. It used the regulatory costs to populate a calibrated economic model of Central Valley agriculture that was linked to an input-output model (IMPLAN) that evaluated direct, indirect, and induced *economic impacts* (i.e., the central question in this DEIR). That is, the McCullough et al. study illustrates that changes in regulatory costs have *economic impacts that affect the physical environment* (land use change, fallowing, jobs, and regional socioeconomic outcomes).

Environmental Setting (Compliance Costs for Ag Order 3.0)

The section describing the costs of compliance with Ag Order 3.0 is a starting point for assessing the compliance costs of the current Order. However, these implementation costs need to be refined and tailored to Ag Order 4.0. In addition, the Ag Order 4.0 does not include an estimate of the impact of surface water related limits, nitrogen discharge limits, or riparian setback areas.

The cost of regulatory compliance with the Order includes the following general categories:

1. Direct costs of fees, assessments, and paperwork
2. Changing management practices, inputs, rotations, and land use to comply with discharge targets/limits (additional direct costs), and potential loss of commercially marketable yield.
3. Changing land use to comply with riparian and operational setback requirements and developing a RAMP
4. Opportunity costs of management time for compliance paperwork, training, and other administration
5. Opportunity costs of land out of production (e.g., riparian setbacks)

Appendix A to the Order describes example costs for item (1), only. The analysis needs to be extended to consider: (i) more accurate cost estimates for all direct costs, (ii) potential *economic* impacts and associated physical changes caused by those costs, and (iii) an assessment of the significance of those costs or ways reduce impacts. As written, the DEIR and Order do not include key regulatory costs and do not estimate how these costs would affect Central Coast agriculture.

Impact Analysis

The DEIR is essentially a literature review of various accounting measures. No economic impact analysis is developed. As such, the DEIR does not assess how the economic or social effects of the Order would result in physical changes in the Central Coast or other socioeconomic impacts. This would include changes in crop mix, land retirement (fallowing and/or convert to non-agricultural uses), and regional socioeconomic impacts to jobs, income, and the local economy. Job impacts would be most significant in disadvantaged Central Coast communities.

One key deficiency of the DEIR analysis is that it provides examples of some regulatory costs but fails to connect those costs to decisions by Central Coast producers through a standard economic analysis framework. By failing to complete this analysis, the DEIR omits important impacts that, based on our experience with other economic impact analyses, are likely to be significant. As written, it is not possible to assess whether impacts disclosed in the DEIR are in fact significant. Instead, the DEIR provides a summary of largely outdated or irrelevant facts and figures, suggests that the regulatory environment and farming is “complicated,” and states that economic impacts are “speculative.” To the contrary, data, methods, and models exist that are able to evaluate the economic impact of regulatory costs to Central Coast growers and the physical environment.

The central question is whether regulatory costs added to the existing regulatory costs borne by growers increase regulatory costs to such a degree that it would cause or result in significant impacts such as growers going out of business. That question cannot be answered without the kind of analysis we describe above, but we believe it is likely that some agricultural lands would be converted to nonagricultural uses. Due to the potential that growers on the Central Coast would not be able to double-crop, among other challenges due to the complexities associated with compliance, the Order would disproportionately affect small farms or ranches. In turn, this would result in a significant loss of agricultural employment that will disproportionately impact disadvantaged communities. The DEIR has not addressed this important question and therefore, in our opinion, has no basis for dismissing economic impacts, and therefore any associated impacts, as less than significant.

We disagree with the conclusion of less than significant impacts ECON-1 and ECON-2 on the following basis:

- Management practices and potential costs are known, and others that are missing from the DEIR can be established. Therefore, these costs are not speculative and can be estimated.

- A method exists to translate regulatory costs to economic impacts and changes in the physical environment. See the following section for a summary of where and how this has been applied by other agencies, including the CVWB.
- The Order is likely to disproportionately affect small farms/ranches because these smaller operations tend to have less access to capital for new capital investments and a smaller footprint that makes it difficult to spread regulatory costs over more acreage/production.
- The Order is likely to result in employment and income impacts that are likely to fall disproportionately on disadvantaged communities in the Central Coast.
- We note that one of the most obvious omissions is that no real analysis has been done on nitrogen fertilizer applications as the nitrogen discharge targets and ultimately limits into the groundwater are reduced by approximately 90%. This type of change, even spread over a period of years, could have substantial yield, crop mix, crop rotation, and land retirement impacts.

Central Valley Water Board and Other Analyses

The CVWB Irrigated Lands Regulatory Program (ILRP) regulates discharges from irrigated lands throughout the Central Valley. In 2009, as the CVWB was assessing the effectiveness, costs, and impacts of alternatives for its long-term ILRP, it contracted with consultants including engineers, hydrologists, agronomists, and economists (collectively, the evaluation team) to evaluate the economic effects on agricultural production, costs, and associated impacts. The long-term ILRP, which was adopted via a series of orders in 2012 and 2013, instituted a number of additional management practices and expanded the previous surface water program to cover all commercial farms and discharges to surface and groundwater.

The economic analysis was used to assist the CVWB in selecting among five alternatives and to identify both costs to growers and the associated impacts on land use, agricultural production and returns, farming viability, and the regional economy. The alternatives varied with respect to lead responsibility to oversee the program (CVWB or another lead entity), and grower regulatory responsibility (e.g., preparing water quality plans, recordkeeping, changes in surface water monitoring practices, groundwater monitoring).

The analysis looked at all of the management practices and compliance options being considered. For major categories of crops in the Central Valley, the evaluation team estimated the additional compliance costs relative to the baseline condition, then used that information with an economic model of Central Valley agriculture to assess how the incremental costs associated with each alternative would impact agriculture, land use, and the regional economy. The steps in the analysis were:

1. Develop the incremental compliance costs for each water quality management action, including hardware, operations, monitoring and record-keeping, and administration.
2. Assess how those costs would apply to different crop categories, regions, and alternatives.

3. Use a regional agricultural economic model (this study applied a model called CVPM) to evaluate how the costs imposed by each alternative would affect agricultural production, returns, and land use (crop mix and acreage). Prepare a geospatial analysis to overlay changes in crop mix and land retirement on Farmland Mapping and Monitoring Program data.
4. Use results from the agricultural economic model to evaluate direct effects on agricultural income, output, and jobs. Link these results to an input-output model, such as IMPLAN, to estimate impacts on the broader regional economy, especially on jobs and income.
5. Use the results of (1) – (4) to assess significance of socioeconomic, agriculture resource, land use, environmental justice, and other associated impacts.

The CCWB analysis develops a partial assessment of step 1, only. Table 3.5-9³ of the DEIR summarizes some example costs for general management practices that may or may not apply to the Order. The Order determinations (Appendix A) provide cost estimates for compliance (reporting) but do not estimate the cost (or feasibility) of meeting the order’s requirements.

This stepwise approach has been used to evaluate the effects of other federal, state, and local projects or policies. Examples include, but are not limited to the following:⁴:

- 2018 – 2019 Central Valley Project Cost Allocation Study; US Bureau of Reclamation
- 2016 – 2018 Off-Road Vehicle Emission Regulations; California Air Resources Board
- 2016 – 2017 Water Storage Investment Program; Department of Water Resources (DWR)
- 2015 Governor’s Executive Order B-29-15; State Water Resources Control Board
- 2015 CVP M&I Water Shortage Policy; Reclamation
- 2016 Bay Delta Water Quality Control Plan SED; State Water Resources Control Board
- 2014 – 2016 California Drought Impact Studies; California Department of Food and Agriculture
- 2013 – 2015 Bay-Delta Conservation Plan; DWR
- 2012 – 2015 CVP Long-Term Operations; Reclamation
- 2012 CVP Integrated Resources Plan; Reclamation
- 2010 North of the Delta Offstream Storage (Sites Reservoir) Feasibility Study; Reclamation
- 2009 Biological Opinions; DWR/Reclamation
- 2009 California Water Plan Update; DWR
- 2006 – 2007 Environmental Water Account; DWR
- 1998 – 2006 CALFED Bay-Delta Program (EIR and various studies); DWR
- 1997 – 1999 Trinity River Mainstem Fishery Restoration; DWR

³ We did not review and therefore have no opinion on these costs as part of this initial assessment. In general, it is hard to tell from the summary table provided in the DEIR how (if) capital costs were included, which operating costs were included, and if all appropriate opportunity costs were considered (e.g., if land is taken out of production to develop riparian habitat area this would include the loss in the value of the land in addition to the cost of developing that land into different types of habitat).

⁴ The list is not exhaustive and was prepared based on our personal recollections from projects we are familiar with, or directly involved with, over the last couple of decades.

- 1992 – 1996 Central Valley Project Improvement Act; Reclamation

Results of the economic analysis supported policy decisions by the CVWB and provided the needed basis for assessing impacts and significance in the EIR, as well as complying with Water Code section 13263 and 13241 requirements. In contrast, the CCWB has not prepared this type of standard economic assessment.

Ag Order 4.0 Economic Impact Analysis Approach

This section summarizes a technical approach for developing an economic impact analysis of the salient features of the Order, how those economic impacts result in physical changes to the environment, and assess socioeconomic impacts to Central Coast communities. The method applies standard economic analysis approaches that have been peer-reviewed (see example references below) and that have been widely applied to evaluate similar economic questions by other state, federal, and local agencies (see preceding section).

The proposed Order would require a substantial change in the way that several key inputs (e.g., pesticides, fertilizers) to agricultural production are used both in terms of the quantity, timing, and tracking of use. An economic analysis of the impacts requires accounting/engineering cost, agronomic, and economic inputs integrated into a sequential analysis. Contrary to the DEIR, this type of analysis is not speculative and applies standard economic methods.

The key economic impacts would be driven by:

1. Direct costs of fees, assessments, and paperwork.
2. Changing management practices, inputs, rotations, and land use to comply with discharge targets/limits (additional direct costs). This would include the effect of nitrogen discharge limits on the ability to continue multi-cropping (2-3 crops/year) that is prevalent in the Central Coast and directly contributes to current land and lease values in the region. It would also include the effect on growers' ability to meet surface water discharge limits using currently available pesticide chemistries.
3. Changing land use to comply with riparian and operational setback requirements and developing a RAMP.
4. Opportunity cost of management time for compliance paperwork, training, and other administration.
5. Opportunity cost of land out of production (e.g., riparian setbacks).

Measures of economic impact would include:

1. Increases in production costs and lower yields and/or crop quality that would affect farming risk, income, and competitiveness of Central Coast producers.
2. Changes in cropping patterns and intensity that would impact land values and lease rates,

3. Land retirement.
4. The effect of (1) – (3) on crop and input markets (e.g., prices) and any effect of price changes on consumers (i.e., measure of consumer surplus losses).
5. Regional economic impacts including employment and wages, with associated impacts to disadvantaged communities, processing, shipping, and retail industries.

The purpose of the economic analysis is to quantify all regulatory costs caused directly or indirectly by the Order, determine what effect these additional regulatory costs would have on Central Coast agriculture, and quantify related socioeconomic impacts and physical changes. As discussed in the preceding section, the technical approach follows five steps:

1. Develop the incremental compliance costs for each water quality management action, including hardware/equipment, operations, monitoring and record-keeping, and administration. This would include an assessment of the potential effects of the surface water discharge limits, nitrogen discharge limits and riparian/operational setback areas to assess effects on farm operations and capital costs.
 - a. The CCWB has developed initial estimates of some of the compliance costs. These costs would be reviewed with growers and compared with other studies. In particular, the assumption of \$45/hr compliance cost seems low and unjustified. The opportunity cost of management time is typically greater than \$45 per hour. The CVWB economic analysis, completed in 2010, applied a management cost of \$120 per hour. Accounting for general inflation using the GDP-IDP, this is over \$141 per hour in current dollars.
 - b. The CCWB did not develop an estimate of the impact of surface water discharge limits, nitrogen discharge limits or riparian/operational setback areas. In addition, the opportunity cost of land and management time is not factored into other operation and monitoring costs. This phase of the analysis would establish these costs.
2. Assess how regulatory costs would apply to different crop categories, regions, and alternatives.
 - a. Define baseline market conditions, practices, costs, and key areas (e.g., surface water, riparian, and groundwater zones) consistent with the Order's regulations and farming practices in the Central Coast. In addition, clearly define the important features of Central Coast agriculture and update the Environmental Setting sections of the DEIR accordingly.
3. Develop a regional agricultural economic model to evaluate how the costs imposed by each alternative would affect agricultural production, returns, and land use (crop mix and acreage). Prepare a geospatial analysis to overlay changes in crop mix and land retirement on Farmland Mapping and Monitoring Program data.
 - a. A standard model such as the Statewide Agricultural Production Model (SWAP) would be adapted using the information developed under (1) and (2) and calibrated to Central Coast conditions. Regulatory alternatives and baseline (No Project Alternative)

conditions would be defined to accurately estimate the incremental economic impact of the Order.

- b. The economic model would be applied to assess the economic impacts of the Order, including all costs to producers, related industries, and consumers.
 - c. This phase of the analysis would also be used to identify ways to modify the Order to achieve the Order's objectives at a lower economic cost to businesses and individuals in the state.
4. Use results from the agricultural economic model to evaluate direct effects on agricultural income, output, and jobs. Link these results to an input-output model, such as IMPLAN, to estimate impacts on the broader regional economy, especially on jobs and income. Extend the analysis to include a geospatial overlay of disadvantaged communities to quantify additional socioeconomic impacts.
 - a. The input-output model uses the results of phases (1) – (3) to quantify the indirect and induced effects of the Order on Central Coast agriculture and linked industries. The results of this analysis would be combined with the results of (3) to quantify the total (direct, indirect, plus induced) economic impact.
 5. Use the results of (1) – (4) to assess significance of socioeconomic, agriculture resource, land use, environmental justice, and other associated impacts. The DEIR would be revised, all additional impacts would be disclosed, and significance determinations would be based on the results of the economic analysis.

Policy Implications

As written, the provisions in the Order would have substantial effects on Central Coast agriculture. In particular, and as discussed earlier, surface water discharge limits, nitrogen discharge limits and riparian/operational setbacks have the potential to impose significant economic costs on producers by making current rotation systems infeasible. These costs reduce land and lease rates, affect related agricultural businesses, ripple through the regional economy impacting other businesses, and for some crops can ultimately end up affecting food prices for consumers (resulting in consumer surplus losses).

Some important policy implications for the Order include:

- Regulatory costs affect the ability of California producers to compete in an increasingly global market. As a result, industries, jobs, and the resulting economic activity can be pushed out of the state or to other countries. California has experienced this with major industries shifting to Mexico, Arizona, and other Western states because it is more cost effective to produce in these areas. The increasing complexity and cost of the regulatory environment in California has been cited by several studies as an area of growing concern for California producers and a factor that

is likely to have negative impacts on the future competitiveness of the industry.⁵ The cumulative effect of regulatory costs can result in entire industries leaving the state.

- Economic impacts of additional regulations typically fall on disadvantaged or severely disadvantaged communities (SDAC/DAC). Agriculture is a significant share of jobs and income for many Central Coast communities. These communities provide the people that work the fields, factories, and equipment in the Central Coast. Regulations can have the indirect effect of reducing jobs and wages in these communities.
- Regulatory costs are cumulative. Any economic assessment should acknowledge the current regulatory environment and how that is changing so that the incremental cost of additional regulations can be assessed in addition to the cumulative effect on the industry. For example, groundwater subbasins in the Central Coast are currently developing Groundwater Sustainability Plans (GSPs) to meet the requirements of the Sustainable Groundwater Management Act. Projects and policies specified in GSPs are expected to increase farming costs across most subbasins through a combination of fees and assessments on land and water. This affects farm income, risk, competitiveness, and the jobs and long run viability of agricultural industries.

Based on our review of the Order and experience developing economic impact analyses for similar types of regulations, we believe the implementation costs of the Order are likely to cause land retirement, land use change, and direct, indirect, and induced socioeconomic impacts to producers and ancillary businesses in the Central Coast. The Order and DEIR did not prepare an economic impact analysis to quantify these effects. Standard, peer-reviewed economic methods are available, and have been applied by CVWB and other state agencies, to quantify the economic impact of similar regulatory programs and policies. In addition to requirements under Water Code sections 13263 and 13241 and CEQA, an economic analysis would be used to identify alternatives that reduce implementation costs and minimize socioeconomic impacts to communities in the Central Coast.

⁵ For example:

Hurley, Sean. 2005. A Synopsis of the Regulatory Environment Affecting California Specialty Crops. Report prepared for the California Institute for the Study of Specialty Crops.

Johnston, Warren E., and Alex F. McCalla. 2004. Whither California Agriculture: Up, Down, or Out? Some Thoughts about the Future. Giannini Foundation of Agricultural Economics. Special Report.

Noel, Jay E., Mechel Paggi, and Fumiko Yamazaki. 2013. The Impact of California Regulatory Compliance Costs on California Orange Producer Profitability.

McCullough, M., J. Noel, L. Hamilton, R. Howitt, D. MacEwan. 2018. Economic Impacts of Off-Road Mobile Agricultural Equipment Emission Reduction Strategies on the Agricultural Sector in the San Joaquin Valley. Prepared for the California Air Resources Board.

Attachment 1

[see resumes on the following pages]

Stephen Hatchett, Ph.D.

Director, ERA Economics

Bio: Steve is a senior economist and project manager specializing in water resources, agriculture, mathematical modelling, and statistical analysis. He was senior principal economist and project manager in the Sacramento office of CH2M HILL for more than 20 years, from 1987-1998 and 2009-2018, and was principal and owner of Western Resource Economics from 1999 to 2009. Steve has more than 30 years of experience in project evaluation, including financial analysis, benefit-cost analysis, cost allocation, and regional economic impacts. He has assisted federal, state, and local agencies in implementing large programs resulting from new laws, regulations, and court decisions.

Education

Ph.D., Agricultural Economics, University of California at Davis

M. A., Administration, University of California at Riverside

B. S., Forestry, University of California at Berkeley

Selected Projects

Project Manager, Implementation and Rulemaking for the Sustainable Groundwater Management Act, Department of Water Resources, Sacramento, CA; 2015-16. Assisted DWR with developing regulations, including supporting economic analysis and other documents, to implement the Sustainable Groundwater Management Act of 2015.

Task Manager, Economic Impact Analysis of the Proposed Long-term Irrigated Lands Regulatory Program, Central Valley Regional Water Quality Control Board, Sacramento, CA; 2010-2011. As part of a team of experts, assessed the potential direct and indirect costs of alternative water quality management regulations on agricultural producers in the Central Valley of California. Used a regional agricultural production model to evaluate the economic effects of five implementation alternatives on different regions and crops.

Project Manager, Rulemaking Assistance and Quantification of Public Benefits for the Water Storage Investment Program, California Water Commission, Sacramento, CA; 2015-present. Currently working with California Water Commission and DWR staff to develop and implement methods for quantification and management of public benefits. Helped staff prepare regulation text on quantification of benefits. The team assisted the Commission in reviewing the water operations, economic, and financial analysis in applications submitted for State funding. Over \$2.5 billion in funding is expected to be provided for 8 water storage projects.

Economics Task Manager; Efficiency Conservation Program; Imperial Irrigation District; El Centro, CA; 2005-2009. With Davids Engineering, worked with the District Program Manager and staff to develop and implement IID's water conservation program. Responsible for designing and evaluating alternative incentive programs to encourage growers to adopt water-conserving irrigation technologies. Worked with engineers and hydrologists to develop a field-level grower decision model of the District that compared costs and water savings under different conservation program designs.

Economist; Economic Analysis of the 2014 Drought for California Agriculture. California Department of Food and Agriculture and UC Davis; Sacramento, CA; 2014-2015. With ERA Economics, assisted a team of agricultural economists that updated and revised the SWAP agricultural production model to assess economic impacts of the drought on California agriculture. Developed a framework to assess the effect of changing water supply availability and cost on the agricultural economy.

Economic Review of Grant Program Applications, Department of Water Resources, Sacramento, CA; 2001-2017. Assisted the Department in developing guidelines and reviewing ten rounds of grant applications submitted for local funding, including proposals for water conservation, integrated regional water management, flood control, groundwater recharge and storage, and desalination.

Project Manager, Implementation of the Water Conservation Act of 2009, Department of Water Resources, Sacramento, CA; 2010-2013. Worked with DWR management, staff, and stakeholder committees to implement urban and agricultural water use efficiency provisions of the 2009 law. Tasks included developing guidelines for urban agencies to meet the 20-by-2020 water conservation goals; developing standard methodologies to quantify agricultural water use efficiency; preparing regulations and supporting documentation to implement agricultural water measurement; assisting stakeholder technical panels to develop new best management practices for water use and conservation.

Task Manager, Economic Impact Analysis of the Proposed Long-term Irrigated Lands Regulatory Program, Central Valley Regional Water Quality Control Board, Sacramento, CA; 2010-2011. As part of a team of experts, assessed the potential direct and indirect costs of alternative water quality management regulations on agricultural producers in the Central Valley of California. Used a regional agricultural production model and economic impact model to evaluate the effects of five alternatives.

Selected Publications

With D. MacEwan, M. Cayar, A. Taghavi, D. Mitchell, and R. Howitt. Hydroeconomic Modeling of Sustainable Groundwater Management. *Water Resources Research*. Vol: 53, Pages: 2384–2403. 2017.

With Lisa Porta. Coordinated Use of a Regional Groundwater Model and an Agricultural Economic Production Model to Assess Impacts of Water Policy. Presented at the Groundwater Resources Association of California Conference, Sacramento, CA. March 5, 2014.

Economic Modeling of Agricultural Water Use and Production. Presented at the California Water and Environment Modeling Forum, Technical Workshop at Univ. of California, Davis, CA. January, 2014.

With R. Bliesner, J. Eckhardt, and G. Davids. Alternatives for Implementing Efficiency Conservation in the Imperial Irrigation District. Prepared for the Proceedings of the U.S. Committee on Irrigation and Drainage Water Management Conference. Scottsdale, AZ. May 2008.

Calibration Methods for Irrigated Agricultural Models. Presented at the 1998 Annual Meeting of the American Agricultural Economics Association. Salt Lake City, UT. August 2-5, 1998.

Jay Noel, Ph.D.

Senior Principal Economist, ERA Economics

Bio: Jay joined ERA Economics in 2015 and is professor emeritus in the Agribusiness Department at California Polytechnic State University. He has more than 30 years of experience in California agriculture. He previously served as the Director of the California Institute for the Study of Specialty Crops and as the Chief Operating Officer of RGA. Jay's experience includes agriculture and specialty crop policy analysis, agribusiness strategic management, and regulatory impact analysis. He has developed economic analyses of issues ranging from specialty crop transportation to agricultural risk, uncertainty, and regulatory impacts on agricultural profitability.

Education

Ph.D., Agricultural Economics, University of California Davis

M.S., Agricultural Economics, University of California Davis

B.S., Soil and Water Science, University of California Davis

Professional Memberships

American Agricultural Economics Association (AAEA)

Western Agricultural Economics Association

Selected Projects

Processing Tomato Industry Baseline Analysis, California Tomato Growers Association, Sacramento, CA.

2018 - Present. Jay is the technical advisor for an assessment of the processing tomato industry costs, returns, markets, and market potential. The analysis was commissioned by the Association due to significant cost, price, and regulatory pressure faced by the industry. The study includes establishing production cost, regulatory costs, and returns under current and future market conditions. A second phase of the analysis was developed to evaluate domestic and international market trends for tomato products.

Kern Delta Water Allocation Plan Supplemental EIR, Kern Delta Water District, Bakersfield, CA, 2015 –

2017. In support of litigation between the Kern Delta Water District and opponents of the proposed amendments to the Kern Delta Water Allocation Plan, Jay was the technical advisor to the economic impact assessment of changes in surface water supply and groundwater pumping in Kern Delta Water District and areas north of the Kern River.

San Joaquin Valley Agriculture Regulatory Impact Analysis, California Air Resources Board (CARB) Sacramento, CA. 2015-2017.

Jay was the technical advisor for an assessment of the regulatory compliance costs for specialty crops producers under new air emission standards in the San Joaquin Valley. ERA Economics was responsible for developing an integrated modelling framework which CARB can use to assess the economic and fiscal impacts of increased regulatory costs on agricultural enterprises. The study included close coordination with an agricultural advisory group consisting of agribusiness representatives in the San Joaquin Valley.

Kern Delta Water Allocation Plan Supplemental EIR, Kern Delta Water District, Bakersfield, CA, 2015 – 2018. In support of litigation between the Kern Delta Water District and opponents of the proposed amendments to the Kern Delta Water Allocation Plan, Jay was the technical advisor to the economic impact assessment of changes in surface water supply and groundwater pumping in Kern Delta Water District and areas north of the Kern River. Jay led the grower outreach portion of the analysis. He developed farm cost-of-production budgets for major crops produced in the region, interviewed growers to establish local market conditions, and evaluated trends in prices and costs. The farm production budgets were integrated into a regional economic model of agriculture that was used to establish the impact of changes in surface and groundwater availability and cost.

Selected Publications

Noel, Jay E.; Eivis Qenani, *New Age, New Learners, New Skills: What Skills Do Graduates Need to Succeed in the New Economy?* *International Food and Agribusiness Management Review* Vol. 16, Special Edition 3, 2013.

Noel, Jay E.; Eivis Qenani; Thomas Mastin, *A Benefit Transfer Estimation of Agro-Ecosystems Services;* Western Economics Forum, Volume 08, Number 01, Spring 2009.

Paggi, Mechel S; Jay E. Noel; *The U.S. 2008 Farm Bill: Title X and Related Support for the U.S. Specialty Crop Sector* Choices Volume 23, Issue 3, 3rd Quarter 2008.

Thompson, R.P.; J.E. Noel; R. Hanna; D.D. Piirto *"Hedonic Valuation of Forest Attributes on Small Urban-Interface Properties"* Journal of Arboriculture, 25(5) September, 1999.

Noel, Jay E. and Charles V. Moore. "Valuation of Transferable Delivery Rights in Marketing Cooperatives" *Journal of Cooperatives* pg.: 1-17, 1995.

Noel, J.E., and R.E. Howitt. "Conjunctive Multibasin Management: An Optimal Control Approach" *Water Resources Research*, Vol. 18 No.4 August 1982, pg. 753-763.

Noel, J.E., B.D. Gardner and C.V. Moore "Optimal Regional Conjunctive Water Management" *American Journal of Agricultural Economics*, Vol. 52, 1980, pg. 489-498.

Noel, Jay E.; Mechel S. Paggi; Sean Hurley; Fumiko Yamazaki; Michael McCullough; *The Impacts of Changes in Agricultural Transportation Sector on the Competitiveness of the California Specialty Crop Industry* Reports to: California State University Statewide Agricultural Research Initiative; Agricultural Marketing Service. USDA; California Department of Food and Agriculture Specialty Crop Block Grant August, 2012.

Noel, Jay E. *A Cross State Comparison and Analysis of the Impact of Regulatory Policies on the Competitiveness of Selected Specialty Crops: The Cases of California/Arizona Lettuce and California Strawberries*, California State University Statewide Agricultural Research Initiative report April, 2012.

Paggi, M., Fumiko Yamazaki and Jay E. Noel "The Economic Competitiveness of Processed Tomato Production: A Representative Farm Model Approach" California State University, Fresno Center for Agribusiness report June, 2009.

Duncan MacEwan, Ph.D.

Principal Economist, ERA Economics

Bio: Duncan is the managing partner of ERA Economics. He previously worked as a consultant economist with CH2M (now Jacobs) and concurrently held a position as a postdoctoral scholar in Agricultural and Resource Economics at UC Davis. At ERA he manages a portfolio of clients and projects ranging from local economic feasibility studies to regulatory impact analyses, benefit-cost analyses, and litigation support. His primary focus is on issues related to water and agricultural economics, including assessing economic impacts of proposed agricultural regulations and local, state, and federal water resource policies. He works with private clients to value water assets and prepare crop market assessments. Duncan is currently the lead economist on four Groundwater Sustainability Plans in subbasins in the San Joaquin Valley and Sacramento Valley.

Education

Ph.D., Economic Geography, University of California Davis

Fields: Resource Economics, Econometrics, GIS

M.S., Agricultural and Resource Economics, University of California Davis

B.S., Mathematical Economics and Applied Math, California State University Long Beach

Professional Memberships

American Agricultural and Applied Economics Association

Western Agricultural Economics Association

Selected Projects

Crop and Water Risk Assessments. Farm Credit West. California. 2017 - Present. Farm Credit West engaged ERA Economics to develop regional crop market assessments and water risk evaluations. Water risk assessments establish water costs, value, and risk under current and projected future availability of irrigation water supply to agricultural regions in California.

Processing Tomato Industry Baseline Analysis, California Tomato Growers Association, Sacramento, CA. 2018 - Present. Duncan is the project manager for an assessment of the processing tomato industry costs, returns, markets, and market potential. The analysis was commissioned by the Association due to significant cost, price, and regulatory pressure faced by the industry. The study includes establishing production cost, regulatory costs, and returns under current and future market conditions. A second phase of the analysis was developed to evaluate domestic and international market trends for tomato products.

Groundwater Sustainability Plan (GSP) Development, Chowchilla and Madera Subbasins, Madera County, CA, 2017 - Present. Duncan is the lead economist on the Madera and Chowchilla Subbasin GSPs. The GSP consultant team is working with stakeholders to develop a set of projects and management actions that when fully implemented result in a cost-effective sustainable groundwater condition in the subbasin.

Economic and Financial Feasibility of District-wide Pressurized Irrigation, South San Joaquin Irrigation District, Manteca, CA, 2014 – 2016. Worked with Davids Engineering as the lead agricultural economist to evaluate the financial and economic feasibility of alternative pressurized irrigation systems. Economic and financial feasibility was assessed using a series of economic models to establish grower willingness and ability to pay. The findings of the analysis were presented to district staff and at public Board meetings.

Agricultural Impact Analysis of Groundwater Pumping Charges, Santa Clara Valley Water District, San Jose, CA, 2013 – 2014. Developed an economic model of Santa Clara County agriculture to evaluate the fiscal and land use impacts to agriculture from decreasing the Open Space Credit (increasing groundwater charge). Presented findings at public workshops and to the Board; the charge was left unchanged.

Fiscal Impact Analysis of Proposed Pesticide Regulations, Pyrethroids Working Group, Sacramento, CA, 2017 – 2018. Led a multi-part study to quantify the economic value that pyrethroid insecticides provide to California specialty crop farmers. The analysis included a farm budget and market analysis of pest management approaches under current conditions and a complete ban on pyrethroids.

Agricultural Water Use in The Metropolitan Water District Service Area, California Avocado Commission, Irvine, CA, 2013. Developed an analysis of the total agricultural applied water within the Metropolitan Water District service area. Quantified trends in agricultural markets and production within the area and estimated the crop footprint and corresponding applied water.

Economic Contribution of Specialty Crop Agriculture to the Sacramento Region, Sacramento Area Council of Governments, Sacramento, CA, 2015 – 2016. Project manager for a study to assess the total economic value created by specialty crop producers, processors, and distributors in the greater Sacramento area. The analysis quantified the total employment, value-added, and tax contributions from specialty crop businesses generated in the regional economy.

Agricultural Impact Analysis of Groundwater Pumping Charges, Santa Clara Valley Water District, San Jose, CA, 2013 – 2014. Developed an economic model of Santa Clara County agriculture to evaluate the fiscal and land use impacts to agriculture from decreasing the Open Space Credit (increasing the groundwater pumping charge). Presented findings at a series of public workshops and to the Board.

Selected Publications

MacEwan, D., M. Cayar, A. Taghavi, D. Mitchell, S. Hatchett, and R. Howitt, Hydroeconomic modeling of sustainable groundwater management, *Water Resources Research*, 53, (2017).

Richard E. Howitt, Josue Medellin-Azuara, Duncan MacEwan, and Jay R. Lund. (2012). Calibrating Disaggregate Economic Models of Agricultural Production and Water Management. *Environmental Modeling and Software*. 38, 244-258.

MacEwan, D., Richard Howitt, and Josué Medellín-Azuara, Estimating Behavioral Response to Salinity. *Water Economics and Policy* 02, 1650010 (2016)..

Howitt, R.E., Medellin-Azuara, J., MacEwan, D., Lund, J.R. and Sumner, D.A. (2014). Economic Analysis of the 2014 Drought for California Agriculture. Center for Watershed Sciences, University of California, *Prepared for California Department of Agriculture*. Davis, California. 20p.

Richard E. Howitt, Ph.D.

Director, ERA Economics

Bio: Richard is a founding partner of ERA Economics and professor emeritus in the Department of Agricultural and Resource Economics at the University of California Davis. He has more than 40 years of experience in agricultural, resource, and environmental economics and has provided consulting expertise for numerous water and agriculture projects, for litigation and policy analysis. Richard has extensive experience working with federal, state, and local agencies to convey complex economic issues to a broad audience. He is a leading expert on the economics of irrigated agriculture and has published his research in over 130 referred journal articles, as well as 327 additional publications with over 3,500 citations. Richard has earned six national research awards and was made a Fellow of the American Agricultural and Applied Economics Association in 2009.

Education

Ph.D., Agricultural Economics, University of California Davis

M.S., Agricultural Economics, University of California Davis

B.S., Agricultural Economics, Oregon State University

Professional Memberships

American Agricultural Economics Association, Fellow (2009)

Western Agricultural Economics Association

Australian Agricultural & Resource Economics Society

Selected Projects

Economic Impacts of the 2014 and 2015 Drought, California Department of Food and Agriculture, Sacramento, CA, 2014 - 2016. Richard led the economic impact analysis of the 2014 and 2015 drought on California agriculture. The project included a full assessment of drought impacts and extensive public outreach, in coordination with CDFA staff and Secretary Karen Ross.

Agricultural Economic Analysis of the Santa Clara Valley Water District's Open Space Credit, Santa Clara Valley Water District, San Jose, CA, 2013. Assisted in developing an integrated agricultural economic model of Santa Clara County agriculture and groundwater use to evaluate changes in the rates farmers are charged for irrigation groundwater.

Economic Multiplier Analysis of Specialty Crop Agriculture in the Sacramento Area, SACOG, Sacramento, CA, 2015 – 2016. SACOG engaged ERA Economics to develop an assessment of the economic value of specialty crop agriculture in the Sacramento area. Richard was the project technical advisor. ERA developed an economic analysis of specialty crop production, values, employment, and trends in the Sacramento area. The study data and modeling framework were used to quantify the contribution of specialty crop agriculture to jobs, taxes, and regional value. ERA Economics worked with SACOG to assess the economic benefits of its Farm-to-Fork initiatives to encourage business growth in the region.

Economic Impacts of Executive Order B-29-15, State Water Resources Control Board, Sacramento, CA, 2015. Richard was the technical advisor to a team of consultant economists evaluating the economic

impacts of Governor Brown's 2015 Executive Order (EO) mandating urban water conservation targets. The economic analysis quantified the regulatory impact of the EO on California businesses and individuals.

California Agriculture Off-Road Vehicle Emissions Regulatory Impact Analysis, California Air Resources Board Sacramento, CA, 2014 – Present. Technical advisor for developing an integrated modelling framework which ARB can use to assess the economic impacts of increased regulatory costs. The economic decision support framework can assess the fiscal impacts and direct, indirect, and induced socioeconomic impacts of new regulations at the farm, local, and statewide levels. The project involves a series of interviews with growers and agribusiness leaders to collect sensitive financial information and determine the ability to absorb additional regulatory costs.

Agribusiness Acquisition Feasibility Assessment, Confidential Client, Dallas, TX. 2016. Developed a feasibility analysis of a proposed purchase of a grower-packer-shipper operation located on the east-side of the San Joaquin Valley. The study involved reviewing financial records and performing an independent risk assessment that included short and long-term water supply reliability risk for the operation in question, and a financial feasibility assessment. The results of the study were presented to the potential investors, and the investors ultimately decided not to move forward with the acquisition.

Selected Publications

Newman, C, R. Howitt, D. MacEwan, How are western water districts managing groundwater basins?, *California Agriculture*. 72(1):28-37. (2018).

MacEwan, D., M. Cayar, A. Taghavi, D. Mitchell, S. Hatchett, and R. Howitt, Hydroeconomic modeling of sustainable groundwater management, *Water Resour. Res.*, 53, doi:10.1002/2016WR019639. (2017).

MacEwan, D., Richard Howitt, and Josué Medellín-Azuara, Estimating Behavioral Response to Salinity. *Water Economics and Policy* 02, 1650010 (2016).

Forni, Laura G., et al. "Integrating complex economic and hydrologic planning models: An application for drought under climate change analysis." *Water Resources and Economics* 16 (2016): 15-27.

Burnett, K., Howitt, R.E., Roumasset, J., Wada, C. (2015) *Routledge Handbook of Water Economics and Institutions*. Eds. Routledge Handbooks, New York.

Howitt, R.E. (2014) "Are Water Markets Still Emerging in California?" Chapter 7 in "*Water Markets for the 21st Century: What Have We Learned?*" Eds K.W. Easter and Q. Huang. Springer.

Mérel, P. and R.E. Howitt (2014) "Theory and Application of Positive Mathematical Programming in Agriculture and the Environment" *Annual Review of Resource Economics*

Maneta, M and R. E. Howitt. (2014). "Stochastic Calibration and Learning in Non-Stationary Hydro-Economic Models". *Water Resources Research*. 10.1002/2013WR015196

Howitt, R.E. and S. Msangi (2014) "Entropy Estimation of Disaggregate Production Functions: An Application to Northern Mexico" *Entropy* 2014, 16, 1349-1364; doi:10.3390/e16031349