# The Economic Impact on San Joaquin County of Yield Decrement from Reduction in San Joaquin River Quality

Prepared for South Delta Water Agency et al.

By

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**SDWA-6**

# I. Introduction

This study provides a partial estimate of the economic impact of degraded water quality in the San Joaquin River. Building upon a previous study[1] by G.T. Orlob, this study analyzes the estimated crop decrement of six crop types in the South Delta resulting from increases in salinity of the San Joaquin River. The six crop types include: beans, corn, alfalfa, tomatoes, fruit and nuts and grapes. The estimated value of the lost crops is subsequently analyzed using an input-output model to estimate the overall economic impact from the loss of yields due to water degradation.

The study is an attempt to quantify the economic impact of higher salinity water flows in the San Joaquin River, the estimates presented herein must be interpreted with care. Some caveats regarding the results of this study:

- Additional crop types may also be affected by increased salinity but are not included in this analysis.
- Assumptions are necessarily made regarding soil conditions and distribution in the study area and the crops planted under each type of soil conditions that will differ from actual planting behavior and may somewhat distort the final estimates.
- It is unknown what the exact salinity of irrigation water will be at different points downstream of Vernalis. This study assumes for tractability, that a single salinity level prevails at all points downstream over the region of examined.

[1] Impact of San Joaquin River Quality on Crop Values in the South Delta

- Although we know that water qualities in the Central Delta will be better than those in the South Delta, salt impacts occur in that area at lower levels. For purposes of this analysis, I concluded that treating the whole study area the same was appropriate as indicating what results from incremental increases in salinity.

While all of these factors affect, to varying degrees, the precision of the estimates in this study, they do not change the qualitative or sign of the impacts nor do they have a great influence on the magnitude of the changes arising from increased salinity in the San Joaquin River.

## II. Yield Decrement Due to Increased Salinity

This study does not involve primary research into the effects of salinity changes on crop yields nor does it investigate the ability of various soil types to leach properly. Instead it builds upon the research into the relationship between soil types, leaching and yield decrements conducted in the report by Dr. Orlob and referenced in section I.

Dr. Orlob's study investigates the relationship between the permeability of the soils in the South Delta and the leaching characteristics of these soils. Dr. Orlob details the percent of soil groups in the South Delta by permeability. The overwhelming share of soil groups fall in the slow to moderate permeability classification (91%).

Leaching characteristics were derived from the 1976 South Delta Salinity Status Study (as referenced in the Orlob study ) using observed $EC_e$s and applied water $EC_w$s for 51 sites at 10 different locations. Leaching fractions (LF) were calculated for both spring and fall $EC_e$

profiles at all sites (102 determinations) using the following relation:

$$LF = \frac{EC_w}{2(EC_e)_d}$$

$$LF = Leaching\ Fraction$$
$$EC_W = electrical\ conductivity\ of\ applied\ water, mmhos/cm\ (dS/m)$$
$$(EC_e)_d = electrical\ conductivity\ of\ soil\ solution\ extract\ at\ drainage\ horizon$$
$$(assumed\ to\ be\ the\ maximum\ in\ the\ EC_e\ profiles)\ mmhos/cm\ (dS/m)$$

Mean leaching fractions $(\overline{LF})$ and standard deviations $(\sigma)$ were determined for each location. It was found that there was a large range for the standard deviation ranging from 25 to 65 percent of mean leaching fraction. Dr. Orlob adopted an average standard deviation equal to $(\overline{LF}/3)$ as representative of in-field variation in leaching during the growing season.

Soil permeabilities and leaching fractions were related to one another by identifying specific locations from the Salinity Study (as referenced in the Orlob study) with permeability groups from a Soil Permeability Map (as referenced in the Orlob study). A consistent direct relationship between permeability and leaching fractions emerged with some variability that Dr. Orlob attributed to in-field variation.

From subsequent calculations he classifies soils in the South Delta into three groups; A, B, and C with mean leaching fractions equal to 0.053, 0.093 and 0.188 and standard deviations of 0.0177, 0.0310, and 0.0627 respectively. These parameters of the probability density function for LF are used in subsequent calculation of yield decrement by soil type and water quality that are subsequently calculated by Dr. Orlob.

The relationship between yield decrement, leaching fraction and applied water quality are given by the following equation (equation 2 in Orlob's study):

$$\Delta Y = S(EC_w\{\frac{1+LF}{5LF}\} - B)$$

$$\begin{aligned}
&Where:\\
&\Delta Y = \ yield\ decrement,\ percent\\
&S = unit\ decrement,\ percent / mmho / cm\\
&B = threshold\ EC_e, mmhos / cm.
\end{aligned}$$

Values of S and B for various crops are taken from FAO Irrigation and Drainage Paper 29 (as referenced in the Orlob study) and supplemented by the Water Quality Advisory Panel for the South Delta Salinity Status Study (as referenced in the Orlob study).

Since the LF can vary over a given field, the yield decrement is determined by combining the above relationship with the probability density function for LF (assumed to be normal by Dr. Orlob) and integrating over a range from 0 to $LF_c$, a fraction above which there is no decrement in yield. The new equation for yield decrement thus becomes (equation 3 in Orlob's study):

$$\Delta Y = \int_0^{LF_c} S \left[ EC_w \left\{ \frac{1+LF}{5LF} \right\} - B \right] \frac{1}{\sigma\sqrt{2\pi}} \left( \frac{1}{2} \frac{(LF - \overline{LF})}{\sigma^2} \right) dLF \, .$$

The yield decrement-water quality relationship for a given soil group is obtained by integrating over the range of $EC_w$ that is of interest. For the South Delta he uses a range of 0.7 to 1.3 mmhos/cm. The characteristics of the soil are summarized by mean leaching fraction $(\overline{LF})$ and standard deviation $(\sigma)$ and the susceptibility of the crop is parameterized by S and B. Orlob provides representative yield decrement-water quality relationships for the six crops and three soil types in Table 2 of his report. The yield decrements are summarized provided for three values of $EC_w$: 0.4, 0.7 and 1.0 dS/m. Since historically 0.7 has been maintained at Vernalis we use this salinity level as the baseline for this study.

Using Orlob's yield decrement table we examine crop decrement for increases of salinity levels equal to 0.8, 0.9 and 1.0 dS/m. This is accomplished by interpolating the crop decrement from salinity levels between the baseline 0.7 dS/m and 1.0 dS/m for increments of 0.1 dS/m. Results are displayed in Table A.

Table A; Yield Decrement (Percent), By Soil Group and Salinity Levels

**Soil Group A**
**LF = 0.053, sigma = 0.0177**

| ECw | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| 0.7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.8 | 8.67 | 5.33 | 3.33 | 4.33 | 9.00 | 4.33 |
| 0.9 | 17.33 | 10.67 | 6.67 | 8.67 | 18.00 | 8.67 |
| 1.0 | 26.00 | 16.00 | 10.00 | 13.00 | 27.00 | 13.00 |

**Soil Group B**
**LF = 0.093, sigma = 0.0310**

| ECw | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| 0.7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.8 | 5.00 | 2.67 | 1.33 | 0.67 | 4.67 | 2.67 |
| 0.9 | 10.00 | 5.33 | 2.67 | 1.33 | 9.33 | 5.33 |
| 1.0 | 15.00 | 8.00 | 4.00 | 2.00 | 14.00 | 8.00 |

**Soil Group C**

| **LF = 0.188, sigma = 0.0627** | **Beans** | **Corn** | **Alfalfa** | **Tomatoes** | **Fruit & Nuts** | **Grapes** |
|---|---|---|---|---|---|---|
| ECw | | | | | | |
| 0.7 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.8 | 2.00 | 0.33 | 0.33 | 0.33 | 0.67 | 0.67 |
| 0.9 | 4.00 | 0.67 | 0.67 | 0.67 | 1.33 | 1.33 |
| 1.0 | 6.00 | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 |

Table A is read as follows. If the salinity level remains at 0.7, the current baseline, no additional yield decrement would occur. As salinity is increased, yield decrements increase for all crops. The decline is more pronounced for soil group A, less pronounced for soil group C.

In order to know precisely what the yield decrement would be for each crop requires knowledge of the soil type(s) in which each crop is planted. Since this data was not available a simplifying assumption that each crops acreage is planted uniformly and in the same proportion as the three types of soil in the South Delta.

Commodities and farmed acreages were extracted from the 2004 San Joaquin County Agricultural Commissioner's Office Pesticide Permitting Program Database and commodity valuation was obtained from the San Joaquin County 2004 Annual Crop Report, which is being offered as evidence in this proceeding. Using these data and distributing each crop over the three soil types as described above, yields the following distribution of the total value of the six crop yields by soil type.

Table B; South Delta Crop Value by Soil Grouping (Dollars)

| | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| Soil Group A | $3,916,938 | $14,764,135 | $17,271,999 | $29,897,231 | $17,155,066 | $2,601,210 |
| Soil Group B | $3,329,397 | $12,549,515 | $14,681,199 | $25,412,646 | $14,581,806 | $2,211,029 |
| Soil Group C | $2,546,010 | $9,596,688 | $11,226,799 | $19,433,200 | $11,150,793 | $1,690,787 |

Multiplying the yield decrements derived from the Orlob Study (Table A) with the value of crops planted in each soil group (Table B) for each of the salinity levels yields the estimated value of lost yields for each crop, soil type and salinity level. These estimates are detailed in Table C and aggregated over soil type in Table D.

Table C; Dollar Value of Estimated Loss in Crop Yields by Soil Group and Salinity

**Soil Group A**

| ECw | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| 0.7 | $0 | $0 | $0 | $0 | $0 | $0 |
| 0.8 | $339,468 | $787,421 | $575,733 | $1,295,547 | $1,543,956 | $112,719 |
| 0.9 | $678,936 | $1,574,841 | $1,151,467 | $2,591,093 | $3,087,912 | $225,438 |
| 1.0 | $1,018,404 | $2,362,262 | $1,727,200 | $3,886,640 | $4,631,868 | $338,157 |

| Soil Group B | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| ECw | | | | | | |
| 0.7 | $0 | $0 | $0 | $0 | $0 | $0 |
| 0.8 | $166,470 | $334,654 | $195,749 | $169,418 | $680,484 | $58,961 |
| 0.9 | $332,940 | $669,307 | $391,499 | $338,835 | $1,360,969 | $117,922 |
| 1.0 | $499,410 | $1,003,961 | $587,248 | $508,253 | $2,041,453 | $176,882 |

| Soil Group C | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| ECw | | | | | | |
| 0.7 | $0 | $0 | $0 | $0 | $0 | $0 |
| 0.8 | $50,920 | $31,989 | $37,423 | $64,777 | $74,339 | $11,272 |
| 0.9 | $101,840 | $63,978 | $74,845 | $129,555 | $148,677 | $22,544 |
| 1.0 | $152,761 | $95,967 | $112,268 | $194,332 | $223,016 | $33,816 |

Table D; Dollar Value of Estimated Crop Loss by Salinity Level

| | Beans | Corn | Alfalfa | Tomatoes | Fruit & Nuts | Grapes |
|---|---|---|---|---|---|---|
| **Ecw** | | | | | | |
| **0.8** | **$556,858** | **$1,154,063** | **$808,905** | **$1,529,742** | **$2,298,779** | **$182,952** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **0.9** | **$1,011,876** | **$2,244,149** | **$1,542,965** | **$2,929,929** | **$4,448,880** | **$343,360** |
| **1.0** | **$1,670,574** | **$3,462,190** | **$2,426,716** | **$4,589,225** | **$6,896,337** | **$548,855** |

The impact on crop revenue stemming from increases in salinity of the water in the San Joaquin River is significant. These numbers are sobering; however it does not reflect the total economic impact of this reduction in crop yield on San Joaquin County.

## III. The Economic Impact of a Reduction in Crop Yield

When economic activity is reduced (or increased) in one sector of the economy the repercussion of this decrease is not contained to the sector of origin. Because of interdependencies inherent in a region's economy, the change in activity in the original sector is propagated throughout the rest of the region's economy, contracting output (spending) in other sectors. In order to capture these effects, models that reflect this interdependency should be used to assess the total impact of the change in agricultural output caused by increased salinity in the San Joaquin River.

Input-Output models are commonly used to conduct economic impact analysis as they model the interdependencies between sectors of the economy. Input-Output models statistically quantify the relationship between businesses and between consumers and businesses. Once the structure of the economy of a region has been developed, economic activity in one sector of the economy can be traced as it is propagated throughout the rest of the economy. Thus, when activity changes in one sector the subsequent changes on the rest of the economy can be estimated.

The total economic impact of a change in economic activity in one (or more) sector(s) is comprised of three different effects. The direct effect, which is the change in originating sector(s) that starts the process, and in this case it is the reduction of output in the agricultural sectors caused by increased salinity. The secondary impact of this spending arises from inter-industry purchases triggered by the direct expenditures and is know as the indirect effect. The tertiary impact stems from the spending of employees in the affected primary and secondary industries. These consumer expenditures comprise the induced effect.

A commonly used metaphor for the different types of impacts is a stone tossed into a pond. The stone symbolizes the event or activity whose impact is being measured and the pond represents the economy of the region being analyzed. The initial splash, as the stone hits the pond, is analogous to the direct effect, while the waves and ripples that emanate out from that splash represent the indirect and induced effects on the economy.

In terms of the above metaphor the stone in this case is the reduction crop yields and the pond through which this is propagated is the economy of San Joaquin County (The Stockton-Lodi MSA).

# IV. Economic Impact Results

In order to measure the economic impact we use one of three commonly employed input-output models. The results are generated using a version of the IMPLAN model which is widely used and was originally developed by the U.S. Department of

Agriculture.  The results are presented in tables 1 through 9 below.  The economic impact is estimated for each of the three salinity levels; 0.8, 0.9, and 1.0.   Fore each salinity level three tables of results are presented depicting the economic impact of estimated crop decrements on economic output by industrial sector measured in 2005 dollars, on employment by industrial sector, and on tax revenues accruing to Federal, State/Local governments by revenue type and measured in 2005 dollars.

The economic impacts on San Joaquin County, like the yield decrements themselves, increase with the projected levels of salinity.   The individual crop losses at each level of salinity may not seem as significant when examined individually.  However, when the losses are pooled together and allowed to ripple throughout the region the numbers quickly become more noteworthy.

Examining the results of the impact study for the crop decrement caused by allowing salinity levels to rise to 1.0 dS/m can be found in tables 7, 8 and 9 demonstrates that significant damage is inflicted on the San Joaquin economy by this reduction in water quality.  Loss of output in the economy reaches nearly 32 million dollars and 386 jobs are lost in the county.  As a result of all this lost economic activity the tax revenues accruing to state and local governments decline by 1.4 million dollars.

In summary, the true economic impact of reduced salinity levels in the San Joaquin River cannot just be gauged by looking at the value of crop decrement resulting from higher salinity in irrigation water.  While the estimates of the dollar loss of individual crop yields in the South Delta are not small, especially to the farmers who lose this revenue, the full impact of these losses is much higher than these crop by crop figures alone.  When the total value of lost crops is aggregated and a full economic impact study conducted, the potential damage inflicted by a reduction in river quality become readily apparent.

**Water Quality $EC_W$ = 0.8 MMHOS/CM**

Employment Impact

Table 1

| Industry | Direct | Indirect | Induced | **Total** |
|---|---|---|---|---|
| Ag, Forestry, Fish & Hunting | (75.1) | (21.5) | (0.2) | (96.7) |
| Mining | 0.0 | (0.0) | (0.0) | (0.0) |
| Utilities | 0.0 | (0.2) | (0.1) | (0.2) |
| Construction | 0.0 | (0.4) | (0.1) | (0.5) |
| Manufacturing | 0.0 | (1.7) | (0.5) | (2.2) |
| Wholesale Trade | 0.0 | (1.7) | (0.5) | (2.2) |
| Transportation & Warehousing | 0.0 | (1.5) | (0.6) | (2.1) |
| Retail Trade | 0.0 | (0.3) | (3.7) | (4.1) |
| Information | 0.0 | (0.1) | (0.3) | (0.4) |
| Finance & Insurance | 0.0 | (1.1) | (1.2) | (2.3) |
| Real Estate & Rental | 0.0 | (2.7) | (0.8) | (3.5) |
| Professional Scientific & Tech Services | 0.0 | (0.9) | (0.7) | (1.6) |
| Management of Companies | 0.0 | (0.1) | (0.2) | (0.3) |
| Administrative & Waste Services | 0.0 | (0.8) | (0.9) | (1.7) |
| Educational Services | 0.0 | (0.0) | (0.5) | (0.5) |
| Health & Social Services | 0.0 | (0.0) | (3.8) | (3.8) |
| Arts- Entertainment & Recreation | 0.0 | (0.1) | (0.6) | (0.7) |
| Accommodation & Food Services | 0.0 | (0.2) | (2.6) | (2.7) |
| Other Services | 0.0 | (0.9) | (1.9) | (2.7) |
| Government & Non NAICs | 0.0 | (0.2) | (0.2) | (0.4) |
| **Total** | (75.1) | (34.3) | (19.4) | (128.7) |

## Water Quality $EC_W$ = 0.8 MMHOS/CM

Table 2

Output Impact

| Industry | Direct | Indirect | Induced | **Total** |
|---|---|---|---|---|
| Ag, Forestry, Fish & Hunting | (6,837,314) | (807,905) | (19,886) | (7,665,105) |
| Mining | 0 | (6,476) | (1,758) | (8,235) |
| Utilities | 0 | (56,477) | (28,268) | (84,746) |
| Construction | 0 | (36,404) | (12,889) | (49,293) |
| Manufacturing | 0 | (258,091) | (97,680) | (355,771) |
| Wholesale Trade | 0 | (217,092) | (69,320) | (286,412) |
| Transportation & Warehousing | 0 | (149,173) | (51,809) | (200,983) |
| Retail trade | 0 | (18,242) | (216,251) | (234,493) |
| Information | 0 | (27,239) | (54,907) | (82,146) |
| Finance & Insurance | 0 | (166,688) | (175,565) | (342,253) |
| Real Estate & Rental | 0 | (375,451) | (103,826) | (479,277) |
| Professional- Scientific & Tech Services | 0 | (62,496) | (57,014) | (119,510) |
| Management of Companies | 0 | (10,256) | (15,451) | (25,707) |
| Administrative & Waste Services | 0 | (43,145) | (42,640) | (85,786) |
| Educational Services | 0 | (1,478) | (22,836) | (24,315) |
| Health & Social Services | 0 | (14) | (307,287) | (307,301) |
| Arts- Entertainment & Recreation | 0 | (3,992) | (19,892) | (23,884) |
| Accommodation & Food Services | 0 | (9,537) | (115,884) | (125,421) |
| Other Services | 0 | (93,778) | (123,701) | (217,479) |
| Government & Non NAICs | 0 | (34,066) | (245,475) | (279,540) |
| **Total** | (6,837,314) | (2,378,000) | (1,782,341) | (10,997,655) |

Table 3

**Water Quality $EC_W$ = 0.8 MMHOS/CM**
Tax Impact

| | Employee Compensation | Proprietary Income | Household Expenditures | Enterprises (Corporations) | Indirect Business Tax | Total |
|---|---|---|---|---|---|---|
| Corporate Profits Tax | | | | (136,314) | | (136,314) |
| Indirect Bus Tax: Custom Duty | | | | | (7,429) | (7,429) |
| Indirect Bus Tax: Excise Taxes | | | | | (23,911) | (23,911) |
| Indirect Bus Tax: Fed Non-Taxes | | | | | (8,439) | (8,439) |
| Personal Tax: Estate and Gift Tax | | | | | | 0 |
| Personal Tax: Income Tax | | | (372,727) | | | (372,727) |
| Personal Tax: Non-Taxes (Fines- Fees) | | | (3,147) | | | (3,147) |
| Social Ins Tax- Employee Contribution | (126,575) | (28,780) | | | | (155,355) |
| Social Ins Tax- Employer Contribution | (131,075) | | | | | (131,075) |
| **Federal Government Non-Defense Total** | (257,650) | (28,780) | (375,874) | (136,314) | (39,780) | (838,399) |
| Corporate Profits Tax | | | | (33,315) | | (33,315) |
| Dividends | | | | (396) | | (396) |
| Indirect Bus Tax: Motor Vehicle License | | | | | (2,005) | (2,005) |
| Indirect Bus Tax: Other Taxes | | | | | (16,321) | (16,321) |
| Indirect Bus Tax: Property Tax | | | | | (102,048) | (102,048) |
| Indirect Bus Tax: S/L Non-Taxes | | | | | (18,147) | (18,147) |
| Indirect Bus Tax: Sales Tax | | | | | (150,744) | (150,744) |
| Indirect Bus Tax: Severance Tax | | | | | (77) | (77) |
| Personal Tax: Estate and Gift Tax | | | | | | 0 |
| Personal Tax: Income Tax | | | (107,987) | | | (107,987) |
| Personal Tax: Motor Vehicle License | | | (3,378) | | | (3,378) |
| Personal Tax: Non-Taxes (Fines- Fees) | | | (28,401) | | | (28,401) |
| Personal Tax: Other Tax (Fish/Hunt) | | | (509) | | | (509) |
| Personal Tax: Property Taxes | | | (1,421) | | | (1,421) |
| Social Ins Tax- Employee Contribution | (1,558) | | | | | (1,558) |
| Social Ins Tax- Employer Contribution | (5,608) | | | | | (5,608) |
| **State/Local Govt. Non-Education Total** | (7,166) | 0 | (141,696) | (33,710) | (289,342) | (471,915) |
| **Total** | (264,816) | (28,780) | (517,570) | (170,025) | (329,122) | (1,310,313) |

**Water Quality $EC_W$ = 0.9 MMHOS/CM**

Employment Impact

Table 4

| Industry | Direct | Indirect | Induced | **Total** |
|---|---|---|---|---|
| Ag, Forestry, Fish & Hunting | (144.0) | (41.2) | (0.4) | (185.6) |
| Mining | 0.0 | (0.1) | (0.0) | (0.1) |
| Utilities | 0.0 | (0.3) | (0.1) | (0.4) |
| Construction | 0.0 | (0.7) | (0.2) | (0.9) |
| Manufacturing | 0.0 | (3.3) | (0.9) | (4.2) |
| Wholesale Trade | 0.0 | (3.2) | (1.0) | (4.2) |
| Transportation & Warehousing | 0.0 | (2.8) | (1.2) | (4.0) |
| Retail Trade | 0.0 | (0.6) | (7.2) | (7.8) |
| Information | 0.0 | (0.3) | (0.5) | (0.8) |
| Finance & Insurance | 0.0 | (2.1) | (2.3) | (4.4) |
| Real Estate & Rental | 0.0 | (5.1) | (1.6) | (6.7) |
| Professional Scientific & Tech Services | 0.0 | (1.7) | (1.4) | (3.1) |
| Management of Companies | 0.0 | (0.2) | (0.3) | (0.5) |
| Administrative & Waste Services | 0.0 | (1.5) | (1.8) | (3.3) |
| Educational Services | 0.0 | (0.1) | (0.9) | (1.0) |
| Health & Social Services | 0.0 | (0.0) | (7.3) | (7.3) |
| Arts- Entertainment & Recreation | 0.0 | (0.2) | (1.2) | (1.4) |
| Accommodation & Food Services | 0.0 | (0.3) | (4.9) | (5.2) |
| Other Services | 0.0 | (1.6) | (3.6) | (5.2) |
| Government & Non NAICs | 0.0 | (0.4) | (0.3) | (0.7) |
| **Total** | (144.0) | (65.7) | (37.2) | (246.9) |

**Water Quality $EC_W$ = 0.9 MMHOS/CM**

Table 5

Output Impact

| Industry | Direct | Indirect | Induced | **Total** |
|---|---|---|---|---|
| Ag, Forestry, Fish & Hunting | (13,107,820) | (1,549,612) | (38,164) | (14,695,596) |
| Mining | 0 | (12,405) | (3,374) | (15,780) |
| Utilities | 0 | (108,219) | (54,251) | (162,471) |
| Construction | 0 | (69,760) | (24,736) | (94,496) |
| Manufacturing | 0 | (494,596) | (187,463) | (682,058) |
| Wholesale Trade | 0 | (415,670) | (133,036) | (548,706) |
| Transportation & Warehousing | 0 | (285,611) | (99,430) | (385,041) |
| Retail trade | 0 | (34,955) | (415,018) | (449,972) |
| Information | 0 | (52,198) | (105,374) | (157,572) |
| Finance & Insurance | 0 | (319,823) | (336,935) | (656,758) |
| Real Estate & Rental | 0 | (719,179) | (199,258) | (918,437) |
| Professional- Scientific & Tech Services | 0 | (119,837) | (109,419) | (229,256) |
| Management of Companies | 0 | (19,646) | (29,652) | (49,298) |
| Administrative & Waste Services | 0 | (82,659) | (81,833) | (164,493) |
| Educational Services | 0 | (2,832) | (43,826) | (46,658) |
| Health & Social Services | 0 | (28) | (589,729) | (589,757) |
| Arts- Entertainment & Recreation | 0 | (7,657) | (38,176) | (45,833) |
| Accommodation & Food Services | 0 | (18,279) | (222,400) | (240,678) |
| Other Services | 0 | (179,731) | (237,401) | (417,132) |
| Government & Non NAICs | 0 | (65,271) | (471,102) | (536,374) |
| **Total** | (13,107,820) | (4,557,968) | (3,420,578) | (21,086,366) |

Table 6

# Water Quality $EC_W$ = 0.9 MMHOS/CM

## Tax Impact

| | Employee Compensation | Proprietary Income | Household Expenditures | Enterprises (Corporations) | Indirect Business Tax | Total |
|---|---|---|---|---|---|---|
| Corporate Profits Tax | | | | (261,141) | | (261,141) |
| Indirect Bus Tax: Custom Duty | | | | | (14,255) | (14,255) |
| Indirect Bus Tax: Excise Taxes | | | | | (45,878) | (45,878) |
| Indirect Bus Tax: Fed Non-Taxes | | | | | (16,192) | (16,192) |
| Personal Tax: Estate and Gift Tax | | | | | | 0 |
| Personal Tax: Income Tax | | | (715,318) | | | (715,318) |
| Personal Tax: Non-Taxes (Fines- Fees) | | | (6,041) | | | (6,041) |
| Social Ins Tax- Employee Contribution | (242,929) | (55,223) | | | | (298,152) |
| Social Ins Tax- Employer Contribution | (251,566) | | | | | (251,566) |
| **Federal Government Non-Defense Total** | (494,495) | (55,223) | (721,358) | (261,141) | (76,324) | (1,608,542) |
| Corporate Profits Tax | | | | (63,822) | | (63,822) |
| Dividends | | | | (758) | | (758) |
| Indirect Bus Tax: Motor Vehicle License | | | | | (3,847) | (3,847) |
| Indirect Bus Tax: Other Taxes | | | | | (31,315) | (31,315) |
| Indirect Bus Tax: Property Tax | | | | | (195,798) | (195,798) |
| Indirect Bus Tax: S/L Non-Taxes | | | | | (34,818) | (34,818) |
| Indirect Bus Tax: Sales Tax | | | | | (289,230) | (289,230) |
| Indirect Bus Tax: Severance Tax | | | | | (148) | (148) |
| Personal Tax: Estate and Gift Tax | | | | | | 0 |
| Personal Tax: Income Tax | | | (207,244) | | | (207,244) |
| Personal Tax: Motor Vehicle License | | | (6,483) | | | (6,483) |
| Personal Tax: Non-Taxes (Fines- Fees) | | | (54,505) | | | (54,505) |
| Personal Tax: Other Tax (Fish/Hunt) | | | (977) | | | (977) |
| Personal Tax: Property Taxes | | | (2,727) | | | (2,727) |
| Social Ins Tax- Employee Contribution | (2,990) | | | | | (2,990) |
| Social Ins Tax- Employer Contribution | (10,764) | | | | | (10,764) |
| **State/Local Govt. Non-Education Total** | (13,754) | 0 | (271,935) | (64,580) | (555,155) | (905,424) |
| **Total** | (508,249) | (55,223) | (993,293) | (325,721) | (631,479) | (2,513,965) |

**Water Quality $EC_W$ = 1.0 MMHOS/CM**

Employment Impact

Table 7

| Industry | Direct | Indirect | Induced | **Total** |
|---|---|---|---|---|
| Ag, Forestry, Fish & Hunting | (225.2) | (64.4) | (0.6) | (290.2) |
| Mining | 0.0 | (0.1) | (0.0) | (0.1) |
| Utilities | 0.0 | (0.5) | (0.2) | (0.7) |
| Construction | 0.0 | (1.1) | (0.4) | (1.4) |
| Manufacturing | 0.0 | (5.2) | (1.4) | (6.6) |
| Wholesale Trade | 0.0 | (5.0) | (1.6) | (6.6) |
| Transportation & Warehousing | 0.0 | (4.4) | (1.8) | (6.2) |
| Retail Trade | 0.0 | (1.0) | (11.2) | (12.2) |
| Information | 0.0 | (0.4) | (0.8) | (1.2) |
| Finance & Insurance | 0.0 | (3.3) | (3.6) | (6.9) |
| Real Estate & Rental | 0.0 | (8.0) | (2.5) | (10.6) |
| Professional Scientific & Tech Services | 0.0 | (2.7) | (2.2) | (4.9) |
| Management of Companies | 0.0 | (0.3) | (0.5) | (0.8) |
| Administrative & Waste Services | 0.0 | (2.4) | (2.8) | (5.2) |
| Educational Services | 0.0 | (0.1) | (1.4) | (1.5) |
| Health & Social Services | 0.0 | (0.0) | (11.4) | (11.4) |
| Arts- Entertainment & Recreation | 0.0 | (0.3) | (1.8) | (2.1) |
| Accommodation & Food Services | 0.0 | (0.5) | (7.7) | (8.2) |
| Other Services | 0.0 | (2.6) | (5.6) | (8.2) |
| Government & Non NAICs | 0.0 | (0.6) | (0.5) | (1.1) |
| **Total** | (225.2) | (102.8) | (58.1) | (386.1) |

Table 8

## **Water Quality $EC_W$ = 1.0 MMHOS/CM**

Output Impact

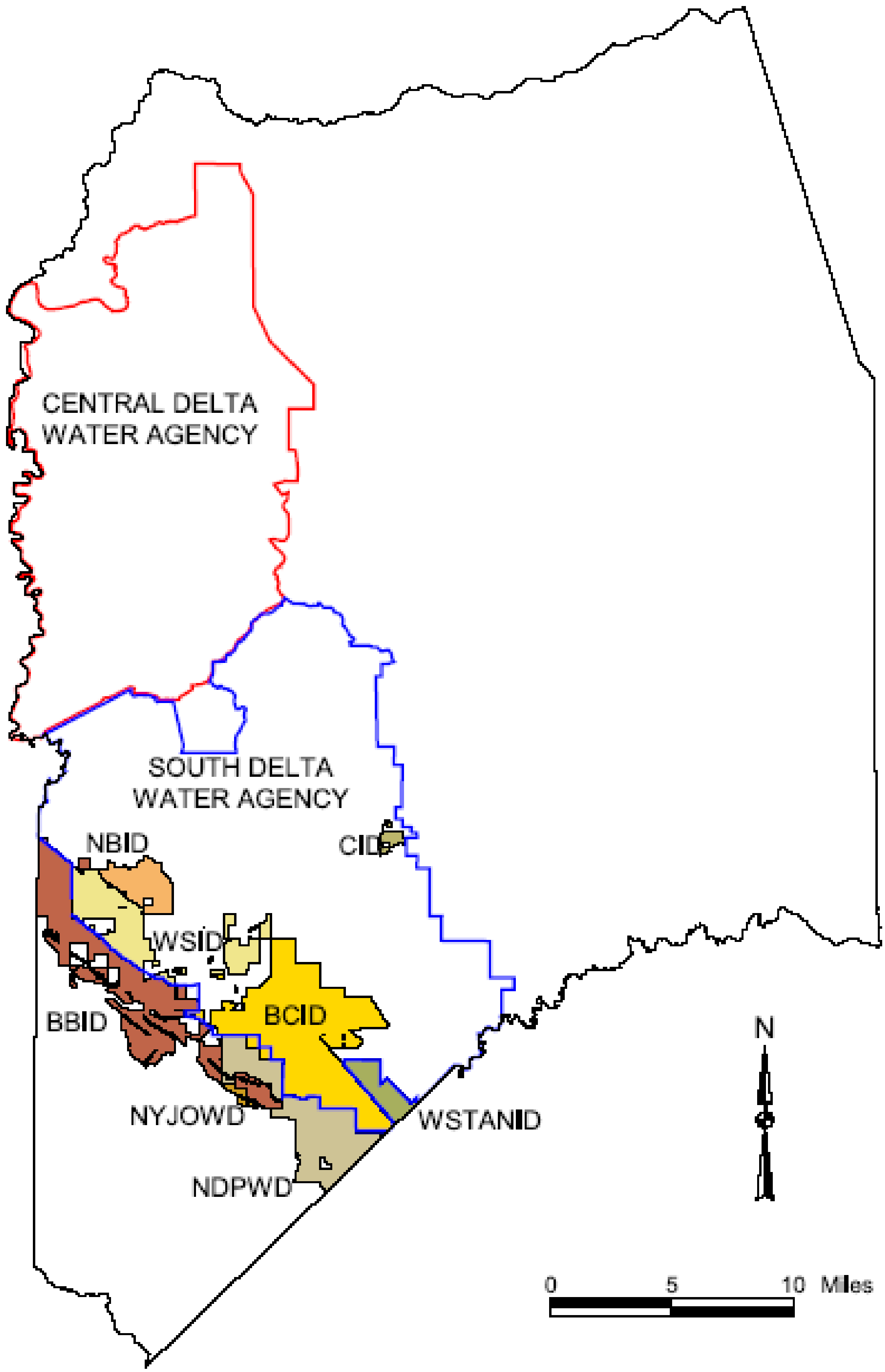
| Industry | Direct | Indirect | Induced | **Total** |
|---|---|---|---|---|
| Ag, Forestry, Fish & Hunting | (20,511,940) | (2,423,715) | (59,658) | (22,995,312) |
| Mining | 0 | (19,429) | (5,275) | (24,704) |
| Utilities | 0 | (169,431) | (84,805) | (254,237) |
| Construction | 0 | (109,213) | (38,667) | (147,880) |
| Manufacturing | 0 | (774,272) | (293,040) | (1,067,313) |
| Wholesale Trade | 0 | (651,275) | (207,961) | (859,236) |
| Transportation & Warehousing | 0 | (447,520) | (155,428) | (602,948) |
| Retail trade | 0 | (54,727) | (648,752) | (703,479) |
| Information | 0 | (81,717) | (164,720) | (246,437) |
| Finance & Insurance | 0 | (500,064) | (526,695) | (1,026,759) |
| Real Estate & Rental | 0 | (1,126,353) | (311,479) | (1,437,832) |
| Professional- Scientific & Tech Services | 0 | (187,487) | (171,043) | (358,530) |
| Management of Companies | 0 | (30,768) | (46,352) | (77,120) |
| Administrative & Waste Services | 0 | (129,436) | (127,921) | (257,357) |
| Educational Services | 0 | (4,435) | (68,509) | (72,944) |
| Health & Social Services | 0 | (43) | (921,860) | (921,904) |
| Arts- Entertainment & Recreation | 0 | (11,975) | (59,677) | (71,652) |
| Accommodation & Food Services | 0 | (28,611) | (347,653) | (376,264) |
| Other Services | 0 | (281,333) | (371,103) | (652,436) |
| Government & Non NAICs | 0 | (102,197) | (736,424) | (838,621) |
| **Total** | (20,511,940) | (7,134,001) | (5,347,023) | (32,992,963) |

Table 9

**Water Quality $EC_W$ = 1.0 MMHOS/CM**

Tax Impact

| | Employee Compensation | Proprietary Income | Household Expenditures | Enterprises (Corporations) | Indirect Business Tax | Total |
|---|---|---|---|---|---|---|
| Corporate Profits Tax | | | | (408,943) | | (408,943) |
| Indirect Bus Tax: Custom Duty | | | | | (22,288) | (22,288) |
| Indirect Bus Tax: Excise Taxes | | | | | (71,733) | (71,733) |
| Indirect Bus Tax: Fed Non-Taxes | | | | | (25,318) | (25,318) |
| Personal Tax: Estate and Gift Tax | | | | | | 0 |
| Personal Tax: Income Tax | | | (1,118,180) | | | (1,118,180) |
| Personal Tax: Non-Taxes (Fines- Fees) | | | (9,442) | | | (9,442) |
| Social Ins Tax- Employee Contribution | (379,725) | (86,341) | | | | (466,066) |
| Social Ins Tax- Employer Contribution | (393,226) | | | | | (393,226) |
| **Federal Government Non-Defense Total** | (772,951) | (86,341) | (1,127,622) | (408,943) | (119,339) | (2,515,196) |
| Corporate Profits Tax | | | | (99,944) | | (99,944) |
| Dividends | | | | (1,187) | | (1,187) |
| Indirect Bus Tax: Motor Vehicle License | | | | | (6,015) | (6,015) |
| Indirect Bus Tax: Other Taxes | | | | | (48,963) | (48,963) |
| Indirect Bus Tax: Property Tax | | | | | (306,144) | (306,144) |
| Indirect Bus Tax: S/L Non-Taxes | | | | | (54,440) | (54,440) |
| Indirect Bus Tax: Sales Tax | | | | | (452,233) | (452,233) |
| Indirect Bus Tax: Severance Tax | | | | | (231) | (231) |
| Personal Tax: Estate and Gift Tax | | | | | | 0 |
| Personal Tax: Income Tax | | | (323,962) | | | (323,962) |
| Personal Tax: Motor Vehicle License | | | (10,134) | | | (10,134) |
| Personal Tax: Non-Taxes (Fines- Fees) | | | (85,202) | | | (85,202) |
| Personal Tax: Other Tax (Fish/Hunt) | | | (1,527) | | | (1,527) |
| Personal Tax: Property Taxes | | | (4,262) | | | (4,262) |
| Social Ins Tax- Employee Contribution | (4,674) | | | | | (4,674) |
| Social Ins Tax- Employer Contribution | (16,825) | | | | | (16,825) |
| **State/Local Govt. Non-Education Total** | (21,499) | 0 | (425,088) | (101,131) | (868,026) | (1,415,744) |
| **Total** | (794,449) | (86,341) | (1,552,710) | (510,074) | (987,365) | (3,930,940) |



CENTRAL DELTA
WATER AGENCY
SOUTH DELTA
WATER AGENCY
NBID
CID
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NYJOWD
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