THE Brattle GROUP

MEMORANDUM

TO: Karla Nemeth

FROM: The Brattle Group

SUBJ: Job Impact Analysis

DATE: May 21, 2014

Job Impact Analysis

This memo describes the approach taken to calculate full-time equivalent[1] (FTE) jobs created and protected from the implementation of the Bay Delta Conservation Plan (BDCP). The job impact analysis of the BDCP is broken into four main categories:

1. Job impacts from the water facility
2. Job impacts from habitat restoration
3. Job impacts from increased water reliability
4. Job impacts from increased water rates and taxes

I. Job Impacts from the Water Facility

Estimates of job impacts from the construction and the operation and maintenance (O&M) of the water facility are based on employment multipliers generated by the IMPLAN model. IMPLAN is an input-output model that is used to calculate employment impacts based on the amount of dollars spent in a particular industry.[2] We partition the $14.4 billion of facility construction costs and $1.5 billion of facility O&M costs into different categories of spending (i.e. labor, materials, equipment, design & project management, subcontractors, and O&M).[3,4] We run the

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[1] Full-time equivalent or FTE is defined as the number of total hours worked divided by the maximum number of compensable hours in a work year as defined by law. For example, an FTE of 1.0 means that the position is equivalent to 1 full-time worker, while an FTE of 0.5 means the position is equivalent to a half-time worker.

[2] IMPLAN is widely used by federal and state government agencies when assessing economic impacts of large scale projects. Official IMPLAN website: https://implan.com/

[3] These costs do not include land acquisition costs. Costs are taken from November 2013 Bay Delta Conservation Plan, Public Draft, Chapter 8, Table 8-5. Available at: www.BayDeltaConservationPlan.com

category-specific costs through IMPLAN using industry-specific multipliers to get direct, indirect, and induced impacts under each category. In cases where there are detailed manning tables on employment associated with costs, such as direct labor, direct design & project management, and direct O&M, we use the manning table employment numbers rather than the IMPLAN results (described in more detail in the next section). We then combine all the employment impacts by category into aggregated direct, indirect, and induced impacts as seen in Table 1 below.[5]

Table 1. Job Impacts from the Construction and O&M of the Water Facility[6]

Type	FTE Impacts		
	Construction	O&M	Total
Direct	19,973	3,200	**23,173**
Indirect	64,479	967	**65,446**
Induced	34,319	1,642	**35,961**
Total	**118,772**	**5,809**	**124,580**

A. Direct Water Facility Construction Jobs by County

Direct employment impacts from the construction of the water facility are comprised of direct labor (i.e. tradesman, craftsmen, and machine operators) and design & project management (from now on referred to as 'design & PM') employment. The direct labor employment is taken straight from the manning tables outlined in the 5RMK estimates.[7] Direct labor employment is broken down into specific job types and categorized into sub-projects (the 3 intakes, 2 forebays, different tunnel reaches, etc.). We aggregate the employment impacts for the sub-projects by county (Sacramento, San Joaquin, and Contra Costa) according to the location of the specific sub-project. The direct design & PM employment figures are taken from a manning table provided by

[4] Roughly $2.0 billion of these costs are assumed to be spent out-of-state on tunnel boring machine equipment, large valves and pumps, and out-of-state administrative costs. Out-of-state costs do not generate job impacts for California and are therefore left out of this analysis.

[5] Direct employment impacts are related to expenditures on construction and design & project management. Indirect impacts are associated with purchases of materials and equipment necessary for project implementation. Induced employment impacts are associated with fluctuations in spending by households experiencing income changes resulting from direct and indirect impacts.

[6] These figures do not include induced employment impacts associated with household income increases from payments received for the land acquisition necessary for the facility construction.

[7] 5RMK estimates were provided by DHCCP on January 30, 2013.

the Delta Habitat Conservation and Conveyance Plan Steering Committee (DHCCP).[8] Design & PM jobs are not grouped by county as it is not yet determined where this work will be based. The resulting impacts can be seen in Table 2.

Table 2. Direct Job Impacts from the Construction of the Water Facility (by County)

County	FTE Impacts
Sacramento County	
Intake 2	804
Intake 3	666
Intake 5	709
Forebay	191
Total Tunnels & Shafts Jobs	3,429
Total	**5,799**
San Joaquin County	
Total Tunnels & Shafts Jobs	5,529
Total	**5,529**
Contra Costa County	
Byron Forebay	1,599
Total Tunnels & Shafts Jobs	1,507
Total	**3,106**
Across All Counties	
Remaining Jobs Along Entire Alignment	**581**
Location TBD	
Design and PM Jobs	**4,958**
Total Impacts	**19,973**

B. Direct Water Facility Construction Jobs by Job Type

The direct employment detailed breakdown is taken straight from the manning tables described above. Table 3 shows the aggregate direct FTE impacts by job type. A more detailed breakdown

[8] Design and PM manning tables were provided by DHCCP on April 9, 2014.

for the Trade & Craft and the Machine Operators (i.e. electrician, mechanic, crane operator, etc.) exists, but is not included in this memo.[9]

Table 3. Direct Job Impacts from the Construction of the Water Facility (by Job Type)

Job Type	FTE Impact
Machine Operator	2,613
Design & Management	4,958
Trade & Craft	12,402
Total	**19,973**

II. Job Impacts from Habitat Restoration

Habitat restoration employment impacts are calculated based on costs associated with Construction & Planning, Operations & Maintenance, Land Acquisition, and Other (administrative, implementation, monitoring, and research). Since some habitat restoration would happen even without the implementation of BDCP, we only asses the employment impacts associated with costs that are incremental to the baseline no BDCP scenario. Costs for these categories (with the exception of Land Acquisition) are entered into IMPLAN under the appropriate IMPLAN sector codes to arrive at direct, indirect, and induced employment impacts. Land Acquisition costs are treated as the change in annual household income to those who are paid out for their land, and are thus entered into IMPLAN as a change in annual household income rather than a cost. IMPLAN outputs associated with the Land Acquisition are induced employment impacts from the change in household income. When adding together the direct, indirect, and induced impacts from the four categories, we end up with total employment gain from habitat restoration.

It is important to assess any job losses associated with retirement of agricultural land from habitat restoration efforts. We take the product of acreage affected[10] by the restoration and the average per-acre revenue[11] to calculate how much revenue loss is associated with agricultural retirement. The revenue loss is then distributed amongst the crop types and counties most likely to be affected. This distribution is used to assign associated IMPLAN sector codes to the revenue loss. IMPLAN is used to calculate the direct, indirect, and induced employment impacts associated

[9] Breakdown included in 5RMK estimates that were provided by DHCCP on January 30, 2013.

[10] Data on acreage affected by habitat restoration were provided by ICF in June 2013.

[11] Data on per-acre revenue were calculated by The Brattle Group in previous studies.

with a decrease in spending on agriculture due to agricultural land retirement.[12] This decrease in employment is accounted for in the final habitat restoration employment impact figures in Table 4.

Table 4. Net Job Impacts from Habitat Restoration

Type	FTE Impact
Direct	21,206
Indirect	(2,454)
Induced	17,566
Total	**36,317**

III. Job Impacts from Increased Water Reliability

Water reliability employment impacts are calculated separately for the commercial/industrial/institutional (CII) and the agricultural sectors. The employment impacts for the CII sector are calculated based on employment multipliers[13] that translate a level of water shortage into an effect on direct employment in the CII sector. A separate multiplier is calculated for shortages below 15% of CII demand and shortages above 15% of demand for employment. The reason for using two separate multipliers for different levels of shortages is that economic impacts are much more severe at high levels of shortage when industries have to start making more drastic changes in operations to account for water limitations. These multipliers are used to calculate the direct employment increase associated with avoided water supply shortage levels due to the implementation of BDCP. The direct employment impacts are then put through IMPLAN to calculate the total employment impacts (including direct, indirect, and induced).[14]

The agricultural sector direct employment impacts are calculated using an econometric regression approach. The approach is based on historical data of Delta water deliveries and agricultural employment (1980 to 2009) for seven counties in the Delta. We are able to recover the effects of water reliability increases on direct employment by regressing historical employment on water deliveries and using control counties (not receiving Delta water deliveries)

[12] We account for the fact that agricultural retirement is a gradual process over the 50 years of habitat restoration and that over time more and more acres are taken out of agricultural production.

[13] CII employment multipliers are taken from MHB Consultants, Inc., "The Economic Impact of Water Delivery Reductions on the San Francisco Water Department's Commercial and Manufacturing Customers," 1994. Tables 13 and 14 (pp. 48, 50).

[14] Use the IMPLAN sectors associated with the MHB NAICS sectors. Assign direct employment impact to each sector proportionally to monetary size of sector.

to capture the effects of general changes in the agricultural economy. We also use year fixed effects to capture any year-to-year differences in employment not associated with water delivery changes. With the results from the econometric estimation we can estimate direct employment impacts associated with an increase in Delta water deliveries as a result of BDCP implementation. We then use an agricultural processing multiplier[15] to translate the direct employment impacts into total employment impacts (including direct, indirect, and induced).

Table 5 shows the total employment impacts from an increase in CII and agricultural water reliability associated with the implementation of BDCP.

Table 5. Job Impacts from Increased Water Reliability

Job Type	FTE Impact
CII	761,840
Agriculture	218,882
Total	**980,722**

IV. Job Impacts from Increased Water Rates and Taxes

The BDCP is largely funded by the State and Federal Water Contractors (68.4%) and through state (16.6%) and federal (14.3%) taxes.[16] Costs borne by the Contractors are passed on to the water consumers through increased water rates. Roughly two-thirds of the cost borne by the Contractors are assumed to translate into increased water rates to households.[17] Most of the remaining costs are passed on to the CII sector. Increased water rates imply that households and CII must spend more money on their water bills leaving less disposable income for other purchases. The decrease of spending in industries outside of water leads to a decrease in employment in those industries. IMPLAN is used to calculate the associated employment impacts assuming that all the Contractor costs (net any costs for habitat restoration that would be incurred with or without BDCP), ultimately borne by the households and CII, translate into a decrease in spending in other industries.

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[15] Ag production multiplier is from The Measure of California Agriculture, page 5-17. Available at: http://aic.ucdavis.edu/publications/moca/moca_current/moca09/moca09chapter5.pdf

[16] Funding breakdown is from the November 2013 Bay Delta Conservation Plan, Public Draft, Chapter 8, Table 8-37.

[17] Proportion of water rate increase attributed to households is based on water demand distribution across sectors from November 2013 Bay Delta Conservation Plan, Public Draft, Chapter 9, Appendix 9.A, Figure 9.A-8.

Increased state and federal taxes affect employment in a similar manner. All state taxes and California's portion of the federal taxes are assumed to translate into a decrease in disposable income for households and CII.[18] A majority of the taxes are assumed to be incurred in the residential sector.[19] IMPLAN is used to calculate employment impacts associated with the decrease in spending. Job impacts from increased water rates and taxes are shown in Table 6.

Table 6. Job Impacts from Increased Water Rates and Taxes

Type	FTE Impacts		
	Water Rates	Taxes	Total
Direct	-32,620	-772	**-33,392**
Indirect	-16,387	-383	**-16,770**
Induced	-94,962	-29,223	**-124,184**
Total	**-143,969**	**-30,377**	**-174,346**

Any decrease in spending by households only affects induced employment. Meanwhile, a decrease in spending by CII affects all three direct, indirect, and induced employment. Consequently, the overall decrease in employment is largely driven by induced employment impacts.

[18] The California portion of federal taxes is assumed to be proportional with California's share of US GDP at roughly 13%. GDP source: http://www.lao.ca.gov/reports/2013/calfacts/calfacts_010213.aspx#Californias_Economy

[19] The distribution of tax payments across residential and CII sectors are allocated by IMPLAN.