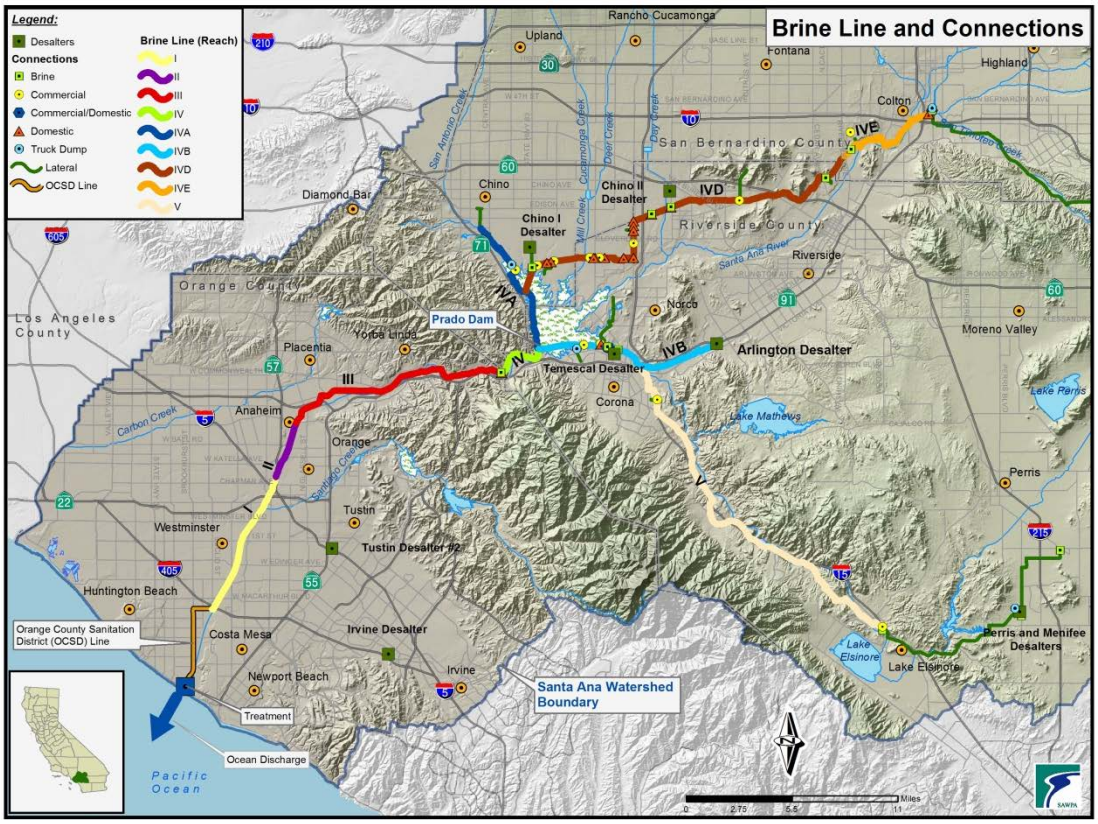
RECLAMATION

Managing Water in the West

Appraisal Level Analysis

Potential Economic, Financial, and Regional Impacts of the Inland Empire Brine Line

Santa Ana Watershed, California



U.S Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado

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Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Acronyms

ACS	American Community Survey
Basin Study	Santa Ana Watershed Basin Study, Inland Empire Interceptor Appraisal Analysis
BOD	biological oxygen demand
Brine Line	Inland Empire Brine Line
CPI	Consumer Price Index
EPA	U.S. Environmental Protection Agency
gpd	gallons per day
hcf	hundred cubic feet
M&I	municipal and industrial
MGD	million gallons per day
TDS	total dissolved solids
TSS	total suspended solids
O&M	Operations and Maintenance
P&Gs	1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies
PR&Gs	2013 Principles, Requirements, and Guidelines for Federal Water Investments
Reclamation	Bureau of Reclamation
SAWPA	Santa Ana Watershed Project Authority
SAWPA four county region	Los Angeles, Orange, Riverside, and San Bernardino Counties
SCRB	Separable Cost – Remaining Benefits
SSSRA	Salton Sea State Recreation Area
WTA	willingness to accept payment
WTP	willingness to pay

Executive Summary

An appraisal level analysis of extending the Inland Empire Brine Line (Brine Line) to the Salton Sea completed by the Bureau of Reclamation (Reclamation) in 2013 identified the need to quantify the benefits associated with the extension. The 2013 Study indicated an analysis was needed to quantify the value of services provided by the possible expansion of the Inland Empire Interceptor to the Salton Sea, as well as the potential impacts on regional economic development and the associated employment and income effects. The Brine Line project would potentially provide several different types of benefits: it would export salt from the Santa Ana Watershed and thereby reduce the accumulation of salt in the Watershed and provide a source of relatively low total dissolved solids (TDS) water to the Salton Sea.

This analysis evaluates the Brine Line from six different perspectives:

1) Financial perspective: An evaluation of cash flows and affordability of a project from the perspective of individual businesses, households, and agencies. A project is considered financially feasible if the financial resources of project beneficiaries are sufficient to pay the capital and annual operation and maintenance (O&M) costs associated with the project. The financial analysis includes an evaluation of the ability to pay of Santa Ana Watershed Project Authority (SAWPA) area households and businesses for water and wastewater services.

2) Economic perspective: An economic analysis is different from a financial analysis because the analysis is from the perspective of society as a whole. A project is considered economically justified if the benefits to all of those impacted by the project, directly or indirectly, are greater than the costs of the project. Benefits and costs can be monetary or non-monetary and could accrue to those inside or outside the project area.

3) Cost effectiveness: An alternative is considered cost effective if it can achieve a particular objective at the lowest cost among a set of alternatives or if it has the lowest cost per unit of change desired. Cost effectiveness aids in choosing the lowest cost options, but does not answer the question of whether or not any of the options are worth doing.

4) Regional impact perspective: A project is evaluated in terms of effects on income, employment, and the value of output produced in the study area. Regional impacts could potentially have short and long term impacts related to construction expenditures; operation, maintenance, and replacement expenditures; the number and types of commercial businesses

and industry that could be supported by Brine Line expansion; and potential impacts on recreation visitation.

5) Fiscal impacts: Fiscal impacts are closely related to regional impacts but are focused on the effects of a project on government finances and services. In a fiscal impact analysis, the positive revenue generating aspects of a project, program, or policy are compared to the costs necessary to support the change resulting from an increase in the demand and need for public services and expenditures. The purpose of a fiscal impact analysis is to evaluate the net effect of a project on government finances and services.

6) Environmental justice: This addresses the fair treatment of people of all races and incomes with respect to Federal actions that affect the environment. An evaluation of potential environmental justice concerns requires an understanding of where project impacts are likely to occur and where potentially affected groups are located.

Financial Analysis

The financial analysis showed that the population located in the SAWPA Brine Line area has a relatively high median household income, a relatively low level of poverty, high unemployment, and a population that is younger and more Hispanic than for all of California. A comparison of the individual counties that have a portion of their populations included in the SAWPA area to the combined Zip Code areas that are within the SAWPA boundaries showed that only Orange County has a higher median household income than the SAWPA area. The SAWPA area median household income is higher and the poverty rate is lower than for all of California. The only county with a younger population and a larger percentage of Hispanic population is San Bernardino County. These general economic conditions will tend to translate into a higher than average ability to pay for water and wastewater services compared to the rest of California. The estimated total value of sales for SAWPA region businesses is estimated to range from $161.34 billion to $343.32 billion annually. This represents approximately 7.3% to 15.6% of the total value of goods and services produced in the state of California and 18.1% to 38.6% of the value of goods produced in the four county region (Los Angeles, Orange, Riverside, and San Bernardino Counties).

Regional household income for the SAWPA area was estimated to be about $74.16 billion. Applying the U.S. Environmental Protection Agency (EPA) affordability thresholds for water and wastewater service to the estimated regional income results in an estimated ability to pay of $1.85 billion for water service and $1.48 billion for wastewater service. The ability to pay for water service by businesses is estimated to range from $3.62 billion to $16.26 billion annually and the ability to pay for wastewater service is estimated to range from $2.84 billion

to $6.06 billion annually. The estimated range of total ability to pay for households and businesses combined is shown below in Table ES-1.

Table ES-1. Estimated total ability to pay for water and wastewater service

Category of service	Households (billions)	Businesses		Total Combined	
		Low (billions)	High (billions)	Low (billions)	High (billions)
Water	$1.85	$3.62	$16.26	$5.47	$18.11
Wastewater	$1.48	$2.84	$6.06	$4.32	$7.54
Total	**$3.33**	**$6.46**	**$22.32**	**$9.79**	**$25.65**

The average household ability to pay for water and sewer service combined is estimated to be about $2,800 per household per year, or $230 per month. The total ability to pay for water supply and sewer service of businesses and industrial water users in the SAWPA region was estimated to range from about $41,200 to $142,400 per business per year, or $3,400 to $11,900 per month.

There is a wide range in the average cost per household of water and sewer service in the region. The range of average water bills presented in this analysis is about $35 to $126 per month and the range of sewer charges ranged from about $10 to $46 per month. Based on an estimated household ability to pay of $230 per month and an upper range estimate of water and sewer charges in the region of $172 per month, the net ability to pay for water- and wastewater-related services would be at least $58 per household per month or about $0.84 billion annually in the SAWPA region.

Due to the large variation in water and sewer charges applicable to various businesses and industry, it is not possible to estimate the net ability to pay for water and wastewater services. However, assuming the same proportion of net ability pay relative to total ability to pay for households applies to businesses, the net ability to pay of businesses would range from $1.63 billion to $5.63 billion.

Benefit Analysis

Use of the Brine Line to export salt can be viewed as a reduced salt loading benefit assuming that the damages avoided from salt removal within the Watershed are not offset by adverse effects of additional salt accumulation experienced elsewhere. A 2004 study of the economic impacts from salinity in the Lower Colorado River Basin estimated an average benefit per ton of salt removed of $158 in 2014 dollars. These damage estimates do not include any separate environmental factors that would benefit from reduced salt loading. A 2014 study of the environmental impacts from winter road salt use estimated ecosystem-related damages from salt to be $187 to $247 per ton in 2014 dollars. It is likely that the value of $158 per ton from the Lower Colorado River Basin salinity

model understates the value of salt removed. Assuming the mid-point of the range of benefit per ton of salt removed results in a value of about $200 per ton.

Water supply reliability is an important part of potential Brine Line benefits. Reliability may not be represented accurately through the estimated average annual monthly increase in the quantity of water supplied compared to conditions without a project because averages do not always adequately portray periods of shortage. As a result, the benefits of avoiding the hardship of water supply shortages need to be estimated to account for potential improved reliability. The potential benefits of improved water supply reliability in the SAWPA area are estimated using previously completed studies of the benefits from improved water supply reliability and avoided shortages. These water supply reliability benefits are estimated to range from $59.98 million to $194.94 million annually or $1.83 billion to $5.95 billion over 100 years using a 3.125% discount rate. The range of estimated values depends on the assumed shortage percentage avoided and the assumed frequency of the shortage.

The results from a recent Pacific Institute study (Cohen, 2014) combined with supplemental information were used to evaluate some of the potential Salton Sea benefits that could be supported by Brine Line expansion. Specific impact categories in the 2014 Cohen study included: health costs associated with increased dust emissions, changes in property values in the region due to declining aesthetic values, reduced agricultural productivity, reduced recreational activity and revenues, and the value of ecological impacts. In addition, the Cohen study indicated that the potential capital cost (in 2013 dollars) for a Salton Sea revitalization alternative preferred by the California Natural Resources Agency was about $10 billion with a present value of annual O&M costs over 40 years of an additional $9.6 billion. The 2014 study provides information on the potential damages that could be avoided if a future decline in conditions at the Salton Sea did not occur. The avoided damages represent a benefit from actions taken to prevent future degradation of the Salton Sea.

The present value of public health costs presented in the 2014 Cohen study as a result of no action at the Salton Sea ranges from about $2.2 billion to $37.5 billion from 2000 through 2047 in 2013 dollars. The average annual equivalent values of the costs range from $141 million to $1.76 billion using discount rates of 4% and 6% as used in the Cohen study. The estimated present value of dust damages over the 2000 to 2047 period translates into a value of approximately $56,400 to $79,900 per ton, which is a high value. For comparison, a U.S. EPA summary report on the benefits and costs of the Clean Air Act (U.S. EPA, 2011) estimated air pollution reduction benefits of $32 per ton for all types of air pollution. The 2011 U.S. EPA study also indicates that additional emission reductions could cost $15,000 per ton, so avoided costs could be as high as $15,000 per ton. Using the $15,000 per ton damage value would result in dust-related damages of $37.5 million to $330.0 million annually or $0.59 billion to $6.99 billion over the period of analysis based on 4% and 6% discount rates used in Cohen (2014).

The 2014 Cohen study estimated potential property value impacts from no action to be at least $400 million and perhaps as high as $7 billion if impacts spread more broadly into the Coachella Valley. These property value impacts likely include to some extent health-related costs, recreation losses, and reduced aesthetics which are factored into individual location decisions and ultimately into property values. As a result, property values are not included as a separate measure of economic value associated with the Salton Sea in this analysis. Agricultural productivity impacts could not be estimated reliably according to the 2014 Cohen study, so a zero agricultural productivity loss value was assumed.

According to the 2014 Cohen study, Salton Sea recreation visitation for the future condition without any action would be 37,000 visitor days annually and average recreation expenditures were estimated at $30 per day. The 37,000 visitation estimate represents a significant decline from the 260,000 visit level experienced during the 1961 to 2009 period. Based on these assumptions, the present value loss of recreation visitation expenditures through 2048 would be $110 million to $150 million in 2014 dollars, depending on the discount rate used. It should be noted that recreation expenditures are not equivalent to recreational benefits.

The loss in recreation estimated in the 2014 Cohen study may be overly pessimistic if recent reductions in recreation visitation stabilize. Assuming future condition visitation is equal to the average visitation over the last three years, future visitation would be 46,400 visits rather than 37,000 visits. Using a recreation database maintained by the Oregon State University Department of Forestry (Rosenberger, 2013) and a summary of recreation values on National Forests and other public lands (Loomis, 2005) as sources for representative recreation values, high and low average recreation benefits per day for the Salton Sea could range from $50.30 (Rosenberger, 2013) to $76.40 (Loomis, 2005) in 2014 dollars. The potential cost of inaction on recreation value could be a loss of $11.2 million to $17.0 million annually assuming the 2014 Cohen study estimates of future recreation visitation (37,000) are accurate. Using average visitation over the last three years for estimated future visitation (46,400), the loss in recreation visitation value would range from $10.7 to $16.3 million annually in 2014 dollars. Both of these loss estimates compare future visitation to an estimate of 260,000 visits across the 1961 to 2009 period.

Non-use values were also included in the 2014 Cohen study using information from a previous study (K2 Economics, 2007). The present value of non-use benefits from halting a decline in Salton Sea habitat values were estimated to range from $10 billion to $26 billion up to 2048. The Cohen study indicated the benefit estimates should not be considered refined and precise.

Cost Effectiveness Analysis

The cost effectiveness of using the Brine Line for brine disposal depends on the quantity of wastewater that would be discharged by the user. For larger users the Brine Line could significantly reduce disposal costs. For smaller users the cost reduction may be negligible. An example cost comparison of disposal options indicated an estimated cost is $250,000 per million gallons for a non-Brine Line connection, $50,000 for the combination Brine Line and trucking combination, and $2,000 for a Brine Line Connection option. The example comparison of costs may overstate the difference in disposal option costs if potential users required a lower quantity of brine disposal than used in the example. The difference in per unit costs will decrease as the quantity of wastewater disposed of decreases.

Cost calculations for two hypothetical waste disposal customers provided in a Santa Ana Regional Interceptor Market Analysis (Market Analysis) Final Draft Report (Environmental Engineering & Contracting, Inc., 2009) indicated that as of July 1, 2009 there were 26 direct dischargers totaling 11.541 million gallons per day (MGD) of disposal flow, or an average of 0.4439 MGD per discharger. The Market Analysis also identified potential new customer opportunities within the service area based on a survey of those that discharge to Publicly Owned Treatment Works. A total of 23 potential new customers with disposal flows were identified. The average disposal flow of those 23 potential new customers was 0.0812 MGD per discharger. The cost per MGD of these potential new customers would therefore be higher than the current average cost. The potential new water users most likely represent a group that would not be paying the lowest cost for direct Brine Line disposal services but may instead use an option that is closer to the Brine Line Collection Station option. For larger users, there could be potential financial benefits from locating in the region and using the Brine Line.

Regional Analysis

Two different approaches were used to evaluate regional impacts. The first estimates the impacts associated with the least cost alternatives presented in the Inland Empire Interceptor Appraisal Analysis Technical Memorandum 3.0 (Reclamation, 2013). The second presents impacts by categories of spending in terms of regional impacts per $1.0 million spent. The second approach is more general, but the results can be applied to any project for which expenditures are known. In addition, the estimated regional impacts from recreation spending are based on the recreational expenditure estimates provided by the Cohen (2014) analysis and the adjusted recreation visitation estimate of 46,400 visitors without taking action to reverse the Salton Sea decline.

The Inland Empire Interceptor Appraisal Analysis (Reclamation, 2013) provided costs estimates for the least cost alternatives for the combined Santa Ana Watershed and Coachella Valley service areas. In addition, the estimated costs of

treatment facility alternatives to remove total suspended solids (TSS) and biological oxygen demand (BOD) from flows prior to discharge to the Salton Sea were provided in the 2013 Reclamation analysis. The potential maximum impact of no action on Salton Sea recreation is estimated in this appraisal level analysis to be a loss of 213,600 visits over the 1961 to 2009 period of analysis. Using the recreation expenditure estimate of $30 per visit from the Cohen study (2014), the potential loss in recreation spending could be about $6.4 million annually. The total estimated regional impacts from the assumed construction, O&M, and recreation expenditures are shown in Table ES-2. In addition, the impacts per million dollars of change in costs are presented. It should be noted that the estimated regional impacts do not include impacts related to commercial and industrial output that would be supported by the Brine Line.

Table ES-2. Regional impacts from construction, O&M, and recreation expenditures

Impact Sector	Value of Output (millions)	Labor Income (millions)	Employment (jobs)
Total construction impact	$1,373.40	$339.56	8,321
Total annual O&M impact	$27.74	$8.95	179
Total recreation impact	$4.5	$1.62	45
Construction impact per million $'s	$0.84	$0.21	5.1
Annual O&M impact per million $'s	$0.80	$0.26	5.1
Recreation impacts per million $'s	$0.70	$0.25	7.0

Fiscal Impacts and Economic Development

The primary purpose of a fiscal impact analysis is to estimate the impact of a project, development, or land use change on the costs and revenues of governmental units serving the project or development. The analysis is generally based on the fiscal characteristics of the community, including categories of revenues and expenditures as well as potential changes in land use and transportation patterns. This type of analysis allows local governments to compare the costs of providing services and infrastructure with the potential revenues associated with a project. Data representing economic development impacts were obtained for the four county region as well as for all of California. County averages are compared to the entire state to help understand the current level of economic development in a county relative to the state as a whole.

County level data on total revenues and expenditures obtained from the California State Controller's Office (2015) combined with U.S. Census Bureau estimates of labor force and employment by county was used to estimate county level revenues and expenditures per employed person in the region. The average revenue is estimated to be $2,806 per employed person and the average expenditure is estimated to be $2,767 per employed person. This result indicates that, on average, increased employment generated by the Brine Line associated with

construction activities as well as commercial activity supported by the Brine Line would result in revenues slightly higher than expenses assuming the current average cost of service would be representative of future expansion costs.

Data from the California Department of Finance, Population and Housing Estimates for Cities, Counties, and the State (2016) were used to evaluate the regional trend in residential vacancies. There was a general increasing trend in residential vacancy rates from 2000 to 2010 followed by a leveling off and slight decline from 2010 to 2015. This pattern indicates that prior to and through the 2007 to 2009 recession, there were excess residential housing stocks in the four county study area, and in California as a whole, but that by 2010, demand caught up with supply to begin decreasing vacancy rates. Assuming this trend continues, economic development would be expected to continue to increase, further reducing vacancy rates.

Vacancy rate information for the industrial and office market was obtained from Daum Commercial Real Estate Services market reports (2016). The residential, industrial, and office space vacancy rate data and information supports the conclusion that economic development is likely to increase in the four county SAWPA region in the near future. Future economic development as indicated by declining vacancy rates will lead greater demand for all goods and services in the region. Therefore, demand for water supplies and wastewater services including brine disposal would be expected to increase.

Overall, the number of building permits for single and multi-family housing in the four county area remained at high levels through 2006 and then dipped in 2007 and continued declining through 2010. This pattern also follows the 2007 to 2009 recession. Beginning in 2010, the annual number of building permits began to increase and has continued to increase through 2014. Another pattern that has occurred since 2000 is a shift from predominately single family residential permits to multi-family permits. This trend has accelerated from 2010 to 2014. Similar to the vacancy rate information, the building permit data indicates future economic growth is likely to occur in the four county region. This will contribute to increased demand for goods and services, including brine disposal services.

According to United States Census Bureau County Business Pattern data, the total number of business establishments in the four county study area has increased in each county from 2005 to 2013. The total number of establishments increased by 3.29% from 2005 to 2013 in the four county region, compared to 1.56% for all of California. However, annual payroll in real terms has been stagnant or has decreased slightly for each of the four study area counties while increasing by 4.76% for all of California from 2005 to 2013. The increase in the number of establishments is another indicator of economic growth and development. However, the lack of growth in real earnings could be a limiting factor for continued growth in the future.

Home value, educational attainment, value of output by sector, and median household income indicate that there is a distinct division of economic status in the four county SAWPA region relative to the State of California. Orange County has higher median home values, a larger percentage of the population 25 years of age or older with bachelor's degrees, higher per capita retail sales and median household incomes, and a smaller percentage of the population in poverty than for all of California and the other three counties. Los Angeles County had higher median home values than for all of California and higher percentages of minority and women owned firms. However, median household income in Los Angeles County was lower than for all of California and the percentage of the population in poverty was higher than for the State.

Riverside County and San Bernardino County both have lower home values and income, and higher poverty and unemployment than the other two counties and the State of California. However, both Riverside County and San Bernardino County have higher percentages of minority and women owned businesses. The percentage of minority owned firms is greater than the state average in three of the four study area counties (Orange County is the one exception). The percentage of women owned firms is also higher than the state average for three of the four study area counties, with again Orange County being the lone exception.

Accommodation and food sales, health care and social assistance receipts, value of manufacturing shipments, value of wholesale sales, value of retail sales, total employment, and the total number of firms in the four county region account for nearly one-half or slightly over one-half of the amounts for all of California. The four county region is a very important part of the overall California economy and contributes enormously to economic growth of the state. Therefore, maintaining an adequate infrastructure in the region, including wastewater and brine disposal and water supplies, is important to economic growth in the State.

The value of taxable property over the 2005 to 2014 period has increased at an average annual rate of 4.08% in Los Angeles County, 2.91% in Orange County, 3.55% in Riverside County, and 3.06% in San Bernardino County. The growth in property values has outpaced inflation in each of the four study area counties on an average annual basis. The years 2009 to 2011 represented a period of declining property values in each of the counties except Orange County in 2009 and Los Angeles County in 2011. Orange County continued to show a decline in 2012 and 2013 and Riverside County had a decline in 2012. The property value declines were primarily a result of the recession from December 2007 to June 2009. Although the effects of the recession on property values were more pronounced in Orange and Riverside counties than in Los Angeles and San Bernardino counties, each county has shown a positive trend above inflation since 2013. This overall positive trend is an indicator of potential future economic development.

Environmental Justice

According to the California Environmental Protection Agency SB 535 list of Disadvantaged Communities (CalEPA, 2016b), a little over 6.265 million people lived in disadvantaged communities in the four county study area included in the SAWPA analysis. This disadvantaged population represents approximately 67% of the total identified disadvantaged population in all of California. This large percentage is an indication that any action taken in the four county area to alleviate environmental or economic burdens will have positive environmental justice impacts. Therefore, the Brine Line would likely generate positive environmental justice impacts.

Economic census data for the four county SAWPA area indicates a relatively high median household income, a low level of poverty, high unemployment, and a younger and more Hispanic population than for all of California. The percentage of the SAWPA area population that is Hispanic is approximately 48.1%. Zip Codes in the SAWPA area with poor household financial conditions and poor prospects for future business expansion appear to be disproportionately Hispanic, and these conditions could be expected to be improved by increased activity that could be supported by the Brine Line.

Based on historical business pattern data, it would appear likely that overall business activity in the SAWPA area would be expected to increase in the future since, even during the recession from 2007 to 2009, the number of business establishments continued to grow. Future growth could be in the range of 1.2% to 2.2% annual rate of growth. This would indicate a growing need for wastewater disposal and water supplies, including recycled water as a supply source.

Summary and Future Considerations

Several different types of evaluation perspectives were described covering a variety of economic, financial, and social aspects. Each perspective represents a different type of impact and impact group. The financial ability to pay analysis indicates that significant financial resources are potentially available for investment in an expansion of the Brine Line or investment in any type of water supply or wastewater improvements. Financial resources are identified as coming from both the residential sector and the commercial and industrial sector.

The economic analysis identified several potential categories of benefits, including water supply reliability, environmental/health benefits (including salt exportation), and recreation benefits. The magnitude of these benefits could be in the billions of dollars over the next 50 years. However, there is considerable uncertainly in the actual resource changes that would occur, so realized benefits could be substantially less than the potential benefits indicated. Recreation and

land value benefits appear to be much lower than the magnitude of water reliability and environmental benefits.

The cost effectiveness analysis indicates a Brine Line expansion could be very cost effective compared to other potential options considering potential demand in the future associated with future commercial and industrial growth. However, the Brine Line is likely to be most cost effective for larger users while other options could be more cost effective for smaller users.

Positive regional impacts are likely to be generated by expansion of the Brine Line due to expenditures associated with construction, annual operation and maintenance expenditures, and from expenditures associated with increased economic activity. Similarly, positive fiscal impacts would be expected from increased tax revenues. However, the fiscal impact analysis indicates that the cost of providing services related to increased activity will largely cancel out additional tax revenues.

The evaluation of vacancy rates, building permits, number of establishments and payroll, property values, and value of output by sector shows signs of economic growth. This growth could extend into the future leading to increased demand for future infrastructure, including the services provided by the Brine Line.

Due to the considerable amount of uncertainty associated with the estimated effects of the Brine Line, it is not possible to definitively say if the benefits associated with a Brine Line expansion would cover the cost of the project. However, what can be said is that expansion of the Brine Line would provide services for which there is considerable demand in the region and would also help address environmental justice issues that exist in the region.

1. Introduction

An appraisal level analysis of extending the Inland Empire Brine Line (Brine Line) to the Salton Sea was completed by the Bureau of Reclamation (Reclamation) in 2013. The 2013 Reclamation analysis identified the need to quantify the benefits associated with the extension, including potential benefits to businesses located in the region and Salton Sea related benefits. The purpose of the Inland Empire Brine Line project is to export salt from the Santa Ana Watershed and to provide a consistent low total dissolved solids (TDS) water source to the Salton Sea to counteract declining Sea levels. The Brine Line could help prevent the accumulation of salt in the Watershed and potentially help protect water supply quality and availability.

The Santa Ana Watershed Basin Study, Inland Empire Interceptor Appraisal Analysis (Basin Study) describes the need for additional economic analysis in the recommendations section. This additional analysis would include quantifying the potential value of services provided by the possible expansion of the Inland Empire Interceptor to the Salton Sea as well as the potential impacts on regional economic development and the associated employment and income effects. It is important to note that economic development and regional impacts are not generally equivalent to economic benefits.

Economic development typically refers to an improvement in the standard of living and economic health of a specific location or region. Improvement can be measured quantitatively or qualitatively and can be defined in terms of the number of commercial establishments, creating or retaining jobs, and supporting or growing incomes and the tax base. Economic development can be characterized by:

- Growth of an economy as measured by employment, value of output, taxable sales, property values;
- Provision of infrastructure and services such as roads and highways, public transportation, water and sewer facilities, community parks, new school programs and facilities, public libraries or swimming pools, new hospitals, and enhanced fire and police service; and
- Job creation and business retention through workforce development, education programs, and small business development programs.

Selected measures of economic development include:

- Increase in per capita income, median household income, median family income;
- Reduction in local unemployment rates;
- Increase in educational attainment;

- Increase in the number of commercial establishments in the local area, value of output, taxable sales, and/or property values;
- Increase in literacy results in children; and
- Increased leisure time and life expectancy.

Economic development goals are particularly important in areas with relatively high unemployment, low income, and tax revenues that do not adequately support local services.

A regional economic impact analysis estimates the change in economic activity for a specified region that is caused by a program, project, or policy. Regional economic impacts are typically measured in terms of employment, income, and the value of output produced in a region. The impacts can be compared to total regional employment, income and business revenue, and gross regional product to evaluate the relative importance of the impacts.

By contrast, economic benefits represent the economic value of goods and services generated by a project or action at a national level. In other words, a change in economic benefits measures the change in welfare of the entire nation as a result of a project or action while economic development and regional impacts measure a change in value to a specific region or location. Net economic benefits are equal to total benefits minus the resource costs of building and operating the project.

As part of recommendations for future work, the Basin Study described the need for analyses based on the 1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&Gs). The P&Gs have been superseded by the *Principles, Requirements, and Guidelines for Federal Water Investments* (PR&Gs). The intent of the PR&Gs is to provide a common framework for evaluating federal water resource investments and to help identify and support water infrastructure projects with the greatest economic and community benefits. The PR&Gs allow inclusion of a broader range of effects in evaluating potential projects and policies.

There are several different types of analyses that can be completed to evaluate a Brine Line to the Salton Sea. The different types of analyses are discussed in Section 2 below. Each type of analysis is potentially valuable, but each represents a very different perspective that requires different types of input data. Each of these perspectives will be applied to the general goals that have been previously identified for the Brine Line:

1) Maintain reliable and resilient water supplies and reduce dependency on imported water,

2) manage the watershed for preservation and enhancement of hydrology to benefit human and natural communities, and preserve and enhance ecosystem services and recreational opportunities,

3) ensure high water quality for human and natural communities, and

4) support economic development. An additional goal that has been identified is to optimize the water used to transport brine so that less water is lost to the ocean through the increased concentration of brine or increased deliveries to the Salton Sea for beneficial use.

This analysis evaluates the Brine Line from six different perspectives. These include the financial, economic, cost effectiveness, regional, fiscal, and environmental justice perspectives. The region evaluated includes the counties which are part of the Santa Ana Watershed Project Authority (SAWPA). These include Los Angeles County, Orange County, Riverside County, and San Bernardino County. The results of the evaluation can be used to better understand the potential benefits and impacts of the Brine Line.

2. Evaluation of the Brine Line - Perspectives

Most water agencies are interested in the financial effects of a change in water supply operations and demands. This has a direct effect on the financial viability of the supplier and the rates paid by customers. This evaluation also includes an analysis of the Brine Line is from an economic perspective, which can be used to evaluate the extent to which expansion could improve society as measured by net economic benefits. Net economic benefits can be defined as the economic value of goods and services provided by a project minus the resource costs of building and operating the project. If net economic benefits of a project are positive, then project construction is justified from an economic perspective. While this goal seems straightforward, in practice there are many different perspectives that can be taken when evaluating a project such as Brine Line expansion, and the perspective of the analysis will influence the conclusions. Part of the reason for arriving at different conclusions is the inability to monetize or accurately define and measure some project benefits and costs. Another reason for different conclusions is the level of aggregation used to measure the impacts of a project, with some analyses evaluating the effects of a project at the local level and some at the national level. Due to the importance of the different analysis perspectives, additional analyses are completed to address concerns from these groups. The different types of analyses and perspectives are described below.

2.1 Financial Analysis

A financial analysis is basically an evaluation of cash flows and affordability of a project or action from the perspective of individual businesses, households, and agencies. A financial analysis generally includes information on project costs, revenues and/or services generated by the project, and the financial resources available to pay for the project compared to project costs. A project is considered financially feasible if the financial resources of the project beneficiaries are sufficient to pay the capital and annual operation and maintenance costs associated with the project. A financial analysis would be an appropriate analysis to use for making a business case to potential Brine Line users to connect to the line rather than using some other method of disposal. If using the Brine Line provides needed services at a cost that is less than other alternatives, then that would be reflected through improved cash flows and increased net revenues. A Brine Line marketing analysis would also be considered a component of a financial analysis.

2.2 Economic Analysis

An economic analysis is different from a financial analysis because the analysis is from the perspective of society as a whole. A project is considered economically justified if the benefits to all those impacted by the project, directly or indirectly, are greater than the costs of the project. An example of a direct benefit would be improved water supply reliability for water users as a result of recycling and reuse. An example of an indirect benefit would be the value of habitat improvements for fish and wildlife to individuals who feel environmental services are worth improving. From this broad perspective, benefits and costs could be monetary or non-monetary and could accrue to those inside or outside the project area. Examples of potential benefit categories include municipal and agricultural water supplies, water quality, and environmental quality. Some benefits are not quantifiable, especially at the appraisal level, but this should not be interpreted as an indication that these non-quantifiable benefits are less important than quantifiable benefits. The PR&Gs recognize the potential importance of non-quantifiable benefits in evaluating projects, programs, and policies.

A project is considered economically feasible when the benefits generated by a project are greater than the resource costs of the project. Economic feasibility implies that society is better off with the project than without the project. An economic analysis typically provides an estimated net present value of the benefits and costs that can be quantified and monetized and a qualitative discussion of the benefits and costs that cannot be quantified or monetized. An economic analysis may also present benefits and costs in terms of a benefit-cost ratio, where a ratio of benefits over costs that is greater than one indicates a project is economically justified.

2.3 Cost Effectiveness Analysis

Cost effectiveness is similar to benefit-cost analysis, except that it answers a slightly different question. A cost effectiveness analysis identifies the alternative that can achieve a particular objective at the lowest cost. Cost effectiveness can also be used to identify the alternative that has the lowest cost per unit of change in a desired outcome. In either case, cost effectiveness helps make a choice between two options instead of explicitly comparing estimated benefits to costs. Cost effectiveness aids in choosing the lowest cost options, but does not answer the question of whether or not any of the options are worth doing.

This approach can be used when it is not possible to estimate the monetary value of benefits associated with project output or if the estimation of monetary benefits is considered to be unreliable. An example would be evaluating the cost of using the Brine Line to dispose of 100,000 gallons of wastewater compared to the cost of using Publicly Owned Treatment Works to dispose of 100,000 gallons of wastewater. It should be noted that cost effectiveness analysis does not necessarily require the quantity of goods or services to be the same to make a comparison of costs. For example, if the level of service for one alternative is 100,000 gallons and the level of service for another alternative is 50,000 gallons, both can be converted into a cost per unit (e.g., cost per 1,000 gallons) and compared to determine which is least expensive on a per unit basis. The validity of this approach assumes that both levels of service would be acceptable to water users.

If there is a mandated goal that needs to be reached and all project alternatives reach a mandated goal, then the most cost effective alternative will also be the alternative with the greatest net benefit because the only variable is cost. However, this still does not provide evidence that the mandated goal generates positive net benefits.

2.4 Regional Impact Analysis

The primary purpose of a regional impact analysis is to evaluate the effect of a project on income, employment, and the value of output produced on the region in which the proposed project is located and direct impacts are incurred. Regional impacts could potentially include the following types of impacts:

- Short-term impacts from construction expenditures.
- Long-term impacts from operation, maintenance, and replacement expenditures.
- Long-term impacts from changes in the number and types of commercial businesses and industry with a Brine Line expansion compared to no expansion.

- Long-term impacts from changes in expenditures associated with any changes in recreation visitation or changes in population growth compared to no expansion.

The total regional impacts associated with the location of an industry in a region are the sum of direct, indirect, and induced effects. Direct effects represent impacts on the industry that is immediately affected. For example, if Brine Line expansion allowed a new industry to locate in the SAWPA region and that industry employed 40 people, the direct effect would be 40 jobs and the income associated with those jobs. Indirect effects account for inter-industry transactions. If new industry locates in the SAWPA region, that industry will have a demand for locally produced materials needed to produce their product. The result is additional jobs created to meet new industry demand. Induced effects measure the effects of the changes in household income on demand for goods and services such as housing, restaurants, and retail sales. Regional impacts are generally measured in terms of employment, income, and the value of output produced.

Regional economic impacts are generally not equivalent to economic benefits. Economic benefit is a measure of well-being from the perspective of all of society while regional economic impacts are a measure of changes in income and other factors from the perspective of a local community or region. Any project or program that results in increased spending in a region will increase economic activity and generate some level of positive regional impacts, but will not necessarily generate economic benefits. Therefore, in most cases regional impacts cannot be added to economic benefits as a measure of total benefit.

In some cases increased employment can be considered an economic benefit. If a region has “substantial and persistent unemployment” and these labor resources will be “employed or more effectively employed” with a project in place, then the net additional income to the unemployed and underemployed can be defined as a benefit (U.S. Water Resources Council, 1983). Substantial and persistent employment is defined in terms of a rate that is 50% to 100% above the national average over a two- to four-year period.

2.5 Fiscal Impact Analysis

A fiscal impact analysis is focused on the effects of a project on government finances and services. Frequently, the level of regional economic activity is directly related to the fiscal position of the local region. However, this is not always the case. For example, if a project is likely to support commercial growth and attract more people into an area, then this will increase local and state tax revenues (such as through sales and property taxes) and will support provision of more government services. However, increased activity will also lead to an increase in the demand and need for public services and expenditures. The purpose of a fiscal analysis is to evaluate the net effect of a project on government finances and services.

2.6 Environmental Justice

Environmental justice addresses the fair treatment of people of all races and incomes with respect to Federal actions that affect the environment. Fair treatment implies that no group of people should bear a disproportionate share of negative impacts from an action. The negative impacts of an action can be considered disproportionately distributed if the percentage of negative impacts to total impacts imposed on a specific group is greater than the percentage of the total population represented by that group. A group can be defined by race, ethnicity, income, community, or some other grouping.

An evaluation of potential environmental justice concerns requires an understanding of where project impacts are likely to occur and where potentially affected groups are located. The analysis typically relies on demographic data from sources such as the U.S. Bureau of the Census, states, individual counties and municipalities, and local school districts to determine the location of different groups of people.

Identifying the location of specific groups can be difficult when nonpermanent residents, such as migrant workers, are in the affected area. Demographic data are poor for these groups of people. Most data sources do not account for all nonpermanent residents because some cannot be contacted or some may not want to be counted. In addition, the Census has a tendency to undercount the number of people in rural areas, due to difficulties encountered with contacting residents in sparsely population regions. However, Census data are typically the most complete and comparable demographic and economic data available for individuals and households.

An evaluation of environmental justice can also be used to evaluate the potential for a project to reverse or stabilize disproportionate environmental impacts that currently exist. For example, if a Brine Line expansion could improve water supply availability and reliability and enhance recreation and ecosystem function in low income and minority areas, then the expansion could be seen as providing an environmental justice benefit.

3. Methodologies Used to Evaluate Different Brine Line Perspectives

3.1 Financial Analysis

Financial feasibility is based on the ability of individuals, businesses, and other involved entities to pay the costs of a project. There are two important considerations when evaluating financial feasibility: the amount individual water

users can pay towards water and wastewater service, and the economic conditions of the service area which affect current and future income of household and revenues generated by businesses. If water and wastewater users have the financial resources to pay the full cost of a project, including construction and operation and maintenance costs, then the project is considered financially feasible. These financial resources may be used to pay for the project through fixed charges, use charges, ad valorem taxes, debt service payments, user fees, or through other funding methods. The funding source is relevant only to the extent that financing costs are accurately translated into an actual payment imposed on those using the service provided.

Financial feasibility is an important consideration for water providers as well as the local, state, and federal government. Providers need to be able to estimate how much water users can afford to pay toward the cost of a project and how that compares to the total cost of different alternatives. This information can be used to determine whether project beneficiaries can afford the project and whether the project is the most cost effective method of achieving a goal (mandated or voluntary). If project costs are determined to be greater than the ability of water users to pay for a project, then imposing the cost of project repayment will result in financial hardship to project beneficiaries. Government agencies are interested in knowing if a project will be financially self-sufficient from a budgeting standpoint so they do not have to worry about insufficient funding in the future. If project costs exceed the ability of water users to make water payments, some government cost sharing would be needed to make a water supply project affordable to water users. A 2001 study by the American Water Works Association indicated that there is an affordability gap between the cost of infrastructure needs and the amount that customers can spend for water supply and disposal improvements (AWWA, 2001).

There is no universally accepted method of measuring payment capability or affordability for domestic water supplies and wastewater disposal. Government agencies, water resource consultants, and academic institutions have used a wide range of methods to evaluate how much water users can pay for domestic water supply improvements. The most common method of evaluating affordability is the cost of water as a percentage of median household income. Using this measure of affordability, total annual user charges are divided by median household income and compared to a predetermined threshold value of water utility affordability. There are variations of the basic formula, such as the use of average (mean) household income in the denominator or using cost of living indices to account for differences in household expenditures in different areas within a state or region. Affordability criteria are often used in conjunction with other measures that consider general socio-economic conditions such as poverty rates or unemployment rates.

The Environmental Protection Agency established affordability criteria for drinking water systems as a result of 1996 Amendments to the Safe Drinking

Water Act. These Amendments allowed small public water supply systems to use less extensive water treatment technology if the most effective technology was not considered affordable. Therefore, EPA was required to define affordability in the context of household bills for sewer and drinking water service. As a result, EPA established a 4% of household income benchmark for affordability (2% for wastewater treatment and 2% for drinking water supplies). This was later amended to 4 ½% to allow 2 ½% for drinking water expenses. It is important to understand that this benchmark applied to whole systems, not to individual households. This measure of affordability was not intended to be applied to individual households. In other words, as a whole system 4% to 4 ½% of the system-wide household income could be used to pay for wastewater and drinking water service, but some households may pay more and some households may pay much less based on ability to pay. The concept of using an overall threshold does not specifically recognize variations in income distribution, so the inability to pay of some individuals would need to be evaluated on a case-by-case basis. The EPA affordability threshold is not a true measure of affordability, but is instead based on acceptability of fee increases by lending institutions and the cost of other utilities. However, the EPA affordability threshold has been applied in past analyses as an indicator of affordability.

Socio-economic indicators can be used to assess general economic well-being of the community and the potential for future changes that could affect affordability. This is similar to the types of analyses that credit rating agencies such as Standard & Poor's and Fitch Ratings use to assign bond ratings. These ratings are based in part on the size and diversity of the customer base, potential for customer growth, debt service coverage, economic stability of the service area, and service rates that are comparable to other entities in the region. General indicators include income, poverty rate, population growth, and employment projections. Financial management indicators for a water and wastewater supplier could potentially include the following:

- Financial structure and stability of the water system, including internal sources of capital and business planning capability.
- Ratio of revenues to expenditures.
- Ratio of net income to revenues.
- Ratio of assets to liabilities.
- Debt-service coverage.
- Access to private and public capital.

3.2 Economic Analysis

Two basic pieces of information are required in order to estimate the benefits associated with a project that generates water resource-related benefits: the quantity and/or quality of the water resource provided, and the value of the good or service generated by the water resource. The accuracy of the estimated total

value is dependent on the level of detail provided for water resource characteristics, such as the location and timing of water supplies, and the source of value estimates, such as a site specific survey of water users or transferring values from previously completed studies. Estimating the quantity and quality of water resources requires input from engineers, hydrologists, biologists, and other disciplines. The value of the good or service generated is based on an economic evaluation of the willingness to pay of individuals (households, businesses, and municipalities) for those goods and services.

The economic benefits generated by a water resource project are theoretically represented by the willingness of water users to pay for additional units of water provided by a project, program, or policy. Willingness to pay can be defined as the dollar amount that an individual or firm is willing to give up or pay to acquire a good or service. Five specific approaches that can be used to measure willingness to pay are discussed below.

1) Stated preference approach – The use of survey techniques to directly estimate benefits based on the willingness to pay for an improved water supply as stated by water users.

2) Revealed preference approach – Based on actual observed behavior in market situations. Markets reveal the preferences of an individual through prices paid for and quantities purchased of a good or service. Market price and quantity combinations can be used to estimate willingness to pay functions from which benefits can be estimated.

3) Use of price elasticity of demand estimates – The price elasticity of demand is a measure of the percentage change in the quantity demanded for a good that results from a percentage change in the price of that good. Estimates of the price elasticity of demand from previous studies and/or from observed changes in the quantity demanded over time can be combined with current quantities and prices in the market to estimate a municipal water demand relationship. This demand relationship can then be used to estimate benefits similar to the revealed preference approach.

4) Benefits transfer approach – Use of results from previously completed studies to estimate benefits at the study site under consideration. The accuracy of benefits-transfer-based estimates depends on the similarity between the site where the original detailed analysis was completed and the site of interest where the transferred benefits are applied. Similarity can be defined in terms of economic conditions, population characteristics, resources within an area, or other characteristics. Application of the benefit transfer method assumes that the relationship between a resource improvement and economic value in one area can be estimated and applied to another geographic area or resource.

5) Cost of the most likely alternative – Using the resource cost of the water supply alternative that would be implemented in the absence of the project under consideration as an estimate of benefits. This approach is an approximation of water supply benefits only when the level of service provided is equivalent for each alternative.

The above approaches each have advantages and disadvantages. The stated preference approach has the advantage of reflecting values for the specific change in resources resulting from a project. However, the values estimated using stated preference are based on hypothetical market values. The accuracy of these hypothetical values can be improved through careful survey design, but some inherent biases may still exist. The revealed preference approach has the advantage of being based on actual behavior, but is limited by the availability of market data that reflects competitive market forces. The price elasticity and benefits transfer approaches are both less time consuming and methodologically easier to implement than the first two approaches because they do not require the collection of primary data and econometric modeling to be completed. However, the price elasticity and benefits transfer approaches are dependent on the availability of existing studies that are applicable to the study area and resource under consideration; hence, the benefit estimates may not be as accurate as those derived via the stated and revealed preference approaches. Finally, the cost of the most likely alternative approach has the advantage of being less data intensive because it does not require estimation of demand relationships from which willingness to pay is derived. However, this is also the primary disadvantage of the approach. Cost-based approaches do not measure willingness to pay, but simply measure the cost of other alternatives that would achieve a goal. The cost of an alternative project may be less or greater than actual willingness to pay.

The benefits associated with goods and services supported by water supplies such as irrigated agriculture, municipal and industrial (M&I) water supplies, recreation, and ecosystem services would ideally be estimated from original research using methods such as farm budget analysis, estimation of municipal water demand curves using historical or cross sectional use and price data, travel cost models for recreation, or contingent valuation studies for ecosystem services. However, when budget or time constraints exist such that original research cannot be completed, other approaches can be used to estimate benefits. The approach used in this appraisal level analysis of benefits is benefits transfer. There are four basic steps in the application of benefits transfer:

1) Identify existing studies and value estimates that are available for transfer.

2) Evaluate the extent to which existing studies are representative of resources and conditions where the values will be transferred.

3) Evaluate the quality of the studies from which values will be transferred.

4) Apply either a point value estimate or range of estimates from the appropriate studies.

The assumption in the use of benefit transfer is that the resource characteristics at the site from which benefit estimates are available (the study site) are similar enough to the area for which benefit estimates are needed (the analysis site) that the study site benefits are representative of values that would be generated with the Brine Line extension in place. It should be noted that the benefits transfer approach is considered acceptable at an appraisal level, where the purpose of the analysis is to present information on the expected magnitude of benefits and to assist in narrowing the number of alternatives to a manageable level for further analysis. However, it is generally recognized that benefit transfer is not as accurate of a method for estimating benefits as completing an original research analysis.

3.3 Cost Effectiveness Analysis

The basic approach used to evaluate cost effectiveness is to simply compare the unit cost of different methods that can be used to generate a desired good or level of service. This study compares the costs of two different methods of removing a ton of salt from the Santa Ana Watershed, where the lowest cost option is cost effective. The primary advantage of this approach is that only two pieces of information are needed: the cost of an option, and the quantity of good or service provided. The disadvantage is that it is not known if the most cost effective option actually generates benefits in excess of costs. The primary sources of information used to evaluate cost effectiveness are a Santa Ana Regional Interceptor Market Analysis (Environmental Engineering & Contracting, Inc., 2009) and cost information presented on the Santa Ana Watershed Project Authority web page (SAWPA, 2015).

3.4 Regional Impact Analysis

Improving water supply reliability and/or reducing the cost of obtaining alternative water supplies can affect the regional economy in several ways. Some economic activities that require water as an input may need to be significantly curtailed during periods of drought or other periods when water supply does not meet demand. It is also possible that the potential for insufficient water supplies could discourage some commercial enterprises from locating to the region. A project that reduces the potential for water shortages could have positive regional economic impacts as compared to conditions without a project in place.

Construction of a Brine Line extension would involve capital construction and annual OM&R expenditures that would generate short term and long term regional economic impacts. The magnitude of regional economic impacts from project-related expenditures depends on the level of expenditures, the source of

payments, and the extent to which construction and OM&R-related services are available within the region. These factors need to be accounted for in a regional impact analysis. The regional economic impacts from construction and operation of facilities associated with each alternative stem from capital, labor, energy, and other material expenditures within the region. These expenditures generally would lead to an increase in regional output and employment. Payments made by water users to repay construction costs and OM&R would reduce purchases of non-project-related goods and services and need to be accounted for in the regional economic analysis. Not accounting for these payments from water users would overstate the positive regional impacts associated with capital construction and OM&R expenditures. If expenditures related to construction and OM&R activities go to service providers located outside of the study region, then these expenditures represent leakages of payments outside the region and will not generate positive regional impacts.

From a biological perspective, the study area for environmental impacts typically covers the area of direct effects from construction and/or changes in operations. From an economic perspective, impacts could extend well outside the direct impact areas to cover indirect effects and to account for flow of goods, services, and payments to major trade centers. Therefore, a regional economic impact analysis generally extends beyond an analysis of other resource impacts. Construction impacts would occur wherever there is project construction activity. Water supply, disposal, and repayment impacts are limited to the service area.

Regional impacts from changes in recreation expenditures, construction costs, and OM&R expenditures are analyzed in this analysis using the IMPLAN (impact analysis for planning) Model. The IMPLAN Model uses the Department of Commerce national input-output model to estimate flows of commodities used by industries and commodities produced by industries. The IMPLAN Model also accounts for the percentage of expenditures in each category that would remain within the region and the percentage of expenditures that would flow outside the region.

In order to estimate regional economic impacts associated with a project, estimates of changes in expenditures for goods and services, as compared to no project taking place, are input into the IMPLAN Model. Regional impacts are generally measured in terms of value of industry output, employee compensation, and employment. The value of industry output is a measure of the total value of purchases by intermediate and final consumers associated with product demand. Industry output is directly comparable to the Gross Regional Product. Therefore, changes in the value of total industry output for each alternative is a measure of the impact each alternative would have on the value of all goods and services produced in the study region. Employee compensation represents wages and benefits paid to employees and employment is the number of part-time and full-time employees.

3.5 Fiscal Impact Analysis

A fiscal impact analysis provides an estimate of the impact of a project on the costs and revenues of governmental entities serving the project area. The analysis is generally based on the fiscal characteristics of the community, such as revenues, expenditures, land values and potential land use changes. The analysis provides local government information to estimate the difference between the costs of providing services with a project compared to revenues generated by a project. A fiscal impact analysis requires information regarding local government finances, tax assessments, and public works.

There are two basic approaches to assess the cost of services that development imposes on a local government: average costing and marginal costing. Average costing attributes costs to new development based on the average cost per unit of service for existing development multiplied by the increased number of units of demand that are estimated in the future. Average costing does not take into account excess or deficient capacity to deliver services, and it assumes that average costs per unit of municipal services will remain stable in the future. Marginal costing relies on analysis of the demand and supply relationships for public services. This procedure recognizes that excess and deficient capacity exits in communities. For this appraisal level analysis, the average cost method is used. These impacts are evaluated for potential conditions with and without a Brine Line extension.

Data that are typically needed for a fiscal impact analysis include: estimates of the overall impact of a project on residential and commercial development, local revenue and expenditure data, local property value data and current mill rate, employment rate, and average household size.

3.6 Environmental Justice

An analysis of environmental justice issues is typically based on the proportion of negative physical or economic impacts associated with a project compared to the distribution of specific population characteristics. If the negative physical or economic impact from a project is proportionately greater for one population group than for the entire population, this indicates possible environmental justice impacts. The negative impacts of an action can be considered disproportionately distributed if the percentage of negative impacts to total impacts imposed on a specific group is greater than the percentage of the total population represented by that group. A group can be defined by race, ethnicity, income, community, or some other category.

Evaluating potential environmental justice concerns requires an understanding of where the negative project impacts are likely to occur and where potentially affected groups are located. This analysis relies on demographic data from the U.S. Census Bureau for individual counties and municipalities as well as

information from the California Communities Environmental Health Screening Tool (CalEPA, 2014). The tool identifies areas that face pollution burdens and populations that are most vulnerable to the effects of pollution, provides information on the racial and ethnic composition of communities throughout the state, and provides relative rankings of communities based on a select group of available datasets through the use of summary scores.

Identifying the location of specific groups can be difficult when nonpermanent residents, such as migrant workers, are in the affected area. Demographic data are poor for these groups of people. Census data do not account for all nonpermanent residents because some cannot be contacted or some may not want to be counted. In addition, the Census has a tendency to undercount the number of people in rural areas, due to difficulties encountered with contacting residents in sparsely populated regions. However, Census data are typically the most complete and comparable demographic and economic data available for individuals and households. For small areas the five-year American Community Survey data from the Bureau of the Census is the most complete source of consistent data. Data have been obtained at the community level for median household income, poverty rate, unemployment, and race in the watershed region to identify areas of interest.

4. Financial Analysis – Description of the Economy and Ability to Pay

The financial analysis below provides an evaluation of the potential financial resources available for households and businesses to pay the costs associated with water supply, wastewater, and other related services as well as a description of the general economic conditions in the SAWPA region. A number of assumptions are made regarding income and business sales in the SAWPA region as well as the appropriate threshold to use in evaluating affordability. However, the analysis does provide an indication of the potential magnitude of the ability to pay for water supplies and wastewater disposal services which could be compared to the costs of various project proposals to evaluate financial feasibility. This analysis does not attempt to allocate costs among project beneficiaries, but a section is included which describes some of the issues that need to be considered when determining how costs are allocated.

4.1 General Economic Conditions

Data were obtained from the U. S. Census Bureau Zip Code Business Patterns and from the 2009 to 2013 American Community Survey (ACS) database for selected economic characteristics and demographic and housing estimates. The Zip Code business pattern data includes information on the number of establishments, the number of paid employees for the pay period including March 12th, and first

quarter payroll and annual payroll. The Zip Code Business Pattern data were collected for 2000, 2004, 2010, and 2013 to represent conditions over a range of years as well as a cross section of SAWPA service area Zip Codes. It should be noted that over this period of time there was rapid economic expansion in the first part of the decade, followed by a recession that officially lasted from December 2007 to June 2009, followed by a period of relatively weak growth. Therefore, even though the data represent only 14 years, they were years of fluctuating economic conditions which could be expected in the future. The ACS data are the most recent 5 years of data available and can be used to compare population and household characteristics across Zip Codes in the SAWPA service area.

The Zip Code Business Pattern data were initially used to get a better understanding of the overall change in business activity that has occurred in the SAWPA area. Initially the business pattern data was used to identify areas of consistent growth or decline. Changes in business activity are shown for various time periods in Table 1. The percentage change in the first three columns from the left represents the total change over the period while the percentages in the right three columns represent average annual changes that would result in the change indicated for the period. Figure 1 illustrates variation in the average annual changes for different time periods. The annual payroll figures are nominal values, meaning that they are measured in dollars for that particular year. Nominal values include inflation so they are not directly comparable for different years. The payroll figures are presented for illustrative purposes and are not the primary focus of the evaluation of business activity.

Table 1. Total and annual equivalent changes in the number of establishments, number of paid employees, and annual payroll in the SAWPA service area

Time Period	% Change in Number of Establish-ments	% Change in Number of Paid Employees	% Change in Annual Payroll	Annual Equivalent Percentage Change in Number of Establish-ments	Annual Equivalent Percentage Change in Number of Paid Employees	Annual Equivalent Percentage Change in Annual Payroll
2000 to 2013	25.29%	18.93%	41.96%	2.27%	1.627%	0.27%
2004 to 2013	10.63%	1.24%	18.52%	1.26%	0.139%	2.30%
2010 to 2013	3.87%	8.13%	13.78%	1.32%	2.595%	4.76%
2000 to 2004	16.41%	17.91%	28.77%	4.58%	5.057%	8.85%
2004 to 2010	7.03%	-6.37%	6.33%	1.22%	-1.024%	1.10%

Source: U. S. Census Bureau, Zip Code Business Patterns. Accessed through the website http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

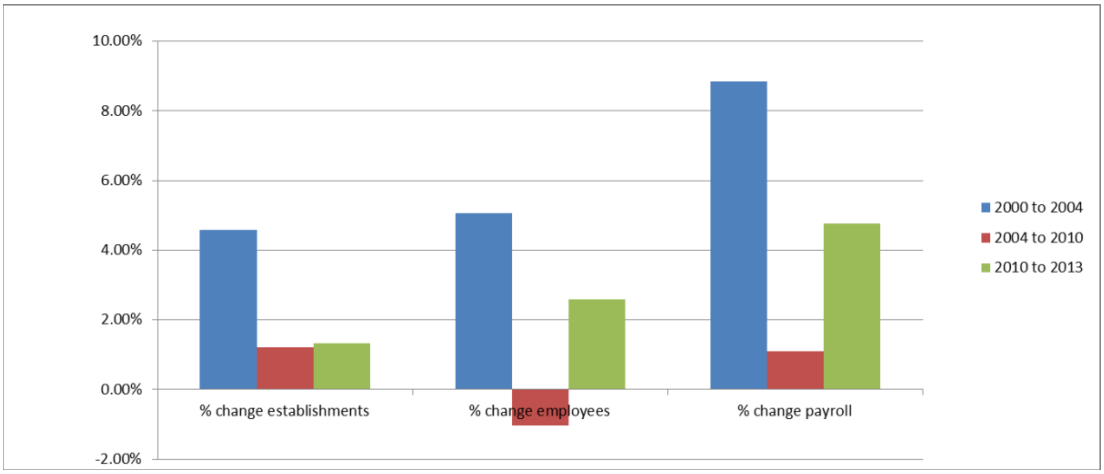

Figure 1. Average annual percentage change in the number of establishments, the number of paid employees, and payroll for selected years in the Brine Line service area

The Zip Code business pattern data shows that the most rapid period of growth in the number of establishments and number of employees region wide was from 2000 to 2004, which was a period of rapid overall economic growth. The number of establishments grew at its slowest pace and the number of paid employees actually decreased over the 2004 to 2010 period, which includes the recession that began in late 2007. The period from 2010 to 2013 has shown a reversal of the previous decline, although the rate of growth in establishments and employees is considerably lower than the rates from 2000 to 2004.

What is a reasonable expectation of growth in the number of businesses and demand for infrastructure and services needed by businesses, including water supplies and wastewater disposal? The advantage of the 2000 to 2013 data is that the period of time includes both periods of rapid expansion as well as a downturn in economic activity. Since the future is likely to include both periods of growth and stagnation, the overall annual growth of 2.27% for the number of business establishments and 1.63% for paid employees could be a reasonable expectation for the future. During the recession the number of establishments actually increased at an average annual rate of 1.22%, so even during economically challenging times the demand for business-related services could be expected to increase.

The ACS data provide a basis for comparing household characteristics across the SAWPA service area and can be combined with the business pattern data described above to help identify areas that could be considered economically disadvantaged and potentially the source of environmental justice concerns. The ACS data used in this analysis is the most recent 5-year data series. Data are not available for single years or for the 3-year series at the Zip Code level. The ACS estimates describe the average characteristics of population and housing over the period of data collection (U.S. Census Bureau, 2015b). The ACS data can be used to compare the population and household characteristics across Zip Codes in the

SAWPA service area. The SAWPA area includes only portions of the four counties shown in Table 2. As a result, the population of the SAWPA area is much smaller than the population of all four counties combined. The ACS data for Zip Codes included in the SAWPA area, local counties, and for all of California are presented in Table 2.

Table 2. Population and household characteristics for the SAWPA area and all of California

Area/County	Population (millions)	Households (millions)	Median Household Income	People Below Poverty	Unemploy-ment	Median Age (years)	Percent Hispanic
SAWPA area	4.073	1.175	$63,111	15.8%	14.0%	32.9	48.1%
Los Angeles	9.818	3.241	$55,909	17.8%	11.4%	34.8	47.7%
Orange	3.010	0.993	$75,422	12.4%	9.4%	33.7	33.7%
Riverside	2.190	0.686	$56,529	16.2%	14.9%	33.7	45.5%
San Bernardino	2.057	0.604	$54,090	18.7%	14.5%	31.9	49.9%
California	37.659	12.542	$61,094	26.6%	11.5%	35.4	37.9%

The data in Table 2 show that the SAWPA Brine Line area has a relatively high median household income, a relatively low level of poverty, high unemployment, and a population that is younger and more Hispanic than for California as a whole. Comparing the SAWPA area to the individual counties showed that SAWPA area median household income is higher than most of the counties, except for Orange County, and the poverty rate lower than most of the counties. The only county with a younger population and a larger percentage of Hispanic population is San Bernardino County. These general economic conditions will tend to translate into a higher than average ability to pay for water and wastewater services compared to the rest of California.

4.2 Ability to Pay

In order to evaluate the ability to pay of water users for a Brine Line expansion, the income of households in the SAWPA service area and the revenues from businesses in the region must be estimated so the potential financial resources available to pay the costs of the extension can be estimated. The estimated payment capability of households is based on median household income, and the payment capability of businesses is based on revenues. Estimating median household income for the SAWPA region is fairly straightforward because income is available at the Zip Code level from the 5-year 2009 to 2013 ACS database (U.S. Census Bureau, 2013). Data are also available for the number of households in the ACS database. Median household income for each Zip Code can be multiplied by the number of households to estimate the median value by Zip Code, which can then be summed to derive a total household income estimate for the SAWPA region.

Based on the ACS data there are an estimated 1,175,200 households in the SAWPA region and the median household income was $63,100. Multiplying total households times median household income results in a regional income figure of

about $74.16 billion. Multiplying regional income times the U.S. EPA affordability threshold of 2.5% (discussed above in the methodology section for financial analysis) results in an estimated ability to pay for water supplies of about $1.85 billion annually. Including 2% of income for wastewater service results in an additional $1.48 billion in ability to pay, or a total of $3.33 billion household ability to pay for water supply and wastewater service.

Estimating the value of sales/receipts for businesses is more complicated because sales data are not available at the Zip Code level from which sales could be aggregated to the SAWPA region. The number of business establishments can be obtained at the Zip Code level using 2013 County Business Patterns data (U.S. Census, 2015a). Data from the 2012 Economic Census available through the U.S. Census factfinder search tool (U.S. Census, 2015b) provides information on the value of sales, shipments, receipts, revenue, or business done by establishments as well as the number of establishments by County. The county level data are used to estimate average sales per establishment for each county, which is then multiplied by the number of establishments in a Zip Code which resides in a particular county. Although this procedure will not result in a precise estimate of the total value of sales/receipts in the SAWPA region, it does provide an estimate of the magnitude of sales in the area from which payment capability for businesses can be estimated.

The county level sales data from the 2012 Economic Census did not include all types of establishments, but did include major the sectors of utilities, manufacturing, wholesale trade, retail trade, real estate and rental/leasing, and accommodation and food services. Therefore, the sales data is not complete but is the only data available. The 2012 Economic Census data for the study area counties are presented in Table 3.

Table 3. 2012 Economic Census data for the SAWPA service area counties

Area	Number of Establishments	Total Value of Sales (1,000's)	Sales per Establishment
Los Angeles County	96,629	$537,575,200	$5,563,000
Orange County	32,986	$208,599,300	$6,323,900
Riverside County	13,399	$65,828,500	$4,912,900
San Bernardino County	13,751	$77,448,600	$5,632,200

The 2013 County business pattern data showed that there were 253,227 establishments in Los Angeles County, 89,496 in Orange County, 34,773 in Riverside County, and 32,426 in San Bernardino County for a total of 409,922 establishments in the four counties combined. The 2013 County Business Pattern data estimated there were 874,243 establishments in all of California and the California Department of Finance estimated Gross Domestic Product for all of California at about $2.2 trillion. This is an average value of production of $2.52 million per establishment on a statewide basis, which is considerably less than the $4.91 million to $6.3 million per establishment range estimated for the four

SAWPA counties. The $2.52 million state average estimate of sales per establishment is used as a lower bound estimate of business revenues.

The estimated sales per establishment shown in Table 3 can be applied to the estimated number of establishments in each Zip Code in the SAWPA service area. The values used to derive the estimated total value of sales in the SAWPA region and the estimated range of total value is shown in Table 4.

Table 4. Estimated value of sales in the SAWPA service area

SAWPA Area County	Estimated Number of SAWPA Region Establish-ments	Estimated Low Value of Sales per Establishment	Estimated High Value of Sales per Establishment	Range of Estimated Total SAWPA Region Sales (billions)
Los Angeles County	5,962	$2,520,000	$5,560,000	$15.02 to $33.15
Orange County	3,473	$2,520,000	$6,320,000	$8.75 to $21.95
Riverside County	26,551	$2,520,000	$4,910,000	$66.91 to $130.36
San Bernardino County	28,039	$2,520,000	$5,630,000	$70.66 to $157.86
Total/Average	**64,025**	**$2,520,000**	**$5,362,000**	**$161.34 to $343.32**

The estimated total value of sales for SAWPA region businesses is estimated to range from $161.34 billion to $343.32 billion annually. This represents approximately 7.3% to 15.6% of the total value of goods and services produced in the state of California and 18.1% to 38.6% of the value of goods produced in the four county region of which SAWPA is a part.

In a 2011 study completed by the Bureau of Reclamation, the ability to pay for water supplies by businesses in Gallup, New Mexico was estimated (Reclamation, 2011). The approach used to estimate the ability to pay of businesses in Gallup was based on the range of actual water payments made by businesses in various New Mexico municipalities as a percentage of gross taxable revenues. Since ability to pay would exceed actual payments, the high end of the range of percentages was used as a measure of ability to pay. It was assumed that using water payments as a percentage of gross taxable business receipts will account for differing scales of business activity and that average use over a variety of business types will lead to a representative percentage that can be applied over all businesses combined. The approach included the following steps:

1) Estimate gross taxable revenues and the percentage of gross taxable revenues spent by commercial water users in municipalities throughout New Mexico. Data were collected for 16 communities.

2) Evaluate the range of percentages of gross taxable revenues spent on water supplies by commercial water users in New Mexico to estimate the maximum percentage of water supply expenditures. This evaluation included the highest observed percentage and the percentage that separates the top 10% of percentages from the other 90%.

3) The two percentages of gross taxable revenues were then applied to Gallup to estimate ability to pay.

The estimated water use and cost of water for an average commercial connection were provided by 16 New Mexico communities. The estimated range of ability to pay as a percentage of gross taxable business receipts was 2.55% to 5.37%. It is interesting to note that the lower end of the range is essentially the same as the percentage used by U.S. EPA to evaluate affordability. It is important to remember that the percentages represent actual water payments; therefore, the highest percentages are most likely to approach actual ability to pay since they represent the highest water bill percentages actually paid. It is also important to note that the percentages are averages and there will be some less profitable businesses that cannot pay the estimated amount based on average percentage of gross business receipts and there will be some more profitable businesses that can pay more than the estimated ability to pay.

Applying the percentages above to the SAWPA area, the ability to pay for businesses is estimated to range from a low of $3.62 billion (based on the state average estimate of sales per establishment and ability to pay of 2.55% of sales) to a high of $16.26 billion (based on the SAWPA region estimate of sales per establishment and ability to pay of 5.37% of sales) annually. Adding an additional 2% ability to pay for wastewater service would add $2.84 to $6.06 billion annually. The estimated range of total ability to pay for households and businesses is shown in Table 5.

Table 5. Estimated total ability to pay for water and wastewater service

Category of Service	Households (billions)	Businesses		Total Combined	
		Low (billions)	High (billions)	Low (billions)	High (billions)
Water	$1.85	$3.62	$16.26	$5.47	$18.11
Wastewater	$1.48	$2.84	$6.06	$4.32	$7.54
Total	**$3.33**	**$6.46**	**$22.32**	**$9.79**	$25.65

4.3 Interpreting the Results of the Financial Ability to Pay Analysis

The ability to pay analysis estimates the total household ability to pay for water supply and sewer service in the SAWPA region to be $3.33 billion annually: $1.85 billion for water supplies and $1.48 billion for sewer/wastewater service. There are 1,175,200 households estimated in the service area. Therefore, the average ability to pay for water and sewer service is estimated to be about $2,800 per household per year, or $230 per month. The monthly ability to pay attributable to water supplies is $128 per month and the ability to pay for sewer/wastewater service is $102 per month. These are representative estimates which can be compared to average household water and sewer costs.

The total ability to pay for water supply and sewer service of businesses and industrial water users in the SAWPA area was estimated to range from $6.46 to $22.32 billion annually, $3.62 to $16.26 billion of which is for water supplies and $2.84 to $6.06 billion of which is for sewer/wastewater service. There are an estimated 156,765 businesses in the service area. Therefore, the average commercial ability to pay for water and sewer service is estimated to range from about $41,200 to $142,400 per business per year, or $3,400 to $11,900 per month. The water supply portion of ability to pay is $1,900 to $8,700 per month and the sewer/wastewater service portion is $1,500 to $3,200 per month. As with the household estimates, these are representative costs which can be compared to average business and industrial costs. However, there is much greater variation in water and sewer usage for the commercial sector due to the many different types of business activities. Some businesses have relatively little water use, such as office buildings, while others such as concrete mixing would have high levels of water use. Therefore, average commercial and industrial water and sewer/wastewater service use is less meaningful than average household use.

The ability to pay analysis presented above gives a broad indication of the financial resources available to pay for water and sewer service. However, in order to better understand the financial resources available for expansion of the brine line, the overall ability to pay estimate needs to be compared what is currently paid for water and wastewater service in the region. Several sources of information on average water bills and rates water are used to evaluate the net ability to pay in the SAWPA region. Some of the sources of information are somewhat outdated, but they still provide a basis for understanding the affordability of an expanded brine line.

A 2006 study of household water rates conducted by Black & Veatch provides estimates of average monthly water use and charges for water suppliers in California. Survey results for entities in Riverside and San Bernardino Counties are presented in Table 6. The rate and use values presented in Table 6 are nearly 10 years old. However, the rates provide a basis for comparing rates between different entities.

Table 6. Average 2006 water charges and usage for selected water suppliers

Entity	Provider[1]	Total Monthly Water Charge	Average Monthly Usage (hundred cubic feet)
Riverside County			
Beaumont	BCVWD	$18.23	17
Cherry Valley	BCVWD	$18.23	17
Corona	City	$37.81	25
Corona	LLWD	$31.05	24
Hemet	EMWD	$33.09	18
Lake Elsinore	EVMWD	$32.10	20
Moreno Valley	EMWD	$33.09	18
Murrieta	EMWD	$33.74	18
Murrieta	WMWD	$43.25	NA
Murrieta	RCWD	$36.64	30
Perris	EMWD	$33.09	18
Riverside	City	$14.57	24
San Jacinto	EMWD	$33.09	18
Temecula	RCWD	$23.44	30
San Bernardino County			
Chino	City	$26.73	21
Chino Hills	City	$27.31	20
Colton	City	$19.38	26
Fontana	SGVWC	$38.16	23
Highland	EVWD	$22.65	25
Loma Linda	City	$25.20	25
Montclair	GSWC	$39.94	29
Ontario	City	$29.20	26
Rancho Cucamonga	CVWD	$28.90	40
Redlands	City	$20.43	14
Rialto	City	$23.50	21
Rialto	WVWD	$22.96	30
San Bernardino	SBMWD	$16.85	22
Upland	City	$26.61	30
Upland	GSWC	$39.94	29
Yucaipa	YVCWD	$22.64	25

Source: Black and Veatch, 2006 California Water Rate Study
Water district or company abbreviation[1]
BCVWD = Beaumont-Cherry Valley Water District
LLWD = Lee Lake Water District
EMWD = Eastern Municipal Water District
EVMWD = Elsinore Valley Municipal Water District
WMWD = Western Municipal Water District
RCWD = Rancho California Water District
SGVWC = San Gabriel Valley Water Company
EVWD = East Valley Water District
CVWD = Cucamonga Valley Water District
WVWD = West Valley Water District
SBMWD = San Bernardino Municipal Water District
GSWC = Golden State Water Company
YVCWD = Yucaipa Valley County Water District

A more recent water rate study for the City of Chino Hills (Glen M. Reiter & Associates, 2011) provides estimates of average residential water bills for Chino Hills and other water suppliers in the region. Average water bills estimated in the Chino Hills analysis are presented in Table 7 assuming household water use of 22 hundred cubic feet (hcf) or 16,456 gallons of water use per month.

Table 7. Average monthly water bills estimated in a 2011 Chino Hills Study

Agency/City	Average Bill
Upland	$35.06
Norco	$43.49
Cucamonga Valley Water District	$44.87
Chino	$45.21
Chino Hills, intermediate	$60.20
Pomona	$54.85
Walnut Valley	$58.93
Yorba Linda Water District	$67.17
Fontana Water Company	$78.65
Ontario	$83.46
Claremont	$83.85

Source: Glenn M. Reiter & Associates, 2011.

The most recent residential and commercial water rate information for selected communities and water districts in or near the SAWPA service area was collected and used to estimate representative water and sewer bills. Representative water and sewer bills were based on average use indicated in the 2006 Black & Veatch survey or supplemental information provided by the service supplier. The results for residential water and sewer service are shown in Table 8.

Table 8. Estimated monthly household water charges and usage for selected Riverside and San Bernardino County water suppliers

Entity	Monthly Water Charge	Monthly Sewer Charge	Total Charge per Month
Riverside County			
Beaumont	$48.14	$21.25	$69.39
Cherry Valley	$48.14	$25.02	$73.16
Corona	$71.43	$45.60	$117.03
Hemet	$44.18 to $62.09	$9.75	$53.93 to $71.84
Riverside	$47.56	$30.75	$78.31
Rancho California Water District			
Rancho Division	$103.80	$20.20	$124.00
Santa Rosa Division	$125.93	$37.93	$163.86
San Bernardino County			
Chino	$66.69	$24.14	$90.83
Chino Hills	$60.20	-	-
Ontario	$65.02	$27.76	$92.78
Upland	$60.46	$33.09	$93.55
Los Angeles County			
Pomona	$54.85	$14.18	$69.03

The average cost of water and sewer service for residential households can be calculated assuming average water use is representative for a household. However, for commercial and industrial service there can be a wide variation in use depending on the type of business that is serviced. Therefore, an "average" commercial and industrial water and sewer cost will have little meaning for a specific site. Table 9 shows a comparison of rates charged to commercial water users rather than a comparison of representative water bills, except for those rates which are provided as a cost per establishment.

Table 9. Monthly water and sewer charges for municipalities in the SAWPA region

Entity	Monthly Water Charge	Monthly Sewer Charge
Riverside County		
Beaumont - Cherry Valley		
- Service charge (5/8" to 12")	$18.01 to $2,791.71	-
- Charge for water used	$0.99	-
- Small restaurants (20 or fewer seating)	-	$146.31
- Large restaurants (more than 20)	-	$146.31 + $9.10 for each above 20
Small retailers and offices		
- Midsize retailers	-	$23.77/unit/month
- Office building	-	$39.66 per month
- Industrial Charge = V*Rv + B*Rb + S*Rs	-	$140.37 per month
V = Volume in hundred cubic feet (HCF)	-	Rv = $0.75/HCF
B = Total monthly discharge of biological oxygen demand (BOD) in pounds	-	Rb = $0.40/lb BOD
S = Total monthly discharge of suspended solids (SS) in pounds	-	Rs = $0.40/lb SS
Corona		
All Commercial (Depends on use tier)	$2.33 to $11.64/HCF	-
Restaurants (1" or smaller)	-	$163.28
- Commercial 5/8"	-	$45.60
- Commercial 1½"	-	$186.06
- Commercial 3"	-	$537.41
- Commercial 6"	-	$1,753.50
Hemet		
- Hotels and Motels (based on rooms)	-	$4.22
- All other commercial, industrial, public	-	$4.22
- Impact fee	-	$3.32
- Ready-to-serve charge	$21.14 to $321.90	-
- Water Charge		
0 to 600 cubic feet	$2.30	-
601 to 1,200 cubic feet	$2.50	-
1,201 or more cubic feet	$2.88	-
Riverside		
- Commercial		
Flat rate	-	$33.62 to $38.83
Rate per hcf		
▪ Restaurants	-	$2.00 to $2.40
▪ Professional offices	-	$6.48 to $6.97
First 550 hcf – Summer	$1.77/hcf	-
All over 550 hcf – Summer	$2.32/hcf	-
First 550 hcf – Winter	$1.42/hcf	-
All over 550 hcf – Winter	$1.99/hcf	-

Entity	Monthly Water Charge	Monthly Sewer Charge
Customer charge/meter/month	$11.57 to $61.51	-
Riverside		
- Industrial		
Rate per hcf	-	$2.07 to $2.76
Rate per pound of chemical oxygen demand	-	$0.38
Rate per pound of total suspended solids	-	$0.38
First 550 hcf – Summer	$1.77/hcf	-
550 hcf to 5,500 hcf – Summer	$1.89/hcf	-
All over 5,500 hcf – Summer	$2.32/hcf	-
First 550 hcf – Winter	$1.42/hcf	-
550 hcf to 5,500 hcf – Winter	$1.54/hcf	-
All over 5,500 hcf – Winter	$1.99/hcf	-
Customer charge per meter per month	$142.52 to $1,330.40	-
Rancho California Water District		
- Rancho Division		
Water rates	$1.23 to $2.88/hcf	-
Energy rates	$0.0405 to $0.5643/hcf	-
- Santa Rosa Division		
Water rates	$1.67 to $2.85/hcf	-
Energy rates	$0.0516 to $0.6180/hcf	-
Monthly service charge – Rancho Division	$20.20 to $1,089.19	-
Monthly service charge – Santa Rosa Division	$37.93 to $2,186.17	-
Wastewater monthly service charge per EDU	-	$38.75
Wastewater fixed capacity charge	-	$20.00
San Bernardino County		
Chino		
- Consumption Charge	$1.77 per hcf	-
- Monthly Readiness-to-Serve Charge (5/8" to 10")	$29.52 to $5247.13	-
- Monthly Water Fire Service Charge (2" to 12")	$10.45 to $376.05	-
- Non-Agricultural Recycled Consumption Charge	$1.24 per hcf	-
- Sewer charge per EDU per month	-	$24.14
Ontario		
- Potable Usage Charge		
o Up to 15 hcf	$2.34/hcf	-
o Over 15 hcf	$2.72/hcf	-
- Recycled Usage Charge	$1.56/hcf	-
- Monthly Readiness-to-Serve Charge (5/8" to 10")		
o Potable	$22.75 to $1,891.20	-
o Recycled	$12.60 to $1,050.10	-
- Monthly Water Fire Service Charge (2" to 16")	$12.10 to $365.55	-
- Sewer charge per unit per month (depends on type of activity)	-	$8.38 to $120.62

Entity	Monthly Water Charge	Monthly Sewer Charge
Upland		
- Commodity rate	$1.88/hcf	-
- Fixed charge (5/8" to 8")	$37.55 to $1,704.40	-
- Sewer charge per EDU per month	-	$33.09
Los Angeles County		
Pomona		
- Bi-Monthly Meter charge – Inside City (5/8" to 10")	$48.26 to $3,908.39	-
- Bi-Meter charge – Outside city (5/8" to 10")	$60.31 to $4,885.50	-
- Commodity rate – Inside City		
1 to 15 hcf	$0.94/hcf	-
16 to 75 hcf	$1.86/hcf	-
- Commodity rate – Outside City		
1 to 15 hcf	$1.19/hcf	-
16 to 75 hcf	$2.37/hcf	-
- Bi-Monthly Fire Service – Inside City (2" to 12")	$67.36 to $735.31	-
- Bi-Monthly Fire Service – Outside City (2" to 12")	$85.35 to $922.05	-
- Bi-Monthly Fixed Sewer Service Charge	-	$5.92
- Usage Charge (Inside or Outside City)	-	$0.51

As noted above, the total annual household ability to pay was estimated to be about $3.3 billion for approximately 1.175 million households. This results in an average household ability to pay of about $230 per household per month. This average ability to pay can be compared to current water and sewer costs paid by households in the region that are shown in Table 8. The estimated current costs range from about $54 to $164 per household per month. Representative current water and sewer payments appear to be well within the estimated ability to pay, which makes sense since these are payments that are actually made, and there appears to be additional household ability to pay towards additional water supply and disposal costs. Although most users of the Brine Line would be commercial and industrial users, the ability of the household sector to pay additional expenses is important because some of the costs imposed on businesses could be ultimately passed on to consumers within and outside the region. The household ability to pay captures some additional financial resources available to pay towards potential project costs.

The ability to pay of the approximately 64,025 commercial and industrial establishments was estimated to range from $6.46 billion to $22.32 billion annually. The low range of estimated ability to pay per establishment translates into about $101,000 annually and the high end of the range is $345,500 annually. This is the equivalent of 1.9% to 6.4% of average revenues per establishment. It should be noted that the average ability to pay per commercial or industrial establishment is not as meaningful as the average ability to pay per household because of the very large variation in the size, value of output, and profitability of different types of firms. Therefore, it is difficult to compare the average ability to

pay per establishment with the rates presented in Table 9. However, the lower bound of the estimate is a relatively small portion of average revenues which is an indicator that the ability to pay estimate may be reasonable.

4.4 How Much Should Individuals Benefiting From a Project Pay?

An important issue that needs to be considered when planning an improvement or expansion of any water supply or wastewater project is how project costs should be distributed among water and wastewater users. Any arrangements that would be made to pay the costs of a Brine Line expansion are unknown at this time. Therefore, it is not possible to analyze the financial impacts of project-related payments on specific groups of project beneficiaries or to evaluate financial feasibility. Determination of the repayment responsibility of project costs could be based on an analysis of the benefits that would accrue to different types of project purposes, the project costs associated with facilities that generate the different types and combinations of benefits, identification of the different groups associated with each project purpose, and allocating costs to those groups based on the benefits derived from the project for each purpose.

Economic theory suggests those who get the greatest benefit should pay the greatest cost. Economic theory also indicates water users should pay the marginal (or incremental) cost of providing services to that particular group of users. Therefore, based on the marginal cost principle, the additional cost of expanding a water supply or disposal system to serve a new group of water users or to improve water quality for existing users should be paid by those project users who benefit from the improvement. However, applying the principle of ability to pay suggests that those who are financially capable of paying the greatest amount should pay the most, as long as the overall project benefits are greater than the costs. There are many variations in project characteristics that can complicate the decision on how to divide project costs among water users. For example, what if expanding the system provides improvements in reliability or water quality that benefits existing water users? In this case should existing water users pay some of the improvement costs and if so, how much?

When evaluating how project costs should be divided among different users, it should be realized that there is a difference between allocating costs among different project purposes and determining how much individuals who are deriving benefit from the same project purpose should pay for their portion of the service. The allocation of costs for different purposes is determined through the application of a cost allocation. However, there is not a set process used to determine how much an individual should pay for their portion of a specific use. For example, suppose it is determined through a cost allocation that a water district is responsible for a specific dollar amount of the total cost of a project that includes water supply as a project purpose. However, the type of rate structure

and the rates charged to individual water users by the district to pay the allocated cost is at the discretion of the district. The basics of the cost allocation process and potential issues related to rate setting are discussed below.

4.4.1 Cost Allocation

A cost allocation is a financial analysis that is completed for Federal water resource projects that provide multiple categories of benefits. The purpose of a cost allocation is to determine a fair and equitable distribution of project costs among multiple purposes. The most commonly used method of cost allocation for Federal water projects is known as the Separable Cost - Remaining Benefits (SCRB) approach. The SCRB method is based on the justified expenditure for each project purpose. The justified expenditure is the smaller of either the benefits attributed to the purpose or the cost of the most cost-effective single purpose alternative project which generates the same benefits for that purpose as the multiple purpose project. Justifiable expenditures are the basis for allocating joint costs in proportion to benefits. Joint costs are associated with facilities that serve more than one purpose, such as reservoirs which provide water supply and recreation.

The steps for a SCRB cost allocation include:

- Estimate the benefits generated by each project purpose.
- Estimate the single purpose alternative costs.
- Use the estimates of benefits and single purpose alternative costs to determine the justifiable expenditure for each purpose. The justifiable expenditure is the smaller of benefits or single purpose alternative costs and represents the maximum cost that can be allocated to a purpose.
- Calculate separable costs by purpose by subtracting the cost of a project that does not include a specific function from the total cost of the multiple purpose project that includes all functions. These separable costs represent the minimum amount that would be allocated to a specific purpose.
- Subtract separable costs from justifiable expenditures to determine remaining justifiable expenditure by purpose.
- Calculate the proportionate share of remaining justifiable expenditure for each purpose.
- Determine the remaining joint costs by subtracting the sum of the separable costs from the total project cost.
- Allocate the remaining joint costs among the project purposes according to the percentages of remaining justifiable expenditure for each purpose.
- Calculate the total costs allocated to each purpose by adding the separable and joint costs for each purpose.

While this may seem like a complicated method of allocating costs to different purposes, the intent is to be as fair and equitable as possible in assigning project costs to multiple purposes. The basis for assigning costs is essentially a function of the relative benefits (or justifiable expenditure) of a project purpose. Obviously

a cost allocation would not be necessary for a single purpose project and the analysis becomes more complicated as the number of project purposes increases. There is essentially only one purpose associated with the Brine Line, exportation of salt from the Santa Ana Watershed benefiting residential, municipal, commercial, and industrial water users, so the question regarding where the burden rests for project payment is not a cost allocation problem but a determination of how much individual beneficiaries should pay.

4.4.2 Individual Payment Toward Project Cost

The basic principle behind cost allocation could be applied to determining how much individuals should pay for their portion of water and wastewater service. Using this approach, benefits would drive the determination of how much each user would pay toward the cost of the project and the conclusion would be that individual payments should be equal to the benefit of the service, or their willingness to pay. However, this approach may not be consistent with the desire to provide water supply and wastewater service at an affordable cost.

Affordability is essential in providing access to safe and reliable water supplies and wastewater service. Unaffordable water and wastewater service can lead to health and safety issues. Water and wastewater rates are typically set with several financial and pricing objectives in addition to affordability. Some of these additional objectives include financial sufficiency, customer equity, minimizing customer impacts, rate stability, and conservation/demand management. Financial sufficiency means that revenue requirements, which are driven by coverage of OM&R and future capital improvement costs needed to meet demand, are met to insure the provider is financially viable. Customer equity, minimization of rate impacts, and rate stability all focus on increasing the acceptability of service rates for customers. Charging customers up to their full willingness to pay may not meet affordability and other objectives discussed above.

One objective that must be met is that water and wastewater revenues must cover the expenses necessary to operate and maintain the water and/or wastewater facilities (financial sufficiency). One approach that can be used to meet the financial sufficiency objective in an equitable manner is to use the cost of service concept, where costs are recovered from users in the same proportion as their use of the system. If an individual uses 3% of the system supply, then that individual pays 3% of the total cost. This approach is based on the average impact of a user on system facilities and operations and imposes the same burden per unit of use on all users. The cost of service approach avoids charging very high rates to customers that have a high marginal cost, which potentially avoids affordability issues. Other approaches based on marginal costs which include assistance for lower income households and small businesses could also potentially meet affordability criteria while applying principles of economic efficiency.

5. Economic Analysis – Potential Benefits of the Brine Line

In order to evaluate the potential benefits of the Brine Line extension, two pieces of information are needed. The first is per unit value associated with each type of benefit and the second is the change in the number of units of the resource generating benefits that would be expected from the Brine Line. For example, if the Brine Line reduces salt loading in the Basin, then the change in the resource would be reduced tons of salt. The value per unit would need to be expressed in terms of benefits per ton, where the total benefit of reduced salt loading would be equal to the estimated reduction in tons of salt multiplied by the value of salt in dollars per ton. The information below provides estimates of the potential benefits associated with a Brine Line extension.

5.1 Benefits of Exporting Salt Out of the Watershed

Use of the Brine Line to export salt can be viewed in the same way as a reduction in salt loading assuming that the damages avoided from salt removal from the Watershed are not offset by adverse effects of additional salt accumulation experienced elsewhere. This is a reasonable assumption if the salt is disposed of in an area where it becomes diluted (such as the ocean) and does not have significant adverse effects. However, to the extent that salt removal does have measurable adverse impacts elsewhere, the benefits would be reduced.

A 2004 study of the economic impacts from salinity in the Lower Colorado River Basin (Reclamation, 2004) provides a general estimate of the average benefit from reduced salt loading. The study estimated an average benefit of $116 per ton of salt removed in 1998 dollars. Using the Bureau of Economic Analysis Implicit Price Deflator for personal income expenditures, the average benefit per ton of salt removed would be about $158 in 2014 dollars.

The benefits from reduced damages indicated in the 2004 Reclamation report are based on a salinity damage model that includes costs to households and commercial and industrial business operations associated with elevated salinity levels in municipal and industrial water supplies as well as reduced crop yields from increased salinity in irrigation water. The damage estimates do not include any separate environmental considerations that would benefit from reduced salt loading. No studies were found addressing the potential environmental damages associated with salt loading in Southern California. However, a study of the cost of salt used for road maintenance in Minnesota provided estimates of the costs imposed by salt for several different categories of damages (Fortin Consulting, Inc., 2014). Categories of damages included vehicle corrosion, extra road maintenance, infrastructure damage, tree damage, and ecosystem damage. The

ecosystem damages in the Fortin Consulting, Inc. study were based on a 2010 study by Kelting and Laxson (2010) that evaluated damages from salt to lakes and rivers, soils, groundwater, and vegetation as a result of winter road management in New York's Adirondack Park.

The Fortin Consulting, Inc. study estimated ecosystem-related damages from salt to be $172 to $227 per ton in 2009 dollars, or $187 to $247 in 2014 dollars after indexing using the Bureau of Economic Analysis Implicit Price Deflator for personal income expenditures. The damages avoided estimated from the Lower Colorado River Basin salinity model and the ecosystem damages estimated from the Adirondack Park study are probably not additive because there could potentially be some double counting of damages. For example, some irrigation-related damages could be considered to be an environmental consequence. However, it does seem likely that the value of $158 per ton from the Lower Colorado River Basin salinity model understates the value of salt removed. It should also be recognized that environmental resources and conditions in the North Central and Northeastern United States are very different than in Southern California so the damages from salt loading (or benefits of salt removal) may be higher or lower than estimated in the Fortin Consulting, Inc. study. In order to account for uncertainty in the transferability of the damage estimates and unaccounted for damages in the Lower Colorado River Basin salinity model based estimate, the mid-point of the range of estimated salt damage values of approximately $200 per ton in 2014 dollars is used to evaluate benefits in this analysis.

5.2 Water Supply Reliability Benefits

Water supply reliability is an important part of this analysis of Brine Line benefits and impacts because one of the potential benefits of the extension is providing an additional source of water supply, which would have the effect of improving water supply reliability. Reliability may not be represented entirely through focusing on an estimate of the average annual or monthly increase in the quantity of water supplied compared to conditions without a project because an average water supply quantity figure may not adequately reflect periods when demand is not fully met. Managing water supplies to meet average demand does not mean that periods of shortage do not occur. As a result, the benefits of avoiding the hardship of water supply shortages need to be estimated to account for potential improved reliability.

Previously completed studies of the benefits from improved water supply reliability and avoided shortages can help provide insight into the potential benefits of improved reliability in the SAWPA area. Most of the previously completed water supply reliability studies have relied on survey data to estimate benefits, where questionnaires are used to ask water users how they would react to different magnitudes of shortages and various event probabilities and how much they would be willing to pay to avoid those shortages. In some studies the

question was also posed in terms of the willingness to accept payment for a reduction in reliability either in terms of increased shortage duration or an increased probability of a shortage. The use of surveys and hypothetical conditions to derive benefit estimates is an application of the stated preference approach to estimating benefits discussed earlier in this paper.

Use of previously estimated benefit values as a basis for estimating reliability benefits in the SAWPA area is an application of benefits transfer, which was also discussed earlier. As a result of the hypothetical nature of the values obtained using the stated preference approach, there are potential errors in the benefit estimates. It is quite possible that there is a difference in actually paying an amount rather than saying how much you would pay or accept in payment. The benefits transfer approach also has the potential to suffer from biased or imprecise estimates. This is mostly due to differences in the characteristics of the resources being valued and the population affected by a resource change. As a result, the benefit estimates used to evaluate the Brine Line are subject to considerable error as a result of the estimation methods used. However, the estimates do provide information on the likely magnitude of water reliability benefits that could be generated by expansion of the Brine Line. Several studies have been completed in several states which have estimated water reliability benefits and the benefits of avoiding water supply shortages.

5.2.1 Barakat and Chamberlin Study

A study prepared by Barakat and Chamberlin (1994) estimated the mean monthly willingness to pay of residential water customers in southern California to avoid water supply shortages. Mean monthly willingness to pay was estimated to range from $11.13 to $16.93 per household per month in 1993 dollars, or $16.52 to $25.13 in 2014 dollars using the Bureau of Economic Analysis Implicit Price Deflators for personal consumption expenditures to adjust prices to 2014 dollars. This translates into a range of $198 to $302 annually per household. The lowest value was for a 10% reduction once every 10 years and the highest was for a 50% reduction once every 20 years. There were several iterations in between the range of values, with different reductions in service (10% increments from 10% to 50%) and frequency of occurrence (from 1 in 3 years to 1 in 30 years).

There are several interesting observations that can be made about the estimates in the Barakat and Chamberlin study. The difference in willingness to pay in Southern California to avoid a 10% reduction in service every 3 years versus a 10% reduction every 10 years is only $0.51 per month or $6.12 per year in 1993 dollars or $0.76 per month and $9.08 per year in 2014 dollars, a difference of only 4.6%. Similarly, the difference between willingness to pay to avoid a 40% reduction in service every 10 years versus a 40% reduction every 30 years is only $19.68 annually in 1993 dollars and $29.21 in 2014 dollars. This seems to indicate that people may not properly account for the impact of shortages in the future (perhaps this is an indication of heavily discounted future effects). However, the discounting argument probably does not explain the small difference in willingness to pay to avoid a 10% shortage every 3 years compared

to every 10 years. One possible explanation is that while an event occurring every 3 years is quite frequent, perhaps a 10% shortage is not seen as an undue burden that is worth paying something to avoid.

It is also interesting to note that the confidence interval for the Southern California Model is estimated to be +/- $0.51, which means that there is no statistical difference between a 10% shortage every 3 years and a 10% shortage every 10 years. This may indicate that the survey respondents are not correctly interpreting the service being presented in the questionnaires. As a result, the survey results may not correctly value water supply reliability.

The results of the Barakat and Chamberlin study indicate the incremental change in the willingness to pay to avoid a water shortage decreases as the shortage (as a percentage of total demand) increases. For example, the willingness to pay to avoid a 40% shortage every 10 years is only 43.9% higher than the willingness to pay to avoid a 10% shortage every 10 years even though the frequency of shortage is 4 times (400%) higher. Economic theory would generally suggest that the value of a good that is in short supply would tend increase as the shortage worsens and the willingness to pay to avoid a loss would also tend to increase. The law of diminishing returns and the concept of diminishing marginal utility would explain why the value of water as an input into production or utility tends to increase as less is available. As a result, individuals would be expected to be willing to pay more to avoid a 1% reduction in a shortage when the shortage is very large than to avoid a 1% reduction in a shortage when the shortage is small. However, the Barakat and Chamberlin study showed the opposite result.

The above discussion of the Barakat and Chamberlin study indicates that there may be some inconsistency in the survey respondent estimates of willingness to pay to avoid water supply shortages and therefore there may be some error in the estimates themselves. The inconsistency may be due to the respondents misunderstanding the survey questions, specifically the meaning of the shortage percentages and the probability of a shortage occurring. For example, the respondents may be able to understand the meaning of a 1 in 3 year occurrence because 3 years is a relatively short timeframe, but the difference between a 1 in 20 year occurrence and a 1 in 30 year occurrence may not be distinguishable if respondents perceive 20 and 30 years similarly as far into the future. However, the estimated range of willingness to pay to avoid reliability problems provides information on the perceived benefits from avoiding a water shortage. Therefore, the focus of the estimated values from Barakat and Chamberlin should not be on the specific values for each shortage percentage and frequency of occurrence, but the range of values associated with some type of shortage. To the extent that expansion of the Brine Line would help reduce water reliability problems by providing an alternate supply of water from reuse, the water reliability benefits could be about $200 to $300 annually per benefited household in 2014 dollars.

5.2.2 Orange County Study

A 2003 study prepared for the Municipal Water District of Orange County (Orange County Business Council, 2003) focused on one region using information from the 1994 Barakat and Chamberlin study as well as providing estimates of business impacts, employment impacts, and landscape impacts based on information from several independent studies

The Orange County study indicated that over the 1993 to 2003 period there had been a rapid increase of the service sector and projections at the time indicated continued growth in that sector. The service sector had grown by 56% from 1999 to 2006, manufacturing had grown 18%, and retail trade had grown 11%. Areas of growth from 1988 to 2001 were identified as textiles (+157.9%), aircraft and parts (+39.0%), precision instruments (+26.3%), and commercial equipment (+23.9%). The time period represented by this analysis was a period of rapid growth.

The analysis surmised that the effect of a water shortage on businesses operations or the portion of business operations within the County would be felt most by very large and very small firms. Very large firms (large multi-location corporations) would probably switch operations to locations outside of Orange County during periods of water supply unreliability to the extent that sufficient water supplies can be found elsewhere. Small firms would probably be at the greatest risk for going out of business because they probably do not have the financial reserves to weather an extended shutdown or slowdown of operations.

It was also stated that manufacturing and tourism would most likely suffer the greatest direct negative effects. Some operations could be hampered if water supplies and/or wastewater service was not available through impacts on rooftop cooling towers that use water, temperature controlled lab environments, and manufacturing that requires large quantities of water as an input into production. Tourism would suffer as loss of water drives away visitors, slows convention bookings, and creates a negative image for Orange County. Businesses would have to close if they could not provide running water for sinks, toilets, and drains for restrooms. They would also close if they did not have adequate water pressure for sprinkler systems.

The Orange County analysis indicated a willingness to pay that ranged from $11.16 to $17.30 per household per month in 1993 dollars, or $16.56 to $25.68 in 2014 dollars. The lower bound estimate is based on a 20% shortage 1 in 30 years while the upper bound estimate represented a 50% shortage 1 in 20 years. The analysis also indicated that a 5% water reduction for a drought with a 1 to 3 year duration would lead to a decrease in revenues of $6.73 billion to $20.18 billion in 2002 dollars, or $8.52 billion to $25.56 billion in 2014 dollars. A 20% water reduction would lead to a decrease in revenues of $20.44 billion to $61.31billion in 2002 dollars, or $25.88 billion to $77.65 billion in 2014 dollars. Employment impacts for the same drought event were estimated to range from 63,365 to

190,094 jobs and the impacts for a 20% reduction would be a decrease in 192,708 to 578,123 jobs.

Finally, the Orange County study also provided summary statistics from survey responses to questions regarding how different sectors would respond to a 60% reduction in water supplies over a two month period. The manufacturing sector indicated a 19% reduction in output from a 60% reduction in water supplies, the service sector would experience a 20% reduction in output, the construction sector would have a 23% reduction in output, the wholesale sector would have a 13% reduction in output, and the finance and real estate sector would experience a 5% reduction in output. These survey responses all indicate a significant value for water supply reliability by commercial establishments.

5.2.3 California Urban Water Agency Study

A study for the California Urban Water Agencies (Spectrum Economics, 1991) discussed the decisions that business managers need to make to minimize production costs during periods of drought. Examples of these decisions include minimizing the costs of obtaining water from alternate water sources, reducing water use per unit of good or service produced, or reducing the level of production. The preferred method of dealing with a water shortage would be to implement relatively inexpensive drought contingency measures while maintaining output. This typically occurs when a drought is not severe and is of short duration. However, when a drought becomes severe and the inexpensive conservation methods are in use, then a reduction in output will most likely occur. The study provides estimates of the reduction in output that could occur from water supply shortages of various magnitudes.

The 1991 study included a survey of commercial/industrial water users and asked for information regarding water use and the implementation of conservation methods under different water supply scenarios. The data gathered from the survey were used to estimate output elasticities for water. An output elasticity or water measures the percentage change in output for a business or industry that would occur as a result of a percentage change in the water input. For example, if a 1% reduction in available water results in a 0.5% reduction in output, then the output elasticity for water is 0.5. An elasticity greater than 1 indicates water is a very important input and the change in output is greater than the change in available water supplies. Output is very sensitive to changes in water as an input. An elasticity less than 1 indicates other inputs can be substituted for water and output changes less than the change in water supplies.

Elasticities are calculated by industry in the study for shortages between 0% and 15% and between 15% to 30% of full water supply. Three industries showed essentially no relationship between industrial output and water supply shortages: meat packing, production of communication equipment, and motor vehicle production. This means that water is not a critical enough input to significantly impact output decisions or that there are inputs or technology that can substitute

for water as an input to production. These three industries can be extrapolated to similar industries such as: general meat processing, production of electronic based equipment, manufacturing of machinery, and some medical-related manufacturing. The aircraft industry and electronic component sectors also showed a weak relationship between water supplies and commercial production. All the non-zero industries showed an increasing sensitivity of production to reduced water supplies as the amount of shortage increases. Some industries show little reaction to a 15% shortage but a much greater reaction to a 30% shortage. The effects of water supplies on production are summarized qualitatively in Table 10 below.

Table 10. Impact of water shortages on output

Highest Impact	Moderately High Impact	Small but Important Impact	Zero Impact
Bakery products Beverages Paint & allied products	Preserved fruits & vegetables Miscellaneous food and related Soap, cleansers, and related Petroleum refining	Industrial chemicals Concrete, gypsum, & plaster Fabricated metal production Computer and office equipment Some drugs	Meat packing Some drugs Communications Motor vehicles Aerospace

5.2.4 Goddard and Fiske Study

Goddard and Fiske (2005) estimated the impacts and degree of hardship that water shortages impose on municipal water systems. The study was conducted for Santa Cruz, California and evaluated the potential impacts water supply shortages impose on municipal water systems. The study evaluated the potential impacts of water supply shortages of 10% to 60% compared to a full supply. The survey included about 1,900 commercial business accounts and 45 industrial accounts. The study indicated a wide variation in production impacts associated with various water supply shortages. The study indicated that the production impacts from a 15% reduction in water supplies varied considerably from business to business. Initial water use reductions were relatively easy to achieve because the least productive water uses will initially be eliminated and revenue losses will be relatively small. Important exceptions indicated in the study included the semiconductor industry, greenhouse and landscaping industries, and restaurants.

The Goddard and Fiske study also indicated that a 25% reduction in water deliveries to business and industrial water users would lead to a significant reduction in output, averaging about 20% across all sectors. Retailers and restaurants would be particularly hard hit. More affected sectors would include smaller hotels and motels, large semiconductor design firms, and potentially, community facilities. Semiconductor manufacturers would also suffer. The

surveys also indicated 60% of the respondents said non-economic hardships were considerable or extreme and small businesses would be most adversely affected.

A 35% shortage in water supplies to business and industry would result in an average revenue loss across all businesses in excess of 30%, which is approximately a proportional change in output resulting from a water shortage compared to a full water supply. The losses would be greater for restaurants and retailers. The surveys indicated 50% of non-economic hardships were characterized as "extreme." A summary is presented in Table 11 below.

Table 11. Impact of various levels of water shortage on businesses

Extent of Shortage	Shortage Percentage	Business Impact[1]
Business Shortage		
Mild	4%	1
Moderate	13%	2
Serious	22%	4
Severe	27%	4-5
Critical	33%	6
Extreme	48%	6
Industrial Shortage		
Mild	5%	2
Moderate	15%	3
Serious	25%	5
Severe	30%	5
Critical	35%	6
Extreme	50%	6

Business Impact[1]

1 = Little or no impacts (0% reduced revenue)
2 = Some impact (5% reduced revenue)
3 = Intermediate impact (15% reduced revenue)
4 = Considerable impact (25% reduced revenue)
5 = Major impact (33% reduced revenue)
6 = Catastrophic impact (100% reduced revenue)

5.2.5 Bay Area Economic Forum Study

A study of the potential economic losses that could occur to the Hetch Hetchy system (Bay Area Economic Forum, 2002) from an earthquake interrupting deliveries of San Francisco Bay area water supplies was estimated to range from $17.2 billion to $28.7 billion in 2002 dollars. The losses were divided into businesses losses, residential losses, and fire damages that would occur due to water delivery interruptions over a 30-day period. The average daily shortage would be 41.6%, more severe at the beginning of the 30-day period and gradually decreasing to no shortage. The fire-related damages are not relevant here because those damages are caused by the earthquake and the inability to get water to burning property. Of the combined business and residential losses, business losses are estimated to range from 79% to 87% of the two combined losses while residential losses account for 13.0% to 21.0% of combined losses. Although the residential and commercial composition of this area is different than the SAWPA

area, the approximate 4 to 1 ratio of business losses to residential losses is an important result when evaluating the benefits of water supply reliability. It appears likely that the business/commercial losses from reduced reliability are substantially greater than residential losses. Therefore, the benefits of increased reliability are likely to be greatest for commercial water users in areas with a high level of commercial and industrial activity.

5.2.6 Griffin and Mjelde Study

Griffin and Mjelde (2000) estimated the willingness to pay (WTP) for a hypothetical increase in water supply reliability or the willingness to accept payment (WTA) for a hypothetical decrease in reliability for seven Texas cities. The mean WTP for sample data was $8.47 per household per month and the predicted WTP from the model was $9.76 in 1995 dollars. The mean WTA for the sample mean was $12.66 and predicted WTA was $13.20 in 1995 dollars. Indexing these values to 2014 dollars using the Implicit Price Deflator for personal consumption expenditures results in a WTP of $12.06 to $13.90 and a WTA of $18.03 to $18.80 per household per month in 2014 dollars. WTA is expected to be higher than WTP for two basic reasons. First, WTA is not bound by income as a constraint while WTP is bound by a household's available disposable income. Second, WTA represents a change to a less desirable level of utility or satisfaction which would generally be avoided by consumers. The improvement in conditions associated with WTP may be from a level of utility that is acceptable and, due to the law of diminishing returns, would not be valued as highly as a decrease in utility to a level that might not be very acceptable without compensation.

The estimates of the value of water supply reliability for Texas would probably be expected to be somewhat less than reliability values in California due in part to lower population density and as a result somewhat less pressure on water supplies in Texas. The population density for California in 2010 was 239.1 persons per square mile compared to 96.3 persons per square mile in Texas. The value of WTP for improved reliability in the Barakat and Chamberlin California study was $16.52 to $25.13 in 2014 dollars. The Texas based WTP estimates are 55% to 73% of the California estimates.

5.2.7 Hensher, Shore, and Train Study

A primary conclusion of a study by Hensher, Shore, and Train (2006) was that there was a general lack of WTP to avoid most relatively minor types of drought-induced restrictions. The study showed that there was essentially a zero WTP to avoid low-level and low-frequency restrictions and a very low WTP for restrictions that are not in place every day. It was acknowledged in the Hensher, et al. study that their results were counter to WTP findings in many other contingent valuation-based water supply reliability studies. However, the conclusion of the authors was that the inconvenience of relatively low-level restrictions was acceptable relative to increasing out-of-pocket expenses as long as water use restrictions were flexible enough to allow customers to maintain their existing lifestyle. In other words, as long as the reliability-related response did not reduce

customer utility, then WTP to avoid the shortage would be very low. A second study by Hensher, Shore, and Train (2005) concluded that a one unit change in water service interruptions for a system that frequently experiences interruptions (say a change from 12 to 11 interruptions a year) will be valued less than a one unit change for a system that rarely experiences interruptions (say a change from two interruptions to one interruption per year). As a result, the benefit of a one unit increase in water supply reliability (such as a one day reduction in shortages) as measured by willingness to pay will tend to be higher for those systems that currently experience limited supply shortages.

5.2.8 Howe and Smith Study

A study of the value of water supply reliability for three cities along the Colorado Front Range (Boulder, Aurora, and Longmont) looked at the WTP and WTA for decreasing and increasing probabilities, respectively, of annual shortage events (Howe and Smith, 1994). For Boulder the changes in reliability evaluated an increase in probability from 1 in 300 to 1 in 100, an increase in probability from a 1 in 300 to 1 in 50, a decrease in probability from 1 in 300 to 1 in 600, and a decrease in probability from 1 in 300 to 1 in 1,000. For Aurora the changes in reliability evaluated an increase in probability from 1 in 10 to 1 in 5, an increase in probability from a 1 in 10 to 1 in 2, a decrease in probability from 1 in 10 to 1 in 30, and a decrease in probability from 1 in 10 to 1 in 60. Finally, for Longmont the changes in reliability evaluated an increase in probability from 1 in 7 to 1 in 4, an increase in probability from a 1 in 7 to 1 in 2, a decrease in probability from 1 in 7 to 1 in 20, and a decrease in probability from 1 in 7 to 1 in 50. The results of the analysis estimated WTP for Boulder ranging from $4.67 to $5.32 per customer per month in 1992 dollars and WTA ranged from $4.53 to $5.44 per customer per month. The results for WTP for Aurora ranged from $5.82 to $6.51 per customer per month in 1992 dollars and WTA ranged from $6.65 to $8.73 per customer per month. The results for WTP for Longmont ranged from $5.99 to $7.97 per customer per month in 1992 dollars and WTA ranged from $11.08 to $16.06 per customer per month. The range of WTP per connection per month for all three cities is $7.10 to $12.12 and the range for WTA is $6.89 to $24.43 in 2014 dollars.

5.2.9 Koss and Khawaja Study

A study by Koss and Khawaja (2001) estimated mean monthly willingness to pay in 10 California water districts to range from $11.67 per household per month (a 10% shortage 1 out of every 10 years) to $16.92 per household per month (a 50% shortage 1 out of every 20 years) in 1993 dollars, depending on the assumed shortage (as a % reduction from full service) and frequency of occurrence (ranging from a 1 in 3 event to a 1 in 30 event). WTP ranges from $17.32 to $25.11 in 2014 dollars. Koss and Khawaja (2001) compare their results to an earlier study by Carson and Mitchell (1987) completed for The Metropolitan Water District of Southern California. The Carson and Mitchell study estimated an annual willingness to pay to avoid various shortage percentages at different intervals. The range of estimated willingness to pay was $83 to $258 annually per

household in 1987 dollars. The estimated willingness to pay per household based on the Carson and Mitchell study results ranges from about $12.60 to $39.20 per month in 2014 dollars.

5.2.10 Overall Water Supply Reliability Effect

The studies discussed above indicate there are significant benefits associated with maintaining or improving water supply reliability and these benefits accrue to residential and commercial/industrial water users. In the context of expansion of the Brine Line, reliability benefits depend on the acceptability of recycled water as part of the water supply. An opinion poll of San Diego County Water Authority water users (2015) indicated that 88% make a strong connection between a strong economy and a reliable water supply and 86% agreed that there was a strong connection between a reliable water supply and quality of life. The same survey also indicated that 94% residents supported the concept of a multi-source diversified water supply. This diversification included treating recycled water used for irrigation for use as part of a potable water supply and the use of advanced treated recycled water as an addition to existing drinking water supplies. Approximately 71% of those polled indicated the process of using recycled irrigation water for potable supplies was possible and 73% favored advanced water treatment. These survey results indicate the potential acceptance of water recycling and treatment for increasing drinking water supplies and generating water supply benefits.

The information provided in the California Urban Water Agencies study (Spectrum Economics, Inc., 1991) and the Goddard and Fiske study (2005) indicate that a water shortage of 7.5% during drought conditions in California would translate into reduced water supplies of about 5.0%. The average commercial business output impact of a 5% water supply reduction indicated by the two California studies is essentially zero. However, a water shortage of 15% is estimated to translate into an 11.7% to 12.1% reduction in water supply. A 12% reduction in available supplies in a marginal area where negative production output effects are beginning to occur would translate into an overall average of a 5% reduction in commercial revenues. This represents a significantly greater potential impact on economic activity.

A shortage of 25% is estimated to translate into a 21.9% to 22.3% reduction in water supply. The two studies indicate that an actual reduction in water use of approximately 22% is likely to translate into a nearly proportional decrease in business revenues, on average across all businesses. This represents a potentially large regional economic impact from a water shortage. A shortage of 35% would translate into a 32.3% to 32.7% reduction in water supply and this level of reduction would translate into very substantial impacts, ranging from 30% to 50% or more depending on the sector affected.

5.3 Potential Water Supply Reliability Benefits of the Brine Line

The studies summarized above indicate water supply reliability benefits would be expected to accrue to both residential and commercial water users. The extent of the benefits depends on the magnitude and frequency of shortages avoided. The reliability estimates shown above provide a basis for estimating the magnitude of Brine Line water supply reliability benefits.

The above estimates of the value of water reliability represent benefits at the retail level, where a treated supply is provided at the tap. However, water supply reliability benefits associated with impacts of the Brine Line would be at the base supply or wholesale level. The value (price) of treated water delivered to the point of final use at the retail level will generally be substantially higher than the value (price) of raw water at the wholesale level as will the associated benefit or value of the water supply. Therefore, water supply benefits measured in terms of increased reliability to commercial, industrial, and residential water users will overstate Brine Line benefits because the values are representative of the retail level. A methodology is needed to adjust retail-based values to the wholesale level which can be used to estimate Brine Line-related reliability values.

5.3.1 Converting Retail Values to Wholesale Values

One approach that can be used to estimate the percentage of retail water values attributable to raw water supplies is to estimate the costs of the various inputs needed to produce a retail water supply and use those costs to calculate percentages of total cost attributable to each input. The percentage of input costs that represent raw water supplies, or wholesale water supplies, can then be applied to retail values to adjust benefits to the appropriate level. The primary difference between water value at the retail level and wholesale level are costs related to the treatment and distribution of municipal water. Estimating the exact treatment and distribution costs for different water suppliers at different times of the year is not feasible for this appraisal level analysis. However, general municipal water supply cost information can be used to estimate the percentage of total water supply costs that are attributable to providing water at the retail level and the difference between total cost and retail- related costs can be assigned to wholesale level supplies. The estimated percentage for wholesale costs can then be used as a proxy of the percentage of total value attributable to wholesale water supplies.

A survey of community water systems by the U.S. Environmental Protection Agency (EPA, 2009) provides estimates of the percentages of water supply costs attributable to different aspects of providing water service. These cost percentages were estimated for purchased water, security, depreciation, income taxes, payments to general and reserve funds, other routine operating expenses, debt service, land, water source, transmission and distribution systems, treatment, and storage. The EPA survey also asked each participating utility about capital expenses over the five-year period prior to the survey. It is assumed that water

treatment and distribution costs are associated with providing retail water service. At least a portion of all other expenses are assumed to be attributable to wholesale service costs. The percentage of total expenses associated with different expense categories are shown in Table 12.

Two categories of expenses shown in Table 12 are considered to be entirely part of the cost of providing wholesale water supplies, purchased water and security. The other seven categories of costs include a wholesale component, but the proportion of the cost attributable to wholesale supplies is not known.

Table 12. Water supply expenses by category as a percentage of total expenses

Expense Category	Percentage of Total Costs
Purchased water	8.9%
Security	0.4%
Depreciation	5.0%
Income taxes	1.2%
Payments to general fund	0.4%
Payments to reserve funds	2.6%
Other routine operating expenses	65.7%
Debt service	8.5%
Capital Improvements	7.3%

Source: U.S. Environmental Protection Agency, Office of Water. 2006 Community Water System Survey, Volume II: Detailed Tables and Methodology. EPA 815-R-09-002, May 2009.

The capital improvements component of expenditures shown in Table 12 is further broken down in the 2009 EPA report into seven expenditure categories, including transmission and distribution system costs and treatment costs. The percentage of total capital expenditures attributable to each expense category is shown in Table 13.

Table 13. Capital-related expenses by category as a percentage of total expenses

Agency/City	Percentage of Capital Expense
Land	1.3%
Water Source	8.7%
Transmission and distribution systems	45.9%
Treatment	24.4%
Storage	8.7%
Security	0.5%
Other	10.5%

Source: U.S. Environmental Protection Agency, Office of Water. 2006 Community Water System Survey, Volume II: Detailed Tables and Methodology. EPA 815-R-09-002, May 2009.

The capital-related expense percentages for transmission and distribution system and treatment costs equal 70.3% of total capital costs, so 29.7% of costs represent wholesale expenses. Assuming this percentage also applies to expenditures in Table 12 that contribute to both retail and wholesale costs, the portion of all costs attributable to wholesale supplies can be estimated. The derivation of these percentages is shown in Table 14.

Table 14. Impact of water shortages on output

Expense Category	Total Expense	Wholesale Factor	Wholesale Portion
Purchased water	8.90%	1.0	8.90%
Security	0.44%	1.0	0.44%
Depreciation	5.00%	0.297	1.49%
Income taxes	1.20%	0.297	0.36%
Payments to General Fund	0.40%	0.297	0.12%
Other Routine Operating Expenses	65.70%	0.297	19.52%
Debt Service	8.50%	0.297	2.53%
Payments to Reserve Funds	2.60%	0.297	0.77%
Land	0.09%	1.0	0.09%
Water Source	0.63%	1.0	0.63%
Transmission and Distribution System	3.35%	0	0%
Treatment	1.78%	0	0%
Storage	0.64%	0.297	0.19%
Other	0.77%	0.297	0.23%
Total	100.00%	-	35.27%

Based on the data provided in the 2009 EPA report and the assumptions discussed above regarding expenses attributable to supplying water at wholesale level, approximately 64.73% of water supply expenses for all systems are attributable to distribution, transmission, and treatment of water. The remaining 35.27% of final water supply costs are related to the raw water supply and provision costs, which is representative of wholesale costs. It should be noted that the percentages presented in Tables 12, 13, and 14 are representative of all systems combined. The distribution of costs would likely vary by type of system and system size.

5.3.2 Potential Brine Line Water Reliability Benefits

Brine Line water reliability benefits would be expected for both residential water users and commercial water users. The previous studies reviewed and discussed in earlier sections of this analysis address both sectors of use. However, the benefits estimated for residential water users are described in terms of dollar values per household for varying levels of shortage while commercial/industrial benefits are described more in terms of changes in output or revenues resulting from water shortages or the relative damages of water shortages on businesses compared to residences. One useful feature of the household sector benefit estimates is that they are presented in terms of benefits per household rather than benefits for a specific quantity of water. Conceivably, potential Brine Line water reliability benefits could be estimated by multiplying the benefit per household by the total number of households in the SAWPA region. However, some assumptions must be made regarding the possible impact of the Brine Line on overall water supplies and reliability, and the value of water supply impacts.

The first assumption is that the impact of the Brine Line on water supply reliability is similar to the effects of at least one of the studies cited. The previous studies evaluated a wide range of potential reliability impacts measured in terms of the frequency and extent of shortages avoided. Clearly, if the Brine Line would have much less of an effect on the frequency or extent of water shortages than those evaluated in the studies cited above, then the reliability benefits of the Brine Line would be less than indicated in previous studies. In order to have water reliability benefits associated with an action (supply project, reuse, increased efficiency, etc.) then there must be a shortage condition. Section 4.1: General Economic Conditions section of this report indicated that population in the region will continue to grow and that the Brine Line would protect water supply quality and availability.

The second assumption is that the value of water in the SAWPA region is similar to the values derived from previous studies. Overall water supply and demand conditions, and therefore the price, of water may be very different than what existed when these studies were conducted. Indexing values to the current time period would not capture changes in specific water market conditions, but would simply account for overall general inflation. The estimated household water supply reliability benefits estimated from the previous studies reviewed and the values adjusted to the wholesale level are presented in Table 15.

Table 15. Estimated water supply reliability benefits potentially applicable to the SAWPA Region

Source of Benefit Estimate	Estimated annual reliability benefit per household at the retail level (2014 $'s)		Estimated annual reliability benefit per household at the wholesale level (2014 $'s)	
	Low	High	Low	High
Barakat and Chamberlin, 1994	$198	$302	$70	$107
Carson and Mitchell, 1987	$151	$470	$53	$166
Griffin and Mjelde, 2000	$145	$167	$51	$59
Koss and Khawaja, 2001	$208	$301	$73	$106
Orange County Business Council, 2003	$199	$308	$70	$109

The estimated population and number of households in the SAWPA region as presented in the General Economic Conditions section is shown in Table 16. The county totals account only for Zip Codes included in the SAWPA region.

Table 16. Estimated population and number of households in the SAWPA area by county

County or Region	Population	Number of Households	Households as a Percentage of SAWPA Regional Total
Los Angeles County	285,200	80,300	6.8%
Orange County	155,600	49,100	4.2%
Riverside County	1,911,500	558,800	47.6%
San Bernardino County	1,720,900	487,000	41.4%
SAWPA Region	**4,073,200**	**1,175,200**	**100.0%**

The information presented in Table 15 and Table 16 is the basis for estimating potential residential sector water reliability benefits. The reliability benefits using each of the studies reviewed for which benefits were monetized are summarized in Table 17. Annual benefits are estimated over a 50- and 100-year period of analysis to represent benefits over the project life. Benefits are present valued using the Fiscal Year 2016 water project planning rate of 3.125%.

Table 17. Estimated total annual and total Brine Line reliability benefits in the SAWPA Region

Source of Benefit Estimate	Estimated Annual Potential Brine Line Reliability Benefit in SAWPA Region (millions)		Present Value of Potential Brine Line Reliability Benefits in the SAWPA Region over 50 and 100 years (billions)	
	Low	High	50 years	100 years
Barakat and Chamberlin, 1994	$82.06	$125.15	$2.062 - $3.145	$2.505 - $3.820
Carson and Mitchell, 1987	$62.66	$194.94	$1.575 - $4.899	$1.913 - $5.950
Griffin and Mjelde, 2000	$59.98	$69.13	$1.507 - $1.737	$1.831 - $2.110
Koss and Khawaja, 2001	$86.13	$124.87	$2.165 - $3.138	$2.629 - $3.812
Orange County Business Council, 2003	$82.35	$127.71	$2.069 - $3.209	$2.513 - $3.898

There is a wide range of reliability benefit estimates presented in Tables 15 and 17 representing different levels of shortage occurring with different levels of frequency. The average of all high and low estimates presented in Table 15 is about $245 annually per household. The Griffin and Mjelde study (2000) is based on Texas data and the Barakat and Chamberlin study results showed some inconsistency in the willingness to pay results as the potential severity and duration of shortage varied. It should be noted that the Orange County Business Council (2003) analysis was based on the Barakat and Chamberlin study data. The Carson and Mitchell (1987) study is dated compared to the other studies and it would be preferable to have more recent estimates. The Koss and Khawaja study (2001) is based on data obtained from California urban water agencies and the lower bound estimate represents the willingness to pay to avoid a 1 in 10 year occurrence of a 10% shortage. The Koss and Khawaja study lower bound estimate of willingness to pay was judged to be potentially the most representative of potential Brine Line water reliability benefits in the SAWPA region. It is not known if the potential supplemental supplies associated with the Brine Line would equate to the potential to avoid this type of shortage, but it is more likely to

alleviate a relatively small shortage than the more extensive shortages described in the other studies. The low end benefit estimates based on the Koss and Khawaja study range from $2.165 billion over a 50-year period of analysis to $2.629 billion over a 100-year period of analysis. However, it must be realized that these benefits assume that the Brine Line would be responsible for alleviating a 10% shortage once every 10 years. It should be noted that if the Brine Line could only address a 5% shortage every 10 years, the benefits attributable to the Brine Line would be much less than indicated above. Therefore, the $2.165 to $2.629 billion estimate of benefits should be considered an indicator of the potential magnitude of benefits rather than as a precise estimate of benefit.

5.4 Potential Salton Sea Benefits

A recent Pacific Institute study (Cohen, 2014) provides an analysis of conditions that could occur at the Salton Sea if no action is taken to restore the Sea and no air quality management projects are undertaken. To the extent that expansion of the Brine Line could provide supplemental water supplies which would aid in restoration of the Sea, some potential Salton Sea benefits could be attributable to Brine Line expansion.

The specific impact categories in the 2014 Cohen study included: health costs associated with increased dust emissions, changes in property values in the region due to declining aesthetic values, reduced agricultural productivity, reduced recreational activity and revenues, and reduced ecological values. In addition, the 2014 study indicated that the potential capital cost (in 2013 dollars) for a Salton Sea revitalization alternative preferred by the California Natural Resources Agency was about $10 billion with a present value of annual O&M costs over 40 years of $9.6 billion. The 2014 study provides information on the potential damages that could be avoided if a future decline in conditions at the Salton Sea did not occur. The avoided damages represent a benefit from actions taken to prevent future degradation of the Salton Sea. The use of avoided damages as a measure of benefit is based on the assumption that the damages would be repaired or mitigated in some way if they occurred. However, avoided damages are not strictly a measure of willingness to pay and actual benefits as measured by willingness to pay could be higher or lower than cost-based avoided damages.

5.4.1 Health Costs

The health effects are described in the 2014 Cohen study in terms of impacts from blowing dust originating from exposed land at the Salton Sea lakebed. Public health-related costs would be expected to increase as the Salton Sea shrinks and exposes more of the lakebed. Health-related damages were evaluated in terms of violations of Federal air quality standards and estimates of particulate-related health damages from a variety of studies. The general approach is based on the benefits transfer concept of combining estimates of current and future dust emissions without any action with per unit estimates of damages. Information is provided which estimates the tons of dust emitted from the Salton Sea playa

through 2047. This provides the physical quantity of the resource affected which is multiplied by the estimated value per unit to estimate the costs of no action. The present value of public health costs estimated in the 2014 study as a result of no action at the Salton Sea ranges from about $2.2 billion to $37 billion for the years 2000 through 2047 in 2013 dollars. The average annual equivalent value of health costs over the period of analysis ranges from $141 million to $1.758 billion using discount rates of 4% and 6% as used in the Cohen study. The estimated present value of dust damages over the 2000 to 2047 period translates into a value of approximately $56,400 to $79,900 per ton.

The estimated value per ton of dust provided in the 2014 Cohen study appears to be quite high. It should be noted that an information source cited in the Cohen study estimated an inflation adjusted health care cost of $55,000 per ton of particulate matter. For comparison, a U.S. Environmental Protection Agency summary report on the benefits and costs of the Clean Air Act (U.S. EPA, 2011) estimated annual air pollution reduction benefits of about $1.95 trillion by 2020 and a pollution reduction of about 61 million tons for 2020, which translates into a value of about $32 per ton for all types of air pollution. However, the 2011 U.S. EPA study also indicates that additional emission reductions could cost $15,000 per ton and at that cost some local entities would be reluctant to pay. So, avoided costs could be as high as $15,000 per ton based on U.S. EPA studies. The damages from particulate pollution tend to be very site specific, so applying the average value per ton for the entire United States to the Salton Sea would not account for local characteristics. However, the $15,000 per ton value may represent a threshold at which the benefits of a reduction are nearly equal to costs at the local level. Using the $15,000 per ton damage value would result in dust-related damages of $37.5 million to $330.0 million annually or $0.59 billion to $6.99 billion based on 45 and 6% discount rates.

5.4.2 Property Values

The estimation of losses stemming from reduced property values is complicated by the fact that many environmental attributes are incorporated in property values. Therefore, including the influence of those attributes on property values as an avoided cost (benefit) and separately estimating the avoided losses (benefits) associated with those attributes will most likely result in double counting of avoided losses. For example, air quality is one factor that can influence property values. All else equal, a home located in an area with poor air quality would be expected to have a lower value than the exact same house in an area with good air quality. Therefore, the difference in property values represents a benefit value for good air quality relative to poor air quality. If a separate analysis was completed using surveys to estimate the economic value of good air quality and that value was added to the estimated change in property values, the air quality benefits would be overstated due to double-counting. However, the estimate of property value costs is still important because changes in property values potentially influence property tax revenues, which is a fiscal impact. The 2014 Pacific Institute study estimated potential property value impacts from no action to be at

least $400 million and perhaps as high as $7 billion if impacts spread more broadly into the Coachella Valley. These property value impacts likely include to some extent health-related costs, recreation losses, and reduced aesthetics which are factored into individual location decisions and ultimately into property values. As a result, property values are not included as a separate measure of economic value associated with the Salton Sea in this analysis.

5.4.3 Agricultural Productivity

Agricultural productivity impacts estimated in the Pacific Institute study were based on the potential impacts of dust on plant growth and production. There was discussion of lettuce crop damages if the effect of dust was equal to 1% of production. However, the use of a 1% damage estimate was arbitrary and the analysis failed to account for potential cropping pattern changes that could compensate for lost revenues due to reduced productivity. As a result, reliable estimates of potential agricultural productivity losses cannot be made and a value of zero is assumed.

5.4.4 Recreation

The Cohen study (2014) indicated Salton Sea recreation visitation is likely to continue to decline in the future if no action is taken, although it is pointed out that inaction would not adversely affect all recreation uses. The study estimated that recent declines have caused a loss of $6 million per year in direct spending at the Salton Sea State Recreation Area. As can best be determined from information provided in the study, the average number of visitor days at the Salton Sea State Recreation Area decreased from about 260,000 visitor days annually over the 1961 to 2009 period, to about 74,000 visitor days from 2010 to 2012, and then to an estimated future condition without any action of 37,000 visitor days annually. Applying the visitation losses estimated by Cohen to the 48-year period from 2000 to 2047 resulted in an estimated present value loss of $110 million to $150 million in recreation expenditures through 2047, depending on the discount rate used (Cohen, 2014). The estimate was described in the study as a conservative estimate. The estimated average expenditure used in the study was $30 per person per day.

It should be noted that recreation expenditures are not the equivalent of recreational benefits. Recreation expenditures are important from a regional perspective because the expenditures represent an injection of money into the region, which is then spent and re-spent to create income and employment (as discussed in the regional impact analysis discussion above). Recreation benefits are represented by the value of an activity in terms of willingness to pay to participate in that activity. The net benefits of a recreation visit are equal to the willingness to pay minus the cost of participation. This value is referred to as consumer surplus and is a measure of economic benefit from recreation. Consumer surplus is not generally equivalent to recreation-related expenditures.

Several recreation activities are supported by the Salton Sea. Some of these activities include wildlife viewing (bird-watching), fishing, camping, and other

general activities. Several studies have been completed estimating the value of these types of activities in southern California which can be used to roughly estimate lost recreation value from no action at the Salton Sea. A recreation database maintained by the Oregon State University Department of Forestry (Rosenberger, 2013) and a summary of recreation values on National Forests and other public lands (Loomis, 2005) can be used as the basis for representative recreation values. The Rosenberger database (2013) includes six California studies providing seven estimates of economic value for wildlife viewing. The average value of these estimates in 2010 dollars was a little over $47 per visitor day, or $50.30 in 2014 dollars. The Loomis study (2005) provided estimates of value for fishing ($44.36/day), general recreation ($32.35 per day), camping ($104.35 per day), and wildlife viewing ($72.48 per day) for the three West Coast states. The average benefit for recreation for these four activities is a little over $63 per day in 2004 dollars, or $76.40 in 2014 dollars. The economic benefit from preventing lost recreation opportunities appears to be larger than the lost recreation revenues. Applying the loss in visitation between the 1961-2009 period and the future estimated by Cohen, a loss of 233,000 visits, to the low and high estimates of value per day from the Rosenberger and Loomis studies results in an estimated loss in recreation value of $11.2 million to $17.0 million annually.

The 2014 Cohen report indicates that some of the decline in Salton Sea State Recreation Area (SSSRA) visitation may reflect the impacts of the recession and decreased discretionary spending, but the full observed decline is used as the basis for estimated recreation impacts. The use of the full decline is likely to overstate the loss in future recreation without any action. To try and address the potential overstatement of losses, recreational visitation and acreage data for all California state parks and for the Colorado Desert District, which includes the SSSRA, were collected from California State Park System Statistical Reports for Fiscal Years 2001/2002, 2010/2011, and 2013/2014. The visitation data are shown in Table 18 below.

Table 18. California State Park System statistical report data

State/Region/Site	Visitation	Acreage	Visits per acre	Percentage change in visitation			
				2001/2002 FY to 2010/2011 FY		2010/2011 FY to 2013/2014 FY	
				Visits	Visits per acre	Visits	Visits per acre
California				-25.8%	-19.3%	+19.0%	-2.9%
2013/2014 FY	75,513,021	1,613,413	46.8	-	-	-	-
2010/2011 FY	63,453,272	1,316,735	48.2	-	-	-	-
2001/2002 FY	85,537,217	1,433,096	59.7	-	-	-	-
Colorado Desert District				-30.2%	-30.7%	+3.1%	+1.2%
2013/2014 FY	1,471,555	654,635	2.2	-	-	-	-
2010/2011 FY	1,428,379	642,845	2.2	-	-	-	-
2001/2002 FY	2,046,960	638,231	3.2	-	-	-	-

Salton Sea State Recreation Area				-46.5%	-46.5%	-59.7%	-55.5%
2013/2014 FY	49,190	15,313	3.2	-	-	-	-
2010/2011 FY	121,982	16,901	7.2	-	-	-	-
2001/2002 FY	228,148	16,901	13.5	-	-	-	-

Source: California Department of Parks and Recreation. Website: www.parks.ca.gov/?page_id=23308.

The state and district recreation data indicate that there appears to have been an overall general decline in recreation use from the 2001/2002 Fiscal Year to the 2010/2011 Fiscal Year in the 25-30 percent range. However, the decline for the SSSRA is approximately double the rate of decline for the state as a whole and about 50% higher than for the Colorado Desert District. In addition, the decline in visitation at the SSSRA continued to the 2013/2014 Fiscal Year while total visitation over the later period increased for all of California and increased slightly for the Colorado Desert District. The conclusion is that some of the decreased historical recreation visitation at the Salton Sea is likely due in part to overall economic conditions but the most recent decline may be due to poor site quality.

The 2014 Cohen study used 37,000 visits as the estimate for diminished recreational use with deteriorating conditions for the Salton Sea. As shown in Table 18 visitation was 49,190 for the 2013/2014 Fiscal Year at the SSSRA. Additional information not shown in Table 18 was obtained from California State Park System Statistical Reports (California Department of Parks and Recreation, 2016) for the 2012/2013 and 2011/2012 Fiscal Years indicated 51,346 visits in 2012/2013 and 38,713 visits in 2011/2012 at the SSSRA. Over the last three years visitation appears to be recovering somewhat. As discussed previously some recreation activities would not be adversely affected by future deteriorating conditions. It is possible that this minimum level of recreation has been reached and future recreation may be relatively stable at the 40,000 to 50,000 visit level even with deteriorating conditions. Visitation dropped precipitously from Fiscal Year 2010/2011 to 2011/2012 by about 68% but then rebounded somewhat, averaging about 50,268 visitors over the following two years. Given the potential that minimum visitation levels have been reached with the low level of visitation recorded in the 2011/2012 Fiscal Year, the latest three year average visitation may be a better measure of future visitation compared to the approach used in Cohen (2014) of arbitrarily cutting the average number of visitor days by one-half. The average visitation over the latest 3 years is 46,400 visits. Using average visitation over the last 3 years as the basis for estimated future visitation, the visitation loss from no action would be 213,600 visits for an estimated range of recreation losses of $10.7 to $16.3 million annually in 2014 dollars.

5.4.5 Environmental/Ecological Values

Non-use values were also included in the 2014 Pacific Institute Salton Sea analysis. The 2014 analysis relied on a previously completed evaluation of potential non-market benefits attributable to the Salton Sea (K2 Economics, 2007). The K2 Economics study used a benefits transfer application based on

several contingent valuation studies for Mono Lake. It was acknowledged in the 2014 Pacific Institute Study that people have more familiarity with Mono Lake than the Salton Sea and would potentially place a higher value on maintaining Mono Lake. The Pacific Institute study goes on to point out that the Salton Sea is larger and supports greater species diversity than Mono Lake, so values based on Mono Lake may be appropriate. However, there are some basic issues with benefits transfer that make the direct use of Mono Lake values for estimating Salton Sea benefits problematic.

In a recreation report by Rosenberger and Loomis (Forest Service, 2001), the conditions necessary for performing benefits transfer are described. These include a good definition of the resource conditions and magnitude of change at the site being evaluated; good data and analysis at the site from which benefits are being transferred; and similarity of resources, similarity of quality and quantity changes, and similarity of markets. There are considerable differences in the two sites in terms of resource conditions, magnitude of change, and similarity of resources. The Rosenberger and Loomis report also specifically states that if the characteristics of the study site and policy site are substantially different, this can lead to very different and distinct values.

The 2007 K2 Economics study indicated the benefit estimates should not be considered refined and precise estimates because they were not based on primary data analysis. The 2014 Pacific Institute analysis used those estimates as a basis for Salton Sea annual non-use benefits of $1.9 to $2.6 billion. “Arbitrarily” assuming a 15% per year decline in habitat values, the estimated present value of lost Salton Sea habitat values were estimated to range from $10 billion to $26 billion through 2047.

6. Cost Effectiveness Analysis

The cost effectiveness of using the Brine Line for brine disposal depends on the quantity of wastewater that would be discharged by the user. For larger users the Brine Line could significantly reduce disposal costs. For smaller users the cost reduction may be negligible. The Santa Ana Watershed Project Authority web page (SAWPA, 2015) provides an example cost comparison between disposal using a Brine Line Connection, a Brine Line and dump truck combination, and a non-Brine Line disposal option. The example is for the Inland Empire Utility Agency and disposing of one million gallons of brine. The estimated cost is $250,000/million gallons for the non-Brine Line disposal option, $50,000 for the Brine Line and dump truck combination, and $2,000 for the Brine Line Connection option. Although the example is generic, it does provide a relevant illustration of potential cost savings/benefits of services associated with the Brine Line.

However, the example comparison of costs may overstate the difference in disposal option costs if potential users required a lower quantity of brine disposal than used in the example. The difference in per unit costs will decrease as the quantity of wastewater disposed of decreases. Example cost calculations for two hypothetical waste disposal customers were provided in a Santa Ana Regional Interceptor Market Analysis (Market Analysis) Final Draft Report (Environmental Engineering & Contracting, Inc., 2009). The quantity of waste disposal required by the pharmaceutical enterprise was assumed to be 40,000 gallons per day (gpd) and the assumed disposal for the laundry enterprise was 100,000 gpd. Some of the categories of disposal costs included in cost calculations are based on owned or leased capacity and are therefore not proportional to disposal volume. The example cost calculations show volume based charges that are 78% higher for the laundry enterprise while the disposal volume was 150% higher for the laundry enterprise. The estimated costs exclude any costs associated with differing biological oxygen demand and total suspended solids characteristics.

The Market Analysis indicated that as of July 1, 2009 there were 26 direct dischargers totaling 11.541 MGD of disposal flow, or an average of 0.4439 MGD per discharger. The Market Analysis also identified potential new customer opportunities within the service area based on a survey of those that discharge to Publicly Owned Treatment Works. A total of 26 potential new customers were identified. Of the 26, two indicated zero disposal flows and one did not provide an estimate. The total disposal flow estimated for the 23 with a disposal flow greater than zero was 1.868 MGD, or an average of 0.0812 MGD per discharger. This quantity represents about 18% of the current direct dischargers' average per discharger.

The Market Analysis also includes estimates of discharge volume for indirect discharges. A total of 43 indirect discharges were identified, averaging 4,203 gpd. The highest volume current indirect discharger had a typical discharge volume of 46,794 gpd. Nine of the 23 potential new customers identifying disposal flows had flows less than 46,794 gpd and could potentially represent indirect dischargers. However, the main point is that the potential new water users most likely represent a group that would not be paying the lowest cost for direct Brine Line disposal services but may instead use an option that is closer to the Brine Line Collection Station option. For larger users there would be some potential economic and financial benefits to future commercial establishments locating in the region and using the Brine Line.

A commercial water user's production decision becomes a problem of profit maximization during times of a water shortage. The same basic approach can be applied to wastewater service, where the choice of type of service is based on the reliability of service and cost. This means that a producer would combine production inputs and determine its level of output based on the availability of water inputs and wastewater service that may be in short supply. Production decisions would be influenced by the following factors:

- The degree to which water supply and wastewater disposal constraints are binding production.
- Uncertainty about the adequacy of future supplies and disposal.
- Future plans of a business to expand and increase input.
- The extent to which water conservation methods have already been adopted and could be adopted further.
- The cost of conservation.
- The extent to which a strategy could be chosen that would lower the risk of interrupted production due to a water supply shortage or wastewater service limitations.

Clearly, if the costs associated with water supply and wastewater service limitations are very high, then the incentive to locate elsewhere increases and the potential negative economic effects of not having adequate wastewater disposal services or water supplies increase.

7. Regional Impact Analysis

As discussed previously in the Regional Impact Analysis subsection of the methodologies section, a regional impact analysis evaluates the effect of a project or change in policy on income, employment, and the value of output produced on the local region most influenced by a proposed project or change. Two different approaches are used to measure regional impacts in this section. The first is to provide estimates of the impacts associated with the least cost alternatives presented in the Inland Empire Interceptor Appraisal Analysis Technical Memorandum 3.0 (Reclamation, 2013). The second is to present impacts by categories of spending in terms of regional impacts per $1.0 million spent. The second approach is more general, but the results can be applied to any project for which expenditures are known.

Regional impacts from recreation spending are based on the recreational expenditure estimates provided by the Cohen (2014) analysis of Salton Sea benefits and the adjusted recreation visits without taking action to reverse the Salton Sea decline described in the Potential Salton Sea Benefits section.

The regional impact area defined for this analysis includes Imperial, Los Angeles, Orange, San Bernardino, and Riverside Counties. Imperial County is included even though it is outside of the SAWPA service area because some regional effects could occur, primarily related to recreation activity, in the Salton Sea area. These five counties have economic linkages which create a region of impacts

resulting from changes in expenditures associated with any project construction that takes place, spending on operation and maintenance activities, commercial production supported by water supplies, household expenditures, and recreation expenditures. A Brine Line extension would result in project construction expenditures that would have employment and income effects. Similarly, operation and maintenance (O&M) expenditures associated with Brine Line construction would also lead to increased employment and income. Finally, business and residential development supported by services and any additional water supplies provided by the Brine Line will also have positive regional economic impacts.

Another issue associated with the estimation of regional impacts from construction and O&M expenditures is the proportion of construction expenditures that are actually spent in the impact region. Inputs necessary for construction and O&M (such as concrete, steel, energy, labor, and others) that are not purchased within the impact region would not generate regional impacts. In addition, the basic principle of a regional economic impact analysis is to include the net changes in expenditures within a region that are associated with a project. For example, if a project is going to receive 50% federal cost sharing and 50% will be locally funded, then the federal portion represents an injection into the local economy that will generate additional regional spending and activity. However, the 50% local share represents a redistribution of spending, not additional expenditures, because the local share would not be spent somewhere else. If O&M is entirely a local regional responsibility, then O&M costs passed on to the businesses and individuals would result in a decrease in spending elsewhere. For the purposes of this analysis it is assumed that 50% of total costs (both construction and O&M) would be cost shared by entities outside the service area. It is assumed that all recreation expenditures are local and represent spending by visitors from outside the region.

IMPLAN version 3.1 is used to estimate regional impacts. The model represents 2013 conditions and the base year data is 2014. In order to estimate the regional economic impacts associated with Brine Line construction, O&M, and recreational expenditures were input into the IMPLAN model. IMPLAN sectors were matched up as closely as possible with each expenditure category. The expenditure categories, IMPLAN sector, and sector description used to estimate impacts are shown in Table 19. Three IMPLAN sectors were used for recreation expenditures, where one-third of expenditures were attributed to each sector. The impacts associated with each alternative are measured in terms of changes in industry output, employee compensation, and employment. Industry output is a measure of the value of industry's total production. Industry output is directly comparable to Gross Regional Product. Employee compensation represents wages and benefits paid to employees.

Table 19. IMPLAN sectors used to estimate regional impacts

Expenditure Category	IMPLAN Sector	IMPLAN Sector Description
Construction	61	Construction of other new nonresidential structures
OM&R	62	Maintenance and repair construction of nonresidential structures
Recreation	400	Retail – food and beverage
	402	Retail – Gasoline station
	499	Hotels and motels, including casino hotels

The Inland Empire Interceptor Appraisal Analysis (Reclamation, 2013) provided cost estimates for the least cost alternatives for the combined Santa Ana Watershed and Coachella Valley service areas. In addition, the estimated costs of treatment facility alternatives to remove TSS and BOD from flows prior to discharge to the Salton Sea were provided. The estimated costs for the least cost Brine Line alternatives and the treatment facility alternative are used to evaluate regional impacts. The costs from the analysis are presented in Table 20.

Table 20. Least cost construction and O&M costs

Description	SAW Alt. 2 (millions)	CV Alt. B-1 (millions)	TF Alt. 5-1 (millions)	Total (millions)
Construction cost	$506.52	$464.13	$665.64	$1,636.29
Annual O&M costs	$20.25	$4.66	$9.98	$34.89

The analysis of the potential maximum impact of no action on Salton Sea recreation in Recreation Section 5.4.4 of this analysis estimated a loss 213,600 visits from the 1961 to 2009. Using the recreation expenditure estimate of $30 per visit from the Cohen study (2014), the potential loss in recreation spending could be about $6.39 million.

The total estimated regional impacts from the expenditures assumed above are presented in Table 21. In addition, the impacts per million dollars of change in costs are presented. Construction impacts represent short term impacts that will only occur during the construction period. Annual O&M and recreation impacts would occur long-term over the life of the project.

Table 21. Estimated regional impacts from construction, O&M, and recreation expenditures

Impact Sector	Value of Output (millions)	Labor Income (millions)	Employment (jobs)
Total construction impact	$1,373.40	$339.56	8,321
Total annual O&M impact	$27.74	$8.95	179
Total recreation impact	$4.5	$1.62	45
Construction impact per million $'s	$0.84	$0.21	5.1
Annual O&M impact per million $'s	$0.80	$0.26	5.1
Recreation impacts per million $'s	$0.70	$0.25	7.0

It should be noted that the impacts presented in Table 21 do not include impacts related to commercial and industrial output that would be supported by the Brine Line and may not occur if the Brine Line was not in place. The magnitude of these impacts is unknown; however, given the potential for commercial growth these additional regional impacts could be significant. The discussion of general economic conditions in the Financial Analysis section and the Ability to Pay section both indicate future growth in commercial activity in the SAWPA region and the forecasted Brine Line flows in the Bureau of Reclamation Santa Ana Watershed Basin Study, Technical Memorandum 3.2 (Reclamation, 2013) all indicate the number of commercial establishments depending on the Brine Line could increase substantially. Given the total value of sales in SAWPA described in Section 4.2: Ability to Pay was over $300 billion annually, even a very small impact of the Brine Line on regional business activity would translate into a relatively large impact.

8. Analysis of Fiscal Impacts and Economic Development

The primary purpose of a fiscal impact analysis is to estimate the impact of a project, development, or land use change on the costs and revenues of governmental units serving the project or development. The analysis is generally based on the fiscal characteristics of the community, including categories of revenues and expenditures as well as potential changes in land use and transportation patterns. This type of analysis allows local governments to compare the costs of providing services and infrastructure with the potential revenues associated with a project.

The appraisal level analysis presented here is a simplified fiscal impact analysis that presents current county level revenues and expenditures on a per capita and per employed person basis as well potential tax revenues from a Brine Line expansion. The basic approach used here is an average cost per-capita multiplier method. This simply means that the current average cost, or expenditure, for different categories of local public spending per person and per employed person is calculated and used as a measure of service costs that would be expected if a project leads to population and employment growth. The same basic approach is used to estimate local government revenues. The average cost approach does not take into account excess or deficient capacity to deliver services and it assumes that average costs of municipal services will remain stable in the future. An alternative approach based on marginal costs of providing services relies on an analysis of the demand and supply relationships for public services and accounts for excess and deficient capacity that may exist in a region. The marginal approach is more accurate because growth is not viewed in a linear manner but is a more cyclical process in terms of the impact on expenditures. The marginal

approach is much more time consuming and costly to complete and would be used in a more extensive feasibility study.

8.1 County Level Revenues and Expenses

County level revenue and expense data were obtained from the Counties Annual Report for the fiscal years that ended June 30, 2012 and June 30, 2009 (California State Controller's Office, 2015). The fiscal year 2012 report was the most recent report available and the 2009 report was used to evaluate changes that may have occurred over the last few years. Expenditure and revenue data were obtained for Los Angeles County, Orange County, Riverside County, and San Bernardino County. Total county expenditures and revenues are shown in Table 22. Individual expenditure categories are shown to illustrate the distribution of expenditures between categories.

Table 22. Fiscal year 2012 county expenditures and revenues

Expenditure Category	Los Angeles County	Orange County	Riverside County	San Bernardino County
Legislative and Administrative	$122,990,255	$29,987,095	$19,820,928	$15,034,978
Finance & other General expenses	$882,028,055	$164,120,447	$153,048,386	$216,609,927
Public Protection	$4,587,366,613	$1,096,349,400	$1,025,048,627	$770,965,439
Public Ways and Facilities	$287,185,252	$118,514,236	$159,504,652	$76,934,095
Health	$2,842,245,464	$581,504,582	$351,737,462	$298,851,259
Public Assistance	$5,094,924,991	$883,327,760	$803,665,356	$926,266,188
Education	$108,392,261	$31,058,731	$19,695,879	$15,780,559
Recreation and Cultural Services	$225,109,299	$14,471,608	$923,140	$16,428,981
Debt Service	$167,550,132	$96,793,227	$92,225,338	$74,145,147
Total Expenditures	**$14,317,792,322**	**$3,016,127,086**	**$2,625,669,768**	**$2,411,016,573**
Total Revenues	**$14,943,120,306**	**$3,027,030,988**	**$2,567,903,388**	**$2,533,806,493**

Source: California State Controller's Office. 2015

Using the population estimates provided in the California State Controller's Office county Annual Reports, revenues and expenditures per capita were estimated and are shown in Table 23. The 2009 revenues and expenditures were converted into comparable 2011 dollars using the Bureau of Labor Statistics Consumer Price Index.

Table 23. Fiscal year 2009 and 2012 county revenues and expenditures

Expenditure category	Los Angeles County	Orange County	Riverside County	San Bernardino County
Revenues per Capita				
2009	$1,450	$955	$1,327	$1,220
2012	$1,512	$991	$1,153	$1,228
Expenditures per Capita				
2009	$1,402	$1,048	$1,386	$1,168
2012	$1,448	$987	$1,179	$1,168

The data presented in Table 23 indicate revenues and expenditures have remained fairly stable over the last few years. Therefore, the most recent fiscal year 2012 data are used to evaluate potential impacts associated with increased population and employment associated with expansion of the Brine Line.

Using the fiscal year 2012 California Controller's Office revenue and expenditure estimates combined with U.S. Census Bureau estimates of labor force and employment by county from the 2009 – 2013 American Community Survey, revenue and expenditures per employed person can be estimated. These estimates per employed person can be used as a measure of fiscal impacts associated with employment effects from the Brine Line. Table 24 shows the estimated county level revenue and expenditures impacts per employed person in the region.

Table 24. Fiscal impacts per employed person in the SAWPA region

Expenditure category	Los Angeles County	Orange County	Riverside County	San Bernardino County
Estimated population	9,884,632	3,055,792	2,227,577	2,063,919
Population % 16 years of age and over	79.0%	78.9%	75.6%	75.0%
Population 16 years of age and over	7,808,339	2,411,590	1,684,146	1,547,337
Estimated labor force	5,067,612	1,608,531	1,034,066	954,707
Estimated employed	4,692,609	1,508,802	939,966	870,693
Total revenue	$14,943,120,306	$3,027,030,988	$2,567,903,388	$2,533,806,493
Total expenditures	$14,317,792,322	$3,016,127,086	$2,625,669,768	$2,411,016,573
Revenue per employed person	$3,184	$2,006	$2,732	$2,910
Expenditures per employed person	$3,051	$1,999	$2,793	$2,769

The estimates presented in Table 24 can be converted into a regional average using the number of households in the SAWPA region attributable to each county as a weight. The average weighted average revenue is estimated to be $2,806 per employed person and the weighted average expenditure is estimated to be $2,767 per employed person. This result indicates that, on average, increased employment generated by the Brine Line associated with construction activities as well as commercial activity supported by the Brine Line would result in revenues slightly higher than expenses, assuming the current average cost of service would be representative of future expansion costs. However, if per unit costs increase in the future by 4.36% in Los Angeles County, 5.09% in San Bernardino County, and only 0.39% in Orange County as a result of population and employment growth, costs would exceed revenues and additional county revenues would need to be generated. Expenditures per employed person already exceed revenues per employed person in Riverside County.

8.2 Economic Development

Increased development results in increased demand for services. New residents and new workers demand local services and their expectations may differ from

those of the existing population and workforce. Fiscal impacts vary according to the type and pattern of development and existing service capacity. If development is spread out over a large area, the cost of service may increase substantially. Development has broad effects on revenues, expenditures and the tax base over time and can affect different groups in different ways. Those who depend on existing services may find that greater demand for services associated with future development reduces their standard of living.

Additional data representing economic development impacts were obtained for the four county region as well as for all of California. County averages can be compared to the entire state to help understand the current level of economic development in a county relative to the state as a whole. The California Association for Local Economic Development (2016) has compiled an extensive list of metrics that can be used to measure economic development. A sub-set of these metrics are shown in Table 25.

Table 25. Economic development indicators

Impact Sector
Community Development • Annual capital expenditures invested in municipal infrastructure • Percent of cities with marketable industrial sites • Investments in community facilities • Investment in distressed areas and change in distress level • Percent of minority and women owned businesses assisted
Real Estate • Industrial space used • Office vacancy rate • Number of building permits issued • Value of industrial and commercial property
Economic Measures • Capital investments per job • Commercial investment • Per capita debt • Gross regional product per capita • Retail sales per capita
Labor & Workforce • Net job growth • Manufacturing wage and salary jobs as a percent of total jobs • Wages/benefits as compared to state levels • Number of job candidates with certifiable skills or college degrees • Unemployment rate • Employment by sector
Business Measures • New business started/New business licenses • Number of business establishments • Manufacturing productivity • Values of key natural resources • Value added in hotel and lodging industry

Source: California Association for Local Economic Development

The indicators shown in Table 25 are measures of economic development at the community, business, and household level. It is important to recognize that some measures represent development in terms of the value of economic activity and the resulting monetary flows, such as the number of business establishments and retail sales per capita, while other measures represent resource values and quality of life, such as educational attainment and investment in distressed areas. If there are indications of the potential for economic development in the Brine Line study area, expansion of the Brine Line could support economic growth.

The list of economic development indicators in Table 25 is extensive and not all of the measures shown in Table 25 are included in this analysis. The economic development measures discussed as part of this analysis include the following:

- Residential home vacancy rates
- Housing permits
- Median home value
- Percentage of persons with a bachelors' degree
- Accommodation & food sales (1,000's)
- Health care & social assistance receipts
- Value of manufacturing shipments
- Value of wholesale sales
- Value of retail sales
- Per capita retail sales
- Median household income
- Persons in poverty
- Total employment
- Number of firms
- Minority owned firms
- Property values

8.2.1 Vacancy Rates

Vacancy rates for both residential homes and commercial space are indicators of economic development because the rates reflect demand for real estate which is derived from expectations of increased activity and economic expansion. Low vacancy rates will tend to precede commercial and residential real estate development.

Commercial real estate markets and to some extent residential markets can be in a constant state of disequilibrium, contributing to volatility in vacancy rates as rents and real estate prices adjust to equalize demand with the existing stock. As a result, vacancy rate information is needed over several years so longer term trends can be evaluated beyond the year-to-year fluctuations. Table 26 and Figure 2 show residential vacancy rates in the four county study area and in all of California from 2000 to 2015.

Table 26 and Figure 2 clearly show an increasing trend in residential vacancy rates from 2000 to 2010 followed by a leveling off and slight decline from 2010 to 2015. This pattern indicates that prior to and through the 2007 to 2009 recession there were excess residential housing stocks in the four county study area, and in California as a whole, but that by 2010 demand caught up with supply to begin decreasing vacancy rates. Assuming this trend continues, economic development would be expected to continue to increase, further reducing vacancy rates.

Table 26. Residential vacancy rates in the four county study area and California

Year	Los Angeles County	Orange County	Riverside County	San Bernardino County	California
2000	4.193%	3.527%	13.419%	12.102%	5.826%
2001	4.323%	3.683%	13.491%	11.957%	5.988%
2002	4.501%	3.923%	13.567%	12.086%	6.230%
2003	4.678%	4.140%	13.661%	12.142%	6.466%
2004	4.858%	4.344%	13.735%	12.196%	6.700%
2005	5.034%	4.539%	13.831%	12.246%	6.942%
2006	5.205%	4.528%	13.839%	12.346%	7.161%
2007	5.389%	4.741%	14.027%	12.418%	7.414%
2008	5.533%	4.922%	14.020%	12.409%	7.596%
2009	5.708%	5.126%	14.156%	12.447%	7.813%
2010	5.919%	5.363%	14.293%	12.581%	8.062%
2011	5.914%	5.361%	14.290%	12.556%	8.047%
2012	5.895%	5.357%	14.266%	12.545%	8.008%
2013	5.872%	5.352%	14.229%	12.525%	7.955%
2014	5.836%	5.343%	14.192%	12.498%	7.879%
2015	5.800%	5.332%	14.180%	12.486%	7.795%

Source: California Department of Finance, Report E-5, Population and Housing Estimates for Cities, Counties, and the State.

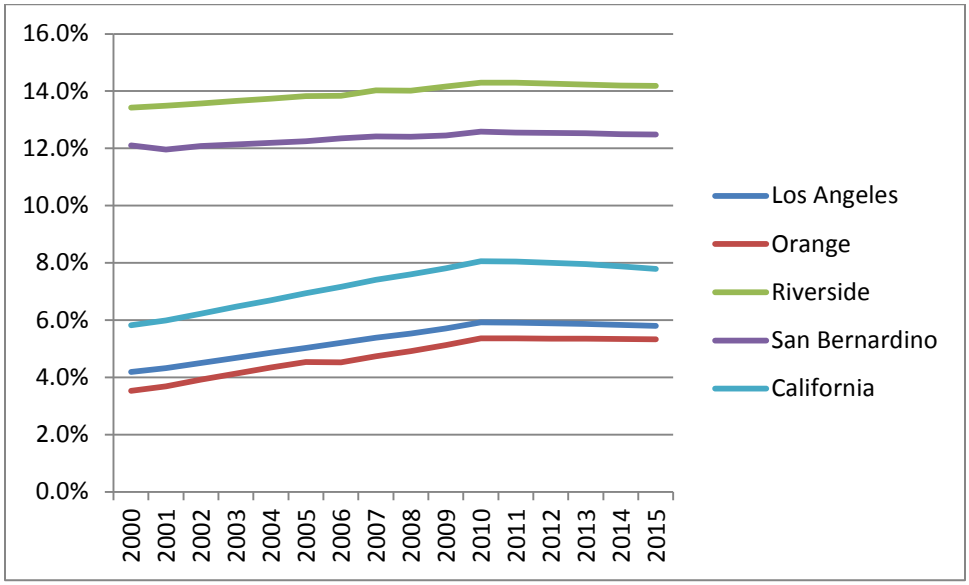

Figure 2. Residential home vacancy rates in the SAWPA study region

Vacancy rate information for the industrial and office market for Los Angeles County, Orange County, and the Inland Empire region (which includes Riverside and San Bernardino Counties) was obtained from Daum Commercial Real Estate Services market reports (2016).

Los Angeles County
Los Angeles County industrial vacancy rates decreased during the 4th quarter of 2015, moving from 2.7% to 2.2% while rental rates increased 11.1% for 2015. Office market vacancy rates decreased from 15.3% to 15.2% during the 4th quarter of 2015. Average office rents increased 7.6% during 2015. Over the period from the 1st quarter of 2011 to the 4th quarter of 2015 Los Angeles County industrial vacancy rates decreased from about 5.6% to 2.2% and office space vacancy rates decreased from 17.0% to 15.2%.

Net absorption is an important measure used to evaluate commercial real estate markets. Net absorption measures the net change in occupied space over a given period of time and is calculated by summing all positive changes in occupancy (move ins) and subtracting all the negative changes in occupancy (move outs). A positive number indicates more space is taken than is vacated. Average net absorption for industrial space in Los Angeles County has been over 2 million square feet per quarter over the 2011 to 2015 period and net absorption has been about 400,000 square feet per quarter for office space over the same period. Three quarters have had significant negative net absorption for office space and two quarters have had negative industrial absorption.

The Daum Los Angeles County industrial market report indicated that available supply will remain extremely tight throughout the county and limited new construction will keep vacancy moving lower and rental rates moving higher. The overall market fundamentals remain strong, with occupancy, rents and sale prices all trending higher. Demand for industrial space will continue to be driven by domestic and global consumption levels, with Los Angeles and Long Beach Port container traffic recording its strongest year since 2007.

The Daum Los Angeles County office market report indicated that vacancy levels are expected to continue to trend lower, with rents expected to increase 3% to 5% in the coming year. The report indicated the investment and sale market for office buildings in Southern California has its highest sales volume since 2007. The market fundamentals are expected to continue to strengthen in the future.

Orange County
Orange County industrial vacancy rates decreased from 2.8% to 2.6% during the 4th quarter of 2015 while rental rates increased 8.3% for 2015. Office market vacancy rates decreased from 13.8% to 13.7% during the 4th quarter of 2015. Average office rents increased 9.5% during 2015. Over the period from the 1st quarter of 2011 to the 4th quarter of 2015 Orange County industrial vacancy rates

decreased from about 7.1% to 2.6% and office space vacancy rates decreased from 21.0% to 13.7%.

Average net absorption for industrial space in Orange County has been about 1 million square feet per quarter over the 2011 to 2015 period and net absorption has been about 500,000 square feet per quarter for office space over the same period. Two quarters have had significant negative net absorption for office space and two quarters have had negative industrial absorption.

The Daum Orange County industrial market report indicated the industrial market continues to see available supply remain extremely low throughout the county and new construction still remains at relatively low levels, which will continue to drive vacancy rates lower until more new supply is delivered. The overall market fundamentals continue to strengthen, with occupancy, rents and sale prices all trending higher. The investment and sales market for industrial real estate in Orange County remains very strong as the total transaction volume finished 2015 with its second largest total since 2007. It is expected that vacancy rates will remain in the 2% to 3% range and rents will rise another 4% to 6% in the next year. The Daum Orange County office market report indicated that vacancy levels are expected to continue to trend lower, with rents expected to increase 4% to 6% in the coming year and the market fundamentals expected to remain strong in the future.

Inland Empire

Inland Empire industrial vacancy rates decreased from 5.2% to 5.0% during the 4th quarter of 2015 while rental rates increased 6.5% for 2015. Office market vacancy rates decreased from 15.0% to 14.5% during the 4th quarter of 2015. Average office rents increased 2.9% during 2015. Over the period from the 1st quarter of 2011 to the 4th quarter of 2015 Inland Empire industrial vacancy rates decreased from about 9.0% to 5.0% and office space vacancy rates decreased from 19% to 14.5%.

Average net absorption for industrial space in the Inland Empire region has been over 4 million square feet per quarter over the 2011 to 2015 period and net absorption has been about 100,000 square feet per quarter for office space over the same period. Four quarters have had significant negative net absorption for office space and one quarter had negative industrial absorption.

The Daum Inland Empire industrial market report indicated overall demand for industrial space will continue to grow into the first half of 2016. The overall market fundamentals continue to strengthen, with occupancy, rents and sale prices all trending higher. The investment and sale market for industrial real estate in the Inland Empire continues to strengthen. It is expected that industrial market growth will continue in the coming quarters, while vacancy levels should remain in the 4% to 6% range.

The Daum Inland Empire office market report indicates vacancy levels are expected to continue to trend lower in the near future and that rents are expected to increase 2% to 5% in the coming year. The market report also predicts that capital markets will remain solid with qualified borrowers continuing to benefit from low interest rates.

Vacancy Rates and Economic Development
The residential, industrial, and office space vacancy rate data and information from the Daum Commercial Real Estate Services market reports support the conclusion that economic development is likely to increase in the four county SAWPA region in the near future. Future economic development as indicated by declining vacancy rates will lead greater demand for all goods and services in the region. Therefore, demand for water supplies and wastewater services including brine disposal would be expected to increase.

8.2.2 Building Permits

The number of building permits is considered a leading indicator of future economic growth or decline. An index published monthly by the Conference Board to predict the direction of the economy's movements includes 10 components, one of which is the number of new building permits for residential buildings. The Conference Board is a non-profit business membership and research group organization that provides information about management and the marketplace. The number of building permits for single and multi-family housing in the four county study area over the 2000 to 2014 time period is shown in Table 27.

Table 27. Number of building permits for single and multi-family housing

County	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Los Angeles											
Single family	8,372	12,523	9,942	7,102	3,249	2,268	2,384	2,275	2,675	3,839	4,586
Multi family	8,596	10,975	15,260	12,142	8,561	2,870	4,876	7,620	8,690	10,937	13,073
Orange											
Single family	6,814	4,103	3,744	2,279	1,130	1,341	1,624	1,822	2,271	3,670	3,714
Multi family	5,706	3,040	4,559	5,093	1,905	802	1,510	2,530	3,811	6.752	5,577
Riverside											
Single family	13,323	30,350	20,882	9,717	3,820	3,406	4,027	2,275	3,107	4,432	5,074
Multi family	1,702	4,023	3,883	2,617	1,948	666	520	989	945	1,492	1,687
San Bernardino											
Single family	5,767	15,135	12,616	6,302	1,976	1,481	1,260	1,103	1,381	2,040	2,148
Multi family	704	1,500	708	1,450	1,207	782	529	3,369	516	1,384	1,257
Total all Counties	50,984	81,649	71,594	46,702	23,796	13,616	16,730	21,983	23,396	27,801	37,116

Source: U.S. Department of Housing and Urban Development State of the Cities Data Systems

Overall, Table 27 shows that the number of building permits for single and multi-family housing in the four county area remained at high levels through 2006 and then dipped in 2007 and continued declining through 2010. This pattern follows the recession that officially ran from December 2007 to June 2009. Beginning in 2010, the annual number of building permits began to increase and has continued

to increase through 2014. Another pattern that has occurred since 2000 is a shift from predominately single family residential permits to multi-family permits. This trend has accelerated from 2010 to 2014.

Similar to the vacancy rate information provided in the previous section, the building permit data indicates future economic growth is likely to occur in the four county region. This will contribute toward increased demand for goods and services, including brine disposal services.

8.2.3 Number of Establishments and Payroll

According to United States Census Bureau, County Business Pattern data, the total number of business establishments in the four county study area has increased in each county from 2005 to 2013. The total number of establishments increased by 3.29% from 2005 to 2013 in the four county region compared to 1.56% for all of California. However, annual payroll in real terms has been stagnant or has decreased slightly for each of the four study area counties while increasing by 4.76% for all of California from 2005 to 2013. The annual payroll estimates for 2005 were converted into real 2013 dollars using the Bureau of Labor Statistics Employment Cost Index for all workers. Establishment and payroll data are shown in Table 28.

Table 28. Number of establishments and annual payroll in the study area and California

Location	2005	2013
Los Angeles County		
Number of establishments	244,859	253,227
Nominal Annual Payroll (1,000's)	$162,202,355	$194,174,611
Real Annual Payroll (1,000's of 2013 $'s)	$195,380,109	$194,174,611
Orange County		
Number of establishments	87,905	89,496
Nominal Annual Payroll (1,000's)	$64,206,683	$73,286,210
Real Annual Payroll (1,000's of 2013 $'s)	$77,339,868	$73,286,210
Riverside County		
Number of establishments	32,825	34,773
Nominal Annual Payroll (1,000's)	$16,243,797	$17,832,588
Real Annual Payroll (1,000's of 2013 $'s)	$19,566,392	$17,832,588
San Bernardino County		
Number of establishments	31,273	32,426
Nominal Annual Payroll (1,000's)	$17,785,413	$20,860,790
Real Annual Payroll (1,000's of 2013 $'s)	$21,423,338	$20,860,790
California		
Number of establishments	860,866	874,273
Nominal Annual Payroll (1,000's)	$588,450,315	$742,523,853
Real Annual Payroll (1,000's of 2013 $'s)	$708,815,152	$742,523,853

Source: United States Census Bureau, County Business Patterns.

The increase in the number of establishments is another indicator of economic growth and development. However, the lack of growth in real earnings could be a limiting factor for continued growth in the future.

8.2.4 Home Values, Value of Output, Income, Business Ownership, and Other Socio-economic Characteristics

Median home value, educational attainment, value of output by sector, median household income, poverty, employment, and minority and women owned firms data were obtained from the Bureau of the Census American FactFinder website (U.S. Census Bureau, 2016). The data are summarized in Table 29.

Table 29. Home values, value of output, business ownership, and other socio-economic characteristics

Measure	Los Angeles County	Orange County	Riverside County	San Bernardino County	California
Median home value	$425,100	$532,300	$236,400	$225,400	$371,400
Percentage with bachelors' degree	29.9%	37.3%	20.8%	18.8%	31.0%
Accommodation & food sales (1,000's)	$22,965,153	$9,050,642	$5,230,919	$2,857,960	$90,830,372
Health care & social assistance receipts	$67,261,267	$20,682,197	$8,412,078	$11,199,315	$248,953,592
Value of manufacturing shipments	$163,829,606	$47,299,399	$15,137,013	$17,591,611	$512,303,164
Value of wholesale sales	$199,804,798	$97,795,982	$18,716,807	$30,996,187	$666,652,186
Value of retail sales	$121,389,378	$45,193,625	$25,058,857	$24,380,486	$481,800,461
Per capita retail sales	$12,184	$14,625	$11,045	$11,714	$12,665
Median household income	$55,870	$75,998	$56,592	$54,100	$61,489
Persons in poverty	18.7%	12.9%	17.1%	20.4%	16.4%
Total employment	3,799,831	1,381,148	493,307	538,336	13,401,863
Total number of firms	1,146,701	340,116	175,971	160,500	3,548,449
Minority owned firms – Total	631,218	145,603	85,804	98,288	1,619,857
Minority owned firms – Percentage	55.05%	42.81%	48.76%	61.24%	45.65%
Women owned firms – Total	439,513	119,431	66,313	63,349	1,320,085
Women owned firms – Percentage	38.33%	35.11%	37.68%	39.47%	37.20%

The data presented in Table 29 indicate that there is a distinct division of economic status in the four county SAWPA region relative to the State of California. Orange County has higher median home values, a larger percentage of the population 25 years of age or older with bachelor's degrees, higher per capita retail sales and median household incomes, and a smaller percentage of the population in poverty than for all of California and each of the other three counties. Los Angeles County had higher median home values than for all of California and higher percentages of minority and women owned firms. However, median household income in Los Angeles County was lower than for all of California and the percentage of the population in poverty was higher than for the State.

Riverside County and San Bernardino County both have lower home values and income and higher poverty and unemployment than the other two counties and the State of California. However, both Riverside County and San Bernardino County have higher percentages of minority and women owned businesses.

The percentage of minority owned firms is greater than the state average in three of the four study area counties (Orange County is the one exception). The

percentage of women owned firms is also higher than the state average for three of the four study area counties, with again Orange County being the lone exception.

Accommodation and food sales, health care and social assistance receipts, value of manufacturing shipments, value of wholesale sales, value of retail sales, total employment, and the total number of firms in the four county region account for nearly one-half or slightly over one-half of the amounts for all of California. Table 30 shows the value of output, employment, and the number of firms in the four county region as a percentage of the California total.

Table 30. Value of output, employment and the number of firms as a percentage of California total

Measure	Los Angeles County	Orange County	Riverside County	San Bernardino County	California
Accommodation & food sales (1,000's)	25.28%	9.96%	5.76%	3.15%	44.16%
Health care & social assistance receipts	27.02%	8.31%	3.38%	4.50%	43.20%
Value of manufacturing shipments	31.98%	9.23%	2.95%	3.43%	47.60%
Value of wholesale sales	29.97%	14.67%	2.81%	4.65%	52.10%
Value of retail sales	25.19%	9.38%	5.20%	5.06%	44.84%
Total employment	28.35%	10.31%	3.68%	4.02%	46.36%
Total number of firms	32.32%	9.58%	4.96%	4.52%	51.38%

Table 30 indicates the four county region is a very important part of the overall California economy and contributes enormously to economic growth of the state. Therefore, maintaining an adequate infrastructure in the region, including wastewater and brine disposal and water supplies, is important to economic growth in the State.

8.2.5 Property Values

County assessor offices in Los Angeles, Orange, Riverside, and San Bernardino Counties collect information on the total value of residential, commercial, and other property which is presented in their annual reports. This information can be used as a proxy measure of economic development based on the assumption that property values in an area will increase as the overall business climate improves, infrastructure needs are met, and individuals are attracted to and remain in the area. Historical trends over the last 10 years can be used as an indicator of the resilience of an area during periods of economic stagnation and potential growth.

The value of taxable property over the 2005 to 2014 period has increased at an average annual rate of 4.08% in Los Angeles County, 2.91% in Orange County, 3.55% in Riverside County, and 3.06% in San Bernardino County. Data for 2015 was not available for Orange County, but property values from 2014 to 2015 increased by 6.13% in Los Angeles County, 5.78% in Riverside County, and 5.08% in San Bernardino County. Annual average consumer price indexes (CPI) provided by the California Department of Finance over the 2006 to 2014 period indicate average CPI growth of 2.19% for all of California and 2.07% for the Los Angeles Consolidated Metropolitan Statistical Area, which includes the counties

of Los Angeles, Orange, Riverside, San Bernardino, and Ventura. The growth in property values has outpaced inflation in each of the four study area counties on an average annual basis.

The years 2009 to 2011 represented a period of declining property values in each of the counties except Orange County in 2009 and Los Angeles County in 2011. Orange County continued to show a decline in 2012 and 2013 and Riverside County had a decline in 2012. The property value declines were primarily a result of the recession from December 2007 to June 2009. Although the effects of the recession on property values were more pronounced in Orange and Riverside counties than in Los Angeles and San Bernardino counties, each county has shown a positive trend above inflation since 2013.

8.3 Tax Revenue Impacts

Fiscal impacts also include tax revenues associated with construction expenditures and activities supported by water supplies and wastewater service. The IMPLAN model used to estimated regional impacts also provides output which estimates state, local, and Federal tax impacts. The potential tax impacts associated with the potential project discussed in the Regional Impact section are shown in Table 31.

Table 31. Tax impacts of least cost alternative expenditures and recreation expenditures

Impact Category	Total Impact or Annual Impact	State and Local Tax Impact (millions)	Federal Tax Impact (millions)
Construction	Total	$122.20	$137.67
Project O&M	Annual	$2.49	$3.97
Recreation	Annual	$0.37	$0.40

9. Environmental Justice

The primary source of data for this analysis is Zip Code data. However, data were also obtained from the California Office of Environmental Health Hazard Assessment (OEHHA, 2016). The OEHHA data is available using the CalEnviroScreen Version 2.0 California Communities Environmental Health Screening Tool (CalEnviroScreen 2.0). CalEnviroScreen is a screening methodology that can be used to help identify California communities that are disproportionately burdened by multiple sources of pollution. The California Environmental Protection Agency (CalEPA) has used the tool to designate California communities as disadvantaged.

In 2012, SB 535 was passed which required 25 percent of the funds allocated from the Greenhouse Gas Reduction Fund to go to projects that provide a benefit to disadvantaged communities. As a result, there was a need to identify disadvantaged communities. SB 535 indicated that socioeconomic, public health and environmental hazard criteria needed to be included in the disadvantaged community designation. These criteria include poverty, income statistics, and identification of areas disproportionately impacted by environmental pollution and negative public health effects. The method used identifies disadvantaged communities by combining Pollution Burden and Population Characteristics from CalEnviroScreen 2.0 (CalEPA, 2016a)

According to the CalEPA SB 535 list of Disadvantaged Communities (CalEPA, 2016b), a little over 6.265 million people lived in disadvantaged communities in the four county study area included in the SAWPA analysis. This disadvantaged population represents approximately 67% of the total identified disadvantaged population in all of California. This large percentage is an indication that any action taken in the four county area to alleviate environmental or economic burdens will have positive environmental justice impacts. Therefore, the Brine Line would likely generate positive environmental justice impacts. Table 32 shows the distribution of the disadvantaged population within region.

Table 32. Disadvantaged population, census tracts and zip codes in the four county area

County	Disadvantaged Population	Number of Disadvantaged Census tracts	Number of Disadvantaged Zip Codes
Los Angeles	4,348,000	1,018	162
Orange	526,857	86	30
Riverside	527,851	104	29
San Bernardino	862,696	160	32
Regional Total	**6,265,404**	**1,368**	**253**

Source: California Environmental Protection Agency, SB 535 list of Disadvantaged Communities. SB 535 Identification of Disadvantaged Communities. Website: www.calepa.ca.gov/EnvJustice/GHGInvest/.

Historical data can also be used to help evaluate patterns of change in socio-economic characteristics over time. The discussion of growth in the number of establishments, number of paid employees, and annual payroll in Section 4.2: Ability to Pay is for the SAWPA service area as a whole does not address the specific locations of growth and decline. There are 98 Zip Code areas identified in the SAWPA service area. In order to evaluate patterns of commercial growth in a manageable way, Zip Codes that experienced a decline as measured by the three categories of business activity over the 2000 to 2013 time period were identified. Two Zip Codes experienced a decline in all three categories over the 2000 to 2013 period: 92382 and 92401 which are in Running Springs and San Bernardino respectively. Both of the areas are in San Bernardino County. Twelve Zip Codes had two out of three categories of business activity that were negative. These 12 Zip Codes are shown in Table 33 below.

One general area where the decline in business activity is clustered appears to be south central San Bernardino County and north central Riverside County. There are also areas to the north near Lake Arrowhead and northwest near Big Bear Lake in San Bernardino County that exhibited a decline in business activity as well as areas to the south near Riverside and further to the south near the Riverside County line.

Table 33. Decline in business activity over the 2000 to 2013 period by Zip Code

Zip Code	City/Place	County	Decline in Number of Establishments	Decline in Number of Paid Employees	Decline in Annual Payroll
92305	Angelus Oaks	San Bernardino	Yes	Yes	No
92358	Lytle Creek	San Bernardino	No	Yes	Yes
92359	Montone	San Bernardino	No	Yes	Yes
92382	Running Springs	San Bernardino	Yes	Yes	Yes
92401	San Bernardino	San Bernardino	Yes	Yes	Yes
92404	San Bernardino	San Bernardino	Yes	Yes	No
92405	San Bernardino	San Bernardino	Yes	Yes	No
92501	Riverside	Riverside	Yes	Yes	No
92503	Riverside	Riverside	No	Yes	Yes
92536	Aguanga	Riverside	No	Yes	Yes
92544	Hemet	Riverside	Yes	Yes	No
92587	Sun City	Riverside	Yes	Yes	No

A total of 36 Zip Codes had one of three business categories that declined from 2000 to 2013. A total of 18 were in San Bernardino County, 13 in Riverside County, 3 in Los Angeles County, and 2 in Orange County. Of the 36 Zip Codes, 13 of those had a decline in the number of establishments, which is probably the most important category in terms of business demand for infrastructure and services. Eight of the 13 are identified in Table 23 above. The additional five Zip Codes that exhibited a decline in number of establishments are: 92313, 92410, 92506, 92543, and 92557. The first two Zip Codes are in or near San Bernardino and the last three are in the northern part of Riverside County and near Hemet (Zip Code 92543).

Based on historical business pattern data, it would appear likely that overall business activity in the SAWPA area would be expected to increase in the future since, even during the recession from 2007 to 2009, the number of business establishments continued to grow, perhaps at a 1.2% to 2.2% annual rate of growth. This would indicate a growing need for wastewater disposal and water supplies, including recycled water as a source of water supplies.

As discussed previously, the data presented in Table 2 in the General Economic Conditions section indicate the SAWPA Brine Line area has a relatively high median household income, a low level of poverty, high unemployment, and younger and more Hispanic population than for all of California.

The individual Zip Codes included in the SAWPA area were compared to the larger counties to get a better understanding of the distribution of income, poverty, unemployment, and ethnic backgrounds in and around the SAWPA area. First, Zip Codes that experienced a percentage of individuals in poverty and an unemployment rate above the average for the SAWPA area as well as a median household income that was lower than the average for the SAWPA area were identified. A total of 29 Zip Codes meets these criteria. Next, those 29 Zip Codes were then compared to Zip Codes that had experienced a decline in 2 of 3 measures of business activity described in the previous section. A total of six Zip Codes met these combined criteria, which indicate the financial situation for households and prospects for future business expansion is relatively poor in those six Zip Codes. Finally, those six Zip Codes were then compared to the percentage of the population that is Hispanic. The results are shown below in Table 34.

Table 34. Zip Codes with combinations of high poverty levels, high unemployment, low income and high percentage of Hispanic population

Criteria	Zip Codes
High % below poverty, High unemployment rate, Low median household Income	91762 (Ontario), 91764 (Ontario), 92314 (Big Bear City), 92316 (Bloomington), 92324 (Colton), 92335 (Fontana), 92376 (Rialto), 92401 (San Bernardino), 92404 (San Bernardino), 92405 (San Bernardino), 92407 (San Bernardino), 92410 (San Bernardino), 92411 (San Bernardino), 92501 (Riverside), 92503 (Riverside), 92507 (Riverside), 92509 (Riverside), 92518 (March Air Reserve Base), 92543 (Hemet), 92544 (Hemet), 92545 (Hemet), 92548 (Homeland), 92551 (Moreno Valley), 92553 (Moreno Valley), 92567 (Nuevo), 92570 (Perris), 92571 (Perris), 92583 (San Jacinto)
High % below poverty, High unemployment rate, Low median household Income, 2 of 3 business Indicators decreasing	92401 (San Bernardino), 92404 (San Bernardino), 92405 (San Bernardino), 92501 (Riverside), 92503 (Riverside), 92544 (Hemet)
High % below poverty, High unemployment rate, Low median household Income, 2 of 3 business Indicators decreasing, High % Hispanic population	92401 (San Bernardino), 92404 (San Bernardino), 92405 (San Bernardino), 92501 (Riverside), 92503 (Riverside)
High % below poverty, High unemployment rate, Low median household Income, and 1 of 3 business Indicators decreasing	91762 (Ontario), 92314 (Big Bear City), 92376 (Rialto), 92401(San Bernardino) , 92404 (San Bernardino), 92405 (San Bernardino), 92501 (Riverside), 92503 (Riverside), 92543 (Hemet), 92544 (Hemet), 92571 (Perris)
High % below poverty, High unemployment rate, Low median household Income, 1 of 3 business Indicators decreasing, High % Hispanic population	91762 (Ontario), 92376 (Rialto), 92401 (San Bernardino), 92404 (San Bernardino), 92405 (San Bernardino), 92501 (Riverside), 92503 (Riverside), 92571 (Perris)

Of the Zip Codes that have a high poverty rate, high unemployment, low income, and 2 of 3 business indicators decreasing over the 2000 to 2013 time period, 5 of 6 (83.3%) occur for a Zip Code that has an Hispanic population that is greater than the average percentage of the total population for the SAWPA area. Of the high poverty rate, high unemployment, low income, and 1 of 3 business indicators decreasing over the 2000 to 2013 time period, 8 of 11 (72.7%) occur for a Zip Code with an Hispanic population that is greater than the average. The percentage of the SAWPA area population that is Hispanic is approximately 48.1%. Therefore, Zip Codes in the SAWPA area with poor household financial conditions and poor prospects for future business expansion are disproportionately Hispanic and these conditions could be expected to be improved by increased activity that could be supported by the Brine Line.

10. Summary and Future Considerations

The primary purpose of this appraisal level analysis of the potential benefits and impacts of extending the Inland Empire Brine Line to the Salton Sea is to supplement the 2013 Bureau of Reclamation analysis, which identified the need to quantify the potential benefits associated with the extension. An appraisal level analysis is based on the use of existing data and information, which limits the ability to precisely estimate and quantify the economic, financial, and social effects of the Brine Line. However, the results from the analysis can be used to make some observations regarding the potential magnitude of the effects from extending the Brine Line.

Several different types of evaluation perspectives were described covering a variety of economic, financial, and social aspects. Each perspective represents a different type of impact and impact group. The financial ability to pay analysis indicates that significant financial resources are potentially available for investment in an expansion of the Brine Line or investment in any type of water supply or wastewater improvements. This conclusion is based on both the ability to pay analysis results and comparison to existing water and sewer payments in the region. The financial resources are identified as coming from both the residential sector and the commercial and industrial sector. The residential sector financial contribution could come from direct payment for service or from costs that are passed on by commercial users.

The economic analysis identified several potential categories of benefits, including water supply reliability, environmental/health benefits (including salt exportation) and recreation benefits. The magnitude of these benefits could be in the billions of dollars over the next 50 years. However, there is considerable uncertainly in the actual resource changes that would occur, so realized benefits

could be substantially less than the potential benefits indicated. Recreation and land value benefits appear to be much lower than the magnitude of water reliability and environmental benefits.

A 2009 Market Analysis completed by Environmental Engineering & Contracting, Inc. and information provided by the Santa Ana Watershed Project Authority indicates the Brine Line expansion could be very cost effective compared to other potential options considering potential demand in the future associated with future commercial and industrial growth. However, the Brine Line is likely to be most cost effective for larger users while other options could be more cost effective for smaller users.

Positive regional impacts are likely to be generated by expansion of the Brine Line due to expenditures associated with construction, annual operation and maintenance expenditures, and from expenditures associated with increased economic activity. Similarly, positive fiscal impacts would be expected from increased tax revenues. However, the fiscal impact analysis indicates that the cost of providing services related to increased activity will largely cancel out additional tax revenues. If marginal cost of providing those services increases relative to current costs, the fiscal impact could be negative.

The evaluation of historical vacancy rates, building permits, number of establishments and payroll, property values, and value of output by sector indicates that the region has recovered somewhat from the recent recession and is showing signs of economic growth. This growth could extend into the future, which will lead to increased demand for infrastructure, including the services provided by the Brine Line.

Due to the considerable amount of uncertainty associated with the estimated effects of the Brine Line, it is not possible to definitively say if the benefits associated with a Brine Line expansion would cover the cost of the project. However, what can be said is that expansion of the Brine Line would provide services for which there is considerable demand in the region and would also help address environmental justice issues that exist in the region.

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