PARCEL BASED ECONOMIC IMPACTS OF SEA LEVEL RISE AND COASTAL FLOODING IN LONG BEACH, CALIFORNIA

Image: Los Angeles Times

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DATE OF SUBMISSION: Draft 1 submitted: May 6, 2019

Draft 2 submitted: May 23, 2019

Final draft submitted: June 10, 2019

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PREFACE

Beginning in May of 2017, NCCOS (The National Oceanic and Atmospheric Administration's (NOAA) National Centers for Coastal Ocean Sciences) began working with University of Southern California (USC) Sea Grant and NOAA's Office for Coastal Management, West Coast Region, on a project to address vulnerability to climate effects and coastal risks in Los Angeles County. Phase I of this project developed location-specific indicators for social, structural, and natural resource vulnerability; identified local coastal risks of most concern and their impacts; intersected base condition vulnerabilities with identified coastal risks; and identified areas of high risk and high vulnerability for further analysis.[1] The framework was developed on a previous project in the Chesapeake Bay[2] and is now being used to assess vulnerability in other areas of the country.

Phase II of this analysis was concluded in January of 2019. Using areas and priorities that were previously identified, Phase II analysis focused on economic impacts, community-scale changes, and further geographic vulnerability. The NCCOS team working on this project had already chosen the topics of focus for Phase II of this project prior to the start of this capstone research project, but had identified several other areas of interest with partners during the planning process, and due to capacity restraints not every thematic area of interest could be part of the greater project. Given my career interests in coastal management and planning for resiliency in addition to economic analysis, I reviewed the areas of interest and selected a project that seemed feasible in the time-scale and scope of the capstone project: a parcel-based economic valuation of different risks by comparing parcels in various risk zones and considering the economic impacts to those parcels. The identified risks from Phase I were: coastal flooding, storm water flooding, erosion, drought, heat, and wildfire. This project will explore and compare economic impacts of coastal flooding coupled with sea level rise to various land parcels in Long Beach, one of the regions that shows a high risk for potential coastal flooding.

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EXECUTIVE SUMMARY

As the climate warms, and the oceans along with it, the intensity of coastal storms is predicted to increase along with today's measured sea level. These two are among the major factors leading to increased instances of coastal flooding and the associated risks placed on coastal communities, their inhabitants, structures, and economic wellbeing. Sea level rise is one of the most obvious manifestations of the trend of climate change, and is an immediate and real threat to lives, livelihoods, transportation, economies and the environment of California. Quantifying and analyzing these potential economic impacts of climate change is an important step towards local government planning for adaptation measures.

This report is a parcel-based economic analysis of the potential impacts of sea level rise and coastal flooding in the specified risk zone of Long Beach in Southern California. The following summarizes the potential losses due to these risks based on eight different CoSMoS scenarios by analyzing the parcel property value for parcels at risk, as well as sales volume and employee data for businesses at risk. The scenarios analyzed are 25cm, 50cm, 100cm, and 150cm of sea level rise with and without 100-year storm events. Parcel data were collected from the Los Angeles County Tax Assessor's office and overlaid with United States Geological Survey Coastal Storm Modeling System (CoSMoS) scenarios and analyzed in ArcGIS. Cascading economic impacts to Long Beach, Los Angeles County, and the State of California were calculated by running data obtained from InfoUSA through the economic impact analysis software IMPLAN.

The parcel-based analysis indicates that Long Beach, Los Angeles County, and the state of California all face significant, yet varying, economic risks due to sea level rise and coastal flooding in the city of Long Beach. At the lowest impact scenario, 2.89% of total parcels (3,077) and 4.3% of total city property value (roughly $1.8 billion) are at risk, while at the highest scenario 9.39% of total parcels (10,000) and 12.71% of total city property value (roughly $5.5 billion) are at risk. Analysis of the sales and employee data for businesses in the City of Long Beach show that for 150cm SLR with a 100-year storm event, a $5.08 billon direct loss of sales translates to a cascading economic impact to the greater City of Long Beach (direct, indirect, and induced) of $7.63 billion in sales lost to the city, an additional $1.12 billion in sales lost to Los Angeles County, and an additional $0.9 billion in sales lost in the entire state of California. All eight scenarios were analyzed and results are depicted in tables in the appendices. The analysis also indicates significant potential loss of tax revenue to both the state/local level and federal government under all CoSMoS scenarios, ranging from $30 million at the lowest scenarios to over $930 million at the highest risk scenarios.

The report concludes with a discussion of and potential explanations for non-linearity in analyzed results, predicted and modeled impacts of sea level rise with and without 100-year storm events, discussion of when Long Beach can expect to experience a tipping point, and policy implications in the local region and state.

INTRODUCTION

During the Pliocene era – over three million years ago – global sea levels were about 25-35 meters higher than they are today, while the average air temperatures were only roughly 2-3 degrees warmer than today.[3] Looking even further back to the Eocene era – over 40 million years ago – sea levels were likely 70 meters higher and the atmosphere contained much higher levels of CO_2 than today.[4] Today in 2019, as our climate warms, sea levels around the globe are rising again and the intensity of storms that inundate our coasts is increasing.[5]

While history shows that sea levels were at one point in time much higher, in today's world almost 40% of the U.S. population lives in a county directly on the shoreline, and that number is expected to increase 8% by 2020.[6] Over 600 million people live in the coastal zone worldwide,[7] so changes in sea levels represent significant potential hazards. Americans have quite literally built their lives, societies and economies in some of the most fragile regions possible. New York City, and with it, the financial center of the globe, sits perilously close to inundation; Florida's iconic Miami Beach is in a race against time as the city regularly floods on sunny days; and in the study area of Southern California, Los Angeles may not be the canary in the coal mine, but as an important county, vacation destination and economic hub of the West Coast, the threat is very real.

According to the Intergovernmental Panel on Climate Change, impacts on natural and human systems from global warming have already been observed.[8] Many land and ocean ecosystems and some of the services they provide have already changed due to climate change. Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C, and is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.[9] The magnitude and rate of global warming, and in return, sea level rise, depends on future carbon emission pathways. Getting a better understanding and more clear estimate of potential economic damages is an important step in the attempt to spur action towards reducing emissions to hold warming to its current levels or possible reversal.

By the year 2050, the *annual* expected financial losses from floods are predicted to exceed 1 trillion USD.[10] In addition to the millions of Americans living on some part of the country's 13,000 miles of coastline, by the end of the 21st century, nearly 2.5 million properties in the United States, collectively valued at over 1 trillion USD today, will be at risk of chronic flooding.[11] Among these properties are residences, shopping districts, medical offices, hospitals, schools, commercial office buildings, cultural centers like churches or aquariums and many others that contribute to local economies in different ways.

Sea level rise is one of the most obvious manifestations of the trend of climate change and is an immediate and real threat to lives, livelihoods, transportation, economies and the environment of California. Quantifying and analyzing these potential economic impacts of climate change is an important step towards local government planning for adaptation measures. Understanding, at a more local and specific level, the costs that may be associated with varying scenarios of sea level rise and coastal flooding can help a city prepare for the future, not only with physical adaptation measures, but ones based in policy as well. Funding adaptation measures at the city, county, or even state level can become difficult if stakeholders

cannot visualize the direct and indirect impact to their localities. This study aims to not only quantify the economic impacts at the parcel level within the City of Long Beach, but to understand the cascading economic impacts to the greater city, county, and state as a result of businesses being lost due to sea level rise and coastal flooding.

The City of Long Beach is one of the areas of Los Angeles County at high risk from sea level rise and coastal flooding. Recent analysis by Climate Central using NOAA sea level rise projection data lists Long Beach in the top five cities in California for total exposure of homes on land below three feet for cities with populations over 100,000.[12] The 2014 National Climate Assessment shows varying risks for Long Beach in terms of economic loss with regards to different future scenarios: Its "High Scenario," in the year 2060, reports that there will be 3,710 homes, roughly $2.5 billion in property value, and almost $30 million in property tax at risk. These numbers represent over 5% of total property value and total property tax base – some of the largest percentages in California. Alternatively, even when using the "Low Scenario," over $250 million in property value and over $3 million in property tax are at risk in Long Beach by the year 2060.[8]

The impacts of sea level rise are predicted to be experienced in the next 40-50 years, so the time is now to begin preparing for when the water comes. In a meeting hosted by Long Beach Development Services (the government planning department for the City of Long Beach) earlier this year, Dr. Jerry Schubel, CEO of the Aquarium of the Pacific located in the Port of Long Beach, pronounced to local homeowners that they "can stand and fight for only so long" and the residents should begin discussions of managed retreats in the very near future. The more useful information regarding the economic impacts of climate change and associated sea level rise and coastal flooding scenarios that can be placed in the hands of local governments and their planning departments, the better equipped cities, and in the case of this research project, Long Beach, will be to make important decisions for the future of city planning.

Long Beach Development Services recently commissioned a sea-level rise economic impact report that is currently under development. According to discussions with the consulting team developing that report, a proprietary model is being used which can provide additional economic analysis of fiscal impacts to parcels in Long Beach and the associated direct and indirect impacts to various industry sectors in the Long Beach community. This paper therefore seeks to compliment this effort. It should be noted that the Long Beach commissioned report is also using internally developed flooding projections that differ slightly from the U.S. Geological Survey's (USGS) Coastal Storm Modeling System (CoSMoS) data used in this analysis. Existing CoSMoS projections did not include some existing flood protections like sea walls, so the flooding estimated by CoSMoS as-is may be overestimated. These projections were not available for this analysis, so this study was completed using the existing CoSMoS scenarios as the best publically available data.

STUDY REGION

The City of Long Beach is located in Southern California, within Los Angeles County (figure 1).

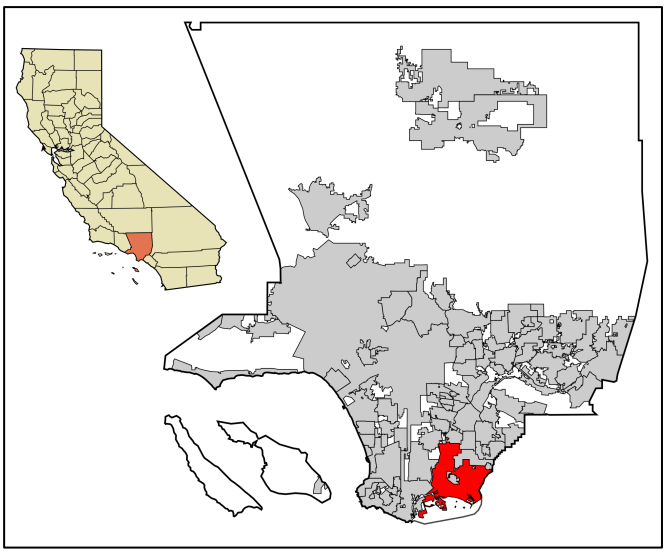


Figure 1: Left - state of California with LA County in orange, right - LA County with City of Long Beach in red. Source: Public Domain, Wikipedia.[13]

Southern California is known for its picturesque coastal landscapes and quintessential beach cities, and Long Beach is one example of the important hubs that make Los Angeles County so popular, as well as a depiction of what stands to be lost due to risks associated with climate change. Nicknamed the “Aquatic Capital of America,” Long Beach is home to unique coastal tourist attractions like the RMS Queen Mary, a retired British ocean liner and museum ship, the Aquarium of the Pacific, a non-profit aquarium host to over 11,000 animals and receiving over 1.5 million visitors per year, and several iconic LA beaches, including the beloved Rosie’s dog beach.

In all scenarios analyzed, there will be significant flooding in the southeastern and southwestern corners of Long Beach, where more than 22,000 people live. The most vulnerable areas in the southeast include the Peninsula, Alamitos Bay, Belmont Shore and the lot north of the Alamitos Bay Marina. When a 100-year storm is added to the scenario, parts of Belmont Heights and College Estates, as well as the marina and Lagoon may be impacted. The Port of Long Beach is the most vulnerable asset predicted to be impacted in the southwestern portion of the city.[14] The entire city can be seen in figure 2 as shown by the Long Beach Convention and Visitors Bureau.

Figure 2: City of Long Beach with points of interest. Source: Long Beach Tourism Board.

Directly seaward of the shore off Long Beach in the harbor lies a breakwater and THUMS Oil islands. In February of 1962, Long Beach voters approved “controlled exploration and exploitation of the oil and gas reserves” underlying their harbor, a reversal as they had prohibited such drilling since 1956. THUMS is an acronym for the five oil companies that joined together to complete this project: Texaco (now Chevron), Humble (now ExxonMobil), Union Oil (now Chevron), Mobil (now ExxonMobil) and Shell Oil Company. This consortium built four artificial islands (see figure 3) at a cost of $22 million (in 1965 dollars), which were not constructed to withstand ocean waves and are predicted to flood.

Figure 3: Locations of THUMS Islands. Source: Wikipedia

Over the past century, Long Beach has been heavily developed and has attempted various shoreline protection strategies to buffer impacts to infrastructure, thereby altering the natural coastal ecosystems in the region. The Aquarium of the Pacific reports that past studies have discovered the existence of now defunct timber jetties, trial installations of artificial kelp and tethered milk jugs to dampen waves, highway crash barriers as sea walls, and a variety of other approaches that have not become commonplace solutions. To date, beach replenishment is the main measure being taken to provide protection from the sea. Beach sand naturally moves from the Peninsula in the southeastern region of the coast and accretes on the western end of the beach near the downtown area. For decades, the city has responded to potential flooding in the Peninsula area by building a sand berm by trucking sand from the western end of the beach to the eastern end, where erosion is most prominent. This practice requires constant, reportedly noisy and dirty, convoys of trucks to move sand from one part of the beach to another to protect the homes in the area. As sea levels continue to rise and storms increase in frequency and severity, sand nourishment may not be a sufficient mode of protection.

In addition to taking these in-situ measures of protection, Long Beach is deeply committed to understanding to what extent climate stressors will impact various assets in the city, and is ready to develop adaptation strategies and adjust planning processes to make informed decisions for future capital investment.[15] In January of 2015, Long Beach mayor Robert Garcia announced that he wanted to make Long Beach a model of a climate resilient city, asking the Aquarium of the Pacific to assess the primary threats posed by climate change.[16] The Aquarium worked with experts from Loyola Marymount University and Oak Ridge National Laboratory and subsequently completed a report titled City of Long Beach Climate Resiliency Assessment Report.[17] Two other reports were completed, aimed at helping citizens of Long Beach take part in making the city more climate resilient. In the fall of 2016, the Port of Long Beach released its own Climate Adaptation and Resiliency Plan (CRP), and in November of 2018, AECOM released the final climate change vulnerability assessment results on behalf of Long Beach Development Services in the form of the Long Beach Climate Action and Adaptation Plan. This work is ongoing, as the completion of that report represents the first three steps in a 7-step process for climate adaptation planning, all the while engaging various stakeholders in the process.

TECHNICAL BACKGROUND

Sea Level Rise: Best Available Science

The observations and science are clear: Climate change is causing global sea levels to rise due to the thermal expansion of warming ocean water and melting of land ice with increasing temperatures.[18] The pace and severity of sea level rise will depend on several factors, most importantly greenhouse gas emissions leading to these increases in sea surface temperature and ocean heat content. Ocean thermal expansion accounts for roughly 50% of global mean sea level rise, while the melting of land ice (a mix of mountain glaciers and ice caps as well as the polar ice sheets covering Greenland and Antarctica) accounts for the other 50%.

The state of California is committed to providing guidance for incorporating sea level rise projections into planning, design, permitting, construction, investment and other decisions,[19] made clear by several recent documents prepared on behalf of the California Ocean Protection Council. *Rising Seas in California: An Update on Sea-Level Rise Science* and the *State of California Sea-Level Rise Guidance: 2018 Update* summarize the best available science for California sea level rise projections, approaches and limitations of these projections, and guidance and recommendations for how to use this best available science to make planning and adaptation decisions on a regional and local scale. These guidance documents approach sea level rise projections based on the IPCC's set of GHG emissions scenarios titled 'representative concentration pathways,' more commonly referred to as RCPs. The projections are regional in scale, based on tide gauge data from up and down the coast. The pathways used in these projections are RCP 8.5, 6.0, 4.5, and 2.6 where RCP 8.5 is consistent with a future in which there are no significant global efforts to limit or reduce carbon emissions and RCP 2.6 includes a stringent emissions reduction scenario that closely aligns with the aspirational goals of the United Nations Framework Convention on Climate Change's (UNFCCC) Paris Agreement from 2015, which called for limiting global mean warming to less than 2°C by the end of the century.[20] According to the IPCC, sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century, and the marine ice sheet instability in Antarctica and/or the irreversible loss of the Greenland ice sheet could result in multi-meter rise over hundreds to thousands of years.

The California Sea-Level Rise Guidance document outlines the low to high probability of sea level rise scenarios based on the varying RCPs, some of which correspond to the scenarios chosen for this study, as well as an extreme case called the H++ scenario. This is included as a potential worst-case scenario if the West Antarctic ice sheet melting occurs at a rapid rate, which is a possibility, but the probability of which is currently unknown due to high levels of uncertainty.

Coastal Storm Modeling System

There are two types of models used to predict coastal flooding caused by sea level rise: static, or "bathtub" models, and hydrodynamic models. The simpler static model does not consider the dynamics of water motion – waves, currents, vegetation and land cover – which can have an effect on the depth and extent of flooding. In the bathtub approach, estimated water level is calculated by summing the influence of various water level components and considering anything below that elevation to be underwater. This is an approximation, since some processes that drive coastal flooding – run-up of waves onto the shore, for example – involve hydrodynamic effects that alter the extent and duration of flooding. However, bathtub modeling cannot represent the changes in hydrodynamic processes as a result of sea level rise.[21]

While bathtub modeling is typically an effective and affordable approach for broad estimations of sea level rise inundation, hydrodynamic modeling more accurately predicts future flooding at finer spatial scales. While it is more expensive than static modeling and harder to implement at a large scale, it has been successfully implemented in California and stands as one of the leading methods for identifying coastal vulnerabilities on the West Coast. In collaboration with leading scientists worldwide, the USGS developed CoSMoS model assesses the coastal

impacts of climate change for the California coast, including the combination of sea level rise, storms, and coastal change.[22]

CoSMoS is a dynamic model that allows more detailed predictions of coastal flooding due to both future sea level rise and a 100-year storm integrated with long-term coastal changes over large areas. CoSMoS models all the relevant physics of a 100-year storm, and scales it down to local flood projections for use in community-level coastal planning and decision-making. The third iteration of the model (CoSMoS 3.0) covers the Southern California coast from Point Conception to the U.S. / Mexico border (figure 4). Improvements include, but are not limited to, high resolution grids for better representation of harbors, lagoons, bays, estuaries, and overland flow, fluvial discharges, beach change and bluff retreat, uncertainties associated with land motion, and alterations to coastal storm intensity and frequency associated with a changing climate.[13] Most relevant to this study, the updates to the model allow jurisdictions to visualize predictions for sea level rise with no storm and sea level rise *with* 100-year storms, allowing for demonstrations of the compounded effect on flooding that storms will have over time with elevated sea levels.

Figure 4: Locations of regions modeled during phase 2 of CoSMoS for Southern California v3.0. Within Los Angeles County, data were modeled in 8 sub-regions, City of Long Beach data were contained in LA01 and LA02. Source: USGS CoSMoS, 2017.

Lastly, CoSMoS does not use time predictions, while other sea level rise models, like the National Research Council Sea-Level Rise for California, Oregon, and Washington, do. CoSMoS simply lays out the scenarios and predictions for each without associated years of occurrence because there is uncertainty on how quickly sea level rise will accelerate. This is important to note because economic data presented in this report are based on present and future dollars, which makes a difference in the fiscal impact results. However, as coastal development progresses, it's important for planners and decision-makers to have an idea of when to expect sea levels to rise, and to what extent to expect it. The California Sea Level Rise Guidance documents have added an approximate time frame in which users can expect varying stages of sea level rise based on future carbon emissions. As shown in figure 5, global mean sea levels and relative sea levels in San Francisco have been rising steadily since 1880, based on historical data.[23] The three emissions scenarios pictured below are as follows: H++, the most extreme scenario; RCP8.5, the high emissions scenario; and RCP2.6, the most stringent, best case emissions scenario closely aligned with the Paris agreement. It is

important to note that regardless of the emissions scenario modeled, global and local sea levels will continue to rise over the next 80 years.

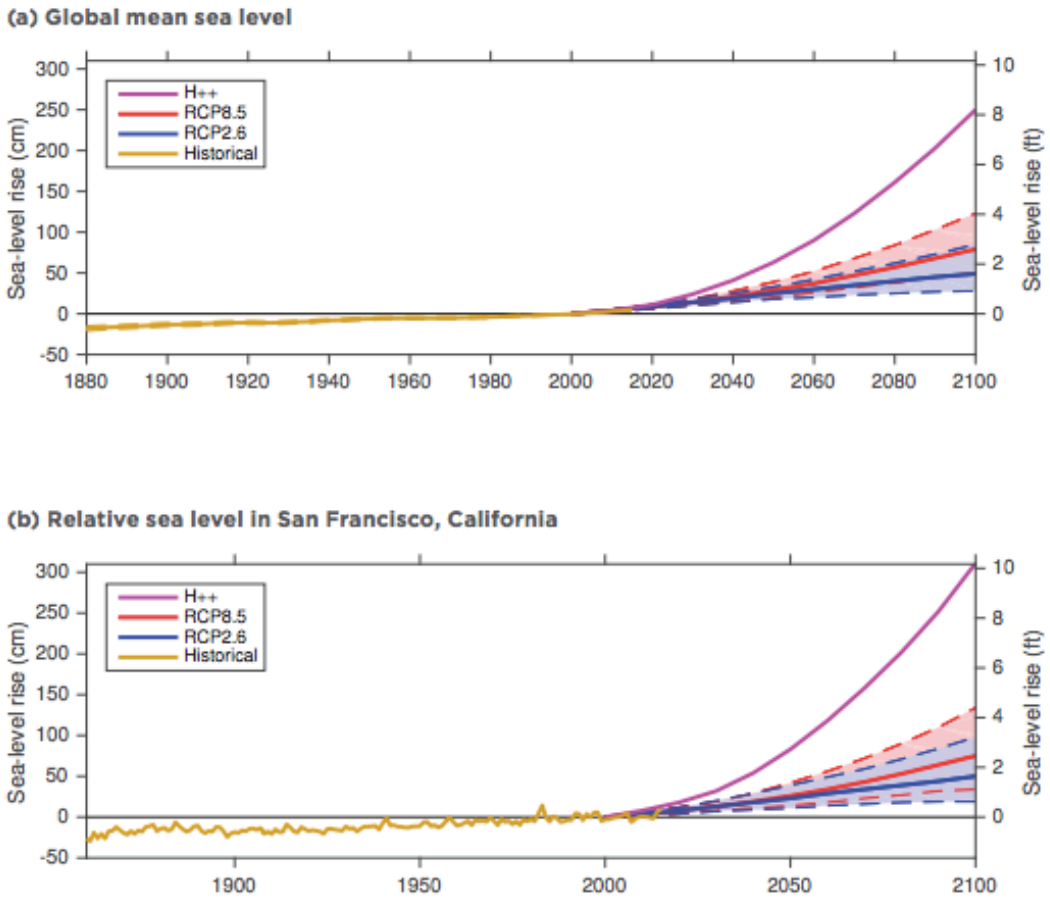


Figure 5: Projections of (a) global mean sea level and (b) relative sea level in San Francisco, CA. Source: Rising Seas in California: An Update on Sea Level Rise Science, 2017.

IMPLAN

Impact Analysis for Planning (IMPLAN) is an economic assessment software system that uses classic input-output (I-O) analysis and pairs it with regional social accounting matrices (SAMs), allowing users to create economic models using data collected for a defined region, not just national averages. An I-O model offers a "snapshot" of the economy, detailing the sales and purchases of goods and services between all sectors of the economy for a given period of time within a conceptual framework derived from economic theory.

For a specified region, the input-output table accounts for all dollar flows between different sectors of the economy. With the right input data, the software helps users gain insight into an industry's contributions to a region, quantify the impact of a shock to an economy, examine the effects of a new or existing business, model the impacts of expected growth or changes, or study any other event specific to the economy of a particular region and how it will be impacted. Using this information, IMPLAN models the way a dollar injected into one sector is spent and re-spent in other sectors of the economy, generating waves of economic activity, or so-called “economic multiplier” effects. The model uses national industry data and county-level economic data to generate a series of multipliers, which in turn estimate the total economic

implications of economic activity. For the sake of this study, the economic shock is the loss of land parcels – and their associated businesses – due to predicted sea level rise and coastal flooding outlined by each of the eight selected scenarios.

The results of the IMPLAN model identify direct impacts of an economic shock by sector, and then develop a set of indirect and induced impacts by sector (figure 6). The direct effects are the immediate results of the direct spend, or in the case of this study the loss of sales volume and employees to the businesses that are predicted to flood. Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond to this loss of sales. The indirect impacts stem from local industries' purchases of inputs (goods and services) from other local industries – otherwise known as intermediate expenditures. IMPLAN does not assume that all input purchases are made from local businesses and the proportion of local vs. non-local purchases varies by commodity and is built into the IMPLAN system. Lastly, the induced impacts reflect the spending of wages from residents in the study area. The IMPLAN model accounts for commuting patterns, as well as imports, and does not assume that all purchases of goods and services are completed within the study area.[24]

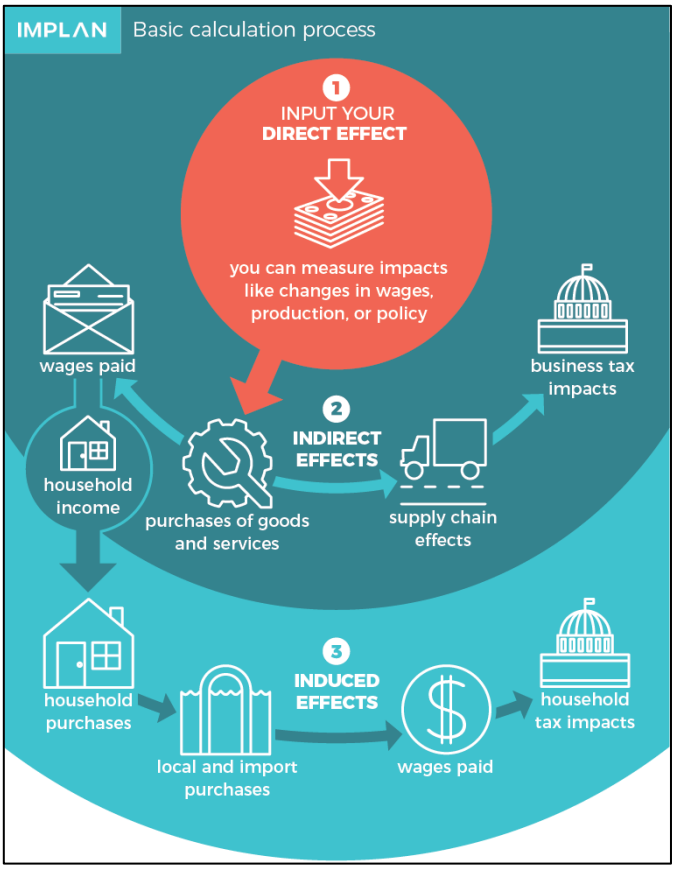


Figure 6: The IMPLAN model's basic calculations. Source: IMPLAN blog

Global Climate Change: Long Beach in Context

As earlier noted, USGS does not include years of impact alongside their sea level rise predictions, but the California Ocean Protection Council's (OPC) Sea Level Rise Guidance documents provides probabilistic time-based projections for the height of sea level rise, based on various carbon emissions scenarios – H++ (extreme scenario), RCP8.5 (high emissions),

and RCP2.6 (low emissions). These probabilistic projections are depicted in the table below (figure 7), and have been translated into a graphic format as seen in figure 8.

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					H++ scenario (Sweet et al. 2017) *Single scenario
		MEDIAN	LIKELY RANGE		1-IN-20 CHANCE	1-IN-200 CHANCE	
		50% probability sea-level rise meets or exceeds...	66% probability sea-level rise is between...		5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...	
				Low Risk Aversion		Medium - High Risk Aversion	Extreme Risk Aversion
High emissions	2030	0.3	0.2 -	0.5	0.6	0.7	1.0
	2040	0.5	0.4 -	0.7	0.9	1.2	1.7
	2050	0.7	0.5 -	1.0	1.2	1.8	2.6
Low emissions	2060	0.8	0.5 -	1.1	1.4	2.2	
High emissions	2060	1.0	0.7 -	1.3	1.7	2.5	3.7
Low emissions	2070	0.9	0.6 -	1.3	1.8	2.9	
High emissions	2070	1.2	0.8 -	1.7	2.2	3.3	5.0
Low emissions	2080	1.0	0.6 -	1.6	2.1	3.6	
High emissions	2080	1.5	1.0 -	2.2	2.8	4.3	6.4
Low emissions	2090	1.2	0.7 -	1.8	2.5	4.5	
High emissions	2090	1.8	1.2 -	2.7	3.4	5.3	8.0
Low emissions	2100	1.3	0.7 -	2.1	3.0	5.4	
High emissions	2100	2.2	1.3 -	3.2	4.1	6.7	9.9
Low emissions	2110*	1.4	0.9 -	2.2	3.1	6.0	
High emissions	2110*	2.3	1.6 -	3.3	4.3	7.1	11.5
Low emissions	2120	1.5	0.9 -	2.5	3.6	7.1	
High emissions	2120	2.7	1.8 -	3.8	5.0	8.3	13.8
Low emissions	2130	1.7	0.9 -	2.8	4.0	8.1	
High emissions	2130	3.0	2.0 -	4.3	5.7	9.7	16.1
Low emissions	2140	1.8	0.9 -	3.0	4.5	9.2	
High emissions	2140	3.3	2.2 -	4.9	6.5	11.1	18.7
Low emissions	2150	1.9	0.9 -	3.3	5.1	10.6	
High emissions	2150	3.7	2.4 -	5.4	7.3	12.7	21.5

Figure 7: Projected sea level rise for Los Angeles and recommended projections for use in low, medium-high, and extreme risk aversion decisions. Source: California Ocean Protection Council, 2018.

In order to understand when the Long Beach area could expect the impacts of sea level rise and coastal flooding to occur, and if it is within the lifespan of coastal development projects that might be in the process of conception and design today, the chosen scenarios have been graphed through 2070, and three benchmark sea level rise scenarios were graphed alongside. The blue lines represent the likely range, or 66% probability that sea level rise will fall somewhere in that range, if emissions are on the RCP2.6 track, referred to in the OPC guidance documents as “low emissions”. The darker blue line in the middle of the range represents the median, or 50% probability that sea level rise will meet or exceed the listed number. The red lines represent the likely range, or 66% probability that sea level rise will fall somewhere in that range, if emissions are on the RCP8.5 track, referred to in the OPC guidance documents as “high emissions”. The darker red line in the middle of the range represents the median, or 50% probability that sea level rise will meet or exceed the listed number. The light red line on the top represents the 1-in-200 chance, or 0.5% probability that sea level rise will meet or exceed the listed number at a high emissions scenario. The OPC guidance recommends that developers and policymakers practice low risk aversion when

planning future development, which corresponds to the high-range projections of the likely range. So as this graph shows, by the year 2070 – roughly 50 years from today, Long Beach is likely to hit the critical tipping point where the economic disruption from sea level rise with a large storm event is predicted to go from modest to major. There is a 0.5% chance that within 50 years Long Beach will experience 100cm of sea level rise, and while not pictured on this graph, there is a slight chance that in the absolute worst case emissions scenario (the event of the H++ scenario, with which projections are very uncertain), within 50 years the Los Angeles region could experience the most severe sea level rise scenario analyzed, 150cm.

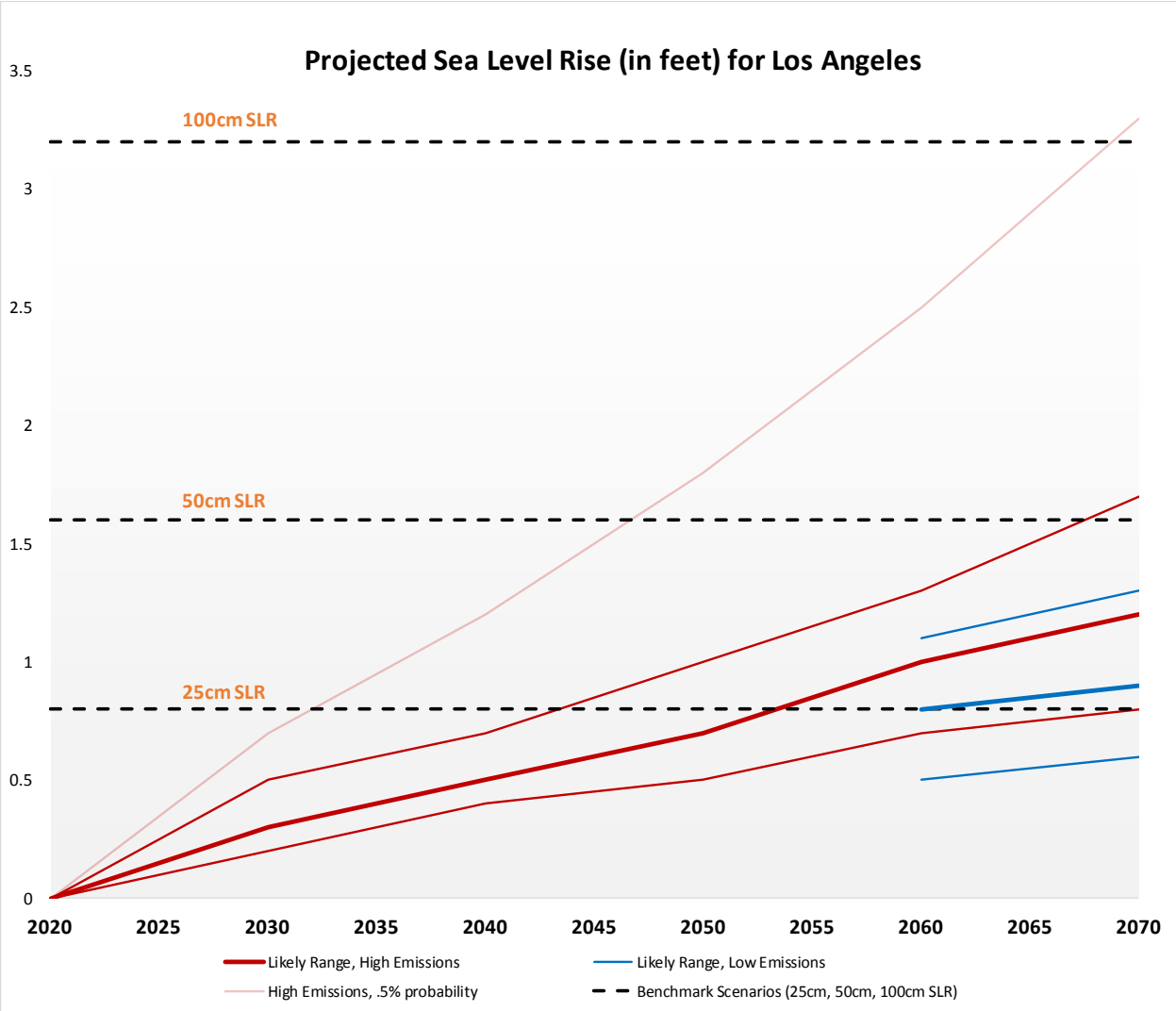


Figure 8: 25cm, 50cm, and 100cm of sea level rise in Los Angeles area and their associated probabilities of occurrence, through 2070. Data from California Ocean Protection Council 2018, CoSMoS 2017.

METHODS

Many cities in the state of California have completed climate change vulnerability assessments, and Long Beach is no exception. Numerous sea level rise and coastal flooding models and associated scenarios are available, so it was important to choose ones that have already been featured and analyzed in previous assessments for the City of Long Beach, for ease of comparison. In this study, eight CoSMoS scenario results were used for analysis; see

Table 1 for chosen study scenarios. For context, a 100-year storm is a storm that has a 1 percent chance of occurring in any given year.

Study Scenario	CoSMoS Scenario
1	25 cm SLR, average conditions
2	50 cm SLR, average conditions
3	100 cm SLR, average conditions
4	150 cm SLR, average conditions
5	25 cm SLR, 100-year storm
6	50 cm SLR, 100-year storm
7	100 cm SLR, 100-year storm
8	150 cm SLR, 100-year storm

Table 1: Chosen scenarios for this study. Data from USGS CoSMoS, 2017.

Once the relevant scenarios were selected, the flood depth and duration projections for average conditions and the 100-year storm in Los Angeles County were downloaded from the USGS ScienceBase-Catolog and organized on a local hard drive. These datasets are available to the public to download for free, intended for policy makers, resource managers, science researchers, students, and the general public for the purpose of identifying and assessing possible areas of vulnerability.[25] The parcel dataset was collected from The City of Long Beach and the Los Angeles County Tax Assessors Office, downloaded for free from publicly available data on each region's website. Parcels were categorized as residential, commercial, industrial, recreational, institutional, or miscellaneous. Examples of residential parcels included single family residences, duplexes, or apartment buildings; examples of commercial parcels included banks, shopping centers, or restaurants; examples of industrial parcels included manufacturing plants, warehouses, or lumber yards; examples of recreational parcels included athletic facilities or water recreation companies; examples of institutional parcels included churches and schools; and those categorized as miscellaneous included government owned property, petroleum and gas, privately owned, rights of way, rivers and lakes, and utility properties. The total parcel value was listed as the total sum of land value, improvement value (all buildings, structures, wells, fences, etc. on or affixed to the land within the parcel), and fixture value (defined as an item of personal property classified as realty for tax purposes because it is physically or constructively annexed to land or buildings with the intent that it remain annexed indefinitely).

The parcel dataset was overlaid with each of the eight CoSMoS scenarios using GIS in ArcMap 10.6.1. Parcels vulnerable to sea level rise and flooding were extracted as spreadsheets for each scenario. For the purposes of this study, parcels were defined as vulnerable if they are located within the predicted flood zone of the chosen scenarios. Tables were created using the pivot table functionality in Microsoft Excel to display the total number of parcels, land value, improvement value, and total property value at risk due to sea level rise and flooding predictions for each scenario, broken out by industry and specific sector (see appendices for full tables).

In order to complete the economic impact analysis model runs, additional data from InfoUSA, which provides information on sales volume and number of employees at businesses located in the risk zones, were purchased for $723.07. The InfoUSA website has a map tool, and an

outline was drawn of the highest risk scenario and data on only the businesses within that zone was purchased. The data were delivered in an excel spreadsheet, which was subsequently matched by street address to each dataset of vulnerable parcels. This resulted in eight spreadsheets with the parcel ID, total property value (negative value since these are considered losses), total sales volume (again negative values), total number of employees, and associated NAICS (North American Industry Classification System) code for each business in the risk zone for each sea level rise and flooding scenario. NAICS codes are used by businesses and government authorities to differentiate types of business according to their process of production.[26] The IMPLAN model must have the specific sector of each business as an input in order to predict the future economic impact a loss will have on the economy, so the IMPLAN sector codes were matched to the NAICS codes. For this study, the chosen year of occurred change is 2019, and the results are displayed in 2019 U.S. dollars.

Once the model input spreadsheets were finalized, each of the eight scenarios was run through IMPLAN three times for three different defined study regions. The first study region modeled was City of Long Beach only zip codes, followed by Los Angeles County, and lastly the entire state of California. See appendices for an example of data that was input into IMPLAN. The results were downloaded for analysis in this report.

Limitations on the Analysis

Government establishments and public institutions are not included in the data, as they do not produce sales volume and cannot be run through IMPLAN. These methods also assume a full loss of the business if it is located within the affected area as outlined by each of the eight CoSMoS scenarios. Full loss is defined as removal of all property value, sales volume, and employees if the business or parcel is located within the flood zone. Time did not permit analysis by assigning a weighted value based on the depth of predicted flooding to establish an even more refined estimate of the potential economic impact, and remains an interesting place for further work on this topic.

Further refined estimates could be achieved by using a centroid approach, where a business is only considered a full loss if the centroids of that parcel is inundated, or a threshold approach, where a business is only considered a full loss if a certain threshold of the parcel is inundated. Due to the nature of the approach taken in this study, economic impact results are likely overestimated, but the patterns revealed are likely to remain constant.

It is important to note that with an input-output model, results are provided by a Social Accounting Matrix (SAM), which represents flows of all economic transactions that take place within an economy. IMPLAN takes the direct inputs and models this flow with multipliers based on various industry information, which generates output of exact numbers in return. The potential fiscal and economic impact dollar amounts included in this report are not exact predictions of what absolutely will happen in the future given these sea level rise and flooding scenarios, but are meant to serve as an estimation of potential future impacts given parcel, sales volume, and employee data input datasets.

RESULTS

This parcel-based analysis indicates that Long Beach, Los Angeles County, and the state of California all face significant economic risks due to sea level rise and coastal flooding in the city of Long Beach. All values are in 2019 U.S. dollars.

Long Beach Property Value at Risk

Based on 2015 parcel data available from the LA County Tax Assessors Office (the most recent dataset publically available), there are 106,533 parcels representing $43,505,708,699 in total parcel value located in the City of Long Beach.[27] Over 90% of the parcels are residential and represent nearly 80% of the property value of the city, and the rest are split between the remaining categories as shown in table 2 below.

City of Long Beach Parcel Totals			
Industry	**Number of Parcels**	**Total Value**	
Residential	97564	$	34,470,354,328
Commercial	5010	$	5,546,440,378
Industrial	1795	$	2,152,540,611
Institutional	439	$	1,126,700,608
Recreational	401	$	104,489,220
Miscellaneous	1299	$	84,794,007
Unavailable	18	$	15,868,481
Irrigated Farm	3	$	3,978,453
Dry Farm	4	$	542,613
Total	**106,533**	**$**	**43,505,708,699**

Table 2: Total number and value of parcels in City of Long Beach. Data from LA County Tax Assessor, 2015.

Of the eight CoSMoS scenarios analyzed, 150cm of sea level rise with a 100-year storm yields the most total number of parcels vulnerable (10,000) and highest amount of total property value at risk (unadjusted, $5,524,885,260). For this scenario, the residential sector is the most severely impacted, at 7,995 parcels valued at over $4.5 billion in total property value. Within the residential parcels impacted, the most at-risk in total property value is single-family residences, at 6,514 valued at over $3.6 billion. The sector that faces the second greatest risk in terms of property value is commercial, with a total of 383 parcels at risk valued at $484,472,489. Within the commercial sector, neighborhood and community shopping centers, stores, and store combinations represent a combined property value of over $230 million, with restaurants/cocktail lounges as the next highest valued at $56 million. The industrial sector shows markedly more parcels at risk, 954, but the property value adds to $357,720,448 – the majority in light manufacturing and general industrial properties. Parcels categorized as miscellaneous at risk total 315 with a total property value of $78,239,970, broken into government owned property, petroleum and gas, privately owned, and utilities. Utilities represent 56 parcels and over $51 million in property value, with petroleum and gas following behind with just 6 parcels but over $25 million in property value. Parcel at risk in the recreational sector are totaled at 340 parcels with a total property value of $29,444,497, nearly two-thirds of which is in the water recreation category (as well as 331 out of the 340 total

parcels). Finally, institutions represent the least at risk sector with eight churches and two private schools adding up to a total property value of $4,548,338.

The second most economically harmful scenario (in terms of parcels and associated total property values) is 100cm of sea level rise with a 100-year storm. The ratio of parcels and value at risk by sector mirror the 150cm SLR with 100-year storm scenario for this, and all subsequent scenarios. In these defined terms, the following is the list from greatest to least impact: 150cm SLR with no storm, 50cm SLR with the 100-year storm, 100cm SLR with no storm, 25cm SLR with the 100-year storm, 50cm SLR with no storm, and finally 25cm with no storm (table 3).

City of Long Beach Parcels at Risk by Scenario			
CoSMoS Scenario	**Total Parcels at Risk**	**Total Parcel Value at Risk**	
150cm SLR, 100-year storm	10,000	$	5,524,885,260
100cm SLR, 100-year storm	7,928	$	4,731,945,786
150cm SLR, no storm	7,912	$	4,714,222,020
50cm SLR, 100-year storm	7,042	$	4,285,127,949
100cm SLR, no storm	7,085	$	4,232,630,029
25cm SLR, 100-year storm	5,960	$	3,740,109,178
50cm SLR, no storm	5,293	$	3,291,373,785
25cm SLR, no storm	3,077	$	1,871,434,565

Table 3: Selected study scenarios with total number and value of parcels at risk, in order from highest to lowest total parcel value. Data from CoSMoS 2017, LA County Tax Assessor 2015.

At the lowest impact scenario, 2.89% of parcels and 4.3% of total city property value are at risk, while at the highest scenario 9.39% of parcels and 12.71% of total city property value are at risk. The majority of parcels in the city limits are very small, so in order to best visualize the parcel layer with the flooding scenarios, figures 9 and 10 are lowest and highest impact scenarios zoomed into the southeastern subarea of the city. Additionally, it is widely reported that buildings closer to the coastline have a higher total property value. Figure 11 depicts the density of the total parcel value at risk in the southeastern subarea at the lowest and highest analyzed scenarios. The lighter the pixel color, the lower the parcel value at risk is, the darker the pixel color, the higher the parcel value at risk is. In general, these maps depict the parcels at risk that are closer to the direct coastlines have higher total property values, while the parcels further away from the coast have lower total property values.

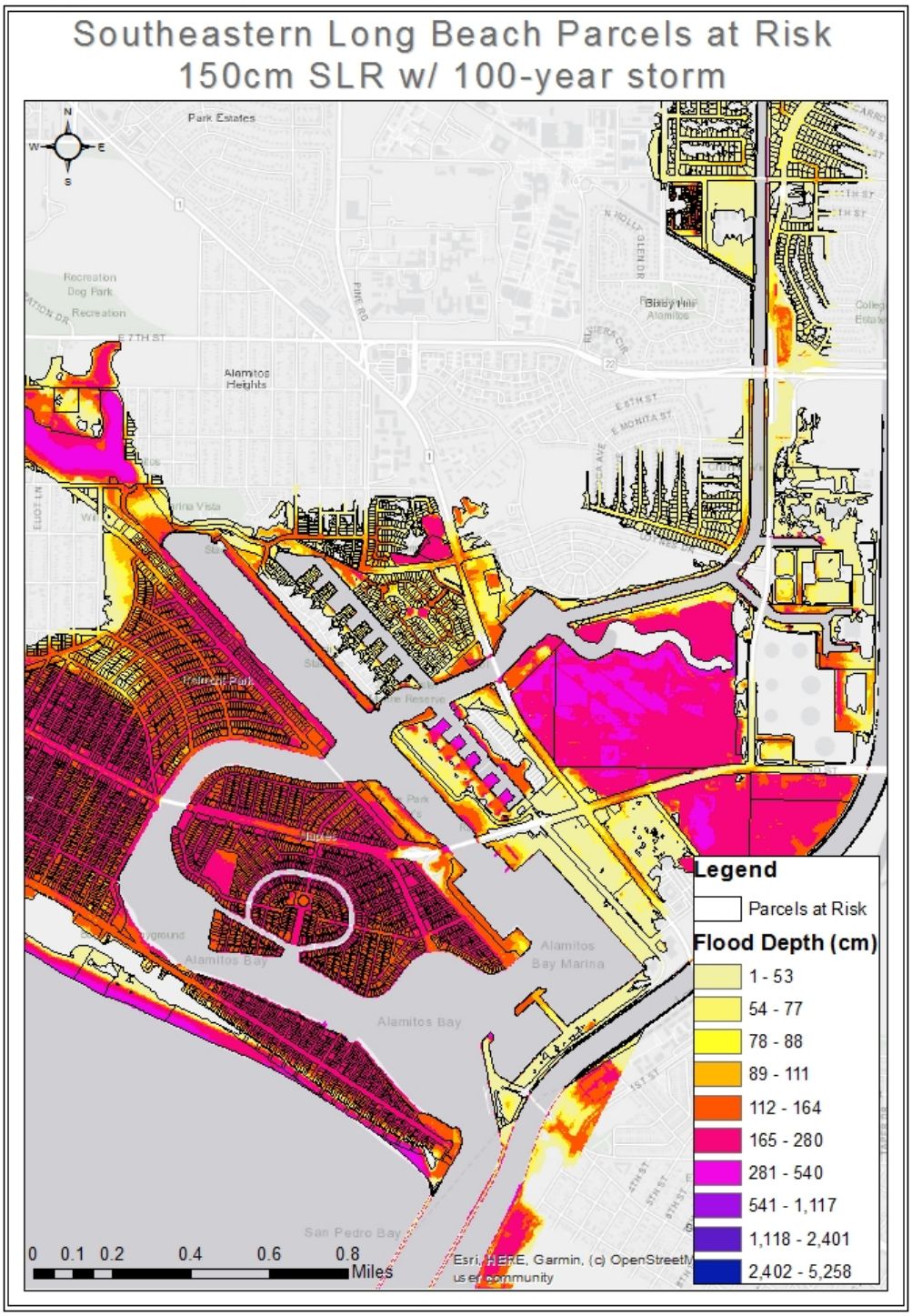


Figure 9: Southeastern Long Beach parcels at risk at 150cm SLR with 100-year storm. Data from CoSMoS, 2017 and LA County Tax Assessor, 2015.

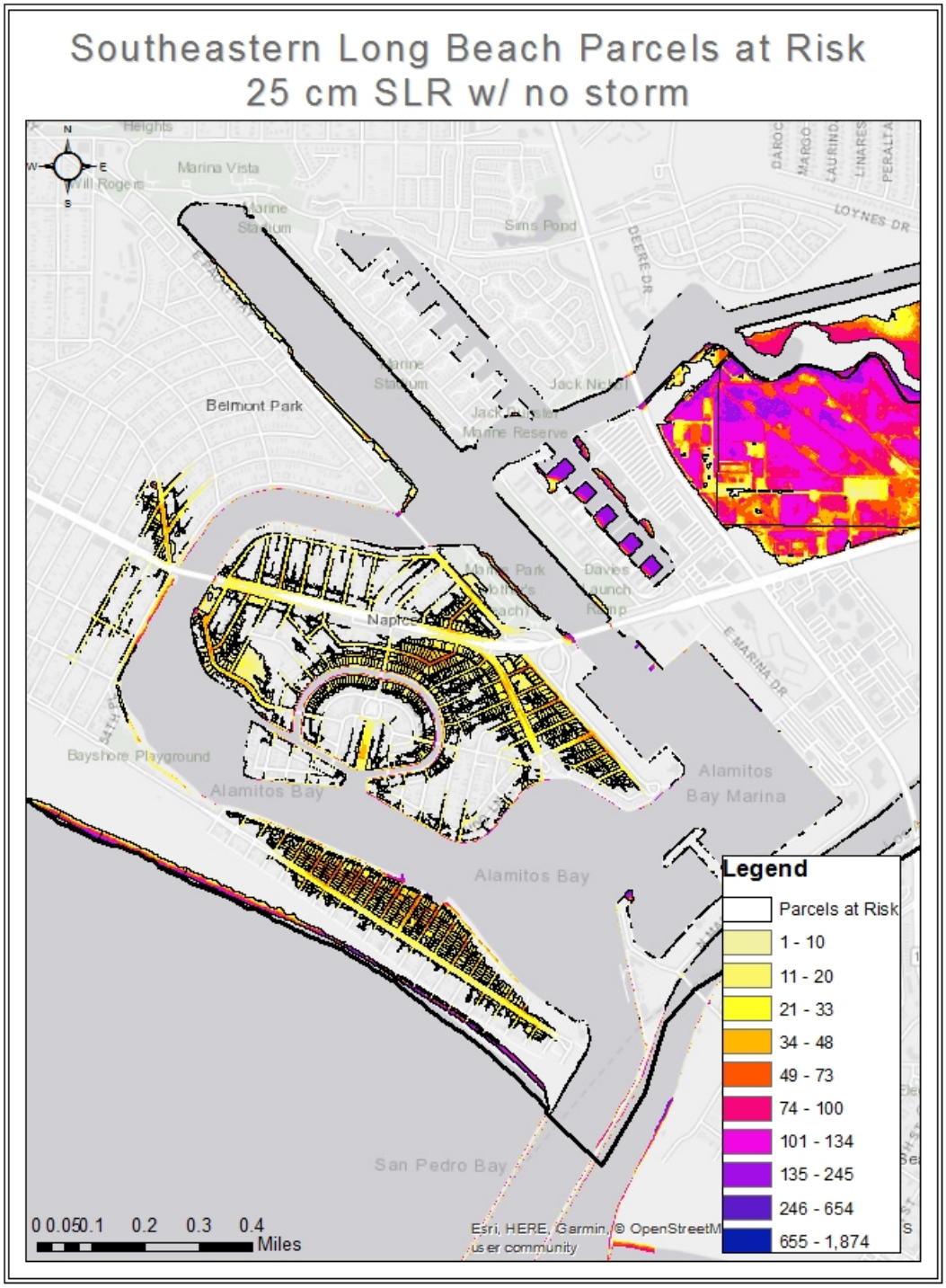


Figure 10: Southeastern Long Beach parcels at risk at 25cm SLR. Data from CoSMoS, 2017 and LA County Tax Assessor, 2015.

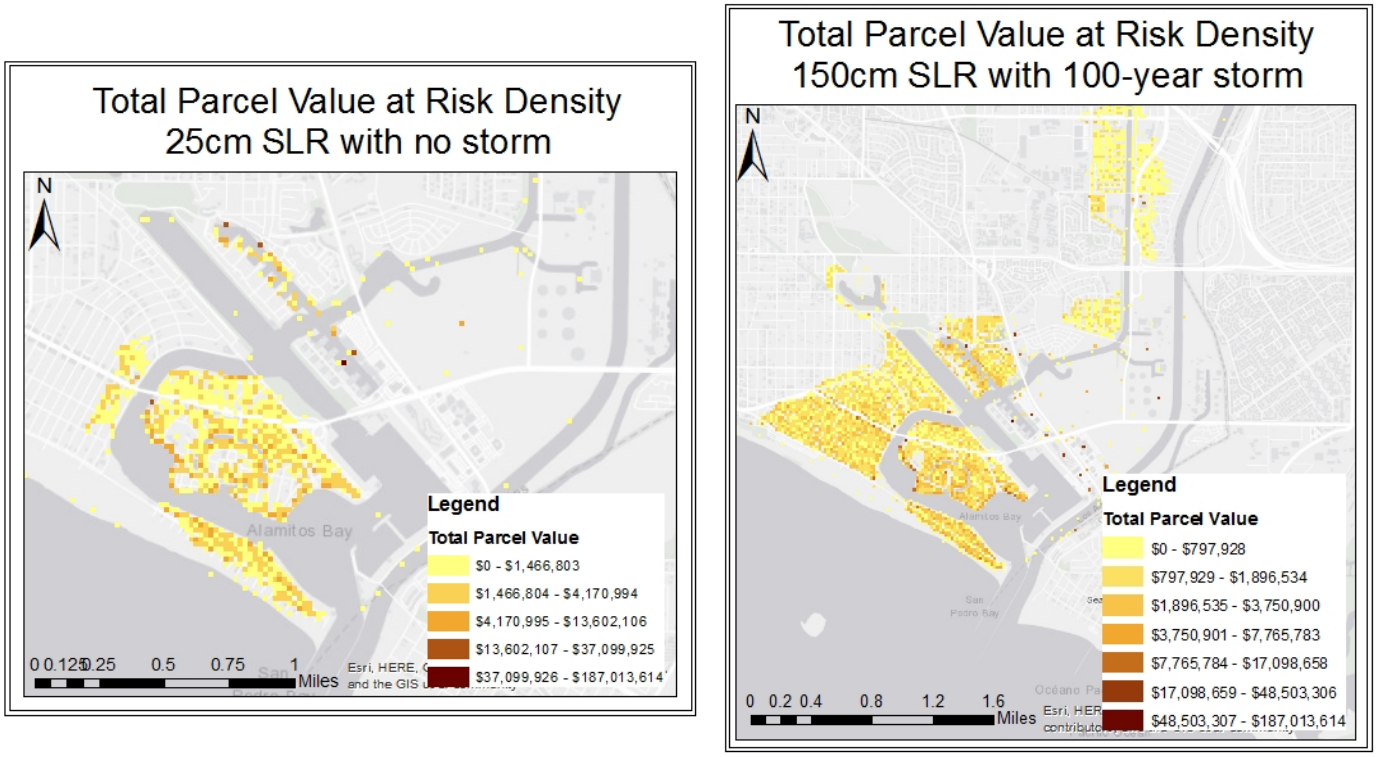


Figure 11: Density of the total parcel value at risk in Southeastern subarea of Long Beach at 25cm SLR with no storm and 150cm SLR with 100-year storm. Data from CoSMoS, 2017 and LA County Tax Assessor, 2015.

Cascading Economic Impacts

The sales and employee data for each scenario were run through IMPLAN under three different study regions: first showing cascading economic impacts of business loss throughout the City of Long Beach, then throughout Los Angeles County, and finally, throughout the entire state of California.

Like the results of the parcel and property value analysis showed, the scenario with the highest rate of business loss (sales volume and employees at risk due to loss of business if flooding caused a 100% loss) is 150cm SLR with the 100-year storm. In this scenario, the direct loss of sales is $5.08 billon with $2.03 billion in direct loss of wages due to the loss of 7,232 jobs. This translates to a cascading economic impact to the greater City of Long Beach (direct, indirect, and induced) of $7.63 billion in sales lost, $2.94 billion in lost wages, and 23,166 jobs lost. Alternatively, these same direct losses translate to direct, indirect, and induced losses of $8.72 billion in sales lost, $3.37 billion in lost wages, and 29,185 jobs lost to the entire Los Angeles County, or $9.63 billion in sales lost, $3.68 billion in lost wages, and 33,380 jobs lost in the entire state of California. A more realistic scenario for Long Beach in the next 50 years is depicted below at 50cm SLR with the 100-year storm (figure 12).

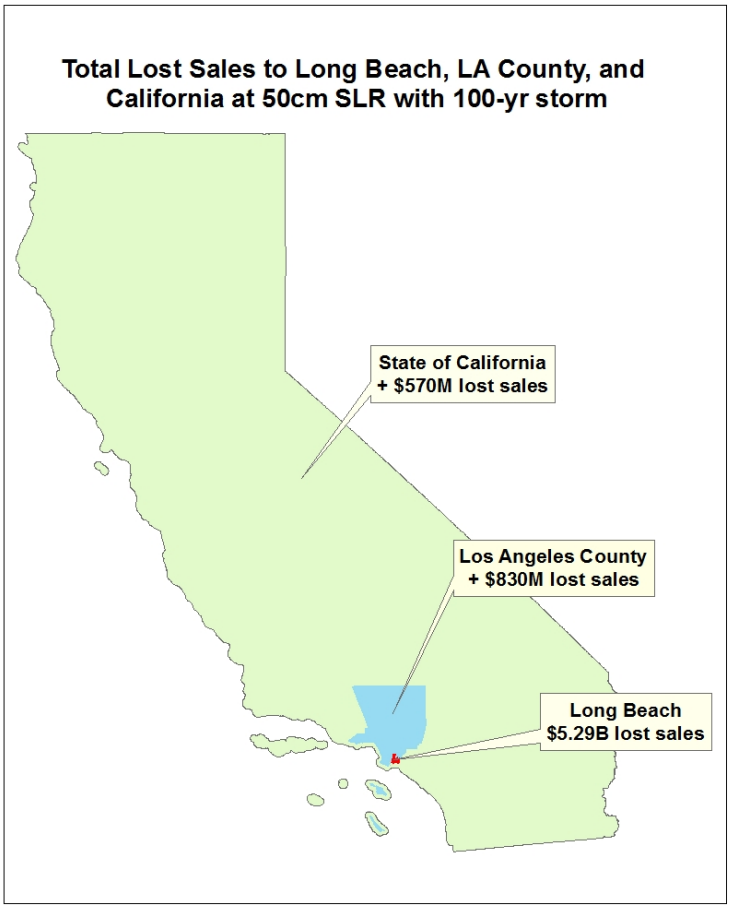


Figure 12: Cascading effect: total lost sales to Long Beach, LA County, and the State of California at 50cm SLR with 100-year storm. Data from CoSMoS, 2017 and InfoUSA, 2018.

As the scenarios move from having the least direct and indirect economic impact (25cm SLR with no storm) to increased levels of sea level rise and inundation, a non-linear relationship is depicted. From highest to lowest impact the list is as follows: 150cm SLR with the 100-year storm, 150cm SLR with no storm, 100cm SLR with the 100-year storm, 100cm SLR with no storm, 50cm SLR with the 100-year storm, 25cm SLR with the 100-year storm, 50cm SLR with no storm, and finally 25cm SLR with no storm (see table 4).

Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on Long Beach			
CoSMoS Scenario	**Total Lost Sales ($, Mil)**	**Total Lost Wages ($, Mil)**	**Total Lost Employees**
150cm SLR, 100-year storm	$ (7,628)	$ (2,941)	(23,167)
150cm SLR, no storm	$ (7,513)	$ (2,892)	(22,544)
100cm SLR, 100-year storm	$ (7,326)	$ (2,798)	(21,709)
100cm SLR, no storm	$ (5,564)	$ (1,906)	(15,995)
50cm SLR, 100-year storm	$ (5,292)	$ (1,810)	(14,992)
25cm SLR, 100-year storm	$ (511)	$ (200)	(3,901)
50cm SLR, no storm	$ (492)	$ (193)	(3,776)
25cm SLR, no storm	$ (298)	$ (113)	(2,178)

Table 4: Selected study scenarios with direct and indirect economic impact, in order from highest to lowest total impact. Data from CoSMoS 2017, InfoUSA 2018.

The losses show a drastic increase from 50cm SLR with no storm to 50cm SLR with the 100-year storm. This is due to the inclusion of a parcel, a petroleum wholesale merchant called Westair Gases & Equipment, which reports over $2 billion in yearly sales. A second drastic increase (though not as large as the first) occurs between 100cm SLR with no storm to 100cm SLR with the 100-year storm, which is explained by the inclusion of a parcel containing a commercial property that reported over $950 million in yearly sales with 1500 employees. This parcel contains a company called United Rentals, a nationwide business that primarily rents out construction equipment, with this location focused on trench safety. See tables 5 - 7 for all scenarios and figure 13 for a visual representation of this breakdown.

Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on Long Beach			
CoSMoS Scenario	Total Lost Sales ($, Mil)	Total Lost Wages ($, Mil)	Total Lost Employees
25cm SLR, no storm	$ (298)	$ (113)	(2,178)
25cm SLR, 100-year storm	$ (511)	$ (200)	(3,901)
50cm SLR, no storm	$ (492)	$ (193)	(3,776)
50cm SLR, 100-year storm	$ (5,292)	$ (1,810)	(14,992)
100cm SLR, no storm	$ (5,564)	$ (1,906)	(15,995)
100cm SLR, 100-year storm	$ (7,326)	$ (2,798)	(21,709)
150cm SLR, no storm	$ (7,513)	$ (2,892)	(22,544)
150cm SLR, 100-year storm	$ (7,628)	$ (2,941)	(23,167)

Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on Los Angeles County			
CoSMoS Scenario	Total Lost Sales ($, Mil)	Total Lost Wages ($, Mil)	Total Lost Employees
25cm SLR, no storm	$ (341)	$ (129)	(2,406)
25cm SLR, 100-year storm	$ (586)	$ (229)	(4,305)
50cm SLR, no storm	$ (565)	$ (221)	(4,165)
50cm SLR, 100-year storm	$ (6,122)	$ (2,130)	(19,425)
100cm SLR, no storm	$ (6,437)	$ (2,243)	(20,659)
100cm SLR, 100-year storm	$ (8,407)	$ (3,212)	(27,493)
150cm SLR, no storm	$ (8,618)	$ (3,316)	(28,459)
150cm SLR, 100-year storm	$ (8,752)	$ (3,371)	(29,185)

Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on State of California			
CoSMoS Scenario	Total Lost Sales ($, Mil)	Total Lost Wages ($, Mil)	Total Lost Employees
25cm SLR, no storm	$ (374)	$ (141)	(2,569)
25cm SLR, 100-year storm	$ (650)	$ (251)	(4,616)
50cm SLR, no storm	$ (626)	$ (242)	(4,463)
50cm SLR, 100-year storm	$ (6,689)	$ (2,373)	(22,174)
100cm SLR, no storm	$ (7,036)	$ (2,498)	(23,566)
100cm SLR, 100-year storm	$ (9,241)	$ (3,509)	(31,497)
150cm SLR, no storm	$ (9,475)	$ (3,615)	(32,576)
150cm SLR, 100-year storm	$ (9,625)	$ (3,676)	(33,381)

Tables 5 – 7: Total (direct, indirect, and induced) loss of sales and wages by CoSMoS scenarios – impacts on Long Beach, LA County, and state of California. Data from InfoUSA, modeled in IMPLAN 2019.

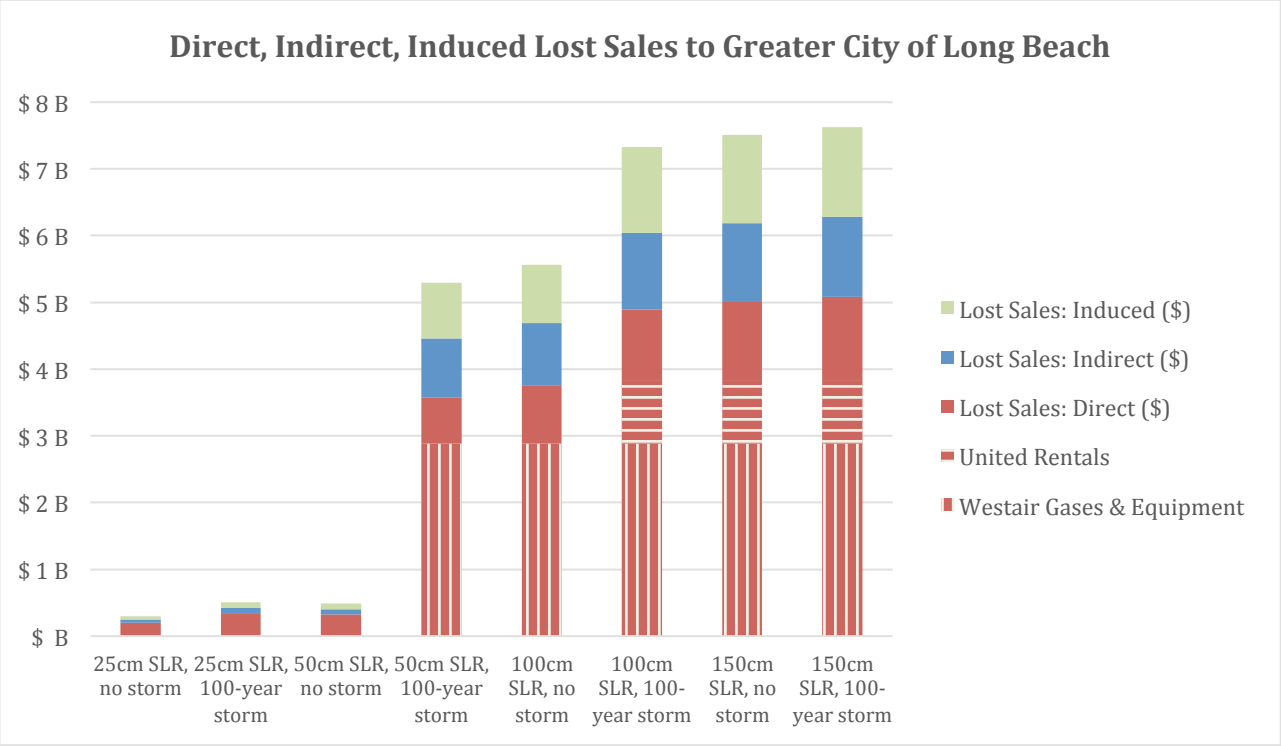


Figure 13: Direct, indirect, and induced economic impact due to potential lost sales to Long Beach for all scenarios analyzed.

Tax Base Implications

In addition to the aforementioned cascading economic impacts the loss of businesses creates, these potential sales losses also imply a loss in both the state/local *and* federal tax base. IMPLAN models these losses along with the previously stated sales, wage, and employee impacts.

IMPLAN's state/local tax table results estimate taxes paid to all state and local units of government in the study area, separated by county (revenue collected by county governments), sub-county general (revenue collected by city, township, village, etc.), sub-county special (revenue collected by units of government such as public school and fire districts), and state government (revenue collected by state governments). IMPLAN then reports an additional loss in taxes to the federal government. Similar to the loss of sales and employee impacts, the tax base results are also reported as direct, indirect, and induced (see tables 8 and 9).

As seen with the prior results, the scenario with the lowest potential loss of taxes is 25cm SLR with no storm, and the highest potential loss of taxes is 150cm SLR with the 100-year storm. The same pattern follows, with the next highest impact scenario being 50cm SLR with no storm, 25cm SLR with the 100-year storm, 50cm SLR with the 100-year storm, 100sm SLR with no storm, 100cm SLR with the 100-year storm, 150cm SLR with no storm, and finally 150cm SLR with the 100-year storm, as seen in the tables below.

For example, in the most severe (and least likely) scenario of 150cm SLR with the 100-year storm, the total potential loss in taxes for the state and local level is over $933 million, with an additional over $740 million in lost taxes at the federal level. For each of these impact levels,

the largest effect is felt from the direct loss of taxes due to business interruption, with much smaller yet still significant tax loss from the indirect and induced effects throughout the region.

State/Local Tax Implications by Scenario - Impacts on Long Beach				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (30,686,806)	$ (2,464,130)	$ (3,943,009)	$ (37,093,945)
25cm SLR, 100-year storm	$ (43,661,196)	$ (4,203,248)	$ (6,991,737)	$ (54,856,181)
50cm SLR, no storm	$ (42,915,480)	$ (4,031,152)	$ (6,735,467)	$ (53,682,099)
50cm SLR, 100-year storm	$ (621,064,402)	$ (50,570,961)	$ (63,171,649)	$ (734,807,012)
100cm SLR, no storm	$ (646,665,323)	$ (53,157,272)	$ (66,526,182)	$ (766,348,777)
100cm SLR, 100-year storm	$ (741,710,357)	$ (68,892,795)	$ (97,345,447)	$ (907,948,599)
150cm SLR, no storm	$ (753,005,995)	$ (70,084,127)	$ (100,579,308)	$ (923,669,430)
150cm SLR, 100-year storm	$ (759,775,819)	$ (71,012,547)	$ (102,267,871)	$ (933,056,237)

Federal Tax Implications by Scenario - Impacts on Long Beach				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (20,481,458)	$ (4,237,847)	$ (4,647,448)	$ (29,366,751)
25cm SLR, 100-year storm	$ (34,690,156)	$ (7,138,150)	$ (8,240,573)	$ (50,068,879)
50cm SLR, no storm	$ (33,600,262)	$ (6,850,142)	$ (7,938,532)	$ (48,388,936)
50cm SLR, 100-year storm	$ (344,164,216)	$ (82,057,267)	$ (74,487,746)	$ (500,709,229)
100cm SLR, no storm	$ (361,046,351)	$ (86,186,601)	$ (78,441,581)	$ (525,674,533)
100cm SLR, 100-year storm	$ (489,863,045)	$ (106,064,931)	$ (114,669,592)	$ (710,597,568)
150cm SLR, no storm	$ (502,983,948)	$ (108,131,304)	$ (118,467,133)	$ (729,582,385)
150cm SLR, 100-year storm	$ (510,478,652)	$ (109,717,056)	$ (120,454,367)	$ (740,650,075)

Tables 8 - 9: State/Local and Federal tax implications on Long Beach broken out by CoSMoS scenarios. Input data from InfoUSA, modeled in IMPLAN, 2019.

State/local tax losses stem mostly from lost sales tax income from businesses lost for the state of California, as well as the small percentage of employee income that goes towards local taxes stemming from loss of jobs. The potential lost taxes to the federal government stem from lost collections in social insurance (Medicare, Medicaid, Social Security, unemployment benefits) and income tax on wages, on production and imports (TOPI) in the form of excise and custom duty taxes, and corporate profits taxes. Total lost wages are roughly one-third lower for all scenarios when compared to total lost sales, suggesting an explanation for the fact that even though federal income tax is 12% for the state of California and California state sales tax is 7.25%, the relative and cumulative loss of tax base hits the state and local level harder than the federal level.[28,29]

To put these numbers into perspective, in 2015 the state of California collected just under $406 million in total tax revenue. At the highest scenario of 150cm SLR with a 100-year storm, the impact of a loss (as defined by this study) of businesses in Long Beach alone could erode roughly .23% of the states' total tax collections, causing an additional roughly $740 million in lost taxes to the federal government.

DISCUSSION AND ANALYSIS

These results show that the loss of businesses in Long Beach due to sea level rise and coastal flooding have a quantifiable impact on the economy of not only Long Beach, but LA County and the state of California as well. In addition, the potential loss of businesses in Long Beach shows a quantifiable impact to the economy not only in terms of direct loss of sales, but indirect and induced lost sales, wages, and jobs in the region. If realized, these lost businesses

are also predicted to have an impact on both the state/local and federal tax bases. The initial goal of this study was to begin to understand the potential economic impacts of sea level rise and coastal flooding outside of just property value. This study has done that by using IMPLAN to look at the potential ripple effects that might occur when businesses are lost. By undertaking this analysis on a very local scale – just one city in Southern California – the results can be analyzed on a more granular level than the regional scale. Recommendations for adaptation could be made on a parcel-by-parcel level for impact areas of interest, and decision-makers can have more local-scale information for creating policies or approving permits.

While this study may overestimate the total economic impact for each scenario due to the assumption of full loss of property value or sales and jobs as outlined in the results and associated appendices, further work can be done to refine the estimates as stated in the Methods section of this report. The relationships between the scenarios analyzed and industries impacted are likely to persist with more refined estimates; therefore, the implications and takeaways discussed remain relevant.

Impact by Sector

Given the nature of the City of Long Beach, it is understandable that the majority of the parcels are categorized as residential, and that those parcels add up to a sizable portion of the parcel property value due to the high-value neighborhoods of Naples and Belmont Shores. The commercial and industrial sectors have the second and third highest parcel property value at risk and take up almost the rest of the pie; as displayed for 50cm SLR with the 100-year storm in figure 14.

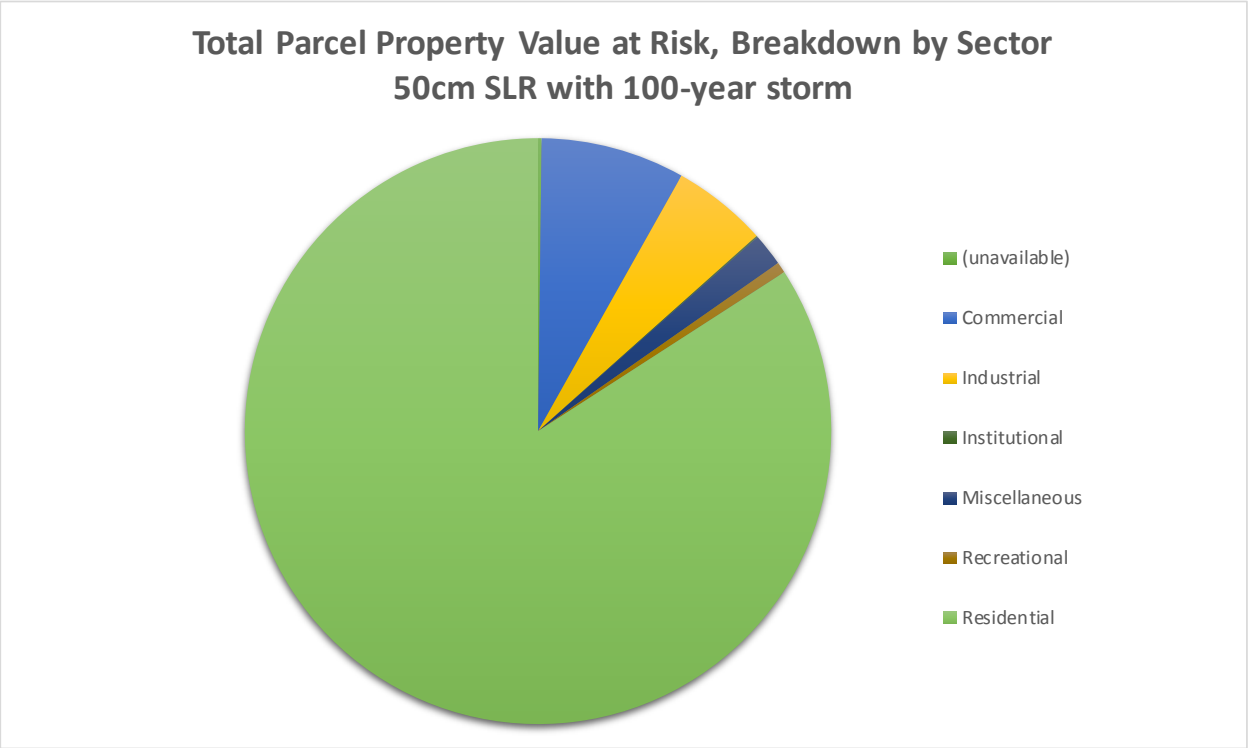


Figure 14: At 50cm SLR with 100-year storm, the majority of parcel property value at risk is residential, with commercial and industrial following. Data from LA County Tax Assessor, 2015.

When residential parcels are removed, the story becomes a bit different, and parcel property values are more evenly represented across sector. Out of the top 10 parcel values by general use at risk due to 50cm SLR with the 100-year storm, four are in the industrial sector, five are in the commercial sector, and one is categorized as miscellaneous (figure 15). Light manufacturing has over $80 million total property value at risk in this scenario, with the next most impacted general use sector of 'store' totaling just over $70 million. These two sectors being the most heavily impacted in terms of property value are important indicators of the contrast between the southeastern and southwestern portions of Long Beach that are at risk due to sea level rise and coastal flooding. The southeastern portion of the city is heavily residential, with community shopping centers supporting the local population, while the Port of Long Beach and other industrial storage facilities and warehouses dominate the southwestern subarea of the city.

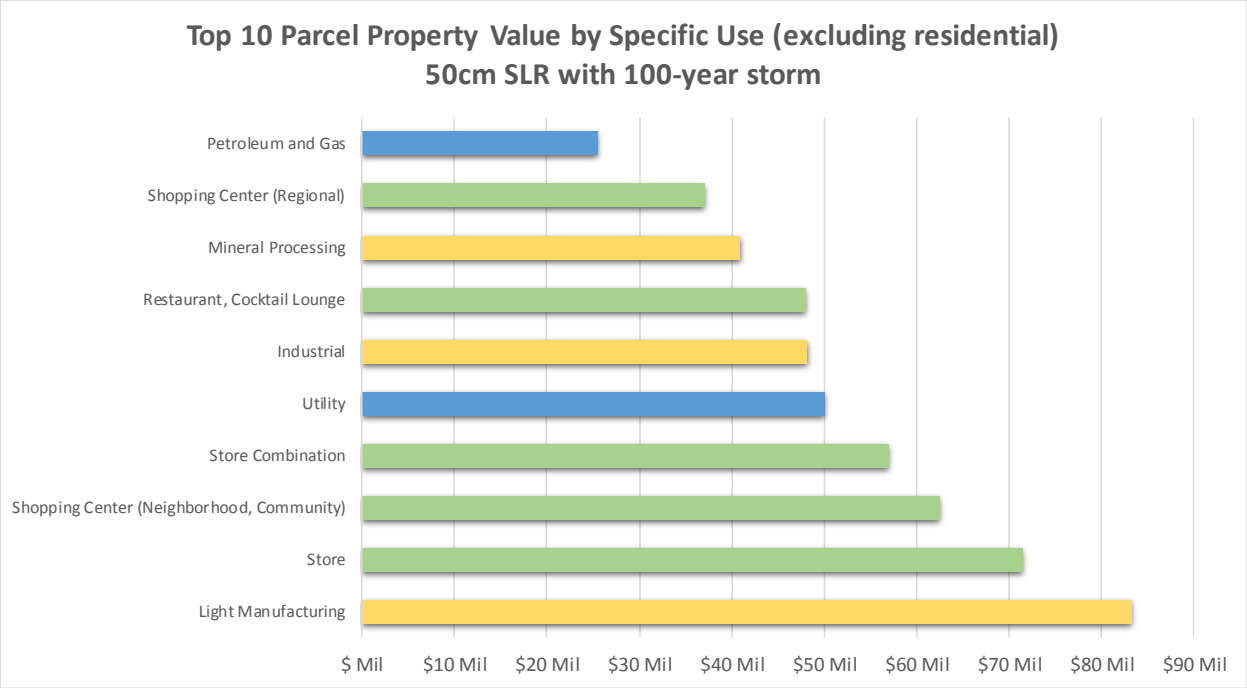


Figure 15: Top 10 highest value parcels by general use at risk due to 50cm SLR with 100-year storm, regardless of sector. Yellow represents industrial sector, blue represents miscellaneous sector, and green represents commercial sector. This chart excludes residential properties. Data from LA County Tax Assessor, 2015.

Order of Scenarios

The results of the parcel property value analysis show that the storms scenarios overall have more impact than the scenarios without storms. When this pattern is compared to economic impact due to business disruption, the results are more linear by scenario. Comparing these eight scenarios with one another in property value is an interesting analysis. The biggest difference between these two datasets is that parcel property value includes residential properties, which are extremely significant because they account for over 90% of the total property value and 80% of the number of parcels analyzed. The economic impact dataset only includes businesses that reported sales volume and employees in 2018, so the inherent difference between the two analyses are vastly different but tell equally important stories that can be individually packaged to stakeholders during policy discussions.

The order of the scenarios from least impacted to most impacted is slightly different between the two types of analysis; the lowest impact scenarios are always 25cm SLR with no storm, 50cm SLR with no storm, 25cm SLR with the 100-year storm, and the highest is 150cm SLR with the 100-year storm. However, in between there are slight differences in the order, as shown in tables 2 and 3 as shown on pages 18 and 19 of the results section of this report. The 150cm SLR with 100-year storm is the only analyzed scenario in which the flooding in the Southeastern subarea is realized all along the Los Cerritos Channel into the neighborhoods of Bixby Hill and College Estates, which shows stark contrast to even the second most impactful scenarios of both 150cm SLR with no storm and 100cm SLR with the 100-year storm. These two neighborhoods are mostly residential. The parcel property value analysis shows the second most impactful scenario as 100cm SLR with the 100-year storm, while the economic impact analysis shows 150cm SLR with no storm as the second most impactful scenario. The main differences between these two are the former scenario includes predicted flooding of the Colorado Lagoon and Marina Vista Park in Alamitos Heights, mainly residential areas (see figure 16 for more detail) while the latter includes more flooding of a main thoroughfare, West Willow Street in the Southwestern subarea, which is mainly populated with local businesses.

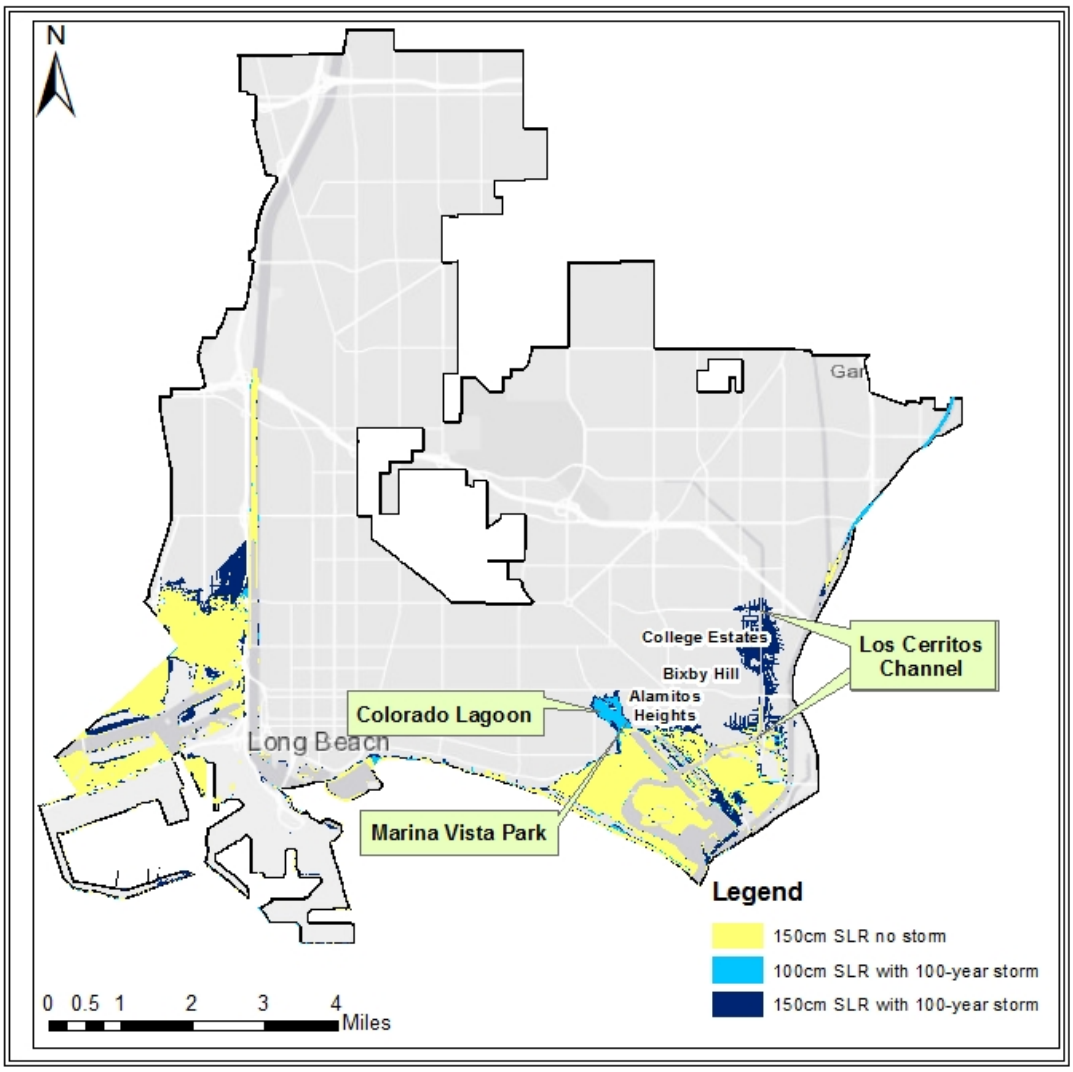


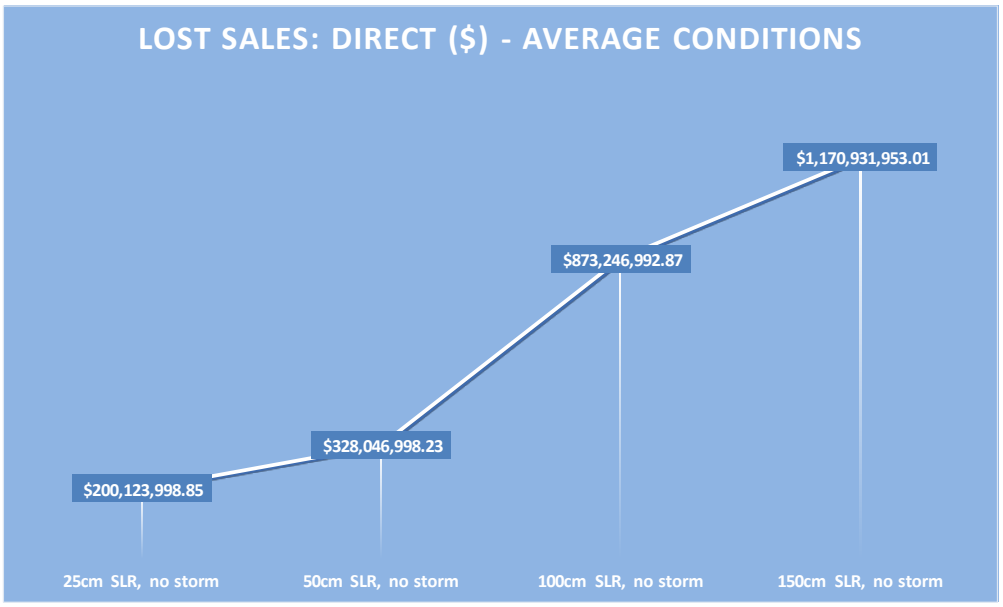
Figure 16: 100cm SLR with 100-year storm (light blue), 150cm SLR with no storm (yellow), and 150cm SLR with 100-year storm (dark blue) together on one map. Areas of interest in southeastern subarea labeled for reference. Data from CoSMoS, 2017.

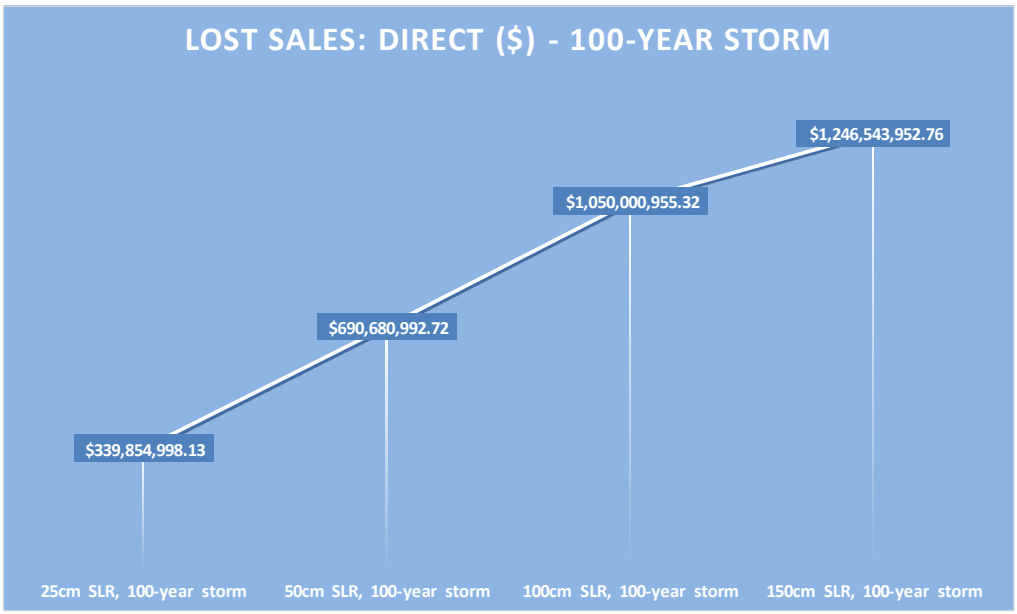
Sea level rise with no storm versus 100-year storm

The ability of the CoSMoS data to display projections for sea level rise with and without the impact of coastal storms is important, and yields interesting comparisons that have implications for management and policy moving into the future. For example, when analyzing 25cm of sea level rise with and without a 100-year storm, the differences are marked. The number of parcels at risk nearly doubles, and the economic impact increases by just under 60%. In most of these scenarios, residential properties are the parcels most heavily impacted. Just by adding a 100-year storm to 25cm of sea level rise, over $1 billion worth of single-family residences are added to the properties at risk, going from 2,109 to 4,038 parcels impacted. As shown in figures 6 and 7, and discussed above, the southeastern subarea is a low-lying area that is very heavily developed with a lot of very high-value residential properties. There is a caveat here that must be noted: projected flooding in these areas may be overstated by the CoSMoS model because some small-scale topographic features like seawalls may not be accurately captured in the flood model. The commercial sector also showed large variation between the two scenarios. 25cm of sea level rise brings 72 parcels and $88 million worth of property value at risk, and adding a 100-year storm more than doubles the impact with 184 parcels and $241 million worth of property value at risk. In the southeastern subarea of Long Beach, adding the storm event to the 25cm of sea level rise brings the main thoroughfare of Naples, East 2nd Street, into the flood plain. This is the central commercial street in the district, with blocks full of shops, restaurants, and bars, which also leads this scenario to rank as more impactful than 50cm SLR with no storm when it comes to loss of sales and taxes.

Nonlinearity of Damages

Given the results discussed throughout this report, it is clear that there is a tipping point in which the economic impacts between the eight studied scenarios go from modest to major: between 50cm and 100cm of sea level rise. As shown in figures 17 and 18, even with Westair Gases & Equipment and United Rentals removed from the direct sales impact figures, between 50cm SLR at average conditions and 100cm SLR at average conditions, the economic impact more than doubles, and continues up steadily from there.





Figures 17 + 18: Lost sales (direct only) for all scenarios, removing Westair Gases & Equipment and United Rentals. Data from InfoUSA, modeled in IMPLAN 2019.

This finding is important to note because it shows the economic impacts of sea level rise and associated coastal storms do not exhibit a linear relationship, therefore risk and concern should not be scaled in a linear fashion. There is an established tipping point in which the community is suddenly significantly more vulnerable than it was at a previous scenario, and adaptation planning should be completed accordingly. When this critical point is reached will depend on future emissions and warming, but as depicted by figure 8 in the Technical Background section of this report, by the year 2070 – roughly 50 years from today, Long Beach is **likely** to hit the critical tipping point where the economic disruption from sea level rise with a large storm event is predicted to go from modest to major (50cm of sea level rise).

Policy Implications

State and Local Policies

California is a particularly progressive state that was an early leader in the U.S. in terms of climate resiliency policies and strategies. In 2008, Governor Schwarzenegger signed an executive order requiring the California Natural Resources Agency to develop a state Climate Adaptation Strategy in coordination with local, regional, state and federal public and private entities. This order required an independent panel to complete the first California Sea Level Rise Assessment Report, to be reviewed every two years, as well as required state agencies planning construction projects in areas vulnerable to future sea level rise to consider its impacts.[30] Since then, the California Ocean Protection Council along with the California Natural Resources Agency has put out State of California Sea Level Rise Guidance documents in 2010, 2013, 2017, and 2018 in collaboration with the Governor's Office of Planning and Research.

California Assembly Bill (AB) 691 was signed by Governor Brown in 2013, and is intended to prepare California for the impacts of sea level rise by requiring holders of public trust lands to

assess the impacts and report the results to the State Lands Commission. The law requires a local trustee whose gross public trust revenues average over $250,000 annually between January 1, 2009, and January 1, 2014, to prepare and submit to the commission, no later than July 1, 2019 an assessment of how it proposes to address sea level rise.[31] That date is right around the corner, so as plans are submitted to the State Lands Commission and begin being implemented, the results of this study and others like it will become crucial for appropriate direction of funds for potential adaptation projects.

The percentage of the California state tax base that could be lost due to sea level rise is small (~0.23% at the highest analyzed scenario in this study) but significant. As the economy becomes more of a venue for discussing the impacts of climate change, it also becomes a venue for potential solutions. In order to protect residents from these negative impacts of sea level rise, funding mechanisms like a stormwater utility or green infrastructure tax could be implemented to pay for adaptation strategies in the present in an effort to reduce a potential compounded loss of tax base in the future.

Insurance

According to a recent study completed by the Union of Concerned Scientists, not only will average homeowners lose the ability to capitalize on their greatest asset when the resale value of their homes drastically decreases, but purchasing flood insurance for these properties will become increasingly expensive – if available at all.[32]

Due to the lack of availability of flood coverage by private insurance markets, the U.S. government established the National Flood Insurance Program (NFIP) in 1968. The goals were to provide subsidized flood insurance to encourage homeowners' to protect against the risk entailed by living in flood zones and to encourage risk reduction efforts by local communities in exchange for premium deductions. Since 1973, properties located on the 100-year floodplain as defined in the program are required to purchase flood insurance if they have federally-backed mortgages or have received FEMA assistance in the past. Coverage by the NFIP has risen to over 5 million policyholders – and in 2016 was $23 billion in debt. Congress passed the Biggert-Waters Flood Insurance Reform Act in 2012, which eliminated subsidies to flood insurance rates, leading to steep increases in flood insurance premiums. This act was amended and renamed Homeowner Flood Insurance Affordability Act, or the Grimm-Waters Act, in 2014 to slow down rate increases and redraws the floodplains.[33]

The NFIP covers both residential and commercial properties with varying degrees of requirement, coverage, and policy types. Regular homeowners insurance plans rarely cover floods, and according to the Insurance Information Institute, only 12% of U.S. homes have flood insurance plans.[34] On the commercial end, according to the Insurance Institute for Business and Home Safety, over 25% of businesses that close due to a devastating event like a flood never reopen.[35] The updates to the NFIP are a step in the right direction, and must be taken into consideration by local policymakers and organizations like the California Coastal Commission. When approvals for new construction or other coastal development are requested, sensible insurance policies or requirements should be taken into consideration before allowing projects to move forward. Understanding potential business loss and its cascading economic impacts at a local scale can provide essential information to decision makers in two ways: the methods employed in this study could be used to estimate potential

losses to the greater economy should the business fail due to flooding as part of a cost/benefit analysis, and the refined estimates could serve as a starting point for implementing potential future adaptation taxes or insurance requirements for new development projects.

Lastly, FEMA does not take climate change or sea level rise into consideration when developing new insurance policies or when outlining the updated 100-year floodplains. As sea levels rise due to increased carbon emissions and a warming atmosphere, flooding from storms is only going to get worse. Further updates to the NFIP are necessary to include predicted future impacts if the program is going to have a chance of success as the first line of defense for economic protection against flooding and other inundation-related disasters.

Disadvantaged Communities/Vulnerable Populations

As property values in coastal areas decrease, local tax revenue from these properties decrease in return. This in turn can create a negative feedback loop that can be hard to break – as the local tax base erodes due to loss in property tax revenue or community members move away because of increased property tax rates to recover the shortfall, local government coffers shrink and funds that might be put towards maintenance and new construction of critical flooding adaptation infrastructure may be redirected elsewhere. As chronic flooding worsens in a given municipality, the associated credit rating could suffer in return, potentially reducing access to additional capital for adaptation projects as that local tax base shrinks.[8] And lastly, completing the loop back to the homeowner, mortgages on homes that could be at chronic risk of flooding may inevitably exceed the value of the asset. If this happens, more mortgage-holders could foreclose than the current rate, risking the potential trigger of another housing crisis, and not all communities are impacted equally. In areas of the country where the poverty level is above the national average, the erosion of the property tax base could have severe consequences for local residents.[8] Not only is it possible that the poor will be negatively impacted because they are less likely financially to be able to move away from a flood-prone region or rebuild after a flooding event, but if property tax base is lost the public programs they may rely on could be lost too.

This study did not analyze disadvantaged populations, but with the data collected, it is very possible to analyze the parcels showing the lowest value, or overlaying the economic impact analysis completed by IMPLAN with demographic information provided by the city or county. For the sake of equity in a changing environment, this level of detail should be included in resiliency policy recommendations at the local level to prevent unbalanced economic burden on vulnerable populations. If decision makers have a better understanding of the impacts and the location of these communities, the easier it will be to begin to tailor recommendations in the future.

CONCLUSION

Sea level rise and coastal flooding are predicted to significantly impact the Long Beach, LA County, and California state economies. While the majority of parcels predicted to be impacted in Long Beach are residential, loss of sales and employees in small markets can have a wide impact on the greater region, state, and country in both GDP and tax base. The

differences in economic impact between sea level rise alone and large storm events are substantial, and on a local scale can be pinpointed to neighborhoods and even streets predicted to visualize the impact.

The results show that these potential economic impacts are not linear, suggesting that some sea level rise with storm scenarios may have greater impact than a higher threshold of sea level rise alone. If a storm or threshold of sea level rise renders a business or area of operation useless, or cuts off access to an area of business that has a disproportionate impact on the local economy, induced and indirect impacts can follow not only in the direct region of impact, but in the surrounding area as well. Keeping a close eye on the particular businesses at highest risk could be crucial when prioritizing areas and structures for adaptation funding and measures. These economic analyses can provide important context and additional information to make safe city planning decisions in the face of a changing climate.

APPENDICES

Appendix 1: Table of all direct, indirect, and induced economic impacts on Long Beach, LA County, and California (sales, wages, and employees)

Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on Long Beach

SMoS Scenario	Lost Sales: Direct ($)	Lost Sales: Indirect ($)	Lost Sales: Induced ($)	Total Lost Sales ($)	Lost Wages: Direct ($)	Lost Wages: Indirect ($)	Lost Wages: Induced ($)	Total Lost Wages ($)	Lost Employees: Direct	Lost Employees: Indirect	Lost Employees: Induced	Lost Employees: Total
5cm SLR, no storm	$ (200,123,998.85)	$ (46,456,441.32)	$ (51,905,244.74)	**$ (298,485,685.00)**	$ (77,679,192.74)	$ (17,467,726.07)	$ (17,999,590.03)	**$ (113,146,509.00)**	(1,559)	(271)	(347)	**(2,178)**
5cm SLR, 100-year storm	$ (339,854,998.13)	$ (79,388,771.22)	$ (92,035,719.35)	**$ (511,279,489.00)**	$ (139,448,623.88)	$ (29,289,120.26)	$ (31,915,390.75)	**$ (200,653,135.00)**	(2,832)	(453)	(616)	**(3,901)**
0cm SLR, no storm	$ (328,046,998.23)	$ (76,115,724.13)	$ (88,662,332.25)	**$ (492,825,055.00)**	$ (134,458,589.75)	$ (28,094,087.63)	$ (30,745,602.01)	**$ (193,298,279.00)**	(2,748)	(435)	(593)	**(3,776)**
0cm SLR, 100-year storm	$ (3,577,820,992.72)	$ (883,185,738.29)	$ (831,868,763.71)	**$ (5,292,875,495.00)**	$ (1,178,779,547.97)	$ (342,980,366.00)	$ (288,535,871.60)	**$ (1,810,295,786.00)**	(4,153)	(5,275)	(5,563)	**(14,992)**
00cm SLR, no storm	$ (3,760,386,992.87)	$ (928,052,185.01)	$ (876,027,389.13)	**$ (5,564,466,567.00)**	$ (1,242,421,290.96)	$ (360,284,361.92)	$ (303,849,109.68)	**$ (1,906,554,763.00)**	(4,598)	(5,539)	(5,859)	**(15,995)**
00cm SLR, 100-year storm	$ (4,887,271,955.32)	$ (1,158,737,665.90)	$ (1,280,807,212.22)	**$ (7,326,816,833.00)**	$ (1,921,396,382.35)	$ (433,371,183.58)	$ (444,017,344.22)	**$ (2,798,784,910.00)**	(6,441)	(6,698)	(8,570)	**(21,709)**
50cm SLR, no storm	$ (5,008,202,953.01)	$ (1,181,843,741.34)	$ (1,323,244,123.98)	**$ (7,513,290,818.00)**	$ (1,992,161,253.07)	$ (441,853,323.91)	$ (458,704,536.26)	**$ (2,892,719,113.00)**	(6,859)	(6,831)	(8,855)	**(22,544)**
50cm SLR, 100-year storm	$ (5,083,814,952.76)	$ (1,199,681,563.27)	$ (1,345,443,788.28)	**$ (7,628,940,304.00)**	$ (2,026,571,298.36)	$ (448,447,055.76)	$ (466,396,721.44)	**$ (2,941,415,076.00)**	(7,232)	(6,931)	(9,003)	**(23,167)**

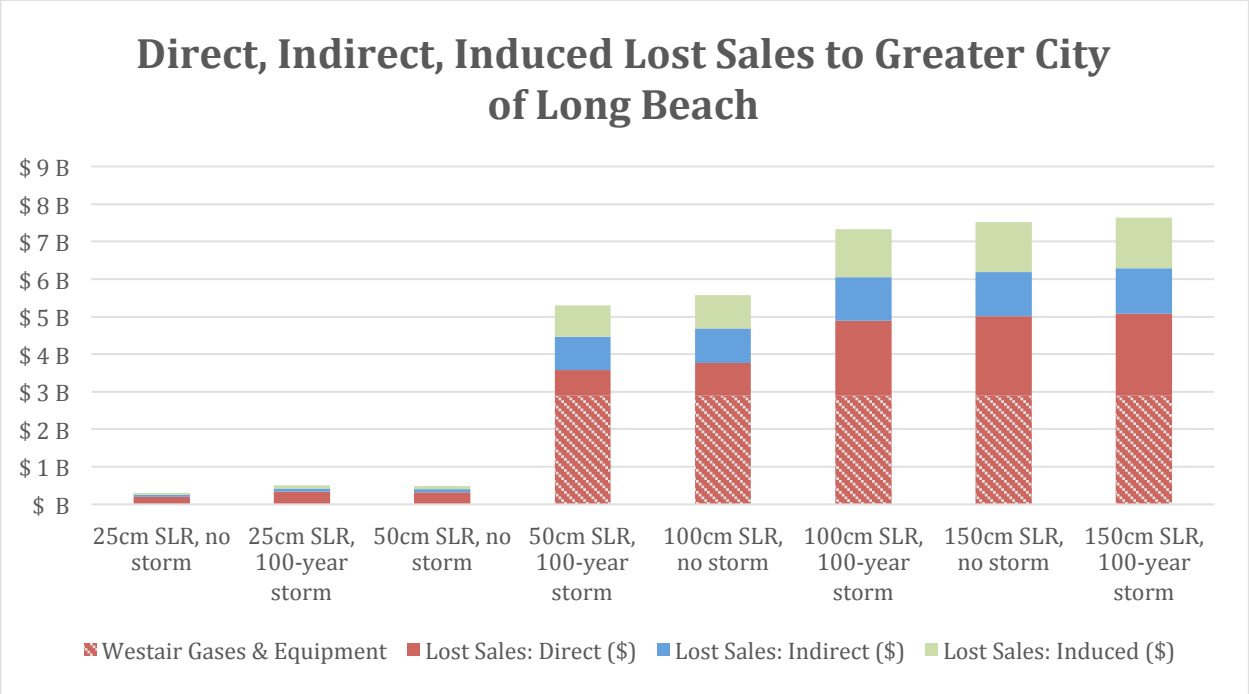
Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on Los Angeles County

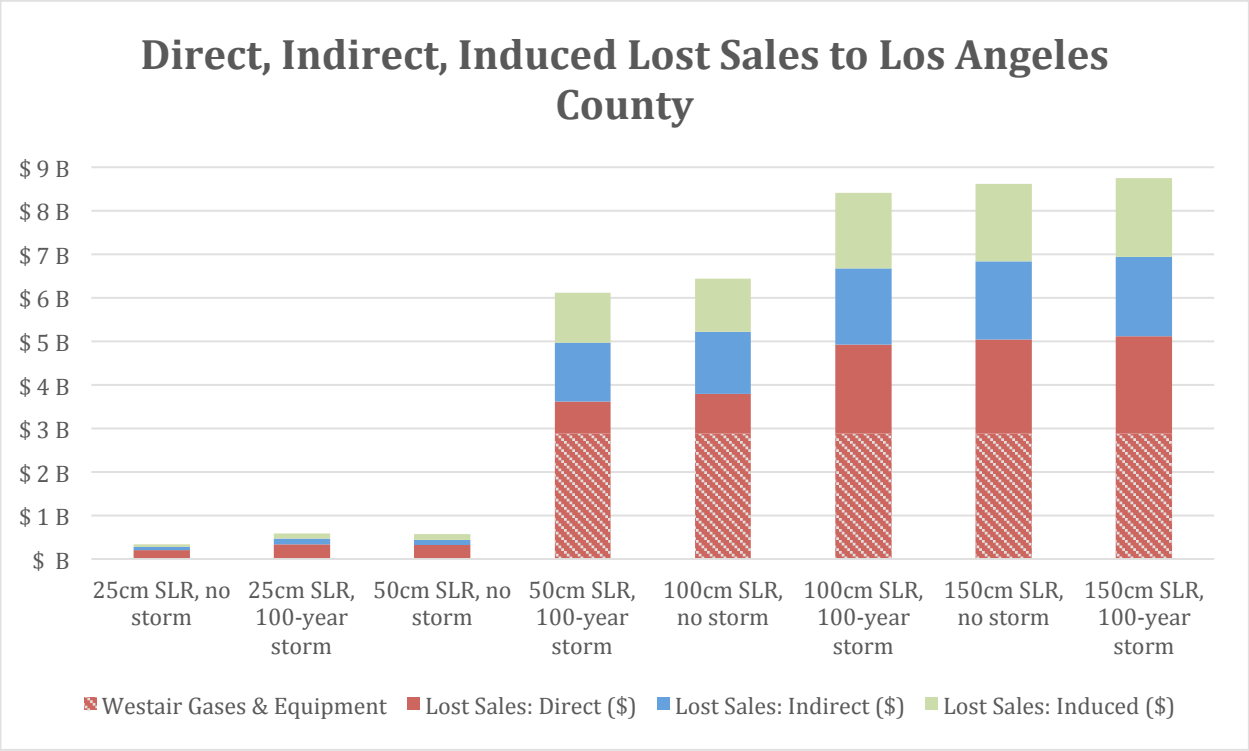
SMoS Scenario	Lost Sales: Direct ($)	Lost Sales: Indirect ($)	Lost Sales: Induced ($)	Total Lost Sales ($)	Lost Wages: Direct ($)	Lost Wages: Indirect ($)	Lost Wages: Induced ($)	Total Lost Wages ($)	Lost Employees: Direct	Lost Employees: Indirect	Lost Employees: Induced	Lost Employees: Total
5cm SLR, no storm	$ (200,364,998.87)	$ (70,842,967.42)	$ (70,153,746.38)	**$ (341,361,713.00)**	$ (77,699,329.15)	$ (27,248,417.79)	$ (24,831,807.29)	**$ (129,779,554.00)**	(1,561)	(385)	(460)	**(2,406)**
5cm SLR, 100-year storm	$ (340,496,998.14)	$ (122,224,541.82)	$ (124,194,657.14)	**$ (586,916,197.00)**	$ (139,576,152.15)	$ (46,237,716.93)	$ (43,960,197.33)	**$ (229,774,066.00)**	(2,837)	(653)	(815)	**(4,305)**
0cm SLR, no storm	$ (328,688,998.24)	$ (117,376,695.87)	$ (119,629,907.85)	**$ (565,695,602.00)**	$ (134,586,117.85)	$ (44,395,562.97)	$ (42,344,457.97)	**$ (221,326,139.00)**	(2,753)	(627)	(785)	**(4,165)**
0cm SLR, 100-year storm	$ (3,613,943,992.74)	$ (1,355,139,713.55)	$ (1,153,877,575.06)	**$ (6,122,961,281.00)**	$ (1,184,993,582.38)	$ (537,497,527.16)	$ (408,441,697.47)	**$ (2,130,932,807.00)**	(4,297)	(7,563)	(7,565)	**(19,425)**
00cm SLR, no storm	$ (3,799,062,992.90)	$ (1,423,445,714.31)	$ (1,214,649,799.80)	**$ (6,437,158,507.00)**	$ (1,249,152,600.18)	$ (564,253,007.49)	$ (429,952,789.21)	**$ (2,243,358,397.00)**	(4,755)	(7,940)	(7,964)	**(20,659)**
00cm SLR, 100-year storm	$ (4,925,706,955.34)	$ (1,749,556,335.23)	$ (1,732,055,770.01)	**$ (8,407,319,061.00)**	$ (1,928,107,514.56)	$ (671,689,988.96)	$ (613,054,321.50)	**$ (3,212,851,825.00)**	(6,596)	(9,532)	(11,364)	**(27,493)**
50cm SLR, no storm	$ (5,046,236,953.02)	$ (1,784,855,677.10)	$ (1,786,940,066.45)	**$ (8,618,032,697.00)**	$ (1,998,765,004.45)	$ (684,940,215.71)	$ (632,475,359.82)	**$ (3,316,180,580.00)**	(7,011)	(9,723)	(11,725)	**(28,459)**
50cm SLR, 100-year storm	$ (5,122,490,952.79)	$ (1,813,054,897.92)	$ (1,816,896,528.43)	**$ (8,752,442,379.00)**	$ (2,033,302,569.11)	$ (695,590,112.16)	$ (643,077,595.08)	**$ (3,371,970,276.00)**	(7,389)	(9,874)	(11,922)	**(29,185)**

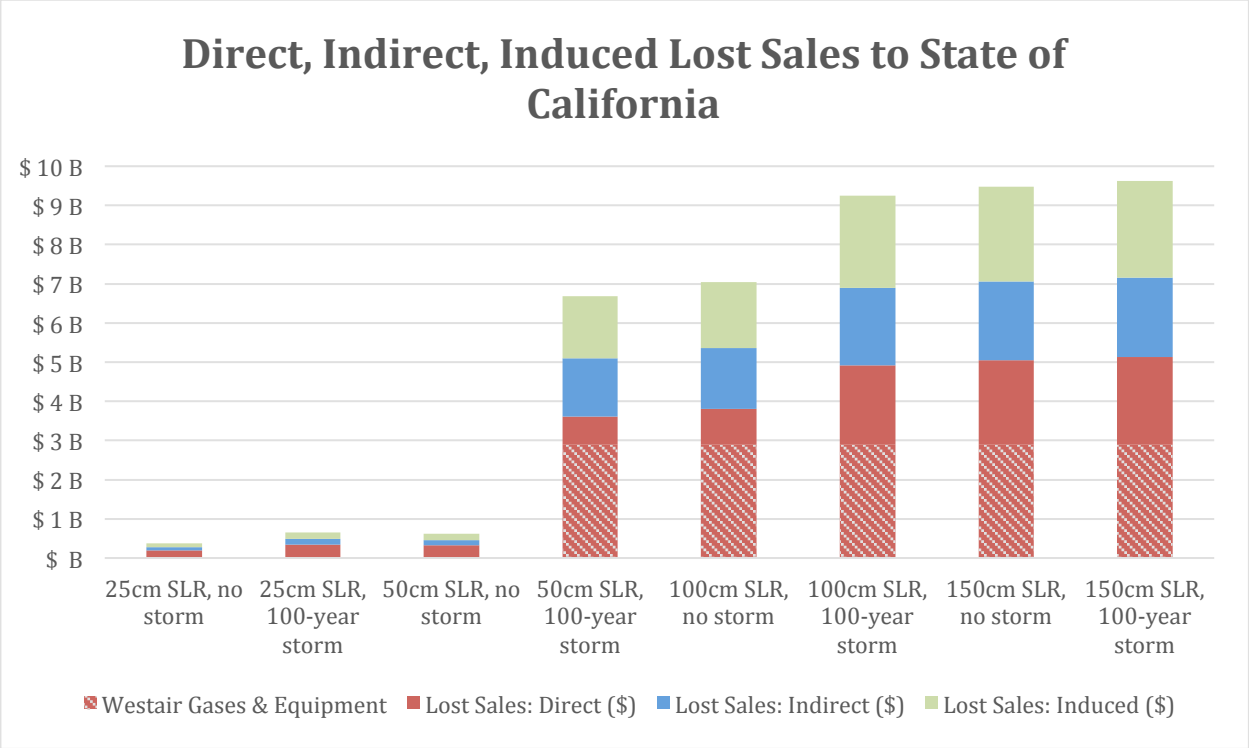
Direct and Indirect Loss of Sales and Wages by Scenario - Impacts on State of California

SMoS Scenario	Lost Sales: Direct ($)	Lost Sales: Indirect ($)	Lost Sales: Induced ($)	Total Lost Sales ($)	Lost Wages: Direct ($)	Lost Wages: Indirect ($)	Lost Wages: Induced ($)	Total Lost Wages ($)	Lost Employees: Direct	Lost Employees: Indirect	Lost Employees: Induced	Lost Employees: Total
5cm SLR, no storm	$ (200,364,998.87)	$ (78,643,875.17)	$ (95,288,322.28)	**$ (374,297,196.00)**	$ (79,017,451.20)	$ (30,163,002.52)	$ (32,619,668.05)	**$ (141,800,122.00)**	(1,561)	(423)	(585)	**(2,569)**
5cm SLR, 100-year storm	$ (340,496,998.14)	$ (141,359,495.27)	$ (168,951,091.01)	**$ (650,807,584.00)**	$ (140,903,064.55)	$ (52,864,003.02)	$ (57,836,526.27)	**$ (251,603,594.00)**	(2,837)	(741)	(1,037)	**(4,616)**
0cm SLR, no storm	$ (328,688,998.24)	$ (135,525,893.81)	$ (162,673,099.09)	**$ (626,887,991.00)**	$ (135,873,398.10)	$ (50,695,274.09)	$ (55,687,401.46)	**$ (242,256,074.00)**	(2,753)	(711)	(999)	**(4,463)**
0cm SLR, 100-year storm	$ (3,613,943,992.74)	$ (1,478,060,990.89)	$ (1,597,940,821.59)	**$ (6,689,945,805.00)**	$ (1,242,813,133.08)	$ (583,608,431.70)	$ (547,012,423.30)	**$ (2,373,433,988.00)**	(4,297)	(8,070)	(8,070)	**(22,174)**
00cm SLR, no storm	$ (3,799,062,992.90)	$ (1,555,200,970.68)	$ (1,682,080,822.88)	**$ (7,036,344,786.00)**	$ (1,309,099,841.26)	$ (613,692,954.47)	$ (575,815,713.81)	**$ (2,498,608,510.00)**	(4,755)	(8,487)	(10,324)	**(23,566)**
00cm SLR, 100-year storm	$ (4,925,706,955.34)	$ (1,963,594,425.71)	$ (2,352,014,090.00)	**$ (9,241,315,471.00)**	$ (1,956,080,257.36)	$ (747,848,043.42)	$ (805,164,393.47)	**$ (3,509,092,694.00)**	(6,596)	(10,455)	(14,446)	**(31,497)**
50cm SLR, no storm	$ (5,046,236,953.02)	$ (2,006,998,274.89)	$ (2,422,353,200.41)	**$ (9,475,588,428.00)**	$ (2,022,133,584.92)	$ (763,972,142.90)	$ (829,244,823.71)	**$ (3,615,350,552.00)**	(7,011)	(10,686)	(14,879)	**(32,576)**
50cm SLR, 100-year storm	$ (5,122,490,952.79)	$ (2,040,140,122.32)	$ (2,463,234,237.06)	**$ (9,625,865,312.00)**	$ (2,056,923,561.83)	$ (776,440,372.51)	$ (843,239,867.21)	**$ (3,676,603,802.00)**	(7,389)	(10,862)	(15,130)	**(33,381)**

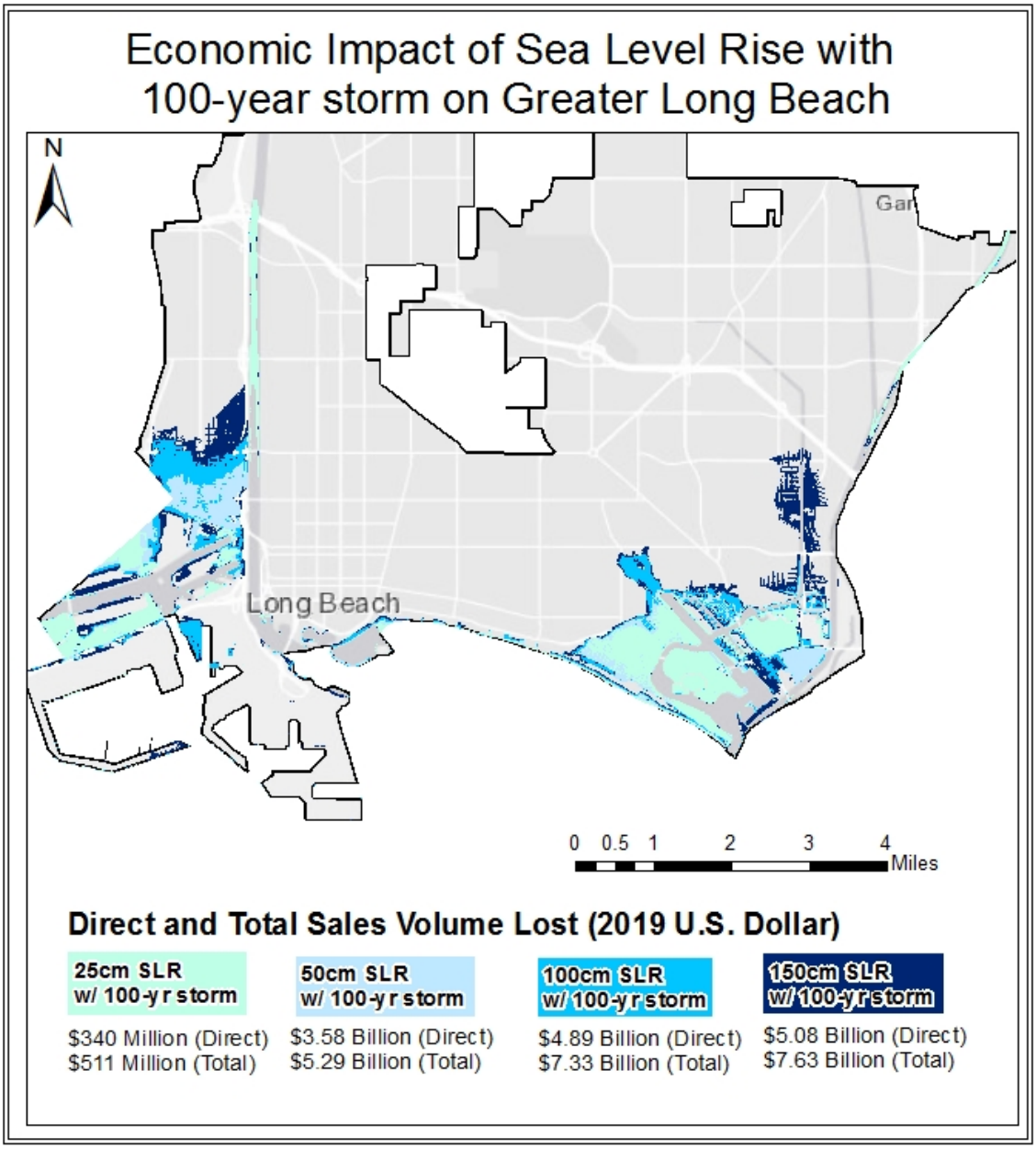
Appendix 2: Charts representing direct, indirect, and induced lost sales

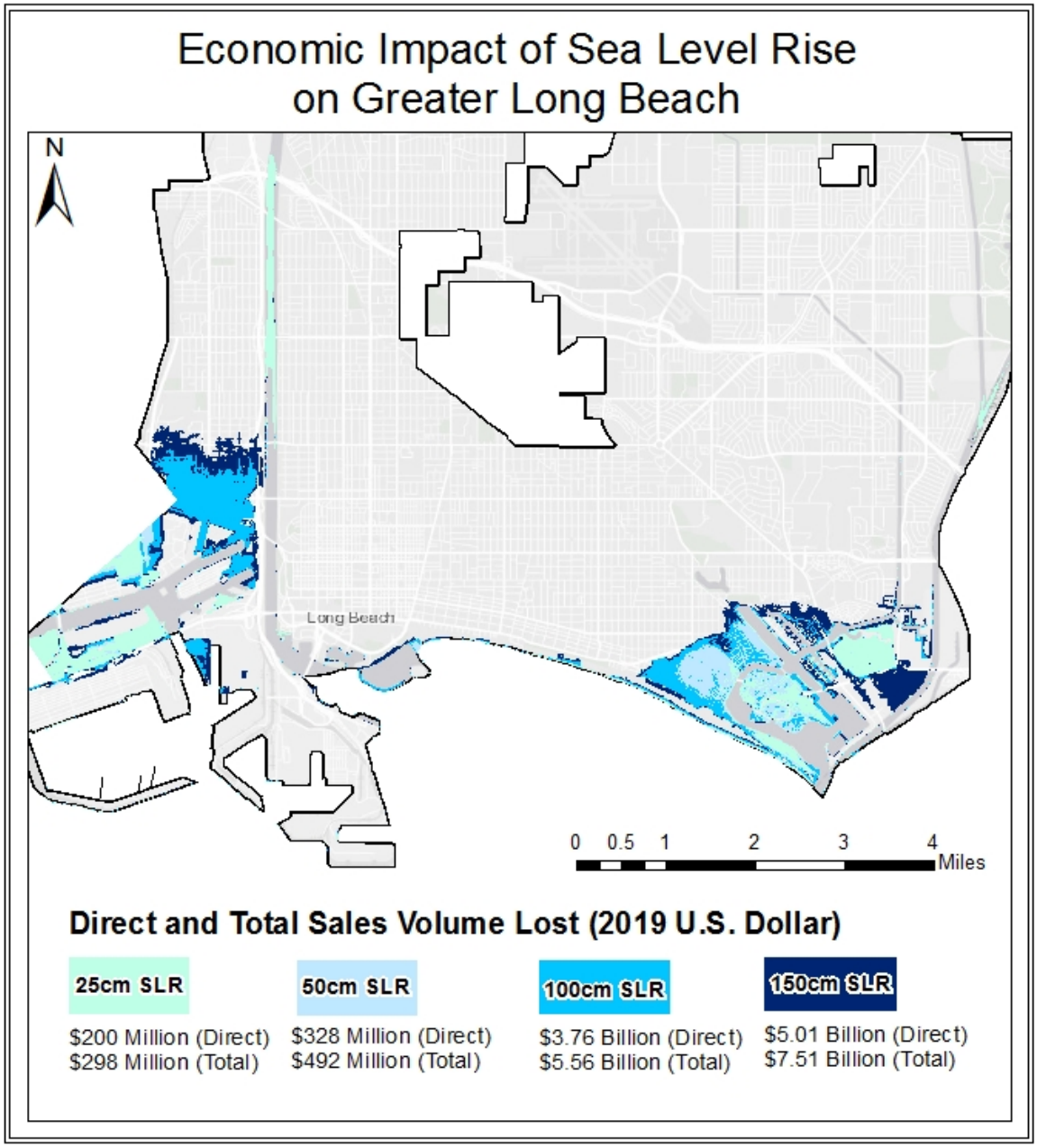





Direct, Indirect, Induced Lost Sales to State of California
$ 10 B
$ 9 B
$ 8 B
$ 7 B
$ 6 B
$ 5 B
$ 4 B
$ 3 B
$ 2 B
$ 1 B
$ B
25cm SLR, no storm
25cm SLR, 100-year storm
50cm SLR, no storm
50cm SLR, 100-year storm
100cm SLR, no storm
100cm SLR, 100-year storm
150cm SLR, no storm
150cm SLR, 100-year storm
Westair Gases & Equipment
Lost Sales: Direct ($)
Lost Sales: Indirect ($)
Lost Sales: Induced ($)

Appendix 3: Economic impact at average conditions and with the 100-year storm to City of Long Beach, broken out by direct and total sales volume lost




Economic Impact of Sea Level Rise
on Greater Long Beach
N
Long Beach
0 0.5 1 2 3 4
Miles
Direct and Total Sales Volume Lost (2019 U.S. Dollar)
25cm SLR
$200 Million (Direct)
$298 Million (Total)
50cm SLR
$328 Million (Direct)
$492 Million (Total)
100cm SLR
$3.76 Billion (Direct)
$5.56 Billion (Total)
150cm SLR
$5.01 Billion (Direct)
$7.51 Billion (Total)

Appendix 4: State/Local and Federal tax implication tables by scenario, impacts on Long Beach, LA County, California state

Federal Tax Implications by Scenario - Impacts on Long Beach				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (20,481,458)	$ (4,237,847)	$ (4,647,448)	$ (29,366,751)
25cm SLR, 100-year storm	$ (34,690,156)	$ (7,138,150)	$ (8,240,573)	$ (50,068,879)
50cm SLR, no storm	$ (33,600,262)	$ (6,850,142)	$ (7,938,532)	$ (48,388,936)
50cm SLR, 100-year storm	$ (344,164,216)	$ (82,057,267)	$ (74,487,746)	$ (500,709,229)
100cm SLR, no storm	$ (361,046,351)	$ (86,186,601)	$ (78,441,581)	$ (525,674,533)
100cm SLR, 100-year storm	$ (489,863,045)	$ (106,064,931)	$ (114,669,592)	$ (710,597,568)
150cm SLR, no storm	$ (502,983,948)	$ (108,131,304)	$ (118,467,133)	$ (729,582,385)
150cm SLR, 100-year storm	$ (510,478,652)	$ (109,717,056)	$ (120,454,367)	$ (740,650,075)

State/Local Tax Implications by Scenario - Impacts on Long Beach				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (30,686,806)	$ (2,464,130)	$ (3,943,009)	$ (37,093,945)
25cm SLR, 100-year storm	$ (43,661,196)	$ (4,203,248)	$ (6,991,737)	$ (54,856,181)
50cm SLR, no storm	$ (42,915,480)	$ (4,031,152)	$ (6,735,467)	$ (53,682,099)
50cm SLR, 100-year storm	$ (621,064,402)	$ (50,570,961)	$ (63,171,649)	$ (734,807,012)
100cm SLR, no storm	$ (646,665,323)	$ (53,157,272)	$ (66,526,182)	$ (766,348,777)
100cm SLR, 100-year storm	$ (741,710,357)	$ (68,892,795)	$ (97,345,447)	$ (907,948,599)
150cm SLR, no storm	$ (753,005,995)	$ (70,084,127)	$ (100,579,308)	$ (923,669,430)
150cm SLR, 100-year storm	$ (759,775,819)	$ (71,012,547)	$ (102,267,871)	$ (933,056,237)

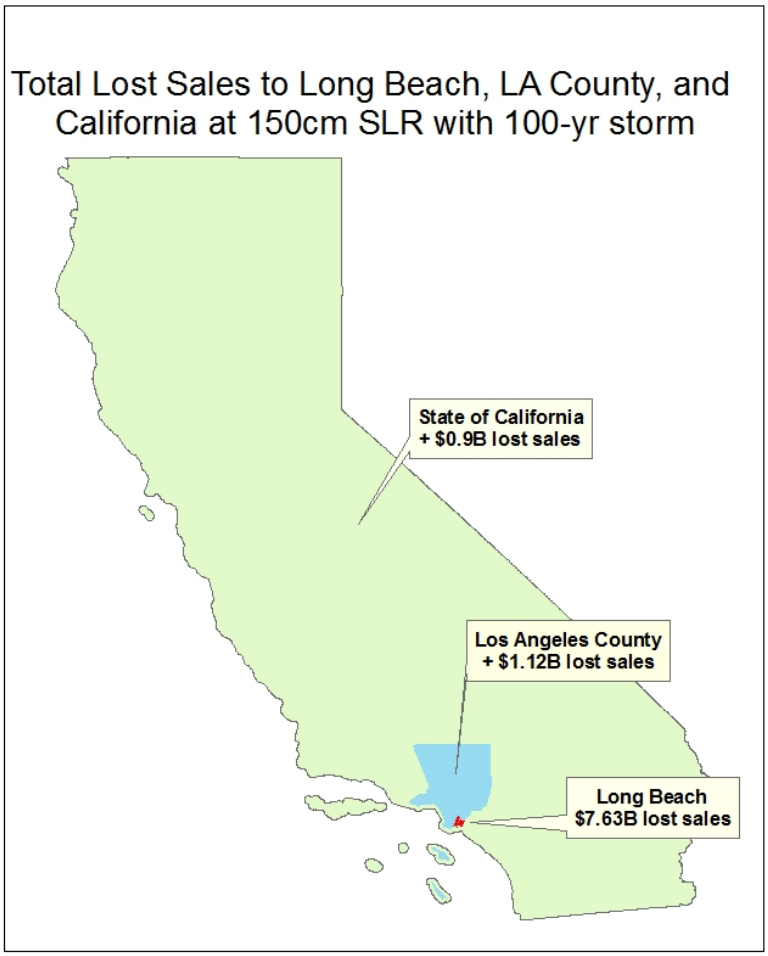
State/Local Tax Implications by Scenario - Impacts on Los Angeles County				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (30,569,800)	$ (3,276,896)	$ (4,791,759)	$ (38,638,454)
25cm SLR, 100-year storm	$ (43,463,321)	$ (5,641,784)	$ (8,483,144)	$ (57,588,249)
50cm SLR, no storm	$ (42,724,429)	$ (5,416,142)	$ (8,171,326)	$ (56,311,897)
50cm SLR, 100-year storm	$ (619,594,765)	$ (66,687,997)	$ (78,783,249)	$ (765,066,011)
100cm SLR, no storm	$ (645,143,750)	$ (70,082,330)	$ (82,934,237)	$ (798,160,317)
100cm SLR, 100-year storm	$ (739,444,711)	$ (89,274,754)	$ (118,379,145)	$ (947,098,610)
150cm SLR, no storm	$ (750,658,487)	$ (90,866,110)	$ (122,143,117)	$ (963,667,714)
150cm SLR, 100-year storm	$ (757,394,653)	$ (92,139,910)	$ (124,192,402)	$ (973,726,965)

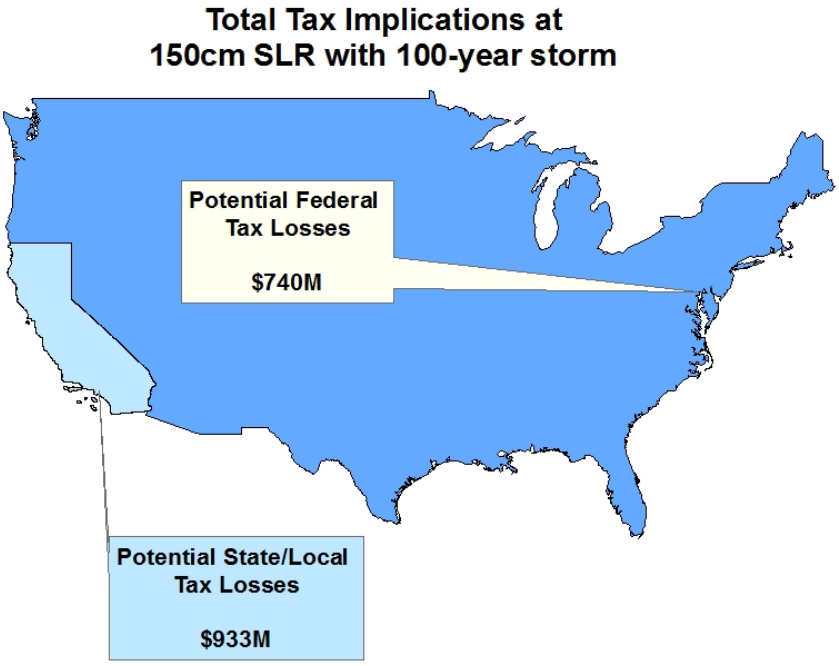
Federal Tax Implications by Scenario - Impacts on Los Angeles County				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (20,664,451)	$ (6,471,676)	$ (6,287,595)	$ (33,423,722)
25cm SLR, 100-year storm	$ (35,085,764)	$ (11,007,199)	$ (11,131,083)	$ (57,224,046)
50cm SLR, no storm	$ (33,979,062)	$ (10,575,014)	$ (10,721,960)	$ (55,276,036)
50cm SLR, 100-year storm	$ (347,306,672)	$ (125,916,553)	$ (103,414,069)	$ (576,637,294)
100cm SLR, no storm	$ (364,452,105)	$ (132,188,736)	$ (108,860,836)	$ (605,501,677)
100cm SLR, 100-year storm	$ (497,082,038)	$ (160,392,535)	$ (155,244,961)	$ (812,719,534)
150cm SLR, no storm	$ (510,613,995)	$ (163,552,890)	$ (160,165,638)	$ (834,332,523)
150cm SLR, 100-year storm	$ (518,273,185)	$ (166,065,175)	$ (162,850,848)	$ (847,189,208)

State/Local Tax Implications by Scenario - Impacts on State of California				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (30,168,082)	$ (3,588,316)	$ (6,258,608)	$ (40,015,006)
25cm SLR, 100-year storm	$ (43,212,402)	$ (6,404,367)	$ (11,098,423)	$ (60,715,192)
50cm SLR, no storm	$ (42,468,556)	$ (6,140,320)	$ (10,686,035)	$ (59,294,911)
50cm SLR, 100-year storm	$ (598,292,578)	$ (71,388,468)	$ (104,915,933)	$ (774,596,979)
100cm SLR, no storm	$ (623,005,269)	$ (75,161,252)	$ (110,442,087)	$ (808,608,608)
100cm SLR, 100-year storm	$ (719,139,361)	$ (98,851,888)	$ (154,560,265)	$ (972,551,514)
150cm SLR, no storm	$ (731,278,713)	$ (100,775,702)	$ (159,193,768)	$ (991,248,183)
150cm SLR, 100-year storm	$ (738,088,514)	$ (102,250,066)	$ (161,882,451)	$ (1,002,221,031)

Federal Tax Implications by Scenario - Impacts on State of California				
CoSMoS Scenario	Lost Taxes Direct ($)	Lost Taxes Indirect ($)	Lost Taxes: Induced ($)	Total Lost Taxes ($)
25cm SLR, no storm	$ (20,492,561)	$ (7,118,451)	$ (8,182,606)	$ (35,793,618)
25cm SLR, 100-year storm	$ (34,530,984)	$ (12,482,680)	$ (14,508,436)	$ (61,522,100)
50cm SLR, no storm	$ (33,431,467)	$ (11,976,666)	$ (13,969,325)	$ (59,377,458)
50cm SLR, 100-year storm	$ (349,140,516)	$ (135,858,247)	$ (137,212,355)	$ (622,211,118)
100cm SLR, no storm	$ (366,315,418)	$ (142,853,087)	$ (144,437,598)	$ (653,606,103)
100cm SLR, 100-year storm	$ (492,403,435)	$ (177,711,450)	$ (201,984,981)	$ (872,099,866)
150cm SLR, no storm	$ (505,550,168)	$ (181,536,437)	$ (208,027,330)	$ (895,113,935)
150cm SLR, 100-year storm	$ (513,135,113)	$ (184,443,156)	$ (211,538,452)	$ (909,116,721)

Appendix 5: Maps representing cascading economic impacts at 150cm SLR with the 100-year storm





Appendix 6: Tables representing total parcel property value by industry for each CoSMoS scenario

25cm SLR with no storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**2**	**$ 3,556,270**	**$ 2,371,197**	**$ 5,927,467**	**$ 5,927,467**
(unavailable)	2	$ 3,556,270	$ 2,371,197	$ 5,927,467	$ 5,927,467
Commercial	**72**	**$ 43,206,775**	**$ 45,173,671**	**$ 88,380,446**	**$ 88,381,186**
Auto, Recreation Equipment, Construction Equipment Sales and Service	1	$ 236,839	$ 91,102	$ 327,941	$ 327,941
Bank, Savings and Loan	1	$ 322,311	$ 435,995	$ 758,306	$ 758,306
Commercial	10	$ 1,789,291	$ -	$ 1,789,291	$ 1,789,291
Department Store	1	$ 1,382,269	$ 3,207,505	$ 4,589,774	$ 4,589,774
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	1	$ 233,327	$ 118,871	$ 352,198	$ 352,198
Office Building	10	$ 2,056,088	$ 2,042,846	$ 4,098,934	$ 4,098,934
Parking Lot (Commercial Use Property)	11	$ 1,328,532	$ 18,225	$ 1,346,757	$ 1,346,757
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	8	$ 3,766,280	$ 2,099,331	$ 5,865,611	$ 5,865,611
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	8	$ 3,509,298	$ 3,877,668	$ 7,386,966	$ 7,386,966
Store Combination	19	$ 12,911,411	$ 10,087,533	$ 22,998,944	$ 22,999,684
Industrial	**55**	**$ 59,390,573**	**$ 9,896,403**	**$ 69,286,976**	**$ 78,493,004**
Heavy Manufacturing	6	$ 8,393,057	$ 5,899,268	$ 14,292,325	$ 14,292,325
Industrial	32	$ 8,722,614	$ -	$ 8,722,614	$ 8,722,614
Light Manufacturing	12	$ 12,451,306	$ 3,307,486	$ 15,758,792	$ 15,758,792
Mineral Processing	4	$ 29,823,596	$ 689,649	$ 30,513,245	$ 39,719,273
Warehousing, Distribution, Storage	1	$ -	$ -	$ -	$ -
Institutional	**2**	**$ 787,421**	**$ 428,982**	**$ 1,216,403**	**$ 1,216,403**
Church	2	$ 787,421	$ 428,982	$ 1,216,403	$ 1,216,403
Miscellaneous	**163**	**$ 55,342,549**	**$ 222,951**	**$ 55,565,500**	**$ 55,565,500**
Government Owned Property	134	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	2	$ 4,981,582	$ -	$ 4,981,582	$ 4,981,582
Privately Owned	7	$ -	$ -	$ -	$ -
Rights of Way	1	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	17	$ 49,442,912	$ 222,951	$ 49,665,863	$ 49,665,863
Recreational	**334**	**$ 17,543,805**	**$ 4,403,841**	**$ 21,947,646**	**$ 21,947,646**
Athletic and Amusement Facility	2	$ 815,122	$ 1,264,920	$ 2,080,042	$ 2,080,042
Club, Lodge Hall, Fraternal Organization	1	$ 968,508	$ 220,012	$ 1,188,520	$ 1,188,520
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**2,449**	**$ 1,060,650,612**	**$ 559,160,167**	**$ 1,619,810,779**	**$ 1,619,903,359**
Double, Duplex, or Two Units	229	$ 91,626,341	$ 51,235,611	$ 142,861,952	$ 142,878,312
Five or More Units or Apartments (Any Combination)	44	$ 18,085,810	$ 12,645,949	$ 30,731,759	$ 30,790,789
Four Units (Any Combination)	30	$ 13,677,391	$ 7,105,708	$ 20,783,099	$ 20,791,229
Single Family Residence	2,109	$ 919,177,399	$ 478,155,930	$ 1,397,333,329	$ 1,397,336,409
Three Units (Any Combination)	37	$ 18,083,671	$ 10,016,969	$ 28,100,640	$ 28,106,620
Grand Total	**3,077**	**$ 1,240,478,005**	**$ 621,657,212**	**$ 1,862,135,217**	**$ 1,871,434,565**

25cm SLR with 100-year storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**184**	**$ 127,662,211**	**$ 113,434,392**	**$ 241,096,603**	**$ 241,103,783**
Auto, Recreation Equipment, Construction Equipment Sales and Service	1	$ 236,839	$ 91,102	$ 327,941	$ 327,941
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	13	$ 2,223,455	$ -	$ 2,223,455	$ 2,223,455
Department Store	1	$ 1,382,269	$ 3,207,505	$ 4,589,774	$ 4,589,774
Hotel and Motel	2	$ 8,647,086	$ 4,871,411	$ 13,518,497	$ 13,518,497
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	2	$ 1,463,327	$ 288,871	$ 1,752,198	$ 1,752,198
Office Building	13	$ 2,231,511	$ 2,148,000	$ 4,379,511	$ 4,379,511
Parking Lot (Commercial Use Property)	33	$ 6,695,022	$ 220,704	$ 6,915,726	$ 6,915,726
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	23	$ 20,588,102	$ 19,425,750	$ 40,013,852	$ 40,013,852
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	51	$ 35,713,570	$ 26,083,607	$ 61,797,177	$ 61,797,177
Store Combination	37	$ 29,020,630	$ 27,337,207	$ 56,357,837	$ 56,365,017
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**61**	**$ 69,836,507**	**$ 10,597,168**	**$ 80,433,675**	**$ 89,639,703**
Heavy Manufacturing	6	$ 8,393,057	$ 5,899,268	$ 14,292,325	$ 14,292,325
Industrial	37	$ 18,722,614	$ -	$ 18,722,614	$ 18,722,614
Light Manufacturing	12	$ 12,451,306	$ 3,307,486	$ 15,758,792	$ 15,758,792
Mineral Processing	5	$ 30,269,530	$ 1,390,414	$ 31,659,944	$ 40,865,972
Warehousing, Distribution, Storage	1	$ -	$ -	$ -	$ -
Institutional	**5**	**$ 1,419,921**	**$ 1,085,809**	**$ 2,505,730**	**$ 2,515,730**
Church	4	$ 1,260,668	$ 854,094	$ 2,114,762	$ 2,124,762
School (Private)	1	$ 159,253	$ 231,715	$ 390,968	$ 390,968
Miscellaneous	**198**	**$ 75,848,824**	**$ 222,951**	**$ 76,071,775**	**$ 76,071,775**
Government Owned Property	161	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	3	$ 25,487,857	$ -	$ 25,487,857	$ 25,487,857
Privately Owned	7	$ -	$ -	$ -	$ -
Rights of Way	1	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	24	$ 49,442,912	$ 222,951	$ 49,665,863	$ 49,665,863
Recreational	**336**	**$ 19,009,923**	**$ 6,571,481**	**$ 25,581,404**	**$ 25,581,404**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	2	$ 1,314,069	$ 233,556	$ 1,547,625	$ 1,547,625
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**5,173**	**$ 2,176,043,490**	**$ 1,120,334,024**	**$ 3,296,377,514**	**$ 3,296,740,614**
Double, Duplex, or Two Units	628	$ 236,757,169	$ 132,664,500	$ 369,421,669	$ 369,465,919
Five or More Units or Apartments (Any Combination)	209	$ 102,341,707	$ 69,154,104	$ 171,495,811	$ 171,715,536
Four Units (Any Combination)	151	$ 57,103,121	$ 34,816,581	$ 91,919,702	$ 91,972,862
Single Family Residence	4,038	$ 1,717,460,960	$ 848,337,050	$ 2,565,798,010	$ 2,565,812,190
Three Units (Any Combination)	147	$ 62,380,533	$ 35,361,789	$ 97,742,322	$ 97,774,107
Grand Total	**5,960**	**$ 2,475,003,417**	**$ 1,255,519,453**	**$ 3,730,522,870**	**$ 3,740,109,178**

50cm SLR with no storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**172**	**$ 118,822,132**	**$ 108,478,121**	**$ 227,300,253**	**$ 227,301,633**
Auto, Recreation Equipment, Construction Equipment Sales and Service	1	$ 236,839	$ 91,102	$ 327,941	$ 327,941
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	12	$ 2,095,285	$ -	$ 2,095,285	$ 2,095,285
Department Store	1	$ 1,382,269	$ 3,207,505	$ 4,589,774	$ 4,589,774
Hotel and Motel	1	$ 8,557,997	$ 4,808,656	$ 13,366,653	$ 13,366,653
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	2	$ 1,463,327	$ 288,871	$ 1,752,198	$ 1,752,198
Office Building	11	$ 2,231,511	$ 2,148,000	$ 4,379,511	$ 4,379,511
Parking Lot (Commercial Use Property)	32	$ 6,529,158	$ 216,652	$ 6,745,810	$ 6,745,810
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	21	$ 18,528,908	$ 18,364,147	$ 36,893,055	$ 36,893,055
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	47	$ 30,532,067	$ 24,454,027	$ 54,986,094	$ 54,986,094
Store Combination	36	$ 27,804,371	$ 25,138,926	$ 52,943,297	$ 52,944,677
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**58**	**$ 60,280,798**	**$ 9,896,403**	**$ 70,177,201**	**$ 79,383,229**
Heavy Manufacturing	6	$ 8,393,057	$ 5,899,268	$ 14,292,325	$ 14,292,325
Industrial	35	$ 9,612,839	$ -	$ 9,612,839	$ 9,612,839
Light Manufacturing	12	$ 12,451,306	$ 3,307,486	$ 15,758,792	$ 15,758,792
Mineral Processing	4	$ 29,823,596	$ 689,649	$ 30,513,245	$ 39,719,273
Warehousing, Distribution, Storage	1	$ -	$ -	$ -	$ -
Institutional	**5**	**$ 1,419,921**	**$ 1,085,809**	**$ 2,505,730**	**$ 2,515,730**
Church	4	$ 1,260,668	$ 854,094	$ 2,114,762	$ 2,124,762
School (Private)	1	$ 159,253	$ 231,715	$ 390,968	$ 390,968
Miscellaneous	**177**	**$ 75,848,824**	**$ 222,951**	**$ 76,071,775**	**$ 76,071,775**
Government Owned Property	146	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	3	$ 25,487,857	$ -	$ 25,487,857	$ 25,487,857
Privately Owned	7	$ -	$ -	$ -	$ -
Rights of Way	1	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	18	$ 49,442,912	$ 222,951	$ 49,665,863	$ 49,665,863
Recreational	**335**	**$ 18,664,362**	**$ 6,557,937**	**$ 25,222,299**	**$ 25,222,299**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	1	$ 968,508	$ 220,012	$ 1,188,520	$ 1,188,520
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**4,543**	**$ 1,899,027,613**	**$ 973,166,267**	**$ 2,872,193,880**	**$ 2,872,422,950**
Double, Duplex, or Two Units	514	$ 188,420,253	$ 107,865,985	$ 296,286,238	$ 296,321,748
Five or More Units or Apartments (Any Combination)	116	$ 57,110,418	$ 39,779,435	$ 96,889,853	$ 97,014,598
Four Units (Any Combination)	105	$ 38,225,467	$ 22,578,772	$ 60,804,239	$ 60,836,229
Single Family Residence	3,699	$ 1,566,721,516	$ 775,156,657	$ 2,341,878,173	$ 2,341,891,533
Three Units (Any Combination)	109	$ 48,549,959	$ 27,785,418	$ 76,335,377	$ 76,358,842
Grand Total	**5,293**	**$ 2,179,246,191**	**$ 1,102,681,116**	**$ 3,281,927,307**	**$ 3,291,373,785**

50cm SLR with 100-year storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**239**	**$ 189,351,631**	**$ 150,892,502**	**$ 340,244,133**	**$ 340,251,313**
Animal Kennel	2	$ 152,029	$ 16,569	$ 168,598	$ 168,598
Auto, Recreation Equipment, Construction Equipment Sales and Service	8	$ 2,459,015	$ 1,429,326	$ 3,888,341	$ 3,888,341
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	18	$ 3,194,878	$ -	$ 3,194,878	$ 3,194,878
Department Store	1	$ 1,382,269	$ 3,207,505	$ 4,589,774	$ 4,589,774
Hotel and Motel	2	$ 8,647,086	$ 4,871,411	$ 13,518,497	$ 13,518,497
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	3	$ 1,528,594	$ 368,403	$ 1,896,997	$ 1,896,997
Office Building	24	$ 5,614,797	$ 7,783,415	$ 13,398,212	$ 13,398,212
Parking Lot (Commercial Use Property)	39	$ 7,276,378	$ 234,881	$ 7,511,259	$ 7,511,259
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	34	$ 25,296,889	$ 22,655,843	$ 47,952,732	$ 47,952,732
Service Station	5	$ 2,799,894	$ 989,979	$ 3,789,873	$ 3,789,873
Shopping Center (Neighborhood, Community)	2	$ 42,161,065	$ 20,407,765	$ 62,568,830	$ 62,568,830
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	55	$ 39,932,201	$ 31,607,003	$ 71,539,204	$ 71,539,204
Store Combination	38	$ 29,446,136	$ 27,560,167	$ 57,006,303	$ 57,013,483
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**555**	**$ 155,110,913**	**$ 60,712,365**	**$ 215,823,278**	**$ 225,390,520**
Food Processing Plant	3	$ 508,000	$ 410,129	$ 918,129	$ 918,129
Heavy Manufacturing	8	$ 8,803,235	$ 7,281,881	$ 16,085,116	$ 16,423,574
Industrial	149	$ 47,944,779	$ 265,260	$ 48,210,039	$ 48,210,039
Light Manufacturing	252	$ 44,945,720	$ 38,404,043	$ 83,349,763	$ 83,372,519
Mineral Processing	5	$ 30,269,530	$ 1,390,414	$ 31,659,944	$ 40,865,972
Open Storage	18	$ 1,581,044	$ 2,695	$ 1,583,739	$ 1,583,739
Parking Lot (Industrial Use Property)	64	$ 8,512,627	$ 770,244	$ 9,282,871	$ 9,282,871
Warehousing, Distribution, Storage	56	$ 12,545,978	$ 12,187,699	$ 24,733,677	$ 24,733,677
Institutional	**7**	**$ 1,644,071**	**$ 1,623,478**	**$ 3,267,549**	**$ 3,277,549**
Church	6	$ 1,484,818	$ 1,391,763	$ 2,876,581	$ 2,886,581
School (Private)	1	$ 159,253	$ 231,715	$ 390,968	$ 390,968
Miscellaneous	**250**	**$ 76,593,528**	**$ 408,422**	**$ 77,001,950**	**$ 77,001,950**
Government Owned Property	189	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	6	$ 25,505,991	$ -	$ 25,505,991	$ 25,505,991
Privately Owned	8	$ 204,668	$ 185,471	$ 390,139	$ 390,139
Rights of Way	1	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	44	$ 49,964,814	$ 222,951	$ 50,187,765	$ 50,187,765
Recreational	**336**	**$ 19,009,923**	**$ 6,571,481**	**$ 25,581,404**	**$ 25,581,404**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	2	$ 1,314,069	$ 233,556	$ 1,547,625	$ 1,547,625
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**5,652**	**$ 2,359,067,520**	**$ 1,245,694,593**	**$ 3,604,762,113**	**$ 3,605,169,044**
Double, Duplex, or Two Units	656	$ 245,320,645	$ 137,248,890	$ 382,569,535	$ 382,616,935
Five or More Units or Apartments (Any Combination)	253	$ 123,241,570	$ 82,571,116	$ 205,812,686	$ 206,065,027
Four Units (Any Combination)	188	$ 68,645,061	$ 42,000,631	$ 110,645,692	$ 110,704,117
Manufactured Home Park	2	$ 988,104	$ -	$ 988,104	$ 988,104
Single Family Residence	4,400	$ 1,855,467,900	$ 946,809,244	$ 2,802,277,144	$ 2,802,293,164
Three Units (Any Combination)	153	$ 65,404,240	$ 37,064,712	$ 102,468,952	$ 102,501,697
Grand Total	**7,042**	**$ 2,805,960,127**	**$ 1,469,176,469**	**$ 4,275,136,596**	**$ 4,285,127,949**

100cm SLR with no storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**253**	**$ 180,422,648**	**$ 141,130,255**	**$ 321,552,903**	**$ 321,560,083**
Animal Kennel	2	$ 152,029	$ 16,569	$ 168,598	$ 168,598
Auto, Recreation Equipment, Construction Equipment Sales and Service	8	$ 2,459,015	$ 1,429,326	$ 3,888,341	$ 3,888,341
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	19	$ 2,605,280	$ -	$ 2,605,280	$ 2,605,280
Department Store	1	$ 1,382,269	$ 3,207,505	$ 4,589,774	$ 4,589,774
Hotel and Motel	2	$ 8,647,086	$ 4,871,411	$ 13,518,497	$ 13,518,497
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	4	$ 1,557,532	$ 402,648	$ 1,960,180	$ 1,960,180
Office Building	29	$ 4,465,077	$ 3,604,668	$ 8,069,745	$ 8,069,745
Parking Lot (Commercial Use Property)	43	$ 7,398,688	$ 237,312	$ 7,636,000	$ 7,636,000
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	34	$ 25,296,889	$ 22,655,843	$ 47,952,732	$ 47,952,732
Service Station	5	$ 2,799,894	$ 989,979	$ 3,789,873	$ 3,789,873
Shopping Center (Neighborhood, Community)	1	$ 34,307,219	$ 14,196,087	$ 48,503,306	$ 48,503,306
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	58	$ 40,240,134	$ 31,878,505	$ 72,118,639	$ 72,118,639
Store Combination	39	$ 29,651,136	$ 27,880,167	$ 57,531,303	$ 57,538,483
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**776**	**$ 196,532,032**	**$ 89,258,404**	**$ 285,790,436**	**$ 295,357,678**
Food Processing Plant	6	$ 1,156,044	$ 1,759,108	$ 2,915,152	$ 2,915,152
Heavy Manufacturing	9	$ 9,607,361	$ 8,329,688	$ 17,937,049	$ 18,275,507
Industrial	205	$ 55,912,768	$ 1,772,984	$ 57,685,752	$ 57,685,752
Light Manufacturing	356	$ 66,454,398	$ 55,411,492	$ 121,865,890	$ 121,888,646
Lumber Yard	2	$ 334,426	$ 222,948	$ 557,374	$ 557,374
Mineral Processing	5	$ 30,269,530	$ 1,390,414	$ 31,659,944	$ 40,865,972
Open Storage	21	$ 3,040,752	$ 655,530	$ 3,696,282	$ 3,696,282
Parking Lot (Industrial Use Property)	98	$ 11,362,245	$ 820,875	$ 12,183,120	$ 12,183,120
Warehousing, Distribution, Storage	74	$ 18,394,508	$ 18,895,365	$ 37,289,873	$ 37,289,873
Institutional	**8**	**$ 1,767,275**	**$ 1,656,856**	**$ 3,424,131**	**$ 3,434,131**
Church	6	$ 1,484,818	$ 1,391,763	$ 2,876,581	$ 2,886,581
School (Private)	2	$ 282,457	$ 265,093	$ 547,550	$ 547,550
Miscellaneous	**246**	**$ 76,593,528**	**$ 408,422**	**$ 77,001,950**	**$ 77,001,950**
Government Owned Property	186	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	5	$ 25,505,991	$ -	$ 25,505,991	$ 25,505,991
Privately Owned	8	$ 204,668	$ 185,471	$ 390,139	$ 390,139
Rights of Way	1	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	44	$ 49,964,814	$ 222,951	$ 50,187,765	$ 50,187,765
Recreational	**336**	**$ 19,009,923**	**$ 6,571,481**	**$ 25,581,404**	**$ 25,581,404**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	2	$ 1,314,069	$ 233,556	$ 1,547,625	$ 1,547,625
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**5,463**	**$ 2,299,442,624**	**$ 1,201,390,309**	**$ 3,500,832,933**	**$ 3,501,238,614**
Double, Duplex, or Two Units	651	$ 243,701,095	$ 136,613,918	$ 380,315,013	$ 380,361,983
Five or More Units or Apartments (Any Combination)	255	$ 124,724,458	$ 84,202,354	$ 208,926,812	$ 209,179,273
Four Units (Any Combination)	177	$ 66,217,272	$ 40,461,464	$ 106,678,736	$ 106,736,221
Manufactured Home Park	2	$ 988,104	$ -	$ 988,104	$ 988,104
Single Family Residence	4,225	$ 1,798,407,455	$ 903,047,861	$ 2,701,455,316	$ 2,701,471,336
Three Units (Any Combination)	153	$ 65,404,240	$ 37,064,712	$ 102,468,952	$ 102,501,697
Grand Total	**7,085**	**$ 2,778,950,571**	**$ 1,443,689,355**	**$ 4,222,639,926**	**$ 4,232,630,029**

100cm SLR with 100-year storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**317**	**$ 234,190,011**	**$ 182,625,663**	**$ 416,815,674**	**$ 418,376,954**
Animal Kennel	3	$ 229,807	$ 16,697	$ 246,504	$ 246,504
Auto, Recreation Equipment, Construction Equipment Sales and Service	12	$ 3,738,540	$ 2,460,623	$ 6,199,163	$ 6,199,163
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	36	$ 6,001,629	$ 158,681	$ 6,160,310	$ 6,160,310
Department Store	1	$ 1,382,269	$ 3,207,505	$ 4,589,774	$ 4,589,774
Hotel and Motel	8	$ 25,942,024	$ 11,195,003	$ 37,137,027	$ 37,137,027
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	4	$ 1,557,532	$ 402,648	$ 1,960,180	$ 1,960,180
Office Building	40	$ 10,041,628	$ 15,249,015	$ 25,290,643	$ 26,844,743
Parking Lot (Commercial Use Property)	59	$ 7,967,628	$ 260,426	$ 8,228,054	$ 8,228,054
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	38	$ 26,556,697	$ 23,197,609	$ 49,754,306	$ 49,754,306
Service Station	6	$ 3,455,640	$ 1,121,125	$ 4,576,765	$ 4,576,765
Shopping Center (Neighborhood, Community)	3	$ 57,483,320	$ 35,596,083	$ 93,079,403	$ 93,079,403
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	59	$ 40,617,482	$ 32,046,596	$ 72,664,078	$ 72,664,078
Store Combination	40	$ 29,755,415	$ 27,953,417	$ 57,708,832	$ 57,716,012
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**923**	**$ 228,479,460**	**$ 114,836,783**	**$ 343,316,243**	**$ 352,915,549**
Food Processing Plant	8	$ 2,827,431	$ 3,377,169	$ 6,204,600	$ 6,204,600
Heavy Manufacturing	9	$ 9,607,361	$ 8,329,688	$ 17,937,049	$ 18,275,507
Industrial	256	$ 60,701,770	$ 3,558,574	$ 64,260,344	$ 64,260,344
Light Manufacturing	408	$ 74,111,198	$ 61,681,414	$ 135,792,612	$ 135,847,432
Lumber Yard	2	$ 334,426	$ 222,948	$ 557,374	$ 557,374
Mineral Processing	5	$ 30,269,530	$ 1,390,414	$ 31,659,944	$ 40,865,972
Open Storage	25	$ 3,806,554	$ 717,942	$ 4,524,496	$ 4,524,496
Parking Lot (Industrial Use Property)	118	$ 15,028,750	$ 901,103	$ 15,929,853	$ 15,929,853
Warehousing, Distribution, Storage	92	$ 31,792,440	$ 34,657,531	$ 66,449,971	$ 66,449,971
Institutional	**8**	**$ 1,767,275**	**$ 1,656,856**	**$ 3,424,131**	**$ 3,434,131**
Church	6	$ 1,484,818	$ 1,391,763	$ 2,876,581	$ 2,886,581
School (Private)	2	$ 282,457	$ 265,093	$ 547,550	$ 547,550
Miscellaneous	**284**	**$ 76,593,528**	**$ 408,422**	**$ 77,001,950**	**$ 77,001,950**
Government Owned Property	213	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	6	$ 25,505,991	$ -	$ 25,505,991	$ 25,505,991
Privately Owned	9	$ 204,668	$ 185,471	$ 390,139	$ 390,139
Rights of Way	2	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	52	$ 49,964,814	$ 222,951	$ 50,187,765	$ 50,187,765
Recreational	**337**	**$ 19,139,842**	**$ 6,770,355**	**$ 25,910,197**	**$ 25,910,197**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	3	$ 1,443,988	$ 432,430	$ 1,876,418	$ 1,876,418
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**6,056**	**$ 2,494,132,379**	**$ 1,351,289,246**	**$ 3,845,421,625**	**$ 3,845,850,836**
Double, Duplex, or Two Units	671	$ 250,527,342	$ 139,875,961	$ 390,403,303	$ 390,452,023
Five or More Units or Apartments (Any Combination)	269	$ 132,830,055	$ 90,871,571	$ 223,701,626	$ 223,972,447
Four Units (Any Combination)	193	$ 69,860,649	$ 42,849,391	$ 112,710,040	$ 112,770,945
Manufactured Home Park	3	$ 3,311,592	$ 1,184,071	$ 4,495,663	$ 4,495,663
Single Family Residence	4,765	$ 1,971,804,500	$ 1,039,143,402	$ 3,010,947,902	$ 3,010,963,922
Three Units (Any Combination)	155	$ 65,798,241	$ 37,364,850	$ 103,163,091	$ 103,195,836
Grand Total	**7,928**	**$ 3,059,485,036**	**$ 1,660,860,953**	**$ 4,720,345,989**	**$ 4,731,945,786**

150cm SLR with 100-year storm					
Industry	Number of Parcels	Land Value	Improvement Value	Land + Improvement Value	Total Value
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**383**	**$ 270,926,143**	**$ 210,781,836**	**$ 481,707,979**	**$ 484,472,489**
Animal Kennel	3	$ 229,807	$ 16,697	$ 246,504	$ 246,504
Auto, Recreation Equipment, Construction Equipment Sales and Service	19	$ 4,943,746	$ 3,118,115	$ 8,061,861	$ 8,061,861
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	49	$ 6,559,517	$ 158,681	$ 6,718,198	$ 6,718,198
Department Store	2	$ 1,679,720	$ 3,586,782	$ 5,266,502	$ 5,266,502
Hotel and Motel	13	$ 27,146,395	$ 12,889,526	$ 40,035,921	$ 40,035,921
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	4	$ 1,557,532	$ 402,648	$ 1,960,180	$ 1,960,180
Office Building	44	$ 20,592,120	$ 29,477,026	$ 50,069,146	$ 52,823,246
Parking Lot (Commercial Use Property)	69	$ 17,959,338	$ 615,400	$ 18,574,738	$ 18,574,738
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	47	$ 30,294,750	$ 25,847,534	$ 56,142,284	$ 56,142,284
Service Station	9	$ 7,024,014	$ 2,585,059	$ 9,609,073	$ 9,609,073
Shopping Center (Neighborhood, Community)	3	$ 57,483,320	$ 35,596,083	$ 93,079,403	$ 93,079,403
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	67	$ 44,631,460	$ 36,483,363	$ 81,114,823	$ 81,114,823
Store Combination	46	$ 31,364,024	$ 30,244,687	$ 61,608,711	$ 61,619,121
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**954**	**$ 231,849,081**	**$ 116,272,061**	**$ 348,121,142**	**$ 357,720,448**
Food Processing Plant	8	$ 2,827,431	$ 3,377,169	$ 6,204,600	$ 6,204,600
Heavy Manufacturing	9	$ 9,607,361	$ 8,329,688	$ 17,937,049	$ 18,275,507
Industrial	268	$ 61,790,923	$ 3,558,678	$ 65,349,601	$ 65,349,601
Light Manufacturing	421	$ 75,808,538	$ 63,015,063	$ 138,823,601	$ 138,878,421
Lumber Yard	2	$ 334,426	$ 222,948	$ 557,374	$ 557,374
Mineral Processing	5	$ 30,269,530	$ 1,390,414	$ 31,659,944	$ 40,865,972
Open Storage	25	$ 3,806,554	$ 717,942	$ 4,524,496	$ 4,524,496
Parking Lot (Industrial Use Property)	123	$ 15,358,368	$ 921,107	$ 16,279,475	$ 16,279,475
Warehousing, Distribution, Storage	93	$ 32,045,950	$ 34,739,052	$ 66,785,002	$ 66,785,002
Institutional	**10**	**$ 2,124,671**	**$ 2,413,667**	**$ 4,538,338**	**$ 4,548,338**
Church	8	$ 1,842,214	$ 2,148,574	$ 3,990,788	$ 4,000,788
School (Private)	2	$ 282,457	$ 265,093	$ 547,550	$ 547,550
Miscellaneous	**315**	**$ 77,831,548**	**$ 408,422**	**$ 78,239,970**	**$ 78,239,970**
Government Owned Property	239	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	6	$ 25,505,991	$ -	$ 25,505,991	$ 25,505,991
Privately Owned	9	$ 204,668	$ 185,471	$ 390,139	$ 390,139
Rights of Way	3	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	56	$ 51,202,834	$ 222,951	$ 51,425,785	$ 51,425,785
Recreational	**340**	**$ 22,473,202**	**$ 6,971,295**	**$ 29,444,497**	**$ 29,444,497**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	3	$ 1,443,988	$ 432,430	$ 1,876,418	$ 1,876,418
Golf Course	3	$ 3,333,360	$ 200,940	$ 3,534,300	$ 3,534,300
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**7995**	**$ 2,925,723,502**	**$ 1,635,810,016**	**$ 4,561,533,518**	**$ 4,562,003,349**
Double, Duplex, or Two Units	742	$ 262,728,677	$ 149,307,629	$ 412,036,306	$ 412,085,766
Five or More Units or Apartments (Any Combination)	325	$ 150,262,846	$ 111,388,010	$ 261,650,856	$ 261,952,634
Four Units (Any Combination)	230	$ 76,917,935	$ 51,310,293	$ 128,228,228	$ 128,295,376
Manufactured Home Park	3	$ 3,311,592	$ 1,184,071	$ 4,495,663	$ 4,495,663
Single Family Residence	6514	$ 2,362,377,426	$ 1,281,724,456	$ 3,644,101,882	$ 3,644,118,122
Three Units (Any Combination)	181	$ 70,125,026	$ 40,895,557	$ 111,020,583	$ 111,055,788
Grand Total	**10,000**	**$ 3,536,110,688**	**$ 1,975,930,925**	**$ 5,512,041,613**	**$ 5,524,885,260**

150cm SLR with no storm					
Industry	**Number of Parcels**	**Land Value**	**Improvement Value**	**Land + Improvement Value**	**Total Value**
(unavailable)	**3**	**$ 5,182,541**	**$ 3,273,628**	**$ 8,456,169**	**$ 8,456,169**
(unavailable)	3	$ 5,182,541	$ 3,273,628	$ 8,456,169	$ 8,456,169
Commercial	**338**	**$ 239,218,075**	**$ 183,668,464**	**$ 422,886,539**	**$ 424,450,329**
Animal Kennel	3	$ 229,807	$ 16,697	$ 246,504	$ 246,504
Auto, Recreation Equipment, Construction Equipment Sales and Service	17	$ 4,733,564	$ 3,059,019	$ 7,792,583	$ 7,792,583
Bank, Savings and Loan	5	$ 3,651,296	$ 6,512,066	$ 10,163,362	$ 10,163,362
Commercial	38	$ 6,278,797	$ 158,681	$ 6,437,478	$ 6,437,478
Department Store	2	$ 1,679,720	$ 3,586,782	$ 5,266,502	$ 5,266,502
Hotel and Motel	9	$ 26,454,937	$ 11,949,956	$ 38,404,893	$ 38,404,893
Non-Auto Service and Repair Shop, Paint Shop, or Laundry	4	$ 1,557,532	$ 402,648	$ 1,960,180	$ 1,960,180
Office Building	36	$ 7,211,014	$ 10,041,437	$ 17,252,451	$ 18,806,551
Parking Lot (Commercial Use Property)	62	$ 8,022,817	$ 262,825	$ 8,285,642	$ 8,285,642
Professional Building	1	$ 1,157,200	$ 608,599	$ 1,765,799	$ 1,765,799
Restaurant, Cocktail Lounge	44	$ 29,811,996	$ 25,217,644	$ 55,029,640	$ 55,029,640
Service Station	8	$ 5,151,196	$ 2,362,108	$ 7,513,304	$ 7,513,304
Shopping Center (Neighborhood, Community)	3	$ 57,483,320	$ 35,596,083	$ 93,079,403	$ 93,079,403
Shopping Center (Regional)	1	$ 14,513,929	$ 22,585,996	$ 37,099,925	$ 37,099,925
Store	61	$ 40,753,482	$ 32,302,491	$ 73,055,973	$ 73,055,973
Store Combination	43	$ 30,389,493	$ 28,951,858	$ 59,341,351	$ 59,351,041
Supermarket	1	$ 137,975	$ 53,574	$ 191,549	$ 191,549
Industrial	**942**	**$ 231,224,914**	**$ 116,093,989**	**$ 347,318,903**	**$ 356,918,209**
Food Processing Plant	8	$ 2,827,431	$ 3,377,169	$ 6,204,600	$ 6,204,600
Heavy Manufacturing	9	$ 9,607,361	$ 8,329,688	$ 17,937,049	$ 18,275,507
Industrial	260	$ 61,427,894	$ 3,558,574	$ 64,986,468	$ 64,986,468
Light Manufacturing	418	$ 75,627,635	$ 62,838,342	$ 138,465,977	$ 138,520,797
Lumber Yard	2	$ 334,426	$ 222,948	$ 557,374	$ 557,374
Mineral Processing	5	$ 30,269,530	$ 1,390,414	$ 31,659,944	$ 40,865,972
Open Storage	25	$ 3,806,554	$ 717,942	$ 4,524,496	$ 4,524,496
Parking Lot (Industrial Use Property)	122	$ 15,278,133	$ 919,860	$ 16,197,993	$ 16,197,993
Warehousing, Distribution, Storage	93	$ 32,045,950	$ 34,739,052	$ 66,785,002	$ 66,785,002
Institutional	**9**	**$ 1,802,360**	**$ 1,736,541**	**$ 3,538,901**	**$ 3,548,901**
Church	7	$ 1,519,903	$ 1,471,448	$ 2,991,351	$ 3,001,351
School (Private)	2	$ 282,457	$ 265,093	$ 547,550	$ 547,550
Miscellaneous	**271**	**$ 76,593,528**	**$ 408,422**	**$ 77,001,950**	**$ 77,001,950**
Government Owned Property	201	$ 918,055	$ -	$ 918,055	$ 918,055
Petroleum and Gas	6	$ 25,505,991	$ -	$ 25,505,991	$ 25,505,991
Privately Owned	9	$ 204,668	$ 185,471	$ 390,139	$ 390,139
Rights of Way	3	$ -	$ -	$ -	$ -
Rivers and Lakes	2	$ -	$ -	$ -	$ -
Utility	50	$ 49,964,814	$ 222,951	$ 50,187,765	$ 50,187,765
Recreational	**337**	**$ 19,139,842**	**$ 6,770,355**	**$ 25,910,197**	**$ 25,910,197**
Athletic and Amusement Facility	3	$ 1,935,679	$ 3,419,016	$ 5,354,695	$ 5,354,695
Club, Lodge Hall, Fraternal Organization	3	$ 1,443,988	$ 432,430	$ 1,876,418	$ 1,876,418
Water Recreation	331	$ 15,760,175	$ 2,918,909	$ 18,679,084	$ 18,679,084
Residential	**6012**	**$ 2,476,423,707**	**$ 1,341,078,657**	**$ 3,817,502,364**	**$ 3,817,936,265**
Double, Duplex, or Two Units	665	$ 247,048,522	$ 138,227,979	$ 385,276,501	$ 385,324,301
Five or More Units or Apartments (Any Combination)	279	$ 134,332,208	$ 93,420,488	$ 227,752,696	$ 228,028,007
Four Units (Any Combination)	202	$ 71,409,108	$ 45,354,142	$ 116,763,250	$ 116,825,275
Manufactured Home Park	3	$ 3,311,592	$ 1,184,071	$ 4,495,663	$ 4,495,663
Single Family Residence	4708	$ 1,954,524,036	$ 1,025,527,127	$ 2,980,051,163	$ 2,980,067,183
Three Units (Any Combination)	155	$ 65,798,241	$ 37,364,850	$ 103,163,091	$ 103,195,836
Grand Total	**7,912**	**$ 3,049,584,967**	**$ 1,653,030,056**	**$ 4,702,615,023**	**$ 4,714,222,020**

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