LAND

Asset Profile: Land

Land is a significant asset along the Marin shoreline that provides space for homes, commercial goods and services, recreation and education, worship, and the ability to create financial equity and wealth. Within Eastern Marin's steep narrow valleys, dry, flat, and easily developable land a very limited resource. While a majority of the vulnerable properties feature buildings, several are agricultural, park, service oriented, or natural in use, and have unique vulnerabilities (see Utilities, Working Lands, Recreation, and Natural Resources Profiles). The following are general key issues related to land vulnerability:

- Almost all land hosting human activity identified in scenarios 1, 3, and 5 could be vulnerable to tidal flooding on a near daily basis, with some months worse than others.
- Shoreline property that becomes tidally flooded and transitions to the water side mean sea level boundary would become public trust land, and may be required to pay a leasing fee to the State Lands Commission.
- Many properties are built on fill and mud, which could become soggier and, consequently, vulnerable to increasing rates of subsidence.
- Shoreline armoring protecting land from flooding, except in Hamilton and the Redwood Landfill, is not regulated or certified, and could expect overtopping after three feet of sea level rise.
- Properties untouched by rising tides may become isolated and cut off from essential services, such as wastewater service and travel through low-lying areas.
- San Rafael's Canal neighborhood, one of the lowest income and most diverse areas of the shoreline, could expect a large number of rented or leased properties flooded at the average higher high tide in the near-term. By the end of the century, the entire area could flood daily, from the shoreline to Interstate 580.
- Marin County communities feature several house boat and unauthorized boat communities' that exist within the existing tidal range. These properties are especially vulnerable themselves, as is their connection to dry land.
- Sea level rise will likely simultaneously impact multiple jurisdictions and properties with differing ownership and financial capacities, creating imbalances in adaptation abilities.

IMPACTS AT-A-GLANCE: SCENARIO 6

13,000 properties	**100,000+ people**
$9 billion in assessed land value flooded (2016 dollars)	**Stormwater and tidal impacts already occur along the shoreline and up major creeks**
Residential, commercial, industrial, open space, parks, ranch lands, utilities, and transportation parcels	**Property Owners County of Marin Sausalito Mill Valley Belvedere Tiburon Corte Madera Larkspur San Rafael Novato**

Flooding around houseboats in Sausalito. Nov. 24, 2015. Credit: Marin County DPW

Subsidence in Marinship, Sausalito. C1edit: Marin County CDA

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Corte Madera Ecological Reserve. Credit: C. Kennard

Acres

Near-term: Scenarios 1 &2
As shown in Table 3, overall, less than 5,000 acres could be tidally flooded by 2030, and an additional 3,000 acres could flood with saltwater during storm surges. These acreage figures amount to six percent of the study area as being vulnerable to tidal and storm surge flooding, and another three percent of land in the study area as being vulnerable to a 100-year storms surge alone.

In the near-term, as shown in Table 4, the most impacted communities by acreage are:

1. Bel Marin Keys, 1,759 acres
2. Waldo Point Harbor area, 598 acres, and
3. San Rafael, 449 acres.

Following these top three are Novato with 430 acres, and Strawberry, Corte Madera, and St. Vincent's with around 200 acres flooded each. All other communities could anticipate about or less than 100 acres being exposed to sea level rise. Note that many of these acres, especially in Bel Marin Keys, San Rafael, Novato, Corte Madera, and Larkspur, include several hundred acres in marshland that buffer development from the Bay. Southern Marin shoreline properties east of US Highway 101, especially those resting on fill in the low lying areas, are the most vulnerable to tidal flooding and subsidence. Adding a 100-year storm surge impacts several more properties in these communities, and several others in Corte Madera, Bel Marin Keys, Santa Venetia, and Tamalpais Valley.

Table 3. Exposed Acres by Scenario

Scenarios		Acres	
		#	% of study area
Near-term	1	4,829	6
	2	8,072	9
Medium-term	3	6,685	8
	4	13,544	16
Long-term	5	16,332	20
	6	17,854	21

Source: MarinMap, CoSMoS

Table 4. Acreage Exposed in the Near-term

Location		Scenario 1	Scenario 2
		10" MHHW	+100-year Storm Surge
Municipalities	San Rafael	449	1,360
	Novato	426	1,336
	Corte Madera	230	430
	Larkspur	132	202
	Tiburon	48	47
	Mill Valley	44	103
	Sausalito	26	52
	Belvedere	24	85
Unincorporated Jurisdictions	Bel Marin Keys	1,759	1,794
	Waldo Point	598	610
	St. Vincent's	256	346
	Strawberry	255	282
	North Novato	118	575
	San Quentin	116	115
	Tiburon	102	108
	Almonte	99	137
	Paradise Cay	67	69
	Santa Venetia	29	211
	Pt. San Pedro	14	62
	Greenbrae	13	21
	Kentfield	10	28
	Bayside Acres	9	9
	Country Club	4	4
	Black Point	1	58
	Tamalpais	0	28
Study Area		**4,827**	**8,062**

Source: MarinMap, CoSMoS

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Table 5. Acreage Exposed in the Medium-term

Location		Scenario 3	Scenario 4
		20" MHHW	+100-year Storm Surge
Municipalities	San Rafael	869	1,590
	Novato	1,327	3,535
	Corte Madera	313	640
	Larkspur	147	299
	Tiburon	48	49
	Mill Valley	62	183
	Sausalito	35	65
	Belvedere	24	130
Unincorporated Jurisdictions	Bel Marin Keys	1,802	2,155
	Waldo Point	604	611
	St. Vincent's	339	353
	Strawberry	270	301
	North Novato	226	2,457
	San Quentin	115	115
	Tiburon	103	108
	Almonte	115	146
	Paradise Cay	69	74
	Santa Venetia	56	221
	Pt. San Pedro	58	65
	Greenbrae	14	22
	Kentfield	12	33
	Bayside Acres	10	10
	Country Club	4	4
	Black Point	62	346
	Tamalpais	1	29
	Marin City	None	3
Study Area		**6,685**	**13,544**

Source: MarinMap, CoSMoS

SMART Bridge, Novato. Credit: Marin County DPW

Medium-term: Scenarios 3 &4

A majority of the vulnerable communities do not see significant gains in tidally flooded acreage in medium-term scenario 3. Overall, less than 2,000 additional acres could expect MHHW tidal flooding over scenario 1. And, in general, 10 to 100 more acres are impacted in each community, though communities with large low-lying areas could expect twice as many acres exposed. This is observed for San Rafael, Novato, North Novato, and Santa Venetia. In this time period, Novato surpasses San Rafael in exposed acreage, though much of this land is marsh or wetlands, whereas San Rafael's exposed land is intensely developed. Within the study area, with the compounding 100-year storm surge in scenario 4, 5,000 more acres could flood compared to scenario 2. The 100-year storm surge is the major contributor to flooding on additional land in the medium-term compared to the near-term. This jump in vulnerable area is due to the potential failure of shoreline levees south of Novato.

Long-term: Scenarios 5 &6

At five feet of sea level rise, scenario 5, a much larger number of acres are impacted by higher high tides at 16,300 aces, and an additional 1,500 acres that could expect only storm surge flooding. The communities with the most land area that could be exposed to tidal flooding are:

1. Novato, 3,998 acres,
2. North Novato, 2,827 acres, and
3. Bel Marin Keys, 2,332 acres.

The flooded areas are primarily natural, agricultural, flood control, and sanitary district lands. Corte Madera follows these top three with 900 acres flooded at average high tides, though similarly, much of this land is marsh. With an additional 100-year storm surge, the majority of exposed acreage in the study area is in:

1. Novato, 4,000 acres,
2. North Novato, 3,000 acres
3. Bel Main Keys

Following these communities is San Rafael, with more than 2,100 acres, and St. Vincent's, with more than 1,400 flooded acres. Corte Madera could anticipate nearly 1,000 acres flooded from a storm surge. All other communities could expect 550 acres or less that could suffer 100-year storm surge flooding at 60 inches of sea level rise, scenario 6.

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Table 6. Acreage Exposed in the Long-term

Location		Scenario 5	Scenario 6
		20" MHHW	+100-year Storm Surge
Municipalities	Novato	3,998	4,249
	San Rafael	1,856	2,121
	Corte Madera	906	994
	Larkspur	379	544
	Tiburon	190	273
	Mill Valley	169	180
	Sausalito	106	135
	Belvedere	84	149
Unincorporated Jurisdictions	North Novato	2,827	2,930
	Bel Marin Keys	2,332	2,350
	St. Vincent's	1,240	1,413
	Waldo Point	611	613
	Black Point	388	408
	Strawberry	328	375
	Santa Venetia	232	269
	Almonte	146	157
	San Quentin	122	135
	Tiburon	107	113
	Paradise Cay	91	111
	Pt. San Pedro	78	83
	Kentfield	53	118
	Tamalpais	28	30
	Greenbrae	24	24
	Bayside Acres	12	24
	California Park	9	10
	Country Club	9	10
	Marin City	7	36
Study Area		**16,332**	**17,854**

Source: MarinMap, CoSMoS

House boats. Waldo Point Harbor. Dec. 2014 king tide. Credit: Marin County DPW

Vulnerable Parcels

Land is divided into parcels for ownership and development purposes. Examining parcels can provide a window into the land uses, and how much of each land use, that could be exposed, vulnerable, and by when.

Near-term: Scenarios 1&2

As shown in Table 7, by number of parcels, the top three vulnerable jurisdictions are:

1. San Rafael, 700parcels,
2. Larkspur , 90 parcels, and
3. Mill Valley, 80 parcels.

This highlights that while not the highest in acreage, San Rafael could have the highest number of properties, and therefore people, impacted, requiring a much greater level of preparation and coordination. By proportion a few smaller unincorporated communities emerge as being the most vulnerable. These are:

1. Greenbrae, 62 percent of parcels,
2. Almonte, 32 percent of parcels, and
3. Waldo Pt. Harbor, 12 percent of parcels.

Greenbrae's 62 percent of parcels is alarming, especially given that the parcels are primarily residential that extend into existing tidal areas accessible only by a long narrow boardwalk. The municipalities could expect five percent or less of their parcels tidally flooded within this time period.

With the additional storm surge, scenario 2, Greenbrae could experience increased tidal flooding on 78 percent of the parcels on both sides of US Highway 101. In fact, the homes within the Corte Madera Creek corridor, west of US Highway 101, could be subject to greater flooding than those extending into the marsh lands. Similarly, 68 percent of Almonte could be compromised, as could 36 percent of Santa Venetia, as the existing levees could be overtopped. San Rafael could expect up to 11 percent of its parcels impacted with the additional storm. All other municipalities could expect less than six percent of the parcels impacted by a bay 100-year storm surge.

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By type, the primary land use that could be flooded is tax exempt. These are primarily sanitary and flood control district owned lands, along with some park land. The next most impacted land use by parcel count is residential, with concentrations in San Rafael, Greenbrae, Almonte, Waldo Point, and Larkspur.

Countywide, two percent of parcels could be vulnerable in scenario 1 and an additional 4 percent could also face the storm surge. Broken down by major land use type, as shown in Table 14, one percent of residential, five percent of commercial, and eight percent of industrial parcels could face tidal flooding. Add on the bay storm surge, and an additional four, nine, and 27 percent, respectively, of parcels could weather storm surge flooding.

Table 7. Number and Proportion of Vulnerable Parcels in the Near-term

	Location	Scenario 1		Scenario 2	
		#	%	#	%
Municipalities	San Rafael	709	4	1,926	11
	Larkspur	90	2	246	5
	Mill Valley	80	1	195	3
	Belvedere	51	5	56	6
	Tiburon	46	1	46	1
	Sausalito	40	1	61	2
	Corte Madera	9	0	201	6
	Novato	3	0	7	0
Unincorporated Jurisdictions	Waldo Point	59	12	68	13
	Greenbrae	54	62	68	78
	Bel Marin Keys	45	6	121	16
	Paradise Cay	28	8	34	9
	Strawberry	26	2	29	2
	Almonte	22	32	46	68
	Bayside Acres	19	9	19	9
	Tiburon	13	4	22	7
	St. Vincent's	7	10	12	18
	Santa Venetia	4	0	604	36
	Kentfield	2	0	4	0
	San Quentin	1	1	1	1
	Black Point	1	0	9	1
	Country Club	1	0	2	0
	Tamalpais	0		97	4
Study Area		**1,310**	**2**	**3,826**	**6**

Source: MarinMap, CoSMoS

By community, Greenbrae could expect up to 85 percent of its residential parcels compromised. Both Paradise Cay and Tiburon could expect 20 percent of their commercial parcels compromised. And San Rafael could expect 11 percent of their commercial and 17 percent of industrial parcels compromised. While only a few industrial parcels exist, nearly all of them could suffer tidal impacts.

Table 8. Vulnerable Parcels Land Uses in the Near-term

Land Use	Scenario 1		Scenario 2	
	#	Acres*	#	Acres*
Multi-family Residential Improved	131	51	166	69
Multi-family Residential Unimproved	5	1	7	1
Mobile Homes	7	0	202	1
Single Family Attached	716	11	1,283	36
Single Family-Residential Improved	508	142	2,274	464
Single- Family Residential Unimproved	52	24	93	76
Floating Home	52	1	53	1
Commercial Improved	249	311	437	640
Commercial Unimproved	22	109	67	275
Industrial Improved	109	57	181	123
Industrial Unimproved	11	3	25	143
Common Area	13	50	39	178
Rural Unimproved	0	0	1	169
Exemption Improved	0	0	3	223
Exemption Vacant	0	0	0	0
Tax Exempt	1	28	6	201
No Data	20	13	46	38

**Whole parcels are summed, not just the exposed portion of the parcel. Source: MarinMap, CoSMoS*

With the additional storm surge, these communities and several other could expect sizeable impacts to

residential, commercial, and industrial properties, both improved and unimproved. For example:

- Greenbrae could expect nearly 100 percent of its residential parcels to flood.
- Santa Venetia could expect nearly 40 percent of its residential parcels to flood with surge waters.
- Bel Main Keys and Waldo Point Harbor could expect 14 percent of residential parcels to flood.
- Waldo Point Harbor could anticipate 16 percent of its industrial parcels to be compromised.
- Tamalpais Valley could expect more than 75 percent of their commercial parcels long Shoreline Highway to be compromised.
- Almonte could also anticipate flooding on 50 percent of commercial parcels, and even more considerable, the less than 10 industrial parcels could flood.
- San Rafael could expect nearly ten percent of residential, 25 percent of the commercial compromised, and 52 percent of industrial parcels to suffer from temporary flooding.
- Eighty-three percent of Larkspur's industrial parcels could face storm surge flooding.
- Finally, Corte Madera could expect nearly 20 percent of commercial parcels to flood.

Medium-term: Scenarios 3 and 4

Medium-term scenarios 3 and 4 comparisons for parcels and land use are relatively similar to, though marginally more severe than, scenarios 1 and 2. The top three locations with the greatest number of vulnerable parcels are:

1. San Rafael, 1,301parcels,
2. Larkspur, 121 parcels, and
3. Bel Marin Keys, 97 parcels.

Adding the storm surge alters this order with San Rafael still topping the list, with more than 2,000 flooded parcels, Santa Venetia following with more than 650 parcels, and Corte Madera with slightly less than 650 parcels. Flooded parcels account for nearly 40 percent of the residential parcels in Bel Marin Keys. Several hundred parcels are also vulnerable in Larkspur and Mill Valley. Also of note, Belvedere Lagoon area homes could be temporary flooded with saltwater during a storm surge event.

Canal neighborhood, San Rafael, is highly vulnerable to sea level rise. Credit: MarinMap

As shown in Table 9, he ranking of communities by percent of parcels that could experience tidal flooding in medium-term scenario3 are:

1. Greenbrae, 66 percent of parcels
2. Almonte, 47 percent of parcels, and
3. St. Vincent's, 18 percent of parcels.

The additional 100-year storm surge increases the portion of vulnerable parcels to alarming levels in Greenbrae and Almonte. The top three vulnerable communities by proportion of parcels flooded during a storm surge event are:

1. Greenbrae, 80 percent of parcels,
2. Almonte, 76 percent of parcels, and
3. Santa Venetia, 36 percent of parcels.

Looking closer at land use county wide shows that the majority is vulnerable parcels is made up of residential parcels. This includes multi-family, single-family, and floating homes. As shown in Table 14, by proportion, about 20 percent of industrial parcels could anticipate tidal flooding at MHHW. At the community level:

- *All* of the residential parcels in Greenbrae could face some storm related flooding on the marshland parcels and the associated landward parcels, where many residents park their vehicles.
- If Santa Venetia's existing levees are overtopped as predicted, nearly 40 percent of

the residential parcels there could anticipate temporary bay flooding.

- Similarly, Belvedere could expect storm surge flooding on up to 22 percent of residential parcels.
- Corte Madera could experience storm surge flooding on 57 percent of its industrial parcels, and sixteen percent of its residential parcels eat of US Highway 101.
- Larkspur could expect storm flooding on 90 percent of its industrial parcels east of US Highway 101.
- San Rafael could experience flooding on 57 percent of industrial parcels and 28 percent of commercial parcels.
- Bel Marin Keys could anticipate storms urge flooding on 23 percent of residential parcels.

Table 9. Number & Proportion of Vulnerable Parcels by Community in the Medium-Term

	Location	Scenario 3		Scenario 4	
		#	%	#	%
Municipalities	San Rafael	1,301	7	2,188	12
	Larkspur	121	3	445	10
	Mill Valley	80	1	338	6
	Belvedere	52	5	210	21
	Tiburon	47	1	49	1
	Sausalito	48	1	68	2
	Corte Madera	68	2	635	17
	Novato	6	0	55	0
Unincorporated Jurisdictions	Waldo Pt.	64	13	73	14
	Greenbrae	57	66	70	80
	Bel Marin Keys	97	13	172	23
	Paradise Cay	38	10	54	15
	Strawberry	25	2	76	5
	Almonte	32	47	52	76
	Bayside Acres	19	9	20	9
	Tiburon	16	5	22	7
	St. Vincent's	12	18	13	19
	Santa Venetia	4	0	652	39
	Kentfield	3	0	9	0
	San Quentin	1	1	1	1
	Black Point	15	2	46	5
	Country Club	2	0	2	0
	Tamalpais	3	0	98	4
	North Novato	None		24	3
Study Area		**3,191**	**5**	**5,372**	**8**

Source: MarinMap, CoSMoS

Long-term: Scenarios 5 &6

Throughout the study area, more than 8,000 parcels, or 10 percent of parcels in the study area, could be impacted by 60 inches of sea level rise. Add on the 100-year storm surge, and nearly 12,800 parcels, about 20 percent of all parcels in the study area.

Table 10. Vulnerable Land Uses in the Medium-term

Land Use	Scenario 3		Scenario 4	
	#	Acres*	#	Acres*
Multi-family Residential Improved	102	41	144	56
Multi-family Residential Unimproved	4	1	5	1
Mobile Homes	0	0	166	1
Single Family Attached	465	6	1,092	29
Single Family-Residential Improved	270	94	1,402	305
Single- Family Residential Unimproved	43	28	69	50
Floating Home	52	1	53	1
Commercial Improved	133	123	343	505
Commercial Unimproved	17	89	42	177
Industrial Improved	49	23	158	99
Industrial Unimproved	5	2	19	5
Common Area	12	48	30	122
Rural Unimproved	1	28	1	28
Exemption Improved	14	9	31	17
Exemption Vacant	5	69	5	69
Tax Exempt	135	2,738	314	4,636
No Data	4	9	4	9

Source: MarinMap, CoSMoS

** Whole parcels are counted, not just the exposed portion of the parcel.*

Table 11. Vulnerable Parcels at MHHW by Community in the Long-term

Location		Scenario 3	Scenario 4
		60" MHHW	+100-year Storm Surge
Municipalities	San Rafael	1,856	2,121
	Novato	3,998	4,249
	Corte Madera	906	994
	Larkspur	379	544
	Tiburon	106	135
	Mill Valley	190	273
	Sausalito	84	149
	Belvedere	169	180
Unincorporated Jurisdictions	Bel Marin Keys	2,332	2,350
	Waldo Point	611	613
	St. Vincent's	1,240	1,413
	Strawberry	328	375
	North Novato	2,827	2,930
	San Quentin	122	135
	Tiburon	107	113
	Almonte	146	157
	Paradise Cay	91	111
	Santa Venetia	232	269
	Pt. San Pedro	78	83
	Greenbrae	24	24
	Kentfield	53	118
	Bayside Acres	12	11
	Country Club	9	10
	Black Point	388	408
	Tamalpais	28	30
	Marin City	7	36
	California Park	9	10
Study		**6,685**	**16,332**

Source: MarinMap, CoSMoS

Marin Yacht Club, San Rafael. Credit: Marin County CDA

By number of parcels, the top three impacted communities in long-term scenario 5 are:

1. San Rafael, 2,650 parcels,
2. Corte Madera, 1,104 parcels, and
3. Novato, 800 parcels.

San Rafael, one of the largest communities in the study area, is the most impacted with more than twice as many impacted parcels as the next highest municipality. In San Rafael, the 2,650 vulnerable parcels account for 15 percent of all parcels, 12 percent of residential, and 40 percent of commercial parcels. With the additional 100-year storm surge, an additional 1,000 parcels in San Rafael could be vulnerable to temporary floodwaters. This could damage one fifth of the city overall, with 20 percent residential and 50 percent commercial parcels vulnerable.

According to San Rafael asset managers, vulnerable buildings include 30 grocery stores, 10 pharmacies, 16 medical clinics, 48 doctor offices, 35 childcare facilities, five residential care facilities, seven convalescent facilities, 16 gas stations, 29 building supply stores, and other critical facilities. These businesses contain essential goods, such as food, medical, and buildings supplies.

The second most impacted community by number of parcels, Corte Madera, is also the second most impacted by proportion of vulnerable parcels. One third of Corte Madera parcels could be vulnerable to sea level rise, and more than 40 percent of parcels could be impacted by additional storm surge at this sea level. Nearly 30 percent of residential and 70 percent of commercial parcels could be impacted as well. Adding the storm surge at this sea level, Corte Madera could anticipate impacts to nearly 40 percent of the residential parcels, and 80 percent of the commercial parcels. These properties include homes and major regional retailers.

Novato is the next highest by count; however, these parcels constitute a small percentage of residential and commercial parcels in the community, as many of these parcels are not developed. Larkspur follows, nearing 700 parcels, with a large portion of vulnerable commercial parcels. Similar is true for Tiburon. In Belvedere, 30 to 40 percent of parcels are vulnerable, including 30 to 40 percent of residential and commercial parcels. With the storm surge, these numbers rise to 50 to 60 percent. Mill Valley and Sausalito could anticipate significant

impacts as well, especially with the 100-year storm surge associated with scenario 6.

The top three vulnerable communities by portion of parcels flooded tidally by long-term scenario 5 are:

1. Bel Marin Keys, 94 percent,
2. Greenbrae, 80 percent, and
3. Almonte, 78 percent of parcels.

This outcome mirrors earlier outcomes, where the smallest shoreline communities could expect flooding throughout the entire developed area.

With respect to land use, 10 percent of residential parcels county wide could become vulnerable by long-term scenario 5. While less significant in number, by proportion, a concerning 27 percent of commercial, and 37 percent of industrial parcels county wide could be vulnerable to tidal flooding at MHHW with 60 inches of sea level rise.

The 740 commercial parcels in the study area that could flood at MHHW host 1,720 buildings with 115 living units that would become useable. Vulnerable businesses are concentrated in San Rafael, with more than 550 impacted parcels with structures, with Corte Madera, Larkspur and Sausalito being the next most impacted, nearing 100 parcels with structures each. Vulnerable residential parcels host approximately 8, 450 living units that would flood directly, or at least be difficult to leave or return to.

In unincorporated Marin, Strawberry could expect about 15 percent of commercial parcels to be impacted by sea level rise, and 30 percent of the commercial parcels to be impacted with the additional storm surge, though primarily in the parking areas. Commercial parcels in Black Point tend to be located in the low-lying State Route 37 corridor, and could tidally flood on about 30 percent of parcels, and storms urge flood an additional five percent of parcels. Waldo Point Harbor house boats and commercial areas could also be significantly impacted, especially to the 100-year storm surge.

Table 12. Number & Portion of Vulnerable Parcels in the Long-term

	Location	Scenario 5		Scenario 6	
		#	%	#	%
Municipalities	San Rafael	2,646	15	2,646	15
	Larkspur	687	15	687	15
	Mill Valley	361	6	361	6
	Belvedere	356	36	356	36
	Tiburon	145	4	145	4
	Sausalito	88	3	88	3
	Corte Madera	1,104	30	1,104	30
	Novato	800	4	800	4
Unincorporated Jurisdictions	Waldo Pt.	75	15	75	15
	Greenbrae	70	80	70	0
	Bel Marin Keys	711	94	711	94
	Paradise Cay	103	28	103	28
	Strawberry	155	9	155	9
	Almonte	53	78	53	78
	Bayside Acres	23	11	23	11
	Tiburon	18	5	18	5
	St. Vincent's	22	32	22	32
	Santa Venetia	653	39	653	39
	Kentfield	52	2	52	2
	San Quentin	1	1	1	1
	Black Point	66	8	66	8
	Country Club	6	1	6	1
	Tamalpais	94	4	94	4
	North Novato	30	4	30	4
	California Park	41	15	41	15
	Marin City	None		20	4
	Pt. San Pedro	None		5	50
	China Camp	None		5	45
Total		**8,360**	**13**	**12,763**	**19**

Source: MarinMap, CoSMoS

Table 13. Vulnerable Land Uses in the Long-term

Land Use	Scenario 5		Scenario 6	
	#	Acres*	#	Acres*
Multi-family Residential Improved	192	77	345	292
Multi-family Residential Unimproved	12	2	19	10
Mobile Homes	204	1	220	1
Single Family Attached	1,948	57	2,776	83
Single Family-Residential Improved	4,070	801	5,940	1,384
Single- Family Residential Unimproved	147	88	275	375
Floating Home	52	1	53	1
Commercial Improved	643	796	1,016	1,795
Commercial Unimproved	95	308	133	364
Industrial Improved	204	128	289	519
Industrial Unimproved	38	162	53	170
Common Area	55	188	143	392
Agricultural Improved	1	169	2	640
Agricultural Unimproved	4	317	5	721
Rural-(Improved)	0	0	3	275
Rural Unimproved	10	660	20	880
Exemption Improved	71	44	110	367
Exemption Vacant	19	491	23	494
Tax Exempt	582	8,903	983	16,277
No Data	18	88	28	132

Source: MarinMap, CoSMoS

**Whole parcels are counted, not just the exposed portion of the parcel.*

Condos along Saltworks Canal, Strawberry. Credit: Marin County DPW

In scenario 6, by nearly a factor of nine, the majority of the storm flooded parcels consists of residential parcels, and amounts to 15 percent of all residential parcels in Marin County. In addition, while significantly fewer in number, the vulnerable commercial parcels are more than 40 percent of all commercial parcels in the County. More alarming is that more than 50 percent of industrial parcels could be impacted by flooding during a 100-year storm surge. The 1,149 commercial parcels hosting 2,180 businesses and 258 living units could be vulnerable by scenario 6, 60 inches of sea level rise and 100-yearstorm surge.

As shown in Table 14, the community with the greatest portion of their residential parcels impacted is Greenbrae, with 100 percent of parcels potentially facing tidal flooding. If the tide gates are open or are unable to hold back water, 95 percent of Bel Marin Keys residential parcels could face tidally flooding. In addition, Santa Venetia could anticipate tidal flooding on up to 40 percent of residential parcels, followed by Belvedere and Paradise Cay.

With the 100-year storm surge variable, 100 percent of Greenbrae and Bel Marin Keys could flood making living on dry land a challenge for each entire community. Sixty percent of residential parcels in Paradise Cay and fifty percent in Santa Venetia could flood during a storm surge, only ten percent of which would only suffer storm surge flooding, while the other parcels would experience both tidal and storm surge flooding.

The community with the greatest portion of commercial parcels impacted by tidal flooding at 60 inches of sea level rise is Tamalpais Valley, where much of the commercial development is along

Shoreline Highway in Tamalpais Junction. Corte Madera's vulnerable highway corridor commercial development constitutes 66 percent of all commercial parcels in Corte Madera. Tiburon follows, with 64 percent of commercial parcels, concentrated in the downtown Tiburon area, under tidal influence by long-term scenario 5.

By long-term scenario 6, both North Novato, at Binford Road, and Black Point, along State Route 37, could expect 100 percent of commercial parcels to flood. Belvedere and Almonte could expect more than 80 percent of commercial parcels to flood. Tamalpais Valley and Corte Madera could anticipate about 80 percent of commercial parcels flooding.

By long-term scenario 5, all industrial land in Larkspur and Almonte could flood at MHHW. More than 70 percent of Corte Madera and North Novato industrial parcels could flood at the average higher high tide. By long-term scenario 6, these areas would experience additional storm surge flooding. In addition, 100 percent of North Novato and Pt. San Pedro industrial land could be compromised during a 100-year storm-surge event. San Rafael could suffer, followed by Sausalito, which could expect 62 percent of the industrial parcels to flood with surge waters.

Landfill Sites

Marin residential and business garbage is disposed of at Redwood Landfill. This site may be vulnerable to sea level rise; however, the CoSMoS model does not incorporate recent improvements to the levees surrounding the site intended reduce flooding potential. Thus, modeled sea level rise projections likely overestimate flooding potential on this site. Waste Management makes regular improvements to the levees to account for subsidence, sea level rise, and pest damage.

The formally operated and now inactive landfill sites in the exposure area are:

- San Quentin Disposal Site, San Rafael: Vulnerable at the existing Marin Honda dealership. Vulnerable by scenario 5.
- Ghilotti Brothers Disposal Site, San Rafael: Site is completely surrounded by tidal waters by scenario 5 water levels.
- Horst Hanf Landfill, now Bayview Business Park, San Rafael: Vulnerable at about 40 inches of sea level rise, between scenarios 3 and 5.
- Bellam Landfill, San Rafael: Vulnerable by scenario 5.
- Hamilton Army Airfield Landfill #26: Vulnerable by scenario 5.
- Dunphy Park, Sausalito: Completely covered by, scenario 5.
- Larkspur Disposal Site (Piper Park): Impacts as early as 40 inches of sea level rise, between scenarios 3 and 5, and could anticipate site wide impacts by scenario 5.
- Mill Valley Dump, now Mill Valley Middle School, vulnerable to overland flooding by scenario 5.

Landfills are often subjected to subsidence because they are typically located where marshes once existed, and because buried materials settle over time. If toxic substances are contained in these sites, the toxin could be carried off the site and into the bay.

The maps on the following pages show the northern and southern study area parcels that could be vulnerable to the rising average higher high tide and 100-year storm activity modeled across the 6 scenarios. The areas in the call out circles enable the reader the see areas that are difficult to see on the large scale map. The circles do not indicate that these areas are more vulnerable than others along the shoreline.

Table 14. Portion of Industrial, Residential, and Commercial Land Uses Vulnerable to Sea Level Rise by Community and Onset

	Location	Scenario 1			Scenario 2			Scenario 3			Scenario 4			Scenario 5			Scenario 6		
		% of industrial	% of residential	% of commercial	% of industrial	% of residential	% of commercial	% of industrial	% of residential	% of commercial	% of industrial	% of residential	% of commercial	% of industrial	% of residential	% of commercial	% of industrial	% of residential	% of commercial
Municipalities	San Rafael	17	3	11	52	9	24	37	6	19	57	10	28	61	12	40	76	16	50
	Larkspur	0	2	0	83	5	11	30	2	4	91	9	13	**100**	15	18	**100**	25	48
	Mill Valley	0	1	1	0	3	5	0	1	1	0	5	13	0	6	10	0	12	32
	Belvedere	0	5	0	0	5	0	0	5	0	0	22	25	0	37	33	0	47	58
	Tiburon	0	1	7	0	1	7	0	1	9	0	1	7	0	3	64	0	7	**84**
	Sausalito	3	0	2	21	0	4	8	0	3	30	0	5	41	0	10	62	2	51
	Corte Madera	0	0	0	0	5	17	0	2	3	9	16	41	**76**	29	66	76	39	77
	Novato	0	0	0	0	0	0	0	0	0	2	0	1	5	4	3	22	6	9
Unincorporated Jurisdictions	Almonte	75	0	1	**100**		48	**100**	0	2	**100**	0	70	**100**	0	74	**100**	1	87
	Bayside Acres	0	11	1	0	11	0	0	18	1	0	11	0	0	13	0	0	21	0
	Bel Marin Keys	0	4	0	0	14	0	0	47	0	0	19	0	0	95	0	0	100	0
	Black Point	0	0	0	0	0	0	0	0	0	0	4	18	0	6	27	0	19	36
	California Park	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	23	100
	China Camp SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Country Club	0	2	0	0	0	0	0	3	0	0	0	0	0	2	0	0	6	0
	Greenbrae	0	85	0	0	97	0	0	85	3	0	100	0	0	**100**	0	0	**100**	0
	Kentfield	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	8	0
	Marin City	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50
	North Novato	0	0	0	0	0	0	0	0	0	57	0	20	71	0	40	100	0	100
	Paradise Cay	0	20	1	0	12	0	0	19	1	0	19	0	0	36	0	0	66	0
	Pt. San Pedro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	**100**	0
	San Quentin	0	5	0	0	0	0	0	5	0	0	0	0	0	0	0	0	11	0
	Santa Venetia	0	3	0	0	38	5	0	3	0	0	39	5	0	40	10	0	50	10
	St. Vincent's	0	0	1	0	0	0	0	0	1	0	0	0	0	0	**100**	0	**0**	**100**
	Strawberry	0	7	0	0	1	2	0	7	0	0	4	9	0	9	15	0	17	32
	Tamalpais	0	0	0	0	3	76	0	0	0	0	0	76	0	3	76	0	3	76
	Tiburon	0	20	0	0	9	0	0	20	0	0	9	0	0	7	0	0	32	0
	Waldo Point	4	1	3	16	14	5	13	1	3	16	14	47	16	0	60	16	14	73
Marin County		8	1	5	27	5	14	19	2	6	32	6	18	37	10	27	53	15	42

Source: MarinMap, CoSMoS

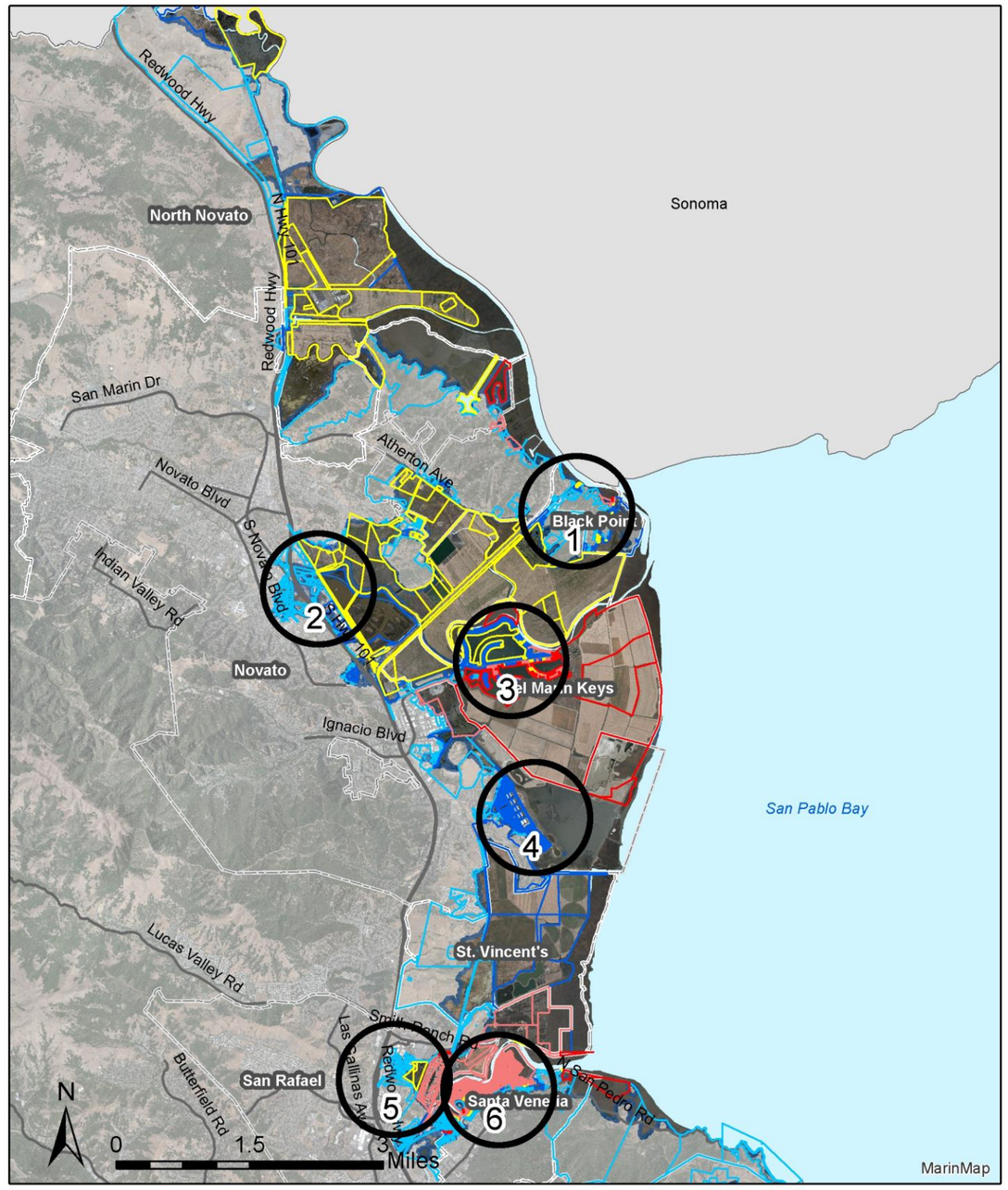
Map 10. Northern Study Area Parcels Vulnerable to Sea Level Rise

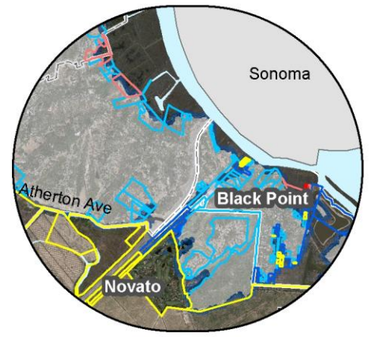
Vulnerable Parcels

- Scen. 1: 10" Sea Level Rise (SLR)
- Scen. 2: 10" SLR+Storm Surge
- Scen. 3: 20" Sea Level Rise
- Scen. 4: 20" SLR+Storm Surge
- Scen. 5: 60" Sea Level Rise
- Scen. 6: 60" SLR+Storm Surge

Location Indicators

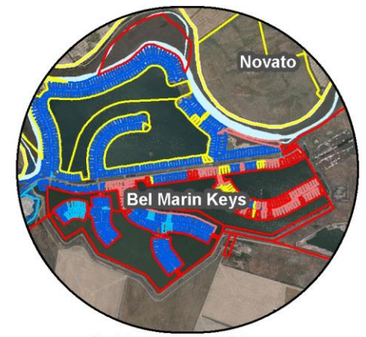
- Unincorporated
- Municipality
- Road
- Bay
- Inland Extent: Sea Level @ 60"+100-year Storm





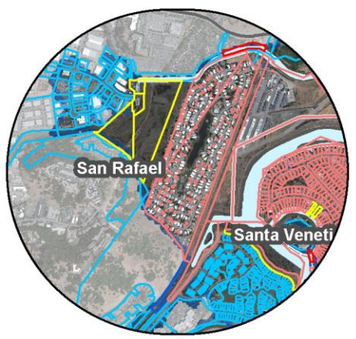
1: Black Point/Green Point

2: U.S. Hwy. 101 @ Rowland Blvd.

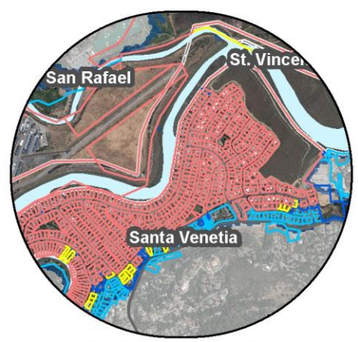


3: Bel Marin Keys

4: Hamilton



5: Marin Lagoon/ Marin Commons



6: Santa Venetia

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

EVB CONSULTING

Date: 4/1/2017

OCOF CoSMoS

Map 11. Southern Study Area Parcels Vulnerable to Sea Level Rise and a 100-year Storm Surge

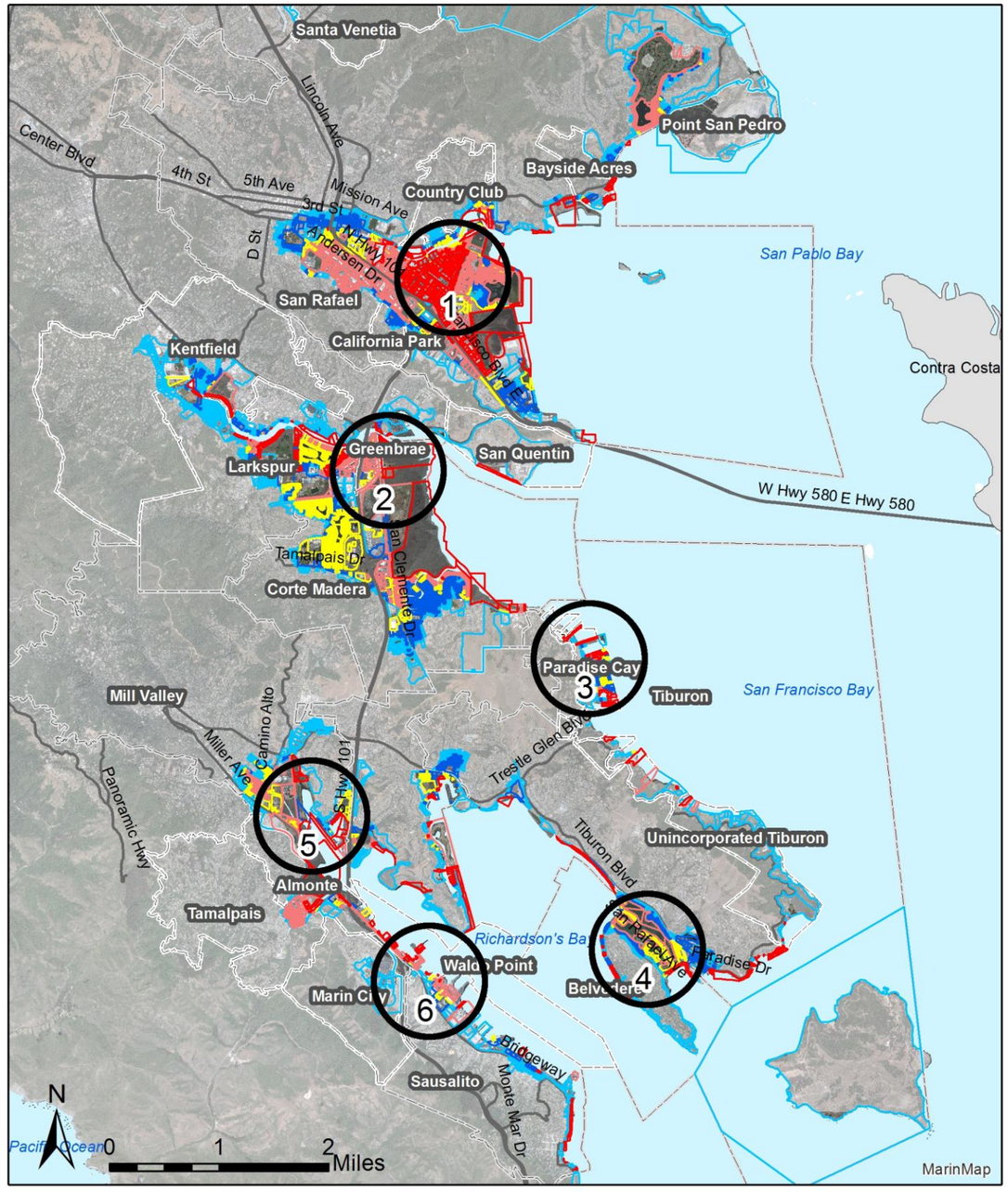
Ne residents

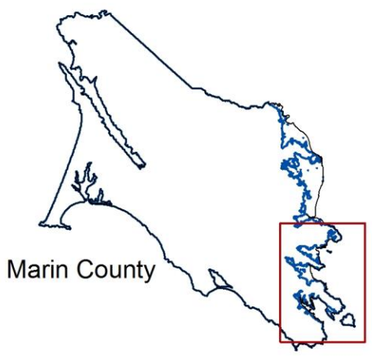
Vulnerable Parcels

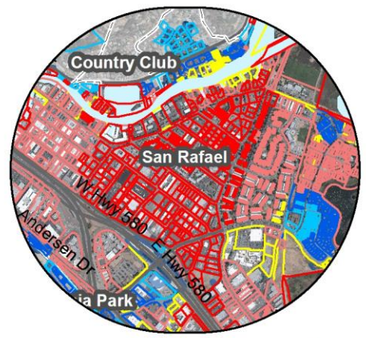
- Scen. 1: 10" Sea Level Rise (SLR)
- Scen. 2: 10" SLR+Storm Surge
- Scen. 3: 20" Sea Level Rise
- Scen. 4: 20" SLR+Storm Surge
- Scen. 5: 60" Sea Level Rise
- Scen. 6: 60" SLR+Storm Surge

Location Indicators

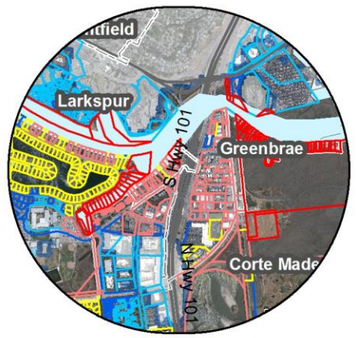
- Unincorporated
- Municipality
- Road
- Bay
- Inland Extent: Sea Level @ 60"+100-year Storm



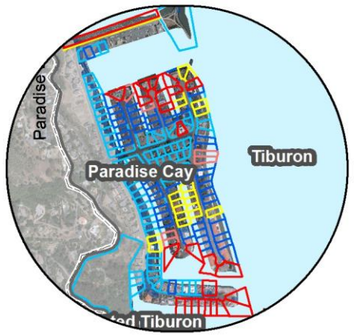




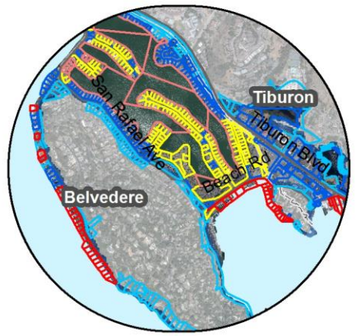
1: Canal Neighborhood



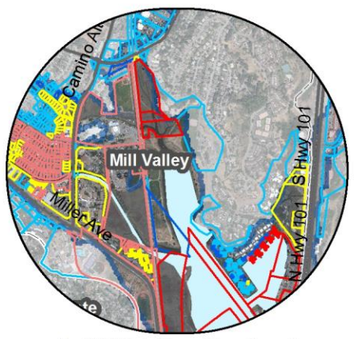
2: Greenbrae/Larkspur



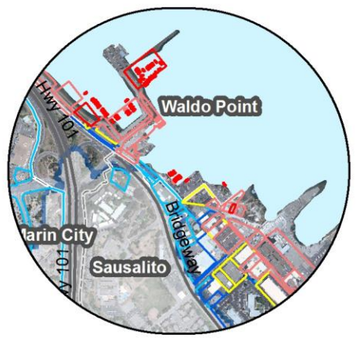
3: Paradise Cay



4: Belvedere/Tiburon



5: Mill Valley Bayfront



6: Waldo Pt. Harbor

Date: 6/15/2017

Disclaimer: Vulnerability Assessment maps, tables, etc. can be used as a resource to help identify potential hazardous areas and vulnerable assets. Marin County, and data providers here in, make no warranties of the accuracy or completeness of maps and data. Maps are representational and subject to future revision. Local site conditions must be examined. Commercial use is prohibited.

Other Considerations

Economic

The Marin shoreline accounts for hundreds of millions of dollars in economic activity. The more than 12,000 vulnerable properties, account for $9 billion[46] in assessed land value as shown in Table 15. Buildings account for even more value, as presented in the Buildings Profile. Unincorporated Marin parcels that are expected to be vulnerable to sea level rise contribute $100 million[47] in annual property tax revenue to roughly 55 taxing agencies. Municipal tax revenues would add several hundred million in additional revenues to this figure. Table 16 breaks down the $100 million in property tax contributions from the vulnerable properties in unincorporated Marin. Improvements, such as buildings and utility services, also contribute to tax contribution figures.

Properties that become part of the tidal prism could face new or increasing lease costs for existing on what would become public trust land. This would add an extra cost of living for shoreline property owners. Consequently, in some cases, state regulatory requirements could be a hurdle for individual property owners in preparing for sea level rise and maintaining their properties in the most cost effective ways.

Finally, several areas are protected by shoreline armoring, such as seawalls, revetments, levees, bulkheads, bluff walls, and other hard engineering structures, to impede flooding and erosion. These protective structures may be, or become, too low, requiring increased maintenance, replacement, or relocation as tides rise. Typically, any of these improvements can be costly to a land owner or to tax payers. Many structures are in need of repair to withstand existing conditions. Several structures in the northern study area are on public lands and maintained by a government agency. Individual private properties in Santa Venetia and other shoreline locations also feature protective walls.

Table 15. Assed Value of Vulnerable Parcels in Long-term Scenario 6

Location	Assessed Land Value
Municipalities	
Belvedere	$514,534,915
Corte Madera	$587,230,682
Larkspur	$545,595,904
Mill Valley	$251,987,082
Novato	$367,196,698
San Rafael	$1,121,051,641
Sausalito	$208,295,600
Tiburon	$225,509,830
Unincorporated Jurisdictions	
Almonte	$257,783,545
Bayside Acres	$69,653,807
Bel Marin Keys	$189,484,482
Black Point	$160,685,655
California Park	$42,337,997
Country Club	$158,247,024
Greenbrae	$15,424,906
Kentfield	$1,680,999,994
Marin City	$114,975,806
North Novato	$186,992,022
Paradise Cay	$193,534,136
Pt. San Pedro	$26,235
San Quentin	$8,213,721
Santa Venetia	$347,647,404
St. Vincent's	$5,532,566
Strawberry	$954,668,631
Tamalpais Valley	$853,733,767
Tiburon	$170,837,044
Waldo Point Harbor	$6,174,871
Total	**$9,238,355,965**

Source: Marin County Department of Finance 2015/2016 tax year

[46] 2016 dollars
[47] 2016 dollars

Table 16. Tax Generation for Parcels Vulnerable to Sea Level Rise Long-term Scenario 6

Tax District	Tax Revenue
County General	$22,835,222
Tamalpais High School District	$10,781,271
Marin Community College	$7,360,565
Education Revenue Augment	$7,303,352
Mill Valley School District	$6,991,178
Southern Marin Fire	$5,750,363
Kentfield School District	$5,225,279
Kentfield Fire	$4,109,315
Novato Unified School District	$3,765,050
County Library	$2,954,595
County School Service Fund	$2,528,240
San Rafael Elementary Schools	$2,253,634
Community Service Area (CSA) #19 Fire Protection	$1,950,984
Novato Fire	$1,906,311
San Rafael High School	$1,690,337
Ross Valley Sanitation No. 1	$1,564,305
Reed Union School	$1,446,789
Marin County Open Space	$1,020,102
Tiburon Fire	$795,261
Richardson Bay Sanitation	$745,599
Tamalpais Community Service District (CSD)	$649,472
Flood Control Zone (FCZ) 3 Richardson Bay	$635,130
Marin County Highway Lt	$615,373
Sausalito-Marin City School District	$595,858
Marin County Transit	$586,546
County Fire Department	$512,272
Ross School	$493,532
Strawberry Recreation	$473,938
Bel Marin Keys CSD	$443,596
CSA 17 Kentfield	$401,931
FCZ 7 Santa Venetia	$359,149
Mosquito Abatement	$317,948
Corte Madera Sanitation No. 2	$288,308
Marin City CSD	$270,722
FCZ 1 Novato	$215,209
Bay Area Air Quality	$205,089
#6 Novato Sanitation	$146,654
CSA 18 Gallinas	$128,756
FCZ 4 Bel Aire	$127,962
Almonte Sanitation	$108,938
Las Gallinas Valley Sanitary District	$104,146
FCZ 9 Ross Valley	$81,954
Larkspur-Corte Madera School District	$80,287
San Rafael Sanitation	$64,836
CSA 6 Santa Venetia	$57,811
Sausalito-Marin City Sanitation	$55,230
CSA 16 Greenbrae	$46,234
Tiburon Sanitation No. 5	$41,804
Murray Park Sanitation	$41,684
San Quentin Sanitation	$19,282
Alto Sanitation	$19,182
CSA 9 Northbridge	$12,074
North Marin Water	$10,822
Petaluma Joint High	$7,026
Dixie School District	$6,543
Santa Rosa Junior College-Laguna Joint School	$1,275
Lincoln School	$723
Total	**$101,205,044**

Source: S. Kucharos, County of Marin Department of Revenue, June 6. 2016

Environmental

Existing seawalls and other shoreline protective devices that could be enhanced or added to protect buildings could result in the loss of beaches, wetlands, and other habitats and recreational areas by preventing these areas from migrating inland. Industrial sites could contain toxic chemicals that could be ecologically damaging if it enters the bay waters. As tidewaters move into marshlands, high marsh, or areas with infrequent saturation could become saturated more often and shift to low marsh, and eventually mudflats, and lastly open water. This could have devastating impacts on natural and recreational resources. Developing new unimproved lands to replace the land that becomes undevelopable could destroy inland habitats. Additionally, upgrading infrastructure that already passes through sensitive marsh and tidal habitats could be temporarily impaired as room is made to

undergo construction. To learn more about the outfall of these potential consequences, see the Natural Resources and Recreation Profiles.

Social Equity

The primary issue with respect to parcels is the difference in tenure. Property owners may be more able to prepare for and implement preparation measures to protect their wellbeing. Whereas, renters would not have the power or ability to change their residence in advance of sea level rise and would be dependent on the action of the property owner and larger public works. This is especially critical because a significant portion of the properties impacted in the near-term host large numbers of multi-family rental units, this disconnect could present challenges in reaching the residents and ensuring their safety.

Without programs to get the word out, renters may miss out on important information and resources to stay safe during storm events and prepare for sea level rise. With long-term sea level rise, displaced residents may not have access to equivalent or affordable housing near the jobs, schools, social networks, and facilities they rely on.

Public shoreline access may also be diminished as parks become inundated, impacting recreational opportunities for everyone, though these impacts could be disproportionately burdensome by lower-income households, especially those fish for food off of public piers and pathways. See the Recreation Profile to learn more about public land equity considerations.

Management

On County of Marin jurisdiction lands, the Baylands District provides for open space, outdoor recreation, and other open lands, including areas suited for park and recreational purposes, access to beaches, and areas that link major recreation areas. State and Federal areas are managed by policies of those governing agencies to provide public access as well.

The Bay Conservation Development Commission (BCDC) retains development permit authority over tidelands below mean high tide, submerged lands, and public trust lands. Potential state boundary changes could occur as waters rise and shift mean sea level rise inland. This would cause the public trust land boundary and regulations to move further inland. This could complicate existing property ownership and management.

In addition, political will and funding would be required to acquire land for necessary road alterations, or other public infrastructure relocations. In most cases, facilities and structures on private property are the responsibility of the property owner. This can present complications when shoreline armoring is owned by individual property owners as is the case in Santa Venetia. Efforts to improve the levees on a comprehensive scale may prove challenging amongst so many decision makers