

COASTAL ENGINEERING CONDITION EVALUATION

CARMEL CITY COUNCIL MEETING

9 MARCH 2023

PRESENTATION BY:

Moses Cuprill, Haro Kasunich and
Associates, Inc.



David Revell & Matthew Jamieson,
Integral Consulting



Coastal Engineering Assessment

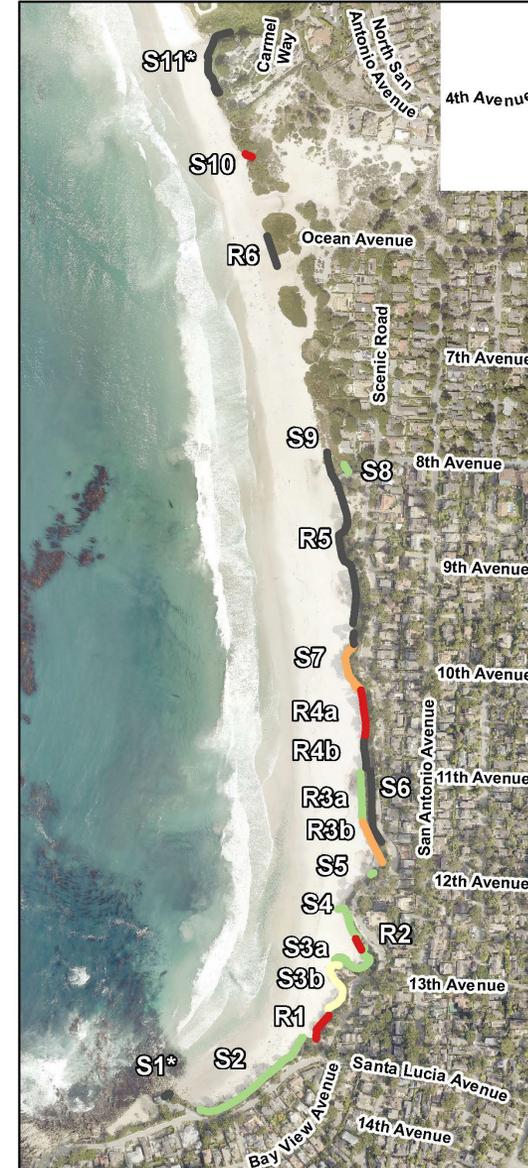
- The HKA team surveyed Carmel Beach on 12/22/2022 & 1/30/2023 from Pescadero Canyon to Martin Way.
- The survey occurred during low tide and following deep scour events.
- HKA took measurements, and photos, and assessed the condition of every seawall, revetment, and stairway to the beach.
- HKA determined the repair needs, rated the repair priority, and identified any public hazards.



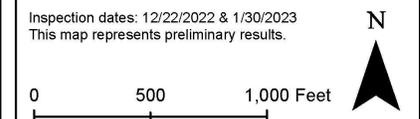
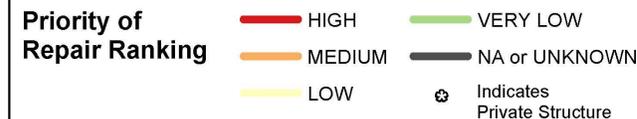
Assessment Findings

- **17** coastal armoring structures were assessed including **6 riprap revetments** and **11 vertical seawalls**. **11 coastal access stairways** were also assessed.
- Seawalls are identified with an **S**, revetments **R**, and stairs **ST**.
- The map shows the priority of repair rankings from **very low** to **high**
- Of the **6** revetments, **4** are in need of repair; **one** in its **entirety** and the others in some portions. The other two revetments were buried in beach sand and the condition was unknown.
- Of the **11** Stairways that we inspected, we recommend **9** be **repaired or modified**. Three we classified as a **high priority**, **4** as a **medium priority**, and **2** as **low priority**.

Coastal Armoring
Seawalls and Revetments



Coastal Access
Stairways and Boardwalks



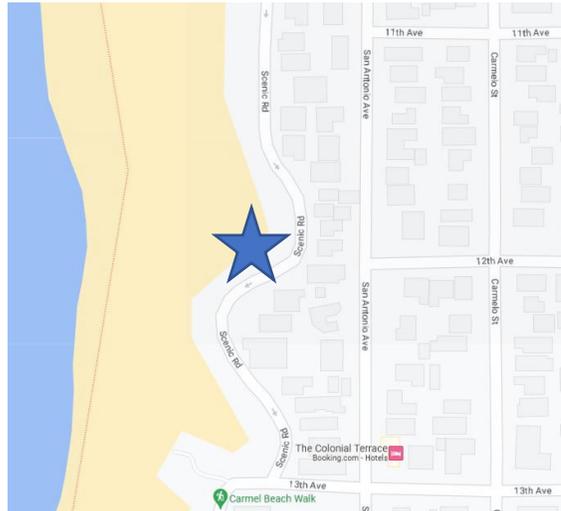
Stairway overview

- **11** total stairways were assessed
- Priority of repair:
 - **4** are high priority
 - **4** are medium priority
 - **3** are low priority



High-priority repairs for stairs

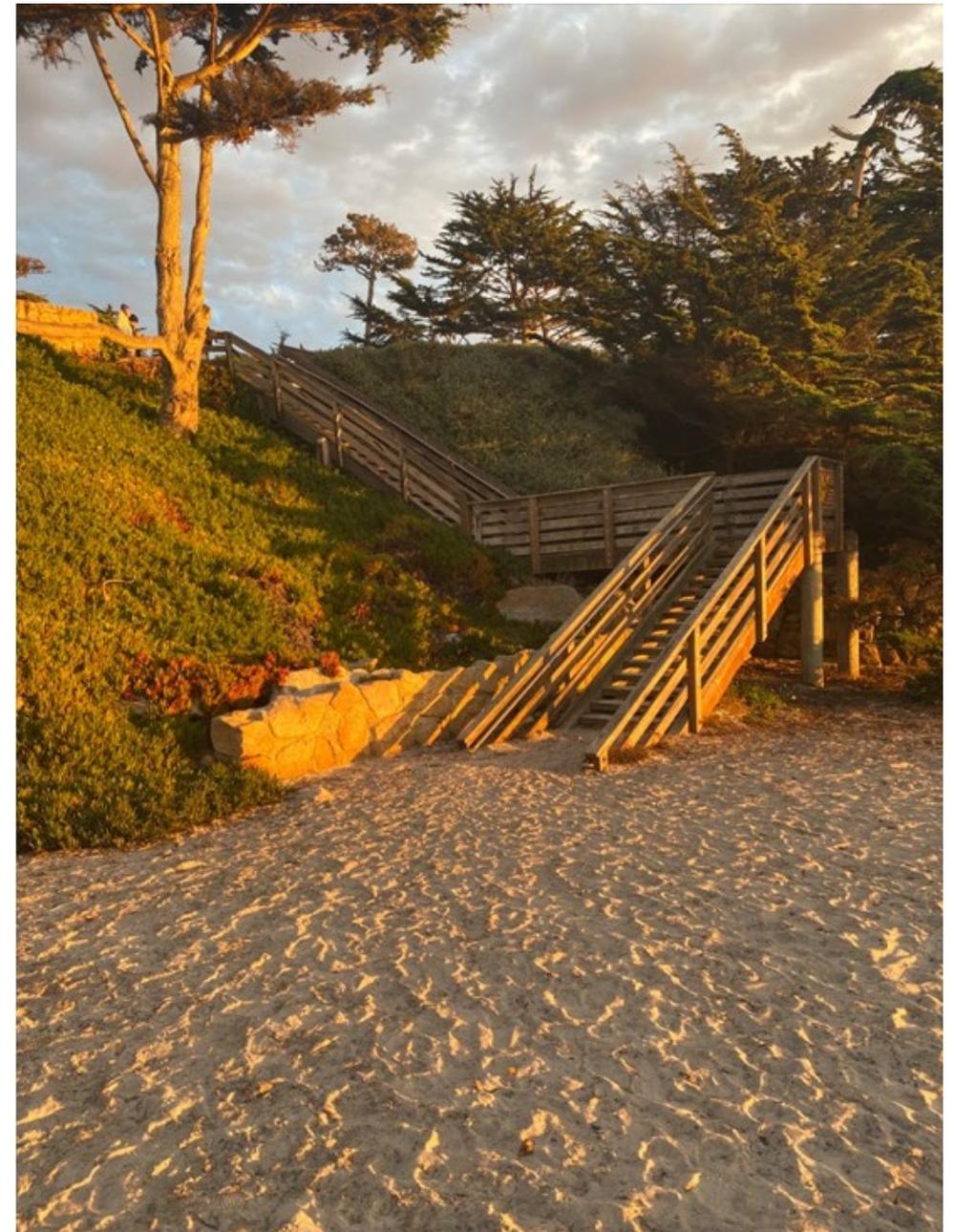
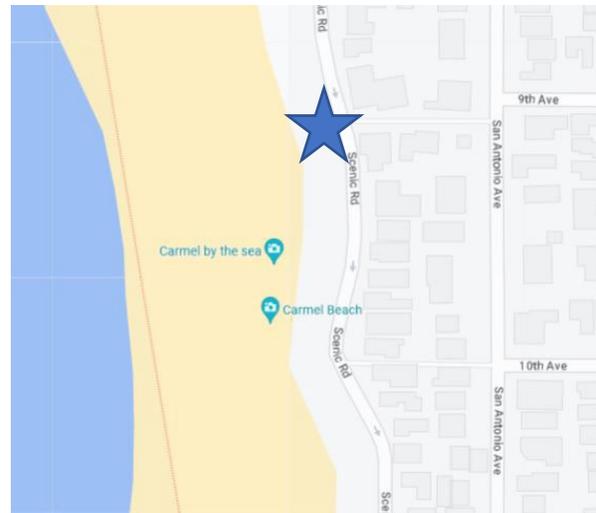
- A total of **4** staircases out of **11**
- Right: The beach access stairway at Scenic Rd and 12th Ave has significantly corroded hardware and splitting wood members.



ST4 at 12th Ave. Source: Greg Easton, 2016

High-priority repairs for stairs

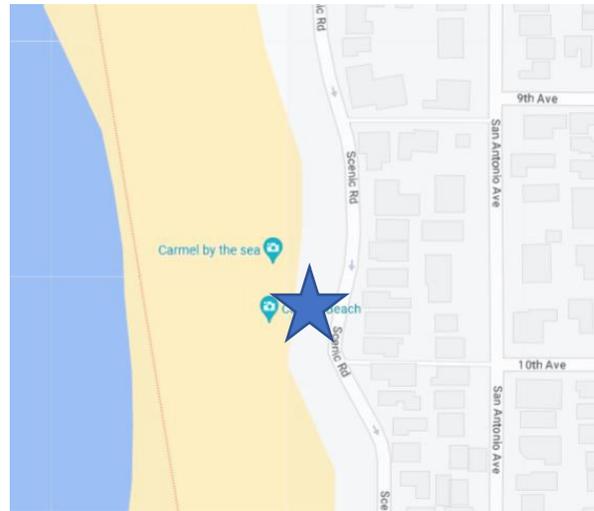
- Beach sand at high elevation along the backshore
- Stairs function well



ST 8 between 9th Ave and 10th Ave

High-priority repairs for stairs

- Deep sand scour condition along backshore
- Stairs have a several feet vertical drop
- Beachgoers may get stranded or jump
- Needs: additional treads + landing to bedrock platform



ST7 between 10th and 9th

Medium-priority repairs for stairs

- 4 out of 11 are ranked medium priority
- Worn down or uneven stair treads.
- Minor amounts of corrosion.
- No additional structural or corrosion inspection needed.
- Sand blast steel reinforcement and patch with concrete grout.
- ST6 between 10th & 11th Ave
- ST1 at Martin Way, ST5 at 11th, ST9 at 8th Ave



ST6 between 10th & 11th Ave

Low-priority repairs for stairs

- 3 out of 11 are ranked low priority.
- In general stairs in good shape.
- No noticeable corrosion.
- Treads are uniform
- Some with bent handrails.
- ST2 at Bay View and Santa Lucia



ST2 at Bay View and Santa Lucia

Low-priority repairs for stairs

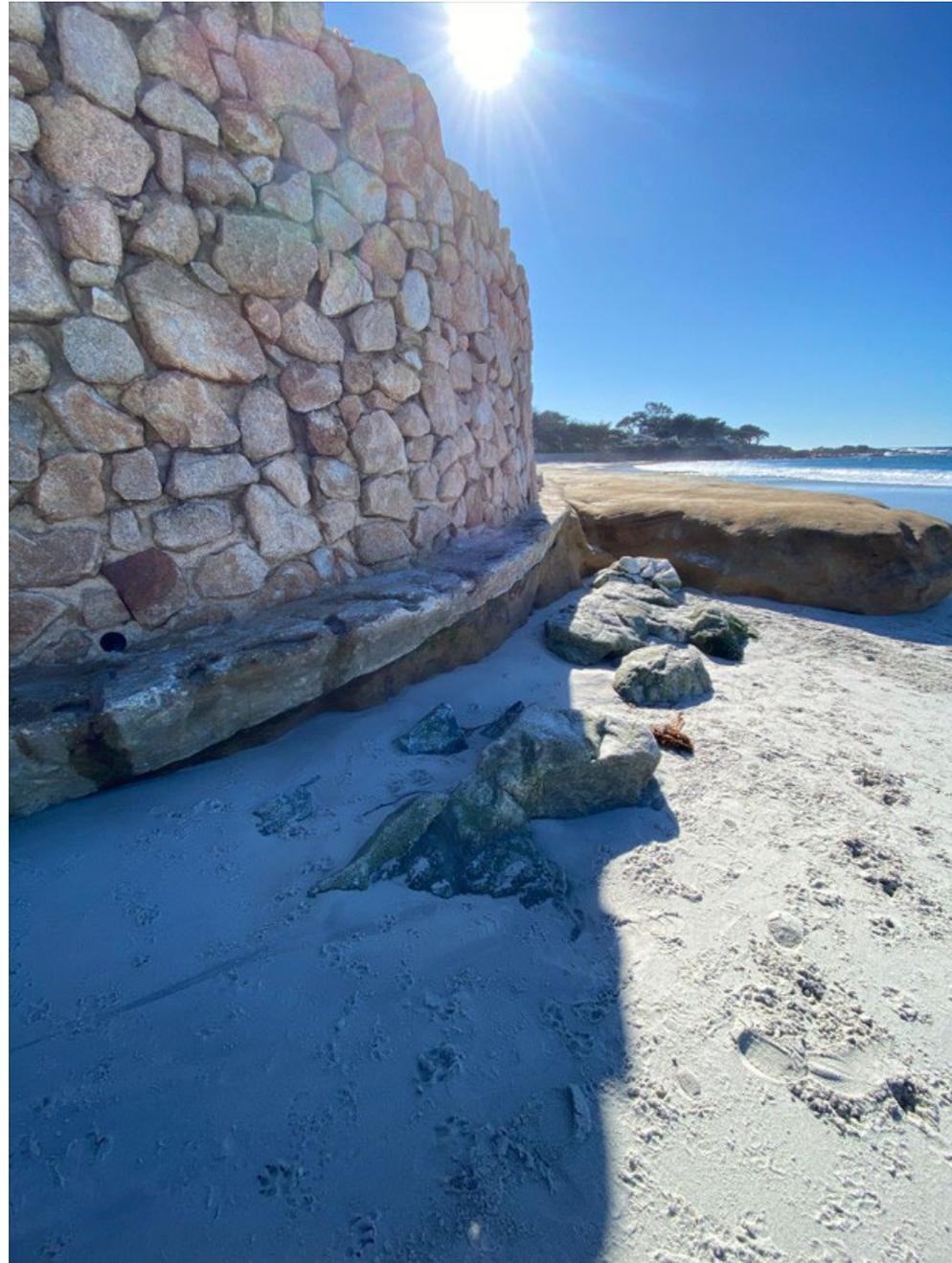
- ST3 near 13th Ave
- Stairs are in good shape
- Example of situation where it is difficult to navigate shoreline during deep scour events.
- Solution is to extend the staircase to long-term scour elevation



- ST3 near 13th Ave

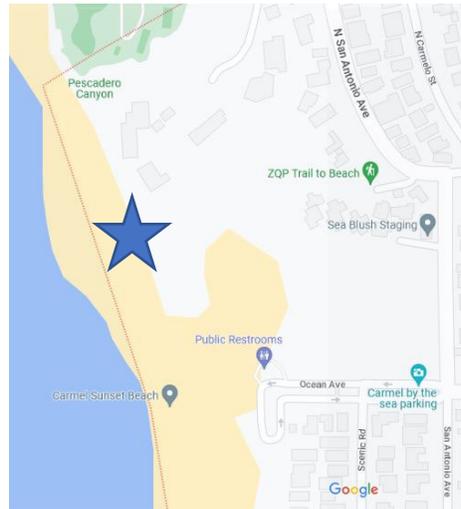
Seawalls overview

- **11** total seawalls were assessed
- Priority of repair:
 - **1** is a high priority
 - **1** is a medium priority
 - **6** are a low priority
 - **3** are private property or NA



High-priority repairs for seawalls

- Seawall just west of the beach volleyball courts between Ocean Ave and Carmel Way.
- Structure is significantly deteriorated and is unstable.
- Demolish and rebuild.



S10 between Carmel Way and Ocean Ave

Medium-priority repairs for seawalls

- S7 at 10th Ave
- Drainpipe is corroded and collapsed 3' behind wall



Low and very low-priority repairs for seawalls

- S3 near 13th Ave
- Seawall stem and foundation in good shape.
- Minor amounts of undermining of seawall foundation from bedrock scour.
- Low rate of bedrock scour due to sand cover protection from wave runnup.



Low and very low-priority repairs for seawalls

- Carving may be 1 inch deep into sandstone dated January 2006 has not eroded away.



High-priority repairs for revetments

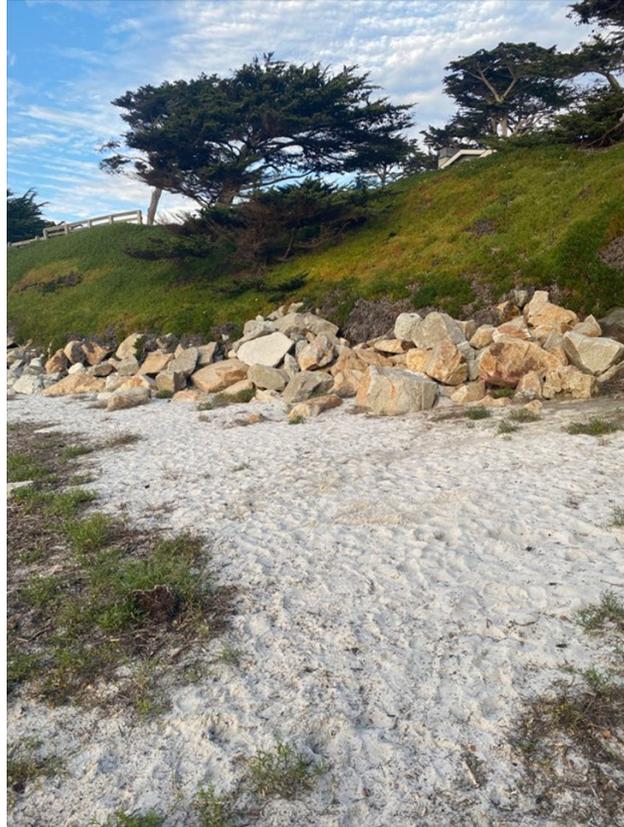
- Only **4** out of **6** rip rap revetments were inspected due to sand cover.
- **3 high priority** ranking and **1 medium to very low**.
- Issues:
 - Rip rap stacked at over steep slope gradient.
 - Undersized rip rap for wave forces.
 - Not properly keyed into bedrock.
- Remove undersize rock and rebuild



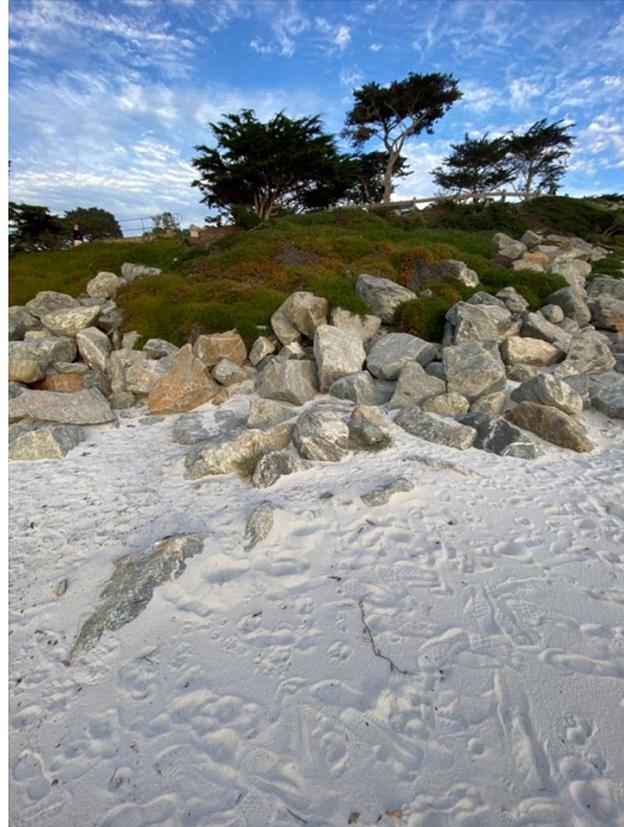
R4a between 10th Ave and 11th Ave

Riprap in need of restacking

R5 near 10th Ave



R5 near 9th Ave



R5 near 8th Ave



Detailed Datasheet

Structure	Approximate Location	Repair Needed?	Risk to Beach Users	Priority of Repair	Estimated Existing Life of Structure Until it Ceases to Protect Coastal Access Path, Stairs and Roadway (Yrs)	Note 1	Note 2
Stairways							
ST1	Martin Way	YES	UNKNOWN**	MEDIUM**	NA	Corroded Structural Elements, Footing on Bedrock	Maintenance Is Essential for Pedestrian Safety
ST2	Santa Lucia Avenue	YES	NO	LOW	NA	Downcoast Railing Bent from Log Impact	Maintenance Is Essential for Pedestrian Safety
ST3	13th Avenue	NO	YES During Scour Events	LOW	NA	Great Condition, Stairs End on Elevated Bedrock Platform; Consider Extending Stairs to Scoured Beach Level	Maintenance Is Essential for Pedestrian Safety
ST4	12th Avenue	YES	YES	HIGH	NA	Hazardous; Undermined in EG Fig 1 (2016?). Corroded Hardware	Maintenance Is Essential for Pedestrian Safety
ST5	11th Avenue	YES	YES During Scour Events	MEDIUM	NA	Concrete Treads Worn; Stairs End on Elevated Bedrock Platform; Consider Extending Stairs to Scoured Beach Level	Maintenance Is Essential for Pedestrian Safety
ST6	S of 10th Avenue	YES	YES	MEDIUM	NA	Needs Minor Tread Work; Corroded Rebar Exposed; Concrete Spalling	Maintenance Is Essential for Pedestrian Safety
ST7	N of 10th Avenue	YES	YES During Scour Events	HIGH**	NA	Toe of Stairs Undermined by Scour 1/2023; Hazardous; Easton (2016?) Said Look at 2008 CRP Photo	Maintenance Is Essential for Pedestrian Safety
ST8	9th Avenue	YES	YES	HIGH	NA	Stairway Terminates Before Reaching Beach During Scour; Needs Seaward Extension	Maintenance Is Essential for Pedestrian Safety
ST9	8th Avenue	YES	YES	MEDIUM	NA	Rock and Mortar Steps; Worn Natural Rock Surfaced Treads Create Slippery Condition	Maintenance Is Essential for Pedestrian Safety
ST10	Ocean Avenue	NO	NO	LOW	NA	Coastal Overlook and Boardwalk; Not Subject to Wave Impact	Maintenance Is Essential for Pedestrian Safety
ST11	Dunes	YES	YES	HIGH	NA	Hazardous; Broken Guard and Handrail on Upcoast Side of lowest Run	Maintenance Is Essential for Pedestrian Safety
Seawalls							
S1	At FLW House	UNKNOWN	NO	NA	30+?	Upcoast corner will need maintenance	Private Property
S2	FLW Home to Santa Lucia	NO	NO	VERY LOW	30+	Good Condition, Slight Undermining Noted in Two Spots	Upcoast End (Last 5 Ft) Has been Undermined and Patched, Some Seepage Below
S3	13th Avenue	NO	YES	VERY LOW (Upcoast) LOW (Downcoast)	Upcoast Part = 50, Downcoast = 20+	In Cove, Sloppy Pumped Concrete on Beach, Downcoast Part is Subject to Slow Undermining	Upcoast Part is Newer Neill Engineers Wall (2010?)
S4	N of 13th Avenue	NO	NO	VERY LOW	Most = 30+; Undersized Rock Area = 0	Mostly Good Condition; Founded on Bedrock Platform; One Section with Undersized Rock Has Failed	
S5	Outfall at 12th Avenue	NO	NO	VERY LOW	30+	Good Condition, Monitor Annually	Small Storm Drain Splash Block Armor
S6	Scenic Rd Retaining Wall	NO	NO	NA	Not a Coastal Protection Structure	Short Coastal Path Wall??? Not Subject to Wave Impact	
S7	Between Stairways 6 and 7	YES	NO	MEDIUM	30	Wall Crack Below Failed Metal 16" Dia Storm Drain Pipe Thru Seawall; Pipe Replacement Needed	Mortar is starting to deteriorate; tuck pointing maintenance needed
S8	Retaining Wall at 8th Ave	NO	NO	VERY LOW	30+	Blufftop Retaining Wall Around Pump Station	Good Condition
S9	Outfall at 8th Ave	NO	NO	VERY LOW	20	CMP Storm Drain Headwall; 60 LF Scattered Rip-rap Below; Rip-rap Foundation Condition Uncertain	Monitor during Scour
S10	Dunes Outfall	YES	YES	HIGH	0 to 10 Until Collapse	Failing/Failed 3x3' Box Culvert Storm Drain Outfall Wall; Needs Replacement	Concrete Cracked, Undermined, Outflanked, Corroded Rebar, Visually Undesirable
S11	At Pescadero Creek Home	UNKNOWN	NO	NA	30?	Private Property (ADJUST LENGTH ON MAP TO DELETE WOOD WALL)	Private Property
Revetments							
R1	Between S2 and S3	YES; Upcoast 1/3	YES	HIGH	Upcoast 1/3 = 0	Upcoast 1/3 Oversteepened, No Filter Fabric, Unstable, Potentially Unsafe	Public Will Benefit from Replacement
R2	Between S3 and S4	YES	NO	HIGH	0 to 5	Failing Structure, Has Voids, Undersized Quarrystone, EG Photo 1	Public Will Benefit from Restacking or Replacement; Consider Vertical Wall Here
R3	Between 11th and 12th Ave	YES; Downcoast 1/4	NO	MEDIUM (Downcoast 1/4); VERY LOW (Upcoast 3/4)	Downcoast 1/4 = 10; Upcoast 3/4 = 30	Downcoast 1/4 Poorly Stacked, Has Had Instability; Upcoast 3/4 REJA 1983	Upper 1/2? Covered by Iceplant; Could Not Inspect It
R4	Between 10th and 11th Ave	YES; Upcoast 1/3	NO	HIGH (Upcoast 1/3); UNKNOWN (Downcoast 2/3)	Upcoast 1/3 = 0 to 5; Downcoast 2/3 = Unknown	Few Quarrystones Visible 12/22/2022 and 1/30/2023; Back Beach Vegetated 12/2022; Monitor When Exposed	Downcoast 2/3 Not Exposed Enough to Inspect Now; Recommend Re-Inspection When Exposed
R5	Between 8th and 10th Ave	Unable to Assess	NO	Unable to Assess	Unknown	Few Quarrystones Visible 1/2023; Monitor When Exposed; May Be Founded on Sand; Downcoast End Has Slumped;	Not Exposed Enough to Inspect Now; Recommend Re-Inspection When Exposed
R6	At Ocean Avenue	Unable to Assess	NO	Unable to Assess	Unknown	Few Quarrystones Visible 1/2023; Monitor When Exposed; May Be Founded on Sand; Downcoast End Has Slumped;	Not Exposed Enough to Inspect Now; Recommend Re-Inspection When Exposed

Detailed Datasheet cont.

Structure	Approximate Location	Date of Inspection	Length (Ft)*	Visible Height (Ft)	Total Height (Ft)	Guesstimated Footprint Area (Ft ²)	Estimated Surface Slope Gradient (H:V)	Estimated Quarrystone Size Range (Tons)	Estimated Rip Rap Volume (CY)	Adequate Protection?	Repair Needed?
Identifier											
Stairways											
ST1	Martin Way	12/22/2022 & 1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST2	Sata Lucia Avenue	12/22/2022 & 1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST3	13th Avenue	12/22/2022 & 1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	NO
ST4	12th Avenue	12/22/2022 & 1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST5	11th Avenue	12/22/2022 & 1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST6	S of 10th Avenue	12/22/2022 & 1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST7	N of 10th Avenue	1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST8	9th Avenue	1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST9	8th Avenue	1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
ST10	Ocean Avenue	1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	NO
ST11	Dunes	1/30/2023	NA	NA	NA	NA	NA	NA	NA	NA	YES
Seawalls											
S1	At FLW House	12/22/2022 & 1/30/2023	27	5	5	162	0:1(Vertical)	NA	0	YES	UNKNOWN
S2	FLW Home to Santa Lucia	12/22/2022 & 1/30/2023	565	8 to 13	8 to 13	1695	0:1(Vertical)	NA	0	YES	NO
S3	13th Avenue	12/22/2022 & 1/30/2023	556	6 to 14	11 to 14?	1668	0:1(Vertical)	NA	0	YES	NO
S4	N of 13th Avenue	12/22/2022 & 1/30/2023	168	6 to 8	6 to 8	504	0:1(Vertical)	NA	0	YES	NO
S5	Outfall at 12th Avenue	12/22/2022 & 1/30/2023	13	8?	8?	39	0:1(Vertical)	NA	0	YES	NO
S6	Scenic Rd Retaining Wall	12/22/2022 & 1/30/2023	317	3	3	951	0:1(Vertical)	NA	0	YES	NO
S7	Between Stairways 6 and 7	12/22/2022 & 1/30/2023	541	8 to 13	8 to 13	1623	0:1(Vertical)	NA	0	YES	YES
S8	Retaining Wall at 8th Ave	1/30/2023	37	2 to 4	2 to 4	111	0:1(Vertical)	NA	0	YES	NO
S9	Outfall at 8th Ave	1/30/2023	13	8 to 10	8 to 10	39	0:1(Vertical)	NA	0	YES	NO
S10	Dunes Outfall	1/30/2023	31	12?	12?	93	0:1(Vertical)	NA	0	NO	YES
S11	At Pescadero Creek Home	1/30/2023	358	6 to 10	Unknown	3580	0:1(Vertical)	NA	0	YES	UNKNOWN
Revetments											
R1	Between S2 and S3	12/22/2022 & 1/30/2023	118			2360	Upcoast 1/3 is 1:1	Upcoast 1/3 is 1 Ton		NO; Upcoast 1/3	YES; Upcoast 1/3
R2	Between S3 and S4	12/22/2022 & 1/30/2023	50			1000	3:1?	< 1 Ton		NO; Upcoast 1/3	YES
R3	Between 11th and 12th Ave	12/22/2022 & 1/30/2023	406	Unknown	Unknown	8120	1.5 to 2.0:1	Upcoast 3/4; 2 to 4 Ton		YES; Upcoast 3/4	YES; Downcoast 1/4
R4	Between 10th and 11th Ave	12/22/2022 & 1/30/2023	336	Unknown	Unknown	6720	Unknown	Unknown	Unknown	NO; Upcoast 1/3	YES; Upcoast 1/3
R5	Between 8th and 10th Ave	1/30/2023	815	6**	Unknown	16300	Unknown	Unknown	Unknown	MAYBE	Unable to Assess
R6	At Ocean Avenue	1/30/2023	136	6 to 7			2:1			MAYBE	Unable to Assess

Thank you!

