CESPL-EDD-C 20 September 2023

MEMORANDUM FOR CESPL-PM-N

SUBJECT: 2023 Redondo Beach King Harbor Structure Condition Inspections

1. The protective coastal structures at Redondo Beach King Harbor were inspected on 9 June 2023 by Caleb Lodge, Matt Wesley and the undersigned, Chuck Mesa, Blake Horita and several representatives from the City of Redondo Beach were also in attendance. This was a routine annual inspection of the North Breakwater and South Breakwater, in accordance with the coastal navigation structure condition inspection program. The purpose was to identify any major and/or significant changes in structural condition that would warrant further investigative action. The observations recorded herein are cursory and general in nature and are not intended to replace the detailed observations, analysis, and conclusions of a comprehensive structure condition inspection. The stationing reported herein is approximate and measured in feet via successive chaining. The inspection was conducted during the period 8:30 – 12:30. The tides ranged from +0.25 to +2.15 ft. MLLW during the inspection. Oceanographic conditions during the time of the inspection did not hinder inspection operations.

2. This walking inspection noted many aspects of structure condition including crest width and elevation, side slope geometry, missing and/or ejected armor stones, and armor stone interlocking. Only those areas that deviate from a good condition are noted.

3. The structures are assigned a District Combined Rating (DCR) which consists of two components: the Structural Condition Rating (SCR) and the Functional Condition Rating (FCR). These ratings are defined in the Coastal Operational Condition Assessment Level One Basic Inspection website and the results of this inspection will be used to update the database.

4. The North Breakwater is given a DCR of ‘B’ based on a SCR of ‘D’ and a FCR of ‘A’. Damage areas along the seaward side of the structure noted in previous inspections have progressed between stations 15+50 and 23+00 with a near breach observed at station 17+25. The harbor side bench shows significant damage at station 20+00 and between stations 24+00 and 28+00. Damage to the seaward side between stations 47+00 and 49+50 have progressed and the portion of the structure having a lower design crest elevation is significantly deteriorated with near breaches observed at 49+70 and 50+00.The navigation aid is missing from the head section while the pedestal and base remain intact. The structure has been authorized for construction funding for repairs, work is anticipated to occur in spring of 2024.

5. The South Breakwater maintains a DCR of ‘A’ based on a SCR of ‘A’ and a FCR of ‘A’. The structure is in good condition with only minimal observable damage.

6. A listing of the specific structure condition observations and/or deficiencies is shown in Appendix A. Field photographs are presented in Appendix B and wave data from the notable swell events that have occurred since the last inspection are included as Appendix C. Any questions concerning this inspection report can be directed to the undersigned.

Chris Hayward

HAYWARD.CHRISTOPHER.ALAN.1541095647 Digitally signed by HAYWARD.CHRISTOPHER.ALAN.1541095647 Date: 2023.10.11 13:38:05 -07'00'

Coastal Engineering Section

APPENDIX A

Redondo Beach King Harbor
2023Condition Inspection
Field Notes

North Breakwater	
Station (s)	Description
15+50 – 16+00	Condition 3. Oversteepened slope on seaward side as seaward slope is failing, armor stones are separating from seaward shoulder, bridging of slope stones above voids. Damage extends from waterline into central crest.
16+10 – 16+40	Condition 3. Oversteepened seaward slope, missing and separated stones at waterline causing loss of interlock on slope up to seaward shoulder. Several missing stones at seaward waterline, outer layer of stones on the seaward slope are missing creating an oversteepened slope and loss of interlock. Damage is approximately 30 feet wide extending from waterline up to crest, additional damage visible on either side of Condition 3 area.
17+00 – 17+50	Condition 4, near breach centered at 17+25. Seaward face of slope has failed, remaining stones are losing interlock revealing underlayer. Multiple stones upturned on structure crest. Damage extends from waterline through central crest. Harbor side shoulder is still intact.
17+75 - 18+00	Condition 2. Loss of interlock along seaward slope resulting in loss of crest elevation on seaward shoulder, damage is progression from Condition 4 area centered at 17+25.
18+00 – 18+20	Condition 3. Several stones missing at waterline of seaward side causing slope stones to slide down the slope and loss of interlock throughout. Upturned stone at waterline and bridged/perched stone at 18+30. Damage appears to have progressed from previous inspection.
18+50	Condition 3. Missing armor stone on seaward slope from waterline up to seaward shoulder. Damage area is roughly 15 feet (approx. 1 stone width) wide. Stones on either side of damage area beginning to separate from structure resulting in 2 perched stones. Damage is newly formed based on comparison of previous 2 inspection reports.
18+75 – 19+00	Condition 2. Missing stones at waterline of seaward side causing slope stones to slide down and some bridging of stones on the upper slope. Loss of crest elevation on seaward shoulder.
19+60 - 19+80	Condition 3. Damage has progressed since previous inspection. Several armor stones separated at waterline, resulting in an oversteepened seaward slope and loss of crest elevation along the seaward shoulder. Damage extends from water line into central crest of structure. Stones on either side are slumping down seaward slope, loss of interlock throughout. Core stone exposed at center of damage at 19+70. Repairs in this area to consist of mostly resets.
19+60 – 19+80	Condition 2. Several stones ejected from harbor side bench visible in water. Seaward side damage appears to be impacting harbor side shoulder stones which are beginning to separate from the central crest.
20+00 – 20+40	Condition 2. Loss of crest elevation and oversteepened slope on seaward side caused by progression of damage at 19+75. Missing stones at waterline and loss of interlock as seaward shoulder stones are separating from central crest.

20+60	Condition 3. Missing several armor stones on seaward slope in 20-30 foot wide area centered at 20+60, shoulder stones slumping down caused by damage at waterline. Damage extends from waterline to seaward shoulder.
21+05	Condition 3. Several stones from seaward slope have become dislodged and have fallen away from structure, visible in water just off the structure. Damage is 20 feet wide (2 stones wide). Armor stones on seaward slope have completely fallen away revealing underlayer, stones on either side are perched. Damage extends up to seaward shoulder.
21+30	Condition 2. Shoulder stone sliding down seaward slope, loss of interlock and missing armor stone at waterline, 2 armor stones visible in water separated from structure. One shoulder stone is upturned. Damage is approximately 20 feet wide, repairs to consist of mostly resets.
21+75 – 22+00	Condition 2. Missing stone at waterline on seaward side resulting in an oversteepened slope and a loss of crest elevation, stones on seaward shoulder beginning to separate from central crest. Repairs to consist of mostly resets.
22+20	Condition 1. Missing stone at seaward waterline causing an oversteepened slope.
22+40	Condition 2. Several missing stones at seaward waterline, resulting in an oversteepened slope. Shoulder stones are beginning to separate from the central crest. Damage is 40 feet wide.
23+30	Condition 2. Damage to harbor side bench, six stones from the bench have been separated from the structure at the waterline, stones can be seen scattered about the shoal.
23+50	Condition 1. Missing stone at seaward waterline, minor loss of crest elevation on seaward shoulder as stones beginning to lose interlock.
24+00	Condition 1. Two missing stones at seaward waterline, minor loss of crest elevation.
24+00 – 25+00	Condition 2. Damage to harborside bench, several stones are visible in water ejected from structure between 24+50 and 25+00. Damage is in approximate location of wave that propagates through structure.
24+75	Condition 1. Stones on seaward shoulder starting to separate from central crest, loss of interlock. Damage is 20 feet wide centered at 24+75 and appears to be caused by some missing stones at the waterline. Damage extends from waterline to seaward shoulder.
25+00	Condition 1. One upturned stone at seaward waterline causing instability in upper slope, shoulder stone starting to separate from central crest.
25+90	Condition 1. Two missing stones at seaward waterline resulting in some sliding of stones on seaward slope.
26+10	Condition 1. Missing shoulder stone on harbor side.
26+20 – 26+50	Condition 2. Damage to harbor side bench, several stones separated from structure at waterline.
26+90	Condition 1. Upturned stone on seaward slope, multiple upturned stones at seaward waterline, some surrounding stones are beginning to lose interlock. Upturned stone on seaward crest. Damage gradually increasing from previous inspection.
27+25 – 27+50	Damage on harbor side bench, several missing stones at waterline and many visible in water separated from structure.
27+80	Condition 1. Two upturned stones on seaward shoulder, missing stone at waterline. Armor stone beginning to slump and lose interlock. Damage area is 15 feet wide.
28+50	Condition 1. Missing stone just above the waterline on seaward side resulting in an

	oversteepened slope.
29+00 – 29+50	Condition 2. Damage to harbor side bench, several stones separated from structure, significant loss of interlock.
29+15	Condition 1. Oversteepened seaward slope caused by missing armor stone at waterline, damage appears to be connected to larger damage area at 29+50.
29+30 – 29+80	Condition 3. Missing armor stone at seaward waterline, seaward slope is starting to fail, several stones have lost interlock and are beginning to separate from the seaward shoulder and slump down. Damage is progressing into the central crest of the structure and appears to be contributing to damage on harbor side.
30+20	Condition 2. Damage is 10-15 feet wide but extends from waterline to seaward shoulder. Missing several stones on seaward slope, surrounding stones are beginning to lose interlock. One upturned stone at shoulder. Underlayer of stone starting to become exposed.
30+80	Condition 1. Missing armor stones at waterline and seaward slope, stones at the waterline have separated creating an oversteepened slope and minor loss of crest elevation. Damage is 10-15 feet wide (1 stone width).
32+05	Condition 1. Upturned stone at seaward waterline.
32+90	Condition 1. Missing multiple stones at seaward waterline resulting in loss of interlock on surrounding slope stones, minor loss of crest elevation, damage approximately 10 feet wide.
33+30	Condition 1. Two stones on the seaward shoulder have been upturned revealing the underlayer of armor stone, surrounding stones are well interlocked.
34+00	Condition 1. Oversteepened slope on seaward side of structure.
34+20	Condition 1. Missing stones and one upturned stone at seaward waterline.
34+80	Condition 1. Damage to harborside bench, several stones separated from structure.
35+25	Condition 2. Three upturned stones on the seaward shoulder exposing the underlayer of armor stones. Stones at waterline are losing interlock and beginning to separate from structure. Minor loss of crest elevation between 35+25 and 35+40.
36+50	Condition 2. One upturned stone on seaward shoulder, two armor stones slumping down seaward slope and one upturned stone at waterline. Result is instability on upper slope and minor loss of crest elevation.
37+75	Condition 2. Oversteepened seaward slope, damage caused by missing stones at waterline, perched stones above and shoulder stones starting to separate from central crest. Extent of damage is from waterline to halfway up seaward slope. Damage has progressed since previous inspection.
39+05	Condition 1. Upturned stone on seaward shoulder.
40+50	Condition 1. Stone on seaward shoulder has become dislodged and now sitting on central crest. Apparent settlement causing minor loss of crest elevation on seaward shoulder.
41+10	Condition 1. Missing stones on seaward waterline and multiple upturned stones on lower seaward slope, minor loss of crest elevation.
43+50 – 43+75	Condition 1. Multiple stones separated at waterline. Damage from waterline to midway up slope, loss of interlock.
46+00	Condition 1. Missing slope on seaward slope above waterline.
46+25 – 46+75	Condition 2. Multiple upturned stones at seaward waterline, slope stones are bridging above the void and an oversteepened slope is present, surrounding stones are losing interlock. Damage extends from waterline to mid-slope; upper slope stones are still

	interlocked.
47+00	Condition 3. Damage area 20 feet wide from waterline up to seaward crest of the structure, several stones have fallen away, loss of interlock throughout, several stones on seaward slope have slumped down revealing the underlayer. Area should be repaired.
47+75	Condition 1. Missing stones at seaward waterline causing loss of interlock and sliding of slope stones. Minor loss of crest elevation.
48+00	Condition 3. Missing armor stones from waterline and seaward slope, stones on either side of damage area have started to lose interlock and slump down the slope. Shoulder stone is in place but slope is severely oversteepened. Damage area is 10 feet wide.
48+75	Condition 4. Entire seaward slope has failed, vertical drop from shoulder to waterline. Several stones have fallen away revealing underlayer and core stone. On either side of damage area, stones are losing interlock and slumping down/perched. Damage is visible from waterline up to seaward shoulder – shoulder stones are separating from crest. Damage appears to be accelerating, this area (48+50 – 49+00) should be included in upcoming maintenance repairs.
49+50	Condition 3. Several missing stones at the seaward waterline causing slope stones to lose interlock and slide, some bridging occurring above the void. Additional damage visible on harbor side. Damage is immediately following the structure crest elevation transition. Damage extends from the waterline and through the crest on the harbor side.
49+75	Condition 4. Near breach, seaward slope is failing and only harbor side shoulder is intact. No interlock on seaward slope. Upturned armor stone and missing stones at waterline. Damage extends from waterline through central crest and into harborside shoulder.
50+00	Condition 4. Near breach. Seaward slope has failed exposing underlayer and core stone and leaving a vertical drop from center of structure to waterline. Damage extends from waterline into central crest, harborside shoulder remains intact.
50+85	Condition 4. Seaward slope has failed, missing stones at waterline and vertical drop from seaward shoulder. Shoulder stones are intact but perched, underlayer is visible, stones on either side of damage are losing interlock and separating from structure, photo of damage area centered at 50+85 and extends up to 51+10, damage roughly 30 feet wide and extends from waterline to central crest.
51+00	Condition 3. Missing several stones on seaward slope, shoulder is intact and well interlocked but missing layer of stones on seaward slope. Damage extends from waterline to shoulder and from 51+50 to navigation aid on seaward side.
Navigation Aid	The navigation aid is missing. The pedestal is showing a significant amount of rust but the actual navigation aid on top is gone. Base is in good condition but has some spalling and cracking around the edges. Grouting underneath the pedestal is beginning to spall.
Head Section	Condition 1. Two separated stones at the waterline along the seaward radial and one missing stone missing along central radial. Minor loss of interlock.

South Breakwater	
Station (s)	Description
1+00	Condition 1. Stone has separated from the structure at the waterline on the seaward side.
1+60	Condition 1. One stone on seaward slope losing interlock and beginning to slump, damage caused by dislodged stone at waterline.
2+75	Condition 1. Slightly oversteepened slope, minor loss of interlock and some stones on seaward slope are starting to slump.
3+50	Condition 1. Stone at the waterline on seaward side has separated from the structure creating a void. Several stones on above slope have started to slide and lose interlock above void.
4+50	Condition 1. Upturned stone on seaward shoulder, missing armor stone at waterline.
6+30	Condition 1. Armor stone at waterline losing interlock.
Head Section	Condition 1. There is a void just above the waterline on the central radial, some stones falling away from the structure creating an oversteepened slope.

Appendix B

Redondo Beach King Harbor
June 2023 Condition Inspection
Structure Photographs

North Breakwater

Figure 1: Warning Signs on Galveston Wall

Figure 2: Condition 3 damage area, loss of armor stone on seaward slope at approx. station 15+75.

Figure 3: Photo from 16+00 looking north

Figure 4: Loss of interlock and armor stone on seaward slope 17+50

Figure 5: Photo from 18+00 looking north, condition 4 damage area at 17+50 visible (center-left).

Figure 6: Missing stones on seaward slope, Station 18+20.

Figure 7: Harbor side bench from Station 19+00 looking north.

Figure 8: Damage to harbor side bench Station 19+80

Figure 9: Loss of crest elevation and oversteepened slope along seaward shoulder from 20+00.

Figure 10: Missing stones at waterline causing instability and loss of interlock up slope, Station 20+60.

Figure 11: Loss of armor stone from seaward slope, Station 21+05.

Figure 12: Loss of interlock on seaward slope, Station 22+00 looking north.

Figure 13: Ejected stones and damage to harbor side bench, Station 23+15.

Figure 14: Station 24+00 along seaward shoulder looking north.

Figure 15: Several stones visible in water, damaged harbor side bench, wave propagating from seaward side, Station 24+25.

Figure 16: Harbor sideshoulder looking north from 26+00, damage to harbor side bench

Figure 17: Looking north along seaward shoulder from Station 28+00.

Figure 18: Loss of interlock and separation from seaward shoulder, Station 29+75.

Figure 19: Looking north from Station 30+00

Figure 20: Loss of armor stone on seaward slope, upturned stone on seaward shoulder, Station 30+25.

Figure 21: Looking north from Station 32+00

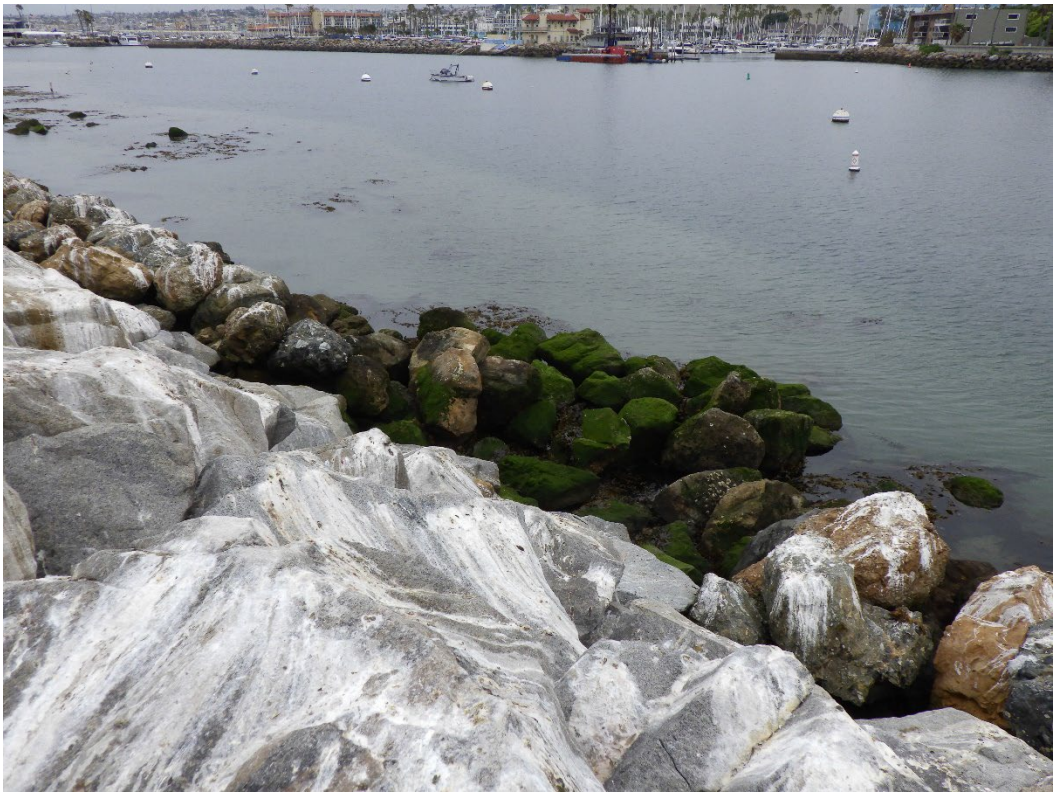


Figure 22: Separation of stones on harbor side bench at Station 32+00.

Figure 23: Two upturned stones on structure crest, Station 33+30.

Figure 24: Harbor side shoulder, looking north from 34+00

Figure 25: Oversteepened seaward slope at Station 36+20.

Figure 26: Looking north along central crest of structure Station 38+00.

Figure 27: Looking north along seaward shoulder, Station 40+00.

Figure 28: Looking north along seaward shoulder, Station 42+00.

Figure 29: Looking north along central crest of structure at Station 44+00.

Figure 30: Looking north along seaward shoulder, Station 46+00.

Figure 31: Upturned armor stones and loss of interlock, loss of armor stone on seaward slope, Station 47+00.

Figure 32: Looking north along seaward shoulder, Station 48+00.

Figure 33: Missing armor stone at waterline and on seaward slope, loss of interlock, Station 48+00.0.

Figure 34: Failure of seaward slope between stations 48+50 and 49+00.

Figure 35: Near breach, failure of seaward slope at Station 50+00.

Figure 36: Failure of seaward slope, underlayer visible and several perched stones, Station 50+85.

Figure 37: Separated armor stone at waterline, seaward radial of head section.

Figure 38: North breakwater navigation aid missing.

South Breakwater

Figure 39: Warning sign at root of south breakwater.

Figure 40: Looking east from Station 1+00

Figure 41: Looking east from Station 2+00

Figure 42: Looking east along seaward shoulder from Station 3+00

Figure 43: Displaced stone at waterline, loss of interlock on seaward slope, station 3+60

Figure 44: Looking southeast along harbor side from Station 4+00

Figure 45 Looking southeast from Station 5+00

Figure 46: Looking southeast from 6+00

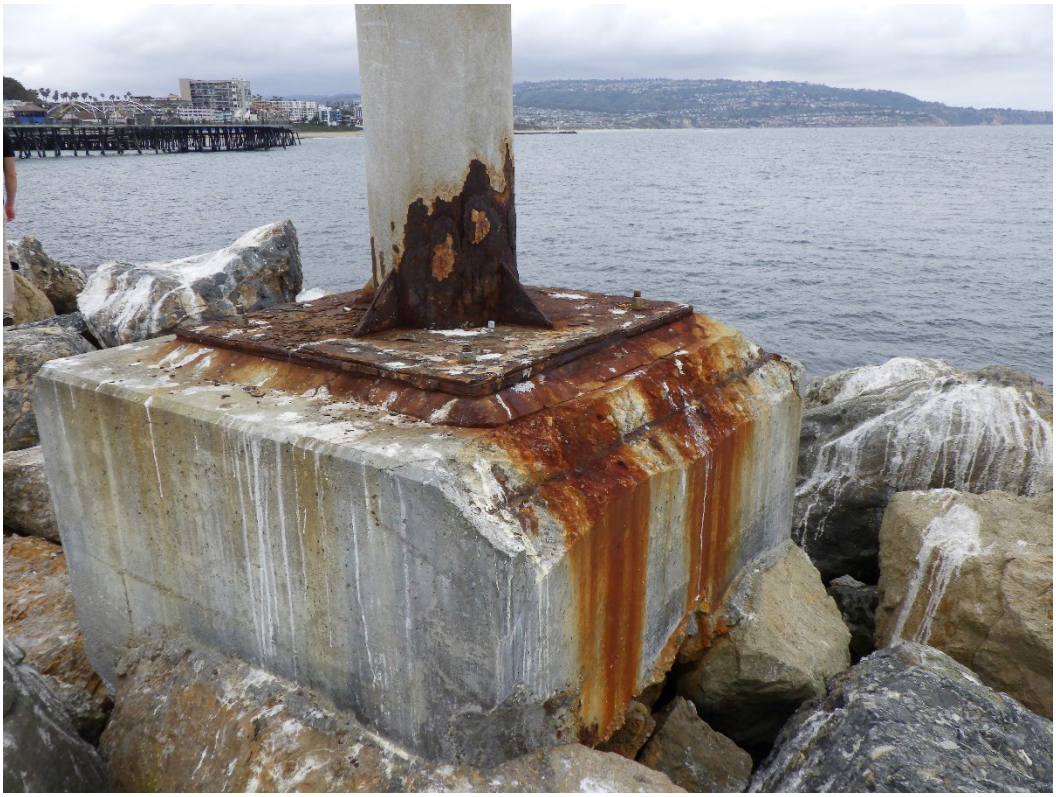


Figure 47: Rust at bottom of navigation aid pedestal and spalling on concrete base.

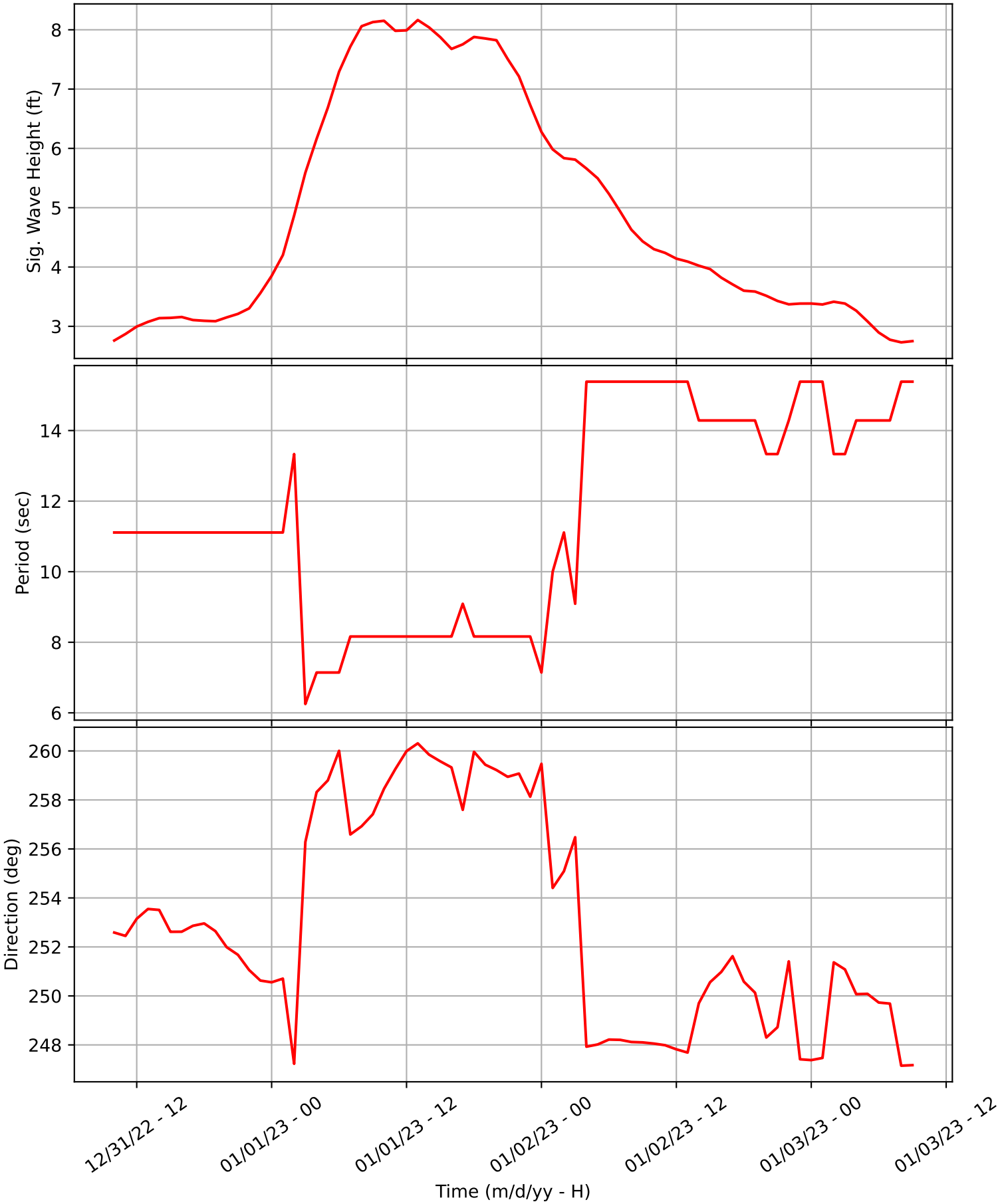
Figure 48: South breakwater navigation aid

Figure 49: South breakwater head section, harbor side radial

Figure 50: South breakwater head section, central radial

Figure 51: South breakwater head section, seaward radial

Redondo Beach King Harbor - North Breakwater: Event 1



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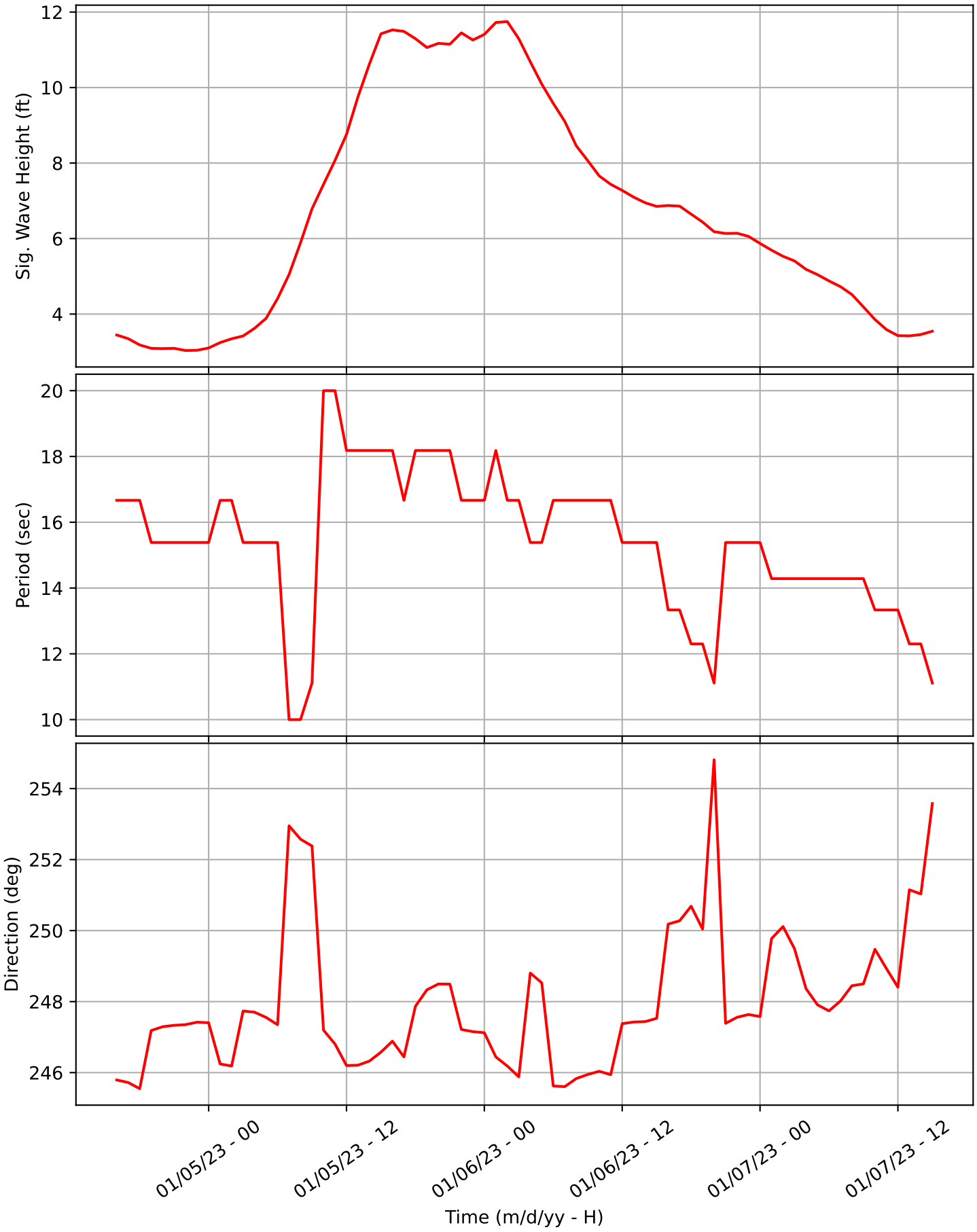
Redondo Beach King Harbor - North Breakwater: Event 2



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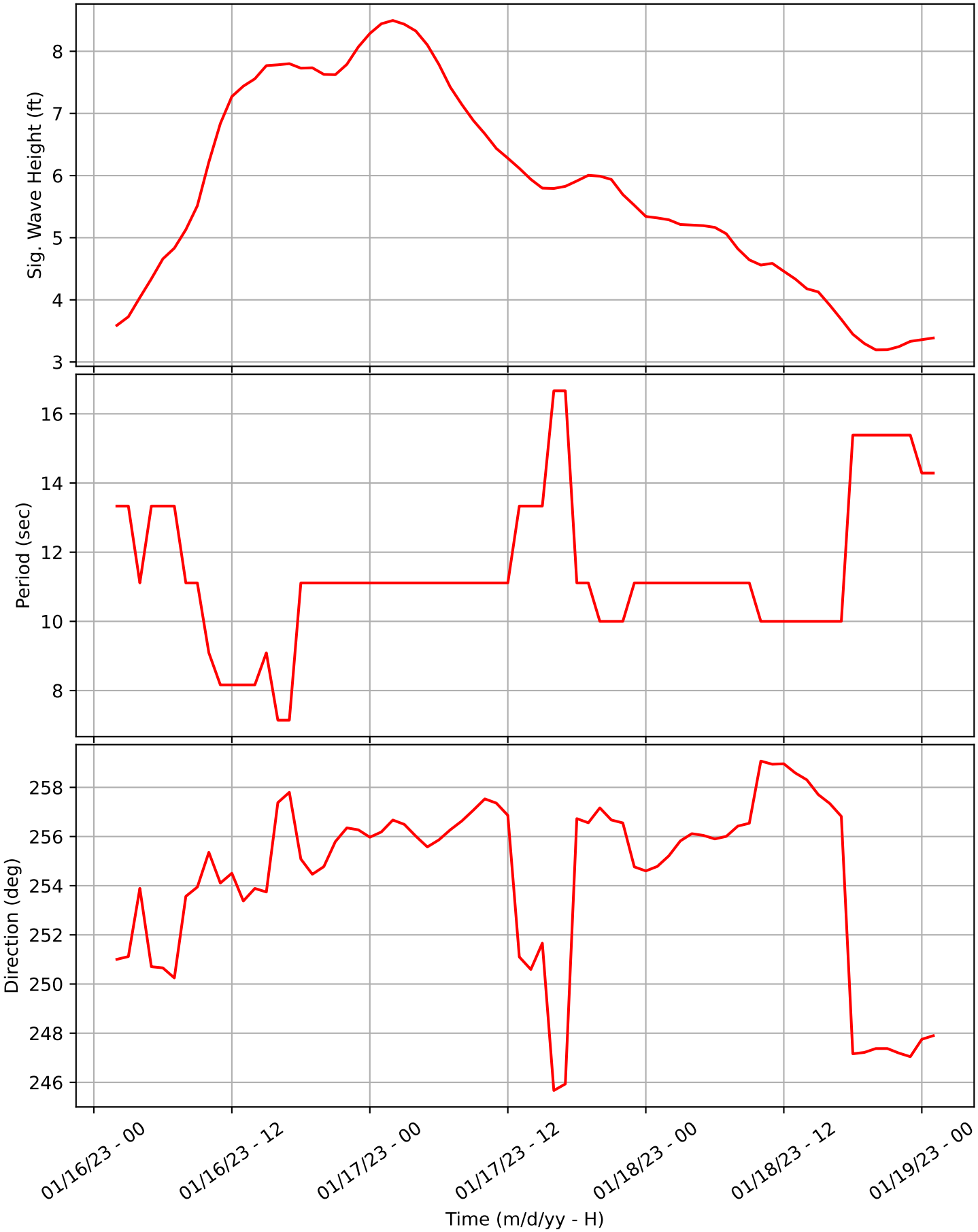
Redondo Beach King Harbor - North Breakwater: Event 3



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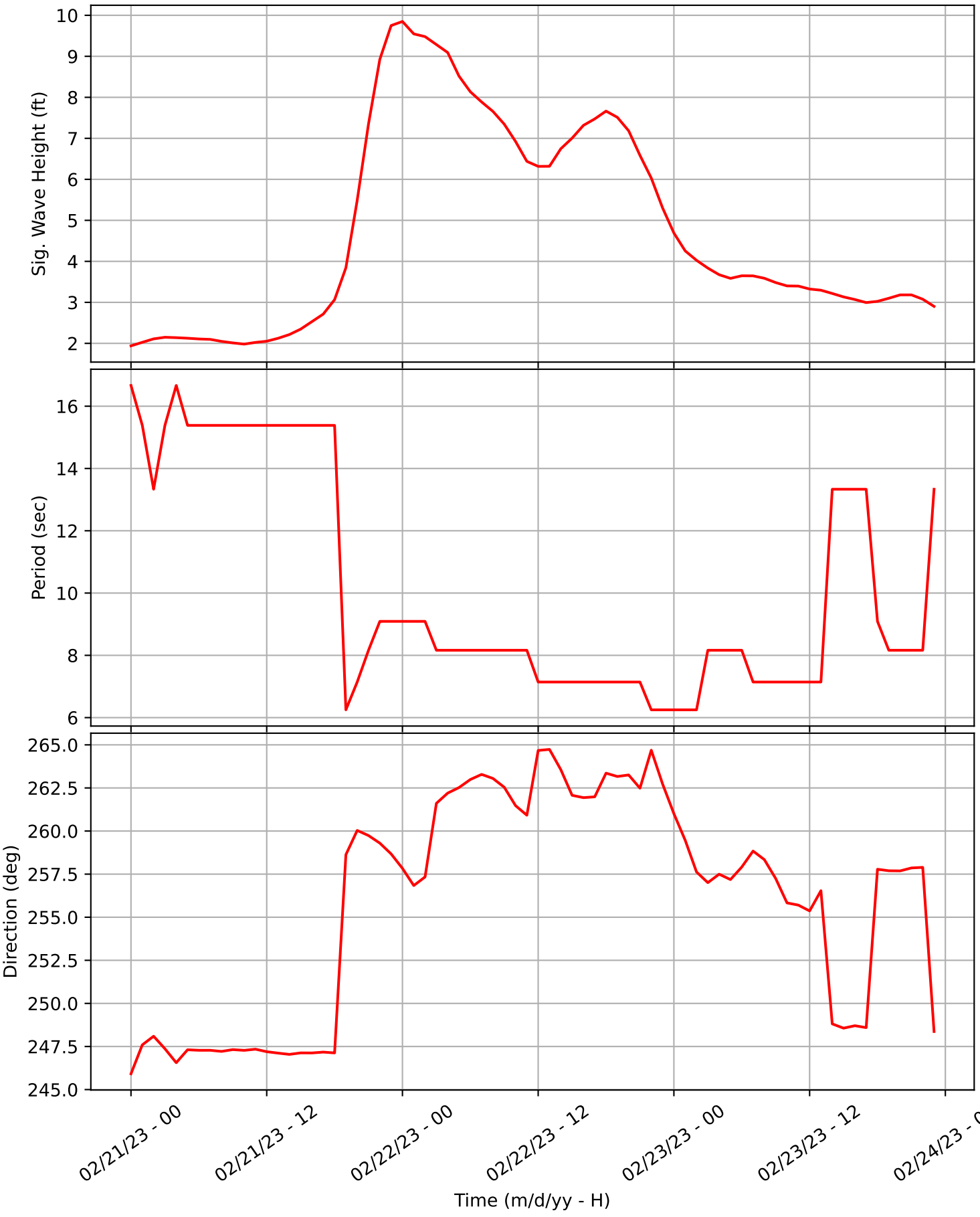
Redondo Beach King Harbor - North Breakwater: Event 4



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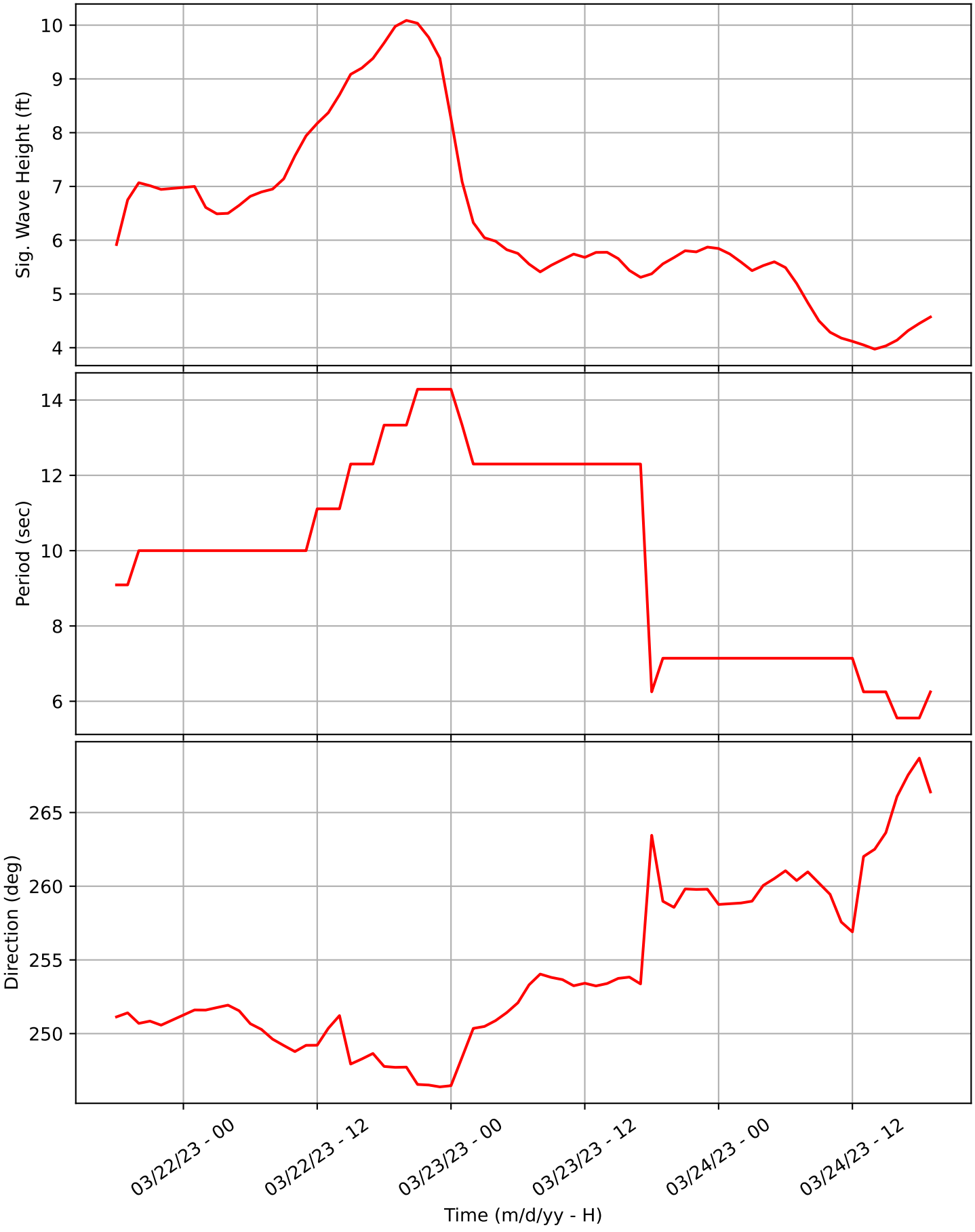
Redondo Beach King Harbor - North Breakwater: Event 5



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