MONITORING REPORT

REYNISFJARA BEACH

Report for measurements done on
24th of July 2026 by

The Molinelli family

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Reynisfjara Beach

Reynisfjara beach, often referred to as “the black sand beach”, is about a 3,5 km long beach on the south coast of Iceland. The beach is in between two headlands, Dyrhólaey and Reynisfjall mountains and can be divided into two parts, (1) the narrow cliff beach in front of Reynisfjall mountain and (2) the sand spit that closes off the wave dominated Dyrhólaós estuary behind it (figure 1). The spit closes the outlet of the estuary during prolong periods of south-eastern wave direction, causing raised water level in the estuary that can cause widespread flooding. In the last few decades, local farmers have dug out the spit to open the outlet and reduce the water level. The beach is supplied by sediment movement from the west to east and erosion of the headlands of Dyrhólaey and Reynisfjall. A small bypass is around the horn of Reynisfjall mountain where sediments can be transported west to east, but it is believed that there is no transport from east to west (DHI, 2022). The beach is therefore supplied with sediments during periods with south-western wave direction, while erosion will occur during long periods of south-eastern wave direction.

Figure 1 shows the extent of Reynisfjara beach, along with the seven profiles on the eastern side of the beach, Dyrhólaey promontory, Dyrhólaós estuary, and Reynisfjall mountain.

Reynisfjall and Dyrhóley are both a tuff mountain (Tuya) that were formed in a volcanic eruption under a glacier and/or in the sea. The lower part of Reynisfjall mountain is made from palagonite breccia, i.e., volcanic ash that has a lot of larger rock fragments within itself, interbedded with intrusions of fully crystallized basalt. The upper part of the mountain is then made of palagonite tuff and breccia, and finally several layers of lava cover the top of the mountain. During large storms and when the cliff beach is unusually short, there is wave undercutting of the cliff face. The undercutting causes regular rock collapses and has formed several small sea caves. There is a large intrusion of fully crystallized basalt at the western end of the cliff, and due to it being more resistant to erosion the columnar basalt protrudes further out than the rest of the cliff face. This causes increased erosion on the lee side of the columns during south-easterly waves.
The nearby Reynisdrangar sea stacks are a similar formation and used to be a part of the mountain, but wave erosion has eroded the weaker palagonite breccia that used to surround them. The palagonite can still be found high up on the stacks where the waves are unable to reach it.
The beach recently underwent a major erosional event which was caused mainly by an unusually long period with prevailing south-eastern wave direction and unusually high (wave height) from that direction as well. This period started at the end of November 2025 but reached its peak in late January and early February 2026. The wave direction caused erosion on the beach, meaning that the beach got much shorter and lower than it was before. The erosion also reached the long-term stable part of the upper beach and beach ridge (where the rocks and vegetation are located). In March, the wave direction changed to south and south-westerly, with several storms where the wave height reached above 5-6 meters. This caused more erosion of the long-term stable part of the beach causing damage to infrastructure close to the beach. The erosion also caused a considerable change in grain size of the beach. Before the erosion the beach was a mixed beach, with the main grain size being sand and gravel, but after the erosion the beach was a gravel beach. Erosion of this magnitude has not happened at Reynisfjara in the last few decades, but the beach has gradually been retreating since the early 1900's (Jónsdóttir and Sigurðarson, 2023).

Objectives of Monitoring Reynisfjara beach

The objective of the monitoring program for Reynisfjara beach is to document the morphological and environmental changes at Reynisfjara beach. Seven profiles are on the eastern part of the beach (figure 1 and 2) which monitor any changes to the beach width and volume. The profiles are measured monthly during spring tide. The profiles are measured by using GTS-6 TopCon GPS devices with accuracy of about ± 1 cm. Along with measuring the beach profiles, photos and drone photos are taken of the beach itself and the environment behind it.

The seven profiles cover the cliff beach and the easternmost part of the spit, which is the most dynamic part of the beach with the largest response to storms and other extreme events. This part of the beach is also the most popular part for tourists, due to its proximity to the basalt columns of Reynisfjall mountain and the nearby Reynisdrangar sea stacks, and it is therefore more important to monitor this part of the beach than others as large changes in morphology of the beach can increase the risk for visitors.

The aim of the drone and camera photos is to document changes on the beach and its surroundings, with a focus on the cliff face of Reynisfjara to monitor its slope stability.

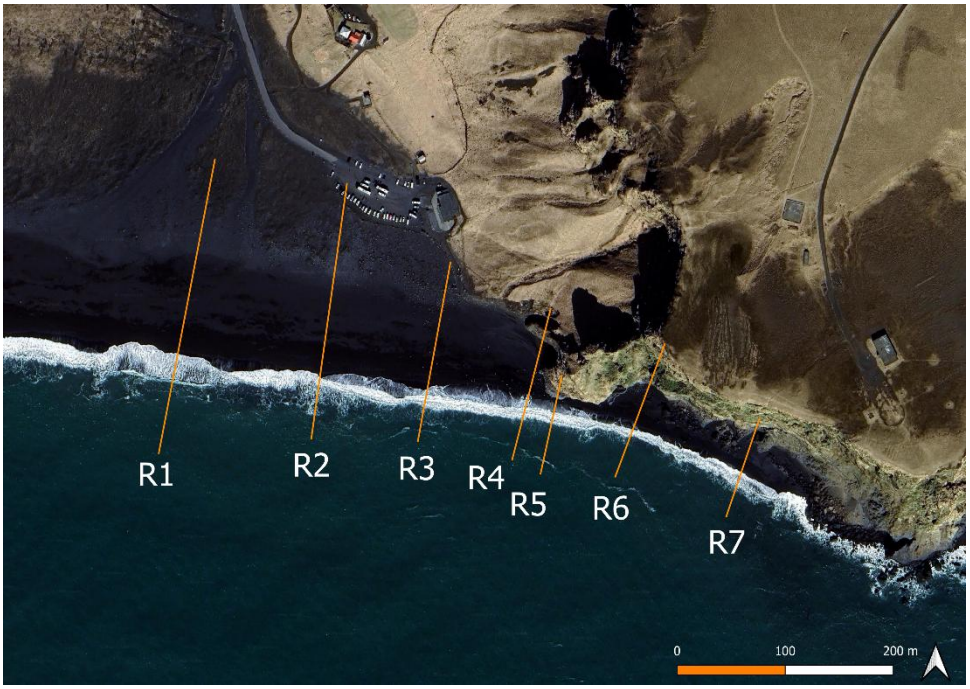

Figure 2 shows the seven profiles at Reynisfjara. Profiles 5-7 have not been accessible since the start of the erosional event in 2026 and were therefore not measured during the fieldwork on 15th of June.

Field work on the 24th of July 2026

A measurement of profiles R1-R4 were made on the 24th of July, along with drone footage of the beach and its surroundings and ground photos of the beach. At the time of the measurements, the sea level was high, and the wave height was about two meters. The lower part of the profiles was therefore not measured as waves reached high up on the beach face. Profiles R5-R7 were not measured as they are still inaccessible since the erosion of the beach in early 2026.

The measurement was made by the Molinelli family:

Alison, Gregory, Madeline, Emerson and Greyson Molinelli. They were accompanied by Johannes M. Johannesson and Ann I. Peters from Katla Geopark for the fieldwork.

Figure 3 shows the Molinelli family, which carried out the fieldwork at Reynisfjara beach on the 24th of July 2026.

Results from field work on the 15th of January 2026

The results of the field measurements can be seen on the figures 4-6 and tables 1-4. On figure 4 the four profile measurements from the 15th of June can be seen along with the previous most recent measurement at Reynisfjara, which was done on the 15th of June 2026.

Profile R1 has decreased in width by 7,7 meters since the measurement in June, while the volume increased by 26 m^3. This stems from the lower of the two gravel ridges that were on the profile in June has been pushed further up on the beach and merged with the upper ridge. This has resulted in that there is only one ridge on the beach now (figure 7 and 11), which in this case has resulted in increased volume but shorter beach. The upper part of the profile is mostly unchanged since last measurement, as there have been no storms or windy days, resulting in minimal movement of material.

Profile R2 has also decreased by 7,5 meters and the volume decreased by 2 m^3. The same thing happened at Profile R2 as at R1, that is two ridges were merged into one, but here the volume did not increase as some material must have been lost.

Profile R3 width increased by 0,1 meters and the volume increased by 33 m^3. Unlike profile R1 and R2, the lower ridge that got pushed up the beach did not raise the height of the profile but rather increased the width. That explains why the beach width did not decrease like on the previous two profiles, and as the ridge is now higher and more sloping, there is a volume increase as well.

Profile R4 was measured, but due to high sea level and wave height the lower part of the profile was inaccessible, and the measurement ended in 1,138 m height. This results in the width of the profile and volume cannot be calculated for the measurement. The width of the beach at 1,138 meters was 60,186 meters and compared to the 49,1 meters width in June at 1 meter, the profile has increased in width by close to 10 meters since last measurement. The profile has also increased in height, and therefore volume, since the last measurement and that can be clearly seen on the graph on figure 4.

The change in width and volume for the four profiles can be found on figure 6 and in tables 1-4. The beach continues to recover slowly since the erosion earlier in 2026 but still has some way to go. The beach is still too narrow to allow access to the beach in front of the cliff face at Reynisfjall mountain. The grain size of the beach is slowly changing, as sand has started to be pushed up the beach, but the dominating grain size remains gravel.

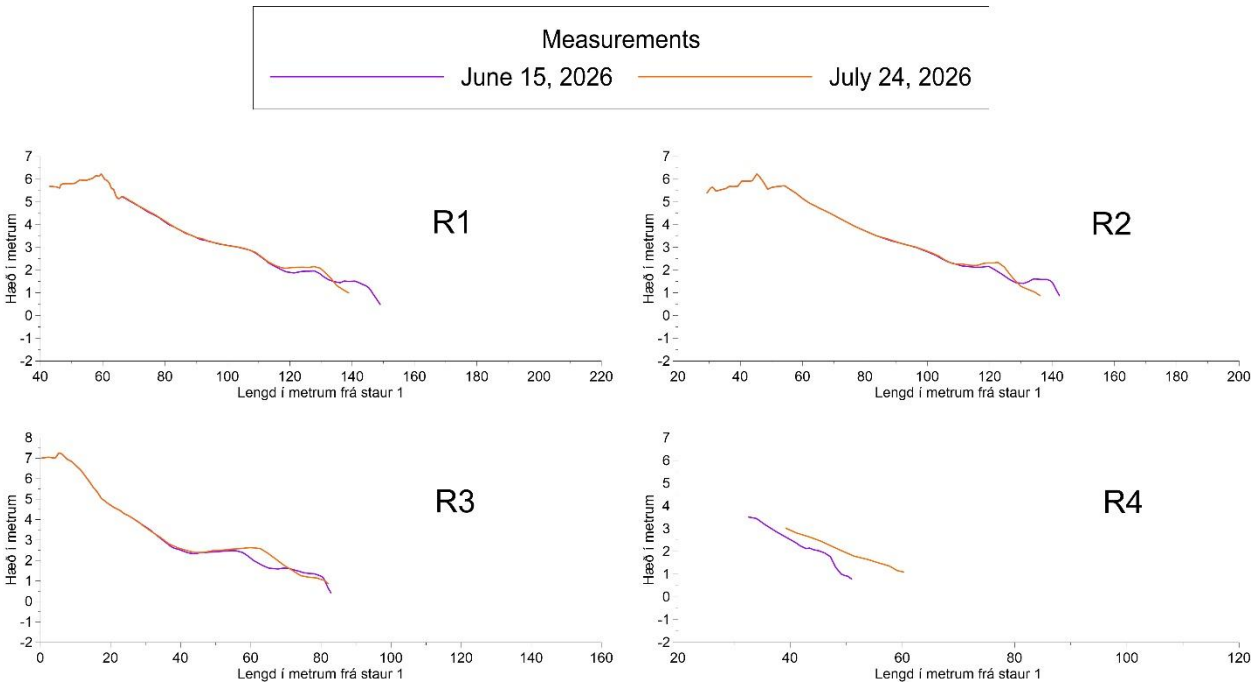

Figure 4 shows the results of the measurement on 15th of June. Comparison of these measurements to previous measurements of Reynisfjara beach can be seen on figure 8.

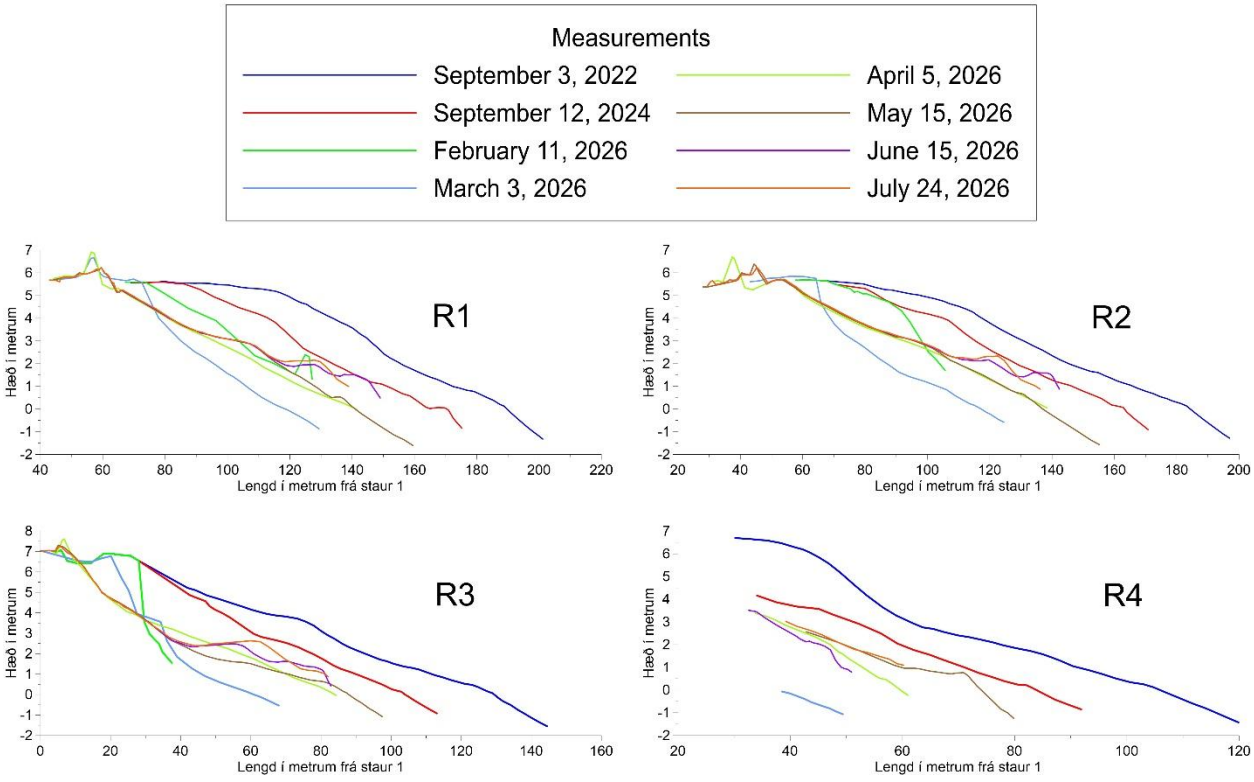

Figure 5 shows the results of measurements of the profiles at Reynisfjara beach, since 2022.

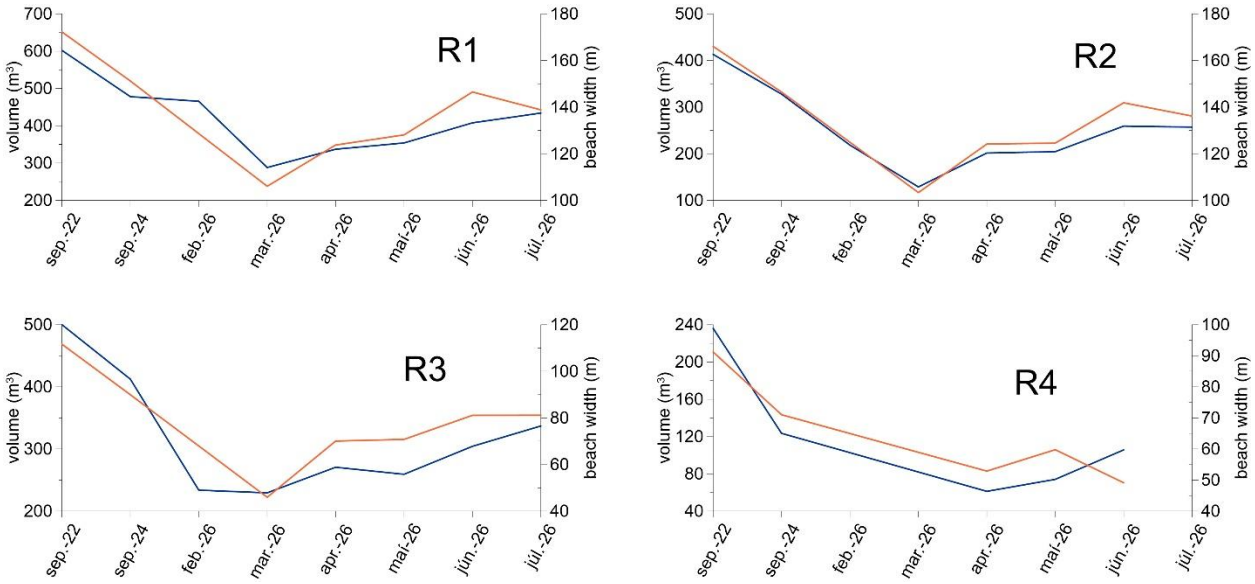

Figure 6 shows the changed in beach width (m) and volume (m3) of profiles R1-R4. The minimum in beach width and volume was reached in February and March 2026, but since then the beach has been slowly recovering.

Table 1-2 shows the changes in beach width (m) and volume (m^3) for the four profiles that were measured on the 15th of June 2026. Beach width is calculated at 1m height, but during the measurements were that depth was not reached and the volume could not be calculated precisely, the label reads NA.

Profile R1	Beach width (m)	Difference since sept 2022 (m)	Change between measurements (m)	Volume (m3)	Difference since sept 2022 (m3)	Change between measurements (m3)
sep.22	172,2			602		
sep.24	151,2	-21,0	-21,0	478	-124	-124
feb.26	NA	NA	NA	466	-137	-13
mar.26	106,1	-66,2	-45,2	288	-314	-177
apr.26	123,7	-48,5	17,7	337	-265	49
maí.26	128,1	-44,2	4,3	354	-248	17
jún.26	146,5	-25,8	18,4	408	-194	54
júl.26	138,8	-33,4	-7,7	434	-168	26

Profile R2	Beach width (m)	Difference since sept 2022 (m)	Change between measurements (m)	Volume (m3)	Difference since sept 2022 (m3)	Change between measurements (m3)
sep.22	166,0			413		
sep.24	146,5	-19,6	-19,6	328	-85	-85
feb.26	NA	NA	NA	218	-195	-109
mar.26	103,3	-62,7	-43,1	129	-284	-90
apr.26	124,2	-41,9	20,8	202	-212	73
maí.26	124,6	-41,5	0,4	204	-209	3
jún.26	141,9	-24,2	17,3	259	-154	55
júl.26	134,4	-31,7	-7,5	257	-156	-2

Table 3-4 shows the changes in beach width (m) and volume (m^3) for the four profiles that were measured on the 15th of June 2026. Beach width is calculated at 1m height, but during the measurements were that depth was not reached and the volume could not be calculated precisely, the label reads NA.

Profile R3	Beach width (m)	Difference since sept 2022 (m)	Change between measurements (m)	Volume (m3)	Difference since sept 2022 (m3)	Change between measurements (m3)
sep.22	111,6			500		
sep.24	90,0	-21,7	-21,7	412	-88	-88
feb.26	NA	NA	NA	234	-266	-179
mar.26	46,0	-65,7	-44,0	229	-270	-4
apr.26	70,1	-41,6	24,1	271	-229	41
maí.26	70,8	-40,8	0,7	259	-241	-11
jún.26	81,1	-30,5	10,3	304	-196	45
júl.26	81,2	-30,5	0,1	337	-163	33

Profile R4	Beach width (m)	Difference since sept 2022 (m)	Change between measurements (m)	Volume (m3)	Difference since sept 2022 (m3)	Change between measurements (m3)
sep.22	91,2			236		
sep.24	71,0	-20,2	-20,2	123	-113	-113
feb.26	NA	NA	NA	NA	NA	NA
mar.26	NA	NA	NA	NA	NA	NA
apr.26	52,9	-38,3	-18,1	61	-175	-62
maí.26	59,8	-31,4	6,9	74	-162	13
jún.26	49,1	-42,1	-10,6	NA	NA	NA
júl.26	NA	NA	NA	NA	NA	NA

Drone and camera photos were taken during the measurement and are used to compare visual changes in the beach, the cliff face and its surroundings. *Figure 7 shows the eastern part of Reynisfjara beach, along with the erosional scarp in Reynisfjall mountain that formed in the erosion earlier in 2026. In the center of the photo, there is a steep gravel ridge and below it is a gently sloping beach face. During the measurement in June, there were two gravel ridges on the beach, but the lower ridge has been fused now with the upper ridge. The grain size of the beach is still very coarse gravel. Some sand has started to accumulate just behind the top of the gravel ridge. The beach below the cliff of Reynisfjall is still inaccessible.* Figure 8 and 9 shows the changes at the erosional scarp in Reynisfjall mountain. Figure 8 was taken during the measurement in June and figure 9 in July. The scarp is still active, and material has been collapsing from its side and top over the last few weeks. The red ring on both pictures shows the active part of the scarp and the white circle is where the material ends up. If collapses continue at this part of the scarp, it might reactivate and old scarp that until now has remained stable (orange circle). There are two large boulders next to the scarp (fig 9) and it is unknown if they are attached to the mountain or if they are freestanding. If they are freestanding and the collapse continues, they could eventually collapse down onto the beach. Figures 10 and 11 show the central and western part of Reynisfjara beach, with Dyrhólaey in the distance and the Dyrhólaós estuary on the right. Figure 10 was taken in June and figure 11 in July. There have been no

changes to the upper part of the beach between measurements. On the lower part of the beach, the lower gravel ridge that was present in June (thin grey line close to the waterline on figure 10) is no longer present on figure 11, as it has been welded on to the higher ridge. Due to high water level and waves, the lower part of the beach face was not accessible during the measurement in July.

One of the objectives of the monitoring at Reynisfjara beach is to observe the slope stability of the cliff face of Reynisfjall mountain. There have been several rock collapses from the mountain in the last few decades, and the most recent one was in 2019 (MBL, 2019). These collapses occur due to wave undercutting of the cliff of Reynisfjall during severe storms, and erosional events like occurred earlier in 2026, which weaken the stability of the overhanging rock. It is therefore likely that there will be several rock collapses in the coming years. At least three collapses have already happened in 2026, and the most recent one can be seen on figure 12 that was taken on the 3rd of July. Figure 13, which was taken during the measurement, does not show any fresh collapses on the beach, but the material from the collapse in June is being reworked by waves.

Figure 8 shows the eastern part of Reynisfjara beach, along with the erosional scarp in Reynisfjall mountain that formed in the erosion earlier in 2026. In the center of the photo, there is a steep gravel ridge and below it is a gently sloping beach face. During the measurement in June, there were two gravel ridges on the beach, but the lower ridge has been fused now with the upper ridge.

Figure 9 the erosional scarp in Reynisfjall mountain. The red ring shows the active part of the scarp and the white circle is where the material ends up. An old scarp that until now has remained stable and is marked with an orange circle.

Figure 10 the erosional scarp in Reynisfjall mountain. The red ring shows the active part of the scarp and the white circle is where the material ends up. An old scarp that until now has remained stable and is marked with an orange circle.

Figure 11 is from the measurement in June and shows the central and western part of Reynisfjara beach, with Dyrhólaey promontory in the distance.

Figure 12 is from the measurement in July and shows the central and western part of Reynisfjara beach, with Dyrhólaey promontory in the distance.

Figure 13 shows the new rock collapse from Reynisfjall mountain. The photo was taken on the 3rd of July 2026.

Figure 14 shows the beach below the cliff face of Reynisfjall. No new collapses seem to have occurred since 3rd of July, but the material from the collapse in June is being reworked by waves.

References

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