

Belvedere Slide Repair

Property Saved From Sliding Into San Francisco Bay

Case Study

The Challenge

Heavy rains and a broken drainage system caused the lower section of a steep property on the water's edge in Belvedere to fail. A large amount of soil was swept downhill, knocking a series of tiered access stairs off their foundations and worse, threatening the stability of the large home above. Access to the site was extremely difficult: egress to the home itself was via a funicular tram that runs from the street to the front door below or, a series of steep stairs. The slide area below the home could only be reached by a steep foot path along the side of the house.

Action

After analyzing the subsurface conditions and taking into consideration the steep site and the extremely limited access, it was decided that the best approach was to use RWR's portable drilling equipment to construct a retention system consisting of 24" diameter drilled piers extending above grade into cast concrete columns. The columns were restrained at the top with 1" diameter double corrosion protected



1st Section Of Wall Built And Scarp Visible Behind

tiebacks grouted in 6" diameter drilled shafts. After casting of the 24" diameter columns and installation of the tiebacks, 6" x 12" .6 ACZA pressure treated timbers were installed for lagging, then a sub-drain system consisting of perforated pipe and class II permeable drain rock was placed behind the lagging. The hillside was then rebuilt by bringing back up the slide soils from below and placing them in compacted lifts behind the new wall system. The tiebacks were initially lightly loaded so as not to pull the columns out of plumb. After all backfill was placed, the tiebacks were proof tested and locked off at full design load. A new surface drainage system was installed to collect rain runoff over the entire repair area, the access stairs to the dock were jacked back onto and reconnected to their foundations and all damage to the stairs was repaired. Lastly, all disturbed areas were seeded then covered with a layer of erosion control blanket and galvanized steel chain link netting anchored to the new piers.



Restored Hillside

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View of the repaired property with dock access stairs visible

Results:

This valuable property has been saved and restored to its former unblemished condition and the Owners sleep well knowing that their property has been safely stabilized.



Stabilized Deck With Stunning Views