Onwater™ Floating Foundations

A Green, Net Zero capable Solution

The best protection against rising sea levels, tsunamis, storms and wildfires

Archimedes Buoyancy Principal: Any floating object displaces its own weight in fluid

Create a mechanically simple, reliable, fast acting, mostly passive, fully automated lift system that can rise quickly to match changing water levels and sea surface conditions:

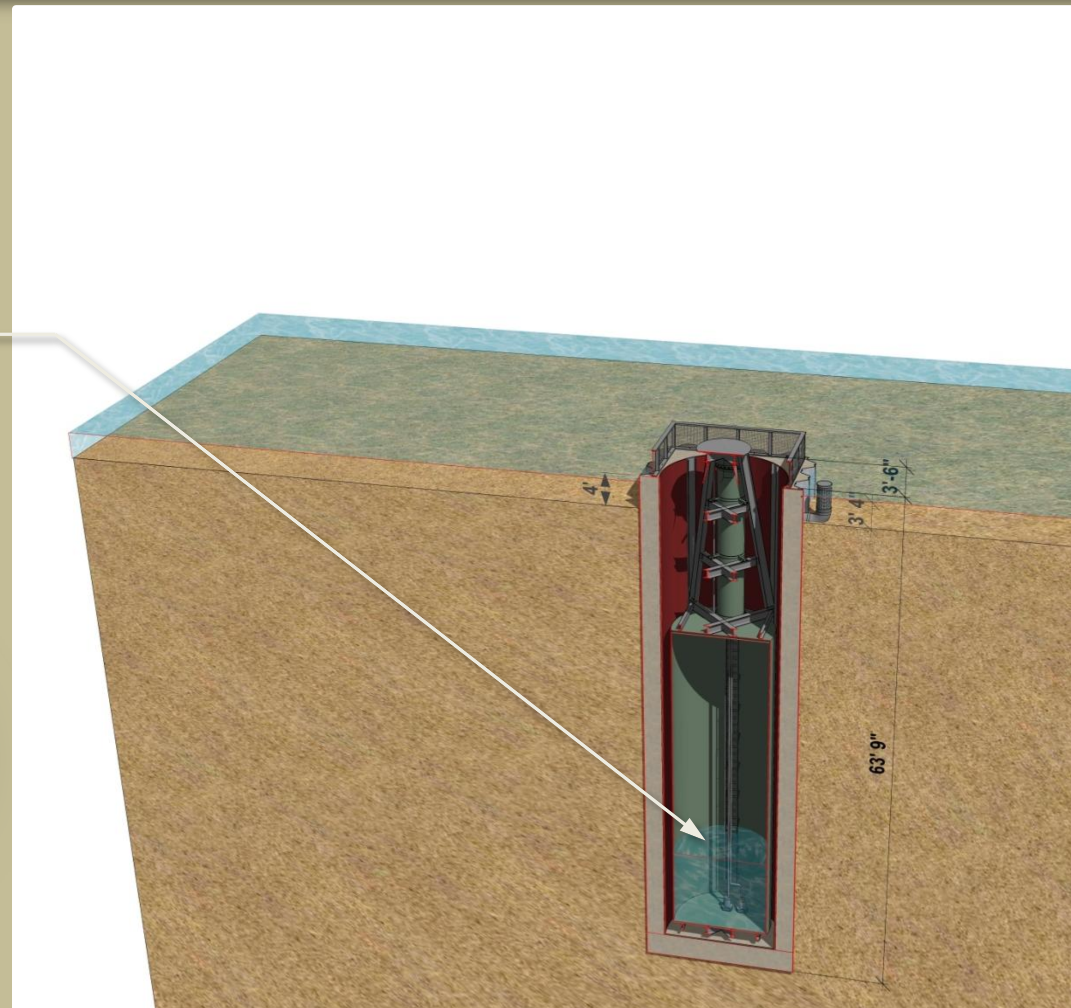
- Use buoyant columnar sponsons positioned below the water surface to passively lift the home without reliance on mechanical equipment or power that might not be functioning during a storm.
  - Position sponsons below the water surface to eliminate wave motion in the structure above.
- House sponsons in a well that is ~60+ feet (20M) deep, 3 ATMs (303 kPa) of atmospheric pressure.
  - Although positioning the sponsons at deeper water depths will not increase lifting capacity, the atmospheric pressure increase will require the sponson to have stronger walls at the bottom
  - A cylindrical shape is the best cross-sectional profile to resist the force of water pressure.
- Anchor sponson sufficiently to bore well foundation walls via a sliding track system that allow the sponson to slide up and down freely and provides ample lateral support to resist predicted winds and waves during the largest storm surge and wave height event with the highest winds.
  - Establishing the amount of overlap length between the sponson and the bore hole wall at the system's maximum lift height is essential in determining the maximum lateral structural loading.
- Tsunamis strike with little or no warning so the diameter of the bore well must be sufficiently larger in diameter than the diameter of the sponson so that water can fill under the sponson fast enough to lift at a rate that keeps the first floor level of the structure above the crest of the tsunami.

Onwater™ Foundation - Height Adjustment Function

System functionality: Lowest position in calm water conditions during low tide

Sponson Buoy in fully retracted position during astronomical low tide, calm sea conditions at 2.5’ (.75M) above mean low tide:

- 12’ø x 40’ (3.7Mø x 12M) 4,472 cubic foot (127 cubic meter) size sponson tank can be filled partially with water ballast to position the first floor level of structure as close to the ocean surface as is deemed practicable
  - *Wave motion sensors in the immediate vicinity of the system and remotely located on buoys in adjacent harbors and ocean waters combined with other state, national or international emergency warning systems can feed data to the automated lift system for continuously monitoring ballast weight and determining the minimum height needed.*

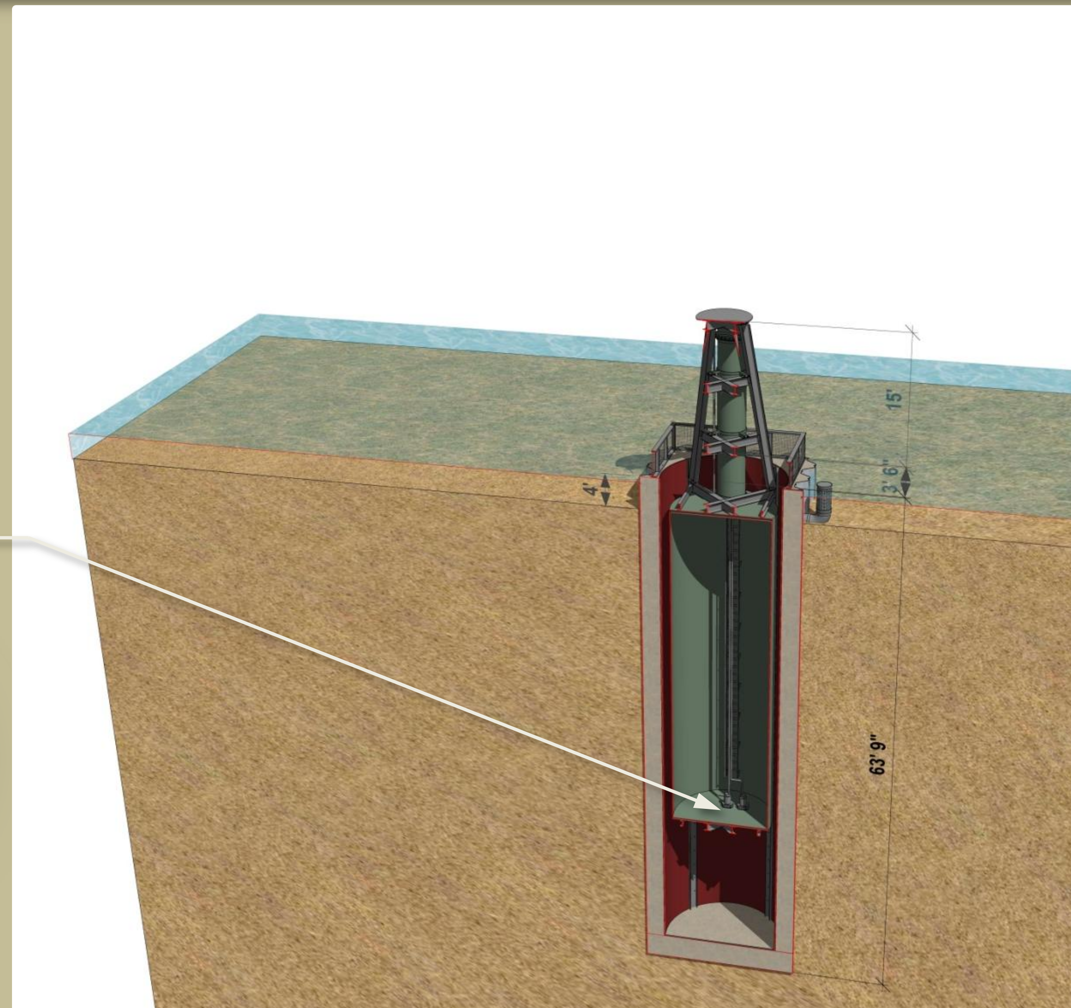


Onwater™ Foundation - Height Adjustment Function

System functionality: Low tide rough sea conditions with large waves

Sponson Buoy shown on right is in its retracted low tide position during rough sea conditions. With ballast water pumped out of the sponson tank, the system raises the structure above 17.5’ (5.3M) higher than the mean water surface.

- The sponson tank can be partially or fully emptied via submersible Siamese well pumps set at the bottom of the sponson tank (see adjacent image).
- Completely emptied of ballast water, the system can raise the first floor level of the structure it supports an additional 15’ (4.5M) higher than the lowest position of 2.5’ (.75M). This raises the first floor level 17.5’ (5.3M) above the ocean surface.
- The pair of pumps can run in reverse to refill the tank with sea water to lower the villa’s height above water as the seas calm down

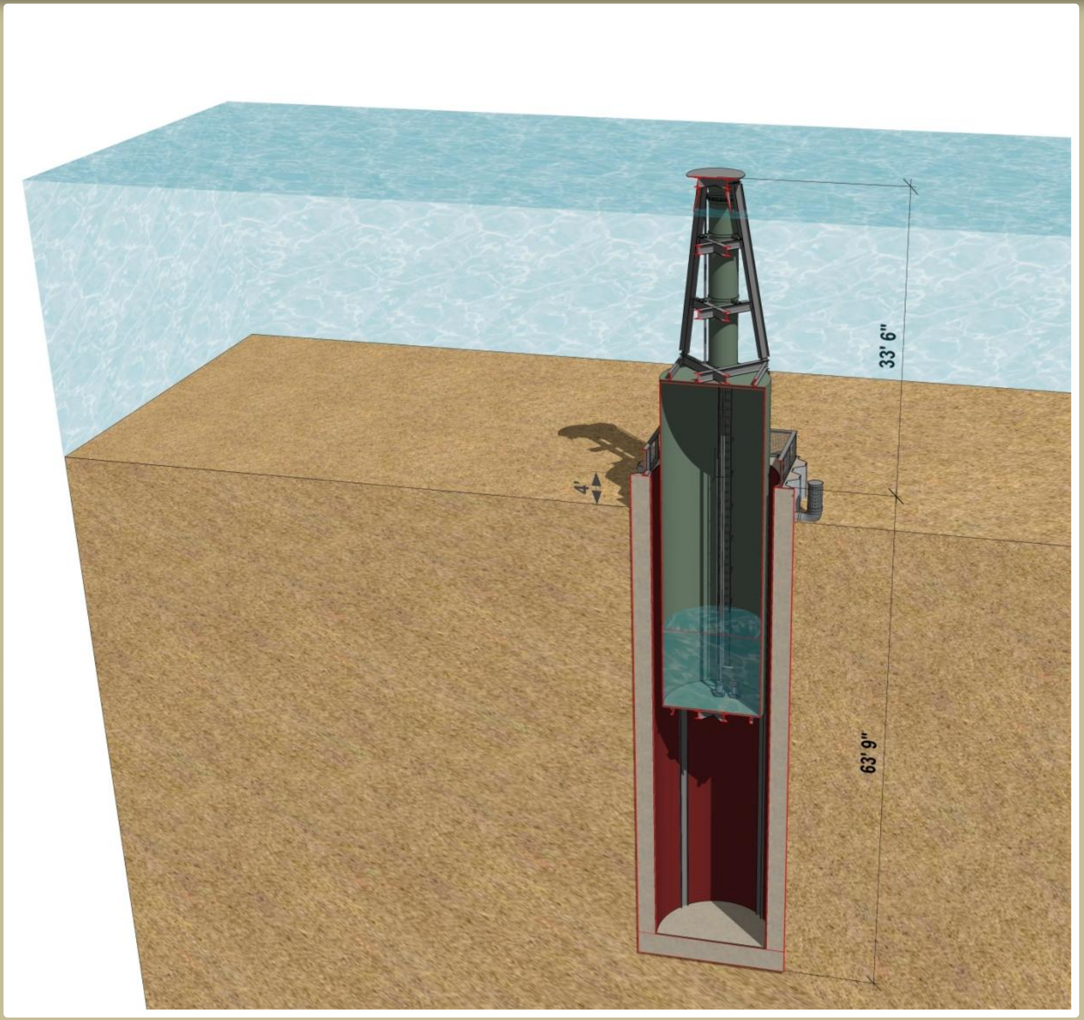


Onwater™ Foundation - Height Adjustment Function

System functionality: Compensation for rising sea levels, storm surges & tsunamis

Sponson Buoy and ocean levels rise at the same right. Image on right depicts the sponson responding to a 30’ (9M) storm surge or tsunami to a position that is 33.5’ (10M) above mean low tide

- Hurricane Dorian in September 2019 generated a 23 foot (7M) high storm surge on Grand Bahama Island.

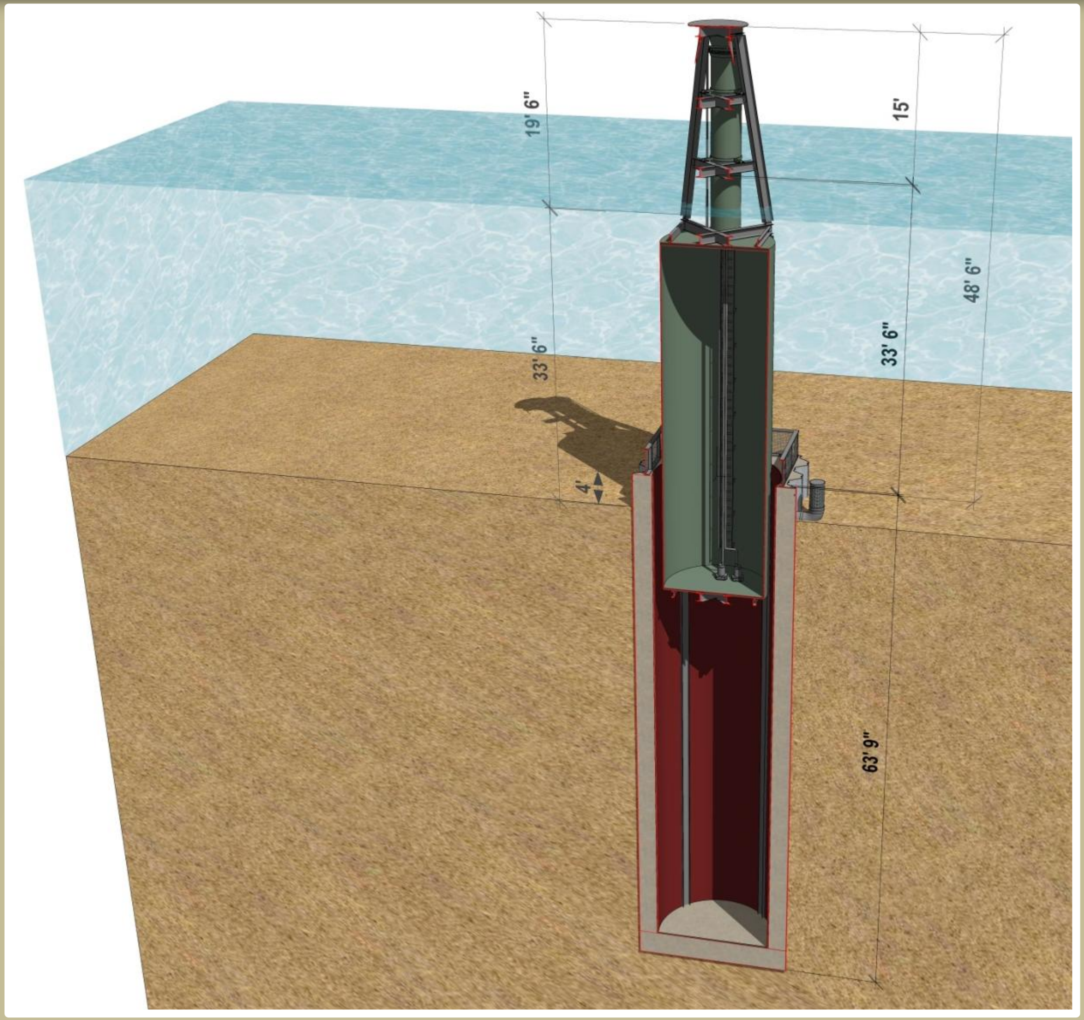


Onwater™ Foundation - Height Adjustment Function

Functionality: Compensate for surface waves during a flood or storm surge

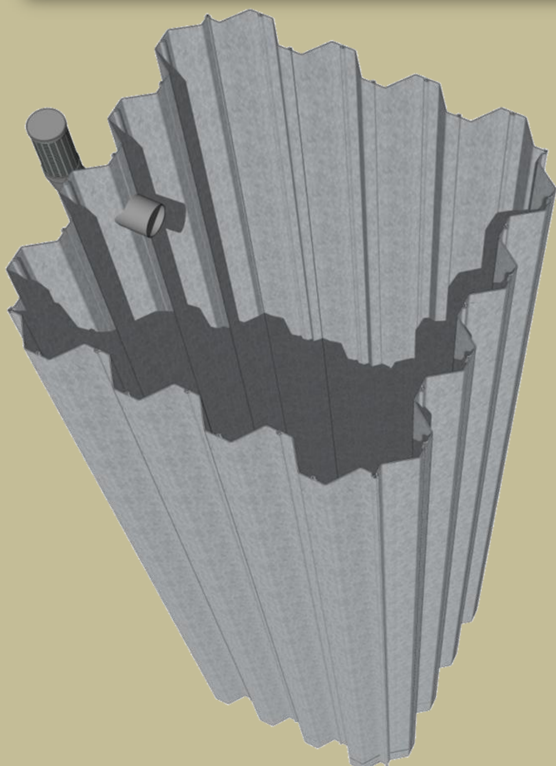
Sponson Buoy Raised to highest position at ~50' (14.75M) above mean low tide

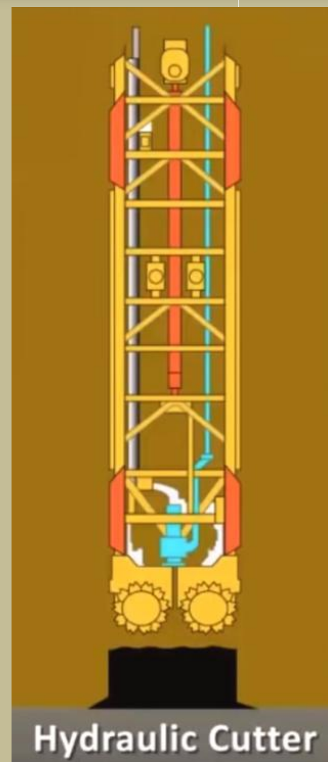
- Water pumped from sponson adds 15' (4.5M) of additional height to compensate for rough water body surface or ocean surface conditions and enables the foundation system to position the structure 48.5' (14.75M) higher than the base low tide position.
- When flash flooding, earthquake or tsunami warnings are issued, the system can pre-position the structure higher than the anticipated water level to compensate for fast rising water levels.



Medium & Large Size Floating Foundation Well Bore Shaft Liner

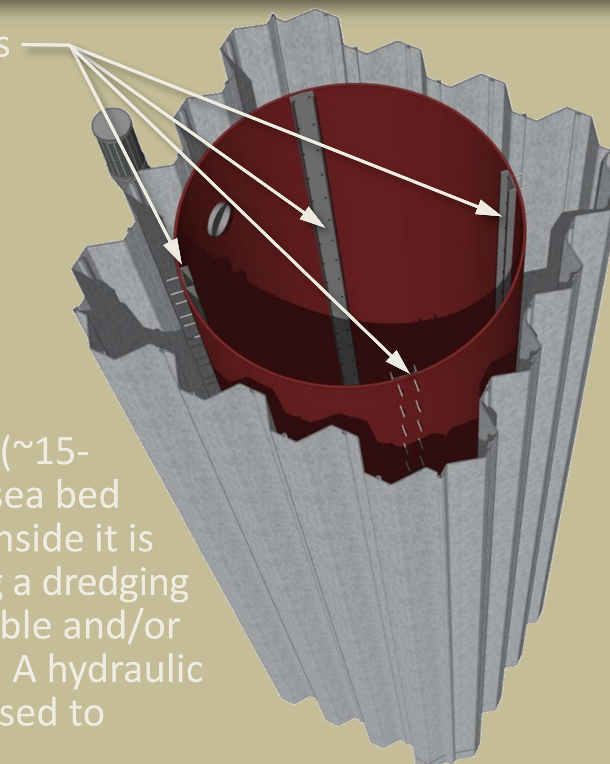
Sheet pile lined bore well is excavated and a cylindrical shaft wall liner is placed





Four continuous vertical tracks control motion of the lifting sponson and counter all lateral forces

Sheet piling is driven ~50-60' (~15-18M) into the sea bed then material inside it is excavated using a dredging crane with a cable and/or hydraulic grab. A hydraulic cutter can be used to remove ledge



A cylindrical Fiber Reinforced Polymer (FRP/GRP) foundation liner/bore hole liner (shown in maroon color in the image on the right) will include 4 continuous vertical stainless steel channel guide tracks bolted onto the inside of the liner. The guide track bolts project a significant enough distance through the cylindrical liner to allow them to function as anchor bolts/shear studs but stop short of the prefabricated stainless steel rebar cage (not shown) that encircles the outer perimeter of the liner.

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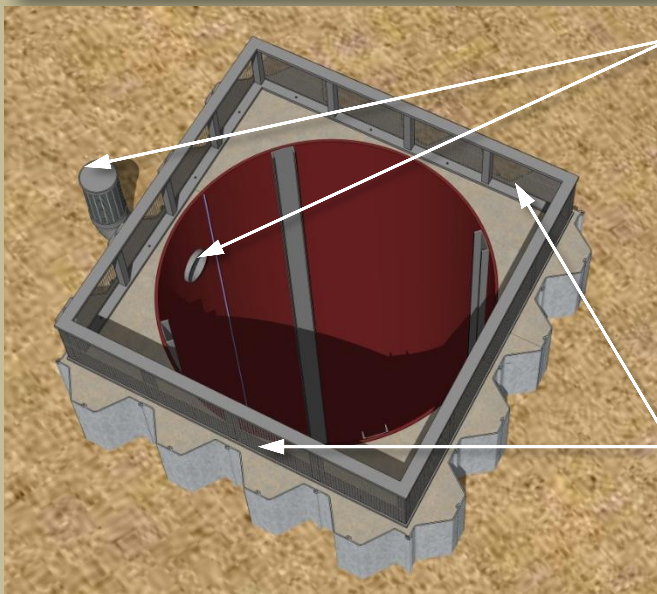
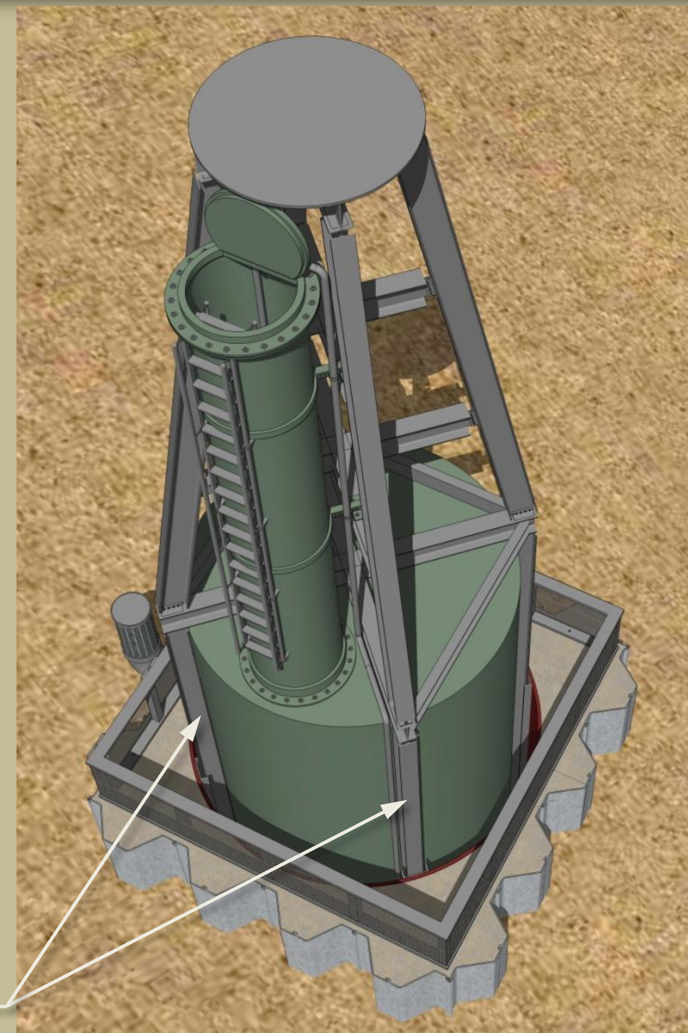
Onwater™ Floating Foundation – Features & Construction

The cavity between the sheet piles and the shaft liner is filled with concrete



At low tide, when the water level is lower than the top of the bore well foundation, equalization of water level inside the well is achieved via a through wall pipe that includes a filter on top

A continuous screen mesh filter barrier keeps debris and sea life out of the well



After the cylindrical FRP liner and rebar cage are lowered inside the sheet pile reinforced bore well and temporary walers/struts are inserted into the 4 guide tracks to reinforce the liner, the void between the sheet piles and the FRP liner is filled with concrete using a tremie pipe. Anchor bolts are set in the wet concrete that attach a mesh screen enclosure at the top of the structure to keep debris out of the well.

After the well is completed, the sponson (foundation buoy) is lowered by crane into the bore hole & guide tracks in the well

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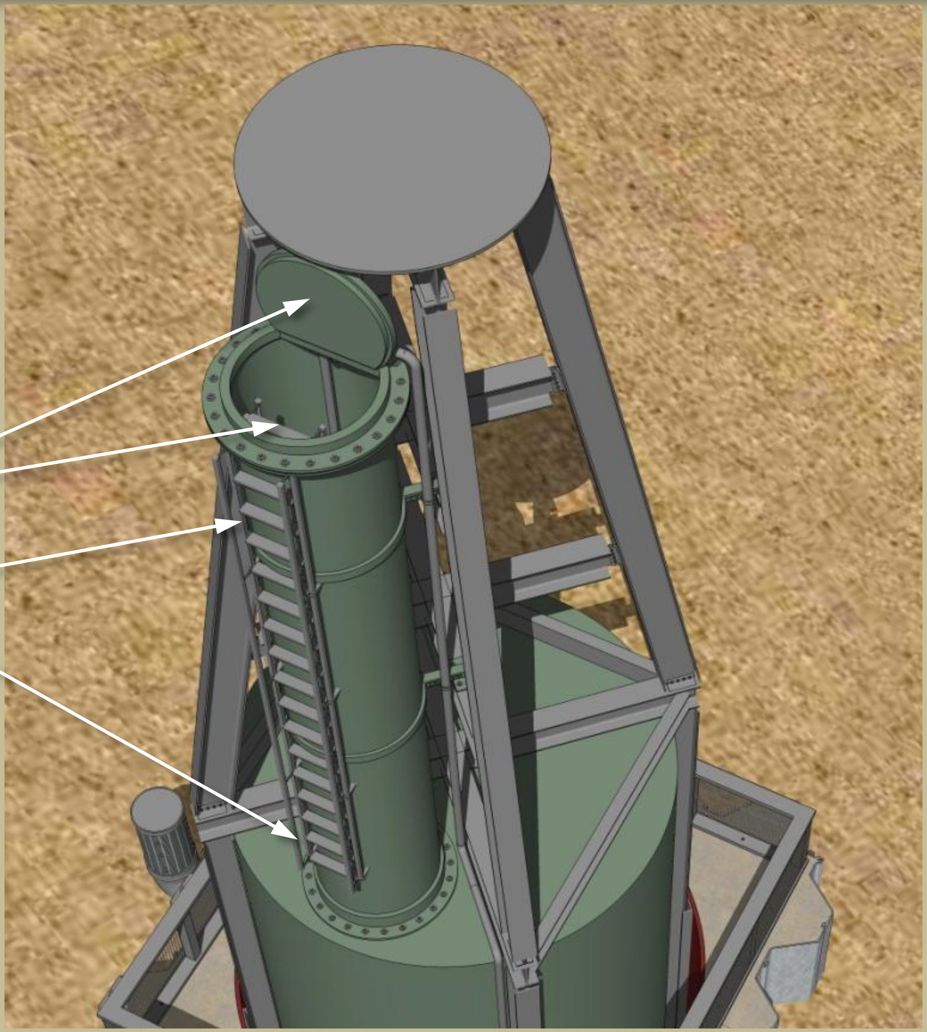
Onwater™ Floating Foundation – Features & Construction

Service access for the sponson tank and emergency access for the villa

An access tower with a watertight hatch at the top provides access to the inside of the lifting sponson to inspect and service the interior of the sponson and the Siamese well pumps submerged at the bottom.
The hatch and the internal and external ladders can be accessed in two ways:

1) From a corresponding floor hatch in the first floor deck directly above the access tower hatch.
2) From the water via a ladder on the exterior of the conning tower.
   - The floor hatch in the structure above in combination with the external ladder on the access tower serve an additional function as an emergency means of egress from the building above to the water when the structure is raised high above the water surface



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Onwater™ Floating Foundation Scalability

The width and depth of the system can vary greatly to suit a vast number of uses

Incorporating the smallest width well pumps available, the system can be scaled down to pipe bore hole and tank diameters that are very small.

The table below lists some potential sizes of sponson tank systems and the weight they can displace/lift:

Item	Submersible Deep Well Pump
HP	1
Rated Voltage	230VAC
Amps	9.8
Phase - Pumps	1
Number of Stages	11
Number of Wires	2
Impeller Material	Celcon
Shaft Material	303 Stainless Steel
Nominal Flow Rate	10 gpm

Flow Rate @ 100 Ft. @ 40 PSI	13.0 gpm
Flow Rate @ 100 Ft. @ 50 PSI	12.0 gpm
Flow Rate @ 150 Ft. @ 40 PSI	11 gpm
Flow Rate @ 150 Ft. @ 50 PSI	10.0 gpm
Max. Head	284 ft.
Discharge Dia.	1-1/4
Recommended Tank	3YA57, 3YA58, 4MY61
Max. Operating Temp.	86

Foundation System Sponson Tank Size Chart - Imperial Units

System Size	Bore Hole ø in Feet	Tank ø	Tank Height	Tank Cubic Foot Volume	Displacement with 64 lbs/cuft Sea Water Weight	Number of units installed	Total Displacement / Bearing Weight	Total Tons Displacement / Bearing Weight (LB Weight /2000)
1	2	1.6	40	80.38	5,144.58	4	20,578.30	10.29
2	2.5	2	40	125.60	8,038.40	4	32,153.60	16.08
3	5.5	4	40	502.40	32,153.60	4	128,614.40	64.31
4	7.5	6	40	1,130.40	72,345.60	4	289,382.40	144.69
5	10	8	40	2,009.60	128,614.40	4	514,457.60	257.23
6	12.5	10	40	3,140.00	200,960.00	4	803,840.00	401.92
7	15	12	40	4,521.60	289,382.40	4	1,157,529.60	578.76

Sponson Tank Size Chart Size Chart - Metric Units

Bore Hole ø in Meters	Tank ø M	Tank Height	Tank Cubic Meter Volume	Displacement with 1026 kg/m3 Sea Water Weight	Number of units installed	Total Displacement / Bearing Weight
0.6096	0.4877	12.192	2.28	2,335.40	4	9,341.61
0.762	0.6096	12.192	3.56	3,649.07	4	14,596.27
1.6764	1.2192	12.192	14.23	14,596.27	4	58,385.08
2.286	1.8288	12.192	32.01	32,841.61	4	131,366.43
3.048	2.4384	12.192	56.91	58,385.08	4	233,540.32
3.81	3.048	12.192	88.91	91,226.69	4	364,906.74
4.572	3.6576	12.192	128.04	131,366.43	4	525,465.71

See next slide for a larger text size copy of this chart

Proprietary & Competition Sensitive

Onwater™ Floating Foundation Scalability

The width and depth of the system can vary greatly to suit a vast number of uses

Foundation System Sponson Tank Size Chart - Imperial Units

This section of the chart is a larger text size copy of the chart on the previous slide

System Size	Bore Hole ø in Feet	Tank ø	Tank Height	Tank Cubic Foot Volume	Displacement with 64 lbs/cuft Sea Water Weight	Number of units installed	Total Displacement / Bearing Weight	Total Tons Displacement / Bearing Weight (LB Weight /2000)
1	2	1.6	40	80.38	5,144.58	4	20,578.30	10.29
2	2.5	2	40	125.60	8,038.40	4	32,153.60	16.08
3	5.5	4	40	502.40	32,153.60	4	128,614.40	64.31
4	7.5	6	40	1,130.40	72,345.60	4	289,382.40	144.69
5	10	8	40	2,009.60	128,614.40	4	514,457.60	257.23
6	12.5	10	40	3,140.00	200,960.00	4	803,840.00	401.92
7	15	12	40	4,521.60	289,382.40	4	1,157,529.60	578.76

Chart of Systems 5, 6 & 7 above with 80' length sponson tanks (comprised of two stacked 40' tanks)

5	10	8	80	4,019.20	257,228.80	4	1,028,915.20	514.45
6	12.5	10	80	6,280.00	401,920.00	4	1,607,680.00	803.84
7	15	12	80	9,043.20	578,764.80	4	2,315,059.20	1,157.52