

Why Treasure Island Is the Super-Green City of the Future

A blighted island in San Francisco Bay could become the world's hottest property, a showcase of sustainable design. With cities now consuming 75 percent of natural resources, it's just in time.



This scale model of San Francisco's Treasure Island shows the mix of dense housing, a canopied retail area and a convenient ferry terminal that will help make it both pedestrian- and eco-friendly.

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Photographs by Ofer Wolberger
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Every day, a few hundred thousand vehicles cross the San Francisco-Oakland Bay Bridge, their drivers barely aware of the small, rectangular land mass lying just to the north. From where I am standing, on rocky Yerba Buena Island, I can both hear the traffic thundering overhead and look across a narrow isthmus to the long-forgotten patch of real estate in the middle of the bay: Treasure Island. Home to an abandoned Navy base and a small population of low- to middle-income residents, the 400-acre property hardly lives up to its prosperous name. Defunct military buildings, rusty oil tanks and electrical transformers litter the landscape. Crumbling asphalt caps chemical dumps.

Treasure Island is an unlikely place to look for the city of the future, but that's what I'm here to find. My guide is Jean Rogers, an environmental engineer with the global design and consulting firm Arup. Surrounded by a panorama of postcard views – San Francisco, Golden Gate, Berkeley Hills – and buffeted by winds that whip in from the Pacific, Rogers seems somewhat unlikely, too: Petite, stylish, with an impressive string of degrees and a down-to-business manner, she speaks with easygoing "likes" and "you knows" sprinkled among phrases such as "tertiary water treatment" and "optimal solar exposure." Rogers jabs at the ground with the heel of her shoe, reminding me what an engineering feat we stand on: Completely man-made, Treasure Island consists of 20 million cubic yards of sea bottom that has been dredged up, dumped into walls made of 287,000 tons of quarried rock and topped with 50,000 cubic yards of loam.

Built for the Golden Gate International Exposition in 1939, Treasure Island was claimed as a Naval base during World War II. When the base was finally decommissioned 11 years ago, San Francisco began studying how to redevelop it. From nearly 300 meetings among city officials, engineers, architects and the public emerged a plan for the most ambitious new community in the United States – a 13,500-person "urban oasis" that will rise from the soil of reclaimed Superfund sites, combining cutting-edge technology with restored natural systems to leave a light footprint on the Earth. After ground is broken in 2009, Treasure Island will become a testbed for the newest ideas in energy efficiency, water conservation, waste management and low-impact living. Says Rogers, with idealism undaunted by the task ahead: "We want it to be the most ecological city in the world."

At no time in history has a model metropolis been more sorely needed. More than half of the people on Earth now live in cities, where they consume 75 percent of the natural resources and are responsible for the majority of greenhouse gases. But while cities can be a liability to the planet – their aging infrastructure ripping through raw materials and compounding the effects of global warming – they can also represent an important opportunity. Typically, food and water enter a city as raw material and exit it as sewage and garbage in what might be called a linear flow. By producing its own energy and recycling its waste, a city can operate less like a factory and more like an ecosystem – supporting a larger number of people with far fewer resources.

Treasure Island represents a rare chance to wipe the slate clean – tear down old infrastructure and lay new foundations using only the smartest ideas for the future. As Jared Blumenfeld, the director of San Francisco's Department of the Environment, asked a crowded forum last spring: "If you could start from scratch, absolute scratch, what would you build?"

How Treasure Island Works



Illustration by Gil Ahn

It is a weekday morning and Treasure Island feels deserted – more like a ghost town than a community of nearly 3000 people. For basic services, schools and jobs, most residents have to leave the island, by car or by the one bus that passes through on its route. Rogers and I drive north on the empty roads, past a pair of star-shaped military barracks that date back to the 1950s, and turn into a housing development built by the Navy. Long curving streets lead past ranch-style houses and end in cul-de-sacs. Cars line the curbs and fill every driveway.

Turning Treasure Island into the archetype of an ideal city – one in which residents want to live, work and play – requires completely re-envisioning how it will be laid out. The single-family homes on cookie-cutter lots will disappear, Rogers explains, and current renters will be able to apply for new multifamily units and residential towers concentrated on the island's south and west edges. Housing density will increase from eight to 75 units per acre, allowing developers to double the amount of land left as open space while accommodating five times as many people.

The sprawling blocks, which now stretch up to 2000 ft. long, will shrink to a pedestrian-friendly 400 ft., and 90 percent of residents will be within a 10-minute walk of downtown. There, they will be able to access stores and services such as a post office and a new ferry terminal that will provide frequent shuttles to San Francisco. Bicycle lanes will connect residents to Yerba Buena Island and the east span of the Bay Bridge.

Similar "new urbanist" principles have been applied to communities across the country, such as Stapleton on the site of Denver's old airport. But Treasure Island's planners take the ideas one step further. After analyzing weather patterns, for example, they decided to reorient street grids 35 degrees west of due south to optimize solar exposure and protection from the wind. Not only will the diagonal alignment make outdoor spaces more comfortable throughout the year, it will save energy on heating, cooling and lighting structures.

All the buildings on Treasure Island will meet the gold standard of the U.S. Green Building Council, further reducing energy consumption. In the island's 220 acres of open space, a new, biologically diverse ecosystem – including plants found in coastal prairie and oak woodlands – will help offset the city's greenhouse gas emissions by locking up carbon dioxide. This natural sequestration, together with increased energy efficiency and a decreased reliance on automobiles, will drop per capita carbon emissions 60 percent, from 7740 to 3030 pounds per year.



Harrison Fraker made a name for himself designing energy-efficient buildings during the 1970s. Today, the pioneering architect and urban planner focuses on sustainable cities, mainly in China where the need is most acute. "The built environment is the most significant contributor to global warming," he says. "Much of the built environment in China wasn't there 10 years ago."

As we round the northeastern corner of Treasure Island, I glance out the window at a procession of broad, low-slung commercial buildings, all of them hemmed in by aprons of asphalt. This, Rogers says – and I have to ask her to repeat herself – is where Treasure Island will grow its food. A few minutes' stroll from the dense urban core, 20 acres of farmland will provide a local, organic alternative to produce hauled in from hundreds, even thousands of miles away.

San Francisco has aggressively reduced the amount of garbage that it sends to landfills, but it has set the bar even higher for Treasure Island – hoping to zero out solid waste by 2020. One important step toward that goal: All food scraps and grass clippings will be composted and used to fertilize the farm.

A hulking wastewater-treatment plant, more than four decades old, sits nearby, destined to be replaced with a modern facility. Currently, all treated water is pumped into the bay. In the future, a quarter will be recycled for irrigating the farm, as well as for flushing toilets in commercial buildings and washing boats in the marina. The island will still tap the mainland for its potable water, but through recycling and conservation measures, such as low-flow fixtures, it will use only 218 million gallons per year – the equivalent of the island's 20 in. of average annual rainfall. Living within a region's water budget is an important principle of sustainability, Rogers explains, especially with chronic drought drying up reservoirs across the West.

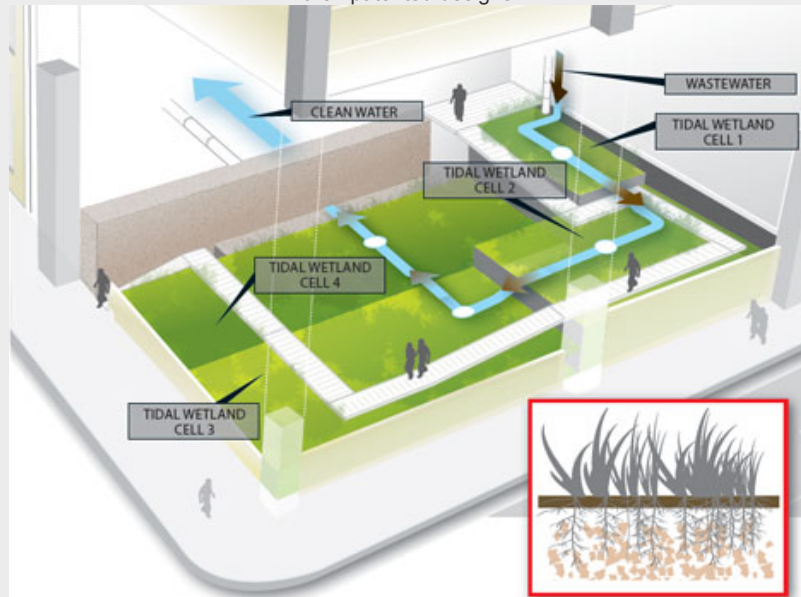
Precipitation that does reach the ground will return to the environment as clean as when it fell, a great improvement over today's conditions. Storm water now runs freely off streets and parking lots into the bay via 49 outfalls. The impermeable portion of Treasure Island will shrink from 64 percent to 39 percent, so more water will seep into the ground; the remainder will be channeled into wetlands that will cleanse it of pollutants.

Artificial wetlands called Living Machines may help close the water loop completely in future cities. Computer-controlled tanks teeming with a food chain of microbes and plants neutralize contaminants in both gray water (from showers) and black water (from toilets). "Engineers have long tried to overcome nature using brute force," Rogers says. "Some of the most complex engineering today mimics biological systems."

Rogers and Harrison Fraker, dean of the College of Environmental Design at the University of California, Berkeley, have planned a series of Living Machines for a future urban community near Qingdao, China – one of the fastest-growing nations in the world. The community that Rogers and Fraker envision, called an "eco-block," will provide a sustainable alternative to the "superblock" – the vehicle-dependent, gated community that is the country's current development model. They estimate Living Machines will meet 90 percent of the eco-block's water needs each year. With enough rain, Fraker says, supplemental water may not be necessary at all.

Inside a Living Machine

Instead of relying on chemicals to treat wastewater, a Living Machine lets nature do the dirty work. Wastewater is screened for solids and then enters a series of tidal-flow wetland cells, which alternately fill and drain to move water through the system. As each cell empties, and water is pumped to the next cell, incoming air helps bacteria oxidize ammonia, forming nitrate. As a cell begins to refill, other microbes break the nitrate into carbon dioxide and nitrogen gas. At the end of the one-day process, 60 percent of the water is recirculated; 40 percent is disinfected for toilet flushing, irrigation and other uses. "Living Machine" is a registered trademark of Worrell Waters Technologies, and this diagram is based on one of their patented designs.



Each watertight cell holds 4 to 6 ft. of gravel-like media engineered to harbor bacteria. Vegetation grows on top, and roots create pathways in the gravel to help distribute water throughout the cell. Microorganisms living on the plant roots keep the bacteria population in check. In indoor systems, a 4- to 6-in. layer of mulch caps the gravel to help scrub odors from wastewater. (Diagram by Gil Ahn)

Driving south now, we pass clapboard-sided maintenance shops and fuel depots with plywood-covered windows – a mid-island expanse slated to become playing fields and urban forest. We slow to a stop beside a heap of old transformers in the island's southeast corner and the discussion shifts to power production. The days of the centralized grid are numbered, Rogers says, with characteristic practicality: "Communities can and should take responsibility for their own energy."

We step out of the car and Rogers, shielding her eyes from the morning sun, indicates where the sleek profile of steel-and-glass towers will pepper the landscape. The south-facing side of these skyscrapers and the glass canopy covering part of the retail district will be clad in transparent photovoltaic skins. Solar panels will cover 70 percent of all rooftops. This strategy will generate 30 million kilowatt-hours of electricity per year, Rogers says: "We'll save open space but still generate enough energy during peak hours to export energy back to the grid."

The spot where Rogers and I now stand will be buffered from the wind by trees and buildings. But at the other end of the island, large-scale wind turbines will spin purposefully in the strong breeze. On the tops of buildings, small-scale vertical turbines will provide individualized power. Solar water-heating systems in the residential areas will supply up to 80 percent of hot-water needs – a significant chunk of home energy use.

San Francisco Bay, winking at us between the gaps in buildings, may offer another strategy for renewable power: Installing tide-driven turbines on the floor of the Golden Gate channel would harness the energy of the narrows. Engineers are also studying the possibility of a biogas generator at the wastewater treatment plant. By capturing hydrogen and methane gas from the decomposition of organic matter, the generator could provide half the power needed for wastewater treatment.

New digital technologies could make these micropower systems considerably more effective. Computer chips in the system and in appliances that rely on it automatically manage power loads, taking into account both peak usage times and periods of low production. Sensors in buildings direct motors to automatically open windows for ventilation or to adjust horizontal fins to block or invite sunlight, improving energy efficiency.

Even so, no one alternative energy source would be able to take the place of the grid. Berkeley's Fraker stresses that the key to renewable power lies in combining a variety of approaches. "If you put solar, wind and biogas together as a 'three-fer,' you have enough oomph to do it." With a slightly larger population than Treasure Island, Fraker's eco-block would draw 100 percent of its energy from on-site renewables, 100 percent of the time – a goal no city anywhere has come close to achieving.

Rogers and I get back in the car and drive past two re-inforced-concrete hangars that date from the Golden Gate International Exposition – the former Hall of Air Transportation and the Palace of Fine and Liberal Arts – and end our tour in front of the only other permanent relic from 1939: the semicircular Administration Building. Standing in front of the imposing art deco structure, I am struck by a line from black-and-white newsreel footage I saw of the fair: "An inspiring tribute to the achievements of our time, here is a dream come true." Though our definition of progress has changed since Treasure Island was first raised from the shoals, optimism is still alive, and this time it may result in something truly sustainable. If you could start from scratch, absolute scratch, what would you build?