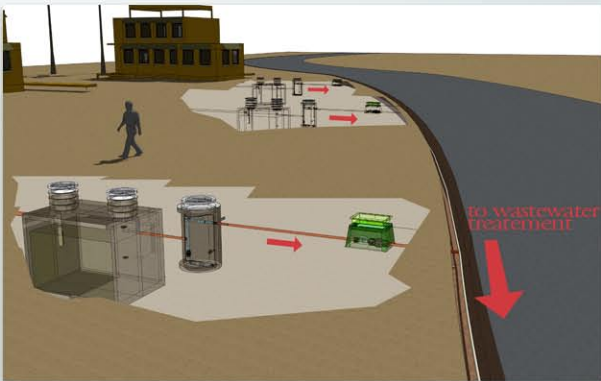


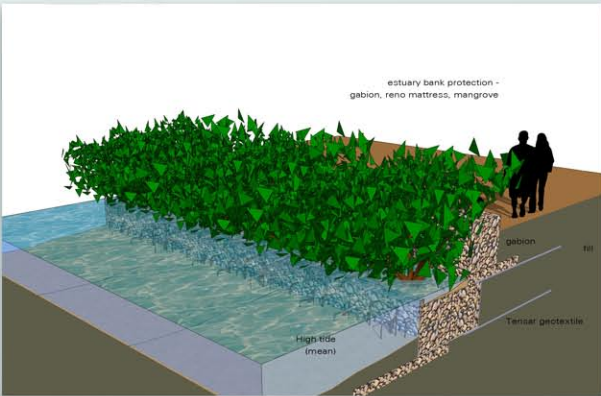
Panamaes Resort, Pedasi, PANAMA



Panamaes (aerial photo)



Small diameter collection detail



Gabion design - Estuary



Stormwater pond - reception area

The Panamaes Resort and Spa is a two hundred room resort and spa with 75 estate lots located on Panama's southwestern coast. The property consists of over 700 acres with two rivers and several spectacular sand beaches. The client's desire was to create a "green" development and simultaneously return the site to a tropical dry rain forest (overgrazing has turned the land to dry pasture). The project was led by a talented design team that included Lacroze Miguens Prati, Cresolus, Edwina Von Gal and Richard Hebert.

NSI was asked to provide engineering and design services for wastewater collection, treatment and reuse; stormwater management and reuse; water supply and fire protection; and estuary protection and storm surge protection for the beach front. The NSI design approach to wastewater required a decentralized collection system that was paired with superior on-site treatment systems. The treatment technology relies on the applied ecologies of the pond (septic), marsh (constructed wetland), river (recirculating sand filter), and woodland (irrigation). The system must remove any possible wastewater contaminants to protect fragile rivers and beaches on the site. Unlike conventional industrial treatment systems, which will often treat wastewater in 8 hours, the proposed system relies on much longer treatment times (6.5 days) to biologically reduce the contaminants in wastewater. After final treatment has been completed wastewater becomes an important resource for irrigation.

The stormwater design relies on a combination of on-lot techniques and development level approaches. Because of the size of the site, NSI was able to suggest many land based approaches including vernal ponds, rain gardens, swales, check dams, and stormwater wetlands. As a design rule stormwater was retained on site helping to minimize erosion, support existing vegetation, recharge the aquifer, and irrigate developing gardens. The combination of on-site infrastructure and landscape design was particularly powerful.

The resort had challenging water demands which fluctuated seasonally. NSI worked with a Panamanian well driller to create a well field capable of providing an adequate supply of pure drinking water from the underlying aquifer. Water tables were close to the surface because of the proximity to the sea.

As part of the watershed restoration design in the estuary and beach front, NSI proposed several approaches to stabilize river banks and beaches. Working with marine consultants, NSI designed a beach protection system proposing Tencate geo-tubes and Maccaferri gabions. The gabions provided a skeleton for bank restoration and mangrove regeneration. The system had to be both aesthetically pleasing and structurally sound.