# Stormwater Solutions Workshop

**Restored Soil, LID Swale, Tree Planting and Native Vegetation** at Coos History Museum


The building of the new Coos History Museum in 2014 provided the museum executive director and board members with the opportunity to demonstrate their commitment to both education and the environment by designing their new facility to reflect the natural environment. Located directly on the Bay, project leaders incorporated green infrastructure practices such as tree plantings, restored soils, and native vegetation into the design concept. Stormwater facilities were implemented throughout the site and provide both water retention and water quality treatment as well as opportunities for environmental interpretation

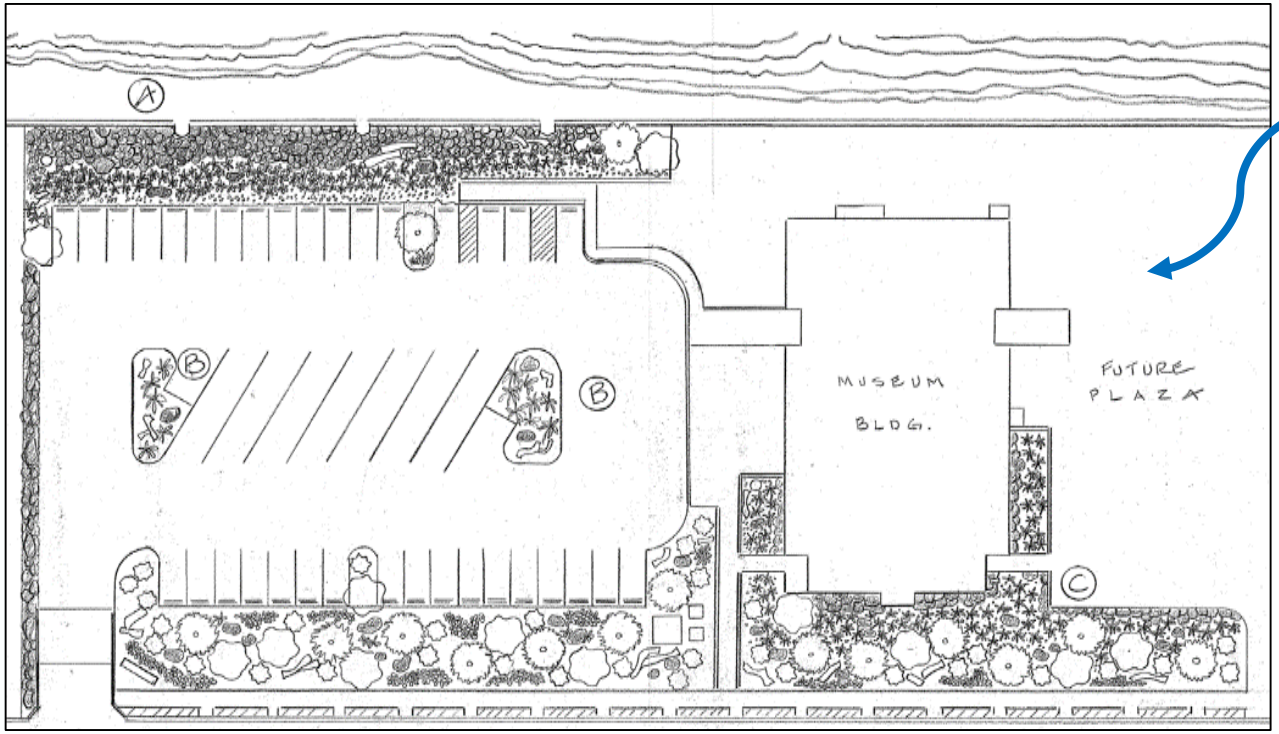
**Cost**
10k
**Hours in the field**
758
**Timeline**
1.5 years

## Site Goals

The site design strived to encapsulate the mission of Coos History Museum: ***"better understanding of life in Coos County and Oregon's South Coast, past and present"*** by blending native plantings and innovative green infrastructure practices. These practices provide on-site education and interpretation of Oregon's South Coast ecosystems to museum visitors, as well as, limiting stormwater runoff from the site into the bay.

## Site Plan

Several local landscape architects worked with the museum executive director and the Coos Watershed Association to create a landscape plan that mimics the coastal and upland ecosystems found in Coos County and reduce stormwater runoff. The site transitions from a coastal forest near Front Street, to two native sand dune ecosystems in the parking lot, and ends near the Bay with a modified raingarden.




*The original site plan. A coastal forest, sand dune and wetland habitat transition across the parking lot from Front Street to the Bay.*

## Project Collaborators

By the Sea Gardens
Clean Cut Landscape Maintenance, LLC
Coos History Museum
Coos Watershed Association
Green Girl LDS, LLC
Harding Learning Center High School
Oregon Department of Forestry
Oregon State University
Vaughn Landscape Design
Coos School District
US Forest Service

## Native Plants

American dunegrass
Beach strawberry
Evergreen huckleberry
Ferns
Kinnikinick
Oregon Grape
Port Orford Cedar
Salal
Shore Pine

# Challenges & Solutions

**High water table:** The site is approximately 11 ft. above sea level making stormwater infiltration challenging, particularly given tidal flows in the area.

***Solution:*** A modified raingarden was designed to capture stormwater and filter pollutants through native vegetation. Geotex fabric lines the facility, acting as a barrier between stormwater runoff and the high water table. Overtime, the filtered stormwater will be returned to the atmosphere via evaporation or be pumped into the bay.

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**Previous site land use:** Previously on an industrial site, DEQ requested soil mitigation measures be taken to address compacted and contaminated soil. Measures included a soil cap (12" below), minimizing disturbance, and retaining contaminated soils onsite permanently. These conditions created challenges in designing the parking lot dunes.

***Solution*:** Project managers chose to carefully amend the soil above the 12" cap with organic matter to create a nutrient rich environment for native dune grass establishment. Soil mitigation will allow for greater stormwater infiltration and root uptake.

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**Budget:** As with all projects, the project team had a limited budget and had to spend their funding carefully.

***Solution:*** With the support of Coos School District, high school students volunteered their time to harvest, transport and plant native vegetation in the parking lot islands. This allowed for flexibility in the budget, later resulting in the ability to provide interpretive signage.

# Challenges & Solutions

**Extreme micro-climate:** Located directly on the bay, the site faces dramatic climatic shifts throughout the year from cold, heavy precipitation in the winter to hot, dry windy summers. The parking lot asphalt intensifies these extremes by increasing the level of stormwater runoff in the winter and radiant heat in the summer.

***Solution*:** A team of local landscape and native plant experts created a list of native plants such as huckleberry, Port Orford cedar, and Oregon grape that have proven to endure in extreme microclimates between water inundations to drought conditions. Once established, tree plantings along Front Street will provide screening, noise buffering, wind protection, and shade to low-lying plants and parked cars, creating a more habitable environment. Irrigation, particularly of the parking lot dunes and the modified raingarden, was considered to help mitigate the summer extremes but was ultimately not implemented for sustainability and maintenance reasons.

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**Clear communication:** The museum had many devoted partners from the very early vision of a new "home" for the museum, throughout the design and construction phase, and into the day to day museum operations. As typical with projects of this magnitude, leadership roles shift as people move on to new projects and others fill their place. These changes can often lead to confusion or sometimes conflicting visions for site goals. In this case, landscape plans were duplicated while information regarding particular site elements was lost during personnel transitions.

***Solution*:** A strong neutral partner – The Coos Watershed Association – was able to convene working groups together to review current and previous site and landscape plans. The Association facilitated open forums with museum leadership, GI experts, and local landscape architects, that allowed the museum leadership to make key decisions to keep landscape projects on target and aligned with the museum's mission and original site goals. These open forums were clearly documented to avoid confusion over future management decisions, particularly the on-going landscape responsibilities of the site.

## Lessons Learned

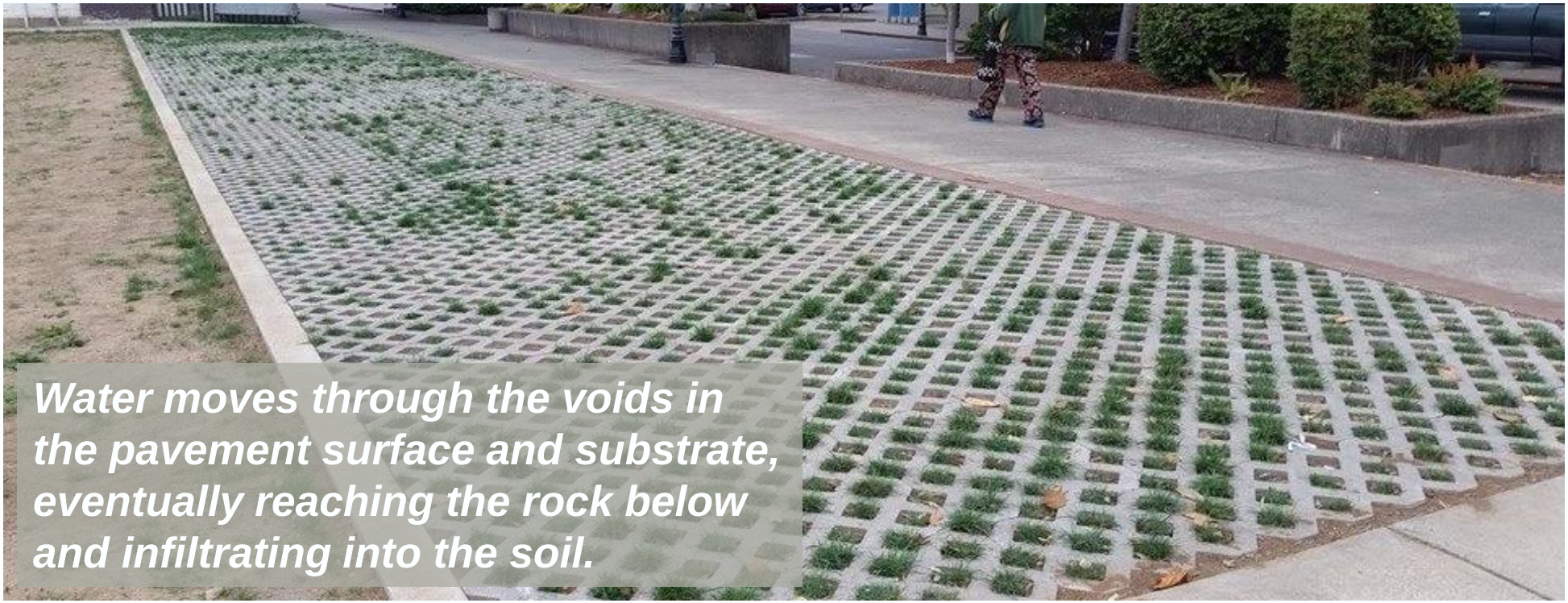
1. **Site goals and objectives.** Establishing clear site goals and revisiting them early and often can help direct conversations and difficult decisions.
2. **Volunteer support.** A strong community of volunteers become assets to projects with limited budgets.
3. **Perseverance.** Even on challenging sites GI is possible. A dedicated team of partners with strong leadership capabilities are able to address site challenges and appropriate solutions.

Special thanks to **Alexa Carleton, Coos Watershed Association,** for providing project insight.

# Stormwater Solutions Workshop

**Permeable Pavers** at 3rd Street & Central Avenue

Oregon State University



***Water moves through the voids in the pavement surface and substrate, eventually reaching the rock below and infiltrating into the soil.***

Permeable pavers, like the ones pictured above, are a cost-effective solution that provide pavement structure with water quality benefits. City of Coos Bay Public Works Department opted to install permeable pavers on a 15 ft. setback of Central Avenue to accommodate street vendors for the farmers' market. Porous pavement technologies have evolved significantly over the past two decades; when properly designed and installed, the pavement can effectively manage stormwater with low maintenance.

**Cost**
$7,500
**Parcel Size/Dimensions**
15' W x 160' L
**Weeks to completion**
4 weeks
**Contractor**
Benny Hempstead Excavating

## The Start of Something Good

The installation of permeable pavers in downtown Coos Bay is the beginning of a city beautification and sustainability revitalization effort. In the near future, the empty lot behind the pavers will become a parking lot with a LID-swale to help manage stormwater runoff.

## Advantages of Porous Pavement

Porous pavement can be designed and engineered to manage stormwater onsite, lessening the impact on traditional "gray" stormwater infrastructure. Here are a few other advantages of porous pavement:

- Infiltrates rainfall
- Reduces impervious surface runoff
- Aesthetically pleasing
- Simple and time-efficient installation
- Tree compatible
- Breaks down hydrocarbons
- Readily available

There are many different types of porous pavement including: interlocking pavers, permeable asphalt, and permeable concrete. Contrary to what many think, paved surfaces are better for water quality than gravel surfaces. Gravel surfaces are highly compacted and expose sediment; leading to low infiltration and high sedimentary runoff. However, porous pavement may not be practical in areas where tire chains are frequently used, because they degrade the pavement quickly.

Permeable pavement and permeable pavers are practical solutions for paths and parking lots.

*Images from The Interlocking Concrete Pavement Association and perviouspavement.org.*

## Additional Resources:

- **LID Guide in Western Oregon: A Practical Guide for Watershed Health,** Porous Pavement BMP (3-67)
- **Porous Pavement Hydrologic Calculator and Video Tutorials** – OSU Extension
- The National Ready Mix Concrete Association
- The Interlocking Concrete Pavement Association

Special thanks to **Randy Dixon, City of Coos Bay,** for providing project insight.

# Stormwater Solutions Workshop

**Green Roof, Tree Protection, Construction Sequencing, Restored Soil & LID Swale** at the Bay Area Hospital

Oregon State University


Quality patient care and satisfaction motivated the Bay Area Hospital decision-makers to incorporate LID practices during the 2013 building expansion project. Adequate hospital parking was a high priority in the expansion design process. The design team selected an adjacent highly managed (e.g. irrigation, fertilizer applications) field as the construction staging area for the hospital and for a new parking area. This choice helped to protect mature trees and natural landscapes surrounding the hospital. The new parking area contains a LID swale to capture and infiltrate stormwater runoff. Additionally, green roofs were installed to promote a healing environment from patient windows.

## Construction

Measures where taken during the design and construction phase of the project to protect the future LID swale and planting areas from excessive soil compaction. Mulch, wattles, and hay dams bale check dams were used to limit soil erosion.

## Health & Green Building Features

Understanding the healing power of nature, hospital leaders opted to install an aesthetic "green roof" visible from patient windows. While not intended to treat stormwater, the 5,000 sq. ft. area is layered with soil and sedum which cools and cleans the air. The green roof retains some stormwater, through the soil substrate and evaporates the water back into the atmosphere. The hospital is an early adopter of this growing trend in healthcare.

For more information about the sustainable building features at the Bay Area Hospital, you can go to bayareahospital.org > About Us > Green Building.

## Site Maintenance Challenges

- On projects such as the Bay Area Hospital, it is important that the design and construction team communicate maintenance expectations before construction begins. Too much maintenance, such as over-watering, can lead to sub-optimal conditions for new vegetation. However, too little maintenance and the LID swale can quickly look "weedy" and lack aesthetics.
- Debris from cars and roadways are constantly being carried by strong coastal winds into the LID swales. Routine removal of the debris is necessary to maintain both functionality and aesthetics.
- Initially, accessing the hospital entrance from the parking lot required patients and visitors to walk around the swales. This resulted in people cutting across the swales causing soil/mulch erosion and destroying the plants. Several concrete bridges were later installed to allow easy access across the swales and protect the facilities.

## Lessons Learned

Ongoing hands-on training is needed to communicate *how* to maintain the LID swale stormwater infrastructure functions and *how* to maintain the aesthetics of the site. The site design phase of any green infrastructure project needs to carefully consider both environmental and human functionality of the design.

Special thanks to **Stephanie Martell, Designer/Project Manager, HGE. Inc** for providing project insight.