

Goldman-Armstrong Ecoroof Final Report

This report concludes two years of hands-on deconstruction, retrofitting, construction, and gardening. The project includes a 16x22 ft Extensive Ecoroof, an additional 176 sq feet of living space, and a porch and upper deck, on my 1937 home in Portland's North Tabor neighborhood. The entire process has been very educational and fulfilling. From the outset materials were salvaged and re-used on site whenever possible. (A complete list is attached).

My initial understanding of ecoroofs has evolved steadily throughout the project as I learned more through various resources, including the BES Ecoroof website, the US EPA's web-conference on Ecoroofs and a slew of online articles. A seminar by Michael Geffel of Native Canopy Landscape and Design at Portland Nursery also proved valuable in the planting phase.

Ecoroof details:

My ecoroof relies in large part on native plants: sedums, knickknick, and wild strawberries; with a border of food/medicinal herbs: oregano, thyme, chamomile, yarrow. The growing medium selected was Swanson Bark's Rooflite semi-intensive mix, at a depth of 5 inches. The semi-intensive mix is a richer growing medium favorable to a greater variety of plants than the extensive mix, yet still resistant to weed growth and lightweight. Two 16" wide scuppers through the 6" high soil retention curb provide an outlet for rainwater. A series of assorted sizes of river rock were used to hold back the growing medium, and prevent erosion. Firestone 60 mil EPDM provides the membrane and root barrier, with custom steel flashing to protect the edges not covered by the growing medium. Densdeck fiberglass gypsum board protects the EPDM from the 3/4" plywood roof deck below.

Ecoroof Benefits:

The benefits of my ecoroof include stormwater runoff reduction, filtration of runoff, enhanced insulation of the living space below, improved roof longevity, and beautification of the home. The ecoroof also serves as aesthetic justification for a shed dormer. The ecoroof on my house improves the view for residents of Providence House, a four-storey elder home that overlooks my property. As Charlie Miller writes in "Extensive Greenroofs" in the *Whole Building Design Guide*, ecoroofs "provide a more restful and restorative environment for patients," in hospitals.

During summer the delayed release of water was quickly evident, as the roof continued to release water for three days after irrigation (with a soaker hose). The additional insulation value the soil provides was also apparent.

Cost: Ecoroof Total Cost: \$8921.60 (\$25.35/sq. ft) (please see attached spreadsheet for a complete list.) Determining the exact cost of the roof was difficult, as the project included the addition of a dormer, and a great deal of seismic retrofitting of the existing house to support the weight of the ecoroof. For the purpose of this report all materials used directly in the construction of the roof itself, and the framing and seismic retrofit. The project as a whole cost an estimated \$30,000.00, with the ecoroof making up just under a third of that expense.

Lessons Learned/Surprises:

The cost of the specific Simpson hangers and straps, and other reinforcement required by the engineer came as a shock, costing nearly as much as the lumber for the first stage of the job. Other than that, there were no real surprises in the cost over-run department. The use of salvaged materials more than offset the cost of the FSC-certified lumber used for the framing. The addition of a protective layer (Dens Deck fiberglass board) between the 30# felt and the EPDM was an unexpected cost, especially as it required proprietary fastening plates.

Another surprise during construction was the location of the glue-in hold down anchors. Basement windows were not specified on the As-Built plans, and two all-thread glue-in anchors had to be moved by the engineer.

Project timeline:

I had plans drawn in September of 2007, got permits September 20, 2007, and began the reinforcement/shearwall retrofit in the winter of 2007-2008. In July of 2008 we tore off the existing roof, then resheeted, tarpapered the front of the house, framed the dormer for the ecoroof. The EPDM for the ecoroof was installed in fall of 2008, but by the time the flashing was ready in November, I decided it would be too late to plant the roof that fall, and concentrated on finishing the interior. I moved into the space in late January 2009. In January of 2009 I heard about the City of Portland BES Ecoroof grant program, so the project was on hold while I waited for the revised grant application. After the grant was approved, I had the growing medium delivered by Swanson Bark. I chose Swanson of Kelso, WA, as they have a blower truck, and were able to blow the growing medium onto the roof. This worked very well, although there was a significant amount of overspray. I began planting that same afternoon with potted sedums, with a series of additional plantings throughout August and September, so I could see what plants did best. The most recent round of planting was completed in late October, including bulbs and seeds. (I see the project as continually evolving, and hope to add a greater diversity of plants over the coming year.

Planting:

The Ecoroof was partially planted in mid-August, and required heavy initial watering. At first there were issues with ponding along the parapet at the low edge of the roof, but within about a month, the growing medium had settled, and this is no longer a problem. As I began planting the ecoroof, I soon realized my initial plan was too much of a monoculture of sedums. I have attempted to incorporate other native plant species among the sedums. Wild Strawberry *Fragaria Chiloensis* is thriving, as are Lewisia and Western Yarrow. After a hike on Wygant Peak in the Columbia Gorge, on which I noted plants that thrive on the exposed rocky slopes, I expect deer fern and pearly everlasting to perform well in an ecoroof setting.

I have also planted several types of seeds and bulbs, which I hope will add seasonal accents next spring.

Irrigation:

Irrigation has been applied on an as needed basis with a soaker hose. My initial watering plan (every other day) proved excessive, resulting in ponding, and little irrigation has

been required since early September. I plan to apply irrigation throughout next summer to allow the plants to become established.

Maintenance:

I am interested to see which plants fair best through both winter and summer. One surprise was that *sedum oreganum*, a plant that has been successful in other ecoroofs, is struggling and several of the plants have died back. Regular weeding has been necessary so far, as I suspect it will be until the desirable plants mature.

Overall, the construction and maintenance of the ecoroof has been an educational experience. I am happy to be contributing to cleaner waterways in the city of Portland, and would like to extend my gratitude to the Bureau of Environmental Services for the grant. I am proud to live in a city that consciously promotes sustainability and green building.

Thanks very much



Abram Goldman-Armstrong

Goldman-Armstrong Ecoroof Expenses

Phase	Item/Service	Vendor	Cost
Desgin	Plans	David Adams, Architect	\$ 800.00
	Engineering	Sherman Engineering	\$ 534.75
	Engineering changes	Sherman Engineering	\$ 218.75
	Permit Fees	City of Portland	\$ 1,404.55
DEMO	Drop box	Cloudburst Recycling	\$ 474.20
Concrete	Cement	Miller's Minimix	\$ 380.00
	Testing for hold down anchors	Carlson Testing	\$ 400.00
Framing	FSC 2x12x16'	Parr Lumber	\$ 391.68
	5 1/8x 13 1/2 Glulam beam	Parr Lumber	\$ 240.68
	4x6 (Curb)	Parr Lumber	\$ 134.96
	LVL microlam	Parr Lumber	\$ 185.76
	3/4 CDX	Mr. Plywood	\$ 551.76
	FSC 2x6x8	Parr Lumber	\$ 72.43
	Header stock	Rebuilding Center	\$ 46.75
	Simpson hangers/straps etc	Misc	\$ 899.19
	30# felt	Mr. Plywood	\$ 86.97
	Finish	Den's deck	Dealers Supply
Insulation plates		Dealers Supply	\$ 76.00
EPDM		Pondcrafters LLC	\$ 325.00
EPDM Sealant		Dealers Supply	\$ 16.46
EPDM Adhesive		Dealers Supply	\$ 128.73
Misc. Flashing		misc	\$ 201.00
Parapet Flashing		Montavilla Sheetmetal	\$ 221.00
Landscaping	Growing medium	Swanson Bark	\$ 658.00
	Plants (to NOV 3, 2009)	Portland Nursery	\$ 322.98
Total:			\$ 8,921.60