

CASE STUDY:

Boardman Residential Bioswales



LOCATION: 525 Juniper Dr SW, Boardman, OR

PROJECT TYPE: Bioswale through use of sloped sidewalks and curb openings

PROPERTY TYPE: Residential Front Yard

CONSTRUCTION DATE: 2006

INSTALLER: Hayden Homes

Summary

Many residential homeowners like a well vegetated lawn. This study highlights a community that decided to take advantage of the infiltration potential of residential landscaping to manage stormwater on-site instead of in catch basins or dry wells. Changes to curb and sidewalk standards helped accomplish this.

Project Background

The City of Boardman is a rapidly growing community in northeastern Oregon along the Columbia River Gorge on Interstate 84. Agriculture is central to the economy and the area also serves as a hub for transportation of manufactured goods (City of Boardman 2008). Average annual precipitation is 8.47" and the sandy soils infiltrate water at rates in the 10" - 12" per hour range. As in most communities, traditional development has streets at the lowest point with long curbs to direct stormwater to a single point (e.g., catch basins or dry wells that require piping). Due to increasing awareness of environmental degradation and growing permitting difficulties for dry wells and other Underground Injection Controls (UICs), the City of Boardman made the choice to adopt low-impact development practices. This case study illustrates the stormwater management approach that is now required for all new development in the city.



Figure 1: Front yard bioswales, sloped sidewalks, curb openings and depressions.

Front yard bioswales are incorporated into the landscape of newly developed homes to manage stormwater from the streets (figure 1). Due to the arid climate in this area, homeowners extensively irrigate their lawns to maintain a certain level of vegetation. It is logical to take advantage of existing conditions and utilize well vegetated lawns as a natural bioswale for stormwater management, rather than trying to establish additional vegetated areas for stormwater. As part of the development code for the city, sloped sidewalks, curb openings, and front yard depressions are required to allow stormwater runoff to channel into the yard which acts as a natural bioswale (figure 2). As opposed to traditional development where soil slopes away from the home, this design incorporates a small depression in the lawn near the sidewalk to allow stormwater to enter and infiltrate through the soil (Beyeler 2008).

To provide effective and cost efficient stormwater management, the city adopted design standards

reflecting a more accurate representation of natural climatic, hydrologic and geologic conditions (City of Boardman 2008).

Specifications

Grading and drainage plan requirements, landscaping criteria, street, curb and sidewalk designs are designed to keep all precipitation from each lot contained upon that lot. The Stormwater Management Development Code is available on the City of Boardman website.



Curb Openings: Curb openings will be constructed in accordance with city construction standards and will be spaced at the frequencies listed in Table 1. This table indicates the distance between curb openings while maintaining the maximum impervious area of 3,500 square feet and a minimum spacing for aesthetics and safety when following prescribed street standards.

Sidewalk Standards: Sidewalks will be constructed of concrete or brick/masonry pavers in accordance with city construction standards

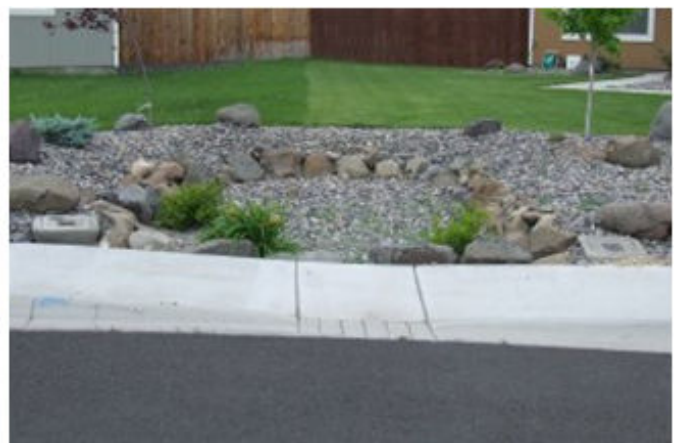


Figure 2 - Front yard bioswales illustrating sloped sidewalks, curb openings, and graded lawn depressions

Curb Standards: Curb designs are consistent with the street design standards of the Transportation System Plan for local streets, neighborhood collectors, collectors and arterial streets and apply to all new construction or reconstruction of streets in the City of Boardman. Curbs within the residential areas on streets classified as local or neighborhood collector shall be a mountable face curb constructed of concrete as set in city construction standards.

and will meet all Americans with Disabilities Act requirements. The vertical transitions for the sidewalks/curbs are 5 feet long with a 2 foot bottom to drain across to the swale. Local street sidewalks will be sloped at 2% grade away from the curb in accordance with City construction standards.

Major Benefits

- Bioswale utilizes homeowner’s front yard
- No pipes, no catch basins

| Street Classification | Area Drained Including Sidewalk (Square feet) | Maximum Spacing (feet) | Minimum Spacing (feet) | Area Drained Including Sidewalk (Square feet) |
|------------------------|---|------------------------|------------------------|---|
| Local Street | 3,500 | 156 | 65' | 1,138 |
| Neighborhood Collector | 3,500 | 143 | 65' | 1,560 |
| Collector | 3,500 | 135 | 65' | 1,690 |
| Arterial | 3,500 | 135 | 65' | 1,690 |

Table 1: Construction standards for spacing of curb openings

- No mosquito development on site
- Incorporated into landscape
- Homeowner maintained
- Eliminates conventional permitting process of pipe installation
- Low cost of development

Costs

By changing development practices to incorporate more environmentally friendly infrastructure, the cost of development decreases approximately 7-15%. This reduction in cost is mainly attributed to eliminating installation of traditional piping. Most developments in the City of Boardman are in excess of 1/4 of a mile from any existing stormwater piping. Therefore, the cost of connecting to an existing system is significant. Estimated costs, using the Capital Improvement Plan formulas (including engineering and contingency) would be \$65/foot for smaller diameter sizes (8" - 10") and would increase as pipe dimension increases. The length of stormwater piping in the 525 Juniper Drive SW subdivision would have been 3,850 feet totaling an estimated cost of \$250,250. The curb costs and the sidewalks costs are nearly identical. There are some increases in grading; however, these increases are hard to determine as grading plans are required for all development, and redistribution of soil through grading is subject to existing and desired topographical profiles (Beyeler 2008).

Maintenance

Residential bioswales are maintained by the homeowner. The bioswales are incorporated into the landscape and vegetation is maintained through traditional yard care and irrigation (Beyeler 2008).

Effectiveness & Monitoring

Homeowners inform the appropriate authorities if the swale is not functioning properly. If the swale

is not effectively draining water, city maintenance crews will visit the site and re-aerate the soil. This might become a problem when dense roots are blocking water infiltration. Otherwise, monitoring is based on simple visual observation during site visits to make sure depressions have not been filled in by the homeowner (Beyeler 2008).

Successes & Lessons Learned

The greatest challenge is grading the soil around new development areas so that it has a natural tendency to collect water in the designated bioswales. It is easy to manipulate the topography of the soil, but if done poorly, it will not function properly. In this swale (figure 3), construction



Figure 3 - Construction of this swale did not comply with grading plans. As a result, the depression is not deep enough to effectively infiltrate all stormwater runoff from the street

did not meet the grading plans indicated. As a result, this swale receives storm water from a significantly larger impervious surface area than the swale can handle. The City will install an overflow system to divert runoff to a dry well. Even though the City does not like the use of dry wells this is an instance where it is needed to correct the problem. Conveying the importance of proper grading to the contractors has proven to be one of the most prohibitive design issues.

The swale will still function as a bioswale and only when the water reaches a certain height will water be diverted away from the swale. The City is hoping to visually screen the overflow pipe in the rock retention wall so it is not an eyesore detracting from the landscaping.

This grading mistake has become a lesson for the City, the developer, the landscape architect and the landscape contractor. As Barry Beyeler put it, “in the words of James Joyce, ‘mistakes are the portals of discovery.’ Sometimes the mistakes are the very essence of getting the designs right.”



Figure 4 - Front yard bioswale incorporated into the landscape

Contact Information

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References

City of Boardman. Development Codes: Stormwater Management. Retrieved May 25, 2008, from http://www.cityofboardman.com/dev_code/chap3_5.pdf

Beyeler, B. (2008). Interview. Low Impact Development in the City of Boardman. City of Boardman Community Development Director.

Pictures courtesy of B. Beyeler.