Designing Residential Landscapes to
Minimize Fertilizer Impact on Water Quality
For Home Sites on the Valley Floor in Jackson Hole

Intended for Architects and Landscape Architects

Friends of Fish Creek

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Many of the streams and creeks that flow into the Snake River in Jackson Hole have demonstrated elevated levels of algae that are well above what would be considered abnormally high for the western US. A prime cause of the algae is directly related to excess levels of nutrients entering the surface and ground water. Elevated algae levels from nutrient loading can alter fish habitat, impact fishing conditions and create human health issues. While we are not at crisis levels yet we want to reverse this trend well before we get anywhere close to those circumstances.

It has been determined that one of the largest sources of this nutrient pollution comes from excessive residential lawn fertilizer applications resulting from the installation of landscaped areas that demand such treatments. Excessive lawn watering compounds the potential for nutrients to migrate to ground and surface waters and thus negatively affect water quality.

As the landscape architect on a new home, or a substantial renovation of an existing home, you have the best opportunity to design landscaping that effectively eliminates any impact from fertilizer run-off and or seepage into the groundwater table. What follows below are some suggested guidelines that will help save our streams, ponds, wetlands and groundwater.

To begin with, even the best design cannot be effective if poor landscape management practices are employed. Please be sure that your homeowner and/or HOA have a copy of our Residential Landscaping Best Practices document. That document can be found on this website and is available via links from many other websites. Please consider linking to the document on your website, plans and other promotional materials.

As you well know, each property is different. You as a landscape architect have the best chance to influence the future of the land, the homeowner's expenses and contentment. Therefore, we are only offering general guidelines. Some of these may or may not be appropriate for all properties.

The design process should begin with a conversation with the homeowner about how they intend to use the property with a specific focus on how much managed lawn area that they want. The most important principal is to leave undisturbed

adapted native plant communities in place on as much of the property as possible. This most simple and inexpensive approach calls for minimizing the amount and size of managed areas. The biodiversity, complexity, and functions of native plant communities are almost impossible to replace because they are “site adapted”. They require no additional maintenance or inputs of nutrients. The less managed area, the less fertilizer to deal with.

A second principal is to eliminate direct or rapid connectivity between managed areas and any surface water resource. If leaving native plant communities in place is impossible, grading to move runoff or seepage away from water resources is the next best approach. Such drainage can even be directed to “bio filtration treatment areas” (see below for description). In such areas, water can be isolated and remediated for nutrients prior to leaving or seeping from the site. The preferable mechanisms are passive, and mirror simple natural processes that allow the conversion of nutrient into beautiful plant matter.

Adding constructed water features is a complicated subject and we do not yet have a position on this. As you may know, the County has put in place a moratorium on new ponds. We will come up with a point of view on this in the next several months.

To summarize, from a water quality, wildlife, pollution and economic perspective, it is generally best to leave as much of the natural vegetation and topography in place as possible. This is especially true on land that touches a surface water resource. You should keep in mind that a shallow groundwater table can be a direct conduit to surface water feature some distance away. While adding engineered buffers and altered grades can be done an existing native vegetation area, abutting a water feature should be left as is if that is the best alternative.

A Grading Plan:

1. The lowest point of the any unavoidably disturbed area on a property should be three feet above the highest predicted ground water levels. This is the level required for plants and microbes to take-up most excess nutrients that could enter groundwater.
2. Rough grading should allow for a minimum of one foot (after compaction) of quality topsoil for managed areas and one foot of lesser quality soil for non-managed, or what we might call “native meadow areas”.
    a. Where expense for topsoil becomes an issue in the budget then amending existing site soil with smaller amounts of topsoil and organic amendments is a ”next best” alternative. In no case should there be less than one foot of “soil material” above the fill materials. This is especially important where the base is cobble or gravel. The one foot of living soil is needed to slow the flow of nutrients into the groundwater and provide for solid turf root development. There is

no better way to remove excess nutrients from our beautiful lands, and top-quality drinking water and waterways.

3. Where possible, direct the site's run-off away from the water resource, into bio-filtration treatment areas and lined ditches.
4. Where this is not feasible, runoff should be drained into self-contained, bio-filtration/remediation areas separate from the water resource.
5. Swales and other areas that were required to be disturbed where surface run-off collects should be graded with broad, gentle cross sections and planted with appropriate native grasses, forbs and shrubs to minimize water depth and maximize retention time thus enhancing bio-filtration, preventing erosion at a minimum being consistent with USDA NRCS guidelines for vegetation lined drainage ways.

A Buffering Plan

Managed turf areas and gardens and impervious surfaces should be separated from any water resource by a riparian buffer.

1. Buffer should ideally be 20 feet wide but can be as small as five feet if that is all the site allows.
2. Buffers should not be mowed or fertilized, they should consist of native and other drought tolerant species of grasses, sedges or rushes, forbs, shrubs and even trees that will serve to retain nutrients and other chemicals and prevent them from entering the waterways.
3. Runoff and seepage from managed areas adjacent to the water resource buffer should be sloped directly away from the water resource including an impervious layer beneath the topsoil that takes chemicals and irrigation water away from the water feature to areas behind a native vegetation buffer zone or collected in containment areas and/or as a last resort piped to bio filtration treatment areas (remembering that the creation of such systems should only minimally disturb existing natural vegetation communities)
4. Lesser desirable alternatives could be wetland that are not connected to water features (versus emergent wetlands with direct water connectivity) or managed natural grasses if those areas must be disturbed and native vegetation communities lost..

For effective bio-filtration of surface runoff or even subsurface runoff from tiling or subterranean impervious layers, the sites should be managed to maintain native plant densities that are healthy, free of rills or large bare areas such that they will allow unimpeded/unfiltered run-off and/or seepage flow and dispersal. To be most efficient more vegetation matter and rot development is important. As a result, mowing is undesirable or should be limited (i.e. not mown shorter than two inches or a height greater than normal depth of surface runoff as sheet flow).

If the area is to be watered, the irrigation system should be designed for total efficiency that aids in preventing any excessive watering because of nutrient or other potential pollutant loading. The intention of irrigation would simply be to

keep vegetation green longer to facilitate nutrient uptake. The best design should include soil moisture sensors, a connection to local weather inputs for daily evapo-transporation (ET) rates and other weather variables and a rain sensor.

Construction of Bio-Filtration Areas:

a. All bio-filtration treatment areas and ditches or tiles that convey runoff to them will be lined to prevent leaching of untreated water. Lining may either be of clay or synthetic materials. Lining is an extremely effective additional way to reduce connectivity with a groundwater table and ensure effective delivery to an appropriate remediation area.
b. Each bio-filtration treatment area associated with site drainage should be constructed as a small basin that will retain and treat water draining from site as well as surface runoff from the 10-year design storm.
c. Design these treatment areas to maximize water retention time to thereby enhance removal of any pollutants prior to water exiting the site. The intent is not to create additional surface water features but vegetated area capable of nutrient uptake and/or conversion.
d. If located near a surface water feature or in a swale, berms may be required along the outer or lower edge of the basin to prevent connectivity with the water feature.
e. Bio-filtration treatment areas should be at least half as large as the area of the site they serve. This minimum size was based on reported rates of nitrate loading per unit area and nitrate concentrations found to be treated effectively by land application of partially treated wastewaters (Water Environment Federation 2001). Please see Lawn Care and Landscape Fertilizer document on this website for proper fertilizing rates and frequencies.
f. Bio-filtration areas should be planted with fine fescue/native upland mix and/or facultative wetland plants based on hydrologic environmental and aesthetics, including a variety of forbs and shrubs. Supplemental irrigation may be provided if necessary to maintain, healthy vegetation during dry periods (avoid excess watering to reduce groundwater connectivity and retain holding capacity of potential runoff events.
g. Quality topsoil substrate over required impermeable lining is to be a minimum of one foot in depth following proper soil compaction techniques. It is important to keep in mind that creating a lined bio-filtration basin requires disturbing more native plant community areas which should be avoided as much as possible. Retaining existing native, adapted plant communities is a trade-off that pays-off in that they are self-sustaining without any management.