New York Golf Foundation

Best Management Practices

Water Conservation, Quality and Protection

NEW YORK STATE BEST MANAGEMENT PRACTICES FOR GOLF COURSES

HTTP://NYSGOLFBMP.CALS.CORNELL.EDU/

WHY IS THIS UNDERTAKING IMPORTANT?

- Educational tool
- Ensure we are doing our best for the environment
- Establish and maintain working relationships with NYSDEC and state lawmakers
- Improve non-golfers perception of our industry

A game based on honor and integrity

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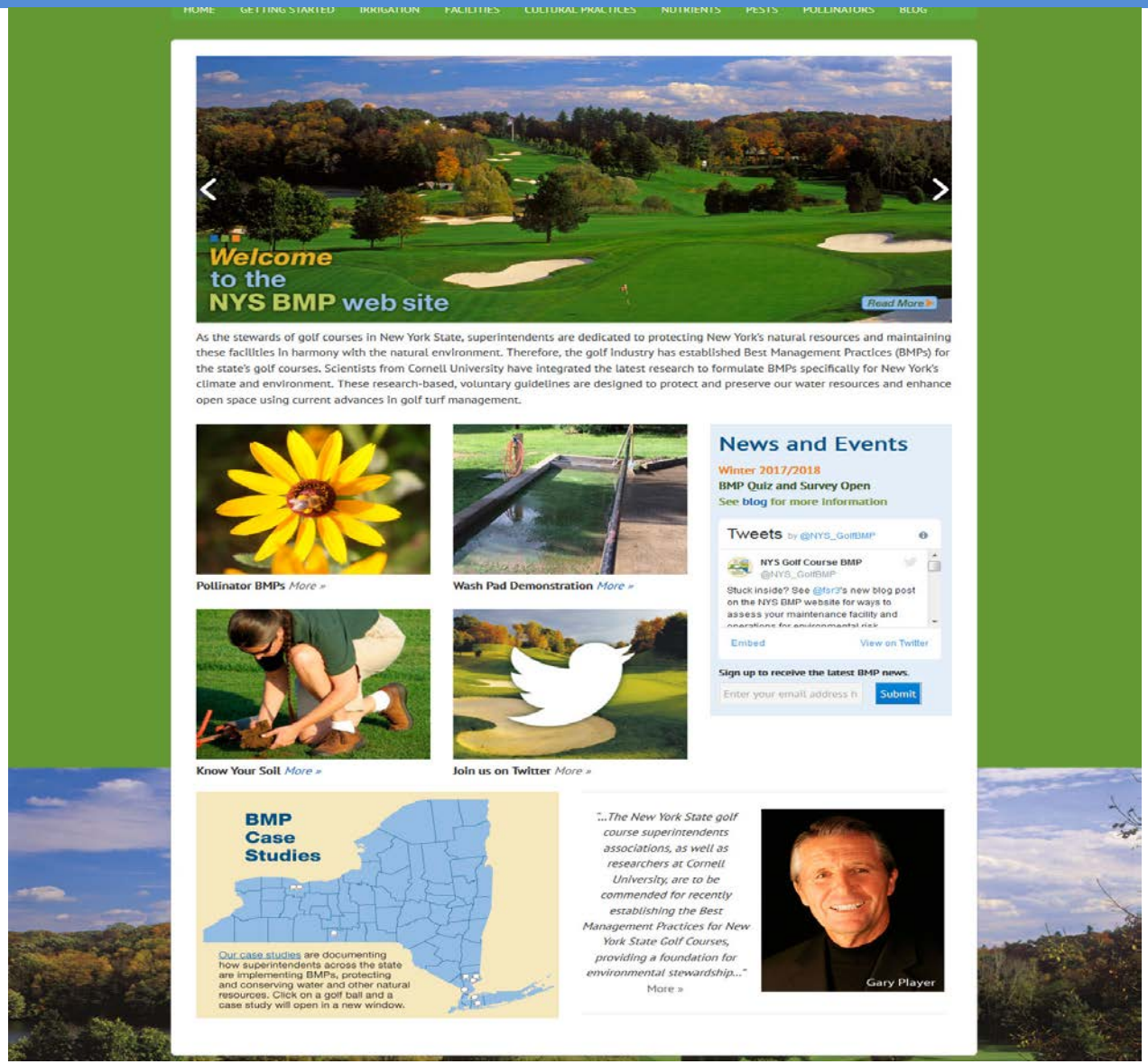

NYS Golf Foundation

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NYS Best Management Practices Assessment

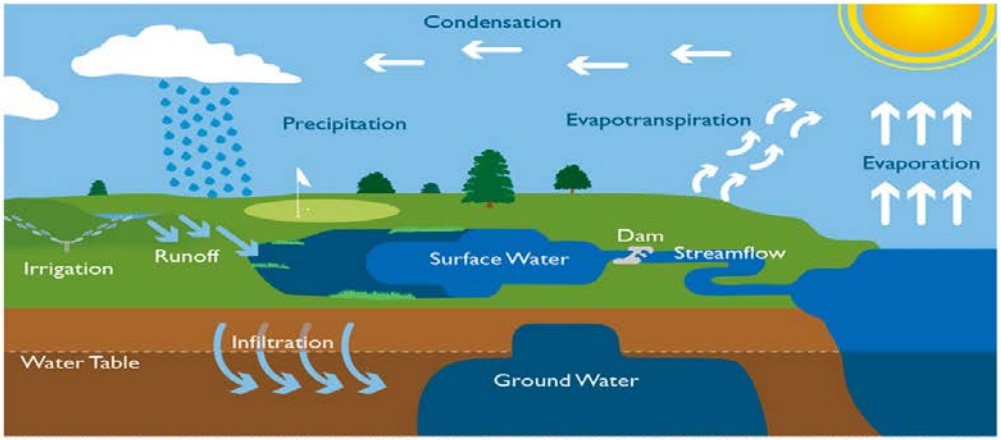
Ch	Title	BMP Statements	Ass
1	Introduction		
2	Environmental Concepts		
3	Water Quality Management	1. Assess current surface and groundwater quality. 2. Conduct water quality assessment using accepted standards. 3. Use an accredited laboratory for water quality assessment.	
4	Site Analysis And Water Quality Protection	1. Properly assess maintenance sites and golf course for priority areas related to water quality protection. 2. Determine most effective structural or vegetative BMP strategy, if needed. 3. Assess effectiveness of implemented BMP strategy.	
5	Irrigation	1. Design and maintain irrigation systems to uniformly apply water to the intended area of management. 2. Determine accurate supplemental water needs based on appropriate climate and soil data. 3. Assess system efficiency through regular audits of application rate and uniformity.	
6	Nutrient Management	1. Recognize all organic waste generated on golf course contains nutrients that are potential contaminants. 2. Determine accurate supplemental nutrient needs based on soil chemical and physical analysis. On sand based areas, consider foliar testing as a diagnostic tool. 3. Supplement soil with appropriate rate and source of nutrients to maintain optimum availability and minimum off-site movement 4. Assess application efficiency through regular equipment calibration.	

7	Cultural Practices	1. Use and manage turfgrass species and varieties adapted to macro and micro climatic conditions of your location. 2. Maintain turf with high shoot density to minimize runoff and maximize infiltration 3. Manage the surface accumulation of organic matter to maintain a permeable system that minimizes runoff and maximizes subsurface retention.
8	Integrated Pest Management	1. Conduct a thorough assessment of pest pressure. 2. Establish appropriate pest thresholds for managed turf areas. 3. Identify and correct growing environments that exacerbate pest pressure. 4. Implement sanitation, exclusion, and cultural practices to minimize pest pressure. 5. Determine least toxic pest control programs including preventive approaches 6. Assess control program effectiveness using established monitoring practices 7. Recognize environmental fate of pesticides and select pesticides using a selection strategy that includes an evaluation of pesticide characteristics and potential for nontarget effects.
9	Pesticide Storage, Handling And Application	1. Ensure full compliance with existing pesticide regulations, including applicator and technician certification and following all label directions. 2. Adapt or implement as many NYSDEC pesticide storage guidelines as possible. 3. Assess site and weather conditions thoroughly before applying pesticides.
10	Maintenance Facilities	1. Assess potential point source pollution risk. 2. Manage organic and inorganic waste to minimize potential 3. point source pollution. 4. Ensure compliance with regulatory requirements designed to prevent point source pollution

Hydrologic Cycle

The sun is the powerhouse for the hydrologic cycle, providing the energy for phase changes of water (evaporation and condensation) and for the storage and release of latent heat. Because water is an efficient solvent, all water-soluble elements follow this cycle at least partially. Thus, the hydrologic cycle is the integrating process for the fluxes of water, energy, and the chemical elements throughout the environment.

Water enters the hydrologic system as precipitation, primarily in the form of rainfall or snowmelt. It is then delivered to surface waters from runoff or infiltrates into the subsurface. Water can leave the system via stream flow or runoff, evaporation from open bodies of water, or evapotranspiration (evaporation from soil surfaces and transpiration from the soil by plants).



The hydrologic cycle is the cyclic movement of water in its various phases through the atmosphere, to the Earth, over and through the land, to the ocean, and back to the atmosphere.

Groundwater Recharge

Water moves through the surface of the earth, eventually through the soil horizons to natural storage areas below the ground. Depending on subsurface rock formations and overall permeability, the filling of these storage areas or "recharge" can collect water from a few hundred square feet to a few square miles. Groundwater often provides the source of water for perennial stream flow at base flow conditions when there is no precipitation. It is critical to understand the basics of groundwater recharge, both in size and scope, to mitigate potential contamination.

Infiltration and Runoff

The amount of water that infiltrates into the ground from the total run off depends on a number of variables, including the intensity of precipitation or irrigation, soil infiltration capacity, site characteristics, antecedent soil moisture, and season.

Water that infiltrates into the soil either is stored within the soil profile or percolates downward toward groundwater, depending on the soil moisture conditions and soil structure. This soil water is then available for evapotranspiration. If the moisture-holding capacity of the soil is exceeded, the excess water percolates downward through the soil profile to groundwater. If the soils are at saturation, any additional precipitation does not infiltrate into the soil and becomes surface runoff instead. It is in this runoff that more soluble compounds applied to turf have the greatest potential to move off site.

Site characteristics including land use, land cover, soils, and topography also influence the amount of infiltration versus amount of runoff. Turf, forests, fields, and other vegetated areas slow down the flow of runoff, filter out sediments, and trap pollutants or break them down biologically. Conversely, hard impermeable surfaces such as buildings, roads, parking areas, and exposed bedrock prevent water from infiltrating into the ground. These hard impermeable surfaces, as well as bare soils, offer little resistance to reduce the velocity of runoff. Similarly, compacted soils and saturated soils retard the infiltration of water and therefore promote runoff. Lastly, steep slopes can increase the rate and amount of runoff.

The amount of runoff versus infiltration at any location also varies seasonally. During the winter, soils in New York are likely to be frozen and impermeable to water. Snowmelt, rain, and low evapotranspiration rates in the spring generate wet soil conditions and downward movement of water to groundwater. The potential for runoff is high because the near-saturated or partially frozen soils have low water infiltration capacities. During the summer, high rates of evaporation and plant water uptake may reduce soil water storage, leaving none to percolate downward. Summer rains only partially recharge the soil profile, and the soil's moisture holding capacity is typically not exceeded. Except for high-intensity thunderstorms, runoff and erosion potentials are generally low during the summer. In the late fall, evapotranspiration rates decrease, and groundwater recharge occurs when the moisture-holding capacity of the soil is exceeded. Runoff and erosion potentials also increase during this period. However, in New York, runoff from turf most often occurs from wet soils and not from high rainfall intensity.

Runoff

Surface runoff is a water flow along the surface of the ground that occurs when the soil is saturated, compacted, high in clay particles, or has lost soil structure (large pores). When runoff flows along the ground, it can pick up contaminants (including but not limited to, fertilizers, and petroleum) that then become discharge or nonpoint source pollution. The potential for runoff is greater on steep slopes. Research on golf courses has shown that in areas with minimal slopes, runoff on fairways is less than 5% of rainfall (Easton et al. 2005).

Surface water is the focus of watershed protection because recent research on the environmental impact of nutrients and pesticides applied to golf courses has indicated that for the majority of the acreage under turf management, surface runoff is a much greater concern than leaching. While leaching of certain materials does occur at low levels and under specific environmental and climatic conditions, more materials are transported in surface runoff than through leaching (Baris, R.D. et al. 2010). However, certain areas of New York have a history of groundwater contamination problems.

BACK NEXT

Protect Water Quality

Regulatory compliance is the first step in aligning golf course management with BMPs. New York State has some of the nation's strictest state regulations on pesticides and fertilizers. Golf course superintendents must be aware not only of regulations on the purchase, storage, handling, and application of fertilizers and pesticides, but also how these and other potential water quality contaminants can potential impact water quality.

Potential Water Quality Contaminants

Fertilizers and pesticides maximize productivity and performance in a variety of agricultural and horticultural settings, including golf turf management. Although application practices can affect water quality, the environment may be at a greater risk from spills of larger volumes of the concentrated chemicals used to mix fertilizers and pesticides for application. Regardless of how the chemicals are released into the environment, superintendents should understand the fate of these inputs as well as other potential sources of contamination, such as sediments, hazardous materials, and waterfowl, in order to prevent or to mitigate any potential effects on water quality. Read more

Potential Water Quality Impacts

If water quality contaminants reach surface waters or groundwater, the potential water quality impacts can include the following:

- drinking water impairment, if nitrogen as either nitrate (NO_3) or nitrite (NO_2) are present at levels above health-based risk values in drinking water, which may adversely affect health
- nutrient enrichment of surface waters
- sedimentation due to eroding soils
- toxicity to aquatic life

Each potential impact is discussed below. Read more

Identify Priority Areas

Understanding the golf course landscape is the first step in assessing potential water quality issues. Areas to identify first are the environmentally sensitive areas such as wetlands, surface water bodies and shorelines, steep slopes to surface water, and areas with shallow depth to ground water or that are located in a critical groundwater recharge zone (especially true for Long Island, due to its sandy soils). In addition, identify relevant geological characteristics such as karst topography, which leaves groundwater vulnerable to contamination. Understanding the basic environmental concepts and fate and transport mechanisms is necessary to successfully identify priority areas.

On golf courses, point sources of pollution should be identified as priority areas for water quality protection. Specifically, these point sources can originate from storage and maintenance facilities and as the unintended release of chemicals, such as pesticides, fertilizers, or fuel, during transportation, storage, handling or cleaning of mowers and pesticide application equipment. Containment measures can easily prevent chemicals from becoming point sources of pollution, as described in the Facilities section of this web site.

The goal of the site assessment process is to identify priority areas, beginning with determining the following:

- the golf course's position relative to its position in the watershed
- drainage basins
- environmentally and ecologically sensitive areas

Watershed Drainage Basins

Drainage basins on the property should be identified on both topographic maps and routing plans. Identifying drainage basins also helps to determine the approximate area of greens, tees, fairways, and roughs in each drainage basin. For more information on watersheds, see the watersheds section of this website.

Environmentally and Ecologically Sensitive Areas

Environmentally sensitive areas are those areas with natural resources susceptible to changes that can alter ecosystem structure or function (such as wetlands), or areas that might be home to an endangered, threatened, rare species, or species of special concern. Information on the presence of endangered species can be obtained from New York's Natural Heritage Program (see http://www.dec.ny.gov/animals/31181.html).

Evaluate Strategies to Protect Priority Areas

Using BMPs and management zones, turfgrass management can coexist in harmony with nature. The quantity and quality of water generated within the property boundaries can be protected by appropriate watershed controls and management practices. Because water is the primary movement mechanism for contaminants, protection of water resources also provides protection for sensitive areas and species.

The thoughtful design and operation of the golf course and maintenance facilities minimizes the potential for point and nonpoint source pollutant input to sensitive areas. At any golf course, preventive strategies should include combinations of land use controls and source prevention practices. An integrated water quality protection system is based on a tiered concept as follows:

- prevention – prevent problems from occurring
- control – have safeguards in place to control any problems
- detection – consider a monitoring program to detect changes in environmental quality

For the purposes of this project, preventive measures have been categorized into two categories: landscape BMPs and source prevention BMPs. Landscape BMPs includes both vegetative practices (such as vegetative buffers) and structural controls that are engineered and incorporated into the course during golf course design and construction. Both vegetative practices and structural controls detain water and thereby reduce runoff quantity and nutrient and pesticide discharge. Examples of landscape BMPs include the following:

- settling and filtering processes for removing sediment and pollutants that are bound to sediment particles associated with surface runoff
- subsurface drainage, infiltration, and use of land absorption areas (vegetated filter strips) to detain water, allow it to be filtered prior to groundwater recharge
- grassed waterways or outlets
- critical area planting to stabilize highly erodible areas

Source prevention BMPs are nonstructural practices that minimize or prevent the generation of runoff and the contamination of runoff by pollutants.These measures include the use of management zones around environmentally sensitive areas and source prevention BMPs. Source prevention BMPs are implemented during golf course operation to prevent or preclude the possibility of movement of sediment, nutrients, or pesticides from the property or from toxic materials being introduced into ecologically sensitive areas. Source prevention BMPs include the use of management zones and IPM strategies. such as careful selection of pesticides and fertilizers.

CASE STUDY

NEW YORK STATE BEST MANAGEMENT PRACTICES FOR GOLF COURSES

Conserving Water by Installing Quick Couplers

Project Details

- **Golf Course Profile:**
  Location: Bedford Hills, NY
  Annual rounds of golf:
  Staff:
  Acreage:
  Public or Private: Private

- **BMP Implementation:** In the past 5 years, GlenArbor has installed 40 quick couplers, saving an estimated 810,000 gallons of water annually.

  Budget Total: $256.50 per valve installed

Project Summary

The GlenArbor Golf Club utilized Best Management Practices (BMP) irrigation guidelines to significantly reduce its water usage. This low cost effort not only reduces water usage, it has the added benefit of also reducing pesticide usage.

Estimated Water Savings

40 quick couplers were installed, replacing 40 irrigation heads. To estimate water savings, the first step is to compare water usage as follows:

- one 690 irrigation head dispenses 60 gallons/minute; running for 3 minutes, it distributes a total of 180 gallons of water
- one quick coupler and hose dispenses 30 gallons/minute and only runs for 1 minute, distributing a total of 30 gallons of water

During the five month growing season, the water savings per quick coupler were estimated as follows:

- 450 gallons of water/day conserved based on the need to use the heads 3 times/day
- Each quick coupler conserves approximately 20,250 gallons of water based on 45 days of use during the growing season
- 40 quick couplers installed x 20,250 gallons water savings per coupler = 810,000 gallons of water saved total

Detailed Cost Information

The total cost per valve installation was $256.50, broken down as follows in the tables below.

Materials	
Swing Joint	$70
Coupler Valve	$87
Tee	$14
Nipple	$ 1.50
Box	$12
Total	**$184.50**

Labor	
4 hours @ $18/hr	$72

Benefits

Implementing irrigation BMPs like this has a number of environmental and cost savings benefits:

- Significant reduction in water usage
- eliminates watering of non-target areas
- by eliminating the irrigation of non-target areas, reduced disease pressure and consequently reduced pesticide applications in those areas
- can use a hose with a wetting agent pellet dispenser in hydrophobic areas, thus reducing the number of "hot spots" throughout the property while further reducing water usage

Phase 2 2016

-Assessment and Education
-Develop questions and instrument
-Go live with assessments in December for 90d.

Marketing and Promotion

-Case Studies

-Best Practices e-letter

Future

Develop strategic plan including; Education using social media formats, video, blog posts and region specific education sessions based on assessment data….fundraising…research opportunities…environmental updates.

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Best Management Practices for New York State Golf Courses

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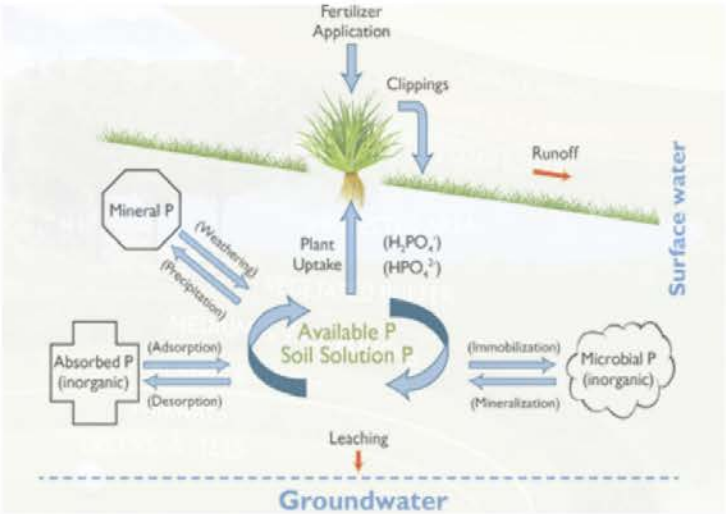

"...The New York State golf course superintendents associations, as well as researchers at Cornell University, are to be commended for recently establishing the Best Management Practices for New York State Golf Courses, providing a foundation for environmental stewardship..."

More »

As the stewards of golf courses in New York State, superintendents are dedicated to protecting New York's natural resources and embrace the responsibility to maintain these facilities in harmony with the natural environment. Therefore, the golf industry has led the effort in establishing Best Management Practices (BMPs) for golf courses in the state. Authors from Cornell University have