



*Native Plant Species*

## Project Details

### COMPANY

**Philip Morris USA, a wholly owned subsidiary of Altria Group Inc.**

### COUNTRY

**United States of America**

### AUTHOR

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## Park 500 Natural Treatment System

### CONTEXT

As the birthplace of tobacco in America, Virginia has a long history of growing and selling tobacco, starting with trade between settlers and Native Americans in the colony's first established settlement in 1607.

Today, Virginia is home to Philip Morris USA (PM USA), the leading manufacturer of cigarettes in the United States (a position held since 1983). Headquartered in Richmond, the company produces some of the most well-known brands in the consumer products industry.

PM USA is a wholly owned subsidiary of Altria Group Inc. Because the Altria family of companies' products are agricultural, Altria understands the effect that nature, including climate changes, may have on our companies and products. We recognize other global concerns, such as water availability and quality, and stakeholders' interest in knowing how PM USA manages our impact. In addition, we believe that applying an environmental lens to our business provides another way to innovate and be more efficient. Altria believes it is important that our companies play an active role in protecting natural resources and reducing our impact on the environment.

Altria's Chief Operating Officer is the executive sponsor of environmental sustainability goals. We review progress against goals with the sponsor and operating company presidents semiannually. Each of Altria's operating companies adopted environmental policies that guide how Altria's employees approach their work. These policies address air emissions, environmental assessment, hazardous materials, waste and wastewater/stormwater management.

### Offsetting water use through onsite treatment

PM USA's Park 500 facility sits on the banks of a quiet part of the James River south of Richmond, surrounded largely by farmland. The facility is essentially a large recycling operation, taking small bits of tobacco collected at PM USA's cigarette manufacturing facility and using them to create sheets of tobacco for use in cigarette production. This process requires up to 1.8 million gallons of water per day. After using the water, it is treated onsite and then returned to the James River. The wastewater contains nitrogen and phosphorus, which are naturally present in tobacco.



*Figure 1. Park 500 natural treatment system cell.*

In 2001, the Park 500 facility nutrient discharge amounts were within the permit levels issued by the Commonwealth of Virginia. However, believing we could do better, PM USA implemented new water treatment methods, and by 2006, succeeded in reducing nitrogen loadings to the river to almost half of its 2001 levels.

In 2006, PM USA began building a natural treatment system (NTS) next to the facility on 42 acres of engineered wetlands that works with nature to further reduce nutrient levels in its wastewater. What was once a field is now teeming with plants and wildlife.

Primary stakeholders include the Virginia Department of Environmental Quality (VDEQ), who focuses on reducing phosphorus and nitrogen loads to the James River while establishing a positive precedent for using treatment wetlands, and the residents of the Bermuda Hundred community, who were concerned with maintaining local drinking aquifer water quality.

### OBJECTIVE AND PROJECT OVERVIEW

The Park 500 NTS was constructed as a voluntary effort to provide a low-energy, low-maintenance alternative to reducing nitrogen and phosphorus in the process's wastewater, which is high in nitrate-nitrogen, organic nitrogen and total phosphorus.

### THE BUSINESS CASE

The project was initiated to reduce the environmental footprint of the tobacco production facility and help PM USA meet its environmental sustainability goals. The NTS reduces mass loading to the James River and creates a performance buffer for the existing plant discharge to ensure long-term compliance.

PM USA also worked with Virginia Commonwealth University to measure the biodiversity impacts of the project. Between 2008 and 2012, more than 230 plant and animal species re-populated the area, including native deer, frogs and birds. This represents more than a 350 percent increase in wildlife usage of the site since the NTS was constructed.

This project was recognized as one of the Conservation Fund's Chesapeake Bay success stories and was a recipient of the Virginia Governor's Office for Environmental Excellence Gold Medal in 2009. Global Water Intelligence recognized this innovative wastewater treatment approach as a finalist for the 2010 Industrial Water Project of the Year. Additionally, the facility participates in the Virginia Nutrient Credit Exchange, which is designed to coordinate and facilitate nutrient credit trading among its members with the goal of improving water quality in the Chesapeake Bay watershed. In 2014, PM USA received a \$35,000 payment within the Exchange for nitrogen credits.

Today, the wetlands are a learning laboratory. Students and environmental researchers can see state-of-the-art sustainability projects in an industrial setting and observe wildlife, including mammals, birds, reptiles, amphibians and insects repopulating the area.

### DECISION-MAKING PROCESS

To expand its corporate sustainability profile, PM USA sought a sustainable and environmentally beneficial approach to reducing nutrient loads to the James River.

Disappointed with the results of a land application feasibility study by others, PM USA became interested in the potential for a treatment wetland application. The engineering feasibility study was limited to NTS alternatives, but included three conceptual designs, a site evaluation and a review of potential benefits. Through initial site visits and discussions, and based on a feasibility study, PM USA proceeded to implement a full-scale treatment wetland to polish nitrogen and phosphorus from the Park 500 facility.

Approval was required from the CEO level with extensive coordination from multiple departments. Corporate management supported the project as it was aligned with the company's environmental objectives. The interdisciplinary project management approach resulted in a fully integrated team and engaged stakeholders. Additionally, PM USA worked collaboratively with VDEQ on this novel approach.

## PROJECT DETAILS

The Park 500 NTS project included the design, construction and operational support of the 42-acre (17-hectare) constructed treatment wetland.

PM USA funded the \$7.175 million Park 500 NTS, constructed from 2006 to 2008. This project consisted of six constructed treatment wetlands designed to flow through two flow paths, with three cells each. Water is pumped from the site wastewater plant to an inlet splitter box, where gravity carries the water through the wetlands and to the main outlet discharge to the James River.

The wetlands were planted with species native to the region, and the system had to meet an 80 percent vegetative cover requirement within two growing seasons.

Water quality performance is assessed weekly. The Park 500 NTS exhibits top performance in nitrate-nitrogen reduction, and shows good reduction in total Kjeldahl nitrogen (TKN), as

well as phosphorus loads and color. For 2013, annual average

total nitrogen was reduced by 44 percent from 13.3 milligrams per liter (mg/L) to 7.4 mg/L. Annual total nitrogen mass reduction for 2013 totalled 17,294 pounds, or 8.6 tons. TKN, which includes both ammonia and organic nitrogen, showed a net decrease from 9.0 mg/L to 7.3 mg/L, a 19 percent reduction.

Ammonia is assimilated in the initial cells, and organic nitrogen is further degraded by the wetland. Much of the nitrogen reduction is through denitrification of nitrate-nitrogen, from an average inflow concentration of 4.4 mg/L to an average outflow concentration of 0.2 mg/L, a reduction of 96 percent. Most nitrate loss occurs in the first cell in each of the flow-paths of the system, and the system rapidly attenuates daily inflow variation. This continued optimal performance is attributed to extensive anaerobic muck soils that have rapidly developed in the Park 500 NTS, as well as the organic matter loading. The denitrification evident in the system clearly illustrates the sustainability and effectiveness of this type of treatment system for nitrate reduction, particularly for discharges to rivers such as the James River, as well as their downstream estuaries. In 2013, average total phosphorus concentrations were reduced by 26 percent from 0.61 mg/L to 0.46 mg/L.



Figure 2. Aerial View of Park 500 Wetlands.

## LESSONS LEARNED

A number of key lessons were learned in completing this project, including:

- Local muskrat populations were difficult to control after construction, as was extensive cattail invasion. It would have been valuable to plant more species that are inedible to muskrats and explore methods of cattail control.
- Detailed feasibility studies are a key to success in executing a constructed wetland.
- Early engagement of key stakeholders was critical to success.
- Dissemination of project details and updates to PM USA employees helped ensure internal and external awareness and support.
- Project constraints included permitting and coordination with state, local and federal regulators; and land area requirements, which are significant for constructed wetlands.
- A number of studies were required, including a cultural resource inventory, pre- and post-construction ecological surveys and an engineering feasibility study.

## FUTURE IMPLEMENTATION AND NEXT STEPS

This project is the first known NTS to treat tobacco process water and has served as a catalyst in improving PM USA's overall environmental management system.

## REFERENCES

- [www.altria.com/responsibility](http://www.altria.com/responsibility)

## ABOUT THE WORLD BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT (WBCSD)

The World Business Council for Sustainable Development (WBCSD), a CEO-led organization of some 200 forward-thinking global companies, is committed to galvanizing the global business community to create a sustainable future for business, society and the environment. Together with its members, the council applies its respected thought leadership and effective advocacy to generate constructive solutions and take shared action. Leveraging its strong relationships with stakeholders as the leading advocate for business, the council helps drive debate and policy change in favor of sustainable development solutions.

The WBCSD provides a forum for its member companies - who represent all business sectors, all continents and a combined revenue of more than \$8.5 trillion, 19 million employees - to share best practices on sustainable development issues and to develop innovative tools that change the status quo. The council also benefits from a network of 70 national and regional business councils and partner organizations, a majority of which are based in developing countries.

<http://www.wbcscd.org/home.aspx>

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