

# Implementing Sustainability Concepts & LEED Awareness for Airfield Pavement Projects



Canadian Airfield Pavement Technical Group

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**APPLIED  
RESEARCH  
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## Introduction

- Airports strive to be fiscally, socially, and environmentally responsible, and to be good neighbors
- Airports typically have a higher focus of public attention due to the type of operation and perceived impact on the surrounding land use

**Airport projects require a proactive “triple bottom line” analysis that addresses economic, environmental, and social sustainability**



# How is Aviation Sustainability Defined?

*Sustainable Development* LEED<sup>TM</sup>

Alternative Fuel Vehicles Recycling

Platinum Points Cost-Recovery Green Roofs

Global Warming ISO 14001 U.S. E.O. 13423

**Environmental Management System**

*Best Management Practices* Economic Survival

*Long term planning* BALANCE Guidance

*Holistic Resource Management* Life Cycle Cost Management

**Environmental STEWARDSHIP**



## Sustainability Process

- Airports cannot wait until construction begins to start discussing sustainable practices
- They must include planners, engineers, and construction experts who can assist the airport in the development of the bid documents that include sustainable construction practices
- Process reviews can incorporate all facets of the airport operations from service delivery to infrastructure renewal
- Airports also must ensure compliance with all federal, provincial, and local regulations

## Why be Sustainable?

- Take social responsibility for the impact of airport operations
- Reduction of green house gas emissions
- Optimize the investment in renewable infrastructure
- Increase business value



# Sustain

Water conservation for  
Increase use of environ

- [illegible]

## The Problem.....

- Airports regularly face decisions on how best to execute an airport improvement project
  - How do we make the project economically viable?
  - How do we ensure the airport remains a good neighbor to the surrounding community?
  - How do we strike an acceptable balance between economic, environmental and social concerns?
  - Focusing on only one area (e.g., environmental sustainability) can result in a project that is not economically viable or minimizes benefits
- The key - is to develop a process that optimizes each element to maximum extent possible

## How can we do this?

- Reducing energy requirements (e.g., warm-mix asphalt instead of conventional hot-mix asphalt)
- Reducing the need for raw materials (e.g., re-use of in-situ materials instead of new premium-select materials)
- Using green building technology including heating and air conditioning, green roofs, etc.
- Capturing and reusing water for irrigation
- Using low energy lighting
- Minimizing construction waste (e.g., rubblize and overlay instead of remove and replace, reuse of building waste materials)
- Minimizing ancillary effects of construction (e.g., reduced size and impact of staging areas, noise impact, etc.)

## Setting the Path

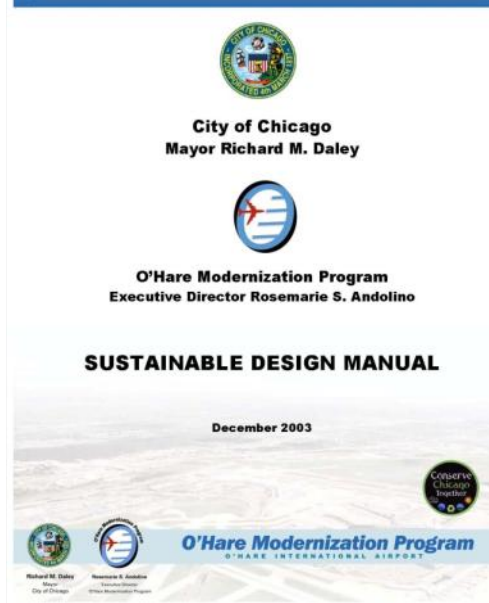
- Establish sustainability guidelines and practices for waste reduction, fleet, building and utility services such as water and wastewater, energy and fuel use
- Reduced use of non-renewable resources
- Complete sustainability reviews (e.g. San Francisco, Los Angeles, Chicago O'Hare, Frankfurt, Toronto Lester B. Pearson International Airport, Brisbane, and Hong Kong Chep Lap Kok)
- Many airports have joined sustainability forums such as the Sustainable Aviation Guidance Alliance (SAGA)

**Airports are in need of a better understanding of the benefits of sustainable projects and a process for evaluating sustainability options and**

## Status

- There is a reasonably good understanding of what constitutes sustainable design and construction
- Benefits of sustainability of items such as noise mitigation, light emissions, improvement to indoor air quality, and wildlife and habitat conservation are difficult to quantify
- How far back in the process (or forward) do we go to judge the sustainability benefits of one product over another?
- ACRP Synthesis 10 – Airport Sustainability Practices
- ACRP Report 42 Sustainable Airport Construction Practices
- ACRP 02-26 – Tools for Evaluating, Measuring and Implementing Sustainability Practices (2012)

# What Resources are Available?

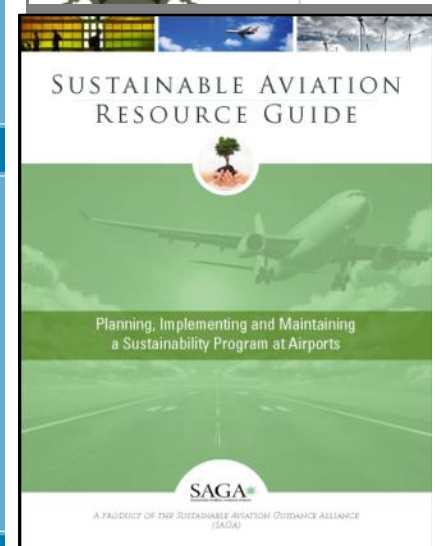


**ACRP**  
REPORT 42

**Sustainable Airport  
Construction Practices**



TRANSPORTATION RESEARCH BOARD  
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<http://www.aci-na.org/sustainability>

# Sustainability Database/Web

http://www.airportsustainability.org:8080/SAGALinks/PracticeListing.aspx?A=1



## SAGA Sustainability Program database

Version: 10/09/09

[Main Menu](#)

### Practice Listing

[Back](#)

Practice Category:

Activity:

Functional Area:

Sub Category:

EONS:

Contains Keyword:



Practice	Category	Sub category	Potential LEED?
Add polyethylene vapor retardant under the floor slab and avoid a layer of sand between the poly and the concrete to reduce the occurrence of mold.	Construction Practices	Foundations	<input type="checkbox"/>
Adopt a "first-in, first-out" policy to prevent finish materials from becoming out-dated. The first materials delivered to the site are the first ones used on-site.	Construction Practices	Logistics	<input type="checkbox"/>
Advertise salvage activities prior to demolition activities to encourage salvaged materials re-use.	Construction Practices	Salvaged Materials and Resources	<input checked="" type="checkbox"/>
Allow adequate time for deconstruction activities.	Construction Practices	Planning for Deconstruction, Disassembly, and Flexible Use of Space	<input type="checkbox"/>
Ask suppliers to deliver supplies using sturdy returnable pallets and containers. Have suppliers pick up pallets and empty containers.	Construction Practices	Logistics	<input type="checkbox"/>
Closely coordinate deliveries of construction materials with scheduled installation times.	Construction Practices	Construction Scheduling and Sequencing	<input type="checkbox"/>
Conduct an emissions inventory for all projected construction activities.	Construction Practices	Emission Inventory and Mitigation	<input type="checkbox"/>
Conduct detailed assessments to better understand materials or equipment that are salvageable vs. recyclable.	Construction Practices	Salvaged Materials and Resources	<input checked="" type="checkbox"/>
Consider installation of moisture resistant greenboard and mold resistant purpleboard.	Construction Practices	Other Construction Equipment/Materials	<input type="checkbox"/>

# Sustainability Database/Excel



		LEED	Activity						Functional Area				
									Terminal Buildings and Interior Areas				
Practice		Potential LEED Applicability	Planning & Design	Construction Activity	Day to Day Airport Operations	Maintenance	Administration & Finance	Community & Public Relations	Terminal Buildings & Concourses	Gate Areas & Passenger Handling	Offices	Tenants / Concessions	Baggage Handling
666	Install Kevlar bird deterrent wires or other mechanisms to prevent waterfowl from using area water bodies.		✓		✓								
667	Develop and implement an Integrated Pest Management plan (IPM).		✓		✓	✓	✓						
<b>Materials and Resources</b>													
<b>Waste Reduction</b>													
668	Include educational training on waste reduction for the project team as part of the initial sustainability project planning meeting.		✓	✓	✓	✓	✓						
669	Participate in a "waste-to-profit" network to identify by-product synergy and material reuse opportunities. The city or state network may (or could) include participants from area companies, institutions, and city or state departments (see <a href="http://www.wastetoprofit.com/">www.wastetoprofit.com/</a> ).			✓	✓	✓	✓	✓				✓	
670	Develop and utilize an off-airport composting facility.		✓		✓	✓	✓	✓	✓			✓	
671	Separate food waste from normal waste to utilize for composting (off-site only), biofuels, livestock feed, and other uses.		✓		✓	✓	✓	✓	✓			✓	
672	Develop and implement public food waste collection stations.		✓		✓	✓	✓	✓	✓			✓	
673	Develop and implement a surplus food program to benefit area food banks by supplying pre-packaged sandwiches, salads, pastries, muffins, cookies, etc.		✓		✓	✓	✓	✓	✓			✓	
674	Establish mandates, incentives, and/or inspections to												

## Other Available Tools

- Chicago sustainable airport manual, green airplane rating system
- Canadian Construction Association Guidelines
- ASCEs sustainable engineering practices
- LEED, (U.S. and Canadian Green Building Councils)
- Washington State's Greenroads guide
- New York State's GreenLITES system
- Ontario Ministry of Transportation's GreenPave
- Transportation Association of Canada's Green Guide for Roads
- Los Angeles World Airports sustainability guidelines
- Saga Sustainability Database
- Dutch Dubocalc sustainability evaluation system

# Sustainability Planning Process

## Phase 1

*Conduct  
Sustainability  
Baseline  
Assessment*

*Establish  
Sustainability  
Goals &  
Objectives*

*Identify  
Candidate  
Sustainability  
Initiatives*

*Evaluate  
Candidate  
Initiatives*

## Phase 2

*Develop  
Sustainability  
Performance  
Targets*

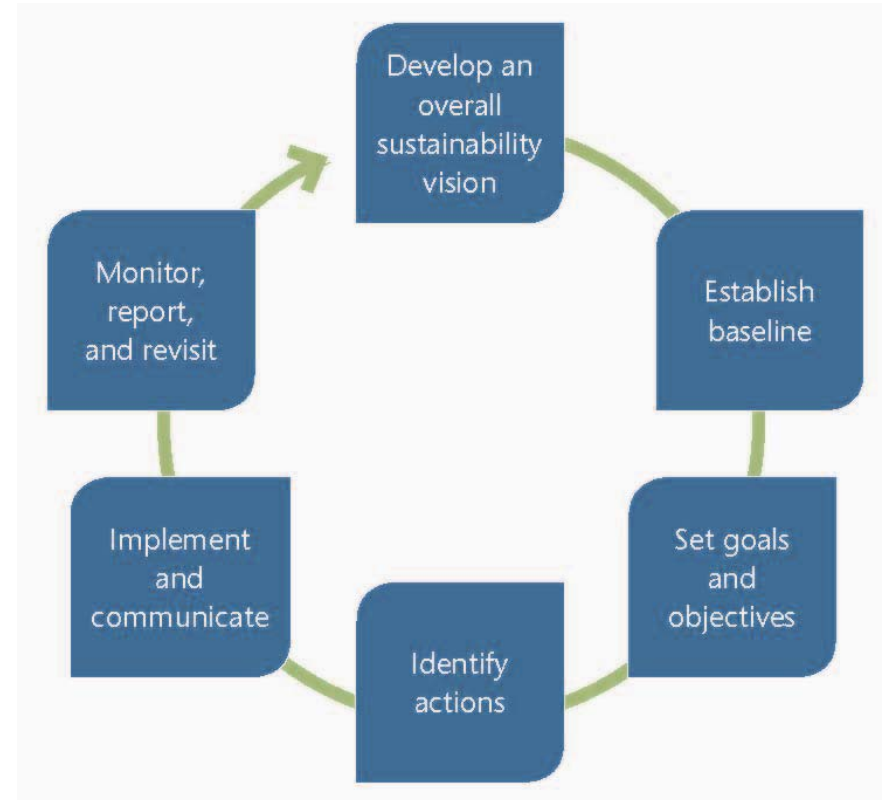
*Develop  
Implementation  
& Monitoring  
Program*

*Prepare  
Sustainability  
Management  
Plan*

*Annual  
Sustainability  
Report Card  
Outline*

## Sustainability Management Approach

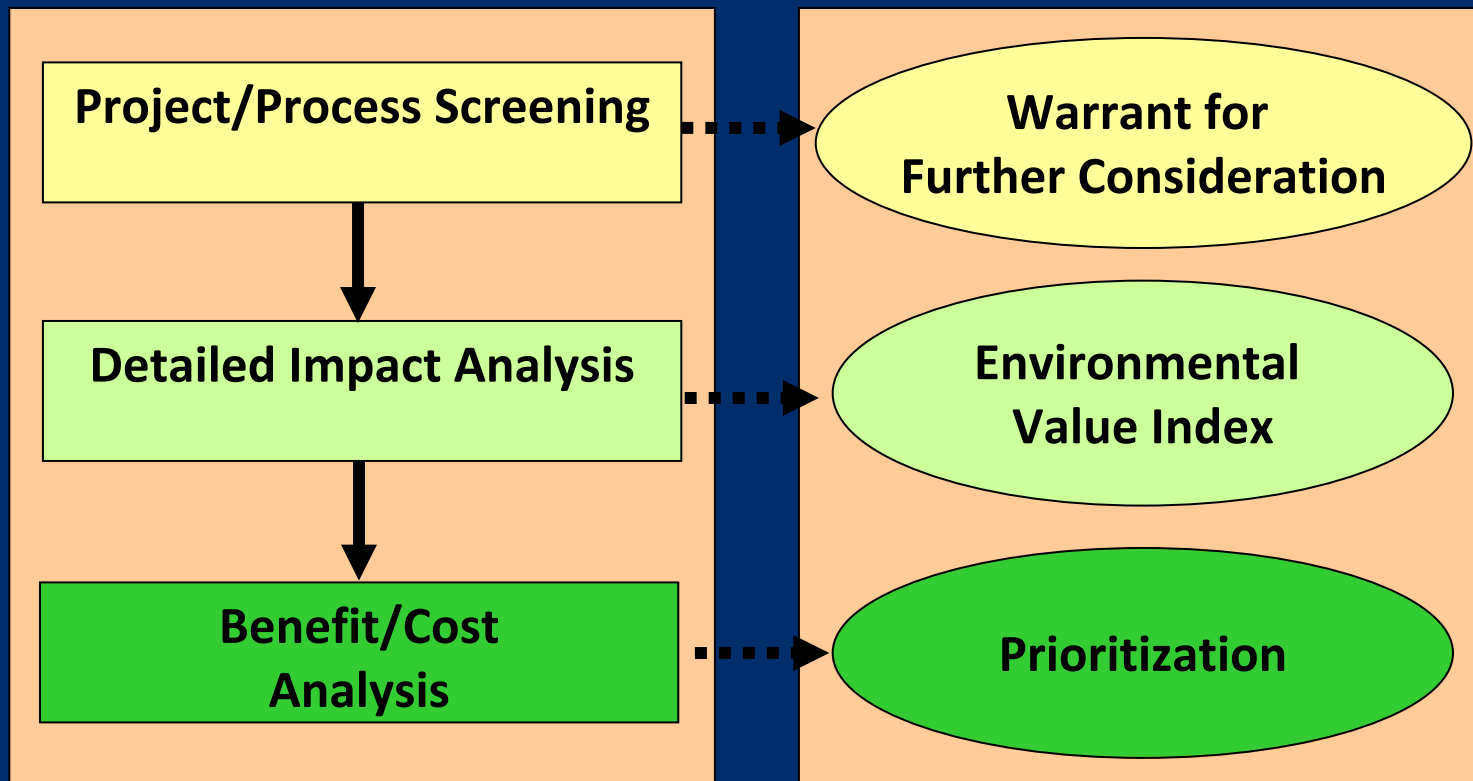
- Formally designating a “sustainability champion”
- Scheduling regular sustainability coordination meetings
- Revisiting the Airport’s goals and performance



# Use or Develop Decision Models

## Element

## Output



## Sustainable Examples

- Recycle Paving Materials
  - PCC Pavement
  - HMA Pavement
  - Aggregate Base Products
  - Combination (Mix In-Place and Rubblization)



## Green Initiatives

- Use of Waste Products
  - Flyash in PCC
  - Flyash in Soil Stabilization
  - Polymers or Ground Rubber in Asphalt Binders



## Green Initiatives

- Waste Building Products
  - Recycled crushed concrete
  - Other building demolition materials such as wall board



## Green Initiatives

- Recycled Asphalt Mixes
  - Reduced virgin aggregate use
  - Decreased trucking costs
  - Example, MassPort - 18 % RAP, PG 64-28, 1 % lime for stripping resistance (used for all mixes since 2004)
  - Accelerated load test screening



## Green Initiatives

- Reduce Energy Usage
  - Trucking
  - Processing
  - Production (Warm Mix)
  - LED Warning Devices



# Warm Mix Asphalt

- WMA reduces production and placement temperatures
  - Reducing Energy Usage
  - Reducing Emissions
  - Reducing Worker Exposure
- Placement
  - Longer Hauls and Lower Temperatures
- Production
  - Wax Like Products
    - Sasobit, Asphaltan B, Fatty Acid Amides
  - Foaming Processes
    - Aspha-min Zeolite, Low Energy Asphalt, WAM Foam
  - Emulsion Base
    - Evotherm
  - Other Additional Technologies



## Use of Warm Mix Asphalt for Airports

- Frankfurt Runway, 2003
- Boston Logan
  - 2006 – Alleyway – 200 tons
  - 2007 – Alleyway – 5,000 tons
  - 2007 – Taxiway – 800 tons
  - 2008 – Runway – 28,000 tons
  - 2009 – Taxiway – 40,000 tons
  - 2009 – Runway - 59,000 tons



## Green Initiatives

- Permeable Pavements
  - Taxiway shoulders (Richmond)
  - Pervious concrete (Pearson)
  - On-site stormwater treatment including TSS removal



## Richmond Permeable Shoulder Pavement

- 3 m porous pavement shoulders
- Constructed in 1995 and 1996
- Purpose: to provide storm water retention areas to reduce downstream impact and treat suspended solids
- Sufficient structural capacity for emergency aircraft use

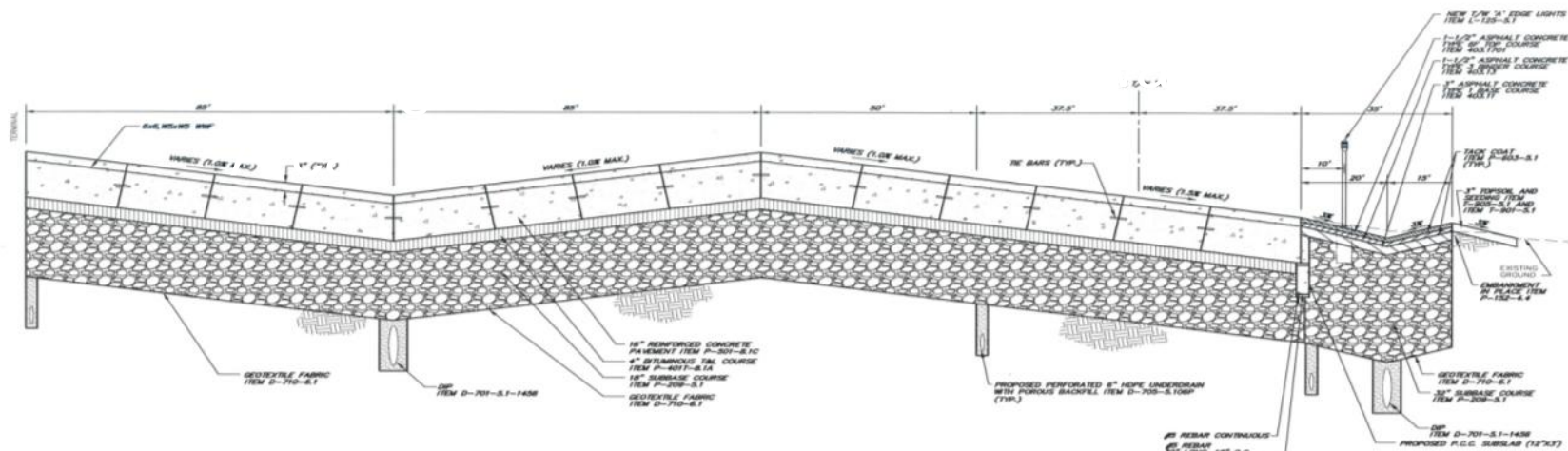
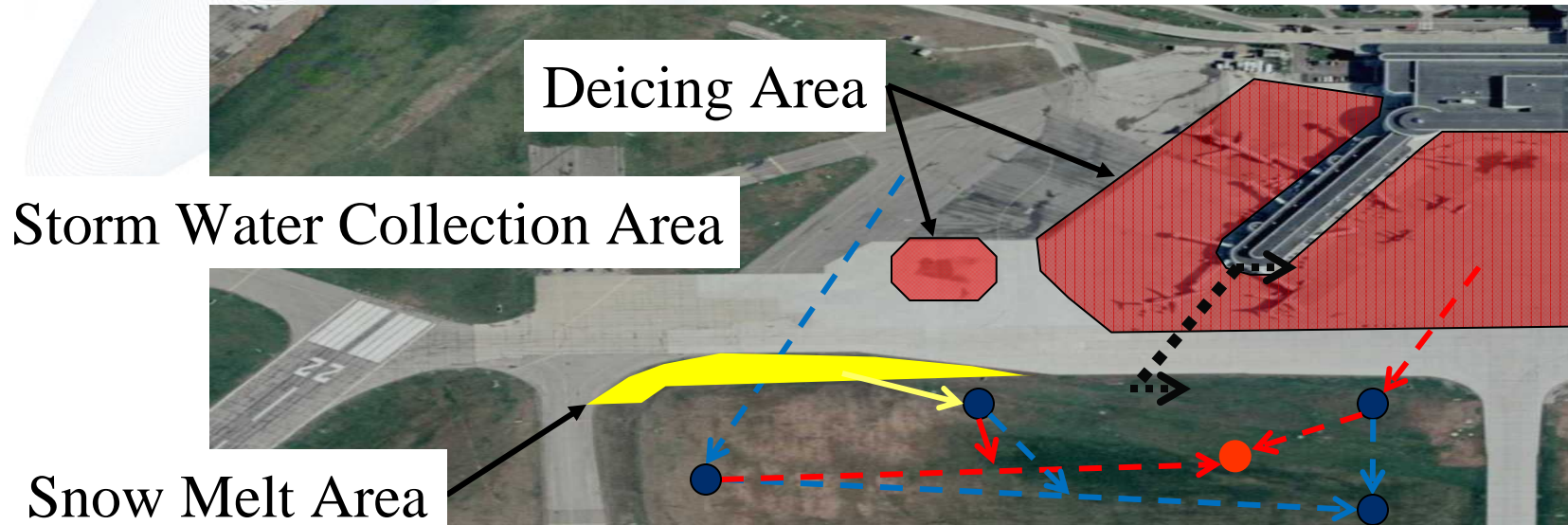


## Green Initiatives

- Permeable Parking Areas
  - Etobicoke Creek Trail



# Isolate Stormwater using Grading



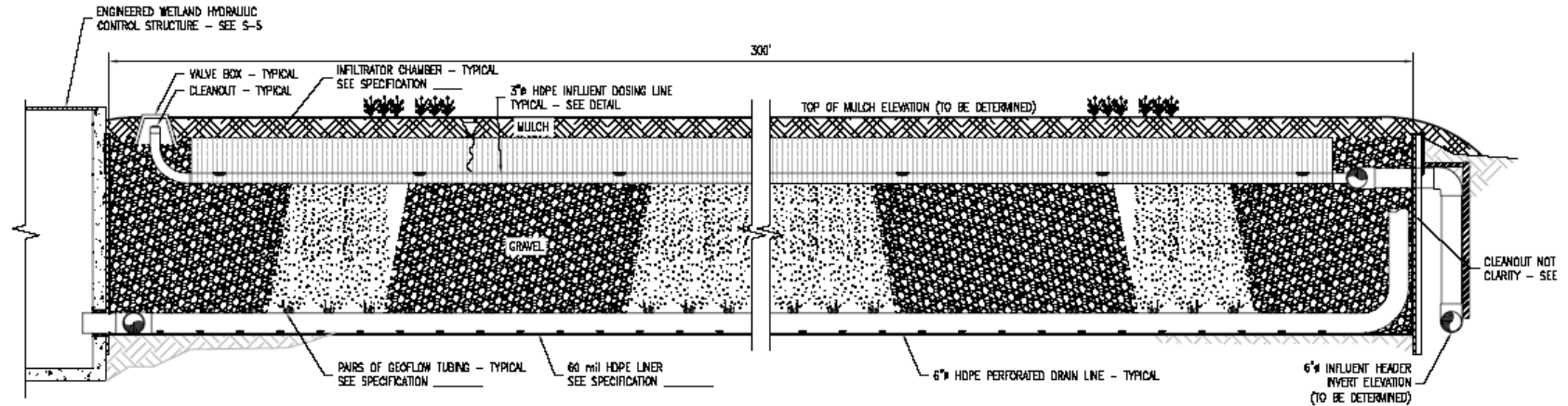
1 FULL DEPTH CONCRETE SECTION WITH GUTTER

# Engineered Wetlands





# Designed for Treatment



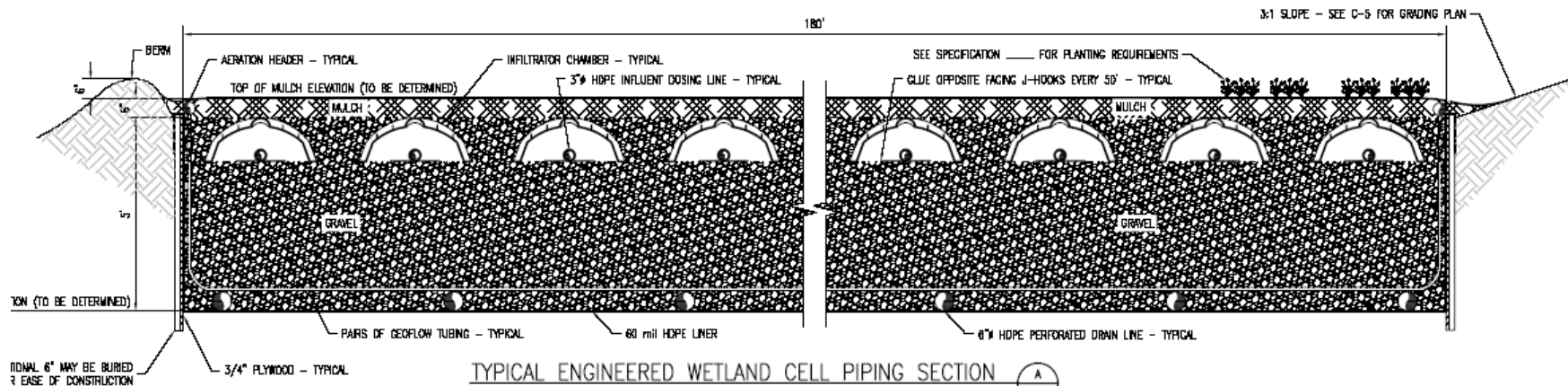
TYPICAL ENGINEERED WETLAND CELL PIPING SECTION

SCALE: NONE

B  
P-7

**NOTES:**

1. INSULATE ALL PIPES OUTSIDE OF ENGINEERED WETLAND.
2. SEAL ALL PIPE PENETRATIONS THROUGH THE WALL OF ENGINEERED WETLAND UNDER THE SUPERVISION OF ENGINEER'S REPRESENTATIVE.



TYPICAL ENGINEERED WETLAND CELL PIPING SECTION

SCALE: NONE

A  
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08/20/2008



## Challenges and Lessons Learned

- Sustainable design, construction and maintenance practices can save money and improve our environmental stewardship
- Many ways to travel the path
  - Engage senior management early
  - Implement a sustainability awards program
  - Track and report sustainable activities
  - Publish an airport wide sustainability report
  - Design long-life pavements
  - Optimize maintenance and rehabilitation
  - Maximize the use of recycled products
  - Use high solar reflectance pavements
  - Integrate pavement design and construction with stormwater management
  - Use less but higher quality pavement materials



Global Reporting Initiative

A Common Language for  
Sustainability Reporting



# Lots of Room for Sustainable Pavement Engineering

