

# This presentation premiered at WaterSmart Innovations

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# USING STORM WATER AS AN ALTERNATIVE WATER SOURCE FOR IRRIGATION AT THE NATIONAL MALL



*Providing innovative design solutions for irrigation worldwide.*

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2009 EPA WaterSense Partner of the Year  
Massachusetts-North Carolina

# BACKGROUND

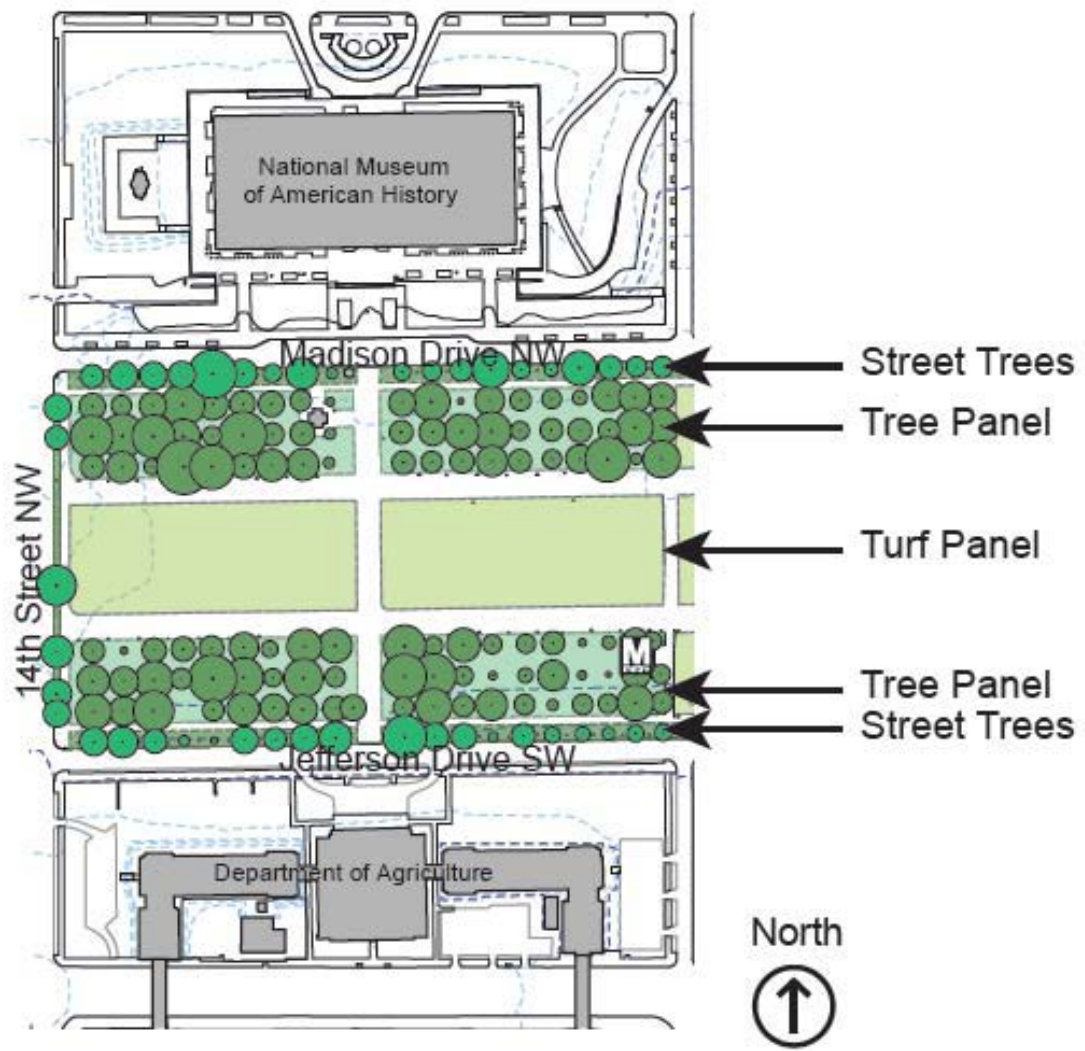
- The Mall is nestled between the Washington Monument and the US Capitol.
- The large open area of lawn panels is commonly referred to as “America’s Front Lawn”.



# BACKGROUND



- Over the past decade the Mall has suffered from dead turf, lack of turf, weeds and bare spots. The Mall is extremely compacted and retains water on the surface.



**PROJECT AREA KEY**



# PROJECT

- Beginning in 2012, three of the eight lawn panels of the Mall started undergoing a major construction project to renovate the soil and turf on these panels.
- A new irrigation system was installed as part of this work.



# LOTS OF ISSUES

- 25 Million Visitors per year
- 3,300 permitted events per year (100 people)
- Unknown number of unpermitted events including baseball, soccer, softball and Frisbee
- Weight, including tanks and Harrier jets
- Lack of sunlight for large periods of time due to tents or other structures - Solar Decathlon
- Vehicular traffic
- 1<sup>st</sup> amendment rights to gather

# ISSUES



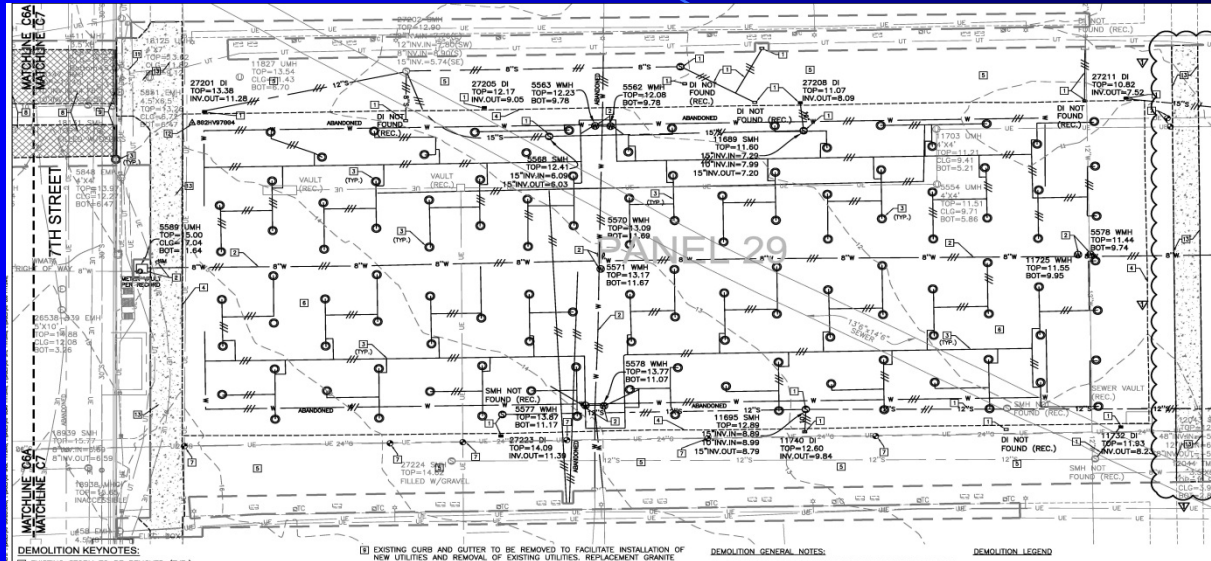


# CONSEQUENCES OF ISSUES

- Sprinkler heads are easily damaged by all these various issues.
- Sprinklers settle and become high, low, crooked or broken.
- Tent stakes are the worst issue as they are up to 48 inches long and go through PVC pipe like it is not there.



# PREVIOUS IRRIGATION



- The mall is unique and provides many challenges to having a long term operational irrigation system.
- The mall has been irrigated in the past and in the past has suffered from activities on the Mall and rarely had the system been completely operational.
- The Mall provides a number of obstacles to conventional irrigation systems.

# DESIGN PARAMETERS

- **Minimize potable water use**
- Minimize damage from tent stakes
- Minimize the amount of irrigation equipment
- Do not impact the historical aspects of the Mall
- Maximum 3 day, 5 hours per day water window
- Central control and weather station required
- Long lasting system with minimal maintenance

# WATER SOURCES

- Ground Water – not legal
- Effluent Water – not available
- Gray Water – not available
- Rainwater – not easily obtainable
- Storm Water – limited by area
- Potomac River – water quality and intake/transfer issues
- Tunnel dewatering - numerous jurisdictional agency issues



# STORM WATER



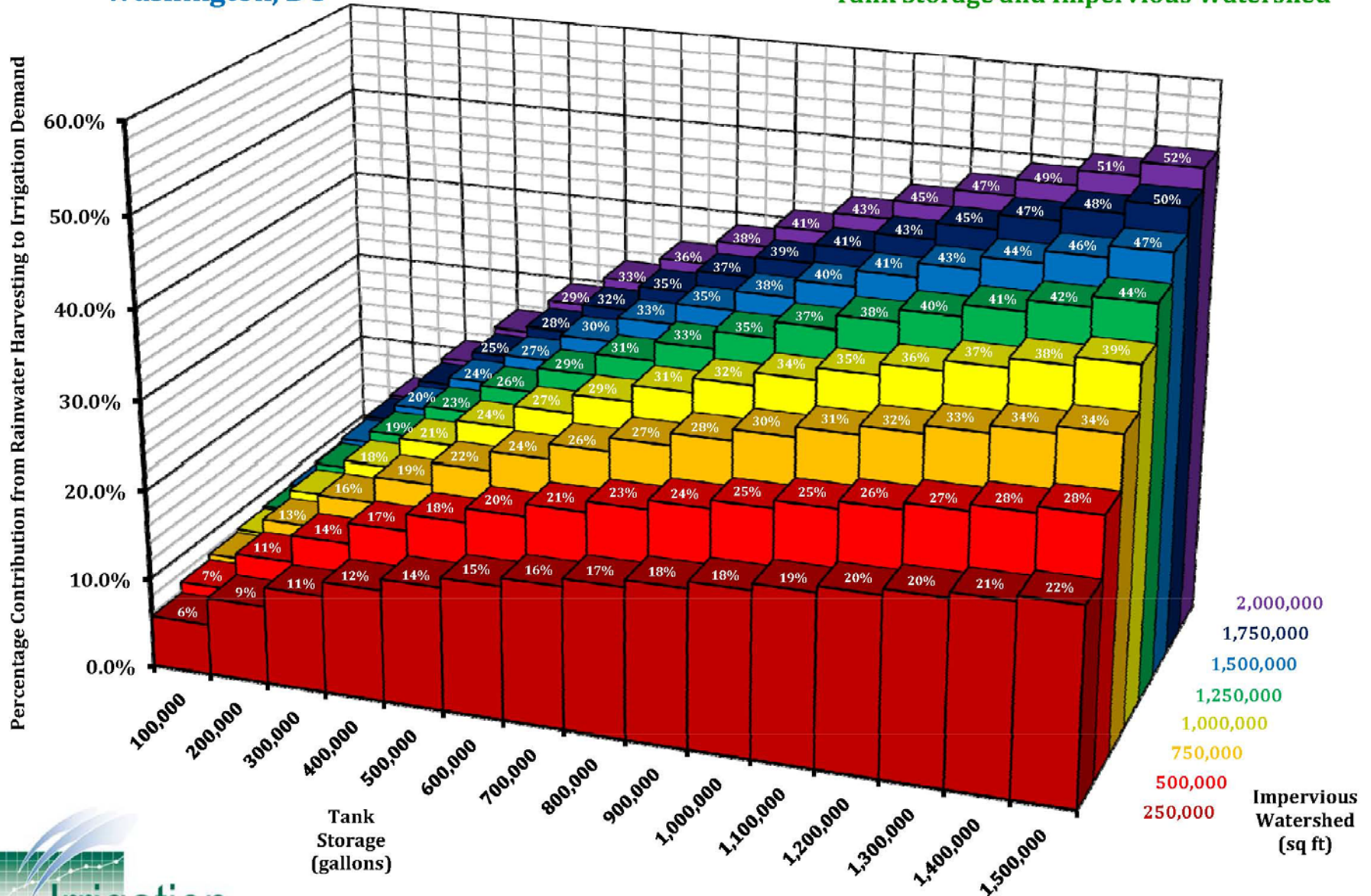
# WATER DEMAND

- The Mall is estimated to use approximately 28 million gallons per year. Just the 8 lawn panels 11.2 million.
- Approximately 31.4 percent of this water can be provided by collecting storm water runoff from approximately 1,000,000 sq. ft. of surface area – 67.5 percent for just the lawn depending on cistern sizing.

<b>National Mall Restoration Project, Washington, DC</b>				
<b>Percentage of Harvested Water Towards Total Irrigation Demand</b>				
<b>Irrigated Landscape Area</b>	<b>Cistern Storage Provided (Gallons)</b>			<b>Total Average Irrigation Demand</b>
	<b>0</b>	<b>500,000</b>	<b>1,000,000</b>	
<b>Lawn Panels Only</b>	0.0%	52.1%	67.5%	<b>11,200,000</b>
<b>Entire Mall</b>	0.0%	21.4%	31.4%	<b>28,000,000</b>

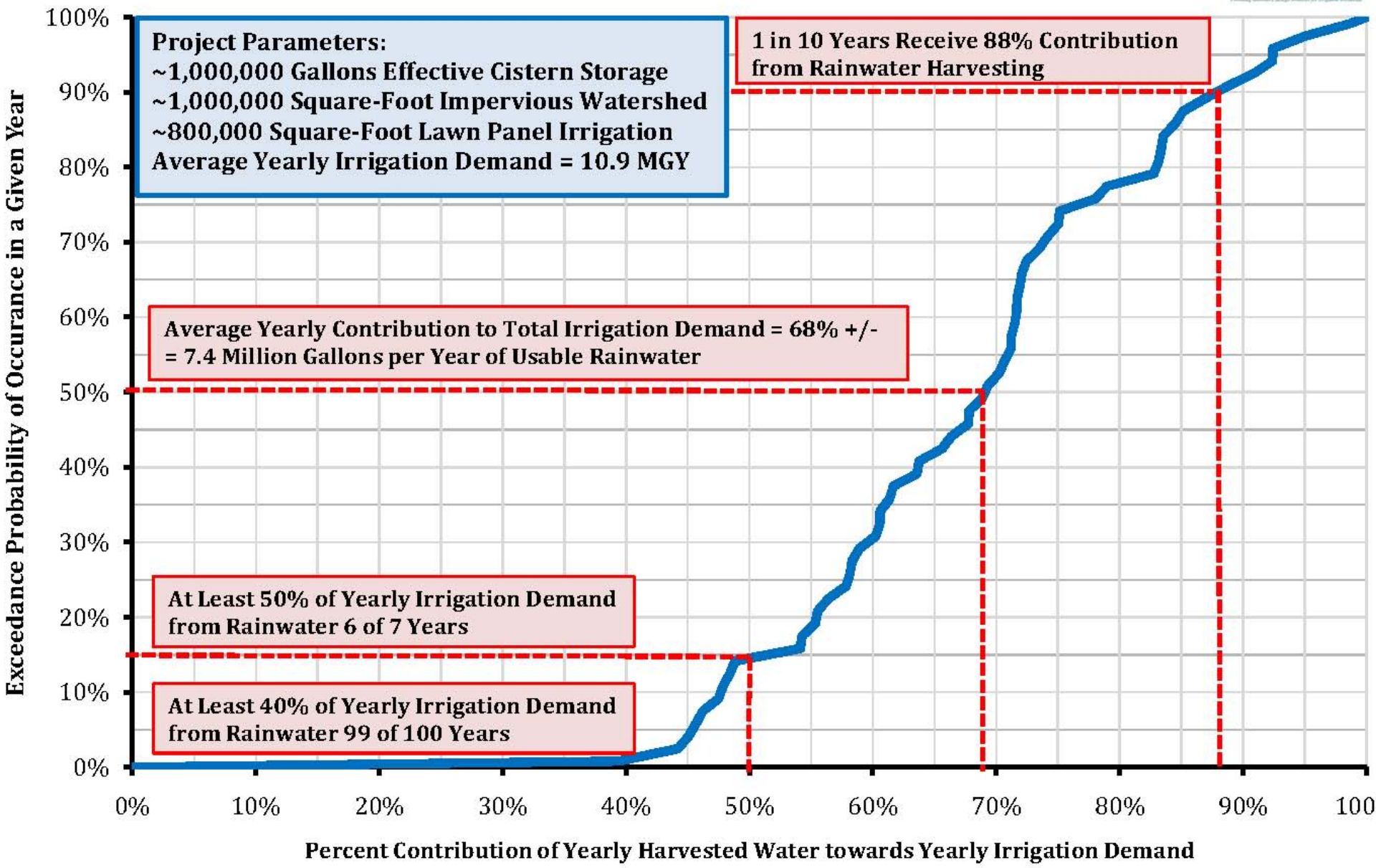
# National Mall Renovation Project Washington, DC

## Rainwater Harvesting Contribution versus Tank Storage and Impervious Watershed



<p>Current Impervious Watershed Dept. of Agriculture, National Gallery of Art National Mall Walkways and Hardscapes = 1,000,000 sq ft +/-</p>	<p>Current Irrigated Landscaped Area: Lawn Panels, Lawn Under Tree Panels, Street Tree Panels = 2,000,000 sq ft +/-</p>
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# Expected Performance of Rainwater Harvesting Cisterns (CD Level) National Mall Renovation, Washington, DC, November 9, 2010



— 60-Year Climate Simulation Results of Yearly Contribution of Harvested Water towards Irrigation Demand



# STORAGE

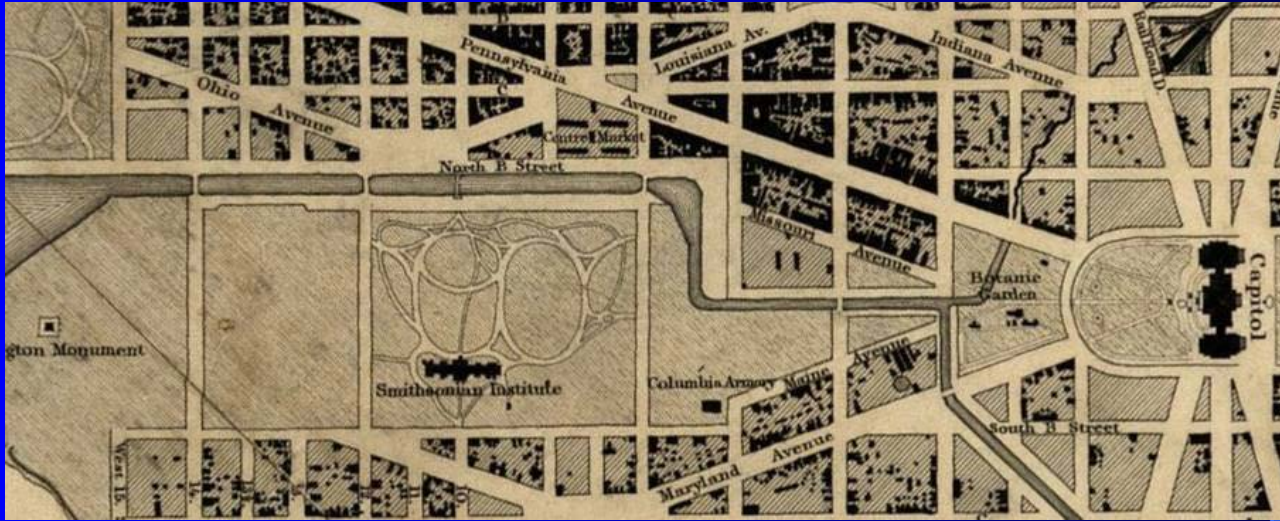
- 1,000,000 gallons of buried underground storage.
- Four 250,000 gallon poured in place concrete cisterns.
- One pumping point from cistern #3.
- Water is transferred from each cistern to the pumping cistern automatically.
- The cistern with the most water in it is used first.
- Potable water back up flows into the cistern that the pump station is pumping from at a specific rate.





05.2

# DESIGN



- Pump station and associated equipment needed to be located on the Mall.
- The historic requirement of the Mall meant no controllers or buildings on the Mall. A large underground vault (36 feet wide x 43 feet long x 14 feet high) includes support equipment such as control system interface, water supply, cistern transfer pump controls, electrical panels and drainage pumps.

# PUMPING

- The 15 hour per week water window dictated a pumping capacity of 1,400 gpm.
- The District of Columbia requires that storm water be disinfected if it is to be spray irrigated.
- This required the inclusion of a UV disinfection system. The UV system required filtration to 30 microns. As a result a 25 micron filtration system consisting of 3 screen filters was specified.



# PUMPING



- The pumping system is flooded suction if the cistern is more than 50% full, but due to elevations required by the cistern as the water level decreases it changes to a suction lift application. As such the system has a foot valve and priming system.
- In order to maximize the amount of storm water used the potable make up water supply is also sized at 1,400 gpm. There is a flow meter on the water supply with a modulated butterfly valve. The flow meter and the pump station flow meter are tied together so that the make up water supply when needed is modulated to fill at the same rate as the water is being pumped.
- Potable water only discharges into the pumping cistern only when it is basically empty.

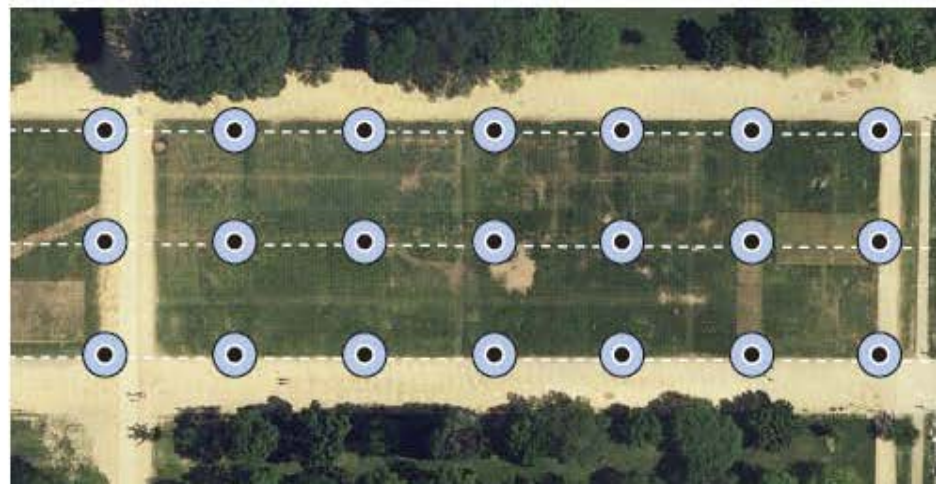
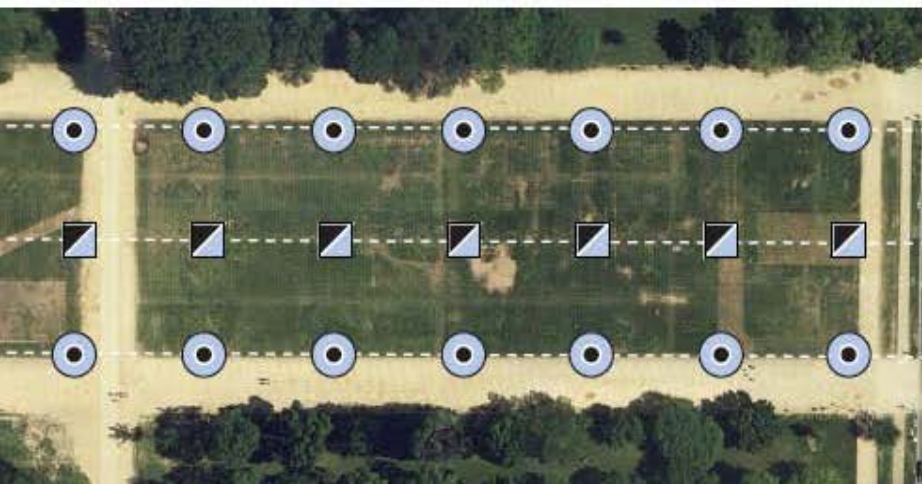
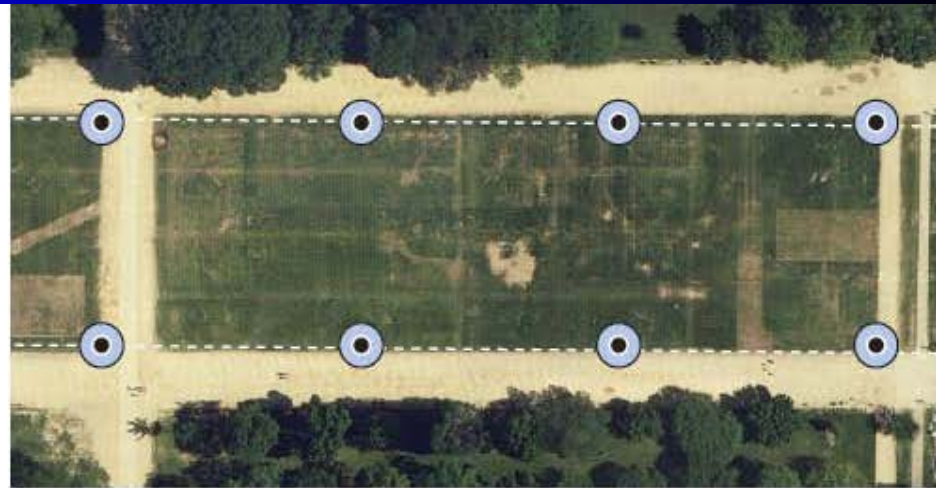
# CONTROLS

- Pump station flow and pressure are monitored.
- Levels in each cistern are monitored and water is transferred from the outlying cisterns to the pumping cistern as necessary.
- Levels for pump transfer pumps off, transfer pumps on, low level, high level and make up water can all be at different levels.
- All of this logic is contained in the pump station control panel.



# IRRIGATION DESIGN

- Several different irrigation design alternatives were considered including
  - Travelers
  - Quick Couplers only
  - Subsurface drip
  - 2-row system
  - 2-row system w/quick couplers in middle
  - 3-row system
  - 5-row system
  - Synthetic Turf





# IRRIGATION DESIGN

- To minimize sprinklers and potential clogging, large golf rotors were used with rubber covers (approximately 90 foot x 85 foot). Two rows were preferred but higher liability.
- Valve-in-head sprinklers were used to eliminate zone valves.
- Two wire system was used to minimize wire and wire splices and to have no controllers. Integrated control modules were used to minimize wire splices and maintenance issues.



# IRRIGATION DESIGN



- Pipe depth of cover is 60 inches to minimize tent stake damage. Drainage 48 inches.
- HDPE pipe was used to eliminate fittings and the thicker wall may deter tent stakes.
- A no stake zone of 5 feet is established along the edges and down the middle of the lawn areas.
- Isolation and air release valve boxes are piped in and out of walkways to eliminate valve boxes in the lawn.

# IRRIGATION DESIGN

- The central control system is located at the closest Mall maintenance area over a mile from the Mall by line of site.
- Do to access issues NPS did not want it in the vault nor is it a good environment for the computer.
- The weather station could also not be on the Mall due to its visual appearance.
- Communication is required from:
  - the computer to the interface
  - the pump station and transfer pumps to computer
  - the weather station to the computer
- Normally this would not be a big issue as radios could be utilized. Radio was proposed but quickly eliminated due to the antennas.

# IRRIGATION DESIGN

- The communication issues were the most difficult aspects of the design.
- Pump station and central communication is over Wi-Fi connections. The control system interface and the pump station monitoring each have individual ISP addresses.
- Internet communication allows for 24/7 access and alarm notification over any smart device.
- The weather station communication is by radio as the weather station is located at the maintenance yard not too far from the central computer in a large lawn area.

# MAINTENANCE

- Maintenance is hopefully minimized by:
  - using less equipment
  - minimal wire and wire splices
  - valve-in-head sprinklers
  - wire in conduit
  - excessive grounding
  - Excessive filtration
  - 60 inch burial depth
  - Meeting with and discussing the design with the maintenance staff during the design phase



# QUESTIONS



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