Clean Water Summit
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Design Considerations for Clean Water & Healthy Urban Trees

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TREES as STORMWATER MANAGEMENT?

TREES as **PART OF** STORMWATER MANAGEMENT SYSTEMS!
MINNEAPOLIS STORMWATER MANAGEMENT OBJECTIVES

Reduced pollutant loading to surface waters

Reduced velocity of flow in local streams, which leads to stabilized streambanks and improved wildlife habitat

Reduced frequency, severity and duration of localized street/intersection flooding

Improved capacity of stormwater drainage system

Increased recharge of groundwater
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CAN WE – grow healthy, large trees, to provide interception, evapotranspiration, and increased infiltration?
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CAN WE – grow healthy, large trees, to provide interception and evapotranspiration?

BUT – it could take +/- 30 years before the tree is large enough to get much stormwater volume reduction, so . . .
SOLUTION – design as system of reservoirs to provide water and good growing conditions for the trees, and to detain or retain the water, for IMMEDIATE stormwater management betterment.

IMMEDIATE and LONG TERM stormwater benefits!
IMMEDIATE

• Rock trench and engineered soil media for UG storage and excellent growing conditions
LONG TERM

• As trees mature they will intercept and consume more and more stormwater while UG capacity may diminish
Bicolor Oak in Minneapolis

replaced every 10 years

Stormwater Runoff Reduction – gallons per year

Reference: i-Tree, U.S. Forest Service
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City of Minneapolis: Recent Trees and Stormwater Projects

**Second Av S and Marquette Av S**

- West 54th St
- Washington Ave N.

- 25th Av SE
- 37th Av N Greenway
Good Design Provides Basic Tree Needs

- Water (Stormwater)
- Oxygen to the Roots
- Sufficient Volume for the Roots to Grow
Proprietary Devices

- Lots of information on the Internet
- Caution: Doubt all before believing anything
- Does the device meet the three basic needs?
What Not To Do
Better
Replace Boulevard Soil at Tree Locations

• MPRB Standard Practice – 2ft x 8ft EW x blvd
Depressed Boulevard

5’ W x 16’ L x 2’ D = 160 cf or 6 cy

* Do Not Compact Topsoil

NOTE:
2’ DEEP TREE TOPSOIL
SECTION EXTENDS 6’ FROM
TREE LOCATION PARALLEL TO CURB, EACH WAY.
Depressed Blvds – simple and effective
Depressed Blvd—simple & effective
Pervious Pavement
Pervious Pavement

• Promotes Oxygen Exchange to the Roots
• Allows Stormwater to Irrigate the Tree
Tree Trenches

4 Main components

- Underground Stormwater Storage
- Growing Media for Trees
- Stormwater Inlet to UG Storage
- Pretreatment of Stormwater
Underground Storage

- Clean Sand  15% to 20% void ratio
- Rock (all 1 size)  35% to 45% void ratio
- Perforated Pipes  100% void ratio

1 ft of 12” pipe = 2.0 cf rock = 5.5 cf sand
UG Storage - Rock
UG Storage - Rock

- Uniform size = maximum void ratio
- Granite (St Cloud) or trap rock (Dresser)
  - Long haul to metro area
- Crushed, hard rock
  - very strong
  - Supports pavement and traffic
UG Storage - Rock

• Select readily available material to lower cost
  – Railroad ballast
  – Crushed river rock
  – Pea rock
  – Call the quarry

• Limestone is NOT a good choice – breaks down too easily
UG Storage - Rock

- Crushed Concrete – Pros and Cons
  - Wash to remove fine cement dust
  - Recycled material
  - Cost effective
  - Can breakdown like limestone
  - High pH
  - It has been used successfully
UG Storage - Pipe

- Generally small diameter
  - 12” dia. = 0.8 cf/ft of pipe
  - 18” dia. = 1.8 cf/ft
  - 24” dia. = 3.1 cf/ft (not 2 x 0.8)

- PVC or CPEP (drain tile)
  - Inexpensive
  - Easy to install
  - Perforated
UG Storage - Pipe
UG Storage - Pipe

- Very high inflow capacity
  - distributes water to rock
Oxygen

- **Storage Pipes**
  - Connected to Surface by CBs
  - Provide “venting” to subsurface
  - Oxygen to roots

- **Pervious Pavement**

- **Greenspace**

- **Uncompacted soil**
Growing Media for Roots

• Topsoil (subcut and extra depth)
• Sand under sidewalk
• Underground storage rock
• Underground storage pipes
• Try to get 2 cf/sf of canopy
Growing Media for Roots

- Planting soil
  - Below high water
  - Capillary action
  - Allows infiltration
- Loamy Sand
- Compost
Growing Media for Roots

- Wash soil into rock – Stockholm, Sweden
  - Small lifts
  - Structural support
  - Maplewood Mall
- 530 cf of agg/tree
Stormwater Inlets

- Greenspace – infiltration
  - slow
- Pervious Pavement
  - Slow
  - Prone to plugging
  - Provides pretreatment - filtering
- Catch basins
Catch Basin Inlets

- High Inlet Capacity
- Very cost effective
- Easy to maintain
CB Inlets with Pretreatment

- Add skimmer
  - Keep out floating debris
- Add Sump
  - Keep out course sediments
Tree Boxes and Rills
“All We are Saying …..”
“...is Give Trees a Chance.”

John Lennon
Water, Oxygen, and Room to Grow

Questions?
Recommended CF of soil per tree or per SF of canopy: 2