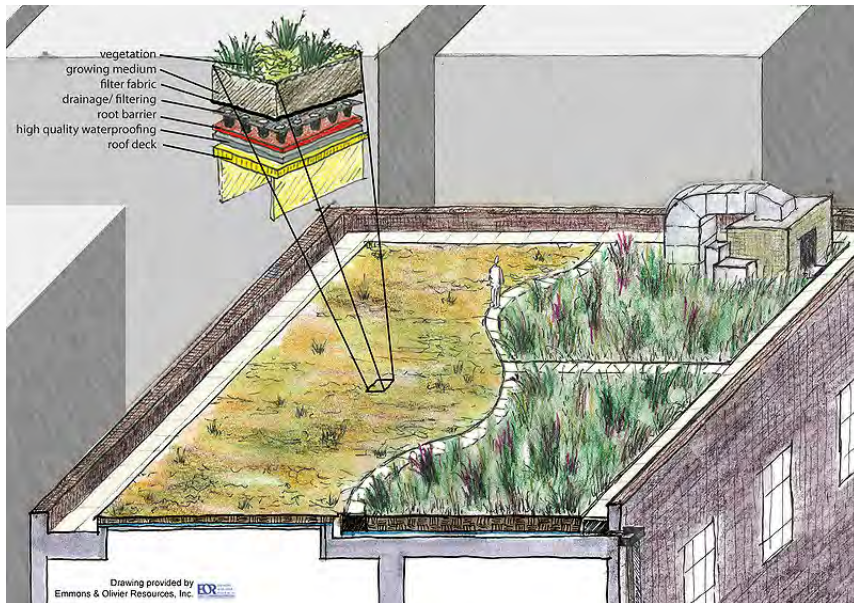


# Incorporating Green Roofs into the MIDS calculator



# Overview of green roof hydrology

- Some canopy interception
- First ½ inch of precipitation fully absorbed
- After ½ inch there is some loss even before media is saturated
- Absorption continues as precipitation proceeds
- Once saturated, water is lost out the bottom (losses across the surface only for very intense, long duration storms)
- After precipitation stops, gravity drainage
- ET occurs immediately and is greatest when soils are wettest
  
- Reduces annual volume vs. traditional roof
- Provides some rate control

# Annual volume reductions

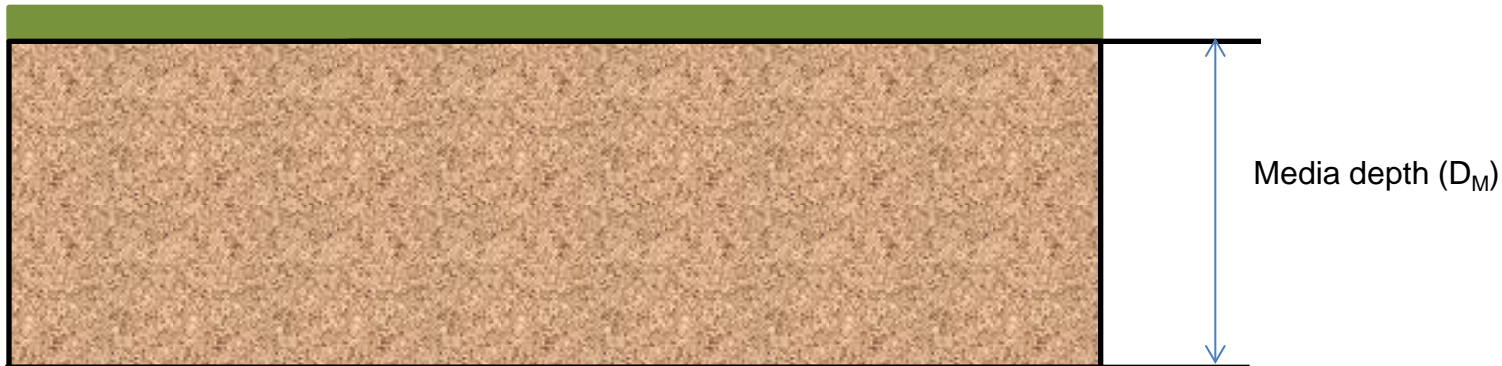
- Varies widely in the literature, ranging from 25 to more than 70 percent
  - Retention affected by local climate (rainfall patterns, humidity, temperature, snow, etc.), design (including media thickness and plant species and drainage layer), study duration (e.g. did study include winter months)
- Typical retention values are in the 50 to 70 percent range
  - Minnesota probably at higher end of this range

# Currently in calculator

- No contributing impervious area
- Inputs are roof area, media depth, and porosity
- P and TSS removal same as for other BMPs

$$V = A_S * D_M * n$$

Top surface area ( $A_S$ )

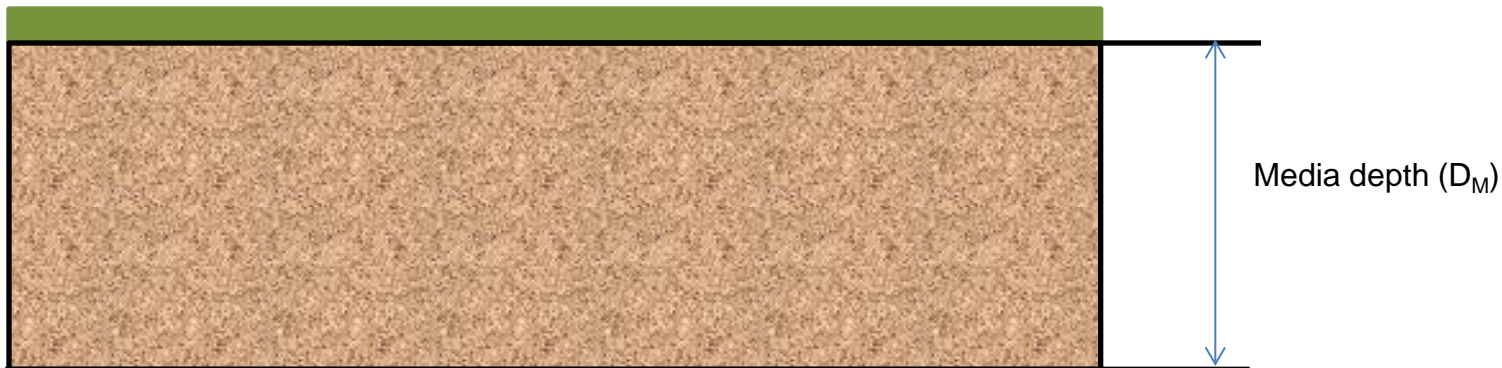


# Recommendations

- Porosity = Moisture holding capacity = 0.33
- $D_M \leq 4$  inches
- Can have contributing impervious; green roof must be 50% or more of total area
- Retention capped at 1.1 inches (no banking)

$$V = 0.33 * (A_S) * D_M$$

Top surface area ( $A_S$ )



# Examples

- 2 inch media = 60% of performance goal
- 3 inch media = 90% of performance goal
- 4 inch media = 100% of performance goal

# Factors that affect volume but that are not included in calculator

- Plant species – affect ET, soil water content needed to thrive
- Media > 4 inches in thickness – data suggests limited benefit of increasing thickness from 4 to 6 inches
- Type of media – the 33% value for moisture holding capacity is on the low end
- Type of drainage layer - low transmissivity drainage layer (e.g. granular drainage layer) increases retention
- Slope of the roof - lower slope = increased retention
- Irrigation – if optimized, little effect on hydrology

# Phosphorus

- Systems leach phosphorus first few years after establishment
- Exacerbated by fertilization first year or two
- P losses decrease with time and eventually green roofs retain phosphorus
- Recommendation = no P credit



# TSS

- Green roofs behave similar to filter media
- Recommendations
  - TSS retention = 85%
  - EMC = 15 mg/L

# Green Roofs Schedule

- Make adjustments to calculator after MIDS workgroup approval
- Kestrel completes tasks late-May
- Incorporation into Manual late May through June