MIDS Work Group Meeting

September 24, 2010

Introduction to Barr's Initial MIDS Tasks

Definitions:

- Natural Hydrology = Pre-settlement conditions?
- Predevelopment = Pre-settlement?
- Pre-settlement considerations = soils and vegetation before any human alteration?
- Any other pre-settlement variables?

Barr's First Tasks

- Provide Background and Foundation for Defining Performance Goals
  - Vegetation and Soils
  - Regional Hydrologic Metrics
    - Precipitation
    - Infiltration
    - Abstractions
  - Performance Goal Alternative Evaluation and Runoff Volume Characterization

Suggested Decision Dates

- September 24:
  - Eliminate one or more common volume control practices from further evaluation
- October 15 (or before):
  - Direct Barr on which performance goal to pursue
- November 19:
  - Finalize performance goal(s)
- December 17:
  - Finalize credits method & model
- January 21:
  - Approve calculator

Variables Affecting Runoff (hydrology)

- Climate (varies by eco-region)
  - Precipitation
    - Amount
    - Duration
      - Intensity
    - Time of year
  - Growing season
  - Air temperature
  - Humidity

Variables Affecting Runoff (hydrology)

- Soils (varies across the state)
  - Infiltration rate
  - Vegetation type
- Groundwater elevation
  - Shallow
  - Deep
- Surface Water
- Bedrock

Variables Affecting Runoff (hydrology)

- Vegetation
  - Prairie
  - Deciduous forest
  - Boreal forest
  - Corn and Soybeans
- Topography
  - flat
  - Steep

“Make everything as simple as possible, but not simpler.”

- Albert Einstein

Variability in 24-hr Precipitation Events in MN

Recurrence Period	Range of Precipitation throughout MN (24-hour rainfall duration)
1-year	1.8 in – 2.6 in
2-year	2.1 in – 2.9 in
5-year	2.8 in – 3.7 in
10-year	3.3 in – 4.4 in
25-year	3.9 in – 5.0 in
50-year	4.4 in – 5.6 in
100-year	4.8 in – 6.2 in

Variability in Rainfall Intensity
Total amount vs. time

Recurrence Period	Minneapolis-St. Paul 24-hr rainfall (in)	Minneapolis-St. Paul 1/2-hr rainfall (in)
1-year	2.3	0.9
2-year	2.8	1.1
5-year	3.5	1.45
10-year	4.1	1.65
25-year	4.8	1.9
50-year	5.3	2.1
100-year	5.9	2.4

Abstractions

Depression Storage

- flat
- rolling
- steep
- roof – sloped vs flat
- pavement

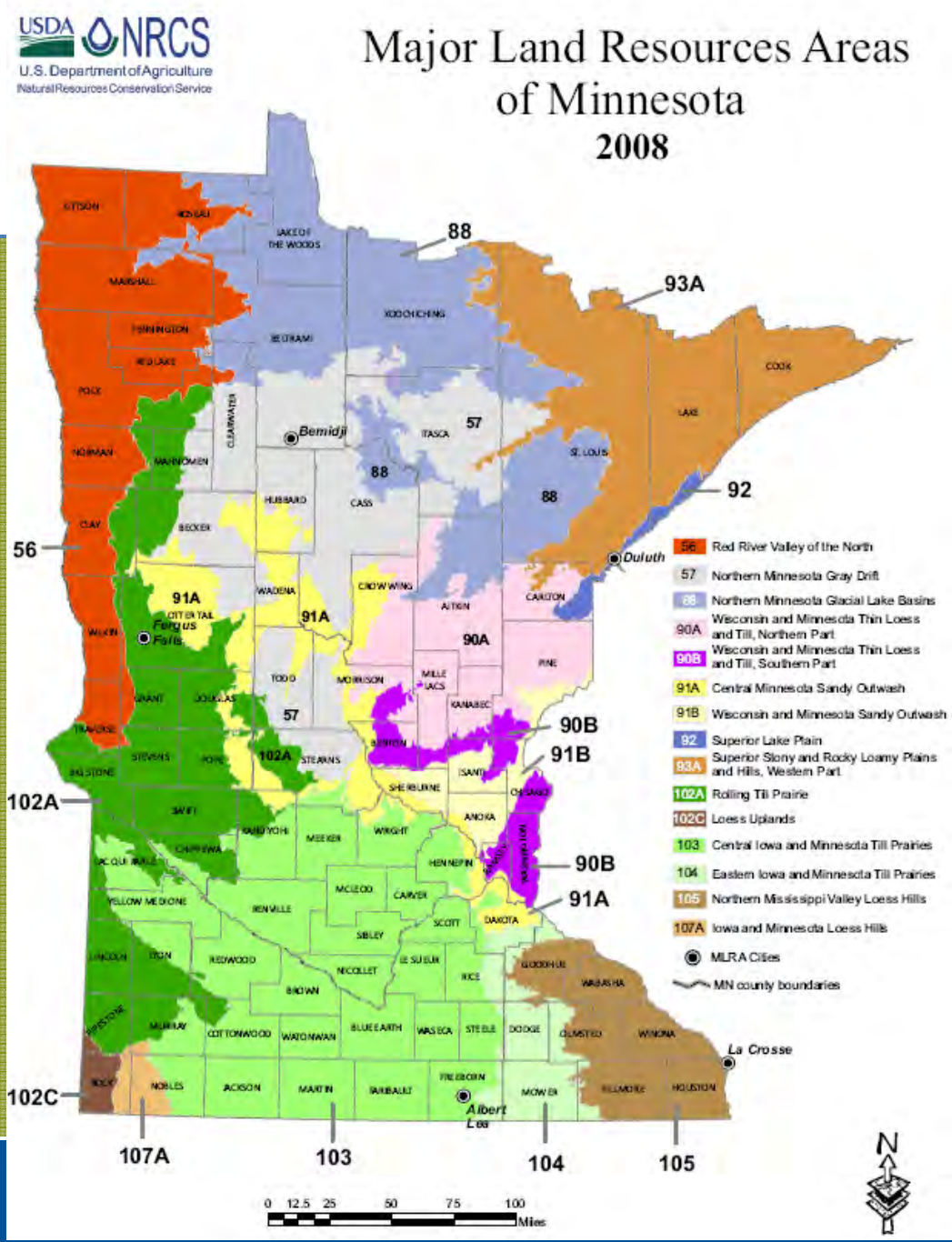
Abstractions

Interception

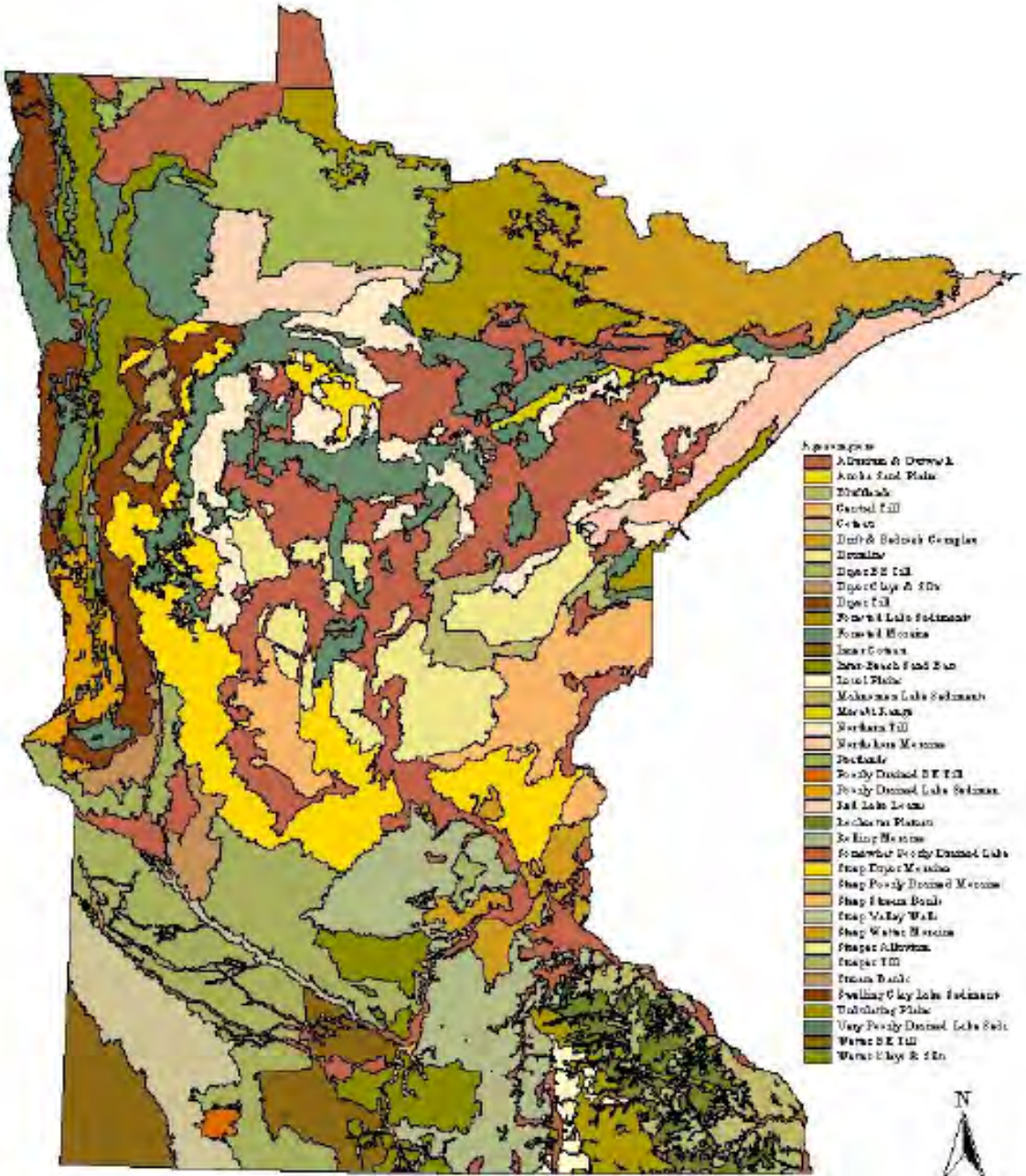
- Trees
  - big vs little
  - Species
- Prairie grass
- Corn
- Pavement

Regional Variations

MLRA


USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service
Major Land Resources Areas of Minnesota
2008
Bemidji
Fergus Falls
Duluth
La Crosse
Albert Lea
88
93A
92
56
91A
90A
90B
91B
102A
102C
107A
103
104
105
57
Red River Valley of the North
Northern Minnesota Gray Drift
Northern Minnesota Glacial Lake Basins
Wisconsin and Minnesota Thin Loess and Till, Northern Part
Wisconsin and Minnesota Thin Loess and Till, Southern Part
Central Minnesota Sandy Outwash
Wisconsin and Minnesota Sandy Outwash
Superior Lake Plain
Superior Stony and Rocky Loamy Plains and Hills, Western Part
Rolling Till Prairie
Loess Uplands
Central Iowa and Minnesota Till Prairies
Eastern Iowa and Minnesota Till Prairies
Northern Mississippi Valley Loess Hills
Iowa and Minnesota Loess Hills
MLRA Cities
MN county boundaries
0 12.5 25 50 75 100
Miles
N

Agroecoregions



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Introduction: Performance Goal Alternative Evaluation

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Goal: Mimic a site's natural hydrology

Another way of thinking of this…

Limit post-construction runoff to a volume equal to or less than the pre-settlement condition based on average annual precipitation vs single event precip.

Three Common Volume Control Methodologies

2. Retain the post-construction runoff volume on site for the 95th percentile storm (1.4 inches in Minneapolis).

   - Use CN method to calculate runoff volume from pervious and impervious areas

   - No Pre-settlement calculation required

Three Common Volume Control Methodologies

3. Limit post-construction runoff from a 1-, 2-, and 5-year 24-hour design storm to a volume equal to or less than the pre-settlement condition.

Return Frequency	Twin Cities Rainfall Depth 24-hour Storm Event (TP-40)
1-year	2.3 in.
2-year	2.8 in.
5-year	3.5 in.

Volume Retention Analysis for Two Development Scenarios

Scenario #1:
40-acre Residential Site
30% Impervious

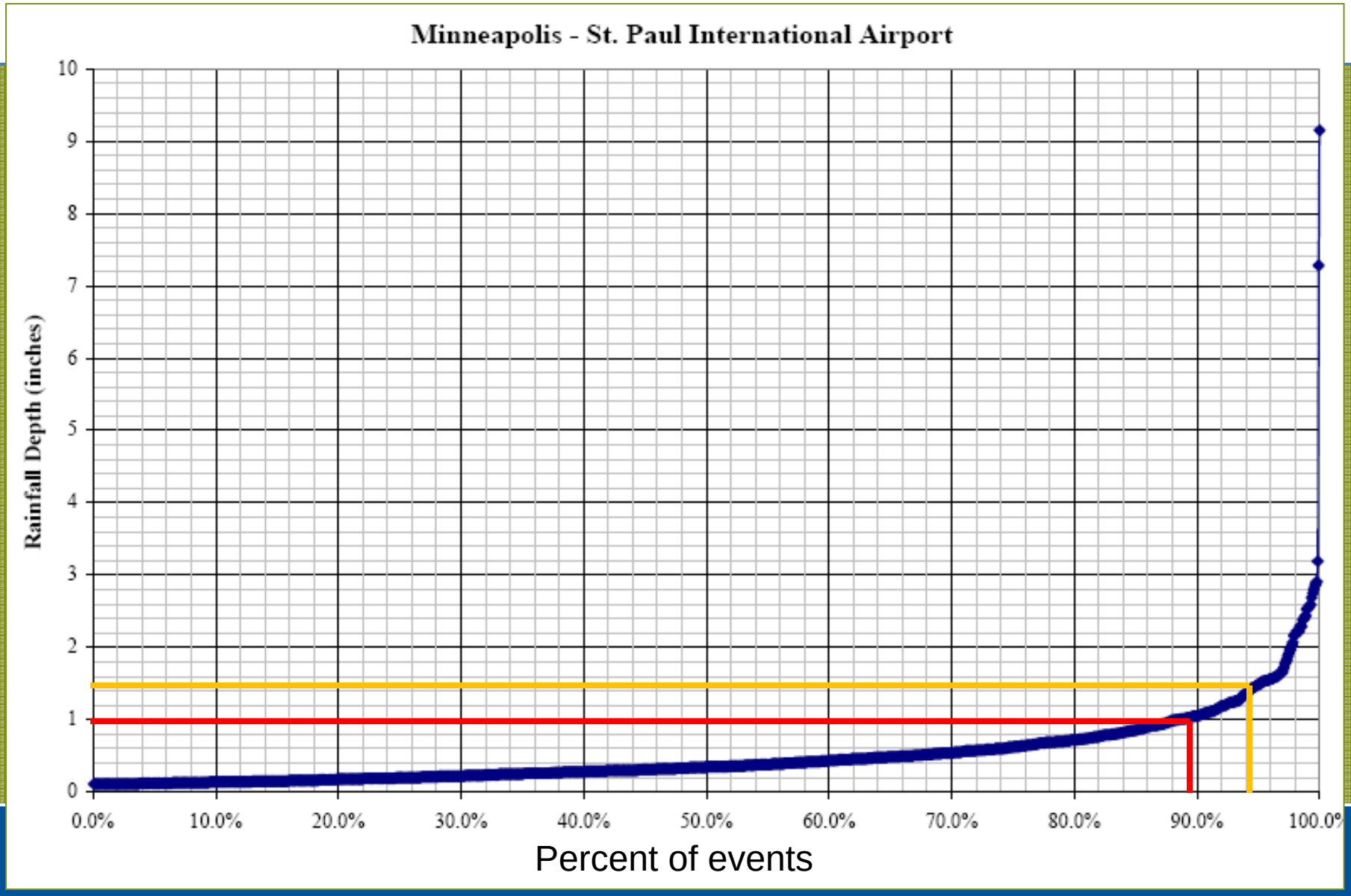
Scenario #2:
10-acre Commercial Site
80% Impervious

Comparison of BMP Land "Footprints"

- "Footprint" = area required for BMP implementation
- Footprint estimated using bioretention basin to achieve volume control
- Sized to drain in 48 hours

Soil Type	Infiltration Rate (in/hr)	Max Depth of Basin (ft)
A	0.8	1.5
B	0.3	1.2
C	0.2	0.8
D	0.03	0.1

% Rainfall Captured



Assess Mimicry of Natural Hydrology

- Develop long-term continuous simulation model to estimate average annual pre-settlement runoff
- Use model to evaluate how volume control standards mimic pre-settlement runoff
- Useful tool for answering complex questions