

Preventing Basement Flooding *Through Early Site Evaluation*

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Waukesha County Land Use Planners meeting

Presentation Outline

- Background
- Case study – 2008 EAP (flood program)
- County flood prevention standards

Basements: Not what they used to be

- Popularity of finished/walk-out basements
- Risk of significant flood damage/losses
- Insurance exemptions



Sump Discharge?



Causes of Basement Flooding

1. Groundwater
2. Site grading/downspouts
3. Sewer backup
4. Surface water/floodplain

- *Combinations of the above*



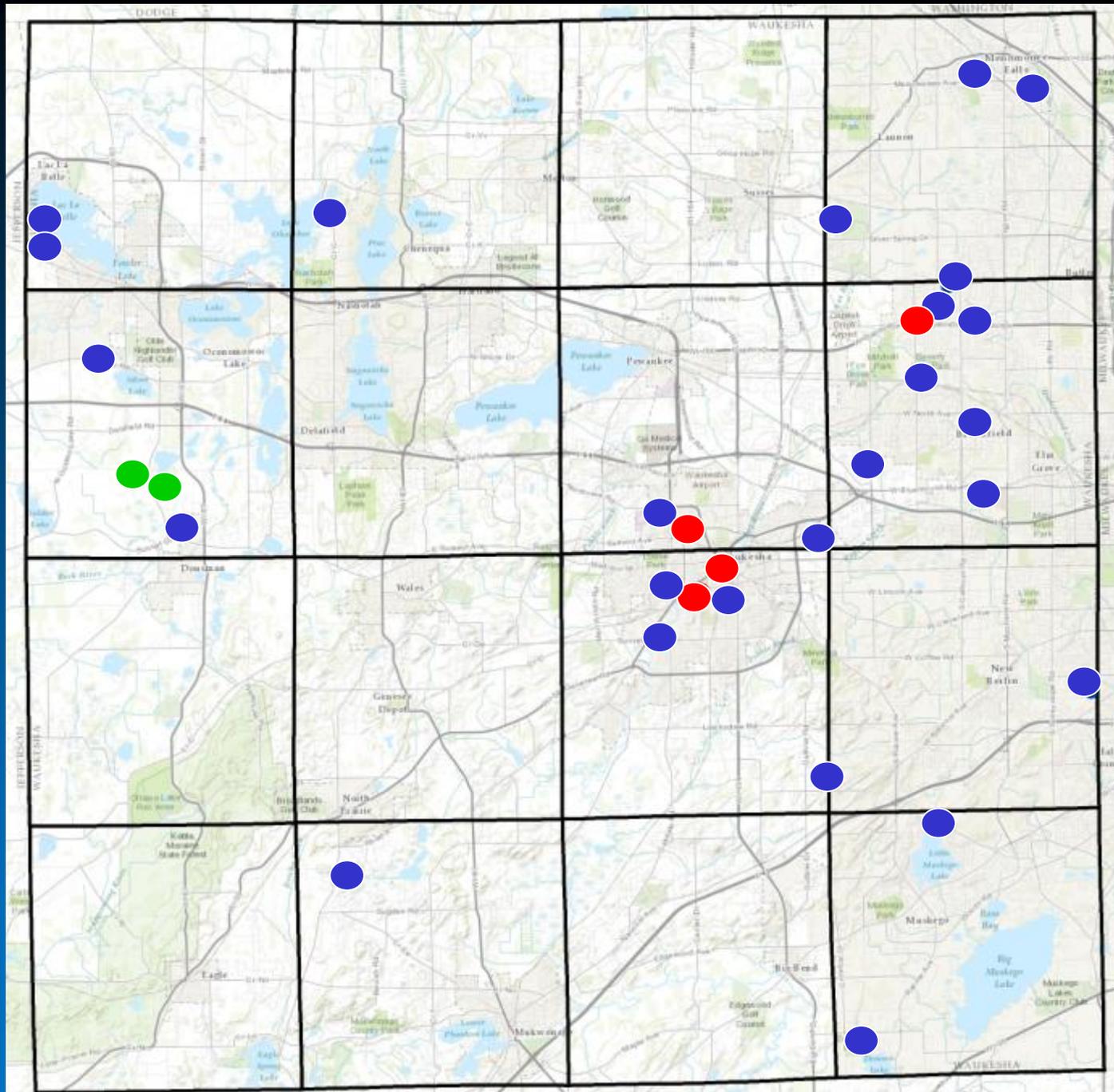
Causes of Basement Flooding

Waukesha County 2008 EAP Case Study

(\$1.7 million /
31 homes)

“Primary” Cause

- “Groundwater”
(81%/25 homes)
- Sewer backup
(13%/4 homes)
- Floodplain
(6%/2 homes)

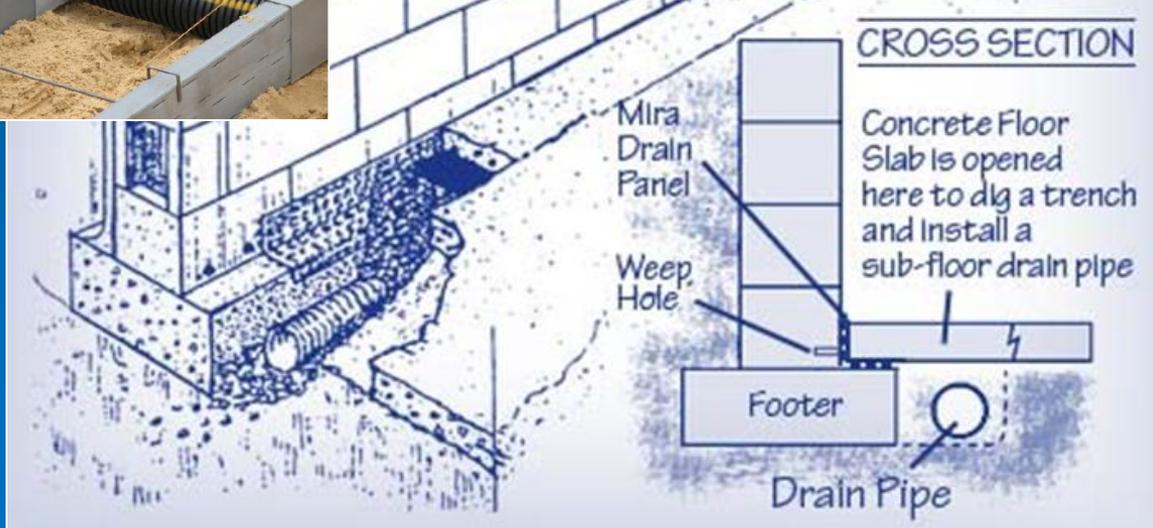
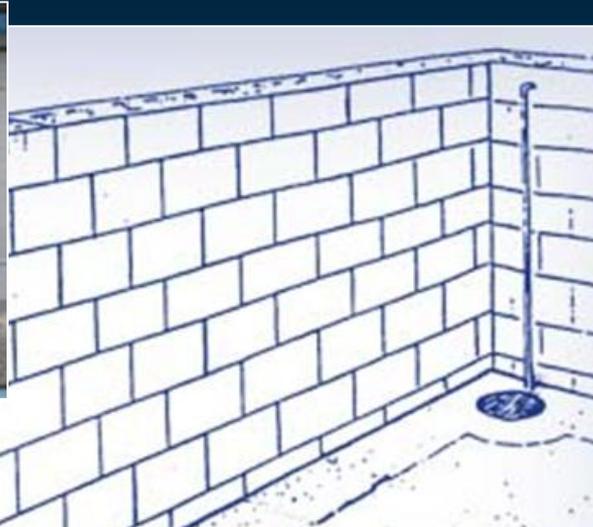


Flood Remediation Methods

(2008 Emergency Assistance Program)

- Foundation drainage system (19)
- Regrading around home (18)
- Anti-backflow valves on sewers (3)
- Flood-proofing/lifting home (2)
- Demolition & relocation (2)

Foundation Drainage Systems (19)

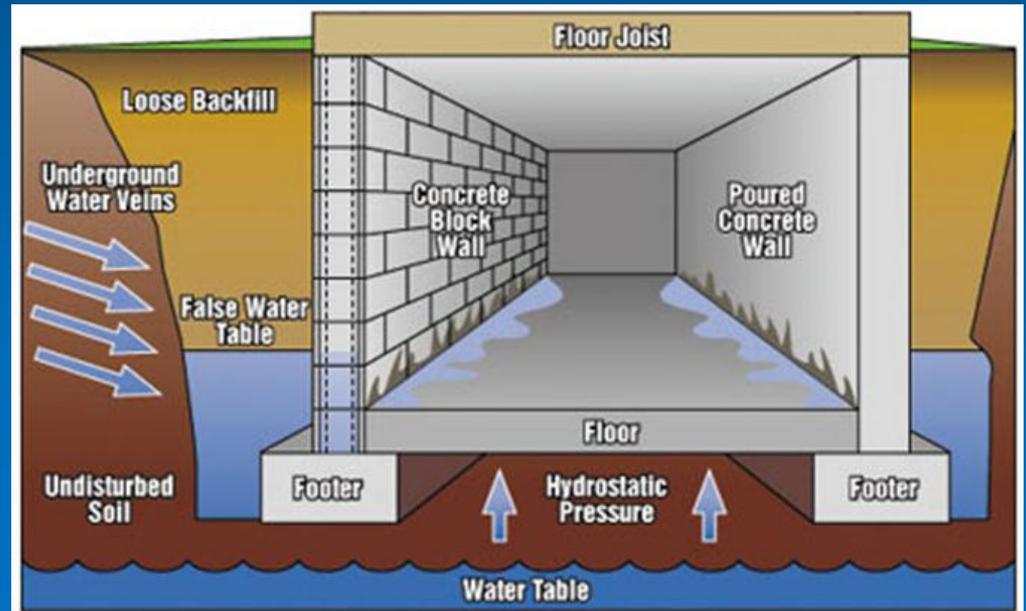


- Exterior water trapped
- Cut 2' conc. along wall
- Drill weep holes
- Install plastic drain panel & interior tile
- Connect to sump

Foundation Drainage System

Technical Challenges

- Pumping rates in coarse/organic soils
- Lack of outlet for discharge water
- Lateral flows
- Bedrock



Flood-proofing/lifting Homes (2)

Lower Genesee
Lake (Summit)



After lifting

- Homes lifted 2-3 feet in elevation
- New foundation

Demolition & Relocation (2)

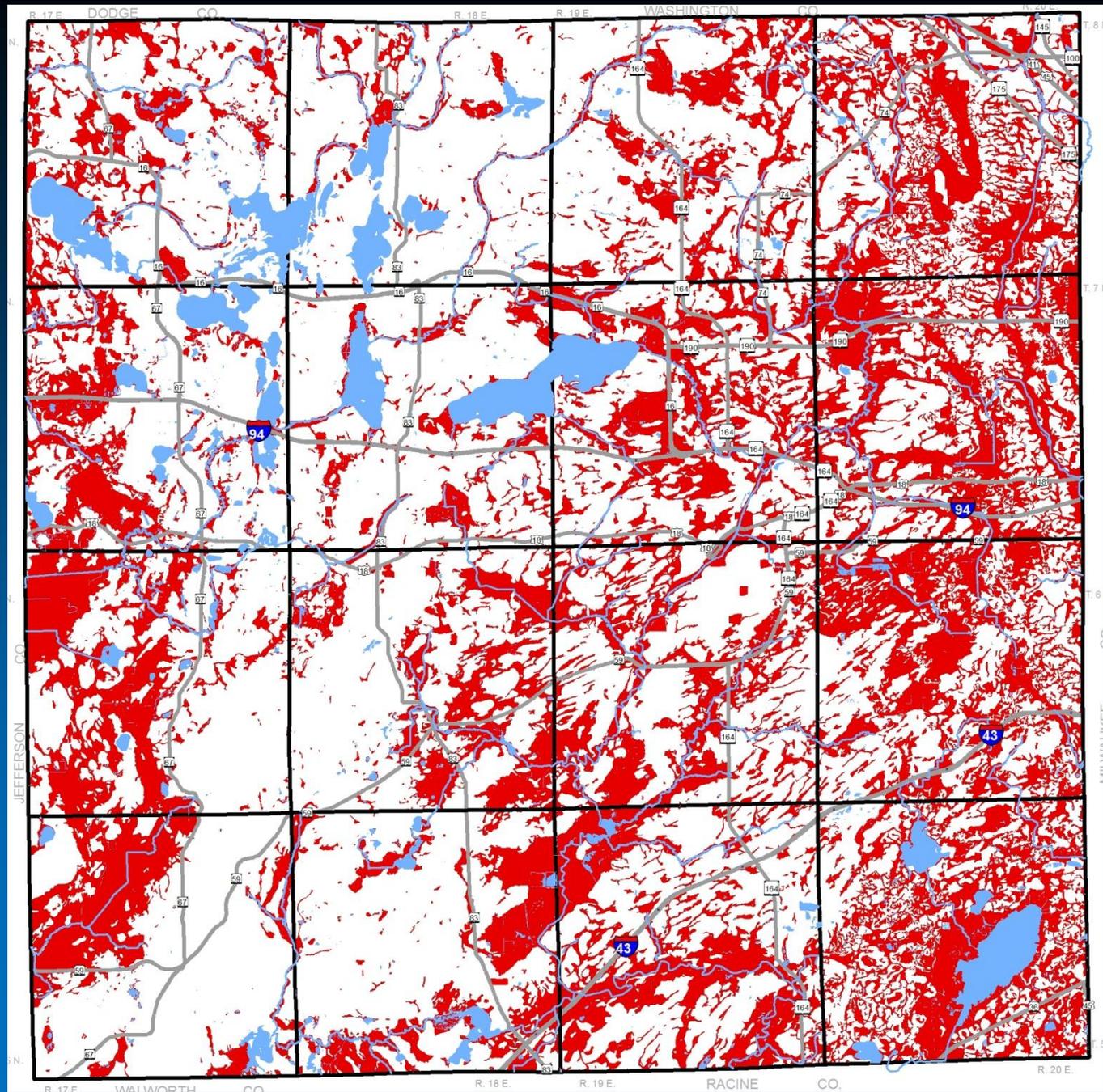


Repair/remediation not economical

Wet Soils

Waukesha County

≤ 3 feet to
seasonal high
water table

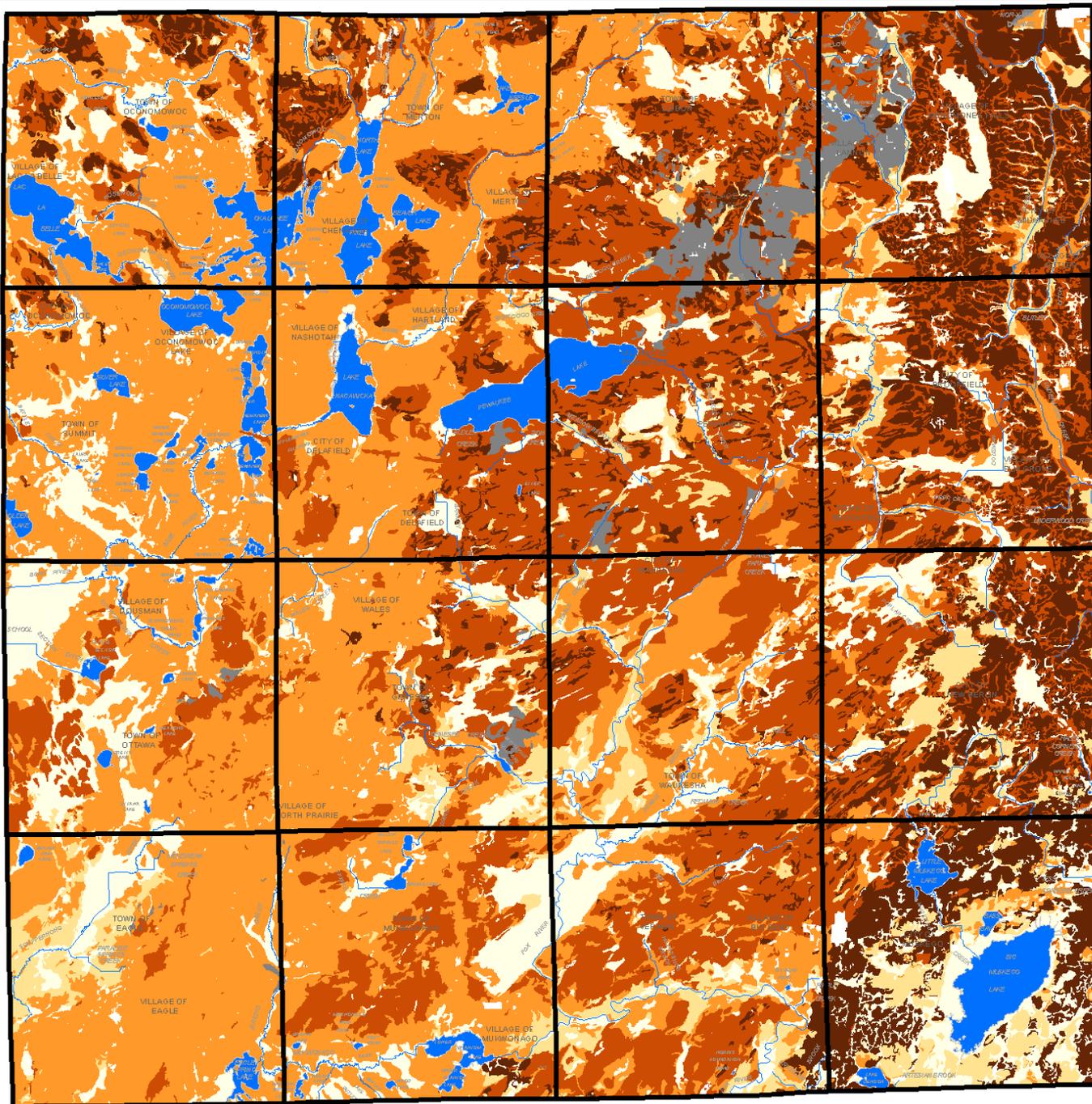


Generalized Soil Parent Material Groups

Waukesha County

Legend

- Dense Glacial Till
- Loamy Glacial Till
- Glacial Outwash
- Lacustrine Deposits
- Alluvium / Organic
- Loess Over Dolomite





Groundwater in outwash soils

Country Bliss Subdivision – T. Mukwonago

Prevention

The seal of Waukesha County, Wisconsin, is a circular emblem with a scalloped border. It features a central figure holding a scale and a sword, surrounded by the text "SEAL OF WAUKESHA COUNTY WISCONSIN".

Waukesha
COUNTY
DEPARTMENT OF
PARKS AND LAND USE

Basement Wetness and Flooding Prevention Standards
Waukesha County Storm Water Management and Erosion Control Ordinance
Land Resources Division (LRD)

Background:

It has become commonplace for residential homes to construct walkout basements and finish lower levels as an extension to their living space. As a result, wetness in or near these areas can cause significant property damage and could lead to other safety or health issues. Let's face it - nobody wants a wet basement. Wetness can occur due to groundwater seepage, surface water runoff, or a combination of both. Most of these problems are preventable, but to be effective, must be addressed during site planning.

To address these concerns, the 2005 update to the Waukesha County Storm Water Management and Erosion Control Ordinance (and many other local ordinances) contains four specific design standards that must be met for any buildings designed for human occupation. These standards apply to all sites that require a Storm Water Permit where a basement is proposed. Since deed restrictions may be involved, these issues *must be addressed at the time of land division*. The standards are briefly summarized below.

Summarized Design Standards (see ordinance for details)

Surface Water (see page 2):

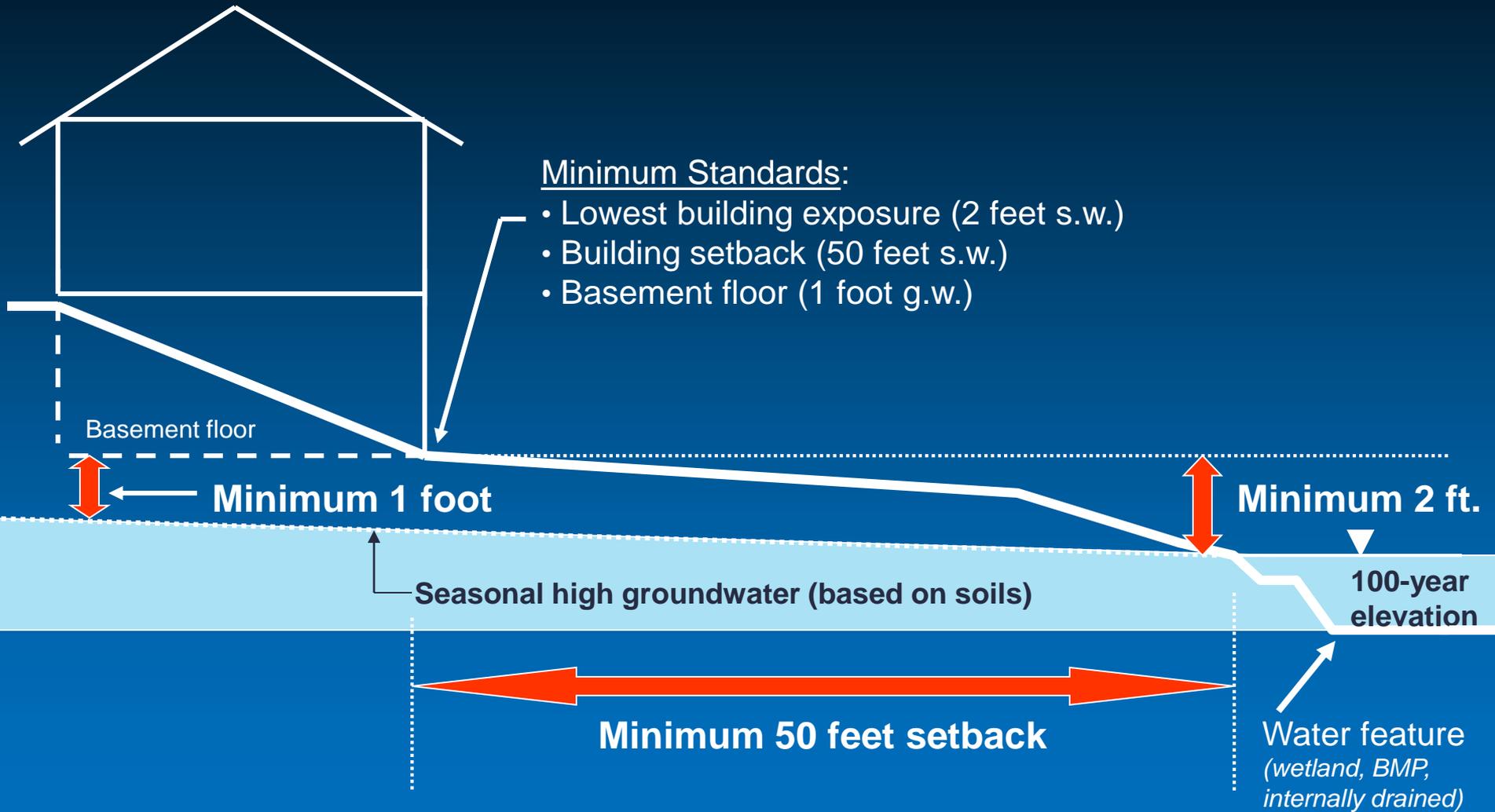
1. A minimum 2-foot vertical separation between the lowest exposed building surface and the peak water surface elevation produced by the 100-year, 24-hour design storm; and
2. A minimum 50-foot horizontal setback from the 100-year design storm elevation.

Basement Flood Prevention Standards

Waukesha County SW & Zoning Ordinances

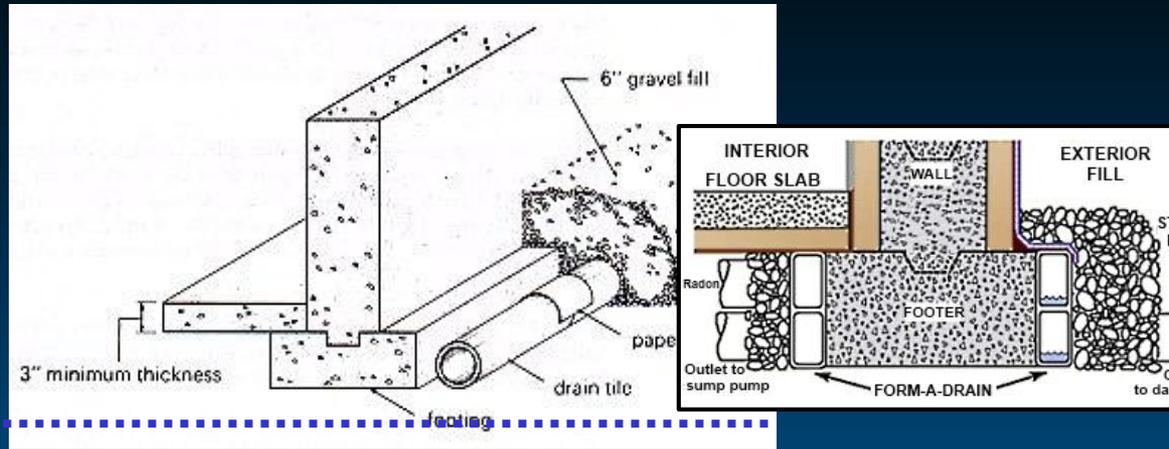
- Surface water:
 - 2 feet above 100-year flood elevation
 - 50 foot setback from 100-year edge
- Groundwater:
 - 1 foot above highest record (using soils)
 - Avoid “hydric” soils (< 1 foot to watertable)
- Site grading / drainage easements

Minimum Flood Prevention Standards



Why 1 foot groundwater separation?

Water table

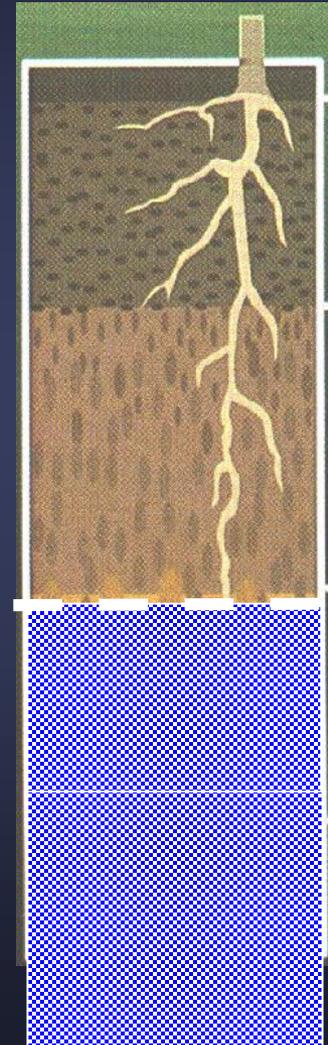


- Minimize:

- Constant flows / discharge “drainage wars”
- High energy bills (electric)
- Damages from sump pump burn-out / failure

“Seasonal High Groundwater”

“The upper limit of the zone of soil saturation caused by underlying groundwater at its highest level”



Soil Pit Evaluations

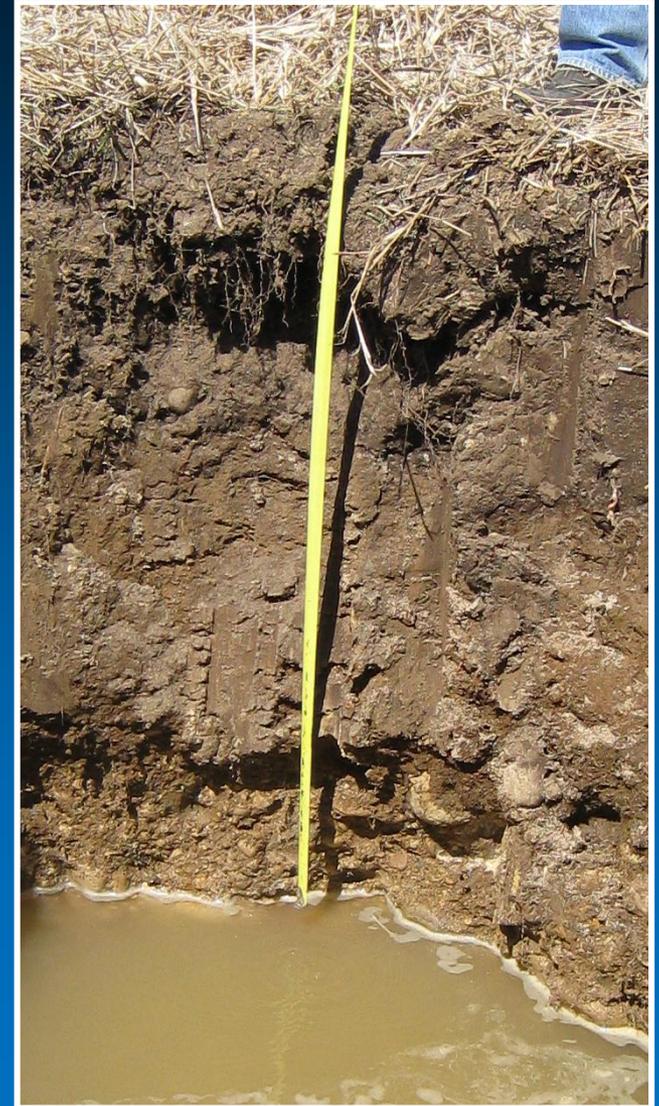
*Best available tool to
predict water table*

- Long term indicator



Water Table Indicators in Soil

- Saturation/water in the hole
 - Snap shot in time
 - Depends on soil texture/time
 - Fluctuates by season (2-5 ft.)
 - Fluctuates by year (>10 ft.)
- Redoximorphic features (mottling/colors)
- Soil structure (massive)



Soil Evaluation Standards

- SPS 385 (WI Admin. Code)
 - Procedures/forms, certif.
 - USDA classification system
- County Standards
 - Minimum 8 foot deep
 - Within 50 feet of basement
 - IF triggered by site screening criteria



Documentation

- Standardized State forms (SPS)

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04 (1) (m)).

County	
Parcel I.D.	
Reviewed by	Date

Property Owner		Property Location						
Property Owner's Mailing Address		Govt. Lot	1/4	1/4 S	T	N	R	E (or) W
City		Lot #	Block #	Subd. Name or CSM#				
State	Zip Code	Phone Number	<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Town Nearest Road					

Drainage area _____ <input type="checkbox"/> sq. ft. <input type="checkbox"/> acres Optional: Test Site Suitable for (check all that apply) <input type="checkbox"/> Irrigation <input type="checkbox"/> Bioretention trench <input type="checkbox"/> Trench(es) <input type="checkbox"/> Rain garden <input type="checkbox"/> Grassed swale <input type="checkbox"/> Reuse <input type="checkbox"/> Infiltration trench <input type="checkbox"/> SDS (> 15' wide) <input type="checkbox"/> Other _____	Hydraulic Application Test Method: <input type="checkbox"/> Morphological Evaluation <input type="checkbox"/> Double-Ring Infiltrometer <input type="checkbox"/> Other (specify) _____
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Obs. # Boring
 pit Ground surface elev. _____ ft. Depth to limiting factor _____ in. Hydraulic App. Rate

Horizon	Depth In.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

Obs. # Boring
 pit Ground surface elev. _____ ft. Depth to limiting factor _____ in. Hydraulic App. Rate

Horizon	Depth In.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

CST/PSS Name (Please Print)	Signature	CST/PSS Number
Address	Date Evaluation Conducted	Telephone Number

Site Screening Criteria

(When a soil test hole is required)

- NRCS wet soil list (*<3 feet to seasonal g.w.*)
- ≤ 8 vert. feet to water feature / hydric soil
- Other known site risks
 - *Other soil tests, seeps, nearby sumps, drainage patterns*

Waukesha County Soil Survey (USDA – NRCS)

All data available on:
NRCS Web Soil Survey or
Waukesha County GIS

SOIL SURVEY OF MILWAUKEE AND WAUKESHA COUNTIES WISCONSIN



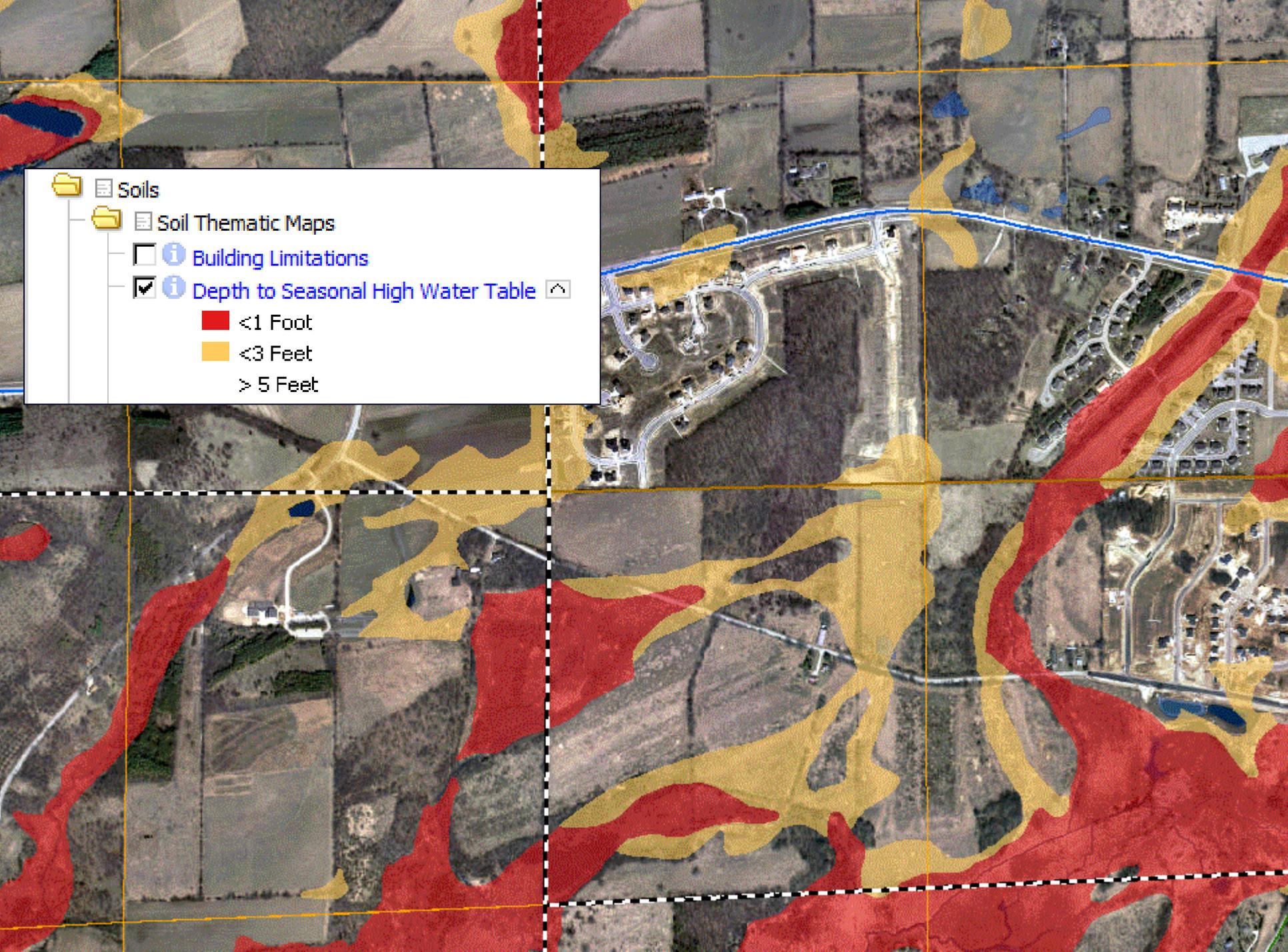
U. S. Department of Agriculture
Soil Conservation Service
In cooperation with
University of Wisconsin
Wisconsin Geological and Natural History Survey
Soils Department and
Wisconsin Agricultural Experiment Station

Issued July 1971

Exhibit X

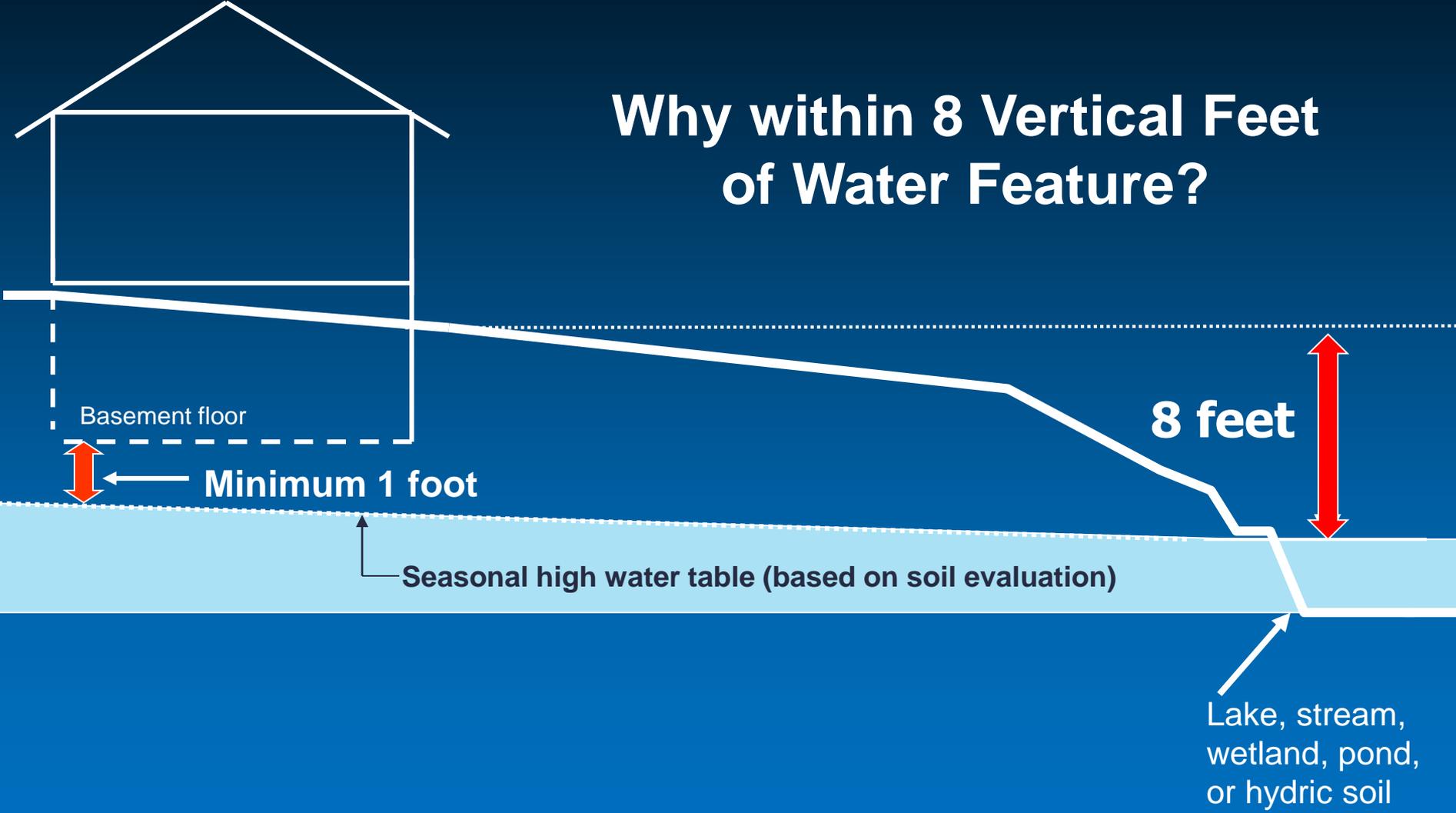
Waukesha County Soil Series Designated as Hydric or Having Seasonal High Water Table Within 3 feet of the Surface*

Soil Map Symbol**	NRCS Soil Series Name	Depth to Water Table (inches)	Hydric Soil (X)
Ac	Adrian muck	0	X
Am	Alluvial land	12-24	
As	Ashkum silty clay	0	X
Az	Aztalan loam	12-36	
Bl	Blount silt loam	12-36	
Bs	Brookston silt loam	0	X
Cv	Clayey land	12-72	
Cw	Colwood silt loam	0	X
Dt	Drummer silt loam, gravelly substratum	0	X
Es	Elliot silt loam	12-36	
Fa	Fabius loam	12-24	
Gd	Gilford loam	0	X
Gf	Granby fine sandy loam	0	X
Gw	Griswold silt loam, mottled subsoil variant	12-36	
Hm/Ho	Hochheim loam, Hochheim	***	
Ht	Houghton muck	0	X
Ke	Kane silt loam	12-36	
Kl	Kendall silt loam	12-36	
Lm	Lamartine silt loam	12-36	
Lo	Lawson silt loam	12-36	
Lu	Loamy land	12-72	



- Soils
 - Soil Thematic Maps
 - Building Limitations
 - Depth to Seasonal High Water Table
 - <1 Foot
 - <3 Feet
 - >5 Feet

Why within 8 Vertical Feet of Water Feature?

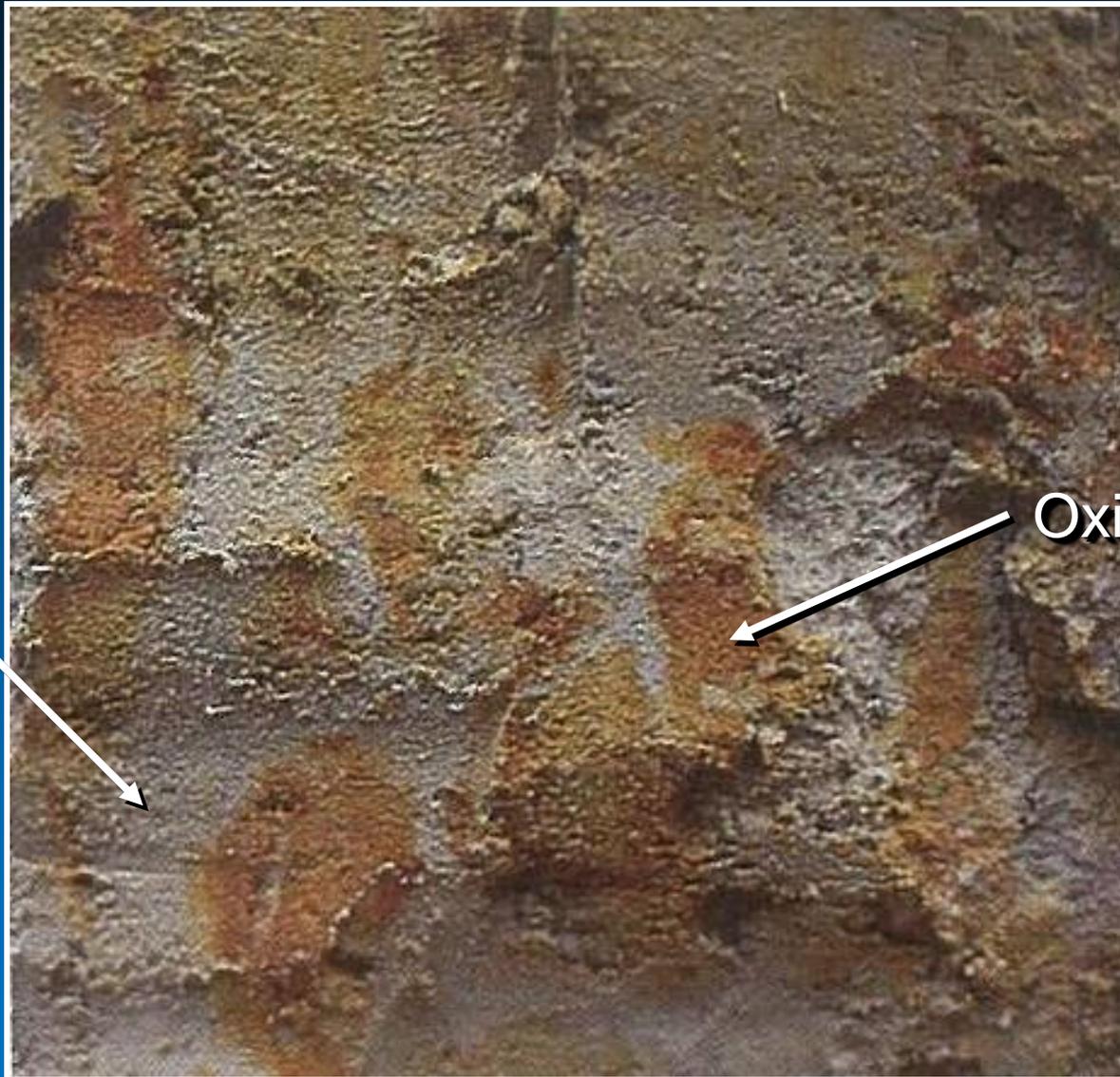


Redoximorphic Features (Soil Mottling)

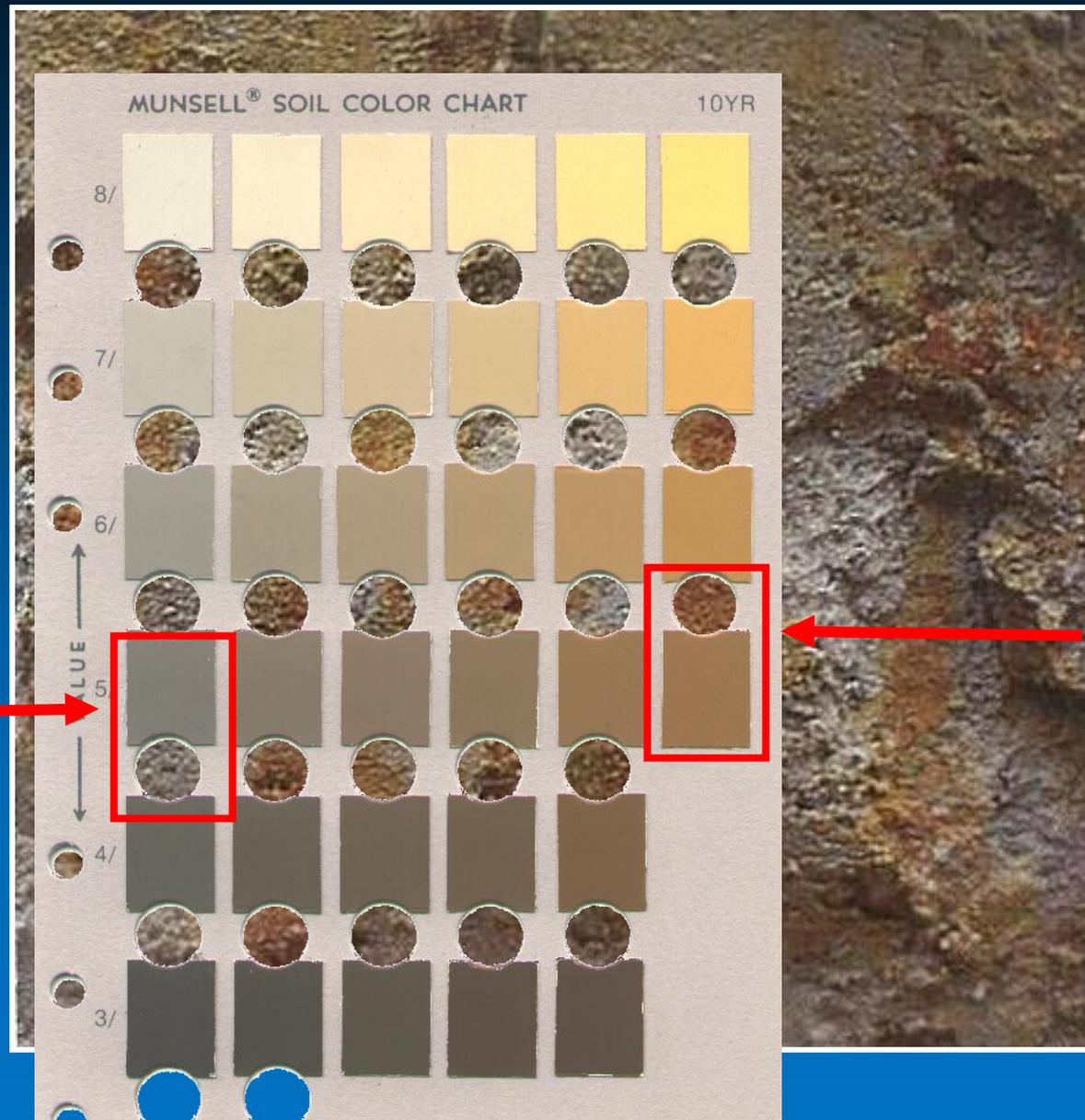
Reduced



Oxidized Fe³⁺



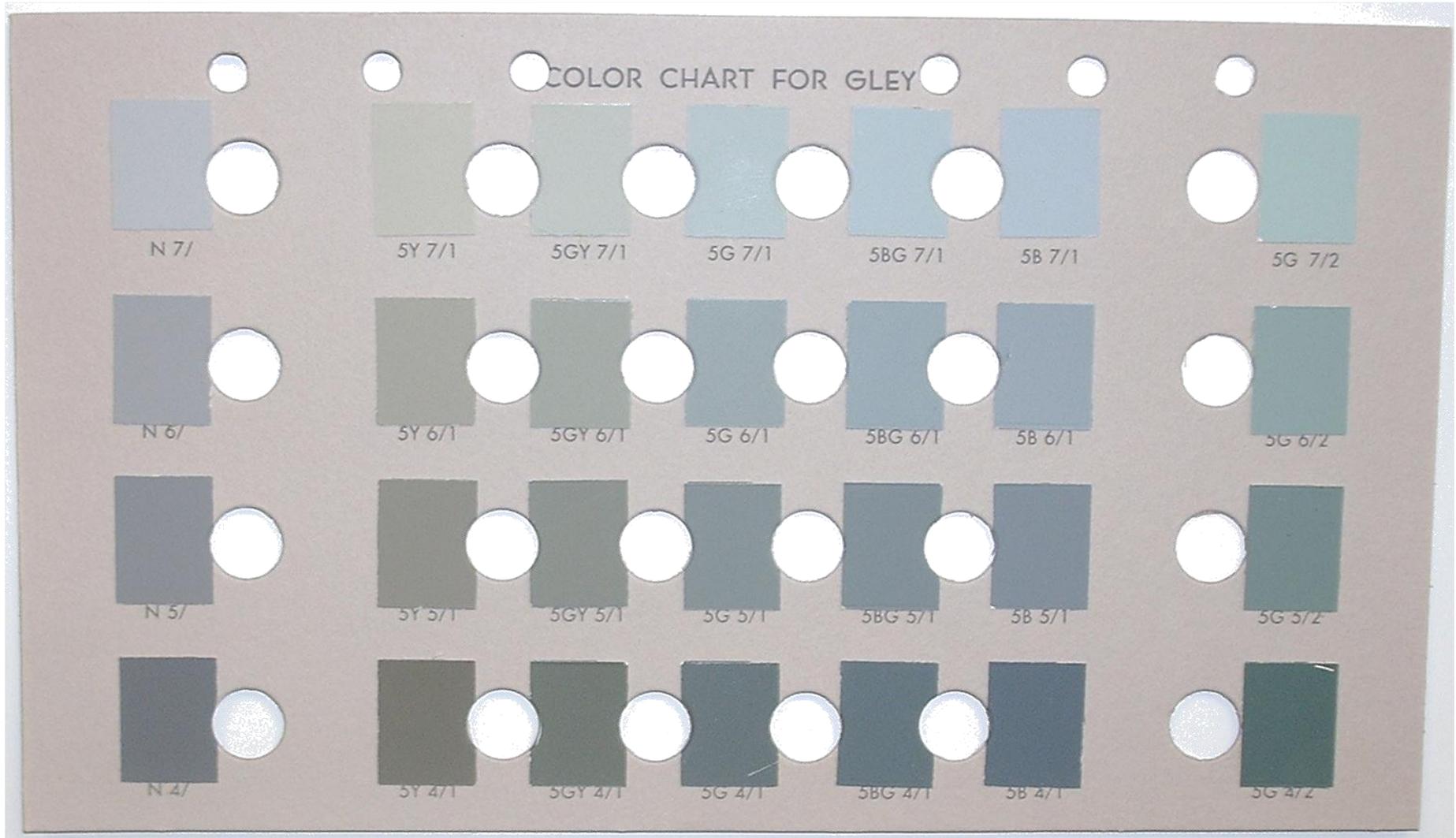
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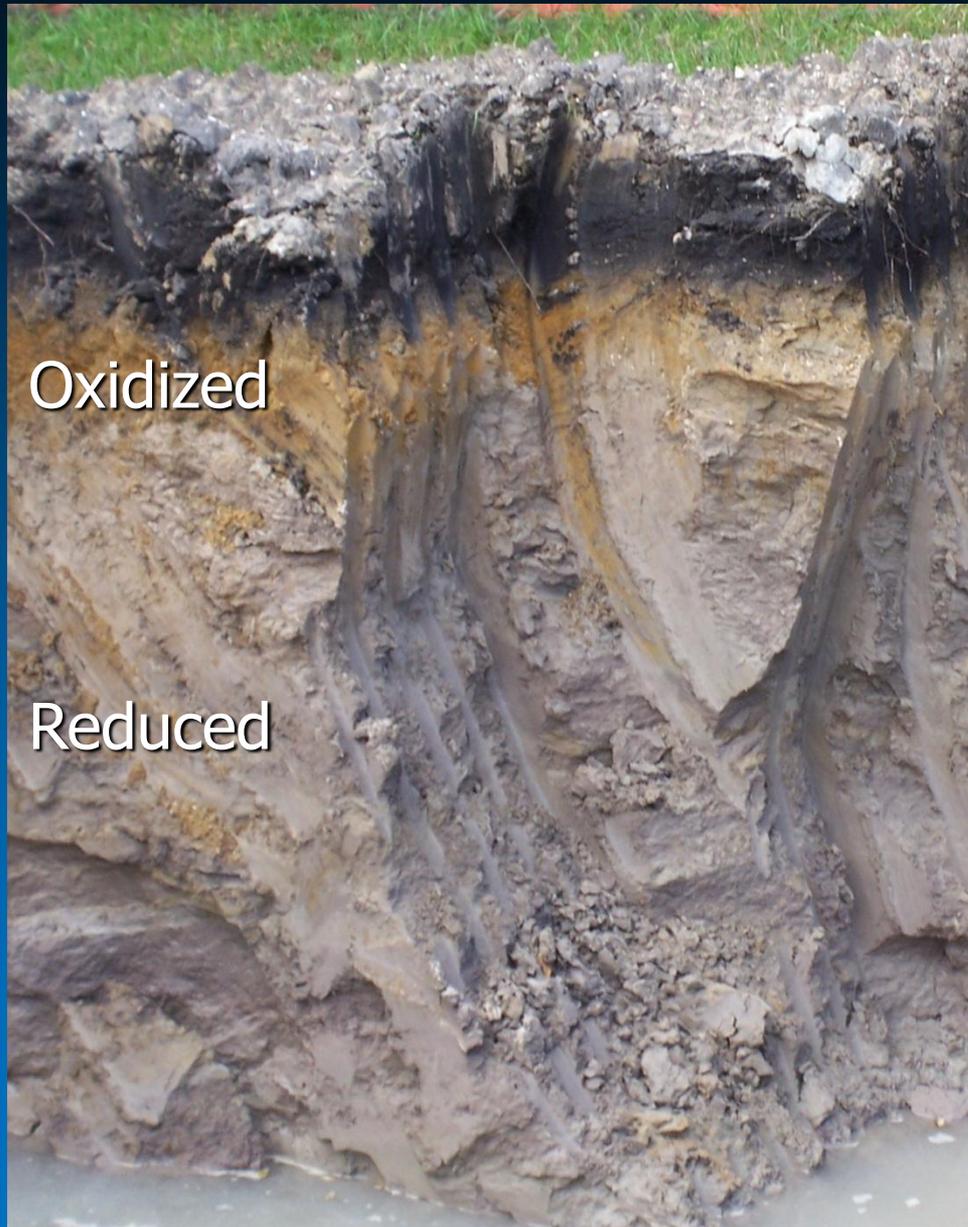
10YR 5/8
(high chroma)

10YR 5/1
(low chroma)

Gley Colors = Very Wet



Hydric Soils (lacustrine)



Redox features

0-13", 7.5YR 3/2 sandy loam

13-16", 10YR 5/3 sandy loam

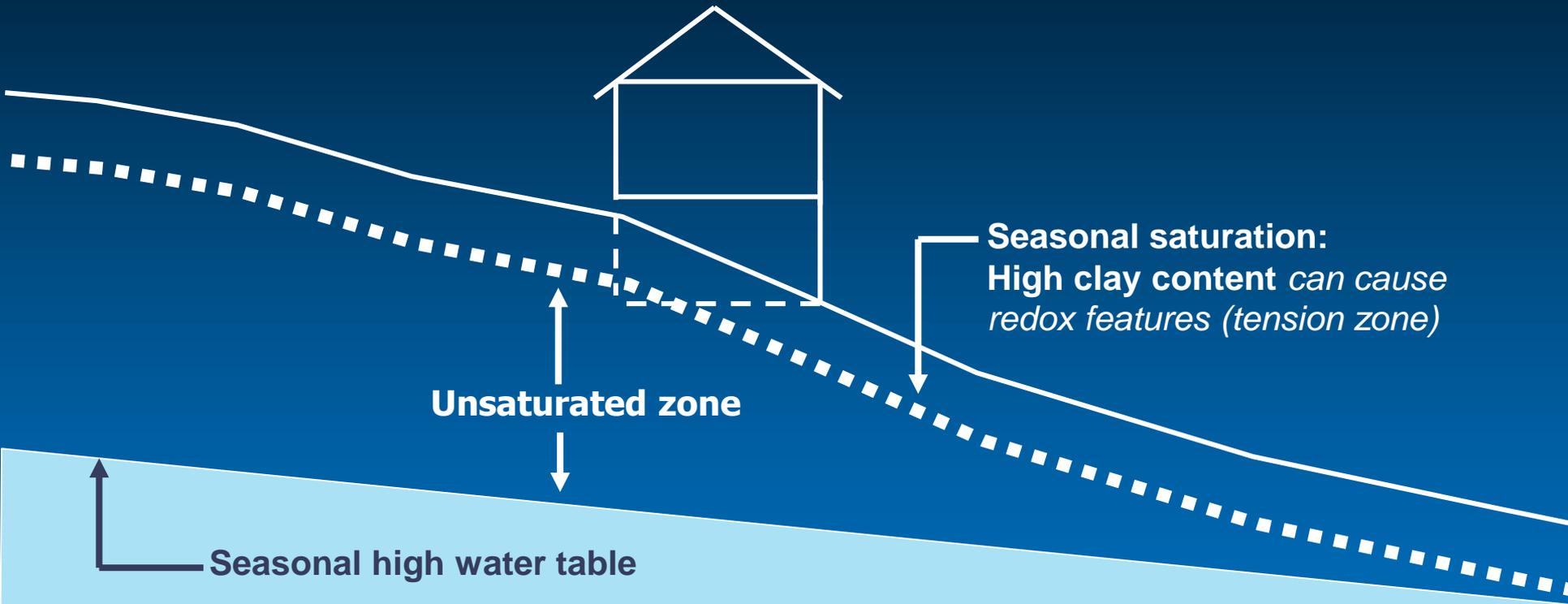
16-30", 7.5YR 4/4 clay loam

30-55", 7.5YR 4/4 gr. clay loam



3
A
16

Sloped Sites & Tension Zones



Building Partially in the Water Table on Sloped Sites

- Requirements:
 - Approved gravity discharge (easement?)
 - P.E. oversight (design/construction)
 - As-builts / recorded maintenance plan

Internally Drained Areas



Rain on frozen ground

Internally Drained Areas



County design standards

Summary

- Basement flooding is preventable
- County standards are a prevention tool
- Soil evaluations: the earlier the better
 - Deep enough and in the right places
 - Use for storm water BMP, septic, buildings, roads, utility, dewatering planning, etc.
- Compliance protects the buyer & seller
- Builders support / looking for consistency

Questions?

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