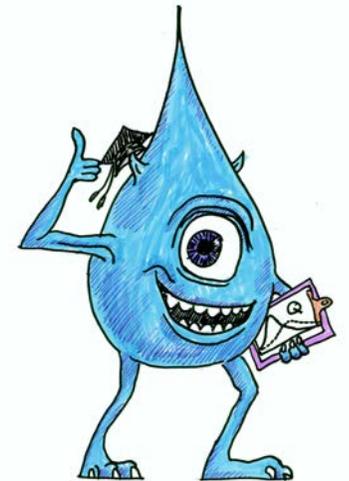


# HOW SOILS INFORMATION SHOULD BE UTILIZED IN BASEMENT DESIGN

ALAN BARROWS  
WAUKESHA COUNTY  
SPRING 2015



# OVERVIEW ON WHEN SOIL TESTING IS NEEDED FOR A BASEMENT

- BASEMENTS PROPOSED IN A SOIL MAPPED BY THE USDA-NRCS AS “HYDRIC”, “HYDRIC INCLUSIONS”, HOCHHEIM OR THERESA (LISTED IN EXHIBIT “X”)



Daniel P. Vrakas  
County Executive



Dale R. Shaver  
Director

## 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.

#### Groundwater (see pages 3-6):

3. A minimum 1-foot vertical separation between seasonal high groundwater table and the basement floor surface; and
4. Avoid hydric (very poorly drained) soils for basement construction as much as possible.

This document provides more information on how the LRD enforces these provisions and what the permit applicant needs to provide to the LRD to demonstrate compliance. Two procedures follow. The first one explains how to comply with the first two standards relating to surface water runoff in internally drained areas. The second explains how to comply with the third and fourth standards relating to basement separation from seasonal high groundwater.

Land Resources Division • 515 W. Moreland Blvd. • Room AC280  
Waukesha, Wisconsin 53188-3888 • Phone: (262) 896-8300 • Fax: (262) 896-8298

Current version dated 8/2014

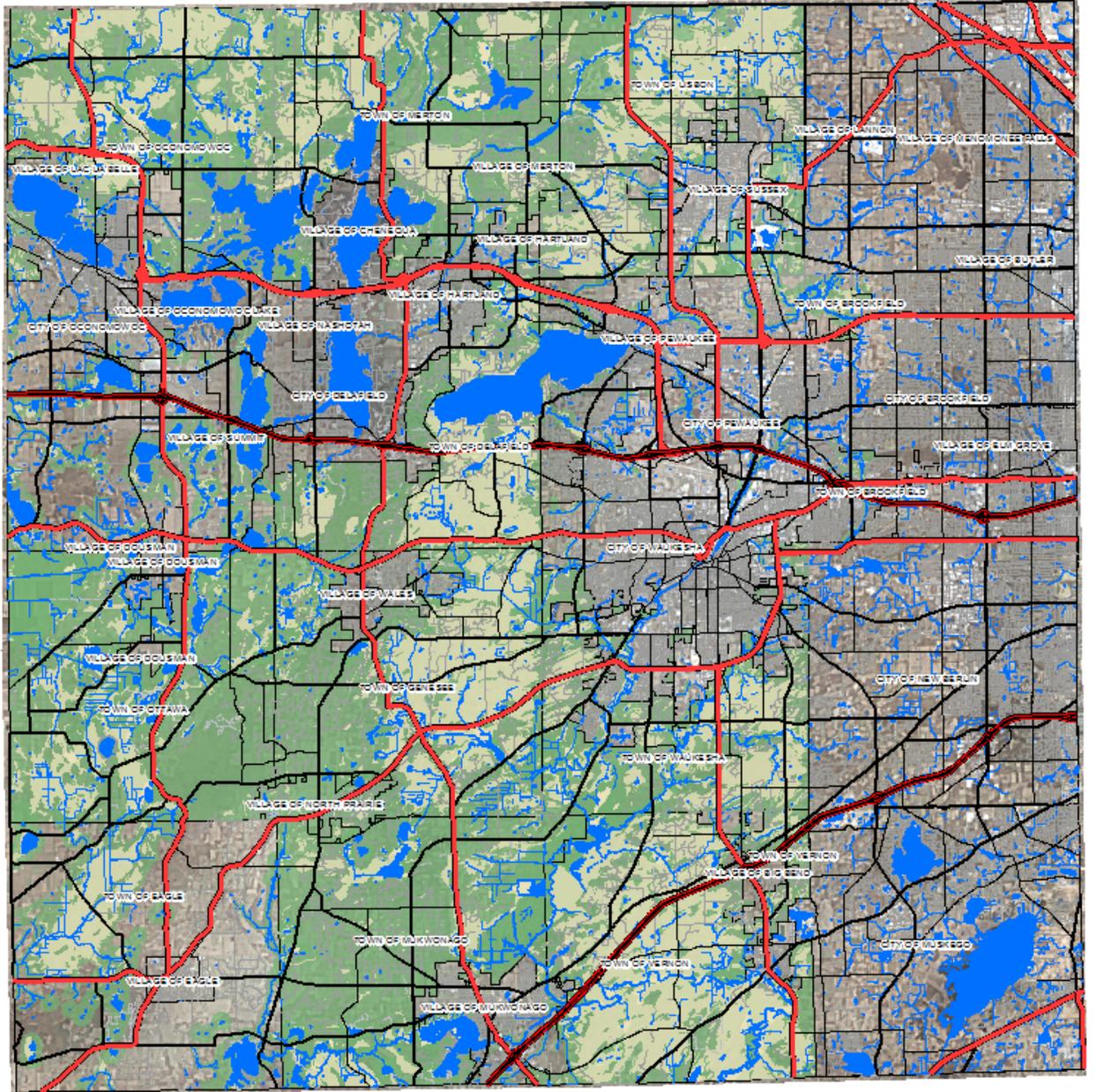
# In Waukesha County:



= Where the 1-foot of separation applies  
(County Codes)



= Soil map units where  
soil tests are required  
for basements



# OVERVIEW ON WHEN SOIL TESTING IS NEEDED FOR A BASEMENT

- WHERE NEARBY SOIL TESTING SHOW INDICATORS OF SEASONAL HIGH WATER TABLE
- WITHIN 8 VERTICAL FEET OF SURFACE WATERS (USE THE ACTUAL DEPTH FOR FOUNDATION DESIGN)
- OTHER AREAS WHERE THE COUNTY DETERMINES THERE TO BE A RISK OF SHALLOW GROUNDWATER

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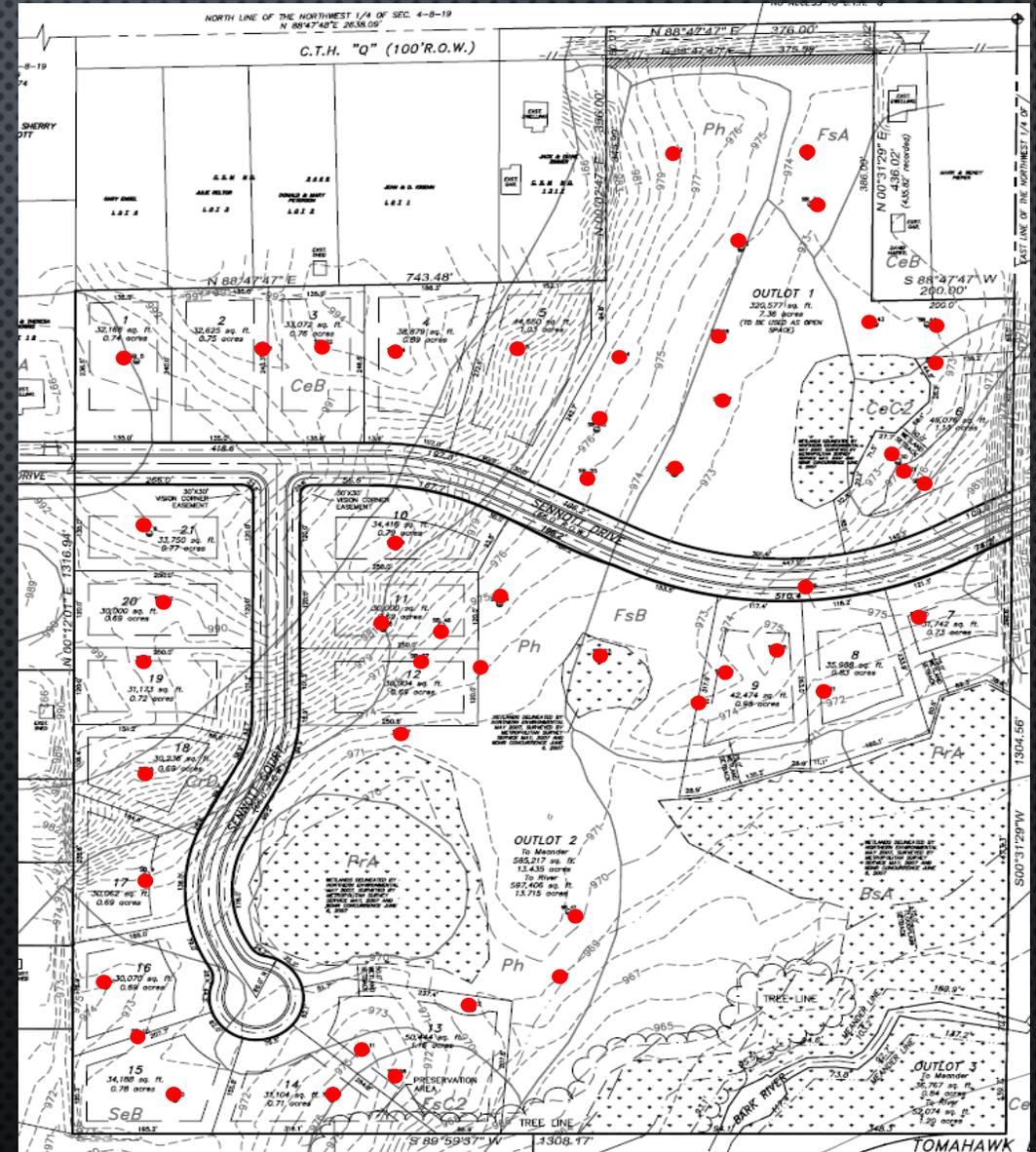
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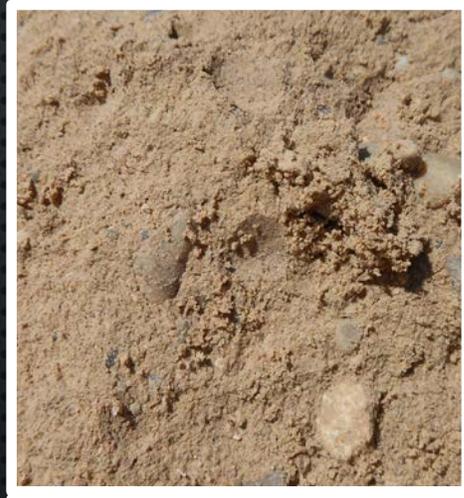
Current version dated 8/2014

# LOCATION AND DEPTH OF SOIL TESTS

- SOIL TESTING FOR BASEMENTS MUST BE WITHIN 50 FEET OF THE PROPOSED BASEMENT
- THE SOIL TEST NEEDS TO GO AT LEAST ONE FOOT DEEPER IN DEPTH THAN THE BASEMENT FLOOR
- AVOID DIGGING IN THE FOOTPRINT OF THE FOUNDATION TO PREVENT COMPACTION ISSUES
- SOME EXCEPTIONS APPLY (I.E. VERY HOMOGENEOUS CONDITIONS; DETERMINED BY THE COUNTY)



# HOCHHEIM AND THERESA SOIL MAP UNITS



Hochheim Dry  
←

Hochheim Wet  
→



# FORM A

## Form A - Seasonal High Groundwater Determination Report

Project/Plat Name: \_\_\_\_\_ Date: \_\_\_\_\_

Project Location (PLS/CSM#): \_\_\_\_\_

The following table summarizes my interpretation of the soil profile evaluations conducted on the above noted site. The purpose of this report is to demonstrate compliance with a Waukesha County ordinance requirement to maintain basement floor elevations at least 1 foot above the seasonal high water table. I understand that the definition for seasonal high water table means the upper limit of the zone of soil saturation caused by underlying groundwater at its highest level. I certify that the information presented in this report represents my best professional judgment in estimating seasonal high water table based on soil and site evaluations in accordance with the procedures contained in Chapter SPS 385 Wisconsin Administrative Code.

Stamp, Sign & Date Here

Interpreters Signature: \_\_\_\_\_

Interpreters Printed Name/Credentials/Lic. #: \_\_\_\_\_

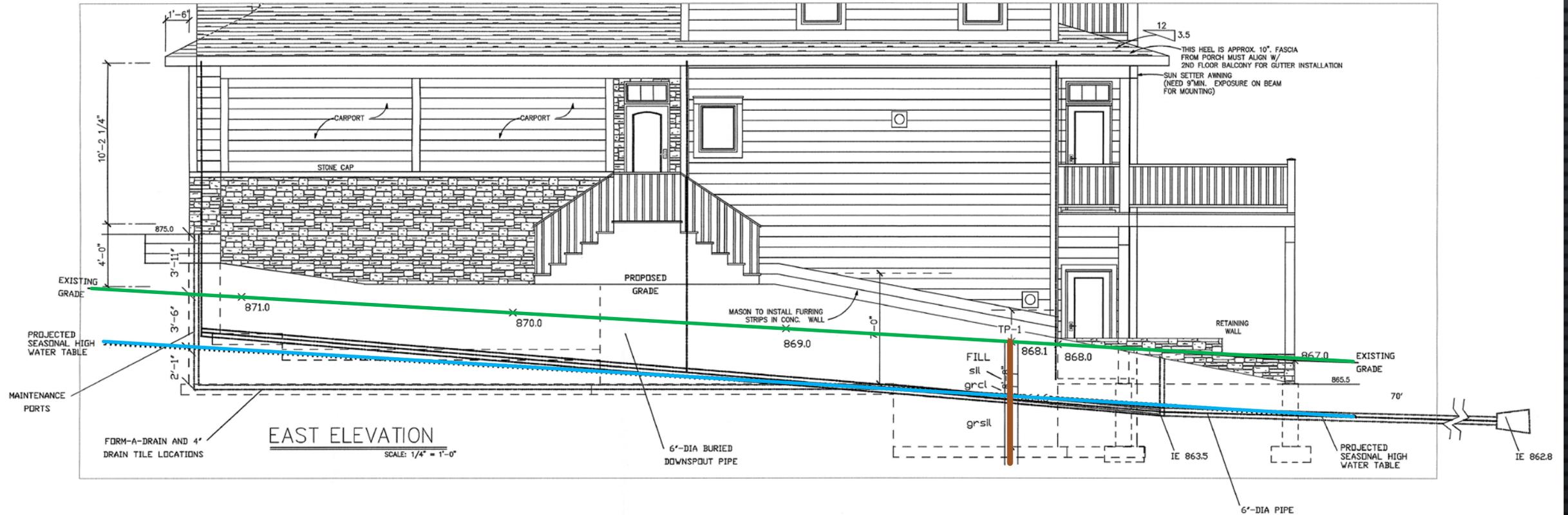
Interpreters Company Name/Address: \_\_\_\_\_

Site Benchmark/Elevation (Co. Stds.): \_\_\_\_\_

References: \_\_\_\_\_

Lot #	Soil Observ. (#)	Surface Elev. (NGVD 29)	Bottom Elev. of Soil Profile	Soil Map Unit Symbol (NRCS)	Elevation of Seasonal High Water Table	Depth to Seasonal High Water Table (Feet)	Proposed Basement Floor Elevation	Notes: List information used to determine seasonal high water table, including any soil color pattern exemptions under SPS 385.30(3) for a basement floor proposed less than 1-foot above redoximorphic features shown in the referenced soil evaluation reports.

# INTERPOLATE THE SOIL TEST RESULTS THROUGH THE FOUNDATION



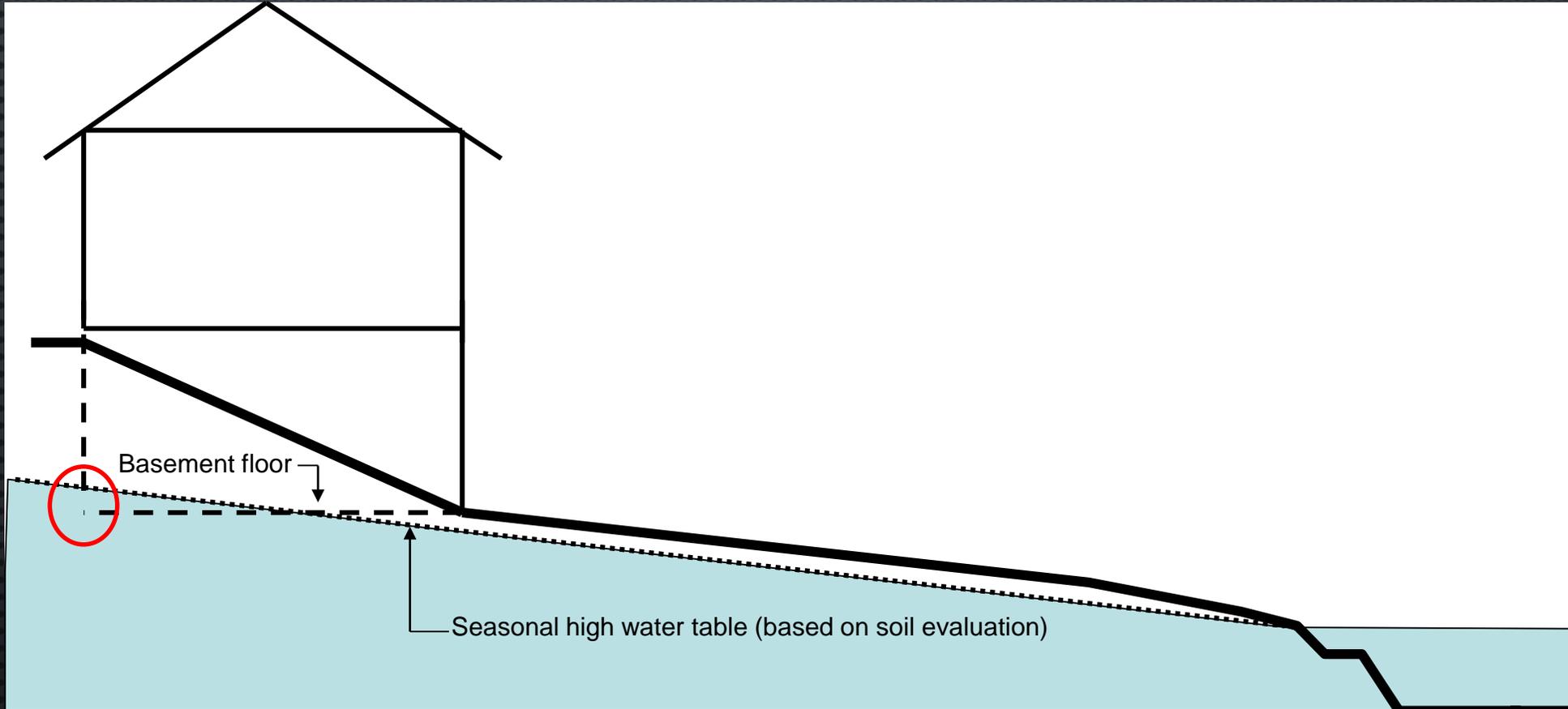
- FOR BASEMENTS, ASSUME THAT THE DEPTH TO SEASONAL HIGH GROUNDWATER FOLLOWS THE SLOPE OF THE GROUND

# INTERPOLATE THE SOIL TEST RESULTS THROUGH THE FOUNDATION

- CONDUCT MULTIPLE SOIL TESTS TO GET A MORE FOCUSED DEPTH TO GROUNDWATER
- USE OTHER INFORMATION TOO, INCLUDING NEARBY:
  - SURFACE WATERS (ORDINARY HIGH WATER MARKS OR WETLAND DELINEATIONS)
  - SEPTIC SOIL TESTS
  - STORM WATER SOIL TESTS
  - LANDSCAPE POSITION, TOPOGRAPHY, LOCAL GEOMORPHOLOGY



# IF THE INTERPOLATED DEPTH TO SHGW INTERSECTS THE BASEMENT



- A GRAVITY FOUNDATION DRAINAGE SYSTEM MAY BE REQUIRED IF A SUITABLE OUTLET IS AVAILABLE

# DRAINAGE SYSTEMS FOR HOMES THAT ARE UNDER COUNTY STORM WATER JURISDICTION

## TYPICALLY:

- SITES WITH 1 ACRE OF GRADING
- SITES WITH CONDITIONAL USE PERMITS
- REFERRALS FROM COUNTY ZONING OR TOWN

## SUBMITTAL REQUIREMENTS:

- STORM WATER PERMIT APPLICATION AND FEE
- PLANS (CONSTRUCTION AND INSPECTION)
- RECORDED MAINTENANCE PLAN
- FINANCIAL ASSURANCE (USUALLY \$2,500)
- AS-BUILT SURVEY
- CONSTRUCTION VERIFICATION LETTER
- FINAL INSPECTION FROM THE COUNTY



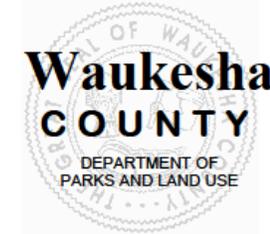
# GRAVITY FOUNDATION DRAINAGE SYSTEM

## We Have a Checklist for That Too!!!

- SOIL LOG, MAP & FORM A
- NARRATIVE DESCRIBING THE DESIGN
- PLAN VIEW AND CROSS SECTIONS
- DESIGN CALCULATIONS
- MAINTENANCE PLAN

Daniel P. Vrakas  
County Executive

Dale R. Shaver  
Director



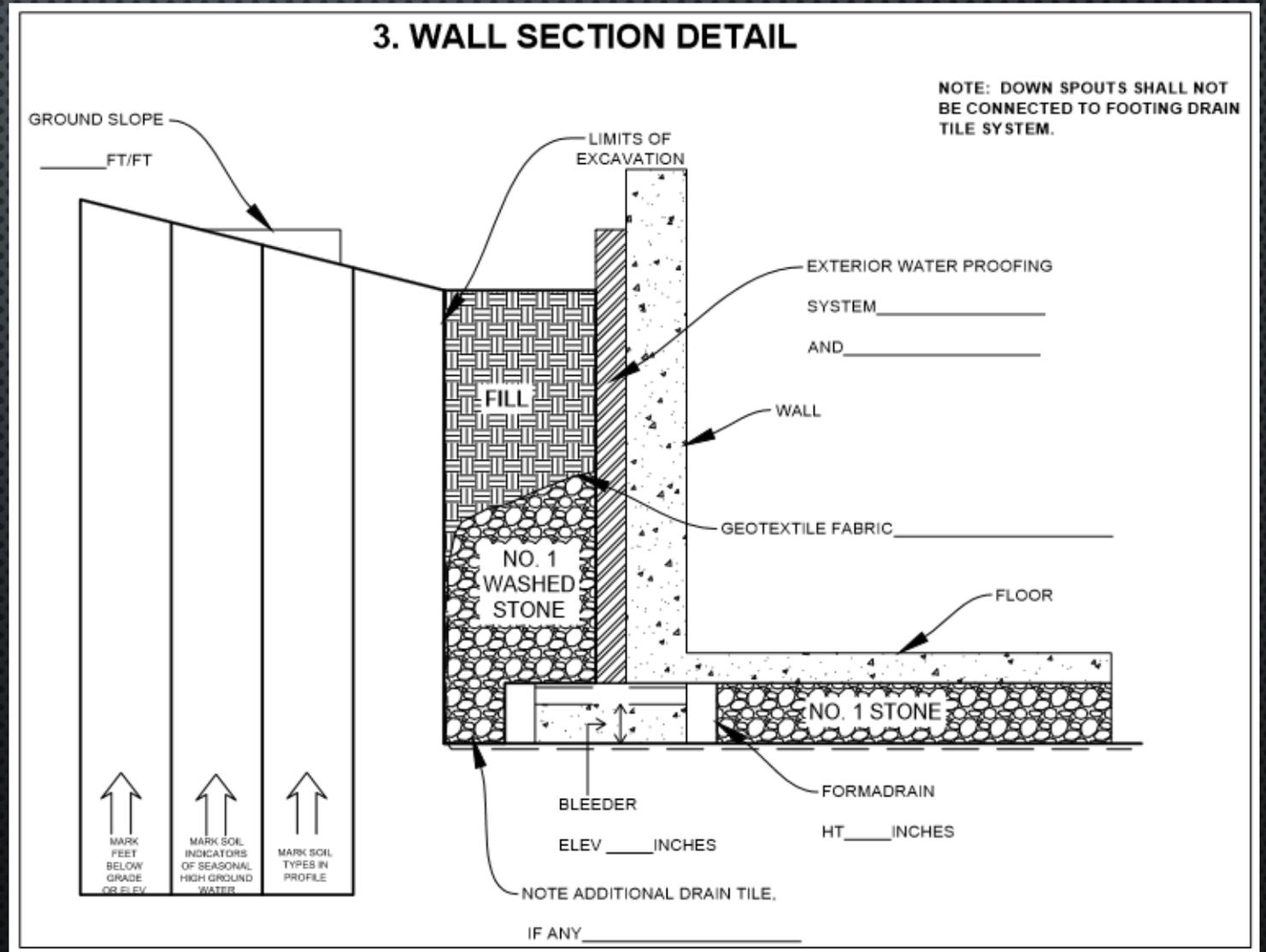
### Foundation Drainage System Checklist For Basements Constructed Partially Below Seasonal High Groundwater Where Gravity Flow Outlets Are Available

- Soil Data. Submittal of a Soil Investigation Report completed by a Certified Soil Tester or Soil Scientist only and Form A – Seasonal High Groundwater Determination Report completed by a Certified Soil Tester, Soil Scientist, P.E., or Hydrogeologist in accordance with standards contained in Chapter SPS 385 WI Admin. Code. The Form A must identify the elevation of the seasonal high water table within 50 ft. of the proposed structure. Multiple soil tests may be required based on topography and variable soil conditions.
- Basement Drainage System Plan. Submitted by a qualified professional engineer, to include the following:
  - o Narrative describing the proposed drainage system.
  - o Plan view, cross-section and profile drawings of the proposed system with key elevations, pipe grades, etc. Show details where pipes are proposed to cross or connect.
  - o System design must include or address the following:
    - Flow calculations for groundwater seepage and system conveyance.
    - Measures to intercept flows and/or alleviate hydrostatic pressure on the walls and floor of the structure.
    - Separation of sump pump system, gravity drains, and exterior down spouts. If connections are proposed, flow impacts must be described and supported by calculations.
    - Access/clean out traps for future maintenance.
    - Location and detail design of the outfall structure, including material specifications, elevations, cover depth/frost protection, animal guards and erosion control measures.
    - The outfall shall not cause adverse drainage on adjacent properties or road right-of-ways, or negatively impact natural resources. Written approval of the downstream landowners or municipality (if public road), may be required.
  - o Material specifications for all key components of the system.
  - o Construction inspection plan and contact information for the engineer who will oversee and verify proper system installation.
  - o Long term maintenance plan and procedures.
- Recorded Maintenance Plan & As-built Drawings. The maintenance plan must be recorded on the deed to notify future owners of the existence of the basement drainage system, its purpose, design, construction, and long-term maintenance needs. A professional engineer licensed in the State of Wisconsin must oversee installation of the drainage system and verify proper construction, including the use of specified materials and an as-built survey of key system elevations. As-built documents and a construction verification letter by the project engineer must be recorded as part of the Maintenance Plan (may be an addendum).

6/9/2014

# SAMPLE PLAN MATERIALS AND DEIGN RESOURCES

- CROSS SECTIONS
- FLOW CALCULATION SPREADSHEETS
- MAINTENANCE PLANS (RECORDED WITH THE REGISTER OF DEEDS)



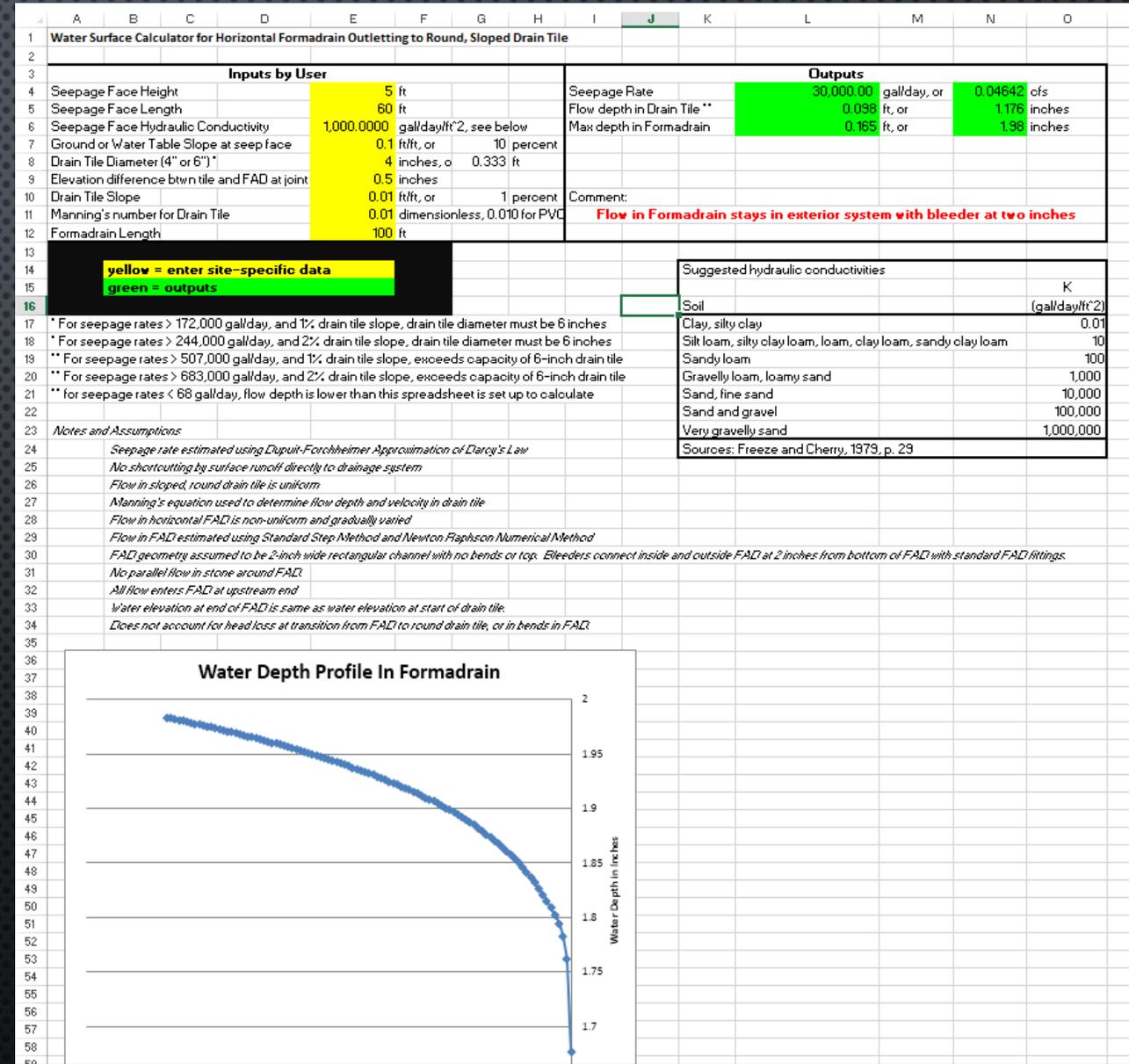
# FORM-A-DRAIN SPREADSHEET

## INPUTS

- SEEPAGE FACE HEIGHT
- SEEPAGE FACE LENGTH
- SEEPAGE RATE (BASED ON SOIL TEXTURE)
- GROUNDWATER SLOPE
- FORM-A-DRAIN LENGTH
- DRAINTILE DIAMETER
- DIFFERENCE AT F-A-D AND DRAIN TILE JOINT
- OUTLET PIPE SLOPE

## ASSUMED

- BLEEDER HEIGHT ABOVE BOTTOM OF FAD IS 2"



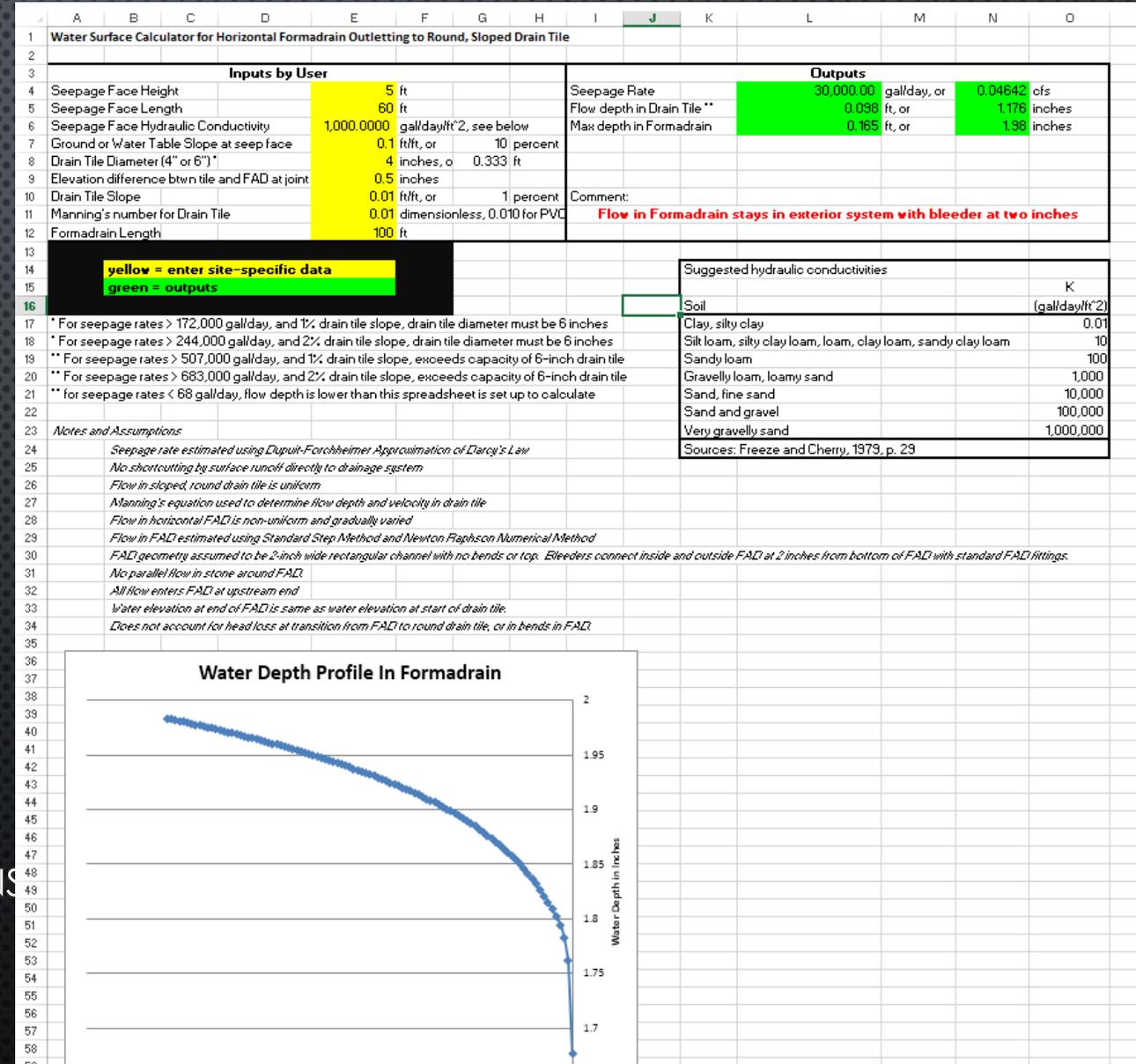
# SLOPED DRAIN TILE SPREADSHEET

## INPUTS

- SEEPAGE FACE HEIGHT
- SEEPAGE FACE LENGTH
- SEEPAGE RATE (BASED ON SOIL TEXTURE)
- GROUNDWATER SLOPE
- DRAIN TILE LENGTH
- DRAIN TILE SLOPE
- DIFFERENCE AT F-A-D AND DRAIN TILE JOINT
- OUTLET PIPE SLOPE

## ASSUMED

- DRAIN TILE IS DISCONNECTED FROM FOOTING DRAINS
- DRAIN TILE IS 4" ROUND & SMOOTH WALLED



# SUITABLE OUTLET



- DAYLIGHTS ON THE PROPERTY (30 FEET FROM LOT LINE PREFERRED)
- DRAINAGE EASEMENTS IF DOWNHILL PROPERTIES WILL BE IMPACTED
- APPROVALS FROM THE LOCAL MUNICIPALITY IF OUTLET IS IN THE RIGHT-OF-WAY
- SCOUR AND EROSION CONTROL AT THE OUTFALL

# HOW TO USE THE INFORMATION

- FOR PLATTING STAGE, INCLUDE THE MINIMUM BASEMENT FLOOR ELEVATIONS ON THE LAND DIVISION OR IN A SEPARATE DOCUMENT (I.E. MASTER GRADING PLAN)
- FOR SITE DESIGN, INTERPOLATE THE RESULTS THROUGH THE BUILDING FOOTPRINT
- ONE-FOOT OF SEPARATION IS NEEDED SOMEWHERE
- IF THE WATER TABLE INTERSECTS THE BASEMENT FLOOR, A GRAVITY DRAIN SYSTEM MAY BE REQUIRED

QUESTIONS???