



TECHNICAL MEMORANDUM

From: Justin Reinhart, PE, Stormwater Technical Assistance

Date: March 18, 2021

Subject: Demonstrating underground stormwater storage providing extended detention of the Water Quality Volume complies with drawdown requirements in Part III.G.2.e of Ohio EPA Permit No. OHC00005

This technical memo provides guidance on methods available to demonstrate an underground stormwater storage facility providing extended detention of the Water Quality Volume (WQv) complies with drawdown requirements in Part III.G.2.e of Ohio EPA Permit No. OHC00005. This guidance should not be construed as a regulatory requirement. Other methods may be available to demonstrate compliance. Please also consult *Post-Construction Storm Water Questions and Answers: Water Quality Volume Drawdown* (September 2019) for general guidance on this subject.

Ohio EPA's *WQv Compliance Spreadsheets*¹ may be used by a designer or regulated community to verify compliance with the WQv drawdown requirements if a surface extended detention basin (wet, wetland, or dry) is proposed as a post-construction storm water management practice, but they do not address underground extended detention facilities due to complexities associated with these designs.

HydroCAD® by HydroCAD Software Solutions, LLC.; Storm & Sanitary Analysis (SSA) by Autodesk®; and Openflows PondPack by Bentley® are civil engineering software commonly used to conduct storm water hydrologic and hydraulic calculations and are all suited to demonstrate an underground system complies with the required WQv storage and drawdown. Each software includes or allows for input of stage-storage data specific to many proprietary systems and can produce a proper volume vs. time hydrograph (or table) for the design water quality outlet (i.e. orifice) similar to the hydrograph produced by the *WQv Compliance Spreadsheets*. Compliance with both the 24-hour minimum drain time and the requirement to discharge no more than one-half the WQv in the first 8 hours must, however, be verified manually from the software produced hydrographs.

Example in HydroCAD

In this example, the WQv has been identified as 0.062 ac-ft for the contributing drainage area of a proposed underground proprietary chamber system that will provide extended detention. A review of the stage-storage table (Figure 1) generated by HydroCAD (10.00-25 Sampler) in the node report for the designed underground facility shows the WQv of 0.062 ac-ft corresponds to the stage elevation of 919.97 feet. The node summary demonstrates this elevation is properly below the secondary outlet elevation of 920.00.

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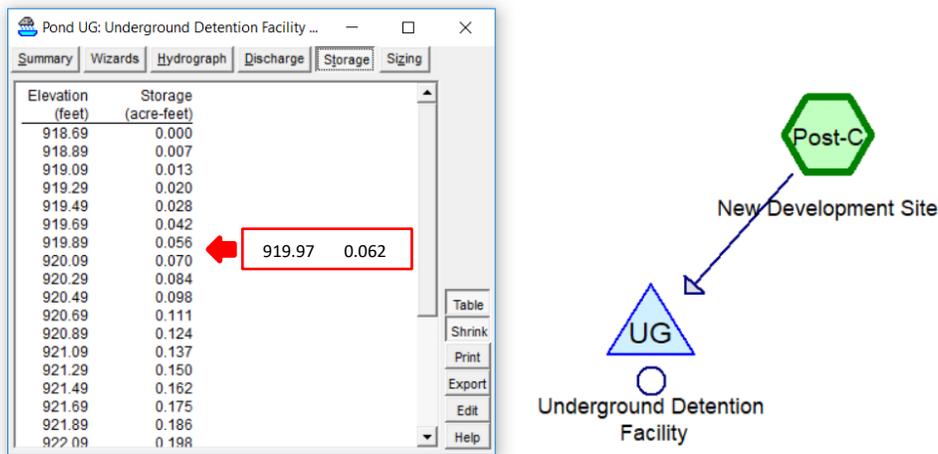


FIGURE 1: Stage-Storage Table Produced in HydroCAD.

A “pull-the-plug” drawdown of the WQv from its corresponding stage elevation can be conducted in HydroCAD to demonstrate the design water quality outlet (i.e. orifice) produces the required discharge. First, disconnect any subcatchments so inflow to the facility is zero. Second, in the advanced tab within the pond editor, set the starting water surface elevation in the underground facility as the WQv elevation. For this example, the elevation was previously determined as 919.97 feet and is entered as shown in Figure 2.

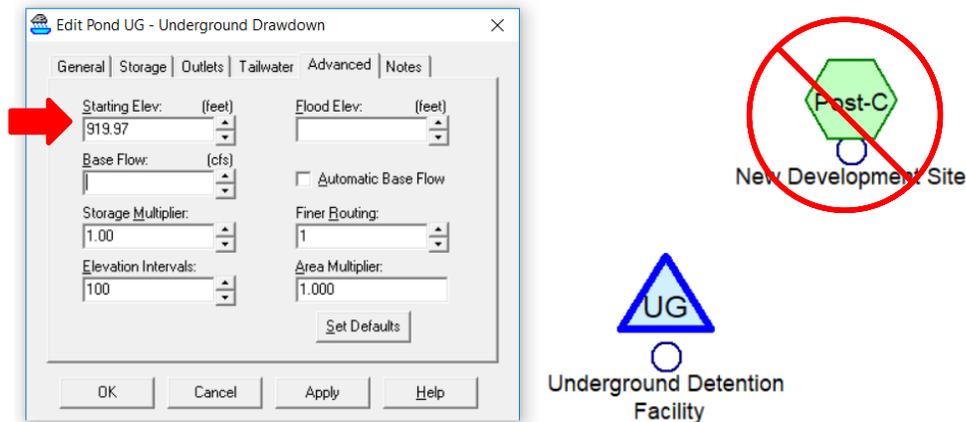


FIGURE 2: Setting the Starting Elevation in Pond Editor.

The hydrograph table produced in the node report for the facility now indicates a “pull-the-plug” drawdown from the WQv elevation. This table can be used to manually assess and verify both drawdown requirements are met. For this example, the hydrograph table (Figure 3) indicates:

- a. draining the full WQv exceeds the minimum 24 hours as 0.002 ac-ft (3% of the WQv) remains in the facility at 24 hours, and
- b. that 0.029 ac-ft (0.062 ac-ft – 0.033 ac-ft) or less than one-half of the WQv (0.062 ac-ft / 2 = 0.031 ac-ft) has drained at 8 hours or 1/3 of the minimum 24-hour drain time.

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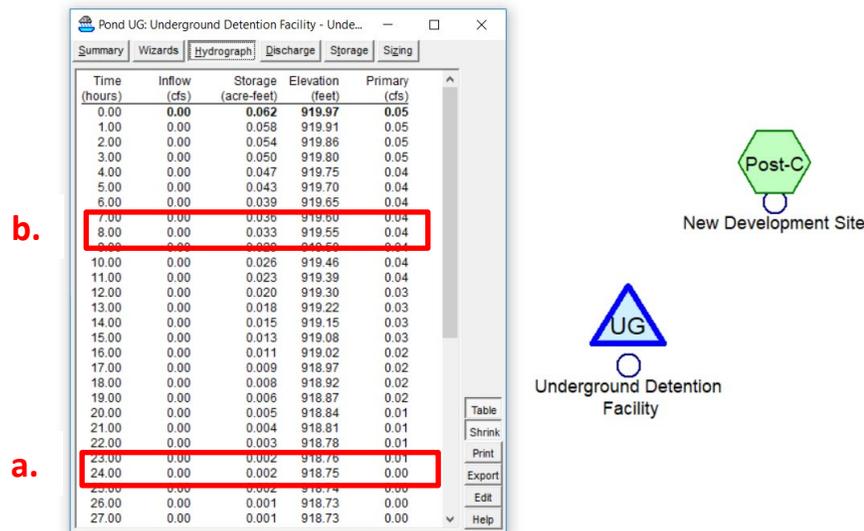


FIGURE 3: Hydrograph Table for the Underground Storm Water Facility.

Both tables shown in Figures 1 and 2, along with the node summary report, can be included in a Storm Water Pollution Prevention Plan (SWP3) to demonstrate compliance with both storage and drawdown of the WQv in an underground extended detention stormwater facility.

Example in PondPack

PondPack by Bentley® (version 08.11.01.56) includes a Minimum Drain Time (MTD) calculator for this purpose. Under the **Analysis** tab, select **Calculators**, then select **Minimum Drain Time**.

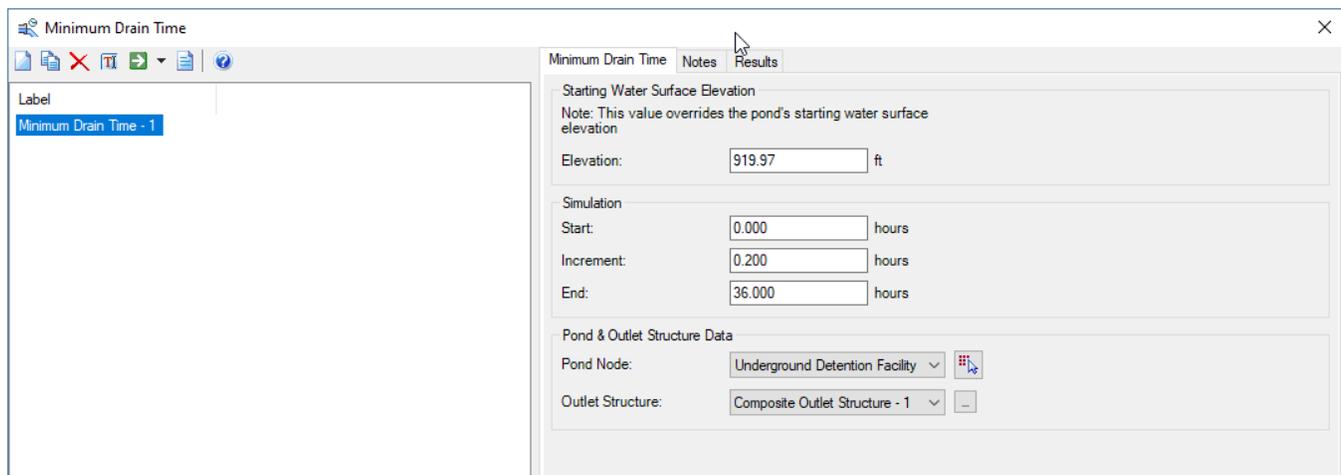


FIGURE 4: PondPack’s Minimum Drain Time Calculator (courtesy of Jon Prier, Environmental Hydraulic Engineer, ODOT).

Set the starting or initial water surface elevation (WSEL) to the stage elevation that corresponds to the WQv according to the facility’s stage-storage curve and assign a simulation time sufficient to empty the storage prior to running the calculator.

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Example in Storm & Sanitary Analysis

Similar to the other software, compliance with WQv drawdown can be demonstrated with Storm & Sanitary Analysis (SSA) by Autodesk® by first setting a starting or initial water surface elevation (WSEL) within the designed detention facility node that corresponds to the required WQv elevation according to the facility's stage-storage curve. A stage-time curve is then developed by routing a "dry hydrograph" or zero-precipitation event through the detention facility.

1. Available for download at: <https://epa.ohio.gov/dsw/storm/index#110504926-technical-assistance--permit-compliance-materials>

REFERENCES

Autodesk Storm and Sanitary Analysis 2014 User's Guide. March 2013. Accessed at: https://images.autodesk.com/adsk/files/Autodesk_Storm_and_Sanitary_Analysis_2014.pdf

Bentley Communities. Accessed at: https://communities.bentley.com/products/hydraulics___hydrology/w/hydraulics_and_hydrology___wiki/33644/using-the-minimum-drain-time-calculator-in-pondpack