

User's Guide for N.J. Geological Survey Digital Geodata Series DGS99-2

Microsoft Excel Workbook Implementing the New Jersey Geological Survey's Ground-Water-Recharge Methodology

By

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BACKGROUND

Ground-water recharge is defined as that water which infiltrates vertically downward from the land surface to below the unsaturated zone. This water may then move laterally to discharge in streams or to enter an aquifer.

The Geological Survey Report GSR-32, "A method for evaluating ground-water-recharge areas in New Jersey," details one method for estimating this recharge (Charles and others, 1993). This method is based on site factors which are a function of the site's land use/land cover (LULC), soil, and location. These factors are presented in GSR-32 as data appendixes but were not published digitally. The methodology was developed in the early 1990s and applies only to New Jersey. This digital product consists of an EXCEL workbook which enables the user to estimate ground-water recharge for a parcel of land. This digital product assumes a working knowledge of the assumptions and procedures described in GSR-32. It requires the user to input factors for the site's LULC, soil, and location. When first opened, this workbook displays a series of windows that allow the user to look up codes to specify the LULC, soil, and location (either municipality or HUC14 watershed) of a land parcel. The workbook automatically calculates the estimated average annual ground-water recharge using the GSR-32 methodology.

If the user enters the area of the lot (in acres) the spreadsheet also calculates the recharge volume in gallons/year.

When the methodology was first published (Charles and others, 1993) a basin calibration factor of 1.3 was recommended. This factor calibrates ground-water recharge from an entire basin to base flow measured at a downstream gage. Based on later research (Hoffman, 1999) the NJ Geological Survey's recommended a basin factor was changed to 1.0. This digital product allows the user to enter different values of the basin calibration factor. This should be done, however, only if the user has conducted a basin-specific calibration of GSR-32 results to observed long-term average baseflow.

The only geographical representation allowed in the original GSR-32 was the municipality of the study location. This has been extended to include the HUC14 watershed in this

implementation of the methodology.

In 2006 the New Jersey Geological Survey reestimated the climate factors for normal precipitation conditions and added climate factors for drought conditions. Annual recharge under normal and drought conditions are now provided.

The National Resource Conservation Survey published a remapping of New Jersey's soils in 2007. Many soils in New Jersey changed names. These new soils were correlated with the older soil nomenclature and appropriate factors assigned in 2008.

LIST OF KEYWORDS

ground-water recharge, calculations, land use, land cover, soils, New Jersey

HOW TO USE THE WORKBOOK

When first opened, the user sees the Calculation Window. Cells which require user input are in light blue

The user uses pull down menus to specify the land use and soil of the lot. Each cell must be clicked on in order to activate the pull down menu.

This recharge methodology does not apply to hydric soils. If the selected soil is hydric no recharge value is estimated. This does not indicate that no ground-water recharge occurs on this soil type, rather the recharge must be estimated by a different method.

The user next indicates how to specify the geographic area the lot is in, either by municipality or HUC14 watershed.

The next input is either the municipality or the HUC14 watershed. A pulldown menu allows the user to input the correct variable.

The next input is the size of the lot is an optional variable. If the user inputs this value then the net annual ground-water recharge volume is estimated. If this value is left blank then net annual ground-water recharge is not estimated.

The NJGS used additional climate stations and a slightly different methodology to recalculate climate factors in New Jersey. This process is described in Hoffman and French (in press). These climate factors were based on two different climate periods, average (1957-1986) and drought (1961-1966). Thus this approach yielded two estimates of recharge, average and drought. The period 1961-1966 is considered to be the drought of record in New Jersey. Version 5 added the revised average recharge climate factors and added drought recharge climate factors. This version was not released to the public.

Version 6.0 includes new SSURGO soils mapped by the National Resource Conservation Service. These soils are on the newly released soil maps of New Jersey. Appropriate recharge factors and recharge constants for each new non-hydric and non-urban soil were assigned by correlating the location of each new soil with older soils. The recharge factor and recharge

constant for the old soil was then assigned to the new soil.

Version 6.1 released October 2009. This corrects the internal flag that incorrectly indicated some udorthent and urban land series were soils for which a recharge could be estimated. The ground-water-recharge methodology cannot be applied to urban or hydric soils. Many thanks to the user who found this error.

DISPLAY CONSIDERATIONS

The windows have also been protected so that their size and positioning cannot be easily changed. This program is distributed in a format suitable for viewing on a 16-inch or larger display screen. On smaller screens (such as those in most laptop computers) it may be necessary to resize and move the windows in order to see the entire display area. If resizing is necessary it can be accomplished in one of two ways. (1) Under the EXCEL 'Tools' pulldown menu select the 'Protection' option and then unprotect the workbook. The windows can then be resized and moved. (2) On the EXCEL 'View' pulldown menu select the 'Toolbars' option and make sure the 'Standard' tool bar is displayed. On this tool bar is a zoom option. By changing this zoom percentage to a lower value the active window is made smaller and more information is displayed.

WORKSHEETS

This digital product consists of the Excel workbook NJ-RECHAGE-v6.XLS. This workbook contains 7 worksheets:

Calculation Window - A worksheet in which the user enters the appropriate codes and the calculated recharge is displayed.

Users guide - A copy of this user's guide.

Metadata - A more formal listing of the history and development of this workbook.

Soil - A list of soils in New Jersey based on the county soil reports available in 1993. This worksheet includes the recharge factor and recharge constant for each soil. These data are from Appendix 5 of GSR-32.

Land Use - A list of the land uses from GSR-32.

Climate Factors - A list of all municipalities and HUC14 watersheds in New Jersey with an assigned climate factor. How these were calculated for municipalities is described in GSR-32 (Charles and others, 1993). A parallel approach was taken to generate HUC14 climate factors.

New Soil-Old Soil - A correlation of the new soils appearing on the NRCS's soil map of New Jersey with previously named soils.

Metadata - A more formal listing of the history and development of this workbook.

PROGRAM AVAILABILITY

This file NJ-RECHARGE-v6.XLS is an EXCEL workbook. This product may be distributed with proper attribution. It is available for downloading on the 'Geodata' page of the the N.J. Geological Survey's web site. It is listed as Digital Geodata Series 99-02 'MS Excel Workbook Implementing the NJGS Ground-Water-Recharge Methodology.'

The ground-water recharge methodology (Charles and others, 1993) was developed in the early 1990s and applies only to New Jersey. Visit the NJ Geological Survey's web site (www.njgeology.org) for information on ordering a paper copy of this report.

A digital copy of Charles and others (1993) is available at:
<http://www.njgeology.org/pricelst/greport/gsr32.pdf>

Please report any errors in this spreadsheet to the authors.

Check the NJGS website for possible additional information.
www.njgeology.org

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DISCLAIMER

The use of brand names is for identification purpose only and does not constitute an endorsement by the New Jersey Geological Survey or the State of New Jersey.

REFERENCES

Charles, E.G., Behroozi, Cyrus, Schooley, Jack, and Hoffman, J.L., 1993, A method for evaluating ground-water-recharge areas in New Jersey: N.J., Geological Survey Report GSR-32, Trenton, 95p.

Hoffman, J.L., 1999, Basin factor calibration for ground-water-recharge estimation: New Jersey Geological Survey Technical Memorandum TM99-1, 2p.