Designation: D 5610 – 94ε1

# Standard Guide for Defining Initial Conditions in Ground-Water Flow Modeling[1]

This standard is issued under the fixed designation D 5610; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Paragraph 1.2 was added editorially October 1998.

## 1. Scope

1.1 This guide covers techniques and procedures used in defining initial conditions for modeling saturated ground-water flow. The specification of initial conditions is an essential part of conceptualizing and modeling ground-water systems.

1.2 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 5447 Guide for Application of a Ground-Water Flow Model to a Site-Specific Problem[3]

D 5609 Guide for Defining Boundary Conditions in Ground-Water Modeling[3]

## 3. Terminology

3.1 *Definitions:*

3.1.1 *aquifer, confined*—an aquifer bounded above and below by confining beds and in which the static head is above the top of the aquifer.

3.1.2 *conceptual model*—an interpretation or working description of the characteristics of the physical system.

3.1.3 *flux*—the volume of fluid crossing a unit cross-sectional surface area per unit time.

3.1.4 *ground-water flow model*—an application of a mathematical model to represent a ground-water flow system.

3.1.5 *hydraulic conductivity—(field aquifer tests)*, the volume of water at the existing kinematic viscosity that will move in a unit time under unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

3.1.6 *hydrologic condition*—a set of ground-water inflows or outflows, boundary conditions, and hydraulic properties that causes potentiometric heads to adopt a distinct pattern.

3.1.7 *simulation*—one complete execution of the computer program, including input and output.

3.1.8 *transmissivity*—the volume of water at the existing kinematic viscosity that will move in a unit time under a unit hydraulic gradient through a unit width of the aquifer.

3.1.9 *unconfined aquifer*—an aquifer that has a water table.

3.1.10 For definitions of other terms used in this test method, see Terminology D 653.

## 4. Significance and Use

4.1 Accurate definition of initial hydrologic conditions is an essential part of conceptualizing and modeling transient ground-water flow, because results of a simulation may be heavily dependent upon the initial conditions.

## 5. Initial Conditions

5.1 Initial hydrologic conditions for a flow system are represented by the head distribution throughout the flow system at some particular time corresponding to the antecedent hydrologic conditions in the aquifer system.[4] The specified heads can be considered reference heads; calculated changes in head through time will be relative to these given heads, and the time represented by these heads becomes the reference time. As a convenience, this reference time is usually specified as zero time or initial time. Time is reckoned from this zero time or initial time. In more formal terms, an initial condition gives head as a function of position at $t = 0$; that is, $h = f(x, y, z;$

[1] This guide is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Investigations.

Current edition approved Sept. 15, 1994. Published January 1995.

[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

[4] Franke, O. L., Reilly, T. E., and Bennett, G. D., "Definition of Boundary and Initial Conditions in the Analysis of Ground-Water Flow Systems—An Introduction," *Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3*, Chapter B5, 1987.