DIRECTOR'S MEMORANDUM

TO: Regional Offices, Water Allocation Bureau and Adjudication Bureau

FROM: R. Keith Higginson

RE: Rate of Flow and Volume for Water Rights With Source of Ground Water

DATE: May 7, 1991

Application Processing No. 51
Permit Processing No. 16
Adjudication Memo No. 31

A review of field examination procedures relative to measurement of rate of flow for diversions from ground water has resulted in the identification of certain water uses for which a theoretical computation is an acceptable substitute for measurement of rate of flow. The purpose of this memorandum is to describe situations where utilization of the theoretical computation is permissible.

The determination of which situations require measurement of rate of flow for a ground water right is outlined in Appendix 1. The procedure for determining rate of flow is described in Appendix 2. This memorandum shall be the authority for removal of flow measurement requirements from water right permits that are shown by Appendix 1 not to require measurement.

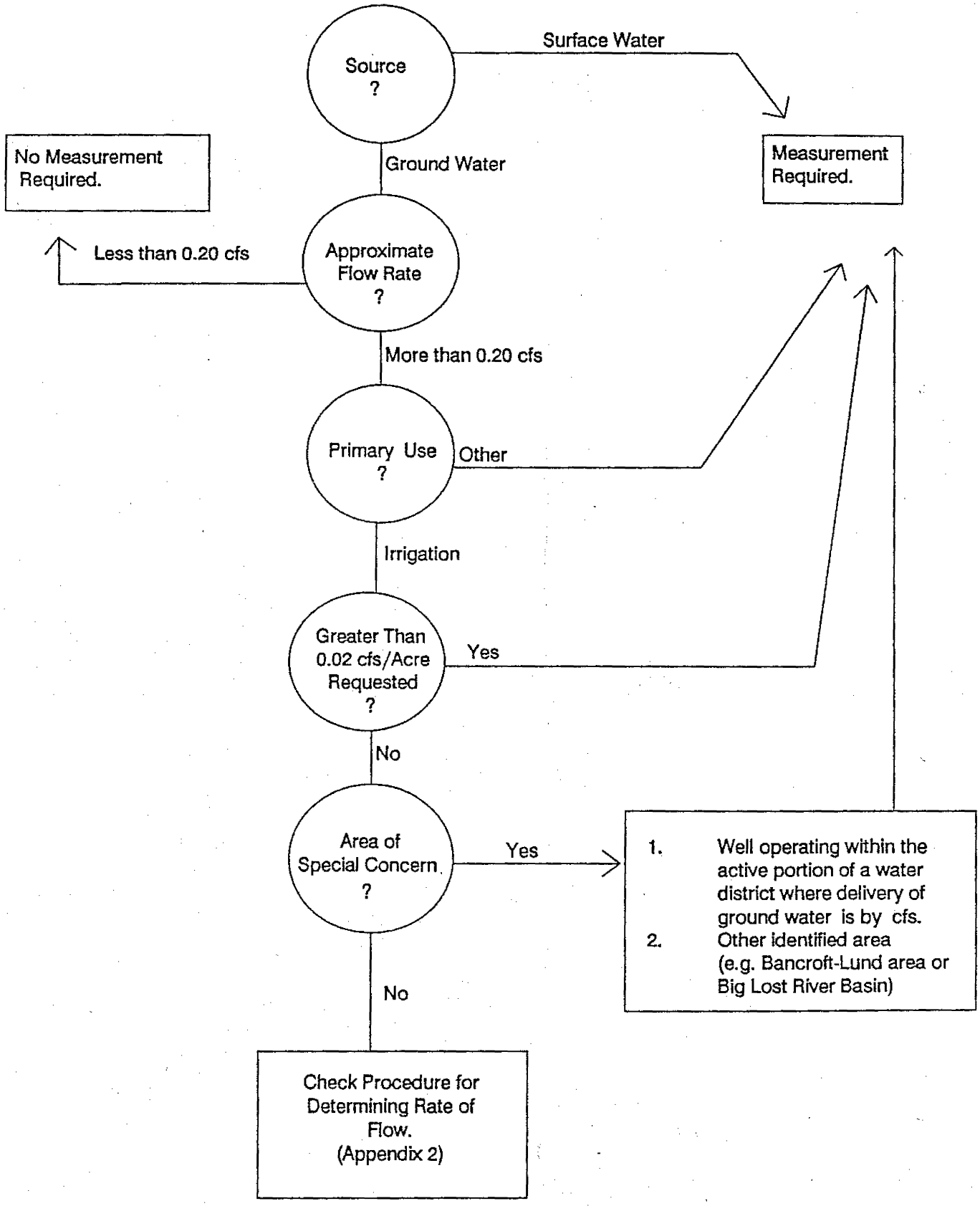
This procedure applies to rate of flow determinations for the preparation of water right licenses and adjudication Director's Reports.

Appendix 1 - Flow Chart for Determining if Flow Measurement is Required

Appendix 2 - Procedure for Determining Rate of Flow

APPENDIX I

FLOW CHART FOR DETERMINING IF FLOW MEASUREMENT IS REQUIRED



Appendix 2

Procedure for Determining Rate of Flow

(Use this procedure in conjunction with Appendix 1)

A. Measure the rate of flow of the system whenever it is possible at time the examination is conducted, even if it is not required.

B. The licensed or decreed rate of flow is not always determined by the system capacity. This is the case when the system capacity obviously exceeds the permitted or claimed flow rate. In such cases no significant effort needs to be made to determine system capacity.

C. An acceptable method of determining a rate of flow for licensing or the director's report for a system not requiring a measurement is as follows:

1. Evaluate whether system capacity is likely to be the limiting factor. If not, base the recommended rate for licensing or decree on the lessor of the permitted or claimed amount or the duty of water.

2. If the system capacity appears to be the limiting factor, make an acceptable estimate by refining the theoretical calculation. Compute the theoretical calculation as described below:

a. Basic equation:

$$Q = \frac{(8.8) \times (HP) \times (E)}{H}$$

Where Q = rate of flow in cubic feet per second,
HP = brake horsepower of the pump motor,
E = pump efficiency, and
H = total head.

b. For purposes of field calculations, parameters are determined in the following manner:

1. HP is obtained from the motor nameplate.

2. E is considered to be the highest operating efficiency of the system, which is assumed to be 70% unless a higher efficiency can be demonstrated by the operator.

3. H is computed as the sum of the dynamic lift (elevation distance between water surface during pumping and location of pressure reading) and the pressure head at the pump, computed as 2.31 times the pressure in psi.

Procedure for Determining Rate of Flow (Cont.)

c. Procedure:

1. Determine HP from motor nameplate.

2. Determine dynamic pumping level (water level during pumping), based on a **combination** of at least two of the following:

   a. Discussions with well owner.

   b. Measurement with a steel tape, pressure tube, or electric well probe (plus a drawdown factor).

   c. Information from exams conducted on nearby wells, if in a homogeneous aquifer, (including the amount of anticipated drawdown).

   d. Information provided on a well log, particularly where the well driller shows pump test data with discharge and draw down.

   e. Information from water level contour maps, such as in the Snake Plain Aquifer.

3. Measure pressure of mainline near the pump, or estimate this pressure based on the type of operating system (high pressure pivot, open discharge, etc.).

4. Compute the theoretical rate of flow.

d. Example:

An irrigation system is found to have a 50 HP motor, a dynamic depth to water of 100 feet, and a pressure of 80 psi near the pump.

$$Q = \frac{(8.8)\ X\ (HP)\ X\ (E)}{H} = \frac{(8.8)\ X\ (50)\ X\ (.70)}{(100 + \{2.31 * 80\})} = 1.08 \text{ cfs}$$

e. Limitations: There are some situations where use of this equation is not applicable, for example where there is no means of determining even an estimate of the dynamic pumping level, and where artesian pressure creates a flowing well. In these situations either measurement is required or alternate techniques must be used to quantify estimated flow rates. Acceptable measurement techniques for these situations include (1) sprinkler measurements for pressurized systems, (2) timed fills of trapezoidal ditches for gravity flow systems, and measurement with a polysonic measuring device.

3. Refine the theoretical measurement by a variety of techniques, including reading the power meter if the system is operating to determine horsepower actually being used, evaluation of whether friction losses are relevant, review of pump design information to improve the estimate of efficiency, or obtaining information on measurements taken by pump installers, electrical companies, etc.

D. When developed in conformance with Appendices 1 and 2, the theoretical rate of flow is an acceptable substitute for a measured rate of flow.