AN EFFICIENT COMPUTER CODE FOR MONITORING HYDROGEOLOGICAL DATA

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ABSTRACT

Water level is an important parameter and needs systematic monitoring. The usual practice of storing and accessing the data is replaced by an efficient computerized system. The developed system is not only for storing the data at minimum space but also provides instantaneous information about fluctuations and their variations in time and space. The developed code is tested with a field example and occupies only 20 K bytes of memory.

INTRODUCTION

WATER level is an important observed hydrogeological parameter and its systematic analysis is of immense value to know the hydrogeological character[1] of any environment. The monitoring of water levels is an important follow-up activity over a specified period after the completion of basin investigations for identifying its nature in time and space. The usual frequency of observation is monthly and is varied to weekly/fortnightly depending on the requirements. The data is generally stored in the form of physical files along with the locations and reference levels. Any additional data subsequently collected are added to the initial information to make systematic monitoring of records. Subsequently, the information required for the fluctuation, its relations with topography and its variation in time and space is studied manually for any quantitative estimation[2]. This is often observed to be a time-consuming and tedious process. Also the frequent use of these files results in their soiling and thus necessitates the replacement by fresh files[3]. Hence for systematic storing and retrieval of water level data, a computerized water level monitoring system is designed and developed.

The monitoring of water levels deals with two aspects, *viz.*, storage of collected data and the utilization of the stored data. The first aspect in turn involves two more components, *i.e.*, storing the available data initially and updating the data files subsequently. Thus the monitoring of water levels warrants the problem to be handled in three phases, *i.e.*, data file creation, updating and retrieval. The scope of these three phases and the design details of the program and data organizations are described in the following sections.

WATER LEVEL DATA ORGANIZATION

This is the first stage of processing the data wherein a decision is invovled for selecting the input device for submitting the data and for indicating the requirement regarding source listings. This kind of information that controls the entire process of execution and allowed through a parameter statement for information to the system, is shown in figure 1. This will be followed by the organized water level data deck as described below.

In an attempt to organize several parameters belonging to the water levels, the data log sheets of the manual practice system are analysed. This study has brought into light that the date of observation and the reference level of the well are always essential for analysing the observed water levels of any well. Also, the periodicity of observation is found necessary to identify the nature of follow-up of the observations. Further, for unique identification of the data, these parameters are coupled with some address pointers like basin number, well number (and name) and also serial number of observation. These three parameters

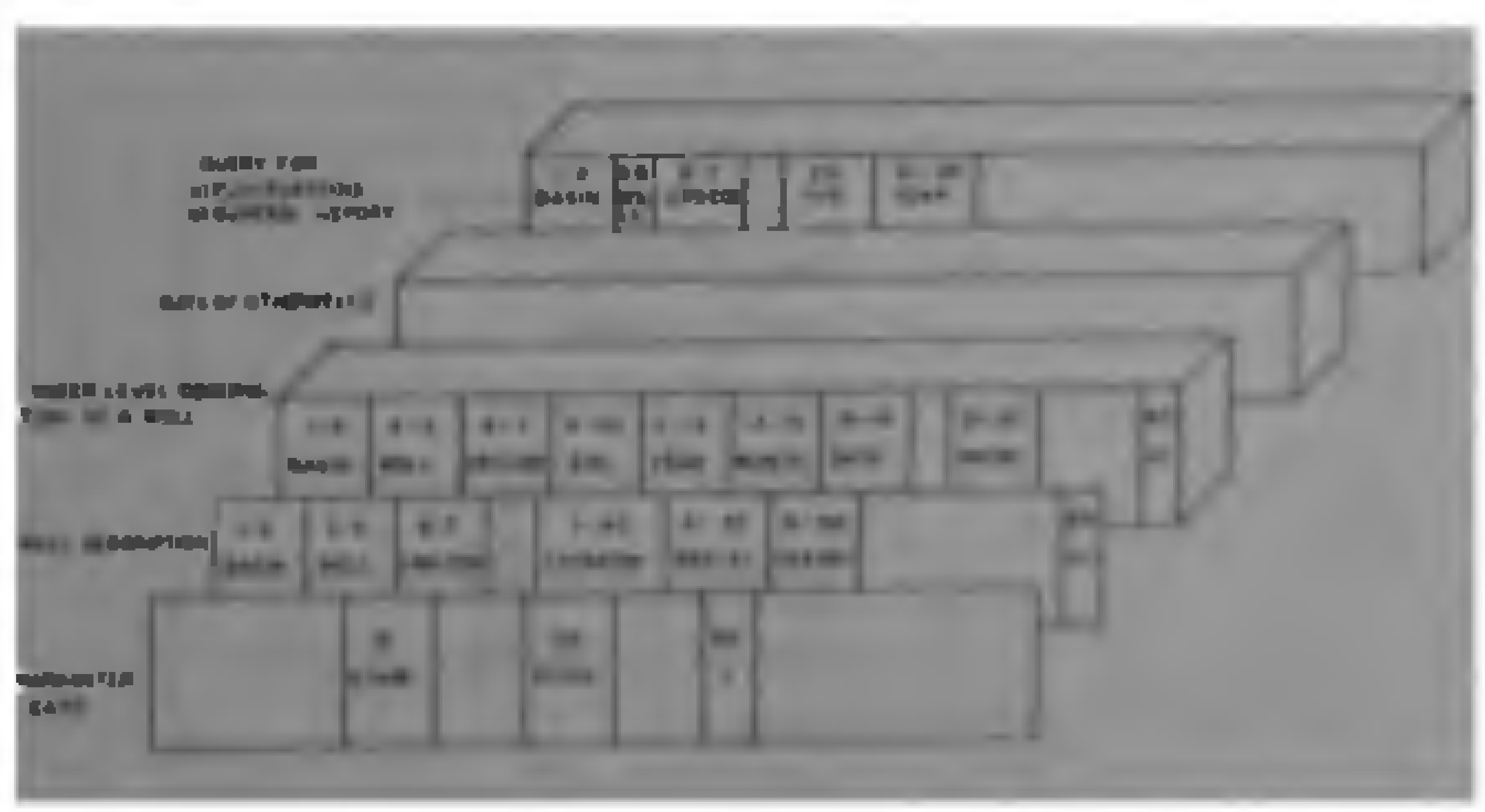

Figure 1. A view of input data records for creation and updation of master file for hydro geological data.

are frequently referred to as the key parameters in the system. The key parameters and the other non-key parameters are further grouped into two different sets forming two record formats for the purpose of data preparation and storage. While designing these formats, the nature of each parameter with reference to its frequency of appearance in the data deck preparation is taken into consideration.

RECORD FORMAT DESCRIPTION

It is noticed that the well name, reference level and the frequency of observation are unique for each well and maintain the same value throughout the observations. Hence these parameters in combination with the basin number and the well number fields are formed into the first record format (figure 1). As can be seen from the figure, the basin number is allotted only two columns of storage (1–2), while the well number is allotted three columns of storage (3–5). The other parameters, *i.e.*, serial number of observation, date (including year and month) and the observed water level values are allotted different number of columns in the second record format, as shown in the same figure. This format facilities handling data of 100 basins simulataneously, with the capacity of 1000 wells in each basin. Further, it has given a provision to the user for specifying 1000 observatory data for each well. Utilizing these two formats, the data of different wells are arranged in an order to form the data record set up as shown in figure 1 for submitting to the data file creation process.

PROCESS OF DATA FILE CREATION

The system initiates the input and output devices involved in the process of data file creation and invokes a subroutine READUP to read one data record at a time from the input device into a buffer IRECI (figure 2). Immediately the system verifies the keyfield contents with the help of the subroutine KEYVLD. Subsequently the program invokes the sobroutines RECVL1 and RECVL2 depending on the format of the input data record. The subroutines verify the data field contents and store their values in an output buffer in internal binary form. The contents of the key fields are also combined with these values in the same output buffer. The system gives a WRITE command to store the contents of this buffer on output device, thus generating a water level data file record. This procedure is repeated for each input data record and correspondingly the data file records are

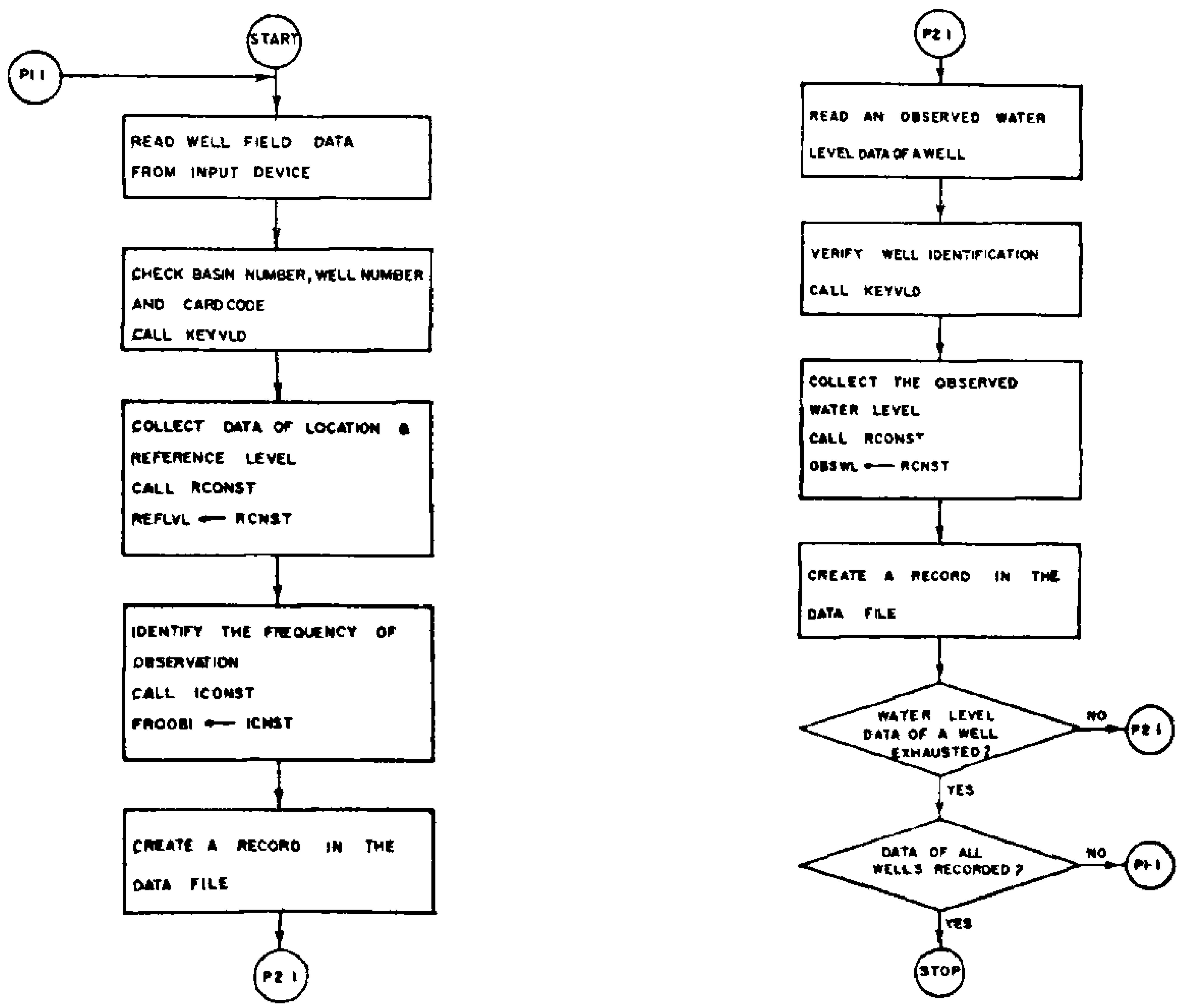

Figure 2. Flow chart describing the sequence of events during the ereation of hydrogeological data file.

generated. When the input data are exhausted, the generated data file is closed, thus indicating the end of data file creating process.

PROCESS OF DATA FILE UPDATION AND RETRIEVAL

The water level data file requires suitable extensions to store the data that is subsequently collected from different well sites. This has been made possible by introducing a process of updation into the system. This process requires the earlier created water level data file and the new updating information and permits three types of operations *i.e.*, introduction of new data records, deletion of unnecessary records and replacement of existing records. For carrying out these operations, two different update records are designed which are similar to the record formats of the creation phase as described earlier. An additional provision is made to store an upadate code in the 80th column (figure 1). As can be seen from the figure, update code can be I for insertion, D for deletion and R for replacement of records. The updating data records are prepared in accordance with this design and are organized to form the update data deck as shown in figure 1.

EVALUATION PROCESS

As the evaluation commences the subroutine READUP reads one update data record at a time and also positions the earlier created water level data file (*i.e.*, old master file) to an appropriate point as indicated by the key fields of the update record. Then depending upon the update code the program invokes the subroutines RECVL1 and RECVL2 to verify the update record contents, and generates a new master file, containing the latest setup of the water level data. The water level data file is now ready for generating the relevant information. Hence a provision is made in the system to allow the users to interact for seeking the information. The interaction can be in the form of several questions for which the system responds spontaneously (figure 3).

For handling these questions, a uniform coded format is evolved as shown in figure 1. These questions are read into the computer by the subroutine MONITOR, which identifies the type of questions from the coded format. Accordingly, it accesses the water level data file and generates necessary information in the form of reports on the listing device.

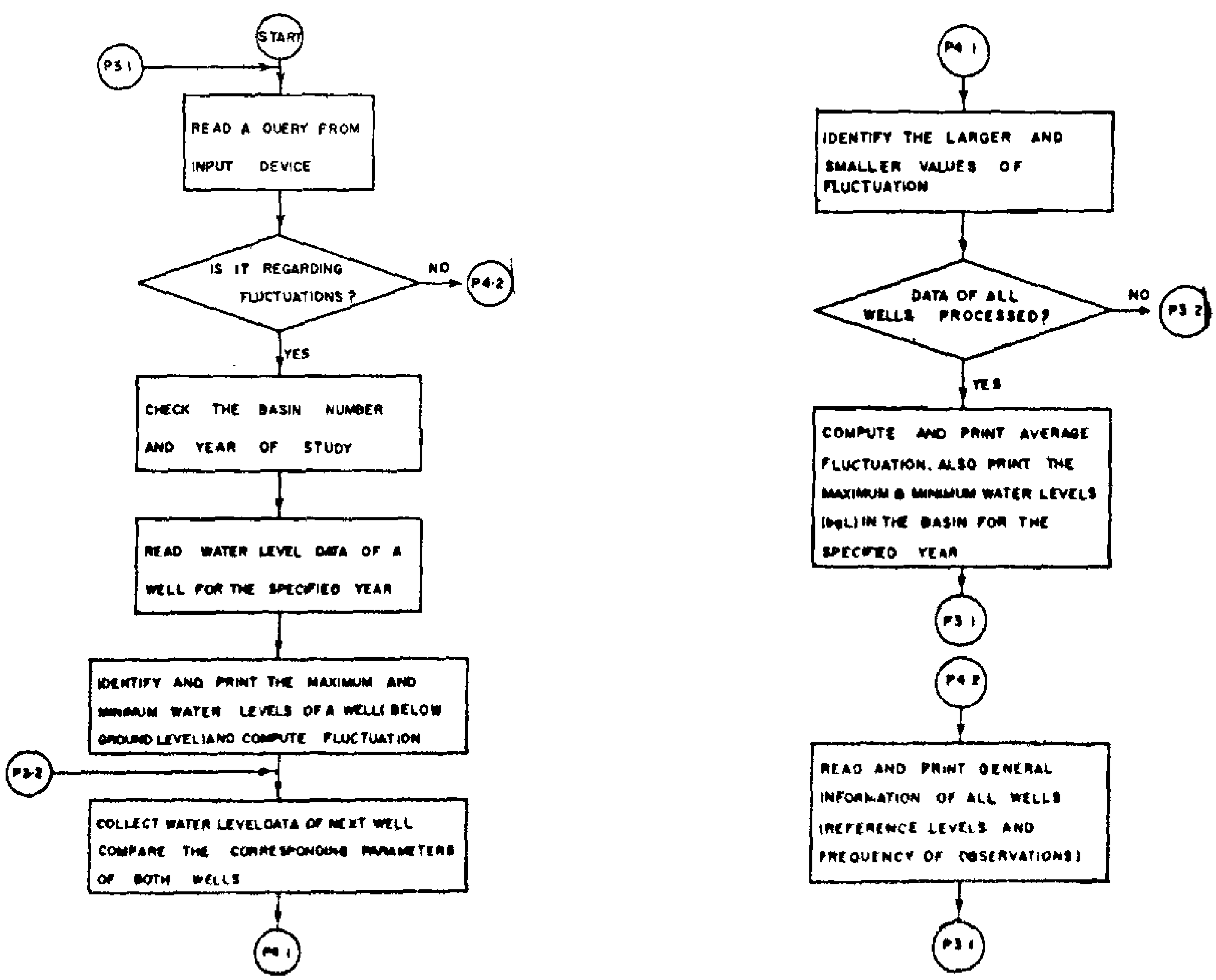

Figure 3. Flow chart describing the information retrieval from hydrogeological data file.

CONCLUSIONS

For systematic monitoring of water levels in any basin investigations, a main program and 12 subroutines are developed. The subroutines provide individual and integrated water level information at a time over different wells in any basin. A generalized process of evaluation is incorporated and the new design is tested with a field example, establishing the efficacy of the code.

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2. Briz-Kishore, B. H., Ph.D., Thesis, Osmania University, Hyderabad, 1980, 109.
3. Briz-Kishore, B. H. and Avadhanulu, R. V. S. S., *Data Base Systems Report*, Administrative Staff College of India, 1981.

ON THE PITUITARY GLAND OF *CHANNA STRIATUS* (BLOCH) WITH RELATION TO GONADAL CYCLE

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ABSTRACT

The structure of the pituitary gland in *Channa striatus* (Bloch) is studied in detail and its relationship with the breeding cycle is established.

INTRODUCTION

PISCINE pituitary has been receiving increased attention recently. The pituitary of teleosts undergoes seasonal changes which are correlated with the gonadal cycle. Depending upon seasonal secretary activity, the pituitary presents different histological pictures at different periods. The cyclic changes in the pituitary of *Janynsia lineata* the relationship between the pituitary gland and gonad in *Fundulus*, the epithelial components and their seasonal changes in the pituitary gland of *Cyprinus carpio* and *Carrasius auratus* have all been studied[1-3]. The morphology and seasonal histological changes in the pituitary of *Cirrhinus reba* and the correlative cyclic changes in the pituitary and gonad of *Mystus seenghala* and *Barbus stigma* have been studied by Sathyanesan who also described the pituitary gland of *Ophicephalus punctatus*[4-6].

The histological changes occurring in the pituitary gland of *Salmo gairdnerii* and *Oncorhynchus* and the seasonal variations in the histology of the pituitary gland in *Cirrhinus mrigala* with relation to gonadal activity have also been studied earlier[7-9]

MATERIALS AND METHODS

For morphological study, the specimens were preserved in 4% formaldehyde solution. The pituitary along with the brain was dissected from the ventral side of the head. The brain length was taken from the end of the olfactory bulb upto the beginning of the first vertebra. For histological details and cellular differentiation, the pituitary along with a portion of the brain was fixed either in Bouin-Hollande sublimate or in Helly's fluid or "Zenker-formal". Serial sections (5-6μ) were stained with (a) Herlant's tetrachrome stain, (b) oxidation-Alcian Blue-PAS-Orange G method and (c) periodic acid Schiff technique.

OBSERVATIONS

The pituitary gland in *C. striatus* is a small, semicircular structure, slightly elongated anteriorly. It is whitish, soft bodied, lying on the ventral side of the brain behind optic chiasma, lodged in a concavity on the floor of the cranium—the sella turcica. A true stalk is absent and therefore platybasic. The adenohypophysis is divided histologically into three regions: the anterior glandular region or rostral pars distalis; the middle glandular region or proximal pars distalis and the posterior glandular region or pars intermedia. The rostral pars distalis is small and occupies the antero-dorsal portion of the gland. The proximal pars distalis comprises the largest portion of the gland and middle in position. The pars intermedia is large and occupies the posters-ventral position of the gland.