Department of Commerce ▪ National Oceanic & Atmospheric Administration ▪ National Weather Service

NATIONAL WEATHER SERVICE MANUAL 10-944

JANUARY 2, 2008

Operations and Services
Hydrologic Services Program, NWSPD 10-9

STANDARD HYDROMETEOROLOGICAL EXCHANGE FORMAT (SHEF) MANUAL

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OPR: W/OS32 (K. Mack) **Certified by:** W/OS3 (T. Graziano)
Type of Issuance: Routine.

SUMMARY OF REVISIONS: This directive supercedes NWS Manual 10-944, "Standard Hydrometeorological Exchange Format (SHEF) Manual," dated October 28, 2005. The following revisions were made to this manual:

1) Restores Type Source (TS) codes FL, 1-9 (F, G, M, P, R, S, T, V, W, X and Z) to the SHEFPARM file since they were inadvertently removed.
2) Adds Type Source FR (Persistence Forecasts) to SHEFPARM file.
3) Adds Physical Element (PE) codes GC, GL, GP, GW, HV, PJ, QZ, TJ, TR, TZ, UE, WA, WS, WX, WY, YI, YP, YV and YY to the SHEFPARM file.
4) Adds Duration (D) codes E and G to the SHEFPARM file.
5) Adds Data Qualifier Codes D, L and W to the SHEFPARM file.
6) Modifies The L and LS Time Zone Codes (Alaska Region) to be 9 hours earlier than UTC and the LD Time Zone Code to 8 hours earlier than UTC.
7) Updates link to this manual (PDF) on the National Weather Service Directives web page.
8) Updates Appendix F, DAYLIGHT/STANDARD TIME CHANGE DATES, to reflect the new Daylight Saving Time dates.

(Signed) December 19, 2007

James E. Hoke Date
Acting Director, Office of Climate,
Water, and Weather Services

Standard Hydrometeorological Exchange Format (SHEF) Manual

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CHAPTER 1 - INTRODUCTION TO SHEF

The Standard Hydrometeorological Exchange Format (SHEF) is a documented set of rules for coding of data in a form for both visual and computer recognition. It is designed specifically for real-time use and is not designed for historical or archival data transfer. All the critical elements for identification of data are covered. Station identifiers, parameter descriptors, time encoding conventions, unit and scale conventions, and internal and retained comment fields are all part of the code.

SHEF was designed for interagency sharing of data, visual and machine readability. The widespread implementation of SHEF allows the same decoding software to process data from various agencies. New data sources can easily be added as they become available. The visual nature of SHEF allows users quickly to become familiar with it. SHEF fully qualifies the data so that receiving databases have all the necessary information to describe the data.

Versions 1.0 and 1.1 of the SHEF documentation were the products of a meeting of National Weather Service (NWS) regional SHEF focal points held in Cincinnati, Ohio in November 1983. Version 1.2 and 1.3 included minor changes to the SHEF format that have been made over the years. Some of the information from the SHEF Version 1.1, Chapters 2, 4, 8, 9, and 10, had been combined into other chapters and the former chapters deleted. Chapter 4 provided an overview of SHEF syntax, while Chapter 5 gave greater detail on some of its features. New Chapters 6 and 7 had been added to document the SHEF decoding software and to include further information on using SHEF. The new chapters contained portions of the National Oceanic and Atmospheric Administration (NOAA) Tech Memo NWS CR-67 (April 1983) and the SHEF Field Office Users' Handbook (May 1985), respectively. Version 1.3 of the SHEF documentation included the changes for year 2000 compliance, extension of input beyond 80 characters, and addition of a retained comment feature.

Version 2.0 introduces many additional paired value (“vector”) physical element (PE) data types in addition to the previous data types for Gate Openings and Soil Temperature (Section 7.4.6). Information that was in Table 22 of the old SHEF 1.3 manual was moved into new Section 7.4.6 in this version of the manual. With respect to these “vector” values, the SHEF Decoder poster, and the SHEF Decoder configuration file (SHEFPARM) were modified to process these paired value PE data types. Changes were made to Table 10 to reflect the significant modifications made with respect to the Data Qualifier Codes. Appendix J was added to provide a list of SHEF error numbers with associated messages. In Version 2.1, Chapter 5.3.1, page 20 describes an increase of maximum allowable blank lines to 50 from 14. Chapter 7.4.6, page 56 describes how missing paired values are handled. In Table 1, page 6, added 5 new Physical Element (PE) codes SB, SE, SM, SP, and SU for SNOW. In Table 2, page 1, added new Send Code “SF” which translates to SFD. In Table 4, page 1, added Type Source (TS) FL to represent Forecast Mean Areal Data. In Table 4, page 2, for Processed Data (non-forecast), added Type Sources A, B, C, D to represent four (4) levels of data quality and Type Sources 2 thru 9 to represent secondary, tertiary, etc. sensors of the same data type at the same location. Also added Type Sources F, G, M, P, R, S, T, V, W, X and Z to represent (11) equipment types and 1 thru 9 to represent 9 available process levels for each equipment type. In Appendix I, description of SHEFPARM file, new PE's and TS's added.

Version 2.2, throughout this document, all new or updated information is in **BOLD** type**.**

The link to NWS Directive 10-944 (SHEF Manual) has been updated and can be found on this page (pg 2). In Table 1, Page 3… added 5 new Physical Element (PE) codes GC, GL, GP, GW and HV: Page 5… added 2 new Physical Element (PE) codes PJ and QZ; Page 6… added 3 new Physical Element (PE) codes TJ, TR and TZ; Page 7… added 3 new Physical Element (PE) codes UE, WA and WS; Page 8… added 6 new Physical Element (PE) codes WX, WY, YI, YP, YV and YY.

In Table 3, Page 1, added two new Duration (D) codes E and G which represent 5 and 10 minute data respectively.

In Table 4, Page 1, added new Type Source (TS) FR to represent Persistence Forecasts generated by verification software. Appendix I, Page 10, Type Source codes FL and Appendix I, Page 12, 1-9(F, G, M, P, R, S, T, V, W, X and Z) were restored to the SHEFPARM file after being previously deleted.

Data Qualifier Codes D, L and W added to the SHEFPARM file (Table 10, Appendix I, Page 19).

The L and LS Time Zone Codes (Alaska Region) have been changed to add 9 hours (actually 540 minutes) and the LD Time Zone Code adds 8 hours (480 minutes). This is a change from the previous 10 and 9 hours respectively. The L code does consider Daylight Saving Time, which would adjust time to 8 hours when in effect (Table 8).

Beginning in 2007, most of the United States began Daylight Saving Time at 2:00 a.m. on the second Sunday in March and will revert to standard time on the first Sunday in November. In the U.S., each time zone switches at a different time. Appendix F, DAYLIGHT/STANDARD TIME CHANGE DATES, was updated to reflect this change.

This SHEF Manual is available on the National Weather Service Directive System home page in PDF format at the following Internet address:

In PDF format…

http://www.nws.noaa.gov/directives/sym/pd01009044curr.pdf

An editorial note - the various tables and appendices are not necessarily referenced sequentially in the chapters. In addition, references to other tables and appendices may be made within the tables and appendices themselves.

CHAPTER 2 - THE BASIC SHEF FORMATS

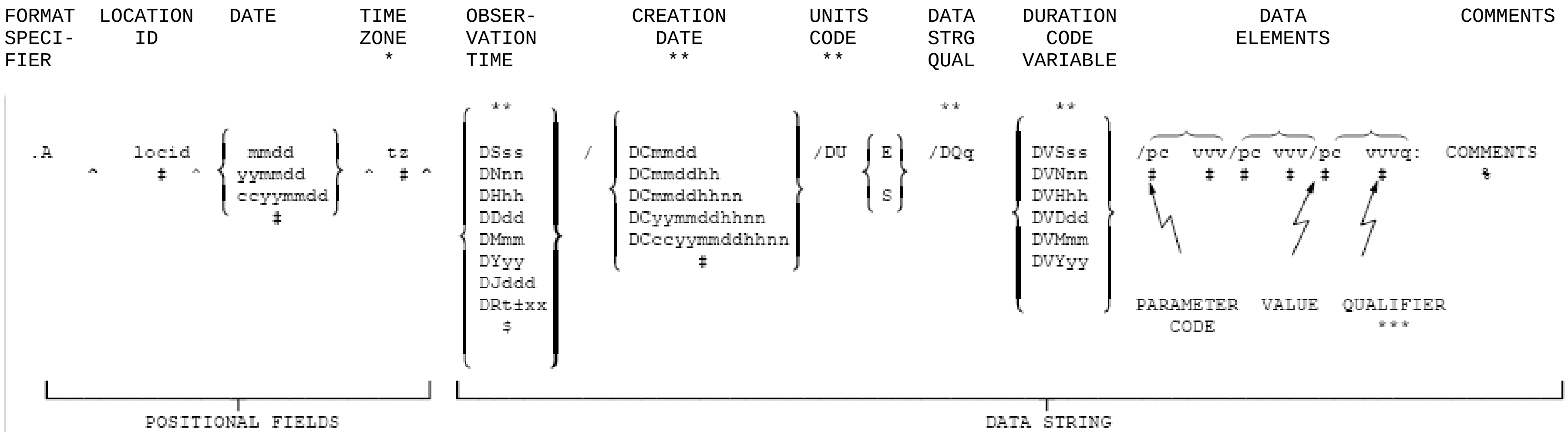
There are three formats that make up SHEF. Through the use of parameter code characters to identify the data, these three basic message formats have the flexibility to transmit a wide range of hydrometeorological information. The formats are as follows:

.A - single station, multiple parameter
.B - multiple station, multiple parameter, header driven
.E - single station, single parameter, evenly spaced time series

2.1 .A Format. The .A format is designed for the transmission of one or more hydrometeorological parameters observed at various times for a single station. As shown in Figure 2-1, the .A format consists of positional fields and the data string. The format can be used for stations that report several different types of hydrometeorological data or report data with uneven time spacing. The .A format lines may be continued, if required.

2.2 .B Format. The .B format can be used for the transmission of one or more hydrometeorological parameters from several stations for which many or all of the parameters are the same and are observed at corresponding times. As shown in Figure 2-2, the .B format consists of three basic parts: header, body, and terminator. The header consists of the positional fields and the parameter control string. The body contains station identifiers and data with optional date/data overrides. The terminator ends the entire .B format message. The format is useful for a routine morning roundup of precipitation and river data for a group of stations. The .B header provides all pertinent date-time and parameter code information needed to decode the data contained in the body of the message. The order of the parameter list is flexible and can vary from message to message. The data values in the body are associated with the order of the parameter codes supplied in the header line. Any parameter that can be reported in the .A format can be reported in the .B format; however, if more than three stations are to be transmitted routinely, the .B format should be more convenient.

2.3 .E Format. The .E format can be used for the transmission of several values of a single hydrometeorological parameter at an evenly spaced time interval for a single station. As shown in Figure 2-3, the .E format consists of positional fields and the data string. This format is useful in the transmission of any evenly spaced time series of observational, processed, or forecast data. The .E format is very similar in structure to the .A format except for two minor differences. First, in order to avoid ambiguity, the .E format accommodates only one hydrometeorological parameter while the .A format can handle several. Second, the .E format requires the explicit specification of a time interval (incremental/decremental) between data values.



.A FORMAT FIELD OPTIONS

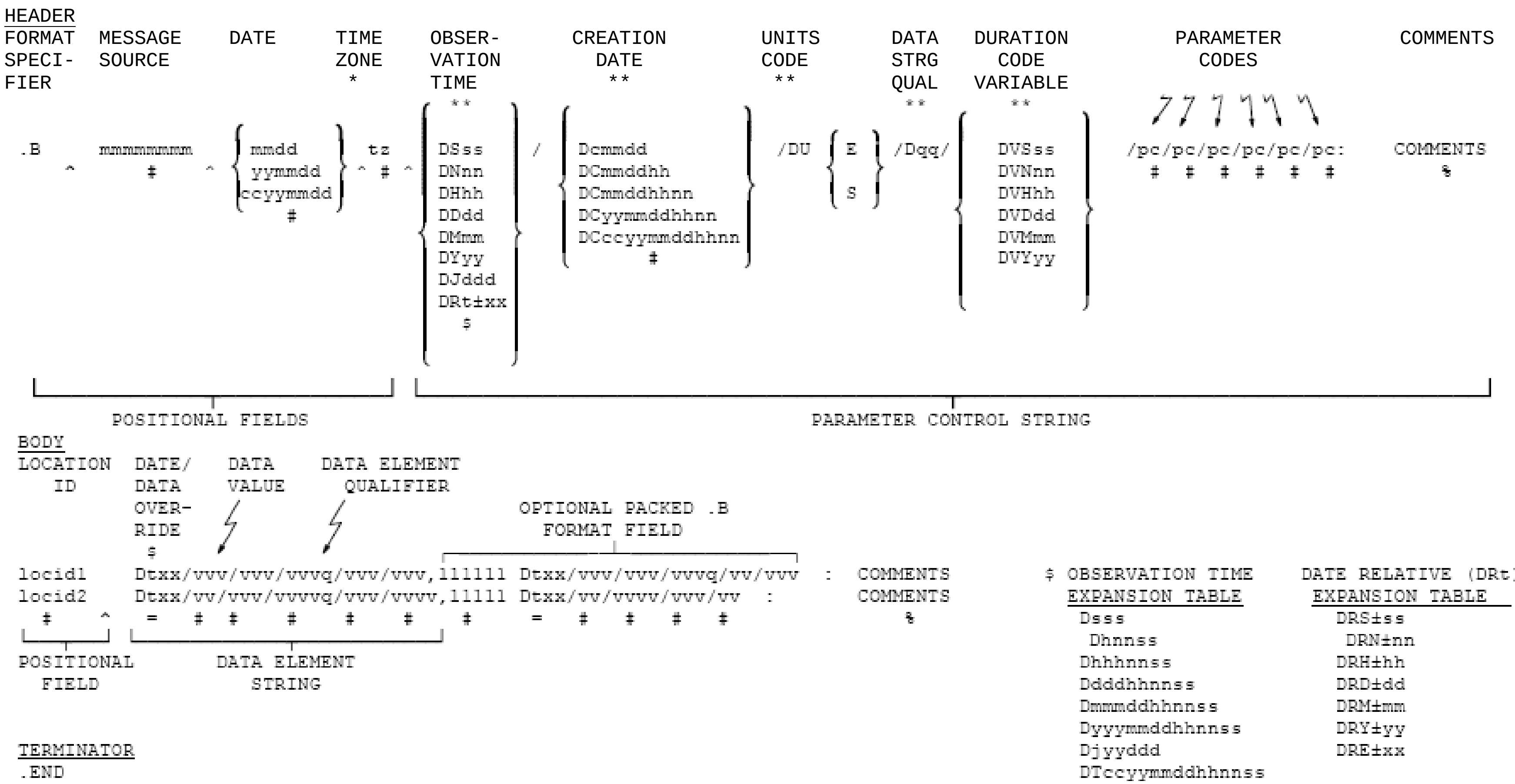
NOTE: A field without a star (*) is a mandatory field.
*   Optional field, defaults to prespecified value, fixed positionally in message.
**   Optional field, defaults to prespecified value, can occur anywhere in DATA STRING.
***   Optional field, occurs directly after the DATA ELEMENT VALUE “v.”

.A FORMAT FIELD DESCRIPTORS

^   Indicates at least 1 mandatory blank as a delimiter (15 blanks maximum).
#   Indicates field of variable length.
$ Indicates expandable field (see table below).
%   Comment field can occur anywhere in SHEF messages. A colon “:” turns the decoder on and off.

$ OBSERVATION TIME EXPANSION TABLE	DATE RELATIVE (DRt) EXPANSION TABLE
DSss	DRS±ss
DNnnss	DRN±nn
DHhhnnss	DRH±hh
DDddhhnnss	DRD±dd
DMmmddhhnnss	DRM±mm
DYyymmddhhnnss	DRY±yy
DTccyymmddhhnnss	DRE±xx
DJyyddd	
DJccyyddd	

Figure 2.1. The Generalized .A Format Message



.B FORMAT FIELD OPTIONS

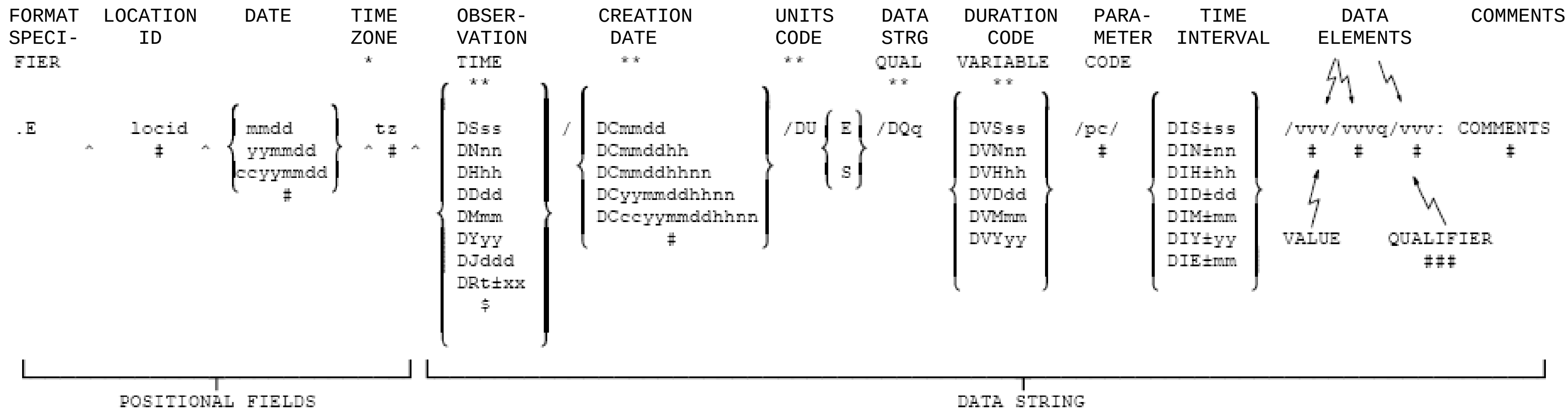
NOTE: A field without a star (*) is a mandatory field.

- `*` Optional field, defaults to prespecified value, fixed positionally in message.
- `**` Optional field, defaults to prespecified value, can occur anywhere in DATA STRING.
- `***` Optional field, occurs directly after the DATA ELEMENT VALUE "v."

.B FORMAT FIELD DESCRIPTORS

- ^ Indicates at least 1 mandatory blank as a delimiter (15 blanks maximum).
- # Indicates field of variable length.
- $ Indicates expandable field (see table above-right).
- % Comment field can occur anywhere in SHEF messages. A colon ':' turns the decoder on and off.
- = Date override for date/data in .B header.

Figure 2.2. Generalized .B Format Message



.E FORMAT FIELD OPTIONS

NOTE: A field without a star (*) is a mandatory field.
*   Optional field, defaults to prespecified value, fixed positionally in message.
**   Optional field, defaults to prespecified value, can occur anywhere in DATA STRING.
***   Optional field, occurs directly after the DATA ELEMENT VALUE 'v'.

.E FORMAT FIELD DESCRIPTORS

^   Indicates at least 1 mandatory blank as a delimiter (15 blanks maximum).
#   Indicates field of variable length.
$ Indicates expandable field (see table below).
%   Comment field can occur anywhere in SHEF messages. A colon “:” turns the decoder on and off.

$ OBSERVATION TIME EXPANSION TABLE	DATE RELATIVE (DRt) EXPANSION TABLE
DSss	DRS±ss
DNnnss	DRN±nn
DHhhnnss	DRH±hh
DDddhhnnss	DRD±dd
DMmmddhhnnss	DRM±mm
DYyymmddhhnnss	DRY±yy
DJyyddd	DRE±xx
DTccyymmddhhnnss	
DJccyyddd	

Figure 2.3. Generalized .E Format Message

CHAPTER 3 - ELEMENTS OF DATA IDENTIFICATION

The SHEF data identification system has been designed both for visual recognition as well as for automated handling. The fundamental elements of data identification in SHEF and the receiving database are (1) location identifier, (2) time identification, and (3) parameter codes.

3.1 Location Identifier. The location name is generally reduced to a unique identifier that can be three through eight alphanumeric characters in length. The underscore ("_") character is also allowed. Different location identifiers should not be used to represent different types of data from the same reporting station. On the other hand, location identifiers for areal values (e.g., mean basin precipitation above a flow point) should be discriminated from point precipitation values.

In some areas of the country, long-standing, three-character identifiers are used to represent a dam or project. One such convention is to add the state designator characters to the project identifier to identify a U.S. Geological Survey (USGS) station immediately downstream of the project.

3.2 Time Identification. In the SHEF messages, every data value is associated with a time of observation which permits observations at nonstandard times to be handled in a general way.

For mean or period values, the observation time would be the end of the period. For example, a mean daily flow for the 24-hour period ending at midnight would have an observation time of midnight ending that day. A maximum, instantaneous temperature for the 24-hour period ending at 1200Z would have an observation time of 1200Z ending that day.

The time at which a data value is created can also be included in the SHEF messages. This allows a creation time to be associated with a particular data value and, in the case of forecast values, to judge the applicability of the latest forecast available.

3.3 Parameter Codes. In SHEF messages, different types of data are keyed by a seven-character parameter code represented by the character string "PEDTSEP." The string is broken down as follows:

PE = Physical Element (gage height, precipitation, etc.)
D = Duration Code (instantaneous, hourly, daily, etc.)
T = Type Code (observed, forecast, etc.)
S = Source Code (a further refinement of type code which may indicate how data was created or transmitted)
E = Extremum Code (maximum, minimum, etc.)
P = Probability Code (90 percent, 10 percent, etc.)

The parameter code string, when fully specified, contains six keys for database identification. In order to reduce manual entry and communications requirements, standard defaults for each key (except PE) reduce identification of most hydrometeorological data to a minimum key of two characters. The default assignments and exceptions for several physical elements and parameter code keys are shown in Table 7. The full key is used primarily in the transmission of unique hydrometeorological data.

The descriptor characters have been selected to permit the greatest possible visual recognition for each key.

3.3.1 PE: Physical Element. This is always specified by a two-character code. Typical physical elements are discharge (QR), gage height (HG), reservoir forebay elevation (HF), or precipitation increment (PP), as shown in Table 1. Unit abbreviation definitions and conversions (English/metric) are located in Appendices A and B, respectively.

The first character of the code usually defines the basic category of the data, while the second character provides additional detail. Certain characters within the table have special meaning. No physical element codes begin with "D" since they are reserved for date/data-quality elements (see Tables 9a and 9b).

Some routinely transmitted hydrometeorological data require up to the full seven parameter code characters to identify the data. To facilitate manual entry for these data, several two-character send codes have been developed. The send codes are identified with an "(S)" in Table 1 and are listed separately in Table 2. The two-character send codes are used only in the transmission of data and represent the seven-character expanded parameter codes for storage in a database. The send codes deal mainly with maxima and minima since the extremum "E" is the sixth character in the parameter code string "PEDTSEP" and would prove somewhat awkward to code routinely.

Certain physical elements such as temperature can be encoded at various depths in a reservoir or in soil. There are ten (10) physical elements classified as "paired values" that may be best described as vector information. The identification and an explanation for these ten (10) physical elements can be found in Chapter 7.4.6.

3.3.2 D: Duration. The duration character combined with physical element describe the vast majority of observed hydrometeorological data. The defined durations are listed in Table 3.

The duration code describes the period to which an observed or computed increment applies, such as mean discharge or precipitation increment. If the physical element described by the duration code is a continuous function, such as river discharge, the physical element value can be assumed to be an average. If the physical element is noncontinuous, such as precipitation increment, the physical element value can be assumed to be a summation over the duration specified.

A provision exists in SHEF for the explicit specification of nonstandard durations (e.g., two monthly). Section 4.4 describes the coding of the duration code variable.

3.3.3 T: Type. The type character is used to describe the basic category of the hydrometeorological data being transmitted. These types include contingency, forecast, historical, observed, and processed, as shown in Table 4. Observed and forecast type codes are relatively self-explanatory. The processed type code is intended for nonforecast-derived values from the observed database, such as mean areal precipitation or temperature. In most applications, the processed parameters would not be used for external transmission of data. Contingency types deal with possible results gained for various hydrometeorological input scenarios. Historical values (such as peaks of record) are not normally sent real-time via external transmission, but the code is designed to accommodate consistent descriptions of real-time and historical information in user databases.

3.3.4 S: Source. The source character is a further refinement of the type code which may indicate how the hydrometeorological data was created or transmitted. The source code is always associated with a type code, as shown in Table 4.

The source codes are structured to allow one to distinguish data values, created from multiple sources and transmitted over differing paths, from a single sensor through use of the proper two-character type/source combination. Several basic data paths have been assigned source characters to accomplish this identification.

For retrieval of observed data from a database, if a user is not concerned with the specific data path but wants a best value, the source codes allow ranking of data such that type/source combination "RA" would imply best, "RB" second best, etc. This would guarantee the user a data value independent of data path. Source code characters "A" through "D" are reserved for this purpose and are not used for external transmission of data.

3.3.5 E: Extremum. This single-character descriptor allows identification of maximum and minimum values, such as crest or minimum stages. As shown in Table 5, each extremum code carries an explicit definition of the time period to which the extremum applies. The code for a daily minimum temperature would be TAIRZN. The code for a maximum hourly mean discharge for a day would be QRHRZX.

NOTE: Several commonly reported parameters, such as maximum and minimum temperatures, have been given two-character send codes in order to reduce manual entry and data transmission requirements.

3.3.6 P: Probability. The probability character descriptor is a key element in identifying both input and products of forecast procedures. Probability descriptors are listed in Table 6.

An example would be designation of probable maximum (90 percent) and probable minimum (10 percent) water supply volume forecasts. Probability can also be used to describe the expected range of crest stage for spring snowmelt.

CHAPTER 4 - THE SYNTAX OF SHEF MESSAGES

This chapter describes the components that comprise the SHEF messages. In order to examine the SHEF messages, each component has been given a name as shown in Figures 2-1, 2-2, and 2-3 and summarized below:

.A format contains the positional fields and data string component
.B format is comprised of three sections: header, body, and terminator
.B header contains the positional fields and parameter control string
.B body contains the positional field and data element string
.B terminator contains ".END"
.E format contains the positional fields and data string component

In Figures 2-1 to 2-3, several of the fields are optional and are appropriately marked. The use of the caret ("^") denotes the need for at least one required blank field. The uppercase characters are keys to the SHEF decoder and are part of the actual data transmission. The lower case characters identify fields that will be replaced by numbers or characters when actual data are transmitted. All references to .A, .B, and .E formats apply also to .AR, .BR, and .ER unless otherwise noted.

In the actual SHEF messages, both upper and lower case characters may be used. All lower case characters will be converted to upper case with the exception of the contents of retained comments.

4.1 Positional Fields. The positional fields are described first since they are the first component in all the SHEF formats.

4.1.1 Format Specifier.

"." Dot in column one

Triggers the decoding process and distinguishes SHEF-coded data from ordinary text lines. If the dot (".") is not in column one, no decoding of the message occurs and an error message is generated.

"A," "B," or "E" in column two

Format designator.

"1," "2," etc., continuation indicator in column three (must be in sequence)

A1, A2, E1, E2, etc., for the continuation of data strings and B1, B2, etc., for the continuation of a .B format header line. The .B format data string in the body cannot be continued. Continuation lines may be coded under revision mode.

"R" in column three

AR, BR, or ER for a revised data transmission. Subsequent continuation lines do not require the "R" to be explicitly specified. When using the "R" specification, the corresponding data values are marked as revised and should replace existing values in the receiving database.

4.1.2 Location Identifier: "locid"

Location identifier length can be three through eight alphanumeric characters. The underscore ("_") character is also allowed. Location identifier field must be delimited by a leading and trailing blank in the .A and .E formats.

Transmitted data are identified using coordinated, approved NWS identifiers. Non-NWS stations with well-established station identifiers can be used as long as no ambiguity results in station identification within the River Forecast Center (RFC) coordinated area of responsibility. "Stranger stations" (stations without established identifiers not in the regular reporting network) are transmitted by a "W," "X," "Y," or "Z," followed by seven digits containing a three-digit latitude and four-digit longitude to the nearest tenth of a degree.

The characters represent the following latitudes and longitudes:

Code	Location on Earth
W	South latitude, west longitude
X	North latitude, west longitude (includes North America)
Y	North latitude, east longitude
Z	South latitude, east longitude

For example, "X3080995" would translate to latitude 30.8 degrees north and longitude 99.5 degrees west. The plain language name of the station may be transmitted following the data and after the colon (":") internal comment field delimiter.

4.1.3 Message Source: "msgsource" (.B format only)

This is the three through eight alphanumeric character identifier for the office or agency which is the source of the data contained in the .B format message. NWS originating offices use their three-character station identifiers. The "msgsource" field must be delimited by a leading and trailing blank.

4.1.4 Date: "mmdd" or "yymmdd" or "ccyymmdd"

mm = Month, two digits (01-12)
dd = Day, two digits (01-31)
yy = Year, two digits (00-99)
cc = Century, two digits (17-21)

When “yy” is not explicitly coded, a 12-month window is used to assign the year that causes the date code to be nearest the current system date at the time of decoding. For example, if the current date is January 11, 2000, and revised data was entered for month/day December 12 without a year explicitly specified, the date-time stamp of the data would be December 12, 1999.

When “cc” is not explicitly coded, a 10 year in the future and 90 year in the past window is used to assign the century that causes the date code to be nearest the current system date at the time of decoding. For example, if a date of 12/12/35 were decoded on 12/27/97 it will be interpreted as 12/12/1935.

CAUTION: Outside the 12-month current date-centered default window, a year other than the default year must be explicitly specified. Also, exercise caution when choosing not to explicitly code year in SHEF messages. If these messages are archived in raw form, header records must be added in the archive function to make future determination of the correct year possible for retrieval software.

Date must be delimited by a leading and trailing blank. Date can be redefined within the data string by the observation time element.

4.1.5 Time Zone: “tz”

Time zone is an optional field. The default is Z for Zulu or Greenwich Mean Time (GMT). Time zone character codes are defined in Table 8. Coding a single-character local time zone requires the program to assume either daylight or standard time based on the daylight/standard change dates in Appendix F. Areas which do not follow time-change conventions must use the two-character time zone codes. The time zone field “tz” cannot be redefined within a SHEF message. Time zone must be delimited by a leading and trailing blank.

4.2 Data String: .A and .E Formats . The data string is the second and final component of the .A and .E formats but is not used in .B formats. The data string must be separated from the positional fields by a blank or temporarily by the internal comment field indicator colon (“:”). All elements within the data string must be separated by a single slash (“/”). In order to preserve readability, an individual data element section cannot be split between continuation lines.

Within the .A and .E data strings, the following parameters may be specified or respecified: observation time, creation date, unit code, data string qualifier, and duration code variable. The parameter code may be specified or respecified for the .A format, but not in the .E format message, in order to avoid confusion in the assignment of parameter code, time, and values. The time interval may be specified or respecified within the .E data string. If specified within the .A or .E data string, the observation time, creation date, unit’s code, data string qualifier, duration code variable, and time interval (.E only) apply to all subsequent data value elements on that line or its continuation.

4.3 Parameter Control String: .B Format . The parameter control string is the second component of the .B header but is not used in either the .A or .E formats. The parameter control string must be separated from the positional fields by at least one blank and terminated by a carriage return or a colon (":"). All elements within the parameter control string must be separated by a slash ("/"). There is no limit to the number of parameter codes which may be specified in the .B header except for its impact on the subsequent location data lines in the .B body.

Within the .B parameter control string, observation time, creation date, units code, data string qualifier, duration code variable, and parameter codes may be specified and apply to all subsequent data value elements unless they are respecified in the body of the .B format.

4.4 Analysis of Elements: Data String (.A and .E Formats) and Parameter Control String (.B Format) .

4.4.1 Observation Time.

The following defaults apply when specifying time:

> If the observation time is not specified, the hour, minute, and second (hhnnss) default to 240000 if a local time zone is specified and 120000 if Zulu time is specified.
>
> If hour (DHnn) is specified without minute (nn) or seconds (ss), nn and ss both default to 00.
>
> If hour and minutes (DHhhnn) are specified without seconds (ss), ss defaults to 00.
>
> If minute (DNnn) is specified without an explicit specification of hour (DHhh), the default hour is 24 under local time specification and 12 under Zulu time specification. Seconds default to 00 in both cases.

When specifying an observation time element, the time definition can be expanded to finer detail without respecifying the date/data-quality type code. For example, month, day, and hour can be specified by coding "DM0901/DH06" or "DM090106." To code hour and minute, "DH06/DN30" or "DH0630" can be used. A restriction here is that if Julian date is specified, time of day must be specified with a separate date/data-quality code.

Time controls can be redefined within all three message formats. In the .A and .E formats, the observation date-time can be redefined (including new month, day, or year) within the data string. In the .B format, the observation date-time can be redefined in the parameter control string and on a line-by-line basis using the date/data override in the .B body.

If the data value is for a period of time rather than instantaneous, the time stamp is always by convention associated with the end of that period. For example, mean daily flow would be coded "DH24" and would be considered the mean daily flow associated with the latest "mmdd" specified in the date field or data string, if redefined.

4.4.2 Creation Date Element: "DC" (optional)

This element is used to indicate the time at which the data elements were created. Coding "DC" is optional but encouraged when transmitting forecast data. A nonfatal SHEF error is generated if it is omitted. Posting and not parsing software should make assumptions about creation date if it is omitted. The following rules apply when specifying the creation date:

cc = Century, two digits (17-21) - optional
The "cc" defaults in the same manner as a "cc" in the date field. The "cc" is only coded when "yymmddhhnn" are also specified.
yy = Year, two digits (00-99) - optional
The "yy" defaults in the same manner as a "yy" in the date field. The "yy" is only coded when "mmddhhnn" are also specified.
mm = Month, two digits (01-12) - required
dd = Day, two digits (01-31) - required
hh = Hour, two digits (00-24) - optional, defaults same as observation time
nn = Minute, two digits (00-59) - optional. The nn defaults to 00 if not specified.

The creation date must be earlier than the valid date. With the -90, +10 rule ,this is an extreme case which should only occur if the observation is older than 90 years or the forecasts go more than 10 years into the future.

If the hour number is NOT given, the default is hour 24 if a time zone was given previously, else it is 12 if the time zone was given as Zulu time. This allows for an end-of-day value for mean or accumulated data types.

If minute and/or second numbers are NOT given, they default to zero (00).

4.4.3 Duration Code Variable: "DV" (optional)

The "DV" codes in Tables 11a and 11b are used to explicitly define durations not listed in Table 3. The "DV" code causes the decoder to look at an explicit duration specification "DVx" within the SHEF message. (The "x" specifies duration wherever a "V" appears in a parameter code for duration.) The duration "x" in the code "DVx" applies only to parameter codes containing a "V" as a duration code and which occur subsequent to the variable duration code in the message. For example, in order to code 9-hour precipitation amounts, specify "DVH9" followed by the parameter code "PPV." To code 5-monthly flow data, specify "DVM5" followed by the parameter code "QPV." The specification of "DVZ" deactivates the process and returns the duration to default value for that physical element if not explicitly specified in the parameter code.

4.4.4 Time Interval Specification: "DI±t" (required for .E format only)

The "DI±t" codes are used in the .E format data string to designate the time interval (either forward or backward) between values as shown in Table 12a. The plus ("+") in "DI±t" is optional. Table 12b lists the allowable range for each time interval code. If "DIN+15" were coded in the .E format data string, it would represent a 15-minute interval increment between data values. Coding "DIH-2" would represent a 2-hour interval decrement, while "DID+1" would indicate a daily interval. The time interval code does not require filling of the two-digit field as is required in the date-time elements. For example, "DIN5" is equivalent to "DIN05." Special case "End-of-Month" (DIE) code allows one to transmit end-of-month values in the .E format without concern for the different number of days in each month. The process is keyed using the latest explicit specification of time (hour, minute, or second) occurring in the last day of any month. Specification of "DIE" outside this last-day time window generates a SHEF error message.

4.4.5 Units Code Element: "DU" (optional)

The "DU" code defaults to English if not specified. "S" denotes "Standard International" (SI) or metric units. "E" denotes "English" units (used in respecification after "S" has been used). The units scaling is in accordance with standard defaults in Tables 1 and 7.

4.4.6 Data String Qualifier: "DQq" (optional)

The data string qualifier is an external means of explicitly qualifying all subsequent data element values in a message. Table 10 lists the "q" character codes and definitions. The specification of a "DQZ" deactivates the qualifier function and allows the parameter code and data value to assume the "no qualification" default.

4.4.7 Data Elements.

The data elements may consist of a parameter code, value, and qualifier. The parameter code and value must be separated by at least one blank for the .A format. For the .B and .E formats, the data elements are usually the data values. The data element value may be immediately followed by an optional qualifier.

The data element parameter code "pc" is an external character code of from two to seven characters and six keys used to identify data. All parameters in the SHEF are fully represented by a seven-character code, although in most external transmission applications only two or three characters are required with the remaining characters completely specified by default conventions.

The data element value "vvv" is the hydrometeorological data being transmitted. Code as a decimal or integer number using appropriate parameter code scaling. The plus ("+") and minus ("-") sign characters are supported but are not necessary for positive numbers.

The data element qualifier "q" is an optional external means of qualifying a particular data element value. Table 10 lists the "q" character codes and definitions. A qualifier attached to a data value within a data element overrides any previously specified data string qualifier (Section 4.4). No spaces are allowed between the data value and the qualifier.

4.5 Analysis of Elements Within the .B Format Body . There is a one-to-one correspondence between the parameter control string in the .B header and the data element string in the .B body. The time controls in the .B header apply to the data values in the .B body unless overridden by the date/data override specification. The date/data override applies only to that specific location identifier.

Multiple groupings of location identifier, date/data override, and data element string may appear on a single .B body line in order to reduce message size. This format is defined as the Packed .B format. A comma (",") is used to separate fields which would normally reside on separate lines. Special care must be exercised when coding the Packed .B format so that data elements in the .B body correspond directly to the parameter control string in the .B header. Ambiguity in the use of the comma (",") delimiter results in the termination of the program for that line and subsequent loss of data in the receiving database.

4.5.1 Location Identifier: "locid" (required)

The location identifier may begin in column one or may be preceded by a comma (",") in the Packed .B format; otherwise, rules in Section 4.1 apply.

4.5.2 Date/Data Override: "Dtxx" (optional)

When coded, "Dtxx" overrides the corresponding date/data fields in the .B format header for that location identifier only or until a comma (",") in the Packed .B format is encountered. Any date/data-quality code in the .B format header can be coded as the date/data override in the .B body. It applies only to that specific location identifier. When the date/data override is not coded, the data transmitted are assigned date and data codes as specified in the .B format header. If no date/data-quality codes are specified in the .B header, standard defaults are assigned. An override in the middle of a .B line only supercedes the positional date, not the relative dates on the .B line itself.

4.5.3 Data Element String: "vvv/vvvq/...." (required)

The data element string and location identifier must be separated by at least one blank but not more than 50 blanks, and data elements must be separated by a slash ("/"). Data element strings terminate with a colon (":") or a carriage return, or in the Packed .B format with a comma (","). A leading slash (/) means the first element is skipped. Two slashes together means the data element between is skipped. If an "M" is used, it means the data element will have a missing code rather than just being skipped.

4.6 .B Format Termination . ".END" in columns one through four specifies normal termination of the .B message. Failure to code ".END" results in the generation of a fatal SHEF error message.

CHAPTER 5 - RULES FOR CODING SHEF MESSAGES

5.1 Data Code Rules

5.1.1 Missing Data Codes.

The alphanumeric characters "+," "-," "m," "mm," "M," "MM," "-9999" coded as the data value can be used to indicate missing data.

5.1.2 Precipitation Data.

The "T" and "t" characters coded as a data value can be used to indicate a trace of precipitation (physical elements PC, PP, and PY) and are decoded as .001 inch. If the decimal point is omitted, it is assumed that the value was observed in hundredths of an inch and the value is divided by one hundred.

5.1.3 Repetitions and Revisions of Data.

The following are guidelines for handling repetitions and revisions to data. If appropriate, the SHEF decoder flags the data as being revised, but the posting program decides what values to overwrite in the target database.

5.1.4 Repetition of Data Values.

If data values are repeated for the same location identifier, date-time stamp, and parameter code, both parameter codes will be parsed without a syntax error; however, only the first parameter code should be posted to the target database unless the message has a revision "R" flag specified. Should the second parameter code hold the correct value, a separate SHEF "R" revision format message should be transmitted to the target database.

5.1.5 Revision of Data.

Actual data values in a target database should be revised using the ".AR," ".BR," or ".ER" revision feature in SHEF.

5.1.6 Revision of a "Missing" Data Value.

Should a missing data code reside in a database and a legitimate value be transmitted to the database in a "nonrevision" standard SHEF format, the actual value should overwrite the missing data code in the target database. If a legitimate value resides in a database, a transmitted missing code in a nonrevision standard SHEF format should not overwrite the legitimate value. The explicit specification of the revision code "R" should result in the overwriting of any data stored in a database for the same location identifier, date-time stamp, and parameter code.

5.2 Time Codes

5.2.1 Date Relative Character Code: "DRx"

The date relative character code enables one to either increment or decrement the last previous explicit date-time specified in the SHEF messages. For example, if a date relative of "DRH+6" then "DRH+12" is specified, the first time offset is 6 hours; the second is 12 hours (not 18 hours) from the last explicit time in the SHEF message.

The date relative code requires the use of signed whole integers corresponding to the date codes in Table 13a.

When the "DRx" code is used to increment or decrement the date-time, the entire time field need not be specified. For example, to increment the date-time stamp by 1 day greater than the latest explicitly specified date-time, code "DRH+24." This new date-time affects all data values which follow until the next explicitly stated date-time.

In the .B format body when the date/data override is specified, the "DRx" code operates on the date/data override. The date/data override is the last previous explicit date-time specified in the SHEF message.

Coding "End-of-Month" date relative (DRE) allows one to transmit end-of-month values without concern for the differing number of days in each month. The process is keyed using the latest explicit specification of time (hour, minute, or second) occurring in the last day of any month. Specification of DRE outside this last day-time window generates a SHEF error message.

5.2.2 Observation Time Changes.

Required changes in date-time within SHEF messages may be accomplished using the date/data-quality codes shown in Table 9a.

All time codes must be padded with zeros to fill the maximum positional size as shown in Table 9b. For example, June 1 would be coded "DM0601."

Time elements with magnitudes greater than hour carry over after redefinition of a larger time element. For example, if the existing month, day, hour, and minute are coded "DM02070830," and month and day are redefined to "DM0308," the hour and minute remain 0830 while the month and day are now March 8. An explicit specification of the entire observation time including second would be coded "DM0308/DH083030" or "DM0308083030." However, specification of hour (DHhh) alone forces minutes and seconds to zero unless explicitly specified using "DHhhnnss."

If hour (DH) is specified, it applies to the last explicitly stated month (DM) or day (DD).

5.2.3 **Semi-Annual Time Changes.**

The Uniform Time Act of 1966, mandated daylight saving time would begin on the last Sunday in April at 0200 local standard time. That time was amended by Public Law 99-359 (7/8/86) to the first Sunday in April beginning in 1987. **The Energy Policy Act of 2005 extended Daylight Saving Time in the U.S. beginning in 2007. Congress retained the right to revert to the 1986 law should the change prove unpopular or if energy savings are not significant. Going from 2007 forward, Daylight Saving Time in the U.S.**

- begins at **2:00 a.m. on the second Sunday of March** and
- ends at **2:00 a.m. on the first Sunday of November**

See Appendix F for exact dates of the time changes.

All SHEF messages regardless of time specifications are parsed to Zulu (GMT) for subsequent database posting.

Handling semi-annual time changes requires a definition of explicit and implicit SHEF time specifications. An explicit time specification is made through the use of date type elements (DS, DN, DH, DD, DM, DJ, DY, or DC). An implicit time specification refers to the use of the date relative in all SHEF messages or use of the .E format time interval code in the .E format.

The following sections specify exactly how semi-annual time changes are handled by SHEF:

5.2.4 Zulu Time.

For explicit specification, no translation is required and times are parsed as transmitted.

For implicit specification, no translation is required and times are parsed as transmitted.

5.2.5 Two-Character Time Zone Specification (daylight saving or standard).

For explicit specification, translation to Zulu is based on the difference in hours between the time zone specified in the SHEF message and Zulu. This difference is applied in the calculation of Zulu time for each time specified in the SHEF message.

For implicit specification, translation to Zulu is exactly the same as explicit in the paragraph directly above.

5.2.6 One-Character Time Zone Specification (daylight saving or standard).

For explicit specification, daylight to standard, the translation to Zulu is based on the difference in hours between Zulu time and the time standard in effect when each explicit time is specified. Times from 0101 to 0200 local time on the day in which the time standard changes from daylight to standard time is always parsed as daylight saving time.

Users are urged to specify either Zulu time, the two-character time zone specification, or implicit time specifications during the hour following the change from daylight to standard time (see example message below).

```
.A STNX 1031 C DH01/HG 1/DH02/HG 2/DRH+1/HG 3
```

The time translation for the above message is as follows:

Central	Zulu
0100	0600
0200	0700
DRH+1	0800
0300	0900

For explicit specification, standard to daylight, the translation to Zulu is based on the difference in hours between Zulu time and the time standard in effect when each explicit time is specified.

To code a message during this transition, remember that the time interval between 0201 and 0300 is invalid and will not be transmitted by SHEF (see example message below).

```
.A STNY 0425 C DH01/HG 1/DH02/HG 2/DH0301/HG 3
```

The time translation for the above message is as follows:

Central	Zulu
0100	0600
0200	0700
0301	0801

For implicit specification, when local times are implicitly specified using either second, minute, or hourly date relative codes or time interval, the absolute time increments will be maintained throughout changes in time standards. The last explicit specification of time will be converted to Zulu according to the applicable local time standard. All subsequent implicitly specified times relate, as coded to the explicit time specification, in Zulu.

When local times are implicitly specified using either daily, monthly, or yearly date relative codes or time interval, translation to Zulu time occurs after the implicit time specifications have been computed from the local explicit specification of time.

5.3 SHEF Message Syntax

5.3.1 Blank Character Fields.

A total of 50 consecutive blanks is allowed per line before decoding process is terminated.

5.3.2 Comments.

There are two types of comments used in SHEF. One is an internal comment used to pass information on to those visually inspecting the SHEF message. The internal comment is ignored by the decoding process. The second is a retained comment which is written to the SHEFOUT file along with the data value and all of its attributes.

Internal Comment Fields.

The colon (":") is the internal comment definition character and is allowed anywhere in a SHEF message with the exception that the dot (".") which initiates the decoding process must always occur in column one. The first colon encountered in a SHEF message terminates the decoding process. Any characters that follow are treated as internal comments and not decoded. A second colon or a carriage return encountered in a SHEF message resumes the decoding process. The first colon on a line always acts as an OFF switch. Any number of colons is allowable and functions as alternating OFF/ON switches. This enables internal comments to be interspersed within a line of SHEF-coded data. The colon should not be used as a punctuation mark in internal comments. All other rules for SHEF coding remain intact when the colon is used.

Retained Comment Fields.

Single or double quotes ("or ') are the retained comment definition characters and are allowed after any data value field. The retained comment will be associated with the SHEFOUT record for the immediately preceding data value. The first quote (double or single) encountered in a SHEF message initiates the comments retention process. Any characters that follow are treated as retained comments and are saved. A second quote (double or single, whichever was used to initiate retention), carriage return, or 15 blanks, whichever comes first, encountered in a SHEF message terminates the comments retention process. This enables retained comments to be interspersed within a line of SHEF-coded data. It also allows the quote (single or double, whichever was not used to initiate retention) to be used as a punctuation mark in retained comments. Retained comments may not be longer than 80 characters. If retained comments are longer than 80 characters they will be truncated and a warning message issued. All other rules for SHEF coding remain intact when the quote is used.

5.3.3 Continuation Lines.

Continuation lines are allowed in the .A and .E data strings and in the .B header. Continuation lines are not allowed in the .B body. SHEF syntax requires a slash ("/") separator for all elements in a data string or header. When coding a continuation line, the following rules apply:

- If no slash is specified at the end of one line or the beginning of the next, an implied slash is assumed.

- If a coded slash exists at either the end of one line or the beginning of the next, the decoder does not add a slash, thus avoiding the creation of an unintended null field.

- If a slash exists at both the end of a line and the beginning of another, the null field is assumed.

5.3.4 Filler Characters in the Parameter Code Field.

At times it may be necessary to specify the full parameter code PEDTSEP to completely define a data value. If, for example, the sixth character "E" (Extremum) required explicit definition but "D" (Duration), "T" (Type), and "S" (Source) could use standard defaults, a "Z" filler character could be used as a pointer to the default characters for "D," "T," and "S." Transmission of parameters "HGZZZX" and "HGIRZX" are equivalent, and translation is as follows:

Parameter Code	Transmitted Code	Full Translation
PE	HG	HG - None
D	Z	I - Instantaneous, HG default
T	Z	R - Reading, type default
S	Z	Z - Nonspecific, source default
E	X	X - Maximum of day

In SHEF parameter code character positions one and two, the "Z" cannot be used because those positions define the physical element transmitted. In parameter code positions three and four, the "Z" is used as a pointer to the default characters for duration and type. Positions five, six, and seven (source, extremum, and probability) already have default values of "Z" (except for some send codes) and is not translated.

5.3.5 Null Field.

A null field occurs whenever a slash ("/") is encountered in the data string instead of a data element or missing code. The null field implies no data value is transmitted for that physical element. The missing code implies a data value is transmitted for that physical element, but the value is not available.

Occasionally, when coding a .B format message, it may be easier to list all possible parameter codes reported by the stations in the header even though not all stations report every parameter. This is done in order to avoid transmission of separate SHEF messages for unique location and physical element combinations. For example, if a data element string in a .B body begins with a slash ("/"), the null field is assigned to the first parameter in the .B header. The SHEF decoder will not decode a value for the first parameter, and consequently no attempt can be made to place a value into receiving databases for that location and parameter.

If no legitimate data element value "v" is found between two consecutive slashes ("//"), the value is treated as a null field or no report. The SHEF decoder will not decode a value for the null field, and no attempt can be made to put a value into receiving databases for that station parameter.

In the .B format body, it is permissible to omit trailing slashes ("/"); null fields will result.

5.3.6 Record Length.

The record length for SHEF messages can vary but has a maximum length of 1000 characters (bytes). Caution should be exercised when going beyond the original limit of 80 characters, as the visual readability of the SHEF message is compromised to some degree.

5.4 Examples of SHEF Messages . Following are some examples of SHEF messages in the .A, .B, and .E formats with a description of each field within the message.

5.4.1 .A Format Message Examples.

EXAMPLE 1: ROUTINE TRANSMISSION OF SEVERAL PHYSICAL ELEMENTS

```
.A EGTM7 1120 C DH08/HG 5.75/QR 5.97/PP 2.15
```

`.A`	-	.A format message
`EGTM7`	-	Edgerton, MO
`1120`	-	November 20 (year nearest current date assumed)
`C`	-	Central local time (decoder determines daylight/standard)
`DH08`	-	Hour 8 a.m.
`HG 5.75`	-	Height, river 5.75 ft (instantaneous) (HG=HGIRZZZ)
`QR 5.97`	-	Discharge, river 5,970 cfs (instantaneous) (QR=QRIRZZZ)
`PP 2.15`	-	Precipitation, 24 hr ending at 8 a.m., 2.15 inches

EXAMPLE 2: ROUTINE TRANSMISSION OF ONE PHYSICAL ELEMENT IN ZULU TZ

```
.A CSAT2 0309 DH12/HG 10.25
```

`.A`	-	.A format message
`CSAT2`	-	Corsicana, TX
`0309`	-	March 9 (year nearest current date assumed)
`DH12`	-	Hour 1200Z (default since no time zone was specified)
`HG 10.25`	-	Height, river 10.25 ft (instantaneous) (HG=HGIRZZZ)

EXAMPLE 3: CHANGE MONTH/DAY CODE IN THE DATA STRING

```
.A MASO1 0907 C DH22/QR .12/DM0908/DH09/QR 5.0
```

`.A`	-	.A format message
`MASO1`	-	Massillon, OH
`0907`	-	September 7 (year nearest current date assumed)
`C`	-	Central local time (decoder determines daylight/standard)
`DH22`	-	Hour 10 p.m. (local time assumed)
`QR .12`	-	Discharge, river 120 cfs (instantaneous) (QR=QRIRZZZ)
`DM0908`	-	September 8 (current year assumed)
`DH09`	-	Hour 9 a.m.
`QR 5.0`	-	Discharge, river 5,000 cfs (instantaneous) (QR=QRIRZZZ)

EXAMPLE 4: CHANGE MONTH/DAY CODE, USE OF THREE CHARACTER "PC"

```
.A BON 810907 P DH24/QID 250./DM090806/QIQ 300./QIQ 310.
```

`.A`	-	.A format message
`BON`	-	Bonneville Dam, OR
`810907`	-	September 7, 1981
`P`	-	Pacific local time (decoder determines daylight/standard)
`DH24`	-	Midnight
`QID 250.`	-	Discharge, inflow 250,000 cfs (mean daily) (QID=QIDRZZZ)
`DM090806`	-	September 8 (current year assumed) 6 a.m.
`QIQ 300.`	-	Discharge, inflow 300,000 cfs (mean for 6 hours ending at 6 a.m.) (QIQ=QIQRZZZ)
`QIQ 310.`	-	Discharge, same time, parsed but not stored in database since no "R" revision code specified

EXAMPLE 5: REVISION OF DATA

```
.AR SRGT2 1212 C DH08/HG 37.5/HG 47.5
```

`.AR`	-	.AR format message for data revision
`SRGT2`	-	Spring Branch, TX
`1212`	-	December 12 (year nearest current date assumed)
`C`	-	Central local time (decoder determines daylight/standard)
`DH08`	-	Hour 8 a.m.
`HG 37.5`	-	Height, river revised to 37.5 ft (HG=HGIRZZZ)
`HG 47.5`	-	Height, river revised to 47.5 ft
	-	*** NOTE *** The first reading 37.5 will override any value stored at that time in the receiving database. The second reading overrides the first since the revision flag "AR" was turned on.

EXAMPLE 6: CODING A CONTINUATION LINE

```
.A SYRT2 1209 C DH1015/HG 12.7/PP .17
.A1 TX 107/TN 55
```

`.A`	-	.A format message
`SYRT2`	-	Seymour, TX
`1209`	-	December 9 (year nearest current date assumed)
`C`	-	Central local time (decoder determines daylight/standard)
`DH1015`	-	Hour 1015 a.m.
`HG 12.7`	-	Height, river 12.7 ft (instantaneous) (HG=HGIRZZZ)
`PP .17`	-	24-hr precipitation ending at 1015 a.m., .17 inch
`.A1`	-	First continuation of .A format message
`TX 107`	-	24-hr maximum temperature 107 degrees Fahrenheit (DF) (period ending 1015 a.m.) (TX=TAIRXZZ)
`TN 55`	-	24-hr minimum temperature 55 DF (period ending 1015 a.m.) (TN=TAIRNZZ)

EXAMPLE 7: ICE AND SNOW REPORT

```
.A MONO3 1231 P DH09/IR 128/SR 2033
```

.A	-	.A format message
MONO3	-	Monument, OR
1231	-	December, 31 (year nearest current date assumed)
P	-	Pacific local time (decoder determines daylight/standard)
DH09	-	Hour 0900 a.m.
IR 128	-	Ice report
	-	Structure = 1 (breaking)
	-	Type = 2 (cake)
	-	Cover = 8 (8/10 - 9/10 covered)
SR 2033	-	Snow report
	-	Structure = 2 (densely packed)
	-	Base of snow cover = 0 (no observation)
	-	Surface of snow cover = 3 (ice)
	-	Area description = 3 (drifted)

5.4.2 <u>.B Format Message Examples</u>.

EXAMPLE 1: ROUTINE ROUNDUP OF STAGE AND PRECIPITATION

```
.B TOP 1010 C DH08/HG/PP   : FIRST DATA  ROUNDUP FROM TOPEKA
: ID  STAGE, PRECIPITATION, STATION NAME
MRYK1 2.75/.50  :MARYSVILLE, KS
NLSK1 10.3/.55  :NILES, KS
LVNK1 5.7/+     :LEAVENWORTH, KS
MTTK1 +/2.75    :MANHATTAN, KS
.END
```

.B	-	.B format message
TOP	-	Message source, Topeka, KS, WFO
1010	-	October 10 (year nearest current date assumed)
C	-	Central local time (decoder determines daylight/standard)
DH08	-	Hour 8 a.m.
HG	-	Height, river (instantaneous)
PP	-	PP precipitation, increment (24-hr amount)
MRYK1 2.75/.50	-	Marysville, KS, stage 2.75 ft; 24-hr precipitation, .50 inch
NLSK1 10.3/.55	-	Niles, KS, stage 10.3 ft; 24-hr precipitation, .55 inch
LVNK1 5.7/+	-	Leavenworth, KS, stage 5.7 ft; 24-hr precipitation missing
MTTK1 +/2.75	-	Manhatten, KS, stage missing; 24-hr precipitation, 2.75 inches
.END	-	Normal termination of .B message

EXAMPLE 2: USE OF THE NULL RECORD TO POSITION DATA STRING

```
.B GEG 0107 P DH0830/SD/SF/TX/XW : SNOWFALL MESSAGE FROM SPOKANE
SQAW1 0/0/+/04
BPAW1 6/2/30/02
SPAW1 //38/02
.END
```

.B	-	.B format message
GEG	-	Message source, Spokane, WA, WFO
0107	-	January 7 (year nearest current date assumed)
P	-	Pacific local time (decoder determines daylight/standard)
DH0830	-	Hour 8:30 a.m.
SD	-	Snow, depth (inches)
SF	-	Snow, new (inches)
TX	-	Temperature, air (max) 24 hr
XW	-	Weather, current (two-character synoptic code)
SQUAW1	-	Snoqualmie Falls, WA
0/0/+/04	-	Snow depth 0; snow new 0; max. temp. missing; fog
BPAW1	-	Blewett Pass No. 2, WA
6/2/30/02	-	Snow depth 6; snow new 2; max. temp. 30 F; cloudy
SPAW1	-	Satus Pass, WA
//38/02	-	Does not report snow depth or new snow; max. temp. 38 F; cloudy
.END	-	Normal termination of .B message

EXAMPLE 3: RELATIVE DATE CONTROL FEATURE AND DATA ELEMENT QUALIFIER

```
.B PDX 1011 P DH06/HG/DRH-12/HG
:
: ID  6 AM STAGE THIS MORNING, 6 PM STAGE LAST NIGHT, STATION NAME
:
PHIO3 9.7/6.2E  :PHILOMATH, OR
JFFO3 4.5/7.2   :JEFFERSON, OR
.END
```

.B	-	.B format message
PDX	-	Message source, Portland, OR, WFO
1011	-	October 11 (year nearest current date assumed)
P	-	Pacific local time (decoder determines daylight/standard)
DH06	-	Hour 6 a.m.
HG	-	Height, river stage (instantaneous) (HG=HGIRZZZ)
DRH-12	-	Date relative control, subtract 12 hr from last explicitly specified date-time stamp. Date will be 6 p.m., October 10
HG	-	Height, river stage (instantaneous)
PHIO3	-	Philomath, OR
9.7/6.2E	-	River stage 9.7 ft; river stage 6.2 ft (estimated)
JFFO3	-	Jefferson, OR
4.5/7.2	-	River stage 4.5 ft; river stage 7.2 ft
.END	-	Normal termination of .B message

EXAMPLE 4: USE OF DATE-TIME OVERRIDE

```
.B PDR 0807 P DH05/SW/PC/DUS/TA
: THIS IS SELECTED SNOTEL DATA
ANRO3 DH0523/0.1/ 72.4/ 7.2          :ANEROID LAKE
BCDO3 DH0456/0.2/ 68.5/13.7          :BIGELOW CAMP
BLAO3 DH0508/0.0/122.9/22.6          :BLAZED ALDER
.END
```

.B	-	.B format message
PDR	-	Message source, NWRFC, Portland, OR
0807	-	August 7 (year nearest current date assumed)
P	-	Pacific time (decoder determines daylight/standard)
DH05	-	Hour 0500
SW	-	Snow water equivalent (in) (SW=SWIRZZZ)
PC	-	Accumulated precipitation (in) (PC=PCIRZZZ)
DUS	-	Units code definition (standard international) Degree Centigrade (DC)
TA	-	Temperature (DC) (TA=TAIRZZZ)
ANRO3	-	Aneroid Lake, OR
DH0523/	-	Date-time override, 0523 Pacific local
0.1/ 72.4/ 7.2	-	SW=0.1 (in), PC=72.4 (in), TA=7.2 (DC)
BCDO3	-	Bigelow Camp, OR
DH0456/	-	Date-time override, 0456 Pacific local
0.2/ 68.5/13.7	-	SW=0.2 (in), PC=68.5 (in), TA=13.7 (DC)
BLAO3	-	Blazed Alder, OR
DH0508/	-	Date-time override, 0508 Pacific local
0.0/122.9/22.6	-	SW=0.0 (in), PC=122.9 (in), TA=22.6 (DC)
.END	-	Normal termination .B format message

EXAMPLE 5: USE OF PY,PPP SEND CODE AND PRECIPITATION INCREMENT

```
.B FTW 0107 C DH13/PY/PPP
SRGT2 .25/1.75
SYRT2 .30/2.33
.END
```

.B	-	.B format message
FTW	-	Message source, Fort Worth, TX, WFO
0107	-	January 7 (year nearest current date assumed)
C	-	Central time (decoder determines daylight/standard)
DH13	-	Hour 1 p.m.
PY	-	Send code, 24-hour precip. increment ending at 7 a.m. local time January 7
PPP	-	Precipitation increment beginning at 7 a.m. local and ending at 1 p.m. local time
SRGT2	-	Spring Branch, TX
.25/1.75	-	24-hr precipitation ending at 7 a.m., .25 inch
	-	6-hr precipitation ending at 1 p.m., 1.75 inches
SYRT2	-	Seymour, TX
.30/2.33	-	24-hr precipitation ending at 7 a.m., .30 inch
	-	6-hr precipitation ending at 1 p.m., 2.33 inches

`.END`	-	Normal termination of .B message

EXAMPLE 6: PACKED .B FORMAT MESSAGE FOR STAGE AND PRECIPITATION DATA

```
.B CHI 1020 /HG/PP
GUNI2 1.9/ .20,RVRI2 3.5/ .35,MORI2 5.6 / 1.25  :GURNEE/RVRSID/MORRIS
WMTW3          M/     M     ,ALGI2     1.37/.19,PNTI2     2.30/     .57
:WILMOT/ALGNQUIN/PONTIAC
LSLI2 11.0//                                    :LA SALLE
.END
```

`.B`	-	.B format message
`CHI`	-	Message source, Chicago, IL
`1020`	-	October 20 (current year assumed) 1200Z default time
`HG`	-	Height, river stage (instantaneous)
`PP`	-	Precipitation increment (24-hour duration ending at 1200Z)
`GUNI2 1.9/ .20`	-	HG 1.9 ft; PP .20 in; Gurnee, IL
`RVRI2 3.5/ .35`	-	HG 3.5 ft; PP .35 in; Riverside, IL
`MORI2 5.6/1.25`	-	HG 5.6 ft; PP 1.25 in; Morris, IL
`WMTW3  M / M`	-	HG reported missing; PP reported missing; Wilmot, WI
`ALGI2 1.37/.19`	-	HG 1.37 ft; PP .19 in; Algonquin, IL
`PNTI2 2.30/.57`	-	HG 2.30 ft; PP .57 in; Pontiac, IL
`LSLI2 11.0//`	-	HG 11.0 ft; no report, no precipitation; collected at La Salle, IL
`.END`	-	Normal termination of .B message

EXAMPLE 7: USE OF DATE/DATA OVERRIDE IN .B FORMAT BODY

```
.B CHI 1010 DH08/HG/DRH+12/HG
STN1 1.0/2.0
STN2 DH0832/3.0/4.0
.END
```

`.B`	-	.B format message
`CHI`	-	Message source, Chicago, IL
`1010`	-	October 10 (year nearest current date assumed)
`DH08`	-	0800Z (.B header time)
`HG`	-	Height, river stage (instantaneous)
`DRH+12`	-	Date relative control, add 12 hr to last explicit time stamp
`HG`	-	Height, river stage (instantaneous)
`STN1`	-	Sample station 1
`1.0/2.0`	-	Stage 1.0 ft, 0800Z; stage 2.0 ft, 2000Z
`STN2`	-	Sample station 2
`DH0832/3.0/4.0`	-	Date/data override to time in .B header
	-	The date/data override applies to this data line only
	-	stage 3.0 ft, 0832Z; stage 4.0 ft, 2032Z
`.END`	-	Normal termination of .B message

EXAMPLE 8: STATE TEMPERATURE AND PRECIPITATION TABLES

```
.B DSM 830111 DH06/TX/DH12/TAIRZP/PP/SD/XW

:...IOWA...
:                                                       6AM
:                     HI   LO   PCPN  SNOW DEPTH  WEATHER
DSM  : DESMOINES    : 38 / 21 / .05 /            / 22 : SNOW
3OI  : LAMONI       : 36 / 25 / .02 /            / 22 : SNOW
3SE  : SPENCER      : 33 / 12 /     /     1      / 03 : CLOUDY
ALO  : WATERLOO     : 38 / 19 / .03 /            / 03 : CLOUDY
BRL  : BURLINGTON   : 38 / 25 / .02 /            / 00 : CLEAR
CID  : CEDAR RAPIDS : 36 / 20 /  T  /            / 01 : PTLY CLDY
DBQ  : DUBUQUE      : 36 / 20 / .05 /            / 00 : CLEAR
MCW  : MASON CITY   : 34 / 12 / .07 /     3      / 22 : SNOW
.END

NOTE:  HIGH YESTERDAY..LOW LAST 12 HOURS...24 HOUR PRECIP ENDING 6AM
CST
SNOW DEPTH AT 6AM CST..WEATHER AT 6AM CST
```

5.4.3 <u>.E Format Message Examples</u>.

EXAMPLE 1: ROUTINE TRANSMISSION OF GOES DATA

```
.E KIDW1 1012 Z DH0300/HGIRG/DIH1/17.2/17.4/17.6/17.8/17.6/17.4
```

.E	-	.E format message
KIDW1	-	Kid Valley, WA (GOES platform)
1012	-	October 12 (year nearest current date assumed)
Z	-	Zulu time (leaving out Z is equivalent to Z)
DH0300	-	Hour time stamp of first data value 0300Z
HGIRG	-	Height, river (ft, instantaneous) GOES
DIH1	-	Time interval between observations, 1 hr
17.2	-	17.2 ft at 0300Z
17.4	-	17.4 ft at 0400Z
17.6	-	17.6 ft at 0500Z
17.8	-	17.8 ft at 0600Z
17.6	-	17.6 ft at 0700Z
17.4	-	17.4 ft at 0800Z

EXAMPLE 2: TRANSMISSION OF DAILY PRECIPITATION AMOUNTS

```
.E WGLM8 1201 M DH06/PP/DID1/1.20/+/3.00/+/.55
```

`.E`	-	.E format
`WGLM8`	-	West Glacier Park, MT
`1201`	-	December 1 (year nearest current date assumed)
`M`	-	Mountain local time (decoder determines daylight/standard)
`DH06`	-	HOUR 6 a.m.
`PP`	-	24-hr precipitation
`DID1`	-	Time interval between observations, 1 day
`1.20`	-	1.20 inches ending 12/01 0600
`+`	-	Missing ending 12/02 0600
`3.00`	-	3.00 inches ending 12/03 0600
`+`	-	Missing ending 12/04 0600
`.55`	-	.55 inch ending 12/05 0600

EXAMPLE 3: TRANSMISSION OF END-OF-MONTH PRECIPITATION DATA

```
.E PDX 0331 P DH07/PPM/DIE01/5.71/6.21/3.73/1.20
```

`.E`	-	.E format
`PDX`	-	Portland, OR, WFO
`0331`	-	March 31 (year nearest current date assumed)
`P`	-	Pacific local (decoder determines daylight/standard)
`DH07`	-	0700 a.m.
`PPM`	-	Precipitation increment, monthly
`DIE01`	-	End-of-month indicator, 1-month interval
`5.71`	-	5.71 inches, monthly total ending March 31
`6.21`	-	6.21 " " " " April 30
`3.73`	-	3.73 " " " " May 31
`1.20`	-	1.20 " " " " June 30

EXAMPLE 4: TRANSMISSION OF DATA USING TIME INTERVAL DECREMENT

```
.E FWHT2 0131 C DH07/HGIRG/DIH-1/5.2/5.0/4.8/4.6
```

`.E`	-	.E format
`FWHT2`	-	Trinity River, Clear Fork, Fort Worth, TX
`0131`	-	January 31 (year nearest current date assumed)
`C`	-	Central local (decoder determines daylight/standard)
`DH07`	-	7 a.m.
`HGIRG`	-	Height, river (instantaneous) (ft) GOES
`DIH-1`	-	Time interval decrement 1 hr
`5.2`	-	5.2 ft at 0700
`5.0`	-	5.0 ft at 0600
`4.8`	-	4.8 ft at 0500
`4.6`	-	4.6 ft at 0400

CHAPTER 6 - THE SHEF PARSE SOFTWARE

6.1 Program Overview. The process of decoding a SHEF message and getting the data written to a database is a two-step process. The first step parses the SHEF message into the essential data. The second step is the posting step which takes the data and writes them to the database.

SHEFPARS is the program which does the parsing step. By parsing the entire SHEF message in one pass and creating as output a file of data, the parsing and posting steps become independent. As a result, SHEFPARS is independent of the database. The posting software reads the output file generated by SHEFPARS which contains the data that has been derived from the SHEF message.

The software architecture recognizes that, while different formats exist in SHEF, the majority of the elements which make up each format are also common to each format. This has been addressed by having software modules that deal with the common elements.

The main driver routine searches the message for a SHEF code. When one is found, it determines the format type and then calls the appropriate routine to decode that format. The following decoding processes are similar for the three SHEF formats:

- determine whether the current line is a continuation and if this continuation is valid
- extract the parameter code, data value, and all the attributes
- perform units and time conversions
- check for and write any warning and/or error messages to the SHEFPRINT file
- if no errors are encountered, write the data value and all the attributes to the SHEFOUT file
- repeat process until no more parameter codes are found

After the format is decoded, the main driver starts looking for more SHEF codes until the end of the message is encountered.

6.2 Files. The following files are needed by SHEFPARS:

SHEFIN
SHEFOUT
SHEFPARM
SHEFPRINT

6.2.1 SHEFIN.

SHEFIN is the message to be decoded. The file contains character data in records of no more than 1000 characters.

6.2.2 SHEFOUT.

This file holds the output of the SHEFPARS program and the input to the posting program. It is a sequential file with fixed length records, one for each piece of data. The data are all the descriptive information from the SHEF message even though some of it is not used by the posting program. All times on the files are in GMT and all units are English.

The format of SHEFOUT is described in Appendix H.

6.2.3 SHEFPARM.

This file contains all the parametric information necessary to validate and interpret SHEF messages for decoding.

The format of SHEFPARM and its parametric information are found in Appendix I.

6.2.4 SHEFPRINT.

This file contains a log of decoded SHEF messages and any warnings or errors. It also has the original message with warning and error messages interspersed and a pointer to the approximate location where the problem occurred. See Appendix J for list of SHEF error/warning messages.

At the completion of the decoding process, the total number of errors and warnings which occurred is written to the file.

6.3 Software Support. The Office of Hydrologic Development provides support for the FORTRAN 77 version of the SHEFPARS program. To obtain a copy of the SHEFPARS software or the test data set, contact the Office of Hydrologic Development at the following address:

NOAA/NWS/ Office of Hydrologic Development
W/OHD1, SSMC2
1325 East-West Highway
Silver Spring, MD 20910

CHAPTER 7 - USER'S GUIDE

This chapter is derived from the SHEF Field Office Users' Handbook, May 1985, and is included here for your convenience.

7.1 The .A Format SHEF Message

7.1.1 How to Code .A Format SHEF Message. All .A format SHEF messages have two parts. The first part is called the positional field, and the second part is called the data string.

Positional Field (.A)

Four groups of information can be entered in this field; however, only three are required as defined below:

- Columns one and two must contain ".A."
- Following a space after the ".A," a location identifier must be entered. This field allows three to eight alphanumeric characters; however, five-character NWS identifiers as specified in the NWS Communication Handbook No. 5 should almost always be used.
- Following a space after the location identifier, the two-digit month (01 = January) and the two-digit day of the month are required. The two-digit year (e.g., 95 for 1995) or two digit century are not required; however, if entered, it must precede the month or year (in the case of century). Therefore, the date group is either mmdd, yymmdd, or ccyymmdd.
- Following a space after the date group, the next group entered is time zone but is not required. Zulu (GMT) time is assumed unless otherwise specified.

Data String (.A)

The following rules should be applied in the data string:

- The data string is separated from the positional field by a blank and is terminated by a carriage return or a colon (":").
- All elements within the data string must be separated by a single slash ("/").
- Generally, the first element in the data string is the observation time element. The following are a subset of the instructions on coding observation times that are found in Chapters 4 and 5:

- If observation time is not included and local time zone is used, hour and minute of observation is assumed to be 2400.

- If observation time is not included and Zulu time is specified (or defaulted to), hour and minute of observation is assumed to be 1200.

- A time group is noted by DY for year, DM for month, DD for day, DH for hour, and DN for minute.

• Observation time codes can be easily expanded to finer detail when entering data.

  DY82/DM11/DD18 becomes DY821118
  DM09/DD01/DH06 becomes DM090106
  DD01/DH06/DN30 becomes DD010630

• Generally, the month and day should be entered in the "DATE" portion of the positional field and DHhhmm in the observation time portion.

Data Elements

The observation data in .A format must be preceded by the parameter code.

• Parameter codes - The complete parameter code is fully represented by a seven-character code. The seven characters represent six "keys" that fully describe the data (the first key has two letters and the remaining five keys have one letter each). Section 3.3 gives full detail on parameter codes.

• Data - Following the parameter code and separated by a space, enter the data value.

  The data value can be integer or decimal.

  The "+" and "-" sign characters can be used; however, when coding positive numbers, "+" is not necessary. In fact, "+" should not be used because it is used to indicate missing data.

  Data are always assumed to be in English units. To send metric units (SI), the preceding data element (remember, this is part of the data string and must be encoded with slashes around it) must be "DUS." All data units following "DUS" are in SI unless they are changed back to English units by entering "DUE."

Miscellaneous - How To Do (.A)

Missing Data Code:

> The character code "+" or "-" or "m" or "mm" (upper or lower case) coded as a data value represents missing data.
>
> The use of a "-9999" decimal or integer coded as a data value represents missing data.

Trace Code for Precipitation Increment:

> Trace code for precipitation increment (used with physical elements PC, PP, and PY).
>
> "T" character (upper or lower case) coded as data value represents an amount of "trace" or 0.001.

Stranger Station Report (locations without an established identifier):

> Use "Xxxxyyyy" where
> xxx represents the latitude (degrees decimal)
> (tens, units, and tenths of degrees)
> yyyy represents the longitude (degrees decimal)
> (hundreds, tens, units, and tenths of degrees)
> (i.e., X3080995 translates to latitude 30.8 degrees north and longitude 99.5 degrees west)
>
> Or, include the location name and description in the internal comment section if the latitude and longitude are not readily available. For example, code:
> :Masterville (5SE Dallas):

Length of line permissible for transmission:

> Up to 1000 characters per line may be used. When data entry is complete on a line (less than 1000 characters), use a carriage return (CR) to go to the next line.

Adding internal comments:

> When data entry is complete on one line but a internal comment is needed, enter a colon ":"; then enter the internal comment , followed by either another ":" or a carriage return.

Entering more location data than can fit on one line:

> This is where the SHEF continuation line feature is used. The second line of the .A format type requires ".A1" in the first three columns. Next, there is a space; then, begin entering more data elements (remember, a data element contains a parameter code, a space, and the data value). If additional lines are needed, add them and increment the integer after the ".A" (e.g., .A2, .A3, etc.).

Use of spaces:

> Do not enter more spaces than are necessary, since this makes a message unnecessarily long. Under some circumstances, spaces are desirable; and SHEF can handle up to 50 consecutive spaces (or blanks) on one line. However, if there are 51 (or more) consecutive spaces, the decoder software stops.

Splitting a data element on two lines:

> The parameter code, space, and data value must be on one line. When the data entry nears the end of a line, put in a carriage return, enter the continuation line (.A1 in columns one, two, and three of the next line), leave one more space, and then enter the complete data element.

Revising data previously reported as missing:

> If data is missing from a certain location when transmitting a report (e.g., a morning report), an "m" may be entered for the missing data. Later, when that location reports the data, it needs to be sent on. The most appropriate manner to replace missing data is to send it as a regular report. Use a regular .A format message and send the correct data value.

Revised data:

> Here you need to use the revision capability of SHEF. If a morning report was transmitted with a stage reading of 19.5 feet, and later an error was recognized, that it should have been only 9.5 feet, the report would need to be corrected. This is done by repeating the message with the 9.5 feet data value but using ".AR" in the first three columns of the line. All the information sent in the original report should stay the same except for .AR instead of .A and 9.5 instead of 19.5.

7.1.2 .A Format Examples

.A Format Message

EXAMPLE 1: TYPICAL HYDROMETEOROLOGICAL DATA REPORT

A typical hydrometeorological data report that looks like this:

STATION	FLOOD STAGE	PCPN 24HR	RIVER STAGE	CURMXMN TEMPS	PRESENT WX
ROSENDALE	18	0.00		38 52 24	OVCAST
SCHENECTADY	223	0.00	MISSING	32 46 22	OVCAST

The report would look like this in .A SHEF:

```
.A ROSN6 1201 ES DH0800/HO 18/PP 0./TA 38/TX 52/TN 24/XW 03
.A SCHN6 1201 ES DH0800/HO 223/PP 0./HG M/TA 32/TX 46/TN 22/XW 03
```

Notes:

ROSN6 does not report river stage (HG) routinely.

SCHN6 does routinely report river stage but, due to gage failure, the report is missing.

EXAMPLE 2: DISSIMILAR PARAMETER CODES

In this example, only one of the seven different parameter codes reported is shared by more than one location. Such a dissimilarity of parameter codes makes the message suitable for encoding in the .A format.

```
.A  AMIT2  850305 /HP 1099.21/QS 2.33/LA 50.75/LS 2353.73
.A  DLRT2  850305 /HG 2.41/HI 1
.A  EPPT2  850305 /HG 3.70/QR 2.85
```

NOTE: No ".END" is required with a .A format since each line that contains the .A format must be marked with .A in columns one and two and a number in column three, if this is a continuation line.

Line 1:

`.A`	-	.A format header code
`AMIT2`	-	Location whose data is being reported (Lake Amistad, TX)
`850305`	-	Date of observation is 03/05/85
`HP 1099.21`	-	Height of pool is 1,099.21 ft
`QS 2.33`	-	Spillway discharge is 2.33 thousands of cfs (2,330 cfs).
`LA 50.75`	-	Surface area of the lake is 50.75 thousands of acres (50,750 acres)
`LS 2353.73`	-	Lake storage is 2,353.73 thousands of acre-feet (2,353,730 acre-feet)

Line 2:

`.A`	-	.A format header code
`DLRT2`	-	Location whose data is being reported (Rio Grande River at Del Rio, TX)
`850305`	-	Date of observation is 03/05/85
`HG 2.41`	-	Gage height is 2.41 ft
`HI 1`	-	River Trend Indicator Code is 1 (river below flood stage and rising) (see Table 19 for complete river trend codes)

Line 3:

`.A`	-	.A format header code
`EPPT2`	-	Location whose data is being reported (Rio Grande River at Eagle Pass, TX)
`850305`	-	Date of observation is 03/05/85
`HG 3.70`	-	Gage height is 3.70 feet
`QR 2.85`	-	River discharge is 2.85 thousands of cfs (2,850 cfs)

EXAMPLE 3: RESERVOIR GATE OPENINGS AND ASSOCIATED DISCHARGES

In the example below, a .A format is used to send time series of reservoir gate openings (NG) and associated discharges (QS). The ".E" format could not be used because the time series is not evenly spaced.

```
.A   GPET2  0305 C   DH1500/NG O/QS O
.A1  DH1625/NG 1/QS 0.6/DH1830/NG 1/QS 1.2
.A2  DH1910/NG 2/QS 2.4/DH2005/NG 4/QS 4.8
.A3  DH2215/NG 8/QS 9.6/DH2314/NG 10/QS 12.0
.A4  DM0306/DHO214/NG 6/QS 7.2/DHO430/NG 3/QS 3.6
.A5  DH0600/NG 1/QS 1.2/DH0745/NG 0/QS 0
```

NOTE: Line five contains a new time group because the data reported fall into the next day.

7.2 The .B Format SHEF Message

7.2.1 How to Code .B Format SHEF Message. All .B format SHEF messages have three major sections. The first section is essentially the first line(s) and is referred to as the header. The second section is composed of several lines and is referred to as the body. The last section is one line and is referred to as the terminator.

The Header

The header can be thought of as an introduction to a speech, since it tells you what is in the body. The header also contains information similar to what is contained in the .A format message; however, no observed data are in the header. Two essential parts are required in the header: positional field and parameter control string.

Positional Field (.B Header)

Four groups of information can be entered here; however, only three are required as defined below:

- Columns one and two must contain ".B."

- Following a space after the ".B," a location identifier must be entered of the station (office) sending the data (this should not be confused with the station where the observation is reported). Generally, this is the three-letter identifier of the WFO, or RFC site.

- Following the space after the sending station identifier, the two-digit month (01 = January) and the two-digit day of the month are required. The two-digit year (e.g., 83 for 1983) or two digit century are not required; however, if entered, it must precede the month or year (in the case of century). Therefore, the date group is either mmdd, yymmdd, or ccyymmdd.

- Time zone is the last item in the positional field of the .B header (following a space after the date group). Time zone is not required; however, if left out, the observation time is expected to be in Zulu (GMT) time. See Section 4.1 for coding time zone.

Parameter Control String (.B Header)

The following rules should be applied in the parameter control string:

- The parameter control string is separated from the positional field by a blank and is terminated by a carriage return or a colon (":").

- All elements within the parameter control string must be separated by a single slash ("/").

- Generally, the first element in the parameter control string is the observation time element. Refer to Section 4.3 for details.

- Within the .B parameter control string, certain date/data type elements (observation time, creation date, unit's code, data string qualifier, duration code variable, and parameter code(s)) apply to all subsequent data value elements in the body of the .B format message.

- Within the .B parameter control string, observation time, creation date, units code, data string qualifier, duration code variable, and parameter code(s) may be specified or respecified.

The Body (.B)

The body contains station identifier(s) and data with optional date/data overrides.

The Terminator (.B)

The terminator contains ".END" in columns one through four.

Miscellaneous - How To Do (.B)

Missing Data Code:

The character code "+" or "-" or "m" or "mm" (upper or lower case) coded as a data value represents missing data.

The use of a "-9999" decimal or integer coded as a data value represents missing data.

Trace code for precipitation increment:

Trace code for precipitation increment (used with physical elements PC, PP, and PY).

"T" character code (upper or lower case) coded as a data value represents an amount of trace or 0.001.

Stranger Station Report (stations without an established identifier):

Use a “Xxxxyyyy” where:
xxx represents the latitude (degrees decimal)
(tens, units, and tenths of degrees)
yyyy represents the longitude (degrees decimal)
(hundreds, tens, units, and tenths of degrees)
(i.e., X3080995 would translate to latitude 30.8 degrees north and longitude 99.5 degrees west

Or, include the location name and description in the internal comment section if the latitude and longitude are not readily available. For example, code:

:Masterville (5SE Dallas):

Length of line permissible for transmission:

Up to 1000 characters per line may be used. When data entry is complete on a line (less than 1000 characters), use a carriage return (CR) to go to the next line.

Adding internal comments:

When data entry on one line is complete but a internal comment is needed, enter a colon “:”; then enter the internal comment , followed by either another “:” or a carriage return.

Use of spaces:

Do not enter more spaces than are necessary, since this makes a message unnecessarily long. Under some circumstances, spaces are desirable; and SHEF can handle up to 50 consecutive spaces (or blanks) on one line. However, if there are 51 (or more) consecutive spaces, the decoder software stops.

Revising data previously reported as missing:

If, when transmitting a report (e.g., a morning report), data are missing from a certain location, an “m” is entered for the missing data. Later, when that location reports, that data needs to be sent on. The most appropriate manner to replace missing data is to send it as a regular report. Use a regular .B format message and send the correct data value.

Revised data:

> Here you need to use the revision capability of SHEF. If a morning report was transmitted with a stage reading of 19.5 feet, and later an error was recognized, it should have been only 9.5 feet, the report would need to be corrected. This is done by repeating the message with the 9.5 feet data value but using ".BR" in the first three columns of the header line. All the information sent in the original report should stay the same except for .BR instead of .B and 9.5 instead of 19.5. Remember to use the terminator ".END" to end the .BR message.

NOTE: The terms "Unpacked" or "Packed" .B format are used, and the difference is this: Unpacked have one location per line, and Packed have two or more locations per line. In either case, more than one data type may be reported. It is important to remember that for Packed .B format the comma must be used to separate the reports of one location from the reports of the following location when both locations appear on the same line.

7.2.2 .B Format Examples

EXAMPLE 1: UNPACKED, ONLY ONE PARAMETER

In this example, a .B format message is used to present a routine morning roundup of lake pool elevations on a chain of lakes that stretches along the Colorado River from above Austin, Texas, through the city. This message could just as easily be placed in a Packed .B format if the creator of the message so desired.

```
.B EWX 850307 /HP
:LAKE LEVELS
:ID CODE   ELEV
BUDT2     1006.94  :BUCHANAN DAM
IKLT2      887.35  :INKS LAKE
GPLT2      825.18  :LAKE LBJ
MFDT2      737.20  :MARBLE FALLS
MSDT2      679.06  :LAKE TRAVIS
ALKT2      492.22  :LAKE AUSTIN
ASNT2      428.30  :TOWN LAKE
.END
```

NOTE: Since only year, month, and day (850307) are specified in the above example, the observation time defaults to 1200Z.

EXAMPLE 2: UNPACKED, MORE THAN ONE PARAMETER

The .B format is used to produce a routine morning roundup of river stages on some Kansas rivers. Also included is the stage trend indicator code.

```
.B TOP 0307 C DH06/HG/HI
:Location ID      STAGE  TREND   FS  LOCATION NAME   TREND CODES
:KANSAS RIVER                                         0=STEADY
TPAK1             3.21  /  2   : 21   TOPEKA          1=RISING
FRI               7.69  /  2   : 21   FORT RILEY      2=FALLING
LCPK1             4.75  /  2   : 17   LECOMPTON       3=UNKNOWN
DSOK1             7.77  /  2   : 24   DE SOTO
WMGK1             6.47  /  1   : 19   WAMEGO
KCKK1            10.40  /  2   : 23   23RD ST BRIDGE AT MKC
:
:STRANGER CREEK
TNGK1             5.51  /  1   : 22   TONGANOXIE
:MARAIS DES CYGNES RIVER
TPOK1            23.70  /  2   : 25   STATE LINE
:POTTAWATOMIE CREEK
GARK1              M    /  M   : 26   GARNET 4N
.END
```

EXAMPLE 3: UNPACKED, MORE THAN ONE PARAMETER

This example is a section of the routine daily hydrometeorological data message from WFO San Antonio.

WFO San Antonio has a group of locations that report stage, precipitation, and temperature daily. An Unpacked .B format was chosen because the complete set of parameter values for two locations on the same line would be too long.

```
.B EWX 850307 /HG/PP/TX/TN
DOWT2 3.2   /  0.00 / 65 / 57 :PRESSURE 30.12 WIND SE 9 FREEPORT
LBRT2  M    /  0.03 / 65 / 56 :EVAPORATION.11         LK BRAUNIG
EPPT2 3.8   /  0.06 / 62 / 56 :EAGLE PASS
FACT2 3.7   /       /    /    :FALLS CITY
.END
```

NOTE: WFO San Antonio elected not to encode the barometric pressure, wind direction and speed, and evaporation. This is quite all right as long as the data is presented in a internal comment field so that the decoder won't decode it.

EXAMPLE 4: PACKED, ONE PARAMETER

This example illustrates one of the most common uses of the single-parameter, Packed .B format message, a morning collection of 24-hour precipitation. This message illustrates the way WFO Lubbock, Texas, presents the precipitation collection from the Texas High Plains.

```
.B LUB 0301 C DH08/PP
BIST2   0.25, BNFT2  0.08, CBTT2  0.01, LAST2  0.20
LOCT2   0.02, LUB    0.01, PDCT2  0.02, SEMT2  0.20
SNYT2   0.06, TSPT2  0.01, THKT2  0.17
.END
```

EXAMPLE 5: PACKED, MORE THAN ONE PARAMETER

The routine message below is the hydrometeorological message from WFO Lake Charles, LA. WFO Lake Charles has 10 river gaging locations, 7 of which routinely report precipitation.

A Packed .B format featuring three locations to a line provides enough room to encode the needed data.

Notice that three of the locations have no precipitation amount, missing or otherwise, encoded. Instead, they have two consecutive slashes ("//") after the river stage. Consecutive slashes, separated only by (optional) blanks and containing no intervening data codes, indicate that this parameter code is not reported by the location.

```
:DAILY RIVER AND RAINFALL REPORTS
:RIVER STAGES (HG) AND PRECIPITATION (PP)
.B LCH 0305 C DH07/HG/PP
LKCL1  0.9   /  .04  , GLML1   13.7 //       , OKDL1  10.6 / .04
KDRL1  M    //       , OTBL1    5.3 /  .08   , LCHL1   2.9 / .07
LCRL1  3.0   /  .12  , BSLL1   21.3 /  .12   , MRML1   4.4 / .08
AEXL1 24.5  //
.END
```

7.3 The .E Format SHEF Message. Refer to Chapters 4 and 5 for details on this simple format. Examples should be sufficient to illustrate its use.

7.3.1 .E Format Examples

EXAMPLE 1: SERIES OF 6-HOURLY PRECIPITATION REPORTS

A series of 6-hourly synoptic precipitation reports are presented in this example. Since the time series is evenly spaced, the .E format is ideal.

```
.E HDO 850306 DH18/PPQ/DIH6/M/M/0.06/0.03
.E SJT 850306 DH18/PPQ/DIH6/0/0/0.06/0
.E MFE 850306 DH18/PPQ/DIH6/0/0/0/0
.E NQI 850306 DH18/PPQ/DIH6/0/0.04/0/0
.E ALI 850306 DH18/PPQ/DIH6/0/0.07/M/0.06
.E BRO 850306 DH18/PPQ/DIH6/0.17/0/0/0
.E DLF 850306 DH18/PPQ/DIH6/0/0/0.02/0.02
```

EXAMPLE 2: TIME SERIES WITH A CONSTANT TIME INTERVAL

Because the .E format message is intended for use in a time series with a constant time interval, this format is well suited for use with automated sensors that dump their data at specified times, which are evenly spaced.

In this example, river stage data from four automated sensors (three GOES Data Collection Platforms and one DARDC) are presented. The first GOES gage, DALT2 (Trinity River at Dallas, Texas), contains a time series of river stages every 6 hours beginning at 0515Z on May 5. The second GOES gage, SOUT2 (Brazos River near South Bend, Texas), contains river stages every 6 hours beginning at 1200Z on May 5. The third GOES gage, RMOT2 (Brazos River near Richmond, Texas), contains a time series of river stages every 12 hours beginning at 1101Z on May 4. The last DARDC gage, GDWT2 (Sabine River near Gladewater, Texas), contains river stages every 6 hours beginning at 1154Z on May 5.

```
.E DALT2 0505 Z DH0515/HGIRG/DIH06/18.03/17.25/15.58/15.11
.E1  14.89/15.06/15.59/19.35/16.71/16.56
.E SOUT2 0505 Z DH1200/HGIRG/DIH06/7.86/7.66/7.61/7.43/7.32
.E1  7.23/6.86/7.12/7.09
.E RM0T2 0504 Z DH1101/HGIRG/DIH12/6.10/6.68/7.98/9.01/9.20
.E1  9.01/8.62
.E GDWT2 0505 Z DH1154/HGIRP/DIH06/25.64/25.80/26.04/+/26.47
.E1   26.63/26.93/27.09/27.19
```

NOTE: In the data source designators above (the first three locations that report through GOES), the G in the parameter code HGIRG indicates the source is GOES. In the last location, the P in the parameter code HGIRP indicates the source is a telephone ASCII (DARDC). Refer to Table 4 for a complete list of type and source codes.

EXAMPLE 3: TIME SERIES OF ANNUAL PRECIPITATION TOTALS

This example illustrates the versatility of the SHEF code. This code is designed to provide much more information than the current river stage and the precipitation in the past 24 hours.

Here, SHEF code has been used to present a concise time series of the annual precipitation totals at the official observing site for Fort Worth for 16 years since 1968. Notice how the time and parameter codes have been encoded to show these data. The date is set to 2400 central time on December 31, and the initial year is set to 1968. The parameter code PPY is used to specify annual precipitation, and the time interval code is set to 1 year.

As a result, the data string represents precipitation (in inches) with an annual duration first year ending initially at 2400C on 12/31/68, with succeeding intervals of 1 year.

```
.E FTWT2 681231 C DH2400/PPY/DIY01/38.48/35.69/36.10/36.26
.E1 22.23/50.62/39.63/29.10/35.63/27.19/24.37/32.42/22.08
.E2 44.60/40.75/31.07/33.89
```

7.4 Applications of SHEF Coding. This section demonstrates the versatility of the SHEF code and illustrates how the code may be utilized to construct messages that fulfill a variety of needs arising from differing reporting times, missing data, etc. Of course, the ability to encode a wide variety of reports also increases the complexity of the code, making message encoding somewhat more difficult. However, most offices issue the same type of message routinely, thereby decreasing the difficulty of encoding as the staff becomes familiar with the message construction.

It is impossible to present in this section examples of all types of messages that can be issued since there is an infinite variety. If the need arises to encode a particular message, consult with the regional SHEF Focal Point or RFC for guidance. The Focal Point can help to encode a message to fit a particular situation.

7.4.1 Encoding Late Reports. Reports often arrive anywhere from several hours to a day or more late in an office. Some cooperative stations only report precipitation if the amount exceeds a criteria (e.g., 0.1 inch) but will include the value on subsequent days where the precipitation amount does exceed the criteria.

Such cases are easily handled with a date-time stamp. The date-time stamp, which consists of the CCYYMMDD or YYMMDD or MMDD field and the “D” codes that denote date-time, define the time of a data observation. These can be changed at will in a message.

There is another way to indicate an old report if the report is at the previous 7 a.m. A series of send codes (PY, HY, and QY) are used to indicate 24-hour precipitation ending at the previous 7 a.m., river stage at the previous 7 a.m., and river discharge at the previous 7 a.m., respectively. Users of the send code, however, should be aware that the three send codes above cannot be used with an explicit or implied Zulu time code.

Users of these send codes must also be aware of the time stamp associated with these send codes when they are written onto the SHEFOUT file by the SHEF decoder. If the date-time of the message is prior to 7 a.m., the date-time stamp of the send code in the SHEFOUT file is the Z time equivalent of 7 a.m. yesterday. If the date-time of the message is 7 a.m. or later, the date-time stamp of the send code in the SHEFOUT file is the Z time equivalent to 7 a.m. today.

There are two methods which can be used to ensure that yesterday's 7 a.m. data are written onto the SHEFOUT file with yesterday's 7 a.m. date-time stamp: (1) time-stamp today's message with a time earlier than 7 a.m.; or, (2) continue to use a 7 a.m. time stamp using the date relative feature of the SHEF code to refer to yesterday. Examples 1 and 2 to follow illustrate these features. Example 3 illustrates how to encode data that are not necessarily precipitation or stage, also illustrating how to encode data when the date of the report is not necessarily at 7 a.m. with the same time yesterday as today.

EXAMPLE 1: PRECIPITATION YESTERDAY

In this message, WFO San Angelo wanted to send yesterday's precipitation in today's message with the PY code. To ensure that both today's and yesterday's data received a reasonably correct date-time stamp, the current hour was encoded to a time close to, but prior to, 7 a.m. local. The message can contain a time up to DH0659 and still have both yesterday's and today's precipitation properly time stamped.

```
.B SJT 850223 C DH0630/PP/PY
BLRT2  1.61/.24 , CLBT2  0.90/.15 , MSNT2  1.50/.07
NTNT2  0.60/.35 , WGTT2  0.50/.27
.END
```

NOTE: The use of a time zone code is mandatory, because the send codes HY, PY, and QY (Table 2) cannot be used with a Zulu time code. Year is 1985, month 02, day 23, data is for 07 central time for today's report (PP) and yesterday's report (PY).

EXAMPLE 2: RIVER STAGES YESTERDAY

As in example 1a, some data for yesterday at 7 a.m. (in this case river stage) are to be reported with data for 7 a.m. today. In this message, however, the date relative code was used to time stamp data for yesterday, and the SHEFOUT file time stamp problems with the send code HY have been avoided.

NOTE: The use of Zulu time with a send code is illegal; therefore, local time zone codes must be used as shown in this example.

```
.B FTW 850315 C DH07/HG/DRD-1/HG
EMYT2 10.35/ 9.39 , MLAT2  9.67/ 7.14
QTMT2   M  /  M   , GDWT2 10.21/ 9.60
LONT2  9.50/ 9.50 , TLCT2 23.13/ 5.36
NAPT2 15.40/11.00
.END
```

EXAMPLE 3: ENCODING EARLIER REPORTS NOT NECESSARILY YESTERDAY AND NOT NECESSARILY PRECIPITATION

This message contains data observed on a previous day, just like Example 1a. However, the data to be encoded are not necessarily precipitation or stage; and the date of the report is not necessarily at 7 a.m. with the same time yesterday as today. Therefore, the send codes PY and HY cannot be used. Instead, the date-time stamp must be explicitly respecified to conform to the time the earlier observation was taken.

NOTE: If the date-time stamp is changed in the .B format header line or in the .A format, that date-time stamp remains in effect until it is changed again.

```
.B SHV 850315 C DH07/HG/DY850314/DH17/HG
    DEKT2 18.9 / 18.4 , INDA4 13.0 / 12.9 , FLTA4 14.7 / 14.0
    SVPL1 16.4 / 16.7 , GREL1   M  / 23.2 , MLUL1 30.2 / 28.8
    WCIO2  4.5 /  4.0 , IDBO2 15.0 / 14.6 , HRTA4 18.2 / 18.8
.END
```

NOTE: Using the DY code to redefine the observation time is one of many ways to change the date.

7.4.2 Encoding “Stranger” Reports. “Stranger” reports are reports from unofficial locations for which no five-character identifier exists. Such reports can come from a variety of sources, including radio and TV stations, law enforcement agencies, community rainfall networks, or private citizens. Even though such reports are infrequently received, it may at times be important to have them deciphered by the SHEF decoder and perhaps stored in a database.

The primary way to encode stranger reports is to fabricate an eight-character identifier beginning with the letter X and followed by seven digits, as described below:

Use “Xxxxyyyy” where:
- xxx represents the latitude (degrees decimal)
  - (tens, units, and tenths of degrees)
- yyyy represents the longitude (degrees decimal)
  - (hundreds, tens, units, and tenths of degrees)
  - (i.e., X3080995 would translate to latitude 30.8 degrees north and longitude 99.5 degrees west)

The message containing the stranger reports can be in any SHEF format, and the fabricated identifier can be mixed with legitimate identifiers.

EXAMPLE 1: USE OF LATITUDE/LONGITUDE IDENTIFIER

The message below contains a mixed bag of legitimate identifiers and fabricated stranger station identifiers. Fabrication of a stranger station identifier allows the SHEF decoder to place the report in the SHEFOUT file so that the posting software can process the report.

```
.B ABI 0412  C DH07/PP
:  RAINFALL REPORTS, ABILENE TEXAS
ALBT2 1.04     , ALYT2 1.22   , EULT2  .97
:  RAINFALL REPORTS - NO 5 CHARACTER IDENTIFIERS AVAILABLE
X3230986 2.00 , X3211005 1.80 : DESDEMONA, MARYNEAL
.END
```

The colon “:” allows for internal comments to aid in the identification of the report.

EXAMPLE 2: NO FABRICATED IDENTIFIER

This is another way to enter stranger reports, or unofficial reports, that have no five-character identifier. By placing internal comment lines after the “.END,” the computer will not process these lines. Of course, the reports won't be processed either, unless done manually.

```
.B FTW 840504  /PP
CYUT2  M    ,CHIT2  0.40              :CAYUGA,CEDAR HILL,
CMTT2  M    ,CLKT2  0.78 ,CLET2  M    :CHALK MT,CLARKSVILLE,CLEBURNE
DRFT2  M    ,DECT2  M    ,DSNT2  0.30 :DANGERFELD,DECATUR,DENISONDAM
ETNT2  M    ,EDMT2  M    ,EMRT2  0.73 :EASTLAND, EDOM 3NNW, EMORY
FWCT2  0.30 ,FRST2  M    ,FRTT2  M    :FTW DWNTWN,FRISCO,FROST
MCTT2  1.50 ,MWLT2  M    ,MLAT2  M    :MID CITY,MINERAL WELL,MINEOLA
MKST2  1.78 ,MNMT2  M    ,MPLT2  M    :MONKSTOWN,MORGAN,MT PLEASANT
RUKT2  M    ,SCNT2  M    ,SHET2  1.26 :RUSK,SCRANTON,SHERMAN PUMP
TYLT2  M    ,VVIT2  1.90 ,WAXT2  M    :TYLER,VALLEY VIEW,WAXAHACHIE
WKLT2  M    ,WINT2  0.66 ,WLFT2  M    :WINKLER,WINNSBORO,WOLFE CITY
.END
: DESDEMONA (15 MI SE OF EASTLAND) 1.25
: DALLAS AREA RAINFALL REPORTS
: CASA LINDA (7 MI EAST OF LOVE FIELD) 0.57
: HIGHLAND PARK (3 MI EAST OF LOVE FIELD) 0.68
: HOUSTON FIRE STATION #2 0.88
```

The stranger reports appear as internal comments after .END. If the location of the report is not well known, include a reference to some better known town (e.g., 15 mi SE of Eastland in the Desdemona report).

7.4.3 Continuation Lines In .A or .E Format Message or a .B Format Header.

If a .A or .E format message, or a .B format header, extend onto other lines, use successively increasing digits to encode extra lines. Below are three continuation examples.

EXAMPLE 1 - .A FORMAT CONTINUATION LINE

```
.A FWOT2 850326 C DH06/HG 0.77/DH0730/HG 0.82/DH10/HG 1.04
.A1 DH1245/HG 0.95/DH1530/HG 0.87/DH20/HG 0.82/DH22/HG 1.00
.A2 DD032701/HG 1.75/DH0225/HG 3.44/DH0345/HG 1.55/DH06/HG 1.15
```

EXAMPLE 2 - .E FORMAT CONTINUATION LINE

```
.E TRNT2 850326 C DH08/QS/DIH01/00.000/00.888/00.888/01.776
.E1 00.888/00.888/01.776/01.776/03.552/07.104/14.208/03.552
.E2 03.552/07.104/14.208/14.208/07.104/03.552/01.776/01.776
.E3 00.888/00.000/00.000
```

EXAMPLE 3 - .B FORMAT CONTINUATION LINE

```
.B SAT 0327 C DH06/HPIRG/PPQ/QSQ/DRD-6/HPIRG/PPQ/QSQ
.B1 /DRD-12/HPIRG/PPQ/QSQ/DRD-18/HPIRG/PPQ/QSQ
TBLT2 2.2/0.16/2.25/2.3/0.22/2.02/2.3/0.00/2.02/2.3/0.15/2.12
CTDT2 2.5/0.05/0.04/2.4/0.00/0.03/2.4/0.01/0.00/2.4/0.00/0.03
.END
```

7.4.4 Encoding Reservoir Data Messages. Below are two examples of SHEF messages containing reservoir data.

EXAMPLE 1 - RESERVOIR POOL ELEVATION, ENERGY PRODUCED FROM PUMPED WATER, AND PRECIPITATION

The parameter codes used in the following message from Atlanta, GA are:

HP is reservoir pool elevation.

VJ is the energy, in megawatt hours, produced from pumped water.

PP is 24-hour precipitation ending at the time indicated (7 a.m. eastern).

```
.B ATL 0328 E DH07/HP/VJ/PP
CLBG1 519.9/792/0.00 ,TIGG1 1854.5 /M  /0.00  :BARTLETTS, BURTON
GOTG1 400.3/M  /0.00 ,JKNG1  525.9 /223/0.00  :GOAT ROCK, JACKSON
SNCG1 338.3/266/0.00 ,TUGG1  888.4 /M  /0.00  :SINCLAIR, TUGALO
WDMG1 434.7/M  /0.00 ,YNHG1  743.3 /38 /M     :WALLACE, YONAH
WWCG1 531.0/M  /0.00                          :CRISP COUNTY
.END
```

EXAMPLE 2 - RESERVOIR POOL ELEVATION, SPILLWAY TAILWATER ELEVATION, PRECIPITATION, AND RESERVOIR DISCHARGE

The following message from Jackson, MS contains two additional parameter codes:

HW is a spillway tail water elevation.

QT is total discharge from the reservoir. (in thousands of cfs)

```
:  JAN RESERVOIR DATA 900 AM CST THU MAR 28 1985
.B JAN 0328 C DH06/HP/HW/PP/QT
: STN ID   POOL      TAILW    PCPN   DISCH K CFS
JSNM6     295.71  /  259.51 / 0.50  /  4.300    : BARNETT
DNNM6     410.1   /  330.3  /  .31  /           : BAY SPRINGS L&D
ABEM6     190.1   /  163.6  /  .17  /           : ABERDEEN L&D
CBUM6     163.5   /  137.1  /  .39  /           : COLUMBUS L&D
ARKM6     210.1   /         /  .07  /   .650    : ARKABUTLA
SRDM6     242.8   /         /  .10  /   .250    : SARDIS
ENDM6     235.1   /         /  .37  /   .100    : ENID
GRNM6     197.6   /         /  .70  /   .100    : GRENADA
BMDA4             /         / 0.00  /  6.393    : BLAKELY, AR
DGDA4             /         /  .10  /  2.634    : DEGRAY, AR
NARA4             /         / 0.00  /  1.244    : NARROWS, AR
.END
```

7.4.5 Encoding Power Generation Information at a Reservoir. At many reservoirs where hydroelectric power is produced, data are transmitted each day to the NWS. These data include the total amount of energy produced during the past 24 hours, plus an estimate of the power they will produce during the next 24 hours. This power estimate is, in reality, a forecast and is encoded in SHEF as such. Since this is a forecast, the message should include the creation date of the forecast (estimate). The creation date is arbitrarily determined as the time the reservoir forecast was received at the local weather office.

EXAMPLE 1 - OBSERVED AND FORECAST POWER GENERATION

```
.B CAE 0401 E DH00/DC04010600/VED/DRD+1/VEDF
CHDS1 0.45/0.36
MTGN1 0.27/0.16
WATS1 0.35/0.07
.END
```

What we have here is both past and future power values in megawatt hours. Power generated during the past 24 hours ends at midnight April 1 eastern time. VED denotes power in megawatt hours, daily (24 hours) value. DRD+1 establishes a future forecast duration of 24 hours (thus ending on April 2 at midnight), and VEDF specifies the value as being daily megawatt hours for the future (forecast) day.

NOTE: DC04010600 is a creation date (April 1, 0600 eastern time). For location CHDS1, there is 0.45 megawatt hours past day and a forecast of 0.36 megawatt hours next day.

EXAMPLE 2 - OBSERVED AND FORECAST POWER GENERATION

Below is another such power report, this time out of Atlanta.

```
.B ATL 0401 E DH00/DC04010600/VED/DRD+1/VEDF
HRTG1  500/450
CLBG1  575/650
.END
```

7.4.6 <u>Encoding Paired Value ("Vector") Physical Elements</u>. SHEF allows two (2) values for any of the ten (10) physical elements that are designated as "paired value" or "vector" physical elements. This capability allows paired values to be encoded to describe a vector of physical information at a station location for a single time, as opposed to a simple scalar. For example, soil temperatures can be encoded for different depths (soil profile) for later decoding. The following ten SHEF physical elements exist:

HQ = Distance from a ground reference point to the river's edge to estimate stage (value units are feet to river's edge for a specific marker number)
MD = Dielectric constant at depth (value units are dimensionless dielectric constant at depth in the soil in inches)
MN = Soil salinity at depth (units are grams per liter of salinity at depth in the soil in inches)
MS = Soil moisture amount at depth (value units are inches of soil moisture amount at depth in the soil in inches)
MV = Percent water volume at depth (value units are percent soil moisture volume at depth in the soil in inches)
NO = Gate opening for a specific gate (value units are feet of lock/dam gate opening for a specific lock/dam gate number)
ST = Snow temperature at depth measured from ground (value units are degrees Fahrenheit at depth in the snow in inches measured up from the soil surface into the snow)
TB = Temperature in bare soil at depth (value units are degrees Fahrenheit at depth in the soil in inches)
TE = Air temperature at elevation above MSL (value units are degrees Fahrenheit at elevation above MSL in feet)
TV = Temperature in vegetated soil at depth (value units are degrees Fahrenheit at depth in the soil in inches)

To illustrate how the data for paired value physical element data type are "encoded" into a SHEF message, consider the following explanation using the "TB" and "TV" data types. The temperature of the soil at various depths below either a bare surface – "TB," or a vegetated surface – "TV," can be specified in an encoded fashion in SHEF by using two-integer numbers connected by a decimal point in the following way:

Depth (inches).temperature (degrees Fahrenheit)

For "TB" and "TV," only the English units of inches and degrees Fahrenheit may be used. The integer to the left of the indicated decimal point ("depth") is always treated as a positive whole number. The integer to the right of the indicated decimal point ("temperature") is always treated as a floating point number with its "real" decimal point located three positions to the right of the "indicated" decimal point. The first digit to the right of the indicated decimal point is the hundreds digit, the second is the tens digit, the third is the units digit, the fourth is the tenths digit, etc. Therefore, leading zeroes may be necessary to properly encode the temperature value in degrees Fahrenheit. If a "TB" or a "TV" observation is encoded in SHEF with a minus sign (i.e., - depth.temperature), then the minus sign applies only to the temperature value, not the depth value.

The SHEF parser, which is the subject of this document (see Chapter 6.1), by design takes the SHEF message and reduces it to an item by item machine readable file (SHEFOUT). In this special case where you have an encoded piece of data representing two integers connected by a decimal point in the format independent.dependent, the parser simply passes the real number on. It is the SHEF poster (specific to a target database) that ultimately breaks this coded value into specific separate values and writes them to the database – in this case depth and temperature.

EXAMPLE 1: SOIL TEMPERATURE (PROFILE) VECTOR DATA

```
A AMIT2 0124 DH12/DC012412/TB 6.065/TV 12.056/
```

.A	:	Format Specifier
AMIT2	:	Location whose data is being reported (Lake Amistad. TX)
0124	:	Data ending January 24 (current year assumed)
DH12	:	1200 Zulu
DC012412	:	Creation date of forecast January 24 1200Z
TB 6.065	:	Temperature, 6 inches below a bare surface is 65° F
TV 12.056	:	Temperature, 12 inches below a vegetated surface is 56° F

12.056 is interpreted as “at 12 inches below the surface, the temperature is 56 degrees Fahrenheit.”

6.065 is interpreted as “at 6 inches below the surface, the temperature is 65 degrees Fahrenheit.”

-21.0058 is interpreted as “at 21 inches below the surface, the temperature is -5.8 degrees Fahrenheit.”

1.1353 is interpreted as “at 1 inch below the surface, the temperature is 135.3 degrees Fahrenheit.”

All nine (9) other SHEF paired value physical element data types are treated in EXACTLY the same fashion as TB and TV. In some cases (e.g., non-temperature data types), negative encoded values make no sense, however, they will be decoded in exactly the same way by the SHEF Decoder poster. Note: there is a technical limitation on the largest absolute data value (i.e., 999.9999999) that may be encoded this way. Given the data types involved, this does not appear to be a practical limitation.

With respect to the posting of missing “paired” data (e.g. temperature at a certain soil depth) if the value is encoded as missing (-9999.), then both values are stored as missing. Also, if only the dependent value (i.e. temperature) is missing, which is the more typical case, then the value is expected to be set as -#.9999, so that the independent value still gets a valid number (e.g. 2 feet if the number is -2.9999) and the dependent value is missing (e.g. missing soil temperature at 2 feet).

7.4.7 Encoding Miscellaneous Data Types.

EXAMPLE 1: ENCODING UNEVENLY SPACED TIME SERIES DATA

The easiest way to encode evenly spaced time series data in SHEF is to use the .E format. In SHEF, an unevenly spaced time series can be encoded by using the “D” codes to reset the observation time for each observation and sending the message in either .A or .B format. See Tables 9a and 9b for a more detailed explanation of the date/data type elements. It may also be necessary to change the day of the month.

In the example below, there are several river stage readings for the Guadalupe River at Comfort that need to be encoded. Since the time series is not evenly spaced, a .E message is undesirable.

Notice how the .A format is continued onto extra lines with the .A1, .A2, and .A3 in the succeeding lines.

```
.A  COMT2 850327 C DH07/HG 1.89/DH1422/HG 2.44/DH1635/HG 8.71
.A1 DH1707/HG 7.77/DH1745/HG 11.42/DH2022/HG 4.78/DH2315
.A2 HG 12.55/DD280020/HG 17.02/DH0140/HG 12.00/DH0420
.A3 HG 27.21/DH0700/HG 10.55
```

Explanation of message: 03/27/85	0700C	River	Stage	l.89
	1422C	“	“	2.44
	1635C	“	“	8.71
	1707C	“	“	7.77
	1745C	“	“	11.42
	2022C	“	“	4.78
	2315C	“	“	12.55
03/28/85	0020C	“	“	17.02
	0140C	“	“	12.00
	0420C	“	“	27.21
	0700C	“	“	10.55

EXAMPLE 2: A MESSAGE INVOLVING SNOW DATA

The example below illustrates a SHEF-coded message containing the more common snow-related hydrologic variables.

SD is snow depth.

SW is snow water equivalent of the accumulated depth of snow on the ground.

PP is 24-hour precipitation (liquid).

SF is 24-hour snowfall.

```
.B SGF 0211 C DH07/PP/SF/SD/SW
:
: PRECIPITATION AND SNOW REPORTS
: NATIONAL WEATHER SERVICE SPRINGFIELD MO
: 930 AM CST MON FEB 11 1985
:
:         24HR   SNOW  SNOW   WATER
:         PREC   FALL  DEPTH  EQUIV.
GLNM7     0.13 / 1.5 /   0  /          : GALENA
GLCM7     0.65 / 2.8 /   2  /  0.18    : GOLDEN CITY
OZRM7     0.82 / 3.5 /   3  /  0.46    : OZARK BEACH
WACM7     0.09 / 1.2 /   8  /  1.14    : WACO
.END
```

NOTE: In the above example (see lines 3, 4, and 5), the type of report, issuing office, and time the report was created is imbedded within the actual SHEF message using the SHEF internal comment feature.

EXAMPLE 3: A TEMPERATURE, PRECIPITATION, AND RIVER STAGE ROUNDUP COLON USAGE

Note that on several of the lines in the example below there are two, or even four, colons. This is the internal comment field "turn-on/turn-off" feature of SHEF. All characters between the two sets of colons are treated as internal comment fields and are not processed. The first colon turns the internal comment field "ON," while the second colon turns it "OFF." The ON/OFF feature operates on each line only (i.e., it does not carry over to the next line). The process continues for any succeeding colons encountered in the message. The message is for data March 28, 0700 hours mountain (M) time.

```
:LOCATION                   MAX      MIN      CUR      PCPN

.B ELP 0328 M DH07/TX/TN/TA/PP
:
: PANTHER JUNCTION  :  PAJT2  87   /   60   /   70   /   .00
: CHISOS BASIN      :  BBPT2  77   /   58   /   61   /   .00
: BOQUILLAS         :  BOQT2  96   /   60   /   73   /   .00
: CASTOLON          :  CSTT2  95   /   75   /   75   /   .00
: PERSIMMON GAP     :  PNGT2  92   /   58   /   68   /   .00
.END
.B ELP 0328 M DH07/HG/DUS/HG/HI
:
: RIVER STAGES        FEET      METERS         TENDENCY
:
: PRESIDIO   : PRST2   4.9   /   1.49     /  : STEADY : 0
: CASTOLON   : CSTT2   2.2   /    .66     /  : STEADY : 0
: BOQUILLAS  : BOQT2   2.9   /    .88     /  : STEADY : 0
: DRYDEN     : DYNT2   3.7   /   1.73     /  : STEADY : 0
.END
```

EXAMPLE 4: 6-HOURLY DUMPS OF AUTOMATED GAGES

This example is a dump of the 6-hourly precipitation accumulations of the Tennessee Valley Authority (TVA) rain gages. Note that these gage readings are taken at 6 a.m., noon, 6 p.m., and midnight. Therefore, the "PPP" parameter code cannot be used to encode the 6-, 12-, and 18-hour accumulations because these time periods do not begin at 7 a.m. Instead, use PPQ for the 6-hour accumulation, PPK for the 12-hour, and PPL for the 18-hour. PP or PPD can be used for the 24-hour.

```
:  TENNESSEE VALLEY ACCUMULATIVE RAINFALL
:
.B MEM 0415 C DH06/DRH-18/PPQ/DRH-12/PPK/DRH-06/PPL/DRH-00/PP
:ID    NOON   6PM   MIDN  6AM          NOON   6PM   MIDN  6AM
GCLV2       /     /     / .04,  MASN7       /     /     / .07
PLMN7       /     /     / .28,  BAKN7       /     /     / .06
SPEN7  .00  / .00 / .20 / .26,  YNCN7  .00  /  00 / .06 / .16
CLPN7       /     /     /1.22,  BTDN7  .00  / .00 / .04 / .14
AVL    .15  / .17 / .23 / .26,  HVLN7       /     /     / .14
.END
```

EXAMPLE 5: HYDROLOGIC VARIABLES WITH NONSTANDARD DURATIONS

Some precipitation networks are able to report only 5 days a week and, on Mondays, report a total accumulation for 72 hours, ending at the reporting time on Monday. The duration codes in Table 3 do not provide for 72-hour duration. However, use of the variable duration code allows a choice of duration time. Below is a weekend total precipitation message.

```
.B BRO 0401 C DH07/DVH72/PPV
WEST2  1.48  :  WESLACO
SHST2  1.52  :  SCHUSTER FARM
SMLT2  1.30  :  SAN MANUD
GCVT2  1.15  :  GARCIASVILLE
MCOT2  1.06  :  MCCOOK
RCNT2  1.57  :  RIVEON
SROT2  1.75  :  SANTA ROSA
.END
```

EXAMPLE 6: AGRICULTURAL WEATHER REPORT

Agricultural weather reports, often called AGOs, contain about the same information in each message: maximum temperature, minimum temperature, current temperature, evaporation, soil maximum temperature, soil minimum temperature, and perhaps soil current temperature. These messages may need to be sent in a completely readable form because they often have to be used for radio broadcasts, etc.

Using SHEF, an easily readable version of a coded message can be produced with some additional effort. The example below illustrates such a message.

```
.B CSG 0401 E DH08/TX/TN/TA/PP/TSIRZX/TSIRZN/ER
:
:                             A I R                  4 IN SOIL
: Location          ID     MAX  MIN  CUR   PCPN    MAX  MIN  EVAP
: ALBANY        :  ABYG1   77 / 43 / 45 /  0.03  / 62 / 55 / 1.08
: BAINBRIDGE    :  BGEG1   74 / 41 / 44 /  0.25  / 65 / 55 / 1.09
: BLAKELY       :  BLKG1   78 / 40/  45 /  0.17  / 66 / 56 / 1.09
: PLAINS        :  PLNG1   76 / 44/  44 /  0.02  / 61 / 57 / 1.07
: TIFTON        :  TFTG1   79 / 50/  50 /  0.34  / 65 / 57 / 1.04
: PITTSVIEW, AL :  PTTA1   75 / 42/  43 /  0.30  / 65 / 55 / 1.06
.END
```

The two six-character parameter codes (the third and the second from the last) are the soil maximum and soil minimum temperatures, respectively. They had to be completely specified because there are no short two-character send codes like there are with the air maximum and minimum temperatures.

ACKNOWLEDGMENTS

Mr. Phillip A. Pasteris formerly of the NWS Northwest River Forecast Center and now retired from the Natural Resources Conservation Service, was the principal author of the original SHEF document. In addition, the following people deserve special recognition for their invaluable contributions to this effort:

Vernon C. Bissell, NWS, NWRFC - Retired
Geoffrey M. Bonnin, NWS, Office of Hydrologic Development
Robert S. Cox, Jr., NWS, MBRFC - Retired
Charles N. Hoffeditz, NWS, Office of Hydrology - Retired
Dale G. Lillie, NWS, ABRFC - Retired
Patrick J. Neuman, NWS, NCRFC
Jerry Nunn, NWS, NWS, WGRFC - Retired
Tim Sweeney, NWS, Office of Hydrology - Retired
David G. Bennett, U.S. Army COE
Scott W. Boyd, U.S. Army COE
Edward M. Davis, U.S. Army COE
David L. Portin, U.S. Army COE
Jon Roe, NWS, Office of Hydrologic Development
Roger L. Ross, U.S. Army COE
Mark Glaudemans, Office of Hydrologic Development

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Table 1. Physical Elements Codes - PE DTSEP

NOTE: Appendix A contains definitions for unit abbreviations and acronyms used in Table 1. Appendix G contains an in-depth explanation of PE codes. The notation of "(S)" after the PE code designates that there is a send code for that data type. See Table 2 for send codes.

CODE	EXPLANATION (UNITS)
A	AGRICULTURAL DATA
AD	Reserved
AF	Surface frost intensity (coded, see Table 20)
AG	Percent of green vegetation (%)
AM	Surface dew intensity (coded, see Table 21)
AT	Time below critical temperature, 25 DF or -3.9 DC (HRS and MIN)
AU	Time below critical temperature, 32 DF or 0 DC (HRS and MIN)
AW	Leaf wetness (HRS and MIN)
BA	Solid portion of water equivalent (in, mm)
BB	Heat deficit (in, mm)
BC	Liquid water storage (in, mm)
BD	Temperature index (DF, DC)
BE	Maximum water equivalent since snow began to accumulate (in, mm)
BF	Areal water equivalent just prior to the new snowfall (in, mm)
BG	Areal extent of snow cover from the areal depletion curve just prior to the new snowfall (%)
BH	Amount of water equivalent above which 100 % areal snow cover temporarily exists (in, mm)
BI	Excess liquid water in storage (in, mm)
BJ	Areal extent of snow cover adjustment (in, mm)
BK	Lagged excess liquid water for interval 1 (in, mm)
BL	Lagged excess liquid water for interval 2 (in, mm)
BM	Lagged excess liquid water for interval 3 (in, mm)
BN	Lagged excess liquid water for interval 4 (in, mm)
BO	Lagged excess liquid water for interval 5 (in, mm)
BP	Lagged excess liquid water for interval 6 (in, mm)
BQ	Lagged excess liquid water for interval 7 (in, mm)
CA	Upper zone tension water contents (in, mm)
CB	Upper zone free water contents (in, mm)
CC	Lower zone tension water contents (in, mm)
CD	Lower zone free water supplementary storage contents (in, mm)
CE	Lower zone free water primary storage contents (in, mm)
CF	Additional impervious area contents (in, mm)
CG	Antecedent precipitation index (in, mm)

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
CH	Soil moisture index deficit (in, mm)
CI	Base flow storage contents (in, mm)
CJ	Base flow index (in, mm)
CK	First quadrant index Antecedent Evaporation Index (AEI) (in, mm)
CL	First quadrant index Antecedent Temperature Index (ATI) (DF, DC)
CM	Frost index (DF, DC)
CN	Frost efficiency index (%)
CO	Indicator of first quadrant index (AEI or ATI)
CP	Storm total rainfall (in, mm)
CQ	Storm total runoff (in, mm)
CR	Storm antecedent index (in, mm)
CS	Current antecedent index (in, mm)
CT	Storm period counter (integer)
CU	Average air temperature (DF, DC)
CV	Current corrected synthetic temperature (DF, DC)
CW	Storm antecedent evaporation index, AEI (in, mm)
CX	Current AEI (in, mm)
CY	Current API (in, mm)
CZ	Climate Index
D	RESERVED FOR DATE/DATA TYPE NONPHYSICAL ELEMENTS (See Table 9a and 9b)
E	EVAPORATION
EA	Evapotranspiration potential amount (IN, MM)
ED	Evaporation, pan depth (IN, MM)
EM	Evapotranspiration amount (IN, MM)
EP	Evaporation, pan increment (IN, MM)
ER	Evaporation rate (IN/day, MM/day)
ET	Evapotranspiration total (IN, MM)
EV	Evaporation, lake computed (IN, MM)
F	FISH COUNT DATA
FA	Fish - shad
FB	Fish - sockeye
FC	Fish - chinook
FE	Fish - chum
FK	Fish - coho
FL	Fish - ladder (1=left, 2=right, 3=total)
FP	Fish - pink
FS	Fish – steelhead

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
FT	Fish type - type (1=adult, 2=jacks, 3=fingerlings)
FZ	Fish - count of all types combined
G	GROUND FROST AND GROUND STATE
GC	**Condition, road surface (coded, see Table 1)**
GD	Frost depth, depth of frost penetration, non permafrost (IN, CM)
GL	**Salt content on a surface (e.g., road) (%)**
GP	**Frost, depth of pavement surface (IN, CM)**
GR	Frost report, structure (coded, see Table 16)
GS	Ground state (coded, see Table 18)
GT	Frost, depth of surface frost thawed (IN, CM)
GW	**Frost, depth of pavement surface frost thawed (IN, CM)**
H	HEIGHT
HA	Height of reading, altitude above surface (FT, M)
HB	Depth of reading below surface (FT, M)
HC	Height, ceiling (FT, M)
HD	Height, head (FT, M)
HE	Height, regulating gate (FT, M)
HF	Elevation, project powerhouse forebay (FT, M)
HG	Height, river stage (FT, M)
HH	Height of reading, elevation in MSL (FT, M)
HI	Stage trend indicator (coded, see Table 19)
HJ	Height, spillway gate (FT, M)
HK	Height, lake above a specified datum (FT, M)
HL	Elevation, natural lake (FT, M)
HM	Height of tide, MLLW (FT, M)
HN (S)	Height, river stage, daily minimum, translates to HGIRZNZ (FT, M)
HO	Height, flood stage (FT, M)
HP	Elevation, pool (FT, M)
HQ	Distance from a ground reference point to the river's edge used to estimate stage (coded, see Chapter 7.4.6)
HR	Elevation, lake or reservoir rule curve (FT, M)
HS	Elevation, spillway forebay (FT, M)
HT	Elevation, project tail water stage (FT, M)
HU	Height, cautionary stage (FT, M)
HV	**Depth of water on a surface (e.g., road) (IN, MM)**
HW	Height, spillway tail water (FT, M)
HX (S)	Height, river stage, daily maximum, translates to HGIRZXZ (FT, M)

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
HY (S)	Height, river stage at 7 a.m. local just prior to date-time stamp, translates to HGIRZZZ at 7 a.m. local time (FT, M)
HZ	Elevation, freezing level (KFT, KM)
I	ICE CODES
IC	Ice cover, river (%)
IE	Extent of ice from reporting area, upstream "+," downstream - (MI, KM)
IO	Extent of open water from reporting area, downstream "+," upstream - (FT, M)
IR	Ice report type, structure, and cover (coded, see Table 14)
IT	Ice thickness (IN, CM)
J	RESERVED
K	RESERVED
L	LAKE DATA
LA	Lake surface area (KAC,KM2)
LC	Lake storage volume change (KAF,MCM)
LS	Lake storage volume (KAF,MCM)
M	MOISTURE AND FIRE/FUEL PARAMETERS
MD	Dielectric Constant at depth, paired value vector (coded, see Chapter 7.4.6 for format)
MI	Moisture, soil index or API (IN, CM)
ML	Moisture, lower zone storage (IN, CM)
MM	Fuel moisture, wood (%)
MN	Soil Salinity at depth, paired value vector (coded, see Chapter 7.4.6 for format)
MS	Soil Moisture amount at depth (coded, see Chapter 7.4.6)
MT	Fuel temperature, wood probe (DF, DC)
MU	Moisture, upper zone storage (IN, CM)
MV	Water Volume at Depth, paired value vector (coded, see Chapter 7.4.6 for format)
MW	Moisture, soil, percent by weight (%)
N	GATE AND DAM DATA
NC	River control switch (0=manual river control, 1=open river uncontrolled)
NG	Total of gate openings (FT, M)
NL	Number of large flash boards down (whole number)
NN	Number of the spillway gate reported (used with HP, QS)
NO	Gate opening for a specific gate (coded, see Chapter 7.4.6)
NS	Number of small flash boards down (whole number)
O	NOT USED FOR EXTERNAL TRANSMISSION (CONFUSED WITH ZERO)

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
P	PRESSURE AND PRECIPITATION
PA	Pressure, atmospheric (IN-HG, KPA)
PC	Precipitation, accumulator (IN, MM)
PD	Pressure, atmospheric net change during past 3 hours (IN-HG, KPA)
PE	Pressure, characteristic, NWS Handbook #7, table 10.7
PF (S)	Precipitation, flash flood guidance, precipitation to initiate flooding, translates to PPTCF for 3-hour intervals (IN, MM)
PJ	**Precipitation, departure from normal (IN, MM)**
PL	Pressure, sea level (IN-HG, KPA)
PM	Probability of measurable precipitation (dimensionless) (coded, see Table 22)
PN	Precipitation normal (IN, MM)
PP	Precipitation (includes liquid amount of new snowfall), actual increment (IN, MM)
PR	Precipitation rate (IN/day, MM/day)
PT	Precipitation, type (coded, see Table 17)
PY (S)	Precipitation, increment ending at 7 a.m. local just prior to date-time stamp, translates to PPDRZZZ at 7 a.m. local time (IN, MM)
Q	DISCHARGE
QA	Discharge, adjusted for storage at project only (KCFS, CMS)
QB	Runoff depth (IN, MM)
QC	Runoff volume (KAF, MCM)
QD	Discharge, canal diversion (KCFS, CMS)
QE	Discharge, percent of flow diverted from channel (%)
QF	Discharge velocity (MPH, KPH)
QG	Discharge from power generation (KCFS, CMS)
QI	Discharge, inflow (KCFS, CMS)
QL	Discharge, rule curve (KCFS, CMS)
QM	Discharge, preproject conditions in basin (KCFS, CMS)
QN (S)	Discharge, minimum flow, translates to QRIRZNZ (KCFS, CMS)
QP	Discharge, pumping (KCFS, CMS)
QR	Discharge, river (KCFS, CMS)
QS	Discharge, spillway (KCFS, CMS)
QT	Discharge, computed total project outflow (KCFS, CMS)
QU	Discharge, controlled by regulating outlet (KCFS, CMS)
QV	Cumulative volume increment (KAF, MCM)
QX (S)	Discharge, maximum flow, translates to QRIRZXZ (KCFS, CMS)
QY (S)	Discharge, river at 7 a.m. local just prior to date-time stamp translates to QRIRZZZ at 7 a.m. local time (KCFS, CMS)
QZ	**Reserved**

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
R	RADIATION
RA	Radiation, albedo (%)
RI	Radiation, accumulated incoming solar over specified duration in langleys (LY)
RN	Radiation, net radiometers (watts/meter squared)
RP	Radiation, sunshine percent of possible (%)
RT	Radiation, sunshine hours (HRS)
RW	Radiation, total incoming solar radiation (watts/meter squared)
S	SNOW DATA
SA	Snow, areal extent of basin snow cover (%)
SB	Snow, Blowing Snow Sublimation (IN)
SD	Snow, depth (IN, CM)
SE	Snow, Average Snowpack Temperature (DF)
SF	Snow, depth, new snowfall (IN, CM)
SI	Snow, depth on top of river or lake ice (IN, CM)
SL	Snow, elevation of snow line (KFT, M)
SM	Snow, Melt (IN)
SP	Snowmelt plus rain (IN)
SR	Snow report, structure, type, surface, and bottom (coded, see Table 15)
SS	Snow density (IN SWE/IN snow, CM SWE/CM snow)
ST	Snow temperature at depth measured from ground (See Chapter 7.4.6 for format)
SU	Snow, Surface Sublimation (IN)
SW	Snow, water equivalent (IN, MM)
T	TEMPERATURE DATA
TA	Temperature, air, dry bulb (DF,DC)
TB	Temperature in bare soil at depth (coded, see Chapter 7.4.6 for format)
TC	Temperature, degree days of cooling, above 65 DF or 18.3 DC (DF,DC)
TD	Temperature, dew point (DF,DC)
TE	Temperature, air temperature at elevation above MSL (See Chapter 7.4.6 for format)
TF	Temperature, degree days of freezing, below 32 DF or 0 DC (DF,DC)
TH	Temperature, degree days of heating, below 65 DF or 18.3 DC (DF,DC)
TJ	**Temperature, departure from normal (DF, DC)**
TM	Temperature, air, wet bulb (DF,DC)
TN (S)	Temperature, air minimum, translates to TAIRZNZ (DF,DC)
TP	Temperature, pan water (DF,DC)
TR	**Temperature, road surface (DF,DC)**
TS	Temperature, bare soil at the surface (DF,DC)
TV	Temperature in vegetated soil at depth (coded, see Chapter 7.4.6 for format)
TW	Temperature, water (DF,DC)
TX (S)	Temperature, air maximum, translates to TAIRZXZ (DF,DC)
TZ	**Temperature, Freezing, road surface (DF,DC)**

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
U	WIND DATA
UC	Wind, accumulated wind travel (MI,KM)
UD	Wind, direction (whole degrees)
UE	**Wind, standard deviation (Degrees)**
UG	Wind, gust at observation time (MI/HR,M/SEC)
UL	Wind, travel length accumulated over specified (MI,KM)
UP	Peak wind speed (MPH)
UQ	Wind direction and speed combined (SSS.SDDD), a value of 23.0275 would indicate a wind of 23.0 mi/hr from 275 degrees
UR	Peak wind direction associated with peak wind speed (in tens of degrees)
US	Wind, speed (MI/HR,M/SEC)
V	GENERATION AND GENERATOR DATA
VB	Voltage - battery (volt)
VC	Generation, surplus capacity of units on line (megawatts)
VE	Generation, energy total (megawatt hours)
VG	Generation, pumped water, power produced (megawatts)
VH	Generation, time (HRS)
VJ	Generation, energy produced from pumped water (megawatt hours)
VK	Generation, energy stored in reservoir only (megawatt * “duration”)
VL	Generation, storage due to natural flow only (megawatt * “duration”)
VM	Generation, losses due to spill and other water losses (megawatt * “duration”)
VP	Generation, pumping use, power used (megawatts)
VQ	Generation, pumping use, total energy used (megawatt hours)
VR	Generation, stored in reservoir plus natural flow, energy potential (megawatt * “duration”)
VS	Generation, station load, energy used (megawatt hours)
VT	Generation, power total (megawatts)
VU	Generator, status (encoded)
VW	Generation station load, power used (megawatts)
W	WATER QUALITY
WA	**Water, dissolved nitrogen & argon (PPM, MG/L)**
WC	Water, conductance (uMHOS/CM)
WD	Water, piezometer water depth (IN, CM)
WG	Water, dissolved total gases, pressure (IN-HG, MM-HG)
WH	Water, dissolved hydrogen sulfide (PPM, MG/L)
WL	Water, suspended sediment (PPM, MG/L)
WO	Water, dissolved oxygen (PPM, MG/L)
WP	Water, ph (PH value)
WS	**Water, salinity (parts per thousand, PPT)**
WT	Water, turbidity (JTU)

Table 1 (continued). Physical Elements Codes - PE DTSEP

CODE	EXPLANATION(UNITS)
WV	Water, velocity (FT/SEC, M/SEC)
WX	**Water, Oxygen Saturation (%)**
WY	**Water, Chlorophyll (ppb, ug/L)**
X	WEATHER CODES
XC	Total sky cover (tenths)
XG	Lightning, number of strikes per grid box (whole number)
XL	Lightning, point strike, assumed one strike at transmitted latitude and longitude (whole number)
XP	Weather, past NWS synoptic code (see Appendix D)
XR	Humidity, relative (%)
XU	Humidity, absolute (grams/FT3,grams/M3)
XV	Weather, visibility (MI, KM)
XW	Weather, present NWS synoptic code (see Appendix C)
Y	RESERVED FOR UNIQUE, STATION SPECIFIC TYPE CODES
YA->YZ	Assigned on an individual basis for unique data, except as noted below
YA	Number of 15-minute periods a river has been above a specified critical level (whole number)
YC	Random report sequence number (whole number)
YF	Forward power, a measurement of the DCP, antenna, and coaxial cable (watts)
YI	**SERFC unique**
YP	**Reserved Code**
YR	Reflected power, a measurement of the DCP, antenna, and coaxial cable (watts)
YS	Sequence number of the number of times the DCP has transmitted (whole number)
YT	Number of 15-minute periods since a random report was generated due to an increase of 0.4 inch of precipitation (whole number)
YU	**GENOR raingage status level 1 - NERON observing sites (YUIRG)**
YV	**A Second Battery Voltage (NERON sites ONLY), voltage 0 (YVIRG)**
YW	**GENOR raingage status level 2 - NERON observing sites (YWIRG)**
YY	**GENOR raingage status level 3 - NERON observing sites (YYIRG)**
YZ	**Time of Observation – Minutes of the calendar day, minutes 0 - NERON observing sites (YZIRG)**
Z	RESERVED

Table 2. Send Codes

SEND CODE	EXPLANATION (UNITS)
HN	Height, river stage (FT,M) minimum of the day translated to "HGIRZNZ"
HX	Height, river stage (FT,M) maximum of the day translated to "HGIRZXZ"
HY	Height, river stage at 7 a.m. local prior to the date-time stamp (FT,M) translated to "HGIRZZZ" 1/
PF	Precipitation, flash flood guidance precipitation to initiate flooding in a 3-hour interval (IN,MM) translated to "PPTCF"
PY	Precipitation increment ending at 7 a.m. local prior to date-time stamp (IN,MM) translated to "PPDRZZZ" 1/
QN	Discharge, river (KCFS,CMS) minimum of the day translated to "QRIRZNZ"
QX	Discharge, river (KCFS,CMS) maximum of the day translated to "QRIRZXZ"
QY	Discharge, river at 7 a.m. local prior to date-time stamp (KCFS,CMS) translated to "QRIRZZZ" 1/
SF	Snow, depth, 24 hour snowfall (IN, CM) translated to "SFDRZZZ"
TN	Temperature, air (DF,DC) minimum of day translated to "TAIRZNZ"
TX	Temperature, air (DF,DC) maximum of day translated to "TAIRZXZ"

NOTE:

1/ The following rules apply to the use of HY, PY, AND QY:
- Cannot be used with a Zulu time zone
- Cannot be used with a .E message
- Cannot be used with a relative date code "DRt"

Table 3. Duration Codes - PE D TSEP

CODE	EXPLANATION	
I	Instantaneous	(0000)
U	1 Minute	(0001)
E	**5 Minutes**	**(0005)**
G	**10 Minutes**	**(0010)**
C	15 Minutes	(0015)
J	30 Minutes	(0030)
H	1 Hour	(1001)
B	2 Hour	(1002)
T	3 Hour	(1003)
F	4 Hour	(1004)
Q	6 Hour	(1006)
A	8 Hour	(1008)
K	12 Hour	(1012)
L	18 Hour	(1018)
D	1 Day	(2001)
W	1 Week	(2007)
N	Mid month, duration for the period from the 1st day of the month to and ending on the 15th day of the same month	
M	1 Month	(3001)
Y	1 Year	(4001)
P	Duration for a period beginning at previous 7 a.m. local and ending at time of observation	(5004)
V	Variable period, duration defined separately (see Tables 11a and 11b) 1/	
S	Period of seasonal duration (normally used to designate a partial period, for example, 1 January to current date) (5001)	
R	Entire period of record (5002)	
X	Unknown duration (5005)	
Z	Filler character, pointer to default duration for that physical element as shown in Table 7.	

NOTE:

1/ Use the "DVx" code (Table 11) to specify durations not listed above.

Table 4. Type and Source Codes - PED TS EP

CODE	EXPLANATION
C CONTINGENCY DATA	
C1	Contingency 1
C2	Contingency 2
C3 -> C9	Contingency 3 thru 9
CA -> CE	Contingency A thru E
CF	Contingency for flash flood guidance
CG -> CY	Contingency G thru K
CZ	Nonspecific contingency (default for this type category)
F FORECAST	
FA	Adjusted model 1
FB	Adjusted model 2
FC	Adjusted model 3
FD	Adjusted model 4
FE	Public version, external
FF	Forecast includes QPF
FG	Reservoir release forecast
FL	Forecast Mean Areal Data
FM	Manual method number 1
FN	Manual method number 2
FP	Manual method number 3
FQ	Manual method number 4
FR	**Persistence forecasts**
FU	Unadjusted model 1
FV	Unadjusted model 2
FW	Unadjusted model 3
FX	Unadjusted model 4
FZ	Nonspecific forecast data (default for this type category)
H RESERVED FOR HISTORICAL DATA USES	
M Model	
MS	Sacramento Soil Moisture Accounting Model
MA	Continuous Antecedent Precipitation Index (API) Model
MK	Kansas City (MBRFC) Event API Model
MC	Cincinnati (OHRFC) Event API Model
MH	Harrisburg (MARFC) Event API Model
MT	Hartford (NERFC) Event API Model
MW	SNOW-17 Snow Accumulation and Ablation Model

Table 4 (continued). Type and Source Codes - PED TS EP

CODE	EXPLANATION
P PROCESSED DATA (NONFORECAST)	(processes defined locally or by convention among interrelated users)
1A, 2A, 3A… 9A	-> Process level 1, Best Quality
1B, 2B, 3B… 9B	-> Process level 1, 2nd Best
1C, 2C, 3C… 9C	-> Process level 1, 3rd Best
1D, 2D, 3D… 9D	-> Process level 1, 4th Best
12, 22, 32… 92	-> Process level 1, 2nd Sensor
13, 23, 33… 93	-> Process level 1, 3rd Sensor
14, 24, 34… 94	-> Process level 1, 4th Sensor
15, 25, 35… 95	-> Process level 1, 5th Sensor
16, 26, 36… 96	-> Process level 1, 6th Sensor
17, 27, 37… 97	-> Process level 1, 7th Sensor
18, 28, 38… 98	-> Process level 1, 8th Sensor
19, 29, 39… 99	-> Process level 1, 9th Sensor
1F, 2F, 3F… 9F	-> Process level 1, Airborne
1G, 2G, 3G… 9G	-> Process level 1, GOES
1M, 2M, 3M… 9M	-> Process level 1, Meteor burst
1P, 2P, 3P… 9P	-> Process level 1, Phone (DARDC/LARC)
1R, 2R, 3R… 9R	-> Process level 1, Radio #1
1S, 2S, 3S… 9S	-> Process level 1, Radio #2
1T, 2T, 3T… 9T	-> Process level 1, Telemark/BDT (phone audio)
1V, 2V, 3V… 9V	-> Process level 1, Visual/manual #1
1W, 2W, 3W… 9W	-> Process level 1, Visual/manual #2
1X, 2X, 3X… 9X	-> Process level 1, Visual/manual #3
1Z, 2Z, 3Z… 9Z	-> Process level 1, Nonspecific observed reading (default)
PA	Process #1
PB	Process #2
PC	Process #3
PD	Process #4
PM	Processed Mean Areal Data
PE -> PL	Process #5 thru #24
PN -> PY	Process #5 thru #24
PZ	Nonspecific processed data (default for this type category)

Table 4 (continued). Type and Source Codes - PED TS EP

CODE	EXPLANATION R READING (OBSERVED) DATA
R2 -> R9	For secondary, tertiary, etc. sensors of the same data type at the same station location following the primary sensor of type RF, RG, RM, RP, RR, RS, RT, RV, RW, RX, and RZ. For example, the primary, secondary, and tertiary sensors of the same data type at a GOES station would be encoded with SHEF Type and Source Codes of RG, R2, and R3 respectively.
RA	Best quality (retrieve code, not for transmission)
RB	2nd best (retrieve code, not for transmission)
RC	3rd best (retrieve code, not for transmission)
RD	4th best (retrieve code, not for transmission)
RF	Airborne
RG	GOES
RM	Meteor burst
RP	Phone ASCII (DARDC/LARC)
RR	Radio #1
RS	Radio #2
RT	Telemark/BDT (phone audio)
RV	Visual/manual #1
RW	Visual/manual #2
RX	Visual/manual #3
RZ	Nonspecific observed reading (default for this category and universal default for type/source)

Table 5. Extremum Codes - PEDTS E P

CODE	EXPLANATION
J	Minimum of record
K	Minimum of year (calendar)
L	Minimum of month
M	Minimum of week
N	Minimum of day
F	Minimum of 1 hour
G	Minimum of 3 hours
H	Minimum of 6 hours
P	Minimum of 12 hours
I	Minimum of 18 hours
T	Maximum of record
U	Maximum of year (calendar)
V	Maximum of month
W	Maximum of week
X	Maximum of day
D	Maximum of 1 hour
E	Maximum of 3 hours
R	Maximum of 6 hours
Y	Maximum of 12 hours
S	Maximum of 18 hours
Z	Null character (filler)

Table 6. Probability Codes - PEDTSE P

CODE		EXPLANATION
A	.002	Chance value is at or below the specified value
B	.004	“ “ “ “ “ “ “ “ “
C	.01	“ “ “ “ “ “ “ “ “
D	.02	“ “ “ “ “ “ “ “ “
E	.04	“ “ “ “ “ “ “ “ “
F	.05	“ “ “ “ “ “ “ “ “
1	.1	“ “ “ “ “ “ “ “ “
2	.2	“ “ “ “ “ “ “ “ “
G	.25	“ “ “ “ “ “ “ “ “
3	.3	“ “ “ “ “ “ “ “ “
4	.4	“ “ “ “ “ “ “ “ “
5	.5	“ “ “ “ “ “ “ “ “
6	.6	“ “ “ “ “ “ “ “ “
7	.7	“ “ “ “ “ “ “ “ “
H	.75	“ “ “ “ “ “ “ “ “
8	.8	“ “ “ “ “ “ “ “ “
9	.9	“ “ “ “ “ “ “ “ “
T	.95	“ “ “ “ “ “ “ “ “
U	.96	“ “ “ “ “ “ “ “ “
V	.98	“ “ “ “ “ “ “ “ “
W	.99	“ “ “ “ “ “ “ “ “
X	.996	“ “ “ “ “ “ “ “ “
Y	.998	“ “ “ “ “ “ “ “ “
J	.0013	Chance value below specified: -3 standard deviations
K	.0228	“ “ “ “ -2 “ “
L	.1587	“ “ “ “ -1 “ “
M	Mean (expected value)	
N	.8413	Chance value below specified: +1 standard deviations
P	.9772	“ “ “ “ +2 “ “
Q	.9987	“ “ “ “ +3 “ “
Z	Null character (filler)	

Table 7. Standard Defaults for Each Parameter Code Key - PEDTSEP

PARAMETER	KEY	CODE	DEFAULT DEFINITION
PHYSICAL ELEMENT	PE :		No default, must be specified
DURATION	**D :**	**' I '**	**Instantaneous**
TYPE	**T :**	**' R '**	**Reading, observed**
SOURCE	**S :**	**' Z '**	**Non-specified source**
EXTREMA	**E :**	**' Z '**	**Null character, no value assigned**
PROBABILITY	**P :**	**' Z '**	**Null character, no value assigned**

EXCEPTIONS TO STANDARD DURATION DEFAULT KEY

PE	D	UNITS (ENG,SI)	PHYSICAL ELEMENT
AT	D	(HRS & MIN)	Time below critical temperature (25 DF, -3.9 DC)
AU	D	(HRS & MIN)	Time below critical temperature (32 DF, 0 DC)
AW	D	(HRS & MIN)	Leaf wetness
EA	D	(IN,MM)	Evapotranspiration potential (amount)
EM	D	(IN,MM)	Evapotranspiration amount
EP	D	(IN,MM)	Evaporation, pan increment
ER	D	(IN/DAY,MM/DAY)	Evaporation rate
ET	D	(IN,MM)	Evapotranspiration total
EV	D	(IN,MM)	Evaporation, lake (computed)
LC	D	(KAF,MCM)	Lake storage change
PP	D	(IN,MM)	Precipitation, actual increment
PR	D	(IN/DAY,MM/DAY)	Precipitation rate
QC	D	(KAF,MCM)	Runoff volume
QV	D	(KAF,MCM)	Cumulative volume increment
RI	D	(LY)	Radiation, accumulated incoming solar
RP	D	(%)	Radiation, sunshine percent of possible
RT	D	(HRS)	Radiation, sunshine hours
SF	D	(IN, CM)	Snow, depth, 24 hour snowfall
TC	S	(DF,DC)	Degree days of cooling (above 65 DF, 18.3 DC)
TF	S	(DF,DC)	Degree days of freezing (below 32 DF, 0 DC)
TH	S	(DF,DC)	Degree days of heating (below 65 DF, 18.3 DC)
UC	D	(MI,KM)	Accumulated wind travel
UL	D	(MI,KM)	Travel length accumulated over specified duration
XG	J		Lightning, number of strikes per grid box
XP	Q		Weather, past NWS synoptic code (Appendix D)

Table 8. Time Zone Designators - "tz"

CODE	LOCATION	TIME CONVERSION FROM UTC
N	Newfoundland local time	UTC - 3:30 or 2:30
NS	Newfoundland standard time	UTC - 2:30
A	Atlantic local time	UTC - 4:00 or 3:00
AD	Atlantic daylight time	UTC - 3:00
AS	Atlantic standard time	UTC - 4:00
E	Eastern local time	UTC - 5:00 or 4:00
ED	Eastern daylight time	UTC - 4:00
ES	Eastern standard time	UTC - 5:00
C	Central local time	UTC - 6:00 or 5:00
CD	Central daylight time	UTC - 5:00
CS	Central standard time	UTC - 6:00
J	China	UTC +8
M	Mountain local time	UTC - 7:00 or 6:00
MD	Mountain daylight time	UTC - 6:00
MS	Mountain standard time	UTC - 7:00
P	Pacific local time	UTC - 8:00 or 7:00
PD	Pacific daylight time	UTC - 7:00
PS	Pacific standard time	UTC - 8:00
Y	Yukon local time	UTC - 8:00 or 7:00
YD	Yukon daylight time	UTC - 7:00
YS	Yukon standard time	UTC - 8:00
H	Hawaiian local time	UTC - 10:00
HS	Hawaiian standard time	UTC - 10:00
L	**Alaskan local time**	**UTC - 9:00 or 8:00**
LD	**Alaskan daylight time**	**UTC - 8:00**
LS	**Alaskan standard time**	**UTC - 9:00**
B	Bering local time	UTC - 10:00 or 9:00
BD	Bering daylight time	UTC - 9:00
BS	Bering standard time	UTC - 10:00

Z Zulu time, also Universal Time Code (UTC), formerly Greenwich Mean Time (GMT) (default time zone if 'tz' not specified)

Table 9a. Date/Data Type Elements

"D" DATE/DATA TYPE ELEMENTS

CODE	EXPLANATION
DS	Second of minute (ss)
DN	Minute of hour (nn) (nnss)
DH	Hour of day (hh) (hhnn) (hhnnss)
DD	Day of month (dd) (ddhh) (ddhhnn) (ddhhnnss)
DM	Month of year (mm) (mmdd) (mmddhh) (mmddhhnn) mmddhhnnss)
DJ	Julian date (ddd) (yyddd) (ccyyddd)
DY	Year (yy) (yymm) (yymmdd) (yymmddhh) (yymmddhhnn)
DI	Time interval specifier for .E format (see Table 12) 1/
DQ	Data qualifier for rest of line (see Table 10) 1/
DR	Date relative increment (see Table 13) 1/
DU	Unit type change (E=English, S=Standard International) 1/
DV	Duration variable code (see Table 11a & 11b) 1/
DT	Century (cc) (ccyy) (ccyymmdd) (ccyymmddhh) (ccyymmddhhnn)

Table 9b. Date/Data Time Unit Definitions

TIME UNIT DEFINITIONS 2/

CODE	DEFINITION	RANGE
ss	Second	00-59
nn	Minute	00-59
hh	Hour	00-24
dd	Day	01-31
mm	Month	01-12
ddd	Julian day	001-366
yy	Year	00-99
cc	Century	17-21

NOTE:

1/ These codes have special applications; see appropriate tables.
2/ When used in an observation time element, these codes require padding to full positional field size.

Table 10. Data Qualifier Codes - "DQq"

CODE	EXPLANATION
(GOOD)	
G	Good, Manual QC *
M	Manual Edit *
S	Screened Level1 (qual = 0)(data value tested using preliminary criteria)
V	Verified Level1, Level2 (qual = 8)(data value verified using a more rigorous method)
W	**Withheld (qual = 2) – The precipitation amount was manually input by the user (the measured precipitation was withheld).**
P	Passed Level1, Level2, Level3 *
(QUESTIONABLE)	
F	Flagged (qual = 1) – Flagged by sensor or telemetry (parity errors, for example)
Q	Questioned in Level2, Level3 (qual = 3)
N	Reserved
(BAD)	
B	Bad, Manual QC *
R	Rejected by Level1
(UNSPECIFIED/GOOD)	
Z	No QC Performed (null character)
E	Estimated (qual = 5)
D	**Partial (qual = 4) – A 24 hour period was missing because 1 to 3 of the 6 hour periods was missing. The 24 hour amount is estimated using available/estimated 6 hour periods.**
L	**Lumped (qual = 6) - Estimated from the gages that have 6 hourly data with the constraint that the sum of the four 6 hourly periods is equal to the 24 hour amount.**
T	Triggered (tells database to start some additional function)

* = New for this version

Level1 = validity checks (i.e. range checking)
Level2 = internal and temporal consistency checks (i.e. rate of change checks)
Level3 = spatial consistency checks (e.g. temperature and precipitation field outliers)

NOTE:
All other letters, except O and I, are reserved for future use. Software should not assume that the above list is all that will ever be used.

Table 11a. Duration Code Variable Specifier

DURATION CODE VARIABLE SPECIFIER "DVx"

CODE UNITS	DEFINITION
DVSss	Seconds
DVNnn	Minutes
DVHhh	Hours
DVDdd	Days
DVMmm	Months
DVYyy	Years
DVZ	Default for particular physical element

Table 11b. Duration Code Variable Specifier Units

DURATION CODE VARIABLE SPECIFIER UNITS

CODE	UNITS	RANGE
ss	Seconds	0-99
nn	Minutes	0-99
hh	Hours	0-99
dd	Days	0-99
mm	Months	0-99
yy	Years	0-99

Table 12a. Time Interval Specifier for .E Format - "DI±t"

CODE UNITS	DEFINITION
DIS±ss	Seconds
DIN±nn	Minutes
DIH±hh	Hours
DID±dd	Days
DIM±mm	Months
DIE±mm 1/	Months
DIY±yy	Years

NOTE:
1/ Use for end-of-month data only

Optional forms include:
Incremental: Dinx, Dinxx, Din+x, DIn+xx
Decremental: Din-x, DIn-xx

Table 12b. Time Interval Specifier Units

CODE	UNITS	RANGE
ss	Seconds	0-99
nn	Minutes	0-99
hh	Hours	0-99
dd	Days	0-99
mm	Months	0-99
yy	Years	0-99

TABLE 13a. Date Relative Code - "DRx"

CODE UNITS	DEFINITION
DRS±ss Seconds	
DRN±nn	Minutes
DRH±hh	Hours
DRD±dd	Days
DRM±mm	Months
DRE±mm 1/	Months
DRY±yy	Years

NOTE:
1/ Use with end-of-month data only

Table 13b. Date Relative Time Units Definition

CODE	UNITS	RANGE
ss	Seconds	0-99
nn	Minutes	0-99
hh	Hours	0-99
dd	Days	0-99
mm	Months	0-99
yy	Years	0-99
cc	Centuries	17-21

Table 14. Ice Codes for Ice Report

ICE REPORT - PHYSICAL ELEMENT "IR"

The ice report consists of a three-digit code:

IR x1x2x3
IR x2x3
IR x3

x1 = Ice type
x2 = Ice structure
x3 = Ice cover

ICE TYPE	CODE	ICE STRUCTURE	CODE
No report	0	No report	0
Running ice	1	Breaking ice	1
Stationary ice	2	Honeycombed	2
Stopped ice	3	Rotten	3
Jammed ice	4	Layered	4
Formed locally	5	Clear	5
Shore ice	6	Hanging	6
Anchor ice	7	Frazil	7
Cake ice	8	Slush	8
Shell ice	9	Sheet	9

ICE COVER	CODE
No ice	0
1/10 Cover	1
2/10 "	2
3/10 "	3
4/10 "	4
5/10 "	5
6/10 "	6
7/10 "	7
8/10 - 9/10	8
Fully covered	9

Table 15. Snow Codes for Snow Report

SNOW REPORT - PHYSICAL ELEMENT "SR"

The snow report consists of a four-digit code:

SR x1x2x3x4
SR x2x3x4
SR x3x4
SR x4

x1 = Snow structure
x2 = Base of snow cover
x3 = Surface of snow cover
x4 = Area description

SNOW STRUCTURE		BASE OF SNOWCOVER	
No report	0	No report	0
Loosely packed	1	Wet snow	1
Densely packed	2	Dry snow	2
		Ice layer	3

SURFACE OF SNOWCOVER		AREA DESCRIPTION	
No report	0	No report	0
Snow crust	1	Uniform	1
Loose	2	Some drifts	2
Ice	3	Drifted	3

Table 16. Ground Frost Report - Ground Frost Structure Physical Element "GR"

FROST, STRUCTURE OF FROZEN GROUND

Concrete	1
Granular	2
Honeycomb	3
Stalactite	4

Table 17. Precipitation Type Codes

PRECIPITATION TYPE - PHYSICAL ELEMENT “PT”

CODE	DEFINITION
0	Ice prism
1	Rain
2	Freezing rain
3	Drizzle
4	Freezing drizzle
5	Snow
6	Snow pellets
7	Snow grains
8	Ice pellets
9	Hail

Table 18. State of Ground Codes

STATE OF GROUND - PHYSICAL ELEMENT “GS”

(WMO Tables 901 and 945)

0-9 Without snow or measurable ice cover

10-20 With snow or measurable ice cover

CODE	EXPLANATION
0	Surface of ground dry (without cracks and no appreciable amount of loose sand)
1	Surface of ground moist
2	Surface of ground wet (standing water in small or large pools on surface)
3	Flooded
4	Surface of ground frozen
5	Glaze on ground
6	Loose dry dust or sand not covering ground completely
7	Thin cover of loose dry dust or sand covering ground completely
8	Moderate or thick cover of loose, dry dust or sand covering ground completely
9	Extremely dry with cracks
10	Ground predominantly covered by ice
11	Compact or wet snow (with or without ice) covering less than one-half of the ground
12	Compact or wet snow (with or without ice) covering at least one-half of the ground but ground not completely covered
13	Even layer of compact or wet snow covering ground completely
14	Uneven layer of compact or wet snow covering ground completely
15	Loose dry snow covering less than one-half of the ground
16	Loose dry snow covering at least one-half of the ground (but not completely)
17	Even layer of loose, dry snow covering ground completely
18	Uneven layer of loose, dry snow covering ground completely
19	Snow covering ground completely deep drifts
20	Sleet or hail covering the ground completely

Table 19. River Trend Indicator Code

RIVER TREND INDICATOR - PHYSICAL ELEMENT “HI”

CODE	DEFINITION
0 1/	Stationary
1 1/	Rising
2 1/	Falling
3	Unknown
4 2/	Stationary
5 2/	Rising
6 2/	Falling
7	Frozen

NOTE:

1/ Code figures 0, 1 or 2 as appropriate only when stage is below flood stage.

2/ Code figures 4, 5, or 6 as appropriate only when stage is at or above flood stage.

Table 20. Surface Frost Intensity Codes

SURFACE FROST PHYSICAL ELEMENT "AF"

CODE	DEFINITION
0	No frost
1	Light frost: surface objects, vegetation, etc., covered with a thin deposit of frost, which may be more or less patchy
2	Moderate frost: surface objects, vegetation, etc., covered with a thicker but patchy deposit of frost
3	Heavy frost: surface objects, vegetation, etc., covered with copious deposit of frost

Table 21. Surface Dew Intensity Codes

SURFACE DEW INTENSITY - PHYSICAL ELEMENT “AM”

CODE	DEFINITION
0	None
1	Light dew: dew droplets not connected, no dew under trees or sheltered areas
2	Moderate dew: dew droplets mostly connected but surfaces not saturated and no dripping occurring
3	Heavy dew: nearly saturated surfaces and dripping, some moisture under trees and sheltered areas

Table 22. Probability of Measurable Precipitation Codes

PROBABILITY OF MEASURABLE PRECIPITATION - PHYSICAL ELEMENT “PM”

This code will require the addition of a new SHEF physical element “PM” that will be defined as “probability of measurable precipitation.” The physical element units will be “coded” (dimensionless), and the precipitation amounts represented by the code will be in inches (>= .01”, >= .25”, etc.).

The form of the code will be as follows:

```
                PM Value =  p6    p5    p4    p3    p2    p1    b

Where:                ^     ^     ^     ^     ^     ^     ^
                            :     :     :     :     :     :     :
                            :     :     :     :     :     :     :
                            :     :     :     :     :     :     "best" category   (1-5)
                            :     :     :     :     :     prob of
                            :     :     :     :     :     precip >= .01 inch      (POP)
                            :     :     :     :     :
                            :     :     :     :     prob of
                            :     :     :     :     precip >= .25 inch            (POPA)
                            :     :     :     :
                            :     :     :     prob of
                            :     :     :     precip >= .50 inch                  (POPA)
                            :     :     :
                            :     :     prob of
                            :     :     precip >= 1.00 inch                       (POPA)
                            :     :
                            :     prob of
                            :     precip >= 2.00 inches                           (POPA)
                            :
                            prob of
                            precip >= x.xx (reserved for future)                  (POPA)
```

Table 22 (continued). Probability of Measurable Precipitation Codes

For all values of P_1, the following probability table would apply:

Code P_1		Probability (%)
0	=	0-9
1	=	10-19
2	=	20-29
3	=	30-39
4	=	40-49
5	=	50-59
6	=	60-69
7	=	70-79
8	=	80-89
9	=	90-100

Table 22 (continued). Probability of Measurable Precipitation Codes

For values of “b” (best category), the following table would apply:

Code “b”	Category of Precipitation
1 =	.00 - .24
2 =	.25 - .49
3 =	.50 - .99
4 =	1.00 - 1.99
5 >=	2.00

An example of typical coding of this new physical element would be “PMDFZ 34572.” The code represents the following model output statistics (MOS) information:

```
                  PMDFZ  34572
                  ^ ^^^  ^^^^^
                  : :::  :::::
Best Category     : :::  ::::2  (.25-.49 inch)
                  : :::  :::::
Prob of Meas Prec : :::  :::7:  (70-79% prob of >= .01 inch)
                  : :::  :::::
Daily Duration    : :::  ::5::  (50-59% prob of >= .25 inch)
                  : :::  :::::
Forecast          : :::  :4:::  (40-49% prob of >= .50 inch)
                  : :::  :::::
Nonspecific       : :::  3::::  (30-39% prob of >= 1.00 inch)
```

Leading fields which are missing are assumed less than 10 percent precipitation probabilities.

The nonspecific source code “Z” can be changed later to another character to identify forecasts generated with differing MOS equations.

Also, a subtle but important characteristic of this format is that the larger the MOS code value, the greater the precipitation threat in the corresponding category amount.

Table 22 (continued). Probability of Measurable Precipitation Codes

The complete SHEF message is as follows:

```
.B SID 0206 DH12/DC020512/TAIFZX/TAIFZN/PMDFZ/DRD+1
.B1 /TAIFZX/TAIFZN/PMDFZ/DRD+2/TAIFZX/TAIFZN/PMDFZ
STN1  45/30/45671/46/32/23452/50/45/0024992
STN2  55/32/35791/44/32/12341/55/48/36993
STN3  60/44/24692/55/32/00231/60/47/00591
.END
```

.B	:	Format specifier
SID	:	Message source ID
0206	:	Data ending February 6 (current year assumed)
DH12	:	1200 Zulu
DC020512	:	Creation date of forecast February 5 1200Z
TAIFZX	:	Temperature, instantaneous, forecast maximum of day
TAIFZN	:	Temperature, instantaneous, forecast minimum of day
PMDFZ	:	MOS code, daily forecast POPs, POPAs, and best category
DRD+1	:	Date relative increment of 1 day, new effective
	:	date is February 7 1200Z
.B1	:	Continuation of .B format header
TAIFZX	:	Same as above
TAIFZN	:	Same as above
PMDFZ	:	Same as above
DRD+2	:	Date relative increment of 2 days, new effective
	:	date is February 8 1200Z
	:	Rest of header same
STN1	:	Station ID
DATA	:	Maximum, minimum, and coded MOS
STN2	:	Etc....
.END	:	.B format terminator

APPENDIX A

UNIT ABBREVIATION AND ACRONYM DEFINITIONS FOR TABLE 1 PHYSICAL ELEMENTS

UNIT	DEFINITION
CFS	Cubic feet per second
CM	Centimeters
CMS	Cubic meters per second
DC	Degrees Centigrade
DF	Degrees Fahrenheit
FT	Feet
FT2	Square feet
FT3	Cubic feet
HRS	Hour
IN	Inches
IN-HG	Inches of mercury
JTU	Jackson turbidity units
KAC	Thousands of acres
KAF	Thousands of acre-feet
KCFS	Thousands of cubic feet per second
KFT	Thousands of feet
KM	Kilometers
KM2	Square kilometers
KM3	Cubic kilometers
KPA	Kilopascals
KPH	Kilometers per hour
LY	Langleys
M	Meters
M2	Meters squared
M3	Cubic meters
MCM	Millions of cubic meters
MG/L	Milligrams per liter
MI	Mile
MIN	Minute
MLLW	Mean of lower of the low waters (tides)
MM	Millimeters
MM-HG	Millimeters of mercury
MPH	Miles per hour
MSL	Mean sea level
PPM	Parts per million
%	Percent
SEC	Second
SWE	Snow water equivalent
W	Watt
uMHOS/CM	Micromhos per centimeter

APPENDIX B

UNITS CONVERSION FOR TABLE 1 PHYSICAL ELEMENTS

SI 1/	FACTOR	ENGLISH 2/
CM	.393701	IN
CMS	.0353147	KCFS
DC	(DC*1.8)+32	DF
GRAMS/FT3	2.2883564	GRAINS/FT3
KM	.6213712	MI
KM	3.2808399	KFT
KM2	247.10541	KAC
KPA	.296134	IN-HG
LY	4.18	JOULES
LY	.011624	KW HOUR/M2
M/SEC	3.2808399	FT/SEC
M/SEC	2.2369363	MI/HR
M	3.2808399	FT
M	.00328084	KFT
MCM	.8107131	KAF
MM	.0393701	IN

NOTES:

1/ International System of Units; metric.
2/ The value in SI units times the conversion FACTOR equals the value in English units.

APPENDIX C

NWS SYNOPTIC CODES
“XW”
CODE TABLE 4
[WMO CODE 4677]
SYMBOL WW=PRESENT WEATHER

00-49: No precipitation at the station at the time of observation

00-19: No precipitation, fog, ice fog (except for 11 and 12), dust storm, drifting or blowing snow at the station at the time of observation or (except for 09 and 17) during the preceding hour

No meteors except photometeors	00 Cloud development not observed or not observable	Characteristic change of the state of sky during past hour
	01 Clouds generally dissolving or becoming less developed	
	02 State of sky on the whole unchanged	
	03 Clouds generally forming or developing	

Haze, dust, sand or smoke	04 Visibility reduced by smoke (i.e., veldt or forest fires, industrial smoke, or volcanic ashes)
	05 Haze
	06 Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation
	07 Dust or sand raised by wind at or near the station at the time of observation but no well-developed dust whirl(s) or sand whirl(s) and no dust storm or sandstorm seen or, in the case of ships, blowing spray at the station
	08 Well-developed dust whirl(s) and sand whirl(s) seen at or near the station during the preceding hour or at the time of observation but no dust storm or sandstorm
	09 Dust storm or sandstorm within sight at the time of observation or at station during the preceding hour

APPENDIX C (continued)

NWS SYNOPTIC CODES
"XW"

```
          10  Light fog (visibility 1,100 yd or more)

                                             ( Shallow fog or ice
                                             ( fog at the station,
          11  Patches of                     ( whether on land or
                                             ( sea, not deeper than
          12  More or less continuous        ( about 6 ft on land
                                             ( or 33 ft at sea
                                             ( (apparent visibility
                                             ( less than 1,100 yd)

          13  Lightning visible, no thunder heard
          14  Precipitation within sight but not reaching the
              ground or the surface of the sea
          15  Precipitation within sight, reaching the ground or
              the surface of the sea but distant (i.e., estimated
              to be more than 3.1 mi) from the station
          16  Precipitation within sight, reaching the ground or
              the surface of the sea near to but not at the
              station
          17  Thunderstorm but no precipitation at the time of
              observation
          18  Squalls at or within sight of the station during
              the preceding hour or at the time of observation
          19  Funnel cloud(s) (i.e., tornado cloud or waterspout)
              at or within sight of the station during the
              preceding hour or at the time of observation


20-29:  Precipitation, fog, ice fog, or thunderstorm at the station
        during the preceding hour but not at the time of observation

          20  Drizzle (not freezing) or       (
              snow grains                     (
          21  Rain (not freezing)             (  Not falling
          22  Snow                            (  as shower(s)
          23  Rain and snow or ice pellets    (
              (type A)                        (
          24  Freezing drizzle or freezing    (
              rain                            (

          25  Shower(s) of rain
          26  Shower(s) of snow, or rain
              and snow
```

APPENDIX C (continued)

NWS SYNOPTIC CODES
"XW"

27 Shower(s) of hail, or of rain and hail
28 Fog or ice fog (visibility less than 1,100 yd)
29 Thunderstorm (with or without precipitation)

30-39: Dust storm, sandstorm, drifting or blowing snow

```
30  )                 ( Has decreased during the
    ) Slight or       ( preceding hour
31  ) moderate        ( No appreciable change during the
    ) dust storm      ( preceding hour
32  ) or sandstorm    ( Has begun or has increased during
                      ( preceding hour

33  )                 ( Has decreased during the
    ) Severe          ( preceding hour
34  ) dust storm      ( No appreciable change during the
    ) or sandstorm    ( preceding hour
35  )                 ( Has begun or has increased during
                      ( the preceding hour
```

36 Slight or moderate drifting snow, generally low (less than 6 ft)
37 Heavy drifting snow, generally low (less than 6 ft)
38 Slight or moderate blowing snow, generally high (6 ft or more)
39 Heavy blowing snow, generally high (6 ft or more)

40-49: Fog or ice at the time of observation (visibility less than 1,100 yd)

40 Fog or ice fog at a distance at the time of observation but not at the station during the preceding hour; the fog or ice fog extending to a level above that of the observer

41 Fog or ice fog in patches

APPENDIX C (continued)

NWS SYNOPTIC CODES
"XW"

```
42  Fog or ice fog,                 ( Has become
    sky discernible                 ( thinner
43  Fog or ice fog,                 ( during the
    sky not discernible             ( preceding hour
                                    (

44  Fog or ice fog,                 (
    sky discernible                 ( No appreciable
45  Fog or ice fog,                 ( change during the
    sky not discernible             ( preceding hour
                                    (

46  Fog or ice fog,        (
    sky discernible        (   Has begun or has become
47  Fog or ice fog,        (   thicker during
    sky not discernible    (   the preceding hour

48  Fog, depositing rime, sky discernible
49  Fog, depositing rime, sky not discernible
```

50-99: Precipitation at the station at the time of observation

50-59: Drizzle

```
50  Drizzle, not freezing, (
    intermittent           (   Slight at time of
51  Drizzle, not freezing, (   observation
    continuous             (

52  Drizzle, not freezing, (
    intermittent           (   Moderate at time
53  Drizzle, not freezing, (   of observation
    continuous             (

54  Drizzle, not freezing, (
    intermittent           (   Heavy (dense)
55  Drizzle, not freezing, (   at time of
    continuous             (   observation
                           (

56  Drizzle, freezing, slight
57  Drizzle, freezing, moderate or heavy (dense)
```

APPENDIX C (continued)

NWS SYNOPTIC CODES
"XW"

```
          58  Drizzle and rain, slight
          59  Drizzle and rain, moderate or heavy

60-69:  Rain

          60  Rain, not freezing, intermittent ( Slight at time
          61  Rain, not freezing, continuous   ( of observation

          62  Rain, not freezing, intermittent ( Moderate at time
          63  Rain, not freezing, continuous   ( of observation

          64  Rain, not freezing, intermittent ( Heavy at time
          65  Rain, not freezing, continuous   ( of observation

          66  Rain, freezing, slight
          67  Rain, freezing, moderate or heavy
          68  Rain or drizzle and snow, slight
          69  Rain or drizzle and snow, moderate or heavy


70-79:  Solid precipitation not in showers


          70  Intermittent fall of snow flakes ( Slight at time
          71  Continuous fall of snow flakes   ( of observation

          72  Intermittent fall of snow flakes ( Moderate at time
          73  Continuous fall of snow flakes   ( of observation

          74  Intermittent fall of snow flakes ( Heavy at time of
          75  Continuous fall of snow flakes   ( observation

          76  Ice prisms (with or without fog)
          77  Snow grains (with or without fog)

          78  Isolated star-like snow crystals (with or without
                                                fog)
          79  Ice pellets (type a) (sleet, U.S. definition)


80-99:  Showery precipitation, or precipitation with current or recent
        thunderstorm
```

APPENDIX C (continued)

NWS SYNOPTIC CODES
"XW"

80	Rain shower(s), slight	
81	Rain shower(s), moderate or heavy	
82	Rain shower(s), violent	
83	Shower(s) of rain and snow mixed, slight	
84	Shower(s) of rain and snow mixed, moderate or heavy	
85	Snow shower(s), slight	
86	Snow shower(s), moderate or heavy	
87 88	Shower(s) of snow pellets, or ice pellets (type B), with or without rain; or rain and snow mixed	Slight; moderate or heavy
89 90	Shower(s) of hail, with or without rain; or rain and snow mixed, not associated with thunder	Slight; moderate or heavy
91	Slight rain time of observation	Thunderstorm during the preceding hour but not at time of observation
92	Moderate or heavy rain at time of observation	
93	Slight snow, or rain and snow mixed, or hail at time of observation	
94	Moderate or heavy snow, or rain and snow mixed, or hail at time of observation	
95	Thunderstorm, slight or moderate without hail but with rain and/or snow at time of observation	Thunderstorm at time of observation
96	Thunderstorm, slight or moderate with hail at time of observation	
97	Thunderstorm, heavy, without hail, but with rain and/or snow at time of observation	

APPENDIX C (continued)

NWS SYNOPTIC CODES
"XW"

```
98  Thunderstorm combined with       (
    dust storm or sandstorm at       (   Thunderstorm
    time of observation              (   at time of
99  Thunderstorm, heavy with         (   observation
    hail at time of observation      (
```

APPENDIX D

NWS SYNOPTIC CODES
"XP"
(WMO TABLE 456)
PAST WEATHER CODE
(MOST SIGNIFICANT IN LAST 6 HOURS)

CODE	DEFINITION
0	Cloud covering one-half or less of the sky throughout period
1	Cloud covering more than one-half of the sky part of the appropriate period and covering one-half or less during part of the period
2	Cloud covering more than one-half of the sky throughout the appropriate period
3	Sandstorm, dust storm, or blowing snow
4	Fog or ice fog or thick haze
5	Drizzle
6	Rain
7	Snow or rain and snow mixed
8	Shower(s)
9	Thunderstorm(s) with or without precipitation

APPENDIX E

ICE AND FROST TERMINOLOGY/STRUCTURE OF FROZEN GROUND

TERMINOLOGY	ICE TYPE DEFINITIONS
Running ice	Moving with current
Stationary ice	Not in motion because of no current
Stopped ice	Not in motion in spite of current
Jammed ice	Jammed or gorged; an accumulation of broken river ice caught against an obstruction or construction
Formed locally	Not brought in by current
Shore ice	Formed along and fastened to shore; does not extend the entire width across
Anchor ice	Ice cap or layer that forms on the bottom of a stream
Cake ice	Surface ice or an ice gorge having broken at some point upstream
Shell ice	Ice on a body of water that remains as an unbroken surface when the water lowers so that a space occurs between the water surface and the ice (also called cat ice and ice bridge)

TERMINOLOGY	ICE STRUCTURE DEFINITIONS
Breaking ice	Stopped, jammed, or frozen ice that shows signs of weakening or cracking; usually accompanied by cracking noises
Honeycombed	Contains numerous small air bubbles or spaces
Rotten	Weakened by warm temperatures
Layered	Ice formed in distinct layers, similar to plywood
Clear	Clear ice, also called blade ice
Hanging	An agglomeration of slush ice attached, or in the process of attaching, to the bottom of sheet ice
Frazil	Suspended ice composed of small crystals (also called needle ice)
Slush	An accumulation of ice crystals which remain separate or only slightly frozen together
Sheet	Smooth, thin layer of ice on a quiet water surface

APPENDIX E (continued)

ICE AND FROST TERMINOLOGY/STRUCTURE OF FROZEN GROUND

TERMINOLOGY	STRUCTURE OF FROZEN GROUND DEFINITIONS
Concrete	Saturated or supersaturated ground that is completely frozen, extremely dense
Granular	Small ice crystals intermixed with soil particles and aggregate around them; loose, porous, easily broken into pieces
Honeycomb	Similar to granular but with a higher degree of connection among ice crystals and a lower porosity
Stalactite	Small, needle-like ice crystals aligned vertically and extending downward into the soil from a heaved surface; often formed from a refreeze period

APPENDIX F

DAYLIGHT/STANDARD TIME CHANGE DATES

YEAR	DAY IN MARCH	DAY IN NOVEMBER
2007	1	4
2008	9	2
2009	8	1
2010	14	7
2011	13	6
2012	11	4
2013	10	3
2014	9	2
2015	8	1
2016	13	6
2017	12	5
2018	11	4
2019	10	3
2020	8	1
2021	14	7
2022	13	6
2023	12	5
2024	10	3
2025	9	2
2026	8	1
2027	14	7
2028	12	5
2029	11	4
2030	10	3
2031	9	2
2032	14	7
2033	13	6
2034	12	5
2035	11	4
2036	9	2
2037	8	1
2038	14	7
2039	13	6
2040	11	4
2041	10	3
2042	9	2
2043	8	1
2044	13	6
2045	12	5

APPENDIX F (continued)

DAYLIGHT/STANDARD TIME CHANGE DATES

YEAR	DAY IN MARCH	DAY IN NOVEMBER
2046	11	4
2047	10	3
2048	8	1
2049	14	7
2050	13	6
2051	12	5
2052	10	3
2053	9	2
2054	8	1
2055	14	7
2056	12	5
2057	11	4

APPENDIX G

PHYSICAL ELEMENT DEFINITIONS

AF Surface Frost Intensity - An observation of frost amounts on surface objects, vegetation, etc.

AG Percent of Green Vegetation

AM Surface Dew Intensity - An observation of dew amounts on surface objects, vegetation, etc.

AT Time Below Critical Temperature - Cell damage is likely below this temperature, 25 degrees Fahrenheit (DF), -3.9 degrees Centigrade (DC).

AU Time Below Critical Temperature - Cell damage is possible (depending on crop) below this temperature, 32 DF, 0 DC.

AW Time with Leaf Wetness - Duration of any detectable liquid water (film, droplets, etc.) on a leaf surface.

BA Solid portion of water equivalent (mm)

BB Heat deficit (mm)

BC Liquid water storage (mm)

BD Temperature index (DC)

BE Maximum water equivalent since snow began to accumulate (mm)

BF Areal water equivalent just prior to the new snowfall (mm)

BG Areal extent of snow cover from the areal depletion curve just prior to the new snowfall (%)

BH Amount of water equivalent above which 100 percent areal snow cover temporarily exists (mm)

BI Excess liquid water in storage (mm)

BJ Areal extent of snow cover adjustment (mm)

BK Lagged excess liquid water for interval 1 (mm)

BL Lagged excess liquid water for interval 2 (mm)

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

BM Lagged excess liquid water for interval 3 (mm)

BN Lagged excess liquid water for interval 4 (mm)

BO Lagged excess liquid water for interval 5 (mm)

BP Lagged excess liquid water for interval 6 (mm)

BQ Lagged excess liquid water for interval 7 (mm)

CA Upper zone tension water contents (mm)

CB Upper zone free water contents (mm)

CC Lower zone tension water contents (mm)

CD Lower zone free water supplementary storage contents (mm)

CE Lower zone free water primary storage contents (mm)

CF Additional impervious area contents (mm)

CG Antecedent precipitation index (in)

CH Soil moisture index deficit (in)

CI Base flow storage contents (in)

CJ Base flow index (in)

CK First quadrant index Antecedent Evaporation Index (AEI) (in)

CL First quadrant index Antecedent Temperature Index (ATI) (DF)

CM Frost index (DF)

CN Frost efficiency index (%)

CO Indicator of first quadrant index (AEI or ATI)

CP Storm total rainfall (in)

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

CQ Storm total runoff (in)

CR Storm antecedent index (in)

CS Current antecedent index (in)

CT Storm period counter (integer)

CU Average air temperature (DF)

CV Current corrected synthetic temperature (DF)

CW Storm antecedent evaporation index, AEI (in)

CX Current AEI (in)

CY Current API (in)

CZ Climate Index (SOI,MEI,WPI,NAO)

EA Evaporation Potential - The amount of moisture which would be removed from a fully vegetated land surface by evapotranspiration if there were always an adequate water supply available.

ED Evaporation, Pan Depth - The depth of water in an evaporation pan usually obtained with the aid of a hook gage set in a still well.

EM Evapotranspiration - The total amount of water transferred from the earth's surface to the atmosphere. The amount is usually measured with an evapotranspirometer which consists of a vegetation soil tank so designed that all water added to the tank and all water left after evapotranspiration can be measured.

EP Evaporation, Pan Increment - The change in depth of water over a specified duration in an evaporation pan usually obtained with the aid of a hook gage set in a stilling well.

ER Evaporation Rate - The amount of liquid or solid transformed through physical process into the gaseous state over a specified time.

ET Evapotranspiration Total - The evaporation from all water, soil, snow, ice, vegetative, and other surfaces plus transpiration.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

EV Evaporation, Lake - The estimate of lake evaporation derived by use of pan evaporation.

FA Fish - Shad

FB Fish - Sockeye

FC Fish - Chinook

FE Fish - Chum

FK Fish - Coho

FL Fish - Ladder

FP Fish - Pink

FS Fish - Steelhead

FT Fish Type

FZ Fish - Count of All Types Combined

GC Condition, Road Surface – The road surface conditions (dry, damp, wet, ice, salt, freezing wet, unknown).

GD Frost Depth, Depth of Frost Penetration - The depth of non-permafrost penetration as measured by instrumentation (frost meter, probe, auger).

GL Surface Salt Content – The salt content on a surface (e.g., road).

GP Frost Depth, Pavement - The depth of frost on a pavement.

GR Frost Report, Structure - The structure of surface frost.

GS Ground State - The ground state.

GT Frost, Depth of Surface Frost Thawed - The depth of surface frost thawed as obtained by instrumentation (frost meter, probe, auger).

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

GW **Frost Thawed, Pavement – depth of pavement surface frost thawed.**

HA Height of Reading - The vertical or perpendicular elevation of an observation above a given datum.

HB Depth of Reading - The vertical or perpendicular elevation of an observation below a given datum.

HC Height, Ceiling - The height ascribed to the lowest layer of clouds or obscuring phenomena when it is reported as broken, overcast, or obscuration and not classified “thin” or “partial.”

HD Height, Head - The amount of energy per pound of fluid.

HE Height, Regulating Gate - The height of a regulating gate opening.

HF Elevation, Project Powerhouse Forebay - The elevation of the impoundment immediately above a dam or hydroelectric plant intake structure. The term is usually expressed in mean sea level (MSL) and is applicable to all types of hydroelectric developments (i.e., storage, run-of-river, and pumped-storage).

HG Height, River Stage - The elevation of the water surface at a specified station above some arbitrary zero datum.

HH Height, of Reading - The elevation above MSL at which an observation is taken.

HI Stage Trend Indicator - Such as rising, falling, and stationary.

HJ Height, Spillway Gate - Height of spillway gate opening above spillway crest.

HK Height, Lake Above a Specified Datum - The elevation of the water surface at a specified station above some arbitrary zero datum. This elevation is usually not MSL.

HL Elevation, Natural Lake - The elevation of the water surface in MSL of a lake having no man-made outlet.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

HM Height of Tide - The periodic height of water resulting from gravitational interactions between the sun, moon, and earth. "MLLW" is defined as the Mean Lower Low Water. It is the mean of the lower low water heights of a mixed tide observed over a specific 19-year Metonic cycle.

HN Height, Minimum River Stage - The minimum elevation of the water surface at a specified station above some arbitrary zero datum for the day.

HO Height, Flood Stage

HP Elevation, Pool - The elevation of the impoundment not necessarily observed immediately above a dam or hydroelectric plant intake structure. The term is usually expressed in MSL.

HQ Distance from a Ground Reference Point to River Level - Used to estimate stage.

HR Elevation, Lake or Reservoir Rule Curve - The elevation of a reservoir from an operation under specified conditions to obtain best or predetermined results.

HS Elevation, Spillway Forebay - Spillway crest elevation usually expressed in MSL.

HT Elevation, Project Tail water Stage - The elevation of the water surface immediately downstream from a dam or hydroelectric power plant. This elevation is usually expressed in MSL.

HU Cautionary Stage, height that may require action by local officials

HV Depth, Surface Water – the depth of water on a surface (e.g., road)

HW Height, Spillway Tail water - The invert (lowest) elevation of a spillway. This elevation is usually expressed in MSL.

HX Height, Maximum River Stage - The maximum elevation of the water surface at a specified station above some arbitrary zero datum for the day.

HY Height, River Stage at 7 a.m. - The elevation of the water surface at a specified station above some arbitrary zero datum at 7 a.m. local just prior to the date-time stamp.

HZ Elevation, Freezing Level - The lower altitude in the atmosphere, over a given location, at which the air temperature is 32 DF, 0 DC. The value is usually expressed relative to MSL.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

IC Ice Cover, River - The percentage of ice covering a given surface area of the river.

IE Extent of Ice from Reporting Area - The extent of river ice upstream "+" and downstream "-" observed at the reporting location.

IO Extent of Open Water from Reporting Area - The extent of open water downstream "+" and upstream "-" observed at the reporting location.

IR Ice Report - Ice Report including type, structure, and cover.

IT Ice Thickness - The measured thickness of ice in the river.

LA Lake Surface Area - The horizontal extent of surface area coverage by water.

LC Lake Storage Volume Change - The change in lake volume storage over specified duration.

LS Lake Storage Volume - The space occupied, as measured by cubic units, by water in a lake.

MD Moisture, Soil Dielectric Constant - The dielectric constant of soil-water mixture at a specified depth.

MI Moisture, Soil Index or API - A measure of soil wetness based upon moisture depleted from a particular basin under specified meteorological conditions.

ML Moisture, Lower Zone Storage - In the Sacramento model, a measure of capacity of water which is available for drainage as baseflow or subsurface outflow not appearing in the channel.

MM Fuel Moisture, Wood - The water content of a fuel particle expressed as a percent of the oven dry weight of the fuel particle.

MN Moisture, Soil Salinity - The soil salinity (accumulations of salt) at a specified depth.

MS Moisture, Soil - The amount of water which is held in the soil between the field capacity and the wilting point; water which may be taken up by plants.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

MT Fuel Temperature, Wood Probe - A physical element measured by a thermistor temperature element embedded within a ponderosa pine dowel. The sensor simulates short-time (10-hour) constant fuels located on the floor of forests and provides a composite temperature affected by precipitation, relative humidity, air temperature, and solar radiation.

MU Moisture, Upper Zone Storage - In the Sacramento model, a measure of capacity of water which is available for percolation to lower zones and for interflow.

MV Moisture, Volume of Water - The volume of water at a specified depth.

MW Moisture, Soil, Percent by Weight - The amount of water in the soil expressed in terms of percentage of the weight of oven dry soil.

NC River Control Switch

NG Total of Gate Openings - The summation to one number of the individual gate heights at a project.

NL Number of Large Flash Boards Down

NN Number of the Spillway Gate Reported - The dam spillway gate number associated with the data value reported.

NO Gate Opening for a Specific Gate

NS Number of Small Flash Boards Down

PA Pressure, Atmospheric - The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question.

PC Precipitation, Accumulator - The summation of precipitation collected beginning at a specified date.

PD Pressure, Net Change - during past 3 hours

PE Pressure, Characteristic - NWS Handbook #7, table 10.7

PF Precipitation, Flash Flood Guidance - The precipitation needed to initiate flooding.

PJ Precipitation, Departure From Normal

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

PL Pressure, sea level

PM Probability of Measurable Precipitation

PN Precipitation Normal

PP Precipitation, Actual Increment - The discrete increase in precipitation amount over a specified duration.

PR Precipitation Rate - The average precipitation rate (per day).

PT Precipitation Type - The particular kind of precipitation as defined by the U.S. Department of Commerce, "Surface Observations," Federal Meteorological Handbook No. 1.

PY Precipitation, Increment Ending at 7 a.m. Local - The precipitation amount at 7 a.m. local prior to the date-time stamp in a SHEF message. It is generally of a 24-hour duration.

QA Runoff Volume, Adjusted for Storage at Project(s) - The amount of volume which reached a stream channel, adjusted to the volume which would have occurred except for storage changes at upstream reservoirs. This does not adjust for irrigation diversions. This term is used extensively in water supply forecasting.

QB Runoff Depth - The amount of water, expressed as a depth that reaches a stream channel.

QC Runoff Volume - The amount of water, expressed by cubic units, that reaches a stream channel.

QD Discharge, Canal Diversion - The flow diverted to a canal or auxiliary channel.

QE Discharge, Percent of Flow Diverted from Channel - The percent of flow diverted from the channel.

QF Discharge Velocity - The flow measured at points along a stream.

QG Discharge from Power Generation - The flow passing through turbines generating power.

QI Discharge, Inflow - The flow into a specified impoundment.

QL Discharge, Rule Curve - The flow derived from a curve, or family of curves, indicating how a reservoir is to be operated under specified conditions to obtain best or predetermined results.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

QM Discharge, Pre-project Conditions in Basin - The flow at a given point adjusted to eliminate the effects of all man-made development.

QN Discharge, Minimum Flow - The minimum flow over a duration of 24 hours.

QP Discharge, Pumping - The flow measured from pumping.

QR Discharge, River - The flow measured at points along a stream.

QS Discharge, Spillway - The flow measured at a structure which bypasses the streamflow at the dam after the reservoir has been filled to capacity.

QT Discharge, Computed Total Project Outflow - The flow at a project which includes power generation and spill to the downstream channel. This does not include pumping or diversion.

QU Discharge, Controlled by Regulating Outlet - The flow measured through regulating outlet(s).

QV Cumulative Volume Increment - The discrete increase in volume over a specified duration.

QX Discharge, Maximum Flow - The maximum flow over a duration of 24 hours.

QY Discharge, River at 7 a.m. - The flow at 7 a.m. (local time) just prior to local time.

QZ **Reserved**

RA Radiation, Albedo - The ratio of the amount of electromagnetic radiation reflected by a body to the amount incident upon it, commonly expressed as a percentage.

RI Radiation, Accumulated Incoming Solar Over Specified Duration in Langleys - The summation over specified duration of energy propagated through space in the form of an advancing disturbance in electric and magnetic fields existing in space.

RN Radiation, Net Radiation - Balance between incoming and outgoing shortwave and longwave radiation.

RP Radiation, Sunshine Percent of Possible - The ratio of observed sunshine to astronomically possible sunshine as measured by an actinometer.

RT Radiation, Sunshine Hours - The number of hours of observed sunshine.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

RW Radiation, Total Incoming Solar Radiation - Electromagnetic radiation that originates from the sun.

SA Snow, Areal Extent of Basin Snow Cover - The ratio of observed areal basin snow cover to maximum possible areal snow cover.

SD Snow, Depth - The actual depth of snow on the ground at any instant during a storm, or after any single snowstorm or series of storms.

SF Snow, Depth (New Snowfall) - The incremental depth of snow on the ground at any instant since last snow depth (SD) observation.

SI Snow, Depth on Top of River or Lake Ice - The actual depth of snow on top of river of lake ice at any instant during a storm, or after any single snowstorm or series of storms.

SL Snow, Elevation of Snow Line - In general, the elevation of the outer boundary of a snow-covered area.

SR Snow Report - Structure, type, surface, bottom of snow.

SS Snow Density - The ratio of the volume of melt water that can be derived from a sample of snow to the original volume of the sample strictly speaking; this is the specific gravity of the snow sample.

ST Snow Temperature - Snow temperature at depth measured from ground.

SW Snow, Water Equivalent - The depth of water that would result from melting a core sample of snow on the ground. The amount of liquid water resulting from this melting is referred to as the water content of snow.

TA Temperature, Air (Dry Bulb) - Technically, the temperature registered by the dry-bulb thermometer of a psychrometer. However, it is identified with the temperature of the air and may also be used in that sense.

TB Temperature, Bare Soil at Specified Depths - The temperature of the ground at various depths below bare soil.

TC Temperature, Degree Days of Cooling - A measure of the departure of the mean daily temperature from a given standard (in this case 65 DF, 18.3 DC) one degree day for each degree of departure above the standard during one day.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

TD Temperature, Dew Point - The temperature to which a given parcel of air must be cooled at constant pressure and constant water vapor content in order for saturation to occur.

TE Temperature, Air - Air temperature at elevation above MSL.

TF Temperature, Degree Days of Freezing - A measure of the departure of the mean daily temperature from a given standard (in this case 32 DF, 0 DC).

TH Temperature, Degree Days of Heating - A measure of the departure of the mean daily temperature from a given standard (in this case 65 DF, 18.3 DC) one degree day for each degree of departure below the standard during the day.

TJ Temperature, Departure from Normal

TM Temperature, Air (Wet Bulb) - The temperature an air parcel would have if cooled adiabatically to saturation at constant pressure by evaporation of water into it, all latent heat being supplied by the parcel.

TN Temperature, Air Minimum - The minimum air temperature observed over a duration of 24 hours.

TP Temperature, Pan Water - The water temperature at the bottom of an NWS class-A evaporation pan.

TR Temperature, road surface (DF,DC).

TS Temperature, Bare Soil - The surface temperature of bare soil at the surface.

TV Temperature, Vegetated Soil at Specified Depths - The temperature of the ground at various depths below vegetated soil.

TW Temperature Water - The temperature of water at a specified depth.

TX Temperature, Air Maximum - The maximum air temperature observed over a duration of 24 hours.

TZ Temperature, Freezing, road surface (DF,DC).

UC Wind, Accumulated Wind Travel

UD Wind, Direction - The wind direction most frequently observed during a given period,.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

UE **Wind, standard deviation (Degrees)**

UG Wind, wind gust at observation time

UL Wind, Travel Length Accumulated Over Specified Duration - The travel length of wind over a specified duration.

UP Peak Wind Speed - The peak velocity of air in motion relative to the surface of the earth.

UQ Wind Direction and Speed Combined - (SSS.SDDD) A value of 23.0275 would indicate a wind of 23.0 knots from 275 degrees.

UR Peak Wind Direction Associated with Peak Wind Speed

US Wind, Speed - The velocity of air in motion relative to the surface of the earth.

VB Voltage - Battery - Electromotive force, or difference in electrical potential in a battery.

VC Generation, Surplus Capacity of Units on Line - The difference between assured system capacity and the system peak load for a specified period.

VE Generation, Energy Total - The total energy produced at a project.

VG Generation, Pumped Water, Power Produced - A measurement of energy produced by water stored in a reservoir filled during off-peak periods.

VH Generation, Time - The number of hours of generation at a project.

VJ Generation, Energy Produced from Pumped Water - The energy produced from a reservoir filled during off-peak periods.

VK Generation, Energy Stored in Reservoir Only - The energy available for generation in a reservoir.

VL Generation, Storage Due to Natural Flow Only - The energy available for generation due to natural flow volume only.

VM Generation, Losses Due to Spill and Other Water Losses - Measurement of energy loss due to spill, leakage, etc.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

VP Generation, Pumping Use, Power Used - Measurement of power used to pump water into a pumped storage reservoir.

VQ Generation, Pumping Use, Total Energy Used - Measurement of energy used to pump water into a pumped storage reservoir over a specified duration.

VR Generation, Stored in Reservoir Plus Natural Flow - The aggregate energy capable of being developed over a specified period by practicable use of the available streamflow, reservoir storage, and river gradient.

VS Generation, Station Load, Energy Used - The amount of energy used by the station to maintain operations over specified duration.

VT Generation, Power Total - The aggregate time rate of energy transfer for all power-producing components in a project.

VU Generator Status - The number of main units carrying load under the remote control of a control dispatch office (digits one and two); the number of main units on-line and generating or condensing at speed-no-load at end of the hour (digits three and four); and the number of main units available that could be on-line within 5 minutes if needed (digits five and six).

VW Generation, Station Load, Power Used - The time rate of energy transfer measured at a project.

WA Water, Dissolved Nitrogen and Argon - The amount of nitrogen and argon dissolved in water.

WC Water Conductance - A measure of the conducting power of a solution equal to the reciprocal of the resistance.

WD Water, Water Depth - The depth of water below soil surface used in computing the pore pressure of the soil Piezometer.

WG Water, Dissolved Total Gases, Pressure - Measured, dissolved total gases in a liquid.

WH Water, Dissolved Hydrogen Sulfide - The amount of hydrogen sulfide dissolved in water.

WL Water, Suspended Sediment - The very fine soil particles that remain in suspension in water for a considerable period of time without contact with the solid fluid boundary at or near the bottom.

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

WO Water, Dissolved Oxygen - The amount of oxygen dissolved in water.

WP Water, PH - The reciprocal of the logarithm of the hydrogen-ion concentration. The concentration is the weight of hydrogen ions, in grams, per liter of solution.

WS Water, salinity (parts per thousand, PPT).

WT Water, Turbidity - An analytical quantity usually reported in turbidity units determined by measurements of light diffraction.

WV Water, Velocity - The velocity of a particle(s) of water in a stream.

WX Water, Oxygen Saturation (%).

WY Water, Chlorophyll (ppb, ug/L).

XC Total Sky Cover - The amount of sky covered but not necessarily concealed by clouds or by obscuring phenomena aloft.

XG Lightning, Number of Strikes per Grid Box - The number of lightning strikes in a box of standard dimensions over specified duration.

XL Lightning, Point Strike - This is one strike assumed to have occurred at transmitted latitude and longitude.

XP Weather, Past - NWS synoptic code.

XR Humidity, Relative - The ratio of the actual vapor pressure of the air to the saturation vapor pressure expressed in percent.

XU Humidity, Absolute - In a system of moist air, the ratio of the mass of water vapor present to the volume occupied by the mixture, i.e., the density of the water vapor component.

XV Weather, Visibility - The greatest distance in a given direction at which it is possible to see and identify with the unaided eye (a) in the daytime: a prominent, dark object against the sky at the horizon; and (b) at night: a known, preferably unfocused, moderately intense light source.

XW Weather, Present NWS Synoptic Code

YA Number of 15-Minute Periods a River Has Been Above a Specified Critical Level

APPENDIX G (continued)

PHYSICAL ELEMENT DEFINITIONS

YC Random Report Sequence Number

YF Forward Power - A measurement of the data collection platform (DCP), antenna, and coaxial cable.

YI SERFC unique

YP Reserved Code

YR Reflected Power - A measurement of the DCP, antenna, and coaxial cable.
Note: EIRP=effective power
dBm+antenna gain-line loss where effective power=P forward-reflected

YS Sequence Number of the Number of Times the DCP Has Transmitted - Sequence number increased by one after each self-timed transmission and random transmission.

YT Number of 15-Minute Periods Since a Random Report Was Generated Due to an Increase of 0.4 Inch of Precipitation.

YU GENOR raingage status level 1 - NERON observing sites (YUIRG)

YV A Second Battery Voltage - (NERON sites ONLY), voltage 0 (YVIRG).

YW GENOR raingage status level 2 - NERON observing sites (YWIRG)

YY GENOR raingage status level 3 - NERON observing sites (YYIRG).

YZ Time of Observation – Minutes of the calendar day, minutes 0 - NERON observing sites (YZIRG)

APPENDIX H

SHEFOUT FILE

Description

ATTRIBUTES: fixed length 208 byte binary records

RECORD STRUCTURE:

There is one record for each piece of data. The data are all the descriptive information from the SHEF message. All times are in GMT and all units are English.

RECORD STRUCTURE:

Word Pos.	Type	Dimension	Description
1-2	A8	1	Station identifier
3	I	1	Year of observation date (4 digits)
4	I	1	Month of observation date
5	I	1	Day of month of observation date
6	I	1	Hour of observation (range of 0-23)
7	I	1	Minute of observation date
8	I	1	Second of observation date
9	I	1	Year of creation date (4 digits) 1/
10	I	1	Month of creation date 1/
11	I	1	Day of creation date 1/
12	I	1	Hour of creation date 1/
13	I	1	Minute of creation date 1/
14	I	1	Second of creation date 1/

APPENDIX H (continued)

SHEFOUT FILE

15	A1	1	First character of Physical Element code
16	A1	1	Second character of Physical Element code
17	I	1	Encoded duration code 2/
18	A1	1	Type code
19	A1	1	Source code
20	A1	1	Extremum code
21	R	1	Probability code 3/
22-23	R8	1	Data value (double precision)
24	A1	1	Data Qualifier
25	I	1	Revision code: 0 = not a revision 1 = revision
26-27	A8	1	Data source
28	I	1	Time series indicator: 0 = not a time series 1 = first element in a time series 2 = subsequent element
29-30	A7	1	Full parameter code
31-32	A8	1	Unused
33-52	A80	1	Retained comments for data value

APPENDIX H (continued)

SHEFOUT FILE

NOTES:

1/ All values are set to zero if there was no creation date specified.

2/ Duration codes specify units and number as follows:

7XXX seconds
OXXX minutes
1XXX hours
2XXX days
3XXX months
4XXX years
5000 specified as default
5001 seasonal
5002 entire period of record
5003 variable period - duration specified separately (see Table 11a and Table 11b)
5004 time period beginning at 7AM local time prior to the observation and ending at the observation time
5005 unknown
6XXX months - end of month

Where XXX is the number of units. For example, eight days would be coded as 2008, instantaneous as 0.

A special case exists when the duration is specified as 2015. . .

a) If translated from SHEF code V with DVD15, then any 15 day duration is implied

b) If translated from SHEF code N, then duration is first day of the month to and ending on the 15th day of the same month.

3/ Probability codes are a decimal value where 50 percent = 0.5. The mean (P code of M) is coded as -.05. If the Probability code is unspecified, it is -1.0.

APPENDIX I

SHEFPARM FILE

SHEF PARAMETER FILE

Purpose

This file contains the information needed to decode and validate SHEF messages.

File Description

The file is a ASCII text file with the following record structure:

Columns	Contents
Comment Card:	
1	'$'
Command card (indicates which parameters are to follow):	
1-2	*n
	where n is one of the following:
	1 = Physical element codes
	2 = Duration codes
	3 = Type/Source codes
	4 = Extremum codes
	5 = Probability codes
	6 = Send codes or duration defaults
	7 = Data qualifier codes
	* = Maximum number of errors
Physical element codes:	
1-2	Physical element code
4-23	Conversion factor metric to English, (a code of -1.0 means convert degrees C to degrees F)
Duration codes:	
1	Duration code
4-8	The integer translation of the duration code
Type/Source codes:	
1-2	Type/Source code
4-5	1.0 to indicate it is used

APPENDIX I (continued)

SHEFPARM FILE

Extremum codes:

1	Extremum code
4-5	1.0 to indicate it is used

Columns	Contents
Probability codes:	
1	Probability code
3-22	The equivalent probability
Send codes or duration defaults:	
1-2	Physical element or send code
4-11	The fully expanded parameter code for send codes or the three- character 'PED' combination for duration defaults
12-13	For send codes, place a '1' in this column if the observe time is the previous 7 AM
Data qualifier codes:	
1	Qualifier letter
Maximum errors:	
1	Maximum number of errors allowed before decoding stops

The following is the contents of the SHEF Parameter File:

```
$  DEFINE SHEF PARAMETER INFORMATION
$

SHEFPARM
*1                  PE CODES AND CONVERSION FACTORS
AD 1.0
AF 1.0
AG 1.0
AM 1.0
AT 1.0
AU 1.0
AW 1.0
BA 0.0393701
BB 0.0393701
BC 0.0393701
BD -1.0
BE 0.0393701
BF 0.0393701
```

APPENDIX I (continued)

SHEFPARM FILE

```
BG 1.0
BH 0.0393701
BI 0.0393701
BJ 0.0393701
BK 0.0393701
BL 0.0393701
BM 0.0393701
BN 0.0393701
BO 0.0393701
BP 0.0393701
BQ 0.0393701
CA 0.0393701
CB 0.0393701
CC 0.0393701
CD 0.0393701
CE 0.0393701
CF 0.0393701
CG 0.0393701
CH 0.0393701
CI 0.0393701
CJ 0.0393701
CK 0.0393701
CL -1.0
CM -1.0
CN 1.0
CO 1.0
CP 0.0393701
CQ 0.0393701
CR 0.0393701
CS 0.0393701
CT 1.0
CU -1.0
CV -1.0
CW 0.0393701
CX 0.0393701
CY 0.0393701
CZ 1.0
EA 0.0393701
ED 0.0393701
EM 0.0393701
EP 0.0393701
ER 0.0393701
ET 0.0393701
```

APPENDIX I (continued)

SHEFPARM FILE

```
EV 0.0393701
FA 1.0
FB 1.0
FC 1.0
FE 1.0
FK 1.0
FL 1.0
FP 1.0
FS 1.0
FT 1.0
FZ 1.0
GC 1.0
GD 0.3937008
GL 1.0
GP 0.3937008
GR 1.0
GS 1.0
GT 0.3937008
GW 0.3937008
HA 3.2808399
HB 3.2808399
HC 3.2808399
HD 3.2808399
HE 3.2808399
HF 3.2808399
HG 3.2808399
HH 3.2808399
HI 1.0
HJ 3.2808399
HK 3.2808399
HL 3.2808399
HM 3.2808399
HN 3.2808399
HO 3.2808399
HP 3.2808399
HQ 1.0
HR 3.2808399
HS 3.2808399
HT 3.2808399
HU 3.2808399
HV 0.0393701
HW 3.2808399
HX 3.2808399
```

APPENDIX I (continued)

SHEFPARM FILE

```
HY 3.2808399
HZ 3.2808399
IC 1.0
IE 0.6213712
IO 3.2808399
IR 1.0
IT 0.3937008
LA 247.10541
LC 0.8107131
LS 0.8107131
MD 1.0
MI 1.0
ML 0.3937008
MM 1.0
MN 1.0
MS 1.0
MT -1.0
MU 0.3937008
MV 1.0
MW 1.0
NC 1.0
NG 3.2808399
NL 1.0
NN 1.0
NO 1.0
NS 1.0
PA 0.295297
PC 0.0393701
PD 0.295297
PE 1.0
PJ 0.0393701
PL 10.
PF 0.0393701
PM 1.0
PN 0.0393701
PP 0.0393701
PR 0.0393701
PT 1.0
PY 0.0393701
QA 0.0353147
QB 0.0393701
QC 0.8107131
QD 0.0353147
```

APPENDIX I (continued)

SHEFPARM FILE

```
QE 1.0
QF 0.6213712
QG 0.0353147
QI 0.0353147
QL 0.0353147
QM 0.0353147
QN 0.0353147
QP 0.0353147
QR 0.0353147
QS 0.0353147
QT 0.0353147
QU 0.0353147
QV 0.8107131
QX 0.0353147
QY 0.0353147
QZ 1.0
RA 1.0
RI 1.0
RN 1.0
RP 1.0
RT 1.0
RW 1.0
SA 1.0
SB 0.0393701
SD 0.3937008
SE -1.0
SF 0.3937008
SI 0.3937008
SL 0.00328084
SM 0.0393701
SP 0.0393701
SR 1.0
SS 1.0
ST 1.0
SU 0.0393701
SW 0.0393701
TA -1.0
TB 1.0
TC -1.0
TD -1.0
TE 1.0
TF -1.0
TH -1.0
```

APPENDIX I (continued)

SHEFPARM FILE

TJ -1.0
TM -1.0
TN -1.0
TP -1.0
TR -1.0
TS -1.0
TV 1.0
TW -1.0
TX -1.0
TZ -1.0
UC 0.6213712
UD 1.0
UE 1.0
UG 2.2369363
UL 0.6213712
UP 1.0
UQ 1.0
UR 1.0
US 2.2369363
VB 1.0
VC 1.0
VE 1.0
VG 1.0
VH 1.0
VJ 1.0
VK 1.0
VL 1.0
VM 1.0
VP 1.0
VQ 1.0
VR 1.0
VS 1.0
VT 1.0
VU 1.0
VW 1.0
WA 1.0
WC 1.0
WD 3.2808399
WG .0393701
WH 1.0
WL 1.0
WO 1.0
WP 1.0

APPENDIX I (continued)

SHEFPARM FILE

```
WS 1.0
WT 1.0
WV 3.2808399
WX 1.0
WY 1.0
XC 1.0
XG 1.0
XL 1.0
XP 1.0
XR 1.0
XU 2.2883564
XV 0.6213712
XW 1.0
YA 1.0
YC 1.0
YF 1.0
YI 1.0
YP 1.0
YR 1.0
YS 1.0
YT 1.0
YV 1.0
YY 1.0
*2            DURATION CODES AND ASSOCIATED VALUES
A   1008
B   1002
C   0015
D   2001
E   0005
F   1004
G   0010
H   1001
I   0000
J   0030
K   1012
L   1018
M   3001
N   2015
P   5004
Q   1006
R   5002
S   5001
T   1003
```

APPENDIX I (continued)

SHEFPARM FILE

```
U   0001
V   5003
W   2007
X   5005
Y   4001
Z   5000
*3                           TS CODES
C1 1
C2 1
C3 1
C4 1
C5 1
C6 1
C7 1
C8 1
C9 1
CA 1
CB 1
CC 1
CD 1
CE 1
CF 1
CG 1
CH 1
CI 1
CJ 1
CK 1
CL 1
CM 1
CN 1
CO 1
CP 1
CQ 1
CR 1
CS 1
CT 1
CU 1
CV 1
CW 1
CX 1
CY 1
CZ 1
FA 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
FB 1
FC 1
FD 1
FE 1
FF 1
FG 1
FL 1
FM 1
FN 1
FP 1
FQ 1
FR 1
FU 1
FV 1
FW 1
FX 1
FZ 1
HA 1
HB 1
HC 1
HD 1
HE 1
HF 1
HG 1
HH 1
HI 1
HJ 1
HK 1
HL 1
HM 1
HN 1
HO 1
HP 1
HQ 1
HR 1
HS 1
HT 1
HU 1
HV 1
HW 1
HX 1
HY 1
HZ 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
MA 1
MC 1
MH 1
MK 1
MS 1
MT 1
MW 1
PA 1
PB 1
PC 1
PD 1
PE 1
PF 1
PG 1
PH 1
PI 1
PJ 1
PK 1
PL 1
PM 1
PN 1
PO 1
PP 1
PQ 1
PR 1
PS 1
PT 1
PU 1
PV 1
PW 1
PX 1
PY 1
PZ 1
R2 1
R3 1
R4 1
R5 1
R6 1
R7 1
R8 1
R9 1
RA 1
RB 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
RC 1
RD 1
RF 1
RG 1
RM 1
RP 1
RR 1
RS 1
RT 1
RV 1
RW 1
RX 1
RZ 1
ZZ 1
1A 1
1B 1
1C 1
1D 1
1F 1
1G 1
1M 1
1P 1
1R 1
1S 1
1T 1
1V 1
1W 1
1X 1
1Z 1
12 1
13 1
14 1
15 1
16 1
17 1
18 1
19 1
2A 1
2B 1
2C 1
2D 1
2F 1
2G 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
2M 1
2P 1
2R 1
2S 1
2T 1
2V 1
2W 1
2X 1
2Z 1
22 1
23 1
24 1
25 1
26 1
27 1
28 1
29 1
3A 1
3B 1
3C 1
3D 1
3F 1
3G 1
3M 1
3P 1
3R 1
3S 1
3T 1
3V 1
3W 1
3X 1
3Z 1
32 1
33 1
34 1
35 1
36 1
37 1
38 1
39 1
4A 1
4B 1
4C 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
4D 1
4F 1
4G 1
4M 1
4P 1
4R 1
4S 1
4T 1
4V 1
4W 1
4X 1
4Z 1
42 1
43 1
44 1
45 1
46 1
47 1
48 1
49 1
5A 1
5B 1
5C 1
5D 1
5F 1
5G 1
5M 1
5P 1
5R 1
5S 1
5T 1
5V 1
5W 1
5X 1
5Z 1
52 1
53 1
54 1
55 1
56 1
57 1
58 1
59 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
6A 1
6B 1
6C 1
6D 1
6F 1
6G 1
6M 1
6P 1
6R 1
6S 1
6T 1
6V 1
6W 1
6X 1
6Z 1
62 1
63 1
64 1
65 1
66 1
67 1
68 1
69 1
7A 1
7B 1
7C 1
7D 1
7F 1
7G 1
7M 1
7P 1
7R 1
7S 1
7T 1
7V 1
7W 1
7X 1
7Z 1
72 1
73 1
74 1
75 1
76 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
77 1
78 1
79 1
8A 1
8B 1
8C 1
8D 1
8F 1
8G 1
8M 1
8P 1
8R 1
8S 1
8T 1
8V 1
8W 1
8X 1
8Z 1
82 1
83 1
84 1
85 1
86 1
87 1
88 1
89 1
9A 1
9B 1
9C 1
9D 1
9F 1
9G 1
9M 1
9P 1
9R 1
9S 1
9T 1
9V 1
9W 1
9X 1
9Z 1
92 1
93 1
```

APPENDIX I (continued)

SHEFPARM FILE

```
94 1
95 1
96 1
97 1
98 1
99 1
*4                        EXTREMUM CODES
D   1
E   1
F   1
G   1
H   1
I   1
J   1
K   1
L   1
M   1
N   1
P   1
R   1
S   1
T   1
U   1
V   1
W   1
X   1
Y   1
Z   1
*5             PROBILITY CODES AND ASSOCIATED VALUES
A 0.002
B 0.004
C 0.01
D 0.02
E 0.04
F 0.05
G 0.25
H 0.75
J 0.0013
K 0.0228
L 0.1587
M -0.5
N 0.8413
P 0.9772
```

APPENDIX I (continued)

SHEFPARM FILE

```
Q 0.9987
T 0.95
U 0.96
V 0.98
W 0.99
X 0.996
Y 0.998
Z -1.0
1 0.1
2 0.2
3 0.3
4 0.4
5 0.5
6 0.6
7 0.7
8 0.8
9 0.9
*6        SEND CODES OR DURATION DEFAULTS OTHER THAN I
AD ADZZZZZ
AT ATD
AU AUD
AW AWD
EA EAD
EM EMD
EP EPD
ER ERD
ET ETD
EV EVD
HY HGIRZZZ  1
HN HGIRZNZ
HX HGIRZXZ
LC LCD
PF PPTCF
PP PPD
PR PRD
PY PPDRZZZ  1
QC QCDQN QRIRZNZ
QV QVZ
QX QRIRZXZ
QY QRIRZZZ  1
SF SFDRZZZ
RI RID
RP RPD
```

APPENDIX I (continued)

SHEFPARM FILE

```
RT RTD
TC TCS
TF TFS
TH THS
TN TAIRZNZ
TX TAIRZXZ
UC UCD
UL ULD
XG XGJ
XP XPQ
*7                      DATA QUALIFIER CODES
B
D
E
F
G
L
M
N
P
Q
R
S
T
V
W
**                 AX NUMBER OF ERRORS (I4 FORMAT)
500
**
```

APPENDIX J

SHEFPRINT ERROR MESSAGES

Num	Remark
001	Intentionally left blank
002	Two digits are required in date or time group
003	An expected parameter code is missing
004	File read error while accessing data file
005	No dot in column 1 when looking for new message
006	Dot found but not in column 1 of new message
007	Unknown message type, looking for .A, .B, or .E
008	Bad char in message type format (or missing blank delimiter)
009	Last message format was different from this continuation messg
010	Last message was NOT a revision unlike this continuation messg
011	Last message had an error so cannot continue
012	No positional data or no blank before it
013	Bad character in station id
014	Station id has more than 8 characters
015	Bad number in positional data date group
016	Incorrect number in date group
017	Incorrect number in time group
018	Missing blank char in positional data
019	Bad creation date
020	Bad date code letter after the character “D”
021	Unknown data qualifier, data value is lost
022	Unknown data units code (need S or E)
023	Unknown duration code
024	Bad 2-digit number following duration code
025	Unknown time interval code (need Y,M,D,H,N,S,E)
026	Bad 2-digit number following time interval code
027	Bad character after “DR” (relative date code)
028	Bad 1- or 2-digit number in relative date code
029	Bad character in parameter code
030	Bad parameter code calls for send code
031	Trace for code other than PP, PC, PY, SD, SF, SW
032	Variable duration not defined
033	Bad character where delimiter is expected
034	Non-existent value for given type and source parameter code
035	ZULU, DR, or DI has send code QY, PY, or HY
036	Forecast data given without creation date
037	No value given after parameter code and before slash or eol

APPENDIX J (continued)

SHEFPRINT ERROR MESSAGES

Num	Remark
038	Explicit date for codes DRE or DIE is not the end-of-month
039	Year not in good range (1753-2199)
040	Exceeded limit of data items
041	Too many data items for given .B format
042	Not enough data items for given .B format
043	Cannot adjust forecast date to Zulu time
044	Time between 0201 & 0259 on day changing from standard to daylight
045	No time increment specified (use DI code)
046	No ".END" message for previous ".B" format
047	ID requires 3 to 8 characters
048	For daylight savings time, check Apr or Oct for 1976 thru 2040 only
049	Bad character in the message
050	Missing parameter code
051	Bad value chars (or missing delimiter), data may be lost
052	Bad character in data field
053	"?" not accepted for missing, use "M" or "+"
054	Parameter code is too long or too short
055	Missing delimiter between data type fields
056	Missing delimiter after data type field
057	Should use "/" after date, time, or other D-code; before data
058	Parm codes PP and PC require decimal value
059	Abort, cannot read "shefparm" file correctly
060	Non-existent value for given duration parameter code
061	Non-existent value for given extremum parameter code
062	Non-existent value for given conversion factor parameter code
063	Non-existent value for given probability parameter code
064	Parameter code too short or field misinterpreted as param-code
065	Comma not allowed in data field, data value is lost
066	Date check for yr-mo-da shows bad date
067	No data on line identified with a message type format
068	An unexpected ".END" message was encountered
069	BUMMER!!! Maximum number of errors reached, abort message
070	Cannot output to binary shefpars file
071	Cannot access "PE conversion factors" from the "shefparm" file
072	Cannot access "send codes" from the "shefparm" file
073	Cannot access "duration codes" from the "shefparm" file

APPENDIX J (continued)

SHEFPRINT ERROR MESSAGES

Num	Remark
074	Cannot access “type/source codes” from the “shefparm” file
075	Cannot access “extremum codes” from the “shefparm” file
076	Cannot access “probability codes” from the “shefparm” file
077	Cannot read “SHEFPARM” file!!!!!
078	Bad character in data value, data value is lost
079	Julian day should be written with 3 digits
080	Too many digits in date group!
081	Too many characters in quotes
082	Data line found before completing .B format line(s)
083	Missing slash delimiter or bad time zone code
084	Too many chars in qualifier code, data value is lost
085	Bad data qualifier, rest of format is lost
086	Retained comment found without a data value, comment is lost
087	Unexpected slash found after parameter code, before data value
088	Cannot access “qualifier codes” from the “shefparm” file
089	Intentionally left blank
090	Unknown error number given