Precipitation records.

Process of Analyzing, Approving and Auditing of Precipitation Records

Analyzing Precipitation Records (permanent)

This section applies to “permanent” records of rainfall as opposed to “temporary” records that are only displayed for 120 days and do not require periodic station analysis or approval. Site categorization at permanent precipitation sites as it relates to Continuous Records Processing is not based on physical conditions at the site but rather by WSC policy on the number of calibrations required each year. WMA policy (OSW TM 2006.01) dictates that precipitation records cannot be approved unless that period is bookended by successful instrument calibrations. Thus, completion of the “Analyzed” phase of precipitation records processing may or may not infer readiness for the approval phase. But because this is primary data that could be displayed up to 3 years, it would be prudent to provide as much analysis as possible between calibrations, which could be as much as a year apart. Requisite field collection requirements outlined in OSW TM 2006.01 should be followed during all interim visits and the results properly documented. It is the responsibility of the hydrographer who performed the field work to finish any field notes including any calibrations, if needed, before the record can be analyzed. All entries to databases, archival of electronic files, and any other storage and updating of data collected, such as back up data, are to be completed by the party who collected the data, or other designated person per the Center’s surface-water quality assurance plan. Field data needs to be verified for transcription errors and evaluated for consistency and proper technique prior to beginning the analysis process. As per OSW TM 2006.01, data displayed on the Internet should be scanned daily and spurious spikes corrected during major storms. Less obvious errors should be corrected during periodic analysis. A station analysis must be written using the established Station Analysis Template and stored in the Record Management System (RMS). The record-period analyst executes the following steps to bring the time-series record to an analyzed state:

- Ensure that required verification and evaluation of field data has been done and documented, as per WSC procedures, before the analysis begins.
- If a year or more has elapsed since the last successful calibration, action should be taken to schedule a calibration as soon as possible.
- Update the Station Description with any relevant changes that have occurred at the site during the analysis period.
- [*If one or more calibrations were made during the analysis period*] Examine the calibration notes for accuracy and completeness. Verify and document as needed, any

actions taken as a result of the calibration(s) (note no factor corrections based on calibrations are allowed). Document the date and results of the calibration in the **Calibrations** section of the station analysis.

- Merge any backup time-series data when needed and available. Where the data came from, why there was a gap in the primary time-series, and the period that contains the merged data are to be presented in the **Precipitation Record: Backup Data** section of the station analysis. Periods with transmission errors for which no back-up data from on-site loggers is available should be documented in this section as well.
- Examine the recorded incremental rainfall time series and identify periods of erroneous or missing values. Describe any site or instrument conditions that could compromise the quality of the record. Periods when recorded values are missing, affected by ice/snow, funnel clogging or damage to the gage itself should be provided in the **Precipitation Record: Missing, ice/snow, or funnel clog affected** section of the station analysis. Erroneous values should be deleted to remove them from further analysis. Provide dates for any gaps/deletions and describe edits to the cumulative rainfall record in the **Precipitation Record: Edits** section.
- Generally, data corrections are discouraged since little or no data is available to support how and when corrections should be applied. Provide dates for any corrections and describe them in detail in the **Precipitation Record: Corrections** section.
- If required, develop estimates of instantaneous or daily values for any identified gaps in the time series. An example would be filling in an instantaneous values record gap, where it has been verified that no precipitation occurred, with zeroes. Instantaneous values during storm events should never be estimated but where ice/clogging occurs during periods of 3 days or less and the total volume is deemed correct but the distribution by recording interval is not known, DAILY VALUES can be estimated per OSW TM 2006.01. A detailed discussion on how such estimates were developed, their period of applicability, and why they were deemed necessary for the analysis period must be included in the **Precipitation Record: Estimates** section of the station analysis.
- Compare the computed incremental rainfall time series (hyetograph) for the analysis period to another time series from a different USGS or National Weather Service site. The station(s) used in the comparison and the methods used for comparison are to be documented in the **Precipitation Record: Hyetographic Comparison** section of the station analysis. The results of the comparison, to include periods that compared both favorably and not, should be discussed and reasons why periods did not compare well should be provided. If a reasonable comparison station does not exist, a statement to that effect must be made in the **Precipitation Record: Hyetographic Comparison** section of the station analysis.
- Provide any pertinent remarks or comments for the analysis period that are not contained in other sections in the **Comments** section of the station analysis, such as recommendations that might remediate compromising site conditions. No quality-designation (good, fair, poor) should be assigned to the record in the station analysis.

After completing the above described tasks, the analyst should set the record for the analysis period to the analyzed state in NWIS and in the records tracking system. Only periods which end with an instrument calibration should be subsequently forwarded for "approval" after being marked as analyzed. If annual calibrations are overdue and the record has been analyzed and approved, revisions (deletion of 1+ years of record) may be required as per established revision criteria.

Approving Precipitation Records

Each precipitation record is subject to a quality control process that involves a thorough examination of the methods and procedures used, and to verify the accuracy and interpretations of the analyzed record period. The examination includes the checking for gross errors in the record computation process as well as verifying that interpretations and justifications for the decisions made during analysis are sound and valid. Verification of the analyst's work may require updates to the analyzed period. The record approver documents this examination in RMS using the established Approval Guidance. Analysis periods that are determined to have errors are documented and returned to the record analyst for corrections. Contentious changes are negotiated among the parties, with the Data Chief or Field Office Chief resolving any difference of opinion. After all issues are resolved, the analysis period will be set to the approved state in NWIS and the records tracking system. The record-period approver executes the following steps to bring the time-series record to an approved state:

- Verify that field and calibration notes were reviewed and the reviews were documented in accordance with WSC procedures. This task must be completed before continuing on with the remaining approval tasks.
- Ensure that the Station Description is current and relevant and has been properly updated to reflect any changes made during analysis period.
- Verify the need for an instrument calibration based on WSC policy or minimum WMA policy standards (one year). Analysis periods wherein a calibration is overdue, or when calibration procedures were deficient should not be further reviewed or set to "approved" until a proper calibration is performed. If calibration is overdue, or determined to be invalid, and the record is approved, make arrangements for a calibration immediately. If approved record is followed by an unsuccessful calibration, all data since the last calibration should be deleted from the database.
- Verify that any edits to the recorded record were done properly, and that they were documented in the station analysis. The approver should verify the period(s) identified as affected by ice or clogs.
- Determine if IV and DV estimates are appropriate, consistent, were done using adequate methods and data, and documented in the station analysis.
- Evaluate the adequacy of the hyetographic comparison and accompanying narrative.
- Provide a brief written final assessment of the analysis period.

After completing the above described tasks, the approver should set the record for the analysis period to the approved state in NWIS and in the records tracking system.

Auditing Precipitation Records

Routine Auditing of Precipitation Records

A minimum of 10 percent of a WSC's precipitation records should be audited at intervals of about 1 year or less. More frequent audits are welcome, however no more than 90 percent of the data can be left un-audited for longer than fifteen months. If significant issues are found at a number of sites during routine audits, the percent of stations being audited should be expanded. Routine audits are performed by Field Office Chiefs, senior hydrographers, surface-water specialists or the Data Chief. It is highly encouraged to have a subset of routine audits done by other offices within the WSC or offices in other WSCs. The purpose of the routine audits is to ensure proper methods were applied throughout the process of obtaining the precipitation data and computing the record. Errors found during a routine audit are to be revised if they meet revision criteria. Contentious changes should be coordinated among the parties, with the Center designee resolving any disputes. Routine audits are to be documented by filling out the Audit Template in RMS. It is the responsibility of the record auditor to review the following:

- Station analysis
- Approval documentation
- Calibration documentation
- Applied corrections
- Edits to recorded precipitation data
- Estimated values
- Hyetographic comparisons
- Stated record quality
- The station description should be reviewed for completeness and accuracy.

Non-routine Auditing of Precipitation Records

Non-routine audits includes any aspect of any record which has already been set to an approved state. For example, an end-user may have a question about rainfall data approved two years previously. Errors found during non-routine audits are subject to defined error threshold criteria for revisions. Non-routine audits do not have any required tasks aside from documentation of the audit to include; the date of the audit, the auditor, what was examined, why it was examined, and the outcome of the audit to include a discussion of potential revisions, if any. Another example of a non-routine audit would be a record that is examined during a triennial discipline review. In this case, all aspects of a designated period are examined and the documentation would include the notes or forms that were filled out by the reviewer. Non-routine audits are to be documented by filling out the Audit Template in RMS.