

Methodology 8: Criteria for Adjustments to Compliance Daily Per Capita Water Use

Introduction

In writing SBx7-7, the legislature recognized that factors outside of a water suppliers control could cause water use during a compliance year (2015 or 2020) to exceed the supplier's water use target despite the supplier's efforts to improve water use efficiency. The legislature addressed this issue in section 10608.24 (d) by providing three possible adjustments water suppliers can use in calculating compliance daily per capita water use. These include adjustments for:

1. weather that is different from the average of the baseline years,
2. changes in water use due to new or expanded institutions, or economic activity beyond what is accounted for by population growth, and
3. extraordinary events such as increased water use to fight a large fire.

Methodology 8 was not included in the October 2010 publication of the Methodologies for Calculating Baseline and Compliance Urban per Capita Water Use as the methodology was not required for water suppliers to complete their 2010 urban water management plans.

Methodology 8 describes the process that urban retail water suppliers must follow if they are eligible for and choose to adjust their compliance daily per capita water use. The methodology addresses:

- The conditions under which suppliers are eligible to adjust compliance year daily per capita water use
- The order in which adjustments are to be made in cases where water suppliers consider making more than one adjustment
- The information suppliers must provide to justify and calculate the compliance year adjustments. (I think you can continue to use "must" on the first page, for example they must follow the methodology and must provide us information. They don't have the option of not providing even any information about how they came up with their adjustments. It's in the details of the adjustments that we can give them some flexibility)
- Adjustment calculations and application to the supplier's compliance daily per-capita water use.

Definition of Adjustments to Compliance Daily Per Capita Water Use

Section 10608.24 states:

(1) When determining compliance daily per capita water use, an urban retail water supplier may consider the following factors:

(A) Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period.

(B) Substantial changes to commercial or industrial water use resulting from increased business output and economic development that have occurred during the reporting period.

(C) Substantial changes to institutional water use resulting from fire suppression services or other extraordinary events, or from new or expanded operations, that have occurred during the reporting period.

(2) If the urban retail water supplier elects to adjust its estimate of compliance daily per capita water use due to one or more of the factors described in paragraph (1), it shall provide the basis for, and data supporting, the adjustment in the report required by Section 10608.40.

Water Code Section 10608.12(i) defines “*Institutional water user*” as *a water user dedicated to public service. This type of user includes, among other users, higher education institutions, schools, courts, churches, hospitals, government facilities, and nonprofit research institutions.*

Water Code Section 10608.12(d) defines “*Commercial water user*” as *“a water user that provides or distributes a product or service.”*

Water Code Section 10608.12(h) defines “*Industrial water user*” as *“a water user that is primarily a manufacturer or processor of materials as defined by the North American Industry Classification System code sectors 31 to 33, inclusive, or an entity that is a water user primarily engaged in research and development.”*

Water Code Section 10608.12 (e) defines “*Compliance daily per-capita water use*” as *“the gross water use during the final year of the reporting period.”*

Overview of Process and Sequence of Adjustments to Compliance Daily Per Capita Water Use

The adjustments described in this chapter are to be applied to compliance year water use. No adjustments should be made to the target water use and/or baseline water use. Baseline and target water use may be revised, but the revisions should be based on revised population and/or gross water use data or the selection of another target method. Directions for baseline and target revisions are provided in Methodologies 1, 2 and 3. Water suppliers may choose to adjust their compliance year water use regardless of the target method chosen.

Prior to making compliance year adjustments, the supplier should first calculate an unadjusted compliance daily per capita water use following Methodologies 1, 2 and 4 for gross water use, service area population and compliance daily per capita water use. Suppliers who are eligible and elect to exclude industrial process water use from the gross water use calculations must also exclude industrial process water use from all other calculations for compliance year adjustments.

Methodology 8 separates substantial changes in institutional water use into two adjustments (CWC 10608.24 (c)). Adjustment 1 is used for substantial changes to institutional water use due to extraordinary events such as fire suppression. Increases in institutional water use due to extraordinary events are primarily unmetered and are one time or rare occurrences. Adjustment 2 is used for substantial changes in institutional water use due to new or expanded operations, as well as substantial changes in commercial or industrial water use due to increased business output and economic development. The increase in institutional water use due to new or expanded operations should be based on metered data and the adjustment should be addressed in a manner consistent with adjustments for increased commercial or industrial water use.

Adjustments to compliance daily per capita water use should be applied via one of the two optional sequences:

Option 1

Step 1) Adjustments for institutional water use resulting from fire suppression services and other extraordinary events.

Step 2) Adjustments to institutional water use resulting from new or expanded operations and adjustments to commercial or industrial water use resulting from increased business output and economic development.

Step 3) Adjustments for differences in evapotranspiration and rainfall between the baseline and compliance reporting periods.

Option 2

It may be possible to develop both the weather and economic adjustments from a single statistical model. Within this single statistical model approach, water suppliers have the option of taking a credit due to unusual weather, or a credit due to differences in economic conditions, or both. They do not have to take both credits, even though both weather and economic effects could be included in the statistical model. However, water suppliers cannot engage in double-counting, by first adjusting their Gross Water Use for unusual economic conditions, then fitting a dual weather/economy normalization model to already adjusted Gross Water Use. Therefore the following sequence should be followed:

Step1) Adjust Gross Water Use for fire suppression services and other extraordinary institutional events.

Step 2) Further adjust Gross Water Use, using results of the statistical model fitted to Gross Water Use developed in Step 1 above, for differences in evapotranspiration, rainfall and economic factors between the baseline and compliance reporting periods.

Sequence of Adjustments to Compliance Daily Per Capita Water Use

Calculate compliance daily per capita water use

1. One-time, Extraordinary Events:

Substantial changes to institutional water use from fire suppression services or other extraordinary events that have occurred during the reporting period

2. New Institutions or Economic Development:

Substantial changes to institutional water use from new or expanded operations, or substantial changes to commercial or industrial water use resulting from increased business output and economic development, that have occurred during the reporting period

Using a single model for weather and economic conditions?

no

yes

Adjust for Economic Conditions and/or Weather

3. Weather Normalization:

Differences in evapotranspiration and rainfall in the baseline period compared to the compliance reporting period

Calculate adjusted compliance daily per capita water use

Adjustment 1: Calculating Adjustments to Institutional Water Use for Fire Suppression Services or Other Extraordinary Events

This category of adjustments accounts for one-time, extraordinary events that substantially increased a supplier's compliance year water use and did not occur on a regular basis either in the baseline or compliance reporting years. The institutional water use associated with extraordinary events, such as fire suppression is typically unmetered. To document an unmetered increase in water use, water suppliers can use water production records during the time of the event, as shown in step 2A below. Adjustments for metered institutional use for extraordinary events should use step 2B. Adjustments to metered commercial or industrial use for extraordinary events should use Adjustment 2.

Step 1: Document that the event was extraordinary – for both metered and unmetered institutional use

Water suppliers must provide documentation illustrating that the event and its associated increase in water use was a one time or rare event and did not occur on a regular basis in the baseline period. This documentation can be in the form of fire department or emergency service records, media reports or other historical records.

Step 2: Document Use for Extraordinary Event

Step 2A: For Unmetered Institutional Use:

Since water use under this category of adjustment is rarely metered, water suppliers shall estimate the water use for the extraordinary event through other available data such as water treatment plant production data, or drawdown from storage in the distribution system. When using water production data, the water supplier must calculate the increase in production for the time period of the event relative to the normal water production for that time period. The calculation of increased water use is only for water that is included in the gross water calculation. Water that is used for the extraordinary event that comes from sources outside of the distribution area defined in the gross water use calculation should not be included in the extraordinary event adjustment calculations.

Step 2B: For Metered Institutional Use:

The water supplier shall document the quantity of increased water use during the time period of the extraordinary event, relative to the normal water use for that time period and relative to the use immediately prior and after the event, based on metered data. The calculation of increased water use is only for water that is included in the gross water calculation. Water that is used for the extraordinary event that comes from sources outside of the distribution area defined in the gross water use calculation should not be included in the extraordinary event adjustment calculations.

Step 3: Calculate Extraordinary Event Institutional Use Adjustment

- 3.1. Convert the volume of water from step 2A or step 2B into daily per capita water use units. Divide the volume of water from step 2A or step 2B by the water supplier's compliance year service area population and 365 days of the year. This constitutes the extraordinary event institutional water use adjustment, in GPCD.

- 3.2. Calculate the compliance year water use adjusted for an extraordinary event. Subtract the extraordinary event water use in units of GPCD (Step 3.1) from the unadjusted compliance year daily per capita water use. The result is the compliance year daily per capita water use adjusted for an extraordinary event.

Institutional Use Adjustment for Fire Suppression or Extraordinary Events

Document basis of one-time, extraordinary event by providing supporting institutional use data and narrative descriptions of the event

Calculate compliance year unadjusted daily per capita use

Calculate increase in institutional use for extraordinary event in GPCD

subtract

Adjusted Compliance Urban Daily Per Capita Use

Example 1A: Extraordinary Fire Suppression Services

Water Supplier A provides water for fire suppression services. In the interim compliance year 2015, there was an extraordinary fire event that lasted for five days called the Cleveland Fire. Fire department reports and local news story documented that the fire was the largest and long lasting fire the region had experienced. Using water treatment plant records, Water Supplier A estimated that the quantity of treated water produced and sent into the distribution system during the five day period increased by 8.6 million gallons (MG).

The extraordinary fire suppression adjustment is calculated as 2.4 GPCD by dividing 8.6 MG by the water supplier's 2015 service area population of 10,000 and further divided by 365 days of the year. Water Supplier A had calculated an unadjusted compliance daily per capita water use of 148.2. Subtracting 2.4 GPCD, Water Supplier A's compliance daily per capita water use adjusted for the Cleveland fire is 145.8.

Adjustment 2: Calculating Adjustments to Institutional Water Use from New or Expanded Operations or Adjustments to Commercial or Industrial Water Use Resulting from Increased Business Output and Economic Development

Adjustment 2 accounts for substantial changes to commercial, industrial or institutional water use due to new or expanded institutional water use or due to increased commercial and/or industrial business output and economic development. The increase in water use due to economic activity should be as a result of factors outside of service area population growth. Therefore any adjustment may primarily be driven by institutions and businesses that serve nonresident populations and customers. Examples include the expansion of a college or university that draws students from outside the service area, a regional mall, or a business making a product that is sold broadly.

Increases in water use from institutions or businesses that are started or expanded to serve a new residential development or a larger population are not eligible for this adjustment. Since compliance year water use is reported on a daily per capita basis, the increase in water use for institutions or businesses which expand to serve larger population should not increase the compliance year daily per capita water use.

To account for possible changes in water use between sectors (an industrial facility becoming a commercial facility) water suppliers must first document that the percentage reduction in CII water use between baseline years and the compliance year is less than the percent reduction from the baseline water use required to meet the supplier's water use target. Water suppliers whose CII percentage reduction is greater than the water use target percent reduction are not eligible for Adjustment 2.

Water suppliers must document that the increase in institutional, commercial or industrial water use proposed for adjustment has increased due to new or expanded institutions, or due to increased business output and economic development. Water suppliers can document the increase through measures like institutional enrollments, employment statistics, and statistics on business output or trade.

Step 1: Quantify CII Water Use Reduction

This step is intended to identify CII water use that may be eligible for adjustment. The calculations also separate the effect of changes in CII water use due to new or expanded institutions and economic development from that due to growth in population. Only the former may be eligible for this adjustment.

- 1.1. Calculate daily CII water use per capita for both the baseline period and the compliance year(s) using Methodology 7. Calculate the percentage reduction achieved in CII daily per capita water use for the compliance year(s) compared to the baseline period.
- 1.2. If the percentage reduction in CII daily per capita water use in the compliance year(s) (from step 1.1) equals or exceeds the target percentage reduction in baseline GPCD, no economic adjustment can be made.

Step 2: Documentation of Basis and Supporting Data for the Adjustment

Water suppliers making the economic adjustment must provide both a narrative description and numeric water use data to substantiate the adjustments. The data must illustrate the specific changes in institutional, commercial, or industrial water use by customer accounts where possible, between the baseline period and the compliance year(s).

2.1 For substantial changes to institutional water use from new or expanded operations:

- 2.1.1** Provide a narrative that identifies and documents new institutions or existing institutions with expanded operations within the service area that have caused institutional water use to increase significantly during the reporting period.
- 2.1.2** Calculate the change in the compliance year's institutional daily per capita water use compared to that in the baseline period.

2.2 For substantial changes to commercial or industrial water use from increased business output and economic development:

- 2.2.1** Provide a narrative that identifies and explains the increase in commercial and industrial water use within the service area due to increased business output and economic development.
- 2.2.2** Document the change in compliance year(s) daily commercial and/or industrial water use per capita compared to that in the baseline period.

Step 3: Correlation with Institutional or Economic Development Indicators

Demonstrate that the increase in institutional, commercial, or industrial water use is directly related to a net expansion in institutional operations, or a net increase in business output and economic development between the supplier's baseline period and compliance year(s). This step is necessary to prove that the increase in CII use is driven by economic factors and is not a result of service area population growth or change in water management.

- 3.1** Provide the institutional or economic development indicators that correlate with the increase in institutional, commercial, or industrial water use documented in step 2. Institutional or economic indicators include:
 - Employment statistics¹ that show net increases in the specific institutional, commercial, or industrial sectors.
 - Net increase in institutional enrollment, census, employment, or occupancy.
 - Net gain in measures of business output and economic development such as production volume, sales tax revenue², US Department of Commerce measures of retail trade, or other indicators of manufacturing and wholesale activities.
 - Net gain in measures of non-resident population such as hotel occupancy rates, or measures of consumer expenditures such as attendance at entertainment venues.

¹ Employment Development Department publishes monthly labor force data by county.

² Board of Equalization publishes annual reports on local sales tax distribution by city.

- Net increase in commercial sector activities due to an extraordinary, mega-event such as hosting the Olympics or Super Bowl during the compliance year.
- Other economic indicators.

3.2 Adjust any economic indicators measured in dollars for inflation by using the CPI (reference to specific CPI series, such as USACPIBLS).

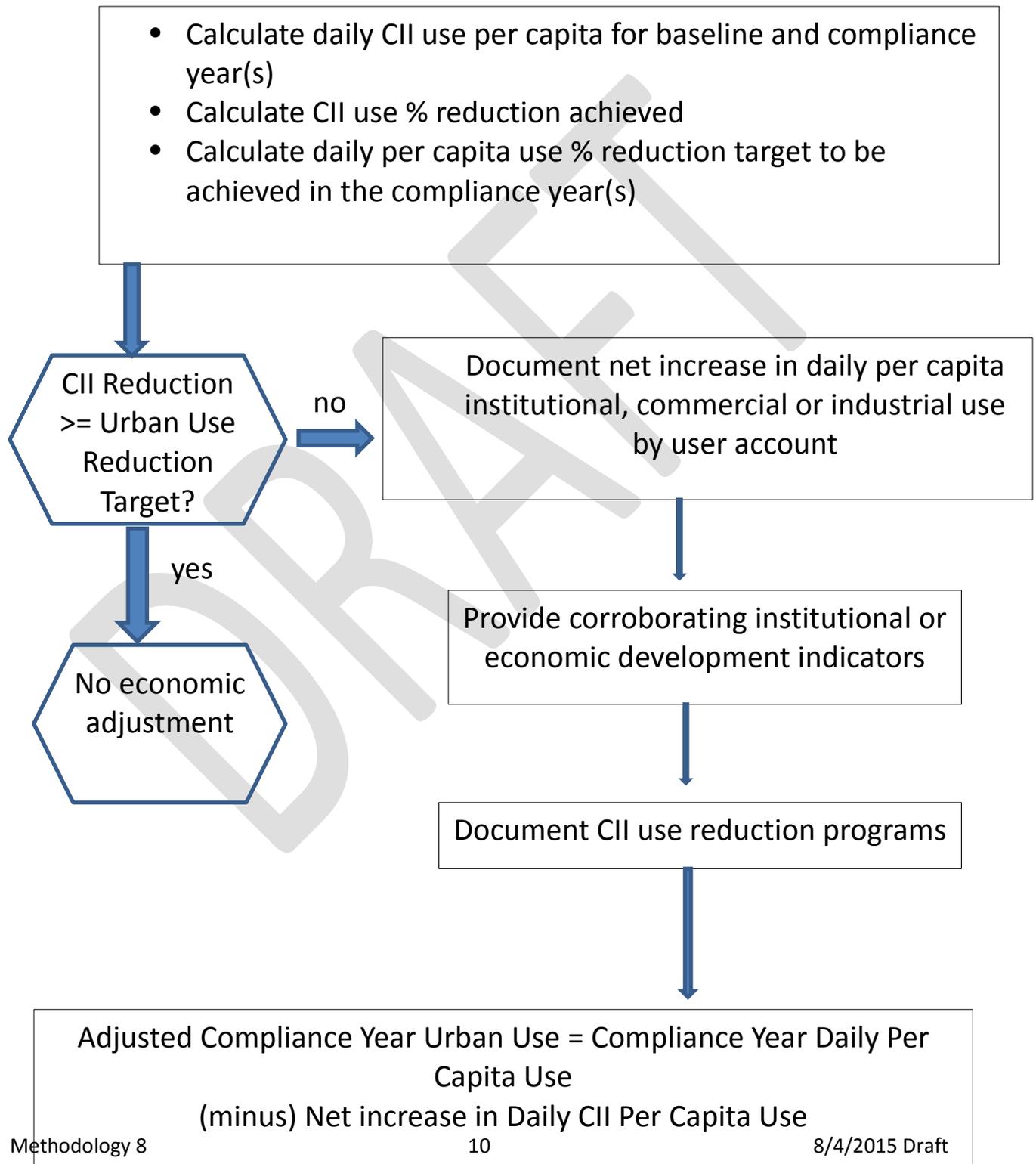
Step 4: Document CII Water Use Reduction Programs and Efforts

Describe, in the demand management section of the supplier's urban water management plan or through the California Urban Water Conservation Council BMP reports submitted in lieu of the UWMP DMM section, the CII demand management measures the water supplier has implemented. Water suppliers not implementing CII DMMs are not eligible for the compliance year economic adjustment.

Step 5: Calculate the Economic Adjustments due to New or Expanded Institutions or Increased Business Output and Economic Development

To calculate the compliance daily per capita water use adjusted for economic activity, subtract the net change in commercial daily per capita water use, institutional daily per capita water use, or industrial daily per capita water use (from step 2.1.2 or 2.2.2) from the unadjusted compliance year daily per capita water use.

CII Use Adjustment from Expanded Institutional Operations or Increased Business Output and Economic Development



Example 2A: Expanded Operation at a University Campus

Retail water supplier A provides water service to University U. Between the baseline period and year 2020, University U expanded its campus and enrollment increased. Water Supplier A needs to compare the CII use reduction achieved in year 2020 to the 2020 urban water use reduction target, after factoring in the increase in resident population. The CII use reduction achieved in 2020 was 16%, smaller than the 2020 urban water use reduction target of 19%. Water Supplier A is thus eligible to make the expanded institutional water use adjustment.

Although institutional water use for University U increased between 2020 and the baseline period, the net increase in total institutional water use within Water Supplier A's service area was only 2.3 GPCD, due to downsizing of some government facilities. The net institutional water use adjustment is 2.3 GPCD, to be subtracted from the 2020 urban daily per capita water use.

Example 2B: Increased Industrial Water Use Resulting from Increased Business Output and Economic Development

There was a net increase in industrial water use between the baseline period and year 2015 within the service area of Water Supplier B. After performing the eligibility step, the supporting data show a decrease of industrial water use in the Fruit and Vegetable Preserving and Specialty Food Manufacturing Sector and an increase in industrial water use in the Dairy Product Manufacturing Sector. The net increase in daily per capita industrial water use is 1.2 GPCD and constitutes the economic adjustment to be subtracted from the compliance year unadjusted daily per capita water use.

Example 2C: Increased Commercial Water Use Resulting from Economic Development

In the intervening years between the baseline period and the compliance reporting year 2015, City C built a new sports stadium. There were also new commercial establishments such as retail businesses and restaurants built in the area. Existing commercial establishments also reported a general increase in sales. The water supplier that serves City C performed the eligibility step and provided supporting economic data including: employment figures, sales revenue, hotel occupancy rates, and stadium attendance records. Commercial water use in the Entertainment, Food Sales and Hospitality sectors show a net increase of Y GPCD in year 2015 compared to the baseline period. This Y GPCD is the magnitude of economic adjustment that can be subtracted from the 2015 urban daily per capita water use to arrive at the adjusted 2015 compliance urban daily per capita water use.

Adjustment 3: Approach to Calculating Adjustments due to Differences in Evapotranspiration and Rainfall and Economic Activity in the Baseline Period Compared to the compliance Reporting Year

It is expected that water suppliers who will adjust for unusual weather and and/or differences in economic conditions will use a statistical model, calibrated using data from their selected baseline period.

DWR has evaluated several different approaches using real-world water supplier data for normalizing compliance year GPCD. As a result of that exploratory modeling, DWR is in a position to offer several guidelines for water suppliers to follow while developing their weather normalization, or their combined weather/economic normalization models. DWR will examine several model efficacy metrics before determining if the adjustments to compliance GPCD generated by said models meet DWR's criteria.

DWR Modeling Criteria

DWR has separated out the criteria into the following topics:

- A. Model Specification Criteria
- B. Regression Output Criteria

A. Model Specification Criteria

These criteria are intended to ensure that weather and economic adjustments are produced using an appropriate method and that the resulting adjustments are used in an appropriate manner. For each criterion that is not met, an explanation with justification must be provided for DWR review.

1. To weather normalize compliance year GPCD, total water demand (Gross Water Use) should be modeled at the monthly level, or finer. Analysis at an annual level does not provide an adequate basis for weather normalization because the impact of weather on water demand is considerably attenuated. Water suppliers wishing to develop a combined weather/economic normalization model should include the unemployment rate or labor-force participation rate, as economic variables in these models. If these economic measures are available at a monthly level then monthly data should be used. Otherwise, annual economic values can be used by interpolating to obtain monthly values.
2. Water demands normally show variation from month to month, hitting minimum in winter and maximum in summer. This normal variation due to climate should be captured by inclusion of eleven monthly indicator variables or other alternatives, such as Fourier harmonics in the model specification. If one or more of these eleven monthly indicator variables is excluded, suppliers must demonstrate that excluded coefficients had p-values exceeding 0.32 (or t-statistic below 1). This criterion will help ensure that variation due to climate will not be erroneously attributed to weather.
3. Changes in service area characteristics, including conservation, rate structure changes, etc. may cause GPCD to change over time. The model specification should, at a minimum, include a

trend term, and possibly other variables and features, to capture effects influencing water demand during the model calibration period.

4. Unusual weather can cause deviations in the month-to-month variation in water demand that is otherwise considered normal for a given area. The model specification should include measures of weather to capture these deviations. Weather measures should include rainfall and temperature, or rainfall and evapotranspiration; should be representative of the majority of the population in the service area; and should be from a credible source. DWR will make available these weather measures with statewide coverage.
5. If the percentage correction being applied to compliance GPCD to account for abnormal weather exceeds half of the abnormality in weather itself, suppliers must provide a narrative that justifies this adjustment. (For example, if the weather measure used in the model indicates that the compliance year was 10% abnormal relative to the baseline, taking a GPCD credit greater than 5% may trigger a review.)
6. Models should be specified to account for the seasonal differences in the influence of weather on water demand. Weather variables for at least three seasons should be included in the model specification.
7. If water suppliers choose to construct a combined weather/economic normalization model, economic measures should include the unemployment rate or the labor force participation rate for the geographic jurisdiction that best overlaps with a water supplier's service area. These data should be obtained from a state or federal source.
8. For the purpose of model estimation the dependent variable (monthly GPCD) should first be logarithmically transformed. The log specification has a long, respected pedigree in water demand modeling. A model with a log transformed dependent variable generates compliance year corrections --because of deviations in weather and/or economic variables between the compliance year and baseline period—directly in the form of percentages, making it a more robust way for adjusting compliance year GPCD. Example calculations are provided in DWR's Weather Normalization Guidelines document.

B. Regression Output Criteria

These criteria are intended to ensure that, by meeting specific objectives, the model results can be reasonably applied to adjust compliance year GPCD.

1. Model coefficients associated with the weather and, if applicable, economic variables that are used for adjusting compliance year GPCD should be statistically significant at the 5% level at a minimum (p-value ≤ 0.05).
2. Normality assumption for linear regression should not be unacceptably violated. Any appropriate statistical test for residual normality may be deployed. Up to four extreme residuals (outliers) may be excluded before performing this test. The test should demonstrate at a significance level of 10% that model residuals are distributed normally. .
3. Coefficients for the weather and economic variables should have the expected sign.
4. The model's annual GPCD prediction error band should be within $\pm 10\%$ (i.e., the percentage difference between actual and predicted annual GPCD across all the years included in the model calibration time period is within $\pm 10\%$).

Modeling Documentation

The following documentation is necessary to allow DWR to verify that the modeling and regression output criteria have been met.

Water suppliers must submit:

1. Source of and type of weather data with an explanation of how these are representative of supplier's service area.
2. Source of and type of economic data, if a dual weather/economic model is being estimated, with an explanation of how these are representative of supplier's service area.
3. Model description, including dependent and independent variables used in the model.
4. Statistical software used.
5. Model input data.
6. Regression output, including R-square and estimated regression coefficients with the significance (p-values) of each of these coefficients.
7. Indicators of the credibility of the regression significance metrics.
 - Probability plot of model residuals.
 - Results from a test of residual normality.
 - Results from a test for serial correlation.
8. Percent difference between actual GPCD and model predicted GPCD for each year during the baseline period (error band for the model calibration years).
9. Compliance year weather adjustment calculations and, if used, economic adjustment calculations.

Model and weather data options are offered in DWR's Weather Normalization Guidelines document.