

# **CITY OF SACRAMENTO**

# **WATER STUDY DESIGN MANUAL**

This manual is intended to provide developers information needed to complete a water study for a new development project, including the form(s) necessary for a complete submittal.

**January 2018**

Every project, regardless of size, must fill out and submit the “SB 610/SB 221 Water Supply Assessment and Certification Form” (see Attachment 1). This form will confirm or deny the availability of water supply, per the latest Urban Water Management Plan, before the project can proceed.

Once water supply has been validated for the project, then a water study shall be completed for the project design. This study must be stamped by a licensed engineer and submitted to the Department of Utilities for review. The submittal shall include an electronic copy of every submittal, and if requested, electronic copies of the model/calculation tool.

The study must be based on a water system design that meets the City design standards for a public water system, including but not limited, to properly sizing pipe to meet both water quality and fire flow needs for the project, looping systems for redundancy and improved water supply, and hydrant placement as it relates to the surrounding area as well as the project.

Water studies shall follow the “Water Distribution System Criteria” (see Attachment 2) and incorporate the following information:

**1) Study Purpose and Objectives**

- a) Include description of the development including any proposed phasing of the improvements
  - i) Geographic location of the project and the surrounding area, including elevations
  - ii) Land use type of the project and the surrounding area (identify if different from the current General Plan)
  - iii) Number of services being proposed
  - iv) Existing water infrastructure as well as proposed new infrastructure, including pipe size, age, and material
  - v) Descriptions of any non-standard proposed designs and reasons for not meeting standards

**2) Study Area**

- a) Location Map
- b) Modeled Water Distribution Layout Map – Include pipe size, demand junctions (include elevations based on project area survey results), tie-in locations, and any necessary system modifications

**3) Demands and Peaking Factors**

- a) Land Use Designation (Units, Acres, and Demand Factor – include source)
- b) Flows to be assessed (concurrently)
  - i) Domestic
  - ii) Irrigation
  - iii) Hydrant Flow
  - iv) Fire Sprinkler Loads (\*Fire sprinkler loads may be waived if authorization is provided by the current City of Sacramento Fire Marshall and the report includes details of the correspondence)
- c) Demand Factor (by Land Use Designation if more than one)
  - i) Average Day Demand (ADD)

- ii) Maximum Day Demand (MDD) - 2.0 x Average Day
  - iii) Peak Hour Demand (PHD) - 2.6 x Average Day
  - iv) Assumed System Losses
- 4) **Design Criteria**
- a) City of Sacramento Design Criteria – Include Source
    - i) Minimum velocity during Average Day Demand
    - ii) Minimum residual pressure during Peak Hour Demand
    - iii) Maximum velocity during Peak Hour Demand
    - iv) Minimum residual pressure during Maximum Day Demand plus fire flow
    - v) Maximum velocity during Maximum Day Demand plus fire flow
    - vi) Maximum headloss per 1,000-LF
    - vii) Minimum velocity during Average Day Demand
    - viii) Hazen Williams “C”
    - ix) Elevations at demand nodes (should reflect surveyed elevations for project)
  - b) Fire Flow Requirements – As Required by the Fire Department (shall be no less than 1,000-gpm with 20-psi residual)
    - i) Flow (gpm)
    - ii) Residual Pressure (psi)
    - iii) Duration (Hours)
- 5) **Hydraulic Analysis Summary**
- a) Model Description - Include software information (if applicable) and source of data
  - b) Existing Boundary Conditions, including results from field hydrant testing
  - c) Model Scenarios and Results
    - i) Include Minimum/Maximum Pressure and Maximum Velocity for Average Day Demand, Maximum Day Demand, Maximum Day Demand plus Fire Flow, and Peak Hour Demand for each scenario (include back-up by junction and pipe segment)
    - ii) Phased projects shall include intermediate and cumulative results
- 6) **Conclusions**

At the discretion of the City Engineer, additional information may be required for the water study. Each project is different and may require additional information dependent on the location, size of development and land use being proposed for the project.

**City of Sacramento**  
**SB 610/SB 221 Water Supply Assessment and Certification Form**

This form may be used to complete water supply assessments for projects located in an area covered by the City's most recent Urban Water Management Plan.

Note: Please do not use this form if the projected water demand for your project area was not included in the City's latest Urban Water Management Plan. To review the City's Urban Water Management Plan, please visit:  
<http://www.cityofsacramento.org/Utilities/Resources/Reports>

**Project:**

**Date:**

**Project Applicant (Name of Company):**

**Applicant Contact (Name of Individual):**

**Phone Number:**

**E-mail:**

**Address:**

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**Project Applicant to fill in the following:**

1. Does the project include:

| Type of Development  | Yes | No |
|--|-----|----|
| A proposed residential development of 500 or more dwelling units   |     |    |
| A shopping Center employing more than 1,000 persons or having more than 500,000 square feet?   |     |    |
| A Commercial Office building employing more than 1,000 persons or having more than 250,000 square feet?  |     |    |
| A proposed hotel or motel, or both, having more than 500 rooms   |     |    |
| A proposed industrial, manufacturing, or processing plant or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area |     |    |
| A mixed use project that includes one or more of the projects specified above  |     |    |
| A project that would demand an amount of water equivalent to, or greater than, the water required by a 500 dwelling unit project   |     |    |

If the answer is no to all of the above, a water supply assessment is not required for the project.

2. Is the projected water demand for the project location included in the City's 2015 Urban Water Management Plan, adopted June 21, 2016?

Yes: \_\_\_\_\_

No: \_\_\_\_\_

If the answer is no, you cannot use this form. Please refer to the requirements of SB 610 for preparing a water supply assessment.

3. Please fill in the project demands below:

| Type of Development  | Land Use Category                              | Demand Factor                                   |  | Proposed Development  |                  |              | Current Zoning        |                  |              |
|----------------------|--|---|--|-----------------------|------------------|--------------|-----------------------|------------------|--------------|
|                      |  | Residential Water Use Factor, afy/dwelling unit | Non-Residential Water Use Factor, afy/employee | Number Dwelling Units | Number Employees | Total Demand | Number Dwelling Units | Number Employees | Total Demand |
| Residential - Low    | Rural Residential (RR)                         |   |  |                       |                  |              |                       |                  |              |
|                      | Suburban Neighborhood Low Density (SNLD)       |   |  |                       |                  |              |                       |                  |              |
|                      | Traditional Neighborhood Low Density (TLDR)    |   |  |                       |                  |              |                       |                  |              |
| Residential - Medium | Suburban Neighborhood Medium Density (SMDR)    |   |  |                       |                  |              |                       |                  |              |
|                      | Urban Neighborhood Low Density (ULDR)          |   |  |                       |                  |              |                       |                  |              |
| Residential - High   | Suburban Neighborhood High Density (SHDR)      |   |  |                       |                  |              |                       |                  |              |
|                      | Traditional Neighborhood Medium Density (TMDR) |   |  |                       |                  |              |                       |                  |              |
|                      | Urban Neighborhood Medium Density (UMDR)       |   |  |                       |                  |              |                       |                  |              |
|                      | Traditional Neighborhood High Density (THDR)   |   |  |                       |                  |              |                       |                  |              |
| Mixed Use            | Employment Center Mid Rise (ECMR)              |   |  |                       |                  |              |                       |                  |              |
|                      | Suburban Center (SCnt)                         |   |  |                       |                  |              |                       |                  |              |
|                      | Suburban Corridor (Scor)                       |   |  |                       |                  |              |                       |                  |              |
|                      | Traditional Center (TCnt)                      |   |  |                       |                  |              |                       |                  |              |

|                            |  |    |  |  |  |  |  |  |  |
|----------------------------|--|----|--|--|--|--|--|--|--|
| Mixed Use - Higher Density | Urban Center High (UCntHigh)           |    |  |  |  |  |  |  |  |
|                            | Urban Center Low (UcntLow)             |    |  |  |  |  |  |  |  |
|                            | Urban Corridor High (UCorHigh)         |    |  |  |  |  |  |  |  |
|                            | Urban Corridor Low (UCorLow)           |    |  |  |  |  |  |  |  |
| Central Business District  | Central Business District (CBD)        |    |  |  |  |  |  |  |  |
|                            | Urban Neighborhood High Density (UHDR) |    |  |  |  |  |  |  |  |
| Commercial                 | Regional Commercial (RC)               |    |  |  |  |  |  |  |  |
|                            | Employment Center Low Rise (ECLR)      |    |  |  |  |  |  |  |  |
| Industrial                 | Industrial (IND)                       | NA |  |  |  |  |  |  |  |
| Public                     | Public/Quasi-Public (PUB)              |    |  |  |  |  |  |  |  |
| Park                       | Parks and Recreation (PRK)             |    |  |  |  |  |  |  |  |
| Open Space                 | Open Space (OS)                        |    |  |  |  |  |  |  |  |
| Other                      |  |    |  |  |  |  |  |  |  |
| Other                      |  |    |  |  |  |  |  |  |  |
| Other                      |  |    |  |  |  |  |  |  |  |
| <b>Total Demand (AFY)</b>  |  |    |  |  |  |  |  |  |  |

4. Required Elements of Water Supply Assessment (Water Code § 10910)

- A. Water supply entitlements, water rights or water service contracts (Water Code § 10910(d)):

The City's water supply entitlements, water rights and water service contract are identified and discussed in the Urban Water Management Plan, Chapters 3, 6 and 7.

All infrastructure necessary to deliver a water supply to the project is in place, excepting any distribution facilities required to be constructed and financed by the project applicant: Yes: \_\_\_\_\_ No: \_\_\_\_\_

- B. Identification of other sources of water supply if no water has been received under City's existing entitlements, water rights or water service contracts (Water Code § 10910(e)):

Not applicable.

- C. Information and analysis pertaining to groundwater supply (Water Code § 10910(f)):

Addressed by Urban Water Management Plan, Chapters 3, 6 and 7.

|  |
|--|
| <p><b><u>Verification of Water Supply</u></b><br/><b>(for residential development of more than 500 dwelling units)</b></p> <p>Based on the City's most recent Urban Water Management Plan, are there sufficient water supplies for the project during normal, single dry and multiple dry years over a 20 year period?</p> <p>Yes: _____ No: _____</p> <p>By: _____</p> <p>Title: _____</p> <p>Date: _____</p> <p style="text-align: center;"><b><u>This box to be filled in by the City</u></b></p> |
|--|

Distribution:

Applicant  
Development Services Department (Org: 4913) – Assigned Planner: \_\_\_\_\_  
Utilities Department (Org: 3334) - Development Review (Tony Bertrand)  
Utilities Department (Org: 3332) - Capital Improvements (Brett Ewart)

**City of Sacramento**  
**Water Distribution System Criteria**

Summary of Recommended Potable Water System Performance and Operational Criteria

| Component  | Criteria  | Comments  |   |
|--|---|---|---|
| <b>Fire Flow Requirements (flow [gpm] @ duration [hours])</b>      |   |   |   |
| Single Family Residential  | 1,500 gpm @ 2 hrs   | Existing Development will be evaluated on a case-by-case basis because of the historical varying standard   |   |
| Multi Family Residential   | 2,500 gpm @ 2 hrs   |   |   |
| Commercial   | 3,500 gpm @ 4 hrs (w/ approved automatic sprinkler system)          |   |   |
| Industrial   | 4,500 gpm @ 4 hrs (w/ approved automatic sprinkler system)          |   |   |
| Institutional  | 4,500 gpm @ 4 hrs (w/ approved automatic sprinkler system)          |   |   |
| <b>Water Transmission Line Sizing</b>                              |   |   |   |
| Diameter   | >= 18-inches  | Locate new transmission pipelines within designated utility corridors wherever possible.  |   |
| <i>Average Day Demand Condition</i>                                |   |   |   |
| Minimum Pressure [psi]   | 30 psi  | Criteria based on requirements for new development, existing transmission mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure. |   |
| Maximum Pressure [psi]   | 80 psi  |   |   |
| Maximum Head loss [ft/kft]   | 3 ft/kft  |   |   |
| Maximum Velocity [ft/sec]  | 3 ft/sec  |   |   |
| Minimum Velocity [ft/sec]  | 0.10 ft/sec   |   |   |
| <i>Maximum Day Demand Condition</i>                                |   |   |   |
| Maximum Pressure [psi]   | 30 psi  |   |   |
| Maximum Head loss [ft/kft]   | 3 ft/kft  |   |   |
| Maximum Velocity [ft/sec]  | 5 ft/sec  |   |   |
| <i>Peak Hour Demand Condition</i>                                  |   |   |   |
| Minimum Pressure [psi]   | 30 psi  | For consistency in hydraulic modeling.  |   |
| Maximum Head loss [ft/kft]   | 3 ft/kft  |   |   |
| Maximum Velocity [ft/sec]  | 5 ft/sec  |   |   |
| Hazen Williams "C" Factor  | 130   |   |   |
| Pipeline Material  | CCP (Concrete Cylinder Pipe), Ductile Iron, or Welded Steel         |   |   |
| <b>Water Distribution Line Sizing</b>                              |   |   |   |
| Diameter   | < 18-inches   | Must verify pipeline size with maximum day plus fire flow analysis. Locate new distribution pipelines within designated utility corridors wherever possible   |   |
| <i>Average Day Demand Condition</i>                                |   |   |   |
| Minimum Pressure [psi]   | 30 psi  | Criteria based on requirements for new development, existing distribution mains will be evaluated on case-by-case basis. Evaluation will include age, material type, velocity, head loss, and pressure. |   |
| Maximum Pressure [psi]   | 80 psi  |   |   |
| Maximum Head loss [ft/kft]   | 7 ft/kft  |   |   |
| Maximum Velocity [ft/sec]  | 5 ft/sec  |   |   |
| Minimum Velocity [ft/sec]  | 0.10 ft/sec   |   |   |
| <i>Maximum Day with Fire Flow Demand Condition</i>                 |   |   |   |
| Minimum Pressure [psi] (at fire node)                              | 20 psi  |   |   |
| Maximum Head loss [ft/kft]   | 10 ft/kft   |   |   |
| Maximum Velocity [ft/sec]  | 10 ft/sec   |   |   |
| <i>Peak Hour Demand Condition</i>                                  |   |   |   |
| Minimum Pressure [psi]   | 30 psi  | 6-inch may apply where minimum velocities aren't met  |   |
| Maximum Head loss [ft/kft]   | 7 ft/kft  |   |   |
| Maximum Velocity [ft/sec]  | 7 ft/sec  |   |   |
| <i>Minimum Pipeline Diameter</i>                                   |   |   |   |
| General  | 8-inches  | 4-inch may apply where minimum velocities aren't met and the dead end is no longer than 250-feet. 6-inch dead end runs shall be no longer than 500-feet.  |   |
| Industrial   | 12-inches   |   |   |
| Distribution to cul-de-sac / dead-end street                       | 6-inches  | For consistency in hydraulic modeling.  |   |
| Distribution to fire hydrants                                      | 8-inches  |   |   |
| Hazen Williams "C" Factor  | 130   | Install PRV if service pressure is greater than 80 psi.   |   |
| Pipeline Material  | Ductile Iron or C900 PVC  |   |   |
| <b>Maximum Water Service Pressure [psi]</b>                        | 80 psi  |   |   |
| <b>Gross Unit Water Use Factors for Retail Distribution System</b> | Composite Residential Use Factor <sup>(a)</sup> [afy/dwelling unit] | Composite Non-Residential Water Use Factor <sup>(b)</sup> [afy/employee]  | (a) Use factor includes 10% for unaccounted-for water. Public and Park uses show small increases in residential dwelling units because the spatial analysis captures small residential areas adjacent to these land uses. Average of residential category used to estimate this small residential use. Significant irrigation requirements for parks are assumed to be provided from wells not connected to the potable water system. Other use factors, such as residential categories, include neighborhood park water use, incorporate park irrigation use in the non-residential category.<br>(b) Use factor includes 10% for unaccounted for water. Residential Low, Medium and High have small non-residential water use sample size. Therefore, Mixed Use Non-Residential used for Residential Low and Medium. Mixed Use - Higher Density used for Residential High. |
| Residential Low  | 0.61  | 0.09  |   |
| Residential Medium   | 0.39  | 0.09  |   |
| Residential High   | 0.12  | 0.04  |   |
| Mixed Use  | 0.19  | 0.09  |   |
| Mixed Use (Higher Density)   | 0.15  | 0.04  |   |
| Central Business Density   | 0.15  | 0.02  |   |
| Commercial/Office  | 0.15  | 0.09  |   |
| Industrial   | --  | 0.14  |   |
| Public   | 0.37  | 0.17  |   |
| Park   | 0.37  | 0.17  |   |
| <b>Gross Unit Water Use Factors for Study Areas</b>                |   |   | Use factor includes 10% for unaccounted-for water and 15% to account for rights-of-way and streets (net water use x 1.1/1.5 = gross water use).   |
| Gross Water Use Factor [afa/acre]                                  |   |   |   |
| Residential Low  | 3.6   |   |   |
| Residential Medium   | 3.8   |   |   |
| Mixed Use  | 2.0   |   |   |
| Commercial/Office  | 1.5   |   |   |
| Industrial   | 0.9   |   |   |
| Park   | 3.0   |   |   |