

R309-510 Facility Design and Operation: Minimum Sizing Requirements.

Table of Contents

R309-510-1. Purpose.	3
R309-510-2. Authority.	3
R309-510-3. Definitions.	3
R309-510-4. General.	3
R309-510-5. Reduction of Requirements.	4
R309-510-6. Water Conservation.	4
R309-510-7. Source Sizing.	5
(1) Peak Day Demand and Average Yearly Demand.	5
(2) Estimated Indoor Use.	5
(3) Estimated Outdoor Use.	8
(4) Accounting for Variations in Source Yield.	9
R309-510-8. Storage Sizing.	11
(1) General.	11
(2) Equalization Storage.	11
(3) Fire Suppression Storage.....	12
(4) Emergency Storage.	12
R309-510-9. Distribution System Sizing.	13
(1) General Requirements.	13
(2) Indoor Use, Estimated Peak Instantaneous Demand.	13
(3) Outdoor Use, Estimated Peak Instantaneous Demand.	14
(4) Fire Flows.....	14

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R309-510. Facility Design and Operation: Minimum Sizing Requirements.

R309-510-1. Purpose.

This rule specifies requirements for the sizing of public drinking water facilities such as sources (along with their associated treatment facilities), storage tanks, and pipelines. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

R309-510-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

R309-510-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

R309-510-4. General.

This rule provides estimates of quantities and flow rates which shall be used in the design of new systems, or if there is an absence of data collected by the public water system meeting the required confidence level for a reduction mentioned below, when evaluating water sources, storage facilities and pipelines. Within each of these three broad categories, the designer shall ascertain the contributions on demand from the indoor use of water, the outdoor use of water, and fire suppression activities (if required by local authorities). These components must be added together to determine the total demand on a given facility.

Guidance: Rules in this section are designed to assure that a water system never runs out of water. This is not only an inconvenience for the public, but a risk to public health and safety. When a distribution goes dry, the risk of system contamination from in-leakage and backflow increases. Furthermore, no fire protection would be available. Thus, the design engineer must give careful consideration to the daily and yearly variations of demand and verify that the system facilities are sufficient. Furthermore, the design engineer shall consider how the system

would behave during drought periods when demands may be higher than usual, and source yield (particularly the of springs) will likely be reduced.

R309-510-5. Reduction of Requirements.

If acceptable data are presented, certain number of days of peak day demand to establish minimum source capacity; certain number of years of annual demand to establish minimum water right requirements; and certain number of readings of peak hourly demand to establish minimum peak instantaneous demand; showing that the requirements made herein are excessive for a given project, the requirements may be appropriately reduced to the 90th percentile of readings, on a case by case basis by the Director. In the case of Recreational Home Developments, in order to qualify for a quantity reduction, not only must the actual water consumption be less than quantities required by rule but enforceable policy restrictions must have been approved which prevent the use of such dwellings as a permanent domicile and these restrictions shall have been consistently enforced. The Director may re-consider any reduced minimums if the nature and use of the system changes.

Guidance: The Director may allow a reduced source and/or storage requirement if the water system presents sufficient and acceptable water use data justifying the reduction (instead of using the default requirements outlined in this rule). The reduction request and the water use data supporting the request are reviewed on a case-by-case basis due to the wide variety of factors to be considered and differences in water systems. It is recommended that, prior to collecting or compiling the water use data for a reduction request, you meet with the Division of Drinking Water engineering staff to understand the information needed for a reduction request and to establish a data collection protocol. The Division has developed two documents to aid public water systems in understanding the information needed to request a reduction in the source or storage requirement.

- *“Information Needed for Reduction in Source Sizing Requirement”*
- *“Information Needed for Reduction in Storage Sizing Requirement”*

These documents are available through the Division as well as on the Division of Drinking Water’s website.

R309-510-6. Water Conservation.

This rule is based upon typical current water consumption patterns in the State of Utah. They may be excessive in certain settings where legally enforceable water conservation measures exist. In these cases the requirements made in this section may be reduced on a case-by-case basis by the Director.

Guidance: Drinking water systems are encouraged to use the water resources of the state wisely. Conservation measures such as low flow toilets and low water demand landscaping (xeriscaping) may significantly reduce the demands on water systems.

R309-510-7. Source Sizing.

(1) Peak Day Demand and Average Yearly Demand.

Sources shall legally and physically meet water demands under two separate conditions. First, they shall meet the anticipated water demand on the day of highest water consumption. This is referred to as the peak day demand. Second, they shall also be able to provide one year's supply of water, the average yearly demand.

Guidance: If the above two criteria are met, the source(s) can be relied upon to adequately serve the system under most, if not all, conditions. The term “legally”, above, refers to what is permitted by the owner’s water right. The design engineer shall fully investigate the available water rights for a system. Water rights vary in the way they are written. Some are written in “cfs”, others are written in terms of “AF”. Still others are written in terms of allowable acreage or livestock. Furthermore, water rights may be restricted to certain times of the year, or certain uses (e.g. irrigation). Consult the Division for assistance in determining how many connections a specific water right may support.

(2) Estimated Indoor Use.

In the absence of firm water use data, Tables 510-1 and 510-2 shall be used to estimate the peak day demand and average yearly demand for indoor water use.

Table 510-1 Source Demand for Indoor Use		
Type of Connection	Peak Day Demand	Average Yearly Demand
Year-Round Use		
Residential	800 gpd/conn	146,000 gal./conn
ERC	800 gpd/ERC	146,000 gal./ERC
Seasonal / Non-Residential Use		
Modern Recreation Camp	60 gpd/person	(see note 1)
Semi-Developed Camp		
a. With pit privies	5 gpd/person	(See note 1)
b. With flush toilets	20 gpd/person	(See note 1)
Hotels, Motel & Resort	150 gpd/unit	(See note 1)
Labor Camp	50 gpd/person	(See note 1)
Recreational Vehicle Park	100 gpd/pad	(See note 1)
Roadway Rest Stop	7 gpd/vehicle	(See note 1)
Recreational Home Development	400 gpd/conn	(See note 1)

Note 1. Annual demand shall be based on the number of days the system will be open during the year times the peak day demand unless data acceptable to the Director, with a confidence level of 90% or greater showing a lesser annual consumption, can be presented.

TABLE 510-2SOURCE DEMAND FOR INDIVIDUAL ESTABLISHMENTS ^(a) (Indoor Use)	
Type of Establishment	Peak Day Demand (gpd)
Airports	
a. per passenger	3
b. per employee	15
Boarding Houses	
a. for each resident boarder and employee	50
b. for each nonresident boarders	10
Bowling Alleys, per alley	
a. with snack bar	100
b. with no snack bar	85
Churches, per person	5
Country Clubs	
a. per resident member	100
b. per nonresident member	25
c. per employee	15
Dentist's Office	
a. per chair	200
b. per staff member	35
Doctor's Office	
a. per patient	10
b. per staff member	35
Fairgrounds, per person	1
Fire Stations, per person	
a. with full time employees and food prep	70
b. with no full time employees and no food prep	5
Gyms	
a. per participant	25
b. per spectator	4
Hairdresser	
a. per chair	50
b. per operator	35
Hospitals, per bed space	250
Industrial Buildings, per 8 hour shift, per employee (exclusive of industrial waste)	
a. with showers	35
b. with no showers	15
Launderette, per washer	580
Movie Theaters	5

a. auditorium, per seat	10
b. drive-in, per car space	
Nursing Homes, per bed space	280
Office Buildings & Business Establishments, per shift, per employee (sanitary wastes only)	
a. with cafeteria	25
b. with no cafeteria	15
Picnic Parks, per person (toilet wastes only)	5
Restaurants	
a. ordinary restaurants (not 24 hour service)	35 per seat
b. 24 hour service	50 per seat
c. single service customer utensils only	2 per customer
d. or, per customer served (includes toilet and kitchen wastes)	10
Rooming House, per person	40
Schools, per person	
a. boarding	75
b. day, without cafeteria, gym or showers	15
c. day, with cafeteria, but no gym or showers	20
d. day, with cafeteria, gym and showers	25
Service Stations (b), per vehicle served	10
Skating Rink, Dance Halls, etc., per person	
a. no kitchen wastes	10
b. additional for kitchen wastes	3
Ski Areas, per person (no kitchen waste)	10
Stores	
a. per public toilet room	500
b. per employee	11
Swimming Pools and Bathhouses(c), per person	10
Taverns, Bars, Cocktail Lounges, per seat	20
Visitors Centers, per visitor	5

NOTES FOR TABLE 510-2:

1. Source capacity must at least equal the peak day demand of the system. Estimate this by assuming the facility is used to its maximum.
2. Generally, storage volume must at least equal one average day's demand.
3. Peak instantaneous demands may be estimated by fixture unit analysis as per Appendix E of the 2006 International Plumbing Code.

(a) When more than one use will occur, the multiple use shall be considered in determining total demand. Small industrial plants maintaining a cafeteria and/or showers and club houses or motels maintaining swimming pools and/or laundries are

typical examples of multiple uses. Uses other than those listed above shall be considered in relation to established demands from known or similar installations.

(b) or 250 gpd per pump,

(c) $20 \times \{\text{Water Area (Ft}^2) / 30\} + \text{Deck Area (Ft}^2)$

(3) Estimated Outdoor Use.

In the absence of firm water use data, Table 510-3 shall be used to estimate the peak day demand and average yearly demand for outdoor water use. The following procedure shall be used:

Guidance: The demand on drinking water sources is related to whether the system supplies water for outdoor use such as the irrigation of lawns and gardens. While the indoor use of water can be expected to remain relatively constant throughout the state, the outdoor use component is highly variable through the year, and is related to the amount of land irrigated as well as local climatological conditions.

(a) Determine the location of the water system on the map entitled Irrigated Crop Consumptive Use Zones and Normal Annual Effective Precipitation, Utah as prepared by the Soil Conservation Service (available from the Division). Find the numbered zone, one through six, in which the water system is located (if located in an area described "non-arable" find nearest numbered zone).

Guidance: The irrigation zone map is provided below. If you are viewing a printed copy of this rule, the map may be in black and white. A more usable colored version of the map may be viewed or downloaded from:

http://drinkingwater.utah.gov/irrigation_map_intro.htm

Tip: If you are viewing an electronic version of this rule, to make the map more readable use any zoom-in feature which may be available.

(b) Determine the net number of acres which may be irrigated. This is generally done by starting with the gross acreage, then subtract out any area of roadway, driveway, sidewalk or patio pavements along with housing foundation footprints that can be reasonably expected for lots within a new subdivision or which is representative of existing lots. Before any other land area which may be considered "non-irrigated" (e.g. steep slopes, wooded areas, etc.) is subtracted from the gross area, the Director shall be consulted and agree that the land in question will not be irrigated.

Guidance: For instance, in the case of a heavily wooded mountain home subdivision, it may be claimed that large lawns will not be put in by the lot

owners. The division must review and concur with this judgment.

(c) Refer to Table 510-3 to determine peak day demand and average yearly demand for outdoor use.

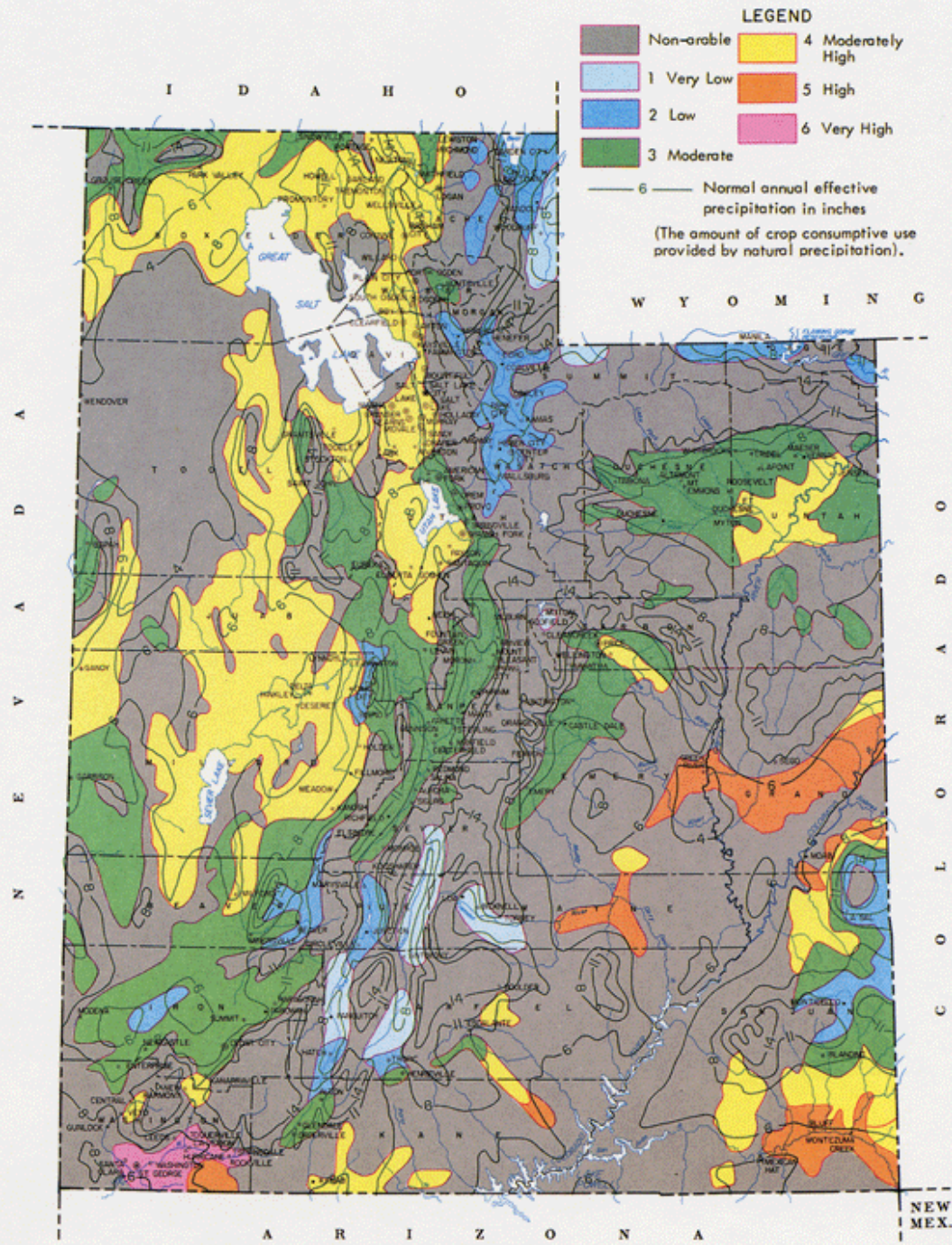
(c) The results of the indoor use and outdoor use tables shall be added together and source(s) shall be legally and physically capable of meeting this combined demand.

Table 510-3 Source Demand for Irrigation (Outdoor Use)		
Map Zone	Peak Day Demand(gpm/irrigated acre)	Average Yearly Demand(AF/ irrigated acre)
1	2.26	1.17
2	2.80	1.23
3	3.39	1.66
4	3.96	1.87
5	4.52	2.69
6	4.90	3.26

(4) Accounting for Variations in Source Yield.

The design engineer shall consider whether flow from the source(s) may vary. Where flow varies, as is the case for most springs, the minimum flow rate shall be used in determining the number of connections which may be supported by the source(s). Where historical records are sufficient, and where peak flows from the source(s) correspond with peak demand periods, the Director may grant an exception to this requirement.

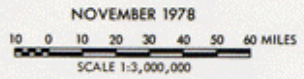
Guidance: The design engineer is cautioned to thoroughly investigate spring behavior. During dry periods, springs (particularly those at higher elevations) may drastically decrease in flow. In assessing minimum flowrates of springs, watersheds shall be assumed to have received only 80% of normal precipitation.



LEGEND

- Non-arable
 - 1 Very Low
 - 2 Low
 - 3 Moderate
 - 4 Moderately High
 - 5 High
 - 6 Very High
- 6 — Normal annual effective precipitation in inches
(The amount of crop consumptive use provided by natural precipitation).

Source:
Base map prepared by SCS, WTSC Carto Staff from USGS 1:1,000,000 National Atlas.
Thematic detail compiled by state staff.
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE



M7-OL-23893

R309-510-8. Storage Sizing.

(1) General.

Each storage facility shall provide:

- (a) equalization storage volume, to satisfy average day demands for water for indoor use as well as outdoor use,
- (b) fire suppression storage volume, if the water system is equipped with fire hydrants and intended to provide fire suppression water, and
- (c) emergency storage, if deemed appropriate by the water supplier or the Director, to meet demands in the event of an unexpected emergency situation such as a line break or a treatment plant failures.

(2) Equalization Storage.

- (a) All public drinking water systems shall be provided with equalization storage. The amount of equalization storage which must be provided varies with the nature of the water system, the extent of outdoor use and the location of the system.
- (b) Required equalization storage for indoor use is provided in Table 510-4. Storage requirements for non-community systems not listed in this table shall be determined by calculating the average day demands from the information given in Table 510-2.

Table 510-4 Storage Volume for Indoor Use	
Type	Volume Required(gallons)
Community Systems	
Residential; per single resident service connection	400
Non-Residential; per Equivalent Residential Connection (ERC)	400
Non-Community Systems	
Modern Recreation Camp; per person	30
Semi-Developed Camp; per person	
a. with Pit Privies	2.5
b. with Flush Toilets	10
Hotel, Motel, & Resorts; per unit	75
Labor Camp; per unit	25
Recreational Vehicle Park; per pad	50
Roadway Rest Stop; per vehicle	3.5
Recreational Home Development; per connection	400

(c) Where the drinking water system provides water for outdoor use, such as the irrigation of lawns and gardens, the equalization storage volumes estimated in Table 510-5 shall be added to the indoor volumes estimated in Table 510-4. The procedure for determining the map zone and irrigated acreage for using Table 510-5 is outlined in Section R309-510-7(3).

Table 510-5 Storage Volume for Outdoor Use	
Map Zone	Volume Required (gallons/irrigated acre)
1	1,782
2	1,873
3	2,528
4	2,848
5	4,081
6	4,964

(3) Fire Suppression Storage.

Fire suppression storage shall be required if the water system is intended to provide fire fighting water as evidenced by fire hydrants connected to the piping. The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration. This information shall be provided to the Division. Where no local fire suppression authority exists, needed fire suppression storage shall be assumed to be 120,000 gallons (1000 gpm for 2 hours).

Guidance: The 1991 Uniform Fire Code has been adopted statewide in Utah. However, local authorities are authorized to deviate from this code if it can be justified. Normal fire storage volume is given in Table A-III-A-1 of the code. According to this table, flow duration must be 2 to 4 hours depending on the size and type of structure which must be protected. Fire flow storage for a one or two family dwelling of less than 3,600 square feet would be 120,000 gallons (1,000 gpm x 120 minutes). Larger volumes would be required for other structures.

(4) Emergency Storage.

Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system dependability. The Director may require emergency storage when it is warranted to protect public health and welfare.

Guidance: It is advisable to provide water storage for emergency situations, such as pipeline failures, major trunk main failures, equipment failures, electrical power outages, water treatment facility failures, raw-water supply contamination, or natural

disasters. Generally, the need for emergency storage shall be determined by the water supplier and design engineer.

R309-510-9. Distribution System Sizing.

(1) General Requirements.

The distribution system shall be designed to insure that minimum water pressures as required in R309-105-9 exist at all points within the system. If the distribution system is equipped with fire hydrants, the Division will require a letter from the local fire authority stating the fire flow and duration required of the area to insure the system shall be designed to provide minimum pressures as required in R309-105-9 to exist at all points within the system when needed fire flows are imposed upon the peak day demand flows of the system.

(2) Indoor Use, Estimated Peak Instantaneous Demand.

(a) For community water systems and large non-community systems, the peak instantaneous demand for each pipeline shall be assumed for indoor use as:

$$Q = 10.8 \times N^{0.64}$$

where N equals the total number of ERC's, and Q equals the total flow (gpm) delivered to the total connections served by that pipeline.

Guidance: The equation above shall only be used to estimate the flow required for N connections from a single pipeline and shall not be used to estimate node or junction demands utilized in hydraulic analyses.

For Recreational Vehicle Parks, the peak instantaneous flow for indoor use shall be based on the following:

Table 510-6 Peak Instantaneous Demand for Recreational Vehicle Parks	
Number of Connections	Formula
0 to 59	$Q=4N$
60 to 239	$Q= 80+ 20N^{0.5}$
240 or greater	$Q= 1.6N$

NOTES FOR TABLE 510-6:

Q is total peak instantaneous demand (gpm) and N is the

maximum number of connections. However, if the only water use is via service buildings the peak instantaneous demand shall be calculated for the number of fixture units as presented in Appendix E of the 2006 International Plumbing Code.

(b) For small non-community water systems the peak instantaneous demand to be estimated for indoor use shall be calculated on a per-building basis for the number of fixture units as presented in Appendix E of the 2006 International Plumbing Code.

(3) Outdoor Use, Estimated Peak Instantaneous Demand.

Peak instantaneous demand to be estimated for outdoor use is given in Table 510-7. The procedure for determining the map zone and irrigated acreage for using Table 510-7 is outlined in Section R309-510-7(3).

Table 510-7 Peak Instantaneous Demand for Outdoor Use	
Map Zone	Peak Instantaneous Demand (gpm/irrigated acre)
1	4.52
2	5.60
3	6.78
4	7.92
5	9.04
6	9.80

(4) Fire Flows.

(a) Distribution systems shall be designed to deliver needed fire flows if fire hydrants are provided. The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration. This information shall be provided to the Division. Where no local fire suppression authority exists, needed fire flows shall be assumed to be 1000 gpm unless the local planning commission provides a letter indicating that the system will not be required to provide any fire flows, in which case fire hydrants will not be allowed to be installed on any mains.

Guidance: Generally, fire flows shall be as required by Appendix B of the 2003 International Fire Code. According to this appendix, minimum fire flow for a one or two family dwelling not exceeding 3,600 square feet is 1,000 gpm. Fire flows for other types of buildings are higher. The 2003 International Fire Code has been adopted statewide in Utah. However, local authorities are authorized to deviate from this code if it can be justified.

(b) If a distribution system is equipped with fire hydrants, the system shall be designed to insure that minimum pressures required by R309-105-9 exist at all points within the system when fire flows are added to the peak day demand of the system. Refer to Section R309-510-7 for information on determining the peak day demand of the system.

KEY: drinking water, minimum sizing, water conservation

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