



Total Mods for Plumbing in Pending Review: 12

Total Mods for report: 12

Proposed Code Modifications

This document created by the Florida Department of Business and Professional Regulation -
850-487-1824

TAC: Plumbing

Total Mods for **Plumbing** in **Pending Review**: 12

Total Mods for report: 12

Sub Code: Building

P7798

1

Date Submitted	12/9/2018	Section	454.1.6.1	Proponent	Mo Madani
Chapter	4	Affects HVHZ	No	Attachments	Yes
TAC Recommendation	Pending Review				
Commission Action	Pending Review				

Comments

General Comments	Yes	Alternate Language	No
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Related Modifications

Table 406.3 Plumbing

Summary of Modification

Incorporating Commission's declaratory statements as required by 553.73(7)(d), Florida Statutes. DS2018-040

Rationale

To clarify that the square footage of interactive water features are required to be considered when calculating the "size of pool" for purpose of determining the type and number of fixtures for sanitary facilities.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

There is no fiscal impact on the local entity relative to enforcement.

Impact to building and property owners relative to cost of compliance with code

There is no fiscal impact to building and property owners relative to the cost of compliance.

Impact to industry relative to the cost of compliance with code

There is no fiscal impact to industry relative to the cost of compliance.

Impact to small business relative to the cost of compliance with code

There is no fiscal impact to small business relative to the cost of compliance.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Has a reasonable and substantial connection with the health and safety and welfare of the general public - the code change clarifies the code

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Strengthens or improves the code by making the code requirements clearer to the user.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against materials, products, methods, or systems of construction. The proposed code change provides clarification to the code.

Does not degrade the effectiveness of the code

Does not degrade the effectiveness of the code.

The code change improves the effectiveness of the code by making it more clear.

1st Comment Period History

Proponent	Kari Hebrank	Submitted	2/13/2019	Attachments	No
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Comment:

The Florida Swimming Pool Association is OPPOSED to this code modification.

P7798-G1

FBC, Building

Revise table to add Note 1

TABLE 454.1.6.1

PUBLIC SWIMMING POOL—REQUIRED FIXTURE COUNT

(No change to the Table)

Note:

¹ Square Footage of Interactive water features are required to be included when calculating the “size of pool” for the purposes of determining the type and number of fixtures for the sanitary facilities.

FBC, Plumbing

Revise table to add Note 1

TABLE 406.3

PUBLIC SWIMMING POOL—REQUIRED FIXTURE COUNT

(No change to the Table)

Note:

¹ Square Footage of Interactive water features are required to be included when calculating the “size of pool” for the purposes of determining the type and number of fixtures for the sanitary facilities.

STATE OF FLORIDA
BUILDING COMMISSION

FILED	
Department of Business and Professional Regulation Deputy Agency Clerk	
CLERK	Brandon Nichols
Date	8/28/2018
File #	2018-07182

In the Matter of

G.B. COLLINS ENGINEERING, P.A.

DS 2018-040

Petitioner.

_____ /

DECLARATORY STATEMENT

The foregoing proceeding came before the Florida Building Commission (Commission) by a Petition from Samuel A. Liberatore, for G.B. Collins Engineering, P.A. (Petitioner) that was received May 23, 2018. Based on the statements in the petition, the material subsequently submitted and the subsequent request by the Petitioner, the Commission states the following:

Findings of Fact

1. The petition is filed pursuant to, and must conform to the requirements of Rule 28-105.002, Florida Administrative Code.
2. Petitioner's representative in this matter is Samuel A. Liberatore, 300 Alternate 19 North, Suite A, Palm Harbor, FL 34683.
3. Petitioner is a professional design engineering company that is considering undertaking two projects, each of which would include a public swimming pool and interactive water features. The first project would feature a swimming pool with an area of 1,330 square feet, and an interactive water feature with an area of 1,256 square feet. The second project would feature a swimming pool with an area of 1,060 square feet, and an interactive water feature with an area of 2,490 square feet.

4. Petitioner seeks clarification of section 454.1.6.1.1, Florida Building Code, Building, 6th Edition (2017), as it pertains to the provision of sanitary facilities for the projects in question.

5. Specifically, the Petitioner requests an answer to the following question based upon the projects described within the petition for declaratory statement:

For the prospective projects, should the proposed interactive water features be considered when calculating the “size of pool” for the purpose of determining the type and number of fixtures for sanitary facilities at the accompanying public swimming pools?

Conclusions of Law

6. The Commission has the specific statutory authority pursuant to Section 553.775(3)(a), Florida Statutes (2018) to interpret the provisions of the Florida Building Code by issuing a declaratory statement.

7. Section 454.1, Florida Building Code, Building, 6th Edition (2017), states:

Public swimming pools and bathing places.

Public swimming pools and bathing places shall comply with the design and construction standards of this section.

Exceptions:

1. A portable pool used exclusively for providing swimming lessons or related instruction in support of an established educational program sponsored or provided by a school district may not be regulated as a public pool. Such pool shall be regulated as a private swimming pool under Section 454.2.

2. A temporary pool may not be regulated as a public pool. Such pool shall be regulated as a private swimming pool under Section 454.2.

8. Section 454.1.1, Florida Building Code, Building, 6th Edition (2017), states:

Flood hazard areas.

Public swimming pools installed in flood hazard areas established in Section 1612.3 shall comply with Section 1612.

Note: Other administrative and programmatic provisions apply. See Department of Health (DOH) Rule 64E-9, Florida Administrative Code and Chapter 514, Florida Statutes. The regulation and enforcement of the initial and annual operation permit for public pools are preempted to the DOH. The construction permit holder is responsible for obtaining an operation permit issued by DOH, as a public swimming pool shall not be put into operation without an inspection and operation permit issued from the DOH. DOH may grant variances from the provisions of the Florida Building Code specifically pertaining to public swimming pools and bathing places as authorized by Section 514.0115, Florida Statutes. Building officials shall recognize and enforce variance orders issued by the Department of Health pursuant to Section 514.0115(5), Florida Statutes including any conditions attached to the granting of the variance.

“Bathing load” means the maximum number of persons allowed in the pool or bathing place at one time.

...

“Interactive water features” means a structure designed to allow for recreational activities with recirculated, filtered, and treated water; but having minimal standing water. Water from the interactive fountain type features is collected by gravity below grade in a collector tank or sump. The water is filtered, disinfected and then pumped to the feature spray discharge heads. The collector tank and water filtration features required make this structure a type of public swimming pool.

...

A **“public swimming pool”** or **“public pool”** means a watertight structure of concrete, masonry, or other approved materials which is located either indoors or outdoors, used for bathing or swimming by humans, and filled with a filtered and disinfected water supply, together with buildings, appurtenances, and equipment used in connection therewith. A public swimming pool or public pool shall mean a conventional pool, spa-type pool, wading pool, special purpose pool, interactive water feature or water recreation attraction, to which admission may be gained with or without payment of a fee and includes, but is not limited to, pools operated by or serving camps, churches, cities, counties, day care centers, group home facilities for eight or more clients, health spas, institutions, parks, state agencies, schools, subdivisions, or the cooperative living-type projects of five or more living units, such as apartments, boardinghouses, hotels, mobile home parks, motels, recreational vehicle parks, and townhouses. The term does not include a swimming pool located on the grounds of a private residence.

...

“Spa pool” means a pool used in conjunction with high-velocity air or water.

...

“Wading pool” means a shallow pool designed to be used by children.

“Water recreation attraction” means a facility with design and operational features that provide patron recreational activity and purposefully involves immersion of the body partially or totally in the water. Water recreation attractions include water slides, river rides, water course rides, water activity pools, interactive water features, wave pools and any additional pool within the boundaries of the attraction.

“Water activity pool” means a water recreation attraction which has water-related activities such as rope ladders, rope swings, cargo nets and other similar activities.

(underscore provided).

9. Section 454.1.1.1, Florida Building Code, Building, 6th Edition (2017), states:

Sizing.

The bathing load for conventional swimming pools, wading pools, interactive water features, water activity pools less than 24 inches (610 mm) deep and special purpose pools shall be computed on the basis of one person per 5 gpm (0.32 L/s) of recirculation flow. The bathing load for spa type pools shall be based on one person per each 10 square feet (0.9 m²) of surface area. The filtration system for swimming pools shall be capable of meeting all other requirements of these rules while providing a flow rate of at least 1 gpm (0.06 L/s) for each living unit at transient facilities and ³/₄ gpm (0.04 L/s) at nontransient facilities. Recreational vehicle sites, campsites and boat slips designated for live-aboards shall be considered a transient living unit. For properties with multiple pools, this requirement includes the cumulative total gpm of all swimming pools, excluding spas, wading pools and interactive water features. All other types of projects shall be sized according to the anticipated bathing load and proposed uses. For the purpose of determining minimum pool size only, the pool turnover period used cannot be less than 3 hours.

10. Section 454.1.6, Florida Building Code, Building, 6th Edition (2017), states:

Sanitary facilities.

Public swimming pools and bathing places shall comply with the

Swimming pools with a bathing load of 20 persons or less may utilize a unisex restroom. Pools with bathing loads of 40 persons or less may utilize two unisex restrooms or meet the requirements of Table 454.1.6.1. Unisex restrooms shall meet all the requirements for materials, drainage and signage as indicated in Sections 454.1.6.1.1 through 454.1.6.1.4. Each shall include a water closet, a diaper change table, a urinal and a lavatory. Pools with a bathing load larger than 40 persons shall provide separate sanitary facilities labeled for each sex. The entry doors of all restrooms shall be located within a 200-foot (60 960 mm) walking distance of the nearest water's edge of each pool served by the facilities.

Exception: Where a swimming pool serves only a designated group of residential dwelling units and not the general public, poolside sanitary facilities are not required if all living units are within a 200-foot (60 960 mm) horizontal radius of the nearest water's edge, are not over three stories in height unless serviced by an elevator, and are each equipped with private sanitary facilities.

TABLE 454.1.6.1
PUBLIC SWIMMING POOL—REQUIRED FIXTURE COUNT

SIZE OF POOL (square feet)	MEN'S RESTROOM			WOMEN'S RESTROOM	
	Urinals	WC	Lavatory	WC	Lavatory
0 - 2,500	1	1	1	1	1
2,501 - 5,000	2	1	1	5	1
5,001 - 7,500	2	2	2	6	2
7,501 - 10,000	3	2	3	8	3

For SI: 1 square foot = 0.0929 m².

- Section 454.1.6.1.1, Florida Building Code, Building, 6th Edition (2017), states:

Required fixtures.

Fixtures shall be provided as indicated on Table 454.1.6.1. The fixture count on this chart is deemed to be adequate for the pool and pool deck area that is up to three times the area of the pool surface provided. When multiple fixture sets are required and separate facilities are provided for each sex, the fixtures used in ancillary family-style restrooms can be used to meet the requirements of this section.

One diaper changing table shall be provided at each restroom. Diaper changing tables are not required at restrooms where all pools served are restricted to adult use only. Swim diapers are recommended for use by children that are not toilet trained. Persons that are ill with diarrhea cannot enter the pool.

Exception: When a public swimming pool meets all of the following conditions the following shall apply:

1. The pool serves only a designated group of dwelling units,
2. The pool is not for the use of the general public, and
3. A building provides sanitary facilities;

The fixture requirement for the building shall be determined and if it exceeds the requirement in Table 454.1.6.1 then the building requirement shall regulate the fixture count, otherwise the fixture count shall be based on the requirement for the pool. Under no circumstances shall the fixture counts be cumulative.

An additional set of fixtures shall be provided in the men's restroom for every 7,500 square feet (697 m²) or major fraction thereof for pools greater than 10,000 square feet (929 m²).

Women's restrooms shall have a ratio of three to two water closets provided for women as the combined total of water closets and urinals provided for men.

Lavatory counts shall be equal.

12. Section 403.6, Florida Building Code, Plumbing, 6th Edition (2017), states:

Sanitary facilities for public swimming pools.

Swimming pools with a bathing load of 20 persons or less may utilize a unisex restroom. Pools with bathing loads of 40 persons or less may utilize two unisex restrooms or meet the requirement of Table 403.6. Unisex restrooms shall meet all the requirements for materials, drainage and signage as indicated in Sections 454.1.6.1.1 through 454.1.6.1.4 of the Florida Building Code, Building. Each shall include a water closet, a diaper change table, a urinal, and a lavatory. Pools with a bathing load larger than 40 persons shall provide separate sanitary facilities labeled for each sex. The entry doors of all restrooms shall be located within a 200-foot (60 960 mm) walking distance of the nearest water's edge of each pool served by the facilities.

Exception: Where a swimming pool serves only a designated group of residential dwelling units and not the general public, poolside sanitary facilities are not required if all living units are within a 200-foot horizontal radius of the nearest water's edge, are not over three stories in height unless serviced by an elevator, and are each equipped with private sanitary facilities.

13. Section 403.6.1, Florida Building Code, Plumbing, 6th Edition (2017), states:

Required fixtures.

Fixtures shall be provided as indicated on Table 403.6. The fixture count of Table 403.6 is deemed to be adequate for the pool and pool deck area that is up to three times the area of the pool surface provided. An additional set of fixtures shall be provided in the men's restroom for every 7,500 square feet or major fraction thereof for pools greater than 10,000 square feet. Women's restrooms shall have a ratio of three to two water closets provided for women as the combined total of water closets and urinals provided for men. Lavatory counts shall be equal.

14. Table 403.6, Florida Building Code, Plumbing, 6th Edition (2017), states:

TABLE 403.6
PUBLIC SWIMMING POOL - REQUIRED FIXTURES COUNT

SIZE (square feet)	MEN'S RESTROOMS			WOMEN'S RESTROOMS	
	Urinals	WC	Lavatory	WC	Lavatory
0 - 2500 sq ft	1	1	1	1	1
2501 - 5000 sq ft	2	1	1	5	1
5001 - 7500 sq ft	2	2	2	6	2
7501 - 10,000 sq ft	3	2	3	6	3

For SI: 1 square foot = 0.0929 m².

15. In response to Petitioner's question, the answer is yes. Pursuant to section 454.1.6.1.1 and table 454.1.6.1, Florida Building Code, Building, 6th Edition (2017), and section 403.6 and table 403.6 Florida Building Code, Plumbing, 6th Edition (2017), the size of the proposed interactive water features is required to be included when calculating the "size of pool" for the purpose of determining the type and number of fixtures for the sanitary facilities for the projects in question.

DONE AND ORDERED this 21st day of AUGUST, 2018, in Punta Gorda,
Charlotte County, State of Florida.


E. JAY CARLSON
Chairman, Florida Building Commission

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NOTICE OF RIGHT TO APPEAL

Petitioner and all other interested parties are hereby advised of their right to seek judicial review of this Order in accordance with Section 120.68(2)(a), Florida Statutes (2018), and Florida Rules of Appellate Procedure 9.110(a) and 9.030(b)(1)(C). To initiate an appeal, a Notice of Appeal must be filed with the Agency Clerk, Department of Business and Professional Regulation, 2601 Blair Stone Road, Tallahassee, Florida 32399-2203 and with the appropriate District Court of Appeal not later than thirty (30) days after this Order is filed with the Clerk of the Department of Business and Professional Regulation. A Notice of Appeal filed with the District Court of Appeal shall be accompanied by the filing fee specified by Section 35.22(3), Florida Statutes (2018).

CERTIFICATE OF FILING AND SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing order has been filed with the undersigned and furnished by U. S. Mail to the persons listed below this 28th day of August, 2018.



Agency Clerk's Office
Department of Business and Professional Regulation
& Florida Building Commission
2601 Blair Stone Road
Tallahassee, Florida 32399-2203

Via U.S. Mail

G.B. Collins Engineering, P.A.
Attn: Samuel A. Liberatore
300 Alternate 19 North, Suite A
Palm Harbor, FL 34683

Anthony Tilton
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Tallahassee, FL 32301

Via Inter-Office or Email Delivery

Mo Madani, Planning Manager
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Marjorie Holladay
Joint Administrative Procedures Committee
Pepper Building, Room 680
Tallahassee, Florida 32399-1300

P7202

2

Date Submitted	11/6/2018	Section	8	Proponent	Jonathan Sargeant
Chapter	8	Affects HVHZ	No	Attachments	No
TAC Recommendation	Pending Review				
Commission Action	Pending Review				

Comments

General Comments	Yes	Alternate Language	Yes
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Related Modifications

Summary of Modification

Update LC 1/CSA 6.26 from 2013 to 2018. The 2018 standard contains language for arc-resistant CSST not contained in the 2013 standard.

Rationale

Current language under consideration includes an update to address installation of arc-resistant CSST. The CSST standard, LC-1, must also be updated so that the version of the standard referenced includes testing criteria for arc-resistant CSST.

Fiscal Impact Statement

- Impact to local entity relative to enforcement of code**
Standard update only. No impact.
- Impact to building and property owners relative to cost of compliance with code**
Standard update only. No impact.
- Impact to industry relative to the cost of compliance with code**
Standard update only. No impact.
- Impact to small business relative to the cost of compliance with code**
Standard update only. No impact.

Requirements

- Has a reasonable and substantial connection with the health, safety, and welfare of the general public**
Standard update only. No impact.
- Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction**
Correlates with proposed changes to address arc-resistant CSST.
- Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities**
Standard update only. No impact.
- Does not degrade the effectiveness of the code**
Standard update only. No impact.

1st Comment Period History

7202-A1	Proponent	Jonathan Sargeant	Submitted	1/4/2019	Attachments	Yes
	Rationale	Alternate language amends the proposal by updating the language in the IRC as well as the language in the IFGC.				
	Fiscal Impact Statement					
	Impact to local entity relative to enforcement of code	Standard update only - No impact anticipated.				
	Impact to building and property owners relative to cost of compliance with code	Standard update only - No impact anticipated.				
	Impact to industry relative to the cost of compliance with code	Standard update only - No impact anticipated.				
	Impact to Small Business relative to the cost of compliance with code	Standard update only. No impact.				
	Requirements					
	Has a reasonable and substantial connection with the health, safety, and welfare of the general public	Standard update only - No impact anticipated.				
	Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction	Standard update only - No impact anticipated.				
Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities	Standard update only - No impact anticipated.					
Does not degrade the effectiveness of the code	Standard update only - No impact anticipated.					

1st Comment Period History

P7202-G1	Proponent	Jonathan Sargeant	Submitted	1/2/2019	Attachments	No
	Comment:	<p>Upon review I noticed that the same standard update is necessary in Chapter 44 of the IRC:</p> <p>"LC1/CSA 6.26—13 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) G2414.5.3"</p> <p>I hope if this change is successful in the IFGC that staff can update the standard in the IRC as well.</p>				

LC 1/CSA 6.26-4318 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST) .
..... 403.5.4

IFGC:

LC 1/CSA 6.26-1318 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)
. 403.5.4

IRC:

LC1/CSA 6.26—1318 Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)
. .G2414.5.3

P7194

3

Date Submitted	11/7/2018	Section	419.5	Proponent	Gary Kozan
Chapter	4	Affects HVHZ	No	Attachments	Yes
TAC Recommendation	Pending Review				
Commission Action	Pending Review				

Comments

General Comments	Yes	Alternate Language	No
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Related Modifications

Summary of Modification

Restores the option of providing cold water to hand-washing facilities

Rationale

Early editions of the FBC-Plumbing included a Florida-specific provision which allowed cold tap water to be delivered from hand-washing lavatories. This provision sunsetted with the Fifth (2014) Edition, and was never submitted for renewal. Current code requires tempered water (85-110 deg. F) to be delivered from all hand-washing facilities. Scientific studies have proven that the water temperature for hand-washing has no impact on the efficacy of removing bacteria. A Center for Disease Control and Prevention (CDC) study sums it up best - "The temperature of the water does not appear to affect microbe removal; however, warmer water may cause more skin irritation and is more environmentally costly." CDC also lists a favorable Legionella bacteria growth range of 90-113 deg. F. The cost of providing hot water systems to serve public lavatories can be significant. Because of the extremely low flow rates and infrequent usage, the Energy Code mandates a maximum distance of only 2 feet of 1/2-inch piping from the public lavatory faucet to the heated water supply pipe. The designer is left to choose between using multiple tankless water heaters, or a serpentine hot water circulation system. The initial costs and maintenance costs associated with either option can be considerable. There is a simple solution. According to research conducted by the National Renewable Energy Laboratory, the average cold water temperatures in water distribution mains is calculated to be between 73.2 deg. F (Tallahassee) to 82.4 deg. F (Miami.) That is just slightly below the code definition of tempered water. By allowing the designer the option of providing cold tap water to public handwashing facilities, much of the hot water piping system can be eliminated, resulting in significant cost savings and energy savings. The risk of Legionella would be reduced. And Florida would again benefit from a proven practice that is simple, economical, and sustainable.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No cost impact to code enforcement

Impact to building and property owners relative to cost of compliance with code

Building maintenance costs would go down by the elimination of additional water heaters and/or circulating systems provided for hand-washing fixtures

Impact to industry relative to the cost of compliance with code

Plumbing system costs would go down by the elimination of additional water heaters and/or circulating systems provided for hand-washing fixtures

Impact to small business relative to the cost of compliance with code

No impact to small business

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Restores the previous Florida code option of providing cold tap water for hand-washing facilities

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Provides less expensive option for hand-washing facilities, while minimizing the growth of Legionella bacteria

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Provides an additional cold water option for hand-washing facilities

Does not degrade the effectiveness of the code

Actually improves the effectiveness of the code by providing a more economical and sustainable option

1st Comment Period History

Proponent	Gary Kozan	Submitted	1/4/2019	Attachments	Yes
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Comment:

I am attaching a recent article from Plumbing Engineer magazine which speaks directly to the issues regarding room temperature lavatories.

P7194-G1

419.5 ~~Tempered w~~Water for public hand-washing facilities. *Cold or Tempered water* shall be delivered from lavatories and group wash fixtures located in public toilet facilities provided for customers, patrons, and visitors. *Tempered water* shall be delivered through an *approved* water-temperature limiting device that conforms to ASSE 1070/ASME A112.1070/CSA B125.70 or CSA B125.3.

By Duane Jonlin, FAIA



The Room-Temperature Lavatory

There is one provision in both the Uniform Plumbing Code (UPC) and International Plumbing Code (IPC) that endangers public health and bloats construction budgets: the requirement to provide hot water at all public lavatories.

The idea that you should “always wash your hands with warm soapy water” has been repeated for decades by federal agencies, health department restaurant placards, and hospital regulations, and is embedded in the model plumbing codes. We would generally have no reason to question such a universal truism, especially one that falls into the sacred category of “things that Mom told us.”

However, research demonstrates not only that handwashing hygiene is equally effective using cold water or hot, but also that the distribution system for hot water provides an environment that supports the growth of bacteria. The concurrent increases in construction cost, carbon emissions and operating costs from hot water handwashing may pale in importance when compared with the public health hazards, but are themselves significant.

Perhaps without realizing it, you, and millions like you, have already vetted the concept of room-temperature handwashing water many times. The water in the uninsulated section of piping between the circulating hot water and the lavatory rapidly cools towards room temperature, while most users only run the water for 4 – 6 seconds, not nearly enough to draw hot water all the way from the circulating loop to the tap. It may be that few users of public lavatories would even notice this change.

It's important to point out that there is no need to prohibit hot-water handwashing; individual developers and institutions should be able to decide for themselves whether providing hot water is worth any additional risk and expense. Facility directors of buildings that primarily serve healthy adults may decide that the risks of maintaining the status quo are acceptably small, while the directors of other facility types may opt for room-temperature handwashing. Allowing the responsible party to make an informed choice is what's urgently needed.

Hand hygiene

Bacteria and other microorganisms primarily spread among building occupants by hand contact with surfaces, which is why healthcare facilities have lavatories, sanitizer dispensers, and surgical sinks everywhere one looks. Although in recent years many individuals have become hyper-vigilant about touching restroom door handles, all the building's other door handles are equally contaminated,

not to mention the elevator buttons, handrails, and touch-screens. Periodic handwashing does dramatically reduce the bacteria count on your hands, at least until the next time you touch something, but the temperature of that water has no impact at all. (What is important for hygiene is to use soap, and to continue scrubbing your hands for 15 - 20 seconds. Only a fraction of hand-washers has been observed to stick with it for the full 20 seconds, long enough to sing through the “Happy Birthday” song twice.)

Few people appeared to have been paying much attention to this issue until a new code provision was inserted in the 2015 International Energy Conservation Code (IECC), severely limiting the volume of water that can be held in the pipe between a public lavatory and the circulating hot water loop. The intention to get hot water to the users more quickly, so that the reduced flow time would reduce water heating energy use. As the new code was adopted around the country however, this provision was found to be more disruptive and expensive than expected, and has been provoking considerable resistance among contractors. While individual mini-tank or demand water heaters at each cluster of lavatories could also be used to comply, those solutions would involve considerable cost.

Searching for economical ways to comply with this code provision, designers began questioning whether we really need to provide hot water in the first place. The code mandates hot water at lavatories because it's been widely believed to be important for hygiene. As noted above however, each researcher studying the influence of water temperature on handwashing has arrived at the same conclusion; washing one's hands in cold or room temperature water removes bacteria just as effectively as washing them in warm or hot water – the water temperature itself is irrelevant. In fact, use of higher-temperature water increases skin irritation, providing a more vulnerable substrate for formation of bacterial colonies, and potentially causing people such as nurses who should wash their hands often to reduce their handwashing frequency and intensity.

“Nosocomial infections” are infections acquired while in a hospital, and they're a serious source of liability and hazard for these facilities. (“Nosocomial” could translate from Latin as “Please call my lawyer.”)

Deaths and hospitalizations from nosocomial infections in hospitals are orders of magnitude more common than those from fire, even though fire safety is rigorously enforced in hospital design. Meanwhile, Legionella and other organisms thrive in the pipes and mixing valves that supply that warm water for the very handwashing that's

48/Plumbing Engineer

December 2018

Lavatory

intended to prevent disease transmission in the first place. The optimal temperature range for *Legionella* growth extends 20°F above and below our human body temperature of 98.6°F – clearly not a coincidence – so not only is the provision of hot water unnecessary for personal hygiene, a delivery temperature of 110°F is just right for the growth of microorganisms in plumbing systems. Those who simply rinse their hands under warm tap water without using soap could actually end up increasing the bacteria count on their hands.

Energy waste and operational expenses

The public health hazard created by the code requirement for hot water at lavatories should be sufficient reason to abandon that rule. However, utility bills and carbon pollution considerations provide another strong argument. The heating, reheating and pumping of hot water to the lavatories throughout a building constitutes a modest portion of total building energy use, but the fact that this is often wasted energy, doing more harm than good, makes it a perfect candidate to be an energy efficiency measure.

However, the current plumbing codes prohibit this. As lavatories are typically the most numerous fixtures on a building's hot water system, heating and pumping energy use will drop significantly when they're removed. The combined expenses of utility bills, annual maintenance, periodic repairs, leakage risks, and eventual equipment replacement adds up, especially where this is an unnecessary system in the first place.

Construction cost

A complex system is required to properly heat and circulate water to all the lavatories in a hospital, high school, or office tower: boiler, pumps, piping, insulation, mixing valves, controls, and more. All these components consume space – space in mechanical rooms, ceiling cavities and plumbing chases, as well as service access. If the lavatories were to provide room-temperature water instead, the use of distributed mini-water heaters at kitchens and showers might be a sensible option for serving the modest number of remaining fixtures, so that the entire central system could then be eliminated. If on the other hand a client still prefers to install a circulating hot water system, the length and size of insulated piping required for the building would be reduced, as would the boiler and pump sizes.

System selection

The best system choice for providing “room-temperature” water might depend on your location. In the American South and other locations where year-round water utility supply temperatures are already within the range of typical room temperatures, water can flow directly to the lavatories.

In northern climates where incoming water temperatures are too cold for comfortable handwashing, especially in winter, one easy option would be to allow the water to reach room temperature in a tempering tank or oversized pipe. However, the best strategy for these climates might be to incorporate a drain water heat recovery system. Most readers will be familiar with this technology – typically a copper supply pipe wrapped in a tight upward spiral around

a section of vertical waste pipe, with the inner face of the copper pipe flattened to maximize contact area.

Liquids tend to adhere to the walls of vertical pipes while falling, so that enough of the heat transfers through the waste pipe to the incoming supply pipe that the “cold” water will reach room temperature without mechanical heating. This provides a simple, maintenance-free pre-heating system with no moving parts, resulting in significant cost savings. A side benefit of using drain water heat recovery is that the subsequent temperature lift for shower and kitchen water heating would be reduced, speeding up recovery times.

Optimal water temperature

For room-temperature lavatories, water should be delivered at temperatures low enough to prevent bacterial growth, while still warm enough to encourage thorough hand washing. Fortunately, the typical room temperature range of 68° to 75°F aligns nicely with the optimal hand-washing water temperature range of 65° to 80°F.

80°F is the maximum safe temperature to prevent *Legionella* growth, while 65°F is a good minimum temperature range for handwashing comfort. Much below that temperature, tap water feels uncomfortably cold to users, which could discourage adequate handwashing. (For a related reference point, note that the minimum allowable water delivery temperature for laboratory emergency showers is 60°F.)

68°F is the minimum space heating capability required by the building code, while 75°F is the minimum cooling setpoint permitted for load calculations in the energy code, bracketing the “typical” indoor temperatures.

There are certainly situations for which warm water is still important for handwashing, specifically where the occupants' hands are likely to be greasy or heavily soiled, such as at repair garages, greenhouses, or art classrooms. Private lavatories in dwelling and sleeping units should also provide warm water, since they're used for additional grooming purposes. Beyond these, there are bound to be many other situations where warm water for handwashing is desirable.

Optional, not mandatory

For the above reasons, plumbing code change proposals submitted by Seattle to ICC and IAPMO in 2018 would not prohibit hot water for handwashing, but rather make it optional. Developers and facility managers would then be empowered to make their own decisions about whether hot water at lavatories is worth any additional cost, space, energy use, or health risks.

At the very least, this proposed change will allow that choice to be made, and give local health departments a legal basis on which to permit that choice. For the many cities and states with carbon reduction and energy efficiency goals, an option to dispense with hot water for handwashing would allow those jurisdictions to incentivize the choice to provide room temperature handwashing water.

Proposed code change language

Based on feedback received regarding the original code

Lavatory

change proposals, the simplest formulation appears to be best. The following exception would be inserted at Sections 419.5 and 607.1 of the IPC, or Section 601 of the UPC.

Exception: Lavatories and other handwashing fixtures not serving dwelling or sleeping units are not required to provide hot water or tempered water.

The path forward

Any new code provision generally requires a cost/benefit analysis, to balance the increased construction costs of the proposal against future utility savings or public health protection. In this case however, all the costs and the benefits fall on the positive side of the ledger, seemingly making this an obvious choice for approval. Public health benefits with lower construction and operating costs – a slam-dunk! However, the proposal was swiftly and unanimously disapproved by both the ICC and IAPMO plumbing code committees.

A friendly engineer took this author aside after one of these debates and said, "You know, you're asking a panel of plumbing professionals to approve something that'll cut into their business. The fact that it permits a smaller plumbing system makes it an uphill battle."

The IAPMO proposal is still on the table, through the public comment process (as Item 55), and beyond that are the individual state code processes. To succeed, either of

these will need support from concerned design, construction and public health professionals. Change is always a challenging task, but the public health protection provided in this change makes it well worth the effort. ●

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References

- Centers for Disease Control and Prevention (2017), *Show Me the Science - How to Wash Your Hands*
- International Journal of Consumer Studies (2013), *The environmental cost of misinformation: why the recommendation to use elevated temperatures for handwashing is problematic*
- Infection Control Today (2017), *Cool Water as Effective as Hot for Removing Germs During Handwashing*
- Food Service Technology (2002), *Water temperature as a factor in handwashing efficacy*
- UK Health and Safety Executive
- Becker's Clinical Leadership and Infection Control
- Energy.gov (2018), *Drain Water Heat Recovery*

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Show Me the Science - How to Wash Your Hands

Keeping hands clean is one of the most important steps we can take to avoid getting sick and spreading germs to others. Many diseases and conditions are spread by not washing hands with soap and clean, running water. CDC recommends cleaning hands in a specific way to avoid getting sick and spreading germs to others. The guidance for effective handwashing and use of hand sanitizer was developed based on data from a number of studies.

Microbes are all tiny living organisms that may or may not cause disease.

Germs, or pathogens, are types of microbes that can cause disease.

Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.

Why? Because hands could become recontaminated if placed in a basin of standing water that has been contaminated through previous use, clean running water should be used ¹. However, washing with non-potable water when necessary may still improve health ³. The temperature of the water does not appear to affect microbe removal; however, warmer water may cause more skin irritation and is more environmentally costly ⁴⁻⁶.

Turning off the faucet after wetting hands saves water, and there are few data to prove whether significant numbers of germs are transferred between hands and the faucet.

Using soap to wash hands is more effective than using water alone because the surfactants in soap lift soil and microbes from skin, and people tend to scrub hands more thoroughly when using soap, which further removes germs ^{2,3,7,8}.

To date, studies have shown that there is no added health benefit for consumers (this does not include professionals in the healthcare setting) using soaps containing antibacterial ingredients compared with using plain soap ^{2,10}. As a result, FDA issued a final rule in September 2016 that 19 ingredients in common “antibacterial” soaps, including triclosan, were no more effective than non-antibacterial soap and water and thus these products are no longer able to be marketed to the general public. This rule does not affect hand sanitizers, wipes, or antibacterial products used in healthcare settings.

Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails.

Why? Lathering and scrubbing hands creates friction, which helps lift dirt, grease, and microbes from skin. Microbes are present on all surfaces of the hand, often in particularly high concentration under the nails, so the entire hand should be scrubbed ¹¹⁻¹⁵.

Scrub your hands for at least 20 seconds. Need a timer? Hum the "Happy Birthday" song from beginning to end twice.

Why? Determining the optimal length of time for handwashing is difficult because few studies about the health impacts of altering handwashing times have been done. Of those that exist, nearly all have measured reductions in overall numbers of microbes, only a small proportion of which can cause illness, and have not measured impacts on health. Solely reducing numbers of microbes on hands is not necessarily linked to better health ¹⁶. The optimal length of time for handwashing is also likely to depend on many factors, including the type and amount of soil on the hands and the setting of the person washing hands. For example, surgeons are likely to come into contact with disease-causing germs and risk spreading serious infections to vulnerable patients, so they may need to wash hands longer than a woman before she prepares her own lunch at home. Nonetheless, evidence suggests that washing hands for about 15-30 seconds removes more germs from hands than washing for shorter periods ^{15, 17, 18}.

Accordingly, many countries and global organizations have adopted recommendations to wash hands for about 20 seconds (some recommend an additional 20-30 seconds for drying):

- The Benefits of Hand Washing (<http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/diseases-maladies/hands-mains-eng.php>)
- New Zealand. Step-by-Step Guide to Hand Washing (http://www.handhygiene.org.nz/index.php?option=com_content&view=article&id=7&Itemid=110)
- The Global Public-Private Partnership for Handwashing. Why Handwashing? (<http://www.globalhandwashing.org/why/faq>)
- World Health Organization. Guidelines on Hygiene in Health Care: A Summary [PDF - 64 pages] (http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.07_eng.pdf)

Rinse your hands well under clean, running water.

Why? Soap and friction help lift dirt, grease, and microbes—including disease-causing germs—from skin so they can then be rinsed off of hands. Rinsing the soap away also minimizes skin irritation ¹⁵. Because hands could become recontaminated if rinsed in a basin of standing water that has been contaminated through previous use, clean running water should be used ¹⁻¹². While some recommendations include using a paper towel to turn off the faucet after hands have been rinsed, this practice leads to increased use of water and paper towels, and there are no studies to show that it improves health.

Dry your hands using a clean towel or air dry them.

Why? Germs can be transferred more easily to and from wet hands; therefore, hands should be dried after washing ^{15, 19}. However, the best way to dry hands remains unclear because few studies about hand drying exist, and the results of these studies conflict. Additionally, most of these studies compare overall concentrations of microbes, not just disease-causing germs, on hands following different hand-drying methods. It has not been shown that removing microbes from hands is linked to better health ¹⁶. Nonetheless, studies suggest that using a clean towel or air drying hands are best ^{18, 20, 21}.

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Handwashing Water Temperature Effects on the Reduction of Resident and Transient (*Serratia marcescens*) Flora when Using Bland Soap

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ABSTRACT

For many years, sanitarians have specified that hands be washed using warm or hot water to reduce cross-contamination risks, with various authors indicating temperatures between 38°C and 48.9°C. However, it has been suggested that these temperatures may contribute to skin damage when frequent handwashing is necessitated (in health care and food service). This study evaluates the bacterial reduction efficacy of water temperature during normal handwashing. The hands of two groups of four experimental subjects were soiled with sterile or contaminated substances (tryptic soy broth and hamburger meat). Uninoculated menstruum was used to study the effects of treatment temperatures on resident microflora reduction, while *Serratia marcescens*-inoculated menstruum was used to study treatment effects on transient microorganism reduction. Following contamination with appropriate media, one hand was immediately sampled to obtain baseline (control) data, using the "glove-juice" technique for microorganism recovery. Hands were then moistened with water at the assigned temperature (4.4°C, 12.8°C, 21.1°C, 35°C or 48.9°C), washed 15 s with bland soap, and rinsed 10 seconds at the same temperature as was used before; and the opposing hand was then sampled. Results indicate that water temperature has no effect on transient or resident bacterial reduction during normal handwashing when bland soap is used.

A peer-reviewed article.

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TABLE 1. Year 2000 Conference for Food Protection water temperature issues

Issue #	Submitter	Requested change from 110°F (43°C) minimum	Reasons given for change requested
2000-I-23	L. Wisniewski (Select Concepts)	"Warm Water"	1. Hand discomfort decreases frequency
2000-I-24	M. Scarborough (GA Dept. of Human Resources, Div. Publ. Health)	37.7°C (100°F)	1. No science (110°F vs. 100°F) 2. Plumbing code @100°F max. (safety concerns)
2000-I-25	J. Budd (Healthminder/ Sloan Valve Co.)	35°C (95°F)	1. No scientific basis 2. Max. soap efficacy at 35°C 3. Hand comfort 4. Hot water discourages hand washing
2000-I-26	E. Rabotoski (WI Conference Food Protection)	"Tempered" 85°F (29.5°C) to 110°F (43°C)	1. Hand discomfort 2. Possible scalding
2000-I-27	B. Adler (MN Dept. of Health)	Impose temp. range 110°F (43°C) to 130°F (54.4°C)	1. Need upper limit or subject to OSHA 2. Food workers don't wash 25 s so cannot scald
2000-I-28	F. Reimers (H.E.B. Grocery Co.)	"Tempered" to warm	1. No science 2. Max. soap efficacy 3. 110°F risks injury 4. Waste water as wait for temp. at 110°F

INTRODUCTION

A critical and thorough evaluation of a simple handwashing reveals numerous variables that must be considered to achieve maximum or appropriate degerming of the hands and fingernail regions. Numerous studies have explored topics such as type of soap (e.g., antibacterial vs. plain, liquid vs. bar), amount of soap and handwashing technique, nailbrush or sanitizer use, drying technique (e.g., cloth vs. paper towels, paper towels vs. air-drying), and applica-

tion of hand sanitizers (post-wash liquids). Although studies indicate that these variables are crucial in achieving effective removal of transient bacteria from the hands under controlled testing conditions, testing to determine specific guidelines for water temperatures and flow rates is rarely mentioned in the scientific literature. Many of the currently employed handwashing practices may be based on untested traditions that could actually result in compromised skin health. With so many variables involved in such a "simple" procedure, it would make

sense to explore and maximize all possible aspects of the process while minimizing negative collateral. This is especially important because many observations of food service workers have revealed what are considered poor habits in handwashing techniques. Studies indicate that handwashing compliance drops considerably without supervision and monitoring, or in situations where skin damage occurs. This further amplifies the need to strengthen knowledge of all variables that might improve or weaken daily handwashing prac-

TABLE 2. A comparison of resident flora and transient flora studies

	Resident flora	Transient flora
Test Laboratory	BioScience Laboratories	Silliker Research Laboratories
Location	Bozeman, MT	South Holland, IL
Study Director	D. Paulson J. Budd	V. Gangar M. Arenas
Test Subjects	Paid Volunteers	Laboratory Workers
No. Test Subjects	4 (3 Females, 1 Male)	4 (1 Female, 3 Male)
Test subjects age (range)	26 - 56	24 - 25
Test temperatures (°C)	4.4, 12.8, 21.1, 35, 48.9	4.4, 12.8, 21.1, 35, 48.9
Test temperatures (°F)	40, 55, 70, 95, 120	40, 55, 70, 95, 120
Test soil		
Tryptic soy broth (TSB)	1.0 ml (0.5 ml/hand)	1.0 (ml/hand)
Y - irradiated ground beef (GB)	3.0 grams (1.5 g/)	3.0 grams
Microbial inoculum	None	<i>S. marcescens</i>
No. test days/soil/	1	2
Temperature/ Subject		
Total data points/temperature	8	16
Mean baseline count Log ₁₀		
TSB	6.05	6.91
GB	6.40	7.21
Amount of time massaged with TSB and GB	45 seconds	2 minutes
Amount of time TSB and GB air-dried	2 minutes	1 minute
Amount of soap used for handwashing	3 ml	3 ml

tices throughout the food and health care industries.

Two types of flora, transient and resident, exist on the hands. The transient flora are generally removed fairly easily. They do not have adhesion characteristics that hold them to the skin's surface (8) and are somewhat suppressed by secretions and competitive exclusion by normal resident flora. Resident flora are removed more slowly. Because of co-evolution, resident flora

have adapted to conditions on the skin surface that cause rapid die-off of most transients. Invaginations such as the nail fold, hair follicles and sebum-producing sebaceous glands support a rich resident flora. Transient flora may consist of pathogens, spoilage bacteria or harmless environmental species. Under certain conditions transient flora can change status and become permanent residents. Resident flora as a rule are not pathogenic types.

Frequent or prolonged exposure of the skin to microbial contamination in soils, skin damage or fissures provide portals of entry to deeper tissue and may result in the presence of many pathogenic bacteria among the resident species (11,27).

Removal of viable bacteria, dirt and grease from the skin is accomplished by friction and surfactant action, which lowers surface tension. Alkaline detergent solutions remove bacteria from skin more efficiently than acid or neutral so-

lutions do (20), forming the basis for skin sampling solutions used in this study (37).

Added to the aforementioned studies are the many references to warm or hot water use for hand-washing from the Internet or popular press. These references are meant to provide information to food workers or consumers. Questions need to be answered regarding water temperature guidelines with respect to handwashing: Do soaps perform better depending on the water temperature for hand-washing? Does hot water help cleanse the hands better than cool or plain tap water? What are the physiological changes of the skin when different temperature/soap combinations are used? Does water temperature make a significant difference in reducing the numbers of transient and/or resident bacteria on the hands?

The effective water temperature used for washing and rinsing hands has been under debate recently at the Year 2000 Conference for Food Protection. Six issues were brought before Council I with regard to FDA Food Code hand washing water temperature specifications. The 1999 Food Code (36) requires sinks used for handwashing to be equipped so as to be "capable of providing water of at least 43°C (110°F), accomplished through use of a mixing valve or a combination faucet." An outline summarizing the issues brought forth by the various submitters at the Year 2000 Conference, including requested changes and reasons given for those changes, is provided in Table 1.

All but one of the issue submissions requested temperature decreases with the intent of improving hand comfort, as the discomfort associated with higher temperatures results in decreases in hand washing frequency or compliance (I-23, I-25). Several submitters note a lack of scientific information on the subject (I-24, I-25, I-28). There is concern that a minimum hand-washing temperature of 43°C (110°F) in addition to causing

discomfort (I-23, I-26), will result in injury or scalding (I-28, I-24, I-26) and may even be in conflict with local plumbing codes (I-24). Two submitters point out that soaps currently available target maximum effectiveness at around 35°C (95°F) (I-25, I-28). Two submitters requested that the minimum temperature of 43°C (110°F) be changed to warm water (I-23, I-28) or that it be tempered to a range of 29.5°C (85°F) to 43°C (110°F). And finally, one submission (I-27) sought to place an upper temperature limit of 54.4°C (130°F), for fear that these regulations would be subject to OSHA scrutiny and criticism without a limit. Interestingly, it was noted in this submission, through reference to the Consumer Product Safety Commission, that second- or third-degree burns have been shown to occur in the elderly at temperatures not much over 43°C (110°F). Council I and the General assembly of voting delegates passed a recommendation to lower the Food Code water temperature minimum to 29.5°C (85°F).

The universe of food handling situations requiring effective personal hygiene runs from temporary handwash stations set up in produce fields to advanced state-of-the-art kitchens used to produce extended-shelf-life ready-to-eat foods sold at retail. In many of these situations, it is difficult to provide water meeting strict temperature ranges. Further, it is difficult to manage and monitor food handlers to insure that the 43°C (110°F) temperature minimum is maintained during all handwashing activities. When subject to regulatory inspections, violations are given to food industry entities based on Food Code specifications. Therefore, in the interest of possibly increasing handwashing compliance or efficacy and clarifying the importance of this issue to enforcement authorities, handwashing studies were undertaken.

In a literature search for effect of water temperature on hygienic efficiency, only two experimental studies shed light on this issue. Both

of these involved hand sampling studies, in which the objective was to remove and enumerate as many bacteria on the hands as possible, either as normal or transient flora. In hand scrubbing experiments, Price (27) found that at temperatures from 24°C (75.2°F) to 56°C (132.8°F) there was no difference in de-germing rate. Because he scrubbed hands with a brush for a specific period of time, each in turn in a series of sterile wash basins, he might have been capable of seeing differences upon counting the flora in each basin. After conducting over 80 experiments in a 9-year period, Price concluded that the largest variable in determining the rate of removal of bacteria from the hands was the vigorosity of scrubbing. Other factors, such as soap used or water temperature, were less important. In later hand sampling experiments implementing the glove juice method for recovery of microorganisms, no differences in isolation rates were seen at either 6°C (42.8°F) or 23°C (73.4°F) (12). Although this information is inconclusive and does not answer questions concerning bacterial loads suspended in a confounding soil, they tend to indicate that there may not be a very great difference in efficacy over a range of temperatures from 6°C (42.8°F) to 56°C (132.8°F).

Various menstruum have been used for handwashing efficacy studies. For studies involving transient flora, the most often used soil is tryptic soy broth (TSB). Microorganisms exhibit good survivability, with even distribution of contaminating microorganisms into skin cracks, creases and invaginations being possible. Ground beef probably represents the most appropriate menstruum because of concern for risks of *E. coli* O157:H7 infection, but is only occasionally used (30, 31). Numerous cases of food-borne illness have been tied to poor personal hygiene after ground beef preparation.

On the basis of all the information gained from the literature search and analysis, experiments

were performed to determine if there was a superior temperature or range of temperatures for removal of bacterial contamination from hands during handwashing. This involved contaminating hands with marker bacteria and washing hands with soap and water, followed by counting resident and transient (marker) bacteria. Because it was realized that both the use of antimicrobial soap and drying with paper towels would confound and alter the effects of water temperature washing and rinsing, bland soap was used and hands were not dried with paper towels.

MATERIALS AND METHODS

This study was performed at BioScience Laboratories (for resident bacteria) and Silliker Research and Laboratory Services (for transient bacteria). Table 2 provides a comparison of methods used for testing in the two laboratories.

A stable pigmented strain of *Serratia marcescens* (SLR 1421) was used to simulate transient hand contamination. This organism is used frequently used in hand disinfection studies (5, 22, 23, 24, 28).

Tryptic soy agar (TSA) and tryptone glucose yeast (TGY) agar spread plates, deionized water, sterile stripping fluid, Butterfield's phosphate buffer solution, phosphate buffer with 0.1% Triton X-100, TSB with 1% Tween and 0.3% lecithin, sterile latex-free surgical gloves, alcohol, and Ivory® liquid soap (non-antimicrobial) were used.

Subjects rinsed both hands under running tap water at the designated temperature, and shook off any excess. Three ml of Liquid Ivory® Soap was dispensed into the subjects' cupped hands and rubbed over all surfaces, including the lower third of forearms, making sure not to lose any soap. After complete soap dispersal, a small amount of tap water was added, and subjects lathered their hands and forearms vigorously for 15 s. Subjects then rinsed their hands and forearms for

10 s under running tap water maintained at a flow rate of 7.6 liters/min (2 gallons/min) at the designated temperature, after which they shook the hands two times to remove excess moisture. While still wet, the subjects' hands were gloved for sampling using the Glove Juice technique.

Glove juice sampling procedure

The effectiveness of bacterial reductions from the hands was evaluated using the glove juice recovery method as described in ASTM test methods (4). Following the prescribed wash and rinse procedure, sterile, powder-free latex gloves were donned. Seventy-five ml of Sterile Stripping Fluid (aqueous phosphate buffer with 0.1% Triton) were instilled into the glove, the wrists were secured, and attendants massaged the hands through the gloves in a uniform manner for 60 s. Aliquots of the glove juice were removed and serially diluted in Butterfield's Phosphate Buffer solution containing 1.0% Tween 80 and 0.3% Lecithin as product neutralizers.

Enumeration

For normal (resident) bacteria, duplicate spiral plates were prepared from appropriate dilutions using TSA with product neutralizers. The plates were incubated at $30^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($86^{\circ}\text{F} \pm 2^{\circ}\text{F}$) for 48 h. Colonies were counted and the data recorded using the CASBA™ 4 plate-counting system.

For transient (*Serratia marcescens*) bacteria, Samples were spread on TGY agar following appropriate dilutions, and incubated at 35°C (95°F) for 24 to 48 h. Any pink colonies observed were considered to be *S. marcescens*, while the others were considered to be normal flora. The number of bacteria were tabulated using the following formula:

$$B = A[\sum x/n]^{10 \cdot D}$$

Where:

B = estimated number of microorganisms

A = portion volume = 75 ml (phosphate buffer added to glove)

$\sum x/n$ = average CFU per plate for each dilution level

D = dilution level

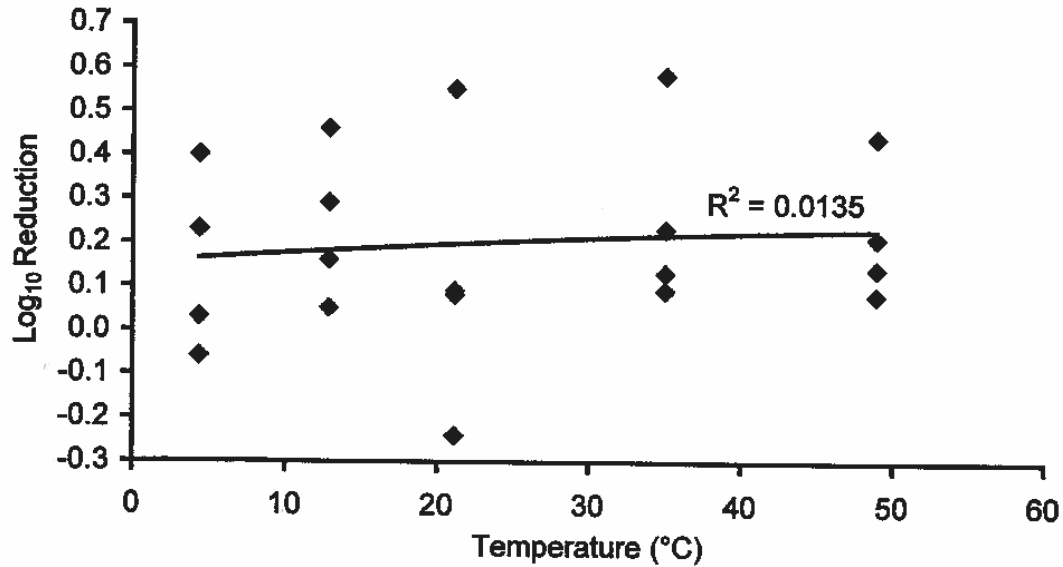
Subjects for normal (resident) flora experiment

The constant exposure of microbiology laboratory technicians to sanitizers and the necessity of disinfection provides the potential for high variability in the resident or "normal" flora and physiological condition of their hands and forearms. Working daily with various microorganisms that are not considered part of the normal (resident) skin flora (including agents used in their testing and evaluation) increases the susceptibility of these individuals to infection and skin damage. For this reason, volunteers were used to get a more accurate picture of the effects of water washing temperature on resident flora.

Between the ages of twenty-six and fifty-six four healthy subjects were selected, three females and one male. All subjects' hands and forearms were free from clinically evident dermatosis, injuries, open wounds, hangnails, or any other disorder that could compromise the subject and the study. Participation was restricted to individuals not currently using any topical or systemic antimicrobials, steroids, or other medication known to affect the resident microbial flora of the skin.

The "pre-test period, seven days prior to the testing portion of the study, was designed to generate optimum levels of resident flora for testing purposes. During this period, subjects were instructed to avoid using medicated soaps, lotions, deodorants and shampoos, as well as skin contact with solvents, detergents, acids and bases, or other

Figure 1. Handwashing efficacy (\log_{10} reduction) for resident flora in TSB and selected water washing and rinsing temperature



products known to affect the microbial population of the skin. Avoidance of UV tanning beds and swimming or bathing in biocide-treated pools or hot tubs was mandatory. During this period, subjects were supplied with a personal hygiene kit, containing non-medicated soap, shampoo, deodorant, lotion, and rubber gloves to be worn when contact with antimicrobials, solvents, detergents, acids, or bases could not be avoided. For subjects' safety, leaving the lab once the testing began was prohibited.

Testing period of normal (resident) flora

Each subject was utilized for approximately one-half hour every other day of the test period, excluding weekends and holidays (a total of ten test days per subject). Subjects were instructed to avoid washing their hands for two hours prior to testing, and fingernails were trimmed to a free-edge of less than 1 mm if not already done. All jewelry was removed from the hands and arms prior to washing.

Testing of normal (resident) flora with TSB

On each of the five test days, subjects had 1.0 ml (0.5 ml per hand) of TSB placed into their cupped hands in ten aliquots of approximately 0.1 ml. The broth was distributed evenly over both hands, not reaching above the wrists, by gentle continuous massage for 45 s. After a timed two-minute air dry, the non-dominant hand of each subject was sampled for baseline using the Glove Juice Sampling technique. Subjects washed their hands as previously described, and the other hand was then sampled using the Glove-Juice technique. These procedures were repeated each day, with the non-dominant hand being used for baseline sampling for each subject on each test day. The water temperature for the handwashes on each test day was adjusted for subjects to wash at a different temperature. Test days one through five were performed at the following water temperatures, respectively: 4.4°C (40°F), 12.8°C (55°F), 21.1°C (70°F), 35°C (95°F), and 48.9°C (120°F).

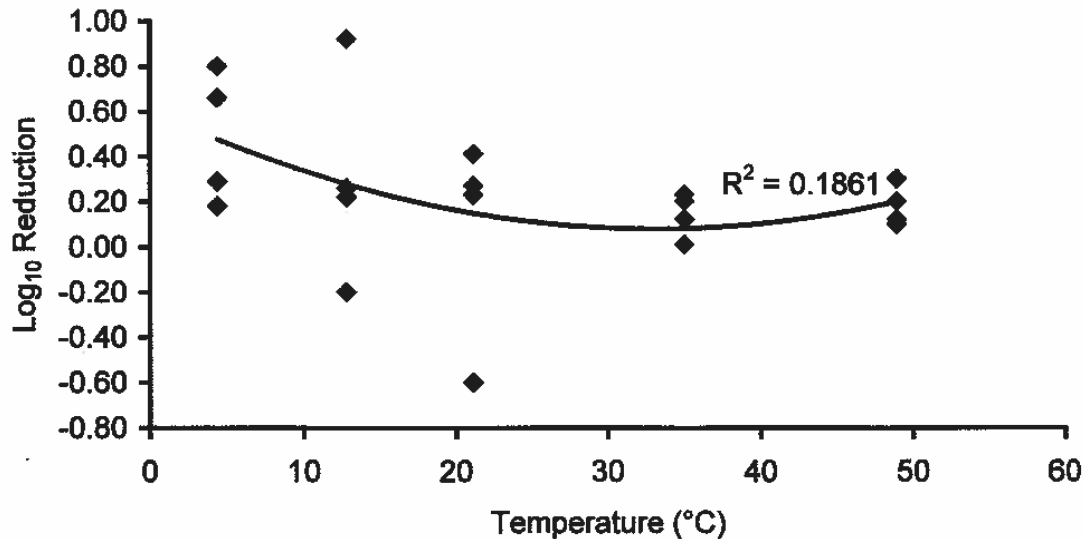
Testing of normal (resident) flora with ground beef

On each of five test days, subjects handled and smeared three grams of gamma-irradiated hamburger meat on their hands for two minutes. After a timed two-minute air dry, the non-dominant hand of each subject was sampled for baseline using the glove juice sampling technique. Subjects washed their hands as previously described, and the other hand was then sampled using the glove-juice technique. These procedures were repeated each day, with the non-dominant hand being used for baseline sampling for each subject on each test day. Wash and rinse temperatures were each day identical to those used for the resident flora with TSB testing.

Testing of transient flora with TSB and gamma-irradiated ground beef

Four laboratory workers, one female and three males, twenty-four to twenty-five years of age, were chosen for this experiment. Testing was performed over a four-week

Figure 2. Handwashing efficacy (\log_{10} reduction) for resident flora in ground beef at selected water washing and rinsing temperatures



period in order to alternate left and right hands for baseline readings for each temperature and inoculum. Testing procedures for the ground beef were identical to testing for normal (resident) flora, with the addition of 1×10^8 *S. marcescens*. Testing with TSB was similar to the tests for transient flora, with the following exceptions: the addition of 1×10^8 *S. marcescens*, a two-minute massage period of broth into the hands, and a one-minute drying period. Subjects washed their hands as previously described, with the opposing hand being used for baseline on alternate days. Hands were washed as previously described, and the glove juice technique was utilized for recovery.

Methods of analysis of normal (resident) and transient bacteria

The plate count data collected from this study were evaluated using MiniTab® statistical computer software. Prior to performing a statistical analysis, exploratory data analysis was performed. Stem-leaf ordering, letter value displays, and box plots were generated. Geomet-

ric mean colony counts were obtained and log or % reductions in transient and normal flora were determined from these values through comparisons to baseline counts. The experiments were analyzed for significance using statistical ANOVA software. A series of two-sample Student *t*-tests were conducted using the 0.05 significance level for Type I (α) error and corrected for multiple comparisons on means.

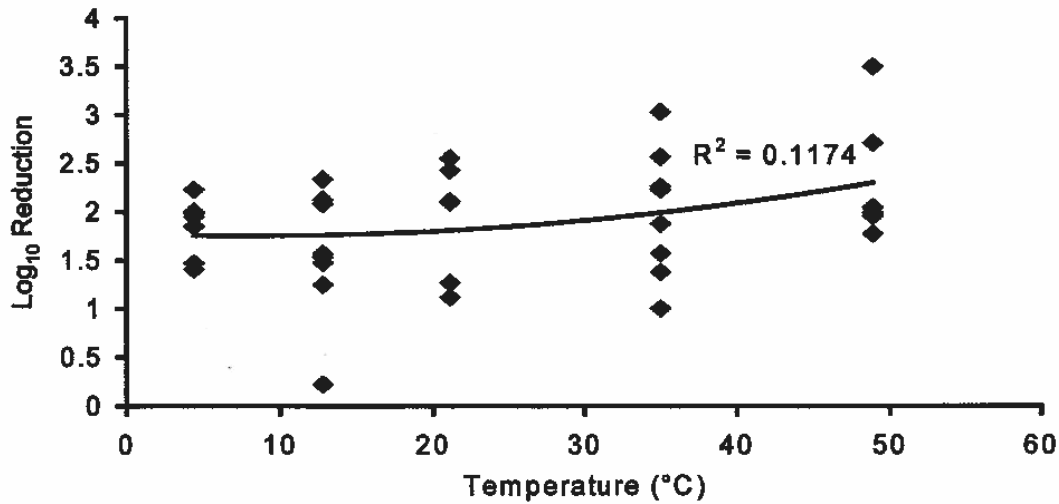
RESULTS AND DISCUSSION

Because a number of submitters at the Conference for Food Protection brought forward the issue of skin injury and possible scalding at temperature above 43°C (110°F), a review of pertinent literature was undertaken to determine if facts support lowering of the temperature for reasons other than efficacy. The Consumer Product Safety Commission has noted that residential water heater thermostat settings should be set at 49°C (120°F) to reduce the risk of the majority of tap water scald injuries. Although the majority of scalding incidents in the home oc-

cur in children under the age of five and in the elderly, third-degree burns are known to result from a 2 s exposure to 66°C (150°F), 6 s at 60°C (140°F) and 30 s at 54.4°C (130°F) (35). As we age, our skin becomes thinner, losing suppleness. This fact is important, as many seniors are now actively involved in the food industry. Due to the elder risk particularly, some have recommended that water be delivered from the tap at even lower temperatures, of less than 43°C (110°F) (33).

The activity of soaps, friction, and rinsing become crucial because the temperatures recommended in handwashing water alone would not provide thermal destruction of pathogenic microorganisms. Relevant to the discomfort issue (brought forward as issues I-23 and I-26) is a study involving dishwashing soaps. In that study, participants could withstand only water temperatures of 43°C, 45°C, and 49°C (110°F, 113°F and 120°F), with tolerance levels related to discomfort peaking at one minute (9). Even though this is considerably longer than the 10 to 25 s exposure period that would result from hand-wash-

Figure 3. Handwashing efficacy (\log_{10} reduction) for transient flora (*S. marcescens*) in ground beef at selected water washing and rinsing temperatures



ing, it is indicative of the fact that temperatures from 43°C to 49°C (110° to 120°F) are at the discomfort threshold.

Appropriate handwashing duration (15 seconds) for this study was determined through review of various governmental agency recommendations and previous handwashing study observations (1, 3, 10, 36). Suggested lathering times by specific agencies are: the 1999 FDA Food Code (20 seconds) (36), the American Society for Testing and Materials (ASTM) (15 seconds) (3), The Association for Professionals in Infection Control and Epidemiology (APIC) (minimum of 10 seconds) (10), and The American Society for Microbiology (ASM) (a 10 to 15 s vigorous scrub) (1). Several studies support a washing duration of at least 10 seconds, with sufficient transient removal efficiency achieved by 30 seconds. A study by Stiles and Sheena (32) involving workers in a meat processing facility determined that a wash of 8 to 10 s was too short for adequate soil removal from the hands. A study by Ojarjarvi (21) compared a 15 s and a two-minute wash, with the latter providing only an additional 3% transient bacterial reduc-

tion. Two observational studies were reviewed in the health care and food service industries to determine average durations in the real world. A study of nurses (34) revealed an average wash time of 21 s, while a survey of restaurant employees (4) showed that the average duration was 20 s.

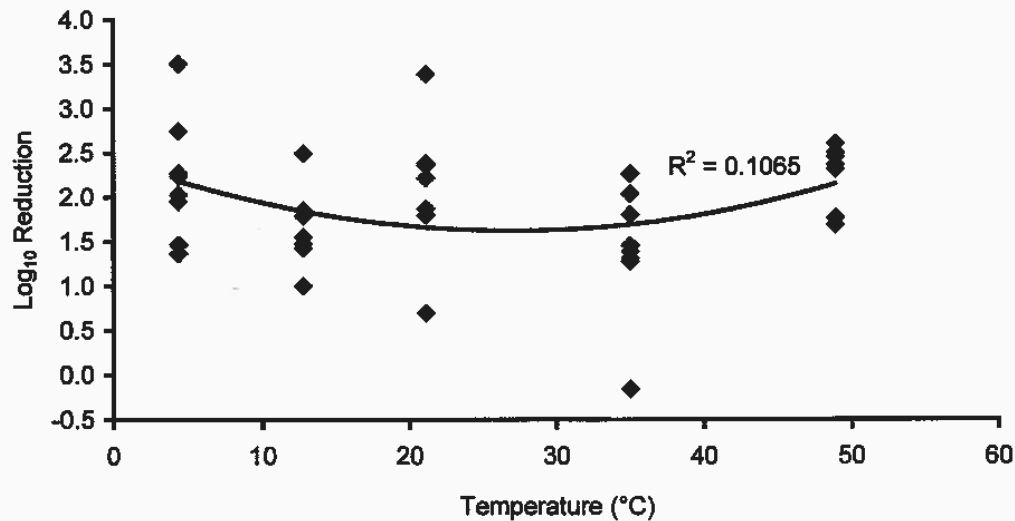
After experiments were completed, \log_{10} reductions of each individual handwashing were calculated by subtracting counts obtained after handwashing from baseline data. Statistical analysis using ANOVA, was performed, with no statistical difference seen between any set of handwashing and rinsing temperatures for normal (resident) or transient flora with either of the two contaminating soils. Figures 1 and 2 show \log_{10} reduction results for the range of temperatures used in these experiments for normal (resident) flora soiled with TSB and with gamma irradiated ground beef, respectively. Four data points are provided at each temperature and soil. Two \log_{10} reduction data points for both TSB and ground beef appear as negative for transient flora. Polynomial regression analysis was performed to display potential trends

even though no statistical significance could be shown. In respect to normal (resident) flora, although rising temperature reduction efficacy seemed to increase slightly with TSB inocula, a slight decrease in efficacy was seen with ground beef. Resident TSB and ground beef R^2 values of 0.0135 and 0.1861, respectively, provide evidence of the lack of a relationship between the two variables.

Figures 3 and 4 show \log_{10} reduction results for transient flora in TSB and gamma irradiated ground beef, respectively, at temperatures tested. Only one negative \log_{10} reduction figure was observed. While polynomial regression showed a slight increase in efficacy with increasing temperature for ground beef inoculum, both high 48.9°C (120°F) and low 4.4°C (40°F) temperatures tended to have higher \log_{10} reductions than the mid temperatures tested. Again, TSB and ground beef R^2 values of 0.1065 and 0.1174, respectively, provide evidence of a lack of relationship between the two variables.

The geometric mean \log_{10} reduction for all transient flora experiments involving both TSB and ground beef inocula was 1.9,

Figure 4. Handwashing efficacy (\log_{10} reduction) for transient flora (*S. marcescens*) in TSB at selected water washing and rinsing temperatures



whereas the resident flora \log_{10} reduction was 0.2 for both menstruum. These \log_{10} reduction figures are in agreement with results from other similarly performed studies of both resident (6, 19) and transient flora (2, 7, 26).

A comparison of \log_{10} reduction variability (as seen in Fig. 1-4) was reviewed for trends that could indicate increased or decreased variability with certain temperatures under specific inoculum conditions. Coefficient of variation values for each temperature group for both resident and transient flora as well as both menstruum were determined by obtaining the ratio of the standard deviations of each group to the mean \log_{10} reductions. Figure 5 shows the coefficient of variation (expressed in percent) for each testing condition. Coefficients of variation are fairly consistent for transient flora, with resident flora data exhibiting a great deal of variation. Overall, there appeared to be a slightly lower variation in \log_{10} reduction figures for the 48.9°C (120°F) temperature over the 35°C (95°F) group. Variability data from the 4.4°C (40°F) and 12.8°C (55°F) groups were similarly low, with variability for temperature

ranges peaking at 21.1°C (70°F). Subjects freely commented that the water at a temperature of 4.4°C (40°F) was uncomfortable. In issues brought before the CFP, temperatures at or above 43°C (110°F) were argued to be uncomfortable. Taken together with the variability noted, it suggests that participants more consistently wash their hands when water temperatures are between 35°C (95°F) and 48.9°C (120°F).

Friction has been identified as a key element in removing microbial contaminants from hands (11, 27). Friction applied during the hand drying process is instrumental in finishing the process. Removal of transient flora appears to be even more friction dependent than removal of resident flora. Surfactant and antimicrobial compounds in soap are responsible for lifting soil and killing microorganisms suspended in the soil. When bland soap is used to wash hands, handwashing efficacy appears to be dependent on the effects of surfactant action of the soap along with friction applied during the washing and rinsing process. Rinsing also provides the necessary removal by dilution. To facilitate appropriate rinsing of the hands, some personal

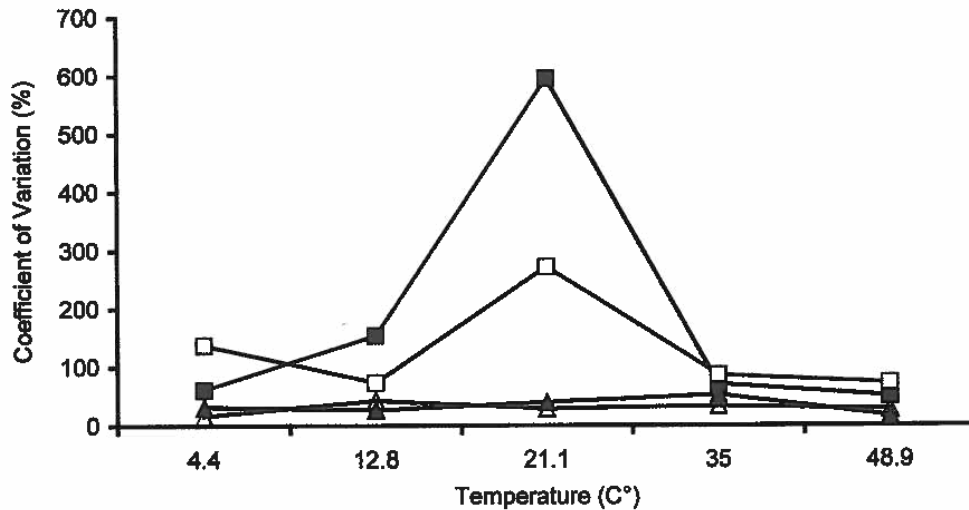
hygiene consultants have suggested the practice of using thicker, higher-viscosity soaps in larger doses, which would require a longer, more vigorous rinsing routine.

Price (27), upon noticing that in his scrubbing experiments water temperature had little effect at de-germing of the skin, commented that water applied to the skin at a given temperature quickly reaches equilibrium with normal skin surface temperature unless hands are totally immersed.

Skin oils derived from sebum are liquid in the sebaceous gland and solidify on the skin surface. Beef tallow melts in the range of 35°C to 40°C (95°F to 104°F), while lard or butterfat are liquefied at temperatures around 30°C (86°F) (15). If handwashing efficacy for both resident and transient floras embedded in both natural and artificially applied fats depended on thermal melting, then \log_{10} reduction figures should have been greatest at the highest temperature and least at temperatures that cause these fats to congeal.

Fats such as tallow or lard are distinguished from oils in that oils are liquids at room temperature.

Figure 5. Coefficient of variation values (%) for handwashing \log_{10} reduction of resident and transient flora with TSB and ground beef soils. Resident flora ground beef ■, resident flora TSB □, transient flora TSB ▲, transient flora ground beef △



Hand soap formulations are designed to lift soil through their foaming action, dispersing and solubilizing organic soils using detergent surfactants. Primary micelles are present, having hydrophilic and hydrophobic groups attached to the ends of the surfactant monomer. Soaps with multiple surfactants form mixed micelles, which increases efficiency with various soil mixtures. In water and organic soil mixtures, these form complex micelle structures around hydrocarbon moieties (encapsulation), resulting in microemulsions. Thus, the soap provides a "bridge" between the oily droplet and water, permitting the soapy water to "wash away" greasy material.

Price (27) described the contradictory aspect of soap, which tends to reduce surface friction. Soaps of his day were not the more developed formulas now available and used in this experiment. In the experiments described here, a 3-ml aliquot of bland soap was used to remove a total of one gram of TSB or three grams of ground beef. Use of lower quantities of soap would obviously provide lower surfactant effectiveness. The quantity of soap used for handwashing has the abil-

ity to affect handwashing efficacy, as shown by Larson (14). Several studies (13, 16, 17, 18, 19, 21, 25, 29, 31) have used soap amounts in the range of 2.5 to 5.0 ml in their handwashing protocol. The higher levels are considered excessive, except in hospital infection control. Many food service operations set soap dispensers at 1 ml per pump, and employees often times use multiple pumps. As the experiments described here utilized 1.5 grams ground beef menstruum per hand, 3 ml of soap was chosen to represent an amount found to be significantly effective in an earlier study (14). In that study, it was determined that 3-ml of soap provided greater bacterial reductions than did 1 ml for a liquid, nonantimicrobial soap. Observations of soap usage by health care employees in the hospital setting were also performed, as nine different departments, from labor and delivery to psychology, determined average soap use to be around 2.18 ml per incidence, compared to 3.5 by the general population (14).

Surfactants in soap have surface tension lowering capabilities. The vigorous rubbing action of hands creates a rapid formation of surfaces and changing pressure gra-

dients, which develop and increase micelle formation. The combined action of soap, friction and dilution appears to outweigh any advantage that temperature might have in the liquefying of fats, which would normally occur in the range of 30°C to 40°C (86°F to 104°F).

Many antimicrobials are inactivated by the presence of organic soils or soaps. Several writers have suggested that these antimicrobial ingredients present in soaps are not in contact with microorganisms long enough to provide sufficient antimicrobial action. Of the commonly used antimicrobial ingredients employed in soap products, only iodophors have been shown to exhibit temperature-dependent antimicrobial effects due to temperature-dependent dissociation constants for PVP and iodine present in the formulation. For these reasons, even if antimicrobial agents were present in soap, it is doubtful that water temperature would have a significant effect on overall hygienic efficiency. It should also be noted that under real-life conditions, hands would be dried (usually with paper towels) and that further bacterial reductions in the range of 1 \log_{10} are seen, reducing any slight difference in efficacy with antimicrobial soaps.

ACKNOWLEDGMENTS

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REFERENCES

- Am. Soc. Microbiol. 1996. Hand-washing survey fact sheet. ASM. 9-25.
- Ansari, S. A., V. S. Springthorpe, S. A. Sattar, W. Tostowaryk, and G. A. Wells. 1991. Comparison of cloth, paper, and warm air drying in eliminating viruses and bacteria from washed hands. *Am. J. Infect. Control* 19:243-249.
- ASTM. 1995. Standard test method for evaluation of health care personnel handwash formulation by utilizing fingernail regions. ASTM E1327-E1390.
- Ayers, T. 1998. Assessment of variables associated with effective handwashing. University of Florida Dept. of Food Sci. and Human Nutr., Gainesville, FL.
- Bartzokas, C. A., J. E. Corkill, and T. Makin. 1987. Evaluation of the skin disinfecting activity and cumulative effect of chlorhexidine and triclosan handwash preparations on hands artificially contaminated with *Serratia marcescens*. *Infection Control* 8:163-167.
- Blackmore, M. 1987. Hand-drying methods. *Nurs. Times* 83:71-74.
- Coates, D., D. N. Hutchinson, and F. J. Bolton. 1987. Survival of thermophilic campylobacters on fingertips and their elimination by washing and disinfection. *Epidemiol. Infect.* 99:265-274.
- Dunsmore, J. M. 1972. The effect of hand washing on the bacteria of skin. *Australian J. Dairy Technol.* 27:137-140.
- Horn, H. and H. Briedigkeit. 1967. On epidemiological and hygienic aspects of the use of modern dishwash detergents. *Z. Gesamte Hyg.* 13:334-336.
- Jennings, J., and F. A. Manian. 1999. APIC Handbook of infection control. Assoc. for Professionals Infect. Control Epidem., Inc. Washington, D.C.
- Kaul, A. F., and J. F. Jewett. 1981. Agents and techniques for disinfection of the skin. *Surg. Gynecol. Obstet.* 152:677-685.
- Larson, E. L., M. S. Strom, and C. A. Evans. 1980. Analysis of three variables in sampling solutions used to assay bacteria of hands: type of solution, use of antiseptic neutralizers, and solution temperature. *J. Clin. Microbiol.* 12:355-360.
- Larson, E. L., A. M. Butz, D. L. Gullette, and B. A. Laughon. 1990. Alcohol for surgical scrubbing? *Infect. Control. Hosp. Epidemiol.* 11:139-143.
- Larson, E. L., P. I. Eke, M. P. Wilder, and B. E. Laughon. 1987. Quantity of soap as a variable in handwashing. *Infect. Control.* 8:371-375.
- Lide, D. R. Handbook of chemistry and physics. 1990. Boston, CRC Press.
- Mahl, M. C. 1989. New method for determination of efficacy of health care personnel hand wash products. *J. Clin. Micro.* 27:2295-2299.
- Michaud, R. N., M. B. McGrath, and W. A. Goss. 1972. Improved experimental model for measuring skin degerming activity on the human hand. *Antimicrob. Agents Chemother.* 2:8-15.
- Michaud, R. N., M. B. McGrath, and W. A. Goss. 1976. Application of a gloved-hand model for multiparameter measurements of skin-degerming activity. *J. Clin. Microbiol.* 3:406-413.
- Miller, M. L., L. A. James-Davis, and L. E. Milanese. 1994. A field study evaluating the effectiveness of different hand soaps and sanitizers. *Dairy Food Environ. Sanit.* 14:155-160.
- Noble, W. C., and D. G. Pitcher. 1978. Microbial ecology of the human skin. *Adv. Microbiol. Ecol.* 2: 245-289.
- Ojajarvi, J. 1980. Effectiveness of hand washing and disinfection methods in removing transient bacteria after patient nursing. *J. Hyg. (Lond)* 85:193-203.
- Paulson, D. S. 1992. Evaluation of three handwash modalities commonly employed in the food processing industry. *Dairy Food Environ. Sanit.* 12:615-618.
- Paulson, D. S. 1993. Evaluation of three microorganism recovery procedures used to determine handwash efficacy. *Dairy Food Environ. Sanit.* 13:520-523.
- Paulson, D. S. 1993. Variability evaluation of two handwash modalities employed in the food processing industry. *Dairy Food Environ. Sanit.* 13:332-335.
- Paulson, D. S. 1994. A comparative evaluation of different hand cleansers. *Dairy Food Environ. Sanit.* 14:524-528.
- Pether, J. V. S., and R. J. Gilbert. 1971. The survival of *Salmonella* on finger-tips and transfer of the organisms to food. *J. Hyg. Cambridge* 69:673-681.
- Price, P. B. 1938. The bacteriology of normal skin; a new quantitative test applied to a study of the bacterial flora and the disinfectant action of mechanical cleansing. *J. Infect. Dis.* 63:301-318.
- Rotter, M. L. 1984. Hygienic hand disinfection. *Am. J. Infect. Control* 5:18-22.
- Rotter, M. L. and W. Koller. 1992. Test models for hygienic handrub and hygienic handwash: the effects of two different contamination and sampling techniques. *J. Hosp. Infect.* 20:163-171.
- Sheena, A. Z., and M. E. Stiles. 1982. Efficacy of germicidal hand wash agents in hygienic hand disinfection food handlers. *J. Food Prot.* 45: 713-720.
- Stiles, M. E., and A. Z. Sheena. 1985. Efficacy of low-concentration iodophors for germicidal hand washing. *J. Hygiene, Cambridge* 94:269-277.
- Stiles, M. E., and A. Z. Sheena. 1987. Efficacy of germicidal hand wash agents in use in a meat processing plant. *J. Food Prot.* 50:289-295.
- Stone, M., J. Ahmed, and J. Evans. 2000. The continuing risk of domestic hot water scalds to the elderly. *Burns* 26:347-350.
- Taylor, L. J. 1978. An evaluation of handwashing techniques-2. *Nursing Times* 75:108-110.
- US Consumer Product Safety Commission (CPSC). Tap water scalds. 2000, Washington, D.C.
- US Public Health Service. Food and Drug Administration Food Code 1999.
- Williamson, P., and A. M. Kligman. 1965. A new method for the quantitative investigation of cutaneous bacteria. *J. Investi. Dermatol.* 45: 498-503.

TOWARDS DEVELOPMENT OF AN ALGORITHM FOR MAINS WATER TEMPERATURE

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ABSTRACT

Mains water temperature (T_{mains}) has significant influence on the energy consumption of water heating equipment. It is dominantly influenced by ambient temperature (T_{amb}). Since T_{amb} is roughly an annual sinusoid, T_{mains} is assumed to be a sinusoid whose mean value varies directly with annual average temperature $T_{amb,ann}$. Model parameters are based on water system physics and include: i) a constant offset from $T_{amb,ann}$; and ii) amplitude and phase which vary linearly with $T_{amb,ann}$. Available T_{mains} data indicate that the offset is $\sim 6^\circ\text{F}$, and that the amplitude is $\sim 0.4\Delta T_{amb}$. Uncertainties include: i) data quality issues, including bias of T_{mains} data from heat exchange with house air; ii) inherent spatial variations in mains networks, and iii) limited data sets. Future work includes acquiring quality data sets, testing the model in northern climates, and refining parameter estimates.

1. INTRODUCTION

Mains water temperature (T_{mains}) is the temperature of the water supplied to the house piping from the water utility's distribution mains piping. T_{mains} affects energy consumption of all water heaters, and its accuracy is of interest. There will be some error (denoted δT_{mains}) in algorithms estimating T_{mains} at any site. δT_{mains} induces a corresponding error in a prediction of water heater energy. For a conventional storage tank water heater (WH) over a period Δt , differentiating the long-term tank energy balance with storage tank losses and manipulating yields:

$$\delta Q_{WH}/Q_{WH} = -[\delta T_{mains}/(T_{set}-T_{mains})][EF_{WH}/\eta_{burn}] \quad (1)$$

For solar collectors, the temperature difference and incident radiation determine efficiency, as in Fig. 1. δT_{mains} induces

an error in the inlet temperature, sliding the operating point along the efficiency curve, as in Fig. 1. Taking differentials of the linear form of the collector efficiency equation yields:

$$\delta\eta_{col}/\eta_{col} = -F_r U_1 \delta T_{mains} / (\eta_{col} I) \quad (2)$$

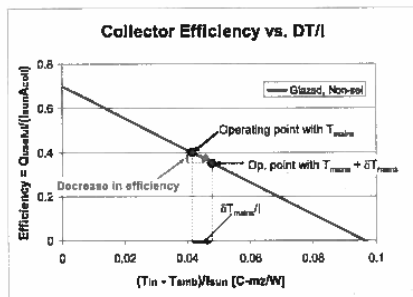


Fig. 1. Collector efficiency plot, showing the decrease in collector efficiency with $\delta T_{mains} > 0$.

Table 1 gives the uncertainty in annual energy calculations for the cases of Eqs. 1,2 with an assumed error of $\delta T_{mains} = +3^\circ\text{C}$. This value is the difference between the T_{mains} algorithm in (1) and the preliminary algorithm here (Sec. 4). Using values noted in Table 1, errors are 7%-9% in these two simple cases. Although not overwhelmingly large, these errors are large enough to motivate minimizing error in T_{mains} algorithms.

TABLE 1. ANALYSIS SENSITIVITY TO T_{mains}

Analysis Result	Potential Error ¹
Conventional WH annual energy ²	-7.1%
SWH annual savings ³	-9.3%

1. Error from Eqs. 1,2, with $\delta T_{mains} = 3^\circ\text{C}$.
2. $T_{set}=50^\circ\text{C}; T_{mains}=10^\circ\text{C}; EF_{tank}=95 @ V_{draw}=64 \text{ gal/day}; \eta_{burn}=0.8$.
3. $(F_r U_1)_{col}=5 \text{ W/m}^2\text{K}; I_{avg}=400 \text{ W/m}^2; \eta_{col}=0.4$.

Previous work in the solar community on T_{mains} has been limited, and the algorithms used in modeling tools have not been well-documented. Existing modeling algorithm types include: i) sinusoid fit to air-temperature data, as in (1); and ii) empirical fit, e.g., expressing $T_{mains,mon}$ as a polynomial in $T_{amb,mon}$ (2). Modeling T_{mains} as a sinusoid with parameters based upon local weather results from recognizing that i) T_{mains} is a strong function of T_{amb} ; and ii) T_{amb} is roughly sinusoidal, as shown in Fig. 2. The sinusoid model in (1) calculates T_{mains} as:

$$T_{mains,ref}(t) = T_{amb,ann} + RAT_{amb}\sin(\omega_{ann}t - \phi_{amb} - \phi_{mains}) \quad (3)$$

ΔT_{amb} is taken as $[(T_{mon,max} - T_{mon,min})/2]$, and the ratio R is taken as a constant at 0.05. The sinusoid algorithm developed in this study is similar in that T_{mains} has the same direct dependence on local $T_{amb,ann}$ and has amplitude proportional to ΔT_{amb} . The model presented here differs in form from Eqn. 3 by: i) adding in a constant offset (ΔT_{offset}); and ii) expressing R and ϕ_{mains} as linear functions of $T_{amb,ann}$. ΔT_{offset} accounts for factors (such as sun and plant transpiration) which cause the annual average surface temperature to differ from $T_{amb,ann}$. Dependence of R and ϕ on $T_{amb,ann}$ reflects expected consequences of burying pipes deeper in colder climates to prevent freezing.

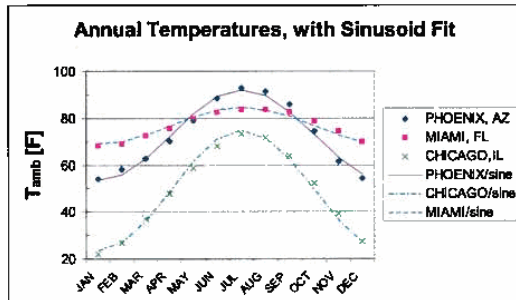


Fig. 2. Monthly air temperature data for three sites, with sine model fits based upon the average and extreme.

2. WATER NETWORKS: GENERAL ISSUES

A block diagram of a potable water supply system is shown in Fig. 3. It is complex, with many factors influencing the water temperature. T_{amb} is a dominant factor, heavily influencing water temperature at all stages of the system, as indicated in Fig. 3. For purposes here, it is useful to break the system into three parts: i) supply, including source, treatment, and storage; ii) mains, the mains distribution line from the storage tank to the house; and iii) house, the piping from mains to the house boundary, and the piping internal to the house. The quantity of interest here is T_{mains} .

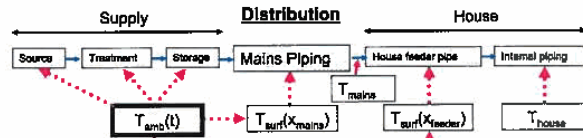


Fig. 3. Block diagram of a potable water supply system, showing importance of T_{amb} on T_{mains} .

2.1 Supply

System water supply comes from surface waters or from well water. Surface waters vary seasonally in temperature, with rivers varying more than lakes/reservoirs. Well water temperature beyond ~30 ft. is constant at the deep-ground temperature, which is close to $T_{amb,ann}$ (3). A local well with “short” piping to the house is a special case of the correlation here, for local wells, the sinusoid expressing annual variation would be dropped. Storage is usually in closed metal tanks exposed to the ambient air. For a well-mixed tank coupled to a constant T_{amb} , the time constant is of order one week, depending on tank size.

2.2 Mains Distribution Piping

The mains distribution piping subjects the water in the pipe to the dynamic influence of ground temperature at the depth to which the pipe is buried ($T_{grd}(z_{pipe},t)$), as in Fig. 4. Mains pipes are typically tens of miles long, and may be a complex maze of interconnecting pipes, valves and pumps, fed by multiple storage tanks supplied from a variety of sources. Modeling temperature in such a complex network would require a vast amount of dynamic information, and direct modeling is considered impractical. Nonetheless, solution of simplified problems may be useful to provide some insight into general features of distribution systems.

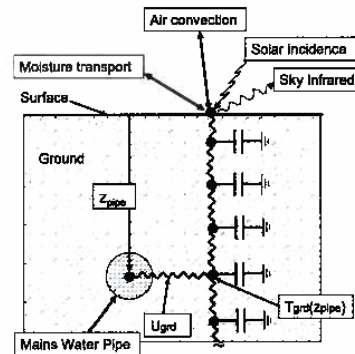


Fig. 4. Buried pipe schematic, with surface energy balance terms and schematic heat transfer model.

2.2.1 Spatial variation in T_{mains} . Generally, T_{mains} is a function of both time and position down the pipe leading from the storage tank, i.e., $T_{mains} = T_{mains}(x_{pipe}, t)$. Variation is due to ground interaction and other factors (such as different sources/storage tanks supplying different parts of the network). To illustrate the ground influence, consider the idealized problem of a single pipe at constant depth z_{pipe} , as shown in Fig. 4. Assume $T_{surf}(t)$ is uniform along the pipe length. If the ground capacitance is ignored and assumptions made as in Fig. 4, the temperature along the pipe is given as

$$T_{mains}(x_{pipe}) = T_{grd}(z_{pipe}) + [T_{mains-in} - T_{grd}(z_{pipe})] \exp(-x_{pipe}/x_0) \quad (4)$$

where $x_0 = (\rho_{water} c_p D_{pipe} v_{pipe} / 4 U_{grd})$. Fig. 5 shows x_0 as a function of v_{pipe} for an 8" diameter pipe. Designs will limit $v_{pipe,max}$ to ~3 ft/sec at anticipated peak demand to avoid pipe-wall erosion. However, $v_{pipe,avg}$ might be 1/10th that value. At higher velocities and shorter distances, the water will not have come into equilibrium with the ground, and T_{mains} is in between T_{amb} and $T_{grd}(z_{pipe})$. At lower velocities/longer lengths, equilibrium between the water and the ground will be attained, and $T_{mains} = T_{grd}(z_{pipe})$.

Variation in T_{mains} throughout the distribution system is significant. Fig. 6 shows data taken across the metropolitan Denver area over a two-week period in Jan. 2007, a time period near the minimum point in T_{mains} where dT_{mains}/dt should be small. The spread is ~10 °F. Data in figs. 9d, 9f (at paper's end) show that T_{mains} varies significantly within these two metropolitan areas also. The effect may partly or entirely be due to ground interaction. We conclude that: *a T_{mains} correlation can provide only an average across the water network. For any individual home, T_{mains} may differ from the correlation by up to ± 5 °F.*

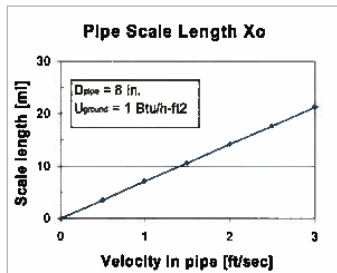


Fig. 5. Scale length x_0 for mains piping as a function of velocity in the pipe. x_0 is defined in Eqn. 4; it is the distance where $T_{mains} = T_{grd}(z_{pipe}) + (T_{mains-in} - T_{grd}(z_{pipe}))/e$.

2.2.2 Ground Temperature. An analytical solution to the ground temperature problem provides guidance for choice of the form of the correlation for T_{mains} . $T_{grd}(z_{pipe}, t)$ is determined by the ground surface temperature $T_{surf}(t)$ (3). If $T_{surf}(t)$ is given as a sinusoid [i.e., $T_{surf,ann} + \Delta T_{surf} \sin(\omega_{ann} t - \phi_{amb})$], then solution of the ground conduction boundary value problem (assuming no moisture convection or freeze/thaw occurs) is given by Eqn. 5 (from (3)):

$T_{grd}(z, t) = T_{surf,ann} + R(z) \Delta T_{surf} \sin(\omega_{ann} t - \phi_{amb} - \phi_{lag}(z))$ (5)

where: $R(z) = \exp(-z/z_0)$, $z_0 = \sqrt{2\kappa/\omega_{ann}}$, $\kappa = k_{grd}/(\rho_{grd} c_{grd})$, and $\phi_{lag}(z) = z/z_0$.

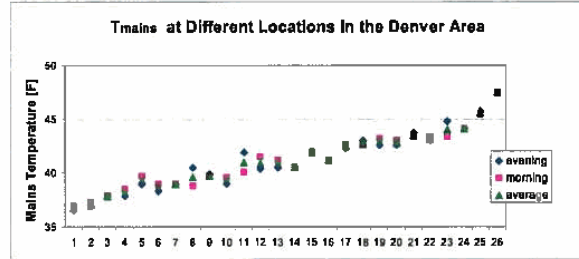


Fig. 6. Mains temperature at different locations in the same area. Data were taken in the Denver Metropolitan area, in mid-Jan. 2007.

Fig. 7 shows $T_{grd}(z_{pipe})$ plots at three depths from Eqn. 5 for Phoenix, Arizona. The curves show the progressive reduction in sinusoid amplitude and increased phase lag as depth increases.

$T_{surf}(t)$ is influenced by a number of factors, as indicated in Fig. 4. It is most strongly coupled with T_{amb} , but is affected by absorbed solar radiation, sky infrared fluxes, rainfall and water percolation, evapotranspiration from plants, snow cover, and freeze-thaw dynamics. In general, we expect

$$T_{surf,ann} = T_{amb,ann} + \Delta T_{offset} \text{ and } \Delta T_{surf} \approx \Delta T_{amb} \quad (6)$$

All the physical drivers but T_{amb} are lumped into the constant ΔT_{offset} . If solar radiation is the largest influence, as expected, we would expect ΔT_{offset} to be positive.

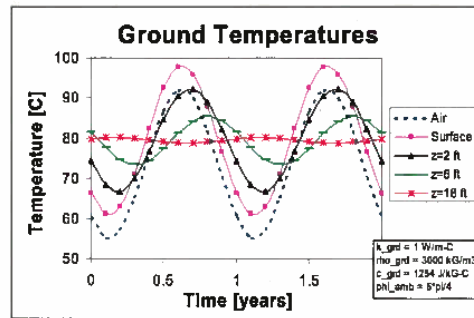


Fig. 7. Plot of $T_{grd}(z, t)$ vs. time for Phoenix, for a 2-year period. T_{amb} , T_{surf} , and T_{grd} at 3 depths are shown.

2.3 House piping

The feeder pipe from the mains to the house boundary may affect T_{mains} , mainly because there may be a very different surface temperature above the feeder pipe (e.g., under a lawn), as opposed to the mains pipe (e.g., under the street). The piping internal to the house generally has a significant affect on the temperature showing up at the end-use points (4), as illustrated in Fig. 8. After a period of several hour with no draws, the water in the house piping will be at temperature T_{house} . As in Fig. 8, the draw-off temperature T_{tap} starts out steady at T_{house} , until a volume of water ~equal to the volume of the upstream piping is drawn. T_{tap} then decays to T_{mains} after draw volume is ~1.5-2.0V_{piping} (4). For a spot measurement, one should draw at the highest rate possible (e.g., bathtub tap) and wait until the temperature is stable (e.g., 3-5 minutes). Data in Fig. 6 were ostensibly taken under this protocol.

When using a data-logger, T_{mains} data must be logged conditionally, i.e., data from the T_{mains} sensor reading is taken only when there is a draw. If not, the sensor average is near T_{house} and is meaningless. However, conditional logging still introduces a bias, especially for short draws. If a two minute draw occurs as in Fig. 8 and the data are conditionally averaged over the entire draw, the average T_{draw} value- when interpreted as T_{mains} - is skewed by about 15 °F. With data loggers, one should not accept T_{mains} data until the draw has gone on for 5 min. or so. It is not known how much this affect contaminates conditionally-logged T_{mains} data from various sources. Note that to accurately estimate the temperature coming into an end-use point (like a water heater), one must model the effect of the pipes between the feeder pipe take-off and the end-use point. Energy to warm or cool the mains water in the house pipes is provided by the house's HVAC systems, trading off with water heater energy. These effects are seldom modeled.

3. T_{mains} CORRELATION

The form of the correlation for $T_{mains}(T_{amb})$ should be a constant + sinusoid, since T_{amb} and T_{surf} are ~sinusoids:

$$T_{mains} = T_{mains,avg} + \Delta T_{mains} \sin(\omega_{amb}t - \phi_{amb} - \phi_{mains}) \quad (7)$$

It is assumed that T_{amb} is at a minimum on January 15, implying ϕ_{amb} is to be taken as 104.8° (1.830 rads). The constant term is linear in $T_{amb,avg}$ with an offset similar to that used in Eqn. 6:

$$T_{mains,avg} = T_{amb,avg} + \Delta T_{offset} \quad (8)$$

ΔT_{mains} and ϕ_{lag} are formulated from trends shown in Eqn. 5. The amplitude in Eqn. 5 is proportional to ΔT_{amb} , and

decreases with increasing depth z. Since pipes are buried deeper the colder the climate, we expect R to decrease with decreasing $T_{amb,ann}$. Using a linear function and injecting a reference temperature ($T_{ref} = 44$ °F) so that K_1 is the value of R at $T_{amb,ann} = T_{ref}$, one has:

$$\Delta T_{mains} = R \Delta T_{amb} = [K_1 + K_2(T_{amb,ann} - T_{ref})] \Delta T_{amb} \quad (9)$$

Similarly, the phase lag ϕ_{mains} is expected to increase with increased z_{pipes} , as in Eqn. 5 and Fig. 7, and a similar linear expression for ϕ_{mains} is proposed (expecting $K_4 < 0$):

$$\phi_{lag} = K_3 + K_4(T_{amb,ann} - T_{ref}) \quad (10)$$

ΔT_{offset} and $\{K_i, i=1,4\}$ are parameters to be determined by fitting to data sets for T_{mains} spanning a wide range of $T_{amb,ann}$.

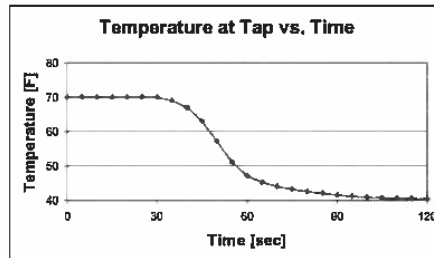


Fig. 8. Temperature at a cold water tap with draw, given no previous draw for several hours. After purging the upstream pipe volume, the tap outlet temperature transitions from T_{house} (~70 °F) to T_{mains} (~40 °F).

There is a practical difficulty in determining the values for the T_{amb} variables in Eqn. 7-10, because T_{amb} data should be coincident with the T_{mains} data. Ideally, T_{mains} data sets should provide $T_{amb}(t)$, overlapping the T_{mains} data (and also ideally extending back in time for a year or so). If average weather like TMY2 (5) is used for calculating T_{amb} values, a random error equal to the RMS variation of annual average temperature (~1 °C) is introduced. Data from other sources such as (6) could be used to get coincident T_{amb} data if not available from the data set directly.

4. DATA SETS AND CORRELATION COEFFICIENTS

Data sets used in this study are shown in Figs. 9a-9i (from (2), (7), and (8)). Local well-water sites in (7) were identified based upon T_{mains} being ~constant and were removed from the analysis. TMY2 data (5) was used for T_{amb} in all cases. The model results are also shown in Figs 9-17. The parameters of the model for the fit shown here are given in Table 2. RMS error between model and data across

the sites in Figs. 9a-9i is $\sim 4^\circ\text{F}$. The model for the coldest climate (Fig. 9a, Duluth Minnesota) is low by $\sim 13^\circ\text{F}$. This may indicate affects of freeze-thaw or snow cover (which invalidate the simple ground model used in Sec. 2). However, other northern sites do not show similar poor fits. Otherwise, the model-data discrepancies are small, usually within 5°F or so. Variation of R and ϕ_{lag} with $T_{\text{amb,ann}}$ is shown in Fig. 10. The ratio R ranges from ~ 0.35 (coldest) to ~ 0.7 (hottest) across the continental U.S. Similarly, the phase lag ϕ_{mains} ranges from about $\sim 10^\circ$ (hottest) to $\sim 40^\circ$ (coldest).

TABLE 2. PARAMETERS FOR T_{mains} CORRELATION

Parameter	Value
ΔT_{offset}	6.0°F
K_1	0.4
K_2	$+0.010^\circ\text{F}^{-1}$
K_3	35 Deg
K_4	$-0.01^\circ\text{Deg}/^\circ\text{F}$

5. CONCLUSIONS AND FUTURE WORK

Results in common water heating analyses depend on T_{mains} , and typical uncertainty/error in T_{mains} can lead to $\sim 10\%$ error in calculations. Data show that T_{mains} varies along the distribution network by $\pm 5^\circ\text{F}$, implying that any simple T_{mains} algorithm can provide only an average value. From general consideration of water systems, it is concluded T_{mains} is heavily influenced by T_{amb} , which is sinusoidal. A sinusoidal correlation linear in $T_{\text{amb,ann}}$ is proposed, introducing several new parameters. The average value of T_{mains} is $T_{\text{amb,ann}}$ plus an offset $\Delta T_{\text{offset}} \approx 6^\circ\text{F}$. The amplitude is given as $R\Delta T_{\text{amb}}$, with $R \approx 0.4$ and R decreasing linearly with decreasing $T_{\text{amb,ann}}$. The phase lag between T_{mains} and T_{amb} decreases linearly with increasing $T_{\text{amb,avg}}$. Data from 9 areas in the U.S. were used to determine coefficients. It is not known if the data are biased by residual influence of T_{house} on T_{mains} data, but it is likely that is the case. This would show up as an increase in ΔT_{offset} (i.e., bias in the T_{mains} algorithm). Additional data are being sought to test the algorithm form and reduce error in parameter estimates. The algorithm form may need to be modified for cold climates where ground freeze and snow cover exist in winter-time.

6. ACKNOWLEDGMENTS

The authors acknowledge funding from the U.S. Department of Energy's Solar Energy Technology Program, Solar Heating and Lighting (SH&L) sub-program, managed by Tex Wilkins and Glenn Strahs.

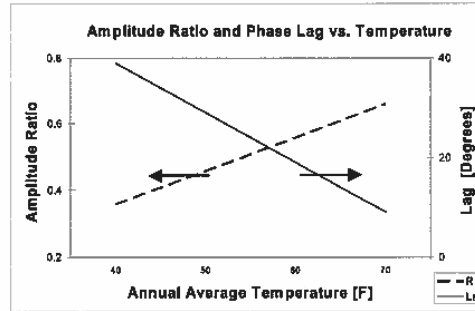


Fig. 10. Amplitude ratio R and phase lag ϕ_{lag} vs. $T_{\text{amb,ann}}$.

7. NOMENCLATURE

Symbols

- A Area of collector
- c_p Heat capacity at constant pressure
- D Pipe diameter
- e natural logarithms base, ~ 2.72
- EF Energy factor of tank ($Q_{\text{to-load}}/Q_{\text{energy-in}}$)
- F_r Heat removal factor in collector theory
- k Conductivity of soil
- K Constant in T_{mains} correlation
- I Solar irradiance in the plane of the collector
- M Mass (of water)
- Q Energy
- R Ratio of amplitudes, $\Delta T_{\text{gn}}(z)/\Delta T_{\text{surf}}$
- t Time
- T Temperature
- U Loss coefficient
- V Volume contained in piping
- x Horizontal distance down the mains pipe
- x_0 Scale length ($1/e$ distance)
- z Vertical distance down from ground surface
- z_0 Scale length for temperature decay ($1/e$ distance)
- Δ Amplitude or difference
- κ $k/\rho c$
- η Efficiency (collector or fuel conversion)
- ρ Density
- ω Angular frequency

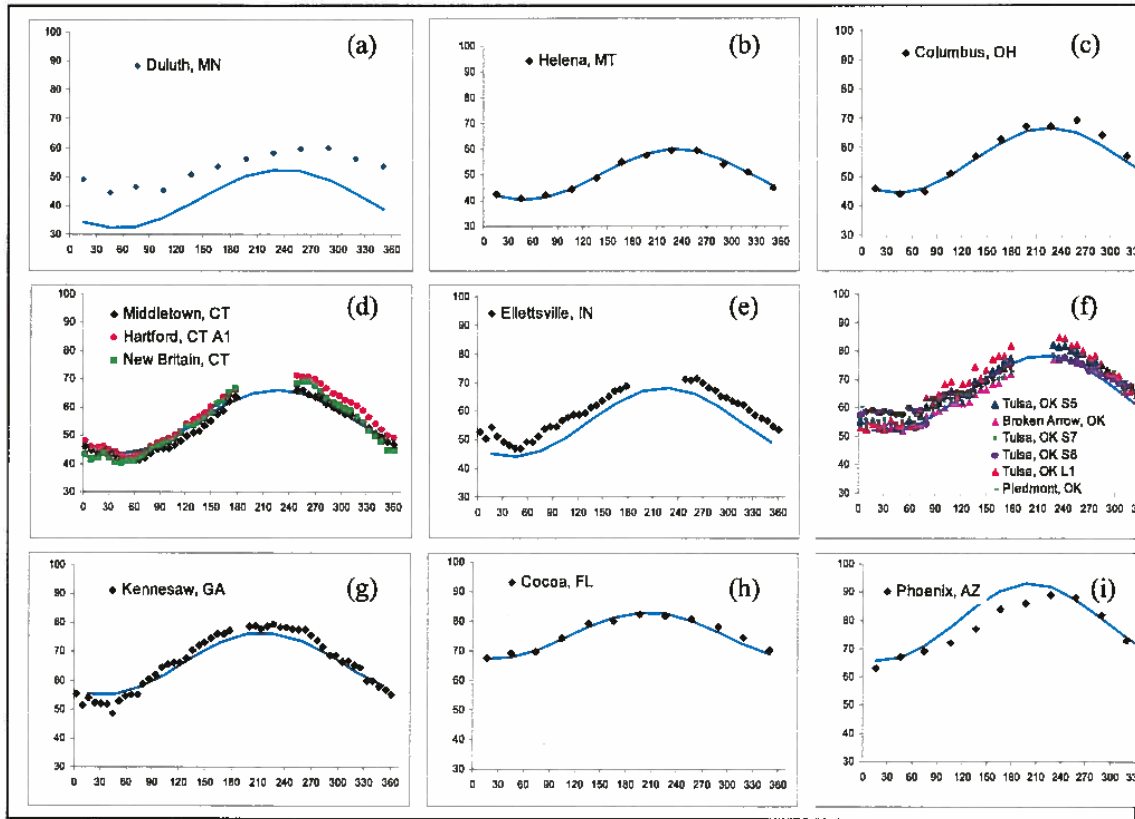
Subscripts

- amb Ambient air dry bulb temperature
- ann Annual time period (one year period)
- avg Average value
- burn burner (for gas water heaters)
- coll Collector
- i Index for data points or correlation parameters
- in Inlet to pipe or end use
- mains Water in the mains distribution piping
- mon Month time period

offset ΔT shift from $T_{amb,ann}$ in T_{mains} correlation
 pipe Mains distribution or house internal piping
 ref Reference temperature, ~ U.S. average
 set Set-point temperature of water heater
 tap End-use point in the house
 WH Water heater

8. REFERENCES

- (1) Private Communication, Dr. Sandy Klein, Solar Energy Laboratory, Madison, WI. The algorithm is used in FCHART, a well-known solar program. However, it is not documented anywhere, to our knowledge.
- (2) Private communication from Danny Parker, Florida Solar Energy Center, Cocoa Beach, FL.
- (3) Carslaw, H. and Jaeger, J., Conduction of Heat in Solids, 2nd Edition, 1959. University Press, Oxford, U.K.
- (4) Wendt, R., Baskin, E., and Durbin, D. "Evaluation of Hot Water Distribution Systems by Numeric Simulation", Final Report, Energy Commission Contract No: 400-00-038. March 2004.
- (5) TMY2 data sets are described and available at: http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/
- (6) National Climatic Data Center, Asheville, North Carolina.
- (7) Abrams, D., and Shedd, A., "Effect of Seasonal Changes in Use Patterns and Cold Water Inlet Temperature on Water-Heating Loads", 1996. ASHRAE Transactions, 1986.
- (8) Private communication from Tim Moss, Sandia National Laboratory, Albuquerque, NM.



Figs. 9a-9i. T_{mains} data over a year for 9 U.S. locations, with Julian Day on the x axis, and T_{mains} on the y axis, for all plots. Data are shown as symbols, and the T_{mains} correlation result is the blue curve, using TMY2 data to calculate the T_{amb} terms in Eqs. 7-10.

Date Submitted 12/14/2018	Section 403.1.3	Proponent Mo Madani
Chapter 4	Affects HVHZ No	Attachments Yes
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language No
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Related Modifications

None

Summary of Modification

To clarify that the ratio established by potty parity is not required to be maintained for the additional fixtures provided in excess of the minimum required fixtures.

Rationale

Incorporating Commission's declaratory statements as required by 553.73(7)(d), Florida Statutes.

DS 2017-033

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

There is no fiscal impact on the local entity relative to enforcement. The proposed code change provides for needed clarification to the code.

Impact to building and property owners relative to cost of compliance with code

There is no fiscal impact to building and property owners relative to the cost of compliance.

Impact to industry relative to the cost of compliance with code

There is no fiscal impact to industry relative to the cost of compliance.

Impact to small business relative to the cost of compliance with code

Has a reasonable and substantial connection with the health and safety and welfare of the general public.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Has a reasonable and substantial connection with the health and safety and welfare of the general public.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Strengthens or improves the code by making the code requirements clearer to the user.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against materials, products, methods, or systems of construction.

Does not degrade the effectiveness of the code

Does not degrade the effectiveness of the code.

403.1.3 Potty parity. In assembly occupancies, restrooms which are open to the public must have a ratio of 3:2 water closets provided for women as the combined total of water closets and urinals provided for men, unless these are two or fewer such fixtures for men, in accordance with §553.86, *Florida Statutes*. The ratio established by potty parity is not required to be maintained for the additional fixtures provided in excess of the minimum required fixtures.

(No change to remaining text)

STATE OF FLORIDA
BUILDING COMMISSION

FILED	
Department of Business and Professional Regulation Deputy Agency Clerk	
CLERK	Brandon Nichols
Date	9/28/2017
File #	2017-07686

In the Matter of

ELITE CONSULTING SWFL

Petitioner.

DS 2017-033

DECLARATORY STATEMENT

The foregoing proceeding came before the Florida Building Commission (Commission) by a Petition from Tatiana Gust, for Elite Consulting SWFL (Petitioner) that was received May 24, 2017. Based on the statements in the petition, the material subsequently submitted and the subsequent request by the Petitioner, the Commission states the following:

Findings of Fact

1. The Petition is filed pursuant to, and must conform to the requirements of Rule 28-105.002, Florida Administrative Code.
2. Petitioner's representative in this matter is Tatiana Gust, 2670 N. Horseshoe Dr., Suite 205, Naples, FL 34104.
3. Petitioner provides plan review, inspection, and consulting services for building projects. Petitioner is in the process of reviewing plans for a clubhouse in a private golf club community. The design professional wishes to include additional bathroom fixtures above the minimum amount required for the building's occupancy load.
4. Petitioner seeks clarification of Sections 403.1.3 and 403.3 of the Florida Building Code, Plumbing, 5th Edition (2014), with respect to the application of "potty parity" plumbing fixture requirements to its project.

5. Specifically, the Petitioner requests answers to the following questions based upon the project described within the petition for declaratory statement:

1. Are bathroom facilities located within a private membership clubhouse considered to be open to the public? Specifically, the verbiage qualifying the applicability of section 403.1.3 applies to the facility that we have described?
2. For the project in question, once the minimum number of required plumbing fixtures is provided in accordance with section 403.1 and section 403.1.3 of the 2014 Florida Plumbing Code based on the occupant load for the building, does the ratio established by potty parity have to be maintained for the additional fixtures provided in excess of the minimum requirements?

Conclusions of Law

6. The Commission has the specific statutory authority pursuant to Section 553.775(3)(a), Florida Statutes (2017) to interpret the provisions of the Florida Building Code by issuing a declaratory statement.

7. Section 403.1.3, Florida Building Code, Building, 5th Edition (2014), states:

Minimum number of fixtures. Plumbing fixtures shall be provided for the type of occupancy and in the minimum number shown in Table 403.1. Types of occupancies not shown in Table 403.1 shall be considered individually by the code official. The number of occupants shall be determined by the Florida Building Code, Building. Occupancy classification shall be determined in accordance with the Florida Building Code, Building.

8. Section 403.1.3.1, Florida Building Code, Building, 5th Edition (2014), states:

Potty parity. In assembly occupancies, restrooms which are open to the public must have a ratio of 3:2 water closets provided for women as the combined total of water closets and urinals provided for men, unless these are two or fewer such fixtures for men, in accordance with Section 553.86, Florida Statutes.

Exception: This section does not apply to establishments licensed under Chapter 509, Florida Statutes, if the establishment does not provide meeting or banquet rooms which accommodate more than

DS 2017-033
Page 3 of 5

150 people, and the establishment has at least the same number of water closets for women as the combined total of water closets and urinals for men.

9. Section 202, Florida Building Code, Plumbing, 5th Edition (2014), provides the following definitions:

PRIVATE. In the classification of plumbing fixtures, "private" applies to fixtures in residences and apartments, and to fixtures in nonpublic toilet rooms of hotels and motels and similar installations in buildings where the plumbing fixtures are intended for utilization by a family or an individual.

PUBLIC OR PUBLIC UTILIZATION. In the classification of plumbing fixtures, "public" applies to fixtures in general toilet rooms of schools, gymnasiums, hotels, airports, bus and railroad stations, public buildings, bars, public comfort stations, office buildings, stadiums, stores, restaurants and other installations where a number of fixtures are installed so that their utilization is similarly unrestricted.

10. In response to Petitioner's question 1, the answer is yes, pursuant to Sections 202 and 403.3, Florida Building Code, Plumbing, 5th Edition (2014), bathroom facilities located within the building in question are subject to the provisions applicable to public or public utilization plumbing fixtures.

11. In response to Petitioner's question 2, the answer is no; since the minimum number of required plumbing fixtures is provided in accordance with Sections 403.1 and 403.1.3, Florida Building Code, Plumbing, 5th Edition (2014), the ratio established by potty parity is not required to be maintained for the additional fixtures.

DONE AND ORDERED this 26th day of September, 2017, in Jacksonville,
Duval County, State of Florida.


RICHARD S. BROWDY
Chairman, Florida Building Commission

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Page 4 of 5

NOTICE OF RIGHT TO APPEAL

Petitioner and all other interested parties are hereby advised of their right to seek judicial review of this Order in accordance with Section 120.68(2)(a), Florida Statutes (2017), and Florida Rules of Appellate Procedure 9.110(a) and 9.030(b)(1)(C). To initiate an appeal, a Notice of Appeal must be filed with the Agency Clerk, Department of Business and Professional Regulation, 2601 Blair Stone Road, Tallahassee, Florida 32399-2203 and with the appropriate District Court of Appeal not later than thirty (30) days after this Order is filed with the Clerk of the Department of Business and Professional Regulation. A Notice of Appeal filed with the District Court of Appeal shall be accompanied by the filing fee specified by Section 35.22(3), Florida Statutes (2017).

DS 2017-033
Page 5 of 5

CERTIFICATE OF FILING AND SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing order has been filed with the undersigned and furnished by U. S. Mail to the persons listed below this 28th day of September, 2017.



Agency Clerk's Office
Department of Business and Professional Regulation
& Florida Building Commission
2601 Blair Stone Road
Tallahassee, Florida 32399-2203

Via U.S. Mail

Elite Consulting SWFL
Attn: Tatiana Gust
2670 N. Horseshoe Dr., Suite 205
Naples, FL 34104

Via Inter-Office or Email Delivery

Mo Madani, Planning Manager
Codes and Standards Section
Department of Business and Professional
Regulation
2601 Blair Stone Road
Tallahassee, Florida 32399
Mo.Madani@myfloridalicense.com

Marjorie Holladay
Joint Administrative Procedures Committee
Pepper Building, Room 680
Tallahassee, Florida 32399-1300

FILED	
<small>Department of Business and Professional Regulation</small>	
<small>Deputy Agency Clerk</small>	
<small>CLERK</small>	<small>Brandon Nichols</small>
<small>Date</small>	<small>5/24/2017</small>
<small>File #</small>	

**PETITION FOR DECLARATORY STATEMENT
BEFORE THE FLORIDA BUILDING COMMISSION**

Company: Elite Consulting SWFL
Address: 2670 N Horseshoe Dr, Suite 205
 Naples, FL 34104

Name: Tatiana Gust
Title: Principal
Telephone: (239) 280-0570
Email: Tatiana@eliteSWFL.com

DS 2017-033

Statute(s), Agency Rule(s), Agency Order(s) and/or Code Section(s) on which the Declaratory Statement is sought:

2014 Florida Plumbing Code (FPC)
 Section 403.1.3 Potty parity

Background:

Elite Consulting of SWFL is a private provider company as defined in the Florida Statutes 553.79. We provide plan review, inspections, and consulting services for building projects in the South West Florida area. We currently have a commercial project, which we are providing plan review and inspections services for. This project consists of the replacement of an existing clubhouse within a private golf club community. The new private membership clubhouse contains a dining room area, locker room area, reading area, and other amenities within the building. The building is classified as A3 with an occupant load of 450 occupants. Based in this occupant load the design professional determined that the required number of water closet/urinals is 2 male fixtures and 4 female fixtures per the Florida Plumbing Code section 403.1. This calculation also satisfies the ratio of 3:2 female to male number of WC/Urinals fixtures as required on section 403.1.3 of the Florida Plumbing Code.

To provide convenience for the club members, the design professional would like to provide additional WC/Urinals for both male and female. The proposed building is to have (8) fixtures for male and (6) fixtures for female. The club members that use the facility on a daily basis are majority male, and use the building while they play golf in the surrounding areas. There are also social events, such as holiday parties held at this facility where members can have additional guests.

In previous projects, the local building department has required us to maintain the ratio of section 403.1.3. for fixtures above the minimum required by the code. In working with the design professional, the question has risen about providing the minimum required by the code and what the criteria is for providing fixtures beyond the minimum requirements.

Also, during our study of the project another question came up with regards to “restrooms open to the public” since this is a qualifying statement for the applicability of section 403.1.3. Our client maintain that this is a private membership facility for the residents and guests of the subdivision that the clubhouse serves.

For the above mentioned reasons, Elite Consulting of SWFL, seeks clarification of these requirements as “substantially affected person” under the procedures set forth in F.S. 553.775.

Per the 2014 Florida Building Code, Building section 201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

Definition of Clubhouse per Merriam-Webster (1) a house occupied by a club or used for club activities, (2) locker rooms used by an athletic team, (3) a building at a golf course typically housing a locker room, pro shop, and restaurant.

Per 5th Edition of the Florida Plumbing Code

Section 403.1.3 Potty Parity.

In assembly occupancies, restrooms which are open to the public must have a ratio of 3:2 water closets provided for women as the combined total of water closets and urinals provided for men, unless these are two or fewer such fixtures for men, in accordance with Section 553.86, Florida Statutes.

Exception: This section does not apply to establishments licensed under Chapter 509, Florida Statutes, if the establishment does not provide meeting or banquet rooms which accommodate more than 150 people, and the establishment has at least the same number of water closets for women as the combined total of water closets and urinals for men.

Per Florida Statutes 2016

F.S. 553.86 Public restrooms; ratio of facilities for men and women; application; incorporation into the Florida Building Code.—The Florida Building Commission shall incorporate into the Florida Building Code, to be adopted by rule pursuant to s. 553.73(1), a ratio of public restroom facilities for men and women which must be provided in all buildings that are newly constructed after September 30, 1992, and that have restrooms open to the public. This section does not apply to establishments licensed under chapter 509 if the establishment does not provide meeting or banquet rooms which accommodate more than 150 persons and the establishment has at least the same number of water closets for women as the combined total of water closets and urinals for men.

The exception presented under 2014 Florida Plumbing Code Section 403.1.3 does not seem to apply to the use that we are seeking interpretation for. References to sections are included below:

**The 2016 Florida Statutes, Chapter 509 – Lodging and Food Service Establishments;
Membership Campgrounds**

F.S. 509.013 (4)(a) "Public lodging establishment" includes a transient public lodging establishment as defined in subparagraph 1. and a nontransient public lodging establishment as defined in subparagraph 2.

1. "Transient public lodging establishment" means any unit, group of units, dwelling, building, or group of buildings within a single complex of buildings which is rented to guests more than three times in a calendar year for periods of less than 30 days or 1 calendar month, whichever is less, or which is advertised or held out to the public as a place regularly rented to guests.

2. "Nontransient public lodging establishment" means any unit, group of units, dwelling, building, or group of buildings within a single complex of buildings which is rented to guests for periods of at least 30 days or 1 calendar month, whichever is less, or which is advertised or held out to the public as a place regularly rented to guests for periods of at least 30 days or 1 calendar month.

F.S. 509.013 (5)(a) "Public food service establishment" means any building, vehicle, place, or structure, or any room or division in a building, vehicle, place, or structure where food is prepared, served, or sold for immediate consumption on or in the vicinity of the premises; called for or taken out by customers; or prepared prior to being delivered to another location for consumption. The term includes a culinary education program, as defined in s. 381.0072(2), which offers, prepares, serves, or sells food to the general public, regardless of whether it is inspected by another state agency for compliance with sanitation standards.

F.S. 509.502 (3) "Campground" means any real property which is a part of a membership camping plan. This term does not include a mobile home, lodging, or recreational vehicle park or recreational camp as defined in chapter 513 so long as no membership camping plan is offered for sale, sold, or otherwise promoted with regard to such park.

Question

- 1. Are bathroom facilities located within a private membership clubhouse considered to be open to the public? Specifically, the verbiage qualifying the applicability of section 403.1.3 applies to the facility that we have described?**
- 2. For the project in question, once the minimum number of required plumbing fixture is provided in accordance with section 403.1 and section 403.1.3 of the 2014 Florida Plumbing Code based in the occupant load for the building, does the ratio established by potty parity have to be maintained for the additional fixtures provided in excess of the minimum requirements?**

Date Submitted 11/7/2018	Section 606.2	Proponent Gary Kozan
Chapter 6	Affects HVHZ No	Attachments Yes
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language No
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Related Modifications**Summary of Modification**

Clarifies that shutoff valves are not required for tub and showers when installed in residential occupancies.

Rationale

This proposal is intended to clarify that shutoff valves are not required for bathtubs or showers in any type of residential occupancy. The FBC-Residential already does not require such shutoff valves in one- and two-family dwellings. There is no reason to treat bathtubs and showers that are located in apartments or condos any differently. This inconsistency had been previously addressed by a Florida-specific provision which occurred in the first four editions of the FBC-Plumbing (see attached 2010 FBC-P text). That provision sunsetted in the 5th edition, and was never renewed. This proposal simply restores the previous exception, in the interest of promoting clarity and uniformity.

Fiscal Impact Statement**Impact to local entity relative to enforcement of code**

Simplifies code enforcement because it makes the Plumbing and Residential Codes consistent like before

Impact to building and property owners relative to cost of compliance with code

Lowers the cost of code compliance. Installing tub and shower valves without stops lowers the construction cost by approx. \$20-30 per valve.

Impact to industry relative to the cost of compliance with code

Simplifies code compliance because it makes the Plumbing and Residential Codes consistent like before

Impact to small business relative to the cost of compliance with code

No impact to small business.

Requirements**Has a reasonable and substantial connection with the health, safety, and welfare of the general public**

Provides adequate protection to residential occupancies without the added cost of extra shutoff valves. Restores previous FBC-P requirements.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Improves the code by providing a wider range of tub and shower valve products without the need for behind-the-wall shutoff valves

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against any current product or construction method.

Does not degrade the effectiveness of the code

Improves the code by eliminating extra cost and making installation and enforcement more consistent

606.2 Location of shutoff valves. Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture other than bathtubs and showers in ~~one- and two-family~~ residential *occupancies*, and other than in individual sleeping units that are provided with unit shutoff valves in hotels, motels, boarding houses and similar *occupancies*.
2. On the water supply to each sillcock.
3. On the water supply pipe to each appliance or mechanical equipment.

8. On the water supply pipe to every water heater.

606.2 Location of shutoff valves. Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture other than bathtubs and showers in one- and two-family residential occupancies, and other than in individual sleeping units that are provided with unit shutoff valves in hotels, motels, boarding houses and similar occupancies.
2. On the water supply pipe to each sillcock in other than one- and two-family residential occupancies.
3. On the water supply pipe to each appliance or mechanical equipment.

Exception: Shutoff valves are not required on tubs and showers in residential occupancies.

606.3 Access to valves. Access shall be provided to all full-open valves and shutoff valves.

606.4 Valve identification. Service and hose bibb valves shall be identified. All other valves installed in locations that are not adjacent to the fixture or appliance shall be identified, indicating the fixture or appliance served.

606.5 Water pressure booster systems. Water pressure booster systems shall be provided as required by Sections 606.5.1 through 606.5.10.

606.5.1 Water pressure booster systems required. Where the water pressure in the public water main or individual water supply system is insufficient to supply the minimum pressures and quantities specified in this code, the supply shall be supplemented by an elevated water tank, a hydropneumatic pressure booster system or a water pressure booster pump installed in accordance with Section 606.5.5.

606.5.2 Support. All water supply tanks shall be supported in accordance with the *Florida Building Code, Building*.

606.5.3 Covers. All water supply tanks shall be covered to keep out unauthorized persons, dirt and vermin. The covers of gravity tanks shall be vented with a return bend vent pipe with an area not less than the area of the down-feed riser pipe, and the vent shall be screened with a corrosion-resistant screen of not less than 16 by 20 mesh per inch (630 by 787 mesh per m).

606.5.4 Overflows for water supply tanks. Each gravity or suction water supply tank shall be provided with an overflow with a diameter not less than that shown in Table 606.5.4. The overflow outlet shall discharge at a point not less than 6 inches (152 mm) above the roof or roof drain; floor or floor drain; or over an open water-supplied fixture. The overflow outlet shall be covered with a corrosion-resistant screen of not less than 16 by 20 mesh per inch (630 by 787 mesh per m) and by 1/4-inch (6.4 mm) hardware cloth or shall terminate in a horizontal angle seat check valve. Drainage from overflow pipes shall be directed so as not to freeze on roof walks.

**TABLE 606.5.4
SIZES FOR OVERFLOW PIPES FOR WATER SUPPLY TANKS**

MAXIMUM CAPACITY OF WATER SUPPLY LINE TO TANK (gpm)	DIAMETER OF OVERFLOW PIPE (Inches)
0 - 50	2
50 - 150	2 1/2
150 - 200	3
200 - 400	4
400 - 700	5
700 - 1,000	6
Over 1,000	8

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m.

606.5.5 Low-pressure cutoff required on booster pumps. A low-pressure cutoff shall be installed on all booster pumps in a water pressure booster system to prevent creation of a vacuum or negative pressure on the suction side of the pump when a positive pressure of 10 psi (68.94 kPa) or less occurs on the suction side of the pump.

606.5.6 Potable water inlet control and location. Potable water inlets to gravity tanks shall be controlled by a fill valve or other automatic supply valve installed so as to prevent the tank from overflowing. The inlet shall be terminated so as to provide an air gap not less than 4 inches (102 mm) above the overflow.

606.5.7 Tank drain pipes. A valved pipe shall be provided at the lowest point of each tank to permit emptying of the tank. The tank drain pipe shall discharge as required for overflow pipes and shall not be smaller in size than specified in Table 606.5.7.

**TABLE 606.5.7
SIZE OF DRAIN PIPES FOR WATER TANKS**

TANK CAPACITY (gallons)	DRAIN PIPE (Inches)
Up to 750	1
751 to 1,500	1 1/2
1,501 to 3,000	2
3,001 to 5,000	2 1/2
5,000 to 7,500	3
Over 7,500	4

For SI: 1 inch = 25.4 mm, 1 gallon = 3.785 L.

606.5.8 Prohibited location of potable supply tanks. Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping or any source of contamination.

606.5.9 Pressure tanks, vacuum relief. All water pressure tanks shall be provided with a vacuum relief valve at the top

Date Submitted 12/15/2018	Section 1003.3	Proponent Eberhard Roeder
Chapter 10	Affects HVHZ No	Attachments No
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language No
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Related Modifications

P230-15

Summary of Modification

The modification keeps the distinction between grease interceptors as part of onsite sewage treatment and disposal systems vs. for central sewer systems (Florida Statutes 381.0065(2)(k)) and incorporates some changes of the 2018 IPC. The onsite sewage requirement moved to 1003.3.9 instead of 1003.5.

Rationale

The proposed modification incorporates some new language of the 2018 IPC and maintains the current distinction between grease interceptors as part of onsite sewage treatment and disposal systems in accordance with Florida Statutes (Section 381.0065(2)(k)), and grease interceptors for central sewer systems. Grease interceptors are included in the definition of "onsite sewage treatment and disposal system" per 381.0065(2)(k) Fl. Statutes. The modification also maintains the option (phrased as exception) to use grease interceptors approved for onsite systems under Chapter 64E-6 of the Florida Administrative Code with central sewer systems. This allows continued use of interceptors approved for onsite sewage systems and manufactured frequently by Florida tank manufacturers. The sudden prohibition of such grease interceptors could disrupt the onsite industry.

The onsite sewage grease interceptor requirement with its reference to Chapter 64e-6, of the Florida Administrative Code, has been moved into section 1003.3.9 instead of 1003.5 to fit in logically into the structure of the 1003.3 grease interceptor section.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Proposal simplifies enforcement by keeping requirements for components of onsite sewage treatment and disposal systems, including a grease interceptor, in one place, Chapter 64E-6. No impact on local entities that enforce the Florida Building Code-Plumbing, the existing requirements remain the same.

Impact to building and property owners relative to cost of compliance with code

No impact on building and property owners, the existing requirements remain the same.

Impact to industry relative to the cost of compliance with code

Reduces costs, as it allows continued use of currently approved and manufactured onsite sewage grease interceptors instead of requiring re-review and re-approval. Several manufacturers have sought approval under the standards of Chapter 64E-6 in order to enter the market.

Impact to small business relative to the cost of compliance with code

The modification results in no impact, as the existing requirements remain the same.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Properly operating grease interceptors protect sewer systems and onsite sewage and disposal systems and their functioning, which in turn protects health, safety and welfare of the general public.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

The proposed modification makes the code clearer by referencing a set of requirements that will apply to grease interceptors as part of onsite sewage treatment and disposal systems.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

The proposed modification does not discriminate in this manner. It prevents a prohibition of a system of construction that has been used largely satisfactorily in Florida for about two decades.

Does not degrade the effectiveness of the code

By making the building code and the onsite sewage treatment code more consistent with each other the code system overall will become more effective.

1003.3 Grease traps and grease interceptors for publicly-owned or investor-owned sewage systems.

Grease interceptors for publicly owned or investor-owned sewage systems shall comply with the requirements of Sections 1003.3.1 through 1003.3.58. Grease interceptors for onsite sewage treatment and disposal systems shall comply with the requirements of 1003.3.2 and 1003.3.9

1003.3.1 Grease interceptors and automatic grease removal devices required.

A grease interceptor or automatic grease removal device shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, hospitals, school kitchens, bars, factory cafeterias and clubs. Fixtures and equipment shall include pot sinks, prerinse sinks; soup kettles or similar devices; wok stations; floor drains or sinks into which kettles are drained; automatic hood wash units and dishwashers without prerinse sinks. Grease interceptors and automatic grease removal devices shall receive waste only from fixtures and equipment that allow fats, oils or grease to be discharged. Where lack of space or other constraints prevent the installation or replacement of a grease interceptor, one or more grease interceptors shall be permitted to be installed on or above the floor and upstream of an existing grease interceptor.

1003.3.2 Food waste disposers.

Where food waste disposers connect to grease interceptors, a solids interceptor shall separate the discharge before connecting to the grease interceptor. Solids interceptors and grease interceptors shall be sized and rated for the discharge of the food waste disposers. Emulsifiers, chemicals, enzymes and bacteria shall not discharge into the food waste disposer.

1003.3.3 Additives to grease interceptors.

Dispensing systems that dispense interceptor performance additives to grease interceptors shall not be installed except where such systems dispense microbes for the enhancement of aerobic bioremediation of grease and other organic material, or for inhibiting growth of pathogenic organisms by anaerobic methods. Such microbial dispensing systems shall be installed only where the grease interceptor manufacturer's instructions allow such systems and the systems conform to ASME A112.14.6. Systems that discharge emulsifiers, chemicals or enzymes to grease interceptors shall be prohibited.

1003.3.34 Grease interceptors and automatic grease removal devices not required.

A grease interceptor or an automatic grease removal device shall not be required for individual dwelling units or any private living quarters.

1003.3.45 Hydromechanical grease interceptors, fats, oils and greases disposal systems and automatic grease removal devices.

Hydromechanical grease interceptors; fats, oils, and greases disposal systems and automatic grease removal devices shall be sized in accordance with ASME A112.14.3, ASME A112.14.4, ASME A112.14.6, CSA B481.3 or PDI G101. Hydromechanical grease interceptors; fats, oils, and greases disposal systems; and automatic grease removal devices shall be designed and tested in accordance with ASME A112.14.3, ASME A112.14.4, CSA B481.1, PDI G101 or PDI G102. Hydromechanical grease interceptors; fats, oils, and greases disposal systems; and automatic grease removal devices shall be installed in accordance with the manufacturer’s instructions. Where manufacturer’s instructions are not provided, hydromechanical grease interceptors; fats, oils, and greases disposal systems; and automatic grease removal devices shall be installed in compliance with ASME A112.14.3, ASME A112.14.4, ASME A112.14.6, CSA B481.3 or PDI G101.

Exception: Grease interceptors that are sized, constructed and approved in accordance with Rule 64E-6, *Florida Administrative Code* and that are located outside the building shall not be required to meet the requirements of this section.

1003.3.45.1 Grease interceptor capacity.

Grease interceptors shall have the grease retention capacity indicated in Table 1003.3.4.1 for the flow-through rates indicated.

TABLE 1003.3.45.1

CAPACITY OF GREASE INTERCEPTORS^a

TOTAL FLOW-THROUGH RATING (gpm)	GREASE RETENTION CAPACITY (pounds)
4	8
6	12
7	14
9	18
10	20
12	24
14	28

15	30
18	36
20	40
25	50
35	70
50	100
75	150
100	200

For SI: 1 gallon per minute = 3.785 L/m, 1 pound = 0.454 kg.

- For total flow-through ratings greater than 100 (gpm), double the flow-through rating to determine the grease retention capacity (pounds).

1003.3.45.2 Rate of flow controls.

Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow. The flow-control device shall be vented and terminate not less than 6 inches (152 mm) above the flood rim level or be installed in accordance with the manufacturer's instructions.

1003.3.56 Automatic grease removal devices.

Where automatic grease removal devices are installed, such devices shall be located downstream of each fixture or multiple fixtures in accordance with the manufacturer's instructions. The automatic grease removal device shall be sized to pretreat the measured or calculated flows for all connected fixtures or equipment. Ready access shall be provided for inspection and maintenance.

1003.3.67 Gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems.

The required capacity of gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems shall be determined by multiplying the peak drain flow into the interceptor in gallons per minute by a retention time of 30 minutes. Gravity grease interceptors shall be designed and tested in accordance with IAPMO/ANSI Z1001. Gravity grease interceptors with fats, oils, and greases disposal systems shall be designed and tested in accordance with ASME A112.14.6 and IAPMO/ANSI Z1001. Gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems shall be installed in accordance with manufacturer's instructions. Where manufacturer's instructions are not provided, gravity grease interceptors and gravity grease interceptors with fats, oils, and greases disposal systems shall be installed in compliance with ASME A112.14.6 and IAPMO/ANSI Z1001.

1003.3.78 Direct connection.

The discharge piping from a grease interceptor shall be directly connected to the sanitary drainage system.

1003.3.9 Grease interceptors for onsite sewage treatment and disposal systems.

Grease interceptors are not required for a residence. However, one or more grease interceptors are required where grease waste is produced in quantities that could otherwise cause line stoppage or hinder sewage disposal. Where a grease interceptor is required or used, only kitchen wastewater shall first pass through the interceptor and then be discharged into the first compartment of a septic tank or other approved system. Grease interceptors shall be water tight. Each interceptor shall be engineered to withstand the load, such as from vehicular traffic, to be placed on the interceptor. Grease interceptors shall be sized, constructed and approved in accordance with Rule 64E-6, Florida Administrative Code.

1003.4 Oil separators required.

At repair garages where floor or trench drains are provided, car washing facilities, factories where oily and flammable liquid wastes are produced and hydraulic elevator pits, oil separators shall be installed into which oil-bearing, grease-bearing or flammable wastes shall be discharged before emptying into the building drainage system or other point of disposal.

Exception: An oil separator is not required in hydraulic elevator pits where an approved alarm system is installed. Such alarm systems shall not terminate the operation of pumps utilized to maintain emergency operation of the elevator by fire fighters.

1003.4.1 Separation of liquids.

A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an *approved* receptacle.

1003.4.2 Oil separator design.

Oil separators shall be listed and labeled, or designed in accordance with Sections 1003.4.2.1 and 1003.4.2.2.

1003.4.2.1 General design requirements.

Oil separators shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 18-inch (457 mm) water seal.

1003.4.2.2 Garages and service stations.

Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a capacity of not less than 6 cubic feet (0.168 m³) for the first 100 square feet (9.3 m²) of area to be drained, plus 1 cubic foot (0.028 m³) for each additional 100 square feet (9.3 m²) of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator.

~~1003.5 Grease interceptors for onsite sewage treatment and disposal systems.~~

~~Grease interceptors are not required for a residence. However, one or more grease interceptors are required where grease waste is produced in quantities that could otherwise cause line stoppage or hinder sewage disposal. Where a grease interceptor is required or used, only kitchen wastewater shall first pass through the interceptor and then be discharged into the first compartment of a septic tank or other approved system. Grease interceptors shall be water tight. Each interceptor shall be engineered to withstand the load, such as from vehicular traffic, to be placed on the interceptor. Grease interceptors shall be sized, constructed and approved in accordance with Rule 64E-6, *Florida Administrative Code*.~~

Renumber subsequent sections to 1003.5 etc

Date Submitted 12/14/2018	Section 1401	Proponent Cheryl Harris
Chapter 14	Affects HVHZ No	Attachments Yes
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language Yes
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Related Modifications

8163

Summary of Modification

Modification adds Surface and Subsurface Landscape Irrigation Systems connected to either potable or nonpotable water supplies and modifies the current Chapter 14 numbering system to integrate into the new section. Current code addresses subsurface irrigation connected to nonpotable water supply.

Rationale

Chapter 14 of the Plumbing Code was added during the last cycle direct from ICC Green Construction. However, it only addressed subsurface landscape irrigation systems connected to nonpotable water sources. The majority of Florida’s landscape/turf irrigation is done by surface systems and subsurface systems connected to both potable and non potable water sources not from on-site reuse systems. Without addressing all types of irrigation systems the code now in place intended to encourage water conservation does little to conserve or protect the quality of Florida’s water. The most widely used method of irrigation not addressed in code uses approximately 40% of Florida’s water. Properly designed and installed irrigation systems will save and improve the quality of Florida’s limited water resources.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Minimal except jurisdictions w/o local ordinance requiring permits. Unknown how many jurisdictions do not have commercial or residential irrigation requirements. Backflow device inspection is required so costs for adding inspection at same time for irrigation could be recovered by permit fees.

Impact to building and property owners relative to cost of compliance with code

Irrigation system is optional. If system is installed it should be done in accordance to a standard that conserves water supply and quality. Offset to any extra cost would be in the savings of consumers water bills and cost to the public to find new water sources.

Impact to industry relative to the cost of compliance with code

No impact to the irrigation industry relative to compliance with code.

Impact to small business relative to the cost of compliance with code

No impact to small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Conservation of Florida’s water supply and quality through proper installation of irrigation systems is critical to the health and welfare of the general public.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Strengthens code by adding a standard for design and installation of irrigation systems.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Modification does not discriminate.

Does not degrade the effectiveness of the code

Modification does not degrade but to the contrary improves the effectiveness of the code.

Alternate Language

1st Comment Period History

8091-A2

Proponent Eberhard Roeder Submitted 2/18/2019 Attachments Yes

Rationale

The proposed alternate language achieves the objective of the Florida Irrigation Society to include irrigation language in Chapter 14. It clarifies that onsite sewage treatment and disposal systems and their drainfields are regulated by Chapter 64E-6, Florida Administrative Code. This will avoid conflicts between Plumbing Code and Florida Onsite Sewage Statutes. The proposed alternate language deletes the language that my proposed modification 8384 aimed to delete as well. Several smaller edits for clarity are also included. The proposed alternate language was the result of discussions with Ms. Harris of the Florida Irrigation Society, the author of this modification 8091.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

Proposal simplifies enforcement by clarifying that there is a single jurisdiction over onsite sewage treatment and disposal systems. Graywater systems are included in the definition of "onsite sewage treatment and disposal system" per 381.0065(2)(k) Fl. Statutes. No impact on local entities.

Impact to building and property owners relative to cost of compliance with code

Simplifies compliance with code by avoiding conflicts with Department of Health regulations. No impact on building and property owners, the existing requirements remain the same.

Impact to industry relative to the cost of compliance with code

Simplifies compliance with code by avoiding conflicts with Department of Health regulations. No impact, the existing requirements remain the same.

Impact to Small Business relative to the cost of compliance with code

No impact to small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Sanitary wastewater, including of graywater, disposal protects public health and the environment, and a clear code helps to achieve that. Application of Florida's onsite sewage regulations provides uniformity and protection.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

The proposed modification makes the code clearer by avoiding conflict with another state regulation, namely 64E-6, Florida Administrative Code, which provides at least equivalent methods.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

The proposed modification does not discriminate in this manner.

Does not degrade the effectiveness of the code

By making the building code and the onsite sewage treatment code more consistent with each other the code system overall will become more effective.

Alternate Language

1st Comment Period History

8091-A1

Proponent Cheryl Harris Submitted 2/18/2019 Attachments Yes

Rationale

After reviewing the Modification number SP8384 submitted by the Florida Department of Health, the Florida Irrigation Society agrees with the rationale of completely eliminating the content of Chapter 14 as it was published in the 2017 Florida Building Code Plumbing. This change would eliminate a potential conflict between Florida Building Code and the Florida Administrative Code that is already in effect governing subsurface irrigation systems. However, we suggest alternate language for Chapter 14 and the scope in Section 1401 to cover irrigation systems EXCEPT for systems connected to on-site sewage treatment and disposal systems and add wording for design and installation of all other irrigation systems. There were also minor changes in wording in the following for grammar, correction of definition, correction of Agency Title: 1401.5.9, 1401.12.1.2, 1401.13.7, 1401.14.1.5 and 1401.14.1.6. from the original submittal.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

The alternate language clarifies that that the Department of Health/FAC has jurisdiction over subsurface connection to onsite wastewater treatment and sewage treatment reuse systems for irrigation purposes.

Impact to building and property owners relative to cost of compliance with code

There would be no change in cost to comply as current Florida Administrative Code is in place and would continue to prevail.

Impact to industry relative to the cost of compliance with code

There would be no change in cost to comply as current Florida Administrative Code is in place and would continue to prevail.

Impact to Small Business relative to the cost of compliance with code

No impact to small business.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes. Clarifies that the Department of Health has jurisdiction over onsite wastewater and sewage treatment water reuse systems.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Does not degrade the effectiveness of the code.

CHAPTER 14
SUBSURFACE LANDSCAPE IRRIGATION SYSTEMS
SECTION 1401
GENERAL

1401.1 Scope.

The provisions of Chapter 14 shall govern the materials, design, construction and installation of ~~subsurface~~ landscape irrigation systems connected to either potable or nonpotable water from on-site water reuse systems.

SECTION 1402**Subsurface Landscape Irrigation Systems Connected to NonPotable On-site Water Reuse Systems****1402.1 Scope.**

The provisions of Section 1402 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems.

1402.2 1402.2 Materials.

Above-ground drain, waste and vent piping for subsurface landscape irrigation systems connected to NonPotable On-site Water Reuse Systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.

1401.3 1402.3 Tests.

Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.

1401.4 1402.4 Inspections.

Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.

1401.5 1402.5 Disinfection.

Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.

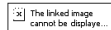
1401.6 1402.6 Coloring.

On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.

SECTION 1402
SYSTEM DESIGN AND SIZING

1402.4 1402.7 Sizing.

The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons-per-day-per-occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:



(Equation 14-1)

where:

A = Number of occupants:

Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.

Commercial—Number of occupants shall be determined by the *Florida Building Code, Building*.

B = Estimated flow demands for each occupant:

Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.

Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.

C = Estimated gray water discharge based on the total number of occupants.

1402.2 1402.8 Percolation tests.

The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

1402.2.1 1402.8.1 Percolation tests and procedures.

At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

1402.2.1.1 1402.8.1.1 Percolation test hole.

The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.

1402.2.1.2 1402.8.1.2 Test procedure, sandy soils.

The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1303.7.1.3.

1402.2.1.3 1402.8.1.3 Test procedure, other soils.

The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than 1/16 inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

1402.2.1.4 1402.8.1.4 Mechanical test equipment.

Mechanical percolation test equipment shall be of an *approved* type.

1402.2.2 1402.8.2 Permeability evaluation.

Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section ~~1402.2.1.1~~ 1402.8.1.1 for evaluating the soil.

1402.3 1402.9 Subsurface landscape irrigation site location.

The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table ~~1402.3~~ 1402.9. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

**TABLE ~~1402.3~~ 1402.9
LOCATION OF SUBSURFACE IRRIGATION SYSTEM**

ELEMENT

Storage tank (feet)

Buildings	5
Lot line adjoining private property	5
Water wells	50
Streams and lakes	50
Seepage pits	5
Septic tanks	0
Water service	5
Public water main	10
For SI: 1 foot = 304.8 mm.	

**SECTION 1403
INSTALLATION**

1403.1 1402.10 Installation.

Absorption systems shall be installed in accordance with Sections ~~1403.1.1~~ 1402.10.1 through ~~1403.1.5~~ 1402.10.1.5 to provide landscape irrigation without surfacing of water.

1403.1.1 1402.10.1 Absorption area.

The total absorption area required shall be computed from the estimated daily gray water discharge and the design-loading rate based on the percolation rate for the site. The required absorption area equals the estimated gray water discharge divided by the design-loading rate from Table ~~1403.1.1~~ 1402.10.1.

**TABLE ~~1403.1.1~~ 1402.10.1
DESIGN LOADING RATE**

PERCOLATION RATE(minutes per inch)	DESIG:
0 to less than 10	
10 to less than 30	
30 to less than 45	
45 to 60	

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

1403.1.2 1402.10.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.

1403.1.3 1402.10.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

1403.1.4 1402.10.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

1403.1.5 1402.10.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from 1/2 to 2 1/2 inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

1403.2 1402.11 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 1403.2 1402.11. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

**TABLE 1403.2-1402.11
DISTRIBUTION PIPE**

MATERIAL

Polyethylene (PE) plastic pipe

Polyvinyl chloride (PVC) plastic pipe

Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core or

For SI: 1 inch=25.4 mm.

1403.2.1 Joints.

Joints in distribution pipe shall be made in accordance with Section 705 of this code.

SECTION 1403

Surface and Subsurface Landscape Irrigation Systems

1403.1 Scope.

The provisions of Section 1403 shall govern the materials, design, construction and installation of turf and landscape irrigation systems that apply potable or nonpotable water by means of permanent above ground or subsurface sprinkler or microsprinkler equipment that move water through various means of mechanical pressure.

1403.1.2 This section shall apply to all irrigation systems used on residential and commercial landscape areas.

1403.1.3 This section shall apply to all new irrigation systems and any new work to existing irrigation systems.

Exemption. This section shall not apply to irrigation systems for golf courses, nurseries, greenhouses, or agricultural production systems.

1403.1.4 Nothing contained in this section shall be deemed to require any irrigation system or part thereof, which existed prior to the establishment of this code, to be changed altered or modified to meet the standards of this code.

1403.2 Permits.

1403.2.1 A permit shall be required for new installation of landscape irrigation systems and for repairs or modifications to the system design that exceed \$1000.00 in labor and material based on invoice value.

1403.2.2 No permit shall be required for general maintenance or repairs which do not change the structure or alter the system and the value of which does not exceed \$1000.00 in labor and material based on invoice value.

1403.3 Preconstruction submittals.**1403.3.1 Plans or drawings.**

1403.3.1.1 Single-family residence. Design drawings or shop drawings, where required, shall be provided for the installation of irrigation systems prior to start of construction. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, and include all improvements. Drawings shall be prepared by a licensed plumbing or irrigation contractor or licensed landscape architect.

1403.3.1.2 Commercial, industrial, municipal and multiple-family. Professionally designed drawings prior to start of construction shall be provided for landscape irrigation systems. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, including all improvements, and shall include but not be limited to: date, scale, revisions, legend, specifications which list all aspects of equipment and assembly there of, water source, water meter and/or point of connection, backflow prevention devices, pump station size, pump station location, design operating pressure and flow rate per zone, precipitation rate per zone, locations of pipe, controllers, valves, sprinklers, sleeves, gate valves, sensors, etc. The plans and specifications shall be prepared in accordance with Section 107 of the Florida Building Code, Building.

1403.4 Definitions. The following definitions are exclusive to this section of the code.

ABS Pipe. Acrylonitrile-butadiene-styrene black, semi-rigid, plastic pipe extruded to IPS. ABS pipe is in limited use in present day irrigation systems. Solvent weld fittings are used with this pipe (see ASTM D 1788).

Air Release Valve. A valve which will automatically release to the atmosphere accumulated small pockets of air from a pressurized pipeline. A small orifice is used to release air at low flow rates. Air release valves are normally required at all summits of mainline and submain pipelines in an irrigation system.

Anti-Siphon Device. A safety device used to prevent back-flow of irrigation water to the water source by back-siphonage.

Application Rate. The average rate at which water is applied by an irrigation system, sometimes also called precipitation rate. Units are typically inches/hr or mm/hr.

Application uniformity. Irrigation application uniformity (also known as distribution uniformity) describes how evenly water is distributed within an irrigation zone.

Arc. The angle of coverage of a sprinkler in degrees from one side of throw to the other. A 90-degree arc would be a quarter-circle sprinkler.

Atmospheric Vacuum Breaker (AVB). An anti-siphon backflow device which uses a floating seat to allow an air break to interrupt the vacuum effect on water flow.

Automatic Control Valve. A valve in a sprinkler system which is activated by an automatic controller by way of hydraulic or electrical control lines and controls a single device or multiple devices.

Automatic System. An irrigation system which operates following a preset program entered into an automatic controller.

Backflow Prevention Device. An approved safety device used to prevent pollution or contamination of the irrigation water supply due to backflow from the irrigation system.

Belled (Pipe). Pipe which is enlarged at one end so that the spigot end of another length of pipe can be inserted into it during the assembly of a pipeline.

Block (of sprinklers). A group of sprinklers controlled by one valve. Also called zones or subunits.

Block System. An irrigation system in which several groups of sprinklers are controlled by one valve for each group.

Bubbler Irrigation. The application of water to the soil surface or a container as a small stream or fountain. Bubbler emitter discharge rates generally range from 0.5 to 2 gpm but are generally less than 60 gph.

Check Valve. A valve which permits water to flow in one direction only.

Chemical Water Treatment. The addition of chemicals to water to make it acceptable for use in irrigation systems

Chemigation. The application of water soluble chemicals by mixing or injecting with the water applied through an irrigation system.

Contractor. Any person who engages in the fabrication and installation of any type of irrigation system on a contractual basis in accordance with all stipulations receiving compensation.

Control Lines. Hydraulic or electrical lines which carry signals to open and close the valves from the controller to the automatic valves.

Controller. The timing mechanism and its mounting box. The controller signals the automatic valves to open and close on a pre-set program or based on sensor readings.

Coverage. Refers to the way water is applied to an area.

Cycle. Refers to one complete run of a controller through all programmed controller stations.

Demand (or irrigation demand). Refers to the irrigation requirements of the irrigated area. Demand primarily depends on the type of crop, stage of growth, and climatic factors.

Design Area. The specific land area to which water is to be applied by an irrigation system.

Design Emission Uniformity. An estimate of the uniformity of water application with an irrigation system.

Design Pressure. The pressure at which the irrigation system or certain components are designed to operate. The irrigation system design pressure is that measured at the pump discharge or entrance to the system if there is no pump, and a zone design pressure is the average operating pressure of all emitters within that zone.

Direct Burial Wire. Plastic-coated single-strand copper wire for use as control line for electric valves.

Discharge Rate. The instantaneous flow rate of an individual sprinkler, emitter, or other water emitting device, or a unit length of line-source micro irrigation tubing. Also, the flow rate from a pumping system or from a reduced pressure assembly or relief valve.

Double Check Valve. An approved assembly of two single, independently-acting check valves with test ports to permit independent testing of each check valve.

Drain Valve. A valve used to drain water from a line. The valve may be manually or automatically operated.

Drip Irrigation. The precise low-rate application of water to or beneath the soil surface near or directly into the plant root zone. Applications normally occur as small streams, discrete or continuous drops, in the range of 0.5 to 2.0 gph.

Effluent water. Also referred to as reclaimed or gray water is wastewater which has been treated per Florida Statute, §403.086 and is suitable for use as a water supply for irrigation systems.

Emitters. Devices which are used to control the discharge of irrigation water from lateral pipes. This term is primarily used to refer to the low flow rate devices used in micro irrigation systems.

Fertigation. The application of soluble fertilizers with the water applied through an irrigation system.

Filtration System. The assembly of physical components used to remove suspended solids from irrigation water. These include both pressure and gravity type devices, such as settling basins, screens, media filters, and centrifugal force units (vortex sand separators).

Flexible Swing Joint. A flexible connection between the lateral pipe and the sprinkler which allows the sprinkler to move when force is applied to it.

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Flow Meters. Devices used to measure the volume of flow of water (typically in gallons), or flow rates (typically in gpm), and to provide data on system usage.

Gauge (Wire). Standard specification for wire size. The larger the gauge number, the smaller the wire diameter.

Head. A sprinkler head. Sometimes used interchangeably with and in conjunction with "Sprinkler."

Infiltration Rate. The rate of water flow across the surface of the soil and into the soil profile. Units are usually inches/hr.

Irrigation. Application of water by artificial means, that is, means other than natural precipitation. Irrigation is practiced to supply crop water requirements, leach salts, apply chemicals, and for environmental control including crop cooling and freeze protection.

Irrigation Water Requirement or Irrigation Requirement. The quantity of water that is required for crop production, exclusive of effective rainfall.

Landscape. Refers to any and all areas which are ornamentally planted, including but not limited to turf, ground covers, flowers, shrubs, trees, and similar plant materials as opposed to agricultural crops grown and harvested for monetary return.

Lateral. The water delivery pipeline that supplies water to the emitters or sprinklers from a manifold or header pipeline downstream of the control valve.

Line-Source Emitters. Lateral pipelines which are porous or contain closely-spaced perforations so that water is discharged as a continuous band or in overlapping patterns rather than discrete widely-spaced points along the pipeline length.

Looped System. A piping system which allows more than one path for water to flow from the supply to the emitters or sprinklers.

Low Volume Sprinklers. Sprinkler heads that emit less than .5 gallons per minute.

Mainline. A pipeline which carries water from the control station to submains or to manifolds or header pipelines of the water distribution system.

Manifold. The water delivery pipeline that conveys water from the main or submain pipelines to the laterals. Also sometimes called a header pipeline.

Manual System. A system in which control valves are manually operated rather than operated by automatic controls.

Matched Precipitation. An equal distribution of water over a given area or zone.

Meter Box. A concrete or plastic box buried flush to grade which houses flow (water) meters or other components.

Microirrigation. The frequent application of small quantities of water directly on or below the soil surface, usually as discrete drops, tiny streams, or miniature sprays through emitters placed along the water delivery pipes (laterals). Microirrigation encompasses a number of methods or concepts, including drip, subsurface, bubbler, and spray irrigation. Previously known as trickle irrigation.

Overlap. The amount one sprinkler pattern overlaps another one when installed in a pattern. Expressed as a percentage of the diameter of coverage.

PE Pipe. Flexible polyethylene pipe for use in irrigation systems, normally manufactured with carbon black for resistance to degradation by ultraviolet radiation.

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Potable Water. Water which is suitable in quality for human consumption and meets the requirements of the Health Authority having jurisdiction.

Pressure Relief Valve. A valve which will open and discharge to atmosphere when the pressure in a pipeline or pressure vessel exceeds a pre-set point to relieve the high-pressure condition.

Pressure Vacuum Breaker. A backflow prevention device which includes a spring-loaded check valve and a spring-loaded vacuum breaker to prevent the backflow of irrigation system water to the water source.

Pumping Station. The pump or pumps that provide water to an irrigation system, together with all of the necessary accessories such as bases or foundations, sumps, screens, valves, motor controls, safety devices, shelters and fences.

PVC Pipe. Polyvinyl chloride plastic pipe made in standard thermoplastic pipe dimension ratios and pressure rated for water. Manufactured in accordance with AWWA C-900 or ASTM D-2241.

Rain Shut off Device. A calibrated device that is designed to detect rainfall and override the irrigation cycle of the sprinkler system when a predetermined amount of rain fall has occurred.

Reduced Pressure Principle Backflow Preventer (RPZD) (also known as Reduced Pressure Zone Device RPZ or RPZ Valve). A type of backflow prevention device used to protect water supplies from contamination.

Riser. A threaded pipe to which sprinklers or other emitters are attached for above-ground placement.

Runoff. The result of excess water applied either naturally (precipitation) or mechanically (irrigation) that exceeds the absorption rate of the soil, moving to an area of a lower elevation.

Sleeve. A pipe used to enclose other pipes, wire, or tubing; usually under pavement, sidewalks, or planters.

Spacing. The distance between sprinklers or other emitters.

Spray Irrigation. The micro irrigation application of water to the soil or plant surface by low flow rate sprays or mists.

Sprinkler. The sprinkler head. Sometimes called "Head."

Supply (Water Source). The origin of the water used in the irrigation system.

Swing Joint. A ridged connection between the lateral pipe and the sprinkler, utilizing multiple elbows and nipples, which allows the sprinkler to move when force is applied to it.

Tubing. Generally used to refer to flexible plastic hydraulic control lines which are usually constructed of PE or PVC.

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1403.4 DESIGN CRITERIA

1403.4.1 Design defined. Within the scope of this code, irrigation system design is defined as the science and art of properly selecting and applying all components within the system

1403.4.2 Water supply.

1403.4.2.1 The water source shall be adequate from the stand-point of volume, flow rate, pressure, and quality to meet the irrigation requirements of the area to be irrigated, as well as other demands, if any, both at the time the system is designed and for the expected life of the system.

1403.4.2.2 If the water source is effluent, it shall meet the advanced waste treatment standard as set forth in Florida Statute §403.086(4) as well as any other standard as set forth by the controlling governmental agency.

- 1403.4.3 Application uniformity.

- 1403.4.3.1 Sprinkler irrigation systems shall be designed with the appropriate uniformity for the type of plants being grown and the type of soil found in that area. The general watering of different types of plants as one group without regard to their individual water requirements shall be avoided.

- 1403.4.3.2 Sprinkler head spacing, type and nozzle selection that achieves the highest application uniformity shall be utilized.

- 1403.4.3.3 Application rates which avoid runoff and permit uniform water infiltration into the soil shall be utilized. Land slope, soil hydraulic properties, vegetative ground cover, and prevailing winds and sun exposure shall be considered when application rates are specified. Different types of sprinklers with different application rates, i.e., spray heads vs. rotor heads, bubbler heads vs rotor heads, shall not be combined on the same zone or circuit.

- 1403.4 System zoning. The irrigation system shall be divided into zones based on consideration of the following hydrozoning practices.

- 1403.4.1 Available flow rate.

- 1403.4.2 Cultural use of the area.

- 1403.4.3 Type of vegetation irrigated, i.e., turf, shrubs, native plants, etc.

- 1403.4.4 Type of sprinkler, i.e., sprinklers with matching precipitation rates.

- 1403.4.5 Soil characteristics and slope.

- 1403.4.6 Sun exposure.

- 1403.5 Sprinkler/emitter spacing and selection.

- 1403.5.1 Sprinkler/Emitter spacing shall be determined considering the irrigation requirements, hydraulic characteristics of the soil and device, and water quality with its effect on plant growth, sidewalks, buildings, and public access areas.

- 1403.5.2 All pop-up spray head bodies in turf areas shall be no less than 6" in height for St. Augustine, Zoysia and Bahia and no less than 4" in height for Bermuda, Centapede and Seashore Paspalum.

- 1403.5.3 Sprinklers shall be located in accordance with manufacturer's specifications in each irrigated zone area for a matched precipitation rate objective.

- 1403.5.4 Single row head spacing shall only occur when an additional row will cause saturated soils at the toe of a slope or other inefficiencies.

- 1403.5.5 All heads shall not exceed 50% of manufacturer's specified diameters of coverage.

- 1403.5.6 Water conservation shall be taken into consideration by minimizing irrigation of non-vegetated areas.

- 1403.5.7 Microirrigation systems shall be designed using the Emission Uniformity concept. Microirrigation emitters shall be spaced to wet 100 percent of the root zone in turf areas and 50 percent of the root zone for shrubs and trees.

- 1403.5.8 Microirrigation or low volume heads shall be required in all areas to be irrigated that are less than 4 feet in any direction from the emitter or nozzle.

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1403.5.9 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to supply pipelines to protect the emission devices from contamination from a PD main or lateral break.

1403.5.10 Each plant shall have an adequate number and size (gph) of microirrigation devices, properly placed, to meet the plant water requirements for no rainfall.

1403.6 Pipelines. Pipelines shall be sized to limit pressure variations so that the working pressure at all points in the irrigation system will be in the range required for uniform water application. Velocities shall not exceed 5 feet (1524 mm) per second.

1403.7 Wells.

1403.7.1 Well diameters, depths and location shall correspond to the irrigation system demand and in compliance to all applicable state, regulatory agencies and local codes and regulations.

1403.8 Pumps.

1403.8.1 Pump and motor combinations shall be capable of satisfying the total system demand without invading the service factor of the motor except during start-up and between zones.

1403.8.2 Pumps shall be positioned with respect to the water surface in order to ensure that the net positive suction head required (NPSHr) for proper pump operation is achieved.

1403.8.3 The pumping system shall be protected against the effects of the interruption of water flow.

1403.9 Control valves.

1403.9.1 Control valve size shall be based on the flow rate through the valve. Friction loss through the valve, an approved air gap separation, or a reduced pressure assembly shall not exceed 10 percent of the static mainline head.

1403.9.2 Control systems using hydraulic communication between controller and valve(s) shall comply with the manufacturer's recommendations for maximum distance between controller and valve, both horizontally and vertically (elevation change).

1403.9.3 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications; based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except individual, _____ single _____ lot _____ residential systems.

1403.9.4 Manually operated control valves shall be located so that they can be operated without wetting the operator.

1403.9.5 In ground valves shall be located away from large tree and palm root zones.

1403.9.6 A manual shut off valve shall be required to be installed close to the point of connection but downstream from any backflow device (or/unless included in the backflow device) to minimize water loss when the system is shut off for repairs or emergencies.

1403.9.7 An automatic shut-off valve or master valve (normally closed) is required on all systems with a constantly pressurized mainline to confine the water loss from minor main line leaks, weeping valves, or stuck on valves to just the time the system is operating automatically.

1403.10 Automatic irrigation controller. Automatic irrigation controllers shall conform to UL 1310 and have an adequate number of stations and power output per station to accommodate the irrigation system design. The controller shall be capable of incorporating a rain shut off device or other sensors to override the irrigation cycle when adequate rainfall has occurred, as required by Florida Statutes, Section 373.62.

1403.11 Chemical injection.

1403.11.1 Chemical injection systems for the injection of fertilizer, pesticides, rust inhibitors, or any other injected substance will be located and sized according to the manufacturers' recommendations.

1403.11.2 Injection systems shall be located downstream of the applicable backflow prevention devices as required by Florida Statutes, Section 487.021 and 487.055; the Environmental Protection Agency (EPA); Pesticide Regulation Notice 87-1; or other applicable codes.

1403.11.3 If an irrigation water supply is also used for human consumption, an air gap separation or an approved reduced pressure principal backflow prevention device shall be required in compliance with ASSE 1013 and Section 1403.12.

1403.12 Backflow prevention methods. Backflow prevention assemblies at all cross connections with all water supplies shall be provided in accordance with county, municipal or other applicable codes. In the event of conflicting regulations the assembly type shall be provided which gives the highest degree of protection.

1403.12.1 Irrigation systems into which chemicals are injected shall conform to Florida state law (Florida Statutes 487.021 and 487.055) and Environmental Protection Agency Pesticide Regulation Notice 87-1, which requires backflow prevention regulations to be printed on the chemical label.

1403.12.1.1 For municipal water supplies, chemical injection equipment must be separated from the water supply by an approved air gap separation or a reduced pressure principle assembly that is approved by the Foundation for CCC and the Hydraulic Research Institute. The equipment shall comply with ASSE 1013 to protect the water supply from back-siphonage and back-pressure.

1403.12.1.2 For other water supplies, Florida State law, EPA regulations, or other applicable local codes shall be followed. In the absence of legal guidelines at minimum a PVB shall be required.

SECTION 1403.13 REFERENCED STANDARDS

The standards referenced below are exclusive to this section.

1403.13.1 American Society of Agricultural Engineers (ASAE) Standards:

ASAE S330.1: Procedure for sprinkler distribution testing for research purposes.

ASAE S376.1: Design, installation, and performance of underground thermoplastic irrigation pipelines.

ASAE S397.1: Electrical service and equipment for irrigation.

ASAE S435: Drip/Trickle Polyethylene Pipe used for irrigation laterals.

ASAE S398.1: Procedure for sprinkler testing and performance reporting.

ASAE S339: Uniform classification for water hardness.

ASAE S394: Specifications for irrigation hose and couplings used with self-propelled, hose-drag agricultural irrigation system.

ASAE EP400.1: Designing and constructing irrigation wells.

ASAE EP405: Design, installation, and performance of trickle irrigation systems.

ASAE EP409: Safety devices for applying liquid chemicals through irrigation systems.

1403.13.2 ASTM International Standards:

ASTM D 2241: Poly (Vinyl Chloride) (PVC) Plastic pipe (SDR-PR).

ASTM D 2239: Specification for polyethylene (PE) plastic pipe (SDR-PR).

ASTM D 2466: Specification for socket-type poly (vinyl chloride) (PVC) and chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 40.

ASTM D 2855: Standard recommended practice for making solvent cemented joints with polyvinyl chloride pipe and fittings.

ASTM D 3139: Specification for joints for plastic pressure pipes using flexible elastomeric seals.

ASTM F 477: Specification for elastomeric seals (gaskets for joining plastic pipe).

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1403.13.3 American Water Works Association (AWWA) standards:

AWWA C-900: PVC pipe standards and specifications

1403.13.4 American Society of Sanitary Engineers (ASSE) Standards:

ASSE 1001: Pipe applied atmospheric type vacuum breakers.

ASSE 1013: Reduced pressure principle backflow preventers.

ASSE 1015: Double check valve backflow preventers.

ASSE 1020: Vacuum breakers, anti-siphon, pressure type backflow preventers.

ASSE 1024: Dual check valve backflow preventers.

1403.13.5 Hydraulic Institute Standards, 14th Edition

1403.13.6 Standards and Specifications for Turf and Landscape Irrigation Systems Florida Irrigation Society (FIS) Standards

1403.13.7 Soil Conservation Service (SCS) Field Office Technical Guide, Section IV-A — Cropland Codes:

SCS Code 430-DD: Irrigation water conveyance, underground, plastic pipeline.

SCS Code 430-EE: Irrigation water conveyance. Low pressure, underground, plastic pipeline.

SCS Code 430-FF: Irrigation water conveyance, steel pipeline.

SOS Code 441-1: Irrigation system, trickle.

SCS Code 442: Irrigation system sprinkler.

SCS Code 449: Irrigation water management.

SCS Code 533: Pumping plant for water control.

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SCS Code 642: Well.

1403.13.8. Underwriters Laboratories (UL) 333 Pflingsten Road, Northbrook, IL 60062-296 Standards

UL 486C-1995 Splicing Wire Connectors

UL 969-2013 Standard for Marking and Labeling Systems

UL 1310-2011 Standard for Class 2 Power Units

Section 1403.14 MATERIALS

The materials referenced below are exclusive to this section.

1403.14.1 PVC pipe and fittings.

1403.14.1.1 PVC pipe shall comply with one of the following standards ASTM D 1785, ASTM D 2241, AWWA C-900, or AWWA C-905. SDR-PR pipe shall have a minimum wall thickness as required by SDR-26. All pipe used with effluent water systems shall be designated for nonpotable use by either label or by the industry standard color purple.

1403.14.1.2 All solvent-weld PVC fittings shall, at a minimum, meet the requirements of Schedule 40 as set forth in ASTM D 2466.

1403.14.1.3. Threaded PVC pipe fittings shall meet the requirements of Schedule 40 as set forth in ASTM D 2464.

1403.14.1.4. PVC gasketed fittings shall conform to ASTM D 3139. Gaskets shall conform to ASTM F 477.

1403.14.1.5. PVC flexible pipe should be pressure rated as described in ASTM D 2740 with standard outside diameters compatible with PVC IPS solvent-weld fittings.

1403.14.1.6. PVC cement should meet ASTM D 2564. PVC cleaner-type should meet ASTM F 656.

1403.14.2 Ductile iron pipe and fittings.

1403.14.2.1 Gasket fittings for iron pipe shall be of materials and type compatible with the piping material being used.

1403.14.3. Steel pipe and fittings.

1403.14.3.1. All steel pipe shall be rated Schedule 40 or greater and be hot-dipped galvanized or black in accordance with ASTM 53.

1403.14.3.2 Threaded fittings for steel pipe shall be Schedule 40 Malleable Iron.

1403.14.4 Polyethylene pipe.

1403.14.4.1 Flexible swing joints shall be thick-walled with a minimum pressure rating of 75 psi (517 kPa) in accordance with ASTM D 2239.

1403.14.4.2 Low pressure polyethylene pipe for micro-irrigation systems shall conform with ASAE S-435.

1403.14.4.3 Use fittings manufactured specifically for the type and dimensions of polyethylene pipe used.

1403.14.5 Sprinklers, spray heads, and emitters.

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1403.14.5.1 Units and nozzles shall be selected in accordance with the size of the area and the type of plant material being irrigated. Sprinklers shall fit the area they are intended to water without excessive overspray. Intentional direct spray onto walkways, buildings, roadways, and driveways is prohibited.

1403.14.5.2 Equipment shall be used that is protected from contamination and damage by use of seals, screens, and springs where site conditions present a potential for damage.

1403.14.5.3 Riser-mounted sprinklers shall be supported to minimize movement of the riser resulting from the action of the sprinkler.

1403.14.5.4 Swing joints, either flexible or rigid, shall be constructed to provide a leak-free connection between the sprinkler and lateral pipeline to allow movement in any direction and to prevent equipment damage.

1403.14.5.5 Check valves shall be installed on any sprinkler where low point drainage occurs.

1403.14.5.6 The pop-up height for sprays and rotator nozzles shall be adequate to prevent being obstructed by the turf grass blades: 6" height for St. Augustine, Zoysia and Bahia and 4" height for Bermuda, Centapede and Seashore Paspalum.

1403.14.5.7 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to PVC pipe to protect the emission devices from contamination from a PVC main or lateral break.

1403.14.5.8 All microirrigation zones shall have adequate pressure regulation installed at the zone valve or at the point where the drip tubing is attached to the PVC to ensure that all emission devices meet the manufacturer's performance standards.

1403.14.5.9 Each plant shall have a adequate number and size(gph) of microirrigation devices, properly placed to meet the plant water requirements for no rainfall.

1403.14.5.10 All tubing shall be secured to prevent movement in accordance with manufacturer's specification.

1403.14.6 Valves.

1403.14.6.1 Valves shall have a maximum working pressure rating equal to or greater than the maximum pressure of the system, but not less than 125 psi (861 kPa). This requirement shall be waived for low mainline pressure systems [30 psi (207 kPa) or less].

1403.14.6.2 Only valves that are constructed of materials designed for use with the water and soil conditions of the installation shall be used. Valves that are constructed from materials that will not be deteriorated by chemicals injected into the system shall be used on all chemical injection systems.

1403.14.7 Valve boxes.

1403.14.7.1 Valve boxes shall be constructed to withstand traffic loads common to the area in which they are installed. They should be sized to allow manual operation of the enclosed valves without excavation.

1403.14.7.2. Each valve box shall be permanently labeled in accordance with UL 969 to identify its contents.

1403.14.8 Low voltage wiring.

1403.14.8.1 All low voltage wire which is directly buried shall be labeled for direct burial wire. Wire not labeled for direct burial shall be installed in watertight conduits, and be listed TWN or THHN type wire as described in the NEC. All wire traveling under any hardscape or roadway must installed within a conduit and sleeve.

1403.14.8.2 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications, based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids

operating, on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except single lot individual residential systems.

1403.14.8.3 Connections shall be made using devices conforming to UL 486 specifically designed for direct burial. All splices shall be enclosed within a valve box.

1403.14.9 Irrigation controllers.

1403.14.9.1 All irrigation controllers shall conform to UL 1310 and the provisions of the National Electric Code (NEC) and be grounded in accordance with the manufacturer's specifications. Solid state controls shall be equipped with surge suppressors on the primary and secondary wiring, except single lot residential systems.

1403.14.9.2 The controller housing or enclosure shall protect the controller from the hazards of the environment in which it is installed.

1403.14.9.3 The rain switch shall be placed on a stationary structure minimum of 5-foot (1524 mm) clearance from other outdoor equipment, free and clear of any tree canopy or other overhead obstructions, and above the height of the sprinkler coverage. Soil moisture sensors and ET sensors shall be installed in accordance with manufacturer's specifications and Florida Statutes, Section 373.62.

1403.14.10 Pumps and wells.

1403.14.10.1 Irrigation pump electrical control systems shall conform to the NEC and local building codes.

1403.14.10.2 The pumping system shall be protected from the hazards of the environment in which it is installed.

1403.14.10.3 Use electric motors with a nominal horsepower rating greater than the maximum horsepower requirement of the pump during normal operation. Motor shall have a service factor of at least 1.15.

1403.14.10.4 Casings for drilled wells shall be steel, reinforced plastic mortar, plastic, or fiberglass pipe. Only steel pipe casings shall be used in driven wells. See SCS code FL-642. Steel casings shall conform to ASTM A 589.

1403.14.11 Chemical injection equipment.

1403.14.11.1 Chemical injection equipment shall be constructed of materials capable of withstanding the potential corrosive effects of the chemicals being used. Equipment shall be used only for those chemicals for which it was intended as stated by the injection equipment manufacturer.

1403.14.12 Filters and strainers.

1403.14.12.1 Filtration equipment and strainers constructed of materials resistant to the potential corrosive and erosive effects of the water shall be used. They shall be sized to prevent the passage of foreign material that would obstruct the sprinkler/emitter outlets in accordance with the manufacturer's recommendations.

Section 1403.15 INSTALLATION

1403.15.1 Pipe installation.

1403.15.1.1 Pipe shall be installed at sufficient depth below ground to protect it from hazards such as vehicular traffic or routine occurrences which occur in the normal use and maintenance of a property. Depths of cover shall meet or exceed SCS Code 430-DD, Water Conveyance, as follows:

1403.15.1.1.1 Vehicle traffic areas.

Pipe Size (inches)

Depth of Cover (inches)

½ - 2 ½

18 - 24

3 - 5

24 - 30

6 and larger

30 - 36

-

-

1403.15.1.1.2 All areas except vehicle traffic:

-

Pipe Size (inches)

Depth of Cover (inches)

½ - 1 ½

6

2 - 3

12

4 - 6

18

More than 6

24

1403.15.1.2 All pipe joints and connections shall be made according to manufacturer's specifications. All solvent-weld connections shall be performed in accordance with ASTM D 2855.

1403.15.1.3 Minimum clearances shall be maintained between irrigation lines and other utilities. In no case shall one irrigation pipe rest upon another.

1403.15.1.4 Thrust blocks shall be used on all gasketed PVC systems. They must be formed against a solid, hand-excavated trench wall undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and trench shall be filled to the height of the outside diameter of the pipe. Thrust blocks shall be sized in accordance with ASAE S-376.1.

1403.15.1.5 The trench bottom shall be uniform, free of debris, and of sufficient width to properly place pipe and support it over its entire length. Native excavated material may be used to backfill the pipe trench. However, the initial backfill material shall be free from rocks or stones larger than 1-inch in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. Blocking or mounding shall not be used to bring the pipe to final grade.

1403.15.1.6. Pipe sleeves shall be used to protect pipes or wires installed under pavement or roadways. Pipe sleeves two pipe sizes larger than the carrier pipe or twice the diameter of the wire bundle shall be used under the paving or roadway and extending a minimum of 3 feet beyond the paved area or as required by the Florida

Department of Transportation (FDOT). Pipe sleeves shall be Sch 40. Proper backfill and compaction procedures shall be followed.

1403.15.2 Control valve installation.

1403.15.2.1 Valve installation shall allow enough clearance for proper operation and maintenance. Where valves are installed underground, they shall be provided with a valve box with cover extending from grade to the body of the valve. The top of the valve body should have a minimum of 6 inches (152 mm) of cover in nontraffic and noncultivated areas and 18 inches (457 mm) of cover in traffic areas. The valve box shall be installed to minimize the effect of soil intrusion within the valve box with the use of filter fabric, pea gravel, or other approved material. If an automatic valve is installed under each sprinkler, then the valve box may be omitted.

1403.15.2.2 Valve boxes shall be installed so that they do not rest on the pipe and the box cover does not conflict with the valve stem or interfere with valve operation. They shall be flush with the ground surface and do not present a tripping hazard or interfere with routine maintenance of the landscape.

1403.15.2.3. Quick coupling valves shall be installed on swing joints or flexible pipe with the top of the valve at ground level.

1403.15.2.4 Any above-ground manually-operated valves on nonpotable water systems shall be adequately identified with distinctive purple colored paint. Hose bibb connections on irrigation systems that utilize nonpotable water supplies shall not be permitted.

1403.15.3 Sprinkler installation.

1403.15.3.1. On flat landscaped areas, sprinklers shall be installed plumb. In areas where they are installed on slopes, sprinklers may be tilted as required to prevent erosion. Sprinklers shall be adjusted to avoid unnecessary discharge on roads, pavements and structures.

1403.15.3.2. There shall be a minimum separation of 4 inches (102 mm) between sprinklers and pavement. There shall be a minimum separation of 12 inches (305 mm) between sprinklers and buildings and other vertical structures. Piping shall be thoroughly flushed before installation of sprinkler nozzles. Surface mounted and pop-up heads shall be installed on swing joints, polyethylene (PE) nipples or flexible pipe. Polyethylene (PE) nipples shall not be used in maintenance equipment traffic areas or alongside roadways and driveways. Above-ground (riser mounted) sprinklers shall be mounted on Schedule 40 PVC or steel pipe and be stabilized.

1403.15.4 Pump installation.

1403.15.4.1 Pumps shall be installed in accordance with the manufacturer's specifications. Pumps shall be set plumb and secure to a firm concrete base. There shall be no strain or distortion on the pipe and fittings. Pipe and fittings shall be supported to avoid placing undue strain on the pump. Steel pipe shall be used on pumps 5 horsepower (hp) or larger.

1403.15.4.2 Pumps shall be installed in a manner to avoid loss of prime. Suction line shall be installed to prevent the accumulation of air pockets. All connections and reductions in suction pipe sizes shall be designed to avoid causing air pockets and cavitation.

1403.15.4.3 Pumps shall be located to facilitate service and ease of removal. Appropriate fittings shall be provided to allow the pump to readily be primed, serviced, and disconnected. An enclosure shall be provide of adequate size and strength, with proper ventilation, to protect the pump from the elements (except residential systems).

1403.15.5 Low voltage wire installation.

1403.15.5.1 Install low voltage wire (less than 98 volts) with a minimum depth of cover of 12 inches (305 mm) where not installed directly under the mainline. A sufficient length of wire shall be provided at each connection to allow for thermal expansion/shrinkage. As a minimum, a 12-inch (305 mm) diameter loop shall be provided at all splices and connections. Terminations at valves shall have 24 inches (610 mm) minimum free wire.

1403.15.5.2 All above-ground wire runs and wire entries into buildings shall be installed in electrical conduit. Common wires with a different color than the power wires (white shall be used for common wires) shall be provided. Connections shall be made using devices conforming to UL 486C specifically designed for direct burial. All splices shall be enclosed within a valve box.

Exception: When wiring above ground manifolds from the valve to the ground immediately beneath it, no conduit is required.

1403.15.6 Hydraulic control tubing installation

1403.15.6.1 For hydraulic control systems, a water supply shall be used that is filtered and free of deleterious materials, as defined by the hydraulic control system manufacturer's specifications. A backflow prevention device shall be installed where the hydraulic control system is connected to potable water supplies.

1403.15.6.2 Tubing shall be installed in trenches and spaced so that it will not rub against pipe, fittings, or other objects that could score the tubing, and with a minimum 12-inch (305 mm) diameter loop at all turns and connections. A minimum depth of cover of 12 inches (305 mm) shall be provided.

1403.15.6.3 Tubing shall be connected with couplings and collars according to Manufacturer's specifications. All splices shall be made in valve boxes. Tubing shall be prefilled with water to expel entrapped air and tested for leaks prior to installation.

1403.15.6.4 Exposed tubing shall be installed in a protective conduit manufactured from Schedule 40 UV protected PVC or electrical conduit.

1403.16 As-Built Drawings.

1403.16.1 An As-Built drawing shall be required of all irrigation systems installed on commercial and residential developments and shall contain the following information:

1403.16.1.1 Location, type, pressure and maximum flow available of all water sources.

1403.16.1.2 Location, type and size of all components including sprinklers, microirrigation, main and lateral piping, master valves, valves, moisture sensors, rain sensors, controllers, pump start relays, backflow devices, pumps, wells, etc.

1403.16.1.3 The flow rate, application rate (inches per hour), and the operating pressure for the sprinklers and micro irrigation within each zone.

1403.16.1.4 The name, address, phone, email, professional license or certification number of the installation contractor.

1403.16.1.5 Date of installation.

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CHAPTER 14
LANDSCAPE IRRIGATION SYSTEMS
SECTION 1401
GENERAL

1401.1 Scope.

The provisions of Chapter 14 shall govern the materials, design, construction and installation of subsurface turf and landscape irrigation systems connected to either potable or nonpotable water from on-site water reuse systems.

~~Exception: Landscape irrigation systems connected to onsite sewage treatment and disposal systems shall be regulated by Chapter 64E-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems.~~

~~Exception: All Turf and Landscape irrigation systems serving as drainfields for onsite sewage treatment and disposal systems shall be regulated by Chapter 64E-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems.~~

SECTION 1402

Subsurface Landscape Irrigation Systems Connected to NonPotable On-site Water Reuse Systems

1402.1 Scope.

The provisions of Section 1402 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems.

1402.2 1402.2 Materials.

~~Above-ground drain, waste and vent piping for subsurface landscape irrigation systems connected to NonPotable On-site Water Reuse Systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.~~

1401.3 1402.3 Tests.

~~Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.~~

1401.4 1402.4 Inspections.

~~Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.~~

1401.5 1402.5 Disinfection.

~~Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.~~

1401.6 1402.6 Coloring.

~~On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.~~

SECTION 1402
SYSTEM DESIGN AND SIZING

1402.1 1402.7 Sizing.

The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to

the gallons per day per occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:

(Equation 14-1)

where:

A = Number of occupants:

~~Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.~~

~~Commercial—Number of occupants shall be determined by the Florida Building Code, Building.~~

B = Estimated flow demands for each occupant:

~~Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.~~

~~Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.~~

C = Estimated gray water discharge based on the total number of occupants.

~~1402.2 1402.8 Percolation tests.~~

~~The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.~~

~~1402.2.1 1402.8.1 Percolation tests and procedures.~~

~~At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.~~

~~1402.2.1.1 1402.8.1.1 Percolation test hole.~~

~~The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.~~

~~1402.2.1.2 1402.8.1.2 Test procedure, sandy soils.~~

~~The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1303.7.1.3.~~

~~1402.2.1.3 1402.8.1.3 Test procedure, other soils.~~

~~The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches~~

~~(152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $\frac{1}{16}$ inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.~~

~~**1402.2.1.4 1402.8.1.4 Mechanical test equipment.**~~

~~Mechanical percolation test equipment shall be of an *approved type*.~~

~~**1402.2.2 1402.8.2 Permeability evaluation.**~~

~~Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 1402.2.1.1 1402.8.1.1 for evaluating the soil.~~

~~**1402.3 1402.9 Subsurface landscape irrigation site location.**~~

~~The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 1402.3 1402.9. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.~~

**TABLE 1402.3 1402.9
LOCATION OF SUBSURFACE IRRIGATION SYSTEM**

ELEMENT	MINIMUM HORIZONTAL DISTANCE	
	Storage tank (feet)	Irrigation disposal field (feet)
Buildings	5	2
Lot line adjoining private property	5	5
Water wells	50	100
Streams and lakes	50	50
Seepage pits	5	5
Septic tanks	0	5
Water service	5	5
Public water main	10	10

For SI: 1 foot = 304.8 mm.

**SECTION 14031
INSTALLATION**

~~**14031.1 1402.10 Installation.**~~

~~Absorption systems shall be installed in accordance with Sections 14031.1.1 1402.10.1 through 14031.1.5 1402.10.1.5 to provide landscape irrigation without surfacing of water.~~

~~**14031.1.1 1402.10.1 Absorption area.**~~

~~The total absorption area required shall be computed from the estimated daily gray water discharge and the design-loading rate based on the percolation rate for the site. The required~~

absorption area equals the estimated gray water discharge divided by the design loading rate from Table 14031.1.1 1402.10.1.

**TABLE 14031.1.1 1402.10.1
DESIGN LOADING RATE
PERCOLATION RATE(minutes per inch)**

0 to less than 10

10 to less than 30

30 to less than 45

45 to 60

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

14031.1.2 1402.10.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.

14031.1.3 1402.10.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

14031.1.4 1402.10.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

14031.1.5 1402.10.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from $\frac{1}{2}$ to $2\frac{1}{2}$ inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved synthetic materials* or 9 inches (229 mm) of uncompactd marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

14031.2 1402.11 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 14031.2 1402.11. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

TABLE 14031.2 1402.11

DISTRIBUTION PIPE

MATERIAL

STANDARD

Polyethylene (PE) plastic pipe

ASTM F405

Polyvinyl chloride (PVC) plastic pipe

ASTM
D2729

Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core or composite wall

ASTM
F1488

For SI: 1 inch=25.4 mm.

14031.2.1 Joints.

~~Joints in distribution pipe shall be made in accordance with Section 705 of this code.~~

SECTION 14031

Surface and Subsurface Landscape Irrigation Systems

~~14031.1 Scope.~~

~~The provisions of Section 14031 shall govern the materials, design, construction and installation of turf and landscape irrigation systems that apply potable or nonpotable water by means of permanent above ground or subsurface sprinkler or microsprinkler equipment that move water through various means of mechanical pressure.~~

~~14031.1.2 This section shall apply to all irrigation systems used on residential and commercial landscape areas.~~

~~14031.1.3 This section shall apply to all new irrigation systems and any new work to existing irrigation systems.~~

~~Exception. This section shall not apply to irrigation systems for golf courses, nurseries, greenhouses, or agricultural production systems.~~

~~14031.1.4 Nothing contained in this section shall be deemed to require any irrigation system or part thereof, which existed prior to the establishment of this code, to be changed altered or modified to meet the standards of this code.~~

~~14031.2 Permits.~~

~~14031.2.1 A permit shall be required for new installation of landscape irrigation systems and for repairs or modifications to the system design that exceed \$1000.00 in labor and material based on invoice value.~~

~~14031.2.2 No permit shall be required for general maintenance or repairs which do not change the structure or alter the system and the value of which does not exceed \$1000.00 in labor and material based on invoice value.~~

~~14031.3 Preconstruction submittals.~~

~~14031.3.1 Plans or drawings.~~

14031.3.1.1 Single-family residence. Design drawings or shop drawings, where required, shall be provided for the installation of irrigation systems prior to start of construction. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, and include all improvements. Drawings shall be prepared by a licensed plumbing or irrigation contractor or licensed landscape architect.

14031.3.1.2 Commercial, industrial, municipal and multiple-family. Professionally designed drawings prior to start of construction shall be provided for landscape irrigation systems. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, including all improvements, and shall include but not be limited to: date, scale, revisions, legend, specifications which list all aspects of equipment and assembly there of, water source, water meter and/or point of connection, backflow prevention devices, pump station size, pump station location, design operating pressure and flow rate per zone, precipitation rate per zone, locations of pipe, controllers, valves, sprinklers, sleeves, gate valves, sensors, etc. The plans and specifications shall be prepared in accordance with Section 107 of the Florida Building Code, Building.

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14031.4 Definitions. The following definitions are exclusive to this section of the code.

ABS Pipe. Acrylonitrile-butadiene-styrene black, semi-rigid, plastic pipe extruded to IPS. ABS pipe is in limited use in present day irrigation systems. Solvent weld fittings are used with this pipe (see ASTM D 1788).

Air Release Valve. A valve which will automatically release to the atmosphere accumulated small pockets of air from a pressurized pipeline. A small orifice is used to release air at low flow rates. Air release valves are normally required at all summits of mainline and submain pipelines in an irrigation system.

Anti-Siphon Device. A safety device used to prevent back-flow of irrigation water to the water source by back-siphonage.

Application Rate. The average rate at which water is applied by an irrigation system, sometimes also called precipitation rate. Units are typically inches/hr or mm/hr.

Application uniformity. Irrigation application uniformity (also known as distribution uniformity) describes how evenly water is distributed within an irrigation zone.

Arc. The angle of coverage of a sprinkler in degrees from one side of throw to the other. A 90-degree arc would be a quarter-circle sprinkler.

Atmospheric Vacuum Breaker (AVB). An anti-siphon backflow device which uses a floating seat to allow an air break to interrupt the vacuum effect on water flow.

Automatic Control Valve. A valve in a sprinkler system which is activated by an automatic controller by way of hydraulic or electrical control lines and controls a single device or multiple devices.

Automatic System. An irrigation system which operates following a preset program entered into an automatic controller.

Backflow Prevention Device. An approved safety device used to prevent pollution or contamination of the irrigation water supply due to backflow from the irrigation system.

Belled (Pipe). Pipe which is enlarged at one end so that the spigot end of another length of pipe can be inserted into it during the assembly of a pipeline.

Block (of sprinklers). A group of sprinklers controlled by one valve. Also called zones or subunits.

Block System. An irrigation system in which several groups of sprinklers are controlled by one valve for each group.

Bubbler Irrigation. The application of water to the soil surface or a container as a small stream or fountain. Bubbler emitter discharge rates generally range from 0.5 to 2 gpm but are generally less than 60 gph.

Check Valve. A valve which permits water to flow in one direction only.

Chemical Water Treatment. The addition of chemicals to water to make it acceptable for use in irrigation systems

Chemigation. The application of water soluble chemicals by mixing or injecting with the water applied through an irrigation system.

Contractor. Any person who engages in the fabrication and installation of any type of irrigation system on a contractual basis in accordance with all stipulations receiving compensation.

Control Lines. Hydraulic or electrical lines which carry signals to open and close the valves from the controller to the automatic valves.

Controller. The timing mechanism and its mounting box. The controller signals the automatic valves to open and close on a pre-set program or based on sensor readings.

Coverage. Refers to the way water is applied to an area.

Cycle. Refers to one complete run of a controller through all programmed controller stations.

Demand (or irrigation demand). Refers to the irrigation requirements of the irrigated area. Demand primarily depends on the type of crop, stage of growth, and climatic factors.

Design Area. The specific land area to which water is to be applied by an irrigation system.

Design Emission Uniformity. An estimate of the uniformity of water application with an irrigation system.

Design Pressure. The pressure at which the irrigation system or certain components are designed to operate. The irrigation system design pressure is that measured at the pump discharge or entrance to the system if there is no pump, and a zone design pressure is the average operating pressure of all emitters within that zone.

Direct Burial Wire. Plastic-coated single-strand copper wire for use as control line for electric valves.

Discharge Rate. The instantaneous flow rate of an individual sprinkler, emitter, or other water emitting device, or a unit length of line-source micro irrigation tubing. Also, the flow rate from a pumping system or from a reduced pressure assembly or relief valve.

Double Check Valve. An approved assembly of two single, independently-acting check valves with test ports to permit independent testing of each check valve.

Drain Valve. A valve used to drain water from a line. The valve may be manually or automatically operated.

~~**Drip Irrigation.** The precise low-rate application of water to or beneath the soil surface near or directly into the plant root zone. Applications normally occur as small streams, discrete or continuous drops, in the range of 0.5 to 2.0 gph.~~

Effluent water. Also referred to as reclaimed or gray water is wastewater which has been treated per Florida Statute, §403.086 and is suitable for use as a water supply for irrigation systems.

Emitters. Devices which are used to control the discharge of irrigation water from lateral pipes. This term is primarily used to refer to the low flow rate devices used in micro irrigation systems.

Fertigation. The application of soluble fertilizers with the water applied through an irrigation system.

Filtration System. The assembly of physical components used to remove suspended solids from irrigation water. These include both pressure and gravity type devices, such as settling basins, screens, media filters, and centrifugal force units (vortex sand separators).

Flexible Swing Joint. A flexible connection between the lateral pipe and the sprinkler which allows the sprinkler to move when force is applied to it.

Flow Meters. Devices used to measure the volume of flow of water (typically in gallons), or flow rates (typically in gpm), and to provide data on system usage.

Gauge (Wire). Standard specification for wire size. The larger the gauge number, the smaller the wire diameter.

Head. A sprinkler head. Sometimes used interchangeably with and in conjunction with "Sprinkler."

Infiltration Rate. The rate of water flow across the surface of the soil and into the soil profile. Units are usually inches/hr.

Irrigation. Application of water by artificial means, that is, means other than natural precipitation. Irrigation is practiced to supply crop water requirements, leach salts, apply chemicals, and for environmental control including crop cooling and freeze protection.

Irrigation Water Requirement or Irrigation Requirement. The quantity of water that is required for crop production, exclusive of effective rainfall.

Landscape. Refers to any and all areas which are ornamentally planted, including but not limited to turf, ground covers, flowers, shrubs, trees, and similar plant materials as opposed to agricultural crops grown and harvested for monetary return.

Lateral. The water delivery pipeline that supplies water to the emitters or sprinklers from a manifold or header pipeline downstream of the control valve.

Line-Source Emitters. Lateral pipelines which are porous or contain closely-spaced perforations so that water is discharged as a continuous band or in overlapping patterns rather than discrete widely-spaced points along the pipeline length.

Looped System. A piping system which allows more than one path for water to flow from the supply to the emitters or sprinklers.

Low Volume Sprinklers. Sprinkler heads that emit less than .5 gallons per minute.

Mainline. A pipeline which carries water from the control station to submains or to manifolds or header pipelines of the water distribution system.

Manifold. The water delivery pipeline that conveys water from the main or submain pipelines to the laterals. Also sometimes called a header pipeline.

Manual System. A system in which control valves are manually operated rather than operated by automatic controls.

Matched Precipitation. An equal distribution of water over a given area or zone.

Meter Box. A concrete or plastic box buried flush to grade which houses flow (water) meters or other components.

Microirrigation. The frequent application of small quantities of water directly on or below the soil surface, usually as discrete drops, tiny streams, or miniature sprays through emitters placed along the water delivery pipes (laterals). Microirrigation encompasses a number of methods or concepts, including drip, subsurface, bubbler, and spray irrigation. Previously known as trickle irrigation.

Overlap. The amount one sprinkler pattern overlaps another one when installed in a pattern. Expressed as a percentage of the diameter of coverage.

PE Pipe. Flexible polyethylene pipe for use in irrigation systems, normally manufactured with carbon black for resistance to degradation by ultraviolet radiation.

Potable Water. Water which is suitable in quality for human consumption and meets the requirements of the Health Authority having jurisdiction.

Pressure Relief Valve. A valve which will open and discharge to atmosphere when the pressure in a pipeline or pressure vessel exceeds a pre-set point to relieve the high-pressure condition.

Pressure Vacuum Breaker. A backflow prevention device which includes a spring-loaded check valve and a spring-loaded vacuum breaker to prevent the backflow of irrigation system water to the water source.

Pumping Station. The pump or pumps that provide water to an irrigation system, together with all of the necessary accessories such as bases or foundations, sumps, screens, valves, motor controls, safety devices, shelters and fences.

PVC Pipe. Polyvinyl chloride plastic pipe made in standard thermoplastic pipe dimension ratios and pressure rated for water. Manufactured in accordance with AWWA C-900 or ASTM D-2241.

Rain Shut off Device. A calibrated device that is designed to detect rainfall and override the irrigation cycle of the sprinkler system when a predetermined amount of rain fall has occurred.

Reduced Pressure Principle Backflow Preventer (RPZD) (also known as Reduced Pressure Zone Device RPZ or RPZ Valve). A type of backflow prevention device used to protect water supplies from contamination.

Riser. A threaded pipe to which sprinklers or other emitters are attached for above-ground placement.

Runoff. The result of excess water applied either naturally (precipitation) or mechanically (irrigation) that exceeds the absorption rate of the soil, moving to an area of a lower elevation.

Sleeve. A pipe used to enclose other pipes, wire, or tubing; usually under pavement, sidewalks, or planters.

Spacing. The distance between sprinklers or other emitters.

Spray Irrigation. The micro irrigation application of water to the soil or plant surface by low flow rate sprays or mists.

Sprinkler. The sprinkler head. Sometimes called "Head."

Supply (Water Source). The origin of the water used in the irrigation system.

Swing Joint. A ridged connection between the lateral pipe and the sprinkler, utilizing multiple elbows and nipples, which allows the sprinkler to move when force is applied to it.

Tubing. Generally used to refer to flexible plastic hydraulic control lines which are usually constructed of PE or PVC.

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14031.4 DESIGN CRITERIA

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14031.4.1 Design defined. Within the scope of this code, irrigation system design is defined as the science and art of properly selecting and applying all components within the system

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14031.4.2 Water supply.

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14031.4.2.1 The water source shall be adequate from the stand-point of volume, flow rate, pressure, and quality to meet the irrigation requirements of the area to be irrigated, as well as other demands, if any, both at the time the system is designed and for the expected life of the system.

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14031.4.2.2 If the water source is effluent, it shall meet the advanced waste treatment standard as set forth in Florida Statute §403.086(4) as well as any other standard as set forth by the controlling governmental agency.

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14031.4.3 Application uniformity.

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14031.4.3.1 Sprinkler irrigation systems shall be designed with the appropriate uniformity for the type of plants being grown and the type of soil found in that area. The general watering of different types of plants as one group without regard to their individual water requirements shall be avoided.

14031.4.3.2 Sprinkler head spacing, type and nozzle selection that achieves the highest application uniformity shall be utilized.

14031.4.3.3 Application rates which avoid runoff and permit uniform water infiltration into the soil shall be utilized. Land slope, soil hydraulic properties, vegetative ground cover, and prevailing winds and sun exposure shall be considered when application rates are specified. Different types of sprinklers with different application rates, i.e., spray heads vs. rotor heads, bubbler heads vs rotor heads, shall not be combined on the same zone or circuit.

14031.4 System zoning. The irrigation system shall be divided into zones based on consideration of the following hydrozoning practices.

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14031.4.1 Available flow rate.

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14031.4.2 Cultural use of the area.

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14031.4.3 Type of vegetation irrigated, i.e., turf, shrubs, native plants, etc.

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14031.4.4 Type of sprinkler, i.e., sprinklers with matching precipitation rates.

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14031.4.5 Soil characteristics and slope.

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14031.4.6 Sun exposure.

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14031.5 Sprinkler/emitter spacing and selection.

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14031.5.1 Sprinkler/Emitter spacing shall be determined considering the irrigation requirements, hydraulic characteristics of the soil and device, and water quality with its effect on plant growth, sidewalks, buildings, and public access areas.

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14031.5.2 All pop-up spray head bodies in turf areas shall be no less than 6" in height for St. Augustine, Zoysia and Bahia and no less than 4" in height for Bermuda, Centapede and Seashore Paspalum.

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14031.5.3 Sprinklers shall be located in accordance with manufacturer's specifications in each irrigated zone area for a matched precipitation rate objective.

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14031.5.4 Single row head spacing shall only occur when an additional row will cause saturated soils at the toe of a slope or other inefficiencies.

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14031.5.5 All heads shall not exceed 50% of manufacturer's specified diameters of coverage.

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14031.5.6 Water conservation shall be taken into consideration by minimizing irrigation of non-vegetated areas.

14031.5.7 Microirrigation systems shall be designed using the Emission Uniformity concept. Microirrigation emitters shall be spaced to wet 100 percent of the root zone in turf areas and 50 percent of the root zone for shrubs and trees.

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14031.5.8 Microirrigation or low volume heads shall be required in all areas to be irrigated that are less than 4 feet in any direction from the emitter or nozzle.

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14031.5.9 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to supply pipelines to protect the emission devices from contamination from a **PD main or lateral break**.

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14031.5.10 Each plant shall have an adequate number and size (gph) of microirrigation devices, properly placed, to meet the plant water requirements for no rainfall.

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14031.6 Pipelines. Pipelines shall be sized to limit pressure variations so that the working pressure at all points in the irrigation system will be in the range required for uniform water application. Velocities shall not exceed 5 feet (1524 mm) per second.

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14031.7 Wells.

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14031.7.1 Well diameters, depths and location shall correspond to the irrigation system demand and in compliance to all applicable state, regulatory agencies and local codes and regulations.

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14031.8 Pumps.

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14031.8.1 Pump and motor combinations shall be capable of satisfying the total system demand without invading the service factor of the motor except during start-up and between zones.

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14031.8.2 Pumps shall be positioned with respect to the water surface in order to ensure that the net positive suction head required (NPSHr) for proper pump operation is achieved.

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14031.8.3 The pumping system shall be protected against the effects of the interruption of water flow.

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14031.9 Control valves.

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14031.9.1 Control valve size shall be based on the flow rate through the valve. Friction loss through the valve, an approved air gap separation, or a reduced pressure assembly shall not exceed 10 percent of the static mainline head.

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14031.9.2 Control systems using hydraulic communication between controller and valve(s) shall comply with the manufacturer's recommendations for maximum distance between controller and valve, both horizontally and vertically (elevation change).

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14031.9.3 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications; based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except individual, single lot residential systems.

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14031.9.4 Manually operated control valves shall be located so that they can be operated without wetting the operator.

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14031.9.5 In ground valves shall be located away from large tree and palm root zones.

14031.9.6 A manual shut off valve shall be required to be installed close to the point of connection but downstream from any backflow device (or/unless included in the backflow device) to minimize water loss when the system is shut off for repairs or emergencies.

14031.9.7 An automatic shut-off valve or master valve (normally closed) is required on all systems with a constantly pressurized mainline to confine the water loss from minor main line leaks, weeping valves, or stuck on valves to just the time the system is operating automatically.

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14031.10 Automatic irrigation controller. Automatic irrigation controllers shall conform to UL 1310 and have an adequate number of stations and power output per station to accommodate the irrigation system design. The controller shall be capable of incorporating a rain shut off device or other sensors to override the irrigation cycle when adequate rainfall has occurred, as required by Florida Statutes, Section 373.62.

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14031.11 Chemical injection.

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14031.11.1 Chemical injection systems for the injection of fertilizer, pesticides, rust inhibitors, or any other injected substance will be located and sized according to the manufacturers' recommendations.

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14031.11.2 Injection systems shall be located downstream of the applicable backflow prevention devices as required by Florida Statutes, Section 487.021 and 487.055; the Environmental Protection Agency (EPA); Pesticide Regulation Notice 87-1; or other applicable codes.

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14031.11.3 If an irrigation water supply is also used for human consumption, an air gap separation or an approved reduced pressure principal backflow prevention device shall be required in compliance with ASSE 1013 and Section 14031.12.

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14031.12 Backflow prevention methods. Backflow prevention assemblies at all cross connections with all water supplies shall be provided in accordance with county, municipal or other applicable codes. In the event of conflicting regulations the assembly type shall be provided which gives the highest degree of protection.

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14031.12.1 Irrigation systems into which chemicals are injected shall conform to Florida state law (Florida Statutes 487.021 and 487.055) and Environmental Protection Agency Pesticide Regulation Notice 87-1, which requires backflow prevention regulations to be printed on the chemical label.

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14031.12.1.1 For municipal water supplies, chemical injection equipment must be separated from the water supply by an approved air gap separation or a reduced pressure principle

assembly that is approved by the Foundation for CCC and the Hydraulic Research Institute. The equipment shall comply with ASSE 1013 to protect the water supply from back-siphonage and back-pressure.

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14031.12.1.2 For other water supplies, Florida State law, EPA regulations, or other applicable local codes shall be followed. In the absence of legal guidelines, at minimum, a PVD Pressure Vacuum Breaker shall be required.

SECTION 14031.13 REFERENCED STANDARDS

The standards referenced below are exclusive to this section.

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14031.13.1 American Society of Agricultural Engineers (ASAE) Standards:

ASAE S330.1: Procedure for sprinkler distribution testing for research purposes.

ASAE S376.1: Design, installation, and performance of underground thermoplastic irrigation pipelines.

ASAE S397.1: Electrical service and equipment for irrigation.

ASAE S435: Drip/Trickle Polyethylene Pipe used for irrigation laterals.

ASAE S398.1: Procedure for sprinkler testing and performance reporting.

ASAE S339: Uniform classification for water hardness.

ASAE S394: Specifications for irrigation hose and couplings used with self-propelled, hose-drag agricultural irrigation system.

ASAE EP400.1: Designing and constructing irrigation wells.

ASAE EP405: Design, installation, and performance of trickle irrigation systems.

ASAE EP409: Safety devices for applying liquid chemicals through irrigation systems.

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14031.13.2 ASTM International Standards:

ASTM D 2241: Poly (Vinyl Chloride) (PVC) Plastic pipe (SDR-PR).

ASTM D 2239: Specification for polyethylene (PE) plastic pipe (SDR-PR).

ASTM D 2466: Specification for socket-type poly (vinyl chloride) (PVC) and chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 40.

ASTM D 2855: Standard recommended practice for making solvent cemented joints with polyvinyl chloride pipe and fittings.

ASTM D 3139: Specification for joints for plastic pressure pipes using flexible elastomeric seals.

ASTM F 477: Specification for elastomeric seals (gaskets for joining plastic pipe).

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14031.13.3 American Water Works Association (AWWA) standards:

AWWA C-900: PVC pipe standards and specifications

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14031.13.4 American Society of Sanitary Engineers (ASSE) Standards:

ASSE 1001: Pipe applied atmospheric type vacuum breakers.

ASSE 1013: Reduced pressure principle backflow preventers.

ASSE 1015: Double check valve backflow preventers.

ASSE 1020: Vacuum breakers, anti-siphon, pressure type backflow preventers.

ASSE 1024: Dual check valve backflow preventers.

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14031.13.5 Hydraulic Institute Standards, 14th Edition

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**14031.13.6 Standards and Specifications for Turf and Landscape Irrigation Systems
Florida Irrigation Society (FIS) Standards**

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14031.13.7 ~~Soil Conservation Service (SCS) Natural Resources Conservation Service (NRCS) Field Office Technical Guide, Section IV-A — Cropland Codes:~~

SCSNRCS Code 430-DD: Irrigation water conveyance, underground, plastic pipeline.

SCSNRCS Code 430-EE: Irrigation water conveyance. Low pressure, underground, plastic pipeline.

SCS NRCS Code 430-FF: Irrigation water conveyance, steel pipeline.

SCSNRCS Code 441-1: Irrigation system, trickle.

SCS NRCS Code 442: Irrigation system sprinkler.

SCS NRCS Code 449: Irrigation water management.

SCS NRCS Code 533: Pumping plant for water control.

SCS NRCS -Code 642: Well.

14031.13.8. Underwriters Laboratories (UL) 333 Pfingsten Road, Northbrook, IL 60062-296 Standards

UL 486C-1995 Splicing Wire Connectors

UL 969-2013 Standard for Marking and Labeling Systems

UL 1310-2011 Standard for Class 2 Power Units

Section 14031.14 MATERIALS

The materials referenced below are exclusive to this section.

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14031.14.1 PVC pipe and fittings.

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14031.14.1.1 PVC pipe shall comply with one of the following standards ASTM D 1785, ASTM D 2241, AWWA C-900, or AWWA C-905. SDR-PR pipe shall have a minimum wall thickness as required by SDR-26. All pipe used with effluent water systems shall be designated for nonpotable use by either label or by the industry standard color purple.

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14031.14.1.2 All solvent-weld PVC fittings shall, at a minimum, meet the requirements of Schedule 40 as set forth in ASTM D 2466.

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14031.14.1.3. Threaded PVC pipe fittings shall meet the requirements of Schedule 40 as set forth in ASTM D 2464.

14031.14.1.4. PVC gasketed fittings shall conform to ASTM D 3139. Gaskets shall conform to ASTM F 477.

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~~14031.14.1.5. PVC flexible pipe should~~shall be pressure rated as described in ASTM D 2740 with standard outside diameters compatible with PVC IPS solvent-weld fittings.

~~14031.14.1.6. PVC cement should~~ shall meet ASTM D 2564. PVC cleaner-type should meet ASTM F 656.

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14031.14.2 Ductile iron pipe and fittings.

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14031.14.2.1 Gasket fittings for iron pipe shall be of materials and type compatible with the piping material being used.

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14031.14.3. Steel pipe and fittings.

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14031.14.3.1. All steel pipe shall be rated Schedule 40 or greater and be hot-dipped galvanized or black in accordance with ASTM 53.

14031.14.3.2 Threaded fittings for steel pipe shall be Schedule 40 Malleable Iron.

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14031.14.4 Polyethylene pipe.

~~14031.14.4.1 Flexible swing joints shall be thick-walled with a minimum pressure rating of 75 psi (517 kPa) in accordance with ASTM D 2239.~~

14031.14.4.2 Low pressure polyethylene pipe for micro-irrigation systems shall conform with ASAE S-435.

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14031.14.4.3 Use fittings manufactured specifically for the type and dimensions of polyethylene pipe used.

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14031.14.5 Sprinklers, spray heads, and emitters.

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14031.14.5.1 Units and nozzles shall be selected in accordance with the size of the area and the type of plant material being irrigated. Sprinklers shall fit the area they are intended to water without excessive overspray. Intentional direct spray onto walkways, buildings, roadways, and driveways is prohibited.

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14031.14.5.2 Equipment shall be used that is protected from contamination and damage by use of seals, screens, and springs where site conditions present a potential for damage.

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14031.14.5.3 Riser-mounted sprinklers shall be supported to minimize movement of the riser resulting from the action of the sprinkler.

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14031.14.5.4 Swing joints, either flexible or rigid, shall be constructed to provide a leak-free connection between the sprinkler and lateral pipeline to allow movement in any direction and to prevent equipment damage.

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14031.14.5.5 Check valves shall be installed on any sprinkler where low point drainage occurs.

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14031.14.5.6 The pop-up height for sprays and rotator nozzles shall be adequate to prevent being obstructed by the turf grass blades: 6" height for St. Augustine, Zoysia and Bahia and 4" height for Bermuda, Centapede and Seashore Paspalum.

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14031.14.5.7 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to PVC pipe to protect the emission devices from contamination from a PVC main or lateral break.

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14031.14.5.8 All microirrigation zones shall have adequate pressure regulation installed at the zone valve or at the point where the drip tubing is attached to the PVC to ensure that all emission devices meet the manufacturer's performance standards.

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14031.14.5.9 Each plant shall have a adequate number and size(gph) of microirrigation devices, properly placed to meet the plant water requirements for no rainfall.

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14031.14.5.10 All tubing shall be secured to prevent movement in accordance with manufacturer's specification.

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14031.14.6 Valves.

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14031.14.6.1 Valves shall have a maximum working pressure rating equal to or greater than the maximum pressure of the system, but not less than 125 psi (861 kPa). This requirement shall be waived for low mainline pressure systems [30 psi (207 kPa) or less].

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14031.14.6.2 Only valves that are constructed of materials designed for use with the water and soil conditions of the installation shall be used. Valves that are constructed from materials that will not be deteriorated by chemicals injected into the system shall be used on all chemical injection systems.

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14031.14.7 Valve boxes.

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14031.14.7.1 Valve boxes shall be constructed to withstand traffic loads common to the area in which they are installed. They should be sized to allow manual operation of the enclosed valves without excavation.

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14031.14.7.2. Each valve box shall be permanently labeled in accordance with UL 969 to identify its contents.

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14031.14.8 Low voltage wiring.

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14031.14.8.1 All low voltage wire which is directly buried shall be labeled for direct burial wire. Wire not labeled for direct burial shall be installed in watertight conduits, and be listed TWN or THHN type wire as described in the NEC. All wire traveling under any hardscape or roadway must installed within a conduit and sleeve.

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14031.14.8.2 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications, based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating, on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except single lot individual residential systems.

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14031.14.8.3 Connections shall be made using devices conforming to UL 486 specifically designed for direct burial. All splices shall be enclosed within a valve box.

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14031.14.9 Irrigation controllers.

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14031.14.9.1 All irrigation controllers shall conform to UL 1310 and the provisions of the National Electric Code (NEC) and be grounded in accordance with the manufacturer's specifications. Solid state controls shall be equipped with surge suppressors on the primary and secondary wiring, except single lot residential systems.

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14031.14.9.2 The controller housing or enclosure shall protect the controller from the hazards of the environment in which it is installed.

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14031.14.9.3 The rain switch shall be placed on a stationary structure minimum of 5-foot (1524 mm) clearance from other outdoor equipment, free and clear of any tree canopy or other overhead obstructions, and above the height of the sprinkler coverage. Soil moisture sensors and ET sensors shall be installed in accordance with manufacturer's specifications and Florida Statutes, Section 373.62.

14031.14.10 Pumps and wells.

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14031.14.10.1 Irrigation pump electrical control systems shall conform to the NEC and local building codes.

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14031.14.10.2 The pumping system shall be protected from the hazards of the environment in which it is installed.

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14031.14.10.3 Use electric motors with a nominal horsepower rating greater than the maximum horsepower requirement of the pump during normal operation. Motor shall have a service factor of at least 1.15.

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14031.14.10.4 Casings for drilled wells shall be steel, reinforced plastic mortar, plastic, or fiberglass pipe. Only steel pipe casings shall be used in driven wells. See NRCS code FL-642. Steel casings shall conform to ASTM A 589.

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14031.14.11 Chemical injection equipment.

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14031.14.11.1 Chemical injection equipment shall be constructed of materials capable of withstanding the potential corrosive effects of the chemicals being used. Equipment shall be used only for those chemicals for which it was intended as stated by the injection equipment manufacturer.

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14031.14.12 Filters and strainers.

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14031.14.12.1 Filtration equipment and strainers constructed of materials resistant to the potential corrosive and erosive effects of the water shall be used. They shall be sized to prevent the passage of foreign material that would obstruct the sprinkler/emitter outlets in accordance with the manufacturer's recommendations.

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Section 14031.15 INSTALLATION

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14031.15.1 Pipe installation.

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14031.15.1.1 Pipe shall be installed at sufficient depth below ground to protect it from hazards such as vehicular traffic or routine occurrences which occur in the normal use and maintenance of a property. Depths of cover shall meet or exceed NRCS Code 430-DD, Water Conveyance, as follows:

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14031.15.1.1.1 Vehicle traffic areas.

Pipe Size (inches)

Depth of Cover (inches)

½ – 2 ½

18 - 24

3 - 5

24 - 30

6 and larger

30 - 36

-

14031.15.1.1.2 All areas except vehicle traffic:

Pipe Size (inches)

Depth of Cover (inches)

½ – 1 ½

6

2 - 3

12

4 - 6

18

More than 6

24

-

14031.15.1.2 All pipe joints and connections shall be made according to manufacturer's specifications. All solvent-weld connections shall be performed in accordance with ASTM D 2855.

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14031.15.1.3 Minimum clearances shall be maintained between irrigation lines and other utilities. In no case shall one irrigation pipe rest upon another. For required minimum clearance to onsite sewage treatment and disposal systems, refer to Rule 64E-6.005(2)(b) of the Florida Administrative Code.

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14031.15.1.4 Thrust blocks shall be used on all gasketed PVC systems. They must be formed against a solid, hand-excavated trench wall undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and trench shall be filled to the height of the outside diameter of the pipe. Thrust blocks shall be sized in accordance with ASAE S-376.1.

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14031.15.1.5 The trench bottom shall be uniform, free of debris, and of sufficient width to properly place pipe and support it over its entire length. Native excavated material may be used to backfill the pipe trench. However, the initial backfill material shall be free from rocks or stones larger than 1-inch in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. Blocking or mounding shall not be used to bring the pipe to final grade.

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14031.15.1.6. Pipe sleeves shall be used to protect pipes or wires installed under pavement or roadways. Pipe sleeves two pipe sizes larger than the carrier pipe or twice the diameter of the wire bundle shall be used under the paving or roadway and extending a minimum of 3 feet beyond the paved area or as required by the Florida Department of Transportation (FDOT). Pipe sleeves shall be Sch 40. Proper backfill and compaction procedures shall be followed.

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14031.15.2 Control valve installation.

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14031.15.2.1 Valve installation shall allow enough clearance for proper operation and maintenance. Where valves are installed underground, they shall be provided with a valve box with cover extending from grade to the body of the valve. The top of the valve body should have a minimum of 6 inches (152 mm) of cover in nontraffic and noncultivated areas and 18 inches (457 mm) of cover in traffic areas. The valve box shall be installed to minimize the effect of soil intrusion within the valve box with the use of filter fabric, pea gravel, or other approved material. If an automatic valve is installed under each sprinkler, then the valve box may be omitted.

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14031.15.2.2 Valve boxes shall be installed so that they do not rest on the pipe and the box cover does not conflict with the valve stem or interfere with valve operation. They shall be flush with the ground surface and do not present a tripping hazard or interfere with routine maintenance of the landscape.

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14031.15.2.3. Quick coupling valves shall be installed on swing joints or flexible pipe with the top of the valve at ground level.

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14031.15.2.4 Any above-ground manually-operated valves on nonpotable water systems shall be adequately identified with distinctive purple colored paint. Hose bibb connections on irrigation systems that utilize nonpotable water supplies shall not be permitted.

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14031.15.3 Sprinkler installation.

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14031.15.3.1. On flat landscaped areas, sprinklers shall be installed plumb. In areas where they are installed on slopes, sprinklers may be tilted as required to prevent erosion. Sprinklers shall be adjusted to avoid unnecessary discharge on roads, pavements and structures.

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14031.15.3.2. There shall be a minimum separation of 4 inches (102 mm) between sprinklers and pavement. There shall be a minimum separation of 12 inches (305 mm) between sprinklers and buildings and other vertical structures. Piping shall be thoroughly flushed before installation of sprinkler nozzles. Surface mounted and pop-up heads shall be installed on swing joints, polyethylene (PE) nipples or flexible pipe. Polyethylene (PE) nipples shall not be used in maintenance equipment traffic areas or alongside roadways and driveways. Above-ground (riser mounted) sprinklers shall be mounted on Schedule 40 PVC or steel pipe and be stabilized.

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14031.15.4 Pump installation.

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14031.15.4.1 Pumps shall be installed in accordance with the manufacturer's specifications. Pumps shall be set plumb and secure to a firm concrete base. There shall be no strain or distortion on the pipe and fittings. Pipe and fittings shall be supported to avoid placing undue strain on the pump. Steel pipe shall be used on pumps 5 horsepower (hp) or larger.

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14031.15.4.2 Pumps shall be installed in a manner to avoid loss of prime. Suction line shall be installed to prevent the accumulation of air pockets. All connections and reductions in suction pipe sizes shall be designed to avoid causing air pockets and cavitation.

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14031.15.4.3 Pumps shall be located to facilitate service and ease of removal. Appropriate fittings shall be provided to allow the pump to readily be primed, serviced, and disconnected. An enclosure shall be provide of adequate size and strength, with proper ventilation, to protect the pump from the elements (except residential systems).

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14031.15.5 Low voltage wire installation.

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14031.15.5.1 Install low voltage wire (less than 98 volts) with a minimum depth of cover of 12 inches (305 mm) where not installed directly under the mainline. A sufficient length of wire shall be provided at each connection to allow for thermal expansion/shrinkage. As a minimum, a 12-inch (305 mm) diameter loop shall be provided at all splices and connections. Terminations at valves shall have 24 inches (610 mm) minimum free wire.

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14031.15.5.2 All above-ground wire runs and wire entries into buildings shall be installed in electrical conduit. Common wires with a different color than the power wires (white shall be used for common wires) shall be provided. Connections shall be made using devices conforming to UL 486C specifically designed for direct burial. All splices shall be enclosed within a valve box.

Exception: When wiring above ground manifolds from the valve to the ground immediately beneath it, no conduit is required.

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14031.15.6 Hydraulic control tubing installation

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14031.15.6.1. For hydraulic control systems, a water supply shall be used that is filtered and free of deleterious materials, as defined by the hydraulic control system manufacturer's specifications. A backflow prevention device shall be installed where the hydraulic control system is connected to potable water supplies.

14031.15.6.2 Tubing shall be installed in trenches and spaced so that it will not rub against pipe, fittings, or other objects that could score the tubing, and with a minimum 12-inch (305 mm)

diameter loop at all turns and connections A minimum depth of cover of 12 inches (305 mm) shall be provided.

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14031.15.6.3 Tubing shall be connected with couplings and collars according to Manufacturer's specifications. All splices shall be made in valve boxes. Tubing shall be prefilled with water to expel entrapped air and tested for leaks prior to installation.

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14031.15.6.4 Exposed tubing shall be installed in a protective conduit manufactured from Schedule 40 UV protected PVC or electrical conduit.

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14031.16 As-Built Drawings.

14031.16.1 An As-Built drawing shall be required of all irrigation systems installed on commercial and residential developments and shall contain the following information:

14031.16.1.1 Location, type, pressure and maximum flow available of all water sources.

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14031.16.1.2 Location, type and size of all components including sprinklers, microirrigation, main and lateral piping, master valves, valves, moisture sensors, rain sensors, controllers, pump start relays, backflow devices, pumps, wells, etc.

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14031.16.1.3 The flow rate, application rate (inches per hour), and the operating pressure for the sprinklers and micro irrigation within each zone.

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14031.16.1.4 The name, address, phone, email, professional license or certification number of the installation contractor.

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14031.16.1.5 Date of installation.

CHAPTER 14
LANDSCAPE IRRIGATION SYSTEMS
SECTION 1401
GENERAL

1401.1 Scope.

The provisions of Chapter 14 shall govern the materials, design, construction and installation of subsurface turf and landscape irrigation systems connected to either potable or nonpotable water from on-site water reuse systems.

Exception: All Turf and Landscape irrigation systems serving as drainfields for onsite sewage treatment and disposal systems shall be regulated by Chapter 64E-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems.

SECTION 1402

~~**Subsurface Landscape Irrigation Systems Connected to NonPotable On-site Water Reuse Systems**~~

~~**1402.1 Scope.**~~

~~The provisions of Section 1402 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems.~~

~~**1402.2 1402.2 Materials.**~~

~~Above-ground drain, waste and vent piping for subsurface landscape irrigation systems connected to NonPotable On-site Water Reuse Systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.~~

~~**1401.3 1402.3 Tests.**~~

~~Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.~~

~~**1401.4 1402.4 Inspections.**~~

~~Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.~~

~~**1401.5 1402.5 Disinfection.**~~

~~Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.~~

~~**1401.6 1402.6 Coloring.**~~

~~On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.~~

SECTION 1402

~~**SYSTEM DESIGN AND SIZING**~~

~~**1402.1 1402.7 Sizing.**~~

~~The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons-per-day-per-occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:~~

~~**(Equation 14-1)**~~

~~**where:**~~

~~**A = Number of occupants:**~~

~~Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.~~

~~Commercial—Number of occupants shall be determined by the *Florida Building Code, Building*.~~

~~**B = Estimated flow demands for each occupant:**~~

~~Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.~~

~~Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.~~

~~**C = Estimated gray water discharge based on the total number of occupants.**~~

~~1402.2 1402.8 Percolation tests.~~

~~The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.~~

~~1402.2.1 1402.8.1 Percolation tests and procedures.~~

~~At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.~~

~~1402.2.1.1 1402.8.1.1 Percolation test hole.~~

~~The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.~~

~~1402.2.1.2 1402.8.1.2 Test procedure, sandy soils.~~

~~The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1303.7.1.3.~~

~~1402.2.1.3 1402.8.1.3 Test procedure, other soils.~~

~~The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $\frac{1}{16}$ inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be~~

made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

1402.2.1.4 1402.8.1.4 Mechanical test equipment.

Mechanical percolation test equipment shall be of an approved type.

1402.2.2 1402.8.2 Permeability evaluation.

Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 1402.2.1.1 1402.8.1.1 for evaluating the soil.

1402.3 1402.9 Subsurface landscape irrigation site location.

The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 1402.3 1402.9. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

**TABLE 1402.3 1402.9
LOCATION OF SUBSURFACE IRRIGATION SYSTEM**

ELEMENT	MINIMUM HORIZONTAL DISTANCE	
	Storage tank (feet)	Irrigation disposal field (feet)
Buildings	5	2
Lot line adjoining private property	5	5
Water wells	50	100
Streams and lakes	50	50
Seepage pits	5	5
Septic tanks	0	5
Water service	5	5
Public water main	10	10

For SI: 1 foot = 304.8 mm.

**SECTION 14031
INSTALLATION**

14031.1 1402.10 Installation.

Absorption systems shall be installed in accordance with Sections 14031.1.1 1402.10.1 through 14031.1.5 1402.10.1.5 to provide landscape irrigation without surfacing of water.

14031.1.1 1402.10.1 Absorption area.

The total absorption area required shall be computed from the estimated daily gray water discharge and the design loading rate based on the percolation rate for the site. The required absorption area equals the estimated gray water discharge divided by the design loading rate from Table 14031.1.1 1402.10.1.

**TABLE 14031.1.1 1402.10.1
DESIGN LOADING RATE**

PERCOLATION RATE (minutes per inch)	DESIGN LOADING FACTOR (gallons per square foot per day)
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0 to less than 10	1.2
10 to less than 30	0.8
30 to less than 45	0.72
45 to 60	0.4

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

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14031.1.2 1402.10.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.

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14031.1.3 1402.10.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

14031.1.4 1402.10.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

14031.1.5 1402.10.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from ¹/₂ to 2¹/₂ inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

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14031.2 1402.11 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 14031.2 1402.11. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

TABLE 14031.2 1402.11

DISTRIBUTION PIPE

MATERIAL

Polyethylene (PE) plastic pipe

Polyvinyl chloride (PVC) plastic pipe

Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core or composite wall

For SI: 1 inch=25.4 mm.

14031.2.1 Joints.

Joints in distribution pipe shall be made in accordance with Section 705 of this code.

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SECTION 14031

Surface and Subsurface Landscape Irrigation Systems

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14031.1 Scope.

The provisions of Section 14031 shall govern the materials, design, construction and installation of turf and landscape irrigation systems that apply potable or nonpotable water by means of permanent above ground or subsurface sprinkler or microsprinkler equipment that move water through various means of mechanical pressure.

14031.1.2 This section shall apply to all irrigation systems used on residential and commercial landscape areas.

14031.1.3 This section shall apply to all new irrigation systems and any new work to existing irrigation systems.

Exception. This section shall not apply to irrigation systems for golf courses, nurseries, greenhouses, or agricultural production systems.

14031.1.4 Nothing contained in this section shall be deemed to require any irrigation system or part thereof, which existed prior to the establishment of this code, to be changed altered or modified to meet the standards of this code.

14031.2 Permits.

14031.2.1 A permit shall be required for new installation of landscape irrigation systems and for repairs or modifications to the system design that exceed \$1000.00 in labor and material based on invoice value.

14031.2.2 No permit shall be required for general maintenance or repairs which do not change the structure or alter the system and the value of which does not exceed \$1000.00 in labor and material based on invoice value. -

14031.3 Preconstruction submittals.

14031.3.1 Plans or drawings.

14031.3.1.1 Single-family residence. Design drawings or shop drawings, where required, shall be provided for the installation of irrigation systems prior to start of construction. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, and include all improvements. Drawings shall be prepared by a licensed plumbing or irrigation contractor or licensed landscape architect.

14031.3.1.2 Commercial, industrial, municipal and multiple-family. Professionally designed drawings prior to start of construction shall be provided for landscape irrigation systems. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated,

including all improvements, and shall include but not be limited to: date, scale, revisions, legend, specifications which list all aspects of equipment and assembly there of, water source, water meter and/or point of connection, backflow prevention devices, pump station size, pump station location, design operating pressure and flow rate per zone, precipitation rate per zone, locations of pipe, controllers, valves, sprinklers, sleeves, gate valves, sensors, etc. The plans and specifications shall be prepared in accordance with Section 107 of the Florida Building Code, Building.

14031.4 Definitions. The following definitions are exclusive to this section of the code.

ABS Pipe. Acrylonitrile-butadiene-styrene black, semi-rigid, plastic pipe extruded to IPS. ABS pipe is in limited use in present day irrigation systems. Solvent weld fittings are used with this pipe (see ASTM D 1788).

Air Release Valve. A valve which will automatically release to the atmosphere accumulated small pockets of air from a pressurized pipeline. A small orifice is used to release air at low flow rates. Air release valves are normally required at all summits of mainline and submain pipelines in an irrigation system.

Anti-Siphon Device. A safety device used to prevent back-flow of irrigation water to the water source by back-siphonage.

Application Rate. The average rate at which water is applied by an irrigation system, sometimes also called precipitation rate. Units are typically inches/hr or mm/hr.

Application uniformity. Irrigation application uniformity (also known as distribution uniformity) describes how evenly water is distributed within an irrigation zone.

Arc. The angle of coverage of a sprinkler in degrees from one side of throw to the other. A 90-degree arc would be a quarter-circle sprinkler.

Atmospheric Vacuum Breaker (AVB). An anti-siphon backflow device which uses a floating seat to allow an air break to interrupt the vacuum effect on water flow.

Automatic Control Valve. A valve in a sprinkler system which is activated by an automatic controller by way of hydraulic or electrical control lines and controls a single device or multiple devices.

Automatic System. An irrigation system which operates following a preset program entered into an automatic controller.

Backflow Prevention Device. An approved safety device used to prevent pollution or contamination of the irrigation water supply due to backflow from the irrigation system.

Belled (Pipe). Pipe which is enlarged at one end so that the spigot end of another length of pipe can be inserted into it during the assembly of a pipeline.

Block (of sprinklers). A group of sprinklers controlled by one valve. Also called zones or subunits.

Block System. An irrigation system in which several groups of sprinklers are controlled by one valve for each group.

Bubbler Irrigation. The application of water to the soil surface or a container as a small stream or fountain. Bubbler emitter discharge rates generally range from 0.5 to 2 gpm but are generally less than 60 gph.

Check Valve. A valve which permits water to flow in one direction only.

Chemical Water Treatment. The addition of chemicals to water to make it acceptable for use in irrigation systems

Chemigation. The application of water soluble chemicals by mixing or injecting with the water applied through an irrigation system.

Contractor. Any person who engages in the fabrication and installation of any type of irrigation system on a contractual basis in accordance with all stipulations receiving compensation.

Control Lines. Hydraulic or electrical lines which carry signals to open and close the valves from the controller to the automatic valves.

Controller. The timing mechanism and its mounting box. The controller signals the automatic valves to open and close on a pre-set program or based on sensor readings.

Coverage. Refers to the way water is applied to an area.

Cycle. Refers to one complete run of a controller through all programmed controller stations.

Demand (or irrigation demand). Refers to the irrigation requirements of the irrigated area. Demand primarily depends on the type of crop, stage of growth, and climatic factors.

Design Area. The specific land area to which water is to be applied by an irrigation system.

Design Emission Uniformity. An estimate of the uniformity of water application with an irrigation system.

Design Pressure. The pressure at which the irrigation system or certain components are designed to operate. The irrigation system design pressure is that measured at the pump discharge or entrance to the system if there is no pump, and a zone design pressure is the average operating pressure of all emitters within that zone.

Direct Burial Wire. Plastic-coated single-strand copper wire for use as control line for electric valves.

Discharge Rate. The instantaneous flow rate of an individual sprinkler, emitter, or other water emitting device, or a unit length of line-source micro irrigation tubing. Also, the flow rate from a pumping system or from a reduced pressure assembly or relief valve.

Double Check Valve. An approved assembly of two single, independently-acting check valves with test ports to permit independent testing of each check valve.

Drain Valve. A valve used to drain water from a line. The valve may be manually or automatically operated.

Drip Irrigation. The precise low-rate application of water to or beneath the soil surface near or directly into the plant root zone. Applications normally occur as small streams, discrete or continuous drops, in the range of 0.5 to 2.0 gph.

Effluent water. Also referred to as reclaimed or gray water is wastewater which has been treated per Florida Statute, §403.086 and is suitable for use as a water supply for irrigation systems.

Emitters. Devices which are used to control the discharge of irrigation water from lateral pipes. This term is primarily used to refer to the low flow rate devices used in micro irrigation systems.

Fertigation. The application of soluble fertilizers with the water applied through an irrigation system.

Filtration System. The assembly of physical components used to remove suspended solids from irrigation water. These include both pressure and gravity type devices, such as settling basins, screens, media filters, and centrifugal force units (vortex sand separators).

Flexible Swing Joint. A flexible connection between the lateral pipe and the sprinkler which allows the sprinkler to move when force is applied to it.

Flow Meters. Devices used to measure the volume of flow of water (typically in gallons), or flow rates (typically in gpm), and to provide data on system usage.

Gauge (Wire). Standard specification for wire size. The larger the gauge number, the smaller the wire diameter.

Head. A sprinkler head. Sometimes used interchangeably with and in conjunction with "Sprinkler."

Infiltration Rate. The rate of water flow across the surface of the soil and into the soil profile. Units are usually inches/hr.

Irrigation. Application of water by artificial means, that is, means other than natural precipitation. Irrigation is practiced to supply crop water requirements, leach salts, apply chemicals, and for environmental control including crop cooling and freeze protection.

Irrigation Water Requirement or Irrigation Requirement. The quantity of water that is required for crop production, exclusive of effective rainfall.

Landscape. Refers to any and all areas which are ornamentally planted, including but not limited to turf, ground covers, flowers, shrubs, trees, and similar plant materials as opposed to agricultural crops grown and harvested for monetary return.

Lateral. The water delivery pipeline that supplies water to the emitters or sprinklers from a manifold or header pipeline downstream of the control valve.

Line-Source Emitters. Lateral pipelines which are porous or contain closely-spaced perforations so that water is discharged as a continuous band or in overlapping patterns rather than discrete widely-spaced points along the pipeline length.

Looped System. A piping system which allows more than one path for water to flow from the supply to the emitters or sprinklers.

Low Volume Sprinklers. Sprinkler heads that emit less than .5 gallons per minute.

Mainline. A pipeline which carries water from the control station to submains or to manifolds or header pipelines of the water distribution system.

Manifold. The water delivery pipeline that conveys water from the main or submain pipelines to the laterals. Also sometimes called a header pipeline.

Manual System. A system in which control valves are manually operated rather than operated by automatic controls.

Matched Precipitation. An equal distribution of water over a given area or zone.

Meter Box. A concrete or plastic box buried flush to grade which houses flow (water) meters or other components.

Microirrigation. The frequent application of small quantities of water directly on or below the soil surface, usually as discrete drops, tiny streams, or miniature sprays through emitters placed along the water delivery pipes (laterals). Microirrigation encompasses a number of methods or concepts, including drip, subsurface, bubbler, and spray irrigation. Previously known as trickle irrigation.

Overlap. The amount one sprinkler pattern overlaps another one when installed in a pattern. Expressed as a percentage of the diameter of coverage.

PE Pipe. Flexible polyethylene pipe for use in irrigation systems, normally manufactured with carbon black for resistance to degradation by ultraviolet radiation.

Potable Water. Water which is suitable in quality for human consumption and meets the requirements of the Health Authority having jurisdiction.

Pressure Relief Valve. A valve which will open and discharge to atmosphere when the pressure in a pipeline or pressure vessel exceeds a pre-set point to relieve the high-pressure condition.

Pressure Vacuum Breaker. A backflow prevention device which includes a spring-loaded check valve and a spring-loaded vacuum breaker to prevent the backflow of irrigation system water to the water source.

Pumping Station. The pump or pumps that provide water to an irrigation system, together with all of the necessary accessories such as bases or foundations, sumps, screens, valves, motor controls, safety devices, shelters and fences.

PVC Pipe. Polyvinyl chloride plastic pipe made in standard thermoplastic pipe dimension ratios and pressure rated for water. Manufactured in accordance with AWWA C-900 or ASTM D-2241.

Rain Shut off Device. A calibrated device that is designed to detect rainfall and override the irrigation cycle of the sprinkler system when a predetermined amount of rain fall has occurred.

Reduced Pressure Principle Backflow Preventer (RPZD) (also known as Reduced Pressure Zone Device RPZ or RPZ Valve). A type of backflow prevention device used to protect water supplies from contamination.

Riser. A threaded pipe to which sprinklers or other emitters are attached for above-ground placement.

Runoff. The result of excess water applied either naturally (precipitation) or mechanically (irrigation) that exceeds the absorption rate of the soil, moving to an area of a lower elevation.

Sleeve. A pipe used to enclose other pipes, wire, or tubing; usually under pavement, sidewalks, or planters.

Spacing. The distance between sprinklers or other emitters.

Spray Irrigation. The micro irrigation application of water to the soil or plant surface by low flow rate sprays or mists.

Sprinkler. The sprinkler head. Sometimes called “Head.”

Supply (Water Source). The origin of the water used in the irrigation system.

Swing Joint. A ridged connection between the lateral pipe and the sprinkler, utilizing multiple elbows and nipples, which allows the sprinkler to move when force is applied to it.

Tubing. Generally used to refer to flexible plastic hydraulic control lines which are usually constructed of PE or PVC.

14031.4 DESIGN CRITERIA

14031.4.1 Design defined. Within the scope of this code, irrigation system design is defined as the science and art of properly selecting and applying all components within the system

14031.4.2 Water supply.

14031.4.2.1 The water source shall be adequate from the stand-point of volume, flow rate, pressure, and quality to meet the irrigation requirements of the area to be irrigated, as well as other demands, if any, both at the time the system is designed and for the expected life of the system.

14031.4.2.2 If the water source is effluent, it shall meet the advanced waste treatment standard as set forth in Florida Statute §403.086(4) as well as any other standard as set forth by the controlling governmental agency.

14031.4.3 Application uniformity.

14031.4.3.1 Sprinkler irrigation systems shall be designed with the appropriate uniformity for the type of plants being grown and the type of soil found in that area. The general watering of different types of plants as one group without regard to their individual water requirements shall be avoided.

14031.4.3.2 Sprinkler head spacing, type and nozzle selection that achieves the highest application uniformity shall be utilized.

14031.4.3.3 Application rates which avoid runoff and permit uniform water infiltration into the soil shall be utilized. Land slope, soil hydraulic properties, vegetative ground cover, and prevailing winds and sun exposure shall be considered when application rates are specified. Different types of sprinklers with different application rates, i.e., spray heads vs. rotor heads, bubbler heads vs rotor heads, shall not be combined on the same zone or circuit.

14031.4 System zoning. The irrigation system shall be divided into zones based on consideration of the following hydrozoning practices.

14031.4.1 Available flow rate.

14031.4.2 Cultural use of the area.

14031.4.3 Type of vegetation irrigated, i.e., turf, shrubs, native plants, etc.

14031.4.4 Type of sprinkler, i.e., sprinklers with matching precipitation rates.

14031.4.5 Soil characteristics and slope.

14031.4.6 Sun exposure.

14031.5 Sprinkler/emitter spacing and selection.

14031.5.1 Sprinkler/Emitter spacing shall be determined considering the irrigation requirements, hydraulic characteristics of the soil and device, and water quality with its effect on plant growth, sidewalks, buildings, and public access areas.

14031.5.2 All pop-up spray head bodies in turf areas shall be no less than 6" in height for St. Augustine, Zoysia and Bahia and no less than 4" in height for Bermuda, Centapede and Seashore Paspalum.

14031.5.3 Sprinklers shall be located in accordance with manufacturer's specifications in each irrigated zone area for a matched precipitation rate objective.

14031.5.4 Single row head spacing shall only occur when an additional row will cause saturated soils at the toe of a slope or other inefficiencies.

14031.5.5 All heads shall not exceed 50% of manufacturer's specified diameters of coverage.

14031.5.6 Water conservation shall be taken into consideration by minimizing irrigation of non-vegetated areas.

14031.5.7 Microirrigation systems shall be designed using the Emission Uniformity concept. Microirrigation emitters shall be spaced to wet 100 percent of the root zone in turf areas and 50 percent of the root zone for shrubs and trees.

14031.5.8 Microirrigation or low volume heads shall be required in all areas to be irrigated that are less than 4 feet in any direction from the emitter or nozzle.

14031.5.9 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to supply pipelines to protect the emission devices from contamination from a PD main or lateral break.

14031.5.10 Each plant shall have an adequate number and size (gph) of microirrigation devices, properly placed, to meet the plant water requirements for no rainfall.

14031.6 Pipelines. Pipelines shall be sized to limit pressure variations so that the working pressure at all points in the irrigation system will be in the range required for uniform water application. Velocities shall not exceed 5 feet (1524 mm) per second.

14031.7 Wells.

14031.7.1 Well diameters, depths and location shall correspond to the irrigation system demand and in compliance to all applicable state, regulatory agencies and local codes and regulations.

14031.8 Pumps.

14031.8.1 Pump and motor combinations shall be capable of satisfying the total system demand without invading the service factor of the motor except during start-up and between zones.

14031.8.2 Pumps shall be positioned with respect to the water surface in order to ensure that the net positive suction head required (NPSHr) for proper pump operation is achieved.

14031.8.3 The pumping system shall be protected against the effects of the interruption of water flow.

14031.9 Control valves.

14031.9.1 Control valve size shall be based on the flow rate through the valve. Friction loss through the valve, an approved air gap separation, or a reduced pressure assembly shall not exceed 10 percent of the static mainline head.

14031.9.2 Control systems using hydraulic communication between controller and valve(s) shall comply with the manufacturer's recommendations for maximum distance between controller and valve, both horizontally and vertically (elevation change).

14031.9.3 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications; based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except individual, single lot residential systems.

14031.9.4 Manually operated control valves shall be located so that they can be operated without wetting the operator.

14031.9.5 In ground valves shall be located away from large tree and palm root zones.

14031.9.6 A manual shut off valve shall be required to be installed close to the point of connection but downstream from any backflow device (or/unless included in the backflow device) to minimize water loss when the system is shut off for repairs or emergencies.

14031.9.7 An automatic shut-off valve or master valve (normally closed) is required on all systems with a constantly pressurized mainline to confine the water loss from minor main line leaks, weeping valves, or stuck on valves to just the time the system is operating automatically.

14031.10 Automatic irrigation controller. Automatic irrigation controllers shall conform to UL 1310 and have an adequate number of stations and power output per station to accommodate the irrigation system design. The controller shall be capable of incorporating a rain shut off device or other sensors to override the irrigation cycle when adequate rainfall has occurred, as required by Florida Statutes, Section 373.62.

14031.11 Chemical injection.

14031.11.1 Chemical injection systems for the injection of fertilizer, pesticides, rust inhibitors, or any other injected substance will be located and sized according to the manufacturers' recommendations.

14031.11.2 Injection systems shall be located downstream of the applicable backflow prevention devices as required by Florida Statutes, Section 487.021 and 487.055; the Environmental Protection Agency (EPA); Pesticide Regulation Notice 87-1; or other applicable codes.

14031.11.3 If an irrigation water supply is also used for human consumption, an air gap separation or an approved reduced pressure principal backflow prevention device shall be required in compliance with ASSE 1013 and Section 14031.12.

14031.12 Backflow prevention methods. Backflow prevention assemblies at all cross connections with all water supplies shall be provided in accordance with county, municipal or other applicable codes. In the event of conflicting regulations the assembly type shall be provided which gives the highest degree of protection.

14031.12.1 Irrigation systems into which chemicals are injected shall conform to Florida state law (Florida Statutes 487.021 and 487.055) and Environmental Protection Agency Pesticide Regulation Notice 87-1, which requires backflow prevention regulations to be printed on the chemical label.

14031.12.1.1 For municipal water supplies, chemical injection equipment must be separated from the water supply by an approved air gap separation or a reduced pressure principle assembly that is approved by the Foundation for CCC and the Hydraulic Research Institute. The equipment shall comply with ASSE 1013 to protect the water supply from back-siphonage and back-pressure.

14031.12.1.2 For other water supplies, Florida State law, EPA regulations, or other applicable local codes shall be followed. In the absence of legal guidelines, at minimum, a PVD Pressure Vacuum Breaker shall be required.

SECTION 14031.13 REFERENCED STANDARDS

The standards referenced below are exclusive to this section.

14031.13.1 American Society of Agricultural Engineers (ASAE) Standards:

ASAE S330.1: Procedure for sprinkler distribution testing for research purposes.

ASAE S376.1: Design, installation, and performance of underground thermoplastic irrigation pipelines.

ASAE S397.1: Electrical service and equipment for irrigation.

ASAE S435: Drip/Trickle Polyethylene Pipe used for irrigation laterals.

ASAE S398.1: Procedure for sprinkler testing and performance reporting.

ASAE S339: Uniform classification for water hardness.

ASAE S394: Specifications for irrigation hose and couplings used with self-propelled, hose-drag agricultural irrigation system.

ASAE EP400.1: Designing and constructing irrigation wells.

ASAE EP405: Design, installation, and performance of trickle irrigation systems.

ASAE EP409: Safety devices for applying liquid chemicals through irrigation systems.

14031.13.2 ASTM International Standards:

ASTM D 2241: Poly (Vinyl Chloride) (PVC) Plastic pipe (SDR-PR).

ASTM D 2239: Specification for polyethylene (PE) plastic pipe (SDR-PR).

ASTM D 2466: Specification for socket-type poly (vinyl chloride) (PVC) and chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 40.

ASTM D 2855: Standard recommended practice for making solvent cemented joints with polyvinyl chloride pipe and fittings.

ASTM D 3139: Specification for joints for plastic pressure pipes using flexible elastomeric seals.

ASTM F 477: Specification for elastomeric seals (gaskets for joining plastic pipe).

14031.13.3 American Water Works Association (AWWA) standards:

AWWA C-900: PVC pipe standards and specifications

14031.13.4 American Society of Sanitary Engineers (ASSE) Standards:

ASSE 1001: Pipe applied atmospheric type vacuum breakers.

ASSE 1013: Reduced pressure principle backflow preventers.

ASSE 1015: Double check valve backflow preventers.

ASSE 1020: Vacuum breakers, anti-siphon, pressure type backflow preventers.

ASSE 1024: Dual check valve backflow preventers.

14031.13.5 Hydraulic Institute Standards, 14th Edition

**14031.13.6 Standards and Specifications for Turf and Landscape Irrigation Systems
Florida Irrigation Society (FIS) Standards**

14031.13.7 Soil Conservation Service (SCS) Natural Resources Conservation Service (NRCS) Field Office Technical Guide, Section IV-A — Cropland Codes:

~~SCS NRCS~~ Code 430-DD: Irrigation water conveyance, underground, plastic pipeline.

~~SCS NRCS~~ Code 430-EE: Irrigation water conveyance. Low pressure, underground, plastic pipeline.

~~SCS NRCS~~ Code 430-FF: Irrigation water conveyance, steel pipeline.

~~SCS NRCS~~ Code 441-1: Irrigation system, trickle.

~~SCS NRCS~~ Code 442: Irrigation system sprinkler.

~~SCS NRCS~~ Code 449: Irrigation water management.

~~SCS NRCS~~ Code 533: Pumping plant for water control.

~~SCS NRCS~~ Code 642: Well.

**14031.13.8. Underwriters Laboratories (UL) 333 Pfingsten Road, Northbrook, IL 60062-296
Standards**

UL 486C-1995 Splicing Wire Connectors

UL 969-2013 Standard for Marking and Labeling Systems

UL 1310-2011 Standard for Class 2 Power Units

Section 14031.14 MATERIALS

The materials referenced below are exclusive to this section.

14031.14.1 PVC pipe and fittings.

14031.14.1.1 PVC pipe shall comply with one of the following standards ASTM D 1785, ASTM D 2241, AWWA C-900, or AWWA C-905. SDR-PR pipe shall have a minimum wall thickness as required by SDR-26. All pipe used with effluent water systems shall be designated for nonpotable use by either label or by the industry standard color purple.

14031.14.1.2 All solvent-weld PVC fittings shall, at a minimum, meet the requirements of Schedule 40 as set forth in ASTM D 2466.

14031.14.1.3. Threaded PVC pipe fittings shall meet the requirements of Schedule 40 as set forth in ASTM D 2464.

14031.14.1.4. PVC gasketed fittings shall conform to ASTM D 3139. Gaskets shall conform to ASTM F 477.

14031.14.1.5. PVC flexible pipe ~~should~~ shall be pressure rated as described in ASTM D 2740 with standard outside diameters compatible with PVC IPS solvent-weld fittings.

14031.14.1.6. PVC cement ~~should~~ shall meet ASTM D 2564. PVC cleaner-type should meet ASTM F 656.

14031.14.2 Ductile iron pipe and fittings.

14031.14.2.1 Gasket fittings for iron pipe shall be of materials and type compatible with the piping material being used.

14031.14.3. Steel pipe and fittings.

14031.14.3.1. All steel pipe shall be rated Schedule 40 or greater and be hot-dipped galvanized or black in accordance with ASTM 53.

14031.14.3.2 Threaded fittings for steel pipe shall be Schedule 40 Malleable Iron.

14031.14.4 Polyethylene pipe.

14031.14.4.1 Flexible swing joints shall be thick-walled with a minimum pressure rating of 75 psi (517 kPa) in accordance with ASTM D 2239.

14031.14.4.2 Low pressure polyethylene pipe for micro-irrigation systems shall conform with ASAE S-435.

14031.14.4.3 Use fittings manufactured specifically for the type and dimensions of polyethylene pipe used.

14031.14.5 Sprinklers, spray heads, and emitters.

14031.14.5.1 Units and nozzles shall be selected in accordance with the size of the area and the type of plant material being irrigated. Sprinklers shall fit the area they are intended to water without excessive overspray. Intentional direct spray onto walkways, buildings, roadways, and driveways is prohibited.

14031.14.5.2 Equipment shall be used that is protected from contamination and damage by use of seals, screens, and springs where site conditions present a potential for damage.

14031.14.5.3 Riser-mounted sprinklers shall be supported to minimize movement of the riser resulting from the action of the sprinkler.

14031.14.5.4 Swing joints, either flexible or rigid, shall be constructed to provide a leak-free connection between the sprinkler and lateral pipeline to allow movement in any direction and to prevent equipment damage.

14031.14.5.5 Check valves shall be installed on any sprinkler where low point drainage occurs.

14031.14.5.6 The pop-up height for sprays and rotator nozzles shall be adequate to prevent being obstructed by the turf grass blades: 6" height for St. Augustine, Zoysia and Bahia and 4" height for Bermuda, Centapede and Seashore Paspalum.

14031.14.5.7 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to PVC pipe to protect the emission devices from contamination from a PVC main or lateral break.

14031.14.5.8 All microirrigation zones shall have adequate pressure regulation installed at the zone valve or at the point where the drip tubing is attached to the PVC to ensure that all emission devices meet the manufacturer's performance standards.

14031.14.5.9 Each plant shall have a adequate number and size(gph) of microirrigation devices, properly placed to meet the plant water requirements for no rainfall.

14031.14.5.10 All tubing shall be secured to prevent movement in accordance with manufacturer's specification.

14031.14.6 Valves.

14031.14.6.1 Valves shall have a maximum working pressure rating equal to or greater than the maximum pressure of the system, but not less than 125 psi (861 kPa). This requirement shall be waived for low mainline pressure systems [30 psi (207 kPa) or less].

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14031.14.6.2 Only valves that are constructed of materials designed for use with the water and soil conditions of the installation shall be used. Valves that are constructed from materials that will not be deteriorated by chemicals injected into the system shall be used on all chemical injection systems.

14031.14.7 Valve boxes.

14031.14.7.1 Valve boxes shall be constructed to withstand traffic loads common to the area in which they are installed. They should be sized to allow manual operation of the enclosed valves without excavation.

14031.14.7.2. Each valve box shall be permanently labeled in accordance with UL 969 to identify its contents.

14031.14.8 Low voltage wiring.

14031.14.8.1 All low voltage wire which is directly buried shall be labeled for direct burial wire. Wire not labeled for direct burial shall be installed in watertight conduits, and be listed TWN or THHN type wire as described in the NEC. All wire traveling under any hardscape or roadway must installed within a conduit and sleeve.

14031.14.8.2 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications, based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating, on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except single lot individual residential systems.

14031.14.8.3 Connections shall be made using devices conforming to UL 486 specifically designed for direct burial. All splices shall be enclosed within a valve box.

14031.14.9 Irrigation controllers.

14031.14.9.1 All irrigation controllers shall conform to UL 1310 and the provisions of the National Electric Code (NEC) and be grounded in accordance with the manufacturer's specifications. Solid state controls shall be equipped with surge suppressors on the primary and secondary wiring, except single lot residential systems.

14031.14.9.2 The controller housing or enclosure shall protect the controller from the hazards of the environment in which it is installed.

14031.14.9.3 The rain switch shall be placed on a stationary structure minimum of 5-foot (1524 mm) clearance from other outdoor equipment, free and clear of any tree canopy or other overhead obstructions, and above the height of the sprinkler coverage. Soil moisture sensors and ET sensors shall be installed in accordance with manufacturer's specifications and Florida Statutes, Section 373.62.

14031.14.10 Pumps and wells.

14031.14.10.1 Irrigation pump electrical control systems shall conform to the NEC and local building codes.

14031.14.10.2 The pumping system shall be protected from the hazards of the environment in which it is installed.

14031.14.10.3 Use electric motors with a nominal horsepower rating greater than the maximum horsepower requirement of the pump during normal operation. Motor shall have a service factor of at least 1.15.

14031.14.10.4 Casings for drilled wells shall be steel, reinforced plastic mortar, plastic, or fiberglass pipe. Only steel pipe casings shall be used in driven wells. See NRCS code FL-642. Steel casings shall conform to ASTM A 589.

14031.14.11 Chemical injection equipment.

14031.14.11.1 Chemical injection equipment shall be constructed of materials capable of withstanding the potential corrosive effects of the chemicals being used. Equipment shall be used only for those chemicals for which it was intended as stated by the injection equipment manufacturer.

14031.14.12 Filters and strainers.

14031.14.12.1 Filtration equipment and strainers constructed of materials resistant to the potential corrosive and erosive effects of the water shall be used. They shall be sized to prevent the passage of foreign material that would obstruct the sprinkler/emitter outlets in accordance with the manufacturer's recommendations.

Section 14031.15 INSTALLATION

14031.15.1 Pipe installation.

14031.15.1.1 Pipe shall be installed at sufficient depth below ground to protect it from hazards such as vehicular traffic or routine occurrences which occur in the normal use and maintenance of a property. Depths of cover shall meet or exceed NRCS Code 430-DD, Water Conveyance, as follows:

14031.15.1.1.1 Vehicle traffic areas.

Pipe Size (inches)

Depth of Cover (inches)

½ – 2 ½

18 - 24

3 - 5

24 - 30

6 and larger

30 - 36

14031.15.1.1.2 All areas except vehicle traffic:

Pipe Size (inches)

Depth of Cover (inches)

½ – 1 ½

6

2 - 3

12

4 - 6

18

More than 6

24

14031.15.1.2 All pipe joints and connections shall be made according to manufacturer's specifications. All solvent-weld connections shall be performed in accordance with ASTM D 2855.

14031.15.1.3 Minimum clearances shall be maintained between irrigation lines and other utilities. In no case shall one irrigation pipe rest upon another. For required minimum clearance to onsite sewage treatment and disposal systems, refer to Rule 64E-6.005(2)(b) of the Florida Administrative Code.

14031.15.1.4 Thrust blocks shall be used on all gasketed PVC systems. They must be formed against a solid, hand-excavated trench wall undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and trench shall be filled to the height of the outside diameter of the pipe. Thrust blocks shall be sized in accordance with ASAE S-376.1.

14031.15.1.5 The trench bottom shall be uniform, free of debris, and of sufficient width to properly place pipe and support it over its entire length. Native excavated material may be used to backfill the pipe trench. However, the initial backfill material shall be free from rocks or stones larger than 1-inch in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. Blocking or mounding shall not be used to bring the pipe to final grade.

14031.15.1.6. Pipe sleeves shall be used to protect pipes or wires installed under pavement or roadways. Pipe sleeves two pipe sizes larger than the carrier pipe or twice the diameter of the wire bundle shall be used under the paving or roadway and extending a minimum of 3 feet beyond the paved area or as required by the Florida Department of Transportation (FDOT). Pipe sleeves shall be Sch 40. Proper backfill and compaction procedures shall be followed.

14031.15.2 Control valve installation.

14031.15.2.1 Valve installation shall allow enough clearance for proper operation and maintenance. Where valves are installed underground, they shall be provided with a valve box with cover extending from grade to the body of the valve. The top of the valve body should have

a minimum of 6 inches (152 mm) of cover in nontraffic and noncultivated areas and 18 inches (457 mm) of cover in traffic areas. The valve box shall be installed to minimize the effect of soil intrusion within the valve box with the use of filter fabric, pea gravel, or other approved material. If an automatic valve is installed under each sprinkler, then the valve box may be omitted.

14031.15.2.2 Valve boxes shall be installed so that they do not rest on the pipe and the box cover does not conflict with the valve stem or interfere with valve operation. They shall be flush with the ground surface and do not present a tripping hazard or interfere with routine maintenance of the landscape.

14031.15.2.3. Quick coupling valves shall be installed on swing joints or flexible pipe with the top of the valve at ground level.

14031.15.2.4 Any above-ground manually-operated valves on nonpotable water systems shall be adequately identified with distinctive purple colored paint. Hose bibb connections on irrigation systems that utilize nonpotable water supplies shall not be permitted.

14031.15.3 Sprinkler installation.

14031.15.3.1. On flat landscaped areas, sprinklers shall be installed plumb. In areas where they are installed on slopes, sprinklers may be tilted as required to prevent erosion. Sprinklers shall be adjusted to avoid unnecessary discharge on roads, pavements and structures.

14031.15.3.2. There shall be a minimum separation of 4 inches (102 mm) between sprinklers and pavement. There shall be a minimum separation of 12 inches (305 mm) between sprinklers and buildings and other vertical structures. Piping shall be thoroughly flushed before installation of sprinkler nozzles. Surface mounted and pop-up heads shall be installed on swing joints, polyethylene (PE) nipples or flexible pipe. Polyethylene (PE) nipples shall not be used in maintenance equipment traffic areas or alongside roadways and driveways. Above-ground (riser mounted) sprinklers shall be mounted on Schedule 40 PVC or steel pipe and be stabilized.

14031.15.4 Pump installation.

14031.15.4.1 Pumps shall be installed in accordance with the manufacturer's specifications. Pumps shall be set plumb and secure to a firm concrete base. There shall be no strain or distortion on the pipe and fittings. Pipe and fittings shall be supported to avoid placing undue strain on the pump. Steel pipe shall be used on pumps 5 horsepower (hp) or larger.

14031.15.4.2 Pumps shall be installed in a manner to avoid loss of prime. Suction line shall be installed to prevent the accumulation of air pockets. All connections and reductions in suction pipe sizes shall be designed to avoid causing air pockets and cavitation.

14031.15.4.3 Pumps shall be located to facilitate service and ease of removal. Appropriate fittings shall be provided to allow the pump to readily be primed, serviced, and disconnected. An enclosure shall be provide of adequate size and strength, with proper ventilation, to protect the pump from the elements (except residential systems).

14031.15.5 Low voltage wire installation.

14031.15.5.1 Install low voltage wire (less than 98 volts) with a minimum depth of cover of 12 inches (305 mm) where not installed directly under the mainline. A sufficient length of wire shall be provided at each connection to allow for thermal expansion/shrinkage. As a minimum, a 12-inch (305 mm) diameter loop shall be provided at all splices and connections. Terminations at valves shall have 24 inches (610 mm) minimum free wire.

14031.15.5.2 All above-ground wire runs and wire entries into buildings shall be installed in electrical conduit. Common wires with a different color than the power wires (white shall be used for common wires) shall be provided. Connections shall be made using devices conforming to UL 486C specifically designed for direct burial. All splices shall be enclosed within a valve box.

Exception: When wiring above ground manifolds from the valve to the ground immediately beneath it, no conduit is required.

14031.15.6 Hydraulic control tubing installation

14031.15.6.1. For hydraulic control systems, a water supply shall be used that is filtered and free of deleterious materials, as defined by the hydraulic control system manufacturer's specifications. A backflow prevention device shall be installed where the hydraulic control system is connected to potable water supplies.

14031.15.6.2 Tubing shall be installed in trenches and spaced so that it will not rub against pipe, fittings, or other objects that could score the tubing, and with a minimum 12-inch (305 mm) diameter loop at all turns and connections A minimum depth of cover of 12 inches (305 mm) shall be provided.

14031.15.6.3 Tubing shall be connected with couplings and collars according to Manufacturer's specifications. All splices shall be made in valve boxes. Tubing shall be prefilled with water to expel entrapped air and tested for leaks prior to installation.

14031.15.6.4 Exposed tubing shall be installed in a protective conduit manufactured from Schedule 40 UV protected PVC or electrical conduit.

14031.16 As-Built Drawings.

14031.16.1 An As-Built drawing shall be required of all irrigation systems installed on commercial and residential developments and shall contain the following information:

14031.16.1.1 Location, type, pressure and maximum flow available of all water sources.

14031.16.1.2 Location, type and size of all components including sprinklers, microirrigation, main and lateral piping, master valves, valves, moisture sensors, rain sensors, controllers, pump start relays, backflow devices, pumps, wells, etc.

14031.16.1.3 The flow rate, application rate (inches per hour), and the operating pressure for the sprinklers and micro irrigation within each zone.

14031.16.1.4 The name, address, phone, email, professional license or certification number of the installation contractor.

14031.16.1.5 Date of installation.

SECTION 1403 Surface and Subsurface Landscape Irrigation Systems

1403.1 Scope.

The provisions of Section 1403 shall govern the materials, design, construction and installation of turf and landscape irrigation systems that apply potable or nonpotable water by means of permanent above ground or subsurface sprinkler or microsprinkler equipment that move water through various means of mechanical pressure.

1403.1.2 This section shall apply to all irrigation systems used on residential and commercial landscape areas.

1403.1.3 This section shall apply to all new irrigation systems and any new work to existing irrigation systems.

Exemption. This section shall not apply to irrigation systems for golf courses, nurseries, greenhouses, or agricultural production systems.

1403.1.4 Nothing contained in this section shall be deemed to require any irrigation system or part thereof, which existed prior to the establishment of this code, to be changed altered or modified to meet the standards of this code.

1403.2 Permits.

1403.2.1 A permit shall be required for new installation of landscape irrigation systems and for repairs or modifications to the system design that exceed \$1000.00 in labor and material based on invoice value.

1403.2.2 No permit shall be required for general maintenance or repairs which do not change the structure or alter the system and the value of which does not exceed \$1000.00 in labor and material based on invoice value.

1403.3 Preconstruction submittals.

1403.3.1 Plans or drawings.

1403.3.1.1 Single-family residence. Design drawings or shop drawings, where required, shall be provided for the installation of irrigation systems prior to start of construction. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, and include all improvements. Drawings shall be prepared by a licensed plumbing or irrigation contractor or licensed landscape architect.

1403.3.1.2 Commercial, industrial, municipal and multiple-family. Professionally designed drawings prior to start of construction shall be provided for landscape irrigation systems. Design drawings shall be clearly readable, to reasonable scale, show the entire

site to be irrigated, including all improvements, and shall include but not be limited to: date, scale, revisions, legend, specifications which list all aspects of equipment and assembly there of, water source, water meter and/or point of connection, backflow prevention devices, pump station size, pump station location, design operating pressure and flow rate per zone, precipitation rate per zone, locations of pipe, controllers, valves, sprinklers, sleeves, gate valves, sensors, etc. The plans and specifications shall be prepared in accordance with Section 107 of the Florida Building Code, Building.

1403.4 Definitions. The following definitions are exclusive to this section of the code.

ABS Pipe. Acrylonitrile-butadiene-styrene black, semi-rigid, plastic pipe extruded to IPS. ABS pipe is in limited use in present day irrigation systems. Solvent weld fittings are used with this pipe (see ASTM D 1788).

Air Release Valve. A valve which will automatically release to the atmosphere accumulated small pockets of air from a pressurized pipeline. A small orifice is used to release air at low flow rates. Air release valves are normally required at all summits of mainline and submain pipelines in an irrigation system.

Anti-Siphon Device. A safety device used to prevent back-flow of irrigation water to the water source by back-siphonage.

Application Rate. The average rate at which water is applied by an irrigation system, sometimes also called precipitation rate. Units are typically inches/hr or mm/hr.

Application uniformity. Irrigation application uniformity (also known as distribution uniformity) describes how evenly water is distributed within an irrigation zone.

Arc. The angle of coverage of a sprinkler in degrees from one side of throw to the other. A 90-degree arc would be a quarter-circle sprinkler.

Atmospheric Vacuum Breaker (AVB). An anti-siphon backflow device which uses a floating seat to allow an air break to interrupt the vacuum effect on water flow.

Automatic Control Valve. A valve in a sprinkler system which is activated by an automatic controller by way of hydraulic or electrical control lines and controls a single device or multiple devices.

Automatic System. An irrigation system which operates following a preset program entered into an automatic controller.

Backflow Prevention Device. An approved safety device used to prevent pollution or contamination of the irrigation water supply due to backflow from the irrigation system.

Belled (Pipe). Pipe which is enlarged at one end so that the spigot end of another length of pipe can be inserted into it during the assembly of a pipeline.

Block (of sprinklers). A group of sprinklers controlled by one valve. Also called zones or subunits.

Block System. An irrigation system in which several groups of sprinklers are controlled by one valve for each group.

Bubbler Irrigation. The application of water to the soil surface or a container as a small stream or fountain. Bubbler emitter discharge rates generally range from 0.5 to 2 gpm but are generally less than 60 gph.

Check Valve. A valve which permits water to flow in one direction only.

Chemical Water Treatment. The addition of chemicals to water to make it acceptable for use in irrigation systems

Chemigation. The application of water soluble chemicals by mixing or injecting with the water applied through an irrigation system.

Contractor. Any person who engages in the fabrication and installation of any type of irrigation system on a contractual basis in accordance with all stipulations receiving compensation.

Control Lines. Hydraulic or electrical lines which carry signals to open and close the valves from the controller to the automatic valves.

Controller. The timing mechanism and its mounting box. The controller signals the automatic valves to open and close on a pre-set program or based on sensor readings.

Coverage. Refers to the way water is applied to an area.

Cycle. Refers to one complete run of a controller through all programmed controller stations.

Demand (or irrigation demand). Refers to the irrigation requirements of the irrigated area. Demand primarily depends on the type of crop, stage of growth, and climatic factors.

Design Area. The specific land area to which water is to be applied by an irrigation system.

Design Emission Uniformity. An estimate of the uniformity of water application with an irrigation system.

Design Pressure. The pressure at which the irrigation system or certain components are designed to operate. The irrigation system design pressure is that measured at the pump discharge or entrance to the system if there is no pump, and a zone design pressure is the average operating pressure of all emitters within that zone.

Direct Burial Wire. Plastic-coated single-strand copper wire for use as control line for electric valves.

Discharge Rate. The instantaneous flow rate of an individual sprinkler, emitter, or other water emitting device, or a unit length of line-source micro irrigation tubing. Also, the flow rate from a pumping system or from a reduced pressure assembly or relief valve.

Double Check Valve. An approved assembly of two single, independently-acting check valves with test ports to permit independent testing of each check valve.

Drain Valve. A valve used to drain water from a line. The valve may be manually or automatically operated.

Drip Irrigation. The precise low-rate application of water to or beneath the soil surface near or directly into the plant root zone. Applications normally occur as small streams, discrete or continuous drops, in the range of 0.5 to 2.0 gph.

Effluent water. Also referred to as reclaimed or gray water is wastewater which has been treated per Florida Statute, §403.086 and is suitable for use as a water supply for irrigation systems.

Emitters. Devices which are used to control the discharge of irrigation water from lateral pipes. This term is primarily used to refer to the low flow rate devices used in micro irrigation systems.

Fertigation. The application of soluble fertilizers with the water applied through an irrigation system.

Filtration System. The assembly of physical components used to remove suspended solids from irrigation water. These include both pressure and gravity type devices, such as settling basins, screens, media filters, and centrifugal force units (vortex sand separators).

Flexible Swing Joint. A flexible connection between the lateral pipe and the sprinkler which allows the sprinkler to move when force is applied to it.

Flow Meters. Devices used to measure the volume of flow of water (typically in gallons), or flow rates (typically in gpm), and to provide data on system usage.

Gauge (Wire). Standard specification for wire size. The larger the gauge number, the smaller the wire diameter.

Head. A sprinkler head. Sometimes used interchangeably with and in conjunction with "Sprinkler."

Infiltration Rate. The rate of water flow across the surface of the soil and into the soil profile. Units are usually inches/hr.

Irrigation. Application of water by artificial means, that is, means other than natural precipitation. Irrigation is practiced to supply crop water requirements, leach salts, apply chemicals, and for environmental control including crop cooling and freeze protection.

Irrigation Water Requirement or Irrigation Requirement. The quantity of water that is required for crop production, exclusive of effective rainfall.

Landscape. Refers to any and all areas which are ornamentally planted, including but not limited to turf, ground covers, flowers, shrubs, trees, and similar plant materials as opposed to agricultural crops grown and harvested for monetary return.

Lateral. The water delivery pipeline that supplies water to the emitters or sprinklers from a manifold or header pipeline downstream of the control valve.

Line-Source Emitters. Lateral pipelines which are porous or contain closely-spaced perforations so that water is discharged as a continuous band or in overlapping patterns rather than discrete widely-spaced points along the pipeline length.

Looped System. A piping system which allows more than one path for water to flow from the supply to the emitters or sprinklers.

Low Volume Sprinklers. Sprinkler heads that emit less than .5 gallons per minute.

Mainline. A pipeline which carries water from the control station to submains or to manifolds or header pipelines of the water distribution system.

Manifold. The water delivery pipeline that conveys water from the main or submain pipelines to the laterals. Also sometimes called a header pipeline.

Manual System. A system in which control valves are manually operated rather than operated by automatic controls.

Matched Precipitation. An equal distribution of water over a given area or zone.

Meter Box. A concrete or plastic box buried flush to grade which houses flow (water) meters or other components.

Microirrigation. The frequent application of small quantities of water directly on or below the soil surface, usually as discrete drops, tiny streams, or miniature sprays through emitters placed along the water delivery pipes (laterals). Microirrigation encompasses a number of methods or concepts, including drip, subsurface, bubbler, and spray irrigation. Previously known as trickle irrigation.

Overlap. The amount one sprinkler pattern overlaps another one when installed in a pattern. Expressed as a percentage of the diameter of coverage.

PE Pipe. Flexible polyethylene pipe for use in irrigation systems, normally manufactured with carbon black for resistance to degradation by ultraviolet radiation.

Potable Water. Water which is suitable in quality for human consumption and meets the requirements of the Health Authority having jurisdiction.

Pressure Relief Valve. A valve which will open and discharge to atmosphere when the pressure in a pipeline or pressure vessel exceeds a pre-set point to relieve the high-pressure condition.

Pressure Vacuum Breaker. A backflow prevention device which includes a spring-loaded check valve and a spring-loaded vacuum breaker to prevent the backflow of irrigation system water to the water source.

Pumping Station. The pump or pumps that provide water to an irrigation system, together with all of the necessary accessories such as bases or foundations, sumps, screens, valves, motor controls, safety devices, shelters and fences.

PVC Pipe. Polyvinyl chloride plastic pipe made in standard thermoplastic pipe dimension ratios and pressure rated for water. Manufactured in accordance with AWWA C-900 or ASTM D-2241.

Rain Shut off Device. A calibrated device that is designed to detect rainfall and override the irrigation cycle of the sprinkler system when a predetermined amount of rain fall has occurred.

Reduced Pressure Principle Backflow Preventer (RPZD) (also known as Reduced Pressure Zone Device RPZ or RPZ Valve). A type of backflow prevention device used to protect water supplies from contamination.

Riser. A threaded pipe to which sprinklers or other emitters are attached for above-ground placement.

Runoff. The result of excess water applied either naturally (precipitation) or mechanically (irrigation) that exceeds the absorption rate of the soil, moving to an area of a lower elevation.

Sleeve. A pipe used to enclose other pipes, wire, or tubing; usually under pavement, sidewalks, or planters.

Spacing. The distance between sprinklers or other emitters.

Spray Irrigation. The micro irrigation application of water to the soil or plant surface by low flow rate sprays or mists.

Sprinkler. The sprinkler head. Sometimes called "Head."

Supply (Water Source). The origin of the water used in the irrigation system.

Swing Joint. A ridged connection between the lateral pipe and the sprinkler, utilizing multiple elbows and nipples, which allows the sprinkler to move when force is applied to it.

Tubing. Generally used to refer to flexible plastic hydraulic control lines which are usually constructed of PE or PVC.

1403.4 DESIGN CRITERIA

1403.4.1 Design defined. Within the scope of this code, irrigation system design is defined as the science and art of properly selecting and applying all components within the system

1403.4.2 Water supply.

1403.4.2.1 The water source shall be adequate from the stand-point of volume, flow rate, pressure, and quality to meet the irrigation requirements of the area to be irrigated, as well as other demands, if any, both at the time the system is designed and for the expected life of the system.

1403.4.2.2 If the water source is effluent, it shall meet the advanced waste treatment standard as set forth in Florida Statute §403.086(4) as well as any other standard as set forth by the controlling governmental agency.

1403.4.3 Application uniformity.

1403.4.3.1 Sprinkler irrigation systems shall be designed with the appropriate uniformity for the type of plants being grown and the type of soil found in that area. The general watering of different types of plants as one group without regard to their individual water requirements shall be avoided.

1403.4.3.2 Sprinkler head spacing, type and nozzle selection that achieves the highest application uniformity shall be utilized.

1403.4.3.3 Application rates which avoid runoff and permit uniform water infiltration into the soil shall be utilized. Land slope, soil hydraulic properties, vegetative ground cover, and prevailing winds and sun exposure shall be considered when application rates are specified. Different types of sprinklers with different application rates, i.e., spray heads vs. rotor heads, bubbler heads vs rotor heads, shall not be combined on the same zone or circuit.

1403.4 System zoning. The irrigation system shall be divided into zones based on consideration of the following hydrozoning practices.

1403.4.1 Available flow rate.

1403.4.2 Cultural use of the area.

1403.4.3 Type of vegetation irrigated, i.e., turf, shrubs, native plants, etc.

1403.4.4 Type of sprinkler, i.e., sprinklers with matching precipitation rates.

1403.4.5 Soil characteristics and slope.

1403.4.6 Sun exposure.

1403.5 Sprinkler/emitter spacing and selection.

1403.5.1 Sprinkler/Emitter spacing shall be determined considering the irrigation requirements, hydraulic characteristics of the soil and device, and water quality with its effect on plant growth, sidewalks, buildings, and public access areas.

1403.5.2 All pop-up spray head bodies in turf areas shall be no less than 6" in height for St. Augustine, Zoysia and Bahia and no less than 4" in height for Bermuda, Centapede and Seashore Paspalum.

1403.5.3 Sprinklers shall be located in accordance with manufacturer's specifications in each irrigated zone area for a matched precipitation rate objective.

1403.5.4 Single row head spacing shall only occur when an additional row will cause saturated soils at the toe of a slope or other inefficiencies.

1403.5.5 All heads shall not exceed 50% of manufacturer's specified diameters of coverage.

1403.5.6 Water conservation shall be taken into consideration by minimizing irrigation of non-vegetated areas.

1403.5.7 Microirrigation systems shall be designed using the Emission Uniformity concept. Microirrigation emitters shall be spaced to wet 100 percent of the root zone in turf areas and 50 percent of the root zone for shrubs and trees.

1403.5.8 Microirrigation or low volume heads shall be required in all areas to be irrigated that are less than 4 feet in any direction from the emitter or nozzle.

1403.5.9 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to supply pipelines to protect the emission devices from contamination from a PD main or lateral break.

1403.5.10 Each plant shall have an adequate number and size (gph) of microirrigation devices, properly placed, to meet the plant water requirements for no rainfall.

1403.6 Pipelines. Pipelines shall be sized to limit pressure variations so that the working pressure at all points in the irrigation system will be in the range required for uniform water application. Velocities shall not exceed 5 feet (1524 mm) per second.

1403.7 Wells.

1403.7.1 Well diameters, depths and location shall correspond to the irrigation system demand and in compliance to all applicable state, regulatory agencies and local codes and regulations.

1403.8 Pumps.

1403.8.1 Pump and motor combinations shall be capable of satisfying the total system demand without invading the service factor of the motor except during start-up and between zones.

1403.8.2 Pumps shall be positioned with respect to the water surface in order to ensure that the net positive suction head required (NPSHr) for proper pump operation is achieved.

1403.8.3 The pumping system shall be protected against the effects of the interruption of water flow.

1403.9 Control valves.

1403.9.1 Control valve size shall be based on the flow rate through the valve. Friction loss through the valve, an approved air gap separation, or a reduced pressure assembly shall not exceed 10 percent of the static mainline head.

1403.9.2 Control systems using hydraulic communication between controller and valve(s) shall comply with the manufacturer's recommendations for maximum distance between controller and valve, both horizontally and vertically (elevation change).

1403.9.3 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications; based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except individual, single lot residential systems.

1403.9.4 Manually operated control valves shall be located so that they can be operated without wetting the operator.

1403.9.5 In ground valves shall be located away from large tree and palm root zones.

1403.9.6 A manual shut off valve shall be required to be installed close to the point of connection but downstream from any backflow device (or/unless included in the backflow device) to minimize water loss when the system is shut off for repairs or emergencies.

1403.9.7 An automatic shut-off valve or master valve (normally closed) is required on all systems with a constantly pressurized mainline to confine the water loss from minor main line leaks, weeping valves, or stuck on valves to just the time the system is operating automatically.

1403.10 Automatic irrigation controller. Automatic irrigation controllers shall conform to UL 1310 and have an adequate number of stations and power output per station to accommodate the irrigation system design. The controller shall be capable of incorporating a rain shut off device or other sensors to override the irrigation cycle when adequate rainfall has occurred, as required by Florida Statutes, Section 373.62.

1403.11 Chemical injection.

1403.11.1 Chemical injection systems for the injection of fertilizer, pesticides, rust inhibitors, or any other injected substance will be located and sized according to the manufacturers' recommendations.

1403.11.2 Injection systems shall be located downstream of the applicable backflow prevention devices as required by Florida Statutes, Section 487.021 and 487.055; the Environmental Protection Agency (EPA); Pesticide Regulation Notice 87-1; or other applicable codes.

1403.11.3 If an irrigation water supply is also used for human consumption, an air gap separation or an approved reduced pressure principal backflow prevention device shall be required in compliance with ASSE 1013 and Section 1403.12.

1403.12 Backflow prevention methods. Backflow prevention assemblies at all cross connections with all water supplies shall be provided in accordance with county, municipal or other applicable codes. In the event of conflicting regulations the assembly type shall be provided which gives the highest degree of protection.

1403.12.1 Irrigation systems into which chemicals are injected shall conform to Florida state law (Florida Statutes 487.021 and 487.055) and Environmental Protection Agency Pesticide Regulation Notice 87-1, which requires backflow prevention regulations to be printed on the chemical label.

1403.12.1.1 For municipal water supplies, chemical injection equipment must be separated from the water supply by an approved air gap separation or a reduced pressure principle assembly that is approved by the Foundation for CCC and the Hydraulic Research Institute. The equipment shall comply with ASSE 1013 to protect the water supply from back-siphonage and back-pressure.

1403.12.1.2 For other water supplies, Florida State law, EPA regulations, or other applicable local codes shall be followed. In the absence of legal guidelines at minimum a PVB shall be required.

SECTION 1403.13 REFERENCED STANDARDS

The standards referenced below are exclusive to this section.

1403.13.1 American Society of Agricultural Engineers (ASAE) Standards:

ASAE S330.1: Procedure for sprinkler distribution testing for research purposes.

ASAE S376.1: Design, installation, and performance of underground thermoplastic irrigation pipelines.

ASAE S397.1: Electrical service and equipment for irrigation.

ASAE S435: Drip/Trickle Polyethylene Pipe used for irrigation laterals.

ASAE S398.1: Procedure for sprinkler testing and performance reporting.

ASAE S339: Uniform classification for water hardness.

ASAE S394: Specifications for irrigation hose and couplings used with self-propelled, hose-drag agricultural irrigation system.

ASAE EP400.1: Designing and constructing irrigation wells.

ASAE EP405: Design, installation, and performance of trickle irrigation systems.

ASAE EP409: Safety devices for applying liquid chemicals through irrigation systems.

1403.13.2 ASTM International Standards:

ASTM D 2241: Poly (Vinyl Chloride) (PVC) Plastic pipe (SDR-PR).

ASTM D 2239: Specification for polyethylene (PE) plastic pipe (SDR-PR).

ASTM D 2466: Specification for socket-type poly (vinyl chloride) (PVC) and chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 40.

ASTM D 2855: Standard recommended practice for making solvent cemented joints with polyvinyl chloride pipe and fittings.

ASTM D 3139: Specification for joints for plastic pressure pipes using flexible elastomeric seals.

ASTM F 477: Specification for elastomeric seals (gaskets for joining plastic pipe).

1403.13.3 American Water Works Association (AWWA) standards:

AWWA C-900: PVC pipe standards and specifications

1403.13.4 American Society of Sanitary Engineers (ASSE) Standards:

ASSE 1001: Pipe applied atmospheric type vacuum breakers.

ASSE 1013: Reduced pressure principle backflow preventers.

ASSE 1015: Double check valve backflow preventers.

ASSE 1020: Vacuum breakers, anti-siphon, pressure type backflow preventers.

ASSE 1024: Dual check valve backflow preventers.

1403.13.5 Hydraulic Institute Standards, 14th Edition

1403.13.6 Standards and Specifications for Turf and Landscape Irrigation Systems Florida Irrigation Society (FIS) Standards

1403.13.7 Soil Conservation Service (SCS) Field Office Technical Guide, Section IV-A — Cropland Codes:

SCS Code 430-DD: Irrigation water conveyance, underground, plastic pipeline.

SCS Code 430-EE: Irrigation water conveyance. Low pressure, underground, plastic pipeline.

SCS Code 430-FF: Irrigation water conveyance, steel pipeline.

SOS Code 441-1: Irrigation system, trickle.

SCS Code 442: Irrigation system sprinkler.

SCS Code 449: Irrigation water management.

SCS Code 533: Pumping plant for water control.

SCS Code 642: Well.

1403.13.8. Underwriters Laboratories (UL) 333 Pfingsten Road, Northbrook, IL 60062-296 Standards

UL 486C-1995 Splicing Wire Connectors

UL 969-2013 Standard for Marking and Labeling Systems

UL 1310-2011 Standard for Class 2 Power Units

Section 1403.14 MATERIALS

The materials referenced below are exclusive to this section.

1403.14.1 PVC pipe and fittings.

1403.14.1.1 PVC pipe shall comply with one of the following standards ASTM D 1785, ASTM D 2241, AWWA C-900, or AWWA C-905. SDR-PR pipe shall have a minimum wall thickness as required by SDR-26. All pipe used with effluent water systems shall be designated for nonpotable use by either label or by the industry standard color purple.

1403.14.1.2 All solvent-weld PVC fittings shall, at a minimum, meet the requirements of Schedule 40 as set forth in ASTM D 2466.

1403.14.1.3. Threaded PVC pipe fittings shall meet the requirements of Schedule 40 as set forth in ASTM D 2464.

1403.14.1.4. PVC gasketed fittings shall conform to ASTM D 3139. Gaskets shall conform to ASTM F 477.

1403.14.1.5. PVC flexible pipe should be pressure rated as described in ASTM D 2740 with standard outside diameters compatible with PVC IPS solvent-weld fittings.

1403.14.1.6. PVC cement should meet ASTM D 2564. PVC cleaner-type should meet ASTM F 656.

1403.14.2 Ductile iron pipe and fittings.

1403.14.2.1 Gasket fittings for iron pipe shall be of materials and type compatible with the piping material being used.

1403.14.3. Steel pipe and fittings.

1403.14.3.1. All steel pipe shall be rated Schedule 40 or greater and be hot-dipped galvanized or black in accordance with ASTM 53.

1403.14.3.2 Threaded fittings for steel pipe shall be Schedule 40 Malleable Iron.

1403.14.4 Polyethylene pipe.

1403.14.4.1 Flexible swing joints shall be thick-walled with a minimum pressure rating of 75 psi (517 kPa) in accordance with ASTM D 2239.

1403.14.4.2 Low pressure polyethylene pipe for micro-irrigation systems shall conform with ASAE S-435.

1403.14.4.3 Use fittings manufactured specifically for the type and dimensions of polyethylene pipe used.

1403.14.5 Sprinklers, spray heads, and emitters.

1403.14.5.1 Units and nozzles shall be selected in accordance with the size of the area and the type of plant material being irrigated. Sprinklers shall fit the area they are intended to water without excessive overspray. Intentional direct spray onto walkways, buildings, roadways, and driveways is prohibited.

1403.14.5.2 Equipment shall be used that is protected from contamination and damage by use of seals, screens, and springs where site conditions present a potential for damage.

1403.14.5.3 Riser-mounted sprinklers shall be supported to minimize movement of the riser resulting from the action of the sprinkler.

1403.14.5.4 Swing joints, either flexible or rigid, shall be constructed to provide a leak-free connection between the sprinkler and lateral pipeline to allow movement in any direction and to prevent equipment damage.

1403.14.5.5 Check valves shall be installed on any sprinkler where low point drainage occurs.

1403.14.5.6 The pop-up height for sprays and rotator nozzles shall be adequate to prevent being obstructed by the turf grass blades: 6" height for St. Augustine, Zoysia and Bahia and 4" height for Bermuda, Centapede and Seashore Paspalum.

1403.14.5.7 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to PVC pipe to protect the emission devices from contamination from a PVC main or lateral break.

1403.14.5.8 All microirrigation zones shall have adequate pressure regulation installed at the zone valve or at the point where the drip tubing is attached to the PVC to ensure that all emission devices meet the manufacturer's performance standards.

1403.14.5.9 Each plant shall have a adequate number and size(gph) of microirrigation devices, properly placed to meet the plant water requirements for no rainfall.

1403.14.5.10 All tubing shall be secured to prevent movement in accordance with manufacturer's specificantion.

1403.14.6 Valves.

1403.14.6.1 Valves shall have a maximum working pressure rating equal to or greater than the maximum pressure of the system, but not less than 125 psi (861 kPa). This requirement shall be waived for low mainline pressure systems [30 psi (207 kPa) or less].

1403.14.6.2 Only valves that are constructed of materials designed for use with the water and soil conditions of the installation shall be used. Valves that are constructed from materials that will not be deteriorated by chemicals injected into the system shall be used on all chemical injection systems.

1403.14.7 Valve boxes.

1403.14.7.1 Valve boxes shall be constructed to withstand traffic loads common to the area in which they are installed. They should be sized to allow manual operation of the enclosed valves without excavation.

1403.14.7.2. Each valve box shall be permanently labeled in accordance with UL 969 to identify its contents.

1403.14.8 Low voltage wiring.

1403.14.8.1 All low voltage wire which is directly buried shall be labeled for direct burial wire. Wire not labeled for direct burial shall be installed in watertight conduits, and be listed TWN or THHN type wire as described in the NEC. All wire traveling under any hardscape or roadway must installed within a conduit and sleeve.

1403.14.8.2 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications, based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating, on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except single lot individual residential systems.

1403.14.8.3 Connections shall be made using devices conforming to UL 486 specifically designed for direct burial. All splices shall be enclosed within a valve box.

1403.14.9 Irrigation controllers.

1403.14.9.1 All irrigation controllers shall conform to UL 1310 and the provisions of the National Electric Code (NEC) and be grounded in accordance with the manufacturer's specifications. Solid state controls shall be equipped with surge suppressors on the primary and secondary wiring, except single lot residential systems.

1403.14.9.2 The controller housing or enclosure shall protect the controller from the hazards of the environment in which it is installed.

1403.14.9.3 The rain switch shall be placed on a stationary structure minimum of 5-foot (1524 mm) clearance from other outdoor equipment, free and clear of any tree canopy or other overhead obstructions, and above the height of the sprinkler coverage. Soil moisture sensors and ET sensors shall be installed in accordance with manufacturer's specifications and Florida Statutes, Section 373.62.

1403.14.10 Pumps and wells.

1403.14.10.1 Irrigation pump electrical control systems shall conform to the NEC and local building codes.

1403.14.10.2 The pumping system shall be protected from the hazards of the environment in which it is installed.

1403.14.10.3 Use electric motors with a nominal horsepower rating greater than the maximum horsepower requirement of the pump during normal operation. Motor shall have a service factor of at least 1.15.

1403.14.10.4 Casings for drilled wells shall be steel, reinforced plastic mortar, plastic, or fiberglass pipe. Only steel pipe casings shall be used in driven wells. See SCS code FL-642. Steel casings shall conform to ASTM A 589.

1403.14.11 Chemical injection equipment.

1403.14.11.1 Chemical injection equipment shall be constructed of materials capable of withstanding the potential corrosive effects of the chemicals being used. Equipment shall be used only for those chemicals for which it was intended as stated by the injection equipment manufacturer.

1403.14.12 Filters and strainers.

1403.14.12.1 Filtration equipment and strainers constructed of materials resistant to the potential corrosive and erosive effects of the water shall be used. They shall be sized to prevent the passage of foreign material that would obstruct the sprinkler/emitter outlets in accordance with the manufacturer's recommendations.

Section 1403.15 INSTALLATION**1403.15.1 Pipe installation.**

1403.15.1.1 Pipe shall be installed at sufficient depth below ground to protect it from hazards such as vehicular traffic or routine occurrences which occur in the normal use and maintenance of a property. Depths of cover shall meet or exceed SCS Code 430-DD, Water Conveyance, as follows:

1403.15.1.1.1 Vehicle traffic areas.

Pipe Size (inches)

Depth of Cover (inches)

1/2 – 2 1/2

18 - 24

3 - 5

24 - 30

6 and larger

30 - 36

1403.15.1.1.2 All areas except vehicle traffic:

Pipe Size (inches)

Depth of Cover (inches)

1/2 – 1 1/2

6

2 - 3

12

4 - 6

18

More than 6

24

1403.15.1.2 All pipe joints and connections shall be made according to manufacturer's specifications. All solvent-weld connections shall be performed in accordance with ASTM D 2855.

1403.15.1.3 Minimum clearances shall be maintained between irrigation lines and other utilities. In no case shall one irrigation pipe rest upon another.

1403.15.1.4 Thrust blocks shall be used on all gasketed PVC systems. They must be formed against a solid, hand-excavated trench wall undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and trench shall be filled to the height of the outside diameter of the pipe. Thrust blocks shall be sized in accordance with ASAE S-376.1.

1403.15.1.5 The trench bottom shall be uniform, free of debris, and of sufficient width to properly place pipe and support it over its entire length. Native excavated material may be used to backfill the pipe trench. However, the initial backfill material shall be free from rocks or stones larger than 1-inch in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. Blocking or mounding shall not be used to bring the pipe to final grade.

1403.15.1.6. Pipe sleeves shall be used to protect pipes or wires installed under pavement or roadways. Pipe sleeves two pipe sizes larger than the carrier pipe or twice the diameter of the wire bundle shall be used under the paving or roadway and extending a minimum of 3 feet beyond the paved area or as required by the Florida Department of Transportation (FDOT). Pipe sleeves shall be Sch 40. Proper backfill and compaction procedures shall be followed.

1403.15.2 Control valve installation.

1403.15.2.1 Valve installation shall allow enough clearance for proper operation and maintenance. Where valves are installed underground, they shall be provided with a valve box with cover extending from grade to the body of the valve. The top of the valve body should have a minimum of 6 inches (152 mm) of cover in nontraffic and noncultivated areas and 18 inches (457 mm) of cover in traffic areas. The valve box shall be installed to minimize the effect of soil intrusion within the valve box with the use of filter fabric, pea gravel, or other approved material. If an automatic valve is installed under each sprinkler, then the valve box may be omitted.

1403.15.2.2 Valve boxes shall be installed so that they do not rest on the pipe and the box cover does not conflict with the valve stem or interfere with valve operation. They shall be flush with the ground surface and do not present a tripping hazard or interfere with routine maintenance of the landscape.

1403.15.2.3. Quick coupling valves shall be installed on swing joints or flexible pipe with the top of the valve at ground level.

1403.15.2.4 Any above-ground manually-operated valves on nonpotable water systems shall be adequately identified with distinctive purple colored paint. Hose bibb connections on irrigation systems that utilize nonpotable water supplies shall not be permitted.

1403.15.3 Sprinkler installation.

1403.15.3.1. On flat landscaped areas, sprinklers shall be installed plumb. In areas where they are installed on slopes, sprinklers may be tilted as required to prevent erosion. Sprinklers shall be adjusted to avoid unnecessary discharge on roads, pavements and structures.

1403.15.3.2. There shall be a minimum separation of 4 inches (102 mm) between sprinklers and pavement. There shall be a minimum separation of 12 inches (305 mm) between sprinklers and buildings and other vertical structures. Piping shall be thoroughly flushed before installation of sprinkler nozzles. Surface mounted and pop-up heads shall be installed on swing joints, polyethylene (PE) nipples or flexible pipe. Polyethylene (PE) nipples shall not be used in maintenance equipment traffic areas or alongside roadways and driveways. Above-ground (riser mounted) sprinklers shall be mounted on Schedule 40 PVC or steel pipe and be stabilized.

1403.15.4 Pump installation.

1403.15.4.1 Pumps shall be installed in accordance with the manufacturer's specifications. Pumps shall be set plumb and secure to a firm concrete base. There shall be no strain or distortion on the pipe and fittings. Pipe and fittings shall be supported to avoid placing undue strain on the pump. Steel pipe shall be used on pumps 5 horsepower (hp) or larger.

1403.15.4.2 Pumps shall be installed in a manner to avoid loss of prime. Suction line shall be installed to prevent the accumulation of air pockets. All connections and reductions in suction pipe sizes shall be designed to avoid causing air pockets and cavitation.

1403.15.4.3 Pumps shall be located to facilitate service and ease of removal. Appropriate fittings shall be provided to allow the pump to readily be primed, serviced, and disconnected. An enclosure shall be provide of adequate size and strength, with proper ventilation, to protect the pump from the elements (except residential systems).

1403.15.5 Low voltage wire installation.

1403.15.5.1 Install low voltage wire (less than 98 volts) with a minimum depth of cover of 12 inches (305 mm) where not installed directly under the mainline. A sufficient length of wire shall be provided at each connection to allow for thermal expansion/shrinkage. As a minimum, a 12-inch (305 mm) diameter loop shall be provided at all splices and connections. Terminations at valves shall have 24 inches (610 mm) minimum free wire.

1403.15.5.2 All above-ground wire runs and wire entries into buildings shall be installed in electrical conduit. Common wires with a different color than the power wires (white shall be used for common wires) shall be provided. Connections shall be made using devices conforming to UL 486C specifically designed for direct burial. All splices shall be enclosed within a valve box.

Exception: When wiring above ground manifolds from the valve to the ground immediately beneath it, no conduit is required.

1403.15.6 Hydraulic control tubing installation

1403.15.6.1. For hydraulic control systems, a water supply shall be used that is filtered and free of deleterious materials, as defined by the hydraulic control system manufacturer's specifications. A backflow prevention device shall be installed where the hydraulic control system is connected to potable water supplies.

1403.15.6.2 Tubing shall be installed in trenches and spaced so that it will not rub against pipe, fittings, or other objects that could score the tubing, and with a minimum 12-inch (305 mm) diameter loop at all turns and connections. A minimum depth of cover of 12 inches (305 mm) shall be provided.

1403.15.6.3 Tubing shall be connected with couplings and collars according to Manufacturer's specifications. All splices shall be made in valve boxes. Tubing shall be prefilled with water to expel entrapped air and tested for leaks prior to installation.

1403.15.6.4 Exposed tubing shall be installed in a protective conduit manufactured from Schedule 40 UV protected PVC or electrical conduit.

1403.16 As-Built Drawings.

1403.16.1 An As-Built drawing shall be required of all irrigation systems installed on commercial and residential developments and shall contain the following information:

1403.16.1.1 Location, type, pressure and maximum flow available of all water sources.

1403.16.1.2 Location, type and size of all components including sprinklers, microirrigation, main and lateral piping, master valves, valves, moisture sensors, rain sensors, controllers, pump start relays, backflow devices, pumps, wells, etc.

1403.16.1.3 The flow rate, application rate (inches per hour), and the operating pressure for the sprinklers and micro irrigation within each zone.

1403.16.1.4 The name, address, phone, email, professional license or certification number of the installation contractor.

1403.16.1.5 Date of installation.

CHAPTER 14
SUBSURFACE LANDSCAPE IRRIGATION SYSTEMS
SECTION 1401
GENERAL

1401.1 Scope.

The provisions of Chapter 14 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to either potable or nonpotable water from on-site water reuse systems.

SECTION 1402

Subsurface Landscape Irrigation Systems Connected to NonPotable On-site Water Reuse Systems

1402.1 Scope.

The provisions of Section 1402 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems.

1402.2 1402.2 Materials.

Above-ground drain, waste and vent piping for subsurface landscape irrigation systems connected to NonPotable On-site Water Reuse Systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.

1401.3 1402.3 Tests.

Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.

1401.4 1402.4 Inspections.

Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.

1401.5 1402.5 Disinfection.

Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.

1401.6 1402.6 Coloring.

On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.

SECTION 1402
SYSTEM DESIGN AND SIZING

1402.4 1402.7 Sizing.

The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons-per-day-per-occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:

$$C = A \times B$$

(Equation 14-1)

where:

A = Number of occupants:

Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.

Commercial—Number of occupants shall be determined by the *Florida Building Code, Building*.

B = Estimated flow demands for each occupant:

Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.

Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.

C = Estimated gray water discharge based on the total number of occupants.

4402.2 1402.8 Percolation tests.

The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

4402.2.1 1402.8.1 Percolation tests and procedures.

At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

4402.2.1.1 1402.8.1.1 Percolation test hole.

The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.

4402.2.1.2 1402.8.1.2 Test procedure, sandy soils.

The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1303.7.1.3.

4402.2.1.3 1402.8.1.3 Test procedure, other soils.

The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate

shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $\frac{1}{16}$ inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

~~1402.2.1.4~~ 1402.8.1.4 Mechanical test equipment.

Mechanical percolation test equipment shall be of an *approved* type.

~~1402.2.2~~ 1402.8.2 Permeability evaluation.

Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section ~~1402.2.1.1~~ 1402.8.1.1 for evaluating the soil.

~~1402.3~~ 1402.9 Subsurface landscape irrigation site location.

The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table ~~1402.3~~ 1402.9. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

**TABLE ~~1402.3~~ 1402.9
LOCATION OF SUBSURFACE IRRIGATION SYSTEM**

ELEMENT	Storage tank (ft)
Buildings	5
Lot line adjoining private property	5
Water wells	50
Streams and lakes	50
Seepage pits	5
Septic tanks	0
Water service	5
Public water main	10

For SI: 1 foot = 304.8 mm.

**SECTION 1403
INSTALLATION**

~~1403.1~~ 1402.10 Installation.

Absorption systems shall be installed in accordance with Sections ~~1403.1.1~~ 1402.10.1 through ~~1403.1.5~~ 1402.10.1.5 to provide landscape irrigation without surfacing of water.

1403.1.1 1402.10.1 Absorption area.

The total absorption area required shall be computed from the estimated daily gray water discharge and the design-loading rate based on the percolation rate for the site. The required absorption area equals the estimated gray water discharge divided by the design-loading rate from Table 1403.1.1-1402.10.1.

**TABLE 1403.1.1 1402.10.1
DESIGN LOADING RATE**

PERCOLATION RATE(minutes per inch)

0 to less than 10
10 to less than 30
30 to less than 45
45 to 60

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

1403.1.2 1402.10.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.

1403.1.3 1402.10.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

1403.1.4 1402.10.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

1403.1.5 1402.10.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from $\frac{1}{4}$ to $\frac{2}{4}$ inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

1403.2 1402.11 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table ~~1403.2~~ 1402.11. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

**TABLE ~~1403.2-1402.11~~
DISTRIBUTION PIPE**

MATERIAL

Polyethylene (PE) plastic pipe

Polyvinyl chloride (PVC) plastic pipe

Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cell

For SI: 1 inch=25.4 mm.

1403.2.1 Joints.

Joints in distribution pipe shall be made in accordance with Section 705 of this code.

Date Submitted 12/15/2018	Section 1402	Proponent Eberhard Roeder
Chapter 14	Affects HVHZ No	Attachments No
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language Yes
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Related Modifications

Summary of Modification

The proposed modification deletes the content of this Chapter from the Florida Building Code-Plumbing consistent with Florida Statutes, which require graywater disposal systems to follow onsite sewage treatment and disposal system standards of Chapter 64-6, of the Florida Administrative Code.

Rationale

The proposed deletion of Chapter 14 is consistent with the adaptations for the 2010 Florida Building Code-Plumbing Appendix C (Graywater Recycling Systems) and the 2014 Florida Building Code-Plumbing Chapter 13 (Graywater Recycling Systems). This issue was missed in the initial adaptation for the 2017 Florida Building Code-Plumbing Chapter 14 (Subsurface Landscape Irrigation Systems).
 The Department of Health is the regulatory authority for permitting onsite sewage treatment and disposal systems, including gray water systems (381.0065(2)(k); 381.0065(3)(k), Fl. Statutes). Chapter 64E-6, of the Florida Administrative Code, provides specifications for them. Gray water and laundry water disposal systems are addressed in the onsite sewage treatment and disposal code.
 Florida has existing requirements for graywater disposal systems, Graywater can be treated separately in graywater onsite sewage treatment and disposal systems subject to requirements described in Chapter 64E-6 of the Florida Administrative Code. Graywater onsite sewage treatment and disposal systems can also be permitted where the blackwater is treated by a central sewerage system (Florida Statute 381.0065(3)(k)).
 Chapter 14 of the 2018 IPC prescribes methods for drainfield sizing and installation that would be inconsistent with and partially duplicate the requirements of Chapter 64-6.

Fiscal Impact Statement

- Impact to local entity relative to enforcement of code**
 Proposal simplifies enforcement by clarifying that there is only a single jurisdiction over onsite sewage treatment and disposal systems. Graywater and laundry wastewater system tanks are included in the definition of "onsite sewage treatment and disposal system" per 381.0065(2)(k) Fl. Statutes.
- Impact to building and property owners relative to cost of compliance with code**
 Simplifies compliance with code by avoiding conflicts with Department of Health regulations. No impact on building and property owners, the existing requirements remain the same.
- Impact to industry relative to the cost of compliance with code**
 Simplifies compliance with code by avoiding conflicts with Department of Health regulations. No impact, the existing requirements remain the same.
- Impact to small business relative to the cost of compliance with code**
 Simplifies compliance with code by avoiding conflicts with Department of Health regulations. No impact, the existing requirements remain the same.

Requirements

- Has a reasonable and substantial connection with the health, safety, and welfare of the general public**
 Graywater contains pathogens, and sanitary treatment and disposal of this sewage is necessary for the protection of health and safety. Application of Florida's onsite sewage regulations provides protection. e.g., Florida, but not the base code, requires an unsaturated zone to remove pathogens.
- Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction**
 The proposed modification makes the code clearer deleting a chapter that would conflict with another state regulation, namely 64E-6, Florida Administrative Code, which provides at least equivalent methods.
- Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities**
 The proposed modification does not discriminate in this manner.
- Does not degrade the effectiveness of the code**
 By making the building code and the onsite sewage treatment code more consistent with each other the code system overall will become more effective.

1st Comment Period History

8384-A1

Proponent Cheryl Harris Submitted 2/18/2019 Attachments Yes

Rationale

The Florida Irrigation Society is in agreement with the Florida Department of Health's modification to completely eliminate the content of Chapter 14 as it was published in the 2017 Florida Building Code Plumbing. This change would eliminate a potential conflict between Florida Building Code and the Florida Administrative Code that is already in effect governing irrigation systems. However, we suggest the modification be changed to remove the existing wording of Chapter 14, retitle Chapter 14 and the scope in Section 1401 to cover irrigation systems EXCEPT for systems connected to on-site sewage treatment and disposal systems and add wording for design and installation of all other irrigation systems.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No change for enforcement of Florida Administrative Code governing on site wastewater or sewage treatment water reuse systems for subsurface irrigation.

Impact to building and property owners relative to cost of compliance with code

No change for enforcement of Florida Administrative Code governing on site wastewater or sewage treatment water reuse systems for subsurface irrigation.

Impact to industry relative to the cost of compliance with code

No change for enforcement of Florida Administrative Code governing on site wastewater or sewage treatment water reuse systems for subsurface irrigation.

Impact to Small Business relative to the cost of compliance with code

Simplifies compliance with code by avoiding conflicts with Department of Health regulations. No impact, the existing requirements remain the same.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Yes.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Yes.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate.

Does not degrade the effectiveness of the code

Does not degrade effectiveness.

CHAPTER 14

SUBSURFACE LANDSCAPE IRRIGATION SYSTEMS (reserved)

1401 GENERAL

1401.1 Scope.

~~The provisions of Chapter 14 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems.~~

1401.2 Materials.

~~Above-ground drain, waste and vent piping for subsurface landscape irrigation systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.~~

1401.3 Tests.

~~Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.~~

1401.4 Inspections.

~~Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.~~

1401.5 Disinfection.

~~Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.~~

1401.6 Coloring.

~~On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.~~

1402 SYSTEM DESIGN AND SIZING

1402.1 Sizing.

~~The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons-per-day-per-occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:~~

$$C = A \times B$$

(Equation 14-1)

where:

A = Number of occupants:

~~Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.~~

~~Commercial—Number of occupants shall be determined by the *Florida Building Code, Building*.~~

B = Estimated flow demands for each occupant:

~~Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.~~

~~Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.~~

C = Estimated gray water discharge based on the total number of occupants.

1402.2 Percolation tests.

~~The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.~~

1402.2.1 Percolation tests and procedures.

~~At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.~~

1402.2.1.1 Percolation test hole.

~~The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.~~

1402.2.1.2 Test procedure, sandy soils.

~~The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a~~

~~point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1303.7.1.3.~~

~~1402.2.1.3 Test procedure, other soils.~~

~~The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $\frac{1}{16}$ inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.~~

~~1402.2.1.4 Mechanical test equipment.~~

~~Mechanical percolation test equipment shall be of an *approved* type.~~

~~1402.2.2 Permeability evaluation.~~

~~Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 1402.2.1.1 for evaluating the soil.~~

~~1402.3 Subsurface landscape irrigation site location.~~

~~The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 1402.3. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.~~

TABLE 1402.3

LOCATION OF SUBSURFACE IRRIGATION SYSTEM

ELEMENT	MINIMUM HORIZONTAL DISTANCE	
	Storage tank (feet)	Irrigation disposal field (feet)
Buildings	5	2
Lot line adjoining private property	5	5
Water wells	50	100
Streams and lakes	50	50
Seepage pits	5	5
Septic tanks	0	5
Water service	5	5
Public water main	10	10

For SI: 1 foot = 304.8 mm.

**SECTION 1403
INSTALLATION**

1403.1 Installation.

Absorption systems shall be installed in accordance with Sections 1403.1.1 through 1403.1.5 to provide landscape irrigation without surfacing of water.

1403.1.1 Absorption area.

The total absorption area required shall be computed from the estimated daily gray water discharge and the design loading rate based on the percolation rate for the site. The required absorption area equals the estimated gray water discharge divided by the design loading rate from Table 1403.1.1.

TABLE 1403.1.1

DESIGN LOADING RATE

PERCOLATION RATE (minutes per inch)	DESIGN LOADING FACTOR (gallons per square foot per day)
0 to less than 10	1.2
10 to less than 30	0.8
30 to less than 45	0.72
45 to 60	0.4

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

1403.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.

1403.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

1403.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

1403.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from $1/2$ to $2 1/2$ inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

1403.2 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 1403.2. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

TABLE 1403.2

DISTRIBUTION PIPE

MATERIAL	STANDARD
Polyethylene (PE) plastic pipe	ASTM F405
Polyvinyl chloride (PVC) plastic pipe	ASTM

D2729

~~Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core
or composite wall~~

ASTM F1488

For SI: 1 inch=25.4 mm.

~~1403.2.1 Joints.~~

~~Joints in distribution pipe shall be made in accordance with Section 705 of this code.~~

CHAPTER 14

SUBSURFACE LANDSCAPE IRRIGATION SYSTEMS ~~(reserved)~~

~~1401 GENERAL~~

1401.1 Scope.

The provisions of Chapter 14 shall govern the materials, design, construction and installation of ~~subsurface~~ turf and landscape irrigation systems connected to either potable or nonpotable water from ~~on-site water reuse~~ systems.

—

Exception: All Turf and Landscape irrigation systems serving as drainfields for onsite sewage treatment and disposal systems shall be regulated by Chapter 64E-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems.

~~1401.2 Materials.~~

~~Above-ground drain, waste and vent piping for subsurface landscape irrigation systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.~~

~~1401.3 Tests.~~

~~Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.~~

~~1401.4 Inspections.~~

~~Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.~~

~~1401.5 Disinfection.~~

~~Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.~~

~~1401.6 Coloring.~~

~~On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.~~

SECTION

1402 SYSTEM DESIGN AND SIZING

~~1402.1 Sizing.~~

~~The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected~~

to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons per day per occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:

where:

A = Number of occupants:

Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.

Commercial—Number of occupants shall be determined by the *Florida Building Code, Building*.

B = Estimated flow demands for each occupant:

Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.

Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.

C = Estimated gray water discharge based on the total number of occupants.

1402.2 Percolation tests.

The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

1402.2.1 Percolation tests and procedures.

At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

1402.2.1.1 Percolation test hole.

The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.

1402.2.1.2 Test procedure, sandy soils.

The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a

point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1303.7.1.3.

1402.2.1.3 Test procedure, other soils.

The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $\frac{1}{16}$ inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

1402.2.1.4 Mechanical test equipment.

Mechanical percolation test equipment shall be of an *approved* type.

1402.2.2 Permeability evaluation.

Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 1402.2.1.1 for evaluating the soil.

1402.3 Subsurface landscape irrigation site location.

The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 1402.3. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

TABLE 1402.3

LOCATION OF SUBSURFACE IRRIGATION SYSTEM

ELEMENT	MINIMUM HORIZONTAL DISTANCE	
	Storage tank (feet)	Irrigation disposal field (feet)
Buildings	5	2
Lot line adjoining private property	5	5
Water wells	50	100
Streams and lakes	50	50
Seepage pits	5	5
Septic tanks	0	5
Water service	5	5
Public water main	10	10

For SI: 1 foot = 304.8 mm.

SECTION 1403 INSTALLATION

1403.1 Installation.

Absorption systems shall be installed in accordance with Sections 1403.1.1 through 1403.1.5 to provide landscape irrigation without surfacing of water.

1403.1.1 Absorption area.

The total absorption area required shall be computed from the estimated daily gray water discharge and the design loading rate based on the percolation rate for the site. The required absorption area equals the estimated gray water discharge divided by the design loading rate from Table 1403.1.1.

TABLE 1403.1.1

DESIGN LOADING RATE

PERCOLATION RATE (minutes per inch)	DESIGN LOADING FACTOR (gallons per square foot per day)
0 to less than 10	1.2
10 to less than 30	0.8
30 to less than 45	0.72
45 to 60	0.4

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

1403.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in *developed length*.

1403.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

1403.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

1403.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from $\frac{1}{2}$ to $2\frac{1}{2}$ inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with *approved* synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

1403.2 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 1403.2. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

TABLE 1403.2
DISTRIBUTION PIPE

MATERIAL	STANDARD
Polyethylene (PE) plastic pipe	ASTM F405
Polyvinyl chloride (PVC) plastic pipe	ASTM

Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core or composite wall ASTM F1488

For SI: 1 inch=25.4 mm.

1403.2.1 Joints.

Joints in distribution pipe shall be made in accordance with Section 705 of this code.

CHAPTER 14 LANDSCAPE IRRIGATION SYSTEMS SECTION 1401 GENERAL

1401.1 Scope.

The provisions of Chapter 14 shall govern the materials, design, construction and installation of ~~subsurface~~ turf and landscape irrigation systems connected to either potable or nonpotable water from ~~on-site water reuse~~ systems.

Exception: Landscape irrigation systems connected to onsite sewage treatment and disposal systems shall be regulated by Chapter 64E-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems.

SECTION 1402

~~Subsurface Landscape Irrigation Systems Connected to NonPotable On-site Water Reuse Systems~~

~~1402.1 Scope.~~

~~The provisions of Section 1402 shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems.~~

~~1402.2 1402.2 Materials.~~

~~Above-ground drain, waste and vent piping for subsurface landscape irrigation systems connected to NonPotable On-site Water Reuse Systems shall conform to one of the standards listed in Table 702.1. Subsurface landscape irrigation, underground building drainage and vent pipe shall conform to one of the standards listed in Table 702.2.~~

~~1401.3 1402.3 Tests.~~

~~Drain, waste and vent piping for subsurface landscape irrigation systems shall be tested in accordance with Section 312.~~

~~1401.4 1402.4 Inspections.~~

~~Subsurface landscape irrigation systems shall be inspected in accordance with Section 110 of the *Florida Building Code, Building*.~~

~~1401.5 1402.5 Disinfection.~~

~~Disinfection shall not be required for on-site nonpotable water reuse for subsurface landscape irrigation systems.~~

~~**1401.6 1402.6 Coloring.**~~

~~On-site nonpotable water reuse for subsurface landscape irrigation systems shall not be required to be dyed.~~

**SECTION 1402
SYSTEM DESIGN AND SIZING**

~~**1402.1 1402.7 Sizing.**~~

~~The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons-per-day-per-occupant number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:~~

~~where:~~

~~**A = Number of occupants:**~~

~~**Residential—Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.**~~

~~**Commercial—Number of occupants shall be determined by the *Florida Building Code, Building*.**~~

~~**B = Estimated flow demands for each occupant:**~~

~~**Residential—25 gallons per day (94.6 lpd) per occupant for showers, bathtubs and lavatories and 15 gallons per day (56.7 lpd) per occupant for clothes washers or laundry trays.**~~

~~**Commercial—Based on type of fixture or water use records minus the discharge of fixtures other than those discharging gray water.**~~

~~**C = Estimated gray water discharge based on the total number of occupants.**~~

~~**1402.2 1402.8 Percolation tests.**~~

~~The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.~~

~~**1402.2.1 1402.8.1 Percolation tests and procedures.**~~

~~At least three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.~~

~~**1402.2.1.1 1402.8.1.1 Percolation test hole.**~~

~~The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. All loose material shall be removed from the hole and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.~~

~~**1402.2.1.2 1402.8.1.2 Test procedure, sandy soils.**~~

The hole shall be filled with clear water to a minimum of 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined, and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but in no case shall the water depth exceed 6 inches (152 mm). Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the above requirements shall be tested in accordance with Section 1402.7.1.3.

1402.2.1.3 1402.8.1.3 Test procedure, other soils.

The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: any soil sloughed into the hole shall be removed and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than $\frac{1}{16}$ inch (1.59 mm). At least three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. Adjustments of the water level shall not be made during the three measurement periods except to the limits of the last measured water level drop. When the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the time interval between measurements shall be 10 minutes and the test run for 1 hour. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

1402.2.1.4 1402.8.1.4 Mechanical test equipment.

Mechanical percolation test equipment shall be of an *approved* type.

1402.2.2 1402.8.2 Permeability evaluation.

Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 1402.2.1.1 1402.8.1.1 for evaluating the soil.

1402.3 1402.9 Subsurface landscape irrigation site location.

The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 1402.3 1402.9. Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited.

Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

**TABLE 1402.3 1402.9
LOCATION OF SUBSURFACE IRRIGATION SYSTEM**

ELEMENT	MINIMUM HORIZONTAL DISTANCE	
	Storage tank (feet)	Irrigation disposal field (feet)
Buildings	5	2
Lot line adjoining private property	5	5
Water wells	50	100
Streams and lakes	50	50
Seepage pits	5	5
Septic tanks	0	5
Water service	5	5
Public water main	10	10

**SECTION 1401
INSTALLATION**

1401.1 1402.10 Installation.

Absorption systems shall be installed in accordance with Sections 1401.1.1 1402.10.1 through 1401.1.5 1402.10.1.5 to provide landscape irrigation without surfacing of water.

1401.1.1 1402.10.1 Absorption area.

The total absorption area required shall be computed from the estimated daily gray water discharge and the design loading rate based on the percolation rate for the site. The required absorption area equals the estimated gray water discharge divided by the design loading rate from Table 1401.1.1 1402.10.1.

**TABLE 1401.1.1 1402.10.1
DESIGN LOADING RATE**

PERCOLATION RATE (minutes per inch)	DESIGN LOADING FACTOR (gallons per square foot per day)
0 to less than 10	1.2
10 to less than 30	0.8
30 to less than 45	0.72
45 to 60	0.4

For SI: 1 minute per inch = min/25.4 mm, 1 gallon per square foot = 40.7 L/m².

1401.1.2 1402.10.1.2 Seepage trench excavations.

Seepage trench excavations shall be not less than 1 foot (304 mm) in width and not greater than 5 feet (1524 mm) in width. Trench excavations shall be spaced not less than 2 feet (610 mm) apart. The soil absorption area of a seepage trench shall be computed by using the bottom of the trench area (width) multiplied by the length of pipe. Individual seepage trenches shall be not greater than 100 feet (30 480 mm) in developed length.

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1401.1.3 1402.10.1.3 Seepage bed excavations.

Seepage bed excavations shall be not less than 5 feet (1524 mm) in width and have more than one distribution pipe. The absorption area of a seepage bed shall be computed by using the bottom of the trench area. Distribution piping in a seepage bed shall be uniformly spaced not greater than 5 feet (1524 mm) and not less than 3 feet (914 mm) apart, and greater than 3 feet (914 mm) and not less than 1 foot (305 mm) from the sidewall or headwall.

1401.1.4 1402.10.1.4 Excavation and construction.

The bottom of a trench or bed excavation shall be level. Seepage trenches or beds shall not be excavated where the soil is so wet that such material rolled between the hands forms a soil wire. All smeared or compacted soil surfaces in the sidewalls or bottom of seepage trench or bed excavations shall be scarified to the depth of smearing or compaction and the loose material removed. Where rain falls on an open excavation, the soil shall be left until sufficiently dry so a soil wire will not form when soil from the excavation bottom is rolled between the hands. The bottom area shall then be scarified and loose material removed.

1401.1.5 1402.10.1.5 Aggregate and backfill.

Not less than 6 inches in depth of aggregate, ranging in size from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches (12.7 mm to 64 mm), shall be laid into the trench below the distribution piping elevation. The aggregate shall be evenly distributed not less than 2 inches (51 mm) in depth over the top of the distribution pipe. The aggregate shall be covered with approved synthetic materials or 9 inches (229 mm) of uncompacted marsh hay or straw. Building paper shall not be used to cover the aggregate. Not less than 9 inches (229 mm) of soil backfill shall be provided above the covering.

1401.2 1402.11 Distribution piping.

Distribution piping shall be not less than 3 inches (76 mm) in diameter. Materials shall comply with Table 1401.2 1402.11. The top of the distribution pipe shall be not less than 8 inches (203 mm) below the original surface. The slope of the distribution pipes shall be not less than 2 inches (51 mm) and not greater than 4 inches (102 mm) per 100 feet (30 480 mm).

TABLE 1401.2 1402.11

DISTRIBUTION PIPE	
MATERIAL	STANDARD
Polyethylene (PE) plastic pipe	ASTM F405
Polyvinyl chloride (PVC) plastic pipe	ASTM D2729
Polyvinyl chloride (PVC) plastic pipe with a 3.5-inch O.D. and solid cellular core or composite wall	ASTM F1488

For SI: 1 inch=25.4 mm.

1401.2.1 Joints.

Joints in distribution pipe shall be made in accordance with Section 705 of this code.

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1401.1.2 This section shall apply to all irrigation systems used on residential and commercial landscape areas.

1401.1.3 This section shall apply to all new irrigation systems and any new work to existing irrigation systems.

Exception. This section shall not apply to irrigation systems for golf courses, nurseries, greenhouses, or agricultural production systems.

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1401.1.4 Nothing contained in this section shall be deemed to require any irrigation system or part thereof, which existed prior to the establishment of this code, to be changed altered or modified to meet the standards of this code.

1401.2 Permits.

1401.2.1 A permit shall be required for new installation of landscape irrigation systems and for repairs or modifications to the system design that exceed \$1000.00 in labor and material based on invoice value.

1401.2.2 No permit shall be required for general maintenance or repairs which do not change the structure or alter the system and the value of which does not exceed \$1000.00 in labor and material based on invoice value.

1401.3 Preconstruction submittals.

1401.3.1 Plans or drawings.

1401.3.1.1 Single-family residence. Design drawings or shop drawings, where required, shall be provided for the installation of irrigation systems prior to start of construction. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, and include all improvements. Drawings shall be prepared by a licensed plumbing or irrigation contractor or licensed landscape architect.

1401.3.1.2 Commercial, industrial, municipal and multiple-family. Professionally designed drawings prior to start of construction shall be provided for landscape irrigation systems. Design drawings shall be clearly readable, to reasonable scale, show the entire site to be irrigated, including all improvements, and shall include but not be limited to: date, scale, revisions, legend, specifications which list all aspects of equipment and assembly there of, water source, water meter and/or point of connection, backflow prevention devices, pump station size, pump station location, design operating pressure and flow rate per zone, precipitation rate per zone, locations of pipe, controllers, valves, sprinklers, sleeves, gate valves, sensors, etc. The plans and specifications shall be prepared in accordance with Section 107 of the Florida Building Code, Building.

1401.4 Definitions. The following definitions are exclusive to this section of the code.

ABS Pipe. Acrylonitrile-butadiene-styrene black, semi-rigid, plastic pipe extruded to IPS. ABS pipe is in limited use in present day irrigation systems. Solvent weld fittings are used with this pipe (see ASTM D 1788).

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Air Release Valve. A valve which will automatically release to the atmosphere accumulated small pockets of air from a pressurized pipeline. A small orifice is used to release air at low flow rates. Air release valves are normally required at all summits of mainline and submain pipelines in an irrigation system.

Anti-Siphon Device. A safety device used to prevent back-flow of irrigation water to the water source by back-siphonage.

Application Rate. The average rate at which water is applied by an irrigation system, sometimes also called precipitation rate. Units are typically inches/hr or mm/hr.

Application uniformity. Irrigation application uniformity (also known as distribution uniformity) describes how evenly water is distributed within an irrigation zone.

Arc. The angle of coverage of a sprinkler in degrees from one side of throw to the other. A 90-degree arc would be a quarter-circle sprinkler.

Atmospheric Vacuum Breaker (AVB). An anti-siphon backflow device which uses a floating seat to allow an air break to interrupt the vacuum effect on water flow.

Automatic Control Valve. A valve in a sprinkler system which is activated by an automatic controller by way of hydraulic or electrical control lines and controls a single device or multiple devices.

Automatic System. An irrigation system which operates following a preset program entered into an automatic controller.

Backflow Prevention Device. An approved safety device used to prevent pollution or contamination of the irrigation water supply due to backflow from the irrigation system.

Belled (Pipe). Pipe which is enlarged at one end so that the spigot end of another length of pipe can be inserted into it during the assembly of a pipeline.

Block (of sprinklers). A group of sprinklers controlled by one valve. Also called zones or subunits.

Block System. An irrigation system in which several groups of sprinklers are controlled by one valve for each group.

Bubbler Irrigation. The application of water to the soil surface or a container as a small stream or fountain. Bubbler emitter discharge rates generally range from 0.5 to 2 gpm but are generally less than 60 gph.

Check Valve. A valve which permits water to flow in one direction only.

Chemical Water Treatment. The addition of chemicals to water to make it acceptable for use in irrigation systems

Chemigation. The application of water soluble chemicals by mixing or injecting with the water applied through an irrigation system.

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Contractor. Any person who engages in the fabrication and installation of any type of irrigation system on a contractual basis in accordance with all stipulations receiving compensation.

Control Lines. Hydraulic or electrical lines which carry signals to open and close the valves from the controller to the automatic valves.

Controller. The timing mechanism and its mounting box. The controller signals the automatic valves to open and close on a pre-set program or based on sensor readings.

Coverage. Refers to the way water is applied to an area.

Cycle. Refers to one complete run of a controller through all programmed controller stations.

Demand (or irrigation demand). Refers to the irrigation requirements of the irrigated area. Demand primarily depends on the type of crop, stage of growth, and climatic factors.

Design Area. The specific land area to which water is to be applied by an irrigation system.

Design Emission Uniformity. An estimate of the uniformity of water application with an irrigation system.

Design Pressure. The pressure at which the irrigation system or certain components are designed to operate. The irrigation system design pressure is that measured at the pump discharge or entrance to the system if there is no pump, and a zone design pressure is the average operating pressure of all emitters within that zone.

Direct Burial Wire. Plastic-coated single-strand copper wire for use as control line for electric valves.

Discharge Rate. The instantaneous flow rate of an individual sprinkler, emitter, or other water emitting device, or a unit length of line-source micro irrigation tubing. Also, the flow rate from a pumping system or from a reduced pressure assembly or relief valve.

Double Check Valve. An approved assembly of two single, independently-acting check valves with test ports to permit independent testing of each check valve.

Drain Valve. A valve used to drain water from a line. The valve may be manually or automatically operated.

Drip Irrigation. The precise low-rate application of water to or beneath the soil surface near or directly into the plant root zone. Applications normally occur as small streams, discrete or continuous drops, in the range of 0.5 to 2.0 gph.

Effluent water. Also referred to as reclaimed is wastewater which has been treated per Florida Statute, §403.086 and is suitable for use as a water supply for irrigation systems.

Emitters. Devices which are used to control the discharge of irrigation water from lateral pipes. This term is primarily used to refer to the low flow rate devices used in micro irrigation systems.

Fertigation. The application of soluble fertilizers with the water applied through an irrigation system.

Filtration System. The assembly of physical components used to remove suspended solids from irrigation water. These include both pressure and gravity type devices, such as settling basins, screens, media filters, and centrifugal force units (vortex sand separators).

Flexible Swing Joint. A flexible connection between the lateral pipe and the sprinkler which allows the sprinkler to move when force is applied to it.

Flow Meters. Devices used to measure the volume of flow of water (typically in gallons), or flow rates (typically in gpm), and to provide data on system usage.

Gauge (Wire). Standard specification for wire size. The larger the gauge number, the smaller the wire diameter.

Head. A sprinkler head. Sometimes used interchangeably with and in conjunction with "Sprinkler."

Infiltration Rate. The rate of water flow across the surface of the soil and into the soil profile. Units are usually inches/hr.

Irrigation. Application of water by artificial means, that is, means other than natural precipitation. Irrigation is practiced to supply crop water requirements, leach salts, apply chemicals, and for environmental control including crop cooling and freeze protection.

Irrigation Water Requirement or Irrigation Requirement. The quantity of water that is required for crop production, exclusive of effective rainfall.

Landscape. Refers to any and all areas which are ornamentally planted, including but not limited to turf, ground covers, flowers, shrubs, trees, and similar plant materials as opposed to agricultural crops grown and harvested for monetary return.

Lateral. The water delivery pipeline that supplies water to the emitters or sprinklers from a manifold or header pipeline downstream of the control valve.

Line-Source Emitters. Lateral pipelines which are porous or contain closely-spaced perforations so that water is discharged as a continuous band or in overlapping patterns rather than discrete widely-spaced points along the pipeline length.

Looped System. A piping system which allows more than one path for water to flow from the supply to the emitters or sprinklers.

Low Volume Sprinklers. Sprinkler heads that emit less than .5 gallons per minute.

Mainline. A pipeline which carries water from the control station to submains or to manifolds or header pipelines of the water distribution system.

Manifold. The water delivery pipeline that conveys water from the main or submain pipelines to the laterals. Also sometimes called a header pipeline.

Manual System. A system in which control valves are manually operated rather than operated by automatic controls.

- **Matched Precipitation.** An equal distribution of water over a given area or zone.

- **Meter Box.** A concrete or plastic box buried flush to grade which houses flow (water) meters or other components.

- **Microirrigation.** The frequent application of small quantities of water directly on or below the soil surface, usually as discrete drops, tiny streams, or miniature sprays through emitters placed along the water delivery pipes (laterals). Microirrigation encompasses a number of methods or concepts, including drip, subsurface, bubbler, and spray irrigation. Previously known as trickle irrigation.

- **Overlap.** The amount one sprinkler pattern overlaps another one when installed in a pattern. Expressed as a percentage of the diameter of coverage.

- **PE Pipe.** Flexible polyethylene pipe for use in irrigation systems, normally manufactured with carbon black for resistance to degradation by ultraviolet radiation.

- **Potable Water.** Water which is suitable in quality for human consumption and meets the requirements of the Health Authority having jurisdiction.

- **Pressure Relief Valve.** A valve which will open and discharge to atmosphere when the pressure in a pipeline or pressure vessel exceeds a pre-set point to relieve the high-pressure condition.

- **Pressure Vacuum Breaker.** A backflow prevention device which includes a spring-loaded check valve and a spring-loaded vacuum breaker to prevent the backflow of irrigation system water to the water source.

- **Pumping Station.** The pump or pumps that provide water to an irrigation system, together with all of the necessary accessories such as bases or foundations, sumps, screens, valves, motor controls, safety devices, shelters and fences.

- **PVC Pipe.** Polyvinyl chloride plastic pipe made in standard thermoplastic pipe dimension ratios and pressure rated for water. Manufactured in accordance with AWWA C-900 or ASTM D-2241.

- **Rain Shut off Device.** A calibrated device that is designed to detect rainfall and override the irrigation cycle of the sprinkler system when a predetermined amount of rain fall has occurred.

- **Reduced Pressure Principle Backflow Preventer (RPZD) (also known as Reduced Pressure Zone Device RPZ or RPZ Valve).** A type of backflow prevention device used to protect water supplies from contamination.

- **Riser.** A threaded pipe to which sprinklers or other emitters are attached for above-ground placement.

- **Runoff.** The result of excess water applied either naturally (precipitation) or mechanically (irrigation) that exceeds the absorption rate of the soil, moving to an area of a lower elevation.

- **Sleeve.** A pipe used to enclose other pipes, wire, or tubing; usually under pavement, sidewalks, or planters.

- **Spacing.** The distance between sprinklers or other emitters.

- **Spray Irrigation.** The micro irrigation application of water to the soil or plant surface by low flow rate sprays or mists.

- **Sprinkler.** The sprinkler head. Sometimes called "Head."

- **Supply (Water Source).** The origin of the water used in the irrigation system.

- **Swing Joint.** A ridged connection between the lateral pipe and the sprinkler, utilizing multiple elbows and nipples, which allows the sprinkler to move when force is applied to it.

- **Tubing.** Generally used to refer to flexible plastic hydraulic control lines which are usually constructed of PE or PVC.

1401.4 DESIGN CRITERIA

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1401.4.1 Design defined. Within the scope of this code, irrigation system design is defined as the science and art of properly selecting and applying all components within the system

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1401.4.2 Water supply.

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1401.4.2.1 The water source shall be adequate from the stand-point of volume, flow rate, pressure, and quality to meet the irrigation requirements of the area to be irrigated, as well as other demands, if any, both at the time the system is designed and for the expected life of the system.

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1401.4.2.2 If the water source is effluent, it shall meet the advanced waste treatment standard as set forth in Florida Statute §403.086(4) as well as any other standard as set forth by the controlling governmental agency.

1401.4.3 Application uniformity.

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1401.4.3.1 Sprinkler irrigation systems shall be designed with the appropriate uniformity for the type of plants being grown and the type of soil found in that area. The general

watering of different types of plants as one group without regard to their individual water requirements shall be avoided.

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1401.4.3.2 Sprinkler head spacing, type and nozzle selection that achieves the highest application uniformity shall be utilized.

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1401.4.3.3 Application rates which avoid runoff and permit uniform water infiltration into the soil shall be utilized. Land slope, soil hydraulic properties, vegetative ground cover, and prevailing winds and sun exposure shall be considered when application rates are specified. Different types of sprinklers with different application rates, i.e., spray heads vs. rotor heads, bubbler heads vs rotor heads, shall not be combined on the same zone or circuit.

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1401.4 System zoning. The irrigation system shall be divided into zones based on consideration of the following hydrozoning practices.

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1401.4.1 Available flow rate.

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1401.4.2 Cultural use of the area.

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1401.4.3 Type of vegetation irrigated, i.e., turf, shrubs, native plants, etc.

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1401.4.4 Type of sprinkler, i.e., sprinklers with matching precipitation rates.

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1401.4.5 Soil characteristics and slope.

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1401.4.6 Sun exposure.

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1401.5 Sprinkler/emitter spacing and selection.

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1401.5.1 Sprinkler/Emitter spacing shall be determined considering the irrigation requirements, hydraulic characteristics of the soil and device, and water quality with its effect on plant growth, sidewalks, buildings, and public access areas.

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1401.5.2 All pop-up spray head bodies in turf areas shall be no less than 6" in height for St. Augustine, Zoysia and Bahia and no less than 4" in height for Bermuda, Centapede and Seashore Paspalum.

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1401.5.3 Sprinklers shall be located in accordance with manufacturer's specifications in each irrigated zone area for a matched precipitation rate objective.

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1401.5.4 Single row head spacing shall only occur when an additional row will cause saturated soils at the toe of a slope or other inefficiencies.

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1401.5.5 All heads shall not exceed 50% of manufacturer's specified diameters of coverage.

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1401.5.6 Water conservation shall be taken into consideration by minimizing irrigation of non-vegetated areas.

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1401.5.7 Microirrigation systems shall be designed using the Emission Uniformity concept. Microirrigation emitters shall be spaced to wet 100 percent of the root zone in turf areas and 50 percent of the root zone for shrubs and trees.

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1401.5.8 Microirrigation or low volume heads shall be required in all areas to be irrigated that are less than 4 feet in any direction from the emitter or nozzle.

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1401.5.9 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to supply pipelines to protect the emission devices from contamination from a main or lateral break.

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1401.5.10 Each plant shall have an adequate number and size (gph) of microirrigation devices, properly placed, to meet the plant water requirements for no rainfall.

1401.6 Pipelines. Pipelines shall be sized to limit pressure variations so that the working pressure at all points in the irrigation system will be in the range required for uniform water application. Velocities shall not exceed 5 feet (1524 mm) per second.

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1401.7 Wells.

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1401.7.1 Well diameters, depths and location shall correspond to the irrigation system demand and in compliance to all applicable state, regulatory agencies and local codes and regulations.

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1401.8 Pumps.

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1401.8.1 Pump and motor combinations shall be capable of satisfying the total system demand without invading the service factor of the motor except during start-up and between zones.

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1401.8.2 Pumps shall be positioned with respect to the water surface in order to ensure that the net positive suction head required (NPSHr) for proper pump operation is achieved.

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1401.8.3 The pumping system shall be protected against the effects of the interruption of water flow.

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1401.9 Control valves.

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1401.9.1 Control valve size shall be based on the flow rate through the valve. Friction loss through the valve, an approved air gap separation, or a reduced pressure assembly shall not exceed 10 percent of the static mainline head.

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1401.9.2 Control systems using hydraulic communication between controller and valve(s) shall comply with the manufacturer's recommendations for maximum distance between controller and valve, both horizontally and vertically (elevation change).

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1401.9.3 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications; based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except individual, single lot residential systems.

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1401.9.4 Manually operated control valves shall be located so that they can be operated without wetting the operator.

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1401.9.5 In ground valves shall be located away from large tree and palm root zones.

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1401.9.6 A manual shut off valve shall be required to be installed close to the point of connection but downstream from any backflow device (or/unless included in the backflow device) to minimize water loss when the system is shut off for repairs or emergencies.

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1401.9.7 An automatic shut-off valve or master valve (normally closed) is required on all systems with a constantly pressurized mainline to confine the water loss from minor main line leaks, weeping valves, or stuck on valves to just the time the system is operating automatically.

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1401.10 Automatic irrigation controller. Automatic irrigation controllers shall conform to UL 1310 and have an adequate number of stations and power output per station to accommodate the irrigation system design. The controller shall be capable of incorporating a rain shut off device or other sensors to override the irrigation cycle when adequate rainfall has occurred, as required by Florida Statutes, Section 373.62.

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1401.11 Chemical injection.

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1401.11.1 Chemical injection systems for the injection of fertilizer, pesticides, rust inhibitors, or any other injected substance will be located and sized according to the manufacturers' recommendations.

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1401.11.2 Injection systems shall be located downstream of the applicable backflow prevention devices as required by Florida Statutes, Section 487.021 and 487.055; the Environmental Protection Agency (EPA); Pesticide Regulation Notice 87-1; or other applicable codes.

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1401.11.3 If an irrigation water supply is also used for human consumption, an air gap separation or an approved reduced pressure principal backflow prevention device shall be required in compliance with ASSE 1013 and Section 1401.12.

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1401.12 Backflow prevention methods. Backflow prevention assemblies at all cross connections with all water supplies shall be provided in accordance with county, municipal or other applicable codes. In the event of conflicting regulations the assembly type shall be provided which gives the highest degree of protection.

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1401.12.1 Irrigation systems into which chemicals are injected shall conform to Florida state law (Florida Statutes 487.021 and 487.055) and Environmental Protection Agency Pesticide Regulation Notice 87-1, which requires backflow prevention regulations to be printed on the chemical label.

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1401.12.1.1 For municipal water supplies, chemical injection equipment must be separated from the water supply by an approved air gap separation or a reduced pressure principle assembly that is approved by the Foundation for CCC and the Hydraulic Research Institute. The equipment shall comply with ASSE 1013 to protect the water supply from back-siphonage and back-pressure.

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1401.12.1.2 For other water supplies, Florida State law, EPA regulations, or other applicable local codes shall be followed. In the absence of legal guidelines, at minimum, a Pressure Vacuum Breaker shall be required.

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SECTION 1401.13 REFERENCED STANDARDS

The standards referenced below are exclusive to this section.

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1401.13.1 American Society of Agricultural Engineers (ASAE) Standards:

ASAE S330.1: Procedure for sprinkler distribution testing for research purposes.

ASAE S376.1: Design, installation, and performance of underground thermoplastic irrigation pipelines.

ASAE S397.1: Electrical service and equipment for irrigation.

ASAE S435: Drip/Trickle Polyethylene Pipe used for irrigation laterals.

ASAE S398.1: Procedure for sprinkler testing and performance reporting.

ASAE S339: Uniform classification for water hardness.

ASAE S394: Specifications for irrigation hose and couplings used with self-propelled, hose-drag agricultural irrigation system.

ASAE EP400.1: Designing and constructing irrigation wells.

ASAE EP405: Design, installation, and performance of trickle irrigation systems.

ASAE EP409: Safety devices for applying liquid chemicals through irrigation systems.

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1401.13.2 ASTM International Standards:

ASTM D 2241: Poly (Vinyl Chloride) (PVC) Plastic pipe (SDR-PR).

ASTM D 2239: Specification for polyethylene (PE) plastic pipe (SDR-PR).

-

ASTM D 2466: Specification for socket-type poly (vinyl chloride) (PVC) and chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 40.

ASTM D 2855: Standard recommended practice for making solvent cemented joints with polyvinyl chloride pipe and fittings.

ASTM D 3139: Specification for joints for plastic pressure pipes using flexible elastomeric seals.

ASTM F 477: Specification for elastomeric seals (gaskets for joining plastic pipe).

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1401.13.3 American Water Works Association (AWWA) standards:

AWWA C-900: PVC pipe standards and specifications

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- **1401.13.4 American Society of Sanitary Engineers (ASSE) Standards:**

- ASSE 1001: Pipe applied atmospheric type vacuum breakers.

- ASSE 1013: Reduced pressure principle backflow preventers.

- ASSE 1015: Double check valve backflow preventers.

- ASSE 1020: Vacuum breakers, anti-siphon, pressure type backflow preventers.

- ASSE 1024: Dual check valve backflow preventers.

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- **1401.13.5 Hydraulic Institute Standards, 14th Edition**

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- **1401.13.6 Standards and Specifications for Turf and Landscape Irrigation Systems
Florida Irrigation Society (FIS) Standards**

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- **1401.13.7 Natural Resources Conservation Service (NRCS) Field Office Technical Guide,
Section IV-A — Cropland Codes:**

- NRCS Code 430-DD: Irrigation water conveyance, underground, plastic pipeline.

- NRCS Code 430-EE: Irrigation water conveyance. Low pressure, underground, plastic pipeline.

- NRCS Code 430-FF: Irrigation water conveyance, steel pipeline.

- NRCS Code 441-1: Irrigation system, trickle.

- NRCS Code 442: Irrigation system sprinkler.

- NRCS Code 449: Irrigation water management.

- NRCS Code 533: Pumping plant for water control.

- NRCS Code 642: Well.

- **1401.13.8. Underwriters Laboratories (UL) 333 Pflingsten Road, Northbrook, IL 60062-296
Standards**

UL 486C-1995 Splicing Wire Connectors

- UL 969-2013 Standard for Marking and Labeling Systems

- UL 1310-2011 Standard for Class 2 Power Units

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- **Section 1401.14 MATERIALS**

The materials referenced below are exclusive to this section.

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1401.14.1 PVC pipe and fittings.
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1401.14.1.1 PVC pipe shall comply with one of the following standards ASTM D 1785, ASTM D 2241, AWWA C-900, or AWWA C-905. SDR-PR pipe shall have a minimum wall thickness as required by SDR-26. All pipe used with effluent water systems shall be designated for nonpotable use by either label or by the industry standard color purple.
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1401.14.1.2 All solvent-weld PVC fittings shall, at a minimum, meet the requirements of Schedule 40 as set forth in ASTM D 2466.
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1401.14.1.3. Threaded PVC pipe fittings shall meet the requirements of Schedule 40 as set forth in ASTM D 2464.
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1401.14.1.4. PVC gasketed fittings shall conform to ASTM D 3139. Gaskets shall conform to ASTM F 477.
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1401.14.1.5. PVC flexible pipe shall be pressure rated as described in ASTM D 2740 with standard outside diameters compatible with PVC IPS solvent-weld fittings.
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1401.14.1.6. PVC cement shall meet ASTM D 2564. PVC cleaner-type should meet ASTM F 656.
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1401.14.2 Ductile iron pipe and fittings.
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1401.14.2.1 Gasket fittings for iron pipe shall be of materials and type compatible with the piping material being used.
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1401.14.3. Steel pipe and fittings.
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1401.14.3.1. All steel pipe shall be rated Schedule 40 or greater and be hot-dipped galvanized or black in accordance with ASTM 53.
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1401.14.3.2 Threaded fittings for steel pipe shall be Schedule 40 Malleable Iron.
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1401.14.4 Polyethylene pipe.
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1401.14.4.1 Flexible swing joints shall be thick-walled with a minimum pressure rating of 75 psi (517 kPa) in accordance with ASTM D 2239.

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1401.14.4.2 Low pressure polyethylene pipe for micro-irrigation systems shall conform with ASAE S-435.

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1401.14.4.3 Use fittings manufactured specifically for the type and dimensions of polyethylene pipe used.

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1401.14.5 Sprinklers, spray heads, and emitters.

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1401.14.5.1 Units and nozzles shall be selected in accordance with the size of the area and the type of plant material being irrigated. Sprinklers shall fit the area they are intended to water without excessive overspray. Intentional direct spray onto walkways, buildings, roadways, and driveways is prohibited.

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1401.14.5.2 Equipment shall be used that is protected from contamination and damage by use of seals, screens, and springs where site conditions present a potential for damage.

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1401.14.5.3 Riser-mounted sprinklers shall be supported to minimize movement of the riser resulting from the action of the sprinkler.

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1401.14.5.4 Swing joints, either flexible or rigid, shall be constructed to provide a leak-free connection between the sprinkler and lateral pipeline to allow movement in any direction and to prevent equipment damage.

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1401.14.5.5 Check valves shall be installed on any sprinkler where low point drainage occurs.

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1401.14.5.6 The pop-up height for sprays and rotator nozzles shall be adequate to prevent being obstructed by the turf grass blades: 6" height for St. Augustine, Zoysia and Bahia and 4" height for Bermuda, Centapede and Seashore Paspalum.

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1401.14.5.7 All microirrigation zones shall have adequate filtration installed at the zone valve or at the point where the drip tubing is attached to PVC pipe to protect the emission devices from contamination from a PVC main or lateral break.

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1401.14.5.8 All microirrigation zones shall have adequate pressure regulation installed at the zone valve or at the point where the drip tubing is attached to the PVC to ensure that all emission devices meet the manufacturer's performance standards.

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1401.14.5.9 Each plant shall have a adequate number and size(gph) of microirrigation devices, properly placed to meet the plant water requirements for no rainfall.

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1401.14.5.10 All tubing shall be secured to prevent movement in accordance with manufacturer's specification.

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1401.14.6 Valves.

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1401.14.6.1 Valves shall have a maximum working pressure rating equal to or greater than the maximum pressure of the system, but not less than 125 psi (861 kPa). This requirement shall be waived for low mainline pressure systems [30 psi (207 kPa) or less].

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1401.14.6.2 Only valves that are constructed of materials designed for use with the water and soil conditions of the installation shall be used. Valves that are constructed from materials that will not be deteriorated by chemicals injected into the system shall be used on all chemical injection systems.

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1401.14.7 Valve boxes.

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1401.14.7.1 Valve boxes shall be constructed to withstand traffic loads common to the area in which they are installed. They should be sized to allow manual operation of the enclosed valves without excavation.

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1401.14.7.2. Each valve box shall be permanently labeled in accordance with UL 969 to identify its contents.

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1401.14.8 Low voltage wiring.

1401.14.8.1 All low voltage wire which is directly buried shall be labeled for direct burial wire. Wire not labeled for direct burial shall be installed in watertight conduits, and be listed TWN or THHN type wire as described in the NEC. All wire traveling under any hardscape or roadway must installed within a conduit and sleeve.

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1401.14.8.2 The size of the electrical control wire shall be in accordance with the valve manufacturer's specifications, based on the solenoid in-rush amperage and the circuit length, considering the number of solenoids operating, on the circuit. Minimum of # 14 AWG single strand control wire shall be used on all systems, except single lot individual residential systems.

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1401.14.8.3 Connections shall be made using devices conforming to UL 486 specifically designed for direct burial. All splices shall be enclosed within a valve box.

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1401.14.9 Irrigation controllers.

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1401.14.9.1 All irrigation controllers shall conform to UL 1310 and the provisions of the National Electric Code (NEC) and be grounded in accordance with the manufacturer's specifications. Solid state controls shall be equipped with surge suppressors on the primary and secondary wiring, except single lot residential systems.

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1401.14.9.2 The controller housing or enclosure shall protect the controller from the hazards of the environment in which it is installed.

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1401.14.9.3 The rain switch shall be placed on a stationary structure minimum of 5-foot (1524 mm) clearance from other outdoor equipment, free and clear of any tree canopy or other overhead obstructions, and above the height of the sprinkler coverage. Soil moisture sensors and ET sensors shall be installed in accordance with manufacturer's specifications and Florida Statutes, Section 373.62.

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1401.14.10 Pumps and wells.

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1401.14.10.1 Irrigation pump electrical control systems shall conform to the NEC and local building codes.

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1401.14.10.2 The pumping system shall be protected from the hazards of the environment in which it is installed.

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1401.14.10.3 Use electric motors with a nominal horsepower rating greater than the maximum horsepower requirement of the pump during normal operation. Motor shall have a service factor of at least 1.15.

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1401.14.10.4 Casings for drilled wells shall be steel, reinforced plastic mortar, plastic, or fiberglass pipe. Only steel pipe casings shall be used in driven wells. See NRCS code FL-642. Steel casings shall conform to ASTM A 589.

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1401.14.11 Chemical injection equipment.

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1401.14.11.1 Chemical injection equipment shall be constructed of materials capable of withstanding the potential corrosive effects of the chemicals being used. Equipment shall be used only for those chemicals for which it was intended as stated by the injection equipment manufacturer.

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1401.14.12 Filters and strainers.

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1401.14.12.1 Filtration equipment and strainers constructed of materials resistant to the potential corrosive and erosive effects of the water shall be used. They shall be sized to prevent the passage of foreign material that would obstruct the sprinkler/emitter outlets in accordance with the manufacturer's recommendations.

Section 1401.15 INSTALLATION

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1401.15.1 Pipe installation.

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1401.15.1.1 Pipe shall be installed at sufficient depth below ground to protect it from hazards such as vehicular traffic or routine occurrences which occur in the normal use and maintenance of a property. Depths of cover shall meet or exceed NRCS Code 430-DD, Water Conveyance, as follows:

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1401.15.1.1.1 Vehicle traffic areas.

Pipe Size (inches)

Depth of Cover (inches)

½ – 2 ½

18 - 24

3 - 5

24 - 30

6 and larger

30 - 36

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1401.15.1.1.2 All areas except vehicle traffic:

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Pipe Size (inches)

Depth of Cover (inches)

½ - 1 ½

6

2 - 3

12

4 - 6

18

More than 6

24

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1401.15.1.2 All pipe joints and connections shall be made according to manufacturer's specifications. All solvent-weld connections shall be performed in accordance with ASTM D 2855.

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1401.15.1.3

Minimum clearances shall be maintained between irrigation lines and other utilities. In no case shall one irrigation pipe rest upon another.

For required minimum clearance to onsite sewage treatment and disposal systems, refer to Rule 64E-6.005(2)(b) of the Florida Administrative Code.

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1401.15.1.4 Thrust blocks shall be used on all gasketed PVC systems. They must be formed against a solid, hand-excavated trench wall undamaged by mechanical equipment. They shall be constructed of concrete, and the space between the pipe and trench shall be filled to the height of the outside diameter of the pipe. Thrust blocks shall be sized in accordance with ASAE S-376.1.

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1401.15.1.5 The trench bottom shall be uniform, free of debris, and of sufficient width to properly place pipe and support it over its entire length. Native excavated material may be used to backfill the pipe trench. However, the initial backfill material shall be free from rocks or stones larger than 1-inch in diameter. At the time of placement, the moisture content of the material shall be such that the required degree of compaction can be obtained with the backfill method to be used. Blocking or mounding shall not be used to bring the pipe to final grade.

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1401.15.1.6. Pipe sleeves shall be used to protect pipes or wires installed under pavement or roadways. Pipe sleeves two pipe sizes larger than the carrier pipe or twice the diameter of the wire bundle shall be used under the paving or roadway and extending a minimum of 3 feet beyond the paved area or as required by the Florida Department of Transportation (FDOT). Pipe sleeves shall be Sch 40. Proper backfill and compaction procedures shall be followed.

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1401.15.2 Control valve installation.

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1401.15.2.1 Valve installation shall allow enough clearance for proper operation and maintenance. Where valves are installed underground, they shall be provided with a valve box with cover extending from grade to the body of the valve. The top of the valve body should have a minimum of 6 inches (152 mm) of cover in nontraffic and noncultivated areas and 18 inches (457 mm) of cover in traffic areas. The valve box shall be installed to minimize the effect of soil intrusion within the valve box with the use of filter fabric, pea gravel, or other approved material. If an automatic valve is installed under each sprinkler, then the valve box may be omitted.

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1401.15.2.2 Valve boxes shall be installed so that they do not rest on the pipe and the box cover does not conflict with the valve stem or interfere with valve operation. They shall be flush with the ground surface and do not present a tripping hazard or interfere with routine maintenance of the landscape.

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1401.15.2.3. Quick coupling valves shall be installed on swing joints or flexible pipe with the top of the valve at ground level.

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1401.15.2.4 Any above-ground manually-operated valves on nonpotable water systems shall be adequately identified with distinctive purple colored paint. Hose bibb connections on irrigation systems that utilize nonpotable water supplies shall not be permitted.

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1401.15.3 Sprinkler installation.

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1401.15.3.1. On flat landscaped areas, sprinklers shall be installed plumb. In areas where they are installed on slopes, sprinklers may be tilted as required to prevent erosion. Sprinklers shall be adjusted to avoid unnecessary discharge on roads, pavements and structures.

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1401.15.3.2. There shall be a minimum separation of 4 inches (102 mm) between sprinklers and pavement. There shall be a minimum separation of 12 inches (305 mm) between sprinklers and buildings and other vertical structures. Piping shall be thoroughly flushed before installation of sprinkler nozzles. Surface mounted and pop-up heads shall be installed on swing joints, polyethylene (PE) nipples or flexible pipe. Polyethylene (PE) nipples shall not be used in maintenance equipment traffic areas or alongside roadways and driveways. Above-ground (riser mounted) sprinklers shall be mounted on Schedule 40 PVC or steel pipe and be stabilized.

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1401.15.4 Pump installation.

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1401.15.4.1 Pumps shall be installed in accordance with the manufacturer's specifications. Pumps shall be set plumb and secure to a firm concrete base. There shall be no strain or distortion on the pipe and fittings. Pipe and fittings shall be supported to avoid placing undue strain on the pump. Steel pipe shall be used on pumps 5 horsepower (hp) or larger.

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1401.15.4.2 Pumps shall be installed in a manner to avoid loss of prime. Suction line shall be installed to prevent the accumulation of air pockets. All connections and reductions in suction pipe sizes shall be designed to avoid causing air pockets and cavitation.

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1401.15.4.3 Pumps shall be located to facilitate service and ease of removal. Appropriate fittings shall be provided to allow the pump to readily be primed, serviced, and disconnected. An enclosure shall be provide of adequate size and strength, with proper ventilation, to protect the pump from the elements (except residential systems).

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1401.15.5 Low voltage wire installation.

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1401.15.5.1 Install low voltage wire (less than 98 volts) with a minimum depth of cover of 12 inches (305 mm) where not installed directly under the mainline. A sufficient length of wire shall be provided at each connection to allow for thermal expansion/shrinkage. As a minimum, a 12-inch (305 mm) diameter loop shall be provided at all splices and connections. Terminations at valves shall have 24 inches (610 mm) minimum free wire.

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1401.15.5.2 All above-ground wire runs and wire entries into buildings shall be installed in electrical conduit. Common wires with a different color than the power wires (white shall be used for common wires) shall be provided. Connections shall be made using devices conforming to UL 486C specifically designed for direct burial. All splices shall be enclosed within a valve box.

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Exception: When wiring above ground manifolds from the valve to the ground immediately beneath it, no conduit is required.

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1401.15.6 Hydraulic control tubing installation

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1401.15.6.1. For hydraulic control systems, a water supply shall be used that is filtered and free of deleterious materials, as defined by the hydraulic control system manufacturer's specifications. A backflow prevention device shall be installed where the hydraulic control system is connected to potable water supplies.

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1401.15.6.2 Tubing shall be installed in trenches and spaced so that it will not rub against pipe, fittings, or other objects that could score the tubing, and with a minimum 12-inch (305 mm) diameter loop at all turns and connections A minimum depth of cover of 12 inches (305 mm) shall be provided.

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1401.15.6.3 Tubing shall be connected with couplings and collars according to Manufacturer's specifications. All splices shall be made in valve boxes. Tubing shall be prefilled with water to expel entrapped air and tested for leaks prior to installation.

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1401.15.6.4 Exposed tubing shall be installed in a protective conduit manufactured from Schedule 40 UV protected PVC or electrical conduit.

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1401.16 As-Built Drawings.

1401.16.1 An As-Built drawing shall be required of all irrigation systems installed on commercial and residential developments and shall contain the following information:

- **1401.16.1.1** Location, type, pressure and maximum flow available of all water sources.

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1401.16.1.2 Location, type and size of all components including sprinklers, microirrigation, main and lateral piping, master valves, valves, moisture sensors, rain sensors, controllers, pump start relays, backflow devices, pumps, wells, etc.

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1401.16.1.3 The flow rate, application rate (inches per hour), and the operating pressure for the sprinklers and micro irrigation within each zone.

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1401.16.1.4 The name, address, phone, email, professional license or certification number of the installation contractor.

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1401.16.1.5 Date of installation.

P7193

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Date Submitted	11/7/2018	Section	2905.3	Proponent	Gary Kozan
Chapter	29	Affects HVHZ	No	Attachments	Yes
TAC Recommendation	Pending Review				
Commission Action	Pending Review				

Comments

General Comments	No	Alternate Language	No
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Related Modifications

Summary of Modification

Adds a 100-ft maximum distance from hot water source to fixtures in the Residential Code

Rationale

The FBC-Residential has never contained a specific distance limitation for hot water piping. The 50-foot limit found in the FBC-Plumbing is often misinterpreted as applying to single-family homes. The confusion was finally resolved at the I-Code hearings this year with the approval of RP10-18 (see attached), which establishes a reasonable 100-foot limit in the Residential Code. This change will appear in the 2021 Edition of the International Residential Code, but that edition will not filter down to Florida until 2024. By adopting this new code language now, we can accelerate its adoption into the 2020 Florida Building Code.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code

No cost impact to code enforcement

Impact to building and property owners relative to cost of compliance with code

No cost impact to building and property owners

Impact to industry relative to the cost of compliance with code

For new SFDs with any plumbing fixture farther than 100 feet from the hot water source, a circulating system would be required. The cost could range from \$500-1000 per home. However, most homes of that size would likely already contain a circulating system, so few new homes would be affected.

Impact to small business relative to the cost of compliance with code

No cost impact to small business

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public

Provides a reasonable 100-foot distance limitation, which could reduce the hot water wait times, and improve customer satisfaction

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction

Updates the code to the latest changes in the International Residential Code

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities

Does not discriminate against any products or methods.

Does not degrade the effectiveness of the code

Actually improves the effectiveness of the code by including a specific distance limitation of 100-feet

Add new section:

P2905.3 Hot water supply to fixtures. The developed length of hot water piping, from the source of hot water to the fixtures that require hot water, shall not exceed 100 feet. Water heaters and recirculating system piping shall be considered to be sources of hot water.

RP6-18

Committee Action:

Approved as Modified

Committee Modification:

P2904.2.3 Freezing areas. Piping shall be protected from freezing as required by Section P2603.5 or by using one of the following:

- 1. ~~A~~ dry pipe automatic sprinkler system that is listed for residential occupancy applications.
- 2. ~~Where sprinklers are required in areas that are subject to freezing, d~~ Dry-side-wall or dry-pendent sprinklers extending from a nonfreezing area into a freezing area ~~shall be installed.~~

Committee Reason: For the Modification: Breaking this into a list is helpful to show that there are two alternate methods.

For the Proposal: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion:

NONE

RP7-18

Committee Action:

Approved as Submitted

Committee Reason: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion:

NONE

RP8-18

Committee Action:

Approved as Modified

Committee Modification:

P2904.4.1.3 Other Ceiling Configurations. For ceiling configurations not addressed by Sections P2904.4.1.1 or P2904.4.1.2, the flow rate shall be subject to approval by the ~~fire~~ code official.

Committee Reason: For the Modification: Smaller jurisdictions might not have a fire code official.

For the Proposal: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion:

NONE

RP9-18

Committee Action:

Approved as Submitted

Committee Reason: The Committee agreed with the published reason statement. (Vote:10-0)

Assembly Motion:

NONE

RP10-18

Committee Action:

Approved as Modified

Committee Modification:

P2905.3 Hot water supply to fixtures. The developed length of hot water piping, from the source of hot water to the fixtures that require hot water, shall not exceed ~~50~~ 100 feet (~~15-240 mm~~). Water heaters and recirculating system piping shall be considered to be sources of hot ~~or tempered~~ water.

Committee Reason: For the Modification: 100 feet is a more feasible threshold than 50 feet.

For the Proposal: Sustainability goals are important. The code needs to provide clear direction that the fixtures cannot be too far away from the hot water source. (Vote:6-4)

Date Submitted 12/14/2018	Section 2902.5.3	Proponent Cheryl Harris
Chapter 29	Affects HVHZ No	Attachments No
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language No
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Related Modifications

Summary of Modification

Change reference to "lawn" to "landscape" irrigation for consistency with other code sections.

Rationale

Lawn is not a consist term in other parts of the code. Landscape is the more acceptable and inclusive terminology.

Fiscal Impact Statement

Impact to local entity relative to enforcement of code
None.

Impact to building and property owners relative to cost of compliance with code
None.

Impact to industry relative to the cost of compliance with code
None.

Impact to small business relative to the cost of compliance with code
None.

Requirements

Has a reasonable and substantial connection with the health, safety, and welfare of the general public
Yes.

Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction
Yes.

Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities
No.

Does not degrade the effectiveness of the code
No.

P2902.5.3 ~~Lawn~~ Landscape irrigation systems.

The potable water supply to lawn landscape irrigation systems shall be protected against backflow by an atmospheric vacuum breaker, a pressure vacuum breaker assembly or a reduced pressure principle backflow prevention assembly. Valves shall not be installed downstream from an atmospheric vacuum breaker. Where chemicals are introduced into the system, the potable water supply shall be protected against backflow by a reduced pressure principle backflow prevention assembly.

Date Submitted 12/14/2018	Section 2914	Proponent Cheryl Harris
Chapter 29	Affects HVHZ No	Attachments No
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No **Alternate Language** No

Related Modifications

Summary of Modification

Add Section for Irrigation Systems in Residential Code that references Chapter 14 in Plumbing Code.

Rationale

Although there is existing code for landscape irrigation systems in Chapter 14 of the Plumbing Code there is no reference to that section in the Residential Code. This modification adds that reference.

Fiscal Impact Statement

- Impact to local entity relative to enforcement of code**
None.
- Impact to building and property owners relative to cost of compliance with code**
None.
- Impact to industry relative to the cost of compliance with code**
None.
- Impact to small business relative to the cost of compliance with code**
None

Requirements

- Has a reasonable and substantial connection with the health, safety, and welfare of the general public**
Yes.
- Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction**
Yes.
- Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities**
No.
- Does not degrade the effectiveness of the code**
No.

P2914 Landscape irrigation systems.

Landscape Irrigation systems shall be designed and installed per Chapter 14 of the Florida Building Code, Plumbing.

Date Submitted 6/21/2016	Section 3009	Proponent Eberhard Roeder
Chapter 30	Affects HVHZ No	Attachments Yes
TAC Recommendation Pending Review		
Commission Action Pending Review		

Comments

General Comments No	Alternate Language No
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Related Modifications

Summary of Modification

Refer gray water landscape irrigation systems to regulation by Chapter 64E-6, Florida Administrative Code. This precludes duplicative regulations and reflects Florida statutory requirements for onsite sewage treatment and disposal.

Rationale

The Florida Department of Health is the regulatory authority permitting onsite sewage treatment and disposal systems including gray water treatment and disposal systems (381.0065(2)(e)(k); 381.0065(3)(a)(b)(k), Florida Statutes). Chapter 64E-6, of the Florida Administrative Code, implements this authority and provides requirements.

The base document (2015 IRC) changes the topic of section P3009 from “GRAY WATER RECYCLING SYSTEMS” as in the 5th edition (2014) Florida Building Code-Residential to “SUBSURFACE LANDSCAPE IRRIGATION SYSTEMS”. The new scope includes all “nonpotable water from on-site water reuse systems”, including gray water. By specifying how gray water is disposed of in subsurface irrigation systems, section P3009 creates new and duplicative regulations for wastewater disposal. The proposed modifications reference Florida regulations. This proposal continues the approach taken in the 5th edition (2014) Florida Building Code-Residential on gray water disposal, where language from the base document on landscape irrigation (P3009.14) was reserved.

Fiscal Impact Statement

- Impact to local entity relative to enforcement of code**
Proposal simplifies enforcement by clarifying that there is only a single jurisdiction over onsite sewage treatment and disposal systems. Gray water and laundry wastewater system tanks are included in the definition of “onsite sewage treatment and disposal system” per 381.0065(2)(k) Fl. Statutes.
- Impact to building and property owners relative to cost of compliance with code**
none
- Impact to industry relative to the cost of compliance with code**
none
- Impact to small business relative to the cost of compliance with code**
none

Requirements

- Has a reasonable and substantial connection with the health, safety, and welfare of the general public**
Gray water contains pathogens, and treatment and disposal of this water is necessary for the protection of health and safety. Application of Florida’s onsite sewage regulations provides uniformity and protection. Florida, but not the base code, requires an unsaturated zone to remove pathogens.
- Strengthens or improves the code, and provides equivalent or better products, methods, or systems of construction**
The proposed language is consistent with the referenced language of 64E-6, Florida Administrative Code. Instead of creating a new methodology for drainfield sizing, the reference to 64E-6 provides an established methodology and construction standards that protect groundwater better from pollution.
- Does not discriminate against materials, products, methods, or systems of construction of demonstrated capabilities**
The proposed language includes the material standards of 64E-6, Florida Administrative Code. Among other aspects, this allows for alternative drainfield materials, while the base code language specifies only gravel for the drainfield.
- Does not degrade the effectiveness of the code**
By making the building code and the onsite sewage treatment code more consistent with each other the code system overall will become more effective.

P3009.1 Scope.

The provisions of this section shall govern the materials, design, construction and installation of subsurface landscape irrigation systems connected to nonpotable water from on-site water reuse systems except onsite sewage treatment and disposal systems regulated by Chapter 64E-6, Florida Administrative Code, Standards for Onsite Sewage Treatment and Disposal Systems.

P3009.7 Sizing.

The system shall be sized in accordance with the sum of the output of all water sources connected to the subsurface irrigation system. ~~Where gray water collection piping is connected to subsurface landscape irrigation systems, gray water output shall be calculated according to the gallons per day per occupant (liters per day per occupant) number based on the type of fixtures connected. The gray water discharge shall be calculated by the following equation:~~

-
-
-
-

~~where:~~

-
-

~~A = Number of occupants:~~

~~Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.~~

~~B = Estimated flow demands for each occupant:~~

~~25 gallons (94.6 L) per day per occupant for showers, bathtubs and lavatories and 15 gallons (56.7 L) per day per occupant for clothes washers or laundry trays.~~

~~C = Estimated gray water discharge based on the total number of occupants.~~

-

P3009.9 Subsurface landscape irrigation site location.

The surface grade of soil absorption systems shall be located at a point lower than the surface grade of any water well or reservoir on the same or adjoining lot. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table P3009.9. ~~Private sewage disposal systems in compacted areas, such as parking lots and driveways, are prohibited.~~ Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

P3009.10.1 Absorption area.

The total absorption area required shall be computed from the estimated daily ~~gray-water~~ discharge and the design-loading rate based on the percolation rate for the site. The required absorption area equals the estimated ~~gray-water~~ discharge divided by the design loading rate from Table P3009.10.1.

P3009.1 Scope.

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~~Number of occupants shall be determined by the actual number of occupants, but not less than two occupants for one bedroom and one occupant for each additional bedroom.~~

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