North Carolina Onsite Wastewater Contractor Inspector Certification Board
Authorized Onsite Wastewater Evaluator Permit Option for Non-Engineered Systems
Notice of Intent (NOI) to Construct

___x_New ____ Expansion ___Repair __ Relocation ____Relocation of Repair Area

Owner or Legal Representative Information: Teri Treffzs

Name: Drees Homes Company

Mailing address: 211 Grandview Drive - Suite 102 City: Ft. Mitchell State: KY Zip: 41017

Phone: 919-256-5478 Email: ttreffzs@dreeshomes.com

Authorized Onsite Wastewater Evaluator Information:

Name: Alex Adams Certification #: AOWE# 10021E

Mailing address: 1676 Mitchell Road City: Angier State: NC Zip: 27501

Phone: 919-414-6761 Email: alexadams@bcsoil.com

Site Location Information:

Site address: Lot #131 (Tobacco Road) 369 Crop Road- Angier, NC 27501

Tax parcel identification number or subdivision lot, block number of property: PIN# 0693-05-6084

County: Harnett

System Information: Accepted Status Wastewater System

Type: Accepted Status Daily Design Flow: 480 gallons/day (Engineer Flow Reduction)

Saprolite System: _____Yes ___X__No

Subsurface Operator Required: _____Yes __X___No Water Supply Type: ____Private Well

___X_Public Water Supply ____ Spring _____Other: _____

Facility Type:

___X_Residential ____5_# Bedrooms ____10__ Maximum # of Occupants

____Business Type of Business and Basis for Flow: _____

____Public Assembly Type of Public Assembly and Basis for Flow: _____

Requird_Attachments:

___x__Plat_or_Siteplan

___x__ Evaluation of Soil and Site Features by Licensed Soil Scientist

Attest: On this the 24th day of October 2025 by signature below I hereby attest that the information required to be included with this NOI to Construct is accurate and complete to the best of my knowledge. Furthermore, I hereby attest that I have adhered to the laws and rules governing onsite wastewater systems in the state of North Carolina. This NOI shall expire on 24h day of October 2030.

Signature of Authorized Onsite Wastewater Evaluator: DocuSigned by: Alex Adams

Signature of Owner or Legal Representative: Bradley Weekley 4E761125D09C444... 10/27/2025 | 1:17:26 PM EDT

Disclosure: The owner may apply for a building permit for the project upon submitting a complete NOI to Construct and the fee required (if any) to the local health department. An onsite wastewater system authorized by an authorized onsite wastewater evaluator shall be transferable to a new owner with the consent of the authorized onsite wastewater evaluator.

Local Health Department Receipt Acknowledgement:

Signature of Local Health Department Representative: _____Date: _____

Adams Soil Consulting, PLLC
1676 Mitchell Road
Angier, NC 27501
919-414-6761
alexadams@bcsoil.com

October 24, 2025
Project #1215

"This AOWE/PE submittal is pursuant to and meets the requirements of G.S. 130A-336.2

RE: Tobacco Road -Lot #131, 369 Crop Road - Angier, NC - 5-bedroom Single Family Residence (PIN# 0693-05-6084)
To whom it may concern:

Adams Soil Consulting (ASC) conducted a preliminary soil evaluation on the above referenced parcel to determine the areas of soils which are suitable for subsurface wastewater disposal systems (conventional & LPP). The soil/site evaluation was performed using hand auger borings during moist soil conditions based on the criteria found in the State Subsurface Rules 15ANCAC 18E. From this evaluation, ASC is providing the attached septic system design for a new single-family home sized for a 480 gallon/day septic system. A separately submitted engineered flow reduction will accompany this permit.

The suitable soils found on the subject property were somewhat variable in the initial and repair areas. The area designated for the initial/primary septic system (see attached septic plan) was found to contain soils with greater than 24 inches in depth before a restrictive horizon was encountered.

The initial and primary septic fields for the new home were sized based on a flow rate of 480 gallons/day and utilizing Accepted Status system for the initial and a PPBPS repair system. Any unauthorized site disturbance, filling, soil removal, or layout changes may result in the permit being revoked.

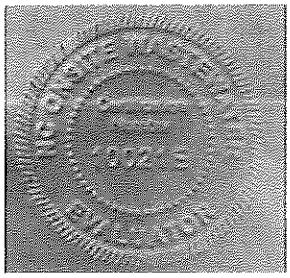
The septic installer contractor shall install the repair (if needed) system on contour, see attached site plan for the primary system and repair. No underground utilities, water lines, or sprinkler systems shall be placed into the initial or repair septic areas. Installation must meet all state and local county regulations for septic system installation. The trenches must be installed in the same location as the site plan. If flags trench flags are missing at the time of installation, they must be remarked by Adams Soil Consulting staff. Contact Alex Adams at 919-414-6761. A preconstruction conference is required with the septic installer prior to construction activities at least 14 days in advance of construction activities.

This report does not guarantee the future function of any waste water disposal system installed.

If you have any questions regarding the findings on the attached site plan or in this report, please feel free to contact me anytime.

Sincerely,

Alex Adams
NC Licensed Soil Scientist #1247
AOWE Certification: 10021E



RESIDENTIAL PRESSURE MANIFOLD DESIGN

Permit # Tobacco Road Lot - 131

# of BDR: 5 Daily Flow: 480 gal/day L.T.A.R.: 0.4000 gal/day/sq.ft

Septic Tank: 1250 gals Pump Tank: 1250 gals Sq. Foot: 900 System Type: Accepted

Number of Taps: 5 Length of Trenches: 300 ft(See Tap Chart for Details)

Depth of Trenches: 24 in Manifold Length: 48 in

Manifold Diameter: 4in sch 80pvc Tap Configuration: 6 in spacing 1 side(s) of manifold

Supply Line: length: 160 ft Diameter: 2 in sch 40pvc

Friction Loss + Fitting Loss: 9.07 ft(supply line length + 70' for fittings in pump tank)

Design Head: 2 ft Elevation Head: 6.00 ft

Total Head: 17.07 ft Pump to Deliver: 42.30 gals/min at 17.07 ft head

Dosing Volume: 146 gals,

Drawdown: 146 gals divided by 30 gals/in = 4.9 inches

Simplex Control Panel required; elapsed time meter and cycle counter required; Floats to be determined by type of pump tank used. A septic tank filter is required.

TAP CHART

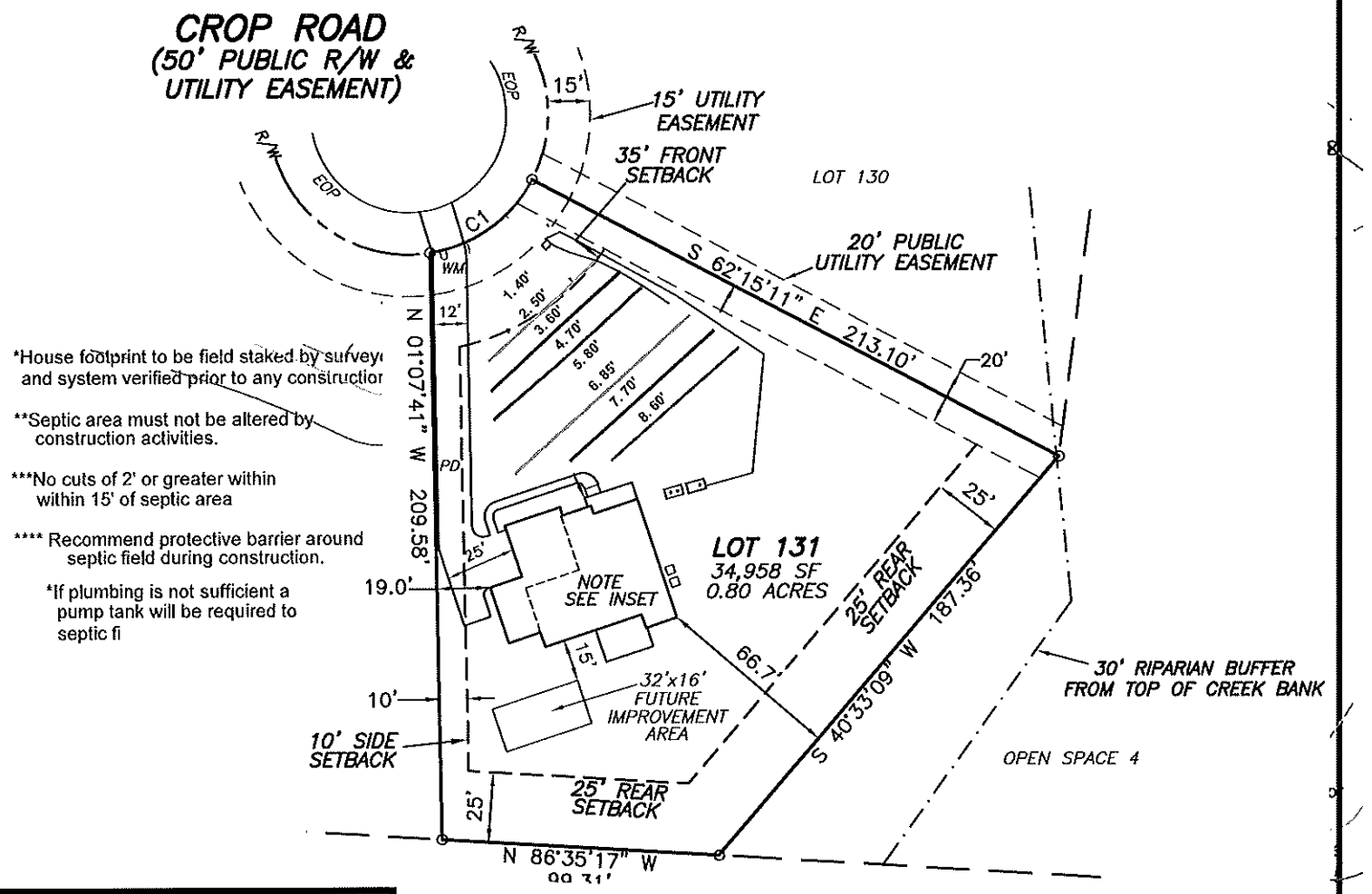
Benchmark is = 100.00 set at — Design Head: 2

Pump tank elev. 100.00 Pump elev. 95.00 Manifold elev. 101.00

line	color	rod read	Elevation	length	hole size	flow/tap	gal/day	trench area	LINE LTAR	# of Panels (PPBPS)
1			100.00	40	1/2in SCH 80	5.48	62.18	120	0.5182	
2			100.00	50	1/2in SCH 40	7.11	80.68	150	0.5379	
3			100.00	60	1/2in SCH 40	7.11	80.68	180	0.4482	
4				70	3/4in SCH 80	10.10	114.61	210	0.5458	
5			100.00	80	3/4in SCH 40	12.5	141.84	240	0.5910	
			100.00			0	0.00	0	#DIV/0!	
			100.00			0	0.00	0	#DIV/0!	
			100.00			0	0.00	0	#DIV/0!	
			100.00			0	0.00	0	#DIV/0!	
			100.00			0	0.00	0	#DIV/0!	
			Total Feet =	300	gal/min =	42.30		LTAR =	0.4000	
			Feet Required =	300	Velocity =	4.05		(ltar + 5%)	0.4200	
Total # of Panels (PPBPS)				Des. Flow	480			(ltar w/25% red)	0.5333	
% of Dose Vol.		75		Pump Run=	11.35			(ltar + 5%)	0.5600	
Dose Volume		146		Tank Gal/IN	30					
Dose Pump Time		3.46		Elev. Head	6.00					
Drawdown in Inches		4.9								

Comments:

Tobacco Road
Lot 131
5 BR, w/480 gpd
Harnett County



*House footprint to be field staked by survey and system verified prior to any construction

**Septic area must not be altered by construction activities.

***No cuts of 2' or greater within within 15' of septic area

**** Recommend protective barrier around septic field during construction.

*If plumbing is not sufficient a pump tank will be required to septic fi

INITIAL:
Lines 1-5 (300')
Accepted Status
Pressure Manifold
REPAIR:
Lines 6-8 (215')
PPBPS
Pressure Manifold

0 60' 120' 180'

GRAPHIC SCALE

Adams
Soil Consulting
919-414-6761

DEPARTMENT OF HEALTH AND HUMAN SERVICES
DIVISION OF PUBLIC HEALTH, ENVIRONMENTAL HEALTH SECTION
ON-SITE WATER PROTECTION BRANCH

PROPERTY ID #: 0693-05-6084
COUNTY: Harnett

SOIL/SITE EVALUATION *for* ON-SITE WASTEWATER SYSTEM

(Complete all fields in full)

OWNER: Drees Homes DATE EVALUATED: 10/23/2025
ADDRESS:
PROPOSED FACILITY: Single Family 5 BR PROPOSED DESIGN FLOW (.0400): 480 gpd PROPERTY SIZE: .80 Acres
LOCATION OF SITE: 369 Crop Rd. Angier NC 27501 PROPERTY RECORDED: Y
WATER SUPPLY: ☒ Public ☐ Single Family Well ☐ Shared Well ☐ Spring ☐ Other WATER SUPPLY SETBACK:
EVALUATION METHOD: ☒ Auger Boring ☐ Pit ☐ Cut TYPE OF WASTEWATER: ☒ Domestic ☐ High Strength ☐ IPWW

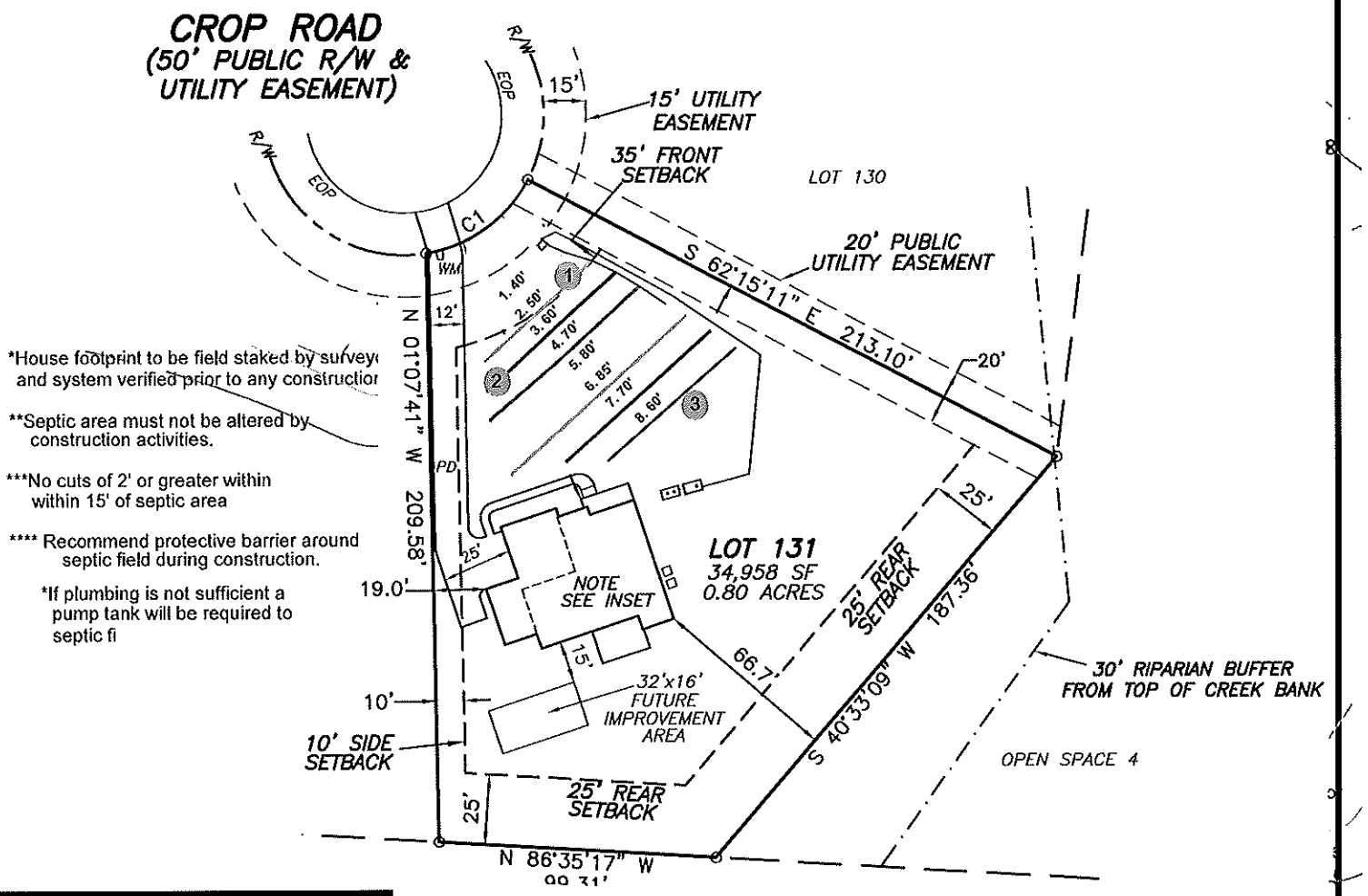
PROFILE #	.0502 LANDSCAPE POSITION/ SLOPE %	HORIZON DEPTH (IN.)	SOIL MORPHOLOGY .0503 STRUCTURE/ TEXTURE	SOIL MORPHOLOGY .0503 CONSISTENCE/ MINERALOGY	OTHER PROFILE FACTORS .0504 SOIL WETNESS/ COLOR	.0505 SOIL DEPTH	.0506 SAPRO CLASS	.0507 RESTR HORIZ	.0509 PROFILE CLASS & LTAR*	.0502(d) SLOPE CORRECTION
1	Linear 2%	0-28	GR/LS	VFR,SEXP,NS	N.O	40"	N.O	N.O	P.S .4	1"
		28-40	SBK SCL	FR,SEXP,S						
2	Linear 2%	0-28	GR/LS	VFR,SEXP,NS	N.O	40"	N.O	N.O	P.S .4	1"
		28-40	SBK SCL	FR,SEXP,S						
3	Linear 2%	0-26	GR/SL	VFR,SEXP,NS	N.O	40"	N.O	N.O	P.S .4	1"
		26-40	SBK SCL	FR,SEXP,S						
4										

DESCRIPTION	INITIAL SYSTEM	REPAIR SYSTEM
Available Space (.0508)	S	S
System Type(s)	III B	III B
Site LTAR	.4	.4
Maximum Trench Depth	20"	20"

SITE CLASSIFICATION (.0509): P.S
EVALUATED BY: Bobby Weaver/Alex Adams
OTHER(S) PRESENT:

Comments:

Tobacco Road
Lot 131
5 BR, w/480 gpd
Harnett County



INITIAL:
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Pressure Manifold
REPAIR:
Lines 6-8 (215')
PPBPS
Pressure Manifold

0 60' 120' 180'
GRAPHIC SCALE

Adams
Soil Consulting
919-414-6761

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 1/22/2025

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Angela Sensenig	
Wade Associates, LLC 250 Pollock St. New Bern NC 28560	PHONE (A/C, No, Ext): (252) 631-5269	FAX (A/C, No): (252) 649-2443
	E-MAIL ADDRESS: asensenig@wadeict.com	
	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A: Lloyd's of London	A1122J
INSURED	INSURER B:	
Alex Adams, DBA: Adams Soil Consulting 1676 Mitchell Rd. Angier NC 27501	INSURER C:	
	INSURER D:	
	INSURER E:	
	INSURER F:	

COVERAGES **CERTIFICATE NUMBER:** 25-26 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	COMMERCIAL GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ CLAIMS-MADE ☐ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
							MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$
	☐ OTHER:							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ☐ NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	☐ UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	☐ EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N						☐ PER STATUTE ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? ☐ N/A (Mandatory in NH)						E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
A	Errors & Omissions			PSN0040221161	1/31/2025	1/31/2026	Each Occurrence	$1,000,000
							General Aggregate	$1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER

FOR INFORMATIONAL PURPOSES ONLY
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXX

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

N Whitsett/RACHEL

Drees Homes

Lot 131 Tobacco Road
(369 Crop Road)

Flow Reduction Request

Harnett County, North Carolina

Project Number: A03523.00

Date of Preparation: October 27, 2025

PROJECT MANAGEMENT

Supporting Information &
Technical Specifications Prepared By:
MacConnell & Associates, P.C.
Full-Service Consulting Engineers

501 Cascade Pointe Lane, Ste 103
Cary, North Carolina 27513

Post Office Box 129
Morrisville, North Carolina 27560

Telephone: (919) 467-1239 Fax: (919) 319-6510

MacCONNELL & ASSOCIATES, P.C.

P.O. Box 129
Morrisville, NC 27560

(919) 467-1239

MacCONNELL & Associates, P.C.
"Engineering Today For Tomorrow's Future"

501 Cascade Pointe Lane
Suite 103
Cary, NC 27513

www.macconnellandassoc.com

Technical Memorandum

To: Harnett County Health Department
Client: Drees Homes
Subject: Lot 131 Tobacco Road

Date: October 27, 2025
From: David Barcal, P.E.
Project No.: A03523.00

This technical memorandum is a request for a design daily flow exemption to a residential dwelling using low flow fixtures as provided for in Session Law 2013-413 (House Bill 74) and Session Law 2014-120 Section 53 which relates to Rule 15A NCAC 18E. Neither the State nor local health department shall be liable for any damages caused by an engineered system approved or permitted pursuant to Session Law 2014-120 Section 53.

Drees Homes is developing the property located at Lot 131 Tobacco Road (369 Crop Road) in Harnett County, NC. A copy of the AOWE (NOI) and soils report can be found in the Existing Information section of this application package. MacConnell & Associates, P.C. (M&A) is requesting a 20 percent flow reduction, using low-flow fixtures, to be incorporated into the design so that the home may be permitted as a 5-bedroom without needing to increase the size of the drainfield. The proposed treatment system is sized for the unadjusted flow of 600-GPD. The proposed initial and repair drainfields are sized for the reduced design flow of 480-GPD.

This request is for a flow reduction per provisions provided in Session Law 2013-413 and Session Law 2014-120. Typically, the basis for the design flow is provided in 15A NCAC 18E and prior regulations. The applicable regulations which preceded the 15A NCAC 18E rules and which served as the basis in determining flow in the 15A NCAC 18E rules: dates well before The Energy Policy Act of 1992 which established maximum flow rates for various fixtures in a nationwide effort to reduce both energy and water use. The flows which were established in the Act have recently been further reduced through the WaterSense program, which allows for labeling of fixtures which meet minimum criteria and conserve water.

Specifications for each fixture model can be found in the Proposed Fixtures section of this application package. A summary of the fixtures and flow rates can be found below in Table 1. A washing machine will be installed by the Owner in the future, so to calculate flow rates, M&A has elected to go with the base-rule flow to provide a conservative estimate

Table 1. Flow rates of proposed fixtures installed by builder.

Fixture	Manufacturer	Flow Rate	Units
Kitchen Faucet	Moen/5923BG	1.5	GPM
Bathroom Faucet 1	Moen/6901BG	1.2	GPM
Bathroom Faucet 2	Moen/6410BN	1.2	GPM
Showerhead 1	Moen/T2692EPBG	2.5	GPM
Showerhead 2	Moen/T2133BN	2.5	GPM
Toilets	Gerber/GWS20912	1.28	GPF

Table 2 identifies the type of fixture, flows for fixtures based on the 15A NCAC 18E rules (Flow A), and flows for proposed fixtures (Flow B). The savings or water conservation from both the rule-based flows and proposed conditions are presented in both flow and percent below (Table 2).

Table 2. Savings of water from rule-based flows with the proposed fixtures.

Fixture

Fixture	Units	Base/Rule Flow A	Proposed Flow B	A to B Savings	A to B % Savings
Kitchen Faucet	GPM	3.0	1.5	1.50	50%
Bathroom Faucet	GPM	3.0	1.2	1.80	60%
Showerhead	GPM	5.5	2.5	3.00	55%
Toilet	GPF	3.5	1.28	2.22	63%
Clothes Washer	GPL	32.0	32.0	0.0	0%

Documentation for the above values is presented at the end of this discussion. The documentation includes:

1. Rule basis of flow and effective dates of rule.
2. Typical indoor water use.
3. Proposed fixtures.
4. Supporting documentation including historical flow rates for fixtures.
5. Technical Advisory Council Report for Wastewater Flows from Single Family Dwellings
6. Existing Information.

The projected flows using rule-based design flowrates would be:

Unadjusted Design Flow per Rule (15A NCAC 18E and prior regulations)

Description	No.	Flow/Unit	Total
Bedrooms	5	120 GPD	600 GPD
Total			600 GPD

Using the information presented above on flow A and B, the projected water use is presented in Table 3 below. The savings presented are from fixture rates when the rules were made effective in comparison to the flow rates with the proposed fixtures.

Fixture	% Use	Base Flow GPD	% Savings	Savings GPD	Adjusted GPD	
Kitchen Faucet	6%	36	50%	18.0	18.0	
Bathroom Faucet	10%	60	60%	36.0	24.0	
Showerhead	19%	114	55%	62.2	51.8	
Toilet	28%	168	63%	106.6	61.4	
Clothes Washer	22%	132	0%	0	132.0	
Leaks & Other	15%	90	0%	0	90.0	
Total	100%	600	37%	222.7	377.3	63%

The projected flow of 377.3 GPD is approximately sixty-three percent of the design flow which we have found to be typical of homes with water conscious fixtures. We are requesting a 20 percent reduction or a design flow for subsurface disposal of 480 GPD.

Analysis of wastewater shows that with the flow reduction, the waste is not considered high strength at presented below:

	Base Flow Concentration	Reduced Flow Concentration (220/1-.20)	High Strength
BOD_5	220 mg/l	275 mg/l	350 mg/l
TSS	220 mg/l	275 mg/l	350 mg/l

Thus, the effluent from the septic tank is expected to be similar to a non-reduced flow effluent. Based on this analysis, the use of low-flow fixtures provides sufficient remaining capacity. We respectfully ask for acceptance of this proposal.

Table of Contents

1. Rule basis of flow and effective dates of rule.

SECTION .0400 – DESIGN DAILY FLOW AND EFFLUENT CHARACTERISTICS

15A NCAC 18E .0401 DESIGN DAILY FLOW

(a) The minimum DDF for dwelling units shall be based on:

(1) 175 gpd for a one bedroom dwelling unit with no more than two occupants and 400 square feet of living space or less; or

(2) 120 gpd per bedroom with a minimum of 240 gpd per dwelling unit or 60 gpd per person when occupancy exceeds two persons per bedroom, whichever is greater.

(b) DDF for facilities other than dwelling units shall be in accordance with Table II as follows:

TABLE II. Design daily flow for Facilities

Facility type	Design daily flow
Commercial	
Airports, railroad stations, bus and ferry terminals, etc.	5 gal/traveler, food preparation not included
Barber shops	50 gal/chair
Bars, cocktail lounges∞	20 gal/seat, food preparation not included
Beauty shops, style shops, hair salons	125 gal/chair
Bed and breakfast homes and inns	Dwelling unit DDF based on Paragraph (a) of this Rule plus 120 gal/rented room which includes the following: Meals served to overnight guests Laundry for linens 150 gal/room with cooking facilities in individual rooms
Event Center∞	5 gal/person with toilets and hand sinks up to 4 hrs 10 gal/person with toilets and hand sinks up to 8 hrs 15 gal/person with toilets and hand sinks greater than 8 hrs Add 5 gal/person with full kitchen
Markets open less than four days/week, such as a flea market or farmers market	30 gal/stall or vendor, food preparation not included
Marinas with no holding tank discharge included	30 gal/boat slip, with bathhouse 10 gal/boat slip, wet slips or slips on dock 5 gal/boat slip, dry storage or warehouse
Motels/hotels	120 gal/room includes the following: No cooking facilities in individual rooms other than a microwave or other similar devices No food service or limited food service establishment Laundry for linens 150 gal/room with cooking facilities in individual rooms
Offices and factories with no IPWW included	12 gal/employee/≤ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift Add 10 gal/employee for showers
Stores, shopping centers, and malls	100 gal/1,000 ft^2 of retail sales area, food preparation not included
Warehouse that are not retail sales warehouses	100 gal/loading bay or 12 gal/employee/≤ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift
Storage warehouse including self-storage facilities and does not include caretaker residence	12 gal/employee/≤ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift
Alcoholic beverage tasting areas with no process wastewater included	200 gal/1,000 ft^2 of tasting area floor space and includes glass washing equipment Food preparation and food clean up not included 12 gal/employee/≤ 8 hr shift
Camps/Campgrounds	
Summer camps with overnight stays*	60 gal/person, applied as follows:

	15 gal/person/food preparation 20 gal/person/toilet facilities 10 gal/person/bathing facilities 15 gal/person/laundry facilities
Day camps not inclusive of swimming area bathhouse*	20 gal/person and 5 gal/meal served with multiuse service or 3 gal/meal served with single-service articles
Temporary Labor Camp or Migrant Housing Camp with overnight stays*	60 gal/person, applied as follows: 15 gal/person/food preparation 20 gal/person/toilet facilities 10 gal/person/bathing facilities 15 gal/person/laundry facilities
Travel trailer or RV in an RV park*	100 gal/space
Recreational Park Trailer or Park Model Trailer 400 ft^2 or less in an RV park*	150 gal/space
Bathhouse for campsites and RV park sites with no water and sewer hook ups with a maximum of four people per campsite	70 gal/campsite
Food preparation facilities	
Food Establishments with multiuse articles*	25 gal/seat or 25 gal/15 ft^2 of floor space open 6 hrs/day or less 40 gal/seat or 40 gal/15 ft^2 of floor space open 6 to 16 hrs/day Add 4 gpd/seat for every additional hour open beyond 16 hrs
Food Establishments with single service articles*	20 gal/seat or 20 gal/15 ft^2 of floor space open 6 hrs/day or less 30 gal/seat or 30 gal/15 ft^2 of floor space open 6 to 16 hrs/day Add 3 gpd/seat for every additional hour open beyond 16 hrs
Food stand with up to eight seats, mobile food units, and commissary kitchens*	50 gal/100 ft^2 of food stand, food unit, or food prep floor space and 12 gal/employee/$\leq$ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift
Other food service facilities*	5 gal/meal served with multiuse articles 3 gal/meal served with single service articles
Meat markets or fish markets with no process wastewater included*	50 gal/100 ft^2 of floor space and 12 gal/employee/$\leq$ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift
Health care and other care institutions	
Hospitals*	300 gal/bed
Rest homes, assisted living homes, and nursing homes*	150 gal/bed with laundry 75 gal/bed without laundry Add 60 gal/resident employee with laundry
Day care facilities	15 gal/person open $\leq$ 12 hr shift without laundry Add 1 gal/person/hr open for more than 12 hrs per day Add 5 gal/person with full kitchen
Group homes, drug rehabilitation, mental health, and other care institutions	75 gal/person with laundry
Orphanages	60 gal/student or resident employee with laundry
Public access restrooms	
Convenience store, service station, truck stop*	250 gal/toilet or urinal meeting the following: Open less than 16 hrs/day Food preparation not included Retail space not included
	325 gal/toilet or urinal meeting the following:

	Open 16 to 24 hrs/day Food preparation not included Retail space not included
Highway rest areas and visitor centers*	325 gal/toilet or urinal or 10 gal/parking space, whichever is greater
Recreational facilities	
Bowling center	50 gal/lane, food preparation not included
Community center, gym∞	5 gal/person plus 12 gal/employee/≤ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift or 50 gal/100 ft^2, whichever is greater
Country club or golf course	10 gal/person 12 gal/employee/≤ 8 hr shift Add 2 gal/employee/hr for more than 8 hr shift 3 gal/person for convenience stations Food preparation not included
Fairground	250 gal/toilet or urinal
Fitness center, spas, karate, dance, exercise∞	50 gal/100 ft^2 of floor space used by clientele Food preparation not included
Recreational park, State park, county park, and other similar facilities with no sports facilities	10 gal/parking space
Outdoor sports facilities, mini golf, batting cages, driving ranges, motocross, athletic park, ball fields, stadium, and other similar facilities	250 gal/toilet or urinal, 5 gal/seat, or 10 gal/parking space, whichever is greater Food preparation not included
Auditorium, theater, amphitheater, drive-in theater	2 gal/seat or 10 gal/parking space, whichever is greater Food preparation not included
Swimming pools and bathhouses	5 gal/person domestic waste only, bathing load of pool may be used as an alternative method of sizing
Sports facilities courts or other similar facilities	250 gal/toilet or urinal or 50 gal/court, whichever is greater
Institutions	
Church or other religious institution*	2 gal/seat sanctuary only 3 gal/seat with warming kitchen in same structure as sanctuary 5 gal/seat with full kitchen in same structure as sanctuary
Public or private assembly halls used for recreation, regularly scheduled meetings, events, or amusement∞* For churches, flow shall be in addition to sanctuary structure flow	2 gal/person with toilets and hand sinks 3 gal/person with addition of a warming kitchen 5 gal/person with full kitchen
Schools	
Day schools*	6 gal/student with no cafeteria or gymnasium 9 gal/student with cafeteria only 12 gal/student with cafeteria and gymnasium
After school program	5 gal/student in addition to flow for regular school day
Boarding schools	60 gal/student and resident employee with laundry

* Facility has potential to generate HSE.
∞Designer shall use the maximum building occupancy assigned by the local fire marshal in calculating DDF unless another method for determining DDF is proposed, including the justification for not using the maximum building occupancy.

(c) The minimum DDF from any facility other than a dwelling unit shall be 100 gpd. For facilities with multiple design units, the minimum DDF shall be 100 gpd per design unit. The DDF of the facility shall be the sum of all design unit flows.
(d) DDF determination for wastewater systems with facilities not identified in this Rule shall be determined using available water use data, capacity of water-using fixtures, occupancy or operation patterns, and other measured data from the facility itself or a comparable facility.

(e) Where laundry is not specified for a facility in Table II, but is proposed to be provided, the DDF shall be adjusted to account for the proposed usage and machine water capacity. The applicant or a licensed professional shall provide cut-sheets for laundry machines proposed for use in facilities.
(f) HVAC unit or ice machine condensate, gutter or sump pump discharge, water treatment system back flush lines, or similar incidental flows shall not discharge to the wastewater system, unless a PE designs the wastewater system for these flows.
(g) Unless otherwise noted in Table II, the DDF per unit includes employees.
(h) Food service facilities and other facilities that are projected to generate wastewater with constituent levels greater than DSE, as defined in Rule .0402 of this Section, are identified in Table II with a single asterisk (*) as HSE. Any facility that has a food service component that contributes 50 percent or more of the DDF shall be considered to generate HSE. Determination of wastewater strength shall be based on projected or measured levels of one or more of the following: BOD, TSS, FOG, or TN. Table III of Rule .0402(a) of this Section identifies the constituent limits for DSE.
(i) Wastewater with constituents other than those listed in Table III of Rule .0402(a) of this Section may be classified as IPWW as defined in G.S. 130A-334(2a) on a site-specific basis.
(j) A request for an adjusted DDF shall be made in accordance with Rule .0403 of this Section.

History Note: *Authority G.S. 130A-335(e); S.L. 2013-413, s.34; S.L. 2014-120, s. 53;*
Eff. January 1, 2024.

15A NCAC 18E .0402 SEPTIC TANK EFFLUENT CHARACTERISTICS
(a) Septic tank effluent standards for DSE shall be as set forth in Table III of this Paragraph. Effluent that exceeds these standards for any constituent shall be considered HSE. When measured, effluent characteristics shall be based on at least two effluent samples collected during normal or above-normal operating periods. A normal period is when the occupancy, operation, or use of the facility is average when compared to the occupancy, operation, or use over a time frame of a minimum of one year. The samples shall be taken from the existing or a comparable facility on non-consecutive days of operation. A comparable facility is based on documentation showing that the hours of operation, floor plan, water use practices, water-using fixtures, location, etc., are similar to the facility listed in the application. The samples shall be analyzed for a minimum of BOD_5, TSS, TN, and FOG.

Table III. Septic tank effluent standards for DSE

Constituent	Maximum DSE mg/L
BOD	≤ 350
TSS	≤ 100
TN*	≤ 100
FOG	≤ 30

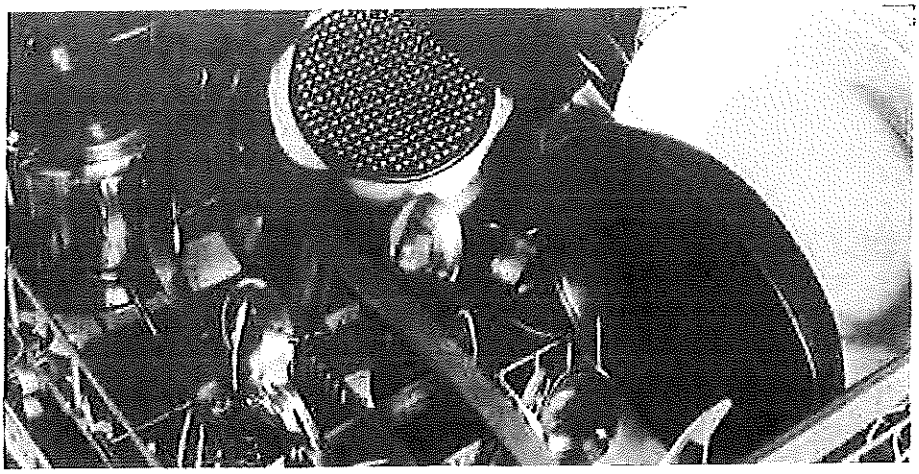
*TN is the sum of TKN, nitrate nitrogen, and nitrite nitrogen

(b) Designs for facilities that generate HSE or when an adjusted DDF is proposed in accordance with Rule .0403 shall address the issue of wastewater strength in accordance with one of the following:
(1) Wastewater systems that meet one of the following criteria shall utilize advanced pretreatment, designed in accordance with Rule .1201(b) of this Subchapter, to produce DSE or better prior to dispersal:
(A) DDF greater than 1,500 gpd and HSE;
(B) any proposed flow reduction in accordance with Rule .0403 of this Section where the DDF is greater than 1,500 gpd; or
(C) any proposed flow reduction in accordance with Rule .0403 of this Section with projected or measured effluent characteristics that exceed DSE as set forth in Table III of this Rule; or
(2) A licensed professional, in accordance with G.S. 89C, 89E, or 89F, may justify not using advanced pretreatment by providing the following, as applicable:

2. Typical indoor water use.

Indoor Water Use at Home

gracelinks.org/124/indoor-water-use-at-home



Shutterstock.com

Fortunately, when we want fresh, clean water, all most of us have to do is turn on a faucet. On average, our direct indoor water use (water you use from your tap, toilet, dishwasher, etc.) adds up to about 60 gallons of water a day per person.

Here's how indoor water use breaks down:

- Toilets (28 percent)
- Washing Machines (22 percent)
- Showers and Baths (19 percent)
- Sinks (16 percent)
- Household Leaks (14 percent)

That last number is surprising – it's almost 10 gallons of water per person per day lost to leaky toilets and faucets.

Conserving Water with Water-Efficient Toilets, Showerheads and More

Fortunately, saving water around the house is easier today than ever before. Newer (low-flow) toilets, showerheads and faucets are designed to be more efficient than older models and can save your household gallons every day. For example, older toilets use up to 7 gallons per flush, whereas low-flow toilets use 1.5 gallons or less.

Likewise, older showerheads flow over 4 gallons per minute, while low-flow models can flow as low as 1.5 gallons per minute. Be careful what showerhead you purchase, though, because some fixtures, especially those with multiple nozzles, exceed the federal limit of 2.5 gallons per minute. If you use one of those, consider cutting back your shower time.

Check out EPA's WaterSense website for water- and energy- saving products. In addition, you can find energy- and water-saving appliances like dishwashers and washing machines through DOE's ENERGY STAR label. By switching to water-saving fixtures and appliances you can reduce your indoor water use by a third on average.

Heating is a Water and Energy Hog!

In most households water heating is a huge energy user, after indoor heating and cooling, appliances, electronics and lighting. So sadly, long hot showers waste both water and energy! Although modern fixtures and appliances are a great way to save gallons, it's still important to simply turn off the tap.

By taking simple steps to reduce your water use at home you can save gallons, energy and dollars every day! To find lots of ways to save water and energy visit the Water Saving Tips page.

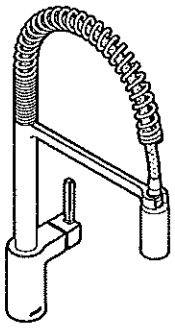
***

Did You Know? Washing dishes by hand takes about 20 gallons per load but Energy Star dishwashers only use 4 to 6 gallons. Even standard machines use only 6 to 8 gallons. If you do wash dishes by hand, turn off the tap until you're ready to rinse.

3. Proposed fixtures.

MOEN®

Specifications



Align™
Single Handle Pre-Rinse Spring Pulldown Kitchen Faucet

Models: 5923 series

NOTE: this faucet is designed to be installed through 1 hole, 1-1/2" (38mm) min. dia. (optional 3-hole escutcheon 141002 available)

GREEN UPC®

FAUCET DESCRIPTION
- Pulldown system offers smooth operation, easy movement and secure docking
- Metal construction with various finishes identified by suffix
- Quick connect installation - Duralock™
- PowerBoost™ spray technology
- Pulldown spray with 68" braided hose
- Flexible supply lines with 3/8" compression fittings
- High arc spout provides height and reach to fill or clean large pots while pulldown wand provides the maneuverability for cleaning or rinsing
- Faucet designed for handle to be mounted on right side

OPERATION
- Lever style handle
- Temperature controlled by 100˚ arc of handle travel
- Operates with less than 5 lbs. of force
- Operates in stream or spray mode in the pullout or retracted position

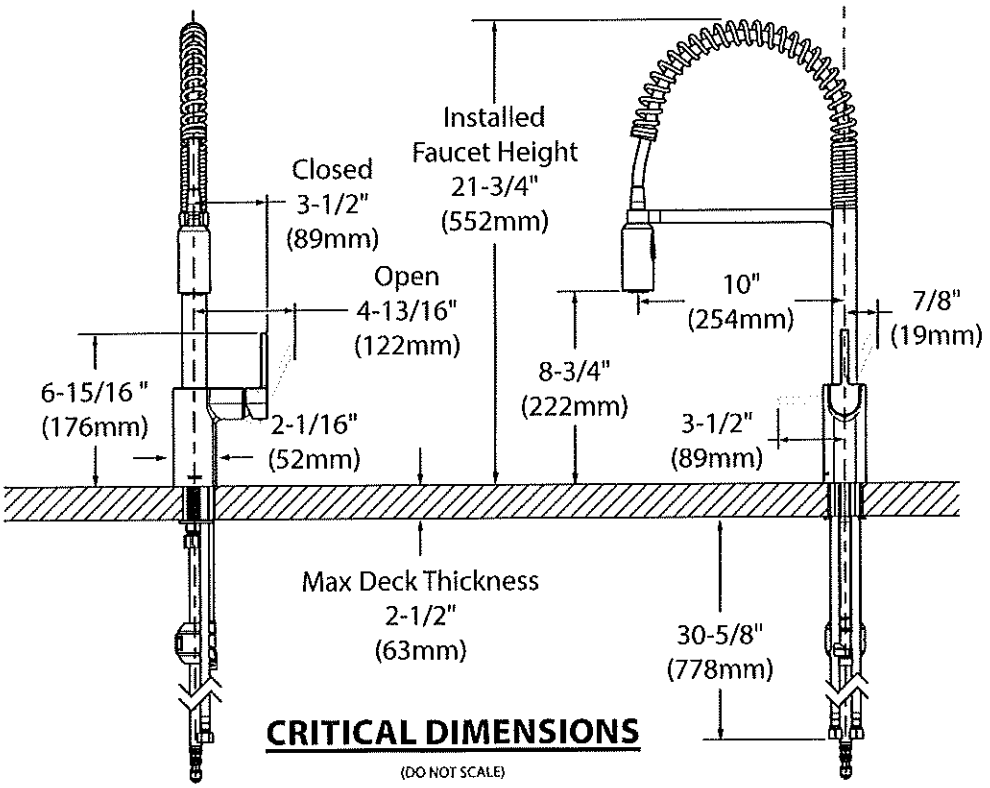
FLOW
- Flow is limited to 1.5 gpm (5.7 L/min) max at 60 psi

CARTRIDGE
- 1255™ Duralast™ cartridge for single handle faucets

STANDARDS
- Third party certified to IAPMO Green, ASME A112.18.1/CSA B125.1 and all applicable requirements therein including NSF 61/9 & 372
- Meets CalGreen and Georgia SB370 requirements
- Complies with California Proposition 65 and with the Federal Safe Drinking Water Act
- The backflow protection system in the device consists of two independently operating check valves, a primary and a secondary which prevent backflow
- ADA for lever handle

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original homeowner
- 10 year limited warranty when used in a multifamily installation
- 5 year limited warranty when used in a commercial installation

Visit www.moen.com/support for complete details and limitations



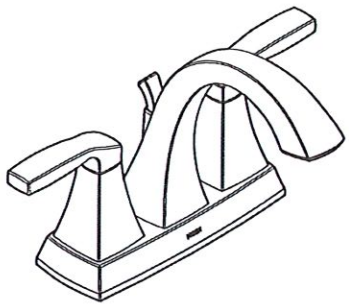
CRITICAL DIMENSIONS

(DO NOT SCALE)

MOEN®

Specifications

There is more than one version of this model.
Page down to identify the version you have.



VOSS™

Two-Handle 4" Centerset Lavatory Faucet

Models:
6901 series includes metal waste

DESCRIPTION

- Metal construction with finish identified by suffix
- ½" IPS connections will accept standard ball nose connection for 3/8" tubing
- Installation through 3 holes, 1" min. diameter, and 4" on center
- Includes pop-up waste assembly

OPERATION

- Lever handles
- Maximum handle rotation angle is 90° to full on
- Hot side counterclockwise to open (clockwise to close)
- Cold side clockwise to open (counterclockwise to close)

FLOW

- Water usage is limited to the maximum flow rates as indicated by the corresponding product markings
  - 1.2 gpm max (4.5 L/min) at 60 psi

CARTRIDGE

- 1234 Duralast® cartridge
- Nonmetallic and stainless steel material

STANDARDS

- Third party certified at WaterSense®, ASME A112.18.1/CSA B125.1, and all applicable requirements referenced therein including NSF 61/9 & 372
- Products marked with 1.2 gpm are compliant with California water efficiency regulations
- Complies with California Proposition 65 and with the Federal Safe Drinking Water Act
- ADA for lever handles

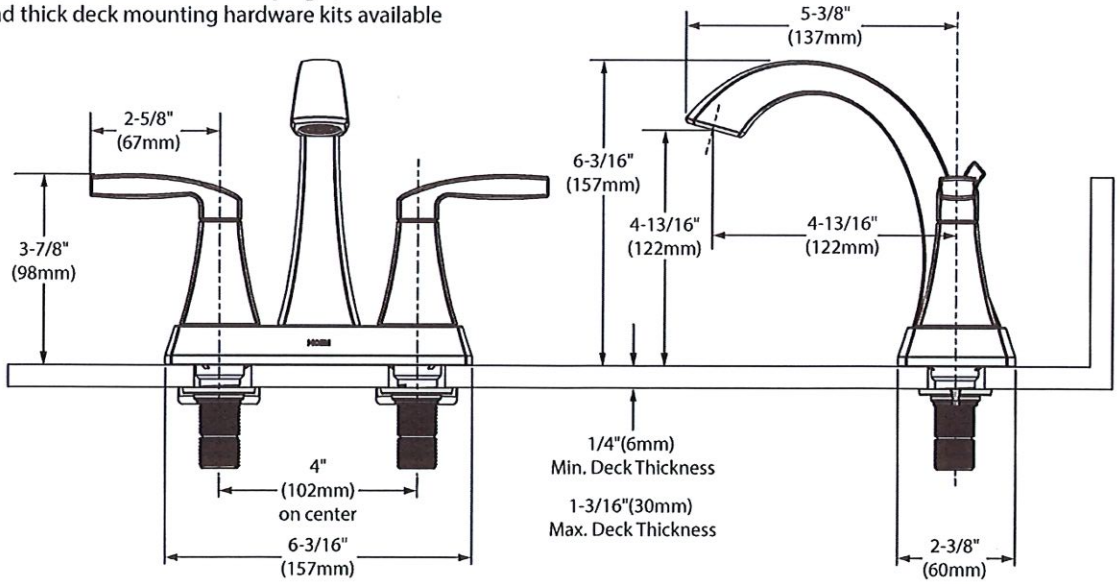
WARRANTY

- Lifetime limited warranty against leaks, drips and finish defects to the original homeowner
- 10 year limited warranty when used in a multifamily installation
- 5 year limited warranty when used in a commercial installation

Visit www.moen.com/support for complete details and limitations

OPTIONS *(See Illustrated Parts page)*

- Thin and thick deck mounting hardware kits available



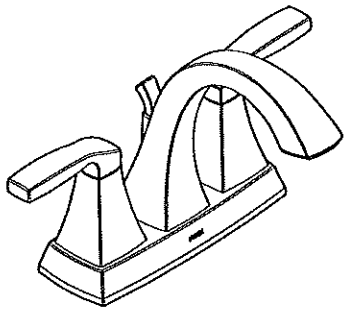
CRITICAL DIMENSIONS

(DO NOT SCALE)

FOR MORE INFORMATION CALL: 1-800-BUY-MOEN
www.moen.com

MOEN®

Specifications



VOSS™

Two-Handle 4" Centerset Lavatory Faucet

Models:
6901 series includes metal waste

DESCRIPTION
- Metal construction with finish identified by suffix
- ½" IPS connections will accept standard ball nose connection for 3/8" tubing
- Installation through 3 holes, 1" min. diameter, and 4" on center
- Includes pop-up waste assembly

OPERATION
- Lever handles
- Maximum handle rotation angle is 90° to full on
- Hot side counterclockwise to open (clockwise to close)
- Cold side clockwise to open (counterclockwise to close)

FLOW
- Water usage is limited to the maximum flow rates as indicated by the corresponding product markings
  - 1.2 gpm max (4.5 L/min) at 60 psi
  - 1.5 gpm max (5.7 L/min) at 60 psi

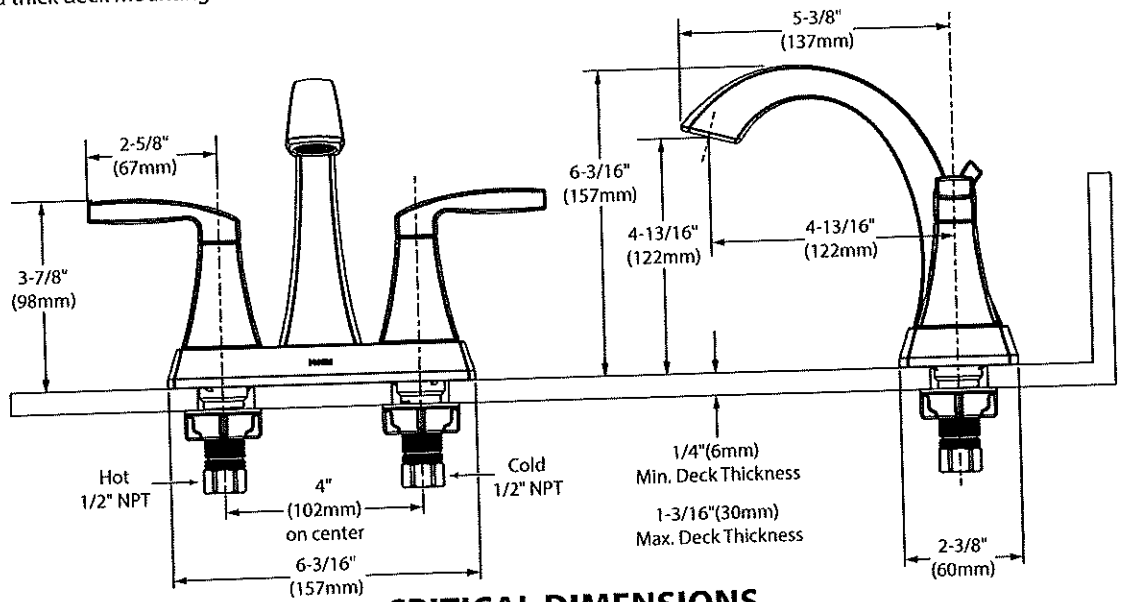
CARTRIDGE
- 1224 cartridge
- Nonmetallic and stainless steel material

STANDARDS
- Third party certified at WaterSense®, ASME A112.18.1/CSA B125.1, and all applicable requirements referenced therein including NSF 61/9 & 372
- Products marked with 1.2 gpm are compliant with California water efficiency regulations
- Complies with California Proposition 65 and with the Federal Safe Drinking Water Act
- ADA for lever handles

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original homeowner
- 10 year limited warranty when used in a multifamily installation
- 5 year limited warranty when used in a commercial installation

Visit www.moen.com/support for complete details and limitations

OPTIONS *(See Illustrated Parts page)*
- Thin and thick deck mounting hardware kits available



CRITICAL DIMENSIONS

(DO NOT SCALE)

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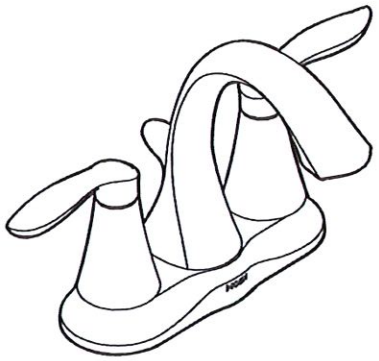
Specifications

There is more than 1 version of this model.
Page down to identify the version you have.



EVA™
4" Lavatory Faucet with Metal Waste Assembly

Models: 6410 series

Bulk Models: 66410, 66411*
(Bulk packed 6 per carton), 50/50 waste assembly
*Includes hot (red) and cold (blue) indicators.

NOTE: THIS FAUCET IS DESIGNED TO BE INSTALLED THRU 3 HOLES, 1" MIN. DIA.

WaterSense Meets EPA Criteria
Certified by IAPMO R&T

DESCRIPTION
- Metal construction with various finishes identified by suffix
- 1/2" IPS connections
- Includes metal pop-up waste assembly

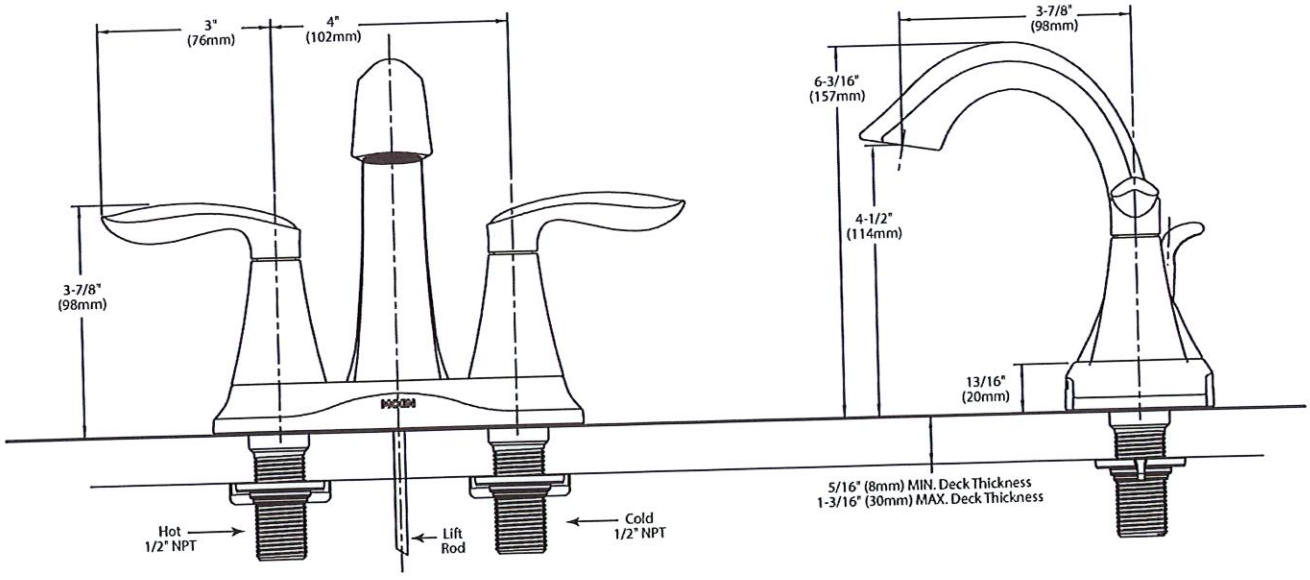
OPERATION
- Lever style handles
- Maximum handle(s) rotation angle is 90° to full on
- Rotate hot side counterclockwise to open (clockwise to close)
- Rotate cold side clockwise to open (counterclockwise to close)

FLOW
- Water usage is limited to these maximum flow rates as indicated by the corresponding product markings
  - 1.2 gpm max (4.5L/min) at 60 psi
  - 1.5 gpm max (5.7L/min) at 60 psi

CARTRIDGE
- 1234 cartridge design
- Nonmetallic and stainless steel material

STANDARDS
- Third party certified to WaterSense®, ASME A112.18.1/CSA B125.1 and all applicable requirements referenced therein
- Certified to NSF 61/9 & 372
- Products marked with 1.2 gpm are compliant with California water efficiency regulations
- Complies with California Proposition 65 and with the Federal Safe Drinking Water Act
- **ADA** for lever handles

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original consumer purchaser
- 5 year warranty if used in commercial installations



CRITICAL DIMENSIONS

(DO NOT SCALE)

MOEN

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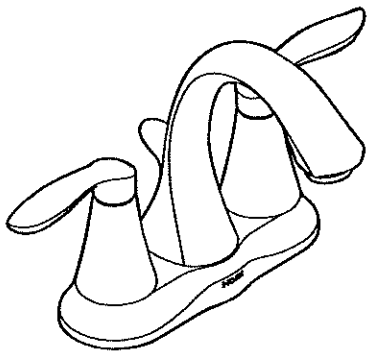
Specifications



EVA™
4" Lavatory Faucet with Metal Waste Assembly

Models: 6410 series

Bulk Models: 66410, 66411*
(Bulk packed 6 per carton), 50/50 waste assembly
*Includes hot (red) and cold (blue) indicators.

NOTE: THIS FAUCET IS DESIGNED TO BE INSTALLED THRU 3 HOLES, 1" MIN. DIA.

DESCRIPTION
- Metal construction with various finishes identified by suffix
- 1/2" IPS connections
- Includes metal pop-up waste assembly

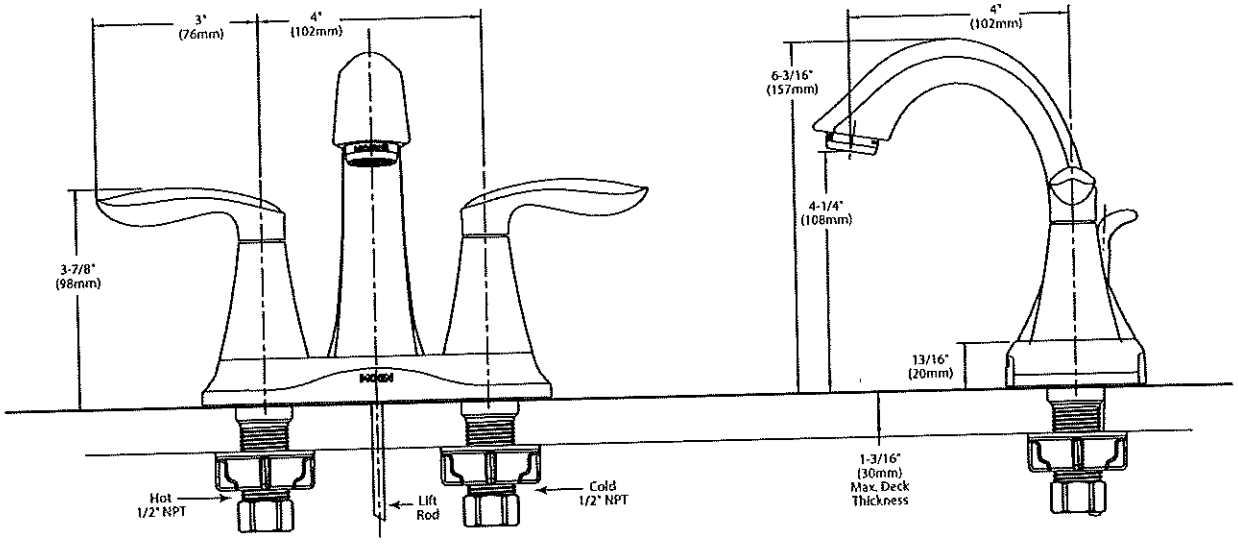
OPERATION
- Lever style handles
- Maximum handle(s) rotation angle is 90° to full on
- Rotate hot side counterclockwise to open (clockwise to close)
- Rotate cold side clockwise to open (counterclockwise to close)

FLOW
- Flow is limited to 1.5 gpm max (5.7L/min) at 60 psi, for products made before October 2008 flow is limited to 2.2 gpm max (8.3 L/min)

CARTRIDGE
- 1224 cartridge design
- Nonmetallic and stainless steel material

STANDARDS
- Third party certified to WaterSense®, ASME A112.18.1/CSA B125.1 and all applicable requirements referenced therein
- Certified to NSF 61/9 & 372
- Complies with California Proposition 65 and with the Federal Safe Drinking Water Act
- **ADA** for lever handles

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original consumer purchaser
- 5 year warranty if used in commercial installations

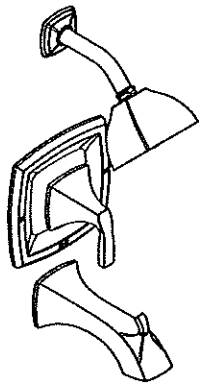


CRITICAL DIMENSIONS

(DO NOT SCALE)

MOEN®

Specifications



VOSS™ POSI-TEMP® Single-Handle Tub/Shower Trim Kit

Models: T2691 series - valve trim only
T2692 series - shower trim only
T2693 series - tub/shower trim
T2693NH series - tub/shower trim less showerhead

Valves: 62300 series
2500 series

DESCRIPTION
- Metal construction with various finishes identified by suffix
- Includes showerhead, arm, flange and diverter tub spout

OPERATION
- Handle operates counterclockwise through a 270° arc with off at 6 o'clock and maximum hot at the 9 o'clock position. Shut off in clockwise direction
- Adjustable temperature limit stop to control maximum hot water temperature
- Pressure balancing mechanism maintains selected discharge temperature to ± 3°

FLOW
- Showerhead is limited to 2.5 gpm (9.5 L/min) at 80 psi
- EP suffix models are limited to 1.75 gpm (6.6 L/min) at 80 psi
- NH suffix models contain no showerhead

CARTRIDGE
- 1222 cartridge design
- Accommodates back to back installations
- Nonmetallic, nonferrous and stainless steel material

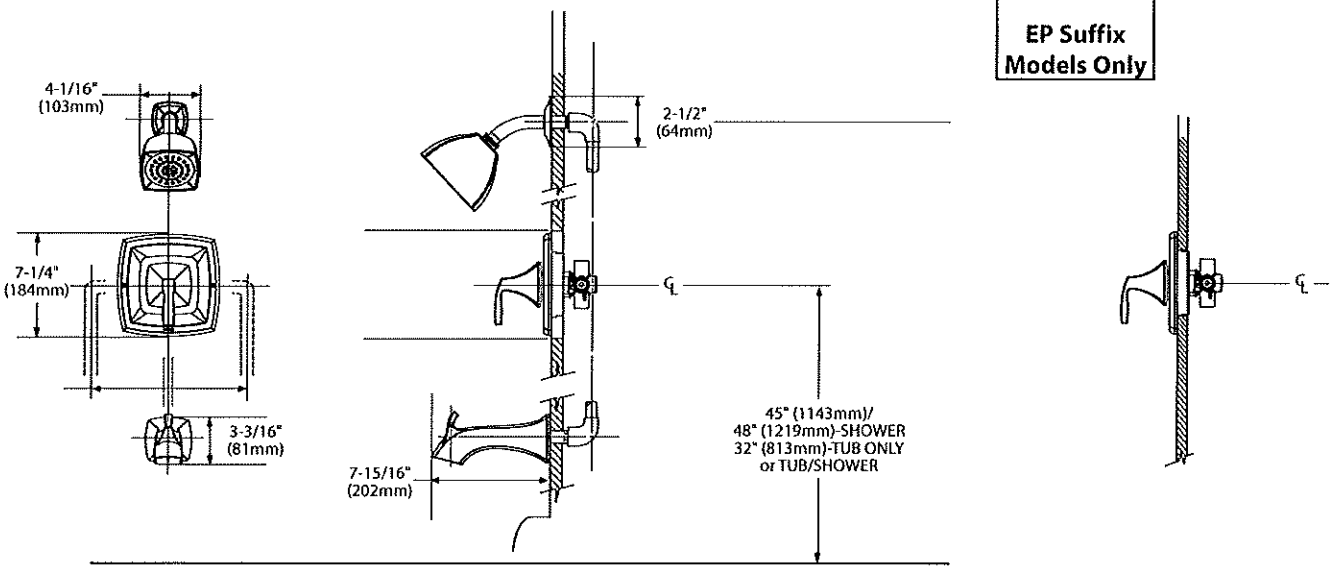
STANDARDS
- Third party certified to meet ASME A112.18.1/CSA B125.1 and all applicable requirements referenced therein
- EP suffix models are third party certified to WaterSense®
- **ADA** for lever handle

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original homeowner
- 10 year limited warranty when used in a multifamily installation
- 5 year limited warranty when used in a commercial installation

Visit www.moen.com/support for complete details and limitations

WaterSense Meets EPA Criteria

EP Suffix Models Only



THICK WALL APPLICATION

THIN WALL APPLICATION

CRITICAL DIMENSIONS
(DO NOT SCALE)

M•pact™ System

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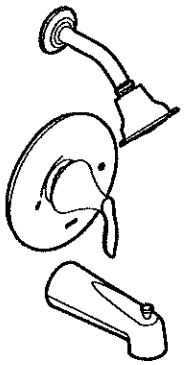
Specifications



EVA™ POSI-TEMP® Single-Handle Tub/Shower Trim Kit

Models: T2131 series - valve trim only
T62131 (Bulk Packed 12 per carton)
T2132 series - shower trim only
T62132 (Bulk Packed 12 per carton)
T2133 series - tub/shower trim
T62133 (Bulk Packed 12 per carton)

Valves: 62300 series
2500 series

DESCRIPTION
- Metal construction with various finishes identified by suffix
- Includes showerhead, arm, flange and diverter spout

OPERATION
- Handle operates counterclockwise through a 270° arc with off at 6 o'clock and maximum hot at the 9 o'clock position. Shut off in clockwise direction
- Adjustable temperature limit stop to control maximum hot water temperature
- Pressure balancing mechanism maintains selected discharge temperature to ± 3°

FLOW
- Showerhead is limited to 2.5 gpm (9.5 L/min) at 80 psi
- EP suffix models are limited to 1.75 gpm (6.6 L/min) at 80 psi
- NH suffix models contain no showerhead

CARTRIDGE
- 1222 cartridge design
- Nonmetallic/nonferrous and stainless steel materials
- Accommodates back to back installations

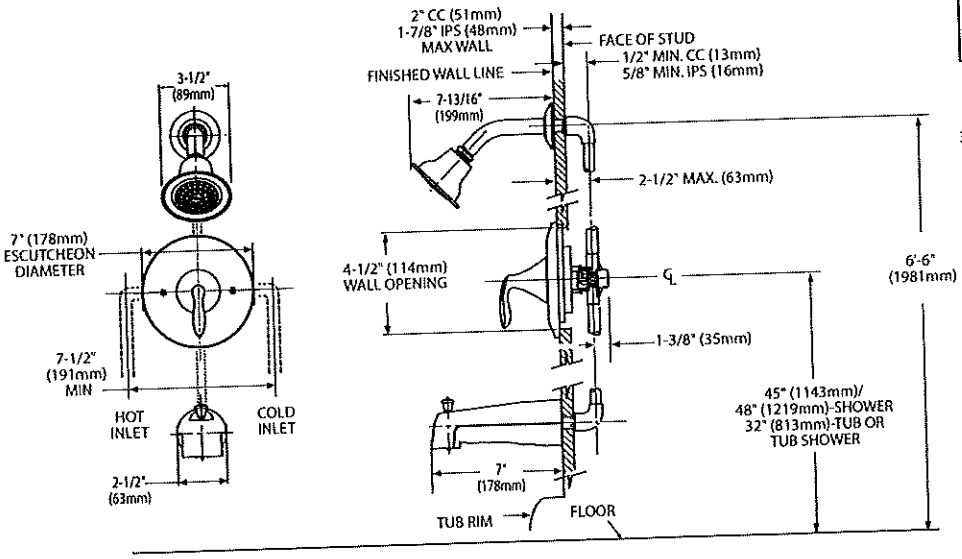
STANDARDS
- Third party certified to meet ASME A112.18.1/CSA B125.1 and all applicable requirements referenced therein
- EP suffix models are third party certified to WaterSense®
- **ADA** for lever handle

WARRANTY
- Lifetime limited warranty against leaks, drips and finish defects to the original homeowner
- 10 year limited warranty when used in a multifamily installation
- 5 year limited warranty when used in a commercial installation

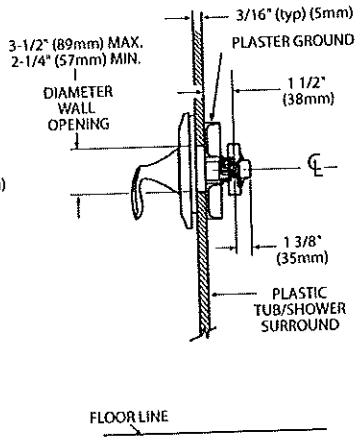
Visit www.moen.com/support for complete details and limitations

WaterSense Meets EPA Criteria

EP Suffix Models Only



THICK WALL APPLICATION



THIN WALL APPLICATION

M•Pact™ System

CRITICAL DIMENSIONS

(DO NOT SCALE)

GERBER

MAXWELL®
1.28 gpf (4.8 Lpf)
Elongated Toilet

Features:

GWS20912

Include Components:

☐ Combination	GWS20912
☐ Bowl	GMX21962
☐ Tank	G0028990

- Vitreous China
- 12" Rough-In
- 3" Flush Valve for Maximum Water Force
- Gerber Pilot Fill Valve
- Corrosion-Resistant Flapper
- Extra-Large Dual Fed Siphon Jet for High Power Bowl Clearing
- 100% Glazed, 2" Large Trapway for Clog-Free Waste Removal
- Double Nut Multi-Point Tank-to-Bowl Mounting System for Tool-Free Installation
- Color Matched Tank Lever
- Color Matched Bolt Caps Included
- Toilet Seat Not Included

Technical Information:

Configuration	Two-Piece, Elongated Toilet
Water Consumption	1.28 gpf (4.8 Lpf)
Rough-In	12"
Height	28 5/8"
Width	17 3/8"
Depth	28 7/8"
Trapway	2"
Water Surface	8 11/16" x 6 5/16"
Shipping Weight Bowl	48.1 lbs
Shipping Weight Tank	30.4 lbs

Accessories Sold Separately:

N/A

Other Tank Options: (Sold Separately)

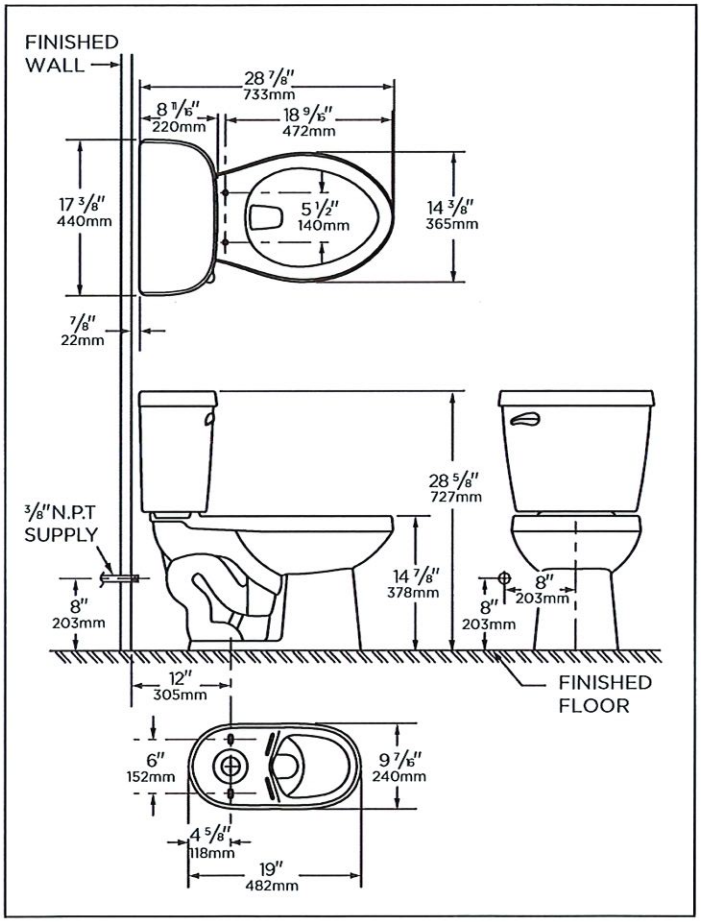
- Insulated Tank G0028992
- Tank with Right Hand Lever G002899097

Available Colors:

- White
- Other: Refer to Price Book for Additional Colors

Warranty:

- Limited Lifetime on Vitreous China, refer to the website for more details.



HIGH EFFICIENCY TOILET HET

NOTES: All dimensions are in inches and millimeters. Illustrations may not be drawn to scale.

IMPORTANT:
Dimensions of fixtures are nominal and may vary within the range of tolerances established by ASME standard A112.19.2/CSA B45.1
THIS FIXTURE QUALIFIES ACCORDING TO ASME TEST PROCEDURES AS A HIGH EFFICIENCY WATER CLOSET WITH AN AVERAGE CONSUMPTION OF 1.28 gpf (4.8 Lpf). WATER CLOSET CONSUMPTION IS DETERMINED BY THE TANK.

Because we are committed to continual product improvement, specifications are subject to change without notice. 08/22

GERBER

MAXWELL®
1,28 gpc (4,8 Lpc)
Toilette allongée

Caractéristiques :

GWS20912

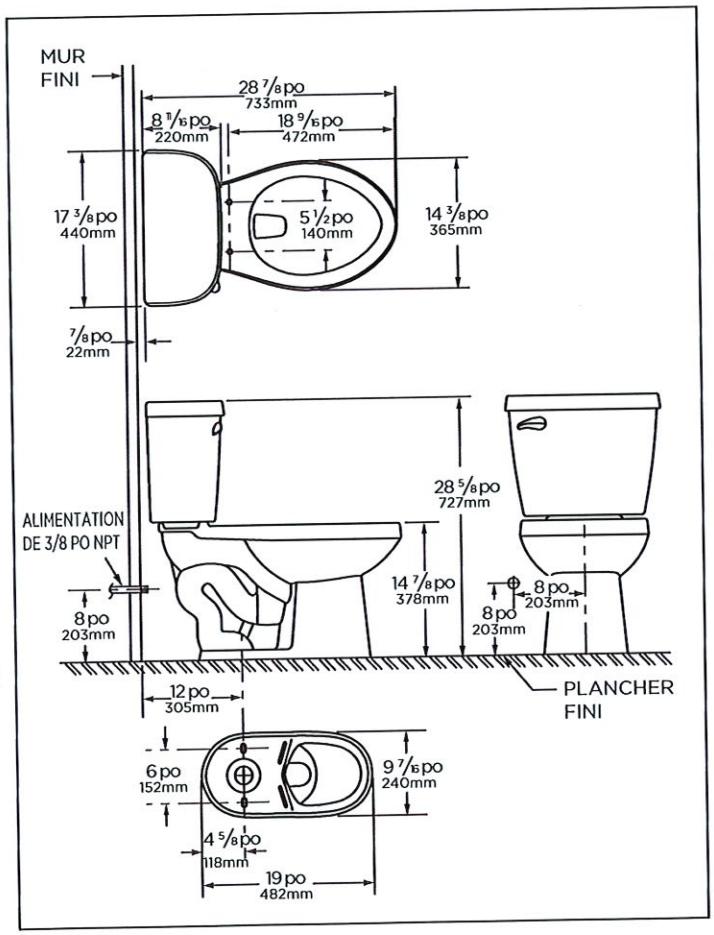
Composants inclus :

☐ Ensemble	GWS20912
☐ Cuvette	GMX21962
☐ Réservoir	G0028990

- En porcelaine vitrifiée
- Plomberie brute de 12 po (30,5 cm)
- Robinet de chasse de 3 po (76 mm) pour une force d'eau maximale
- Soupape de remplissage pilote de Gerber
- Clapet résistant à la corrosion
- Très grand jet siphonique à double alimentation pour une nettoyage de la cuvette à haute puissance
- 100 % vitré, grand siphon de 2 po (5,1 cm) pour une élimination sans obstruction
- Système de fixation à double écrou et multipoint du réservoir à la cuvette pour une installation sans outil
- Levier de réservoir de couleur assortie
- Cache-boulon de couleur assortie inclus
- Siège de toilette non inclus

Informations techniques :

Configuration	Deux pièces, toilette allongée
Consommation d'eau	1,28 gpc (4,8 Lpc)
Plomberie brute	12 po (305mm)
Hauteur	28 5/8 po (727mm)
Largeur	17 3/8 po (440mm)
Profondeur	28 7/8 po (733mm)
Siphon	2 po (51mm)
Surface d'eau	8 11/16 x 6 5/16 po (220 x 160mm)
Poids à l'expédition de cuvette	48,1 lb (21,8 kg)
Poids à l'expédition de réservoir	30,4 lb (13,7 kg)



Accessoires vendus séparément :

SO

Autres options de réservoir : (vendus séparément)

- Réservoir isolé G0028992
- Réservoir avec levier droit G002899097

Couleurs disponibles :

- Blanc
- Autres : consultez le guide de prix pour les autres couleurs

Garantie :

- Limitée à vie sur porcelaine vitrifiée, consultez le site Web pour plus de détails.

HIGH EFFICIENCY TOILET HET

WaterSense Meets EPA Criteria

UPC

REMARQUE : Toutes les dimensions sont en pouces et millimètres. Il se peut que les illustrations ne soient pas dessinées à l'échelle.

IMPORTANT :
Les dimensions des appareils sanitaires sont nominales et peuvent varier dans les limites établies par la norme ASME A112.19.2/CSA B45.1

CET APPAREIL DE PLOMBERIE EST CONFORME AUX PROCÉDURES DE TEST DE L'ASME POUR LES TOILETTES À HAUTE EFFICACITÉ AYANT UNE CONSOMMATION MOYENNE DE 1,28 gpc (4,8 Lpc). LA CONSOMMATION DE LA TOILETTE EST DÉTERMINÉE PAR LE RÉSERVOIR.

Dans un souci d'amélioration continue de nos produits, nous pouvons en changer les caractéristiques sans préavis. 08/22

GERBER

MAXWELL®
1.28 gpf (4.8 Lpf)
Inodoro alargado

Características

GWS20912

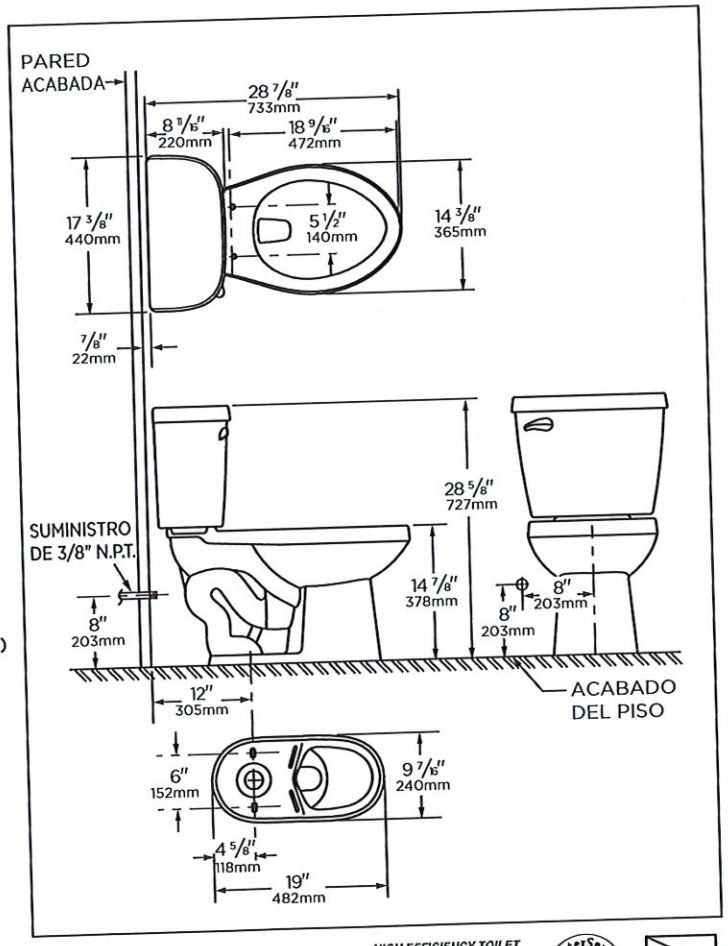
Incluye:

- ☐ Combinación GWS20912
  - ☐ Taza GMX21962
  - ☐ Tanque G0028990

- Porcelana Vítrea
- 30.5 cm de pared a descarga
- Válvula de descarga de 3" para máxima fuerza de agua
- Válvula de carga Gerber tipo Pilot
- Flotador resistente a la corrosión
- Doble alimentación de jet para limpiar con máxima potencia
- Gran trampa de 2" 100% esmaltada, para eliminar los desechos sin obstrucciones
- Instalación taza-tanque con doble tuerca, y multipuntos para instalación sin herramienta
- Palanca del mismo color que la cerámica
- Se incluyen tapas para los pernos, del mismo color que la cerámica
- El asiento del inodoro no está incluido

Información Técnica:

Configuración	Inodoro alargado de dos piezas
Consumo de Agua	1.28 gpf (4.8 Lpf)
Instalación	12"
Alto	28 5/8"
Ancho	17 3/8"
Largo	28 7/8"
Trampa	2"
Superficie de agua	8 11/16" x 6 5/16"
Peso de la taza empacada	21.8 Kgs
Peso del tanque empacado	13.7 Kgs



Accesorios vendidos por separado:

No Aplica

Otras opciones de tanque: (Se venden por separado)

- Tanque aislado G0028992
- Tanque con palanca derecha G002899097

Colores disponibles:

- Blanco
- Otro: consulte el libro de precios para obtener colores adicionales

Garantía:

- Vida útil limitada en porcelana vítrea, consulte el sitio web para obtener más detalles.

HIGH EFFICIENCY TOILET HET

NOTAS: Todas las dimensiones están en pulgadas y milímetros. Las ilustraciones pueden no estar dibujadas a escala.
IMPORTANTE:
Las dimensiones de los accesorios son nominales y pueden variar dentro del rango de tolerancias establecido por la norma ASME A112.19.2/CSA B45.1
ARTEFACTO CALIFICADO DE ACUERDO A LAS PRUEBAS DE ASME COMO INODORO DE ALTA EFICIENCIA CON UN CONSUMO PROMEDIO DE 1.28 gal por descarga (4.8 Litros por descarga). EL CONSUMO DE AGUA DEL INODORO ESTÁ DETERMINADO POR EL TANQUE.

Debido a que estamos comprometidos con la mejora continua del producto, las especificaciones están sujetas a cambios sin previo aviso. 08/22

4. Supporting documentation including historical flow rates for fixtures and washer.

WaterSense® High-Efficiency Lavatory Faucet Specification Supporting Statement

I. Introduction

The WaterSense program released its High-Efficiency Lavatory[1] Faucet Specification (specification) on October 1, 2007, to promote and enhance the market for water-efficient lavatory faucets. The goal of this specification is to allow consumers to identify and differentiate products in the marketplace that meet this specification's criteria for water efficiency and performance.

This specification addresses lavatory faucets and lavatory faucet accessories[2] in private use, such as those found in residences, and private restrooms in hotels and hospitals. Since these types of faucets are used primarily for hand washing and other sanitary activities, such as face washing and razor rinsing, WaterSense believes that maximum flow rates can be reduced enough to impact national water consumption while at the same time not negatively impacting user satisfaction. This specification is not intended to address kitchen faucets, which have a very different set of uses and performance criteria, or public restroom faucets (e.g., airports, theaters, arenas, stadiums, offices, and restaurants), which already have national performance standards and criteria to which they should conform.

II. Current Status of Faucets

WaterSense estimates that currently there are 222 million residential lavatory faucets in the United States. This estimate is based on an assumed one-to-one ratio of lavatory faucets to residential bathrooms.[3] In addition to the existing stock, approximately 25 million new faucets are sold each year for installation in new homes or replacement of aging fixtures in existing homes.[4] Of these 25 million faucets, roughly two-thirds of those are lavatory faucets (approximately 17 million units). Residential lavatory and kitchen faucets account for

[1] Lavatory is the terminology used in the Energy Policy Act of 1992 and ASME A112.18.1 to describe the types of faucets to which the standards apply. In this specification, lavatory means any bathroom sink faucets intended for private use.

[2] Accessory, as defined in ASME 112.18.1, means a component that can, at the discretion of the user, be readily added, removed, or replaced, and that, when removed, will not prevent the fitting from fulfilling its primary function. For the purpose of this specification, an accessory can include, but is not limited to lavatory faucet flow restrictors, flow regulators, aerator devices, laminar devices, and pressure compensating devices.

[3] U.S. Census Bureau, American Housing Surveys for the United States, 1970-2003.

[4] Business Trend Analysts, 2006. "2005/2006 Outlook for the U.S. Plumbing Fixtures and Fittings Industry." <www.mindbranch.com/catalog/print_product_page.jsp?code=R225-358>

approximately 15.7 percent of indoor residential water use in the United States[5]—equivalent to more than 1.1 trillion gallons of water used each year.

The Energy Policy Act of 1992 originally set the maximum flow rate for both lavatory and kitchen faucets at 2.5 gallons per minute (gpm) at 80 pounds per square inch (psi) static pressure. In 1994, American Society of Mechanical Engineers (ASME) A112.18.1M-1994–Plumbing Supply Fittings set the maximum flow rate for lavatory faucets at 2.2 gpm at 60 psi. In response to industry requests for conformity with a single standard, in 1998, the U.S. Department of Energy adopted the 2.2 gpm at 60 psi maximum flow rate standard for all faucets (see 63 FR 13307; March 18, 1998). This national standard is codified in the *U.S. Code of Federal Regulations* at 10 *CFR* Part 430.32. As a point of reference, the maximum flow rates of many of the pre-1992 faucets range from 3 to 7 gpm. Other than the aforementioned maximum flow rate standards, there currently are no universally accepted performance tests or specifications (e.g., rinsing or wetting performance standards) for faucets.

III. WaterSense High-Efficiency Lavatory Faucet Specification

Scope

The WaterSense program developed this specification to address criteria for improvement and recognition of water-efficient and high-performance lavatory faucets and lavatory faucet accessories. WaterSense labeled lavatory faucet accessories can be incorporated into the design of new faucets to control the flow rate and provide the mechanism for meeting this specification's criteria, or can be purchased separately and retrofit onto existing older faucets to provide water efficiency and performance. This specification focuses solely on the category of lavatory faucets intended for private use because of the differences in the uses and performance expectations between private lavatory faucets and kitchen or public restroom faucets. Lavatory faucets are used primarily for hand washing and other sanitary activities, such as teeth brushing, face washing, and shaving. For these activities, discussions with faucet manufacturers and water utility representatives provided a general consensus that a reduction in the maximum flow rate from 2.2 gpm (the current federal water-efficiency standard) to 1.5 gpm, as established by this specification, is not very noticeable for most users. The most noticeable differences are increased wait times when filling the basin or waiting for hot water. While decreasing a faucet's maximum flow rate increases user wait time for these activities, WaterSense determined the potential water savings gained from the primary use of lavatory faucets (i.e., washing and rinsing) outweigh any potential inconvenience caused by increased wait times and will not negatively impact overall user satisfaction.

Kitchen sink faucets were excluded from this specification because the different uses and user expectations require other considerations for defining performance. One major performance consideration is a kitchen faucet's ability to effectively rinse dishes. Kitchen faucets also are commonly used for pot or container filling, and significantly increased wait times might not be acceptable to most users. WaterSense determined that reducing the maximum flow rates of kitchen faucets would create issues of user satisfaction and be counter to its program goals of

[5] Mayer, Peter W. and William B. DeOreo. Residential End Uses of Water. Aquacraft, Inc. Water Engineering and Management. American Water Works Association. 1998.

increasing efficiency while maintaining or improving performance. In order to maintain user satisfaction and ensure a high level of performance, a maximum flow rate greater than what is suitable for lavatory faucets might need to be considered for kitchen faucets. Some type of wetting or rinsing performance test also might need to be included. In addition, there is an emerging area of research and development in multiposition control lever faucet technologies that offer users "high" and "low" settings for different activities. While performance data are not yet available, these technologies might prove to be effective in using water more efficiently. For these reasons, WaterSense intends to evaluate the possibility of developing a WaterSense specification for kitchen faucets at a later date.

Public restroom and metering faucets (faucets that are set to discharge a specific amount of water or run for a specified period of time for each use) also were excluded from this specification because of their differing uses and performance expectations and because standards governing their maximum flow rate already exist. Public restroom faucets, for example, are used almost exclusively for hand washing or simple rinsing, compared to lavatory faucets in homes and in other private bathrooms that face a myriad of uses. As a consequence, the maximum flow rate for these public restroom and metering fixtures can be set significantly lower than the flow rate for private lavatory faucets without negatively impacting user satisfaction. Also, a separate set of standards already apply to these types of fixtures. Codified in the *U.S. Code of Federal Regulations* at 10 *CFR* Part 430 (specifically §430.32(o) Faucets) are standards setting the maximum flow rate for metering faucets at 0.25 gallons/cycle. Section 5.4.1 and Table 1 of ASME A112.18.1/CSA B125.1–Plumbing Supply Fittings also establish the maximum flow rates for public lavatory (other than metering) faucets at 0.5 gpm. As a consequence, this category of faucet is not covered by the current specification. If WaterSense decides to address water efficiency and performance for these types of faucets, it will do so under a separate specification at a later time.

Water-Efficiency and Performance Criteria

The water-efficiency component of this specification establishes a maximum flow rate of 1.5 gpm at an inlet pressure of 60 psi. Lowering the maximum flow rate from 2.2 gpm to 1.5 gpm (both at 60 psi) represents a 32 percent reduction, which is consistent with WaterSense's stated goal of improving efficiency by at least 20 percent. Even when installed in systems with high water pressure (up to 80 psi), faucets designed to this specification will have maximum flow rates of approximately 1.75 gpm, which still represents a greater than 20 percent increase in efficiency. WaterSense chose to specify a test pressure of 60 psi to maintain consistency with the current industry standard (ASME A112.18.1–Plumbing Supply Fittings) to which all faucets sold in the United States must comply.

The requirements of this specification are also in harmony with other international standards. The Joint Standards Australia/Standards New Zealand Committee established standards for the rating and labeling of water-efficient products (AS/NZS 6400:2005). As part of the standard, water-efficient faucets are rated on a scale of 1 to 6 based on maximum flow rates. Under this system, comparable 1.5 gpm WaterSense labeled lavatory faucets would receive a 5 out of 6 star rating, meeting criteria for maximum flow rates between 4.5 liters per minute (L/min) (1.2 gpm) and 6.0 L/min (1.6 gpm).

Meeting or exceeding user expectations via the establishment of performance criteria for WaterSense labeled products is an important aspect of the WaterSense program. From the outset of discussions with interested parties, WaterSense was aware that performance of water-efficient lavatory faucets is affected by low water pressures. To ensure user satisfaction with WaterSense labeled lavatory faucets or lavatory faucet accessories across a range of possible user conditions, WaterSense has established a minimum flow rate of 0.8 gpm at 20 psi in the specification.

In developing these water-efficiency and performance criteria, WaterSense evaluated comments received during the draft specification's public forum and public comment period (see *Response to Issues Raised During Public Comment on February 2007 Draft Specification for WaterSense℠ Labeling of High-Efficiency Lavatory Faucets*). WaterSense also considered user satisfaction data generated from four high-efficiency lavatory faucet retrofit studies and the impact of pressure changes on product flow rates for various types of lavatory faucet accessories.

WaterSense established a maximum flow rate of 1.5 gpm at 60 psi because interested parties that provided comments on the draft specification generally agreed that a flow rate of 1.5 gpm would provide no noticeable difference for most users. In addition, data collected from retrofit studies demonstrate a high level of user satisfaction with high-efficiency lavatory faucets that have maximum flow rates of 1.0 and 1.5 gpm. Aquacraft, Inc. conducted retrofit studies in Seattle, Washington (2000)[6] and East Bay Municipal Utility District (EBMUD), California (2003)[7] in which they replaced existing lavatory faucet aerators with 1.5 gpm pressure compensating aerators. In the Seattle study, 58 percent of the participants felt their faucets with the new aerators performed the same or better than their old faucet fixtures and 50 percent stated they would recommend these aerators to others. In the EBMUD study, 80 percent of the participants felt their faucets with the new aerators performed the same or better than their old faucet fixtures, and 67 percent stated they would recommend these aerators to others. A third Aquacraft, Inc. retrofit study conducted in Tampa, Florida (2004)[8] replaced existing lavatory faucet aerators with 1.0 gpm pressure compensating aerators. The participants in this study were receptive to an even higher-efficiency fixture, with 89 percent saying their new aerators performed the same or better than their old faucet fixtures and would recommend them to others. Seattle Public Utilities also provided WaterSense with survey results of customer use and satisfaction with 1.0 gpm pressure compensating aerators distributed through the utility's direct-mail showerhead and faucet aerator pilot program. According to its survey, 94 percent of the participants that received the free aerators installed them and only 2 percent disliked the aerators and removed them.[9]

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[6] Seattle Home Water Conservation Study: The Impacts of High-Efficiency Plumbing Fixture Retrofits in Single-Family Homes, December 2000.

[7] Water Conservation Study: Evaluation of High-Efficiency Indoor Plumbing Fixture Retrofits in Single-Family Homes in the East Bay Municipal Utility District Service Area, July 2003.

[8] Tampa Water Department Residential Water Conservation Study: The Impacts of High-Efficiency Plumbing Fixture Retrofits in Single-Family Homes, January 2004.

[9] Seattle Public Utilities. "Showerhead/Aerator Pilot Program Summary." Unpublished.

WaterSense established a minimum flow rate of 0.8 gpm at 20 psi for several reasons. First, WaterSense felt this minimum flow rate was reasonable to ensure user satisfaction in homes with low water pressure based on comments that were received regarding the draft specification. Second, WaterSense received comments from several utilities regarding programs in which 1.0 gpm lavatory faucet aerators are provided to customers. These products have shown a high level of user satisfaction, and WaterSense wants to recognize these products and the efforts of the utilities to ensure that additional water savings can be achieved through such programs. Third, WaterSense wants to avoid restricting design options to the extent possible. The specification leaves open the possibility for the use of fixed orifice flow control devices (with a maximum flow rate of 1.5 gpm) instead of restricting manufacturers to the use of pressure compensating devices. Under the specification, a 1.5 gpm maximum flow rate fixed orifice aerator could qualify for use of the label (according to currently available product specifications and flow curves). Pressure compensating devices with maximum flow rates between 1.5 and 1.0 gpm could also qualify for the use of the WaterSense label (according to currently available product specifications and flow curves). WaterSense believes that this approach allows for the greatest degree of design freedom for manufacturers and supports existing utility programs, while still ensuring a high level of performance and user satisfaction.

In order for high-efficiency lavatory faucets to effectively emerge in the market following the release of the final version of this specification, the market must ideally be equipped to produce the faucets or faucet technology that the specification requires. WaterSense is not currently aware of any lavatory faucets on the market with a maximum flow rate of 1.5 gpm. There are, however, several types and models of faucet components and accessories currently available that have the capability to control the flow to the level that is required by this specification. As a result, WaterSense is confident that faucets and faucet accessories that meet the requirements of this specification can be readily brought to market.

Potential Water and Energy Savings

To estimate water and energy savings that can be achieved by products that meet this specification, WaterSense examined the Seattle (2000) and EBMUD (2003) Aquacraft retrofit studies, which provided actual water consumption reductions generated by the installation of high-efficiency, pressure-compensating 1.5 gpm aerators on lavatory faucets. WaterSense expects the results under this specification to be similar to what was found in these two studies. These studies indicate that installing high-efficiency aerators can yield significant reductions in household water consumption. Post faucet retrofit, the weighted average daily per capita reduction in water consumption achieved was 0.6 gallons per capita per day (gcpd). It is important to note that in both of these studies, kitchen faucets in each household were retrofitted with 2.2 gpm pressure compensating aerators. While these retrofits contributed in part to overall reductions in household water consumption, the retrofits simply brought those kitchen sink faucets up to current water-efficiency standards, therefore, WaterSense decided to set aside this confounding influence in order to estimate the water savings. Assuming the average household consists of 2.6 people, this equates to an average annual household savings of approximately 570 gallons of water (see Calculation 1).

Calculation 1. Average Household Water Savings
0.6 gpcd · 2.6 people/household · 365 days = 570 gallons annually

Extrapolated to the national level, potential estimated water savings could be as great as 61 billion gallons annually (see Calculation 2). These estimates clearly demonstrate the significant water savings potential of high-efficiency lavatory faucets and accessories.

Calculation 2. National Water Savings
570 gal/year · 107,574,000[10] occupied residences w/ plumbing fixtures = 61 billion gallons

Based upon these estimates, the average household could save more than 70 kWh of electricity (see Calculation 3) or 350 cubic feet of natural gas (see Calculation 4) each year. National savings could exceed 3 billion kWh hours and 20 billion cubic feet (Bcf) of natural gas each year (see Calculations 5 and 6).

Calculation 3. Electricity Saving Per Household
(570 gal/year · 0.70) · (176.5 kWh of electricity/1,000 gal) = 70 kWh of electricity per year

Calculation 4. Natural Gas Savings Per Household
(570 gal/year · 0.70) · (0.8784 Mcf of natural gas/1,000 gal) = 0.35 Mcf (350 cubic feet) of natural gas per year

Calculation 5. National Electricity Savings Potential
(61,000,000,000 gal · 0.70 · 0.40) · (176.5 kWh of electricity/1,000 gal) = 3 billion kWh of electricity nationwide

Calculation 6. National Natural Gas Savings Potential
(61,000,000,000 gal · 0.70 · 0.56) · (0.8784 Mcf of natural gas/1,000 gal) = 20 million Mcf of natural gas nationwide = 20 Bcf of natural gas nationwide

These calculations are based upon the following assumptions:

- Approximately 70 percent of faucet water used in a household is hot water (Tampa and Seattle Aquacraft studies).
- 42,788,000 (approximately 40 percent) of occupied residences in the United States heat their water using electricity.[11]
- 60,222,000 (approximately 56 percent) of occupied residences in the United States heat their water using natural gas.[12]

[10] U.S. Department of Housing and Urban Development and U.S. Census Bureau. American Housing Survey for the United States 2005. Table 1A-4 page 5.

[11] U.S. Department of Housing and Urban Development and U.S. Census Bureau. American Housing Survey for the United States 2005. Table 1A-5, page 6.

[12] U.S. Department of Housing and Urban Development and U.S. Census Bureau. American Housing Survey for the United States 2005. Table 1A-5, page 6.

- Water heating consumes 0.1765 kWh of electricity per gallon of water heated assuming:
  - Specific heat of water = 1.0 BTU/lb · ° F
  - 1 gallon of water = 8.34 lbs
  - 1 kWh = 3,412 BTUs
  - Incoming water temperature is raised from 55° F to 120° F (Δ 65 ° F).
  - Water heating process is 90 percent efficient, electric hot water heater.

Calculation 7.

[(1 gal · 1.0 BTU/lbs · ° F) (1KWh/3,412 BTUs) / (1 gallon/8.34 lbs) · 65° F] / 0.90
= 0.1765 kWh/gal

- Water heating consumes 0.8784 Mcf of natural gas per 1,000 gallons of water heated assuming:
  - Specific heat of water = 1.0 BTU/lb · ° F
  - 1 gallon of water = 8.34 lbs
  - 1 Therm = 99,976 BTUs
  - Incoming water temperature is raised from 55° F to 120° F (Δ 65 ° F)
  - Water heating process is 60 percent efficient, natural gas hot water heater

Calculation 8.

[(1 gal · 1.0 BTU/lbs · ° F) (1Therm/99,976 BTUs) / (1 gallon/8.34 lbs) · 65° F] / 0.60
= 0.009053 Therms/gal

Calculation 9.

0.010428 Therms/gal · 1,000 gal · 1Mcf/10.307 Therms = 0.8784 Mcf/kgal

Cost Effectiveness and Payback Period

The average homeowner retrofitting their lavatory faucets with WaterSense labeled high-efficiency lavatory faucet accessories (e.g., aerator, laminar flow device, flow restrictor) will realize accompanying $3.26 savings on water and wastewater cost annually due to lower water consumption (see Calculation 10).

Calculation 10. Annual Water and Wastewater Cost Savings

570 gallons/year · $5.72/1,000 gallons[13] = $3.26/year

Factoring in the accompanying energy savings, the average household with electric water heating may save an additional $6.65 (70 kWh/year · $.095/kWh), for a combined annual savings of $9.91. The average household with natural gas water heating, may save an additional $4.56.(0.35 Mcf/year · $13.04/Mcf), for a combined annual savings of $7.82.

[13] Raftelis Financial Consulting. Water and Wastewater Rate Survey. American Water Works Association. 2004.

Assuming that the average household has two lavatory faucets[14], replacing the aerators in each lavatory faucet with a WaterSense labeled aerator would save $1.63 per faucet on annual water and wastewater costs. The average payback period for the replacement of two lavatory faucet aerators would be approximately 10 months for those with electric water heating and 12 months for those heating with natural gas (See Calculations 11 and 12).

Calculation 11. Average Payback Period (Electric Water Heating)
$8.00 / [$3.26/year + (70 kWh/year · $.095/kWh)] = 0.8 years (~10 months)

Calculation 12. Average Payback Period (Natural Gas Water Heating)
$8.00 / [$3.26/year + (0.35 Mcf/year · $13.04 /Mcf)] = 1.0 years (~12 months)

These calculations are based upon the following assumptions:

- WaterSense labeled retrofit devices retail for $4.00 each.
- Average cost of electricity is $0.095/kWh[15].
- Average cost of natural gas is $13.04/Mcf[16].

Unit Abbreviations:
Bcf = billion cubic feet
BTU = British thermal unit
F = Fahrenheit
gal = gallon
gpcd = gallons per capita per day
gpm = gallons per minute
kgal = kilogallons
kWh = kilowatt hour
lbs = pounds
L/min = liters per minute
Mcf = thousand cubic feet
psi = pressure per square inch

WaterSense assumes that the cost of new faucets manufactured and sold as WaterSense labeled fixtures will not increase significantly since in many cases the manufacturer will simply need to substitute the current flow regulating device with a similar, more efficient rated device. In many cases this will be as simple as switching from the current 2.2 gpm aerator or laminar flow device to a comparable 1.5 gpm WaterSense labeled device

[14] U.S. Department of Housing and Urban Development and U.S. Census Bureau. American Housing Survey for the United States 2005. Table 1A-3 page 4.

[15] Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, Energy Information Administration. <www.eia.doe.gov/cneaf/electricity/epa/epat7p4.html>

[16] Short-Term Energy Outlook, Energy Information Administration. <www.eia.doe.gov/steo>

WaterSense® Specification for Showerheads

1.0 Scope and Objective

This specification establishes the criteria for showerheads labeled under the U.S. Environmental Protection Agency's (EPA's) WaterSense® program. It is applicable to showerhead fixture fittings, inclusive of:

- Fixed showerheads that direct water onto a user (excluding body sprays) for bathing purposes; and
- Hand-held showers, a subset of showerheads that are moveable devices for directing water onto a user. Hand-held showers can be installed on a support to function as a fixed showerhead.

When used in this document the term "showerhead" shall also include hand-held showers.

This specification is designed to ensure sustainable, efficient water use and a high level of user satisfaction with showerhead performance.

2.0 General Requirements

2.1 The showerhead shall conform to applicable requirements in ASME A112.18.1/CSA B125.1.[1]

2.2 If the showerhead has more than one mode, all modes must meet the maximum flow rate requirement outlined in Section 3.1.1 and at least one of the modes, as specified by the manufacturer, must meet all of the requirements outlined in this specification.

2.3 The showerhead shall not be packaged, marked, or provided with instructions directing the user to an alternative water-use setting that would override the maximum flow rate, as established by this specification. Any instruction related to the maintenance of the product, including changing or cleaning showerhead components, shall direct the user on how to return the product to its intended maximum flow rate.

3.0 Water-Efficiency Criteria

3.1 The flow rate of the showerhead shall be tested in accordance with the procedures in ASME A112.18.1/CSA B125.1 and shall meet the following criteria:

3.1.1 The manufacturer shall specify a maximum flow rate value (rated flow) of the showerhead. This specified value must be equal to or less than 2.0 gallons per minute (gpm) (7.6 liters per minute [L/min]).

[1] References to this and other standards apply to the most current version of those standards.

3.1.2 The maximum flow rate shall be the highest value obtained through testing at flowing pressures of 20, 45, and 80 ± 1 pounds per square inch (psi) (140, 310, and 550 ± 7 kilopascal [kPa]), when evaluated in accordance with 10 CFR 430 Subpart F, Appendix B, Step 6(b). This maximum flow rate shall not exceed the maximum flow rate value specified in Section 3.1.1.

3.1.3 The minimum flow rate, determined through testing at a flowing pressure of 20 ± 1 psi (140 ± 7 kPa) and when evaluated in accordance with 10 CFR 430 Subpart F, Appendix B, Step 6(a), shall not be less than 60 percent of the maximum flow rate value specified in Section 3.1.1.

3.1.4 The minimum flow rate shall be the lowest value obtained through testing at flowing pressures of 45 and 80 ± 1 psi (310 and 550 ± 7 kPa), when evaluated in accordance with 10 CFR 430 Subpart F, Appendix B, Step 6(a). This minimum flow rate shall not be less than 75 percent of the maximum flow rate value specified in Section 3.1.1.

4.0 Spray Force Criteria

4.1 The spray force of the showerhead shall be tested in accordance with the procedures outlined in Appendix A and shall meet the following criteria:

4.1.1 The minimum spray force shall not be less than 2.0 ounces (0.56 newtons [N]) at a pressure of 20 ± 1 psi (140 ± 7 kPa) at the inlet when water is flowing.

5.0 Spray Coverage Criteria

5.1 The spray coverage of the showerhead shall be tested in accordance with the procedures outlined in Appendix B and shall meet the following criteria:

5.1.1 The total combined maximum volume of water collected in the 2- and 4-inch [in.] (50-, 101-millimeter [mm]) annular rings shall not exceed 75 percent of the total volume of water collected, and;

5.1.2 The total combined minimum volume of water collected in the 2-, 4-, and 6-in. (50-, 101-, 152-mm) annular rings shall not be less than 25 percent of the total volume of water collected.

6.0 Marking

In addition to the marking requirements in ASME A112.18.1/CSA B125.1, the following markings shall apply:

6.1 The product shall be marked with the maximum flow rate value in gpm and L/min as specified by the manufacturer, verified through testing and in compliance with this specification.

6.2 The product packaging shall be marked with the maximum flow rate value in gpm and L/min as specified by the manufacturer, verified through testing and in compliance with this specification.

6.3 The product packaging shall be marked with the minimum flow rate value in gpm and L/min at 45 psi, calculated in Section 3.1.4 as 75 percent of the manufacturer's specified maximum flow rate value, verified through testing and in compliance with this specification.

6.4 Flow rate marking shall be in gpm and L/min in two or three digit resolutions (e.g., 2.0 gpm [7.6 L/min]).

7.0 Effective Date

This specification is effective on February 9, 2010.

8.0 Future Specification Revisions

EPA reserves the right to revise this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. Revisions to the specification would be made following discussions with industry partners and other interested stakeholders.

9.0 Definitions

Definitions within ASME A112.18.1/CSA B125.1 are included by reference

ASME – American Society of Mechanical Engineers

ASME PTC – American Society of Mechanical Engineers Performance Test Codes

ANSI – American National Standards Institute

CFR – Code of Federal Regulations

CSA – Canadian Standards Association

ISA – International Society of Automation

WaterSense® Specification for Showerheads Supporting Statement

I. Introduction

Showering is one of the leading uses of water inside the home, representing approximately 17 percent of annual residential indoor water use in the United States. This translates into more than 1.2 trillion gallons of water consumed each year[1],[2]. The WaterSense program released its final specification for showerheads on March 4, 2010, to capitalize on this opportunity to further improve the nation's water and energy efficiency by raising consumer awareness and promoting the use of more efficient showerheads. The intent of this specification is to help consumers identify those products that have met EPA's criteria for water efficiency and performance.

WaterSense collaborated with the American Society of Mechanical Engineers (ASME)/Canadian Standards Association (CSA) Joint Harmonization Task Force to develop the specification criteria for high-efficiency showerheads. This task force is open to the public and comprises a wide variety of stakeholders, including showerhead manufacturers, water and energy utilities, testing laboratories, consultants, and other water-efficiency and conservation specialists. Their participation, resources, and expertise enabled WaterSense to evaluate showerhead efficiency and performance and develop meaningful testing protocols that can effectively differentiate showerhead performance.

Prior to the task force's work there were no universally accepted criteria for measuring showerhead performance. Federal water-efficiency legislation and national performance standards only establish product flow rates that dictate water consumption—they do not address what makes a satisfactory, or unsatisfactory, shower. Now, with this specification, WaterSense and the task force have bridged this consumer information gap by incorporating performance requirements for products seeking to earn the WaterSense label. The requirements address flow rates across a range of pressures, spray force, and spray coverage, three key attributes of showerhead performance, according to consumer testing. These new requirements are designed to ensure a high level of performance and user satisfaction with high-efficiency showerheads.

II. Current Status of Showerheads

With nearly 110 million occupied housing units in the United States[3] and an average of two showerheads per household[4], WaterSense estimates that there are 220 million showerheads

[1] Assumes a per capita shower use of 11.6 gallons. See Mayer, Peter W. and William B. DeOreo. *Residential End Uses of Water.* Aquacraft, Inc. Water Engineering and Management. American Water Works Association. 1998. Page 102.
[2] According to the U.S. Census Bureau, there are 300 million persons in the United States.
[3] See U.S. Census Bureau and the U.S. Department of Housing and Urban Development's *American Housing Survey for the United States.* 2007.
[4] Mayer and DeOreo, op. cit., 99.

currently installed in homes across the United States. WaterSense also estimates that approximately 10 percent of the existing 220 million showerheads are replaced each year due to wear, remodeling, or other reasons. This means that the vast majority of these existing showerheads have flow rates equal to or less than the federal standard of 2.5 gallons per minute (gpm), which was mandated by the Energy Policy Act (EPAct) of 1992. With normal replacements and units sold for new construction, WaterSense estimates that approximately 25.6 million[5] new showerheads are sold each year. Since Congress enacted the federal requirements in the early 1990s, manufacturers have gone on to develop showerheads that use significantly less water than the flow rates set in EPAct 1992. These high-efficiency showerheads can save at least 20 percent compared to standard fixtures, resulting in a potential savings of more than 1,200 gallons per showerhead per year.

III. WaterSense Specification for Showerheads

Scope

This specification applies to showerheads and hand-held showers. Showerheads are fixed devices for directing water onto a user for bathing purposes. Hand-held showers, a subset of showerheads, are moveable devices for directing water onto a user. Hand-held showers can be installed on a support to function as a showerhead.

Multiple showerheads are eligible to receive the WaterSense label provided the showerheads are sold in combination in a single device intended to be connected to a single shower outlet. Further, each showerhead must meet all of the requirements of the specification and the entire multiple-head system must meet the maximum flow rate requirement of the specification in all possible operating modes.

Body sprays are excluded from this specification because their function and design are wholly different than that of a showerhead or hand-held shower. Retrofit devices, including aftermarket flow control devices, are also excluded because the intent of the specification is to recognize and label complete, fully functioning fixtures or fittings, and not individual components.

General Requirements

Many showerheads are sold with multiple modes to provide the user with options for different spray types (e.g., misting, massaging, or pause). WaterSense wants to maintain manufacturing flexibility and consumer choice for multiple mode showerheads, thus the specification addresses these types of showerheads by requiring all modes to meet the maximum flow rate requirement (i.e., no mode can exceed 2.0 gallons per minute [gpm]) and at least one of the modes, as specified by the manufacturer, must meet all of the requirements contained in the specification, including the maximum and minimum flow rates, spray force, and spray coverage requirements.

Water-Efficiency Criteria

[5] Units sold for replacement is based upon a 10 percent natural replacement rate. Units sold for new construction is based on 1,797,000 new housing starts per year based on the average number of new housing starts from 2003–2007.from U.S. Census. 2007 American Housing Survey, Table 1A-1. www.census.gov/prod/2008pubs/h150-07.pdf.

The water-efficiency component of this specification establishes a maximum flow rate of 2.0 gpm (7.6 liter per minute [L/min]). WaterSense settled on this flow rate after examining the range of products currently available on the market. This maximum flow rate represents a 20 percent reduction from the current federally allowable maximum flow rate of 2.5 gpm established by EPAct 1992, which is consistent with WaterSense's stated water-efficiency goal.

The specification also includes minimum flow rate requirements at 80, 45, and 20 pounds per square inch (psi) of pressure (the upper, mid, and lower range of potential household pressures) to ensure performance and user satisfaction under a variety of household conditions. Specifically, at 45 and 80 psi the tested flow rate cannot be less than 75 percent of the showerhead's maximum "rated"[6] flow rate value. This minimum requirement is specified at both 45 and 80 psi because some showerheads that are designed to compensate and adjust for changes in water pressure will actually produce maximum flow at 45 psi and not at 80 psi. As a result, WaterSense wants to ensure that this minimum flow rate requirement is met at both pressures. Likewise, at 20 psi the tested flow rate cannot be less than 60 percent of the showerhead's maximum rated flow rate value. Table 1 below provides some examples of the allowable minimum flow rates for showerheads with various rated flow rates. Defining minimum flow rate requirements in this manner ensures that the showerhead is designed to provide consistent flow across a range of pressures.

Table 1. Example Minimum Flow Rates

Showerhead Rated Flow Rate	Minimum Allowable Flow Rate		
	80 psi	45 psi	20 psi
2.0 gpm	1.5 gpm	1.5 gpm	1.2 gpm
1.75 gpm	1.3 gpm	1.3 gpm	1.1 gpm
1.5 gpm	1.1 gpm	1.1 gpm	0.9 gpm
1.0 gpm	0.8 gpm	0.8 gpm	0.6 gpm

WaterSense is requiring both the maximum and minimum flow rates of the showerhead to meet the testing and verification protocols for sampling outlined in the *Code of Federal Regulations* (see 10 CFR 430 Subpart F, Appendix B, Steps 6[b] and 6[a], respectively). The U.S. Department of Energy currently uses the sampling plan outlined in the CFR for assessing compliance of showerhead flow rates with EPAct 1992 requirements, and thus referencing it in this specification provides specific and familiar guidance to third-party certifying bodies for determining whether a showerhead meets the flow rate requirements established by WaterSense.

Performance Criteria

Establishing performance-based criteria for WaterSense labeled showerheads is critical to ensuring user satisfaction and maintaining the integrity of the WaterSense label. Prior to this specification, however, there were no universally agreed-upon testing protocols for showerhead performance or measures that adequately defined user satisfaction. WaterSense worked with

[6] The "rated" flow rate is the showerhead's maximum flow rate, as specified by the manufacturer, verified through testing, and in compliance with this specification.

the task force to determine, through its expertise and supported by consumer testing, the key performance attributes of showerheads.

To measure those attributes in a laboratory setting, the task force undertook an intensive effort to develop test protocols. The spray force and spray coverage requirements contained in the specification are a result of these efforts. Both test protocols subsequently underwent several iterations of round robin testing in various laboratories by multiple manufacturers and independent third-party certifiers in order to ensure that the procedures are repeatable and the results reproducible. Laboratory test data were then compared back to the consumer test data for a variety of showerheads to determine the specific performance levels that are included in the specification. These performance levels define the boundaries for user satisfaction for both spray force and spray coverage.

The spray force component of the specification requires a showerhead's spray force to be at least 2.0 ounces (0.56 newtons [N]) at an inlet pressure of 20 psi when the water is flowing. The testing procedure, described in Appendix A of the specification, is a pass/fail test that assesses the relative force of the shower spray through the use of a force balance fixture. The force balance fixture is equipped with a force target on one side that receives the shower spray and counterbalancing weights on the other side, set to the specified force (i.e., 2.0 ounces). As the shower spray hits the force target, the force balance fixture measures the rotation angle of the balance at the pivot point of the two sides (the spray and counterbalancing weights).

If the shower spray force is greater than the specified minimum, it will overcome, or move, the counterbalancing weights to or beyond the point of balance, achieved when the angle rotates within 0.1° of zero or past it. Under this scenario the showerhead would pass the force requirements. If the showerhead's force is less than the specified minimum, it will not overcome the counterbalancing weights and the angle of balance will not rotate within 0.1° of zero or past it. Under this scenario, the showerhead would fail the force requirements. The target force of 2.0 ounces specified in the specification represents the lower bounds of user satisfaction based on results from consumer tests using a variety of showerheads.

The spray coverage component of the specification, as described in Appendix B of the specification, requires the use of an annular ring gauge consisting of a series of concentric rings, starting with a 2-inch diameter center ring and each successive ring increasing in diameter by 2 inches out to 20 inches. The showerhead is positioned and turned on directly above the surface of the annular ring gauge. The relative amount of water captured in each set of concentric rings provides a representation of the distribution of the spray pattern and can be used to evaluate the showerhead's spray coverage.

Simultaneous to the development of the test apparatus, WaterSense gathered consumer test data to determine user preferences with respect to spray coverage. Data showed general dissatisfaction with showerheads that spray with a hollow spot in the center or that have too much water flowing in the center to form a very narrow beam. Thus the criteria contained in the specification were crafted to capture and disqualify showerheads with these types of coverage characteristics. Specifically, to meet the spray coverage requirement, the total volume of water collected in the two center rings (out to 4 inches) cannot exceed 75 percent of the total collected water volume (i.e., the showerhead cannot deliver all its water through a narrow beam in the center). In addition, the total combined volume of water collected in the three center rings (out to

6 inches) must be at least 25 percent of the total collected water volume (i.e., the showerhead cannot have a hollow spot in the center).

Marking

With this specification, WaterSense has adopted a new approach to product and package flow rate marking. The requirements are designed to clarify and clearly indicate which maximum flow rate value the manufacturer is to use. At the outset of certification, the manufacturer specifies a maximum flow rate value ("rated" flow rate), not to exceed 2.0 gpm, which is subsequently verified through testing. WaterSense requires the manufacturer to mark the product and product packaging with this rated flow rate value, so that the information provided to the consumer is both informative and accurate.

In addition to marking the product and packaging with the maximum rated flow rate, the product packaging (but not the product itself) must also be marked with the showerhead's minimum flow rate at 45 psi. This minimum flow rate is calculated as 75 percent of the manufacturer's specified maximum flow rate value and is subsequently verified through testing. The purpose of this marking requirement is to assist installers in properly matching showerheads and automatic-compensating mixing valves for installation in order to provide protection against thermal shock and scalding events (see Section V below for more information).

Potential Water and Energy Savings

Note: Refer to Appendix A for the assumptions and calculations used to derive these estimates.

Showerheads with a flow rate of 2.0 gpm or less have the potential to save significant amounts of water both individually and at the national level. Replacing standard showerheads with WaterSense labeled showerheads could save more than 1,200 gallons per showerhead or 2,300 gallons of water per household per year. Based upon the amount of water saved, the average household could save 300 kilowatt hours (kWh) of electricity or 1,500 cubic feet of natural gas that would otherwise be required to heat the water.

Nationwide, if WaterSense labeled showerheads were purchased for all normal showerhead replacements and installed in all new construction, WaterSense estimates that water savings could reach 30.3 billion gallons per year. National energy savings could exceed 1.6 billion kWh of electricity and 10.9 million cubic feet (Mcf) of natural gas each year.

Cost-Effectiveness

Note: Refer to Appendix A for the assumptions and calculations used to derive these estimates.

The average homeowner retrofitting his or her showerheads with WaterSense labeled showerheads will realize an accompanying $14 savings on water and wastewater costs annually due to lower water consumption. Factoring in the accompanying energy savings, the average household with electric water heating may save an additional $36, for a combined annual savings of $50. The average household with natural gas water heating may save an additional $18 for a combined annual savings of $32.

If the average showerhead costs $30 retail, the average payback period for the replacement of two standard showerheads per household with WaterSense labeled models would be approximately 14 months for those with electric water heating and about two years for those heating with natural gas.

IV. Certification and Labeling

WaterSense has established an independent third-party product certification process, described on the WaterSense Web site at www.epa.gov/watersense/partners/certification.html. Under this process, products are certified to conform to applicable WaterSense specifications by accredited third-party licensed certifying bodies. Manufacturers are then authorized to use the WaterSense label in conjunction with certified products.

V. Other Issues

Detailed Drawings for the Force Balance Test Apparatus

As the specification indicates, the spray force performance requirement is measured via a force balance test apparatus. This force balance test apparatus was developed by the task force specifically for the purpose of determining a showerhead's compliance with the specification's force requirements; therefore it is not a readily available or mass-produced piece of testing equipment. In addition, the test apparatus needs to be manufactured with very specific tolerances to ensure the results are repeatable and reproducible in any laboratory setting. WaterSense has made available the specification drawings to facilitate the construction of this test equipment. Detailed drawings for the force balance test apparatus are available on the WaterSense Web site at www.epa.gov/watersense/products/showerheads.html.

Health and Safety

In developing this specification, WaterSense and the task force considered potential negative impacts of reducing the flow rate on consumer satisfaction, including potential health and safety issues once these products are installed in the plumbing system. Of particular concern is the potential for increasing the risk of thermal shock or scalding as shower flow rates are reduced. Thermal shock or scalding can be caused when a hot- or cold-water-using device is activated (e.g., flushing the toilet or running the dishwasher) while the shower is running. Water is diverted away from the shower, causing a pressure drop in either the hot or cold water supply line to the shower. As a consequence, the balance of hot and cold water is shifted either to a hotter or colder temperature mix. This sudden change in temperature can either cause a user to abruptly move away from the shower stream, potentially resulting in an injury or fall, or if the temperature increase is severe enough, scalding can occur.

To mitigate the risks of temperature-related shower injuries, most U.S. plumbing codes require showers to be outfitted with individual automatic-compensating mixing valves that comply with either the American Society of Sanitary Engineers (ASSE) 1016 or ASME A112.18.1/CSA B125.1 standards. An automatic-compensating mixing valve is a device that is installed as part of the shower's flow control that helps to regulate water temperature; it is not part of the showerhead itself. The valve works either through balancing the incoming hot and cold water

pressures or through controlling the mixed outlet temperature with a thermostatic element that can maintain water temperature to within +/- 3.6°F.

Despite advances in plumbing codes and mixing valve technology, thermal shock and scalding risks are still present under two scenarios. First, automatic-compensating mixing valves are currently only required to be tested and certified at a flow rate of 2.5 gpm at 45 psi. When these devices are outfitted with a showerhead that has a lower flow rate, there may not be adequate assurance that the valve is sensitive enough to provide the required protection. This is potentially true for all showerheads, as standard showerheads are currently tested and certified at a flow rate of 2.5 gpm at 80 psi. Second, not all homes are equipped with an automatic-compensating mixing valve. The risks are of particular concern for showerhead retrofits in homes built prior to 1987.

As a part of the development of the criteria for showerheads, WaterSense and the task force evaluated the link between flow rate and temperature deviations associated with pressure and temperature changes. The task force gathered and presented data to compare the temperature profiles that result from a drop in hot and cold water pressure for both standard and high-efficiency showerheads under the two risk scenarios: (1) installation with various types of automatic-compensating mixing valves (thermostatic, pressure balancing, or combination) designed for a flow rate of 2.5 gpm at 45 psi and (2) installation without the protection of an automatic-compensating mixing valve. The data showed that the risks are present for showerheads of all flow rates, but that more efficient showerheads are more sensitive to sudden changes in water pressure. As a consequence, a temperature change in water exiting the shower may be amplified when the pressure within the cold water or hot water supply plumbing suddenly changes.

Ultimately, WaterSense and the task force came to the conclusion that the thermal shock and scalding risks cannot be fully addressed through the specification for showerheads. First, there is a clear disconnect between the showerhead and automatic-compensating mixing valve compatibility, as the products are tested at different pressures (80 psi and 45 psi, respectively) and currently automatic-compensating mixing valves are only tested at a flow rate of 2.5 gpm. Second, the potential temperature of the hot water is controlled by the design of the hot water heater and delivery system, which can discharge water well in excess of the code required 140°F due to "layering" and the location of the thermostat at a point that is not necessarily the location of the hottest water. Because of the interrelated nature of these three components in the plumbing system, the control of the risks cannot solely rest on the design of the showerhead. In fact, the showerhead itself has very little, if any, control over the outlet water temperature.

To the extent possible, WaterSense has addressed this issue in the specification by requiring manufacturers to mark the product packaging with the minimum flow rate at 45 psi as determined by testing at that pressure. This is a vital step toward providing the information necessary to "match" the showerhead with a compatible automatic-compensating mixing valve that is rated to perform at the same flow rate and tested pressure. In addition, industry is currently working to harmonize automatic-compensating mixing valve standards and showerhead standards to address potential incompatibilities of these plumbing system components. This will go a long way toward addressing the risks of thermal shock and scalding associated with the installation of a WaterSense labeled showerhead, indeed with all

showerheads, particularly in new construction. WaterSense is also educating consumers and program partners regarding the issue and associated risks so that consumers can continue to make informed purchasing decisions.

Appendix A: Calculations and Key Assumptions

Potential Water Savings Calculations

Assumptions:

- Average actual flow rate for an existing showerhead is 2.22 gpm[7] (the average flow rate is less than the standard rated flow rate of 2.5 gpm most likely because the products are rated at 80 psi, but installed in homes with less pressure)
- Average shower duration is 8.2 minutes[11]
- The average person takes 0.67 showers per day[8]
- A WaterSense labeled showerhead reduces the flow rate by 20 percent
- An estimated 10 percent of existing showerheads are replaced each year due to wear, remodeling, or other reasons
- There are an estimated 1,797,000 new housing starts per year based on the average number of new housing starts from 2003–2007[9]

Equation 1. Annual Water Savings Potential from Replacing a 2.5 gpm Rated Showerhead

(((2.22 gpm – (2.22 gpm x (1-0.2))) x 8.2 minutes/shower x 0.67 showers/person/day x 2.6 people/household x 365 days/year) = 2,300 gal/household/year

(2,300 gal/household/year / 2 showerheads/household) = 1,200 gal/showerhead/year

Equation 2. Annual National Water Savings Potential from Replacing All Existing 2.5 gpm Showerheads

(1,200 gal/showerhead/year x 220 million existing showerheads) = 260 billion gal/year

Equation 3. Annual National Water Savings Potential from Natural Replacement with WaterSense Labeled Showerheads

(1,200 gal/showerhead/year x 220 million showerheads * 0.10) = 26 billion gal/year

Equation 4. Annual National Water Savings Potential from Installation of WaterSense Labeled Showerheads in New Construction

(1,200 gal/showerhead/year x 1,797,000 annual new housing starts x 2 showerheads/household) = 4.3 billion gal/year

Unit Abbreviations:
gal = gallon
gpm = gallons per minute
psi = pressure per square inch

Potential Energy Savings Calculations

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[7] Mayer and DeOreo, Op. cit., 102.
[8] Calculated based upon an assumed 17.2 gallons per shower and 11.6 gallons per day for showering. (Ibid.)
[9] U.S. Census. 2007 American Housing Survey, Table 1A-1. www.census.gov/prod/2008pubs/h150-07.pdf.

Assumptions:

- Approximately 73 percent of showerhead water used in a household is hot water[10]
- 42,239,000 (approximately 40 percent) of occupied residences in the United States heat their water using electricity[11]
- 60,998,000 (approximately 56 percent) of occupied residences in the United States heat their water using natural gas[11,12]
- Water heating consumes 0.18 kWh of electricity per gallon of water heated assuming:
  - Specific heat of water = 1.0 Btu/lb x ° F
  - 1 gallon of water = 8.34 lbs
  - 1 kWh = 3,412 Btus
  - Incoming water temperature is raised from 55° F to 120° F (Δ 65 ° F)
  - Water heating process is 90 percent efficient for electric hot water heaters
- Water heating consumes 0.88 Mcf of natural gas per 1,000 gallons of water heated assuming:
  - Specific heat of water = 1.0 Btu/lb x ° F
  - 1 gallon of water = 8.34 lbs
  - 1 Therm = 99,976 Btus
  - Incoming water temperature is raised from 55° F to 120° F (Δ 65 ° F)
  - Water heating process is 60 percent efficient for natural gas hot water heaters

Electricity

Equation 5. KWh Required to Raise 1 Gallon of Water 65° F

[(1.0 Btu/lbs x ° F) (1kWh/3,412 Btus) / (1 gal/8.34 lbs) x 65° F] / 0.90 = 0.18 kWh/gal

Equation 6. Electricity Saving Potential per Household

(2,300 gal/year x 0.73) x (180 kWh of electricity/1,000 gal) = 300 kWh of electricity per year

Equation 7. National Electricity Savings Potential from Replacing All Existing 2.5 gpm Showerheads

(260 billion gal/year x 0.73 x 0.40) x (180 kWh of electricity/1,000 gal) = 14 billion kWh of electricity nationwide

Equation 8. National Electricity Savings Potential from Natural Replacement with WaterSense Labeled Showerheads

(26 billion gal/year x 0.73 x 0.40) x (180 kWh of electricity/1,000 gal) = 1.4 billion kWh of electricity nationwide

Equation 9. National Electricity Savings Potential from Installation of WaterSense Labeled Showerheads in New Construction

[10] DeOreo, William B., and Peter W. Mayer. *The End Uses of Hot Water in Single Family Homes From Flow Trace Analysis*. 2000. Aquacraft, Inc.
[11] U.S. Department of Housing and Urban Development and U.S. Census Bureau. *American Housing Survey for the United States: 2007*. 2008. Table 1A-5, page 7.
[12] Ibid.

(4.3 billion gal/year x 0.73 x 0.40) x (180 kWh of electricity/1,000 gal) = 230 million kWh of electricity nationwide

Natural Gas

Equation 9. Therms Required to Raise 1 Gallon of Water 65° F
[(1.0 Btu/lbs x ° F) (1 Therm/99,976 Btus) / (1 gal/8.34 lbs) x 65° F] / 0.60 = 0.009 Therms/gal

Equation 10. Converting Therms to Mcf
0.009 Therms/gal x 1,000 gal/kgal x 1 Mcf/10.307 Therms = 0.88 Mcf/kgal

Equation 11. Natural Gas Savings Potential per Household
(2,300 gal/year x 0.73) x (0.88 Mcf of natural gas/1,000 gal) = 1.5 Mcf (1,500 cubic feet) of natural gas per year

Equation 12. National Natural Gas Savings Potential from Replacing All 2.5 gpm Showerheads
(260 billion gal x 0.73 x 0.56) x (0.88 Mcf of natural gas/1,000 gal) = 94 million Mcf of natural gas nationwide

Equation 13. National Natural Gas Savings Potential from Natural Replacement with WaterSense Labeled Showerheads
(26 billion gal x 0.73 x 0.56) x (0.88 Mcf of natural gas/1,000 gal) = 9.4 million Mcf of natural gas nationwide

Equation 14. National Natural Gas Savings Potential from Installation of WaterSense Labeled Showerheads in New Construction
(4.3 billion gal/year x 0.73 x 0.56) x (0.88 Mcf of natural gas/1,000 gal) = 1.5 million Mcf of natural gas nationwide

Unit Abbreviations:
Bcf = billion cubic feet
Btu = British thermal unit
F = Fahrenheit
kgal = kilogallons
kWh = kilowatt hour
lbs = pounds
Mcf = thousand cubic feet

Cost-Effectiveness Calculations

Assumptions:
- Price of water and wastewater is $6.06/1000 gallons[13]
- 2009 Price of electricity is $0.12/kWh[14]
- 2009 Price of natural gas is $11.98/Mcf[15]

[13] Raftelis Financial Consulting. *Water and Wastewater Rate Survey*. American Water Works Association. 2006.
[14] U.S. Department of Energy, www.eia.doe.gov/cneaf/electricity/epm/table5_3.html.

Equation 15. Annual Household Water and Wastewater Cost Savings
2,300 gallons/year x $6.06/1,000 gallons = $14/year

Equation 16. Annual Household Electricity Savings
(300 kWh/household/year * $0.12/kWh) = $36/year

Equation 17. Annual Household Natural Gas Savings
(1.5 Mcf/household/year * $11.98/Mcf) = $18/year

Equation 18. Annual Water, Wastewater, and Electricity Savings
($14/year + $36/year) = $50/year

Equation 19. Annual Water, Wastewater, and Natural Gas Savings
($14/year + $18/year) = $32/year

Equation 11. Average Full Payback Period (Electric Water Heating)
($30/showerhead x 2 showerheads/household) / $50/year = 1.2 years (~14 months)

Equation 12. Average Full Payback Period (Natural Gas Water Heating)
($30/showerhead x 2 showerheads/household) / $32/year = 1.9 years (~ 23 months)

[15] U.S. Department of Energy, www.eia.doe.gov/steo.

WaterSense® Specification for Tank-Type Toilets

Version 1.2

June 2, 2014

WaterSense® Specification for Tank-Type Toilets

1.0 Scope and Objective

This specification establishes the criteria for a tank-type high-efficiency toilet under the U.S. Environmental Protection Agency's (EPA's) WaterSense program. It is applicable to:

- Single-flush, tank-type gravity toilets
- Dual-flush, tank-type gravity toilets
- Dual-flush, tank-type flushometer tank (pressure-assist) toilets
- Tank-type, flushometer tank (pressure-assist) toilets
- Tank-type electrohydraulic toilets
- Any other tank-type technologies that meet these performance specifications

The specification is designed to ensure both sustainable, efficient water use and a high level of user satisfaction with flushing performance.

2.0 General Requirements

2.1 The toilet shall conform to applicable water closet requirements in ASME A112.19.2/CSA B45.1,[1] except as otherwise indicated in this specification.

2.2 If the toilet has dual-flush capabilities, it shall conform to requirements in ASME A112.19.14.

3.0 Water Efficiency Criteria

3.1 Single-flush toilets: The effective flush volume shall not exceed 1.28 gallons (4.8 liters) when evaluated in accordance with the sampling plan contained in 10 CFR 429.30. For single-flush toilets, the effective flush volume is the average flush volume when tested in accordance with ASME A112.19.2/CSA B45.1.

3.2 Dual-flush toilets: The effective flush volume shall not exceed 1.28 gallons (4.8 liters) when evaluated in accordance with the sampling plan contained in 10 CFR 429.30. For dual-flush toilets, the effective flush volume is the average flush volume of two reduced flushes and one full flush. Flush volumes shall be tested in accordance with ASME A112.19.2/CSA B45.1 and ASME A112.19.14.

3.3 Samples with average flush volume in excess of 0.10 gallon (0.4 liter) greater than their rated flush volume shall be deemed to fail testing requirements due to excessive flush volume.[2]

[1] References to this and other standards apply to the most current version of that standard.
[2] For example, fixtures rated at 1.28 gallons per flush (the maximum flush volume) but flushing at greater than 1.38 gallons (5.2 liter) when adjusted in accordance with the water consumption test procedure in ASME A112.19.2/CSA B45.1 shall be deemed to have "failed" the requirements of this specification.

3.4 Samples with average flush volumes less than or equal to 0.10 gallon (0.4 liter) greater than their rated flush volume shall be adjusted, if possible, to their rated flush volume prior to performance testing.

3.5 Samples with average flush volumes less than their rated flush volume shall be tested at measured volume and this volume shall be recorded on the test report.

4.0 Flush Performance Criteria

4.1 Toilet model performance is identified as either a "pass" or "fail" depending upon whether it can successfully and completely clear all test media from the fixture in a single flush in at least four of five attempts. Flush performance testing shall be conducted in accordance with the waste extraction test protocol provided in ASME A112.19.2/CSA B45.1.

5.0 Product Marking

5.1 Toilet fixtures shall be marked in accordance with requirements in ASME A112.19.2/CSA B45.1 with the exception identified in Section 5.1.1 below.

5.1.1 Toilet bowls intended to be used with tanks of varying consumption levels (e.g., 1.6 and 1.28 gallons per flush) shall be marked with a dual consumption marking or a consumption range, as indicated in ASME A112.19.2/CSA B45.1; however, toilet bowls shall not be marked with the words "or less" to indicate compatibility with tanks of varying consumption levels.

5.2 Toilet tanks shall not be packaged, marked, nor provided with instructions directing the user to an alternative water use setting that would override the rated flush volume, as established by this specification. Any instruction related to the maintenance of the product shall direct the user on how to return the product to its rated flush volume.

6.0 Effective Date

This specification is effective on June 2, 2014.

7.0 Future Specification Revisions

EPA reserves the right to revise this specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. Revisions to the specification would be made following discussions with industry partners and other interested stakeholders.

8.0 Definitions

Definitions within ASME A112.19.2/CSA B45.1 and ASME A112.19.14 are included by reference.