



Our Water Research Laboratory (WRL)

! "#\$%&'#() *+##%*\$&'*,#- *+*&, .%#/&0),&'),1#()2!

\$%&'!() *(+!, -*!. (/012' !0* 31&)4!. 3,*/!/*' *3/5-!036 (/3, (/&' 7!89/!' ,3++!3/*!/*5(4)&' *1!
* : ; */,' !3,!311/*' ' &)4!. 3,*/!; /(60* <' !35/(' !=3/&(9' !. 3,*/!*' 4&)**/&)4!1&' 5&; 0&)*' !3)1!
)= &/() <*) , '7!>0() 4' &1*!(9/!3531* < &5!/*' *3/5-*/' ?!. *!-3=*!3!, *3<!(+!; /(+' ' &())30!
)4&)**/' !. -(!' (0=*!; /(60* <' !+(/!&)19' ,/@!3)1!4(=*/) <*) ,!&!)3!/3)4*!(+!1&+*/*) ,!. 3@' !
, -(94-!3; ; 0&*1!/*' *3/5-7!#*!-3=*!; -@' &530!036 (/3, (/&' !. -*/!*' *!53)! , *' ,!*)4&)**/&)4!
1* ' &4)' !3)1!& < 903, *!/*30A. (/01!; /(60* <' B!. *!-3=*!1* ' C, (; !3)1!5(<; 9, */!63' *1!
' (09,&())' !. *2=*!1* =*0(; *1!&)A-(9' *B!3)1!. *!30' (!-3=*!3!. &1*!=3/&*, @!(+!*D9&; <*) ,!. *!
53)!9' *!, (!,3C*!<*3' 9/* <*) , ' !&!)! , -*!+&*017!

E

! "#3)4#5&61#76(8+' ,1#),#9): * ,65 *6'#; &,'6* ,+##%&: *#1)8#.)<&0),&' * (#47'%#&'#'%*#
=*6' ,*2!

8=*/! , -*!@*3/' ! , -*/!*!. (901!6*!-9)1/*1' E!#*!-3=*!. (/C*1!&!)3!-94*!/3)4*!(+!3/*3' !+/(<!
4&=&)4!; (0&5@!31=&5*!3)1!* : ; */,' !/*=&* . !, (14(=*/) <*) ,?! , (!. (/C&)4!. & , -!*' 4&)**/&)4!
5(<; 3)&* ' !3)1!5() ,/35, (/ ' !())!03/4*!; /(F*5, ' 7!G@; *' !(+!; /(F*5, ' !/3)4*!+/(<!; /(=&1&)4!
* : ; */,' !. &,) *' ' !3,! , -*/!*5*) ,!H/3) , -3<!!0((!J (<<&' ' &())!(+!K)D9&/@!&), (!, -*!LM" ""!
N9**)' 03)1!+0((1' ?!, (!. * ,03)1!/*' , (/3,&())?!6*35-!*/(' &())!; /(, *5,&())?!&<; /(=&)4! , -*!
1* ' &4)!(+! , (/ <!. 3,*/!' @' , * <' ?!, (!3' ' *' ' &)4!4/(9)1. 3,*/!&' 9* ' !3/(9)1!5(30! ' *3<!
43' !3)1!5(30! < &)*!1* =*0(; <*) , ' 7!

! "#3)4#()#1)8#.)66* . '#47'%#1)8,#9): * ,65 *6'#&6(#76(8+' ,1#; &,'6* ,+2!

!4 ,!(9,!(+!, -*!036 (/3, (/@E!89/!' ,3++!3/*!5() ,&)9(9' 0@!5&/5903,&)4!. & , -!&)19' ,/@!
; /(+' ' &())30' !3,!*=*) , ' !3)1!5() +*/*)5* ' 7!>)1!. *!-3=*!3!5() ' &1*/360*!) * ,. (/C!(+!
&)19' ,/@!5() ,35, ' ! , -3,!. *2=*! ' 955* ' +900@!5(0036 (/3, *1!. & , -!(=*/! , -*!@*3/' !. -(!3/*!
-3; ; @!, (!/*5(<<*)1!9' !, (! , -*/' 7!#*!-3=*!3!0(!,+!&)19' ,/@!5())*5,&())' !. -(!3/*!
OPQ#!309<)&!)3)1! (IC) (!(+!# \$%!, -/(94-!, -*&! ,&<*! ' ,91@&)4!3,!0)&=*/ ' & ,@7!89/!
/*' *3/5-*/' !3/*!35,&=*!(!&)19' ,/@!3)1!4(=*/) <*) ,!; 3)*0' !3)1!6(3/1' ?!3)1!. *2/*!30' (!
=*/!35,&=*!&!)!; /(=&1&)4!5() ,&)9&)4!*1953,&())! , (!; /35,&,&())*/' ! , -/(94-!,/3&)&)4!5(9/' *' 7!

! "#3)4#()#1)8,#, ,)>*. '+#9*6*,&<<1#,)<<#)8'2!

8+,*)!. *!3/*!3; ;/(35-*1!1&*/5,0@!, (!' (0=*!3!' ; *5&+&5!; /(60* <7!# *!/*' *3/5-!, - *!; /(60* <?!
5(<*!9; !. &, -!3!< * , - (1!3) 1!3!' (09,&()?!3) 1! , - *)!3; ; 0@!&,!&)!3!; /35,&530!. 3@7!# *2/*!
;/(6360@!()) *!(+!, - *!+*. !4/(9; ' !&)!>9' ,/30&3! , -3,!35,9300@!-3=*!6(, -!, - *!/*' *3/5-!
C) (. 0*14*!3) 1! , - *!; /35,&530!36&@!, (!3; ; 0@!&,7!8+, *)?!. *200!6 *!&)=(0=*!1! , -/(94-(9,!, - *!
. -(0*!0&+*5@50*!(+!3!; /(F*5,7!I (/!*: 3<; 0*!. *!. */*!- *3=&@!&)=(0=*!1!. &, -!, - *!1* ' &4)!(+!
Q@1) *@2' !1*' 30&)3,&()!; 03),7!# *!69&0,!' 530*!<(1*0' !(+' ; *5&+&5!; 3/, '!(+!, - *!; 03),!, (!

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