! ""#""\$#%&'(' #\$%"&'()%*+(,-"./"#.0%1." 2%34*,5%',"./"6+-7\$.0.8-" 69:"; <=>?@"ABCD"EE; =; <EE; ==F"9%7,(.'D"@@!F"G314,%1"!!<!><!H"

I 400" B"!@D@@J!>D?@" &K"!;!@" #L2" #L2" M*%8. *-"N0"P%-%*0"6\$020"4' 1"N. ' ("R0"P(\$G*40"6\$020" <u>M*%8. *-0P%-%*SG,.0%1.0%16</u>F"N. ' (0P(\$G*4SG,.0%1.0%16"" MP0"T-"433,0"P">J?0"I "!!J>F"NP0"U"VJE0"I">JE" W*(4' 4"X(14' 4" <u>W*(4' 40X(14' 4S*.7Y%,+0G,.0%1.0%16</u>" #L2" HI0"A. 55G' (74,(. ' ". /"W++%++5%' ,"I(' 1(' 8+0"2%5. ' +,*4,%+"4Z4*%' %++". /"5. 1%+". /"*%3. *,"Z*(,(' 8"4' 1" 3*. 8*%++"' . ,%+"

! @W0"a' ,%*)%' ,(. ' "304' ' (' 80"2(+304-+"T4+(7"G' 1%*+,4' 1(' 8". /",\$%"*%04,(. ' +\$(3"T%,Z%%' "4++%++5%' ,"4' 1" (',%*)%',(. ' "

! @L0"9Y(00+D"2(+304-+"T4+(7"\$%03(' 8"+Y(00+""

#\$(+"7. G*+%"+%*)%+"/. G*"54(' "8. 40+0"I(*+,0"(,"3*.)(1%+",\$%"Y' . Z0%18%"4' 1"+Y(00+"' %7%++4*-",. "415(' (+,%*0" +7. *%0"4' 1"(' ,%*3*%,"7. 55. ' 0-"G+%1"+,4' 14*1(\%1",%+,+". /"7. 8' (,()%"4' 1"' %G*. 3+-7\$. 0. 8(740"4T(0(,-0" 9%7. '10",. "G+%",\$%+%"('+,*G5%',+"('"4330(%1"3*47,(7%0"(,"(+"'%7%++4*-",. "G'1%*+,4'1",\$%(*"3+-7\$.5%,*(7" /. G' 14,(. ' +0"+. ",\$%"7. G*+%"3*.)(1%+"4' ".)%*)(%Z". /"3+-7\$. 5%,*(7",\$%. *-"4' 1"*%)(%Z+"*%%)4' ,"14,4"/. *" %47\$",%+,0"#\$(*10",\$%"7.G*+%"3*.)(1%+"4"*%)(%Z"./"4330(%1"4'1",\$%.*%,(740",.3(7+0"4+"Z%00"4+"\$(+,.*(740"4'1" . ' 8. (' 8"1%T4,%+"(' ",\$%"/(‰1". /"3+-7\$. 0. 8(740"4++%++5%' ,0"I. G*,\$0"(,"3*.)(1%+". 33. *,G' (,(%+",. "0%4*' "\$. Z" ,. "7. 55G' (74,%",%+,"/(' 1(' 8+"(' "3*./%++(. ' 40"/.*54,+0",\$*. G8\$"Z*(,,%' "*%3.*,+"4' 1".*40"3*%+%' ,4,(. ' +0""

L-",\$%"%' 1". /",\$%"7. G*+%0"-. G"+\$. G01"T%"4T0%",. D""

!0

$$\label{eq:starses} \begin{split} \# \$ \% * \% '(+"' . "3*\% [G(+(,\%'/. *", \$(+"704++0'', \$. G8\$'4"3*\%)(. G+"7. G*+\%''(' "5\%4+G*\%5\%' ,"4' 1"G' 1\%*8*41G4,\%" +,4,(+,(7+"Z. G01"T\%" \$\%03/G00"9,G1\%' ,+"Z(00"T\%"7. '7G**\%' ,0-"\%' *. 00\%1"(' "8*41G4,\%"7. G*+\%+"(' "I. G' 14,(. '+". /" A0(' (740"6*47,(7\%"4' 1"I. G' 14,(. '+". /" 6+-7\$. ,$\%*43-0") \end{split}$$

п

н

M*.,\$JP4*'4,0"M00"g"U*(8\$,0"W0"N0"d>@!;e0"!"#\$%&&'(&)(*+,-.&/&01-"/("++2++32#4(d;^{!"}%10e0"K.T.Y%'0"CN0" &90"N.\$'"U(0%-"g"9.'+0"a'70"" 5"61&7+(!"#\$&74+("#\$(8641-/2+(

92-. #1-"/("#\$(8\$31#1+46"41&#(: "#7"/+"

W00"8*41G4,%"+,G1%',+"4,"&#"4*%"%b3%7,%1",. "*%410"G'1%*+,4'10"4'1"/.00. Z",\$%"4741%5(7"3.0(7(%+",\$4," 8.)%*'",\$%(*"4,,%'14'7%"4,",\$%"&'()%*+(,-0"#\$%+%"3.0(7(%+"('70G1%0"TG,"4*%"'.,"0(5(,%1",.0"4741%5(7" 1(+\$.'%+,-0"4741%5(7"8*(%)4'7%0"0%4)%"./"4T+%'7%0"4'1",*4'+/%*"./"7*%1(,0"60%4+%"G+%",\$%"/.00. Z('8"&BR",." *%41"4"7.53*%\$%'+()%"0(+,"./"4741%5(7"3.0(7(%+",\$4,"3%*,4('",."-.G"('",\$(+"704++"4'1",\$*.G8\$.G,"-.G*" $\begin{aligned} &+ (1)^{*} =$

п

 $\#\$(+"7. G^{*}+\%"7.)\%^{*}+"V"5. 1G0\%+D"d! e".)\%^{*})(\%Z0"d>e"7. 8' (,()\%"4++\%++5\%' ,0"4' 1"dVe"' \%G^{*}. 3+-7\$. 0. 8(740" 4++\%++5\%' ,F",Z. ". /",$\%+\%"d7. 8' (,()\%"4' 1"' %G^{*}. 3+-7\$. 0. 8(740e"4*\%"7. *\%"7. G^{*}+\%"5. 1G0\%+"4' 1"Z(00"*\%[G(*\%" ,5\%"1\%5. '+,*4,(. '". /",*3\%7(/(7"7. 53\%,\%' 7(\%+0"4+"' ...,%1"T%0. Z0"#$\%"7. G^{*}+\%"Z(00"7. '+(+,". /". '\%"VJ$. G*"704++" 5\%,(' 8"\%47$"Z\%Y0"477. 534' (\%1"T-". '\%"!J$. G*"Z\%Y0-"04T"5\%,(' 80"#$\%"7. ',\%' ,". /",$\%"04T+"Z(00" 7. '*(+7.)\%"1(147,(7"54,\%'(40"7.))\%*%1"('",$\%"704++"$

/*. 5",\$%(*"34*%',". *"0%840"8G4*1(4'",. "34*,(7(34,%". ' "9. ' 40"TG,"+\$. G01"+,(00"+(8' "4' "4++%',"/. *50"h' 0-"G+%",\$%"). 0G',%%*i+"(' (,(40+". ' "4' -". /",\$%",%+,(' 8"54,%*(40+0""

0""

9. 5%"7. '/(1%',(40"70(%',"14,4"(+"G+%1"('",\$(+"704++0"#\$%",%+,"*%+G0,+"4'1"*%3.*,+"4*%"*%147,%1"/. *" 4'. '-5(,-0"TG,",\$%*%"4*%"40+.")(1%.+"./"70(%',+"+\$. Z'"('"704++0"60%4+%"/.00. Z",\$%"%,\$(740"8G(1%0('%+" *%84*1('8"3*.,%7,(.'"./"4++%++5%',"14,4"4'1"('/.*54,(.'0"I.*"8%'%*40"4++%++5%',"3G*3.+%+0"-.G"4*%" %b3%7,%1",."T%"/45(0(4*"Z(,\$",\$%"8N8(>4.1-"/(N61#-1*/2+()&6(N+,-.&/&01+4+(''#\$(F&\$2(&)(F&#\$7-40"%+3%7(400-" 9,4'14*1"HD"\$,,3D<<ZZZ04340.*8<%,\$(7+<7.1%<"

a' ",\$%"h)%*)(%Z"A.G*+%"P.1G0%0"54+,%*-"./",\$%"54,%*(40"7.)%*%1"Z(00"T%"4++%++%1"(' ",\$%"7.',%b,"./"4' " (' ,%8*4,()%"343%*"d!@l e"(' "Z\$(7\$"+,G1%' ,+"1%5.' +,*4,%"Y' . Z0%18%"./",\$%"8%' %*40"3*(' 7(30%+"4' 1",\$%.*(%+" G' 1%*0-(' 8"3+-7\$.0.8(740"4++%++5%' ,"(' ",\$%"7.' ,%b,"./"%,\$(740"4' 1"1()%*+(,-"(++G%+"+40(%' ,",. "4++%++5%' ,0""

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

!" #\$%&" '() *+" ,-./&" 0+%&/12" '() **" () **" () **" () ***"

!"##\$%&%'()\$*+%,"-.%/*0.*1#(-0')\$*+%)/-'23*

14%.4-%5*!%6(-0'*

- ! ''''#\$%*#\$%&"' (()"*+,- "' . */&' 0/*)"' 12"&3' 2",\$",/"*4' &+*"5%6&",1/3&3*/7*
- 8' 4. 3(()"9:"; :)"<"=,*+3)"9:">:"#?!@!7:"8%1A3&B31/"'12"2,*0&,-,1'1/"A'(,2'/,%1".5"/C3"-6(/,/&',/D -6(/,-3/C%2"-'/&,E:")")")"F?D?G@" 8&%1. '0C)"H:"I:)"<"J 33C()"K:L:"#?!@@7:"8%1*/&60/"A'(,2,/5",1"4*50C%(%B,0'("/3*/*:" MF?DNGM:" 031&5)"P:)"J %\$\$,//)"; :"L:)"8'*4,)"Q:)"H'1B(35)"I:)"<"R,(A')"K:"Q:"#?!!S7:"T1"/C3"U&3-3-.&'103"%\$"/C,1B*"4'*/UV" Q"(%1B,/62,1'("3A'(6'/,%1"%\$"/C3"&3/&%*430/,A3"-3/C%2:")")!MD?G?:" :2%,:%&B <u>C//4\WVQEE12%,!%&BW?@@6N&W?@5C@N@4</u>!IGJYEM:@vD". BT-0.0014Tc3-30900.0cmBc460046497.4701(3)0046Tm046Tm046 Z'B'1)"I:"#?!FF7:"; C3"-3'1,1B*"%\$"43&*%1'(,/5"4&32,0'/3*:")"Y?SDYMG:" <u>C//4WW2E:2%,:%&BW?G:?GNXWGGGNDGYY[:SN:F:Y?S</u>"" J 353&)"\:'I:)"=,11)"R:"L:)"L523)"H:)"Z'5)"\:'\]'J %&3('12)"Z:"H:)"9,3*)"]:"]:)"L,*-'1)"L:"I:)"Z6.,*^51)"; :">:)"<"
 -] 332)"\:"J :"#MGG?7:"K*50C%(%B,0' ("/3*/,1B"' 12"4*50C%(%B,0' ("' **3** 31//I"Q"&3A,3__"%\$"3A,23103" ' 12",**63*:")"?MF

! ""#\$2"

Z%/%A)"]:)"Z&63B3&)"]:"=:)" > ' /*%1)"9:)"Q0C31. ' 0C)"; :"J :)"Q(/C%\$\$)"]:"]:)"P' B. 5)"]:"J :)"<":::"k, - - 3&- ' 1)"J :" #MG?X7:"; C3"O,3&' &0C,0' ("; ' E%1% - 5"%\$"K*50C%4' / C%(%B5"#O,; TK7\"Q"2, - 31*,%1' ("' (/3&1' /,A3"/%" /&' 2,/,%1' ("1%*%(%B,3*:")"S@SDSXX:"O,; TK",*"' "13_" 2,- 31*,%1' (,^32"C,3&' &0C,0' ((5"%&B' 1,^32"' 44&%' 0C"/%"6123&*/' 12,1B)"' **3**,1B)"' 12"/&3' /,1B" 4*50C%4' /C%(%B5:" > C' /" - ,BC/". 3"/C3"0C' ((31B3*"%\$", - 4(3 - 31/,1B"/C,*"' 44&%' 0C"&' /C3&"/C' 1"/C3" 9RJ D@d" > C' /"_%6(2". 3"/C3". 313\$,/*d" 93' &5)"c:"I:"#MG?M7:"c1/3((,B3103:"

"S@NDSFM:"

C//4WW2E:2%,:%&BW?G:??SYW' 116&3AD4*50CD?MGX?GD?GGN@N"

H6.,1*+,)"9:"#MGGS7:"c1/&%260/,%1"/%"/C3"R430,' ("R30/,%1"%1"8%B1,/,A3"Q.,(,/,3*V"?GG"n3' &*"Q\$/3&"R43' &- ' 1u*" #?!GS7"Uu\313&' ("c1/3((,B3103)u"T. a30/,A3(5"93/3&- ,132"' 12"J 3' *6&32U:"

)"! YD???:"C//4WW2E:2%,:%&BW?G:?GNXWGGMMDN@?S:FY:?:! Y"

b,*. 3//)"]:"L:)"Q&%1*%1)"I:)"P(',&)"8:)"9,0+31*)">:)"=(511)"I:)"O'(43&1)"9:"=:)"<"; 6&+C3,- 3&)"L:"#MG?M7:" c1/3((,B3103V"b3_"\$,12,1B*"'12"/C3%&3/,0'("23A3(%4-31/*:")"?NGD?@!:" C//4WW2E:2%,;%&BW P31*%1)"b:)"O6('0)"9:"J:)"<"Z&'1^(3&)"I:"O:"#MG?G7:"c123431231/"3E' - ,1'/,%1"%\$"/C3">30C*(3&"Q26(/"

c1/3((,B3103"R0' (3D=%6&/C"L2,/,%1"#>QcRDcq7V">C' /"2%3*"/C3">QcRDcq"- 3' *6&3d"

)"?M?D?NG:"C//4WW2E:2%,:%&BW?G:?GNXW' GG?XXYX" 8'1,A3^)"\:"H:"#MG?N7:"c10&3 - 31/' ("0&,/3&,%1"A' (,2,/5"%\$" > QcRhcq"\$'0/%&",123E"*0%&3*V"]3('/,%1*C,4*"_,/C"

>cQ; hcc" 12">cQ; hccc"*6. /3*/" 12"0%- 4%*,/3"*0%&3*:" #M7)"SFSDS!@:"

C//4WW2E:2%,:%&BW?G:?GNXW' GGNMG! M"

8'1,A3^)"\:"H:)"<">'/+,1*)"J:">:"#MG?G7:"c1A3*/,B'/,%1"%\$"/C3"\$'0/%&"*/&60/6&3"%\$"/C3">30C*(3&"Q26(/" c1/3((,B3103"R0' (3D=%6&/C"L2,/,%1"#>QcR0cq7/"LE4(%&' /%&5"' 12"C,BC3&"%&23&"\$' 0/%&"' 1' (5*3*:")"FMXDFNY:"C//4WW2E:2%,:%&BW?G:?GNXW' GGMGSM! "

8' &(%^^,)"b:"L:)"Z,&*0C)"b:"H:)"Z,*'(')"K:"Q:)"<"; 6(*+5)"9:"R:"#MG?@7:"Q1"LE' - ,1'/,%1"%\$"/C3">30C*(3&"Q26(/" c1/3((,B3103"R0' (3*)"=%6&/C"L2,/,%1"#>QcRDcg7",1",12,A,26' (*"_,/C"0%- 4(,0' /32"J ,(2)"- %23&' /3"' 12" *3A3&3"; &' 6 - ' /,0"P&' ,1"c1a6&5"#; Pc7:")"M?DNX:"

C//4WW2E:2%,:%&BW?G:?GFGW?NF@SGSY:MG?@:?GG@YXX"

- L&2%2,)"H:"Q:)"Q. 3' &3)"8:"Q:)"H,0C/31*/3,1)"I:"9:)"; 5*%1)"P:"; :)"Z60C' &*+,)"P:)"k600' /%)"P:"\:)"<"]%/C)"]:"J:" #MG?X7:" > 30C*(3&"Q26(/"c1/3((,B3103"R0' (3D=%6&/C"L2,/,%1"# > QcRDcq7"4&%03**,1B"*4332"*0%&3*"' *" - 3' *6&3*"%\$"1%10&32,. (3"&3*4%12,1BV"; C3"/C,&2"B313&' /,%1"%\$"3-. 32232"43&\$%&- ' 103"A' (,2,/5" ,12,0' /%&*:")"?SFD?@X:"C//4WW2E:2%,:%&BW?G:?GNXW4' *GGGGN?!"
- J 093&- %//)"K:"Q:)">'/+,1*)"J :">:)"<"]C%' 2)"Q:"J :"#MG?S7:">C%*3"c` ",*",/dDQ**3**%&"., '*"A' &, '103",1"C,BCD */' +3*"4*50C%(%B,0' ("' **3** - 31/:")"MGXDM?S:"

- 9&%^2,0+)"H:">:)"<"86((6-)"8:"J:"#MG??7:"LE4' 12,1B"/C3"30%(%B,0' ("A' (,2,/5"%\$">QcRbcg"' 12">J Rbcg"_,/C" /C3"; 3E' *"=610/,%1' ("H,A,1B"R0' (3:")")"?S?D?@@:" <u>C//4WW2E:2%,;%&BW?G:??XXW?GXN?!???GNFMFSN</u>""
- $9\&\%^{2},0+)"H:">:)"O\%(21'0+)"I:"Q:)">3,**)"H:"\backslash:)"<"kC\%6)"[:"#MG?N7:"TA3&A,3_"%$"/C3">QcRDcgW>J RDcgWQ8R:"c1" I:"Q:"O\%(21'0+)"H:">:"9&\%^{2},0+)"H:"\backslash:">3,**)"<"\backslash:"H:"cA3&*%1"#L2*:7)"$

XN7:"R' 1"9,3B%)"8Q)"fRV"L(*3A,3&"QO' 23 - ,0"K&3**:"<u>C//4WW2E:2%,:%&BW?G:?G?YWP! XFDGD?MDNFY! NSD</u> G:GGGG?DF"

"#44:"?D

9&%^2,0+)"H:">:)"]',\$%&2)"R:"L:)">' C(*/&%-)"9:)"<">3,**)"H:"\:"#MG?F7:"; C3">30C*(3&"Q26(/"c1/3((,B3103" R0' (3D=%6&/C"L2,/,%1"' 12"/C3">30C*(3&"J 3- %&5"R0' (3D

430/&6- "2,%&23&*V"9' /' "\$&%- "/C3"fZ"1' /,%1' ("*430,' (,*/"0(,1,0:" YYN:"<u>C//4WW2E:2%,:%&BW?G:?GFGWG! M! XGS! :MG?F:?@?YMGM</u>")"YSFD

R/34C31*)"; :"H:"#MG?S7:"; C3"' **3** - 31/"%\$"3E306/,A3"\$610/,%1,1B"6*,1B"/C3"93(,*DZ' 4(' 1"LE306/,A3" =610/,%1*"R5*/3 - "#9DZL=R7:"c1"R:"\%(2*/3,1"<"I:"Q:"b' B(,3&,"#L2*:7)"

"#%&BD

Y N

C//4WW2E:2%,:%&BW?G:?X!X

L4*/3,1)"I:"b:)"L&+'1(,)"Q:)"8%113&*)"8:"Z:)"Z('&,0)"I:)"8%*/3((%)"I:"L:)"<"Q1B%(2)"Q:"#MGGN7:"]3('/,%1*"P3/_331" 8%1/,16%6*"K3&\$%&-'103";3*/"K3&\$%&-'103"J3'*6&3*"'12"Q9O9"P3C'A,%&*:" #@7)"@SND@@S:"C//4WW2E:2%,:%&BW?G:?GMNWQV?GM@SG@M?YNN! ""

J ' 0` 6331)"9:"Q:)"J ,1' **,' 1)"Q:)"O31&5)"P:["]H:)"∖353&)"J :"Q:)"n%61B)"I:">:)"<"K3&&5)">:"#MG?F7:" Q - 4C3/' - ,13" - %23*/(5", - 4&%A3*"8%113&*0"8%1/,16%6*"K3&\$%&- ' 103"; 3*/"43&\$%&- ' 103",1" C3' (/C5"' 26(/*:" #N7)"MFNDM! N:"

C//4WW2E:2%,:%&BW?G:?G?XWR?N@@Y?XX?XGGG!G[""

b' B(,3&,)"I:"Q:)"\%(2*/3,1)"R:)"93(' 623&)"P:"n:)"<"ROC_3. ' 0C)"Q:"#MGG@7:"]3(' /,%1*C,4*".3/_331"/C3">cR8Dccc" ' 12"/C3"8%B1,/,A3"Q**3**-31/"R5*/3-"_,/C"8%113&*u"&' /,1B"*0' (3*"' 12"0%1/,16%6*"43&\$%&- ' 103" /3*/*:" #N7)"NF@DSG?:"

<u>C//4WW2E:2%,:%&BW?G:?G?YWa:'01:MGGS:G!:GGF</u>""

RC' +32)["]9:)"=' 6(+13&)"H:"J :"9:)"; %((3)"Z:)">3123(()"8:"]:)"> ' (2*/3,1)"R:"]:)"< "R43103&)"]:"I:"#MG?!7:"]3(,' . ,(,/5" ' 12"A' (,2,/5"%\$"/C3"8%113&*0"8%1/,16%6*"K3&\$%& - ' 103"; 3*/:"

?!"

)"XN?DX@S:"

)"XN!DXYG:"C//4*WW2%,:%&BW?G:?GGMW4,/*:MG@G?""

"?SGD?S@:"

0C%%(D' B3"53' &:"

,231/,\$,0'/,%1:"

C//4WW2E:2%,:%&BW?G:??XXWGXNSMFM!?YY@!MGF""

K:"=(' 1' B' 1"<"L:"J :"J 09%1%6BC"#L2*:7)"

0C,(2&31^{*}_,/C^{**}430,\$,0^{*}(3' &1,1B^{*}2,*' . ,(,/,3*:"

C//4WW2E:2%,:%&BW?G:?G?YWa:,1/3((:MG?X:G?:G?S""

=('1'B'1)"9:"K:)"Q(\$%1*%)"g:"8:)"8%*/')"J:)"K'(-')"Z:)"<"H3'C5)"J:"Q:"#MG?F7:"f*3"%\$"'. (,/5"/3*/*",1"/C3"

=('1'B'1)"9:"]:)"=,%&3((%)"8:"Q:)"<"T&/,^)"R:"T:"#MG?G7:"L1C'10,1B"4&'0/,03"/C&%6BC"'44(,0'/,%1"%\$"8'//3((D 0%&1D8' &&%(("/C3%&5"'12"&3*3' &0CV"Q"U/C,&2"-3/C%2U"'44&%'0C"/%"*430,\$,0"(3' &1,1B"2,*'.,(,/5"))

\,%\$&|)"9:)"; %\$\$'(,1,)"L:)"Q(/%|)"\:)"<"8%&1%(2,)"8:"#MG?X7:"c1/3((,B3103"-3'*6&3*"'*"2,'B1%*/,0"/%%(*"\$%&"

"#44:"YGFDYSM7:"b3_"n%&+)"bn)"fRV"\6,(\$%&2"K&3**:"

,231/,\$,0' /,%1"%\$"*430,\$,0"(3' &1,1B"2,*' . ,(/,3*"_,/C,1"/C3"0%1/3E/"%\$"' 1"%43&' /,%1' ("23\$,1,/,%1:"c1"9:"

O' (3)"I:)"Q(\$%1*%)"g:)"P3&1,1B3&)"g:)"P&' 0+31)"P:)"8C&,*/%)"8:)"8(' &+)"L:)":":":"n' (%\$)"I:"#MG?G7(#) - 1(MG?G7001scq - 1(,) - 2(*) - 2(*)