



62% •D0

V %DEUDKDP ,QVWLWXWH &DPEULGJH &% \$7 8.

V \$OWRV /DEV &DPEULGJH ,QVWLWXWH RI 6FLHQFH &DPEULGJH &% \*3 8.

Y	)LUVW SXEOLVKHG	6HS	
	KWWSV GRL RUJ	I	UHVHDFK
	/DWHVW SXEOLVKHG	6HS	
	KWWSV GRL RUJ	I	UHVHDFK

\$EVWUDFW

%DFNJURXQG 5REXVW DQDO\VLV RI '1\$ VHTX|YHUVLRQ ✓ ? ?  
 LQFOXGH D VHW RI TXDOLW\ FRQWURO VWHS\ 6HS YLHZ YLHZ YLHZ .FDO ELD  
 NHSW WR D PLQLXP \$ PHWULF HDVLO\ REWE HDFK  
 RI WKH QXFOHREDO IRU HDFK SRVLWLRQ DFURVV DOO VHTXHQFLOJ UHJGV  
 +HUH ZH H[SORUH WKH GLIIHUHQFHV LQ QXFOHREDO FRPSRVLWLRQV RI  
 YDULRXV OLEUDU\ W\SHV SURGXFG E\ VWDQGDUGV W\SHV LPHQVDO 5HVHDFK 3D  
 PHWKRG RORJLHV b \$XVWUDOLD  
 0HWKRGV :H REWDLQHG WKH FRPSRVLWLRQV RI QHDOU\ SXEOLFO\  
 DYDLODEOH GDWDVHWV DQG VXEMHFWHG WKH FRPSRVLWLRQV LPHQVDO  
 \$SSUR[LPDWLRQ DQG 3URMHFWLRQ 80\$3 GLPHQLWLRQDOLW\ UHGXFWRU IRU D  
 WZR GLPHQLWLRQDOLW\ UHSUHVHQWDWLRQ RI WKHLU FRPSRVLWLRQ FKDUFDWHULVWL  
 5HVXOWV :H ILQG WKDW PRVW OLEUDU\ W\SHV UHJGV LQ D VSHFLILF FRPSRVLW  
 SURILOH :H XVH WKLV WR JLYH DQ HVWLPHDWK RI KRZ YVUROJO\ WKH  
 FRPSRVLWLRQ RI D WHVW OLEUDU\ UHVHPEOHV WKH SURILOHV RI SUHYLRXVO\  
 SXEOLVKHG OLEUDULHV DQG KRZ OLNHO\ WKH W\SHV FRPSOH LV WR EH RI D  
 SDUWLFXODU W\SH :H LQWURGXFH /LEUDULDQ D XVHU IULHQGO\ ZHE  
 DSSOLFDWLRQ DQG FRPPDQG OLQH WRRO ZKLFK HQDEOHV FKHFNLQJ EDVH  
 FRPSRVLWLRQV RI WHVW OLEUDULHV DJDLQV W\SHV LPHQVDO 5HVHDFK WKH HQG RI  
 &RQFOXVLRQV /LEUDU\ SUHSDUDWLRQ PHWKRGV VWURQJO\ LQIOXHGFH WKH SHU  
 SRVLWLRQ QXFOHREDO FRQWHQW %\ FRPSDULQJ WHVW OLEUDULHV WR D GDWD  
 RI SUHYLRXVO\ SXEOLVKHG OLEUDU\ W\SHV ZH FDQ PDNH SUHGLFWLRQV



Highly enriched regions are often found in the same genomic regions as other features. A number of features have been identified, including DNA binding sites, such as transcription factor binding sites, DNA-protein cross-links (DNA-protein cross-links), and DNA-protein cross-links (DNA-protein cross-links). The enrichment of these features is often correlated with the enrichment of other features. The enrichment of these features is often correlated with the enrichment of other features. The enrichment of these features is often correlated with the enrichment of other features.

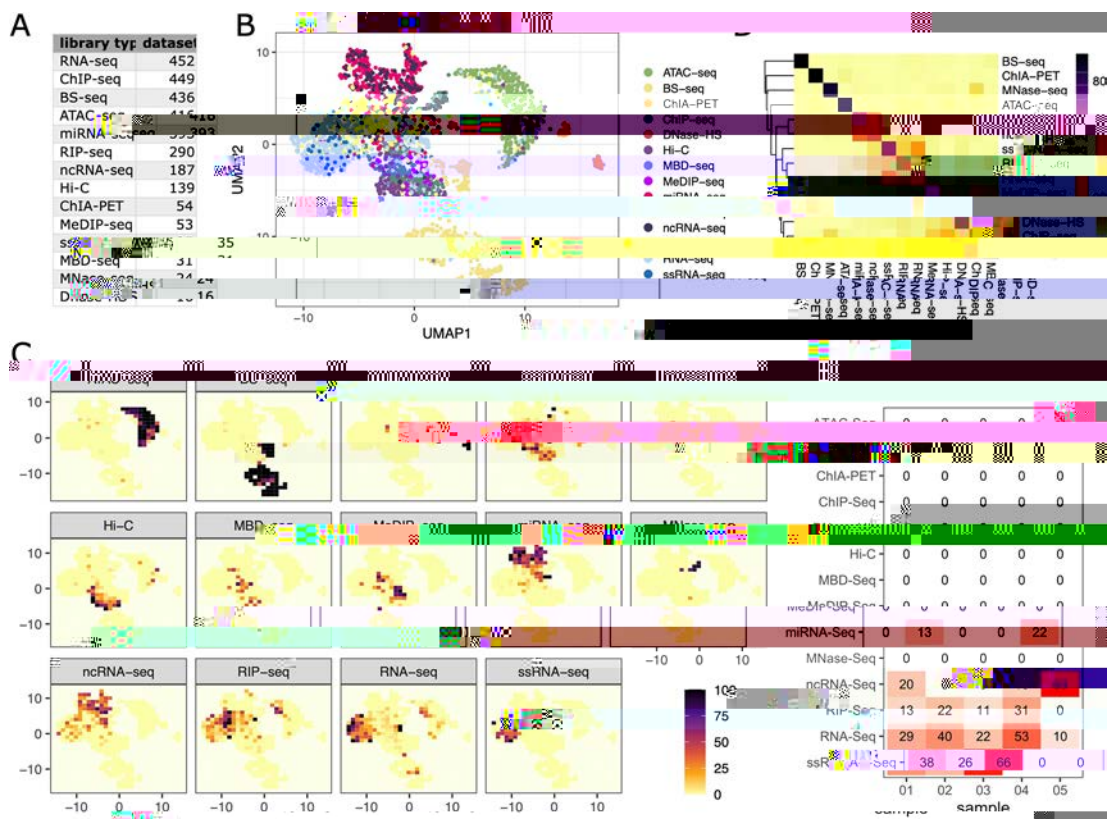
Figure 14 (a) shows the enrichment of these features. The enrichment of these features is often correlated with the enrichment of other features. The enrichment of these features is often correlated with the enrichment of other features. The enrichment of these features is often correlated with the enrichment of other features. The enrichment of these features is often correlated with the enrichment of other features. The enrichment of these features is often correlated with the enrichment of other features.

based on the number of reads. Each read is a sequence of 150 bp, and the reads are aligned to the reference genome. The reads are then grouped into clusters based on their genomic location and sequence similarity.

The 'Peak calling' step is performed using the MACS2 software. The peaks are then annotated with gene names and other genomic features. The 'Peak calling' step is performed using the MACS2 software. The peaks are then annotated with gene names and other genomic features.

Here, we describe the method used for peak calling and annotation. The method involves identifying regions of high signal enrichment and associating them with nearby genes and features.

The data were analyzed using the GEO database (GEO) and the ENTPREP database (ENTREP) to identify differentially expressed genes. The data were analyzed using the GEO database (GEO) and the ENTPREP database (ENTREP) to identify differentially expressed genes.



**Figure 2.** Library types can be distinguished by their base compositions. A) Number of samples per library type included in the analysis. B) UMAP representation of library compositions (reference map). C) Tile based probability map for each library type. Colour represents the percentage of a particular library type per tile. D) Heatmap illustrating the specificity of each library type for tiles of the reference map. All samples were assigned to a reference map tile and colour represents the average percentage of each library type for these tiles. E) Librarian tile probability



O a a e de a a a a e ba e c f e i e c g b a e hea f i e ced b a e e a d  
h i gh h ch e ba a e a ed. Th f d g ca be i ed a a ea i a a i a ce f e e i e ced  
i b c a a b e da a. A a e a a ch g e e e c e d c h i d a e a ed f a g a d a e i de g  
ca e h i d be e g a e d be f e v g h e a a . Wh e a c i d a a e a b e  
d g b a e a a , a b e a a c a e d b a - a da d e a a e a d.

Of e, a i da a b a e f i b h e d e i e c g b a e e f d a a i b e f a e h ch i e a  
d f f e e b a e. Th ce i a e d b a g i f RNA- e a e h ch f a a e g f a e a h ch  
e e e e c f c f ATAC- e . C e e c f a e e e a e e a a a e b a e e e d ced b

L b a a a g a a d a a e e c a a e Ca b d g e B f a c H a c a n ( . c a b h a c u , 21 r 23 d Se 2020) a n a d e a f a e e c i d g S e h e K a e e a d L d g a a . W e i d e a F e K i e g e f i e f i d o a d c a e a d g f h e a i c a

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# 2SHQ 3HHU 5HYLHZ

&XUUHQW 3HHU 5HYLHZ 6WDWXV

9HUVLF

5HYLHZHU 5HSRUWb 2FWREHU

KWWSV GRL RUJ I UHVHDFK U

k \*KDUEL . 7KLV LV DQ RSHQ DFFHVV SHHU UHYLHZ UHSRUW GLVWULEXWHG  
\$WWULEXWLRQ /LFHQVH ZKLFK SHUPLWV XQUHVWULFWHG XVH GLVWULEXWLRQ  
RULJLQDO ZRUN LV SURSHUO\ FLWHG

.DULP \*KIDJEL  
7KH(DUOKDP ,QVWLWXWH 1RUZLFK 8.

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WRRO IRU QH[W JHQHUDWLRQ VHTXHQLQJ 1\*6 GDWDVHWV ZKLFK X  
DORQJ VHTXHQFH UHJGV WR LQIHU WKH OLNHO\ OLEUDU\ SUHSDUDW  
DXWKRUV ILUVW GHPRQVUDWH WKDW QXFOHRWLGH FRPSRVLWLRQ L  
UHFRUGHG LQ WKH \*(2 GDWDEDVH IRU D VHOHFWLRQ RI KXPDQ DQG F  
HVWDEOLVKHG WKLW UHVXOW WKH\ LPSOHPHQWHG D SURJUDP WRRO  
FRPSRVLWLRQ SURILOHV WR D FROOHFWLRQ RI UHIHQFH GDWDVHW  
SURILOHV ZKLFK PD\ EH LQGLFDWLYH RI SRWHQWLDO IDLOXUH GXUL  
VDPSOH GDWD PL[ XSV 7KH WRRO ZKLFK LV DYDLODEOH DV D ZHE D  
H[WUDFWV QXFOHRWLGH FRPSRVLWLRQ IURP XVHU VXSSOLHG )\$674 I  
DJDLQVW H[LVWLQJ SURILOHV VWRUHG LQ WKH /LEUDULDQ GDWDEDV

7KH PDQXVFULSW LV ZHOO ZULWWHQ DQG WKH DXWKRUV SURYLGH V  
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WR EHFRPH DQ LPSRUWDQW VWHS LQ WKH 4& RI 1\*6 GDWD DORQJVL  
DV )DVW4& DQG KHOS GHWHFW TXDOLW\ LVVXHV HDUO\ LQ GDWD SU  
DERXW WKH OLPLDWLRQV RI WKH VRIWZDUH DV FXUUHQWO\ LPSOHP  
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WKH GDWDEDVH RI QXFOHRWLGH FRPSRVLWLRQ SURILOHV L H ZK\



QXFOHRWLGH FRPSRVLWLRQ RI HDFK OLEUDU\ W\SH 6RPH PHWKRGV  
H J ; \*HQRPLFV ZLWK GLIIHUHQW QXFOHRWLGH FRPSRVLWLRQV  
FDQ EH GLDJQRVWLF RI WKH OLEUDU\ W\SH b

7KH VHOHFWLRQ RI \*(2 GDWDVHWV WR EXLOG UHIHUHQFH SURILOHV  
3OHDVH FDQ \RX SURYLGH HYLGHQFH WKDW /LEUDULDQ LV DSSOLFDE  
HVSHFLDOO\ VSHFLHV ZLWK GLYHUJHQW \*& FRQWHQW

7KH GDWH UDQJH ILOWHU LV DOVR OLNHO\ WR K  
OLEUDU\ W\SHV WR EH H[FOXGHG IURP WKH DQDO\VLV DQG WKHUHIR  
OLEUDU\ W\SHV DUH KLJKO\ SRSXODU EXW VXUSULVLQJO\ DEVHQW  
PLVVHG WRR b

7UDQVSRVRQ EDVHG OLEUDU\ SUHSDUDWLRQ LV LQFUHDVLQJO\ SRS  
OLEUDU\ W\SHV LQFOXGLQJ VLQJOH FHOO 51\$ DQG '1\$ VHTXHQFLQJ  
VHT HQULFKPHQW FDSWXUH HWF 7KH DXWKRUV EULHIO\ DFNQRZOH  
WR EH D PDMRU OLPLWDWLRQ RI WKH WRRO L H WUDQVSRVRQ LQV  
OLNHO\ REVFXUH WKH XQGHUO\LQJ OLEUDU\ W\SH FDXVLQJ PRVW W  
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ORUH JHQHUDOO\ VSHDNLQJ , ZRXOG VWURQJO\ HQFRXUDJH WKH D  
W\SHV DQG VSHFLHV VXSSRUWHG E\ /LEUDULDQ LQGLFDWLQJ WKDW  
DQG RU VSHFLHV PD\ UHVXOW LQ LQFRQFOXVLYH RU SRWHQWLDOO\ N  
VRIWZDUH ZLOO DFFHSW DQ\ )\$674 ILOH

0LQRU FRPPHQWV bb bbb b

3OHDVH EULHIO\ FRPPHQW RQ WKH REVHUYHG SDWWHUQ IRU &K,\$ 3  
WKHVH H[SHFWHG DQG FRQVLVWHQW ZLWK WKH OLEUDU\ PHWKRQ &K  
PHWKRQ \$ VKRUW GHVFULSWLRQ VKRXOG EH LQFOXGHG LQ WKH WH

3OHDVH DGG OHJHQG WR )LJXUH ZLWK NH\ PDWFKLQJ FRORXUH G

, ZRXOG VXJJHVW PHWD DQDO\VLV RI SXEOLF GDWDVHWV DV DQRWH  
H J DV D FOHDQ XS WRRO SULRU WR PHWD DQDO\VLV RU LGHQWLI\L  
VXEW\SHV b

3OHDVH FODULI\ ZKHWKHU /LEUDULDQ FDQ ZH EH VHW XS ZLWK D O  
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UHVSRQVHV DQG IXWXUH LWHUDWLRQV RI WKH VRIWZDUH DGGUHVVL

,V WKH UDWLRQDOH IRU GHYHORSLQJ WKH QHZ VRIWZDUH WRRO FOH

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DQG DQ\ UHVXOWV JHQHUDWHG XVLQJ WKH WRRO"  
3DUWO\

\$UH WKH FRQFOXVLRQV DERXW WKH WRRO DQG LWV SHUIRUPDQFH D  
ILQGLQJV SUHVHQWHG LQ WKH DUWLFOH"  
3DUWO\

&RPSHWLQJ ,QWHUHVW 1R FRPSHWLQJ LQWHUHVWV ZHUH GLVFORV

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, FRQILUP WKDW , KDYH UHDG WKLV VXEPLVVLRQ DQG EHOLHYH WKD  
H[SHUWLHV WR FRQILUP WKDW LW LV RI DQ DFFHSWDEOH VFLHQWLIL  
VLJQLILFDQW UHVHUYDWLRQV DV RXWOLQHG DERYH

5HYLHZHU 5HSRUWb

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KWWSV GRL RUJ I UHVHDFK U

k 2NRQHFKQLNRY . 7KLV LV DQ RSHQ DFFHVV SHU UHYLHZ ~~UHSRUW~~ GLVWUL  
&RPPRQV \$WWULEXWLRQ /LFHQVH ZKLFK SHUPLWV XQUHVWULFWHG XVH GLVWUL  
SURYLGHG WKH RULJLQDO ZRUN LV SURSHUO\ FLWHG

.RQVWDQWLQ 2NR<sup>D</sup>HFKQLNRY

\*HUPDQ &DQFHU 5HVHDFK &HQWHU +HLGHOEHUJ \*HUPDQ\

7KH PDQXVFULSW GHVFULEHV WKH TXDOLW\ FRQWURO 4& WRRO /LE  
VHTXHQLQJ OLEUDU\ FRUHFHQWV LQ FRPSDULVRQ WR WKH FRQW  
,QLWLDOO\ IRU WKLV SXUSRVH WKH FRPSRVLWLRQ RI QXFOHRWLGH  
DV LQSXW WR FUHDWH D ODUJH UHIHUHQFH FRQWURO FRKRUW IURP  
WKHVH PHUJHG QXFOHRWLGH SURILOHV YLD 80\$3 DOORZV WR REVHU  
GDWD W\SH RI D GDWDVHW 1RYHO VDP SOH FKHFN LV D SURMHFWLRQ  
RQOLQH WRRO FRQILUPHG LWV XVHIXOQHVV IURP LQVSHFWLRQ RI R  
GLVWLQJXLVKHG FRUHFQWV\ 6XFK SURMHFWLRQ RI D QRYHO GDWDV  
VWHS IRU DQ\ VHTXHQLQJ H[SHULPHQW b +RZHYHU WKH PDQXVFULS  
EH LPSURYHG LQ RUGHU WR SURYLG PRUH GHWDLOV DERXW WKH W

EORFNV

◦ ,Q JHQHUDO WKH PDQXVFULSW FOHDUO\ GHVFULEHV WKH WHFKO  
 OLPLWDWLRQ RI WKH PHWKRQ LV VWDWHG HIIHFW RI D FXW LQ 5  
 WR \$7\$& VHT LQ 'LVFXVLRQ 0RUH YDULDQFH IDFWRUV FRXOG E  
 FRQFOXVLRQV DERXW WKH DQDO\VLV UHVXOWV )RU H[DPSOH W  
 IURP IUR]HQ WLVVXH ))3( LV WKHUH DQ\ LPSDFW RI WKLW SUHS  
 LQVSHFWLRQ WKH VWDQGDUG 51\$ VHT GDWDVHWV ZHUH GLVWLQ  
 GHPRQVWUDWHG WKH FORVHVW VLPLODULW\ WR 0%3' DQG 0H',3  
 DOVR LQFOXGHG KRZHYHU WKH\ YDU\ VLQFH WKH\ FRXOG EH HL  
 VHJPHQW RI D JHQH &RXOG WKLW KDYH DQ LPSDFW RQ UHDO

b

◦ 7KH UHDTV VHOHFWLRQ LV SHUIRUPHG ZLWK . VXEVDPSOLQJ  
 :KDW LV WKH HIIHFW RI WKH WRWDO QXPEHU RI UHDTV" ,V LW VX  
 WKHP" ,Q WKLW FDVH ZKDW LV WKH VXJJHVWHG OLPLW"

b

◦ \$OVR ES UHDTG VHJPHQW LV XVHG DV WKH UHIHUHQFH EXW KF  
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 XVH D ODUJHU VHJPHQW RI WKH UHDTG IRU UHIHUHQFH JHQHUDWL  
 UHDTV KDYH D QHJDWLYH LPSDFW"

b

◦ +RZ VWURQJ LV WKH VSHFLHV HIIHFW" \$UH WKHUH YDULDQFHV R  
 PDWHULDOV LQ IXOO 80\$3 H J FOXVWHUV IRUPDWLRQ" 'RHV LW  
 IRU VXFK D SURFHGXUH HVSHFLDOO\ ZKHQ ZRUNLQJ RQ RWKHU V

)XUWKHU DGGLWLRQDO FRPPHQWV FRXOG KHOS WR LPSURYH WKH PD

◦ ,Q )LJXUH WKH QXFOHRWLGH W\SH FRORU OHJHQG LV PLVVLQJ  
 WH[W GLUHFWO\ E\ VXIL[ D E F G )LJXUH D GHPRQVWUDWHV &  
 LQFOXGHG VLQFH LW V QRW VWDWHG LQ WKH PDQXVFULSW WH[W

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◦ )LJXUH D \$UH WKH DPRXQWV RI PLFH DQG KXPQV PL[HG" :KDW

b

◦ )LJXUH F 6HYHUDO HQULFKPHQW 80\$3 ORFDWLRQV IRU FHUWDLQ  
 RWKHU H J 51\$ VHT +RZ WR LQWHUSUHW WKLW" &RXOG LW EH F  
 WKH GDWDVHW W\SHV"

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◦ :KHQ GRZQORDGLQJ H[DPSOH GDWDVHWV VDPH )\$674 ILOHV  
 \$OVR WKHUH LV QR GRFXPHQWDWLRQ DYDLODEOH UHJDUGLQJ L  
 QRW DOORZHG WR EH J]LSSHG LW V QRW FOHDU ZLWKRXW WHVW

b

◦ \*LWKXE GRFXPHQWDWLRQ RQ WKH HVWDEOLVKPHQW ODXQFK ODF  
 H[WHQG LW HVSHFLDOO\ WR VWDWH ZKDW DUH WKH V\WHP HQY  
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,V VXIILFLHQW LQIRUPDWLRQ SURYLGHG WR DOORZ LQWHUSUHWDWLRQ  
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5HYLHZHU 5HSRUWb 2FWREHU

KWWSV GRL RUJ I UHVHDFK U

k .HQLUV\$LV LV DQ RSHQ DFFHVV SHHU UHYLHZ UHSRUW GLVWULEXWHG XQG  
\$WWULEXWLRQ /LFHQVH ZKLFK SHUPLWV XQUHVWULFWHG XVH GLVWULEXWLRQ  
RULJLQDO ZRUN LV SURSHUO\ FLWHG

\$QGUHZ .HidLU\  
0ROHFXODU 0HGLFLQH 'LYLVLRQ :DOWHU DQG (OLJD +DOO ,QVWLWXV  
\$XVWUDOLD

9DVKLVKWKD DQG FROOHDJXHV SHUIRUP DQ DQDO\VLV RI WKH EDVH  
DYDLODEOH VHTXHQFLQJ GDWD VHWV DQG VKRZ WKDW WKHVH VHJUH  
RI IDVWT ILOHV 7KH DXWKRUV VXJJHVW WKDW WKLW DQDO\VLV FRXO  
LGHQWL\ LQFRUUHFV OLEUDULHV HDUO\ LQ DQDO\VLV SLSHOLQHV D  
WKLW WHVW 6XFK DQ DQDO\VLV FRXOG FHUWDLQO\ EH XVHIXO DQG I  
KH S4& VW DØFK DQP0p°@p0p 0 p€ u Àp 3 LQ DQ p€ pÀ0A0@ €<À S0L

WKLW SHUKDSV HQULFKPHQW WHFKQLTXHV RU GHYHORSPPHQWDO  
b

, P QRW VXUH RI WKH ORJLVWLFV RI WKLW EXW /LEUDULDQ PD\ E  
DV DQ RSWLRQ ZLWKLQ WKH DOUHDG\ ZLGHO\ XVHG IDVWTF

b  
\$Q H[DPSOH RI WKH /LEUDULDQ RXWSXW ZRXOG EH EHQHILFLDO

b  
7KH WHUPV UHIHUHQFH PDS DQG FRPSRVLWLRQV PDS VHHP W  
VLPSOLFV\ RQH WHUP VKRXOG EH XVHG WKURXJKRXW

b  
)LJ \$ VKRZV WKH EDVH FRPSRVLWLRQ RI &K,\$ SHW GDWD \$V WK  
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b  
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,V WKH GHVFULSWLRQ RI WKH VRIWZDUH WRRO WHFKQLFDOO\ VRXQG  
<HV

\$UH VXIILFLHQW GHWDLOV RI WKH FRGH PHWKRGV DQG DQDO\VLV L  
UHSOLFWRQ RI WKH VRIWZDUH GHYHORSPPHQW DQG LWV XVH E\ RW  
<HV

,V VXIILFLHQW LQIRUPDWLRQ SURYLGHG WR DOORZ LQWHUSUHWDLF  
DQG DQ\ UHVXOWV JHQHUDWHG XVLQJ WKH WRRO"  
<HV

\$UH WKH FRQFOXVLRQV DERXW WKH WRRO DQG LWV SHUIRUPDQFH D  
ILQGLQJ SUHVHQWHG LQ WKH DUWLFOH"  
<HV

&RPSHWLQJ ,QWHUHVW 1R FRPSHWLQJ LQWHUHVWV ZHUH GLVFORV  
5HYLHZHU ([SHUWLPH (SLJHQHWLFV GHYHORSPPHQW FHOH ELRORJ

, FRQILUP WKDW , KDYH UHGD WKLW VXEPLVLRQ DQG EHOLHYH WKD  
H[SHUWLPH WR FRQILUP WKDW LW LV RI DQ DFFHSWDEOH VFLHQWLIL



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7KH EHQHILWV RI SXEOLVKLQJ ZLWK ) 5HVHDFK

<RXU DUWLFOH LV SXEOLVKHG ZLWKLQ GD\ V ZLWK QR HGLWRULDO E

<RX FDQ SXEOLVK WUDGLWLRQDO DUWLFOHV QXOO QHJDWLYH UHVX

7KH SHHU UHYLHZ SURFHVV LV WUDQVSDUHQW DQG FROODERUDWLYH

<RXU DUWLFOH LV LQGH[HG LQ 3XE0HG DIWHU SDVVLQJ SHHU UHYLHZ

'HGLFDWHG FXVWRPHU VXSSRUW DW HYHU\ VWDJH

)RU SUH VXEPLVVLRQ HQTXLULHV FRQWDFW **UHVHDFK#1** **FRP**