MOEHRING & ASSOCIATES ——— CONSULTING ENGINEERS

DRAINAGE PLAN

AND

SUPPORTING CALCULATIONS

RIO VISTA ESTATES 4TH ADDITION

WICHITA, KANSAS

PREPARED BY

MOEHRING & ASSOCIATES
CONSULTING ENGINEERS

MAY, 2001

433 S. HYDRAULIC ——— WICHITA, KANSAS 67211 ——— 263-8291

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*******************************************
*  HEC-2 WATER SURFACE PROFILES           *
*                                         *
*  Version   4.6.2;  May 1991             *
*                                         *
*  RUN DATE    09OCT00    TIME   12:46:54  *
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*        (916) 756-1104             *
*************************************
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X    X  XXXXXXX   XXXXX            XXXXX
X    X  X        X     X         X     X
X    X  X        X               X     X
XXXXXXX  XXXX     X        XXXXX   XXXXX
X    X  X        X
X    X  X        X     X         X
X    X  XXXXXXX   XXXXX           XXXXXXX
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THIS RUN EXECUTED 09OCT00 12:46:54

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**************************************
 HEC-2 WATER SURFACE PROFILES

 Version  4.6.2;  May 1991
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T1  LITTLE ARKANSAS RIVER USING SEDGWICK COUNTY BASE FLOOD DISCHARGE
T2  100-YEAR NATURAL PROFILE U/S FROM MERIDIAN AVENUE   FILE LTLARK1.IH2
T3      LTL ARK RIVER

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                                                           1331

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

                        -1


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    110       115       150       200

NC     .060      .060      .060       .1        .3
QT       2      6500      6500
ET                         10.4
  CROSS SECTION DOWNSTREAM FROM MERIDIAN BRIDGE
X1        1        47    100.61    374.63
GR     1340        10   1335.15       100      1335    100.61      1334     102.2      1333    104.85
GR     1332    110.06      1331    114.04      1330    116.87      1329    119.50      1328    123.65
GR     1327    132.35      1326    143.40      1325    154.16      1324    195.96      1323    200.91
GR     1322    204.73      1321    208.22      1320    211.49      1319    213.71   1315.82    230.60
GR     1318    235.84      1317    243.30      1317    287.19      1318    293.20   1316.83    299.57
GR     1319    305.60      1320    307.98      1321    309.85      1322    311.76      1323    312.48
GR     1324    313.52      1325    315.41      1326    328.83      1327    348.04      1328    351.36
GR     1329    354.02      1330    357.73      1330    359.49      1331    359.49      1332    362.94
GR     1333    366.09      1334    370.42      1335    374.63      1336    380.79      1337    387.10
GR   1337.0    387.87      1340       400
   CROSS SECTION  5 FEET D/S FROM D/S FACE MERIDIAN BRIDGE

X1      1.1        46    107.05    350.74        20        20        20
X3       10                                                        1336.5    1336.5
GR     1336       100      1334     104.7   1339.28    107.05    1333.2    107.05      1333     107.5
GR     1332     111.3      1331     113.2      1330     118.8      1329     120.7      1328     123.5
GR     1327       132      1326     142.3      1325     153.6    1324.2    184.42    1324.2    186.92
GR     1323     195.8      1322     198.7      1321     205.2      1320     208.1      1319       209
GR     1318     229.7      1317     231.6      1316     236.3    1315.2     259.7   1315.67    270.87
GR   1315.8    273.37      1316     278.5      1317     283.2      1318     287.9      1319     293.6
GR     1320     297.3      1322     301.1      1323       303      1324       304      1325     306.7
GR     1326     316.1      1327     334.9      1328     336.8      1329     338.7      1330     344.3
GR     1331     346.2      1332     348.1   1334.47    350.74    1339.28    350.74      1336     367.8
GR     1338    381.19
   CROSS SECTION @ D/S FACE MERIDIAN BRIDGE
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X1	1.2	51	107.5	350.74	5	5	5			
X3	10							1336.7	1336.7	
BT	-6	107.05	1339.28	1334.32	184.42	1339.28	1334.28	186.92	1339.28	1334.32
BT		270.87	1339.28	1334.32	273.37	1339.28	1334.32	350.74	1339.28	1332.47
GR	1336	100	1334	104.7	1339.28	107.05	1333.2	107.05	1333	107.5
GR	1332	111.3	1331	113.2	1330	118.8	1329	120.7	1328	123.8
GR	1327	132	1326	142.3	1325	153.3	1324.2	184.42	1331.32	184.42
GR	1334.3	186.92	1324.2	186.92	1323	195.8	1322	198.7	1321	205.2
GR	1320	208.1	1319	209	1318	229.7	1317	231.6	1316	236.3
GR	1315.2	259.7	1315.67	270.87	1334.32	270.87	1334.32	273.37	1315.78	273.37
GR	1316	278.5	1317	283.2	1318	287.9	1319	293.6	1320	297.3
GR	1321	299.2	1322	301.1	1323	303	1324	304	1325	306.7
GR	1326	316.1	1327	334.9	1328	336.8	1329	338.7	1330	344.3
GR	1331	346.2	1332	348.1	1332.47	350.74	1334.32	350.74	1336	367.8
GR	1338	381.19								

CROSS SECTION @ U/S FACE MERIDIAN BRIDGE

X1	1.3	56	112.45	356.1	57	57	57			
X3	10							1334.32	1334.32	
GR	1336	100	1335	103.8	1334	105.6	1333	109.4	1339.28	112.45
GR	1332.3	112.45	1332	114.1	1331	118.8	1330	120.7	1329	124.4
GR	1328	130.1	1327	135.9	1326	137.6	1325	142.3	1324	147
GR	1323	154.5	1322	161.1	1321	166.7	1320	179.9	1319.66	189.82
GR	1334.3	189.82	1334.32	192.32	1319.58	192.32	1319	208.1	1318	212.8
GR	1317	215.6	1316	222.2	1315.4	236.3	1315.4	236.3	1316	255
GR	1317	269.1	1318	276.3	1334.32	276.3	1334.32	278.8	1319	278.8
GR	1319.5	279.5	1320.8	285.1	1322.2	290.7	1323.6	296.4	1325	302
GR	1327	325.5	1328	328.6	1329	331.8	1329	334.9	1330	334.9
GR	1330.4	339.6	1330.7	342.4	1331	345.3	1331.3	345.3	1331.5	351.8
GR	1331.8	354.7	1332	356.1	1334.32	356.1	1334	358.4	1336	361.2
GR	1338	364								

CROSS SECTION 5 FEET U/S FROM U/S FACE MERIDIAN BRIDGE

X1	1.4	47	112.45	356.1	5	5	5			
X3	10							1334.32	1334.32	
GR	1336	100	1335	103.8	1334	105.6	1333	109.4	1332.35	112.45
GR	1332	114.1	1331	118.8	1330	120.7	1329	124.4	1328	130.1
GR	1327	132.9	1326	137.6	1325	142.3	1324	147	1323	154.5
GR	1322	161.1	1321	166.7	1320	179.9	1319.58	192.32	1319	208.1
GR	1318	212.8	1317	215.6	1316	222.2	1315.4	236.3	1316	255
GR	1317	269.1	1318	276.3	1319	278.8	1319.5	279.5	1320.8	285.1
GR	1322.2	290.7	1323.6	296.4	1325	302	1327	325.5	1328	328.6
GR	1329	331.8	1330	334.9	1330.4	339.6	1330.7	342.4	1331	345.3
GR	1331.3	349	1331.5	351.8	1331.8	354.7	1332	356.1	1334	358.4
GR	1336	361.2	1338	364						

NC	.068	.068	.068	.1	.3					

CROSS SECTION NUMBER 2 LOCATED UPSTREAM FROM MERIDIAN

X1	2	44	109.08	447.64	30	30	26			
GR	1340	10	1336	100	1335	109.08	1334	113.40	1333	128.65
GR	1332	142.97	1331	151.56	1330	158.70	1329	167.71	1328	182.10
GR	1327	191.89	1326	196.91	1325	200.37	1324	202.88	1323	205.34
GR	1322	207.87	1321	211.85	1320	223.16	1319.19	237.99	1319	241.21

```
GR     1318    243.54    1317    249.57    1319.01    265.71    1317    289.39    1318    295.44
GR     1319    301.19    1320    309.96       1321    319.87    1322    324.38    1323    328.55
GR     1324    332.93    1325    337.35    1325.82    341.22    1326    342.49 1324.88    346.61
GR     1327    348.47    1328    355.68       1329    364.22    1330    373.58    1332    395.63
GR     1333    408.03    1334    421.25       1335    447.64    1340       450

NC    0.120     0.100     0.108        .1         .3
      CROSS SECTION NUMBER 3 LOCATED UPSTREAM FROM MERIDIAN
X1        3        46    120.40    284.13         90       250       115
GR     1340        10    1338       100    1337    120.40    1336    123.13    1335    125.65
GR     1334    128.32    1333    130.02    1332    131.81    1331    133.72    1330    134.85
GR     1329    136.74    1328    138.45    1327    140.31    1326    141.47    1325    143.30
GR     1324       145    1323    146.65    1322    148.40    1321    150.13    1320    152.07
GR   1319.2    152.49    1319    153.78    1318    158.10    1317    162.45 1319.02    196.08
GR     1317    207.25    1318    226.96    1320    240.88 1319.92    242.74    1321    246.39
GR     1322       251    1323    254.98    1324    260.11    1325    264.77    1326    269.51
GR     1327    273.97    1328    278.73 1329.14    284.13    1329    284.93    1330    314.43
GR     1331    363.35    1332    424.92    1333    499.51    1334    545.44    1335    623.51
GR     1340       650

NC    0.120     0.108     0.108        .1         .3
      CROSS SECTION 4 LOCATED UPSTREAM FROM MERIDIAN
X1        4        42    120.69    381.44        140       160       150
GR     1340        10    1338       100    1337    120.69    1336    129.63    1335    133.88
GR     1334    138.85    1333    139.52    1332    140.07    1331    141.03    1330    141.45
GR     1329    141.86    1328    142.35    1327    142.72    1326    143.52    1325    144.30
GR     1324    145.37    1323    146.65    1322    148.67    1321    151.99 1319.19    164.14
GR     1319    165.60    1318    170.52 1318.95    202.74    1318    224.80    1320    235.73
GR     1321    240.59    1322    245.02    1323    248.54    1324    252.12    1325    256.58
GR   1326.0    259.35    1326    263.41    1327    281.56    1328    297.80    1329    314.21
GR     1330    330.71    1331    347.30    1332    381.44    1333    471.45    1334    543.36
GR     1335    687.08    1340       700

NC     .120      .100      .108        .1         .3
      CROSS SECTION 5 LOCATED UPSTREAM FROM MERIDIAN, LAST CROSS SECTION IN STUDY
X1        5        43    131.41    307.01         88       100        90
GR     1340        10    1338       100    1337    117.83    1336    131.41    1335    134.63
GR     1334    136.45    1333    137.30    1332    137.80    1331    138.69    1330    139.07
GR     1329    139.40    1328    139.97    1327    140.38    1326    141.13    1325    141.96
GR     1324    143.19    1323    144.06    1322    145.96    1321    149.36 1319.19    164.89
GR     1319    166.74    1318    169.27 1318.91    199.64    1318       222    1320    232.82
GR   1319.9    234.46    1321    235.33    1322    237.72 1323.86    239.60    1323    240.13
GR     1324    242.75    1325    259.84    1326    272.34    1327    278.07    1328    285.23
GR     1329    307.01    1330    387.46    1331    425.75    1332    478.23    1333    517.27
GR     1334    554.48    1335    598.58    1340       650
```

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

CCHV= .100 CEHV= .300

*SECNO 1.000

1.000	15.18	1331.00	.00	1331.00	1331.14	.14	.00	.00	1335.00
6500.0	.0	6500.0	.0	.0	2131.7	.0	.0	.0	1335.00
.00	.00	3.05	.00	.000	.060	.000	.000	1315.82	114.04
.000877	0.	0.	0.	0	0	0	.00	245.45	359.49

*SECNO 1.100

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1336.50 ELREA= 1336.50

1.100	15.81	1331.01	.00	.00	1331.17	.16	.02	.00	1339.28
6500.0	.0	6500.0	.0	.0	2046.2	.0	1.0	.1	1339.28
.00	.00	3.18	.00	.000	.060	.000	.000	1315.20	113.17
.000933	20.	20.	20.	0	0	0	.00	233.07	346.23

*SECNO 1.200

3265 DIVIDED FLOW

3370 NORMAL BRIDGE, NRD= 6 MIN ELTRD= 1339.28 MAX ELLC= 1334.32

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1336.70 ELREA= 1336.70

1.200	15.81	1331.01	.00	.00	1331.17	.17	.01	.00	1333.00
6500.0	.0	6500.0	.0	.0	1990.1	.0	1.2	.1	1334.32
.00	.00	3.27	.00	.000	.060	.000	.000	1315.20	113.17
.001254	5.	5.	5.	0	0	0	.00	228.05	346.23

*SECNO 1.300

3265 DIVIDED FLOW

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1334.32 ELREA= 1334.32

1.300	15.69	1331.09	.00	.00	1331.24	.15	.07	.00	1339.28
6500.0	.0	6500.0	.0	.0	2072.2	.0	3.8	.4	1334.32
.01	.00	3.14	.00	.000	.060	.000	.000	1315.40	118.42
.001081	57.	57.	57.	1	0	0	.00	221.88	345.30

*SECNO 1.400

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1334.32 ELREA= 1334.32

1.400	15.70	1331.10	.00	.00	1331.25	.14	.00	.00	1332.35
6500.0	.0	6500.0	.0	.0	2137.1	.0	4.1	.5	1332.00
.01	.00	3.04	.00	.000	.060	.000	.000	1315.40	118.35
.000778	5.	5.	5.	0	0	0	.00	228.11	346.47

CCHV= .100 CEHV= .300
*SECNO 2.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .66

2.000	14.10	1331.10	.00	.00	1331.29	.20	.03	.02	1335.00
6500.0	.0	6500.0	.0	.0	1824.4	.0	5.3	.6	1335.00
.01	.00	3.56	.00	.000	.068	.000	.000	1317.00	150.74
.001766	30.	26.	30.	2	0	0	.00	234.92	385.66

CCHV= .100 CEHV= .300
*SECNO 3.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .67

3.000	14.35	1331.35	.00	.00	1331.60	.25	.29	.02	1337.00
6500.0	.0	6384.7	115.3	.0	1587.1	102.1	10.1	1.4	1329.14
.02	.00	4.02	1.13	.000	.108	.100	.000	1317.00	133.05
.003892	90.	115.	250.	2	0	0	.00	252.06	385.11

CCHV= .100 CEHV= .300

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
*SECNO 4.000									
4.000	14.07	1332.07	.00	.00	1332.28	.21	.67	.00	1337.00
6500.0	.0	6500.0	.0	.0	1766.9	.2	16.0	2.3	1332.00
.03	.00	3.68	.11	.000	.108	.108	.000	1318.00	140.03
.005214	140.	150.	160.	2	0	0	.00	247.81	387.85
CCHV= .100	CEHV= .300								
*SECNO 5.000									
5.000	14.46	1332.46	.00	.00	1332.64	.17	.36	.00	1336.00
6500.0	.0	5950.3	549.7	.0	1710.2	368.6	20.0	2.9	1329.00
.04	.00	3.48	1.49	.000	.108	.100	.000	1318.00	137.57
.003129	88.	90.	100.	2	0	0	.00	358.81	496.38

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T1  LITTLE ARKANSAS RIVER WITH SEDGWICK COUNTY BASE FLOOD DISCHARGE
T2  ENCROACHMENT RUN FOR 100-YEAR FLOOD USING METHOD 10.4
T3      LTL RIVER

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
                3                                                                   1332
J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
     15                  -1
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 2

CCHV= .100 CEHV= .300
*SECNO 1.000
2800 NAT Q1= 2194.53 WSELK= 1331.00 ENC Q1= 2586.03 WSEL= 1332.00 RATIO= -.1784
NAT Q1= 2586. RATIOS LOB, CH, ROB= .0000 1.0000 .0000 WSEL= 1332.00

3470 ENCROACHMENT STATIONS= 100.6 374.6 TYPE= 4 TARGET= .000

1.000	16.18	1332.00	.00	1331.00	1332.12	.12	.00	.00	1335.00
6500.0	.0	6500.0	.0	.0	2380.9	.0	.0	.0	1335.00
.00	.00	2.73	.00	.000	.060	.000	.000	1315.82	110.06
.000632	0.	0.	0.	0	0	0	.00	252.88	362.94

*SECNO 1.100
2800 NAT Q1= 2128.37 WSELK= 1331.01 ENC Q1= 2517.46 WSEL= 1332.01 RATIO= -.1828
NAT Q1= 2517. RATIOS LOB, CH, ROB= .0000 1.0000 .0000 WSEL= 1332.01

3470 ENCROACHMENT STATIONS= 107.1 350.7 TYPE= 4 TARGET= .000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1336.50 ELREA= 1336.50

1.100	16.81	1332.01	.00	1331.01	1332.13	.13	.01	.00	1339.28
6500.0	.0	6500.0	.0	.0	2280.1	.0	1.1	.1	100000.00
.00	.00	2.85	.00	.000	.060	.000	.000	1315.20	111.25
.000666	20.	20.	20.	0	0	0	.00	236.86	348.11

*SECNO 1.200
2800 NAT Q1= 1835.60 WSELK= 1331.01 ENC Q1= 2156.88 WSEL= 1332.01 RATIO= -.1750
NAT Q1= 2157. RATIOS LOB, CH, ROB= .0000 1.0000 .0000 WSEL= 1332.01

3265 DIVIDED FLOW

3370 NORMAL BRIDGE, NRD= 6 MIN ELTRD= 1339.28 MAX ELLC= 1334.32

3470 ENCROACHMENT STATIONS= 107.5 350.7 TYPE= 4 TARGET= .000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1336.70 ELREA= 1336.70

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
1.200	16.80	1332.00	.00	1331.01	1332.14	.13	.00	.00	1333.00
6500.0	.0	6500.0	.0	.0	2219.3	.0	1.3	.1	100000.00
.00	.00	2.93	.00	.000	.060	.000	.000	1315.20	111.26
.000908	5.	5.	5.	0	0	0	.00	232.47	348.15

*SECNO 1.300
2800 NAT Q1= 1976.90 WSELK= 1331.09 ENC Q1= 2251.17 WSEL= 1332.09 RATIO= -.1387
NAT Q1= 2251. RATIOS LOB, CH, ROB= .0000 1.0000 .0000 WSEL= 1332.09

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 112.4 356.1 TYPE= 4 TARGET= .000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1334.32 ELREA= 1334.32

1.300	16.66	1332.06	.00	1331.09	1332.19	.12	.05	.00	1339.28
6500.0	.0	6500.0	.0	.0	2296.2	.0	4.3	.4	100000.00
.01	.00	2.83	.00	.000	.060	.000	.000	1315.40	113.80
.000842	57.	57.	57.	0	0	0	.00	237.30	356.10

*SECNO 1.400
2800 NAT Q1= 2329.64 WSELK= 1331.10 ENC Q1= 2668.14 WSEL= 1332.10 RATIO= -.1453
NAT Q1= 2668. RATIOS LOB, CH, ROB= .0000 1.0000 .0000 WSEL= 1332.10

3470 ENCROACHMENT STATIONS= 112.4 356.1 TYPE= 4 TARGET= .000

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 1334.32 ELREA= 1334.32

1.400	16.68	1332.08	.00	1331.10	1332.19	.12	.00	.00	1332.35
6500.0	.0	6500.0	.0	.0	2366.8	.0	4.6	.5	1332.00
.01	.00	2.75	.00	.000	.060	.000	.000	1315.40	113.78
.000600	5.	5.	5.	0	0	0	.00	242.32	356.10

CCHV= .100 CEHV= .300
*SECNO 2.000
2800 NAT Q1= 1546.63 WSELK= 1331.10 ENC Q1= 1806.26 WSEL= 1332.10 RATIO= -.1679
NAT Q1= 1806. RATIOS LOB, CH, ROB= .0000 1.0000 .0000 WSEL= 1332.10

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .68

3470 ENCROACHMENT STATIONS= 109.1 447.6 TYPE= 4 TARGET= .000

2.000	15.07	1332.07	.00	1331.10	1332.23	.15	.02	.01	1335.00
6500.0	.0	6500.0	.0	.0	2063.2	.0	5.9	.6	1335.00
.01	.00	3.15	.00	.000	.068	.000	.000	1317.00	141.94
.001303	30.	26.	30.	2	0	0	.00	254.58	396.52

CCHV= .100 CEHV= .300
*SECNO 3.000
2800 NAT Q1= 1041.93 WSELK= 1331.35 ENC Q1= 1181.37 WSEL= 1332.35 RATIO= -.1338
NAT Q1= 1235. RATIOS LOB, CH, ROB= .0000 .9566 .0434 WSEL= 1332.35

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .64

3470 ENCROACHMENT STATIONS= 120.4 284.1 TYPE= 4 TARGET= .043

3.000	15.25	1332.25	.00	1331.35	1332.47	.22	.22	.02	1337.00
6500.0	.0	6500.0	.0	.0	1723.1	.0	10.9	1.2	1329.14
.02	.00	3.77	.00	.000	.108	.000	.000	1317.00	131.37
.003198	90.	115.	250.	2	0	0	.00	152.76	284.13

CCHV= .100 CEHV= .300
*SECNO 4.000
2800 NAT Q1= 900.14 WSELK= 1332.07 ENC Q1= 1110.19 WSEL= 1333.07 RATIO= -.2333
NAT Q1= 1115. RATIOS LOB, CH, ROB= .0000 .9957 .0043 WSEL= 1333.07

3470 ENCROACHMENT STATIONS= 120.7 381.4 TYPE= 4 TARGET= .004

4.000	14.82	1332.82	.00	1332.07	1333.00	.17	.52	.00	1337.00
6500.0	.0	6500.0	.0	.0	1948.6	.0	17.2	1.8	1332.00
.03	.00	3.34	.00	.000	.108	.000	.000	1318.00	139.62
.003797	140.	150.	160.	2	0	0	.00	241.82	381.44

CCHV= .100 CEHV= .300
*SECNO 5.000
2800 NAT Q1= 1162.07 WSELK= 1332.46 ENC Q1= 1239.87 WSEL= 1333.46 RATIO= -.0670
NAT Q1= 1423. RATIOS LOB, CH, ROB= .0000 .8712 .1288 WSEL= 1333.46

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	QLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3470 ENCROACHMENT STATIONS= 131.4 307.0 TYPE= 4 TARGET= .129

5.000	15.12	1333.12	.00	1332.46	1333.31	.20	.31	.01	1336.00
6500.0	.0	6500.0	.0	.0	1820.6	.0	21.1	2.3	1329.00
.04	.00	3.57	.00	.000	.108	.000	.000	1318.00	137.20
.003142	88.	90.	100.	2	0	0	.00	169.81	307.01

THIS RUN EXECUTED 09OCT00 12:46:54

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

LTL ARK RIVER

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	1.000	1331.00	.00	1331.14	245.45	.00	6500.00	.00	.00	.00	100.61	374.63	.00
	1.000	1332.00	1.00	1332.12	252.88	.00	6500.00	.00	.00	100.61	100.61	374.63	374.63
	1.100	1331.01	.00	1331.17	233.07	.00	6500.00	.00	.00	.00	107.05	350.74	.00
	1.100	1332.01	1.00	1332.13	236.86	.00	6500.00	.00	.00	107.05	107.05	350.74	350.74
	1.200	1331.01	.00	1331.17	228.05	.00	6500.00	.00	.00	.00	107.50	350.74	.00
	1.200	1332.00	1.00	1332.14	232.47	.00	6500.00	.00	.00	107.50	107.50	350.74	350.74
	1.300	1331.09	.00	1331.24	221.88	.00	6500.00	.00	.00	.00	112.45	356.10	.00
	1.300	1332.06	.98	1332.19	237.30	.00	6500.00	.00	.00	112.45	112.45	356.10	356.10
	1.400	1331.10	.00	1331.25	228.11	.00	6500.00	.00	.00	.00	112.45	356.10	.00
	1.400	1332.08	.97	1332.19	242.32	.00	6500.00	.00	.00	112.45	112.45	356.10	356.10
*	2.000	1331.10	.00	1331.29	234.92	.00	6500.00	.00	.00	.00	109.08	447.64	.00
*	2.000	1332.07	.98	1332.23	254.58	.00	6500.00	.00	.00	109.08	109.08	447.64	447.64
*	3.000	1331.35	.00	1331.60	252.06	.00	6384.71	115.29	.00	.00	120.40	284.13	.00
*	3.000	1332.25	.90	1332.47	152.76	.00	6500.00	.00	.04	120.40	120.40	284.13	284.13
	4.000	1332.07	.00	1332.28	247.81	.00	6499.97	.02	.00	.00	120.69	381.44	.00
	4.000	1332.82	.76	1333.00	241.82	.00	6500.00	.00	.00	120.69	120.69	381.44	381.44
	5.000	1332.46	.00	1332.64	358.81	.00	5950.35	549.65	.00	.00	131.41	307.01	.00
	5.000	1333.12	.65	1333.31	169.81	.00	6500.00	.00	.13	131.41	131.41	307.01	307.01

LTL ARK RIVER

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	1.000	.00	.00	.00	1315.82	6500.00	1331.00	.00	1331.14	8.77	3.05	2131.72	2194.53
	1.000	.00	.00	.00	1315.82	6500.00	1332.00	.00	1332.12	6.32	2.73	2380.89	2586.03
	1.100	20.00	.00	.00	1315.20	6500.00	1331.01	.00	1331.17	9.33	3.18	2046.20	2128.37
	1.100	20.00	.00	.00	1315.20	6500.00	1332.01	.00	1332.13	6.66	2.85	2280.07	2518.87
	1.200	5.00	1339.28	1334.32	1315.20	6500.00	1331.01	.00	1331.17	12.54	3.27	1990.14	1835.60
	1.200	5.00	1339.28	1334.32	1315.20	6500.00	1332.00	.00	1332.14	9.08	2.93	2219.27	2157.18
	1.300	57.00	.00	.00	1315.40	6500.00	1331.09	.00	1331.24	10.81	3.14	2072.16	1976.90
	1.300	57.00	.00	.00	1315.40	6500.00	1332.06	.00	1332.19	8.42	2.83	2296.25	2239.69
	1.400	5.00	.00	.00	1315.40	6500.00	1331.10	.00	1331.25	7.78	3.04	2137.11	2329.64
	1.400	5.00	.00	.00	1315.40	6500.00	1332.08	.00	1332.19	6.00	2.75	2366.79	2652.63
*	2.000	26.00	.00	.00	1317.00	6500.00	1331.10	.00	1331.29	17.66	3.56	1824.43	1546.63
*	2.000	26.00	.00	.00	1317.00	6500.00	1332.07	.00	1332.23	13.03	3.15	2063.21	1800.49
*	3.000	115.00	.00	.00	1317.00	6500.00	1331.35	.00	1331.60	38.92	4.02	1689.20	1041.93
*	3.000	115.00	.00	.00	1317.00	6500.00	1332.25	.00	1332.47	31.98	3.77	1723.09	1149.32
	4.000	150.00	.00	.00	1318.00	6500.00	1332.07	.00	1332.28	52.14	3.88	1767.12	900.14
	4.000	150.00	.00	.00	1318.00	6500.00	1332.82	.00	1333.00	37.97	3.34	1948.60	1054.90
	5.000	90.00	.00	.00	1318.00	6500.00	1332.46	.00	1332.84	31.29	3.48	2078.85	1162.07
	5.000	90.00	.00	.00	1318.00	6500.00	1333.12	.00	1333.31	31.42	3.57	1820.64	1159.65

LTL ARK RIVER

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	1.000	6500.00	1331.00	.00	.00	.00	245.45	.00
	1.000	6500.00	1332.00	1.00	.00	1.00	252.88	.00
	1.100	6500.00	1331.01	.00	.01	.00	233.07	20.00
	1.100	6500.00	1332.01	1.00	.01	1.00	236.86	20.00
	1.200	6500.00	1331.01	.00	.00	.00	228.05	5.00
	1.200	6500.00	1332.00	1.00	.00	1.00	232.47	5.00
	1.300	6500.00	1331.09	.00	.08	.00	221.88	57.00
	1.300	6500.00	1332.06	.98	.06	.98	237.30	57.00
	1.400	6500.00	1331.10	.00	.01	.00	228.11	5.00
	1.400	6500.00	1332.08	.97	.01	.97	242.32	5.00
*	2.000	6500.00	1331.10	.00	-.01	.00	234.92	26.00
*	2.000	6500.00	1332.07	.98	.00	.98	254.58	26.00
*	3.000	6500.00	1331.35	.00	.26	.00	252.06	115.00
*	3.000	6500.00	1332.25	.90	.18	.90	152.76	115.00
	4.000	6500.00	1332.07	.00	.71	.00	247.81	150.00
	4.000	6500.00	1332.82	.76	.57	.76	241.82	150.00
	5.000	6500.00	1332.46	.00	.40	.00	358.81	90.00
	5.000	6500.00	1333.12	.65	.29	.65	169.81	90.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 2.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 2.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 3.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 3.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

Floodway width summary: LTL ARK RIVER
Profile No. 2

Section Number	Elevation Increase	Top Width	Left Encroach Station	Left Sta Distance From Center	Center Station	Right Sta Distance From Center	Right Encroach Station
1.000	1.00	274.02	100.61	137.01	237.62	137.01	374.63
1.100	1.00	243.69	107.05	121.84	228.89	121.85	350.74
1.200	1.00	243.24	107.50	121.62	229.12	121.62	350.74
1.300	.98	243.65	112.45	121.83	234.27	121.83	356.10
1.400	.97	243.65	112.45	121.83	234.27	121.83	356.10
2.000	.98	338.56	109.08	169.28	278.36	169.28	447.64
3.000	.90	163.73	120.40	81.87	202.26	81.87	284.13
4.000	.76	260.75	120.69	130.38	251.07	130.38	381.44
5.000	.65	175.60	131.41	87.80	219.21	87.80	307.01

FLOODWAY DATA, LTL ARK RIVER
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
1.000	253.	2381.	2.7	1332.0	1331.0	1.0
1.100	237.	2280.	2.9	1332.0	1331.0	1.0
1.200	237.	2219.	2.9	1332.0	1331.0	1.0
1.300	242.	2296.	2.8	1332.1	1331.1	1.0
1.400	242.	2367.	2.7	1332.1	1331.1	1.0
2.000	255.	2063.	3.2	1332.1	1331.1	1.0
3.000	153.	1723.	3.8	1332.3	1331.4	.9
4.000	242.	1949.	3.3	1332.9	1332.1	.8
5.000	170.	1821.	3.6	1333.2	1332.5	.7

1. Community Name: WICHITA County: SEDGWICK State: KS

Community-Panel#: 200321 0125 A
Community Number: 200321
Map#: 0125 A

Effective Date: 06/03/86

2. Street Address of Property:

3. Description of Property:
THE E. 40 ACRES OF THE S. 100 ACRES OF THE S.E. 1/4 OF SECTION 12-26-1W OF THE 6TH P.M., SEDGWICK CO., KS. LYING WEST OF THE CENTERLINE OF THE LITTLE ARKANSAS RIVER.

4. Are you requesting that the SFHA designation be removed from (a) all of the land within the bounds of the property, (b) a portion of land within the bounds of the property (metes and bounds description is required), or (c) the structure(s) on the property? -
A

5. Is this request for (a) a single residential structure or lot, (b) a single commercial structure or lot, or (c) multiple structures or lots? -
C

6. Is this request for (a) existing conditions or (b) a proposed project? -
A

7. Has fill been placed in an identified SFHA?: If yes, When? -
NO

8. For proposed projects, will fill be placed:

9. Do you know of previous requests that have been submitted to FEMA for this property or adjacent properties?
NO

If yes, what was the date of FEMA's response letter:

FEDERAL EMERGENCY MANAGEMENT AGENCY
Property Information (page 2)

10. Please enclose this document and the following with your request:

- o Copy of the Plat Map (with recordation data) with recorder's seal
  OR
- o Copy of the Deed (with recordation data) accompanied by a tax assessor's or other suitable map showing the surveyed location of the property with recorder's seal

- o Copy of the effective FIRM panel on which the property location has been accurately plotted (if the request is for more than one lot/structure, this location must be certified by a licensed land surveyor or registered professional engineer)

- o Elevation Information form

Initial Fee: $0.00

11. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Applicant's Name: JAMES CATRON

Mailing Address: 6545 BELLA RD

City: WICHITA State: KS ZipCode: 67204-

Daytime Telephone Number: (316) 755-2413

10-12-00
Date

James R Catron
Signature of Applicant

FEDERAL EMERGENCY MANAGEMENT AGENCY
Elevation Information

This form must be completed by a registered professional engineer or licensed land surveyor

1. Community Name: WICHITA

2. Legal Description of Property:
THE E. 40 ACRES OF THE S. 100 ACRES OF THE S.E. 1/4 OF SECTION 12-26-1W OF THE 6TH P.M., SEDGWICK CO., KS. LYING WEST OF THE CENTERLINE OF THE LITTLE ARKANSAS RIVER.

3. Flooding Source: LITTLE ARKANSAS RIVER

4. Based on the FIRM, this property is located in Zone: A

5. Is any portion of this property located in the regulatory floodway? NO
Are any structures (existing or proposed) located in the regulatory floodway?

6. Is this area subject to land subsidence or uplift? NO

7. What is the BFE for this property:
Elevation NGVD Datum

8. How was the BFE Determined? (attach a copy of the Flood Profile or table from the FIS report, if appropriate, or other necessary supporting information including Forms 3 and 4 from forms entitled " Revisions to National Flood Insurance Program Maps" (RSD-1)).
HEC-2 WATER SURFACE PROFILES

9. All information submitted in support of this request is correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: CRAIG MOEHRING
(please print or type)

Title: Land Surveyor
(please print or type)

Registration #: 875 Expiration Date: 3/21/2001

State KS Telephone Number: (316) 263-8291

Craig Moehring
Signature

Oct 11, 2000
Date

CRAIG MOEHRING REGISTERED LS-875 KANSAS LAND SURVEYOR
Seal (optional)

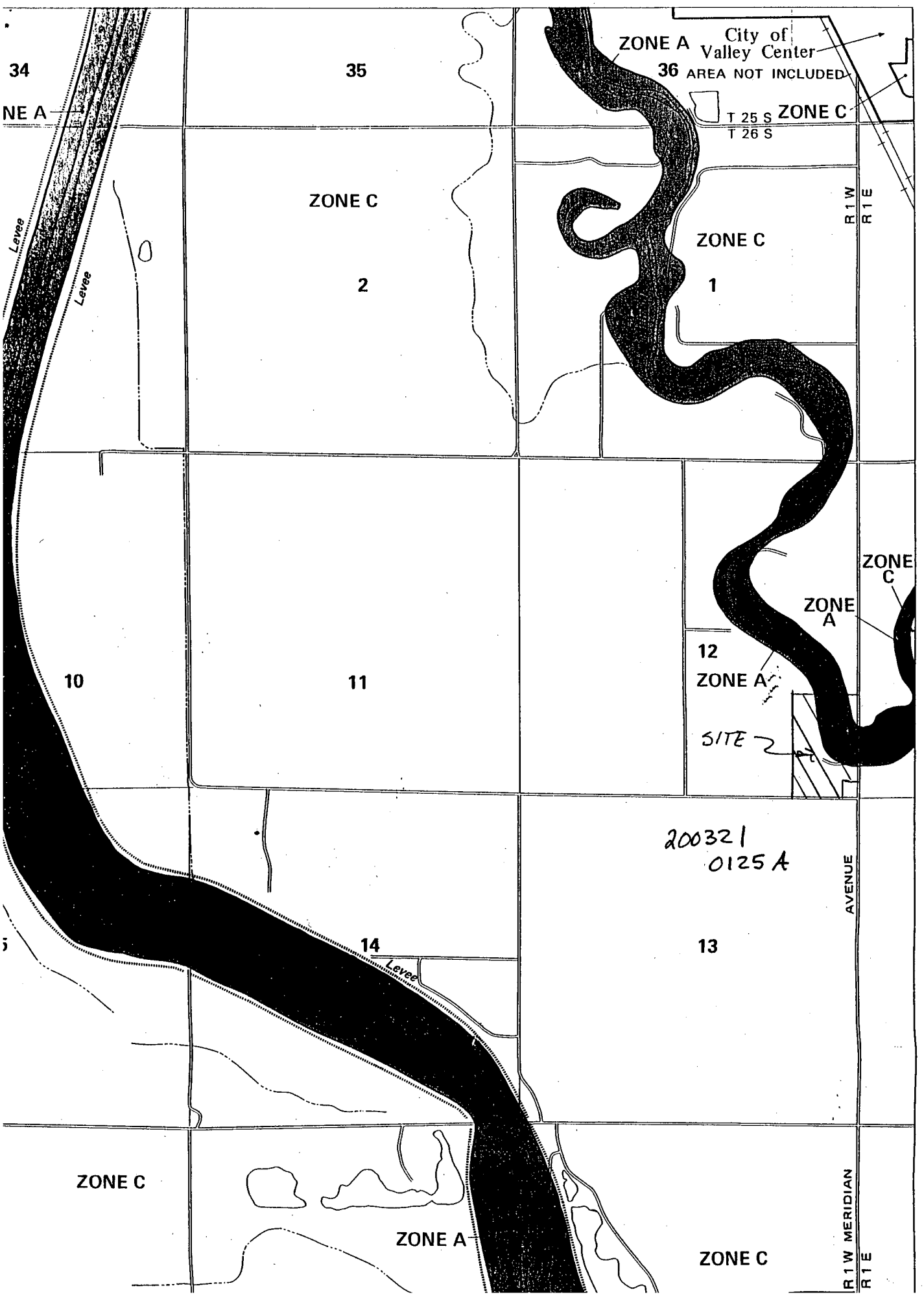
FEDERAL EMERGENCY MANAGEMENT AGENCY

Summary of Elevations

Community Name: WICHITA

Property Address:

Lot	Block	Zone	Lowest Lot Elevation	Lowest Adjacent Grade Elevation	Lowest Floor Elevation (if fill)	100-year Flood Elevation
7	C	A	1332.0			1331.1
8	C	A	1332.0			1331.2
9	C	A	1332.0			1331.2
10	C	A	1331.8			1331.3
11	C	A	1331.6			1331.4
12	C	A	1331.6			1331.6
13	C	A	1332.2			1332.1
14	C	A	1332.6			1332.3
15	C	A	1332.6			1332.5


ZONE A
City of Valley Center
AREA NOT INCLUDED
34
35
36
T 25 S
T 26 S
ZONE C
ZONE C
ZONE C
R 1 W
R 1 E
Levee
Levee
2
1
ZONE
C
ZONE
A
12
ZONE A
10
11
SITE
200321
0125 A
AVENUE
14
13
Levee
ZONE C
ZONE A
ZONE C
R 1 W MERIDIAN
R 1 E

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03837

WARRANTY DEED

STATE OF KANSAS } ss
SEDGWICK COUNTY }

APR 24 4 20 PM '00

BILL MEEK
REGISTER OF DEEDS

Grantor: **Doug E. Trent and Carol D. Trent, husband and wife**

Warrants and Conveys to **Lariat Construction Co. L.P.**

Linda Stubblee
DEPUTY

the following described premises, to-wit:

All that part of the east 40 acres of the south 100 acres of the southeast quarter of section 12, township 26 south, range 1 west of the Sixth Principal Meridian, which lies westerly of the center of the Little Arkansas River, in Sedgwick County, Kansas

REGISTER OF DEEDS KANSAS

for the sum of One Dollar and other good and valuable consideration, the receipt of which is hereby acknowledged. This conveyance is made subject to easements and restrictions of record, if any.

Dated this 21st day of April, 20 00.

Doug E. Trent

Carol D. Trent

6545 Bella Rd, Wichita, KS. 67204

State of Kansas, County of Sedgwick: ss;

Be it remembered that before me, a notary public in and for the State and County aforesaid, personally appeared

Doug E. Trent and Carol D. Trent, husband and wife

known to me to be the same person(s) who executed the within Warranty Deed and who acknowledged the execution of same as a free act and deed, and, if corporation, as the free act and deed of same. In witnes. whereof I have hereunto set my hand and affixed my official seal the day and year last above written.

TONNYA HETZEL
NOTARY PUBLIC
STATE OF KANSAS
My Appt. Exp. 1-12-04

Tonnya Hetzel
TONNYA HETZEL

COLUMBIAN NATIONAL
TITLE INSURANCE COMPANY

Sent to
County Clerk

APR 24 2000

For Entry on
Transfer Record

112359

PREFACE

Attached hereto are the computations for the referenced drainage plan.

The publication "Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita", has been used as a guide for the hydrologic and hydraulic computations. This publication is hereinafter referred to as the "Policy Manual".

Manual #1, as referenced therein, refers to "Design of Urban Highway Drainage - The State of the Art", by Reutz & Jens, Inc., and Manual #2 refers to"Drainage of Highway Pavements, Hydraulic Engineering Circular #12", by Tye Engineering, Inc.

HYDROLOGY METHODS

The Rational Method has been used for hydrologic analysis. Runoff coefficients are based on the table provided in Attachment D, of the "Policy Manual".

The time of concentration was determined by methods contained in "Technical Release #55, Hydrology for Small Watersheds" as derived by the United States Soil Conservation Service.

As recommended in the "Policy Manual", the minimum time of concentration is 15 minutes.

The rainfall intensity for the two-year frequency storm was used as the basis of design for the minor storm, and a check was made to verify that the runoff from the major storm (the 100-year rainfall event) was confined within the public street right-of-way.

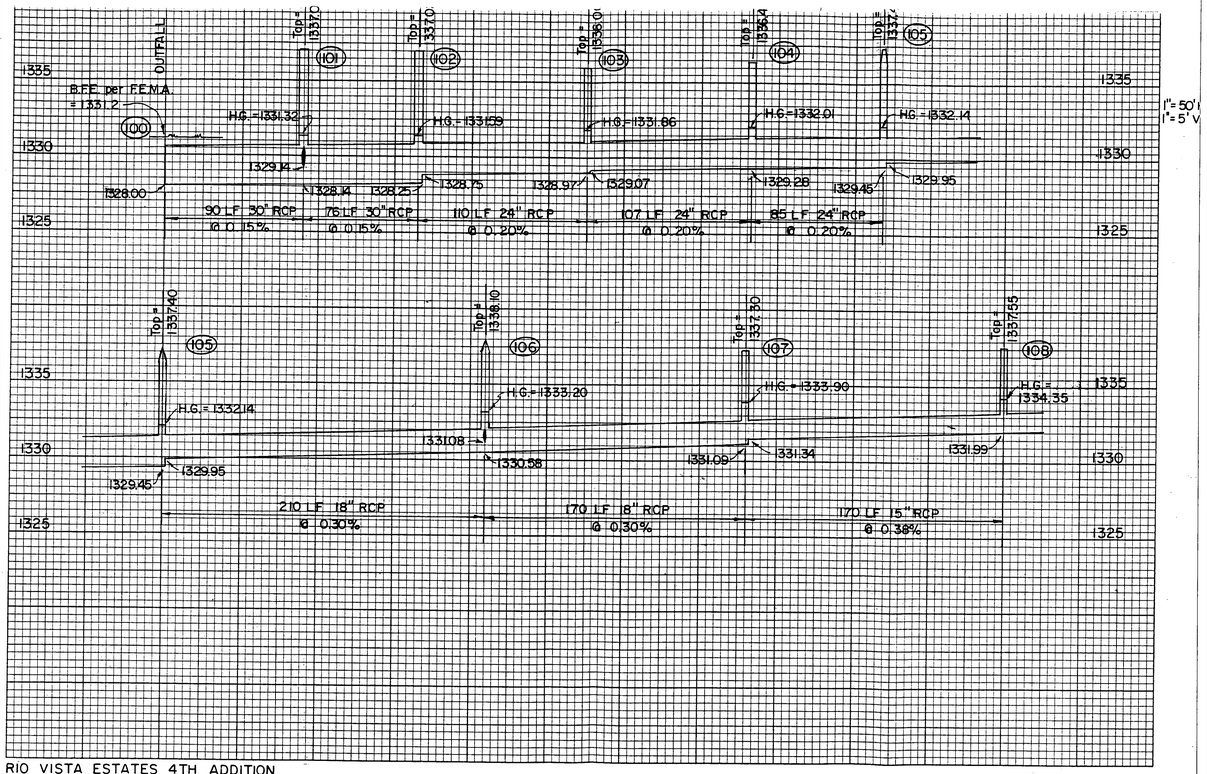
HYDRAULIC DESIGN

At each inlet, the inlet capacity, pipe size and street flooding was checked for the minor storm.

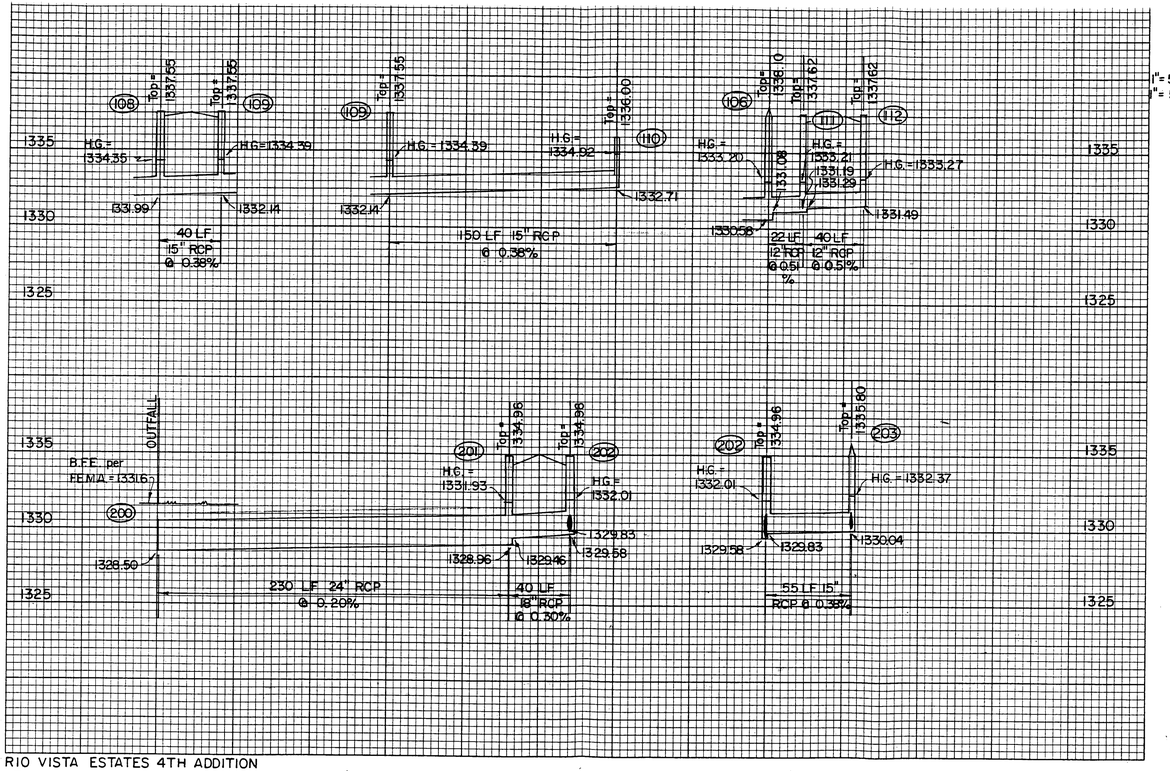
Conveyance in the street was based on the modified Manning Equation, as follows :

$$Q = 0.56 / n * (Sx)^{5/3} * (T)^{8/3} * S^{1/2}$$ (Equation 4, Manual #2)

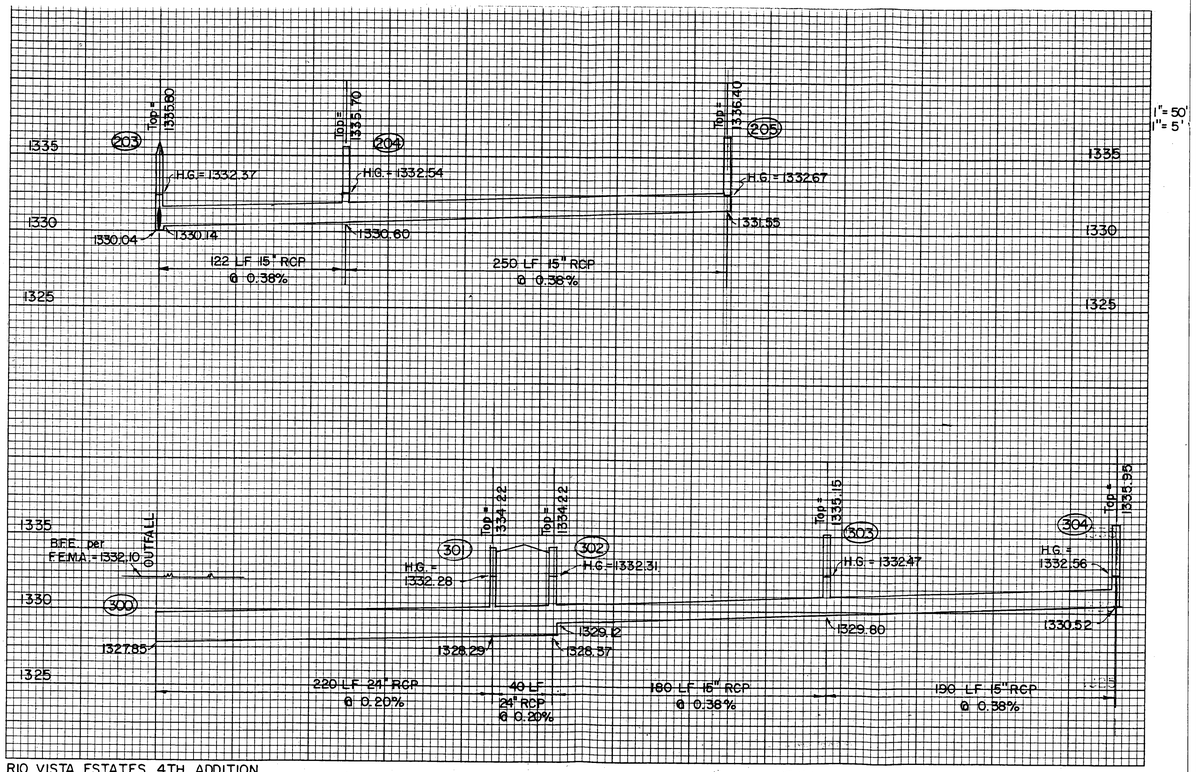
For local streets, curb-deep flow is permissible for the minor storm. In this analyses, City of Wichita Type 1 - A inlets, 3/8 inch per foot cross slope and 6-5/8" standard height curb and gutter were assumed to be utilized.



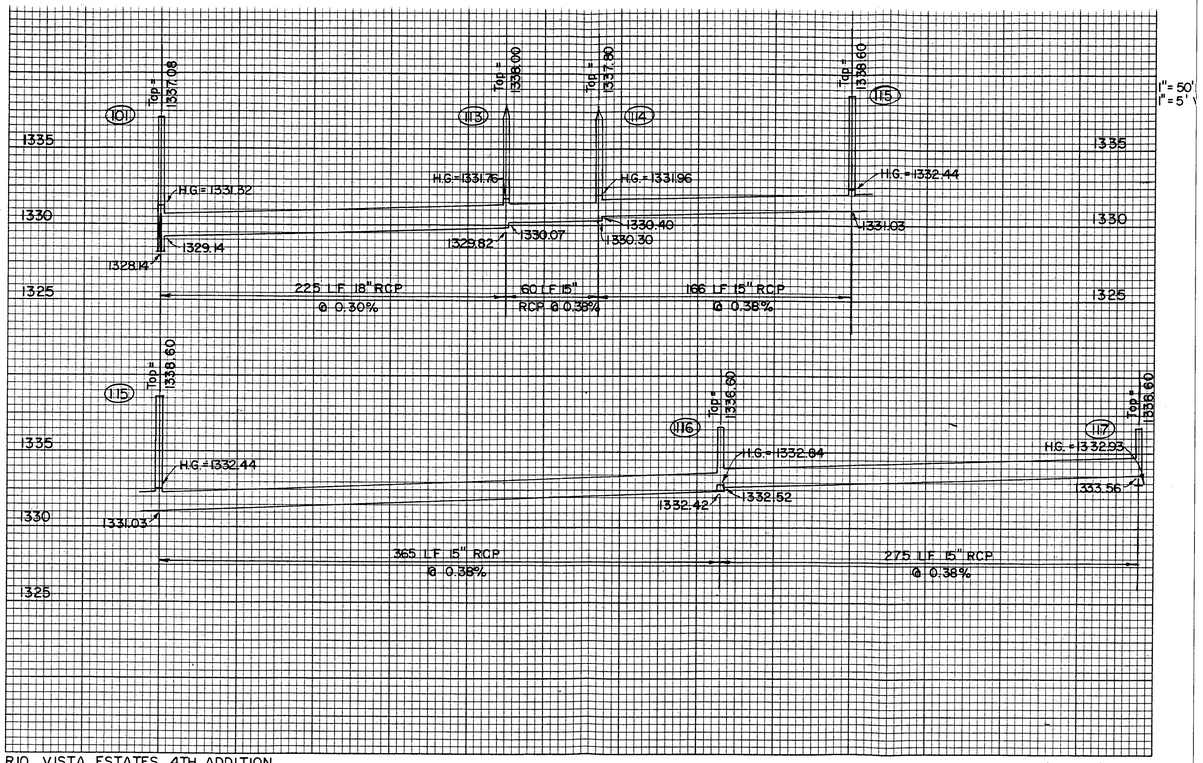
RIO VISTA ESTATES 4TH ADDITION
STORM SEWER PROFILES



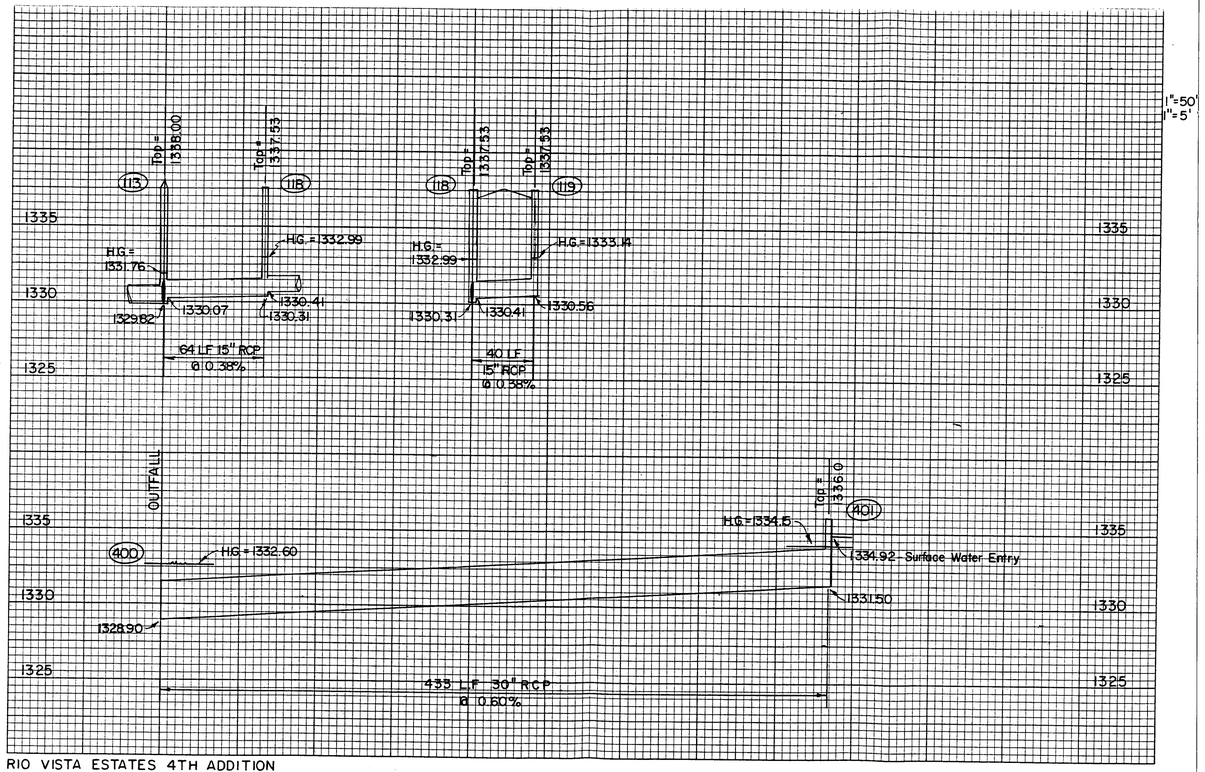
RIO VISTA ESTATES 4TH ADDITION
STORM SEWER PROFILES



RIO VISTA ESTATES 4TH ADDITION
STORM SEWER PROFILES



RIO VISTA ESTATES 4TH ADDITION
STORM SEWER PROFILES



RIO VISTA ESTATES 4TH ADDITION
STORM SEWER PROFILES

Curb inlet capacities in sump conditions were determined by the methods presented in Manual #2, using Chart 12, which provides solutions of the following modified equation for orifice flow:

$$Q_i = C_o * (2 g d_o)^{0.5}$$

Pipe systems were designed using the calculated capacity of each inlet, on the basis of a 2-year frequency storm.

Preliminary pipe sizes were estimated and Mannings equation was used to calculate friction losses in pipes flowing full. Minor losses are accounted for by use of conservation of momentum principles. It is desirable to keep the hydraulic grade line approximately 6 inches below the flow line elevation of the curb.

MAJOR STORM OVERFLOW

For each sub-area, a check was made for conveyance of the runoff from the major storm. To simplify the analysis, the following assumptions were made.

1. The time of concentration is identical for both the major and minor storm. Thus, a ratio of rainfall intensities and "C" factors are used to determine Q_{100} for each sub-basin.

2. The capacity of the pipe system during the major storm is assumed to be the same as during the minor storm. This is a conservative assumption, because increased ponding depths during the major storm event will increase the available head on the inlet / pipe system, thus increasing the capacity of the system.

3. The conveyance capacity of the street R/W's was calculated for variable gradients, and used as a check against tabulated discharges for the 100-year event.

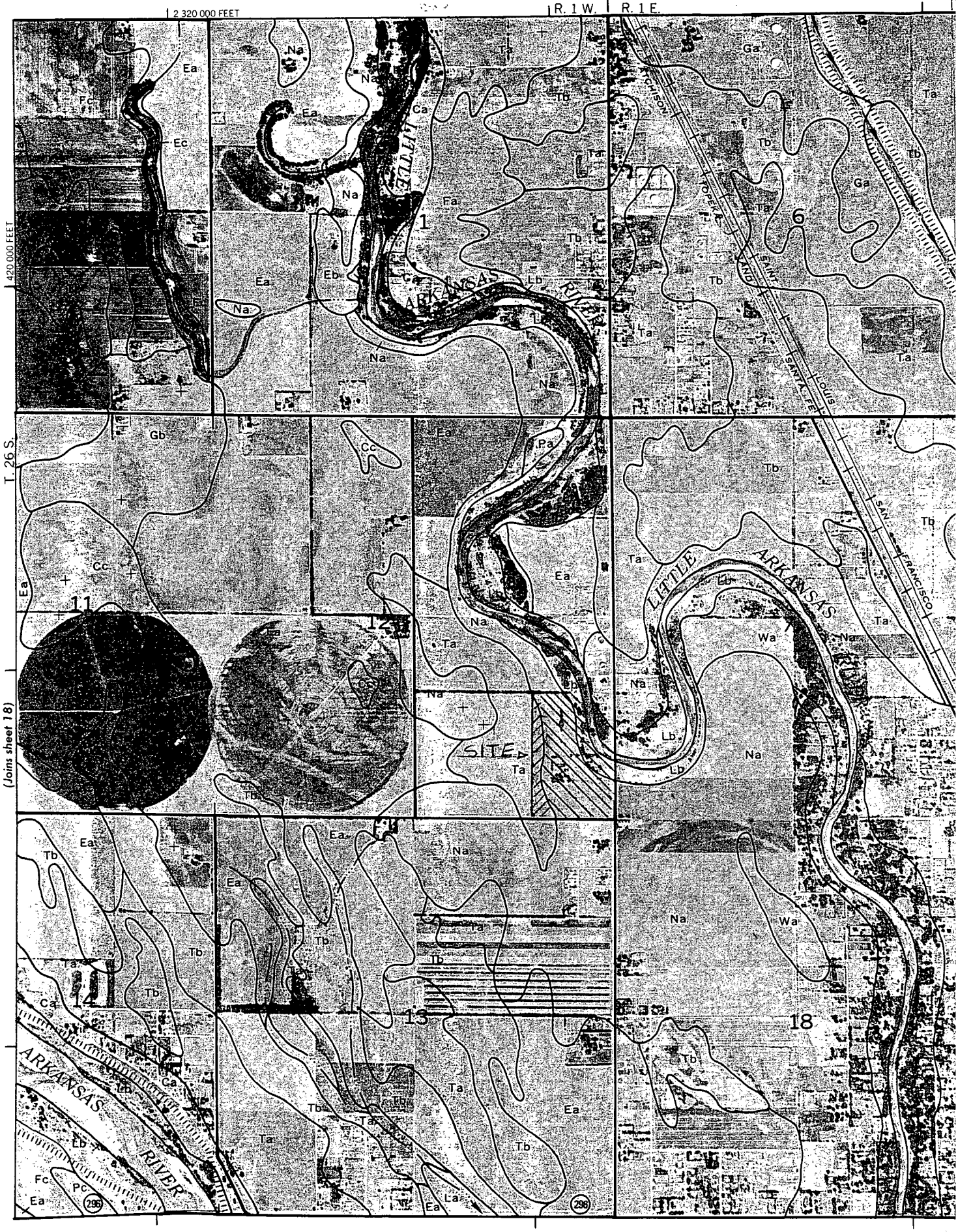
In general, the minimum grade at the R/W line is 0.3 feet above the top of curb. If walk grades higher than minimum are required to confine the major storm overflow, such walk elevations will be noted and identified.

DRAINAGE PLAN HYDROLOGY -

INITIAL DATA

1. S.C.S. Hydrologic Soil Groups

In the drainage areas contributing to the storm water sewer system, there are Naron (Na) soils in Hydrologic Soil Group "B", and also Tabler (Ta) soils in Hydrologic Soil Group "D".


2 320 000 FEET
R. 1 W.
R. 1 E.
420 000 FEET
T. 26 S.
(Joins sheet 18)
LITTLE ARKANSAS RIVER
ARKANSAS RIVER
ATCHISON, TOPEKA AND SANTA FE
SAN FRANCISCO
SITE
1
6
11
12
13
14
18
Ea
Eb
Ec
Fa
Fc
Ga
Gb
Na
Ca
Cc
Ta
Tb
Pa
Lb
Wa
La
Pc
296

2. The total area of Lots, Blocks and interior Street Right-of Ways = 26.84 acres. The total area of interior street Right-of Ways = 5.54 acres, of which the area of street pavement = 3.05 acres and the lawns within the R/W = 2.49 acres. The total area identified as 1/2 acre single family residential = 21.30 acres, of which 2.9 acres are in soil group "D", and 18.4 acres are in soil group "B".

3. Weighted Runoff Coefficient - 2 Year Frequency Storm (Developed Conditions

Land Use	Rational "C"	Basin Area	Product ("C" x A)	Weighted "C"
Pavement in street R/W	0.87	3.05	2.654	
Lawns in street R/W-"B"Soils	0.20	2.30	0.460	
Lawns in street R/W-"D"Soils	0.30	0.19	0.057	
1/2 Ac.- Residential -"B" Soils	0.36	18.4	6.624	
1/2 Ac.- Residential -"D" Soils	0.42	2.90	1.218	
	Totals =	26.84	11.013	

Weighted "C"$_2$ = 11.013 / 26.84 = 0.41

Weighted Runoff Coefficient - 100 Year Frequency Storm

Pavement in street R / W	0.93	3.05	2.836	
Lawns in street R/W-"B"Soils	0.41	2.30	0.943	
Lawns in street R/W-"D"Soils	0.65	0.19	0.124	
1/2 Ac. - Residential -"B"Soils	0.54	18.4	9.936	
1/2 Ac. - Residential -"D"Soils	0.63	2.90	1.827	
	Totals =	26.84	15.67	

Weighted "C"$_{100}$ = 15.67 / 26.84 = 0.58

4. Initial Time of Concentration

The time of concentration (Tc), is the time for runoff to travel from the hydraulicly most distant point in the basin, to a point of reference downstream.

Water moves through watershed as sheet flow, shallow concentrated flow, channel flow, or some combination of these. In the evaluation of this subdivision under developed conditions, it appears that the longest time of concentration to the point of interception into the system of storm sewers would be approximately 10 minutes.

For computation of the tributary runoff to each of the curb inlets and area inlets, the time of concentration will be 15 minutes, and the corresponding rainfall intensity will be at the rate of 3.83"/hr. for the 2 yr. frequency storm and 7.37"/hr. for the 100 yr. design storm.

DRAINAGE PLAN HYDROLOGY

Use Rational Method, $Q = C \times I \times A$

1. Determine Runoff (Q), Tributary to System 100 Inlet Nodes

Node	C_2	C_{100}	I_2	I_{100}	Area	Q_2	Q_{100}
119	0.41	0.58	3.83	7.37	0.36	0.57	1.54
118	0.41	0.58	3.83	7.37	0.59	0.93	2.52
117	0.41	0.58	3.83	7.37	0.54	0.85	2.31
116	0.41	0.58	3.83	7.37	0.79	1.24	2.09
115	0.41	0.58	3.83	7.37	1.07	1.68	4.57
114	M.H.	-	-	-	-	-	-
113	M.H.	-	-	-	-	-	-
112	0.41	0.58	3.83	7.37	0.46	0.72	1.97
111	0.41	0.58	3.83	7.37	0.43	0.68	1.84
110	0.41	0.58	3.83	7.37	0.63	0.99	2.69
109	0.41	0.58	3.83	7.37	0.55	0.86	2.35
108	0.41	0.58	3.83	7.37	0.77	1.21	3.29
107	0.41	0.58	3.83	7.37	1.93	3.03	8.25
106	M.H.	-	-	-	-	-	-
105	M.H.	-	-	-	-	-	-
104	0.41	0.58	3.83	7.37	0.99	1.55	4.23
103	0.41	0.58	3.83	7.37	1.07	1.68	4.57
102	0.41	0.58	3.83	7.37	0.48	0.75	2.05
101	0.41	0.58	3.83	7.37	0.33	0.52	1.41
100	(End Section)		-	-	-	-	-

2. Determine Runoff (Q), Tributary to System 200 Inlet Nodes

205	0.41	0.58	3.83	7.37	0.63	0.99	2.69
204	0.41	0.58	3.38	7.37	0.99	1.56	4.32
203	M.H.	-	-	-	-	-	-
202	0.41	0.58	3.83	7.37	4.05	6.35	17.31
201	0.41	0.58	3.83	7.37	0.80	1.26	3.42
200	(End Section)		-	-	-	-	-

3. Determine Runoff (Q), tributary to System 300 Inlet Nodes

304	0.41	0.58	3.83	7.37	0.62	0.97	2.65
303	0.41	0.58	3.83	7.37	0.65	1.02	2.78
302	0.41	0.58	3.83	7.37	2.70	4.24	11.54
301	0.41	0.58	3.83	7.37	0.74	1.16	3.16
300	(End Section)		-	-	-	-	-

RIO VISTA ESTATES 4TH ADDITION
OFF-SITE CONTRIBUTION FROM WEST
DEVELOPED CONDITIONS

Tc COMPUTATIONS FOR:

SHEET FLOW (Applicable to Tc only)

		A-B	
Segment ID			
Surface description		RESIDENTIAL	
Manning's roughness coeff., n		0.1370	
Flow length, L (total < or = 300)	ft	300.0	
Two-yr 24-hr rainfall, P2	in	3.500	
Land slope, s	ft/ft	0.0041	
$T = \frac{.007 * (n*L)^{0.8}}{P2^{0.5} * s^{0.4}}$	hrs	0.66	= 0.66

SHALLOW CONCENTRATED FLOW

		B - C	
Segment ID			
Surface (paved or unpaved)?		Paved	
Flow length, L	ft	880.0	
Watercourse slope, s	ft/ft	0.0041	
$Avg.V = Csf * (s)^{0.5}$	ft/s	1.3016	
where: Unpaved Csf = 16.1345			
Paved Csf = 20.3282			
T = L / (3600*V)	hrs	0.19	= 0.19

CHANNEL FLOW

Segment ID			
Cross Sectional Flow Area, a	sq.ft	0.00	
Wetted perimeter, Pw	ft	0.00	
Hydraulic radius, r = a/Pw	ft	0.000	
Channel slope, s	ft/ft	0.0000	
Manning's roughness coeff., n		0.0000	
$V = \frac{1.49 * r^{2/3} * s^{1/2}}{n}$	ft/s	0.0000	
Flow length, L	ft	0	
T = L / (3600*V)	hrs	0.00	= 0.00

::

TOTAL TIME (hrs) 0.85

4. Determine Runoff (Q), tributary to System 400 Inlet Node

401	0.41	0.58	3.83	7.37	0.47	0.74 cfs

Additionally, an off-site drainage area of approximately16 acres contributes to Node 401. This area has an overland slope of 0.41% and is in hydraulic soil group "D". As recommended in the "Policy Manual", the rational "C" value of 0.52 has been used. By use of the S.C.S method (TR-55), as shown on the precedimg page, the time of concentration (Tc) is found to be 0.58 hours, or 51 minutes, with a corresponding rainfall intensity of 1.92 inches/minute.

From the Rational Method, $Q = C \times I \times A = 0.52 \times 1.92 \times 16 = 16$ cfs

Because the outline of the off-site drainage area is not easily determined, we have added 25% (4 cfs) to the above value, as a safety factor. Therefore, the anticipated contribution to Node 401 will be as follows:

16 cfs + 4 cfs + 0.74 cfs = 20.74 cfs (Total)

5. Flood Routing / Inlet Sizing - 2 Yr. Design Storm - System 100

Node	Inlet Condition	Inlet Length	Q_2 Approach	Q_2 Intercept	Q_2 By-Pass	By-Pass To Node
119	Sump	5	0.57	0.57	-	-
118	Sump	5	0.93	0.93	-	-
117	Sump	2x4 D.I.	0.85	0.85	-	-
116	Sump	2x4 D.I.	1.24	1.24	-	-
115	Sump	2x4 D.I.	1.68	1.68	-	-
112	Sump	5	0.72	0.72	-	-
111	Sump	5	0.68	0.68	-	-
110	Sump	2x4 D.I.	0.99	0.99	-	-
109	Sump	5	0.86	0.86	-	-
108	Sump	5	1.21	1.21	-	-
107	Sump	2x4 D.I.	3.03	3.03	-	-
104	Sump	5	1.55	1.55	-	-
103	Sump	2x4 D.I.	1.68	1.68		
102	Sump	5	0.75	0.75	-	-
101	Sump	5	0.52	o.52	-	-
100	(End of Section)					

Flood Routing / Inlet Sizing - 2 Yr. Design Storm - System 200

Node	Inlet Condition	Inlet Length	Q_2 Approach	Q_2 Intercept	Q_2 By-Pass	By-Pass To Node
205	Sump	2x4 D.I.	0.99	0.99	-	-
204	Sump	2x4 D.I.	1.56	1.56	-	-
202	Sump	5	6.35	6.35	-	-
201	Sump	5	1.26	1.2	-	-
200	(End of System)					

Flood Routing / Inlet Sizing - 2Yr. Design Storm - System 300

304	Sump	2x4 D.I.	0.97	0.97	-	-
303	Sump	2x4 D.I.	1.02	1.02	-	-
302	Sump	5	4.24	4.24	-	-
301	Sump	5	1.16	1.16	-	-
300	(End of System)					

Flood Routing /Inlet Sizing - 2Yr. Design Storm - System 400

401	Sump	10	20.74	20.74	-	-
400	(End of System)					

6. Street Flow Depths - 2 Yr. Design Storm

Node	Q_2 Approach	Flow Distribution	Street Slope %	Flow Depth	Allowable Depth	
119	0.57	28%N. = 0.16	0.54	0.09	0.55	OK
		72%S. = 0.41	0.50	0.14	0.55	OK
118	0.93	28%N. = 0.26	0.54	0.11	0.55	OK
		72%S. = 0.67	0.50	0.16	0.55	OK
112	0.72	53%N. = 0.38	0.54	0.13	0.55	OK
		47%S. = 0.34	0.50	0.12	0.55	OK
111	0.68	52%N. = 0.35	0.54	0.13	0.55	OK
		48%S. = 0.33	0.50	0.12	0.55	OK
109	0.86	66%N. = 0.57	0.50	0.15	0.55	OK
		34%S. = 0.29	0.50	0.12	0.55	OK
108	1.21	66%N. = 0.80	0.50	0.17	0.55	OK
		34%S. = 0.41	0.50	0.14	0.55	OK

104	1.55	100%W. = 1.51	0.90	0.22	0.55	OK
102	0.75	90%W. = 0.66	0.50	0.16	0.55	OK
		10%E. = 0.09	0.56	0.08	0.55	OK
101	0.52	90%W. = 0.47	0.50	0.14	0.55	OK
		10%E. = 0.05	.50	0.06	0.55	OK
202	6.35	95%S. = 6.03	0.50	0.37	0.55	OK
		05%N. = 0.32	0.50	0.12	0.55	OK
201	1.26	95%S. = 1.20	0.50	0.20	0.55	OK
		05%N. = 0.06	0.50	0.07	0.55	OK
302	4.24	48%N. = 2.03	0.50	0.25	0.55	OK
		52%S. = 2.21	0.50	0.25	0.55	OK
301	1.16	60%N. = 0.70	0.50	0.17	0.55	OK
		40%S. = 0.46	0.50	0.14	0.55	OK

7. EVALUATION OF 100 YR. FLOW WITHIN STREET R/W

The maximum storm water flow in street right-of-way, resulting from the 100 Yr. design storm, will be in Richmond Street at Nodes 201 and 202.

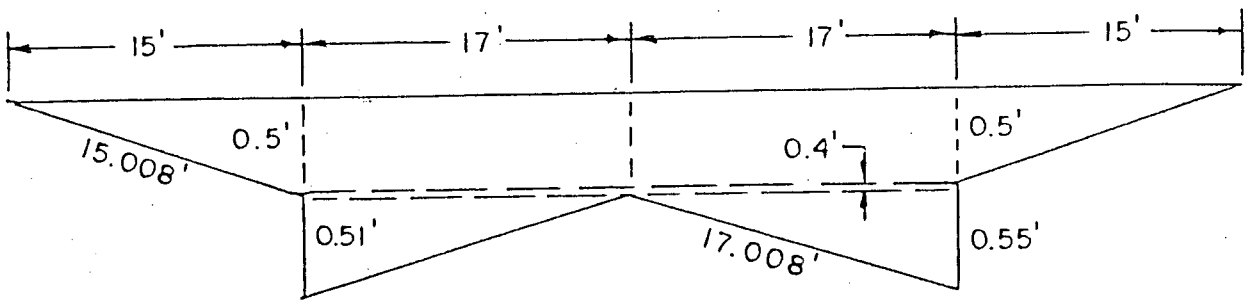
As computed and tabulated on page 5, the total street flow (Q_{100}) approaching these Nodes will be the sum of 17.31 cfs + 3.42 cfs = 20.73 cfs.

The allowable Q_{100} (with 0.3 walk grade) = 109.5 cfs, as determined on the following page.

From the above, the flow resulting from the 100 Yr. design storm will be contained within the street right-of-way as recommended by the "Policy Manual".

8. PROFILES

Enclosed at the back of this report, are the profiles of the proposed storm water sewers, indicating the anticipated pipe sizes, construction grades and resulting hydraulic grade elevation at each Node for Systems 100 through 400, inclusive.



"N" = 0.030 Grass

"N" = 0.013 Conc. C & G

"N" = 0.016 Asph. Pvm't.

64' R/W

0.5' Min. Walk Gr.

34' Fc. to Fc. Pvm't

$$Q = \frac{1.486}{N} AR^{2/3}S^{1/2}$$

$$\text{Weighted "N"} = \frac{2(14.5 \times 0.030) + 2(2.5 \times 0.013) + 2(15 \times 0.016)}{65.13}$$

$$\text{"N"} = \frac{1.415}{65.13} = 0.0217$$

Wetted Perimeter, "P" = 65.13

$$\text{Area "A"} = 2\,\frac{0.5 \times 15}{2} + \frac{0.51 \times 17}{2} + (0.5 \times 17) + (0.04 \times 17)$$

$$= 2(3.75 + 4.335 + 8.5 + 0.68)$$

Area = 34.53 sq.ft.

$$R_h = \frac{A}{P} = \frac{34.53}{65.13} = 0.5302;\ R^{2/3} = 0.6551$$

$$\therefore\ Q = \frac{1.486}{0.0217} \times 34.53 \times 0.6551 \times S^{1/2}$$

$$Q = 1549.04\ (S^{1/2})$$

Note: With a minimum gradient of 0.50%, the flow capacity, within the street R/W = $1549.04\ (0.005)^{0.5}$ = 109.5 cfs

RIO VISTA 4TH ADD'N HYDROLOGY - SYSTEM 100 - 2 Yr. Frequency

Node to Node	"C"	TRIBUTARY AREA Area Ac.	T_c Min.	I_2	Q_2 cfs	SUMMATION T_c Min.	I_2	Q_2 cfs	Sum Q_2	CONDUIT DATA Pipe Size	Vel. fps	Length	T.T.	T.T. + T_c
119 - 118	.41	0.36	15	3.83	0.57	15	3.83	0.57	0.57	15"	0.46	40	1.44	16.44
118 - 113	.41	0.59	15	3.83	0.93	16.44	3.67	0.89	1.46	15"	1.19	64	0.90	17.34
117 - 116	.41	0.54	15	3.83	0.85	15	3.83	0.85	0.85	15"	0.69	275	6.64	21.64
116 - 115	.41	0.79	15	3.83	1.24	21.64	3.20	1.04	1.89	15"	1.54	365	3.95	25.59
115 - 114	.41	1.07	15	3.83	1.68	25.59	2.92	1.28	3.17	15"	2.58	166	1.07	26.66
114 - 113									3.17	15"	2.58	60	0.39	27.05
113 - 101									4.63	18"	2.62	225	1.43	28.48
112 - 111	.41	0.46	15	3.83	0.72	15	3.83	0.72	0.72	15"	0.59	40	1.13	16.13
111 - 106	.41	0.43	15	3.83	0.68	16.13	3.71	0.65	1.37	15"	1.12	22	0.33	16.46
110 - 109	.41	0.63	15	3.83	0.99	15	3.83	0.99	0.99	15"	0.81	150	3.09	18.09
109 - 108	.41	0.55	15	3.83	0.86	18.09	3.50	0.79	1.78	15"	1.45	40	0.46	18.55
108 - 107	.41	0.77	15	3.83	1.21	18.55	3.46	1.09	2.87	15"	2.34	170	1.21	19.76
107 - 106	.41	1.93	15	3.83	3.03	19.76	3.35	2.65	5.52	18"	3.12	170	0.91	20.67
106 - 105									6.89	18"	3.90	210	0.90	21.57
105 - 104									6.89	24"	2.19	85	0.65	22.22
104 - 103	.41	0.99	15	3.83	1.55	22.22	3.15	1.28	8.17	24"	2.60	107	0.69	22.91
103 - 102	.41	1.07	15	3.83	1.68	22.91	3.11	1.36	9.53	24"	3.03	110	0.61	23.52
102 - 101	.41	0.48	15	3.83	0.75	23.52	3.06	0.60	10.13	30"	2.06	76	0.61	24.14
101 - 100	.41	0.33	15	3.83	0.52	28.48	2.70	0.36	14.76	30"	3.01	90	0.49	24.63

HYDROLOGY - 2 YR. | RIO VISTA 4TH ADD'N | SYSTEM 200

TRIBUTARY AREA | SUMMATION | conduit data

Node to Node	"C"	Area Ac.	Tc Min.	I 2	Q_2 cfs	Tc Min.	I 2	Q_2 cfs	ΣQ_2	Pipe Size	Vel. fps	Length	T.T.	T.T. + Tc
205 - 204	0.41	0.63	15	3.83	0.99	15	3.83	0.99	0.99	15	0.81	250	5.14	20.54
204 - 203	0.41	0.99	15	3.83	1.56	20.54	3.29	1.33	2.32	15	1.89	122	1.08	21.62
203 - 202									2.32	15	1.89	55	0.49	22.11
202 - 201	0.41	4.05	15	3.83	6.35	22.11	3.16	5.25	7.56	18	4.28	40	0.16	22.27
201 - 200	0.41	0.80	15	3.83	1.26	22.27	3.15	1.03	8.59	24	2.73	230	1.40	23.67

HYDROLOGY - 2 YR. | RIO VISTA 4TH ADD'N | SYSTEM 300

TRIBUTARY AREA | SUMMATION | CONSUIT DATA

Node to Node	"C"	Area Ac.	Tc Min.	I 2	Q_2 cfs	Tc Min.	I 2	Q_2 cfs	ΣQ_2	Pipe Size	Vel. fps	Length	T.T.	T.T. + Tc
304 - 303	0.41	0.62	15	3.83	0.97	15	3.83	0.97	0.97	15	0.79	190	4.01	19.01
303 - 302	0.41	0.65	15	3.83	1.02	19.01	3.42	0.91	1.88	15	1.53	180	1.96	20.97
302 - 301	0.41	2.70	15	3.83	4.24	20.97	3.25	3.60	5.48	24	1.74	40	0.38	21.35
301 - 300	0.41	0.74	15	3.83	1.16	21.35	3.14	0.95	6.43	24	2.05	220	1.79	23.14

HYDROLOGY - 2 YR. | RIO VISTA 4TH ADD'N | SYSTEM 400

TRIBUTARY AREA | SUMMATION | CONDUIT DATA

Node to Node	"C"	Area Ac.	Tc Min.	I 2	Q_2 cfs	Tc Min.	I 2	Q_2 cfs	ΣQ_2	Pipe Size	Vel. fps	Length	T.T.	T.T. + Tc
401 - 400	0.41	0.47	15	3.83	0.74	51	1.92	16	20.74	30"	4.22	433	1.71	52.71
		NOTE:												
		1.	Summation Columns for T_c; I_2; Q_2 result from "off-site drainage area computations.											
		2.	Q_2 = 16 cfs off-site + 25% Safety Factor + 0.74 cfs tributary area = 20.74 cfs.											

SYSTEM 100 - STRUCTURE HEAD LOSS COMPUTATIONS - 2 YR.

Structure 119 - Curb Inlet

Q_o = 0.57 cfs; D_o = 12"; V_o = 0.73; $V_o^2/2g$ = 0.0083

To generate initial velocity; $H_v = V_o^2/2g$ = 0.008

+ Entrance loss; $H_e = 0.5 \times V_o^2/2g$ = 0.004

Total Structure Head Loss = 0.012'

Structure 118 - Curb Inlet + Upstream Flow @90°

Q_L = 0.57 cfs; V_L = 0.73 fps; $V_L^2/2g$ = 0.008

Q_G = 0.90 cfs; Q_o = 1.47 cfs; V_o = 1.20; $V_o^2/2g$ = 0.034

$H_L - H_o = V_o^2/2g - Q_L/Q_o\ (0.3\ U_L^2/2g)$

$H_L - H_o$ = 0.034 - 0.3878 x 0.0024 = 0.03'

Structure 117 - Drop Inlet

Q_o = 0.85 cfs; D_o = 15"; V_o = 1.08; $V_o^2/2g$ = 0.018

To generate initial velocity; $H_v = V_o^2/2g$ = 0.018

+ Entrance loss; $H_e = 0.5 \times V_o^2/2g$ = 0.009

Total Structure Head Loss = 0.027'

Structure 116 - Drop Inlet + 90° Bend

Q_L = 0.85 cfs; V_L = 1.08; $V_L^2/2g$ = 0.018

Q_G = 1.10; Q_o = 1.95; V_o = 1.59; $V_o^2/2g$ = 0.039

$H_L - H_o = V_o^2/2g - Q_L/Q_o\ (0.3\ V_L^2/2g)$

$H_L - H_o$ = 0.039 - 0.436 x 0.005 = 0.04'

Structure 115 - Drop Inlet + Upstream Flow

$Q_u = 1.95$; $V_u = 1.59$; $V_u^2/2g = 0.039$

$Q_G = 1.36$; $Q_o = 3.31$; $V_o = 2.70$; $V_o^2/2g = 0.113$

$H_u - H_o = V_o^2/2g - Q_u/Q_o\ (V_u^2/2g)$

$H_u - H_o = 0.113 - 0.589 \times 0.039 = 0.09'$

Structure 114 - Manhole w/90° Bend

$Q_u = 3.31$; $V_u = 2.7$ fps; $V_u^2/2g = 0.113$

$Q_o = 3.31$; $V_o = 2.7$; $V_o^2/2g = 0.113$

$H_u - H_o = V_o^2/2g - Q_u/Q_o\ (V_u^2/2g)$

$H_u - H_o = 0.113 - 0.113 = 0.00$

Turn loss 90° = $0.7 \times V_u^2/2g = 0.079$

Total Head Loss = 0.08'

Structure 113 - Manhole - 90° Bend Main +90° Bend Lateral

$Q_u = 3.31$; $V_u = 2.70$; $V_u^2/2g = 0.113$

$Q_L = 1.47$; $V_L = 1.20$; $V_L^2/2g = 0.022$

$Q_o = 4.78$; $V_o = 2.71$; $V_o^2/2g = 0.114$

$H_L - H_o = V_o^2/2g - (Q_L/Q_o)(0.3\ V_L^2/2g) - (Q_u/Q_o)(V_u^2/2g)$

$H_L - H_o = 0.114 - (0.307)(0.0066) - (0.6925)(0.113)$

$H_L - H_o = 0.034$

Turn Loss of Q_L: assume full head = 0.022

Turn Loss of Q_u: assume $0.7 \times V_u^2/2g = 0.002$

Total Head Loss at M.H. = 0.034 + 0.022 + 0.002 = 0.06'

Structure 112 - Curb Inlet

Q_o = 0.72 cfs; V_o = 0.92 fps; $V_o^2/2g$ = 0.013

To generate initial velocity; H_v = 0.013

+ Entrance loss; $H_e = 0.5 \times V_o^2/2g$ = 0.007

Total Head Loss = 0.013 + 0.007 = 0.02'

Structure 111 - Curb Inlet + Lateral @90°

Q_o = 1.38 cfs; V_o = 1.76; $V_o^2/2g$ = 0.048

Q_g = 0.66 cvs

Q_L = 0.72 cfs; V_L = 0.92; $V_L^2/2g$ = 0.013

$H_L - H_o = V_o^2/2g - Q_L/Q_o\ (0.3\ V_L^2/2g)$

$H_L - H_o = 0.048 - 0.52 \times (0.3 \times 0.013) = 0.05'$

Structure 110 - Drop Inlet

Q_o = 0.99 cfs; V_o = 1.26; $V_o^2/2g$ = 0.0247

To generate initial velocity; $H_v = V_o^2/2g$ = 0.0247

+ Entrance loss = $0.5\ (V_o^2/2g)$ = 0.0123

Total Head Loss = 0.0247 + 0.0123 = 0.04'

Structure 109 - Curb Inlet + Upstream Flow

Q_u = 0.99; V_u = 1.26; $V_u^2/2g$ = 0.0247

Q_g = 0.81 cfs; Q_o = 1.80; V_o = 1.47; $V_o^2/2g$ = 0.0102

$H_u - H_o = V_o^2/2g - Q_u/Q_o(V_u^2/2g)$

$H_u - H_o = 0.0102 - 0.55 \times 0.0247 = 0.01'$

Structure 108 - Curb Inlet + Upstream Flow

Q_u = 1.80; V_u = 1.47; $V_u^2/2g$ = 0.0336

Q_g = -0.81; Q_o = 2.93; V_o = 2.39; $V_o^2/2g$ = 0.0887

$H_u - H_o = V_o^2/2g - Q_u/Q_o \ (V_u^2/2g)$

$H_u - H_o$ = 0.0336 - (0.6143 x 0.0336) = 0.01'

Structure 107 - Drop Inlet + Upstream Flow

Q_u = 2.93 cfs; V_u = 2.39 fps; $V_u^2/2g$ = 0.0887

Q_g = 2.73; Q_o = 5.66; V_o= 3.20; $V_o^2/2g$ = 0.1590

$H_u - H_o = V_o^2/2g - Q_u/Q_o \ (V_u^2/2g)$

$H_u - H_o$ = 0.159 - (0.5177 x 0.0887) = 0.11'

Structure 106 - Manhole - Upstream Flow + 90° Lateral

Q_u = 5.66 cfs; V_u = 3.20 fps; $V_u^2/2g$ = 0.1590

Q_L = 1.38; V_L = 1.76; $V_L^2/2g$ = 0.0481

Q_o = 7.04; V_o = 3,98; $V_o^2/2g$ - 0.246

$H_u - H_o = V_o^2/2g - Q_u/Q_o \ (V_u^2/2g) - (.03 \ V_L^2/2g)$

$H_u - H_o$ = -.246 - (0.804 x 0.159) - (0.3 x 0.0481)

$H_u - H_o$ = 0.10

Structure 105 - Manhole - 75° Bend Main

Q_u = 7.04 cfs; V_u = 3.98; $V_u^2/2g$ = 0.246

Q_o = 7.04 cfs; V_o = 2.20; $V_o^2/2g$ = 0.0752

Turn Loss of Q_u: Assume 0.63 x $V_u^2/2g$ = 0.16'

Structure 104 - Curb Inlet + 20° Bend

Q_u = 7.04 cfs; V_u = 2.26; $V_u^2/2g$ = 0.0752

Q_g = 1.32; Q_o = 8.36 cfs; V_o = 2.66; $V_o^2/2g$ = 0.1098

$H_u - H_o = V_o^2/2g = Q_u/Q_o\ (V_u^2/2g)$

$H_u - H_o$ = 0.1098 - (0.84 x 0.0752) = 0.05'

Structure 103 - Drop Inlet + 45° Bend

Q_u = 8.36; V_u = 2.66; $V_u^2/2g$ = 0.1098

Q_g = 1.40; Q_o = 9.76; V_o = 3.11; $V_o^2/2g$ = 0.150

$H_u - H_o = V_o^2/2g - Q_u/Q_o\ (V_u^2/2g) - (0.47 \times V_u^2/2g)$

$H_u - H_o$ = 0.150 - (0.8566 x 0.1098) - 0.0516 = 0.01'

Structure 102 - Curb Inlet + Upstream Flow

Q_u = 9.76; V_u = 3.11; $V_u^2/2g$ = 0.15

Q_g = 0.62; Q_o = 10.38; V_o = 2.11; $V_o^2/2g$ = 0.0691

$H_u - H_o = V_o/2g - Q_u/Q_o\ (V_u^2/2g)$

$H_u - H_o$ = 0.0691 - (0.94 x 0.015) = 0.07'

Structure 101 Curb Inlet + Upstream Flow + Lateral

Q_u = 10.38; V_u = 2.11; $V_u^2/2g$ = 0.0691

Q_g = 0.40 cfs; Q_L = 4.78; V_L = 2.71; $V_L^2/2g$ = 0.114

Q_o = 15.56 cfs; V_o = 3.17; $V_o^2/2g$ = 0.156

$H_u - H_o = V_o^2/2g - (Q_u/Q_o \times V_u^2/2g)$

$H_u - H_o$ = 0.156 - (0.667 x 0.0691) = 0.11

Turn Loss of Q_L = full velocity head = 0.114

Total Head Loss = 0.11 + 0.11 = 0.22'

SYSTEM 200 - STRUCTURE HEAD LOSS CONPUTATIONS - 2 YR.

Structure 205 - Drop Inlet

$Q_o = 0.99$; $V_o = 0.81$; $V_o^2/2g = 0.01$

Initial Velocity, $H_V = V_o^2/2g = 0.01$

Entrance loss, $H_e = 0.5 \times V_o^2/2g = 0.005$

Total Structure Losses = 0.015'

Structure 204 - Drop Inlet + Upstream Flow

$Q_u = 0.99$; $V_u = 0.81$; $V_u^2/2g = 0.01$

$Q_G = 1.33$; $Q_o = 2.32$; $V_o = 1.89$; $V_o^2/2g = 0.06$

$H_u - H_o = V_o^2/2g - (Q_u/Q_o \times V_u^2/2g) = 0.05$

Structure 203 - Manhole + 90° Bend

$Q_u = 2.32$; $V_u = 0.81$; $V_u^2/2g = 0.01$

$Q_o = 2.32$; $V_o = 0.81$; $V_o^2/2g = 0.01$

$H_u - H_o = V_o^2/2g - (Q_u/Q_o \times V_u^2/2g) = 0.00$

90° Turn loss $= 0.7 \times V_u^2/2g = 0.007$

Total Head Losses = 0.01'

Structure 202 - Curb Inlet + Upstream @ 65°

$Q_u = 2.32$; $V_u = 0.81$; $V_u^2/2g = 0.01$

$Q_G = 5.25$; $Q_o = 7.57$; $V_o = 4.28$; $V_o^2/2g = 0.28$

$H_u - H_o = V_o^2/2g - (Q_u/Q_o \times V_u^2/2g) = 0.28$

65° Turn Loss $= 0.58 \times V_u^2/2g$ $= 0.01$

Total Head Loss $= 0.29'$

Structure 201 - Curb Inlet + Upstream Flow

$Q_u = 7.57$; $V_u = 4.28$; $V_u^2/2g = 0.28$

$Q_G = 1.03$; $Q_o = 8.59$; $V_o = 2.73$; $V_o^2/2g = 0.12$

$H_u - H_o = V_o^2/2g - (Q_u/Q_o \times V_u^2/2g)$

$H_u - H_o = 0.12 - (.088 \times 0.28) = 0.12 - 0.25 = -0.13'$

SYSTEM 300 - STRUCTURE HEAD LOSS COMPUTATIONS - 2 YR.

Structure 304 - Drop Inlet

Q_o = 0.97 cfs; D_o = 15"; V_o =0.79; $V_o^2/2g$ = 0.0097

To Generate Initial Velocity: $H_u = V_o^2/2g$ = 0.008

+ Entrance Loss; $H_e = 0.5 \times V_o^2/2g$ = 0.0048

Total Structure Head Loss = 0.01'

Structure 303 - Drop Inlet + Upstream Flow

Q_u = 0.97; V_u = 0.79; $V_u^2/2g$ = 0.0097

Q_G = 0.91; Q_o = 1.88; V_o = 1.53; $V_o^2/2g$ = 0.04'

$H_u - H_o = V_o^2/2g - Q_u/Q_o\ (V_u^2/2g)$

$H_u - H_o$ = 0.04 - (0.516 x 0.0097) = 0.04'

Structure 302 - Curb Inlet + Upstream Flow

Q_u = 1.88; V_u = 1.53; $V_u^2/2g$ = 0.036

Q_G = 3.60; Q_o = 5.48; V_o = 1.74; $V_o^2/2g$ = 0.047'

$H_u - H_o = V_o^2/2g - Q_u/Q_o\ (V_u^2/2g)$

$H_u - H_o$ = 0.047 - (0.343 x 0.036) = 0.04'

Turn Loss of Q_u: Assume $0.25 \times V_u^2/2g$ = 0.036 = 0.01'

Total Losses = 0.05'

Structure 301 - Curb Inlet + Upstream Flow

Q_u = 5.48; V_u = 1.74; $V_u^2/2g$ = 0.047

Q_G = 1.16; Q_o = 6.43; V_o = 2.05; $V_o^2/2g$ = 0.065

$H_u - H_o = V_o^2/2g - (Q_u/Q_o\ (V_u^2/2g)$ = 0.03

Turn Loss of $Q_u = 0.25 \times V_u^2/2g$ = 0.01

Total Head Loss = 0.04'

STORM DRAINAGE - DESIGN COMPUTATIONS

Project - System 100
Rio Vista Estates 4th Add'n

Design Storm Frequency - 2 Yr.
Mannings "n" = 0.013
Plan - Enclosed
Profile - Enclosed

Sheet 1 of 2
Computed By - DM
Checked By -

Line		Length	Struct.	Contrib. Drg. Area (Ac.)	Runoff "C"	I For Σt (in/hr.)	ΣQ Pipe (CFS)	Pipe Size	Pipe Friction Head	V.	$\frac{V^2}{2g}$	Time in Minutes		Constr. Slope %	Req'd Hydr. Slope %	Struct. Head Loss	Hydraulic Grade Elevation		Structure Flowline Elevation		Upper Street Elev.	Remarks
Upper	Lower											t	Σt				Upper	Lower	Upper	Lower		
119	118	40	Curb Inlet	0.36	0.41	3.83	0.57	15"	.003	0.46	.003	1.44	16.44	0.38	0.01	0.01	1333.03	1333.02	1330.56	1330.41	1336.98	3.84' Below Gutter/Inlet
118	113	64	"	0.59	0.41	3.67	1.46	15"	0.03	1.19	0.02	0.90	17.34	0.38	0.05	0.03	1332.99	1332.96	1330.31	1330.07	1336.98	3.99' "
117	116	275	Drop Inlet	0.54	0.41	3.83	0.85	15"	0.05	0.69	.007	6.64	21.64	0.38	0.02	0.03	1332.93	1332.88	1333.56	1332.52	1336.60	3.67' "
116	115	365	"	0.79	0.41	3.20	1.89	15"	0.31	1.54	0.04	3.95	25.59	0.38	0.09	0.04	1332.84	1332.53	1332.42	1331.03	1336.60	3.76' "
115	114	166	"	1.07	0.41	2.92	3.17	15"	0.40	2.58	0.10	1.07	26.66	0.38	0.24	0.09	1332.44	1332.04	1331.03	1330.40	1338.60	6.16' "
114	113	60	M.H.	-	-	-	3.17	15"	0.14	2.58	0.10	0.39	22.05	0.38	0.24	0.08	1331.96	1331.82	1330.30	1330.07	1337.07	5.11' "
113	101	225	M.H.	-	-	-	4.63	18"	0.44	2.62	0.11	1.43	28.48	0.30	0.19	0.06	1331.76	1331.32	1329.82	1329.14	1336.77	5.01' "
112	111	40	Curb Inlet	0.46	0.41	3.83	0.72	15"	.004	0.59	.005	1.13	16.13	0.38	0.01	0.02	1333.27	1333.26	1331.49	1331.29	1337.07	3.80' "
111	106	22	"	0.43	0.41	3.71	1.37	15"	0.01	1.12	0.02	0.33	16.46	0.38	0.05	0.05	1333.21	1333.20	1331.19	1331.08	1337.07	3.86' "
110	109	150	Drop Inlet	0.63	0.41	3.83	0.99	15"	0.02	0.81	0.01	3.09	18.09	0.38	0.02	0.04	1334.92	1334.90	1332.71	1332.14	1336.00	1.08' "
109	108	40	Curb Inlet	0.55	0.41	3.50	1.78	15"	0.03	1.45	0.03	0.46	18.55	0.38	0.08	0.01	1334.39	1334.36	1332.14	1331.99	1337.00	2.61' "
108	107	170	"	0.77	0.41	3.46	2.87	15"	0.34	2.34	0.09	1.21	19.76	0.38	0.20	0.01	1334.35	1334.01	1331.99	1331.34	1337.00	2.65' "
107	106	170	Drop Inlet	1.93	0.41	3.35	5.52	18"	0.60	3.12	0.15	0.91	20.67	0.30	0.27	0.11	1333.90	1333.30	1331.09	1330.58	1337.30	3.4' "

STORM DRAINAGE - DESIGN COMPUTATIONS

Project - System 100
Rio Vista Estates 4th Add'n

Design Storm Frequency - 2 Yr.
Mannings "n" = 0.013
Plan - Enclosed
Profile - Enclosed

Sheet 2 of 2
Computed By - DM
Checked By -

Line Upper	Line Lower	Length	Struct.	Contrib. Drg. Area (Ac.)	Runoff "C"	I For Σt (in/hr.)	ΣQ Pipe (CFS)	Pipe Size	Pipe Friction Head	V.	$\frac{V^2}{2g}$	Time in Minutes t	Time in Minutes Σt	Constr. Slope %	Req'd Hydr. Slope %	Struct. Head Loss	Hydraulic Grade Elevation Upper	Hydraulic Grade Elevation Lower	Structure Flowline Elevation Upper	Structure Flowline Elevation Lower	Upper Street Elev.	Remarks
106	105	210	M.H.	-	-	-	6.89	18"	0.90	3.90	0.24	0.90	21.57	0.30	0.43	0.10	1333.20	1332.30	1330.58	1329.95	1336.96	3.76' Below Gutter/Inlet
105	104	85	M.H.	-	-	-	6.89	24"	0.08	2.19	0.07	0.65	22.22	0.20	0.09	0.16	1332.14	1332.06	1329.45	1329.28	1336.38	4.24' "
104	103	107	Curb Inlet	0.99	0.41	3.15	8.17	24"	0.14	2.60	0.11	0.69	22.91	0.20	0.13	0.05	1332.01	1331.87	1329.28	1329.07	1335.90	3.89' "
103	102	110	Drop Inlet	1.07	0.41	3.11	9.53	24"	0.20	3.03	0.14	0.61	23.52	0.20	0.18	0.01	1331.86	1331.66	1328.97	1328.75	1336.00	4.14' "
102	101	76	Curb Inlet	0.48	0.41	3.06	10.13	30"	0.05	2.06	0.07	0.61	24.14	0.15	0.06	0.07	1331.59	1331.54	1328.25	1328.14	1336.47	4.88' "
101	100	90	"	0.33	0.41	2.70	14.76	30"	0.12	3.01	0.22	0.49	24.63	0.15	0.13	0.22	1331.32	1331.20	1328.14	1328.00	1336.53	5.21' "

STORM DRAINAGE - DESIGN COMPUTATIONS

Project - System 200
Rio Vista Estates 4th Add'n

Design Storm Frequency - 2 Yr.
Mannings "n" = 0.013
Plan - Enclosed
Profile - Enclosed

Sheet 1 of 1
Computed By - DM
Checked By -

Line		Length	Struct.	Contrib. Drg. Area (Ac.)	Runoff "C"	I For Σt (in/hr.)	ΣQ Pipe (CFS)	Pipe Size	Pipe Friction Head	V.	$\frac{V^2}{2g}$	Time in Minutes		Constr. Slope %	Req'd Hydr. Slope %	Struct. Head Loss	Hydraulic Grade Elevation		Structure Flowline Elevation		Upper Street Elev.	Remarks
Upper	Lower											t	Σt				Upper	Lower	Upper	Lower		
205	204	250	Drop Inlet	0.63	0.41	3.83	0.99	15"	0.06	0.81	0.01	5.14	20.54	0.38	0.02	0.02	1332.67	1332.59	1331.55	1330.60	1336.40	3.73' Below Gutter/Inlet
204	203	122	"	0.99	0.41	3.29	2.32	15"	0.16	1.89	0.06	1.08	21.62	0.38	0.13	0.05	1332.54	1332.38	1330.60	1330.14	1335.70	3.16' "
203	202	55	M.H.	-	-	-	2.32	15"	0.07	1.89	0.06	0.49	22.11	0.38	0.13	0.01	1332.37	1332.30	1330.04	1329.83	1335.60	3.23' "
202	201	40	Curb Inlet	4.05	0.41	3.16	7.56	18"	0.21	4.28	0.28	0.16	22.27	0.30	0.52	0.29	1332.01	1331.80	1329.58	1329.46	1334.41	2.40' "
201	200	230	"	0.80	0.41	3.15	8.59	24"	0.33	2.73	0.12	1.40	23.67	0.20	0.14	-0.13	1331.93	1331.60	1328.96	1328.50	1334.41	2.48' "

STORM DRAINAGE - DESIGN COMPUTATIONS

Project - System 300
Rio Vista Estates 4th Add'n.

Design Storm Frequency - 2 - Yr.
Mannings "n" = 0.013
Plan - Enclosed
Profile - Encloses

Sheet 1 of 1
Computed By - DM
Checked By -

Line		Length	Struct.	Contrib. Drg. Area (Ac.)	Runoff "C"	I For Σt (in/hr.)	ΣQ Pipe (CFS)	Pipe Size	Pipe Friction Head	V.	$\frac{V^2}{2g}$	Time in Minutes		Constr. Slope %	Req'd Hydr. Slope %	Struct. Head Loss	Hydraulic Grade Elevation		Structure Flowline Elevation		Upper Street Elev.	Remarks
Upper	Lower											t	Σt				Upper	Lower	Upper	Lower		
304	303	190	Drop Inlet	0.62	0.41	3.83	0.97	15"	0.04	0.79	0.01	4.01	19.01	0.38	0.02	0.01	1332.56	1332.51	1330.52	1329.80	1335.95	3.39' Below Gutter Inlet
303	302	180	"	0.65	0.41	3.42	1.88	15"	0.15	1.53	0.04	1.96	20.97	0.38	0.08	0.04	1332.47	1332.32	1329.80	1329.12	1335.15	2.68' Below Gutter Inlet
302	301	40	Curb Inlet	2.70	0.41	3.25	5.48	24"	0.02	1.74	0.05	0.38	21.35	0.20	0.06	0.01	1332.31	1332.29	1328.37	1328.29	1333.67	1.36' Below Gutter Inlet
301	300	220	"	0.74	0.41	3.14	6.43	24"	0.18	2.05	0.07	1.79	23.14	0.20	0.08	0.01	1332.28	1332.10	1328.29	1327.85	1333.67	1.39' Below Gutter Inlet

STORM DRAINAGE - DESIGN COMPUTATIONS

Project - SYSTEM 400
RIO VISTA ESTATES 4TH ADD'N

Design Storm Frequency - 2 Yr.
Mannings "n" = 0.013
Plan - Enclosed
Profile - Enclosed

Sheet 1 of 1
Computed By - DM
Checked By -

Line		Length	Struct.	Contrib. Drg. Area (Ac.)	Runoff "C"	I For Σt (in/hr.)	Σ Q Pipe (CFS)	Pipe Size	Pipe Friction Head	V.	$\frac{V^2}{2g}$	Time in Minutes		Constr. Slope %	Req'd Hydr. Slope %	Struct. Head Loss	Hydraulic Grade Elevation		Structure Flowline Elevation		Upper Street Elev.	Remarks
Upper	Lower											t	Σt				Upper	Lower	Upper	Lower		
401	400	433	Curb Inlet	0.47 local	0.41	3.83																
			16 off site	0.52	0.52	1.92	20.74	30"	1.13	4.22	0.28	1.71	1.71	0.60	0.26	0.42	1334.15	1332.60	1331.50	1328.90	1336.0	0.77' Below Inlet Crest