7. Will an AMAFCA easement be granted for the floodplain? If so, please show the proposed easement limits on the plan.

8. Plan Sheets 2, 3, 4A, 4B and 5 are not necessary for grading plan approval and need not be provided with the resubmittal.

Please be aware that AMAFCA may have additional comments. If you have any questions, please call me at 924-3982, or contact Brad Catanach at the County or Lisa Manwill at AMAFCA.

Sincerely,

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Brad Catanach, P.E., Bernalillo County Public Works Division
Lisa Manwill, P.E., Albuquerque Metropolitan Arroyo Flood Control Authority
File

Brad Catanach
<bradc@mercury.bernco.gov>

03/15/00 05:57 PM

To: "'Victoria Dery'" <DERY@messenger.asrc.com>

cc: "Susan Calongne (E-mail)" <scalongne@cabq.gov>, "Lisa Manwill (E-mail)" <lmanwill@usa.net>

Subject: RE: Westland - 4W Reservoir

The County does not check contractors' for NPDES permits.

The should address stormwater discharge during discharge such that neighboring property is not adversely impacted, if it becomes an issue then the County may be required to stop the contractor.

The contractor should follow COA criteria stormwater control.

The contractor should reseed per COA specs all disturbed property that is not specifically built on.

> -----Original Message-----
> From: Victoria Dery [SMTP:DERY@messenger.asrc.com]
> Sent: Wednesday, March 15, 2000 8:20 AM
> To: Brad Catanach
> Cc: DERY.ALB.LH@messenger.asrc.com; DIXON.ALB.LH@messenger.asrc.com;
> STOCKTON.ALB.LH@messenger.asrc.com
> Subject: Westland - 4W Reservoir
>
> Will the Contractor be required to obtain an NPDES permit for stormwater
> discharges? Does the Contractor have to address measures to control storm
> water pollution during construction? Is there a County drainage ordinance
> that addresses erosiion/sediment control during and after construction?
> Please let me know as soon as possible so that I can address these issues
> (if necessary) on the construction drawings.

County of Bernalillo

State of New Mexico

BOARD OF COUNTY COMMISSIONERS
TOM RUTHERFORD, CHAIR
DISTRICT 3
BARBARA J. SEWARD, VICE CHAIR
DISTRICT 4
KEN SANCHEZ, MEMBER
DISTRICT 1
STEVE D. GALLEGOS, MEMBER
DISTRICT 2
LES HOUSTON, MEMBER
DISTRICT 5
JUAN R. VIGIL, COUNTY MANAGER

2400 BROADWAY, S.E.
ALBUQUERQUE, NEW MEXICO 87102
PUBLIC WORKS (505) 848-1500

MARK J. CARRILLO, ASSESSOR
JUDY D. WOODWARD, CLERK
IRA ROBINSON, PROBATE JUDGE
JOE BOWDICH, SHERIFF
ORLANDO VIGIL, TREASURER

February 3, 2000

Victoria A. Dery, P.E.
Leedshill-Herkenhoff, Inc.
500 Copper Ave NW
Albuquerque, New Mexico

RE: Drainage Report and Grading and Drainage Plans for 4W Reservoir Site (J7/D1) (PWDN-35) Engineer's Stamp Dated 1/6/00.

Dear Ms. Dery:

This letter is a compilation of comments from my office as well as from County Public Works and AMAFCA. Prior to approval of the above referenced plan, the following comments must be addressed:

1. The report states that the site is within the Westland Master Plan, therefore, please provide the pertinent information from the Westland Master Drainage Management plan that pertains to this site. The master drainage plan for this area was not provided to my office.

2. The off-site drainage basin map (Figure 1) shows that a street and storm drain will cut off the basin sometime in the future. Unless this street and storm drain will be built within the next year or so, the entire off-site basin, including the upland area to the west, must be used to determine whether the site will be damaged in the interim condition. Please show the entire off-site drainage basin. Does the master plan assume that the arroyo is to remain unlined, or is it to be improved in the future?

3. The land treatments use 0% D, therefore developed conditions were not assumed. Please revise the analysis using fully developed land treatments.

4. Why does this development propose a detention pond to restrict the runoff to less than 1 cfs? Typically the developed runoff is restricted to the undeveloped flow rate. Please explain.

5. The Grading and Drainage plan (Sheet 4) shows the limits of the energy grade line (EGL), but the FEMA floodplain limits were not shown. Also provide the locations of the cross-sections in this area that were used in the HEC-RAS analysis. Do the cross-sections in the vicinity of the site take into account the proposed grading on the site?

6. Please calculate the erosion setback (ESB) for the arroyo and plot the ESB limits on the plan.

LEEDSHILL-HERKENHOFF, INC.
an ASCG *Company*
500 Copper Avenue NW, Suite 500
P.O. Box 1217
Albuquerque, New Mexico 87103
(505) 247-0294 Fax (505) 242-4845

LH Project # 99012-04

March 1, 2000

Susan M. Colongne, P.E.
City/County Floodplain Administrator
County of Bernalillo
2400 Broadway, S.E.
Albuquerque, NM 87102

RE: Response to Comments, dated February 3, 2000 – Drainage Report and Grading and Drainage Plans for 4W Reservoir Site (J7/D1) (PWDN-35)

The following responses are enumerated in the same order of those comments received in the referenced correspondence.

1. Drainage management planning for the Westland development is actually presented in the "West I-40 Diversion Drainage Management Plan Summary Report", prepared by Bohannan-Huston, Inc. (BHI) for AMAFCA. We assume you have a copy of this report, dated August, 1999. There is insufficient detail with respect to the portion of Mirehaven Arroyo which impacts the reservoir site.

2. We have discussed with the owner the expected timing of development and he has confirmed that it may not, in fact, occur within the next year or so. Figure 1, attached, reflects "Pre-developed" drainage basin conditions. A new AHYMO run has been generated for "pre-developed" conditions which is also attached. The peak 100-year runoff for pre-development is 180 cfs, which is 20 cfs greater than "post-developed" conditions.

3. Planned development for the tributary basins is for the area to remain as Open Space, thus there will be no land treatment D for off-site basins, even for developed conditions. The reservoir site has land treatment D for all areas covered with an impervious surface. This is properly reflected in the previously submitted Drainage Report, Attachment A-2, calculations for the on-site detention pond outfall pipe. As well, the % D is shown as 17% for HYD 501 computations in the AHYMO file. Locations of land treatment D for the reservoir site are identified on Sheet ELUC4 of 5, attached.

3/3/2000

4. The proposed detention pond was sized based on a peak discharge rate which would result in non-erosive velocities. Based on the pipe size, slope, etc., the discharge rate had to be reduced to 1 cfs to obtain a discharge velocity of less than 5 fps .

5. Flood plain mapping in the FIRM for this arroyo is very general. It was assumed that LH calculations of the water surface profile would be more accurate than trying to translate the FEMA flood plain limits. Delineation of the 100-year flood plain as calculated by LH is illustrated on the attached Figure 2. This figure identifies locations of the cross-sections used for the HEC-RAS analysis. The cross-sections do reflect proposed grading on the site to be developed. Also shown on Figure 2 is the Energy Grade Line limits. The EGL is also plotted on Sheet ELUC4 of 5, attached.

6. It is our understanding that an erosion setback line (ESB) for the arroyo is only relevant if there is no erosion protection on the site. As shown on Sheet ELUC4 of 5, attached, riprap slope protection has been placed around the south and west embankments of the site, which are the surfaces with potential exposure to erosion from the arroyo. The riprap is buried to the calculated scour depth of 5 feet (see attached calculations).

7. The owner has not yet platted the parcel to this level of detail. The owner is responsible for addressing this issue, however, and will do so at the appropriate time.

Should you have any further questions or comments, please call Richard Stockton or me at 247-0294.

LEEDHSILL-HERKENHOFF, INC.

Victoria A. Dery

Victoria A. Dery, P.E.
Project Manager

vad/pg

c: Leroy Chavez, Westland
Brad Catanach, P.E., Bernalillo County PWD
Lisa Manwill, P.E., AMAFCA

J:\WESTLAND\99012\Drainage Comment response.doc

3/3/2000

MIRE14 PRE-DEVELOPMENT

```
START                   TIME=0.0
LOCATION                BERNALILLO COUNTY
* WESTLAND DEVELOPMENT, 4W RESERVOIR, MIREHAVEN ARROYO FLOODPLAIN
* ANALYSIS
* 100-YR, 6-HR RAINFALL
* COMPUTE THE RAINFALL DISTRIBUTION FOR THE ENTIRE PROJECT
*
RAINFALL                TYPE=1   RAIN QUARTER=0.0   RAIN ONE=1.87
                        RAIN SIX=2.20 RAIN DAY=2.66 DT=0.033333
*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10101
*
COMPUTE LT TP           LCODE=1   NK=3  ISLOPE=1
                        LENGTH=1400 FT  SLOPE=0.03  K=0.7
                        LENGTH=410 FT   SLOPE=0.098 K=2
                        LENGTH=450 FT   SLOPE=0.044 K=2

COMPUTE NM HYD          ID=1  HYD=100  DA=0.0380  PER A=59 PER B=32
                        PER C=9 PER D=0  TP=0.0  MASSRAIN=-1
*
SEDIMENT BULK           CODE=1      BULK FACTOR=1.15
*
PRINT HYD               ID=1   CODE=10
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10102
*
COMPUTE LT TP           LCODE=1   NK=3  ISLOPE=1
                        LENGTH=1040 FT SLOPE=0.016 K=0.7
                        LENGTH=390  FT SLOPE=0.026 K=2
                        LENGTH=1380 FT SLOPE=0.054 K=2
*
COMPUTE NM HYD          ID=2  HYD=101 DA=0.0314 PER A=49 PER B=51
                        PER C=0 PER D=0  TP=0.0  MASSRAIN=-1
*
SEDIMENT BULK           CODE=1   BULK FACTOR=1.15
*
PRINT HYD               ID=2   CODE=10
*
*ADD SUB-BASIN 10101 TO 10102
ADD HYD                 ID=3  HYD=102 ID I=1  ID II=2
*
PRINT HYD               ID=3  CODE=10
*
*ROUTE SUB-BASINS 10101 AND 10102
*
COMPUTE RATING CURVE    CID=1  VS NO=2.4  NO SEGS=5  MIN ELEV=5655 FT
                        MAX ELEV=5665 FT  CH SLP=0.5 FP SLP=0.10
                        N=0.04   SEG DIST=50 FT  N=-0.035  SEG DIST=10 FT
                       N=-0.03  SEG DIST=28 FT  N=-0.035  SEG DIST=10 FT
                       N=0.04  SEG DIST=50 FT
                        DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                        0    5665  50    5660  60    5655  88   5655
                        DIST ELEV  DIST  ELEV
                       98   5660  148   5665
*
COMPUTE TRAVEL TIME     ID=4 REACH=1  NO VS=1  L=510  SLP=0.039
*
ROUTE                   ID=4 HYD=200  INFLOW ID=3   DT=0.033333
*
PRINT HYD               ID=4 CODE=10
*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10203
*
COMPUTE LT TP           LCODE=1   NK=2  ISLOPE=1
                        LENGTH=210  FT SLOPE=0.048 K=2
                        LENGTH=1170 FT SLOPE=0.064 K=2
*
COMPUTE NM HYD          ID=5  HYD=201 DA=0.0069 PER A=10 PER B=18
                        PER C=72  PER D=0  TP=0.0  MASSRAIN=-1
*
SEDIMENT BULK           CODE=1    BULK FACTOR=1.15
*
PRINT HYD               ID=5  CODE=10
*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10204
*
```

```
COMPUTE LT TP          LCODE=1   NK=1  ISLOPE=1
                       LENGTH=510  FT SLOPE=0.039 K=2
*
COMPUTE NM HYD         ID=6  HYD=202 DA=0.0088 PER A=0 PER B=86
                       PER C=14  PER D=0  TP=0.0  MASSRAIN=-1
*
SEDIMENT BULK          CODE=1   BULK FACTOR=1.15
*
PRINT HYD              ID=6  CODE=10
*
* ADD FLOWS FROM SUB-BASINS 10203 AND 10204
*
ADD HYD                ID=7 HYD=203  ID I=5  ID II=6
*
PRINT HYD              ID=7  CODE=10
*
*ADD HYDROGRAPHS FOR CHANNEL REACH 1 AND SUB-BASINS 10203 AND 10204
*
ADD HYD                ID=8  HYD=204 ID I=4  ID II=7
*
PRINT HYD              ID=8  CODE=10
*
*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 2
*
COMPUTE RATING CURVE  CID=2  VS NO=3.5  NO SEGS=5  MIN ELEV=5610 FT
                      MAX ELEV=5620 FT  CH SLP=0.25 FP SLP=0.143
                      N=0.040  SEG DIST=35 FT  N=-0.035  SEG DIST=20 FT
                     N=-0.030 SEG DIST=30 FT  N=-0.035  SEG DIST=20 FT
                     N=0.040  SEG DIST=35 FT
                      DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                      0    5620  35    5615  55    5610  85   5610
                      DIST ELEV  DIST  ELEV
                     105  5615  140   5620
*
COMPUTE TRAVEL TIME   ID=9 REACH=2   NO VS=1 L=1305 SLP=0.038
*
ROUTE                 ID=9 HYD=300   INFLOW=8  DT=0.033333
*
PRINT HYD             ID=9  CODE=1
*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10305
*
COMPUTE LT TP        LCODE=1   NK=1  ISLOPE=1
                     LENGTH=1305 FT  SLOPE=0.038 K=2
*
COMPUTE NM HYD        ID=10  HYD=301 DA=0.0299  PER A=0  PER B=16
                      PER C=84 PER D=0 TP=0.0 MASSRAIN=-1
*
SEDIMENT BULK         CODE=1    BULK FACTOR=1.15
*
PRINT HYD             ID=10  CODE=1
*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10306
*
COMPUTE LT TP         LCODE=1   NK=3  ISLOPE=1
                      LENGTH=750 FT  SLOPE=0.085 K=2
                     LENGTH=265 FT  SLOPE=0.019 K=4
                     LENGTH=120 FT  SLOPE=0.167 K=2
*
COMPUTE NM HYD        ID=11  HYD=302  DA=0.0065  PER A=0 PER B=17
                      PER C=83 PER D=0  TP=0.0 MASSRAIN=-1
*
SEDIMENT BULK         CODE=1   BULK FACTOR=1.15
*
PRINT HYD             ID=11   CODE=1
*
* ADD FLOWS FROM SUB-BASINS 10305 AND 10306
*
ADD HYD               ID=12 HYD=303  ID I=10  ID II=11
*
PRINT HYD             ID=12  CODE=10
*
* ADD HYDROGRAPHS FOR SUB-BASINS 10305 AND 10306 AND CHANNEL REACH 2
ADD HYD                ID=13   HYD=304    ID I=12    ID II=9
*
PRINT HYD              ID=13   CODE=10
```

```
*
*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 3
*
COMPUTE RATING CURVE  CID=3  VS NO=4.7  NO SEGS=5  MIN ELEV=5575 FT
                      MAX ELEV=5585 FT  CH SLP=0.20 FP SLP=0.10
                      N=0.040  SEG DIST=50 FT  N=-0.035  SEG DIST=25 FT
                     N=-0.03  SEG DIST=25 FT  N=-0.035  SEG DIST=25 FT
                     N=0.040  SEG DIST=50 FT
                      DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                      0    5585  50    5580  75    5575  100  5575
                      DIST ELEV  DIST  ELEV
                     125  5580  175   5585
*
COMPUTE TRAVEL TIME   ID=14 REACH=3  NO VS=1  L=470  SLP=0.043
*
ROUTE                 ID=14  HYD=400  INFLOW HYD=13  DT=0.033333
*
PRINT HYD             ID=14  CODE=1
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10407
*
COMPUTE LT TP         LCODE=1   NK=1  ISLOPE=1
                      LENGTH=470 FT  SLOPE=0.043 K=2
*
COMPUTE NM HYD        ID=15  HYD=401  DA=0.0095  PER A=0 PER B=34
                      PER C=66  PER D=0  TP=0.0   MASSRAIN=-1
*
SEDIMENT BULK         CODE=1    BULK FACTOR=1.15
*
PRINT HYD             ID=15  CODE=1
*
* ADD HYDROGRAPHS FOR SUB-BASIN 10407 AND CHANNEL REACH 3
*
ADD HYD                ID=16   HYD=402    ID I=15   ID II=14
*
PRINT HYD              ID=16   CODE=10
*
*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 4 IN SUB-BASIN 10508
*
COMPUTE RATING CURVE  CID=4  VS NO=5.8  NO SEGS=5  MIN ELEV=5555 FT
                      MAX ELEV=5565 FT  CH SLP=0.25 FP SLP=0.125
                      N=0.040  SEG DIST=20 FT  N=-0.035  SEG DIST=50 FT
                      N=-0.03  SEG DIST=30 FT  N=-0.035  SEG DIST=50 FT
                      N=0.040  SEG DIST=60 FT
                      DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                      0    5565  20    5560  70    5555  100  5555
                      DIST ELEV  DIST  ELEV
                      150  5560  210   5565
*
COMPUTE TRAVEL TIME   ID=17 REACH=4  NO VS=1  L=270  SLP=0.037
*
ROUTE                 ID=17  HYD=500  INFLOW HYD=16  DT=0.033333
*
PRINT HYD             ID=17  CODE=1
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10509
*
COMPUTE LT TP         LCODE=1   NK=1  ISLOPE=1
                      LENGTH=600 FT  SLOPE=0.105 K=2
*
COMPUTE NM HYD        ID=18  HYD=501  DA=0.0071  PER A=0 PER B=0
                      PER C=83  PER D=17 TP=0.0   MASSRAIN=-1
*
SEDIMENT BULK         CODE=1    BULK FACTOR=1.15
*
PRINT HYD             ID=18  CODE=1
*
* ROUTE FLOWS FROM SUB-BASIN 10509 THROUGH DETENTION POND
*
ROUTE RESERVOIR       ID=19  HYD NO=502 INFLOW ID=18   CODE=5
                      OUTFLOW (CFS)   STORAGE (AC FT)   ELEV (FT)
                      0               0                 5567
                      0.46            0.0970            5568
                      0.64            0.2175            5569
                      0.79            0.3634            5570
                      0.92            0.5387            5571
```

```
*
PRINT HYD                ID=19  CODE=1
*
* ROUTE FLOWS FROM DETENTION POND THROUGH 18-INCH DRAIN PIPE
*
COMPUTE RATING CURVE  CID=5  VS NO=1  CODE=-1  SLP=0.020
                      DIA=1.5 FT  N=0.013
*
COMPUTE TRAVEL TIME   ID=20  REACH=5  NO VS=1 L=108.3 SLP=0.020
*
ROUTE                 ID=20  HYD=503   INFLOW=19  DT=0.03333
*
PRINT HYD             ID=20  CODE=1
*
* ADD HYDROGRAPHS FOR CHANNEL REACH 4 AND 18-INCH DRAIN PIPE
*
ADD HYD               ID=21   HYD=504    ID I=20   ID II=17
*
PRINT HYD             ID=21   CODE=10
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10508
*
COMPUTE LT TP         LCODE=1   NK=1  ISLOPE=1
                      LENGTH=270 FT  SLOPE=0.056 K=2
*
COMPUTE NM HYD        ID=22 HYD=505  DA=0.0020  PER A=0 PER B=16
                      PER C=84  PER D=0  TP=0.0  MASSRAIN=-1
*
SEDIMENT BULK         CODE=1  BULK FACTOR=1.15
*
PRINT HYD             ID=22  CODE=1
*
* ADD HYDROGRAPHS FOR SUB-BASIN 10508, CHANNEL REACH 4 AND 18-INCH
* DRAIN PIPE
*
ADD HYD               ID=23  HYD=506  ID I=22   ID II=21
*
PRINT HYD             ID=23  CODE=10
*
FINISH
```

PRE-DEVELOPMENT :

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =02/16/2000
INPUT FILE = J:\WESTLAND\99012\MIRE14.DAT USER NO.= AHYMO-S-9702c01000LH2-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 NOTATION
START										
LOCATION		BERNALILLO COUNTY								TIME= .00
RAINFALL TYPE= 1										
COMPUTE NM HYD	100.00	-	1	.03800	37.49	1.104	.54483	1.533	1.541	RAIN6= 2.200
SEDIMENT BULK										PER IMP= .00
COMPUTE NM HYD	101.00	-	2	.03140	28.20	1.054	.62916	1.600	1.403	PK BF = 1.15
SEDIMENT BULK										PER IMP= .00
ADD HYD	102.00	1& 2	3	.06940	64.30	2.158	.58298	1.567	1.448	PK BF = 1.15
ROUTE	200.00	3	4	.06940	64.52	2.158	.58299	1.567	1.453	
COMPUTE NM HYD	201.00	-	5	.00690	12.84	.362	.98340	1.500	2.908	
SEDIMENT BULK										PER IMP= .00
COMPUTE NM HYD	202.00	-	6	.00880	13.82	.381	.81218	1.500	2.453	PK BF = 1.15
SEDIMENT BULK										PER IMP= .00
ADD HYD	203.00	5& 6	7	.01570	26.66	.743	.88741	1.500	2.653	PK BF = 1.15
ADD HYD	204.00	4& 7	8	.08510	89.67	2.901	.63915	1.533	1.646	
ROUTE	300.00	8	9	.08510	89.20	2.901	.63915	1.567	1.638	
COMPUTE NM HYD	301.00	-	10	.02990	60.04	1.711	1.07295	1.500	3.138	
SEDIMENT BULK										PER IMP= .00
COMPUTE NM HYD	302.00	-	11	.00650	13.02	.370	1.06869	1.500	3.129	PK BF = 1.15
SEDIMENT BULK										PER IMP= .00
ADD HYD	303.00	10&11	12	.03640	73.06	2.081	1.07218	1.500	3.136	PK BF = 1.15
ADD HYD	304.00	12& 9	13	.12150	158.22	4.982	.76888	1.533	2.035	
ROUTE	400.00	13	14	.12150	157.50	4.982	.76888	1.533	2.025	
COMPUTE NM HYD	401.00	-	15	.00950	17.98	.506	.99888	1.500	2.958	
SEDIMENT BULK										PER IMP= .00
ADD HYD	402.00	15&14	16	.13100	175.24	5.488	.78556	1.533	2.090	PK BF = 1.15
ROUTE	500.00	16	17	.13100	174.77	5.488	.78556	1.533	2.085	
COMPUTE NM HYD	501.00	-	18	.00710	16.37	.505	1.33338	1.500	3.602	
SEDIMENT BULK										PER IMP= 17.00
ROUTE RESERVOIR	502.00	18	19	.00710	.84	.504	1.33020	2.233	.184	PK BF = 1.15
ROUTE	503.00	19	20	.00710	.84	.504	1.33008	2.233	.184	AC-FT= .427
ADD HYD	504.00	20&17	21	.13810	175.35	5.992	.81349	1.533	1.984	
COMPUTE NM HYD	505.00	-	22	.00200	4.02	.114	1.07294	1.500	3.144	
SEDIMENT BULK										PER IMP= .00
ADD HYD	506.00	22&21	23	.14010	179.30	6.107	.81726	1.533	2.000	PK BF = 1.15
FINISH										

use 180 cfs

*****

AHYMO PROGRAM (AHYMO_97) - - Version: 1997.02c
RUN DATE (MON/DAY/YR) = 02/16/2000
START TIME (HR:MIN:SEC) = 11:22:26 USER NO.= AHYMO-S-9702c01000LH2-AH
INPUT FILE = J:\WESTLAND\99012\MIRE14.DAT

START TIME=0.0
LOCATION BERNALILLO COUNTY
Bernalillo County soil infiltration values (LAND FACTORS) used for computations.

Land Treatment	Initial Abstr.(in)	Unif. Infilt.(in/hour)
A	0.65	1.67
B	0.50	1.25
C	0.35	0.83
D	0.10	0.04

* WESTLAND DEVELOPMENT, 4W RESERVOIR, MIREHAVEN ARROYO FLOODPLAIN
* ANALYSIS
* 100-YR, 6-HR RAINFALL
* COMPUTE THE RAINFALL DISTRIBUTION FOR THE ENTIRE PROJECT
*
RAINFALL TYPE=1 RAIN QUARTER=0.0 RAIN ONE=1.87
RAIN SIX=2.20 RAIN DAY=2.66 DT=0.033333

COMPUTED 6-HOUR RAINFALL DISTRIBUTION BASED ON NOAA ATLAS 2 - PEAK AT 1.40 HR.
DT = .033333 HOURS END TIME = 5.999940 HOURS

.0000	.0016	.0033	.0050	.0067	.0085	.0103
.0122	.0141	.0160	.0180	.0201	.0222	.0243
.0266	.0289	.0312	.0337	.0362	.0388	.0415
.0443	.0472	.0502	.0534	.0567	.0601	.0637
.0675	.0715	.0758	.0810	.0865	.0924	.1051
.1335	.1773	.2400	.3257	.4384	.5820	.7607
.9789	1.1808	1.2652	1.3365	1.4000	1.4577	1.5108
1.5602	1.6063	1.6495	1.6902	1.7285	1.7648	1.7991
1.8316	1.8624	1.8917	1.9194	1.9458	1.9519	1.9576
1.9631	1.9683	1.9732	1.9780	1.9826	1.9870	1.9912
1.9953	1.9993	2.0031	2.0068	2.0105	2.0140	2.0174
2.0207	2.0240	2.0272	2.0303	2.0333	2.0363	2.0392
2.0420	2.0448	2.0476	2.0502	2.0529	2.0554	2.0580
2.0605	2.0629	2.0653	2.0677	2.0701	2.0724	2.0746
2.0769	2.0791	2.0812	2.0834	2.0855	2.0876	2.0896
2.0916	2.0936	2.0956	2.0976	2.0995	2.1014	2.1033
2.1052	2.1070	2.1088	2.1106	2.1124	2.1142	2.1159
2.1176	2.1193	2.1210	2.1227	2.1244	2.1260	2.1276
2.1292	2.1308	2.1324	2.1340	2.1355	2.1371	2.1386
2.1401	2.1416	2.1431	2.1446	2.1461	2.1475	2.1489
2.1504	2.1518	2.1532	2.1546	2.1560	2.1573	2.1587
2.1601	2.1614	2.1627	2.1641	2.1654	2.1667	2.1680
2.1693	2.1705	2.1718	2.1731	2.1743	2.1756	2.1768
2.1780	2.1793	2.1805	2.1817	2.1829	2.1841	2.1852
2.1864	2.1876	2.1887	2.1899	2.1911	2.1922	2.1933
2.1945	2.1956	2.1967	2.1978	2.1989	2.2000	

*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10101
*
COMPUTE LT TP LCODE=1 NK=3 ISLOPE=1
LENGTH=1400 FT SLOPE=0.03 K=0.7
LENGTH=410 FT SLOPE=0.098 K=2
LENGTH=450 FT SLOPE=0.044 K=2

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS
NOTE: Upland factor input values have been adjusted to meet Upland/Lag Time requirements.

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	400.0	.030000	.7000
SHALLOW FLOW PORTION	1600.0	.041068	1.9431
CHANNEL FLOW PORTION	260.0	.030000	3.0000

TOTAL BASIN 2260.0 .037836 1.4777

TIME OF CONCENTRATION (HRS)= .2184 TIME TO PEAK (HRS)= .1456 LAG TIME (HRS)= .1638

COMPUTE NM HYD ID=1 HYD=100 DA=0.0380 PER A=59 PER B=32
PER C=9 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1456

K= .161683HR TP= .145605HR K/TP RATIO = 1.110419 SHAPE CONSTANT, N = 3.184557
UNIT PEAK = 77.391 CFS UNIT VOLUME = .9998 B = 296.54 P60 = 1.8700
AREA = .038000 SQ MI IA = .57500 INCHES INF = 1.46000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

*
SEDIMENT BULK CODE=1 BULK FACTOR=1.15
*
PRINT HYD ID=1 CODE=10

PARTIAL HYDROGRAPH 100.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.333	.1	2.667	.9	4.000	.1		
.333	.0	1.667	23.8	3.000	.5	4.333	.0		
.667	.0	2.000	3.8	3.333	.2	4.667	.0		
1.000	.0	2.333	1.8	3.667	.1	5.000	.0		

RUNOFF VOLUME = .54483 INCHES = 1.1042 ACRE-FEET
PEAK DISCHARGE RATE = 37.49 CFS AT 1.533 HOURS BASIN AREA = .0380 SQ. MI.

*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10102
*
COMPUTE LT TP LCODE=1 NK=3 ISLOPE=1
LENGTH=1040 FT SLOPE=0.016 K=0.7
LENGTH=390 FT SLOPE=0.026 K=2
LENGTH=1380 FT SLOPE=0.054 K=2

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS
NOTE: Upland factor input values have been adjusted to meet Upland/Lag Time requirements.

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	400.0	.016000	.7000
SHALLOW FLOW PORTION	1600.0	.043873	1.9462
CHANNEL FLOW PORTION	810.0	.023059	2.7483
TOTAL BASIN	2810.0	.033906	1.4697

TIME OF CONCENTRATION (HRS)= .2884 TIME TO PEAK (HRS)= .1923 LAG TIME (HRS)= .2163

*
COMPUTE NM HYD ID=2 HYD=101 DA=0.0314 PER A=49 PER B=51
PER C=0 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1923

K= .212063HR TP= .192285HR K/TP RATIO = 1.102858 SHAPE CONSTANT, N = 3.205493
UNIT PEAK = 48.691 CFS UNIT VOLUME = .9998 B = 298.17 P60 = 1.8700
AREA = .031400 SQ MI IA = .57350 INCHES INF = 1.45580 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR = 1.15000 AT PEAK FLOW.

*
SEDIMENT BULK CODE=1 BULK FACTOR=1.15
*

PRINT HYD ID=2 CODE=10

PARTIAL HYDROGRAPH 101.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.333	.0	2.667	1.3	4.000	.2	5.333	.0
.333	.0	1.667	24.6	3.000	.7	4.333	.1	5.667	.0
.667	.0	2.000	5.6	3.333	.4	4.667	.1	6.000	.0
1.000	.0	2.333	2.1	3.667	.3	5.000	.0		

RUNOFF VOLUME = .62916 INCHES = 1.0536 ACRE-FEET
PEAK DISCHARGE RATE = 28.20 CFS AT 1.600 HOURS BASIN AREA = .0314 SQ. MI.

*
*ADD SUB-BASIN 10101 TO 10102
ADD HYD ID=3 HYD=102 ID I=1 ID II=2
*
PRINT HYD ID=3 CODE=10

PARTIAL HYDROGRAPH 102.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.333	.1	2.667	2.2	4.000	.2	5.333	.0
.333	.0	1.667	48.4	3.000	1.2	4.333	.1	5.667	.0
.667	.0	2.000	9.4	3.333	.7	4.667	.1	6.000	.0
1.000	.0	2.333	4.0	3.667	.4	5.000	.0		

RUNOFF VOLUME = .58298 INCHES = 2.1578 ACRE-FEET
PEAK DISCHARGE RATE = 64.30 CFS AT 1.567 HOURS BASIN AREA = .0694 SQ. MI.

*
*ROUTE SUB-BASINS 10101 AND 10102
*
COMPUTE RATING CURVE CID=1 VS NO=2.4 NO SEGS=5 MIN ELEV=5655 FT
MAX ELEV=5665 FT CH SLP=0.5 FP SLP=0.10
N=0.04 SEG DIST=50 FT N=-0.035 SEG DIST=10 FT
N=-0.03 SEG DIST=28 FT N=-0.035 SEG DIST=10 FT
N=0.04 SEG DIST=50 FT
DIST ELEV DIST ELEV DIST ELEV DIST ELEV
0 5665 50 5660 60 5655 88 5655
DIST ELEV DIST ELEV
98 5660 148 5665

RATING CURVE VALLEY SECTION 2.4

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
5655.00	.00	.00	.00
5655.53	15.29	342.87	30.11
5656.05	31.69	1108.68	32.21
5656.58	49.20	2218.76	34.32
5657.11	67.82	3647.71	36.42
5657.63	87.54	5383.72	38.53
5658.16	108.38	7421.09	40.63
5658.68	130.32	9757.47	42.74
5659.21	153.37	12392.59	44.84
5659.74	177.53	15327.50	46.95
5660.26	203.35	18656.18	53.27
5660.79	234.16	22405.58	63.80
5661.32	270.52	26515.60	74:33
5661.84	312.41	31007.64	84.86
5662.37	359.85	35900.30	95.38
5662.90	412.82	41210.68	105.91

5663.42	471.34	46954.98	116.44
5663.95	535.40	53148.74	126.96
5664.47	605.00	59806.98	137.49
5665.00	680.14	66945.02	148.00

*

COMPUTE TRAVEL TIME ID=4 REACH=1 NO VS=1 L=510 SLP=0.039

TRAVEL TIME TABLE
REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0063
1.053	31.693	1108.68	.0040
1.579	49.202	2218.76	.0031
2.105	67.819	3647.71	.0026
2.632	87.545	5383.72	.0023
3.158	108.378	7421.09	.0021
3.685	130.320	9757.47	.0019
4.211	153.370	12392.59	.0018
4.737	177.529	15327.50	.0016
5.264	203.351	18656.18	.0015
5.790	234.163	22405.58	.0015
6.316	270.517	26515.60	.0014
6.843	312.411	31007.64	.0014
7.369	359.847	35900.30	.0014
7.896	412.824	41210.68	.0014
8.422	471.342	46954.98	.0014
8.948	535.402	53148.74	.0014
9.475	605.003	59806.98	.0014
10.001	680.145	66945.02	.0014

*

ROUTE ID=4 HYD=200 INFLOW ID=3 DT=0.033333

*

PRINT HYD ID=4 CODE=10

PARTIAL HYDROGRAPH 200.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.333	.1	2.667	2.2	4.000	.2	5.333	.0
.333	.0	1.667	49.7	3.000	1.2	4.333	.1	5.667	.0
.667	.0	2.000	9.6	3.333	.7	4.667	.1	6.000	.0
1.000	.0	2.333	4.0	3.667	.4	5.000	.0		

RUNOFF VOLUME = .58299 INCHES = 2.1578 ACRE-FEET
PEAK DISCHARGE RATE = 64.52 CFS AT 1.567 HOURS BASIN AREA = .0694 SQ. MI.

*

*COMPUTE HYDROGRAPH FOR SUB-BASIN 10203

*

COMPUTE LT TP LCODE=1 NK=2 ISLOPE=1
LENGTH=210 FT SLOPE=0.048 K=2
LENGTH=1170 FT SLOPE=0.064 K=2

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	.0	.000000	.0000
SHALLOW FLOW PORTION	1380.0	.052149	1.9982
CHANNEL FLOW PORTION	.0	.000000	.0000
TOTAL BASIN	1380.0	.052149	1.9982

TIME OF CONCENTRATION (HRS)= .0840 TIME TO PEAK (HRS)= .0560 LAG TIME (HRS)= .0630

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

*

COMPUTE NM HYD ID=5 HYD=201 DA=0.0069 PER A=10 PER B=18
PER C=72 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1333

K= .116200HR TP= .133333HR K/TP RATIO= .871500 SHAPE CONSTANT, N= 4.075881
UNIT PEAK= 18.640 CFS UNIT VOLUME= .9997 B= 360.20 P60= 1.8700
AREA= .006900 SQ MI IA= .40700 INCHES INF= .98960 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT= .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR= 1.15000 AT PEAK FLOW.

*

SEDIMENT BULK CODE=1 BULK FACTOR=1.15

*

PRINT HYD ID=5 CODE=10

PARTIAL HYDROGRAPH 201.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.000	.0	2.000	1.3	3.000	.1		
.333	.0	1.333	.6	2.333	.4	3.333	.0		
.667	.0	1.667	7.0	2.667	.2	3.667	.0		

RUNOFF VOLUME= .98340 INCHES = .3619 ACRE-FEET
PEAK DISCHARGE RATE= 12.84 CFS AT 1.500 HOURS BASIN AREA= .0069 SQ. MI.

*

*COMPUTE HYDROGRAPH FOR SUB-BASIN 10204

*

COMPUTE LT TP LCODE=1 NK=1 ISLOPE=1
LENGTH=510 FT SLOPE=0.039 K=2

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS

	LENGTH (FT)	SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	.0	.000000	.0000
SHALLOW FLOW PORTION	510.0	.039000	2.0000
CHANNEL FLOW PORTION	.0	.000000	.0000
TOTAL BASIN	510.0	.039000	2.0000

TIME OF CONCENTRATION (HRS)= .0359 TIME TO PEAK (HRS)= .0239 LAG TIME (HRS)= .0269

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

*

COMPUTE NM HYD ID=6 HYD=202 DA=0.0088 PER A=0 PER B=86
PER C=14 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1333

K= .127506HR TP= .133333HR K/TP RATIO= .956297 SHAPE CONSTANT, N= 3.695249
UNIT PEAK= 22.065 CFS UNIT VOLUME= .9996 B= 334.31 P60= 1.8700
AREA= .008800 SQ MI IA= .47900 INCHES INF= 1.19120 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT= .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR= 1.15000 AT PEAK FLOW.

```
*
SEDIMENT BULK      CODE=1  BULK FACTOR=1.15
*
PRINT HYD          ID=6  CODE=10

                   PARTIAL HYDROGRAPH  202.00

  TIME   FLOW     TIME   FLOW     TIME   FLOW     TIME   FLOW     TIME   FLOW
  HRS    CFS      HRS    CFS      HRS    CFS      HRS    CFS      HRS    CFS
  .000   .0      1.000   .0      2.000  1.2      3.000   .1      4.000   .0
  .333   .0      1.333   .3      2.333   .5      3.333   .0
  .667   .0      1.667  7.7      2.667   .2      3.667   .0

 RUNOFF VOLUME =    .81218 INCHES    =     .3812 ACRE-FEET
 PEAK DISCHARGE RATE =    13.82 CFS  AT   1.500 HOURS   BASIN AREA =  .0088 SQ. MI.


*
* ADD FLOWS FROM SUB-BASINS 10203 AND 10204
*
ADD HYD            ID=7 HYD=203  ID I=5  ID II=6
*
PRINT HYD          ID=7  CODE=10

                   PARTIAL HYDROGRAPH  203.00

  TIME   FLOW     TIME   FLOW     TIME   FLOW     TIME   FLOW     TIME   FLOW
  HRS    CFS      HRS    CFS      HRS    CFS      HRS    CFS      HRS    CFS
  .000   .0      1.000   .0      2.000  2.5      3.000   .2      4.000   .0
  .333   .0      1.333   .9      2.333   .9      3.333   .1
  .667   .0      1.667  14.7     2.667   .4      3.667   .0

 RUNOFF VOLUME =    .88741 INCHES    =     .7431 ACRE-FEET
 PEAK DISCHARGE RATE =    26.66 CFS  AT   1.500 HOURS   BASIN AREA =  .0157 SQ. MI.


*
*ADD HYDROGRAPHS FOR CHANNEL REACH 1 AND SUB-BASINS 10203 AND 10204
*
ADD HYD            ID=8  HYD=204 ID I=4  ID II=7
*
PRINT HYD          ID=8  CODE=10

                   PARTIAL HYDROGRAPH  204.00

  TIME   FLOW     TIME   FLOW     TIME   FLOW     TIME   FLOW     TIME   FLOW
  HRS    CFS      HRS    CFS      HRS    CFS      HRS    CFS      HRS    CFS
  .000   .0      1.333  1.0      2.667  2.6      4.000   .2      5.333   .0
  .333   .0      1.667  64.4     3.000  1.4      4.333   .1      5.667   .0
  .667   .0      2.000  12.2     3.333   .7      4.667   .1      6.000   .0
 1.000   .0      2.333   5.0     3.667   .4      5.000   .0

 RUNOFF VOLUME =    .63915 INCHES    =    2.9009 ACRE-FEET
 PEAK DISCHARGE RATE =    89.67 CFS  AT   1.533 HOURS   BASIN AREA =  .0851 SQ. MI.


*
*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 2
*
COMPUTE RATING CURVE  CID=2  VS NO=3.5  NO SEGS=5  MIN ELEV=5610 FT
          MAX ELEV=5620 FT  CH SLP=0.25 FP SLP=0.143
          N=0.040  SEG DIST=35 FT  N=-0.035  SEG DIST=20 FT
                   N=-0.030 SEG DIST=30 FT  N=-0.035  SEG DIST=20 FT
                   N=0.040  SEG DIST=35 FT
          DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
          0   5620 35   5615 55   5610 85   5610
```

DIST ELEV DIST ELEV
105 5615 140 5620

RATING CURVE VALLEY SECTION 3.5

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
5610.00	.00	.00	.00
5610.53	16.90	264.43	34.21
5611.05	36.02	869.57	38.42
5611.58	57.35	1768.27	42.63
5612.11	80.90	2951.58	46.84
5612.63	106.66	4419.70	51.05
5613.16	134.64	6176.69	55.27
5613.68	164.84	8228.62	59.48
5614.21	197.26	10582.70	63.69
5614.74	231.89	13246.79	67.90
5615.26	268.94	16365.12	73.69
5615.79	309.67	19960.75	81.06
5616.32	354.28	23920.40	88.43
5616.84	402.76	28258.61	95.80
5617.37	455.13	32988.16	103.17
5617.90	511.37	38121.01	110.54
5618.42	571.50	43668.70	117.91
5618.95	635.50	49642.46	125.28
5619.47	703.38	56053.30	132.64
5620.00	775.14	62912.64	140.00

*

COMPUTE TRAVEL TIME ID=9 REACH=2 NO VS=1 L=1305 SLP=0.038

TRAVEL TIME TABLE
REACH= 2.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0162
1.053	31.693	1108.68	.0104
1.579	49.202	2218.76	.0080
2.105	67.819	3647.71	.0067
2.632	87.545	5383.72	.0059
3.158	108.378	7421.09	.0053
3.685	130.320	9757.47	.0048
4.211	153.370	12392.59	.0045
4.737	177.529	15327.50	.0042
5.264	203.351	18656.18	.0040
5.790	234.163	22405.58	.0038
6.316	270.517	26515.60	.0037
6.843	312.411	31007.64	.0037
7.369	359.847	35900.30	.0036
7.896	412.824	41210.68	.0036
8.422	471.342	46954.98	.0036
8.948	535.402	53148.74	.0037
9.475	605.003	59806.98	.0037
10.001	680.145	66945.02	.0037

*

ROUTE ID=9 HYD=300 INFLOW=8 DT=0.033333

*

PRINT HYD ID=9 CODE=1

HYDROGRAPH FROM AREA 300.00

RUNOFF VOLUME = .63915 INCHES = 2.9009 ACRE-FEET
PEAK DISCHARGE RATE = 89.20 CFS AT 1.567 HOURS BASIN AREA = .0851 SQ. MI.

*

```
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10305
*
COMPUTE LT TP      LCODE=1  NK=1  ISLOPE=1
           LENGTH=1305 FT  SLOPE=0.038 K=2

  Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

  SCS UPLAND METHOD FACTORS
                 LENGTH (FT)    SLOPE (FT/FT)     COMPOSITE K
  SHEET FLOW PORTION          .0        .000000          .0000
  SHALLOW FLOW PORTION      1305.0        .038000         2.0000
  CHANNEL FLOW PORTION          .0        .000000          .0000
  TOTAL BASIN            1305.0        .038000         2.0000

  TIME OF CONCENTRATION (HRS)=  .0930    TIME TO PEAK (HRS)=  .0620    LAG TIME (HRS)=  .0697

  TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
  REVISED VALUES: TIME OF CONCENTRATION (HRS)=  .2000    TIME TO PEAK (HRS)=  .1333    LAG TIME (HRS)=  .1500
*
COMPUTE NM HYD      ID=10  HYD=301 DA=0.0299  PER A=0  PER B=16
           PER C=84 PER D=0 TP=0.0 MASSRAIN=-1
  TIME TO PEAK (hrs)=  .1333

  K=  .109914HR   TP=  .133333HR   K/TP RATIO =  .824357    SHAPE CONSTANT, N =  4.331026
  UNIT PEAK =  84.468   CFS  UNIT VOLUME =  1.000     B =  376.67     P60 = 1.8700
  AREA =    .029900 SQ MI   IA =  .37400 INCHES   INF =  .89720 INCHES PER HOUR
  RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =  .033333

  BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

*
SEDIMENT BULK      CODE=1   BULK FACTOR=1.15
*
PRINT HYD          ID=10  CODE=1

                    HYDROGRAPH FROM AREA  301.00

  RUNOFF VOLUME =    1.07295 INCHES    =     1.7110 ACRE-FEET
  PEAK DISCHARGE RATE =    60.04 CFS  AT  1.500 HOURS  BASIN AREA =  .0299 SQ. MI.

*
*COMPUTE HYDROGRAPH FOR SUB-BASIN 10306
*
COMPUTE LT TP      LCODE=1  NK=3  ISLOPE=1
           LENGTH=750 FT  SLOPE=0.085 K=2
                    LENGTH=265 FT  SLOPE=0.019 K=4
                    LENGTH=120 FT  SLOPE=0.167 K=2

  Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

  SCS UPLAND METHOD FACTORS
                 LENGTH (FT)   ADJUSTED SLOPE (FT/FT)COMPOSITE K
  SHEET FLOW PORTION          .0        .000000          .0000
  SHALLOW FLOW PORTION      870.0        .057813         1.9991
  CHANNEL FLOW PORTION      265.0        .019000         4.0000
  TOTAL BASIN            1135.0        .048751         2.2441

  TIME OF CONCENTRATION (HRS)=  .0636    TIME TO PEAK (HRS)=  .0424    LAG TIME (HRS)=  .0477
```

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

*

COMPUTE NM HYD ID=11 HYD=302 DA=0.0065 PER A=0 PER B=17
PER C=83 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1333

K= .110165HR TP= .133333HR K/TP RATIO= .826242 SHAPE CONSTANT, N= 4.320124
UNIT PEAK= 18.329 CFS UNIT VOLUME= .9996 B= 375.98 P60 = 1.8700
AREA= .006500 SQ MI IA= .37550 INCHES INF= .90140 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT= .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR= 1.15000 AT PEAK FLOW.

*

SEDIMENT BULK CODE=1 BULK FACTOR=1.15

*

PRINT HYD ID=11 CODE=1

HYDROGRAPH FROM AREA 302.00

RUNOFF VOLUME= 1.06869 INCHES = .3705 ACRE-FEET
PEAK DISCHARGE RATE= 13.02 CFS AT 1.500 HOURS BASIN AREA= .0065 SQ. MI.

*

* ADD FLOWS FROM SUB-BASINS 10305 AND 10306

*

ADD HYD ID=12 HYD=303 ID I=10 ID II=11

*

PRINT HYD ID=12 CODE=10

HYDROGRAPH FROM AREA 303.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.000	.0	2.000	8.2	3.000	.3	4.000	.0
.333	.0	1.333	4.5	2.333	2.4	3.333	.1		
.667	.0	1.667	39.2	2.667	.9	3.667	.0		

RUNOFF VOLUME= 1.07218 INCHES = 2.0814 ACRE-FEET
PEAK DISCHARGE RATE= 73.06 CFS AT 1.500 HOURS BASIN AREA= .0364 SQ. MI.

*

* ADD HYDROGRAPHS FOR SUB-BASINS 10305 AND 10306 AND CHANNEL REACH 2

ADD HYD ID=13 HYD=304 ID I=12 ID II=9

*

PRINT HYD ID=13 CODE=10

HYDROGRAPH FROM AREA 304.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.333	5.1	2.667	3.5	4.000	.2	5.333	.0
.333	.0	1.667	108.2	3.000	1.7	4.333	.1	5.667	.0
.667	.0	2.000	21.2	3.333	.9	4.667	.1	6.000	.0
1.000	.0	2.333	7.5	3.667	.5	5.000	.0		

RUNOFF VOLUME= .76888 INCHES = 4.9823 ACRE-FEET
PEAK DISCHARGE RATE= 158.22 CFS AT 1.533 HOURS BASIN AREA= .1215 SQ. MI.

*

*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 3
*

COMPUTE RATING CURVE CID=3 VS NO=4.7 NO SEGS=5 MIN ELEV=5575 FT
MAX ELEV=5585 FT CH SLP=0.20 FP SLP=0.10
N=0.040 SEG DIST=50 FT N=-0.035 SEG DIST=25 FT
N=-0.03 SEG DIST=25 FT N=-0.035 SEG DIST=25 FT
N=0.040 SEG DIST=50 FT
DIST ELEV DIST ELEV DIST ELEV DIST ELEV
0 5585 50 5580 75 5575 100 5575
DIST ELEV DIST ELEV
125 5580 175 5585

RATING CURVE VALLEY SECTION 4.7

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
5575.00	.00	.00	.00
5575.53	14.54	200.70	30.26
5576.05	31.86	671.02	35.53
5576.58	51.95	1385.47	40.79
5577.11	74.80	2345.31	46.05
5577.63	100.43	3557.74	51.32
5578.16	128.83	5032.30	56.58
5578.68	159.99	6779.57	61.85
5579.21	193.93	8810.65	67.11
5579.74	230.64	11136.86	72.37
5580.26	270.47	13922.81	80.27
5580.79	315.49	17198.28	90.80
5581.32	366.06	20839.82	101.33
5581.84	422.17	24867.10	111.86
5582.37	483.81	29297.42	122.38
5582.90	551.00	34146.91	132.91
5583.42	623.73	39430.98	143.44
5583.95	702.00	45164.50	153.96
5584.47	785.82	51362.01	164.49
5585.00	875.17	58038.38	175.00

*
COMPUTE TRAVEL TIME ID=14 REACH=3 NO VS=1 L=470 SLP=0.043

TRAVEL TIME TABLE
REACH= 3.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0058
1.053	31.693	1108.68	.0037
1.579	49.202	2218.76	.0029
2.105	67.819	3647.71	.0024
2.632	87.545	5383.72	.0021
3.158	108.378	7421.09	.0019
3.685	130.320	9757.47	.0017
4.211	153.370	12392.59	.0016
4.737	177.529	15327.50	.0015
5.264	203.351	18656.18	.0014
5.790	234.163	22405.58	.0014
6.316	270.517	26515.60	.0013
6.843	312.411	31007.64	.0013
7.369	359.847	35900.30	.0013
7.896	412.824	41210.68	.0013
8.422	471.342	46954.98	.0013
8.948	535.402	53148.74	.0013
9.475	605.003	59806.98	.0013
10.001	680.145	66945.02	.0013

*
ROUTE ID=14 HYD=400 INFLOW HYD=13 DT=0.033333
*
PRINT HYD ID=14 CODE=1

HYDROGRAPH FROM AREA 400.00

RUNOFF VOLUME = .76888 INCHES = 4.9823 ACRE-FEET
PEAK DISCHARGE RATE = 157.50 CFS AT 1.533 HOURS BASIN AREA = .1215 SQ. MI.

*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10407
*
COMPUTE LT TP LCODE=1 NK=1 ISLOPE=1
LENGTH=470 FT SLOPE=0.043 K=2

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	.0	.000000	.0000
SHALLOW FLOW PORTION	470.0	.042753	2.0000
CHANNEL FLOW PORTION	.0	.000000	.0000
TOTAL BASIN	470.0	.042753	2.0000

TIME OF CONCENTRATION (HRS)= .0316 TIME TO PEAK (HRS)= .0210 LAG TIME (HRS)= .0237

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

*
COMPUTE NM HYD ID=15 HYD=401 DA=0.0095 PER A=0 PER B=34
PER C=66 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1333

K= .114438HR TP= .133333HR K/TP RATIO = .858285 SHAPE CONSTANT, N = 4.143841
UNIT PEAK = 25.981 CFS UNIT VOLUME = .9998 B = 364.65 P60 = 1.8700
AREA = .009500 SQ MI IA = .40100 INCHES INF = .97280 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR = 1.15000 AT PEAK FLOW.

*
SEDIMENT BULK CODE=1 BULK FACTOR=1.15
*
PRINT HYD ID=15 CODE=1

HYDROGRAPH FROM AREA 401.00

RUNOFF VOLUME = .99888 INCHES = .5061 ACRE-FEET
PEAK DISCHARGE RATE = 17.98 CFS AT 1.500 HOURS BASIN AREA = .0095 SQ. MI.

*
* ADD HYDROGRAPHS FOR SUB-BASIN 10407 AND CHANNEL REACH 3
*
ADD HYD ID=16 HYD=402 ID I=15 ID II=14
*
PRINT HYD ID=16 CODE=10

HYDROGRAPH FROM AREA 402.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.333	4.9	2.667	3.8	4.000	.2	5.333	.0
.333	.0	1.667	120.8	3.000	1.8	4.333	.1	5.667	.0

.667	.0	2.000	23.6	3.333	.9	4.667	.1	6.000	.0
1.000	.0	2.333	8.2	3.667	.5	5.000	.0		

RUNOFF VOLUME = .78556 INCHES = 5.4884 ACRE-FEET
PEAK DISCHARGE RATE = 175.24 CFS AT 1.533 HOURS BASIN AREA = .1310 SQ. MI.

*
*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 4 IN SUB-BASIN 10508
*
COMPUTE RATING CURVE CID=4 VS NO=5.8 NO SEGS=5 MIN ELEV=5555 FT
MAX ELEV=5565 FT CH SLP=0.25 FP SLP=0.125
N=0.040 SEG DIST=20 FT N=-0.035 SEG DIST=50 FT
N=-0.03 SEG DIST=30 FT N=-0.035 SEG DIST=50 FT
N=0.040 SEG DIST=60 FT
DIST ELEV DIST ELEV DIST ELEV DIST ELEV
0 5565 20 5560 70 5555 100 5555
DIST ELEV DIST ELEV
150 5560 210 5565

RATING CURVE VALLEY SECTION 5.8

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
5555.00	.00	.00	.00
5555.53	18.56	279.03	40.53
5556.05	42.66	962.31	51.05
5556.58	72.31	2041.71	61.58
5557.11	107.49	3540.47	72.11
5557.63	148.22	5487.42	82.64
5558.16	194.49	7912.92	93.16
5558.68	246.30	10847.61	103.69
5559.21	303.65	14321.90	114.22
5559.74	366.54	18365.80	124.75
5560.26	434.83	23351.85	134.22
5560.79	507.70	29305.38	142.64
5561.32	585.00	35893.29	151.06
5561.84	666.73	43119.02	159.48
5562.37	752.89	50986.23	167.91
5562.90	843.49	59499.21	176.33
5563.42	938.52	68662.96	184.75
5563.95	1037.98	78483.05	193.17
5564.47	1141.88	88965.55	201.59
5565.00	1250.21	100117.60	210.00

*
COMPUTE TRAVEL TIME ID=17 REACH=4 NO VS=1 L=270 SLP=0.037

TRAVEL TIME TABLE
REACH= 4.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0033
1.053	31.693	1108.68	.0021
1.579	49.202	2218.76	.0017
2.105	67.819	3647.71	.0014
2.632	87.545	5383.72	.0012
3.158	108.378	7421.09	.0011
3.685	130.320	9757.47	.0010
4.211	153.370	12392.59	.0009
4.737	177.529	15327.50	.0009
5.264	203.351	18656.18	.0008
5.790	234.163	22405.58	.0008
6.316	270.517	26515.60	.0008
6.843	312.411	31007.64	.0008
7.369	359.847	35900.30	.0008
7.896	412.824	41210.68	.0008

```
                8.422   471.342  46954.98    .0008
                8.948   535.402  53148.74    .0008
                9.475   605.003  59806.98    .0008
               10.001   680.145  66945.02    .0008
*
ROUTE          ID=17  HYD=500  INFLOW HYD=16  DT=0.033333
*
PRINT HYD        ID=17  CODE=1

                 OUTFLOW HYDROGRAPH RESERVOIR  500.00


  RUNOFF VOLUME =    .78556 INCHES    =     5.4884 ACRE-FEET
  PEAK DISCHARGE RATE =   174.77 CFS  AT   1.533 HOURS   BASIN AREA =  .1310 SQ. MI.


*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10509
*
COMPUTE LT TP       LCODE=1  NK=1  ISLOPE=1
          LENGTH=600 FT  SLOPE=0.105 K=2

  Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

  SCS UPLAND METHOD FACTORS
                 LENGTH (FT)   ADJUSTED SLOPE (FT/FT)COMPOSITE K
  SHEET FLOW PORTION          .0        .000000         .0000
  SHALLOW FLOW PORTION      600.0        .058887        2.0000
  CHANNEL FLOW PORTION        .0        .000000         .0000
  TOTAL BASIN             600.0        .058887        2.0000


  TIME OF CONCENTRATION (HRS)=  .0343    TIME TO PEAK (HRS)=  .0229    LAG TIME (HRS)=  .0258


  TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
  REVISED VALUES: TIME OF CONCENTRATION (HRS)=  .2000    TIME TO PEAK (HRS)=  .1333    LAG TIME (HRS)=  .1500
*
COMPUTE NM HYD      ID=18  HYD=501  DA=0.0071  PER A=0 PER B=0
          PER C=83  PER D=17 TP=0.0   MASSRAIN=-1
  TIME TO PEAK (hrs)=  .1333

  K=  .072666HR   TP=  .133333HR   K/TP RATIO =  .545000    SHAPE CONSTANT, N =  7.106420
  UNIT PEAK =  4.7641   CFS  UNIT VOLUME =  .9969     B =  526.28     P60 = 1.8700
  AREA =    .001207 SQ MI   IA =  .10000 INCHES   INF =  .04000 INCHES PER HOUR
  RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =  .033333

  K=  .105893HR   TP=  .133333HR   K/TP RATIO =  .794199    SHAPE CONSTANT, N =  4.514851
  UNIT PEAK =  17.155   CFS  UNIT VOLUME =  .9997     B =  388.14     P60 = 1.8700
  AREA =    .005893 SQ MI   IA =  .35000 INCHES   INF =  .83000 INCHES PER HOUR
  RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =  .033333

  BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

*
SEDIMENT BULK      CODE=1   BULK FACTOR=1.15
*
PRINT HYD        ID=18  CODE=1

                 OUTFLOW HYDROGRAPH RESERVOIR  501.00


  RUNOFF VOLUME =    1.33338 INCHES    =      .5049 ACRE-FEET
  PEAK DISCHARGE RATE =    16.37 CFS  AT   1.500 HOURS   BASIN AREA =  .0071 SQ. MI.
```

*
* ROUTE FLOWS FROM SUB-BASIN 10509 THROUGH DETENTION POND
*
ROUTE RESERVOIR ID=19 HYD NO=502 INFLOW ID=18 CODE=5

OUTFLOW (CFS)	STORAGE (AC FT)	ELEV (FT)
0	0	5567
0.46	0.0970	5568
0.64	0.2175	5569
0.79	0.3634	5570
0.92	0.5387	5571

* * * * * * * * * * * * * * * * *

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
.00	.00	5567.00	.000	.00
.17	.00	5567.00	.000	.00
.33	.00	5567.00	.000	.00
.50	.00	5567.00	.000	.00
.67	.00	5567.00	.000	.00
.83	.00	5567.00	.000	.00
1.00	.00	5567.00	.000	.00
1.17	.01	5567.00	.000	.00
1.33	2.11	5567.08	.007	.04
1.50	16.37	5568.31	.134	.52
1.67	8.56	5569.59	.303	.73
1.83	4.41	5570.07	.377	.80
2.00	2.52	5570.28	.412	.83
2.17	1.15	5570.35	.426	.84
2.33	.61	5570.35	.426	.84
2.50	.36	5570.33	.421	.83
2.67	.22	5570.28	.413	.83
2.83	.14	5570.23	.404	.82
3.00	.09	5570.18	.394	.81
3.17	.06	5570.12	.384	.81
3.33	.05	5570.06	.374	.80
3.50	.03	5570.00	.364	.79
3.67	.03	5569.93	.353	.78
3.83	.02	5569.86	.343	.77
4.00	.02	5569.79	.333	.76
4.17	.02	5569.72	.323	.75
4.33	.02	5569.65	.313	.74
4.50	.02	5569.59	.303	.73
4.67	.02	5569.52	.293	.72
4.83	.02	5569.45	.284	.71
5.00	.02	5569.39	.274	.70
5.17	.02	5569.33	.265	.69
5.33	.02	5569.26	.256	.68
5.50	.03	5569.20	.247	.67
5.67	.03	5569.14	.238	.66
5.83	.03	5569.08	.230	.65
6.00	.03	5569.02	.221	.64
6.17	.01	5568.96	.213	.63
6.33	.00	5568.89	.204	.62
6.50	.00	5568.82	.196	.61
6.67	.00	5568.75	.187	.59
6.83	.00	5568.68	.179	.58
7.00	.00	5568.62	.171	.57
7.17	.00	5568.55	.164	.56
7.33	.00	5568.49	.156	.55
7.50	.00	5568.43	.148	.54
7.67	.00	5568.37	.141	.53
7.83	.00	5568.31	.134	.52
8.00	.00	5568.25	.127	.50
8.17	.00	5568.19	.120	.49
8.33	.00	5568.14	.113	.48
8.50	.00	5568.08	.107	.47

8.67	.00	5568.03	.100	.46
8.83	.00	5567.97	.094	.45
9.00	.00	5567.91	.088	.42
9.17	.00	5567.85	.082	.39

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
9.33	.00	5567.80	.077	.37
9.50	.00	5567.75	.072	.34
9.67	.00	5567.70	.068	.32
9.83	.00	5567.65	.063	.30
10.00	.00	5567.61	.059	.28
10.17	.00	5567.57	.056	.26
10.33	.00	5567.54	.052	.25
10.50	.00	5567.50	.049	.23
10.67	.00	5567.47	.046	.22
10.83	.00	5567.44	.043	.20
11.00	.00	5567.41	.040	.19
11.17	.00	5567.39	.038	.18
11.33	.00	5567.36	.035	.17
11.50	.00	5567.34	.033	.16
11.67	.00	5567.32	.031	.15
11.83	.00	5567.30	.029	.14
12.00	.00	5567.28	.027	.13
12.17	.00	5567.26	.025	.12
12.33	.00	5567.25	.024	.11
12.50	.00	5567.23	.022	.11
12.67	.00	5567.22	.021	.10
12.83	.00	5567.20	.020	.09
13.00	.00	5567.19	.018	.09
13.17	.00	5567.18	.017	.08
13.33	.00	5567.17	.016	.08
13.50	.00	5567.16	.015	.07
13.67	.00	5567.15	.014	.07
13.83	.00	5567.14	.013	.06
14.00	.00	5567.13	.012	.06
14.17	.00	5567.12	.012	.06
14.33	.00	5567.11	.011	.05
14.50	.00	5567.10	.010	.05
14.67	.00	5567.10	.010	.05
14.83	.00	5567.09	.009	.04
15.00	.00	5567.09	.008	.04
15.17	.00	5567.08	.008	.04
15.33	.00	5567.08	.007	.03
15.50	.00	5567.07	.007	.03
15.67	.00	5567.07	.006	.03
15.83	.00	5567.06	.006	.03
16.00	.00	5567.06	.006	.03
16.17	.00	5567.05	.005	.03
16.33	.00	5567.05	.005	.02
16.50	.00	5567.05	.005	.02
16.67	.00	5567.04	.004	.02
16.83	.00	5567.04	.004	.02
17.00	.00	5567.04	.004	.02
17.17	.00	5567.04	.004	.02
17.33	.00	5567.03	.003	.02
17.50	.00	5567.03	.003	.01
17.67	.00	5567.03	.003	.01
17.83	.00	5567.03	.003	.01
18.00	.00	5567.03	.003	.01
18.17	.00	5567.02	.002	.01
18.33	.00	5567.02	.002	.01
18.50	.00	5567.02	.002	.01

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
18.67	.00	5567.02	.002	.01

18.83	.00	5567.02	.002	.01
19.00	.00	5567.02	.002	.01
19.17	.00	5567.02	.002	.01
19.33	.00	5567.02	.002	.01
19.50	.00	5567.01	.001	.01
19.67	.00	5567.01	.001	.01
19.83	.00	5567.01	.001	.01

PEAK DISCHARGE = .837 CFS - PEAK OCCURS AT HOUR 2.23
MAXIMUM WATER SURFACE ELEVATION = 5570.360
MAXIMUM STORAGE = .4265 AC-FT INCREMENTAL TIME= .033333HRS

*
PRINT HYD ID=19 CODE=1

OUTFLOW HYDROGRAPH RESERVOIR 502.00

RUNOFF VOLUME = 1.33020 INCHES = .5037 ACRE-FEET
PEAK DISCHARGE RATE = .84 CFS AT 2.233 HOURS BASIN AREA = .0071 SQ. MI.

*
* ROUTE FLOWS FROM DETENTION POND THROUGH 18-INCH DRAIN PIPE
*
COMPUTE RATING CURVE CID=5 VS NO=1 CODE=-1 SLP=0.020
DIA=1.5 FT N=0.013

RATING CURVE PIPE SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	MAX WIDTH FT
.00	.00	.00	.00
.08	.04	.08	.67
.16	.10	.34	.92
.23	.18	.79	1.09
.31	.27	1.41	1.22
.39	.37	2.21	1.32
.47	.47	3.15	1.39
.55	.58	4.22	1.44
.63	.70	5.40	1.48
.70	.81	6.65	1.50
.78	.93	7.96	1.50
.86	1.05	9.30	1.50
.94	1.16	10.62	1.50
1.02	1.27	11.90	1.50
1.09	1.38	13.11	1.50
1.17	1.48	14.18	1.50
1.25	1.57	15.08	1.50
1.33	1.66	15.72	1.50
1.41	1.72	15.98	1.50
1.50	1.77	15.98	1.50

*
COMPUTE TRAVEL TIME ID=20 REACH=5 NO VS=1 L=108.3 SLP=0.020

TRAVEL TIME TABLE
REACH= 5.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0013
1.053	31.693	1108.68	.0009
1.579	49.202	2218.76	.0007
2.105	67.819	3647.71	.0006
2.632	87.545	5383.72	.0005
3.158	108.378	7421.09	.0004
3.685	130.320	9757.47	.0004
4.211	153.370	12392.59	.0004

4.737	177.529	15327.50	.0003
5.264	203.351	18656.18	.0003
5.790	234.163	22405.58	.0003
6.316	270.517	26515.60	.0003
6.843	312.411	31007.64	.0003
7.369	359.847	35900.30	.0003
7.896	412.824	41210.68	.0003
8.422	471.342	46954.98	.0003
8.948	535.402	53148.74	.0003
9.475	605.003	59806.98	.0003
10.001	680.145	66945.02	.0003

```
*
ROUTE          ID=20  HYD=503  INFLOW=19  DT=0.03333
   Hydrograph incermental time change from DT=  .033333 hours to DT=  .033330 hours
*
PRINT HYD      ID=20  CODE=1

                OUTFLOW HYDROGRAPH RESERVOIR  503.00


  RUNOFF VOLUME =    1.33008 INCHES    =     .5037 ACRE-FEET
  PEAK DISCHARGE RATE =     .84 CFS  AT  2.233 HOURS  BASIN AREA =  .0071 SQ. MI.


*
* ADD HYDROGRAPHS FOR CHANNEL REACH 4 AND 18-INCH DRAIN PIPE
*
ADD HYD        ID=21  HYD=504  ID I=20  ID II=17
*
PRINT HYD      ID=21  CODE=10

                OUTFLOW HYDROGRAPH RESERVOIR  504.00
```

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	1.0	7.999	.5	11.999	.1	15.998	.0
.333	.0	4.333	.9	8.333	.5	12.332	.1	16.332	.0
.667	.0	4.666	.8	8.666	.5	12.665	.1	16.665	.0
1.000	.0	5.000	.7	8.999	.4	12.999	.1	16.998	.0
1.333	4.3	5.333	.7	9.332	.4	13.332	.1	17.332	.0
1.666	123.4	5.666	.7	9.666	.3	13.665	.1	17.665	.0
2.000	24.8	5.999	.7	9.999	.3	13.999	.1	17.998	.0
2.333	9.1	6.333	.6	10.332	.2	14.332	.1	18.331	.0
2.666	4.7	6.666	.6	10.666	.2	14.665	.0	18.665	.0
3.000	2.7	6.999	.6	10.999	.2	14.998	.0	18.998	.0
3.333	1.7	7.333	.5	11.332	.2	15.332	.0	19.331	.0
3.666	1.3	7.666	.5	11.665	.1	15.665	.0	19.665	.0

```
  RUNOFF VOLUME =     .81349 INCHES    =    5.9916 ACRE-FEET
  PEAK DISCHARGE RATE =    175.35 CFS  AT  1.533 HOURS  BASIN AREA =  .1381 SQ. MI.


*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10508
*
COMPUTE LT TP      LCODE=1  NK=1  ISLOPE=1
            LENGTH=270 FT  SLOPE=0.056 K=2

  Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

  SCS UPLAND METHOD FACTORS
                  LENGTH (FT)  ADJUSTED SLOPE (FT/FT)COMPOSITE K
  SHEET FLOW PORTION          .0        .000000          .0000
  SHALLOW FLOW PORTION      270.0        .050496         2.0000
  CHANNEL FLOW PORTION        .0        .000000          .0000
  TOTAL BASIN             270.0        .050496         2.0000
```

TIME OF CONCENTRATION (HRS)= .0167 TIME TO PEAK (HRS)= .0111 LAG TIME (HRS)= .0125

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

*

COMPUTE NM HYD ID=22 HYD=505 DA=0.0020 PER A=0 PER B=16
PER C=84 PER D=0 TP=0.0 MASSRAIN=-1
TIME TO PEAK (hrs)= .1333

K= .109914HR TP= .133333HR K/TP RATIO= .824357 SHAPE CONSTANT, N= 4.331026
UNIT PEAK= 5.6500 CFS UNIT VOLUME= .9982 B= 376.67 P60= 1.8700
AREA= .002000 SQ MI IA= .37400 INCHES INF= .89720 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT= .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR= 1.15000 AT PEAK FLOW.

*

SEDIMENT BULK CODE=1 BULK FACTOR=1.15

*

PRINT HYD ID=22 CODE=1

OUTFLOW HYDROGRAPH RESERVOIR 505.00

RUNOFF VOLUME= 1.07294 INCHES = .1144 ACRE-FEET
PEAK DISCHARGE RATE= 4.02 CFS AT 1.500 HOURS BASIN AREA= .0020 SQ. MI.

*

* ADD HYDROGRAPHS FOR SUB-BASIN 10508, CHANNEL REACH 4 AND 18-INCH
* DRAIN PIPE

*

ADD HYD ID=23 HYD=506 ID I=22 ID II=21

*

PRINT HYD ID=23 CODE=10

OUTFLOW HYDROGRAPH RESERVOIR 506.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	1.0	8.000	.5	12.000	.1	16.000	.0
.333	.0	4.333	.9	8.333	.5	12.333	.1	16.333	.0
.667	.0	4.667	.8	8.667	.5	12.667	.1	16.667	.0
1.000	.0	5.000	.7	9.000	.4	13.000	.1	17.000	.0
1.333	4.6	5.333	.7	9.333	.4	13.333	.1	17.333	.0
1.667	125.6	5.667	.7	9.667	.3	13.667	.1	17.666	.0
2.000	25.2	6.000	.7	10.000	.3	14.000	.1	18.000	.0
2.333	9.3	6.333	.6	10.333	.2	14.333	.1	18.333	.0
2.667	4.7	6.667	.6	10.667	.2	14.667	.0	18.666	.0
3.000	2.7	7.000	.6	11.000	.2	15.000	.0	19.000	.0
3.333	1.7	7.333	.5	11.333	.2	15.333	.0	19.333	.0
3.667	1.3	7.667	.5	11.667	.1	15.667	.0	19.666	.0

RUNOFF VOLUME= .81726 INCHES = 6.1065 ACRE-FEET
PEAK DISCHARGE RATE= 179.30 CFS AT 1.533 HOURS BASIN AREA= .1401 SQ. MI.

*

FINISH

NORMAL PROGRAM FINISH END TIME (HR:MIN:SEC) = 11:22:27

J:\WESTLAND\CALCS\pre.prj
PRE-DEVELOPMENT CONDITIONS

HEC-RAS Plan: Plan 39 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	1000	180.00	90.00	90.81	91.11	91.80	0.040024	8.15	23.58	37.92	1.66
SOUTHERN BRANCH	995	180.00	89.79	90.60	90.92	91.60	0.041231	8.35	23.82	38.00	1.68
SOUTHERN BRANCH	990	180.00	89.59	90.44	90.73	91.38	0.040343	8.09	24.59	40.52	1.66
SOUTHERN BRANCH	980	180.00	89.17	90.10	90.38	91.02	0.033688	7.92	24.87	39.55	1.54
SOUTHERN BRANCH	960	180.00	88.33	89.28	89.60	90.31	0.039951	8.36	23.51	38.34	1.67
SOUTHERN BRANCH	940	180.00	87.50	88.48	88.81	89.52	0.040106	8.37	23.60	38.46	1.67
SOUTHERN BRANCH	920	180.00	86.67	87.78	88.08	88.76	0.035124	8.19	24.31	38.26	1.62
SOUTHERN BRANCH	900	180.00	85.84	86.92	87.25	87.99	0.040368	8.48	23.05	37.39	1.73
SOUTHERN BRANCH	880	180.00	85.00	85.99	86.34	87.13	0.044210	8.64	21.57	34.10	1.78
SOUTHERN BRANCH	870	180.00	84.54	85.33	85.71	86.60	0.059740	9.22	20.52	35.95	1.99
SOUTHERN BRANCH	865	180.00	84.31	85.18	85.53	86.31	0.044490	8.68	21.64	32.82	1.75
SOUTHERN BRANCH	860	180.00	84.08	84.93	85.28	86.08	0.047105	8.65	21.16	31.15	1.77
SOUTHERN BRANCH	850	180.00	83.63	84.79	85.04	85.65	0.028247	7.57	25.18	34.31	1.42
SOUTHERN BRANCH	845	180.00	83.40	84.67	84.91	85.52	0.026393	7.54	25.40	33.62	1.42
SOUTHERN BRANCH	840	180.00	83.17	84.29	84.61	85.33	0.037975	8.30	22.79	32.20	1.62
SOUTHERN BRANCH	820	180.00	82.25	83.29	83.67	84.49	0.044180	8.85	21.05	30.92	1.74
SOUTHERN BRANCH	800	180.00	81.33	82.37	82.73	83.56	0.049137	8.77	20.88	31.62	1.81
SOUTHERN BRANCH	790	180.00	80.87	81.68	82.07	82.97	0.057999	9.20	19.91	29.99	1.95
SOUTHERN BRANCH	780	180.00	80.41	81.36	81.68	82.42	0.042693	8.43	22.04	32.44	1.76
SOUTHERN BRANCH	770	180.00	80.00	80.82	81.17	81.97	0.051550	8.74	21.22	32.99	1.84
SOUTHERN BRANCH	760	180.00	79.55	80.38	80.72	81.48	0.046794	8.56	22.02	34.97	1.78
SOUTHERN BRANCH	740	180.00	78.64	79.59	79.92	80.63	0.037552	8.39	23.63	37.36	1.62
SOUTHERN BRANCH	720	180.00	77.73	78.81	79.16	79.93	0.035853	8.64	22.36	30.51	1.60
SOUTHERN BRANCH	700	180.00	76.82	77.91	78.32	79.22	0.038403	9.46	20.96	27.92	1.69
SOUTHERN BRANCH	680	180.00	75.91	77.10	77.53	78.46	0.040861	9.58	19.86	24.21	1.71
SOUTHERN BRANCH	660	180.00	75.00	76.27	76.70	77.65	0.040678	9.79	19.73	22.61	1.71
SOUTHERN BRANCH	640	180.00	74.19	75.34	75.78	76.76	0.045471	10.05	20.22	29.93	1.85
SOUTHERN BRANCH	620	180.00	73.39	74.75	75.13	75.98	0.030797	9.14	20.64	22.54	1.62
SOUTHERN BRANCH	600	180.00	72.58	74.12	74.49	75.38	0.030077	9.25	20.40	22.06	1.63
SOUTHERN BRANCH	580	180.00	71.77	72.97	73.47	74.56	0.047710	10.50	18.15	20.10	1.86
SOUTHERN BRANCH	570	180.00	71.35	72.47	72.96	74.09	0.053014	10.59	18.22	25.09	2.04
SOUTHERN BRANCH	560	180.00	70.97	72.11	72.56	73.56	0.051471	10.20	20.01	29.86	1.90
SOUTHERN BRANCH	540	180.00	70.16	71.40	71.74	72.54	0.042443	9.11	22.48	32.45	1.72
SOUTHERN BRANCH	520	180.00	69.35	70.56	70.95	71.76	0.035061	9.13	22.16	31.92	1.60
SOUTHERN BRANCH	500	180.00	68.48	69.84	70.23	71.07	0.035528	9.34	22.26	32.33	1.65
SOUTHERN BRANCH	480	180.00	67.16	68.58	69.09	70.20	0.051246	10.37	18.25	24.14	1.90

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	470.*	180.00	66.95	68.23	68.68	69.65	0.045683	9.76	19.34	25.86	1.80
SOUTHERN BRANCH	460	180.00	66.74	67.88	68.29	69.16	0.041395	9.28	20.59	27.74	1.71
SOUTHERN BRANCH	440	180.00	65.87	67.03	67.42	68.33	0.042761	9.70	21.83	36.99	1.81
SOUTHERN BRANCH	420	180.00	65.00	66.13	66.46	67.38	0.052887	9.93	25.58	67.06	1.96
SOUTHERN BRANCH	400	180.00	64.23	65.12	65.48	66.34	0.055333	9.45	22.67	43.71	1.95
SOUTHERN BRANCH	380	180.00	63.46	64.51	64.79	65.42	0.032361	7.94	24.80	37.14	1.51
SOUTHERN BRANCH	360	180.00	62.69	63.72	64.04	64.73	0.037911	8.27	23.42	36.34	1.62
SOUTHERN BRANCH	340	180.00	61.92	62.73	63.10	63.88	0.046813	8.69	21.28	31.19	1.77
SOUTHERN BRANCH	320	180.00	61.15	62.22	62.49	63.10	0.027372	7.92	25.85	35.65	1.41
SOUTHERN BRANCH	310.*	180.00	60.77	61.64	61.99	62.77	0.043903	8.72	21.81	33.70	1.73
SOUTHERN BRANCH	300	180.00	60.39	61.17	61.52	62.29	0.049162	8.58	21.58	34.70	1.80
SOUTHERN BRANCH	280.*	180.00	59.67	60.55	60.81	61.43	0.032349	7.58	24.37	34.31	1.51
SOUTHERN BRANCH	260.*	180.00	58.94	59.83	60.10	60.75	0.035517	7.75	23.66	33.87	1.58
SOUTHERN BRANCH	240.*	180.00	58.22	59.11	59.39	60.04	0.036727	7.77	23.51	34.05	1.60
SOUTHERN BRANCH	220	180.00	57.50	58.41	58.68	59.32	0.037520	7.70	23.67	34.39	1.59
SOUTHERN BRANCH	200.*	180.00	56.81	57.72	57.98	58.61	0.035710	7.58	24.07	34.76	1.56
SOUTHERN BRANCH	180.*	180.00	56.12	57.02	57.28	57.90	0.034993	7.53	24.30	35.26	1.54
SOUTHERN BRANCH	160.*	180.00	55.44	56.33	56.58	57.20	0.035415	7.55	24.36	36.21	1.55
SOUTHERN BRANCH	140	180.00	54.75	55.62	55.88	56.50	0.036008	7.57	24.62	38.68	1.56

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Scour Analysis			SHEET NO. 1 OF 5
	COMPUTED BY: U. Deng	CHECKED BY: DHD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 SUBJECT

Scour analysis of Mirehaven Arroyo

2.0 Purpose

Calculate depth of scour in arroyo along 4W Reservoir Site for potential meandering of arroyo.

3.0 References

3.1 Sediment and Erosion Design Guide prepared for AMAFCA, Nov. 1994

3.2 Hydraulic Analysis of Mirehaven Arroyo Calc. Set, U. Deng, 11/7/99

4.0 Assumptions

4.1 Flow in channel will be parallel to arroyo banks and rock protected berm.

5.0 Criteria/Requirements

5.1 the depth of the rock apron shall be based on the max. scour depth plus 2 feet for additional protection.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Scour Analysis			SHEET NO. 2 OF 5
	COMPUTED BY: V. Deary	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches

See Figure 1 – Ref. 3.2

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: SCOUR ANALYSIS			SHEET NO. OF 3
	COMPUTED BY: RAS	CHECKED BY:	JOB/TASK NO. 99012	DATE:

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 TOTAL SCOUR CALCULATIONS

7.1 ANTI DUNE SCOUR

$h_a = 0.28\,\pi\,y\,F_r^2$

WHERE: $\pi = 3.14$

y = HYDRAULIC DEPTH $\left(\frac{AREA}{TW}\right)$

F_r = FROUDE #

- AT SECTION 940

$F_r = 1.67$

$y = \frac{23.60}{38.46} = 0.61'$

$\therefore h_a = 0.28\,\pi\,(0.61)(1.67)^2 = 1.50'$ $\therefore \frac{1}{2} h_a = \underline{0.75'}$

- AT SECTION 800

$F_r = 1.81$

$y = \frac{20.88}{31.62} = 0.66'$

$\therefore h_a = 0.28\,\pi\,(0.66)(1.81)^2 = 1.90'$ $\therefore \frac{1}{2} h_a = \underline{0.95'}$

- AT SECTION 640

$F_r = 1.85$

$y = \frac{20.22}{29.93} = 0.68'$

$\therefore h_A = 0.28\,\pi\,(0.68)(1.85)^2 = 2.03$ $\therefore \frac{1}{2} h_a = \underline{1.02'}$

- AT SECTION 480

$F_r = 1.90$

$y = \frac{18.25}{24.14} = 0.76'$

$\therefore h_a = 0.28\,\pi\,(0.76)(1.90)^2 = 2.40$ $\therefore \frac{1}{2} h_a = \underline{1.20'}$

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: SCOUR ANALYSIS			SHEET NO. OF 4
	COMPUTED BY: RS	CHECKED BY:	JOB/TASK NO. 99012	DATE:

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

– AT SECTION 400

$F_r = 1.95$

$y = \frac{22.67}{43.71} = 0.52'$

$\therefore h_a = 0.28\pi(0.52)(1.95)^2 = 1.73 \quad \therefore \frac{1}{2} h_a = \underline{0.87'}$

– AT SECTION 300

$F_r = 1.80$

$y = \frac{21.58}{34.70} = 0.62'$

$\therefore h_a = 0.28\pi(0.62)(1.80)^2 = 1.77 \quad \therefore \frac{1}{2} h_a = \underline{0.89'}$

7.2 SCOUR PARALLEL TO WALL

$$\frac{y_s}{y_1} = 0.73 + 0.14\pi F_r^2$$

– AT SECTION 940

$\frac{y_s}{0.61} = 0.73 + 0.14(\pi)(1.67)^2 = \underline{1.19'}$

– AT SECTION 800

$\frac{y_s}{0.66} = 0.73 + 0.14\pi(1.81)^2 = \underline{1.43}$

– AT SECTION 640

$\frac{y_s}{0.68} = 0.73 + 0.14\pi(1.85)^2 = \underline{1.52'}$

– AT SECTION 480

$\frac{y_s}{0.76} = 0.73 + 0.14\pi(1.90)^2 = \underline{1.76'}$

– AT SECTION 400

$\frac{y_s}{0.52} = 0.73 + 0.14\pi(1.95)^2 = \underline{1.25'}$

– AT SECTION 300

$\frac{y_s}{0.62} = 0.73 + 0.14\pi(1.80)^2 = \underline{1.37'}$

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: SCOUR ANALYSIS			SHEET NO. OF 5
	COMPUTED BY: RS	CHECKED BY:	JOB/TASK NO. 99012	DATE:

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

SUMMARY TABLE

SECTION	ANTI-DUNE	LOCAL	TOTAL
940	0.75	1.19	1.94
800	0.95	1.43	2.38
640	1.02	1.52	2.54
→ 480	1.20	1.76	2.96 *
400	0.87	1.25	2.12
300	0.89	1.37	2.26

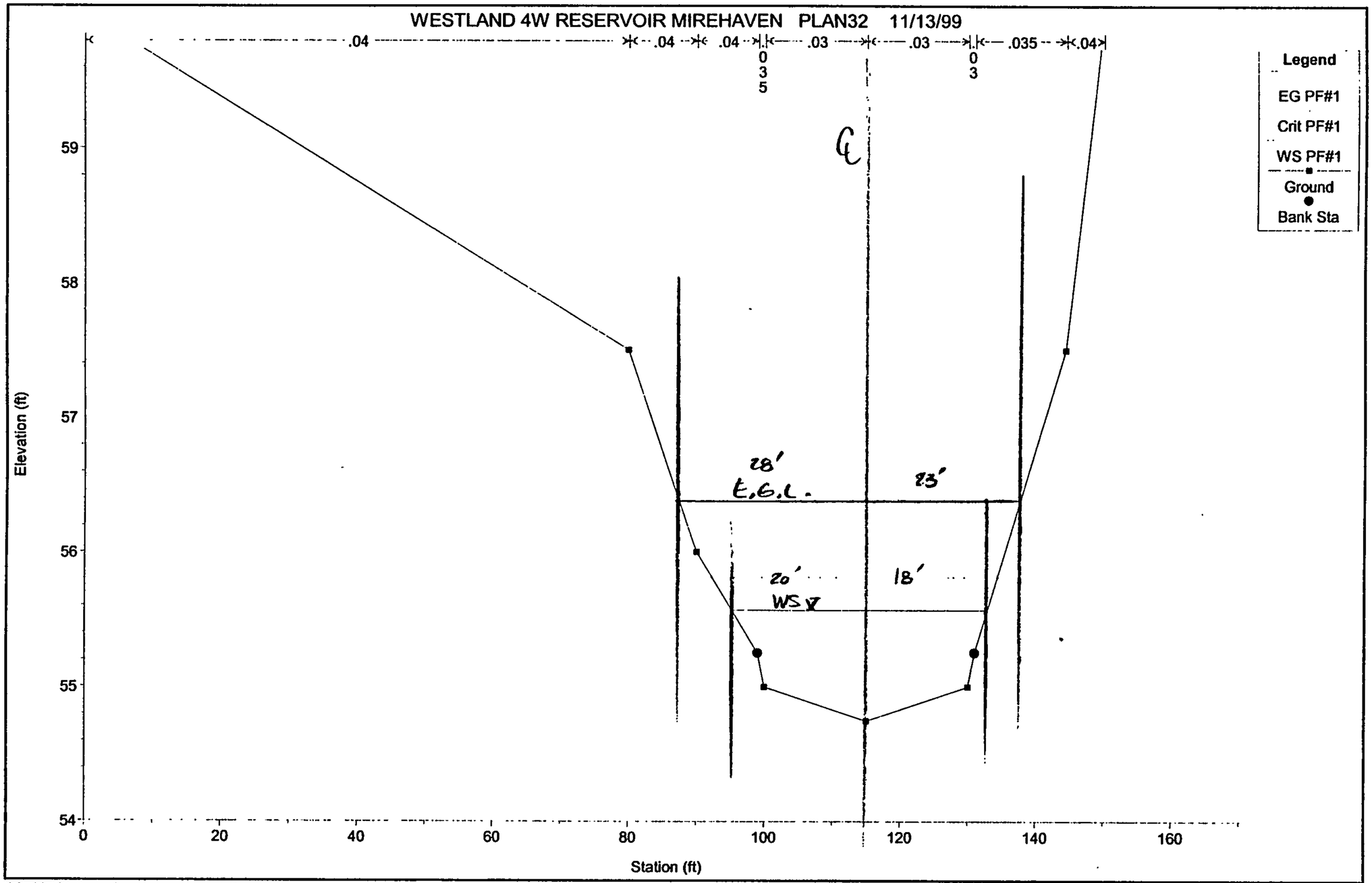
→ * - MOST CRITICAL SECTION

SEE SHEETS 6 AND 7 FOR HYDRAULIC VALUES

CONCLUSION: THE DEEPEST SCOUR CALCULATION IS AT SECTION 480 WHERE THE TOTAL SCOUR = 3.0'. FOR DESIGN ADD 2 ADDITIONAL FEET FOR TOE PROTECTION AND 2 FEET FOR FREEBOARD ABOVE THE EGL ELEVATION.

P:\ACAD\REV-SHT

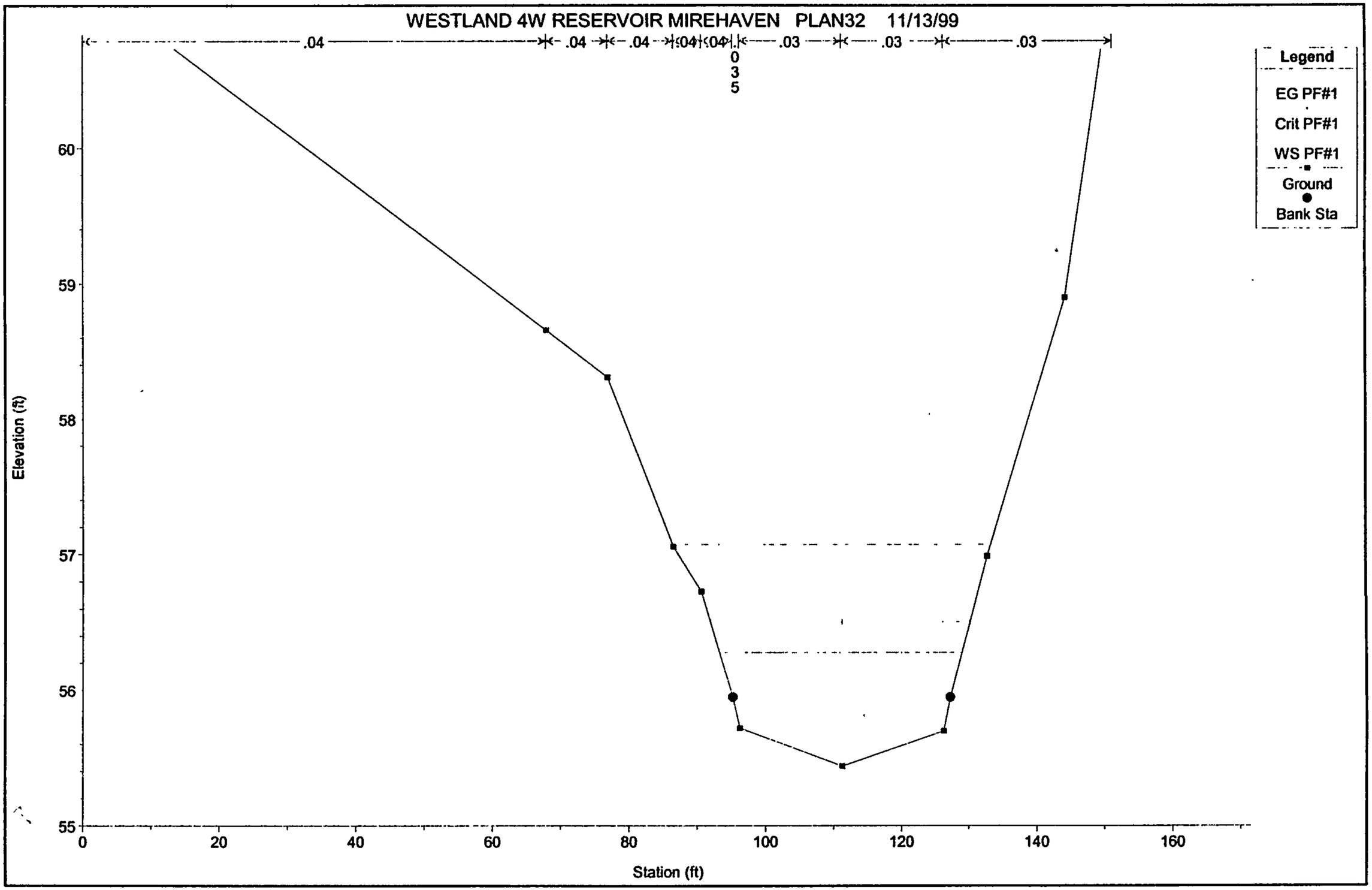
RS = 140



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

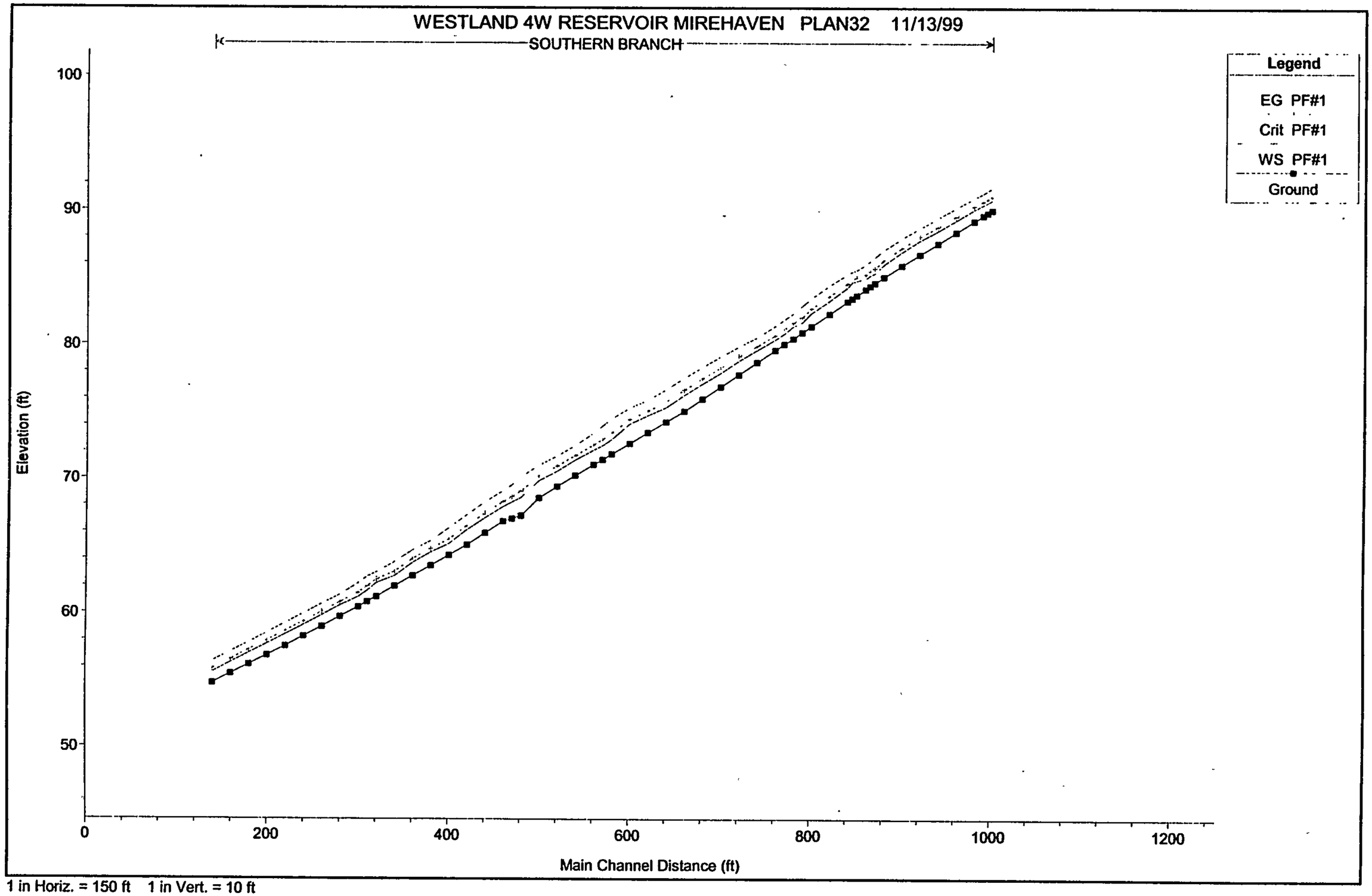
FIGURE 57

RS = 160 *



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 56



1 in Horiz. = 150 ft 1 in Vert. = 10 ft

FIGURE 59

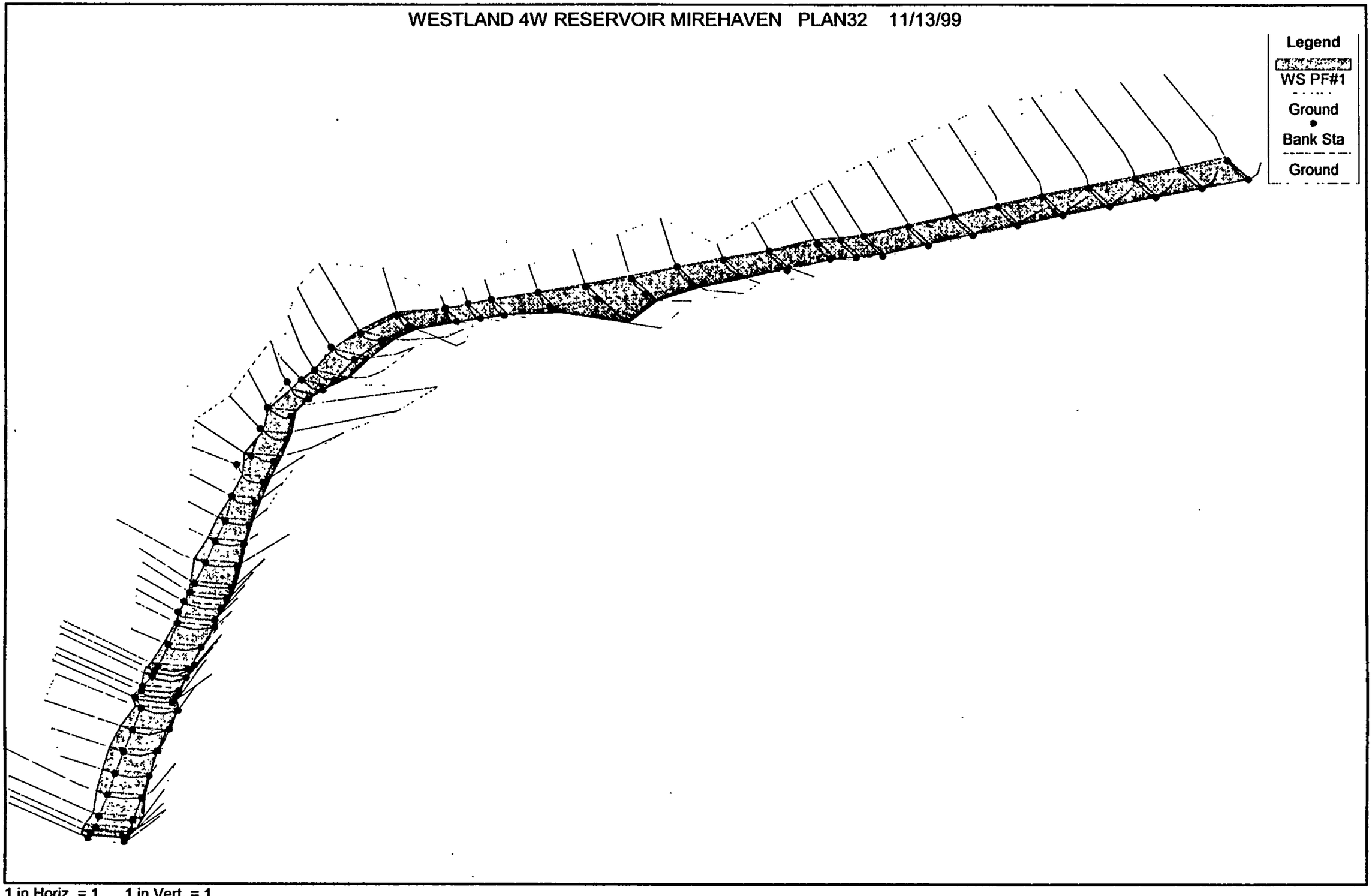

WESTLAND 4W RESERVOIR MIREHAVEN PLAN32 11/13/99
Legend
WS PF#1
Ground
Bank Sta
Ground
1 in Horiz. = 1
1 in Vert. = 1

FIGURE 58

RS = 260*

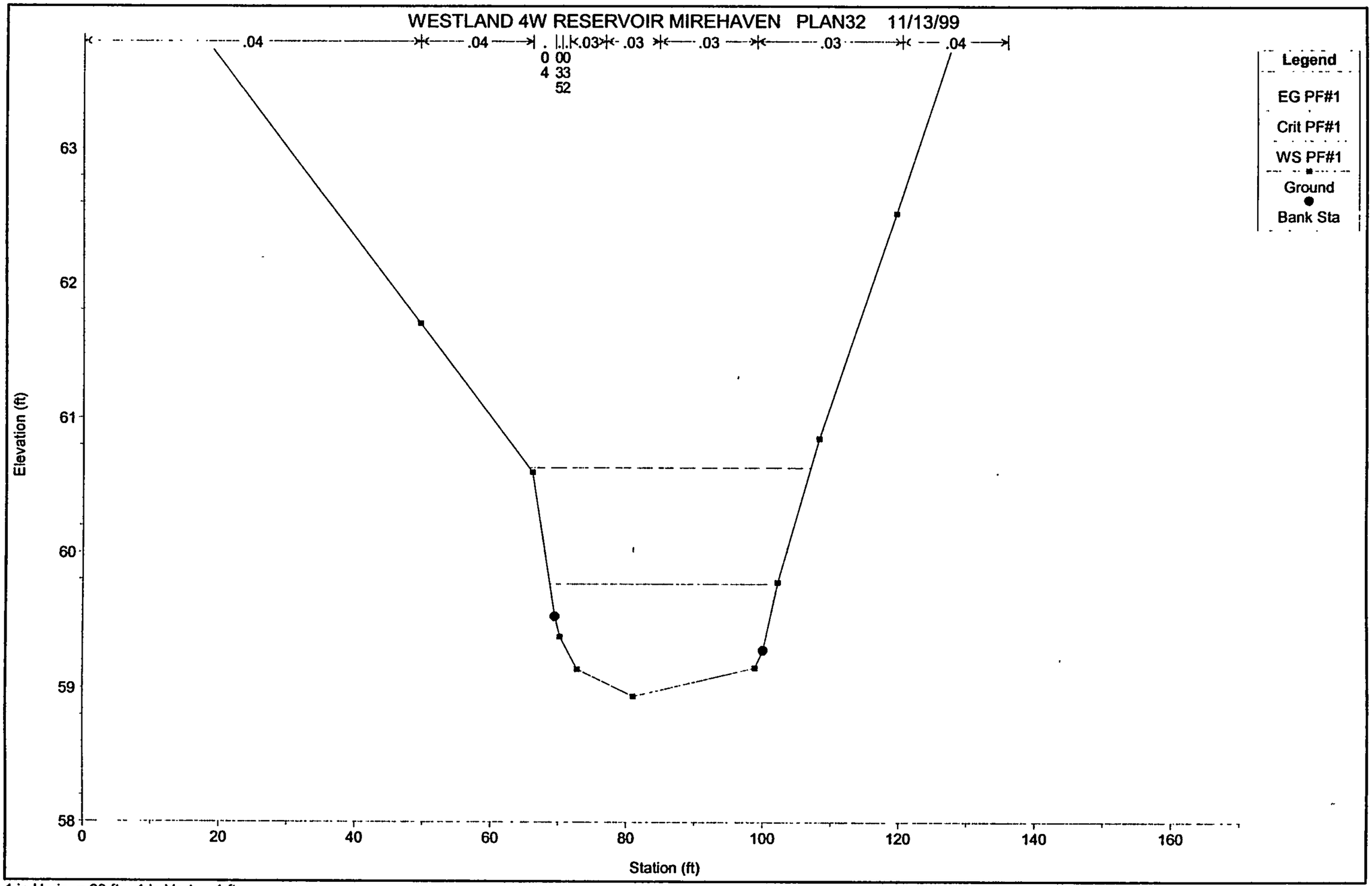
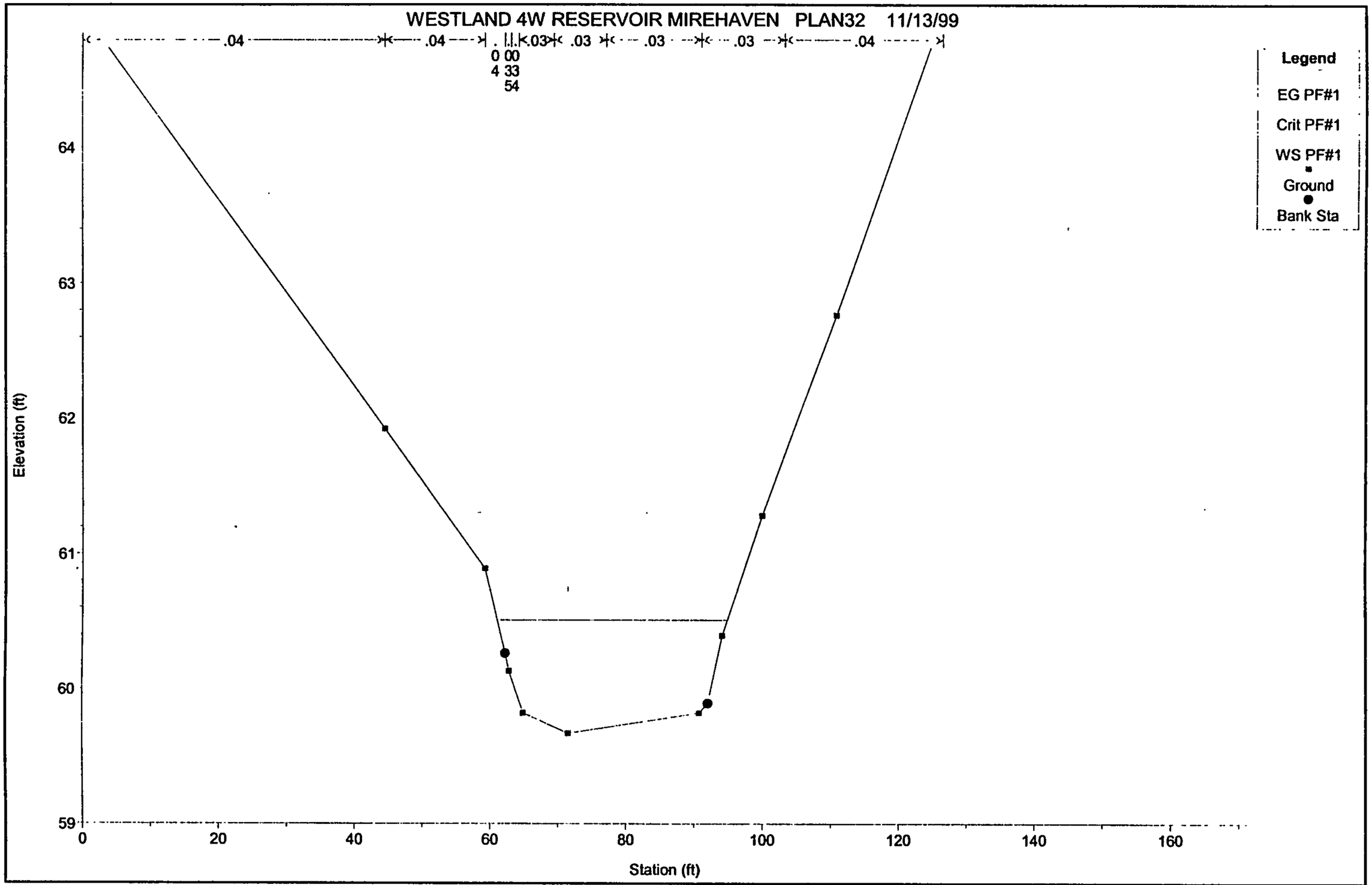


FIGURE 51

RS = 280*



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

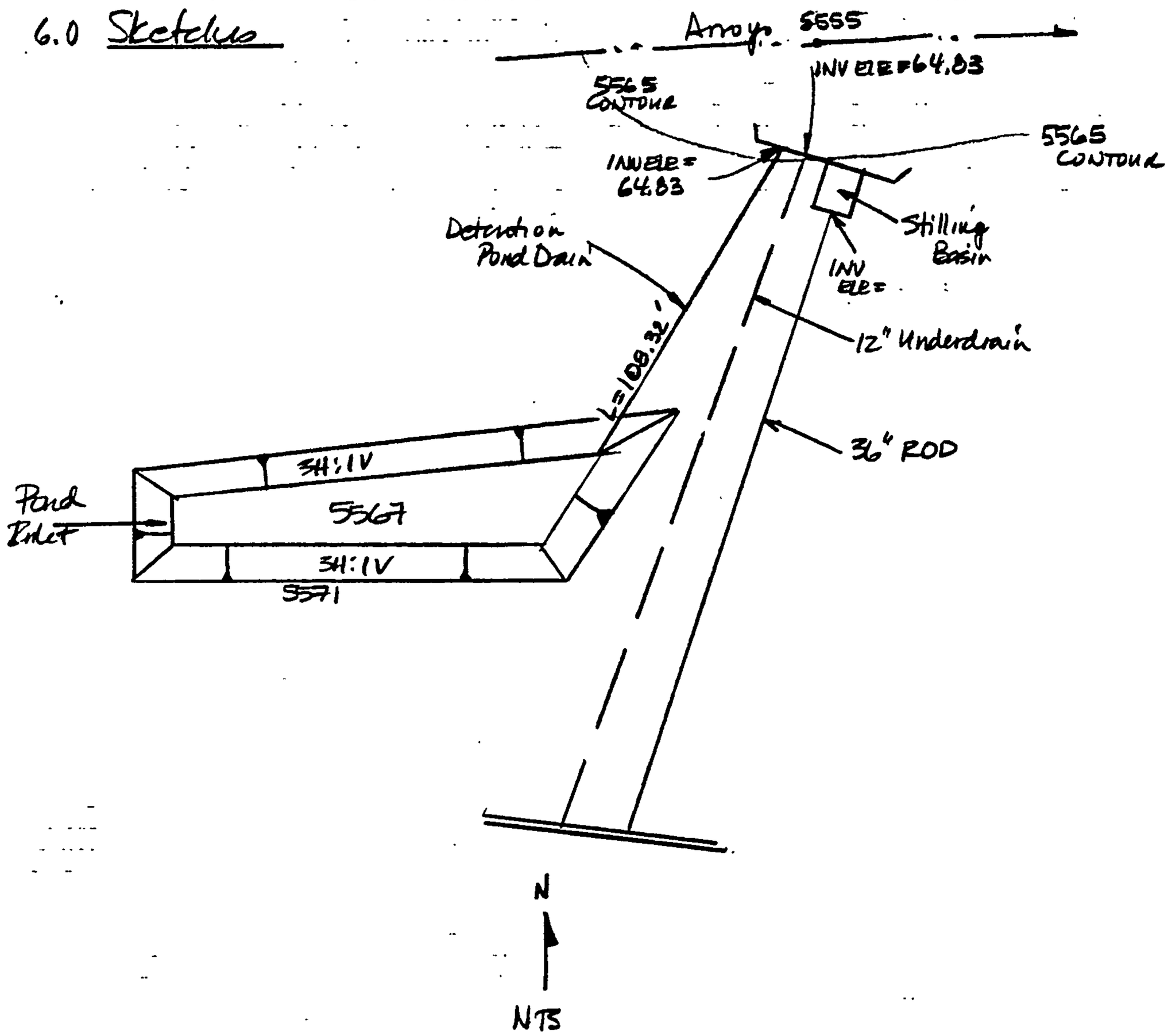
FIGURE 50

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe for 4W Res. Det Pond			SHEET NO. 3 OF 18
	COMPUTED BY: Kerry	CHECKED BY: DWD	JOB/TASK NO. 99012-02	DATE: 11/21/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches



$$S = \frac{67 - 64.83}{108.32}$$

$$= 0.02 \text{ ft/ft}$$

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe for 4W Res. Det. Pond			SHEET NO. 2 OF 11
	COMPUTED BY: V. Dery	CHECKED BY: DWD	JOB/TASK NO. 99012-03	DATE: 11/21/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

5.3 Discharge velocity @ outfall should be greater than 3fps to keep the pipe self cleaning and less than 5 fps to minimize erosion requirements at outfall.

5.4 Size outfall pipe to convey peak flow under non-surcharge conditions for the 100-year, 6-hr rainfall event.

5.5 Minimum pipe slope should be 0.005 ft/ft for adequate drainage.

5.6 Outfall pipe should be sized to drain detention pond within 24 hrs.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: 4W Reservoir Detention Pond			SHEET NO. 6 OF 7
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012-02	DATE: 10/27/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.6 Total Volume

$0.47(43{,}530) + 580 = 21{,}053$ say $\underline{\underline{21{,}000 \text{ cf}}}$

7.7 Spillway (Ref 3.3)

$Q = CLH^{3/2}$

Assume $C = 3$

Assume $H = 1$ ft

Bulk.

$Q = 14.3$ cfs $(1.15) = 16.4$ cfs

$L = \frac{16.4}{3(1)}$

$= 5.5'$ use $\underline{\underline{6'}}$

7.8 Configuration (see Figure 1)

Area @ bottom (elev = 5567) = 3643 sf

Area @ top (elev = 5571) = 8254 sf (spillway elevation)

Volume $= \frac{1}{2}(8254 + 3643) \times (5571 - 5567)$

$= 23{,}794$ cf

Determine how much freeboard is available.

$23{,}794 - 21{,}000 = 2794$ cf

$\frac{2794 \text{ cf}}{8254 \text{ sf}} \times 12 = 4''$ (available freeboard)

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe for 4W Res. Det. Pond.			SHEET NO. 1 OF 11
	COMPUTED BY: V. Deery	CHECKED BY: DWO	JOB/TASK NO. 99012-03	DATE: 10/26/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 Subject

OUTFALL PIPE FOR 4W Reservoir Detention Pond

2.0 Purpose

SIZE OUTFALL PIPE FOR THE 100-YR, 6-HR RAINFALL EVENT

3.0 References

3.1 Chapter 22 of COA Development Process Manual, 1997 ed.

3.2 Civil Engineering Reference Manual, 6th Edition, 1986 Michael R. Lindeburg.

3.3 Hydraulic Analysis of Nuchaven Arroyo Calc. Set, V. Deery, 11/7/99

4.0 Assumptions

4.1 Minimum pipe diameter will be 18" for ease in cleaning and maintenance.

4.2 Drain pipe will be concrete pipe.

4.3 Invert of drain pipe will be 1' above invert of Reservoir Overflow Drain (ROD) at elev. 62.78

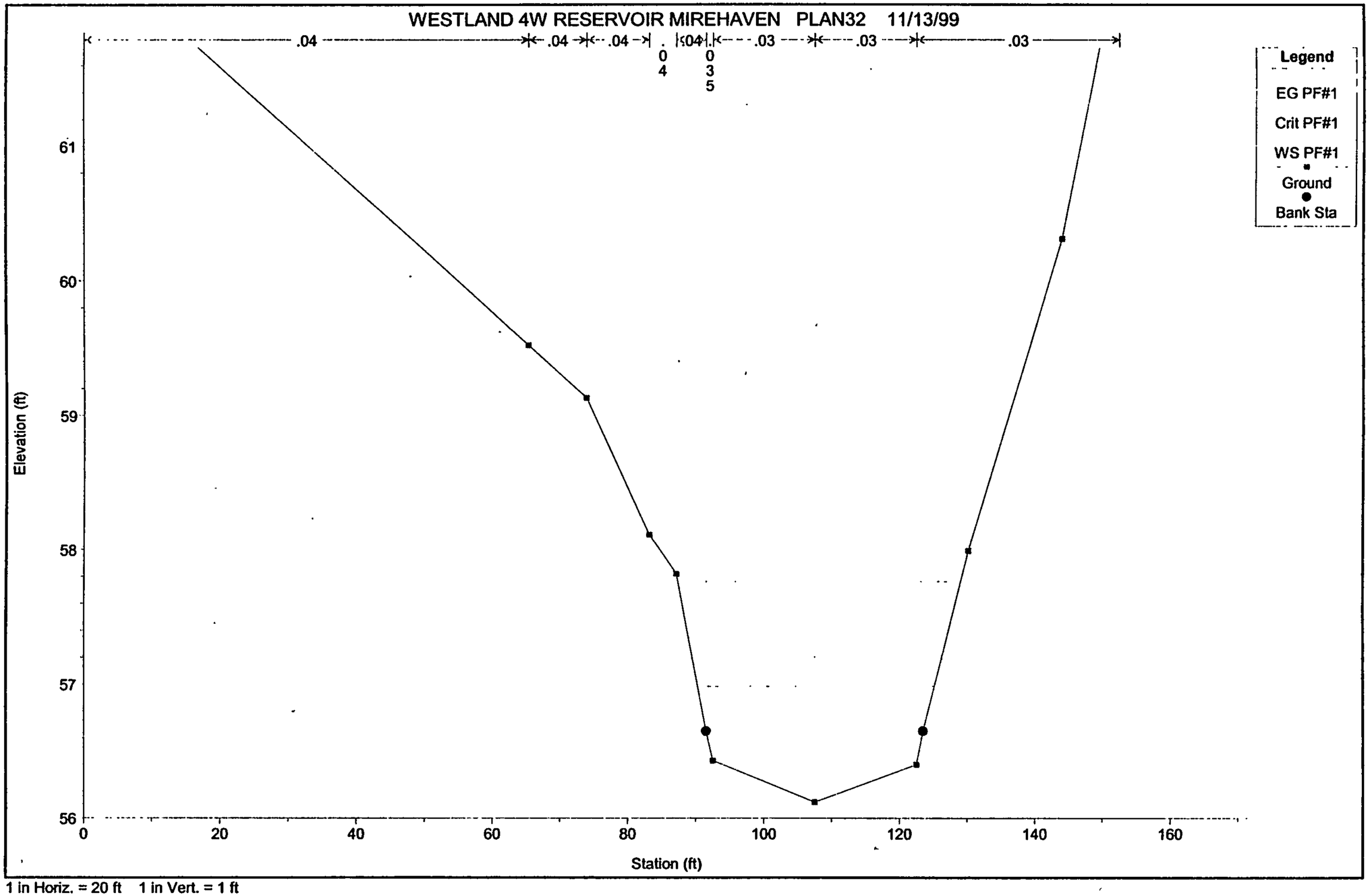
5.0 Criteria/Requirements

5.1 No grading is allowed within the 100-yr floodplain nor the E.G.L. established in the previous calculations.

5.2 The pipe outfall will be located within the property boundary.

REV-SHT

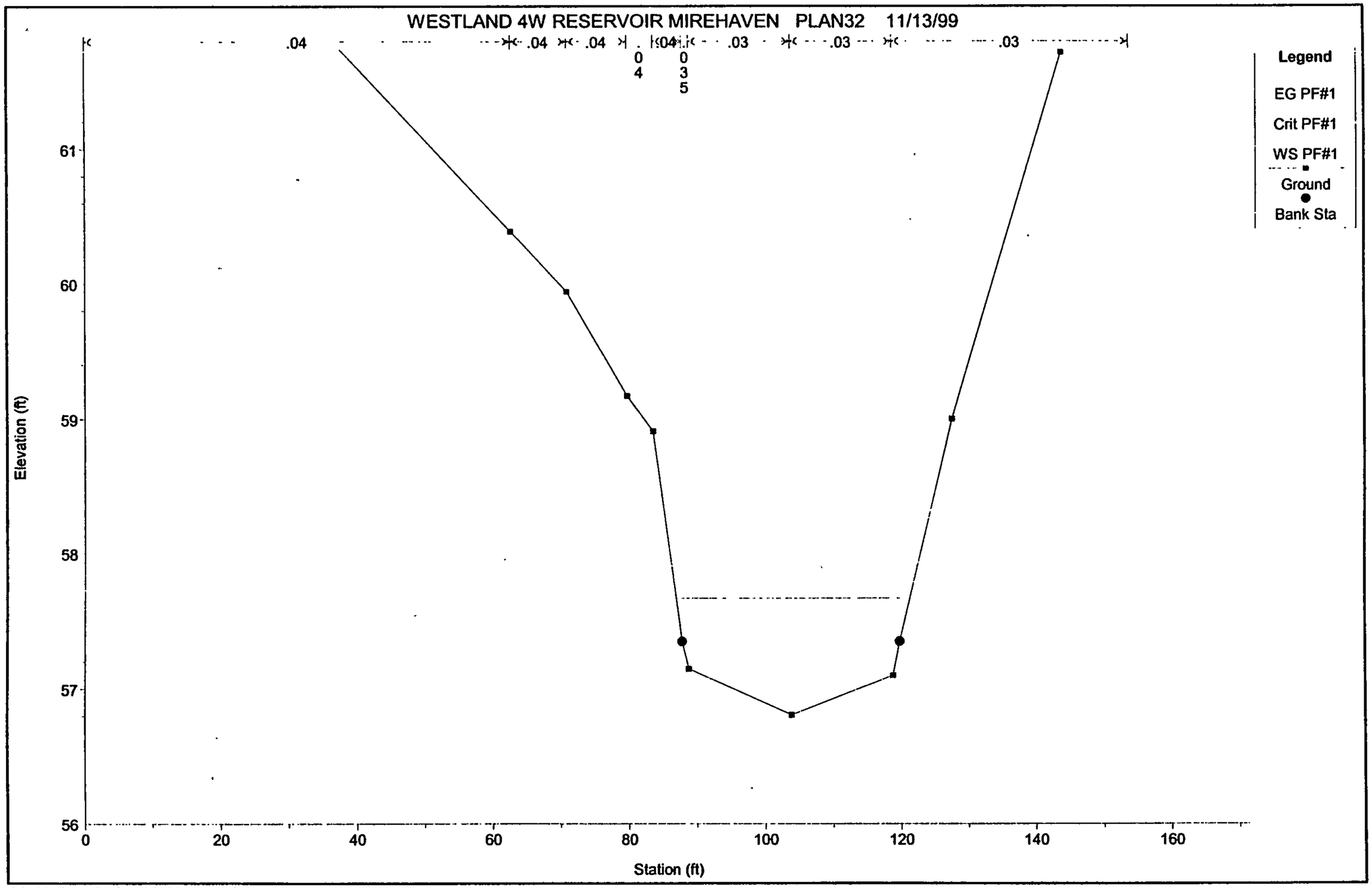
RS =180*



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 55

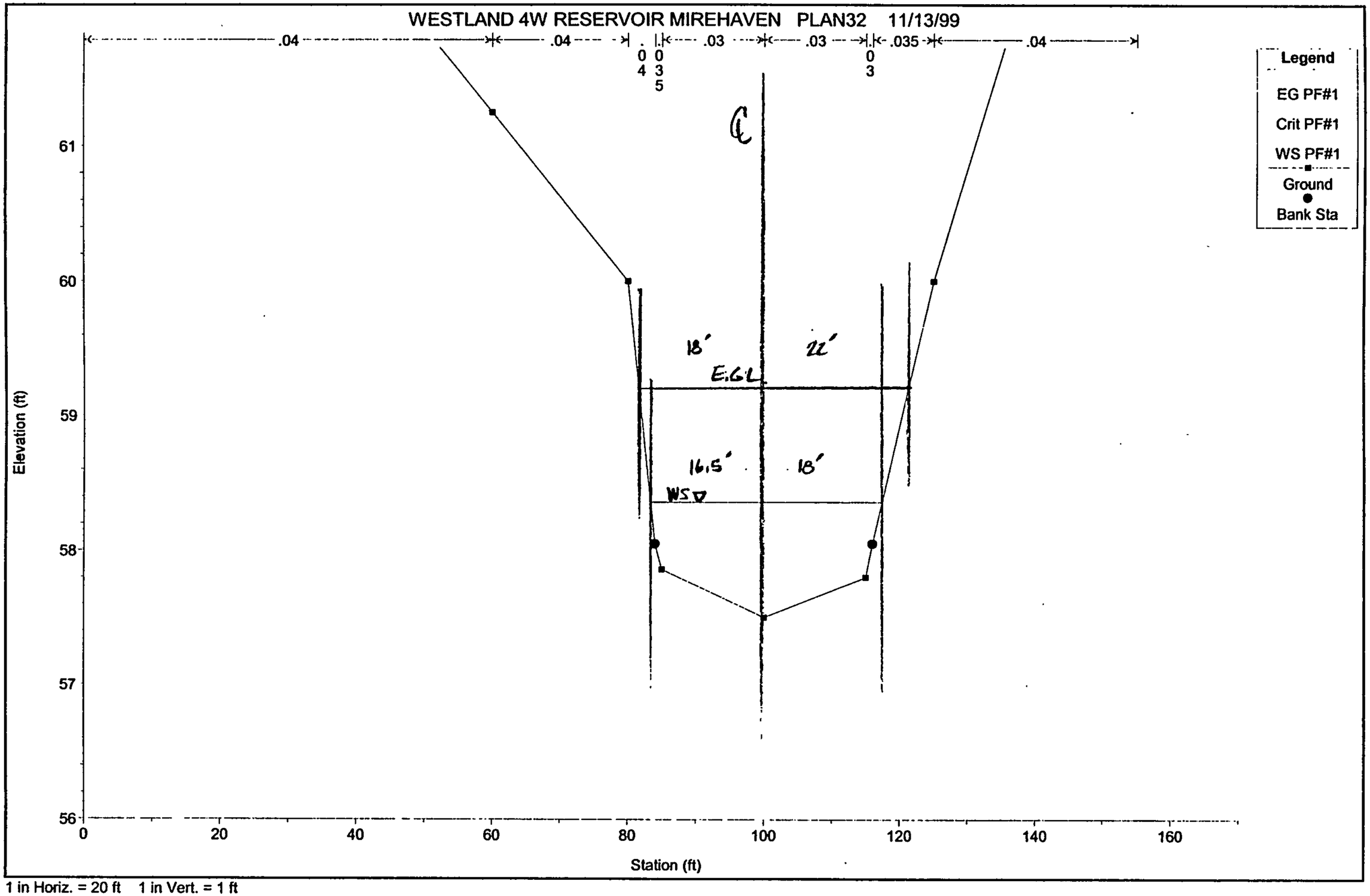
RS = 200*



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 5A

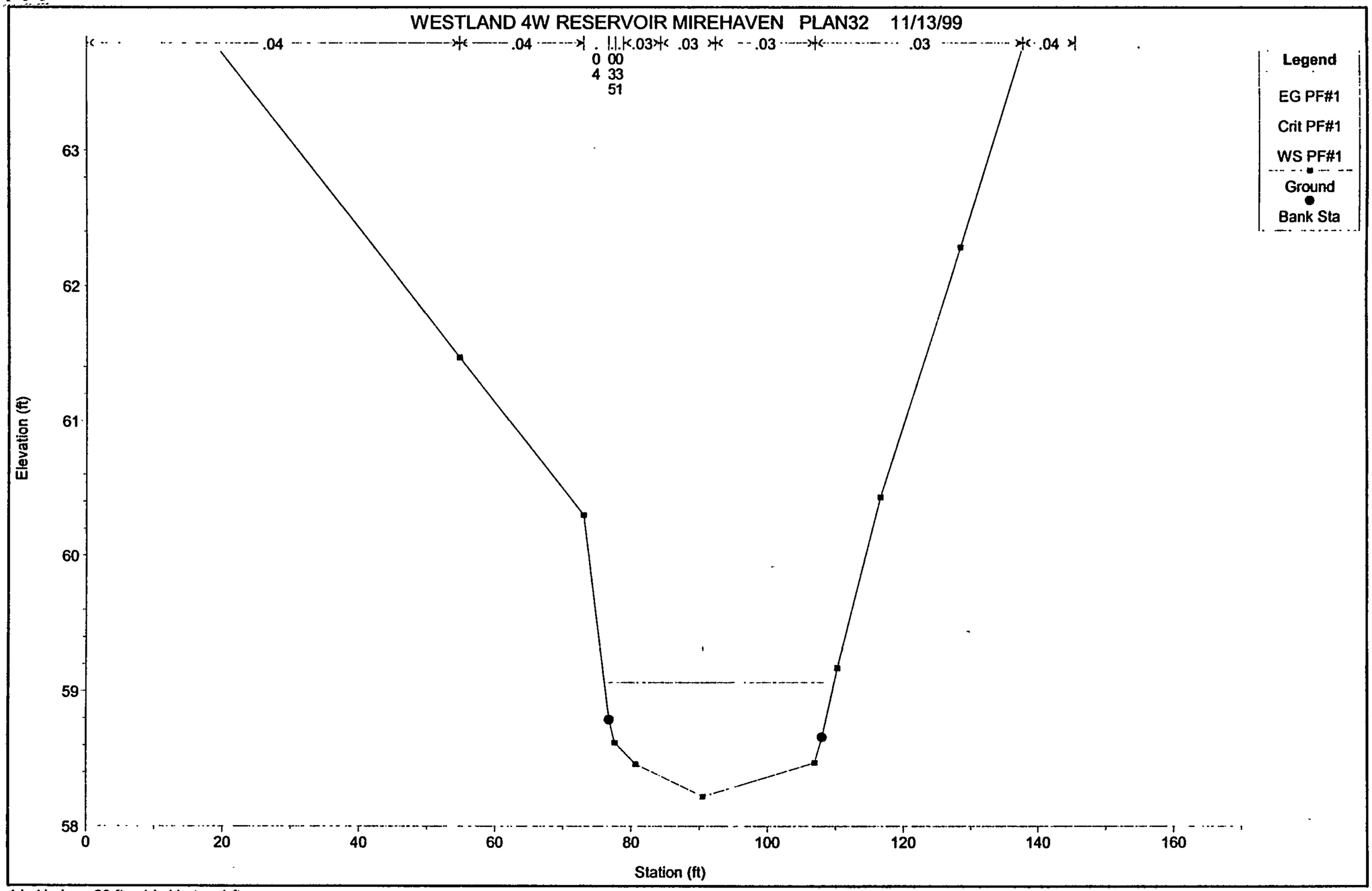
RS = 220



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 53

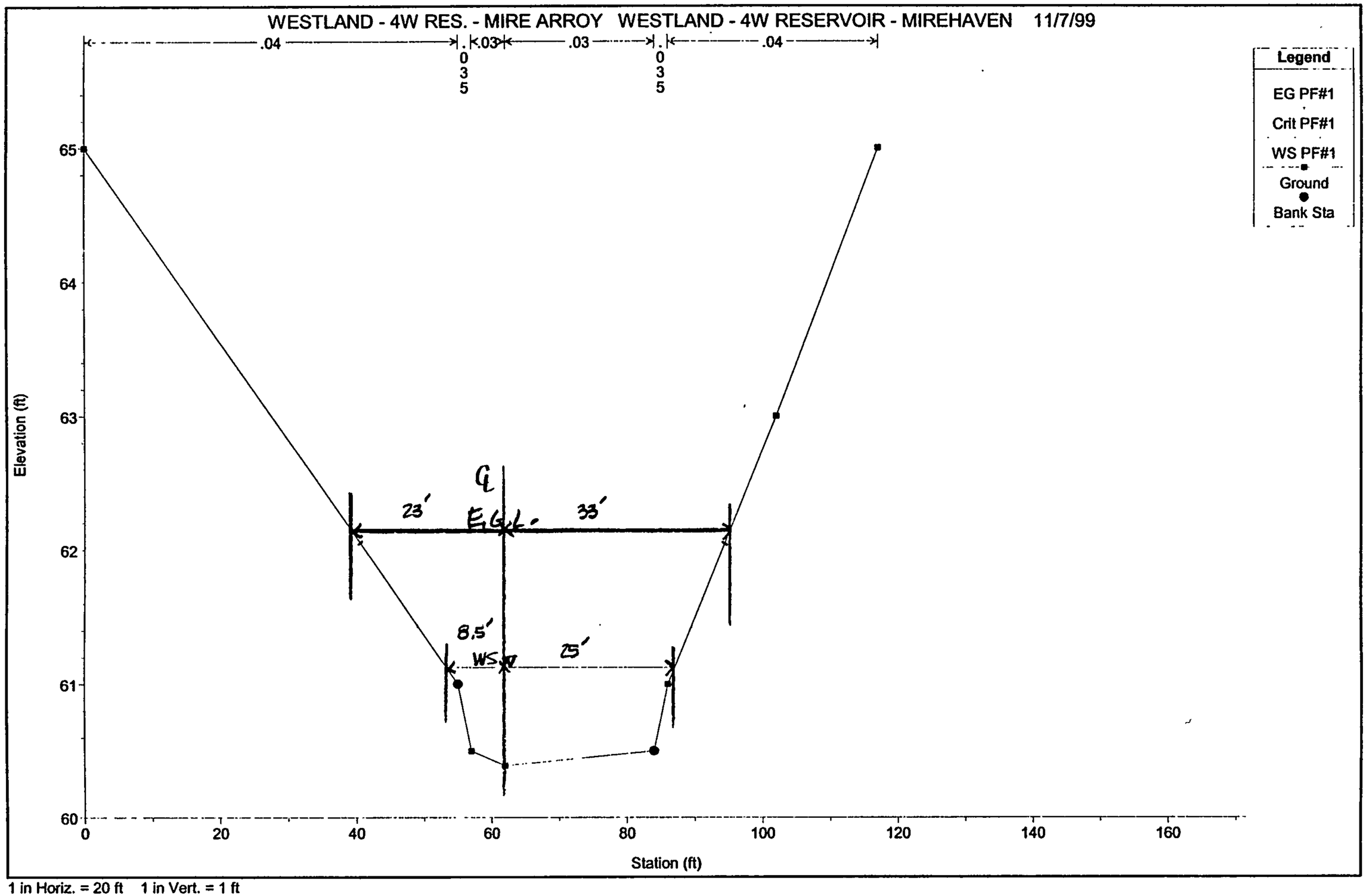
RS = 240*



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 52

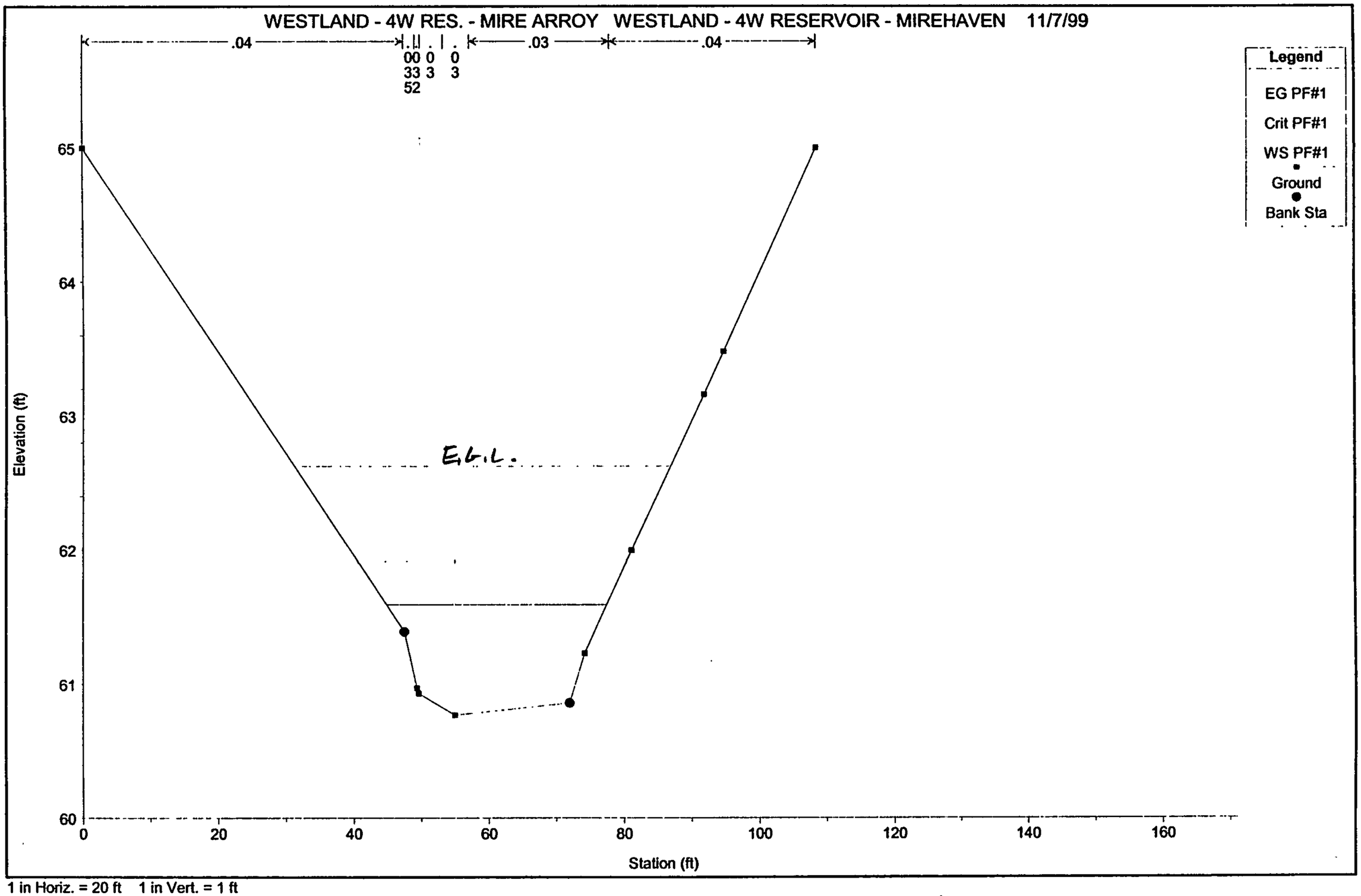
RS = 300



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 49

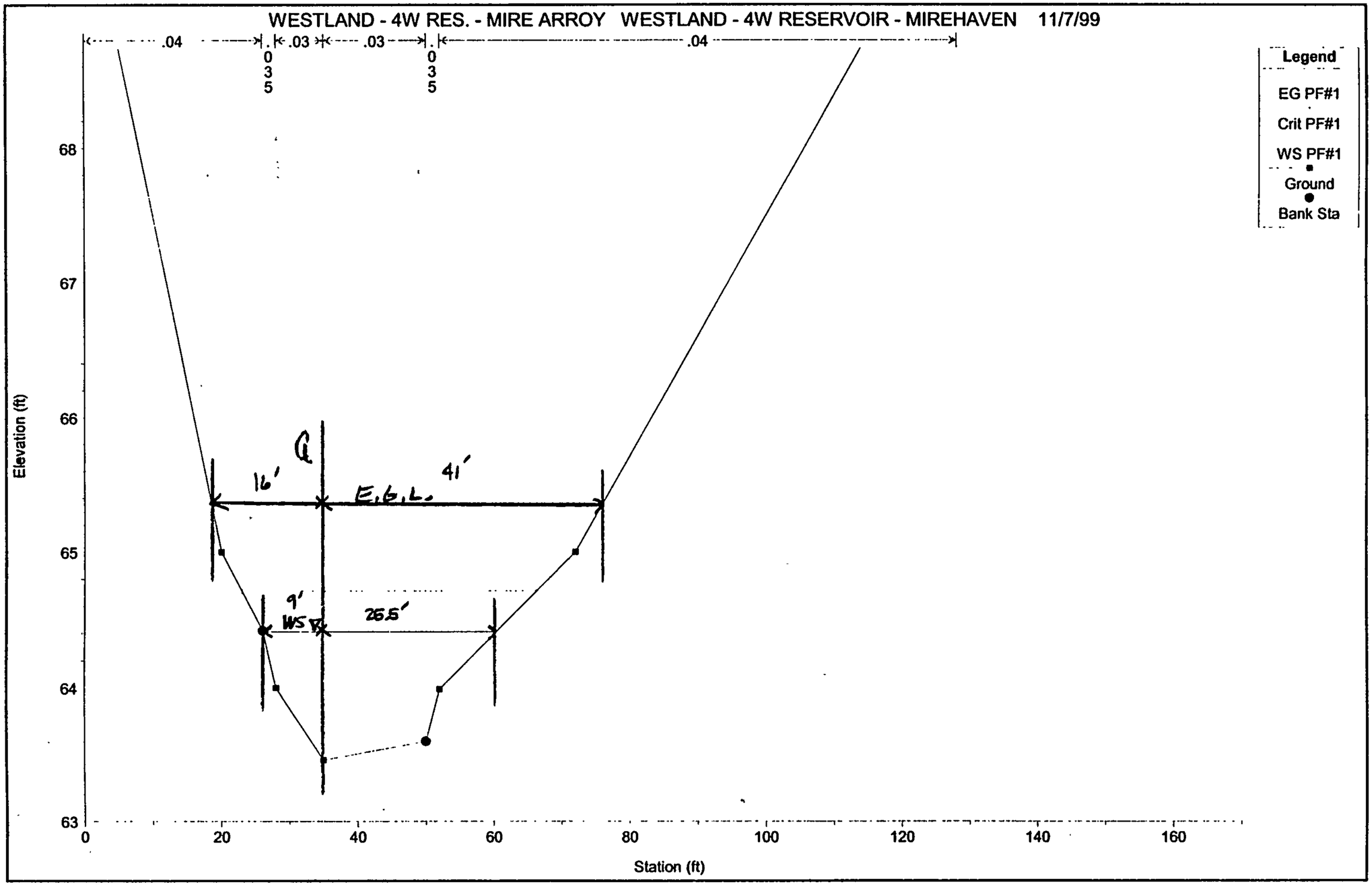
RS = 310*



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 48

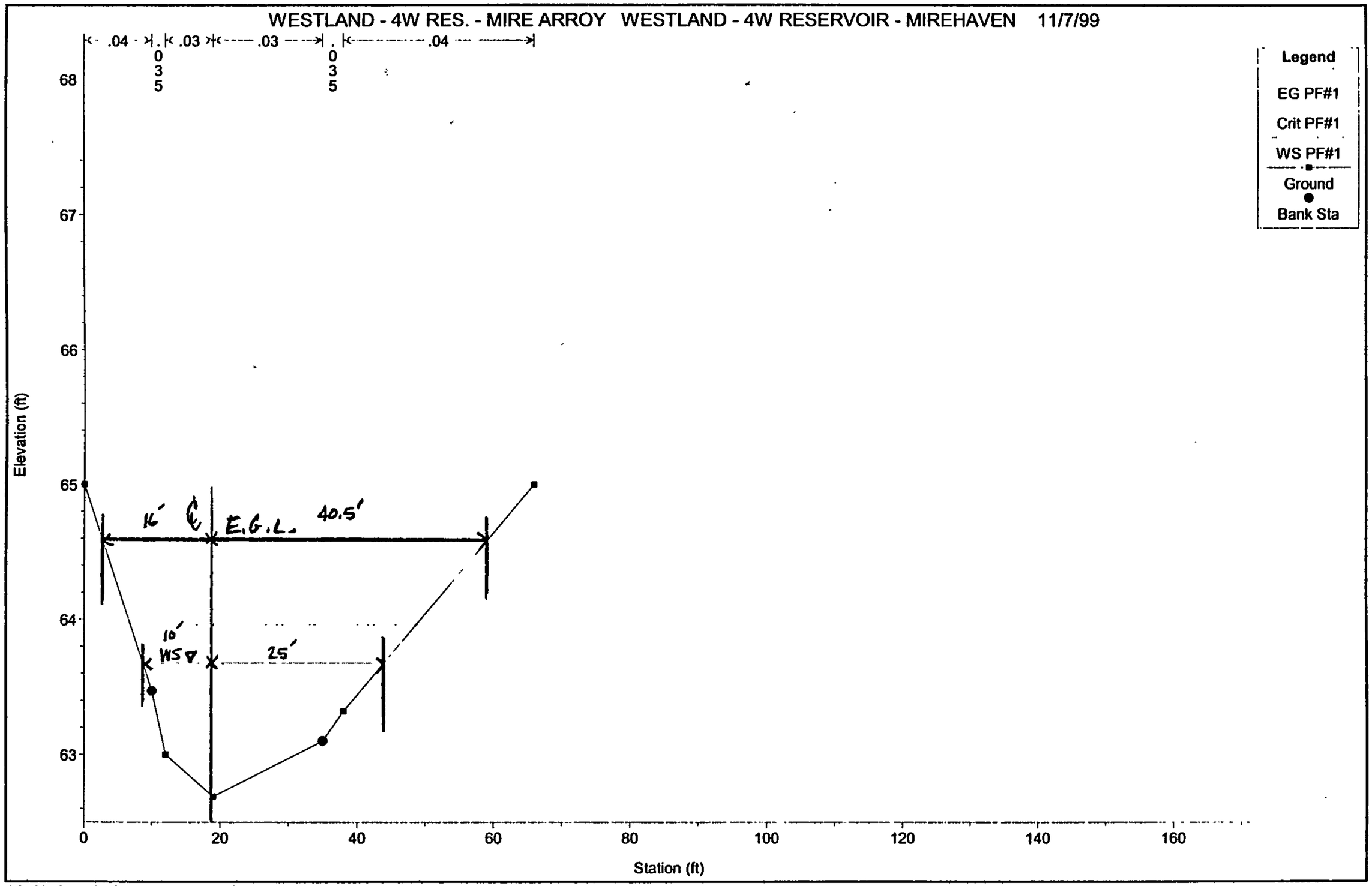
RS = 380



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 44

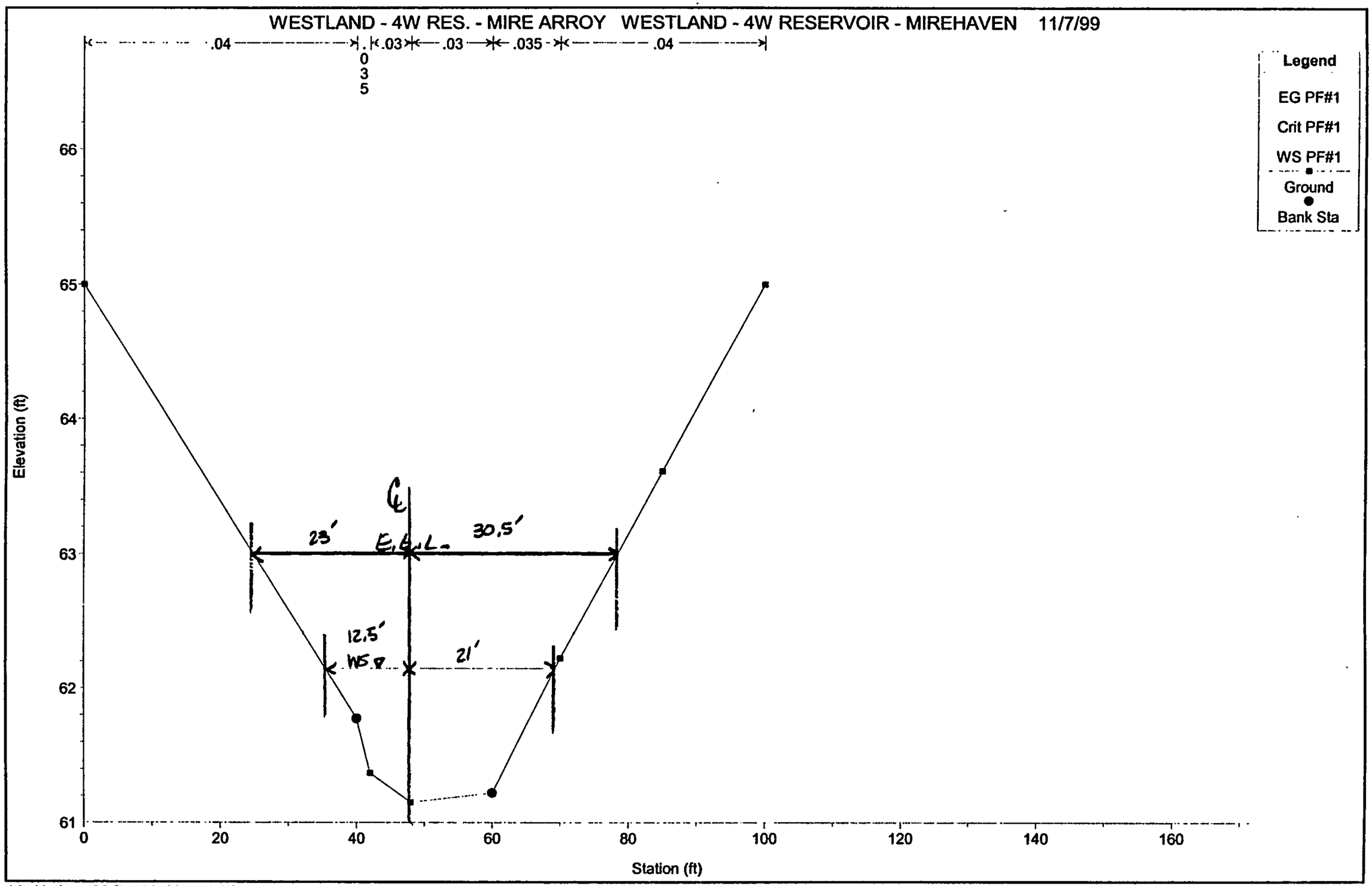
RS = 360



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 45

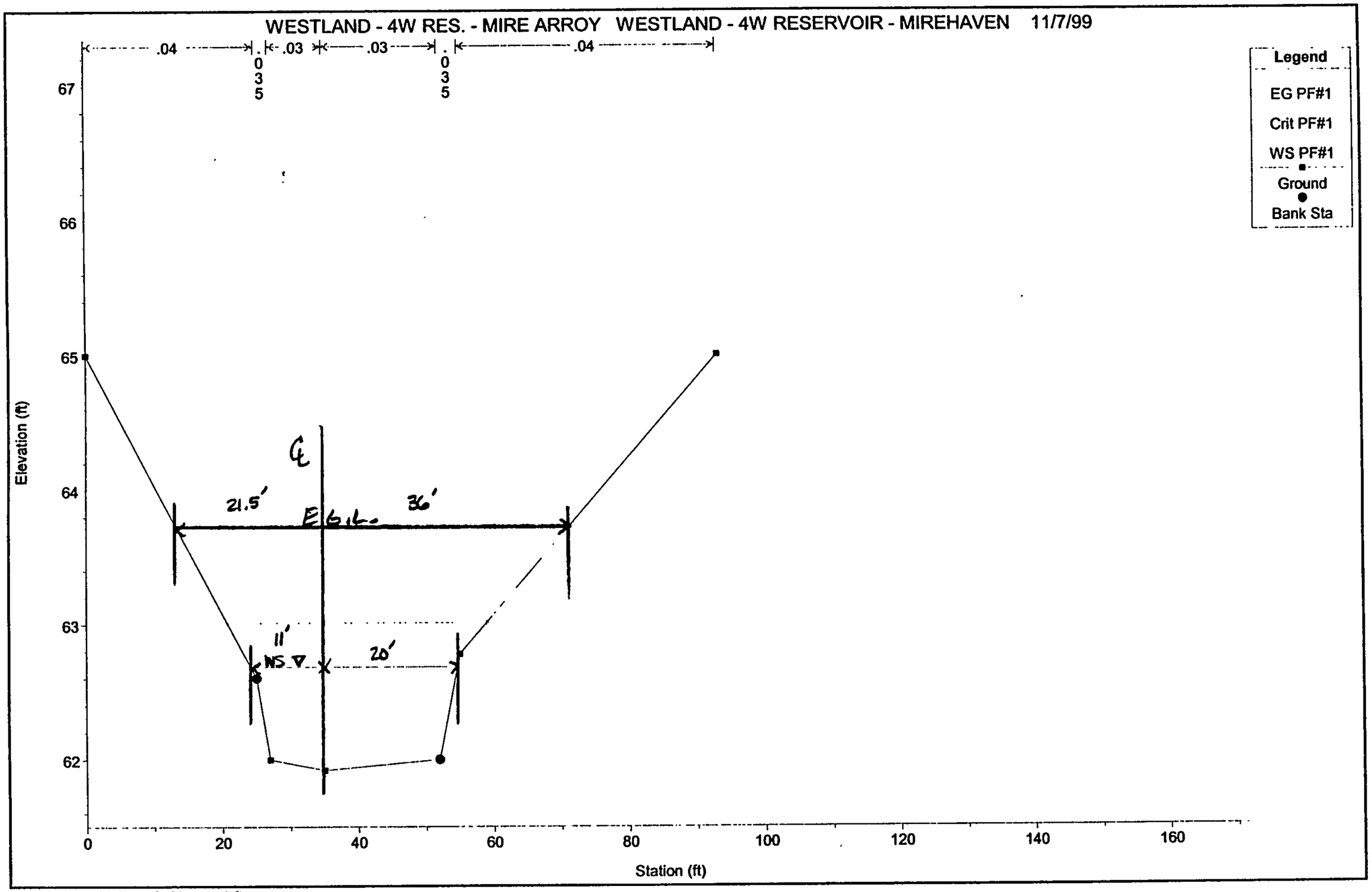
RS=320



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 47

RS = 340



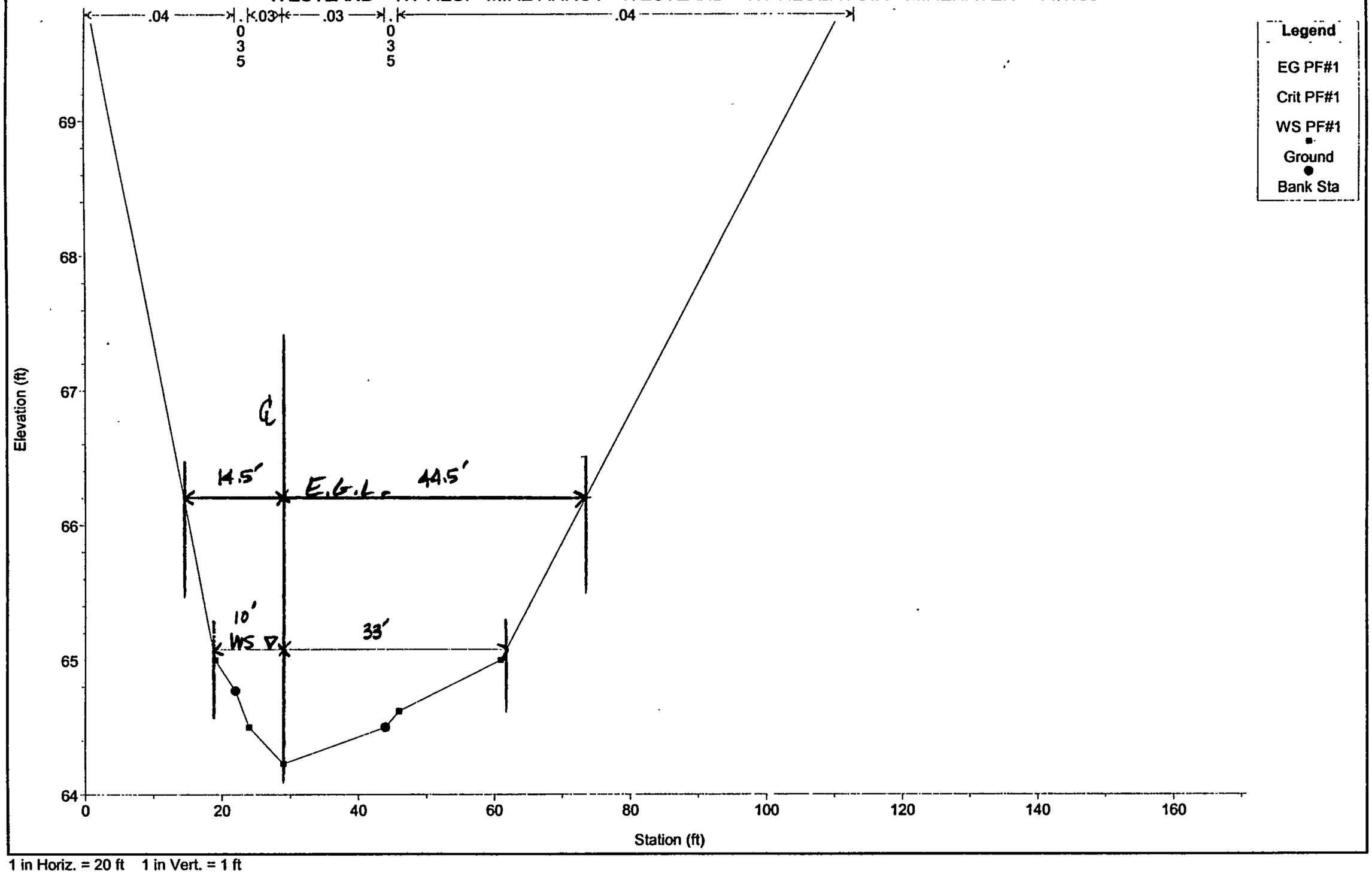
1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 4C

8

RS=400

WESTLAND - 4W RES. - MIRE ARROY WESTLAND - 4W RESERVOIR - MIREHAVEN 11/7/99

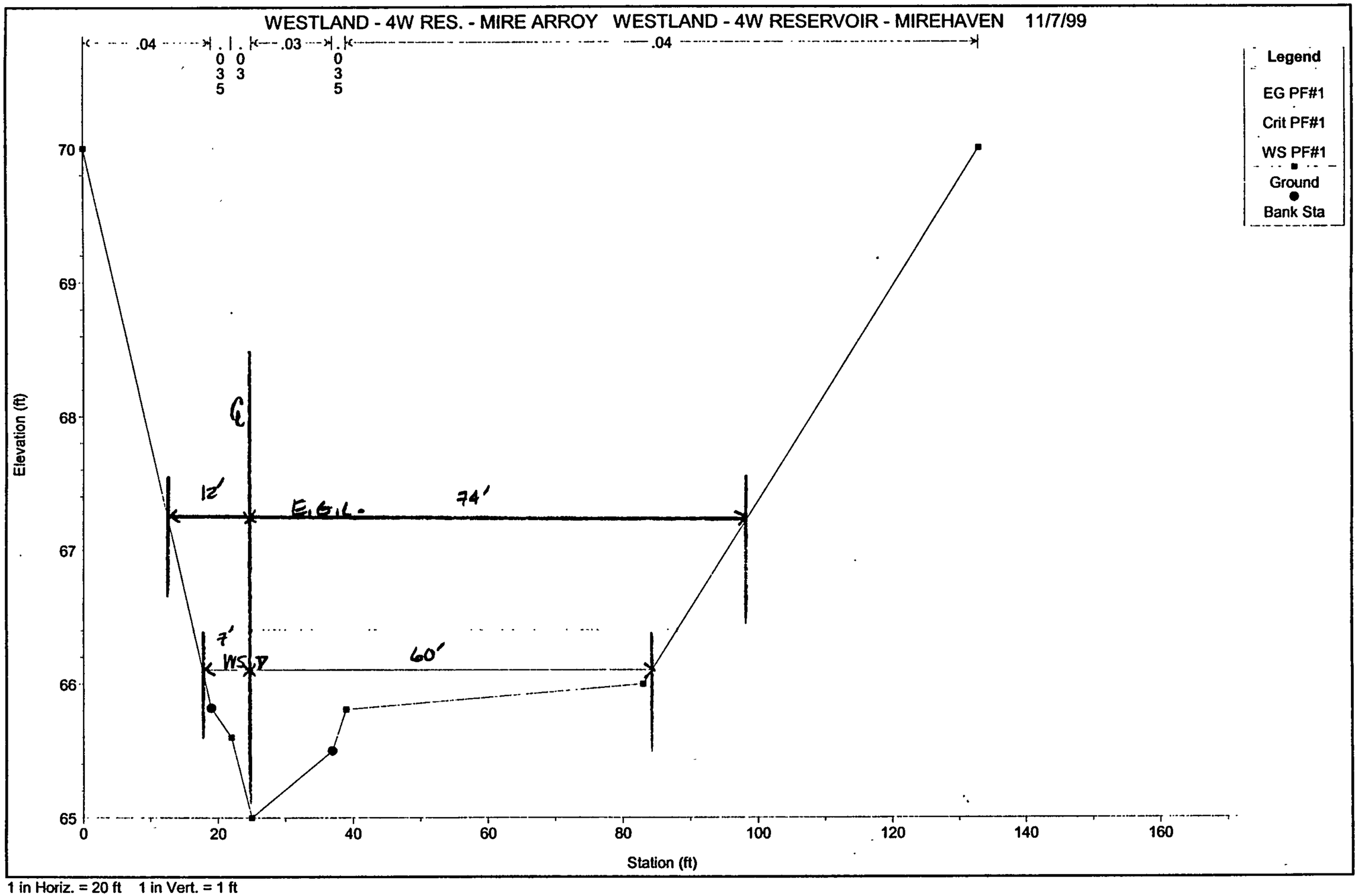


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 43

82

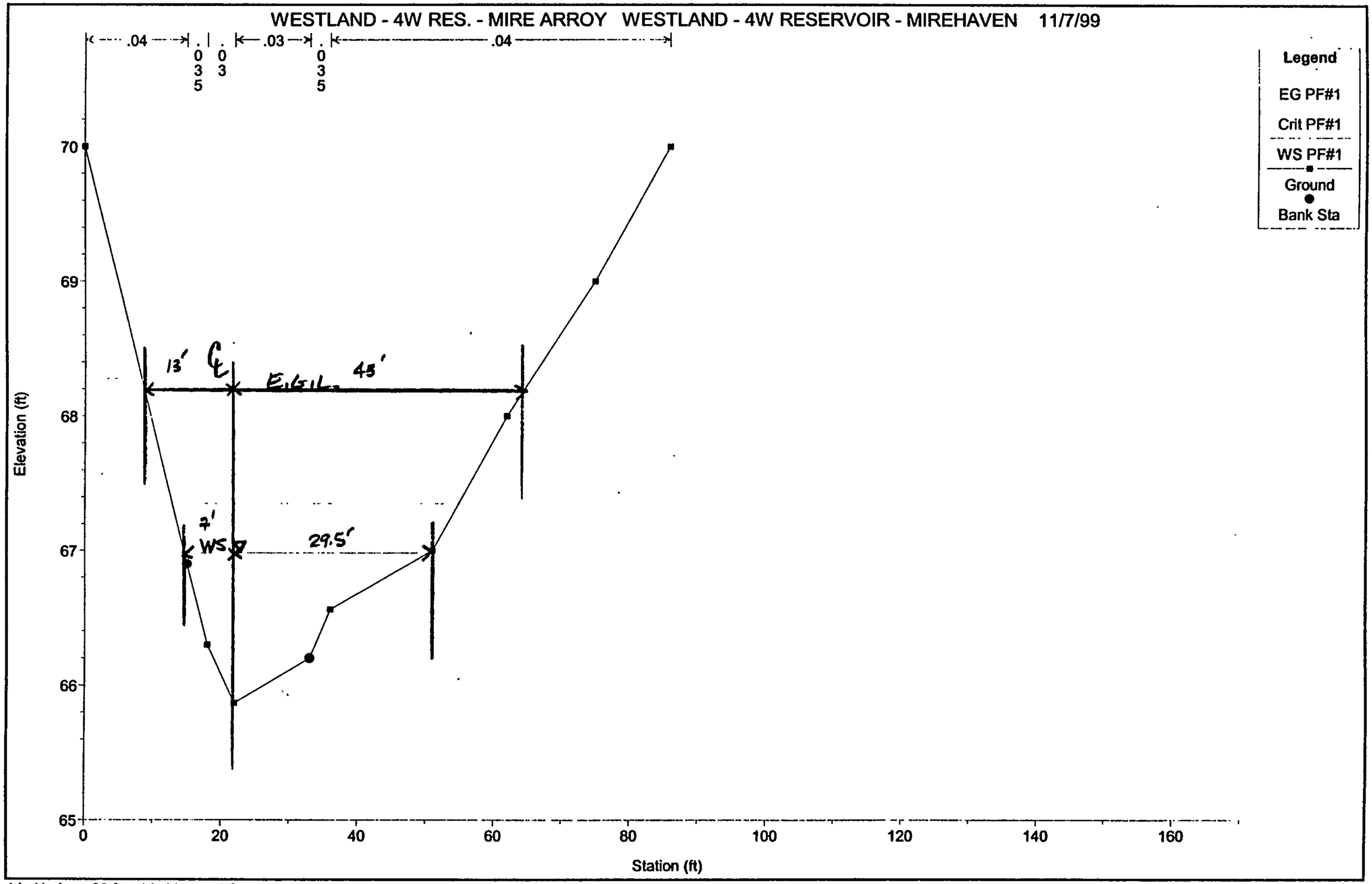
RS=420



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 42

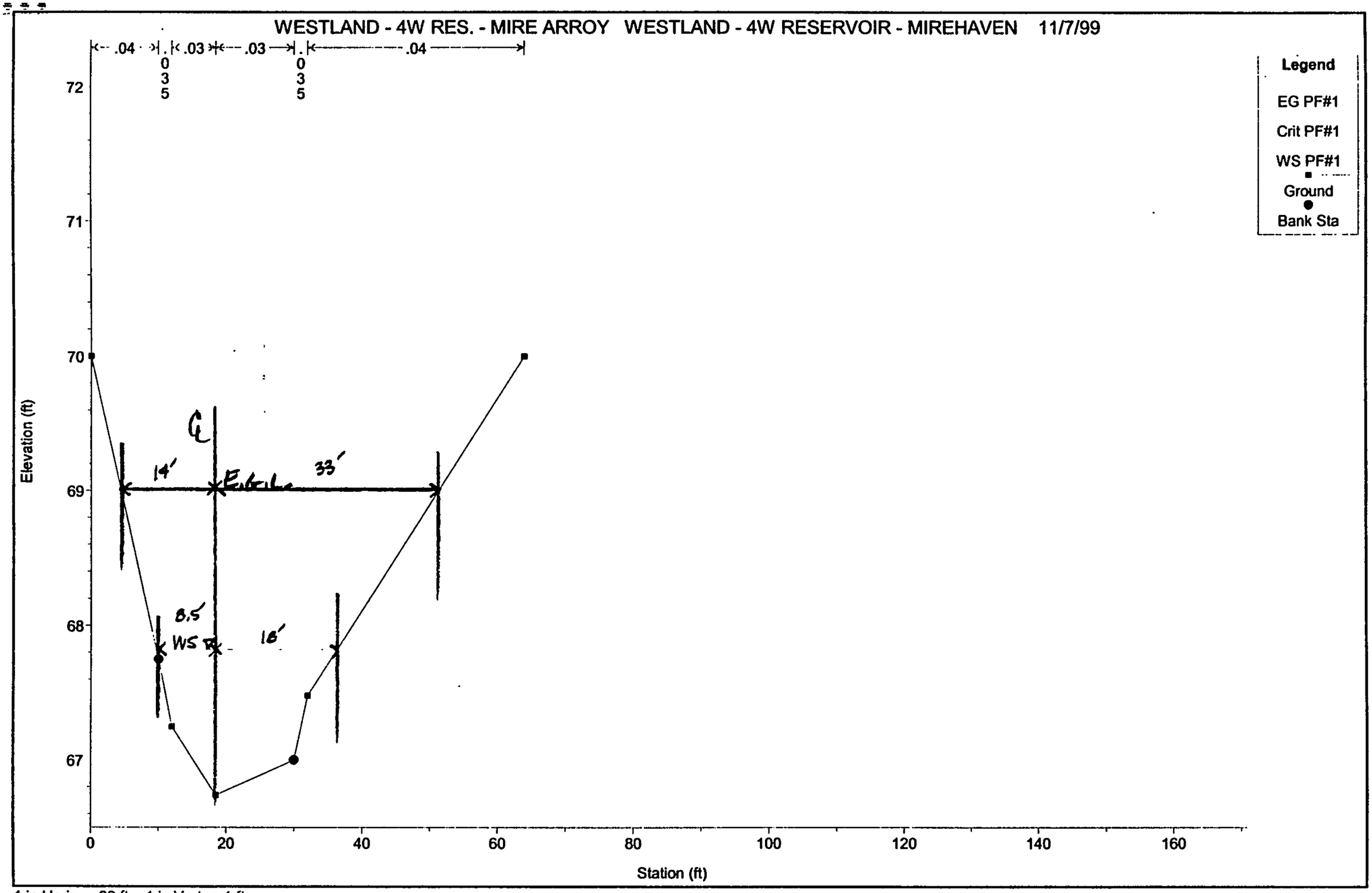
RS=440



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 41

RS = 460

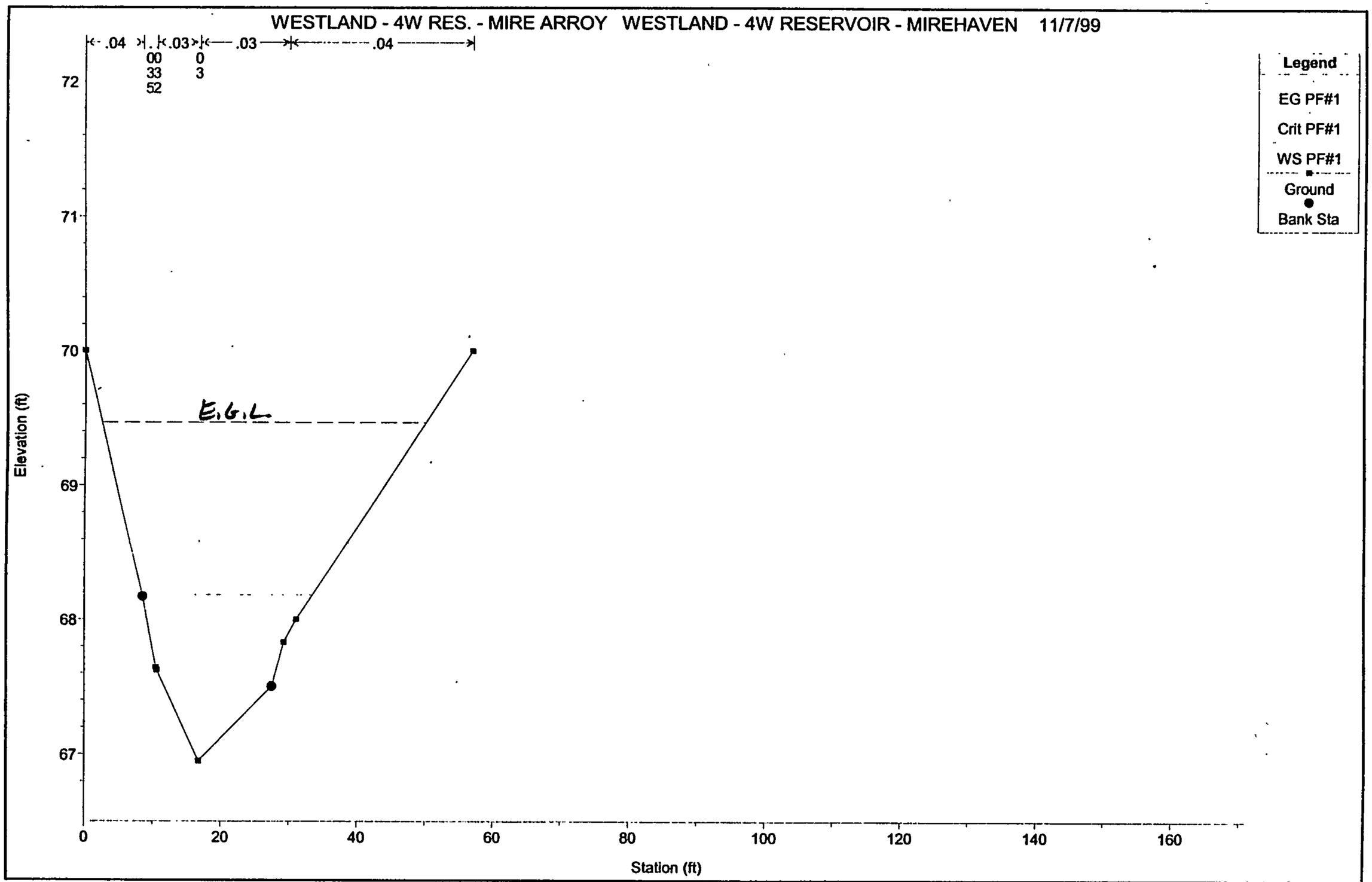


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 4a

RS=470*

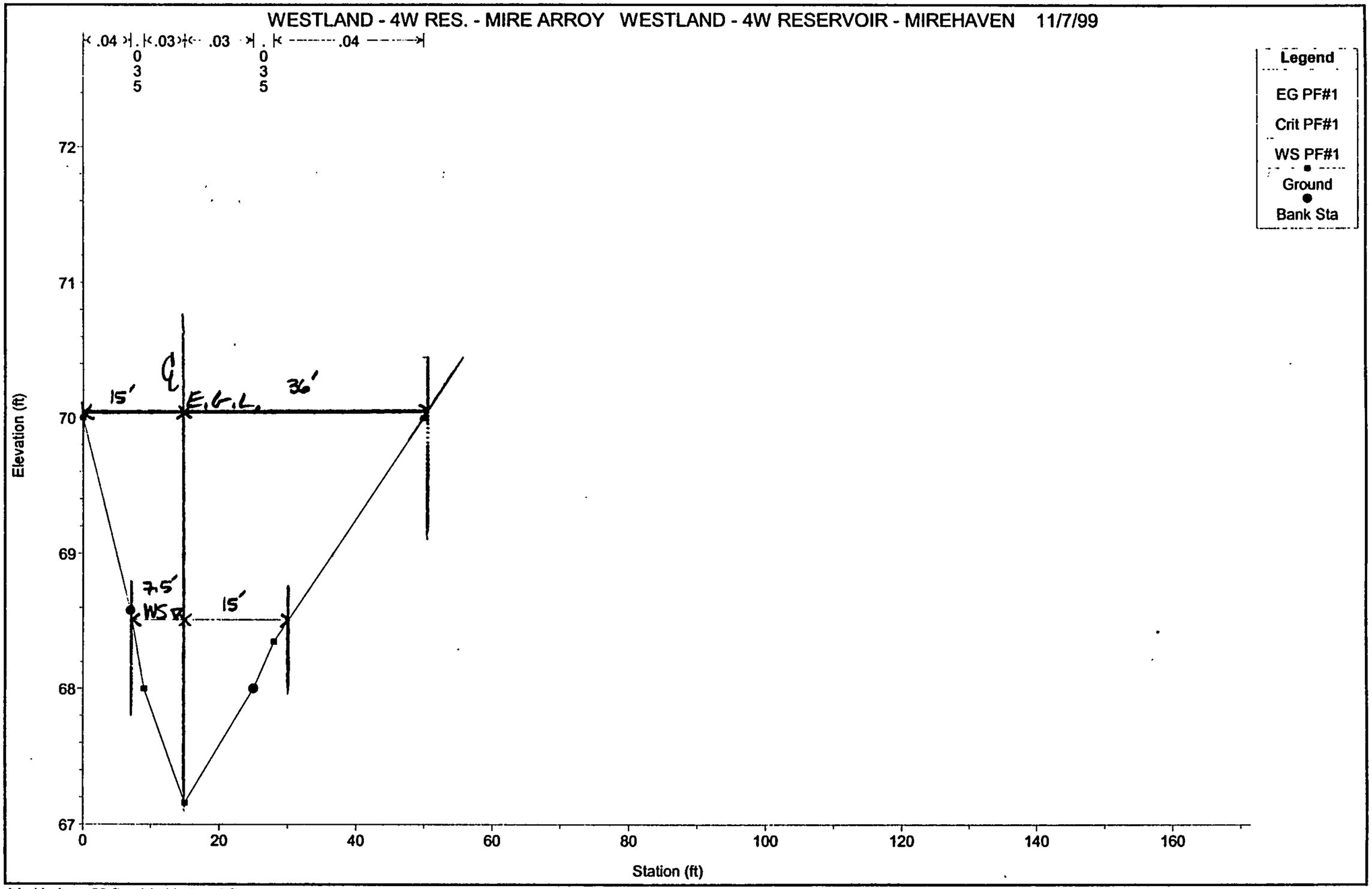
*****



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 39

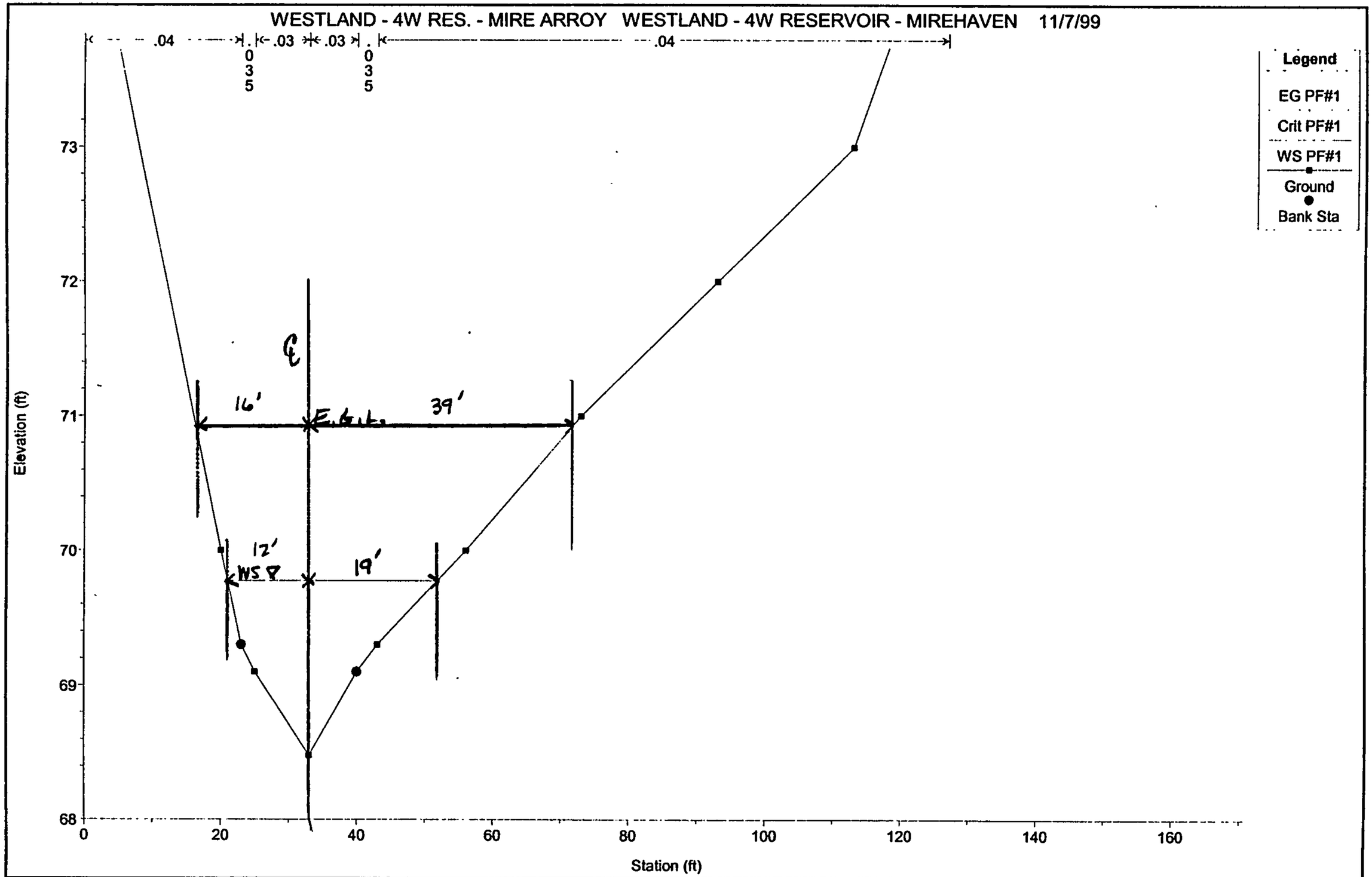
RS = 480



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 38

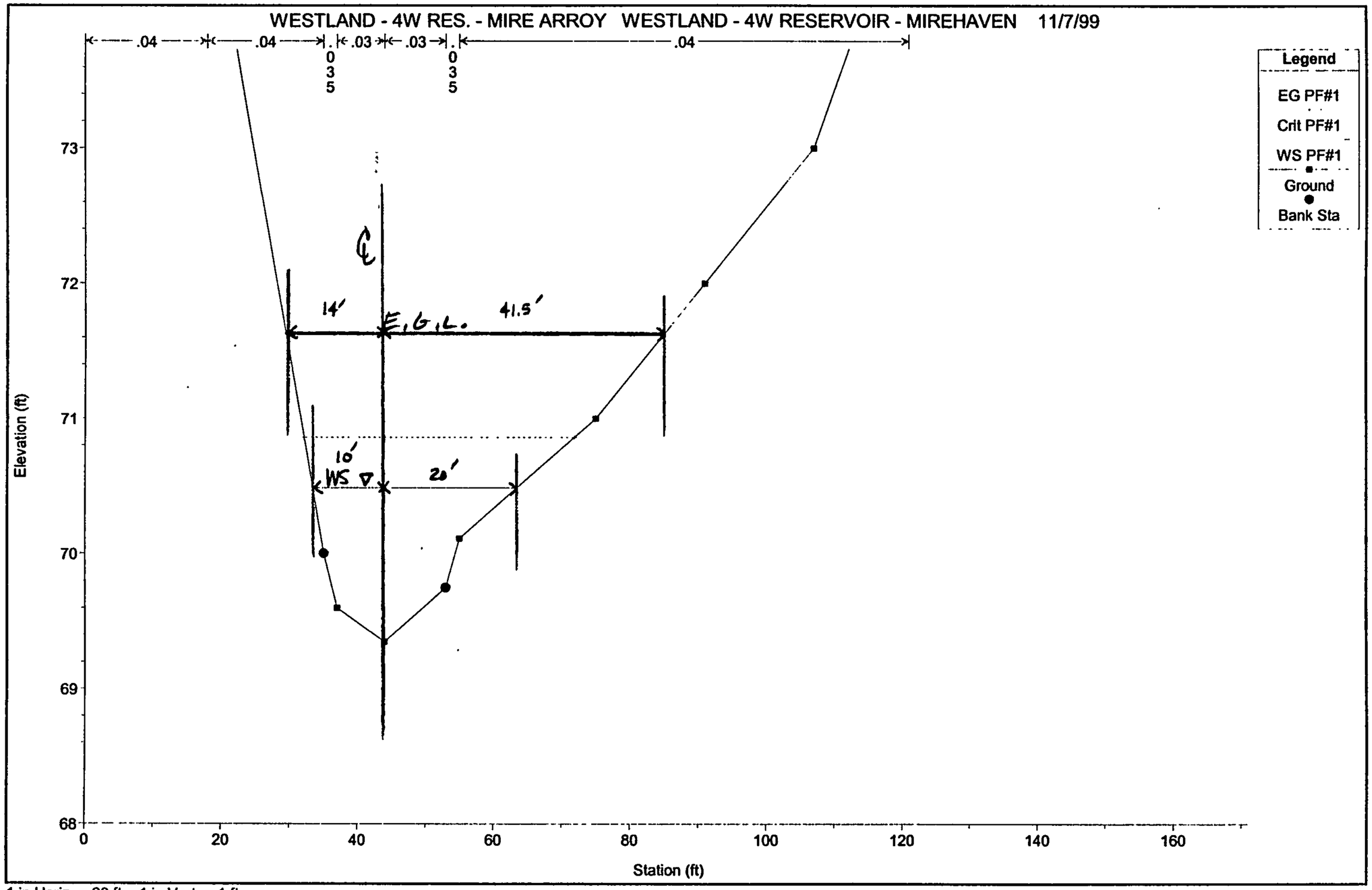
RS=500



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 37

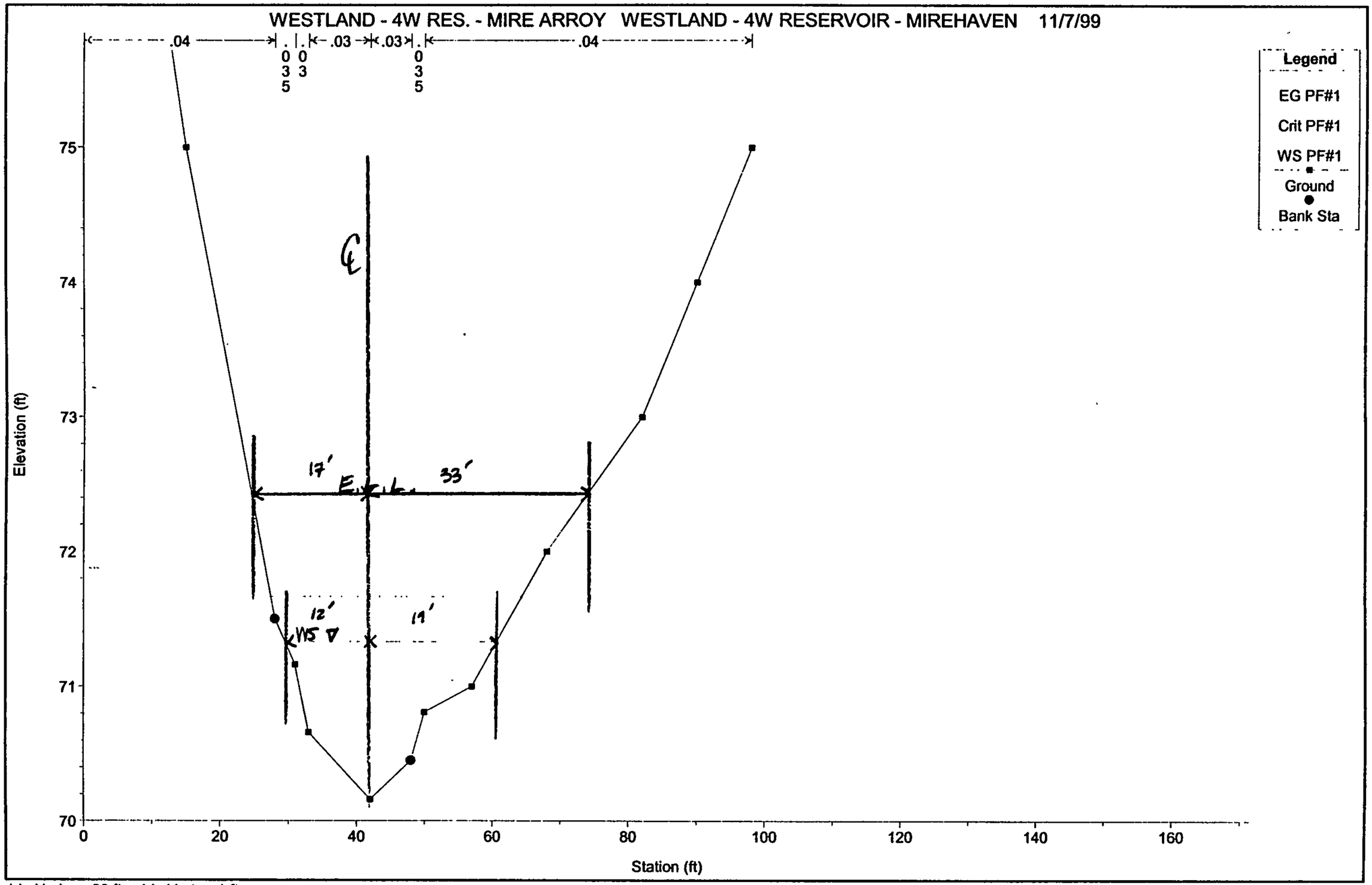
RS=520



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 36

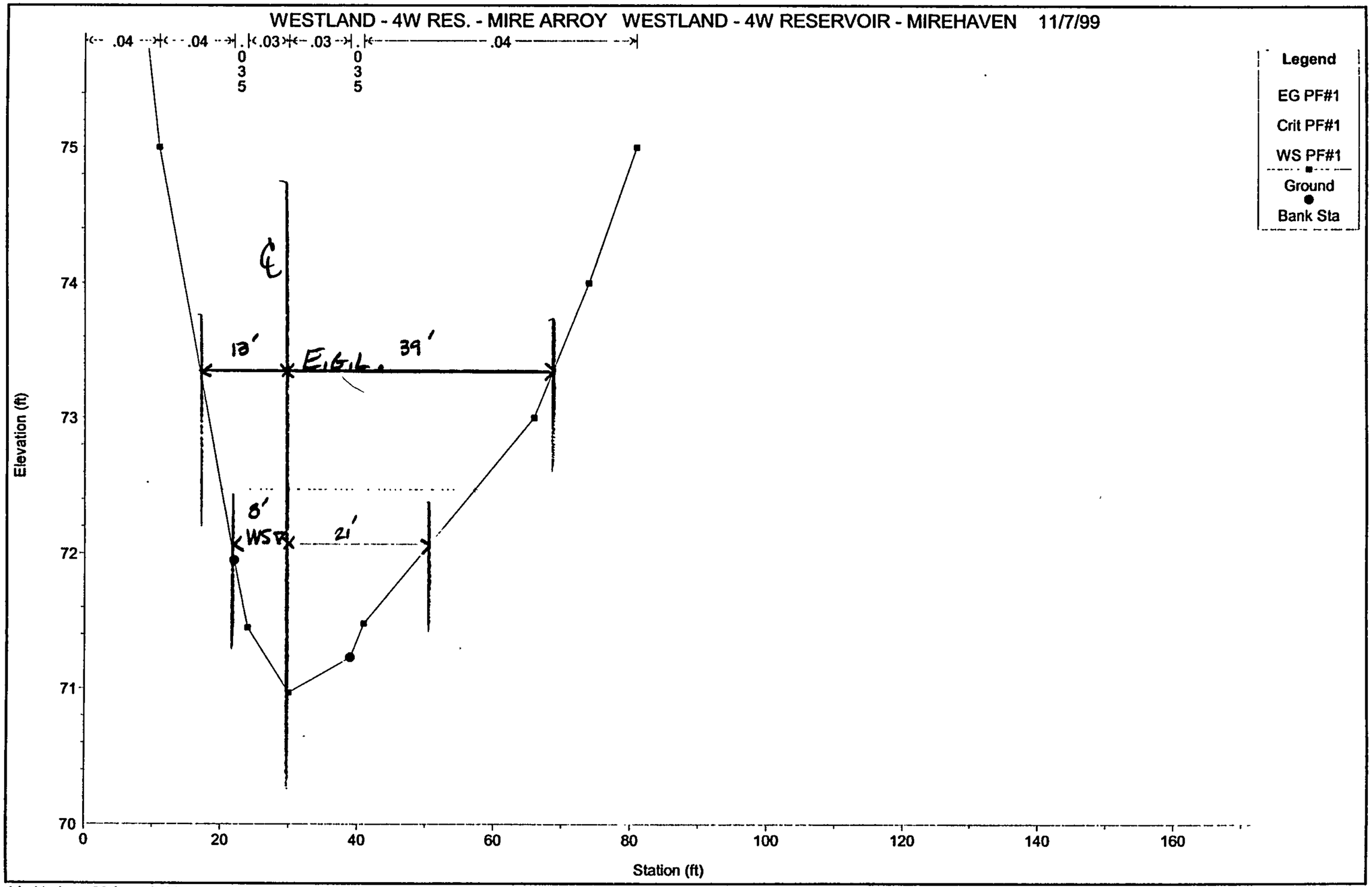
RS = 540



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 35

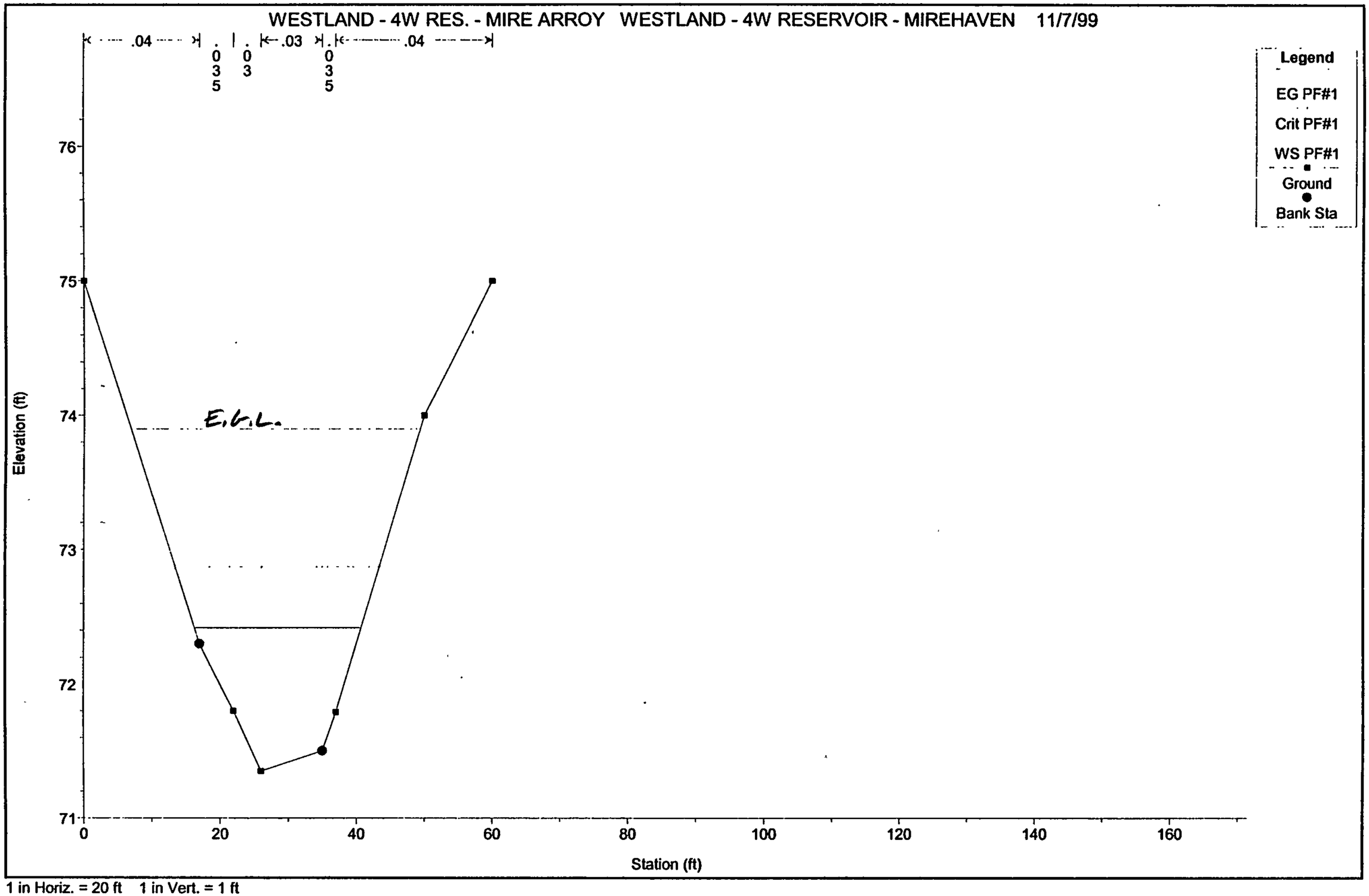
RS=560



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 34

RS = 570

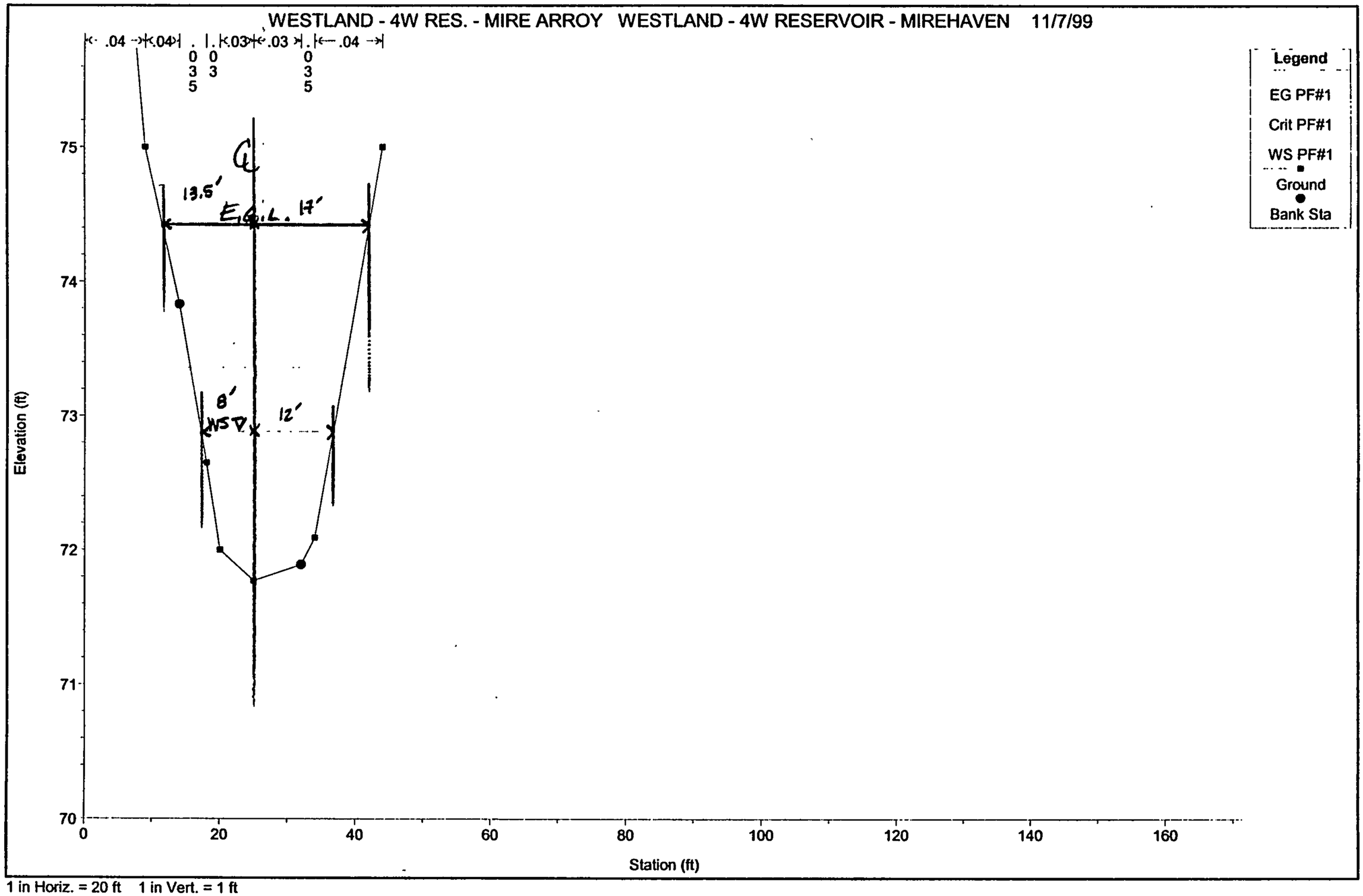


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

22

FIGURE 33

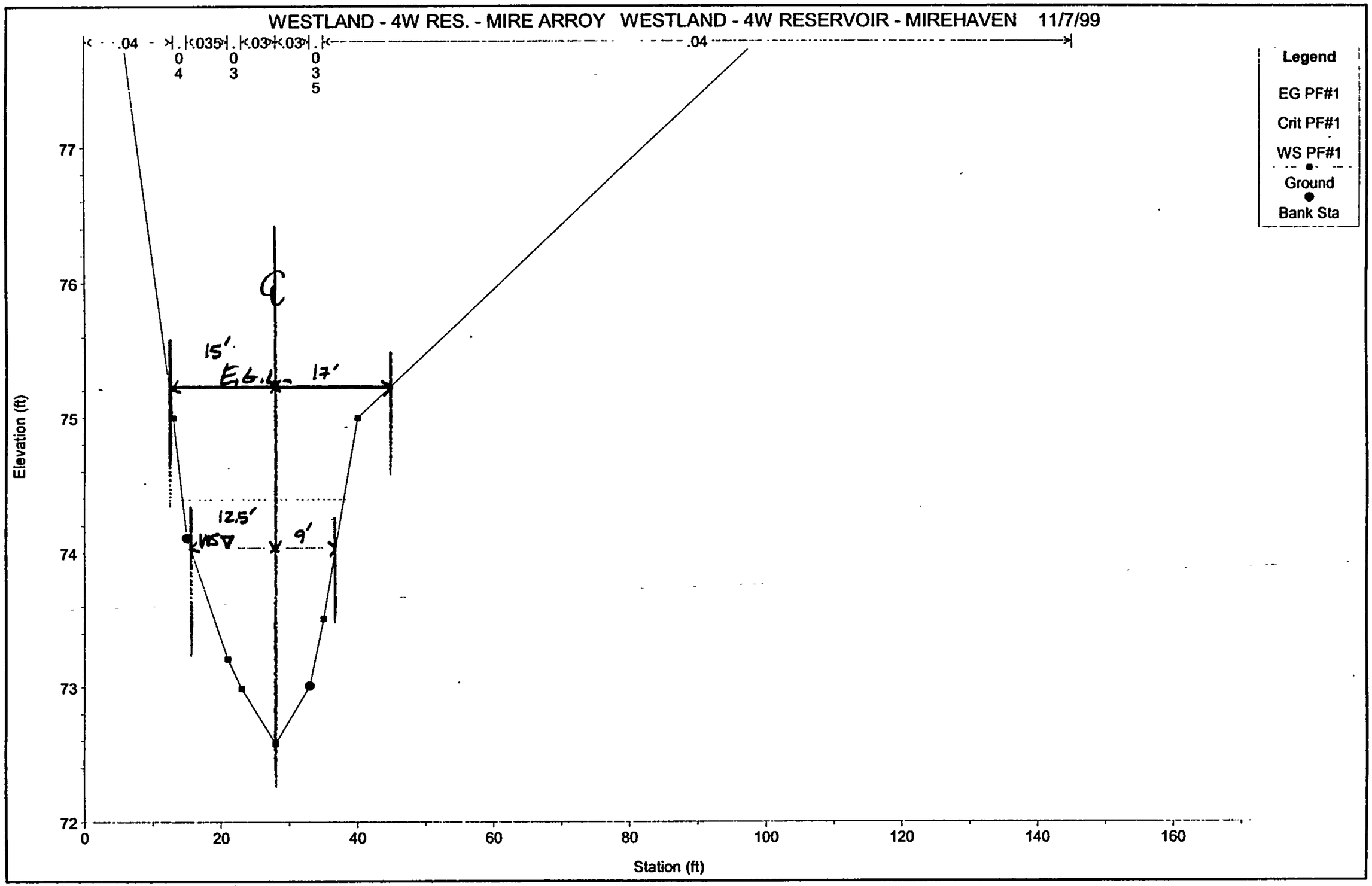
RS=580



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 32

RS = 600

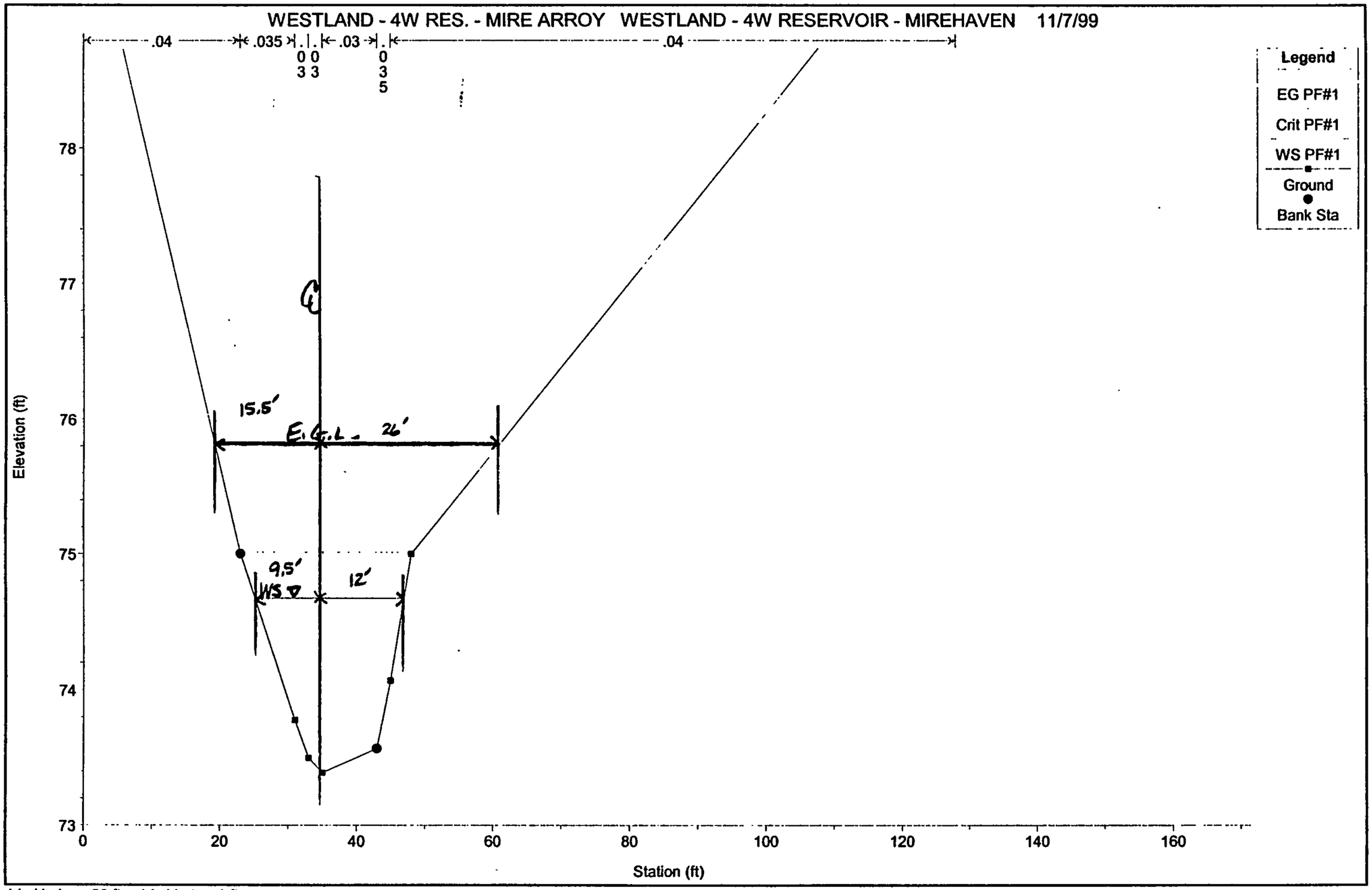


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

70

FIGURE 31

RS=620



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 3D

RS=640

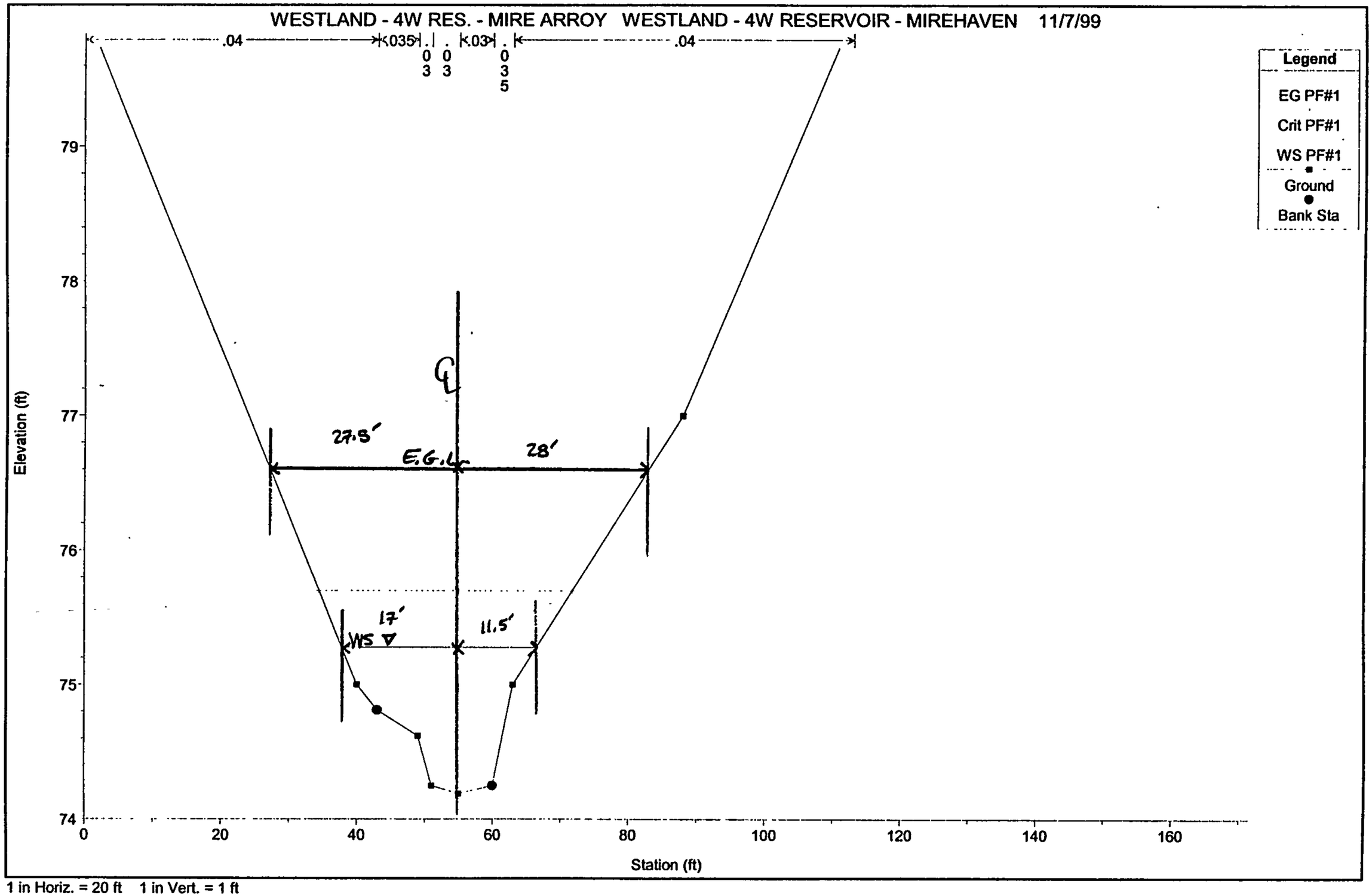
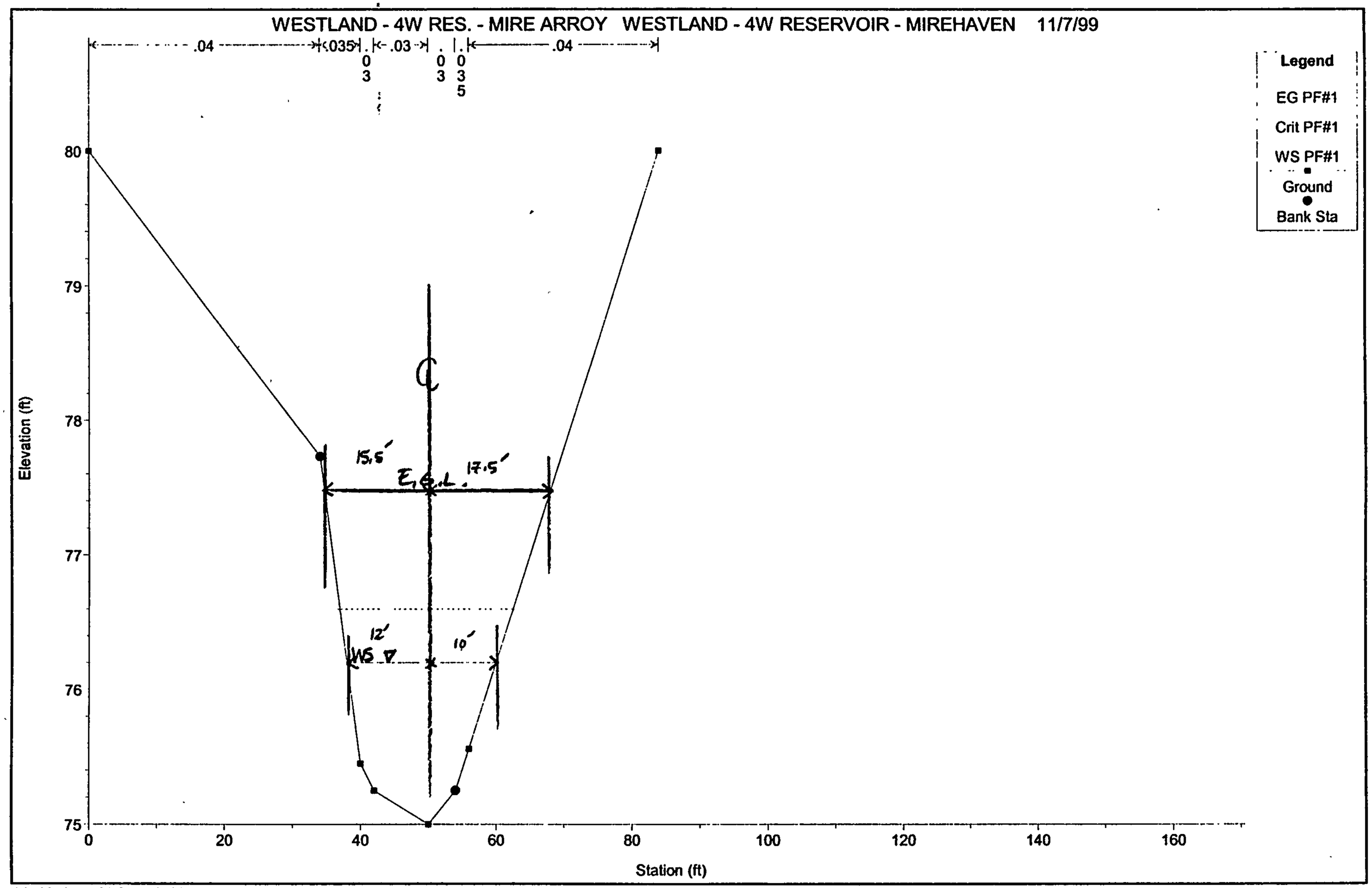


FIGURE 29

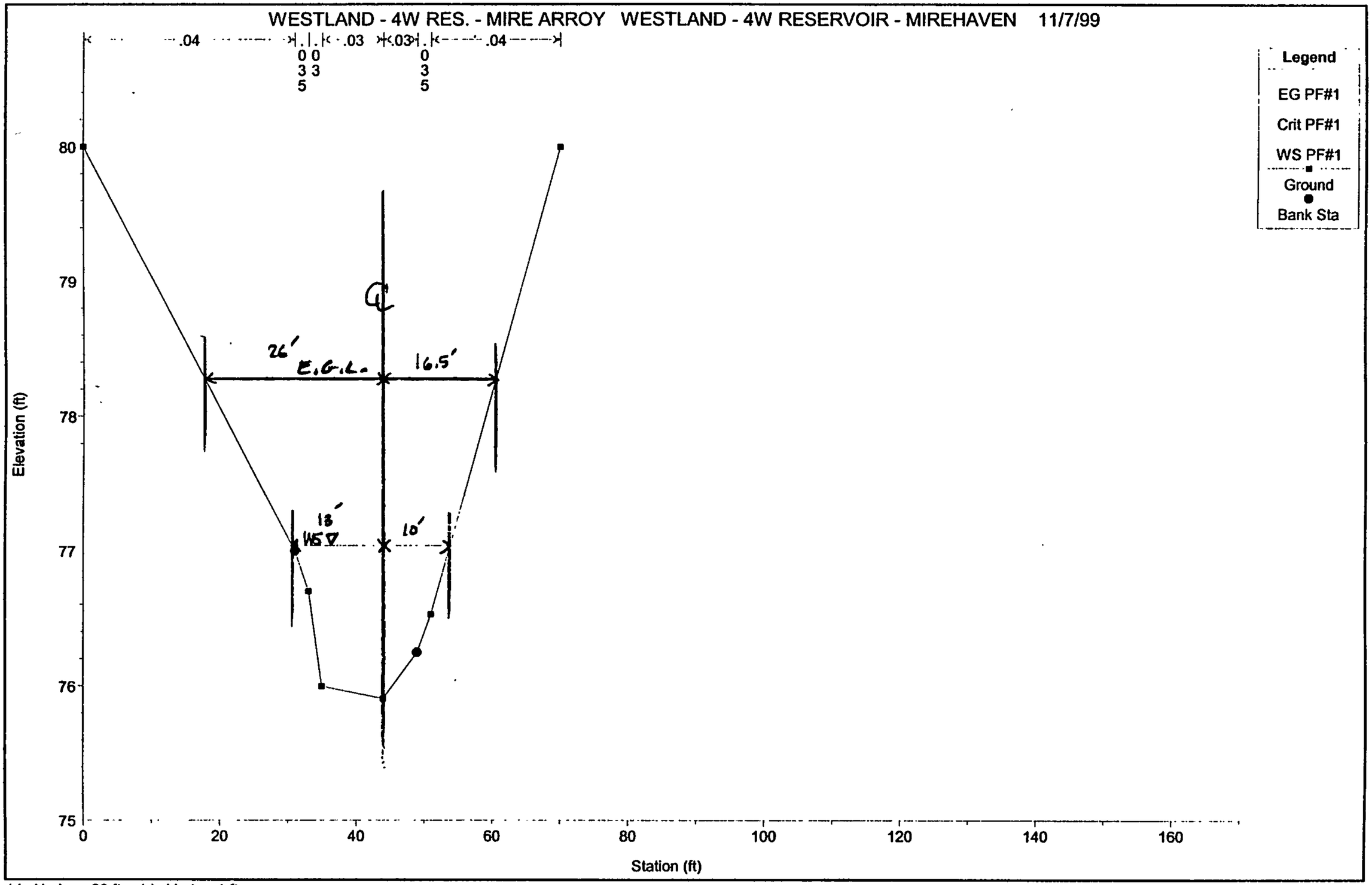
RS=660



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 28

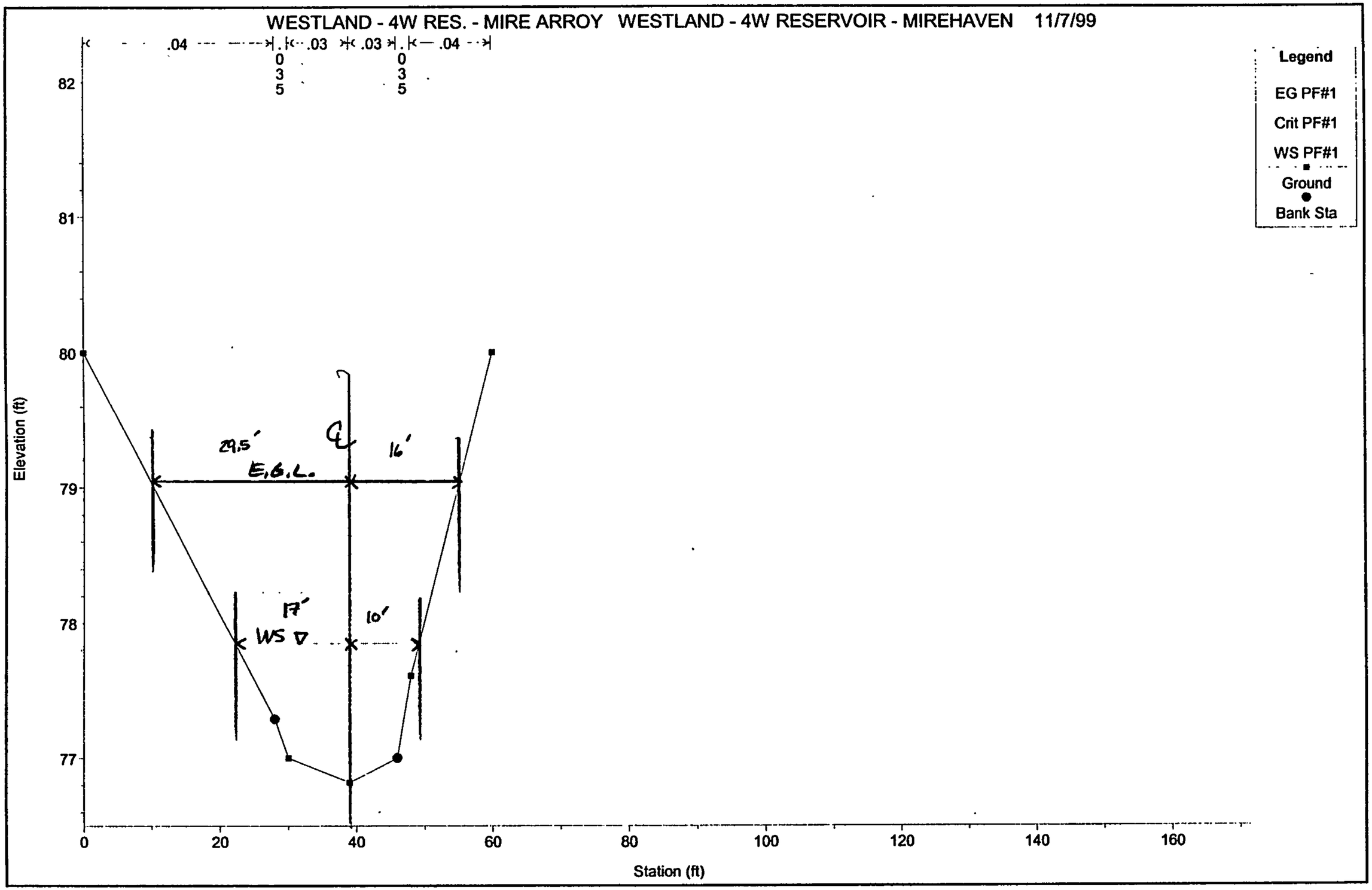
RS=680



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 27

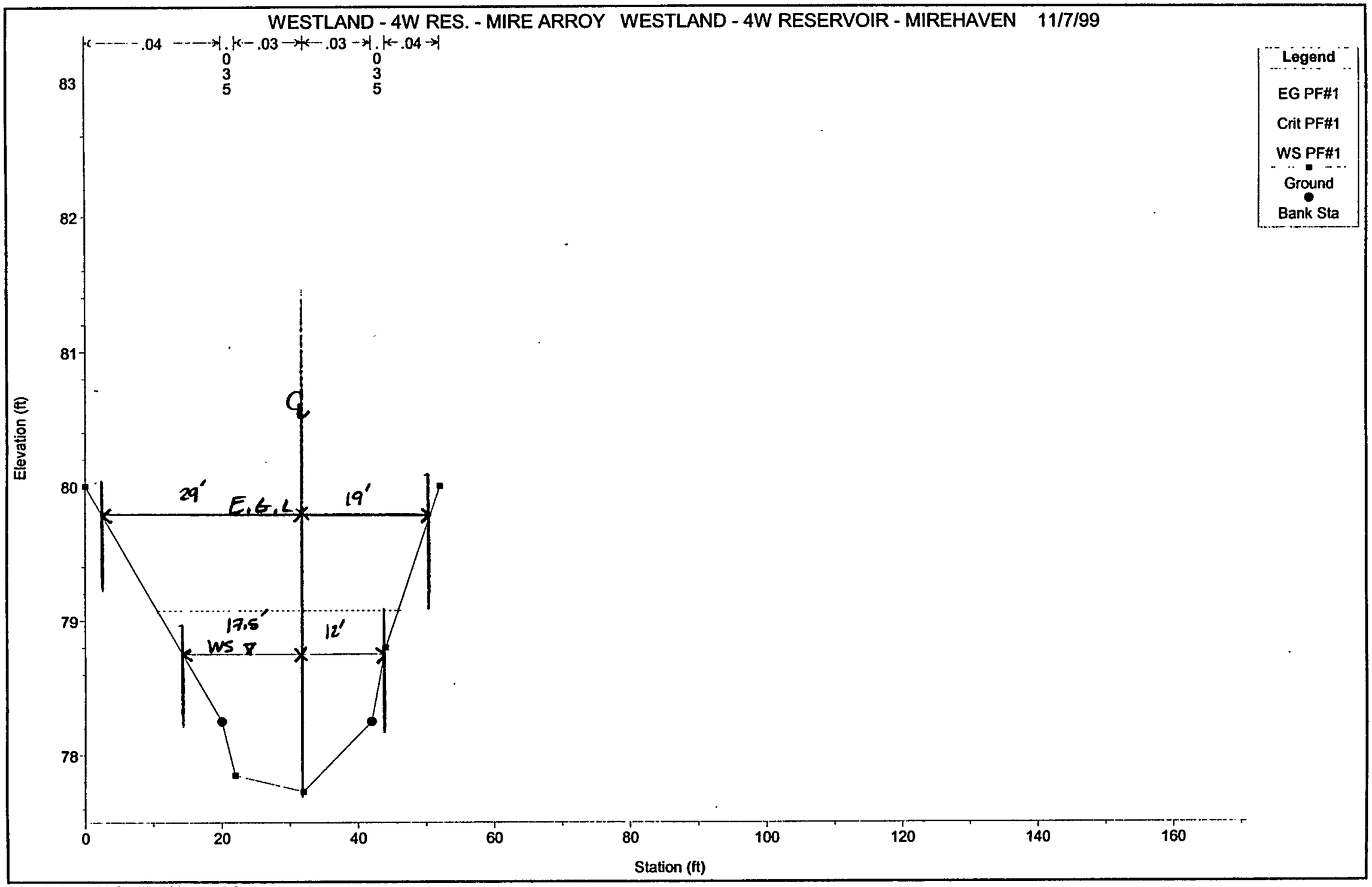
RS=700



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 24

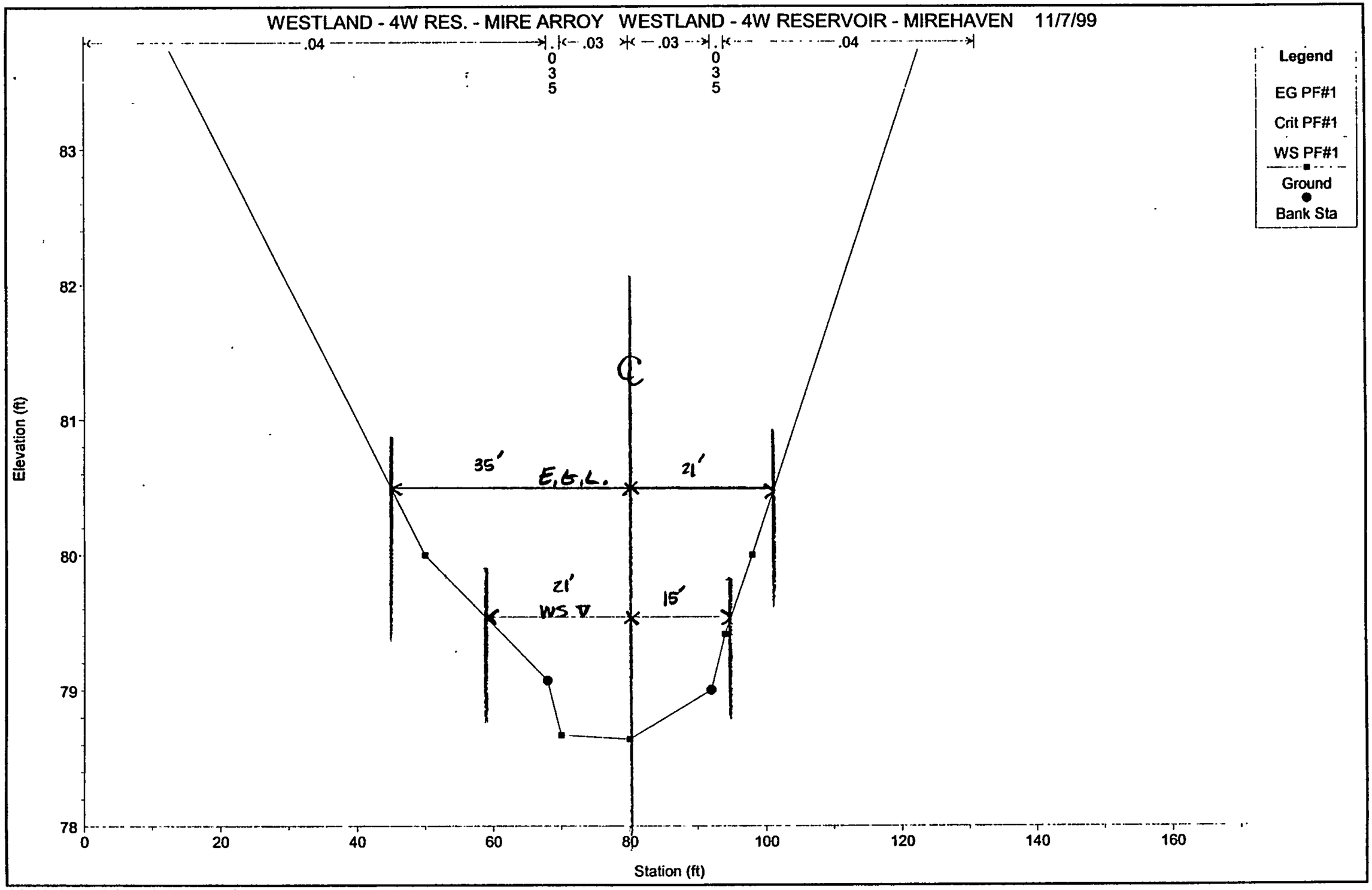
RS=720



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 25

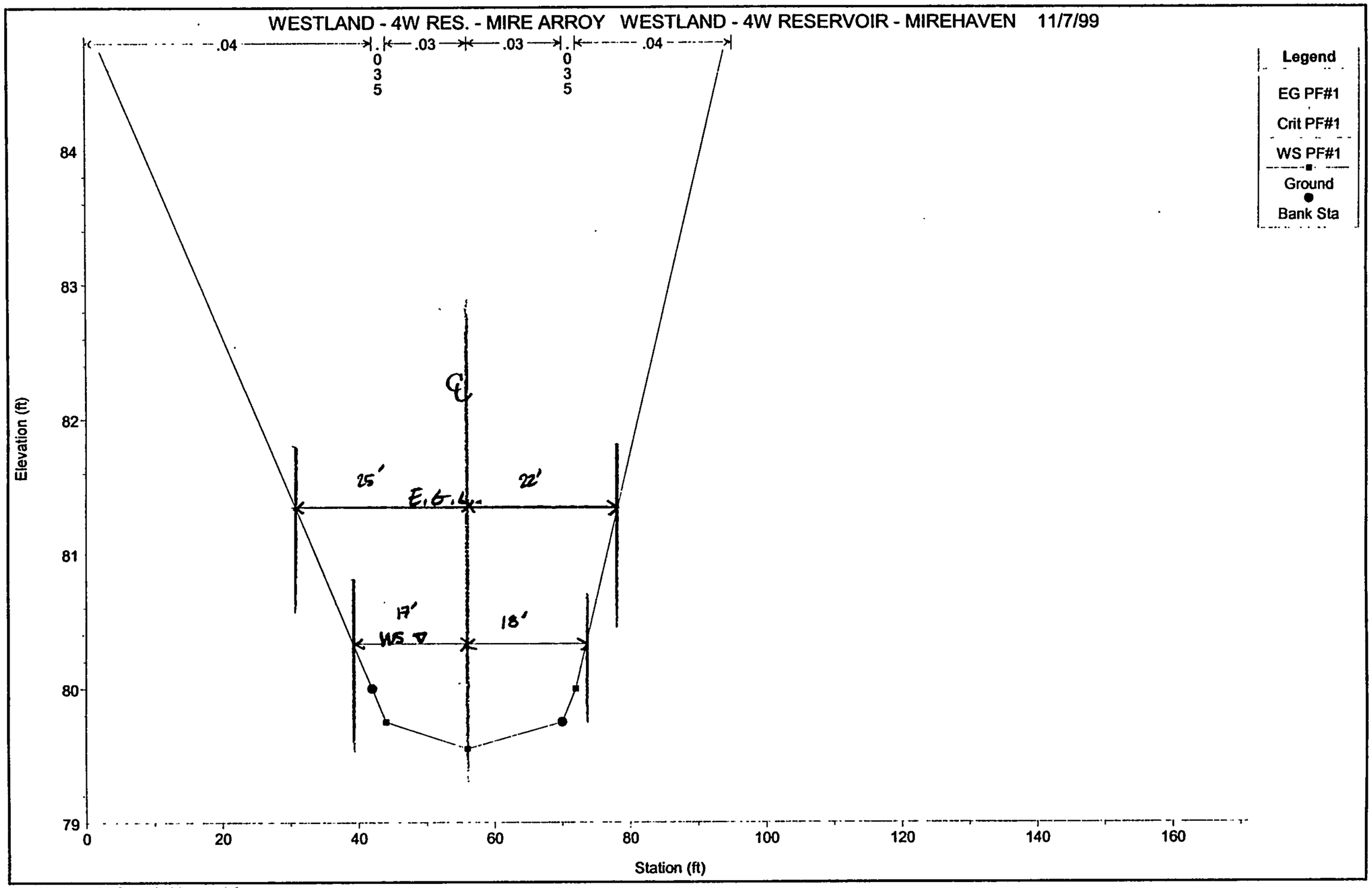
RS=740



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 24

RS = 760

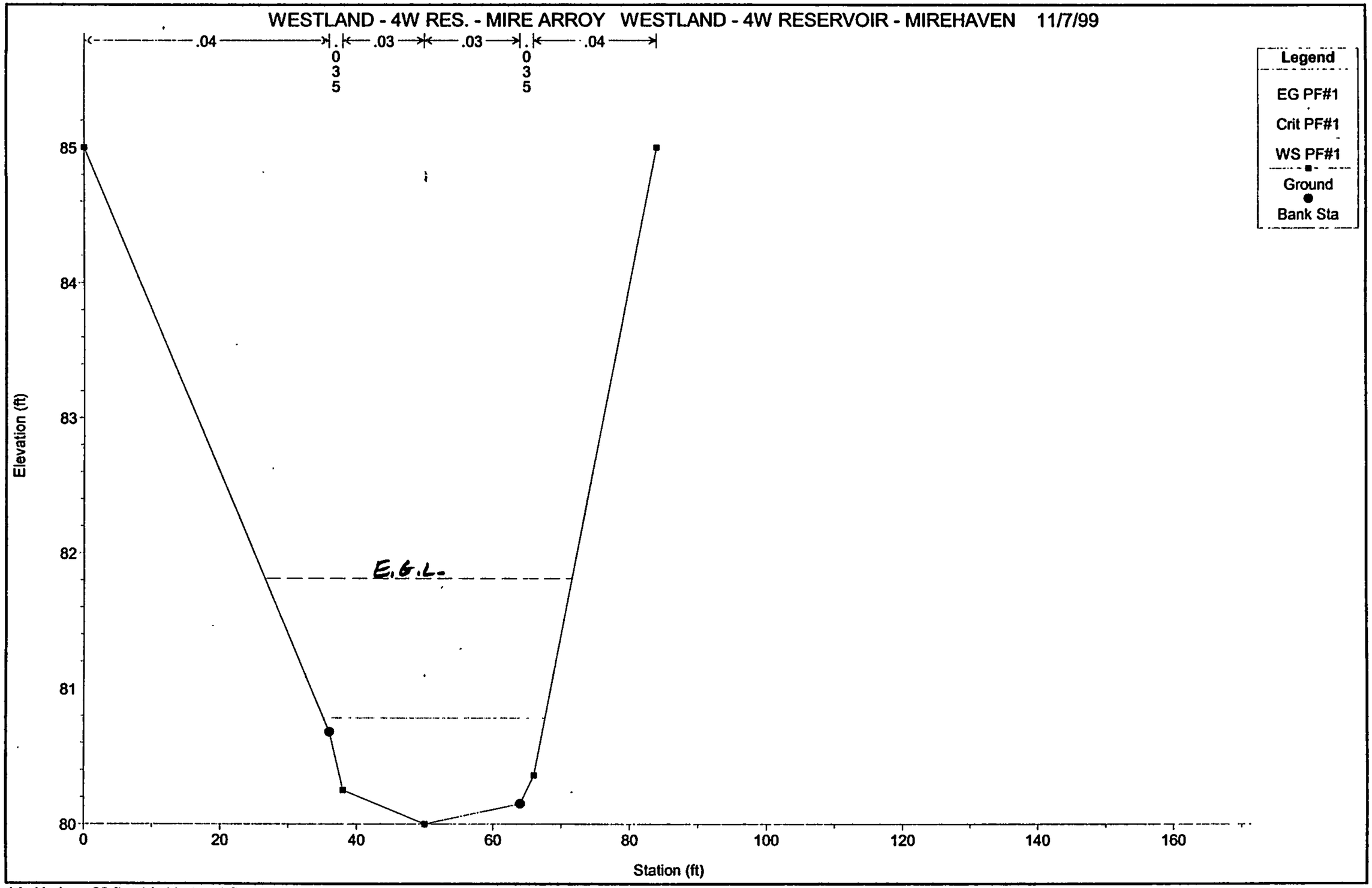


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 23

(8)

RS = 770

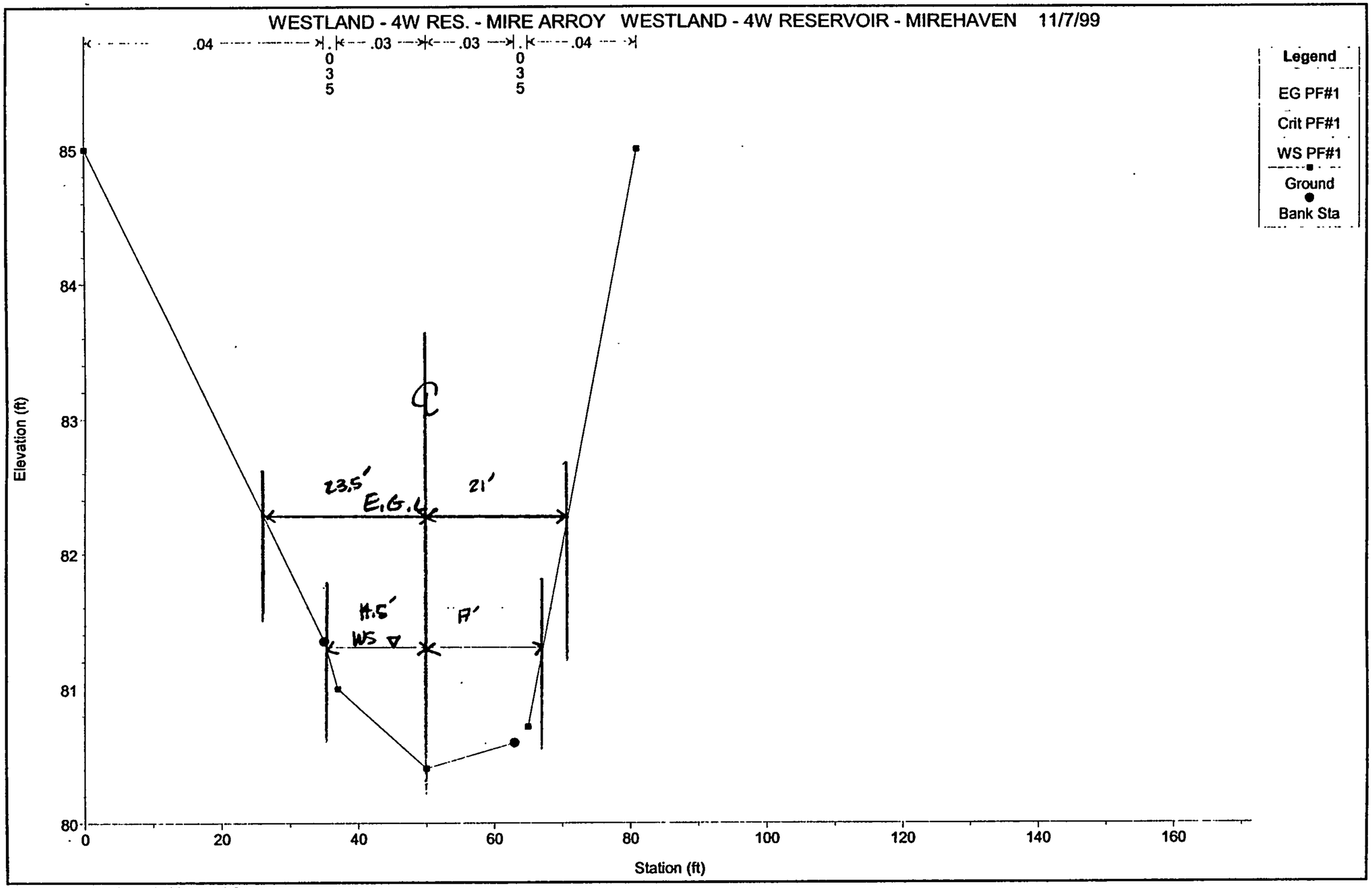


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 22

6

RS = 780

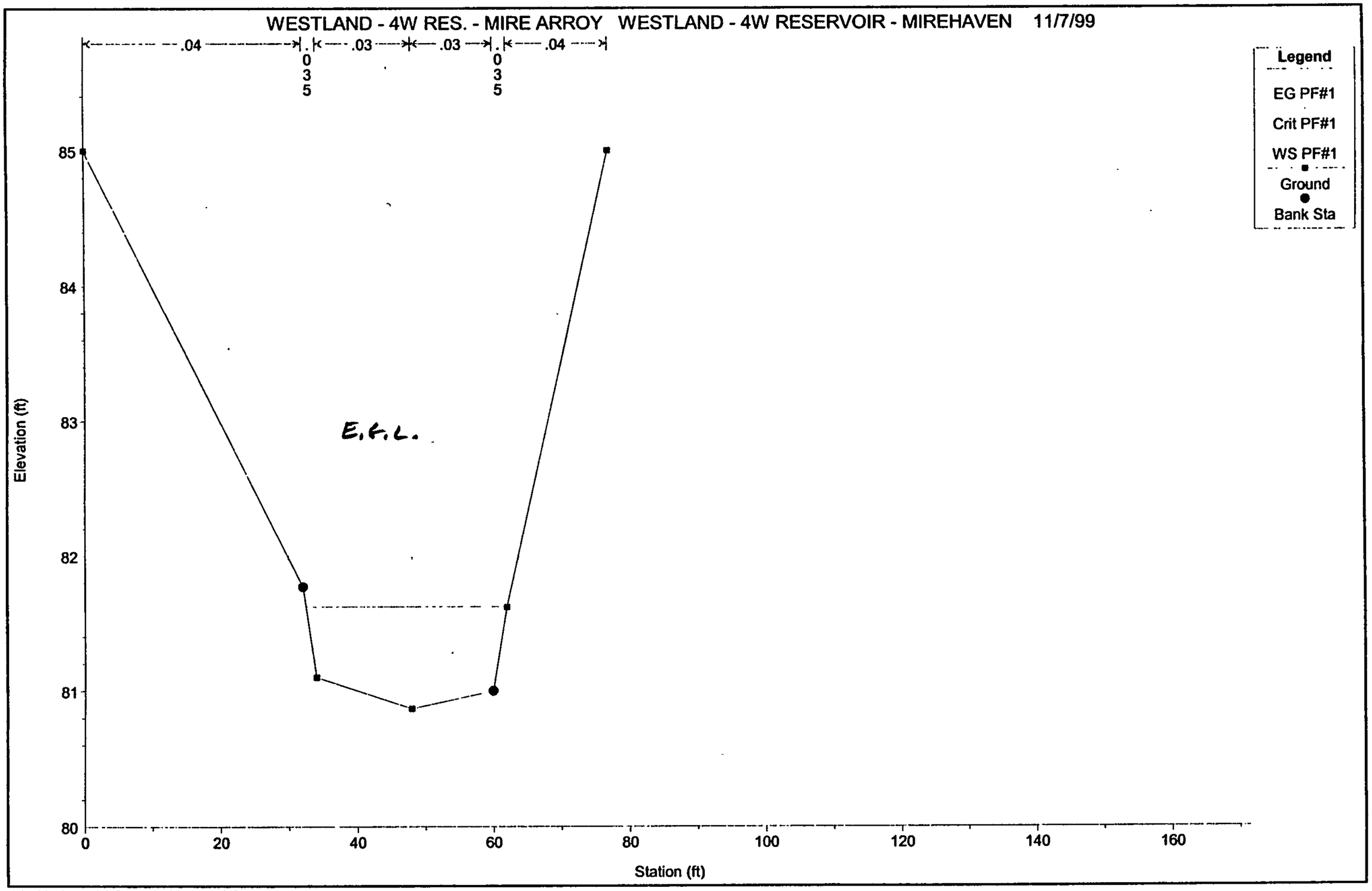


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 21

8

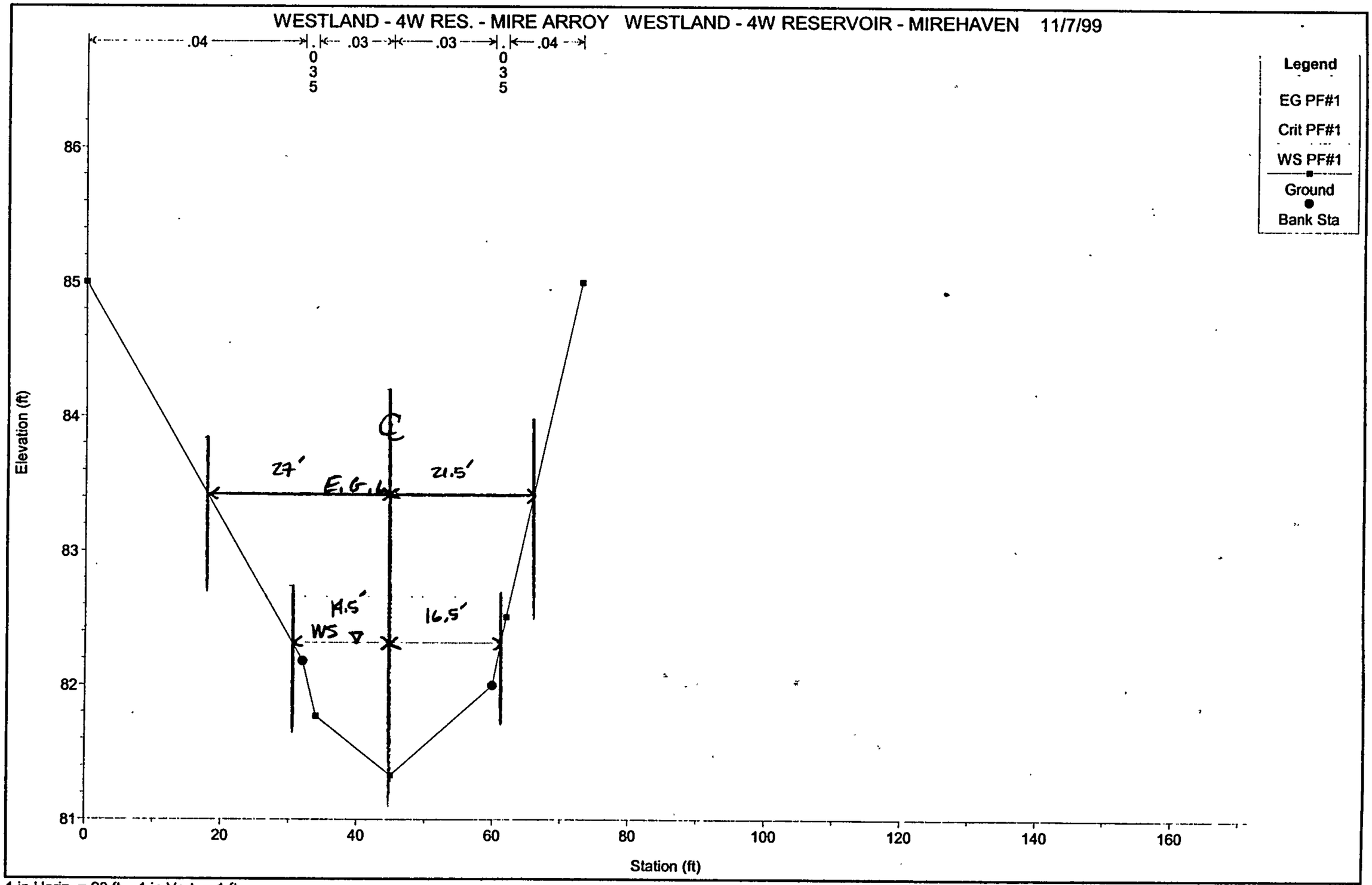
RS=790



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 20

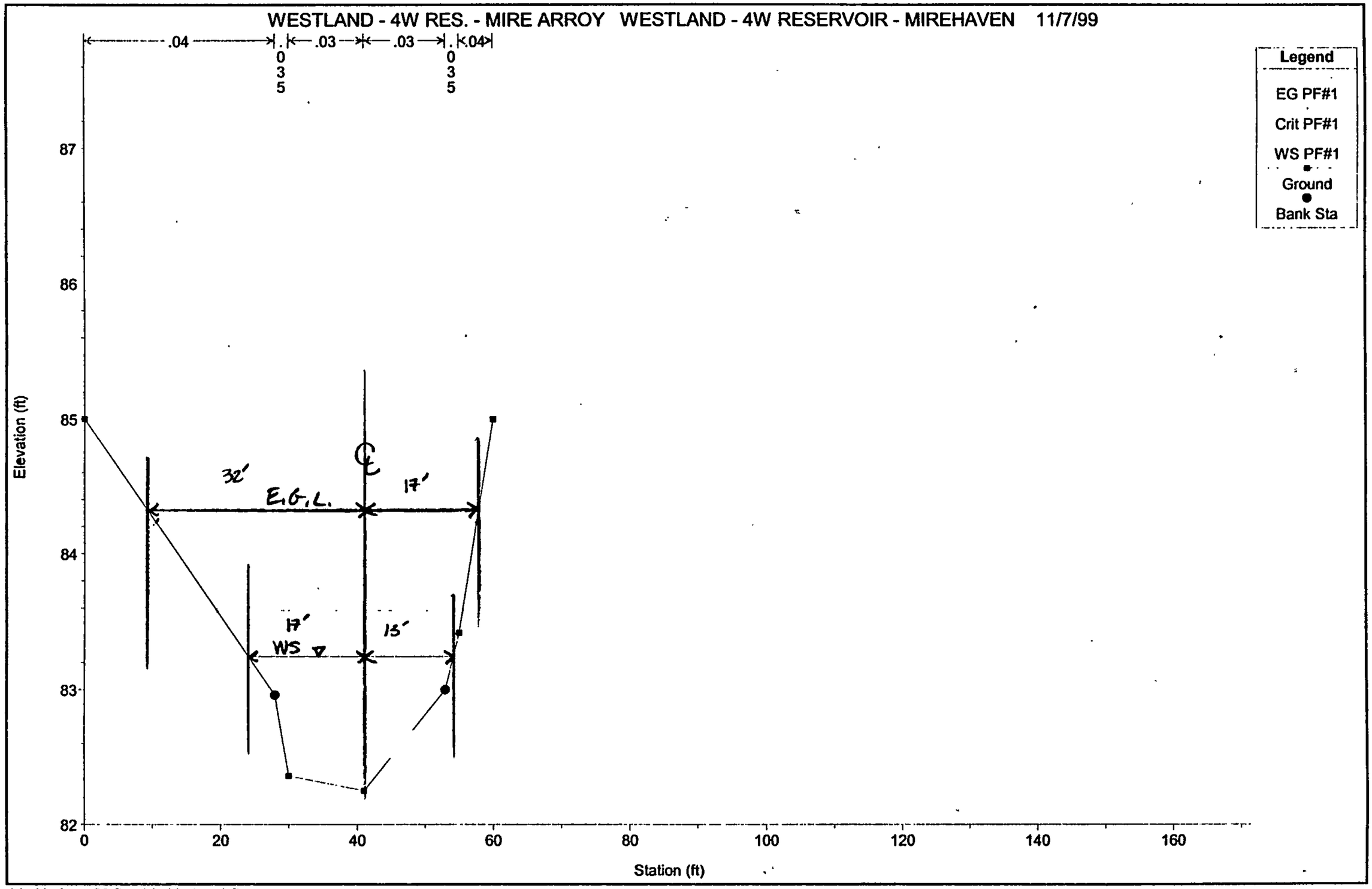
RS=800



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 19

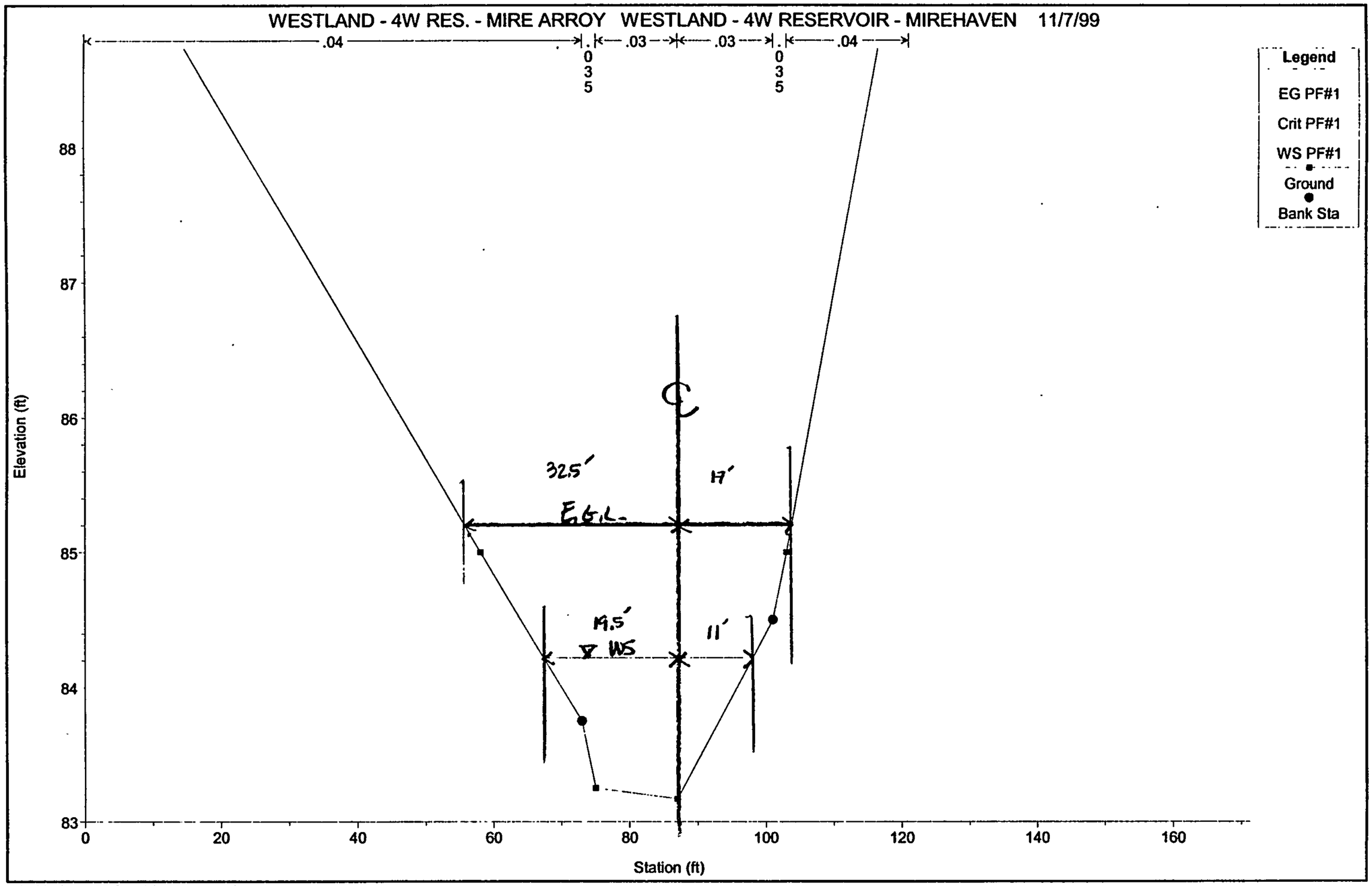
RS=820



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 18

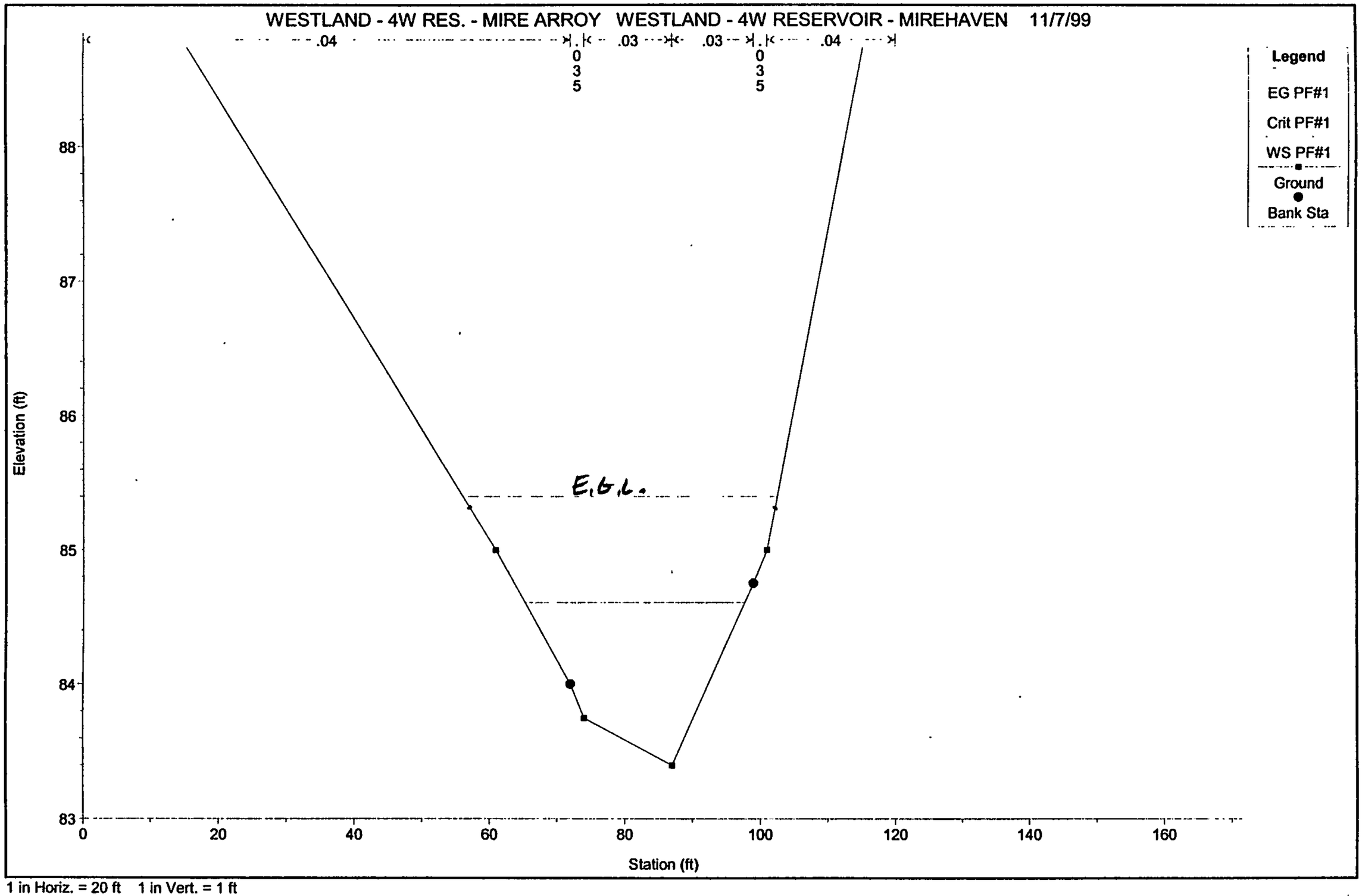
RS = 840



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 17

RS = 845

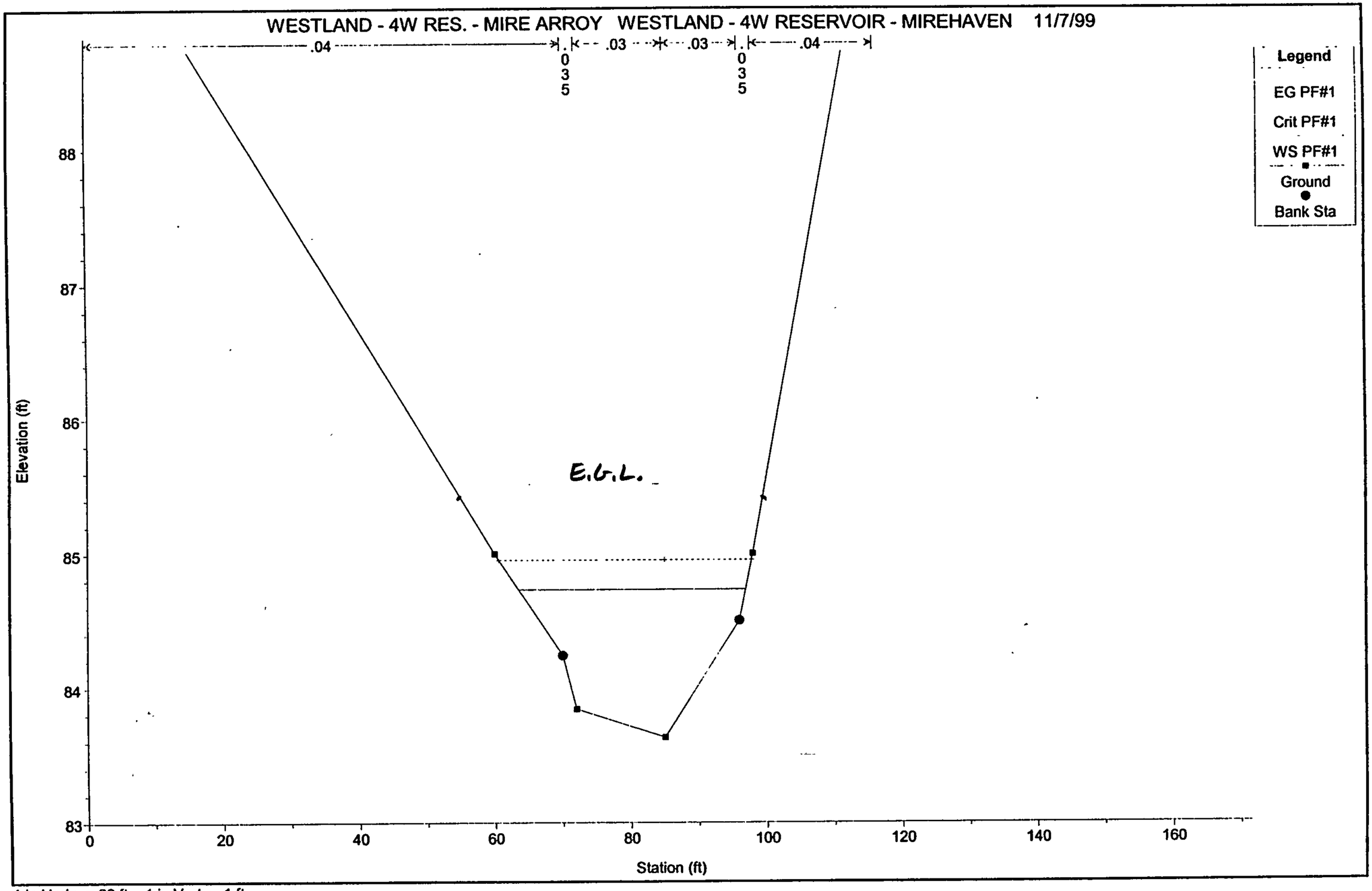


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 16

55

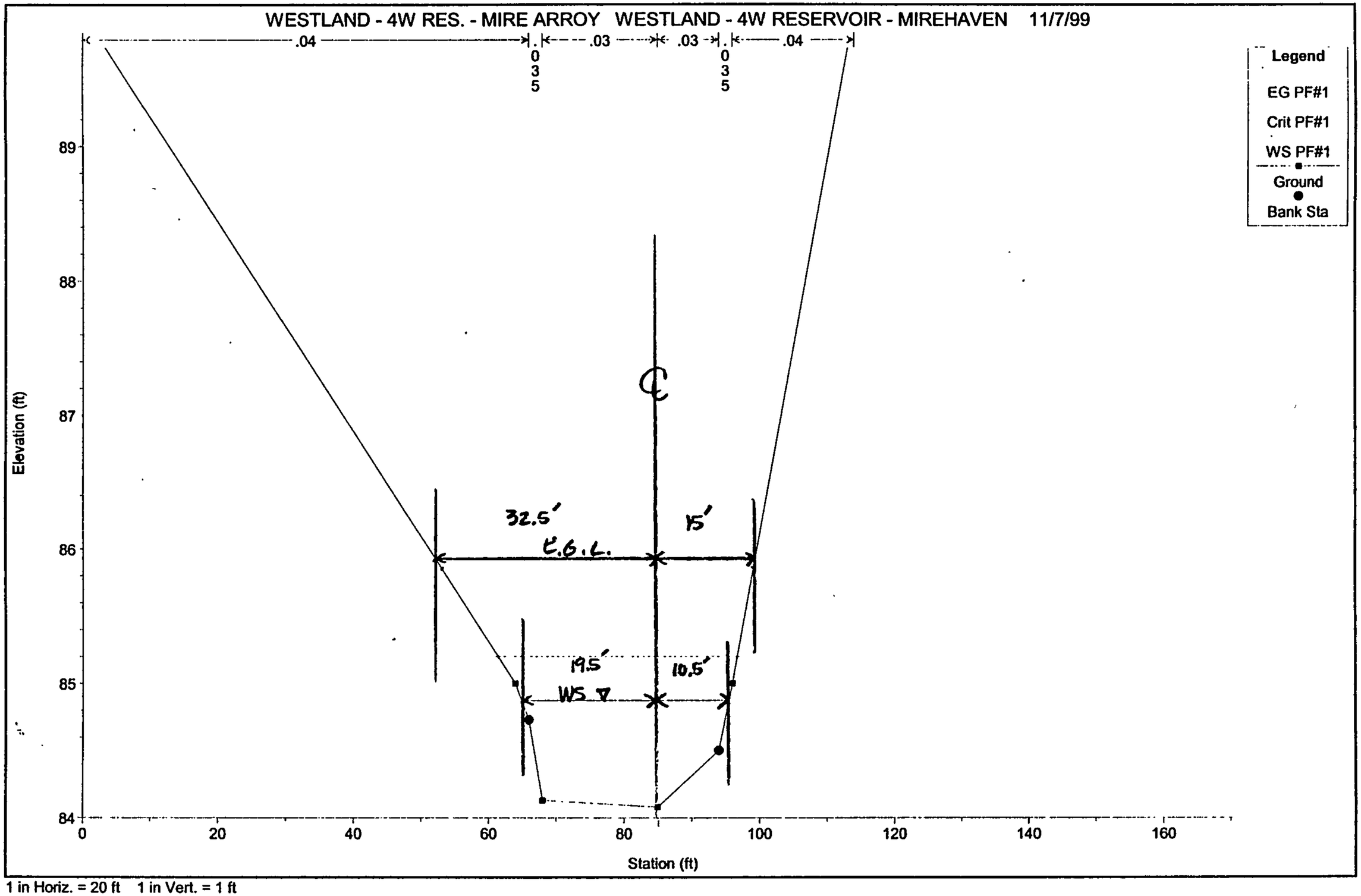
RS = 850



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 15

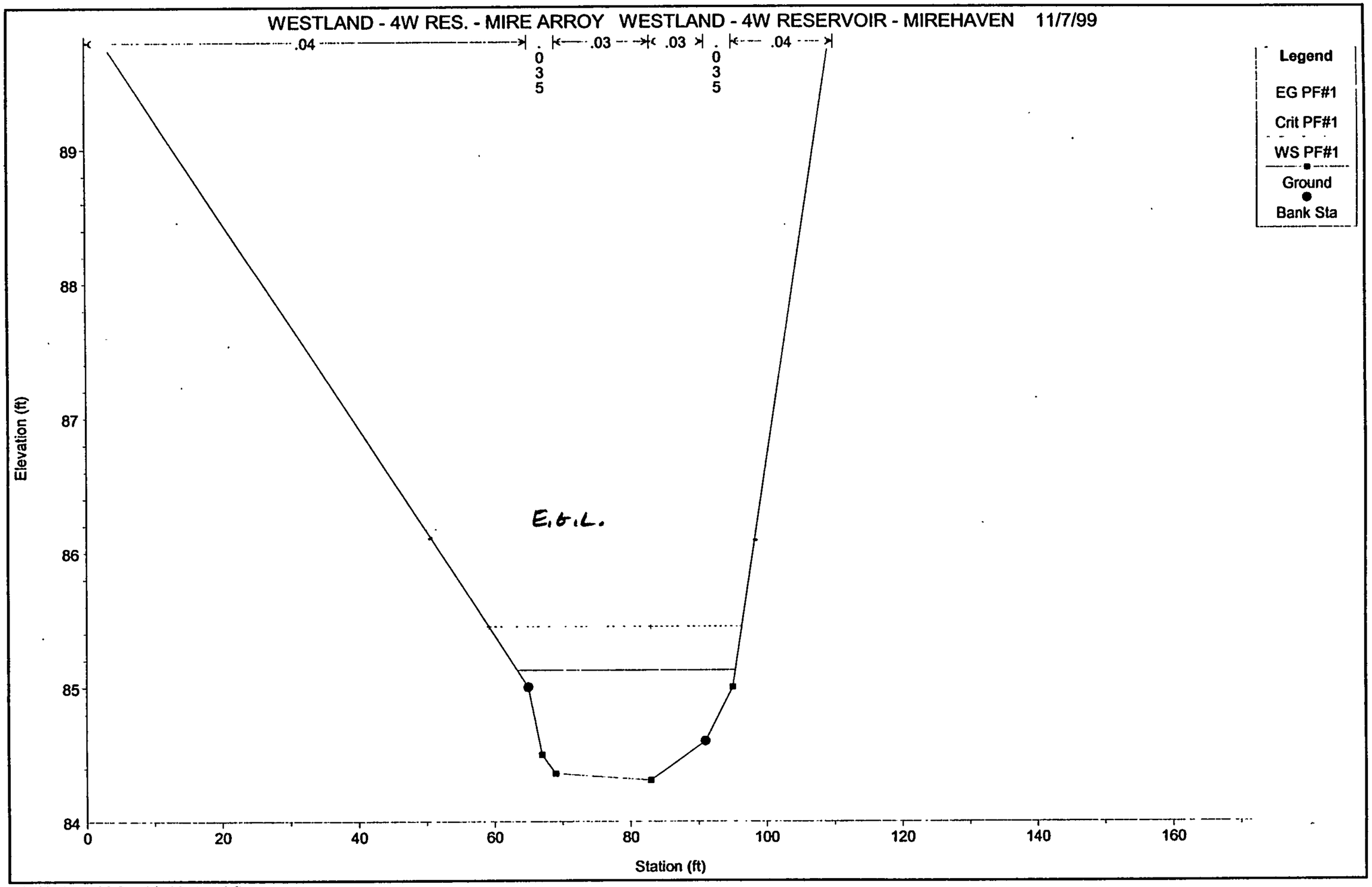
RS = 860



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 14

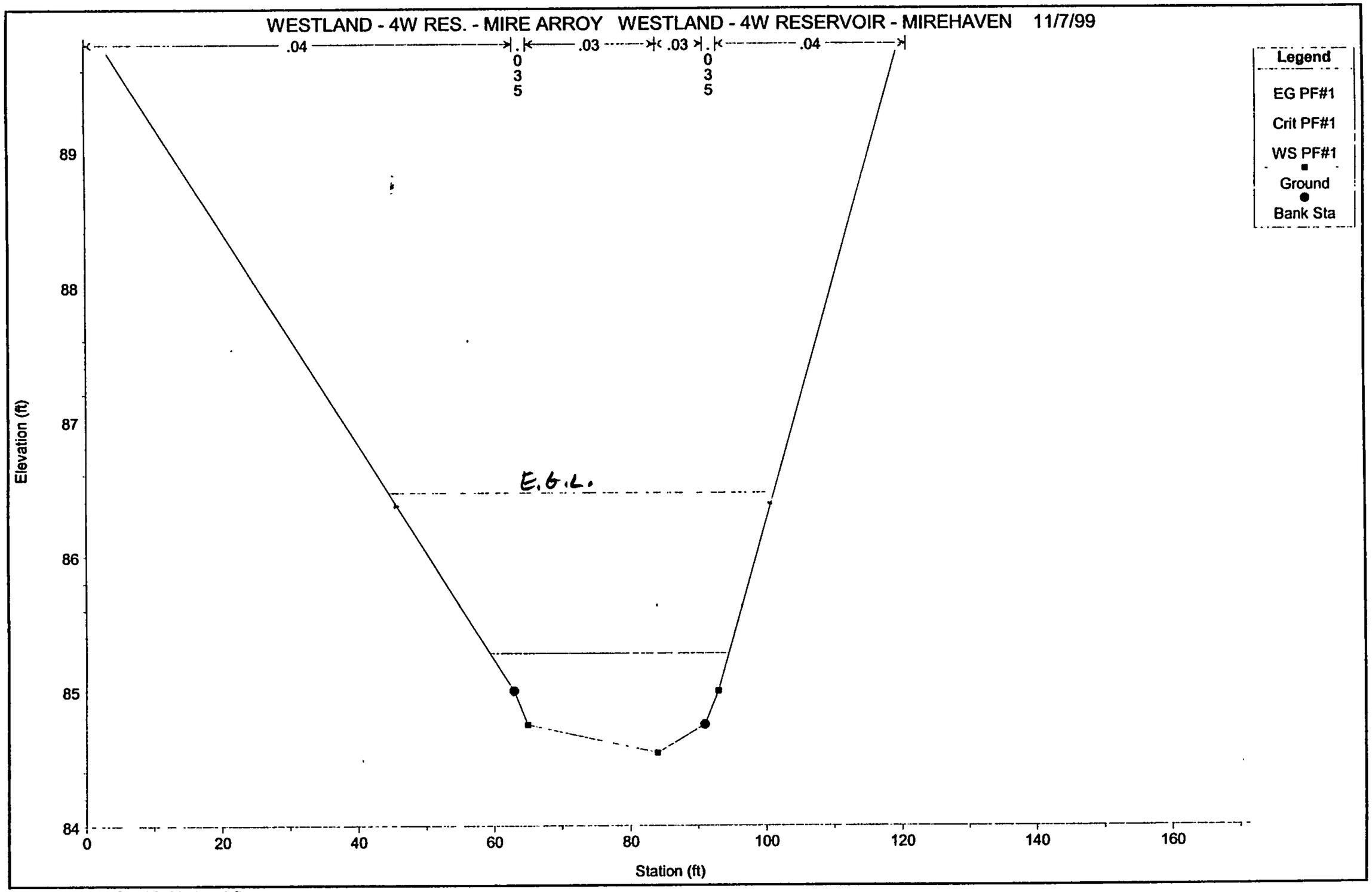
RS = 865



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 13

RS=870



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 12

(15)

RS = 880

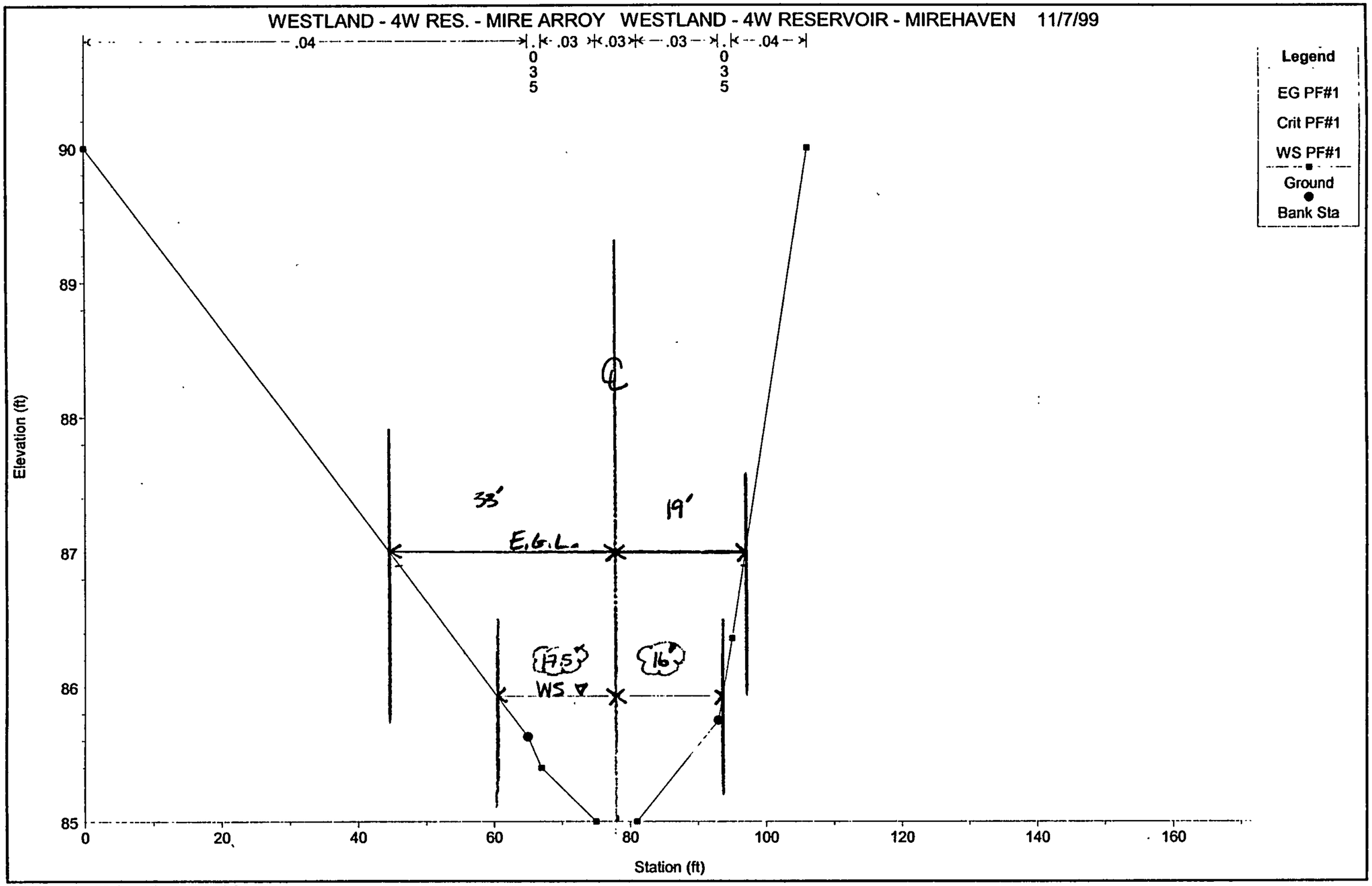
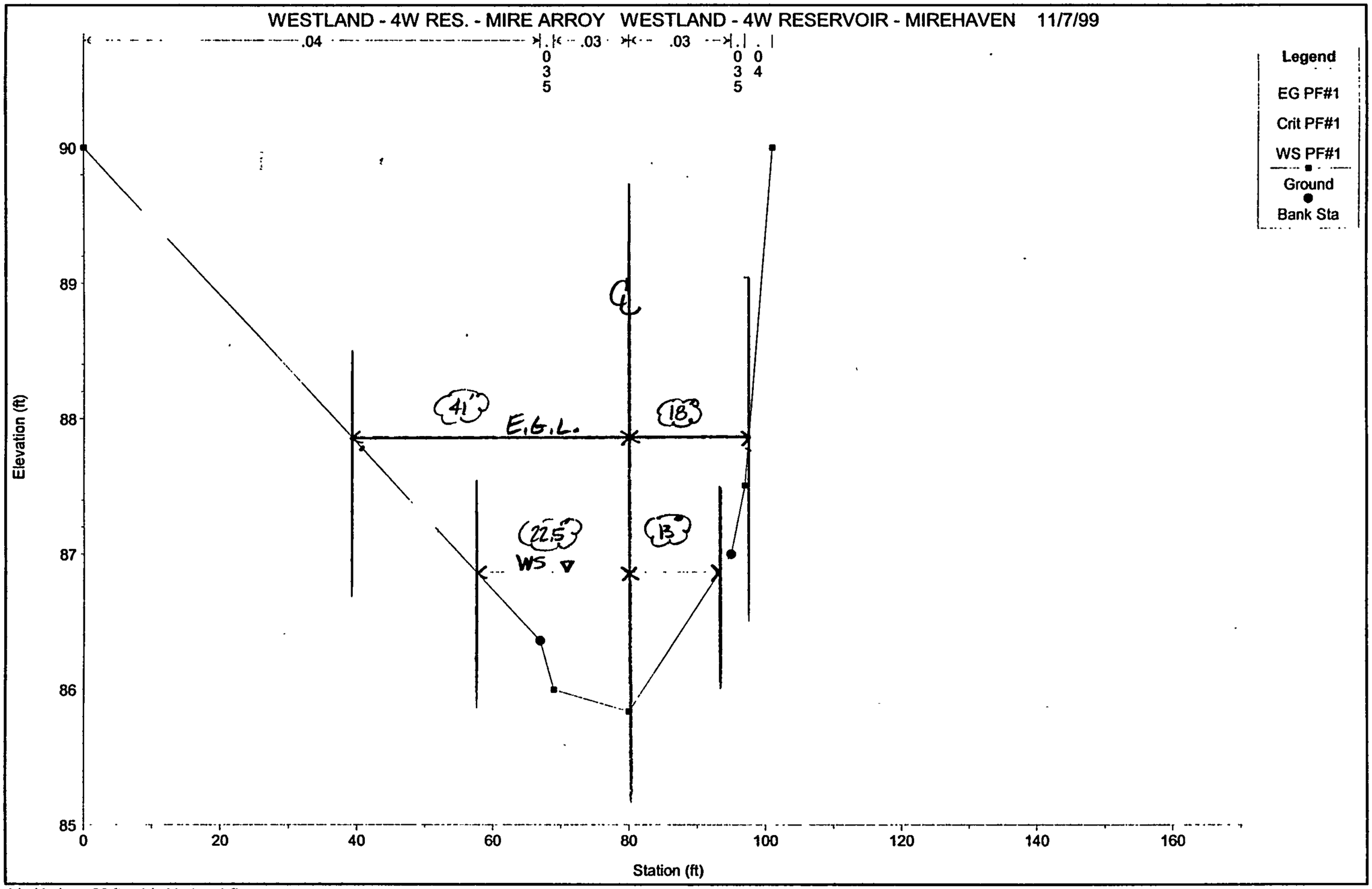


FIGURE 11

50

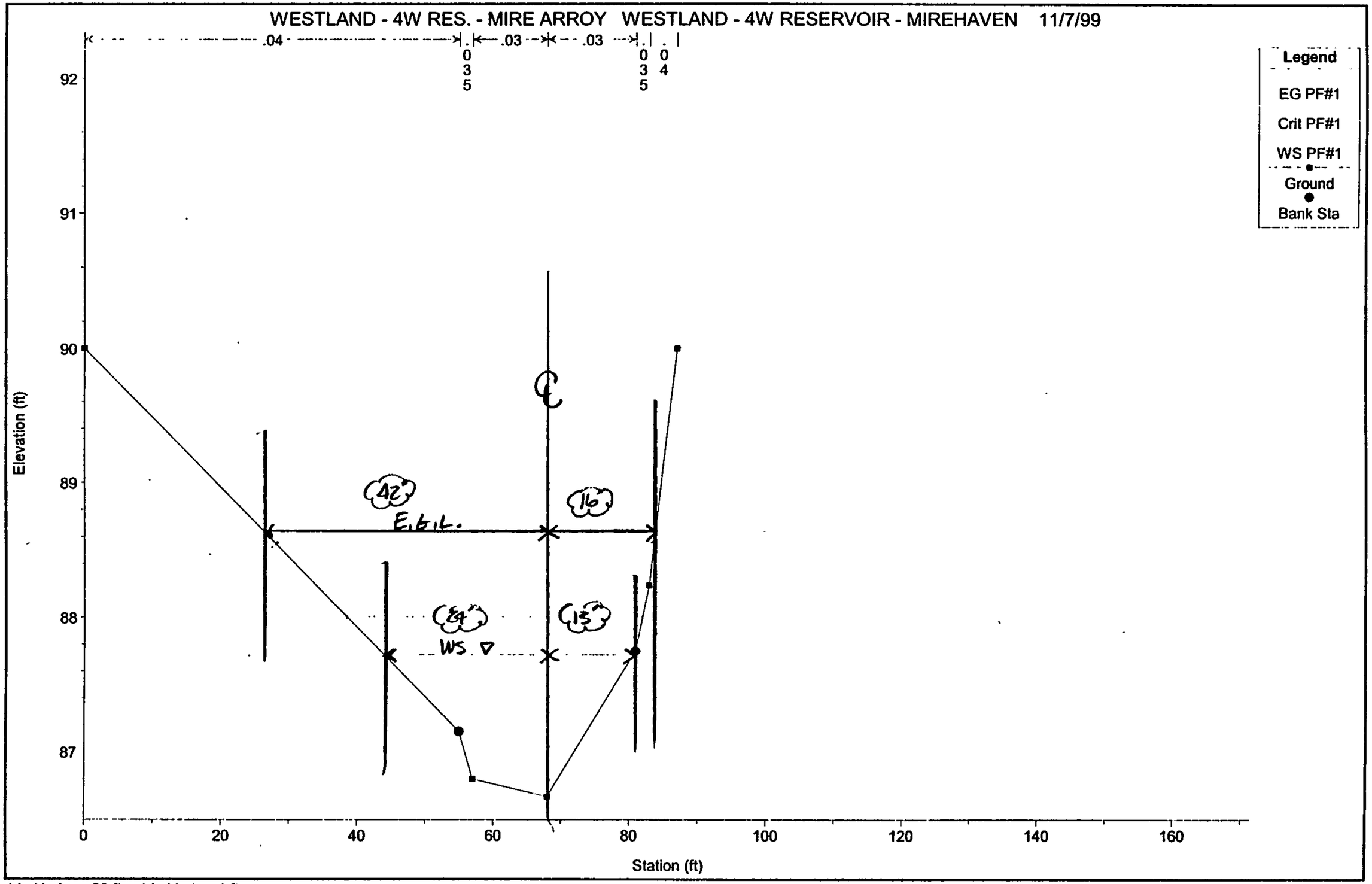
RS = 900



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 10

RS=920

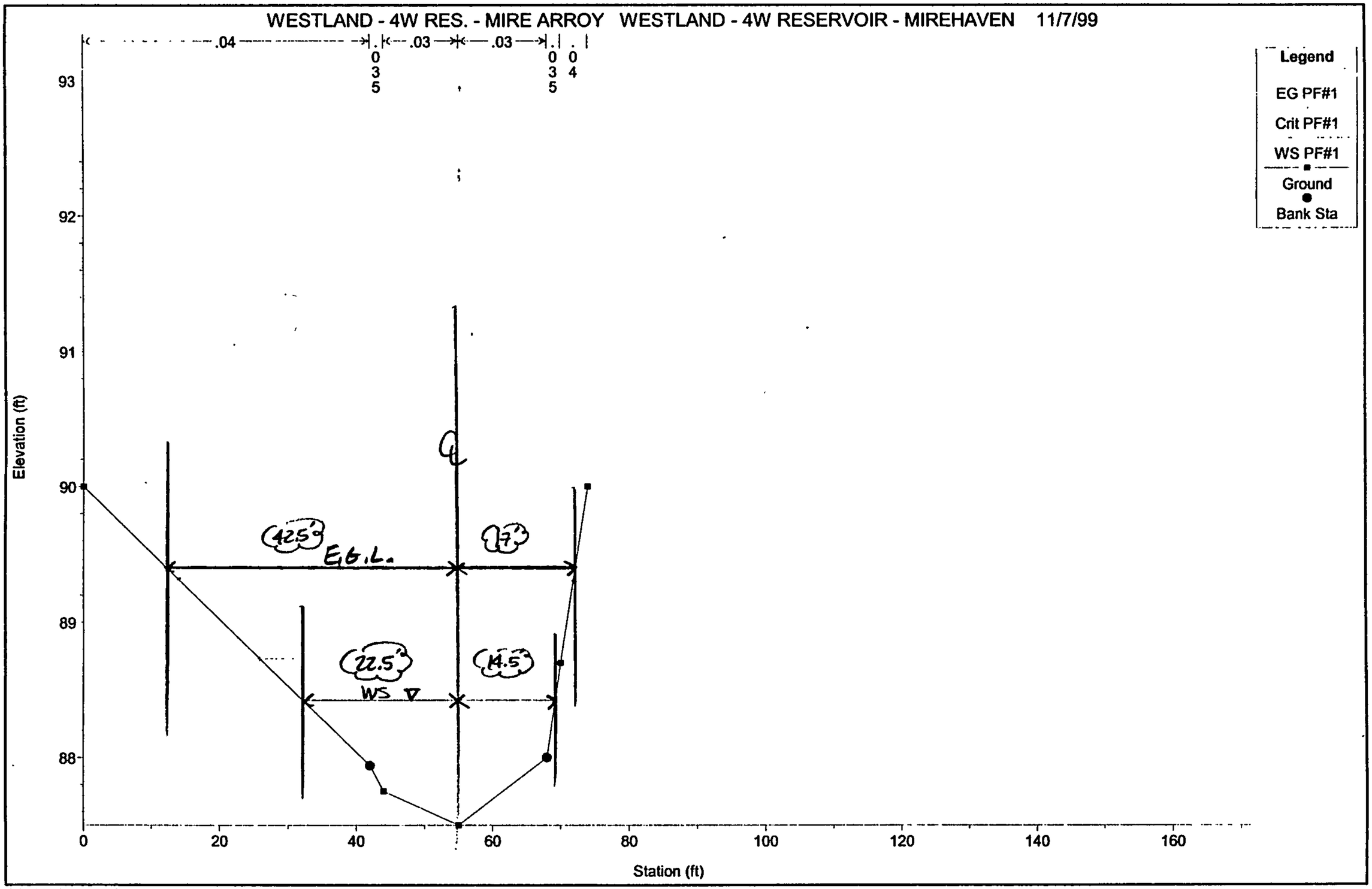


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 9

48

RS = 940

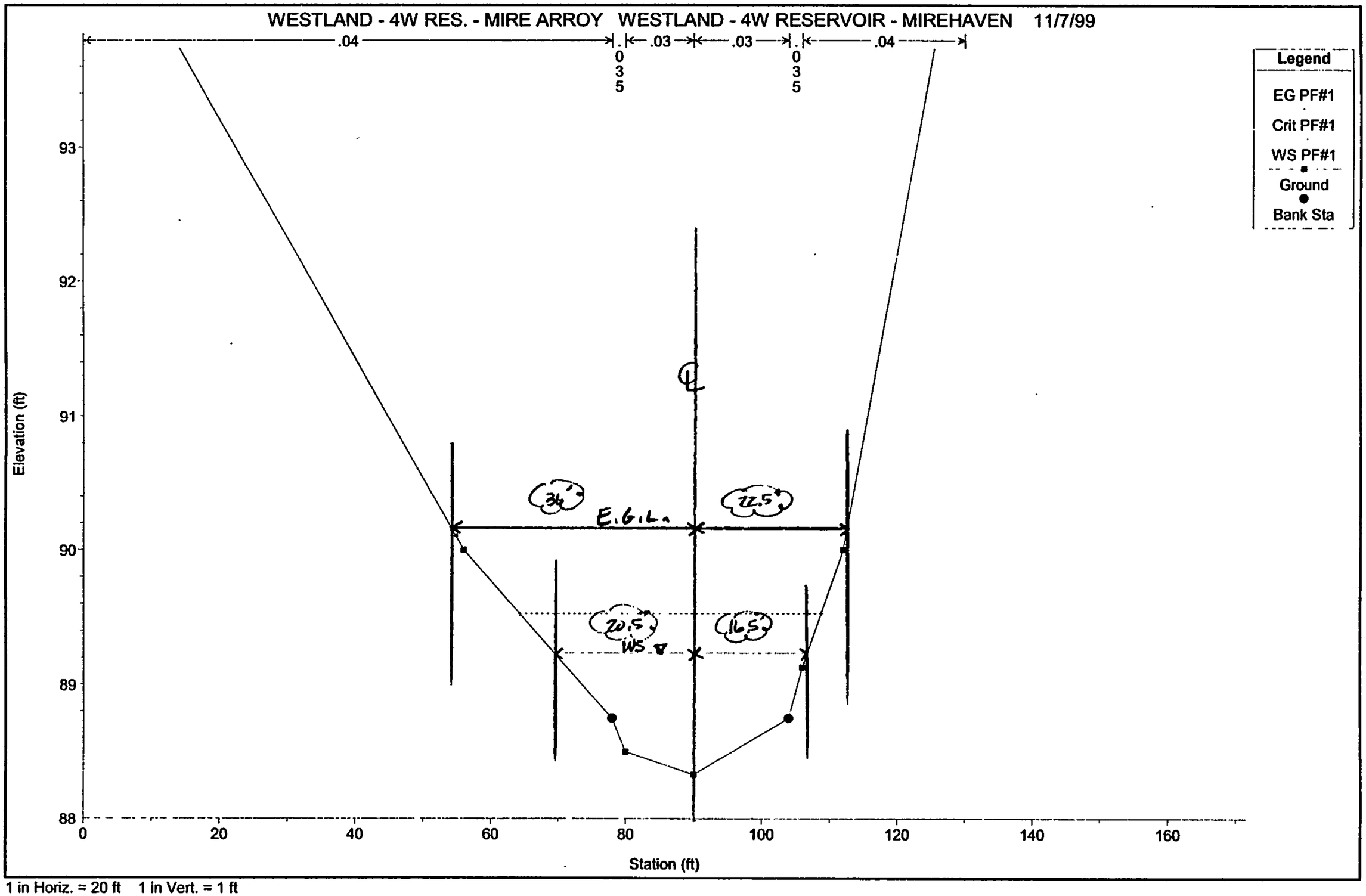


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 8

(47)

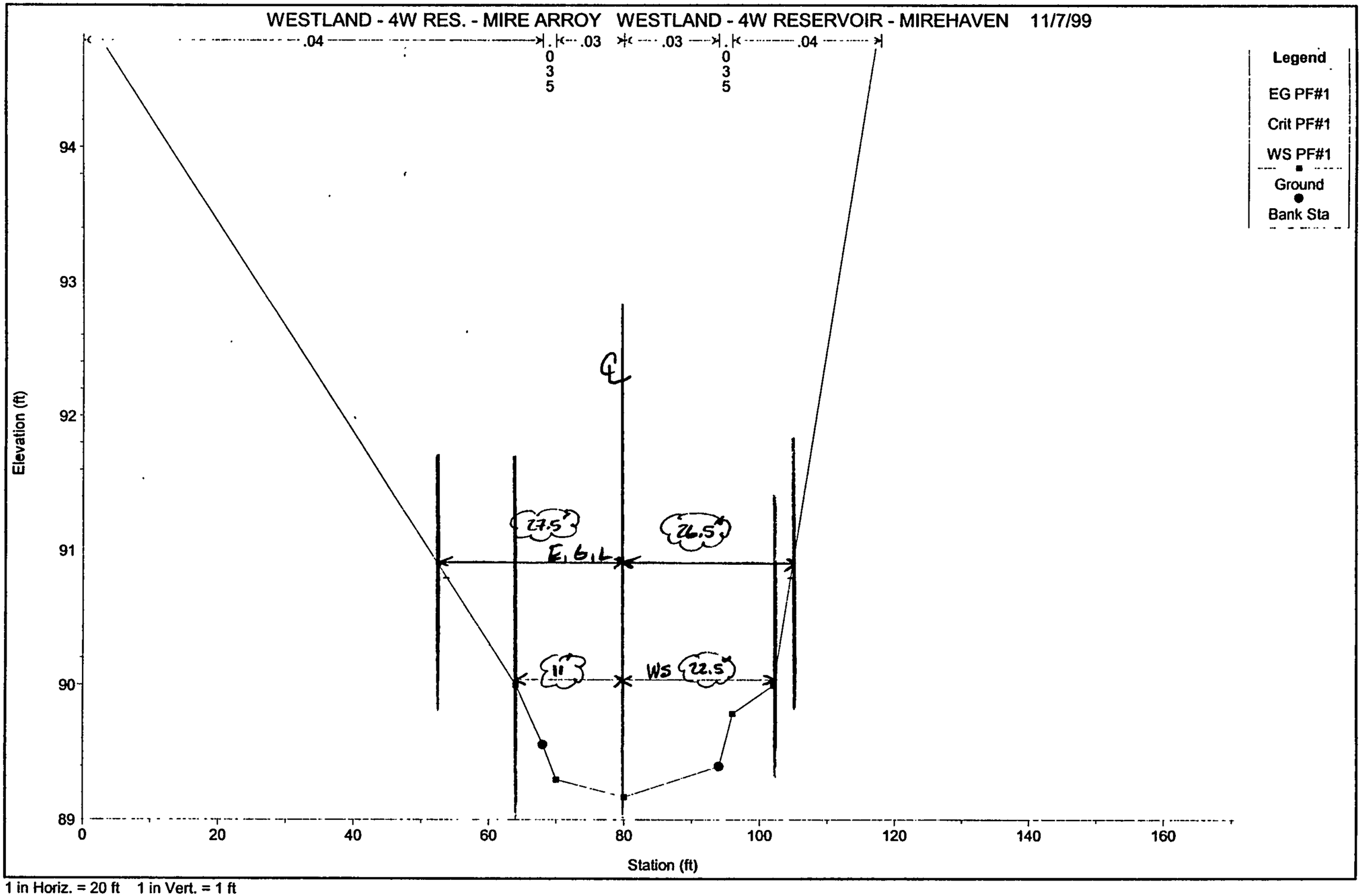
RS=960



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 7

RS = 980

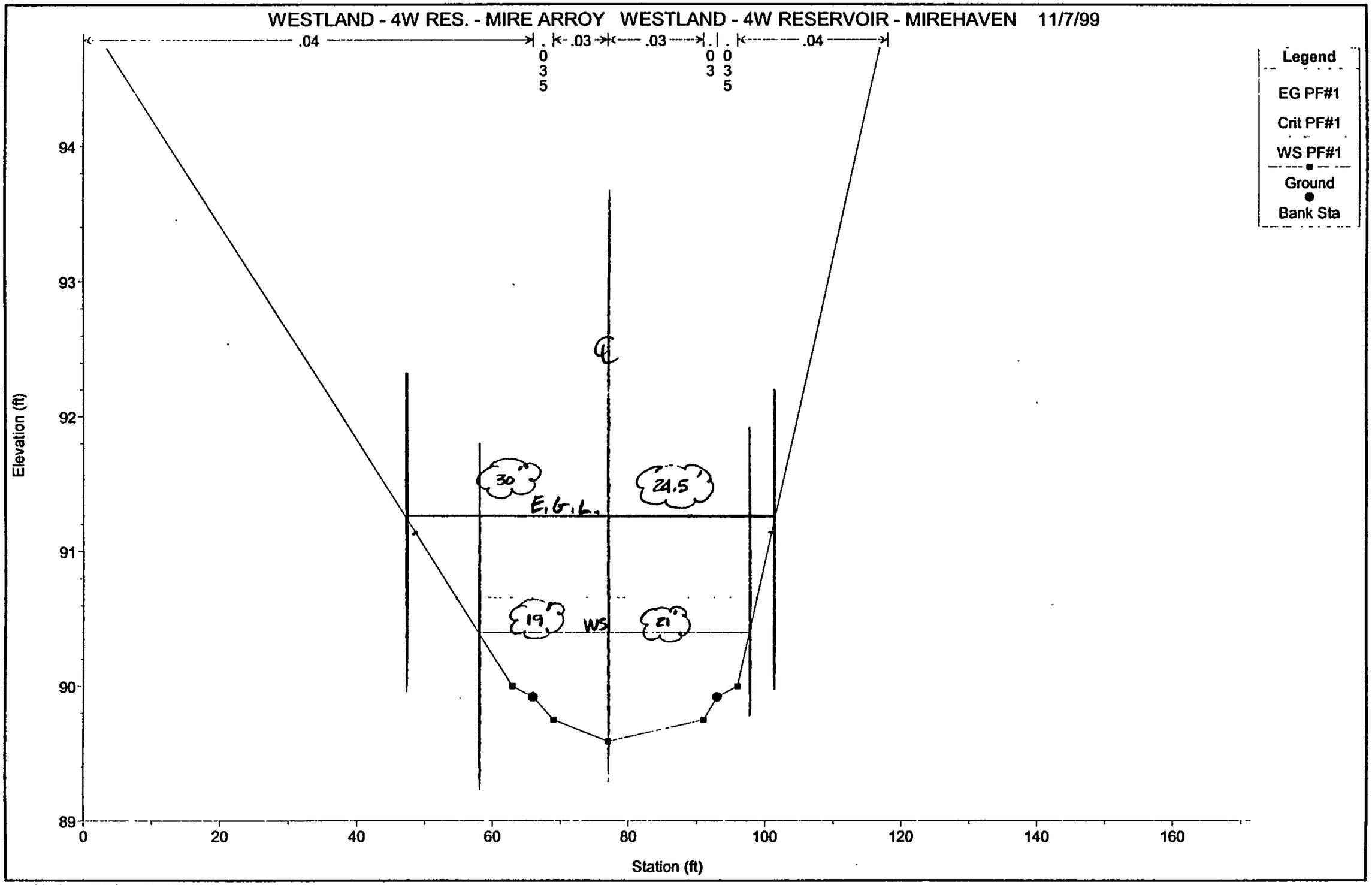


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 6

5

RS = 990

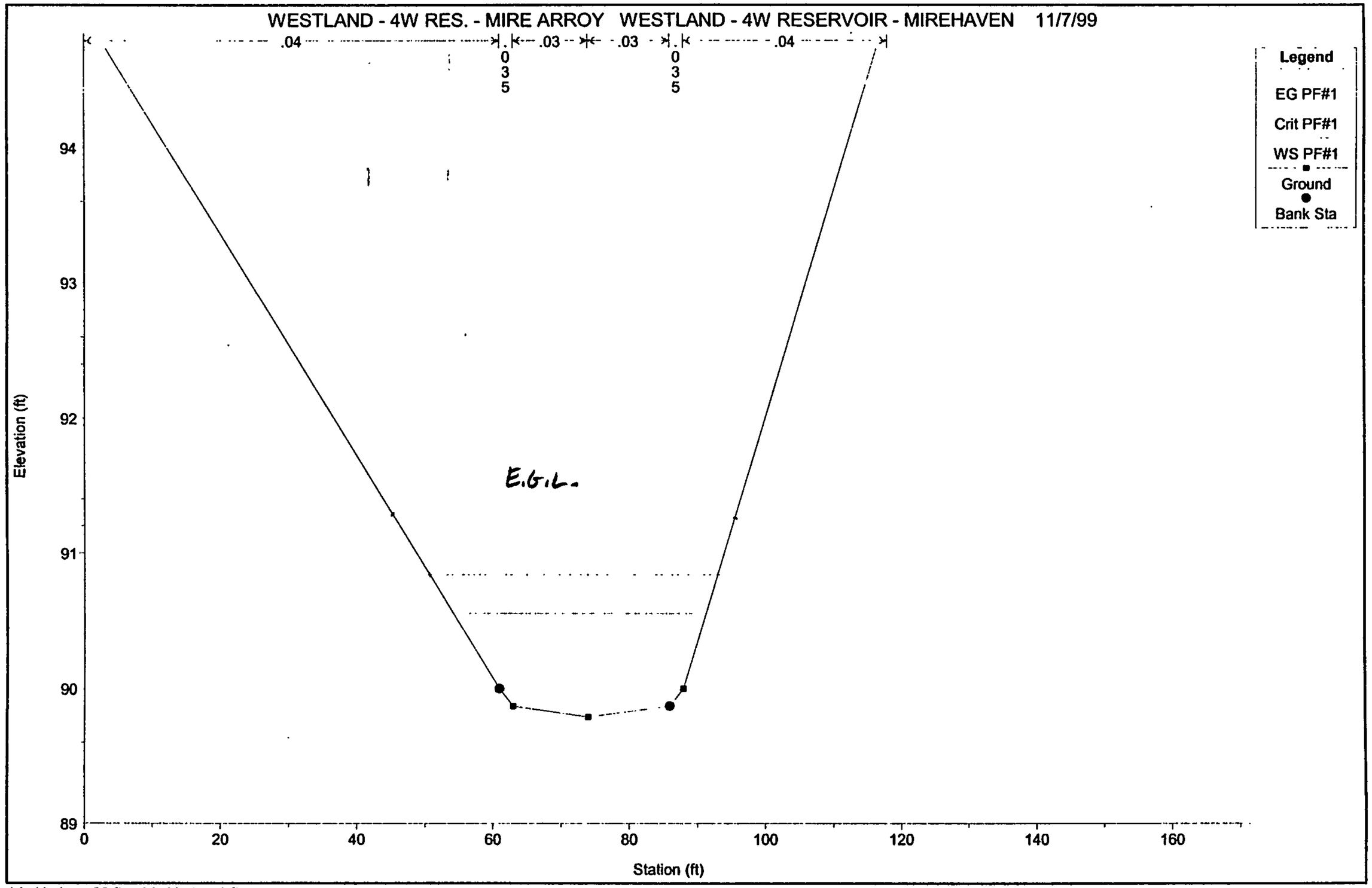


1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 5

(44)

RS = 995



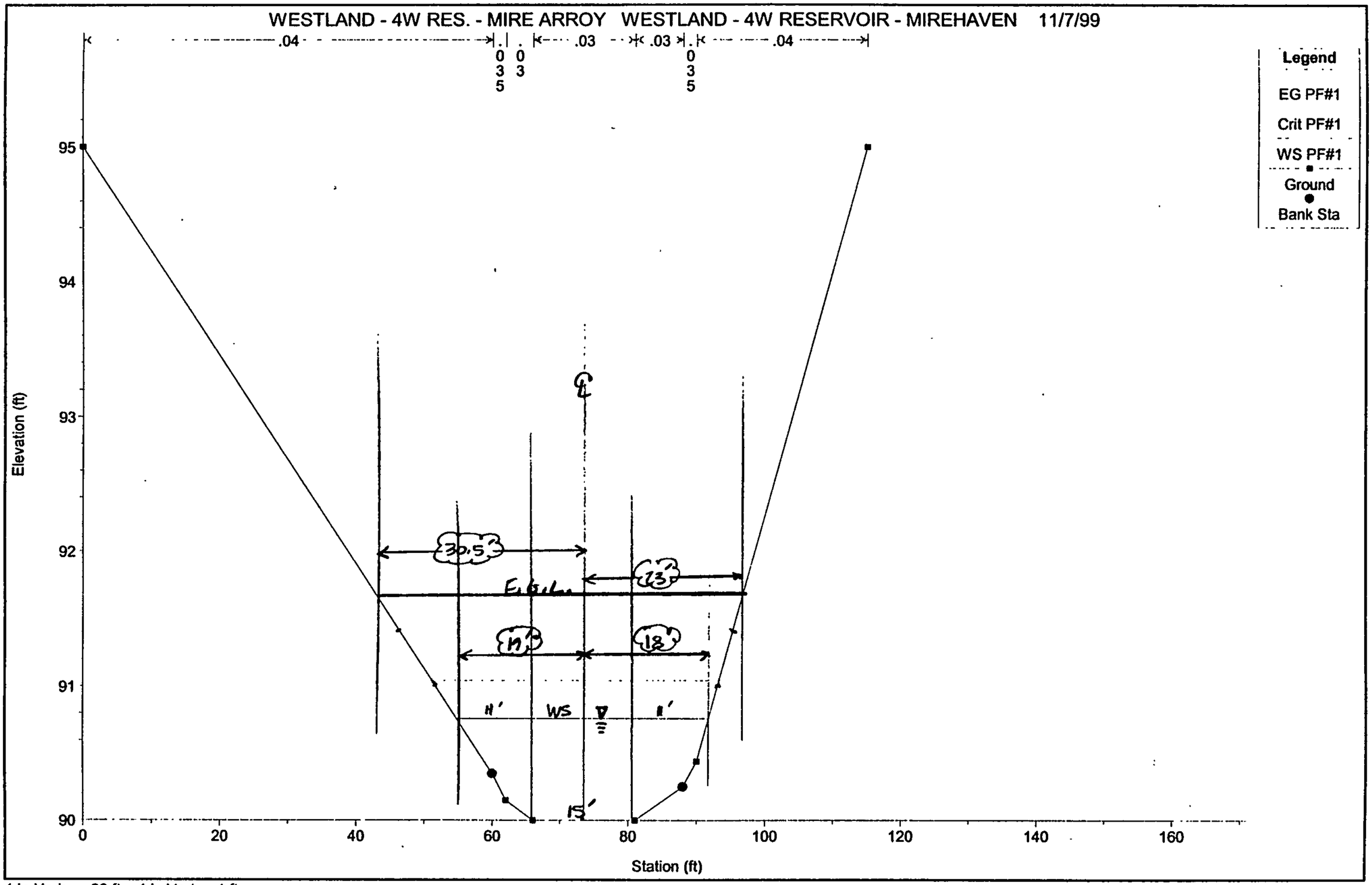
1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 4

43

J:\WESTLAND\CALCS\NEW15.prj

RS=1000



1 in Horiz. = 20 ft 1 in Vert. = 1 ft

FIGURE 3

42

River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 160.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 140 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.

River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 860 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 850 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 840 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 820 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 800 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 790 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 770 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 740 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 720 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 680 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 660 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 580 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 560 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 540 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 520 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 480 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 470.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 460 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 380 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 360 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 340 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 320 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 310.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 300 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 220 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 200.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 180.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.

*
*
*
*
*

Table 3

HEC-RAS Plan: Plan 32 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	470.*	160.00	66.95	68.18	68.58	69.46	0.044239	9.25	18.04	24.96	1.75
SOUTHERN BRANCH	460	160.00	66.74	67.82	68.19	69.01	0.042109	8.92	18.88	26.66	1.71
SOUTHERN BRANCH	440	160.00	65.87	66.99	67.35	68.18	0.041138	9.23	20.16	35.94	1.77
SOUTHERN BRANCH	420	160.00	65.00	66.11	66.40	67.22	0.047528	9.27	24.17	66.70	1.85
SOUTHERN BRANCH	400	160.00	64.23	65.07	65.41	66.24	0.057700	9.21	20.48	42.99	1.97
SOUTHERN BRANCH	380	160.00	63.46	64.45	64.71	65.30	0.032805	7.63	22.70	35.39	1.50
SOUTHERN BRANCH	360	160.00	62.69	63.67	63.96	64.59	0.037358	7.88	21.68	35.21	1.59
SOUTHERN BRANCH	340	160.00	61.92	62.68	63.01	63.73	0.046573	8.28	19.78	30.49	1.75
SOUTHERN BRANCH	320	160.00	61.15	62.17	62.41	62.97	0.026781	7.54	23.93	34.42	1.38
SOUTHERN BRANCH	310.*	160.00	60.77	61.59	61.92	62.63	0.043755	8.33	20.15	32.59	1.71
SOUTHERN BRANCH	300	160.00	60.39	61.12	61.44	62.15	0.048996	8.18	20.00	33.70	1.78
SOUTHERN BRANCH	280.*	160.00	59.67	60.50	60.74	61.30	0.031977	7.22	22.66	33.74	1.49
SOUTHERN BRANCH	260.*	160.00	58.94	59.77	60.02	60.63	0.036850	7.49	21.69	33.37	1.59
SOUTHERN BRANCH	240.*	160.00	58.22	59.06	59.31	59.92	0.036863	7.44	21.79	33.70	1.59
SOUTHERN BRANCH	220	160.00	57.50	58.36	58.60	59.20	0.037849	7.37	21.93	34.05	1.58
SOUTHERN BRANCH	200.*	160.00	56.81	57.67	57.90	58.48	0.036173	7.27	22.27	34.37	1.55
SOUTHERN BRANCH	180.*	160.00	56.12	56.98	57.20	57.76	0.033627	7.10	22.84	34.90	1.50
SOUTHERN BRANCH	160.*	160.00	55.44	56.28	56.51	57.07	0.034868	7.18	22.70	35.69	1.52
SOUTHERN BRANCH	140	160.00	54.75	55.57	55.81	56.39	0.037067	7.30	22.56	37.71	1.56

Table 3

J:\WESTLAND\CALCS\NEW32.prj

HEC-RAS Plan: Plan 32 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	1000	160.00	90.00	90.76	91.04	91.67	0.040010	7.80	21.75	37.02	1.65
SOUTHERN BRANCH	995	160.00	89.79	90.56	90.84	91.47	0.041202	7.99	21.98	37.11	1.66
SOUTHERN BRANCH	990	160.00	89.59	90.40	90.66	91.26	0.039697	7.71	22.81	39.77	1.63
SOUTHERN BRANCH	980	160.00	89.17	90.04	90.30	90.91	0.034579	7.65	22.63	38.63	1.54
SOUTHERN BRANCH	960	160.00	88.33	89.24	89.53	90.17	0.038770	7.93	21.86	37.27	1.63
SOUTHERN BRANCH	940	160.00	87.50	88.43	88.73	89.41	0.041782	8.12	21.40	37.11	1.69
SOUTHERN BRANCH	920	160.00	86.67	87.72	88.00	88.64	0.035363	7.91	22.18	36.71	1.62
SOUTHERN BRANCH	900	160.00	85.84	86.87	87.18	87.87	0.040412	8.20	21.02	35.65	1.72
SOUTHERN BRANCH	880	160.00	85.00	85.93	86.26	87.00	0.045257	8.34	19.72	33.10	1.79
SOUTHERN BRANCH	870	160.00	84.54	85.28	85.64	86.47	0.060852	8.87	18.84	35.10	1.99
SOUTHERN BRANCH	865	160.00	84.31	85.13	85.45	86.17	0.044576	8.31	19.99	32.00	1.73
SOUTHERN BRANCH	860	160.00	84.08	84.87	85.20	85.93	0.047680	8.28	19.56	30.56	1.76
SOUTHERN BRANCH	850	160.00	83.63	84.73	84.95	85.52	0.027544	7.18	23.43	33.43	1.38
SOUTHERN BRANCH	845	160.00	83.40	84.60	84.83	85.40	0.026307	7.26	23.31	32.36	1.41
SOUTHERN BRANCH	840	160.00	83.17	84.22	84.53	85.21	0.038830	8.08	20.67	30.68	1.62
SOUTHERN BRANCH	820	160.00	82.25	83.23	83.58	84.35	0.045780	8.54	19.20	29.80	1.75
SOUTHERN BRANCH	800	160.00	81.33	82.32	82.66	83.42	0.050212	8.42	19.22	30.80	1.81
SOUTHERN BRANCH	790	160.00	80.87	81.62	81.99	82.84	0.060528	8.93	18.23	29.58	1.97
SOUTHERN BRANCH	780	160.00	80.41	81.31	81.60	82.28	0.042446	8.07	20.46	31.95	1.74
SOUTHERN BRANCH	770	160.00	80.00	80.78	81.09	81.81	0.049701	8.25	19.92	32.51	1.79
SOUTHERN BRANCH	760	160.00	79.55	80.33	80.64	81.35	0.047166	8.20	20.32	34.33	1.77
SOUTHERN BRANCH	740	160.00	78.64	79.54	79.84	80.50	0.037464	8.03	21.73	36.00	1.60
SOUTHERN BRANCH	720	160.00	77.73	78.75	79.07	79.79	0.036302	8.30	20.51	29.55	1.59
SOUTHERN BRANCH	700	160.00	76.82	77.85	78.23	79.06	0.038389	9.07	19.27	26.97	1.67
SOUTHERN BRANCH	680	160.00	75.91	77.04	77.44	78.28	0.040916	9.16	18.35	23.21	1.69
SOUTHERN BRANCH	660	160.00	75.00	76.20	76.60	77.48	0.040266	9.40	18.21	22.00	1.69
SOUTHERN BRANCH	640	160.00	74.19	75.28	75.70	76.61	0.045377	9.66	18.49	28.72	1.84
SOUTHERN BRANCH	620	160.00	73.39	74.67	75.01	75.82	0.030745	8.82	18.97	21.80	1.61
SOUTHERN BRANCH	600	160.00	72.58	74.04	74.39	75.24	0.030527	8.99	18.62	21.27	1.63
SOUTHERN BRANCH	580	160.00	71.77	72.88	73.36	74.42	0.050309	10.31	16.40	19.50	1.90
SOUTHERN BRANCH	570	160.00	71.35	72.42	72.87	73.90	0.051604	10.10	16.91	24.44	2.01
SOUTHERN BRANCH	560	160.00	70.97	72.07	72.47	73.34	0.047501	9.53	18.92	29.12	1.81
SOUTHERN BRANCH	540	160.00	70.16	71.33	71.67	72.43	0.042636	8.90	20.40	31.15	1.72
SOUTHERN BRANCH	520	160.00	69.35	70.48	70.86	71.63	0.036420	8.86	19.94	30.07	1.61
SOUTHERN BRANCH	500	160.00	68.48	69.77	70.14	70.93	0.036107	9.02	20.20	30.84	1.64
SOUTHERN BRANCH	480	160.00	67.16	68.51	68.99	70.05	0.052660	10.08	16.56	22.94	1.91

Table 2 - Errors, Warnings & Notes

River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 860 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 850 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 840 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 820 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 800 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 790 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 770 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 740 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 720 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 680 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 660 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 580 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 560 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 540 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 520 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 480 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 470.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 460 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 380 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 360 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 340 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 320 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 310.* Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 300 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.

*****

Table 2-cont.

HEC-RAS Plan: PLAN22 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	470	160.00	66.95	68.18	68.58	69.46	0.044239	9.25	18.04	24.96	1.75
SOUTHERN BRANCH	460	160.00	66.74	67.82	68.19	69.01	0.042109	8.92	18.88	26.66	1.71
SOUTHERN BRANCH	440	160.00	65.87	66.99	67.35	68.18	0.041138	9.23	20.16	35.94	1.77
SOUTHERN BRANCH	420	160.00	65.00	66.11	66.40	67.22	0.047528	9.27	24.17	66.70	1.85
SOUTHERN BRANCH	400	160.00	64.23	65.07	65.41	66.24	0.057700	9.21	20.48	42.99	1.97
SOUTHERN BRANCH	380	160.00	63.46	64.45	64.71	65.30	0.032805	7.63	22.70	35.39	1.50
SOUTHERN BRANCH	360	160.00	62.69	63.67	63.96	64.59	0.037358	7.88	21.68	35.21	1.59
SOUTHERN BRANCH	340	160.00	61.92	62.68	63.01	63.73	0.046573	8.28	19.78	30.49	1.75
SOUTHERN BRANCH	320	160.00	61.15	62.17	62.41	62.97	0.026781	7.54	23.93	34.42	1.38
SOUTHERN BRANCH	310	160.00	60.77	61.59	61.92	62.63	0.043755	8.33	20.15	32.59	1.71
SOUTHERN BRANCH	300	160.00	60.39	61.12	61.44	62.15	0.048996	8.18	20.00	33.70	1.78

River Stations (adj. to det. pond)	Water Depth	W.S. Elev.	Det. Pond Bottom Elev.	E.G.L.	E.G.L. Elev.
460	1.08'	5567.82	5566	2.27'	5569.01
440	1.12'	5566.99		2.31'	5568.18
420	1.11'	5566.11		2.22	5567.22
400	0.84'	5565.07		2.01'	5566.24
380	0.99'	5564.45		1.84'	5565.30
360	0.98'	5563.67		1.90'	5564.59

Table 2 — Interpolated Sections Included

HEC-RAS Plan: PLAN22 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	1000	160.00	90.00	90.76	91.04	91.67	0.040010	7.80	21.75	37.02	1.65
SOUTHERN BRANCH	995	160.00	89.79	90.56	90.84	91.47	0.041202	7.99	21.98	37.11	1.66
SOUTHERN BRANCH	990	160.00	89.59	90.40	90.66	91.26	0.039697	7.71	22.81	39.77	1.63
SOUTHERN BRANCH	980	160.00	89.17	90.04	90.30	90.91	0.034579	7.65	22.63	38.63	1.54
SOUTHERN BRANCH	960	160.00	88.33	89.24	89.53	90.17	0.038770	7.93	21.86	37.27	1.63
SOUTHERN BRANCH	940	160.00	87.50	88.43	88.73	89.41	0.041782	8.12	21.40	37.11	1.69
SOUTHERN BRANCH	920	160.00	86.67	87.72	88.00	88.64	0.035363	7.91	22.18	36.71	1.62
SOUTHERN BRANCH	900	160.00	85.84	86.87	87.18	87.87	0.040412	8.20	21.02	35.65	1.72
SOUTHERN BRANCH	880	160.00	85.00	85.93	86.26	87.00	0.045257	8.34	19.72	33.10	1.79
SOUTHERN BRANCH	870	160.00	84.54	85.28	85.64	86.47	0.060852	8.87	18.84	35.10	1.99
SOUTHERN BRANCH	865	160.00	84.31	85.13	85.45	86.17	0.044576	8.31	19.99	32.00	1.73
SOUTHERN BRANCH	860	160.00	84.08	84.87	85.20	85.93	0.047680	8.28	19.56	30.56	1.76
SOUTHERN BRANCH	850	160.00	83.63	84.73	84.95	85.52	0.027544	7.18	23.43	33.43	1.38
SOUTHERN BRANCH	845	160.00	83.40	84.60	84.83	85.40	0.026307	7.26	23.31	32.36	1.41
SOUTHERN BRANCH	840	160.00	83.17	84.22	84.53	85.21	0.038830	8.08	20.67	30.68	1.62
SOUTHERN BRANCH	820	160.00	82.25	83.23	83.58	84.35	0.045780	8.54	19.20	29.80	1.75
SOUTHERN BRANCH	800	160.00	81.33	82.32	82.66	83.42	0.050212	8.42	19.22	30.80	1.81
SOUTHERN BRANCH	790	160.00	80.87	81.62	81.99	82.84	0.060528	8.93	18.23	29.58	1.97
SOUTHERN BRANCH	780	160.00	80.41	81.31	81.60	82.28	0.042446	8.07	20.46	31.95	1.74
SOUTHERN BRANCH	770	160.00	80.00	80.78	81.09	81.81	0.049701	8.25	19.92	32.51	1.79
SOUTHERN BRANCH	760	160.00	79.55	80.33	80.64	81.35	0.047166	8.20	20.32	34.33	1.77
SOUTHERN BRANCH	740	160.00	78.64	79.54	79.84	80.50	0.037464	8.03	21.73	36.00	1.60
SOUTHERN BRANCH	720	160.00	77.73	78.75	79.07	79.79	0.036302	8.30	20.51	29.55	1.59
SOUTHERN BRANCH	700	160.00	76.82	77.85	78.23	79.06	0.038389	9.07	19.27	26.97	1.67
SOUTHERN BRANCH	680	160.00	75.91	77.04	77.44	78.28	0.040916	9.16	18.35	23.21	1.69
SOUTHERN BRANCH	660	160.00	75.00	76.20	76.60	77.48	0.040266	9.40	18.21	22.00	1.69
SOUTHERN BRANCH	640	160.00	74.19	75.28	75.70	76.61	0.045377	9.66	18.49	28.72	1.84
SOUTHERN BRANCH	620	160.00	73.39	74.67	75.01	75.82	0.030745	8.82	18.97	21.80	1.61
SOUTHERN BRANCH	600	160.00	72.58	74.04	74.39	75.24	0.030527	8.99	18.62	21.27	1.63
SOUTHERN BRANCH	580	160.00	71.77	72.88	73.36	74.42	0.050309	10.31	16.40	19.50	1.90
SOUTHERN BRANCH	570	160.00	71.35	72.42	72.87	73.90	0.051604	10.10	16.91	24.44	2.01
SOUTHERN BRANCH	560	160.00	70.97	72.07	72.47	73.34	0.047501	9.53	18.92	29.12	1.81
SOUTHERN BRANCH	540	160.00	70.16	71.33	71.67	72.43	0.042636	8.90	20.40	31.15	1.72
SOUTHERN BRANCH	520	160.00	69.35	70.48	70.86	71.63	0.036420	8.86	19.94	30.07	1.61
SOUTHERN BRANCH	500	160.00	68.48	69.77	70.14	70.93	0.036107	9.02	20.20	30.84	1.64
SOUTHERN BRANCH	480	160.00	67.16	68.51	68.99	70.05	0.052660	10.08	16.56	22.94	1.91

Table 1 –

ERRORS, WARNINGS & NOTES

River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 860 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 850 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 840 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 820 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 800 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 790 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 770 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 740 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 720 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 680 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 660 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 580 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 560 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 540 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 520 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 480 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 460 Profile: PF#1
Warning - The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 380 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 360 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 340 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 320 Profile: PF#1
Note - Manning's n values were composited to a single value in the main channel.
River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH RS: 300 Profile: PF#1
Warning - The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7
or greater than 1.4. This may indicate the need for additional cross sections.
Note - Manning's n values were composited to a single value in the main channel.

Table 1, cont.

HEC-RAS Plan: PLAN21 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	460	160.00	66.74	67.82	68.19	69.01	0.042161	8.93	18.87	26.65	1.71
SOUTHERN BRANCH	440	160.00	65.87	66.99	67.35	68.18	0.041146	9.23	20.16	35.94	1.77
SOUTHERN BRANCH	420	160.00	65.00	66.11	66.40	67.22	0.047597	9.27	24.15	66.69	1.86
SOUTHERN BRANCH	400	160.00	64.23	65.07	65.41	66.24	0.057497	9.20	20.51	43.00	1.96
SOUTHERN BRANCH	380	160.00	63.46	64.45	64.71	65.30	0.032723	7.63	22.72	35.41	1.50
SOUTHERN BRANCH	360	160.00	62.69	63.67	63.96	64.59	0.037393	7.88	21.67	35.20	1.59
SOUTHERN BRANCH	340	160.00	61.92	62.68	63.01	63.73	0.046559	8.28	19.78	30.49	1.75
SOUTHERN BRANCH	320	160.00	61.15	62.17	62.41	62.97	0.026781	7.54	23.93	34.42	1.38
SOUTHERN BRANCH	300	160.00	60.39	61.11	61.44	62.19	0.053900	8.43	19.40	33.31	1.86

Table 1

HEC-RAS Plan: PLAN21 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	1000	160.00	90.00	90.76	91.04	91.67	0.040010	7.80	21.75	37.02	1.65
SOUTHERN BRANCH	995	160.00	89.79	90.56	90.84	91.47	0.041202	7.99	21.98	37.11	1.66
SOUTHERN BRANCH	990	160.00	89.59	90.40	90.66	91.26	0.039697	7.71	22.81	39.77	1.63
SOUTHERN BRANCH	980	160.00	89.17	90.04	90.30	90.91	0.034579	7.65	22.63	38.63	1.54
SOUTHERN BRANCH	960	160.00	88.33	89.24	89.53	90.17	0.038770	7.93	21.86	37.27	1.63
SOUTHERN BRANCH	940	160.00	87.50	88.43	88.73	89.41	0.041782	8.12	21.40	37.11	1.69
SOUTHERN BRANCH	920	160.00	86.67	87.72	88.00	88.64	0.035363	7.91	22.18	36.71	1.62
SOUTHERN BRANCH	900	160.00	85.84	86.87	87.18	87.87	0.040412	8.20	21.02	35.65	1.72
SOUTHERN BRANCH	880	160.00	85.00	85.93	86.26	87.00	0.045257	8.34	19.72	33.10	1.79
SOUTHERN BRANCH	870	160.00	84.54	85.28	85.64	86.47	0.060852	8.87	18.84	35.10	1.99
SOUTHERN BRANCH	865	160.00	84.31	85.13	85.45	86.17	0.044576	8.31	19.99	32.00	1.73
SOUTHERN BRANCH	860	160.00	84.08	84.87	85.20	85.93	0.047680	8.28	19.56	30.56	1.76
SOUTHERN BRANCH	850	160.00	83.63	84.73	84.95	85.52	0.027544	7.18	23.43	33.43	1.38
SOUTHERN BRANCH	845	160.00	83.40	84.60	84.83	85.40	0.026307	7.26	23.31	32.36	1.41
SOUTHERN BRANCH	840	160.00	83.17	84.22	84.53	85.21	0.038830	8.08	20.67	30.68	1.62
SOUTHERN BRANCH	820	160.00	82.25	83.23	83.58	84.35	0.045780	8.54	19.20	29.80	1.75
SOUTHERN BRANCH	800	160.00	81.33	82.32	82.66	83.42	0.050212	8.42	19.22	30.80	1.81
SOUTHERN BRANCH	790	160.00	80.87	81.62	81.99	82.84	0.060528	8.93	18.23	29.58	1.97
SOUTHERN BRANCH	780	160.00	80.41	81.31	81.60	82.28	0.042446	8.07	20.46	31.95	1.74
SOUTHERN BRANCH	770	160.00	80.00	80.78	81.09	81.81	0.049701	8.25	19.92	32.51	1.79
SOUTHERN BRANCH	760	160.00	79.55	80.33	80.64	81.35	0.047166	8.20	20.32	34.33	1.77
SOUTHERN BRANCH	740	160.00	78.64	79.54	79.84	80.50	0.037464	8.03	21.73	36.00	1.60
SOUTHERN BRANCH	720	160.00	77.73	78.75	79.07	79.79	0.036302	8.30	20.51	29.55	1.59
SOUTHERN BRANCH	700	160.00	76.82	77.85	78.23	79.06	0.038389	9.07	19.27	26.97	1.67
SOUTHERN BRANCH	680	160.00	75.91	77.04	77.44	78.28	0.040916	9.16	18.35	23.21	1.69
SOUTHERN BRANCH	660	160.00	75.00	76.20	76.60	77.48	0.040266	9.40	18.21	22.00	1.69
SOUTHERN BRANCH	640	160.00	74.19	75.28	75.70	76.61	0.045377	9.66	18.49	28.72	1.84
SOUTHERN BRANCH	620	160.00	73.39	74.67	75.01	75.82	0.030745	8.82	18.97	21.80	1.61
SOUTHERN BRANCH	600	160.00	72.58	74.04	74.39	75.24	0.030527	8.99	18.62	21.27	1.63
SOUTHERN BRANCH	580	160.00	71.77	72.88	73.36	74.42	0.050309	10.31	16.40	19.50	1.90
SOUTHERN BRANCH	570	160.00	71.35	72.42	72.87	73.90	0.051604	10.10	16.91	24.44	2.01
SOUTHERN BRANCH	560	160.00	70.97	72.07	72.47	73.34	0.047501	9.53	18.92	29.12	1.81
SOUTHERN BRANCH	540	160.00	70.16	71.33	71.67	72.43	0.042636	8.90	20.40	31.15	1.72
SOUTHERN BRANCH	520	160.00	69.35	70.48	70.86	71.63	0.036420	8.86	19.94	30.07	1.61
SOUTHERN BRANCH	500	160.00	68.48	69.77	70.14	70.93	0.036107	9.02	20.20	30.84	1.64
SOUTHERN BRANCH	480	160.00	67.16	68.51	68.99	70.05	0.052660	10.08	16.56	22.94	1.91

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION Hydraulic Analysis of MA.			SHEET NO. 3.1 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

Figures 3-49 show the elevations of the Water Surface and E.G.L. for each (river) cross-section. From this information, the E.G.L and water surface are delineated on the topographic map of the arroyo and 4W Reserv. Site. (See Figure 2). As shown in the figure, river sections 460 through 360 are closest to the detention pond. At this location, the E.G.L. is the widest due to the leveling of the terrain.

Two more river sections were added (140 and 220) in another computer run since the outfall of the reservoir overflow drain and detention pond drain is about 160 feet downstream of River Section 300. The results of this simulation are shown in Table 3. From this information, the E.G.L. from Station 300 to 140 is delineated on the map. As shown on the Figure, the outfall is outside the limits of the E.G.L. Flow velocities and Froude numbers start to lower downstream of River Station 300 due to reduction in the channel slope.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of MA.			SHEET NO. 30 OF 98
	COMPUTED BY: V. Deny	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

remove it from the E.G.L. boundary and the bottom (pond) elevation raised by 1 foot to elevation 5567 so that it is higher than the calculated W.S. elevation. Also the berm on the north side of the pond should be protected and stabilized with riprap/concrete wall designed to stabilize the slope against velocities up to 10 fps and scour.

LH-REV-SHT

7.4 Steady Flow Analysis

The results of the first flow simulation are included in Table 1. Since there were warning messages @ Sections 460 and 300, one additional cross-section was included between the previous and current sections at each location by the "interpolation" function of the HEC-RAS program. These two new sections were at 310 and 470. The results of this simulation are included in Table 2. As shown on the list of "errors, warnings and notes" – the warning messages were eliminated. [See page 31 for continuation]

8.0 Conclusions

As shown in Table 2 – all Froude No's are above 1 and less than 2, except at Section 570 where it is 2.01. Velocities in the channel range from 7.2 to 10.3 fps. At the location where the channel is closest to the detention pond (Cross-Sections 460-360) channel velocities are 7.6 to 9.3 fps, water surface elevs' are approx. one foot above the channel bottom and the E.G.L. elev. are 2 feet above the channel bottom. Based on this analysis, the Northwest area of the detention pond berm will be inside the limits of the E.G.L. Also the bottom elevation of the det. pond @ 5566 will be lower than the water surface elevations @ channel sections 460 and 440 during the 100-year storm. Therefore the detention pond should be moved further south to

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of MA			SHEET NO. 28 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DHD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	LOB	Channel (feet)	ROB
790	10	10	10
800	10	10	10
820	20	20	20
840	21	20	20
845	5	5	5
850	5	5	5
860	12	10	9
865	5	5	5
870	5	5	5
880	10	10	10
900	20	20	20
920	20	20	20
940	20	20	20
960	20	20	20
980	21	20	20
990	10	10	10
995	5	5	5
1000	5	5	5

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of MA			SHEET NO. 27 OF 98
	COMPUTED BY: UDerry	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.3 Downstream Reach Lengths (See Figure 1)

River Station	LOB	Channel (feet)	ROB
140	0	0	0
220	80	80	80
300	80	80	80
320	20	20	19
340	20	20	19
360	19	20	20
380	20	20	21
400	20	20	20
420	20	20	20
440	20	20	19
460	20	20	20
480	20	20	20
500	20	20	20
520	22	20	19
540	20	20	19
560	20	20	20
570	10	10	10
580	10	10	9
600	20	20	19
620	21	20	20
640	20	20	19
660	22	20	20
680	19	20	20
700	19	20	20
720	20	20	20
740	20	20	20
760	20	20	20
770	10	10	10
780	10	10	10

P:\ACAD\REV-SHT

WESTLAND - 4W RESERVOIR - HEC-RAS ANALY.
Worksheet for Trapezoidal Channel

Project Description	
Project File	j:\westland\calcs\mireflow.fm2
Worksheet	WESTLAND - 4W RESERVOIR - HEC-RAS
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.043000	ft/ft
Left Side Slope	10.000000	H : V
Right Side Slope	28.000000	H : V
Bottom Width	19.00	ft
Discharge	160.00	cfs

Results		
Depth	0.73	ft
Flow Area	24.22	ft²
Wetted Perimeter	46.98	ft
Top Width	46.93	ft
Critical Depth	0.95	ft
Critical Slope	0.015245	ft/ft
Velocity	6.60	ft/s
Velocity Head	0.68	ft
Specific Energy	1.41	ft
Froude Number	1.62	
Flow is supercritical.		

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of M.A.			SHEET NO. 25 OF 98
	COMPUTED BY: V. Dery	CHECKED BY: DWP	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.2 Flow regime Assumption (Supercritical vs. Subcritical)

Using Manning's n Equation – determine if flow in channel will be supercritical/critical/subcritical.

Assume $Q = 160$ cfs

$n = 0.03$

$S = \frac{5590 - 5560}{700}$

5590 = elev. of channel @ Station 1000
5560 = " " " " Station 300

$S = 0.0429$ ft/ft

At River Station 1000 – channel is 19' wide @ bottom, LSS of 10:1 (H:V), RSS of 28:1 (H:V)

See next page for results.

Froude is > 1 ∴ flow is <u>supercritical</u>.

Because flow is supercritical, start the cross-sections at the upstream reach and progress downstream. Base the starting water elevation @ River Station 1000 on normal depth (or normal slope of 0.04 ft/ft)

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of MA			SHEET NO. 24 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/15/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	nValue	Description
220	0	65	0.04	LOB
	60	61.25	0.04	LOB
	80	60	0.04	LOB
	→ 84	58.05	0.035	LMCB
	85	57.86	0.03	MC
	100	57.5	0.03	MC
	115	57.8	0.03	MC
	→ 116	58.05	0.035	RMCB
	125	60	0.04	ROB
	155	65	0.04	ROB
140	0	60	0.04	LOB
	80	57.5	0.04	LOB
	90	56	0.04	LOB
	99	55.25	0.035	LMCB
	100	55	0.03	MC
	115	54.75	0.03	MC
	130	55	0.03	MC
	131	55.25	0.035	RMCB
	144.5	57.5	0.04	ROB
	150	60	0.04	ROB

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirclaren			SHEET NO. 23 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
360	0	65	0.04	LOB
	→ 10	63.47	0.035	LMCB
	12	63	0.03	MC
	19	62.69	0.03	MC
	→ 35	63.1	0.035	RMCB
	38	63.32	0.04	ROB
	66	65	0.04	ROB
340	0	65	0.04	LOB
	→ 25	62.6	0.035	LMCB
330	27	62	0.03	MC
310	35	61.92	0.03	MC
	→ 52	62	0.035	RMCB
	55	62.78	0.04	ROB
	93	65	0.04	ROB
320	0	65	0.04	LOB
	→ 40	61.77	0.035	LMCB
	42	61.37	0.03	MC
	48	61.15	0.03	MC
	→ 60	61.22	0.035	RMCB
	70	62.22	0.04	ROB
	85	63.61	↓	↓
	100	65		
300	0	65	0.04	LOB
	→ 55	61	0.035	LMCB
	57	60.5	0.03	MC
	62	60.39	0.03	MC
	→ 84	60.5	0.035	RMCB
	86	61	0.04	ROB
	102	63	↓	↓
	117	65		

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 22 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
440	0	70	0.04	LOB
	→ 15	66.9	0.035	LMCB
	18	66.5	0.03	MC
	22	65.87	0.03	MC
	→ 33	66.2	0.035	RMCB
	36	66.56	0.04	ROB
	51	67	↓	↓
	62	68		
	75	69		
	86	70		
420	0	70	0.04	LOB
	→ 19	65.82	0.035	LMCB
	22	65.6	0.03	MC
	25	65	0.03	MC
	→ 37	65.5	0.035	RMCB
	39	65.81	0.04	ROB
	83	66	↓	↓
	133	70		
400	0	70	0.04	LOB
	19	65	0.04	LOB
	→ 22	64.77	0.035	LMCB
	24	64.5	0.03	MC
	29	64.23	0.03	MC
	→ 44	64.5	0.035	RMCB
	46	64.62	0.04	ROB
	61	65	↓	↓
	113	70		
380	0	70	0.04	LOB
	20	65	0.04	LOB
	→ 26	64.42	0.035	LMCB
	28	64	0.03	MC
	35	63.46	0.03	MC
	→ 50	63.6	0.035	RMCB
	52	63.99	0.04	ROB
	72	65	↓	↓
	128	70		

45
430
410
390

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 21 OF 98
	COMPUTED BY: VDenz	CHECKED BY: DAO	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
520	0	80	0.04	LOB
	18	75	0.04	LOB
	→ 35	70	0.035	LMCB
	37	69.6	0.03	MC
	44	69.35	0.03	MC
	→ 53	69.75	0.035	RMCB
	55	70.11	0.04	ROB
	75	71		
	91	72		
	107	73		
	114	74		
	121	75		
500	0	75	0.04	LOB
	20	70	0.04	LOB
	→ 23	69.3	0.035	LMCB
	25	69.1	0.03	MC
	33	68.48	0.03	MC
	→ 40	69.1	0.035	RMCB
	43	69.3	0.04	ROB
	56	70		
	73	71		
	93	72		
	113	73		
	120	74		
	127	75		
480	0	70	0.04	LOB
	→ 7	68.58	0.035	LMCB
	9	68	0.03	MC
	15	67.16	0.03	MC
	→ 25	68	0.035	RMCB
	28	68.35	0.04	ROB
	50	70	0.04	ROB
460	0	70	0.04	LOB
	→ 10	67.75	0.035	LMCB
	12	67.25	0.03	MC
	18.5	66.74	0.03	MC
	→ 30	67	0.035	RMCB
	32	67.48	0.04	ROB
	64	70	0.04	ROB

470

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 20 OF 98
	COMPUTED BY: VDeuz	CHECKED BY: DMO	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
580	0	80	0.04	LOB
	9	75	0.04	LOB
	→ 14	73.83	0.035	LMCB
	18	72.65	0.03	MC
	20	72	0.03	MC
	25	71.77	0.03	MC
	→ 32	71.89	0.035	RMCB
	34	72.09	0.04	ROB
	44	75	0.04	ROB
570	0	75	0.04	LOB
	→ 17	72.3	0.035	LMCB
	22	71.8	0.03	MC
	26	71.35	0.03	MC
	→ 35	71.5	0.035	RMCB
	37	71.79	0.04	ROB
	50	74	↓	↓
	60	75		
560	0	80	0.04	LOB
	11	75	0.04	LOB
	→ 22	71.95	0.035	LMCB
	24	71.45	0.03	MC
	30	70.97	0.03	MC
	→ 39	71.23	0.035	RMCB
	41	71.48	0.04	ROB
	66	73	↓	↓
	74	74		
	81	75		
540	0	80	0.04	LOB
	15	75	0.04	LOB
	→ 28	71.5	0.035	LMCB
	31	71.16	0.03	MC
	33	70.66	0.03	MC
	42	70.16	0.03	MC
	→ 48	70.45	0.035	RMCB
	50	70.81	0.04	ROB
	57	71	↓	↓
	68	72		
	82	73		
	90	74		
	98	75		

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 19 OF 98
	COMPUTED BY: VDeiz	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
660	0	80	0.04	LOB
	→ 34	77.73	0.055	LMCB
	40	75.45	0.03	MC
	42	75.25	0.03	MC
	50	75	0.03	MC
	→ 54	75.25	0.035	RMCB
	56	75.56	0.04	ROB
	34	80	0.04	ROB
640	0	80	0.04	LOB
	40	75	0.04	LOB
	→ 43	74.81	0.035	LMCB
	49	74.62	0.03	MC
	51	74.25	0.03	MC
	55	74.19	0.03	MC
	→ 60	74.25	0.035	RMCB
	→ 63	75	0.04	ROB
	88	77	0.04	ROB
	113	80	0.04	ROB
620	0	80	0.04	LOB
	→ 23	75	0.035	LMCB
	31	73.78	0.03	MC
	33	73.5	0.03	MC
	35	73.39	0.03	MC
	→ 43	73.57	0.035	RMCB
	45	74.07	0.04	ROB
	48	75	0.04	
	128	80	0.04	
600	0	80	0.04	LOB
	13	75	0.04	LOB
	→ 15	74.11	0.035	LMCB
	21	73.21	0.03	MC
	23	72.99	0.03	MC
	28	72.58	0.03	MC
	→ 33	73.01	0.035	RMCB
	35	73.51	0.04	ROB
	40	75		
	145	80		

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 18 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
740	0	85	0.04	LOB
	50	80	0.04	LOB
	→ 68	79.07	0.035	LMCB
	70	78.67	0.03	MC
	80	78.64	0.03	MC
	→ 92	79	0.035	RMCB
	94	79.41	0.04	ROB
	98	80	0.04	↓
	131	85	0.04	
720	0	80	0.04	LOB
	→ 20	78.25	0.035	LMCB
	22	77.85	0.03	MC
	32	77.73	0.03	MC
	→ 42	78.25	0.035	RMCB
	44	78.8	0.04	ROB
	52	80	0.04	ROB
700	0	80	0.04	LOB
	→ 28	77.29	0.035	LMCB
	30	77	0.03	MC
	39	76.82	0.03	MC
	→ 46	77	0.035	RMCB
	48	77.61	0.04	ROB
	60	80	0.04	ROB
680	0	80	0.04	LOB
	→ 31	77	0.035	LMCB
	33	76.7	0.03	MC
	35	76	0.03	MC
	44	75.91	0.03	MC
	→ 49	76.25	0.035	RMCB
	51	76.53	0.04	ROB
	70	80	0.04	ROB

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 17 OF 98
	COMPUTED BY: VDeiz	CHECKED BY: DM	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
790	0	85	0.04	LOB
	→ 32	81.77	0.035	LMCB
	34	81.1	0.03	MC
	48	80.87	0.03	MC
	→ 60	81	0.035	RMCB
	62	81.62	0.04	ROB
	77	85	0.04	ROB
780	0	85	0.04	LOB
	→ 35	81.35	0.035	LMCB
	37	81	0.03	MC
	50	80.41	0.03	MC
	→ 63	80.6	0.035	RMCB
	65	80.72	0.04	ROB
	81	85	0.04	ROB
770	0	85	0.04	LOB
	→ 36	80.68	0.035	LMCB
	38	80.25	0.03	MC
	50	80	0.03	MC
	→ 64	80.15	0.035	RMCB
	66	80.36	0.04	ROB
	84	85	0.04	ROB
760	0	85	0.04	LOB
	→ 42	80	0.035	LMCB
	44	79.75	0.03	MC
	56	79.55	0.03	MC
	→ 70	79.75	0.035	RMCB
	72	80	0.04	ROB
	95	85	0.04	ROB

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 16 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DWM	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

530

River Station	Station	Elev.	n Value	Description
845	0	90	0.04	LOB
	61	85	0.04	LOB
	→ 72	84	0.035	LMCB
	74	83.75	0.03	MC
	87	83.4	0.03	MC
	→ 99	84.75	0.035	RMCB
	101	85	0.04	ROB
	120	90	0.04	ROB
840	0	90	0.04	LOB
	58	85	0.04	LOB
	→ 73	83.75	0.035	LMCB
	75	83.25	0.03	MC
	87	83.17	0.03	MC
	→ 101	84.5	0.035	RMCB
	103	85	0.04	ROB
	121	90	0.04	ROB
820	0	85	0.04	LOB
	→ 28	82.96	0.035	LMCB
	30	82.36	0.03	MC
	41	82.25	0.03	MC
	→ 53	83	0.035	RMCB
	55	83.42	0.04	ROB
	60	85	0.04	ROB
800	0	85	0.04	LOB
	→ 32	82.18	0.035	LMCB
	34	81.77	0.03	MC
	45	81.33	0.03	MC
	→ 60	82	0.035	RMCB
	62	82.51	0.04	ROB
	73	85	0.04	ROB

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 15 OF 98
	COMPUTED BY: VDenz	CHECKED BY: DM	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
870	0	90	0.04	LOB
	→ 63	85	0.035	LMCB
	65	84.75	0.03	MC
	84	84.54	0.03	MC
	→ 91	84.75	0.035	RMCB
	93	85	0.04	ROB
	121	90	0.04	ROB
865	0	90	0.04	LOB
	→ 65	85	0.035	LMCB
	67	84.5	0.035	LMCB
	69	84.36	0.03	MC
	83	84.31	0.03	MC
	→ 91	84.6	0.035	RMCB
	95	85	0.04	ROB
	110	90	0.04	ROB
860	0	90	0.04	LOB
	64	85	0.04	LOB
	→ 66	84.73	0.035	LMCB
	68	84.13	0.03	MC
	85	84.08	0.03	MC
	→ 94	84.5	0.035	RMCB
	96	85	0.04	ROB
	114	90	0.04	ROB
850	0	90	0.04	LOB
	60	85	0.04	LOB
	→ 70	84.24	0.035	LMCB
	72	83.84	0.03	MC
	85	83.63	0.03	MC
	→ 96	84.5	0.035	RMCB
	98	85	0.04	ROB
	116	90	0.04	ROB

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of Mirchaven			SHEET NO. 14 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS					
	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
940	0	90	0.04	LOB
	→ 42	87.94	0.035	LMCB
	44	87.75	0.03	MC
	55	87.5	0.03	MC
	→ 68	88	0.035	RMCB
	70	88.7	0.04	ROB
	74	90	0.04	ROB
920	0	90	0.04	LOB
	→ 55	87.15	0.035	LMCB
	57	86.8	0.03	MC
	68	86.67	0.03	MC
	→ 81	87.75	0.035	RMCB
	83	88.24	0.04	ROB
	87	90	0.04	ROB
900	0	90	0.04	LOB
	→ 67	86.36	0.035	LMCB
	69	86	0.03	MC
	80	85.84	0.03	MC
	→ 95	87	0.035	RMCB
	97	87.51	0.04	ROB
	101	90	0.04	ROB
880	0	90	0.04	LOB
	→ 65	85.63	0.035	LMCB
	67	85.4	0.03	MC
	75	85	0.03	MC
	81	85	0.03	MC
	→ 93	85.75	0.035	RMCB
	95	86.36	0.04	ROB
	106	90	0.04	ROB

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analy. of MA			SHEET NO. 13 OF 98
	COMPUTED BY: VDeng	CHECKED BY: PMD	JOB/TASK NO. 99012	DATE: 11/7/99

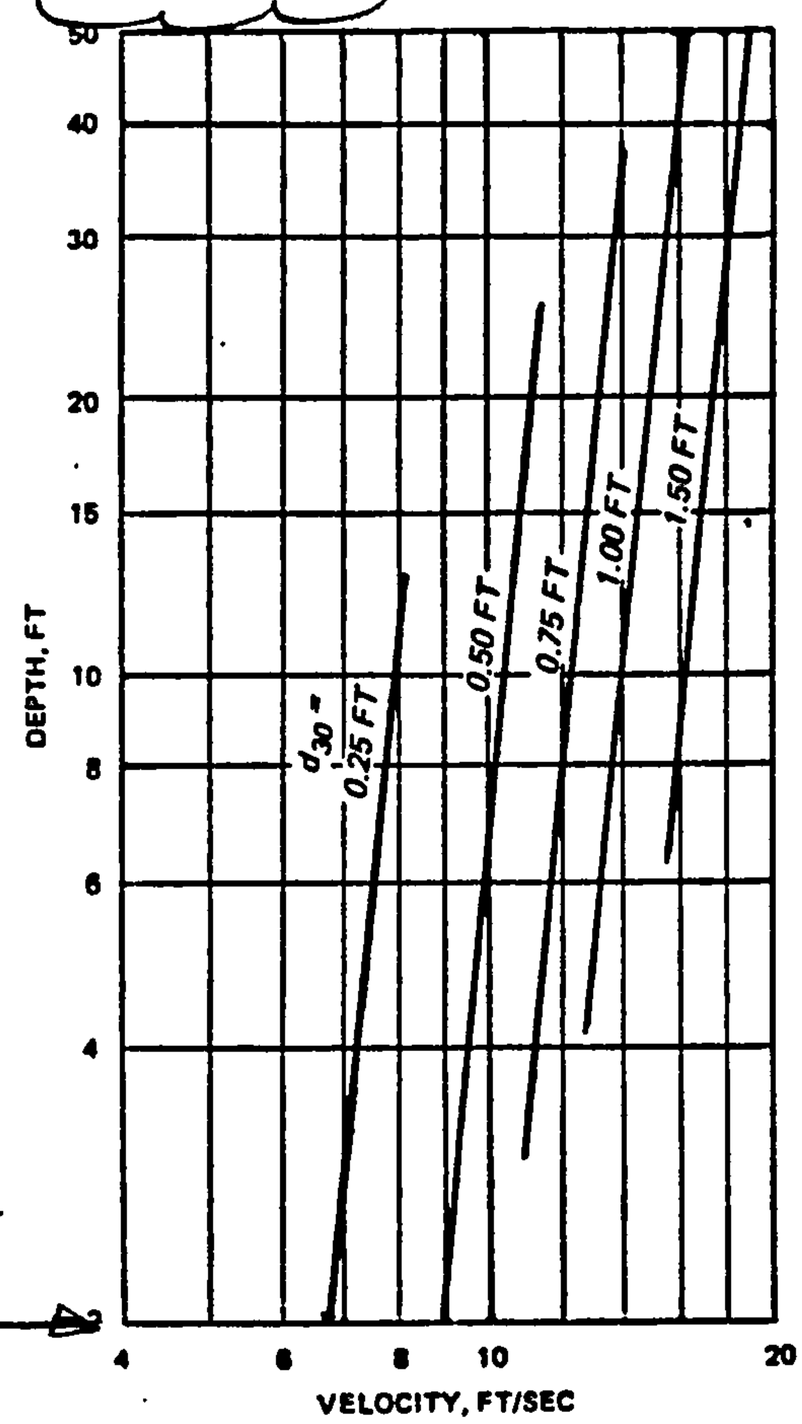
IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

River Station	Station	Elev.	n Value	Description
990	0	95	0.04	LOB
	63	90	0.04	LOB
	→ 66	89.92	0.035	LMCB
	69	89.75	0.03	MC
	77	89.59	0.03	MC
	91	89.75	0.03	MC
	→ 93	89.92	0.035	RMCB
	96	90	0.04	ROB
	118	95	0.04	ROB
980	0	95	0.04	LOB
	64	90	0.04	LOB
	→ 68	89.56	0.035	LMCB
	70	89.3	0.03	MC
	80	89.17	0.03	MC
	→ 94	89.4	0.035	RMCB
	96	89.79	0.04	ROB
	102	90	0.04	ROB
	118	95	0.04	ROB
960	0	95	0.04	LOB
	56	90	0.04	LOB
	→ 78	88.75	0.035	LMCB
	80	88.5	0.03	MC
	90	88.33	0.03	MC
	→ 104	88.75	0.035	RMCB
	106	89.13	0.04	ROB
	112	90	0.04	ROB
	130	95	0.04	ROB

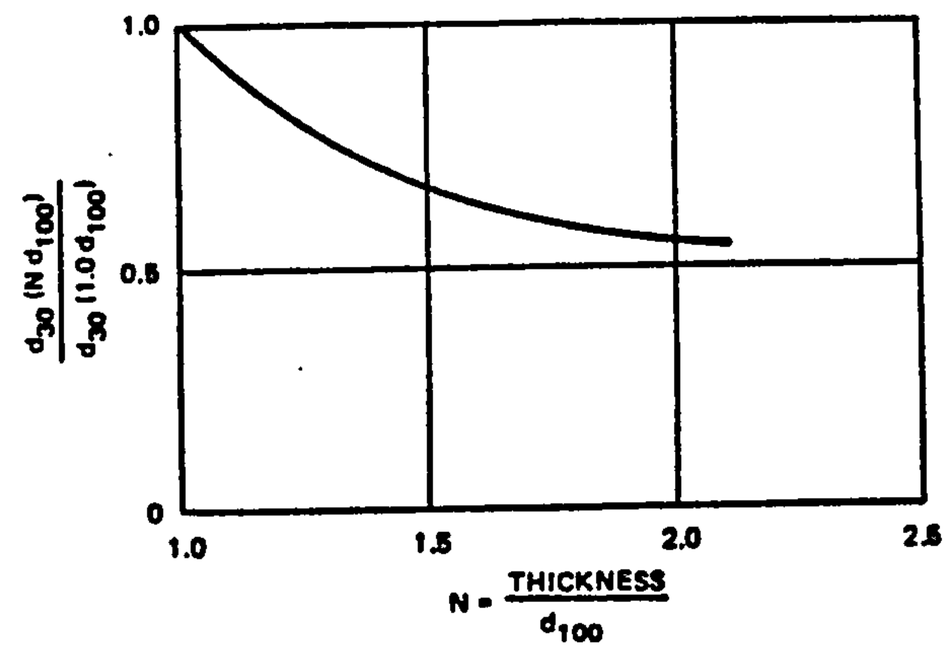
P:\ACAD\REV-SHT

FIGURE 2

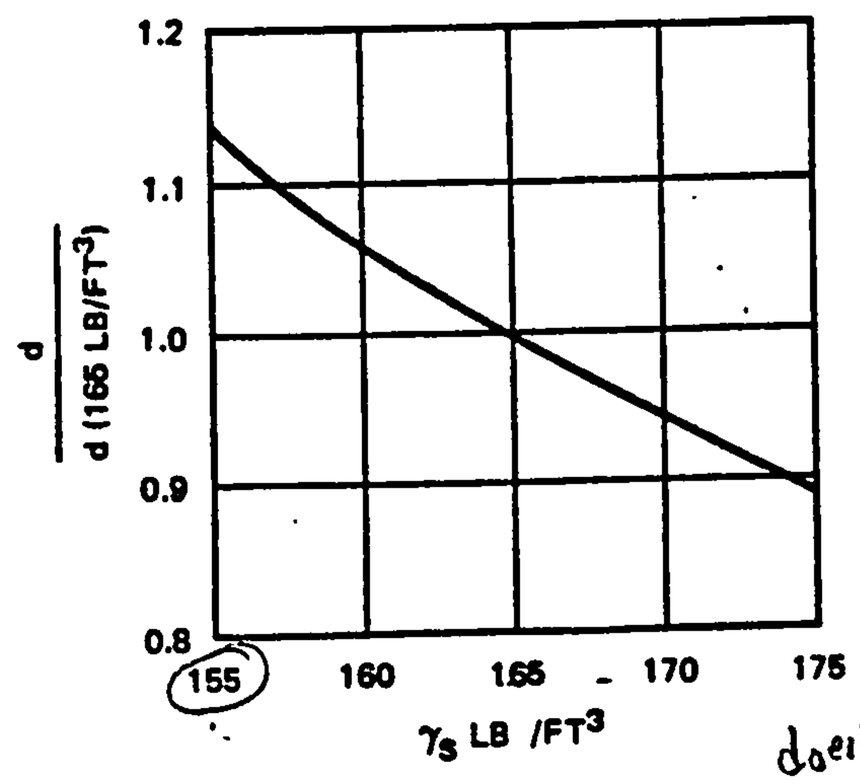


$d_{30} = 0.5'$ or 6"

a. Velocity versus depth versus d_{30} for unit stone weight = 165 pcf, thickness = $1d_{100}$



b. Thickness adjustment for d_{85}/d_{15} = 2.0–2.3



c. Correction for unit stone weight

doesn't go for low unit wt rock

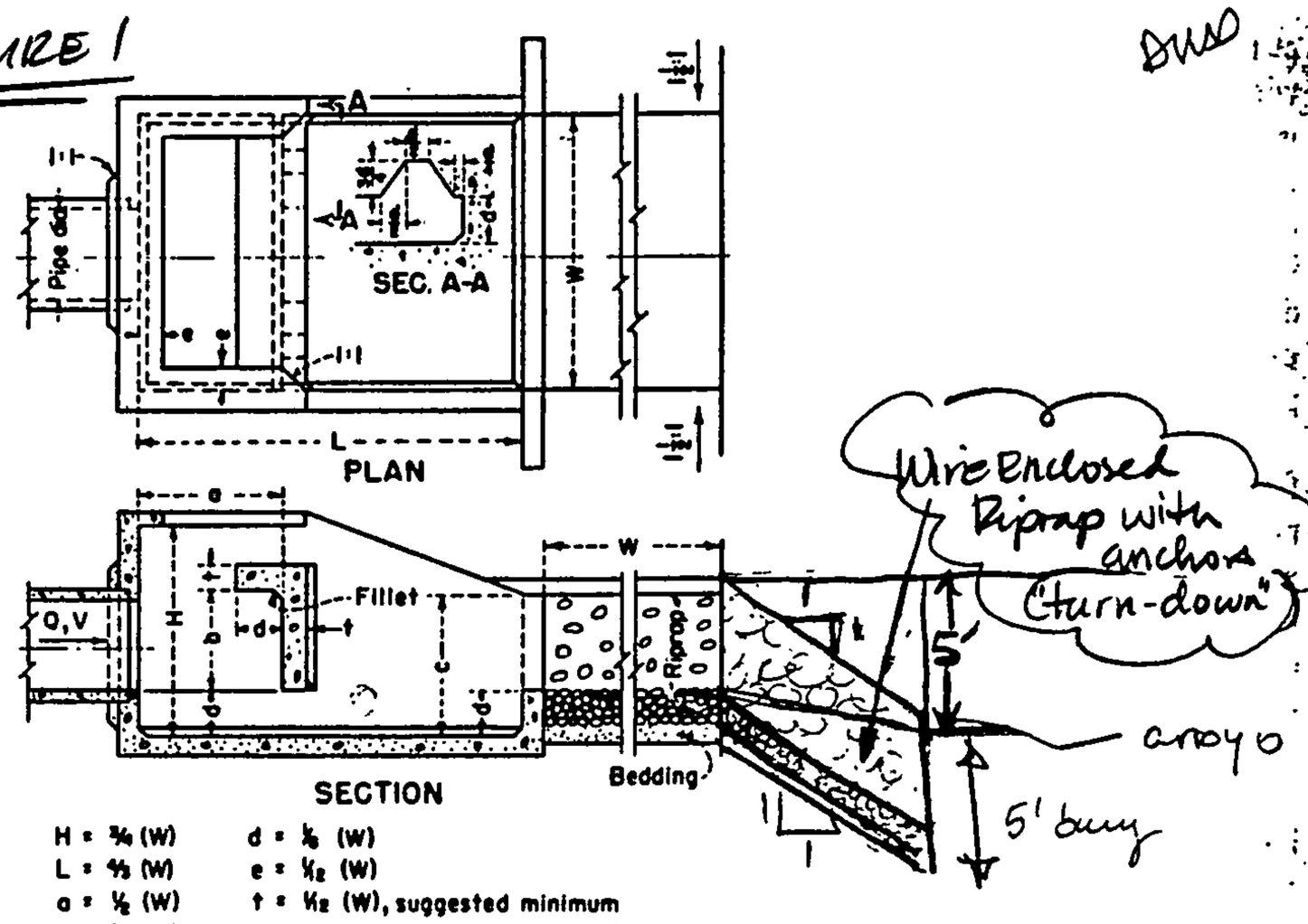
Figure 5.1. Sizing nomograph for riprap

5.2 SIZING NOMOGRAPH

A sizing nomograph of Equation 5.1 is shown in Figure 5.1. In Figure 5.1a, the relationship of average velocity in the vertical, depth, and d_{30} are given for a specific weight of 165 pcf and a blanket thickness of $1d_{100}$. In Figure 5.1b, the adjustment for thickness is given for gradations having d_{85}/d_{15} = 2.0–2.3, which is similar to the gradations given in OCE (1971). In Figure 5.1c, the correction for unit weight of rock is given.

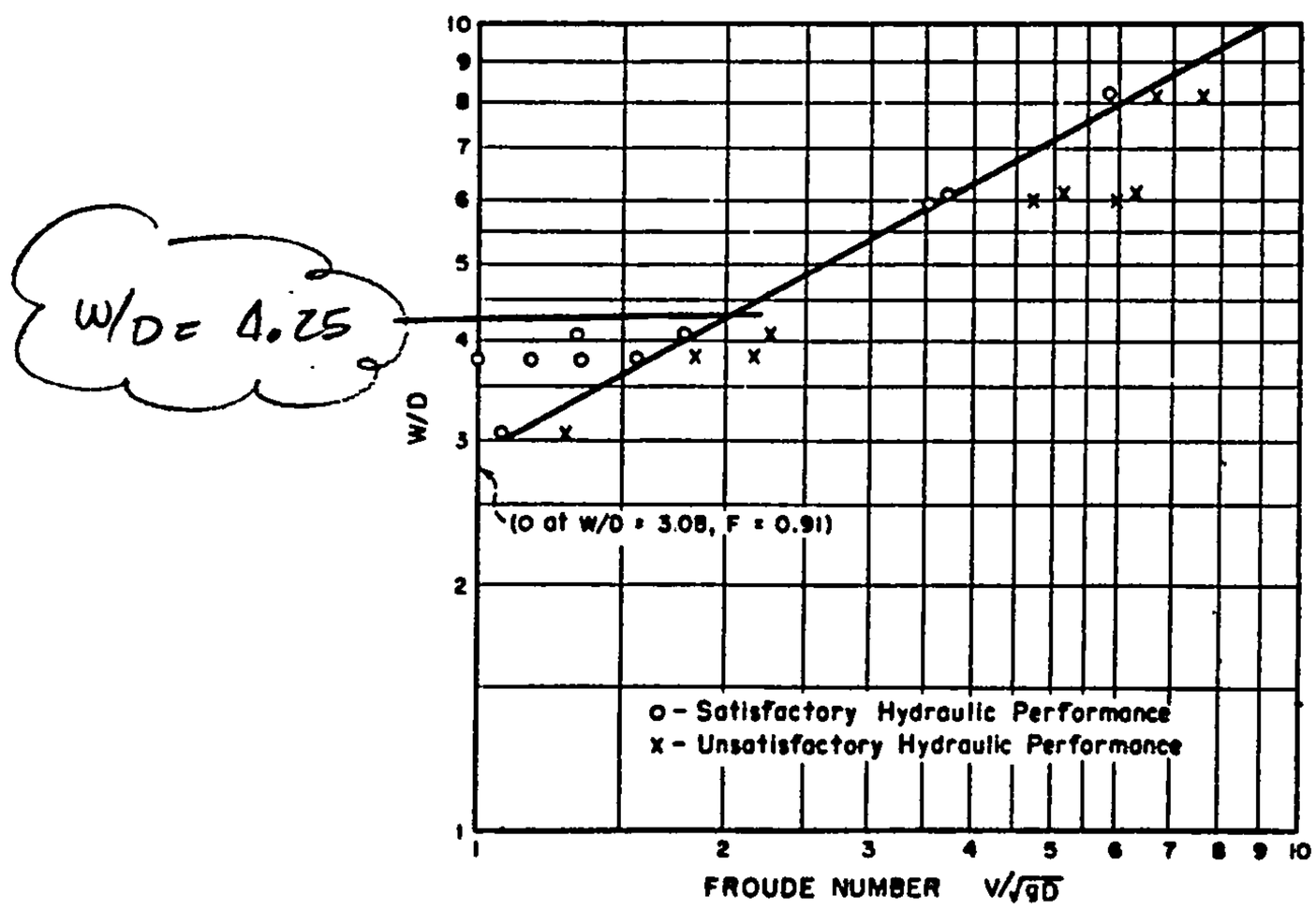
DWG CIVIL 1-1-463
J:\LANL\99017\
(7)
DWD

FIGURE 1



H = ¾ (W)
L = 4⅓ (W)
a = ½ (W)
b = ⅜ (W)
c = ½ (W)
d = ⅛ (W)
e = 1/12 (W)
t = 1/12 (W), suggested minimum
Riprap stone size diameter = 1/20 (W).

STILLING BASIN DESIGN



DESIGN WIDTH OF BASIN

NOTES:

W is the inside width of the basin.
D represents the depth of flow entering the basin and is the square root of the flow area.
V is the velocity of the incoming flow.

Figure 10-14.—Dimensional criteria for impact-type stilling basin. 288-D-2436.

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION Impact-Type Stilling Basin			SHEET NO. 6 OF 8
	COMPUTED BY: VDem	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.3 Riprap Stone Size (See Figure 2)

$d_{30} = 0.5'$ or $6''$

Use a d_{30} of 6" for rock protection on berm and stilling basin.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Impact-Type Stilling Basin			SHEET NO. 5 OF 8
	COMPUTED BY: V. Deny	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Comparison of Flow Depths, Velocities and Froude No.'s in Channel and Pipes

	(ft) Flow Depth	(fps) Velocity	Froude No.
Arroyo – River Section 140	0.82	7.30	1.56
Outlet of 36" RCD	1.72	7.03	0.94
Outlet of 18" ϕ Det. Pond Drain Pipe	0.26	4.87	1.68
Design	use 2.0	use 8	use 2.0

7.2 Stilling Basin Size (See Figure 1)

Based on a Froude No. of 2, and a depth of flow of 2.0, the inside width of the basin should be:

$$W = 4.25(D)$$
$$= 4.25(2.0)$$
$$= 8.5' \text{ say } \underline{\underline{9'}}$$

$H = 3/4(W) = 6.75'$

$L = 4/3(W) = 12'$

$a = 1/2(W) = 4.5'$

$b = 3/8(W) = 3.375'$

$c = 1/2(W) = 4.5'$

$d = 1/6(W) = 1.5'$

$e = 1/12(W) = 0.75'$

$t = 1/12(W) = 0.75'$

Suggested min. riprap stone size diam. $= 1/20(W) = 0.45'$ or 5.4"

use 6"

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Impact - Type Stilling Basin			SHEET NO. 4 OF 8
	COMPUTED BY: V. Deng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches

See Figures 1 and 2.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Impact-Type Stilling Basin			SHEET NO. 3 OF 8
	COMPUTED BY: V. Deng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

5.0 Criteria / Requirements

5.1 The perimeter of the stilling basin shall be lined with wired-enclosed riprap anchored in place with metal stakes. The edges of the perimeter riprap shall include a "turn-down" (see Figure 1) that extends two feet below the max. scour depth of 3 feet (Ref. 3.3). The riprap will be underlain by 6" of bedding (sand) to prevent settlement of the rock into the native materials.

5.2 Minimum D_{50} of the riprap shall be 6".

5.3 The riprap shall be sized for the depth of flow in the channel at the location of the stilling basin or the depth of flow in the POD or det. pond outfall pipe – whichever is greater, and the max. velocity.

5.4 The stilling basin shall be sized for the max Froude No.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Impact-Type Stilling Basin			SHEET NO. 2 OF 8
	COMPUTED BY: V. Deng	CHECKED BY: DWD	JOB/TASK NO.: 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

4.0 Assumptions

4.1 Reservoir will not overflow during the 100-year storm event.

4.2 Unit weight of the rock used for apron will be 165 pcf.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Impact-Type Stilling Basin			SHEET NO. 1 OF 8
	COMPUTED BY: V. Deng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 SUBJECT

Impact-Type Stilling Basin at Pipe Outfall.

2.0 Purpose

Size and design stilling basin with perimeter riprap apron at the outfall of 36" ROD and 18" Φ Detention Pond Drain. The basin will be sized for the worse case condition (i.e. highest Froude No. and depth of flow) which will either be: ① overflow of the reservoir or ② flooding of the channel and on-site drainage from the detention pond during the 100-year storm event.

3.0 References

3.1 Design of Small Dams, Bureau of Reclamation, 1987.

3.2 Stable Riprap Size for Open Channel Flows, U.S. Army Corps of Engineers, March 1988.

3.3 Scour Analysis Calc. Set, V. Deng 11/8/99.

3.4 Hydraulic Analysis of Mirehaven Arroyo Calc. Set, V. Deng, 11/7/99.

3.5 Reservoir Overflow Drain Sizing Calc. Set, V. Deng, 11/7/99.

3.6 Outfall Pipe for 400 Res. Detention Pond Calc. Set, V. Deng, 11/7/99.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Reservoir Overflow Drain Sizing			SHEET NO. 7 OF 7
	COMPUTED BY: V. Deng	CHECKED BY: DW	JOB/TASK NO. 99012-03	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

8.0 Conclusions

Use a 36" ϕ ROD with Drop Manhole. Use Inverts and slopes shown on Figure 1.

P:\ACAD\REV-SHT

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 11, 1999
WESTLAND - 4W RESERVOIR
RESERVOIR OVERFLOW DRAIN
36-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	3.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning`s Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.85
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0050

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
29.4	0.00	2.62	2.72	1.72	1.76	1.76	6.84

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

6

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 11, 1999
WESTLAND - 4W RESERVOIR
RESERVOIR OVERFLOW DRAIN
30-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	2.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.85
Culvert Length (feet)	302.1
Culvert Slope (feet per foot)	0.0050

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
29.4	0.00	3.13	3.24	2.08	1.85	1.85	7.56

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

too high
>7 fps

5

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 11, 1999
WESTLAND - 4W RESERVOIR
RESERVOIR OVERFLOW DRAIN
36-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	3.00
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.85
Culvert Length (feet)	302.1
Culvert Slope (feet per foot)	0.0050

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
29.4	0.00	2.62	1.95	1.72	1.76	1.72	7.03

okay

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

Try 30" ϕpipe

$$\text{Froude No.} = \frac{7.03}{\sqrt{32.2 \times (1.72)}} = 0.94$$

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Reservoir Overflow Drain Sizing			SHEET NO. 4 OF 7
	COMPUTED BY: VDerry	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Hydraulic Grade Line (H.G.L.) of Pipe

$$Q = CA\sqrt{2gh}$$

where $Q = 29.4$ cfs

$C = 0.85$ (for smooth pipe)

Assume pipe $\phi = 36''$

$\therefore A = \frac{1}{4}\pi\left(\frac{36}{12}\right)^2$ assuming pipe flowing full

$$H = \frac{\left[\frac{Q}{CA}\right]^2}{2g}$$

$$= \frac{\left[\frac{29.4\text{ cfs}}{0.85 \times 7.07\text{ sf}}\right]^2}{2(32.2)}$$

$$= 0.37'$$

Since $H < 3'$, water will not be standing in vertical section of pipe inside reservoir tank. Evaluate hydraulic conditions in pipe using the Pipe Culvert Analysis Program, V 1.7 by Dodson & Assoc.: See next page for results.

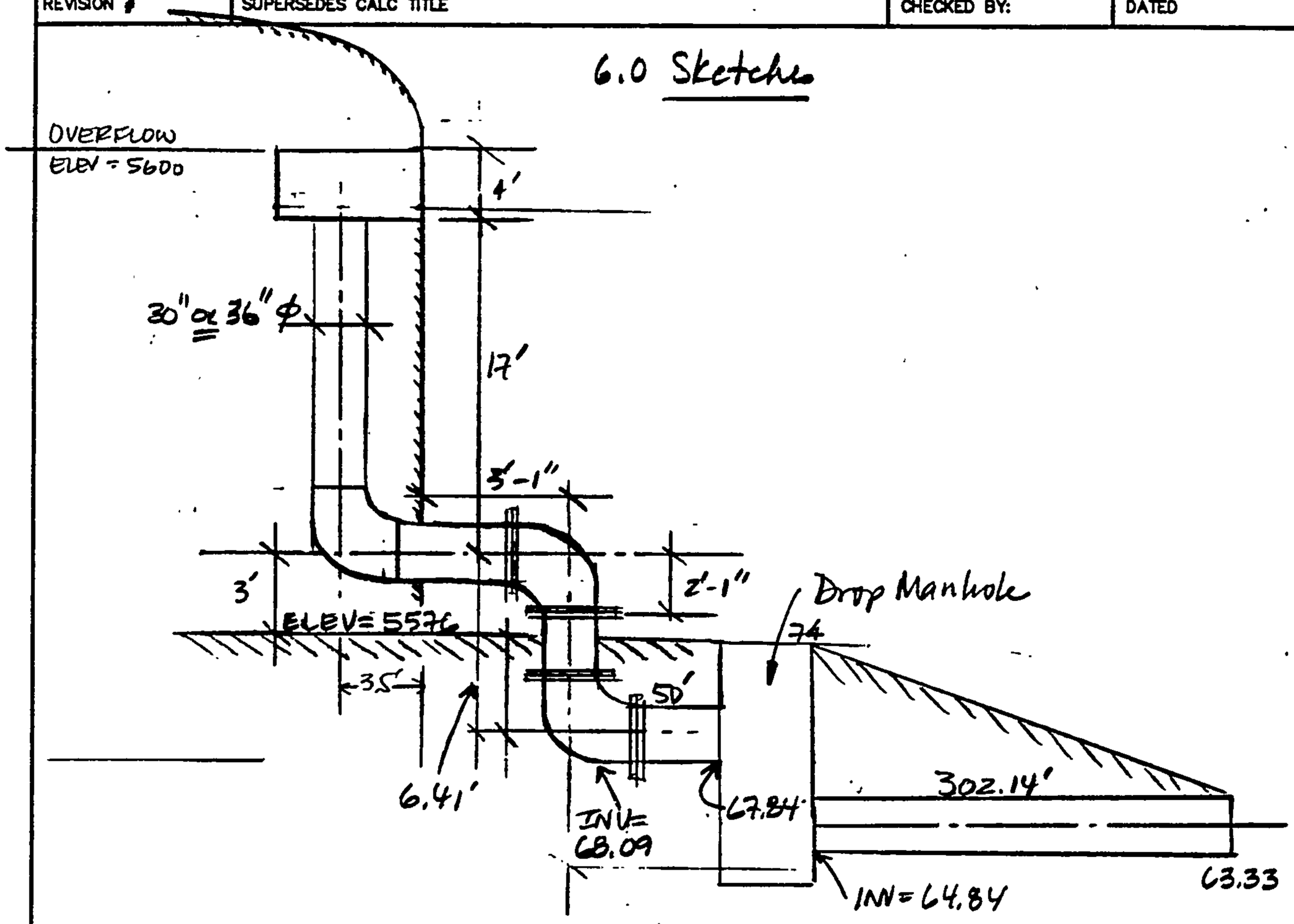
P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Reservoir Overflow Drain Sizing			SHEET NO. 3 OF 7
	COMPUTED BY: V. Dery	CHECKED BY: DAO	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches



$$S = \frac{64.84 - 63.33}{302.14}$$

$$= 0.005 \text{ ft/ft okay}$$

FIGURE 1 – ROD

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Reservoir Overflow Drain Spring			SHEET NO. 2 OF 7
	COMPUTED BY: VDeng	CHECKED BY: DWO	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

5.0 Criteria / Requirements

5.1 ROD must convey the ultimate transfer flow of 29.4 cfs under non-pressure conditions.

5.2 The invert of the ROD at the outfall shall be above the E.b.L. elevation of the channel during the 100-yr storm (which is approx. 5557 ±/- in the vicinity of the proposed outfall.

5.3 In order to minimize rock size requirements and size of stilling basin, minimize flow velocities @ pipe outlet as much as possible - Based on calculated channel velocities (Ref 3.2), velocity from ROD should be ≤ 7 fps. To be self-cleaning, velocity should be ≥ 3 FPS.

5.4 Minimum slope of pipe should be 0.005 ft/ft for adequate drainage

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Reservoir Overflow Drain Sizing			SHEET NO. 1 OF 7
	COMPUTED BY: V. Deng	CHECKED BY: DKD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 SUBJECT

Reservoir Overflow Drain (ROD) for 4W Reservoir.

2.0 Purpose

Size ROD for Reservoir

3.0 References

3.1 Water Utility Division, Reservoir Design Manual

3.2 Hydraulic Analysis of Mirehaven Arroyo Calc. Set, V. Deng 11/7/99

3.3 Bureau of Reclamation, Design of Small Dams

3.4 Impact-Type Stilling Basin Design Calc. Set, V. Deng 11/7/99

3.5 U.S. Army Corps of Engineers, Stable Riprap Size for Open Channel Flows, March 1988

3.6 Scour Analysis Calculation Set, V. Deng, 11/8/99.

4.0 Assumptions

4.1 ROD will discharge into the Mirehaven Arroyo North of 4W Reservoir Site.

4.2 Ultimate transfer flow is 13,200 gpm or 29.4 cfs

4.3 The head above the ROD at the reservoir will be based on the orifice equation.

4.4 Pipe slope is constrained by natural grade, close proximity of arroyo, and established finished floor elevation of reservoir.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe for 4W Res. Det. Pond			SHEET NO. 11 OF 11
	COMPUTED BY: VDerg	CHECKED BY: DMO	JOB/TASK NO. 99012-03	DATE: 11/21/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

8.0 Conclusions

Use an 18" ϕ concrete pipe with 3.5" orifice plate to meter flow in arroyo @ 0.9 to 0.5 cfs.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe to 4W Res. Det. Pond			SHEET NO. 10 OF 11
	COMPUTED BY: VDeng	CHECKED BY: DHD	JOB/TASK NO. 99012-03	DATE: 11/21/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.5 Size Orifice Plate to Meter Flows to ≤ 1 cfs

Assume diam. of orifice plate = 3.5"

$Q = CA\sqrt{2gH}$

where C = 0.85 (for smooth pipe)

$A = \frac{1}{4}\pi d^2$

$= 0.0668$ sf

Elev.	H (ft)	Q (cfs)
5571	4	0.92
5570	3	0.79
5569	2	0.64
5568	1	0.46
5567	0	0

7.6 Evacuation Time

Elevation	Head (ft)	Outflow Rate (cfs)	Increm. Volume (cf)	Time (V/Q=T)
5571	4	0.92	7634	2.31
5570	3	0.79	6355	2.23
5569	2	0.64	5251	2.28
5568	1	0.46	4224	2.55
5567	0	0.	0	
			23,464 cf	9.37 hrs. <24 hrs. okay

* AHYMO results show T = 12.47 HRS @ Q_{OUT} = 0.10 cfs okay

P:\ACAD\REV-SHT

DMO

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 11, 1999
WESTLAND - 4W RESERVOIR
~~RESERVOIR OVERFLOW DRAIN~~ DETI POND.PIPE
18-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	108.3
Culvert Slope (feet per foot)	0.0200

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
1.0	0.00	0.51	-1.21	0.26	0.37	0.26	4.86

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 22, 1999
WESTLAND - 4W RESERVOIR
~~RESERVROIR OVERFLOW DRAIN~~ DET. POND PIPE
18" CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	~~154.0~~ 100.3
Culvert Slope (feet per foot)	0.0210

See next page

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
1.0	0.00	0.51	-2.28	0.26	0.37	0.26	4.87

Okay <5fps

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986 Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092 (713) 895-8322. All Rights Reserved.

$$\text{Froude No.} = \frac{4.87}{\sqrt{32.2 \cdot 0.26}}$$

$$= 1.68$$

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 11, 1999
WESTLAND - 4W RESERVOIR
~~RESERVOIR OVERFLOW DRAIN~~ DET. POND PIPE
18-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	108.3
Culvert Slope (feet per foot)	0.0200

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
5.0	0.00	1.28	-0.56	0.60	0.86	0.60	7.58

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 22, 1999
WESTLAND - 4W RESERVOIR
~~RESERVROIR OVERFLOW DRAIN~~ DET. POND PIPE
18-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	~~154.0~~ 108.3
Culvert Slope (feet per foot)	0.0210

see next page

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
2.5	0.00	0.84	-2.05	0.41	0.60	0.41	6.36

too high

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

Try Q = 1 cfs

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 22, 1999
WESTLAND - 4W RESERVOIR
~~RESERVROIR OVERFLOW DRAIN~~ DET. POND PIPE
18" CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	~~154.0~~
Culvert Slope (feet per foot)	0.0210

108.3 see next page

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
9.6	0.00	2.15	0.08	0.86	1.20	0.86	9.12

too high

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

Try Q = 5 cfs

7

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 22, 1999
WESTLAND - 4W RESERVOIR
~~RESERVOIR OVERFLOW DRAIN~~ DET. POND PIPE
18-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	~~154.0~~ 108.3
Culvert Slope (feet per foot)	0.0210

see next page

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
5.0	0.00	1.28	-1.52	0.59	0.86	0.59	7.77

too high

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

Try Q = 25 cfs

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 11, 1999
WESTLAND - 4W RESERVOIR
~~RESERVOIR OVERFLOW DRAIN~~ DET. POND DRAIN
18-INCH CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	108.3
Culvert Slope (feet per foot)	0.0200

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
9.6	0.00	2.15	0.77	0.88	1.20	0.88	8.93

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. All Rights Reserved.

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

November 22, 1999
WESTLAND - 4W RESERVOIR
~~RESERVROIR OVERFLOW DRAIN~~ DET. POND PIPE
18" CONCRETE PIPE

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	1.50
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	1
Manning`s Roughness Coefficient (n-value)	0.0130
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	~~154.0~~ 108.3
Culvert Slope (feet per foot)	0.0210

see next page

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
9.6	0.00	2.15	0.08	0.86	1.20	0.86	9.12

too high

==========

PIPE CULVERT ANALYSIS COMPUTER PROGRAM Version 1.7 Copyright (c)1986 Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092 (713) 895-8322. All Rights Reserved.

Try Q = 5 cfs

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Scour Analysis			SHEET NO. 2 OF 5
	COMPUTED BY: V. Dery	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches

See Figure 1 – Ref. 3.2

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Scour Analysis			SHEET NO. 1 OF 5
	COMPUTED BY: U. Deng	CHECKED BY: DHD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 SUBJECT

Scour analysis of Mirehaven Arroyo

2.0 Purpose

Calculate depth of scour in arroyo along 4W Reservoir Site for potential meandering of arroyo.

3.0 References

3.1 Sediment and Erosion Design Guide prepared for AMAFCA, Nov. 1994

3.2 Hydraulic Analysis of Mirehaven Arroyo Calc. Set, U. Deng, 11/7/99

4.0 Assumptions

4.1 Flow in channel will be parallel to arroyo banks and rock protected berm.

5.0 Criteria/Requirements

5.1 The depth of the rock apron shall be based on the max. scour depth plus 2 feet for additional protection.

P:\ACAD\REV-SHT

Table 1 (Ref. 3.2)

HEC-RAS Plan: Plan 21 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH

Reach	River Sta	Max Chl Dpth	Hydr Depth	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	1000	0.76	0.59	160.00	90.00	90.76	91.04	91.67	0.040010	7.80	21.75	37.02	1.65
SOUTHERN BRANCH	995	0.77	0.59	160.00	89.79	90.56	90.84	91.47	0.041202	7.99	21.98	37.11	1.66
SOUTHERN BRANCH	990	0.81	0.57	160.00	89.59	90.40	90.66	91.26	0.039697	7.71	22.81	39.77	1.63
SOUTHERN BRANCH	980	0.87	0.59	160.00	89.17	90.04	90.30	90.91	0.034579	7.65	22.63	38.63	1.54
SOUTHERN BRANCH	960	0.91	0.59	160.00	88.33	89.24	89.53	90.17	0.038770	7.93	21.86	37.27	1.63
SOUTHERN BRANCH	940	0.93	0.58	160.00	87.50	88.43	88.73	89.41	0.041782	8.12	21.40	37.11	1.69
SOUTHERN BRANCH	920	1.05	0.60	160.00	86.67	87.72	88.00	88.64	0.035363	7.91	22.18	36.71	1.62
SOUTHERN BRANCH	900	1.03	0.59	160.00	85.84	86.87	87.18	87.87	0.040412	8.20	21.02	35.65	1.72
SOUTHERN BRANCH	880	0.93	0.60	160.00	85.00	85.93	86.26	87.00	0.045257	8.34	19.72	33.10	1.79
SOUTHERN BRANCH	870	0.74	0.54	160.00	84.54	85.28	85.64	86.47	0.060852	8.87	18.84	35.10	1.99
SOUTHERN BRANCH	865	0.82	0.62	160.00	84.31	85.13	85.45	86.17	0.044576	8.31	19.99	32.00	1.73
SOUTHERN BRANCH	860	0.79	0.64	160.00	84.08	84.87	85.20	85.93	0.047680	8.28	19.56	30.56	1.76
SOUTHERN BRANCH	850	1.10	0.70	160.00	83.63	84.73	84.95	85.52	0.027544	7.18	23.43	33.43	1.38
SOUTHERN BRANCH	845	1.20	0.72	160.00	83.40	84.60	84.83	85.40	0.026307	7.26	23.31	32.36	1.41
SOUTHERN BRANCH	840	1.05	0.67	160.00	83.17	84.22	84.53	85.21	0.038830	8.08	20.67	30.68	1.62
SOUTHERN BRANCH	820	0.98	0.64	160.00	82.25	83.23	83.58	84.35	0.045780	8.54	19.20	29.80	1.75
SOUTHERN BRANCH	800	0.99	0.62	160.00	81.33	82.32	82.66	83.42	0.050212	8.42	19.22	30.80	1.81
SOUTHERN BRANCH	790	0.75	0.62	160.00	80.87	81.62	81.99	82.84	0.060528	8.93	18.23	29.58	1.97
SOUTHERN BRANCH	780	0.90	0.64	160.00	80.41	81.31	81.60	82.28	0.042446	8.07	20.46	31.95	1.74
SOUTHERN BRANCH	770	0.78	0.61	160.00	80.00	80.78	81.09	81.81	0.049701	8.25	19.92	32.51	1.79
SOUTHERN BRANCH	760	0.78	0.59	160.00	79.55	80.33	80.64	81.35	0.047166	8.20	20.32	34.33	1.77
SOUTHERN BRANCH	740	0.90	0.60	160.00	78.64	79.54	79.84	80.50	0.037464	8.03	21.73	36.00	1.60
SOUTHERN BRANCH	720	1.02	0.69	160.00	77.73	78.75	79.07	79.79	0.036302	8.30	20.51	29.55	1.59
SOUTHERN BRANCH	700	1.03	0.71	160.00	76.82	77.85	78.23	79.06	0.038389	9.07	19.27	26.97	1.67
SOUTHERN BRANCH	680	1.13	0.79	160.00	75.91	77.04	77.44	78.28	0.040916	9.16	18.35	23.21	1.69
SOUTHERN BRANCH	660	1.20	0.83	160.00	75.00	76.20	76.60	77.48	0.040266	9.40	18.21	22.00	1.69
SOUTHERN BRANCH	640	1.09	0.64	160.00	74.19	75.28	75.70	76.61	0.045377	9.66	18.49	28.72	1.84
SOUTHERN BRANCH	620	1.28	0.87	160.00	73.39	74.67	75.01	75.82	0.030745	8.82	18.97	21.80	1.61
SOUTHERN BRANCH	600	1.46	0.88	160.00	72.58	74.04	74.39	75.24	0.030527	8.99	18.62	21.27	1.63
SOUTHERN BRANCH	580	1.11	0.84	160.00	71.77	72.88	73.36	74.42	0.050309	10.31	16.40	19.50	1.90
SOUTHERN BRANCH	570	1.07	0.69	160.00	71.35	72.42	72.87	73.90	0.051604	10.10	16.91	24.44	2.01
SOUTHERN BRANCH	560	1.10	0.65	160.00	70.97	72.07	72.47	73.34	0.047501	9.53	18.92	29.12	1.81
SOUTHERN BRANCH	540	1.17	0.65	160.00	70.16	71.33	71.67	72.43	0.042636	8.90	20.40	31.15	1.72
SOUTHERN BRANCH	520	1.13	0.66	160.00	69.35	70.48	70.86	71.63	0.036420	8.86	19.94	30.07	1.61
SOUTHERN BRANCH	500	1.29	0.66	160.00	68.48	69.77	70.14	70.93	0.036107	9.02	20.20	30.84	1.64
SOUTHERN BRANCH	480	1.35	0.72	160.00	67.16	68.51	68.99	70.05	0.052660	10.08	16.56	22.94	1.91
SOUTHERN BRANCH	470	1.23	0.72	160.00	66.95	68.18	68.58	69.46	0.044239	9.25	18.04	24.96	1.75
SOUTHERN BRANCH	460	1.08	0.71	160.00	66.74	67.82	68.19	69.01	0.042109	8.92	18.88	26.66	1.71
SOUTHERN BRANCH	440	1.12	0.56	160.00	65.87	66.99	67.35	68.18	0.041138	9.23	20.16	35.94	1.77
SOUTHERN BRANCH	420	1.11	0.36	160.00	65.00	66.11	66.40	67.22	0.047528	9.27	24.17	66.70	1.85
SOUTHERN BRANCH	400	0.84	0.48	160.00	64.23	65.07	65.41	66.24	0.057700	9.21	20.48	42.99	1.97
SOUTHERN BRANCH	380	0.99	0.64	160.00	63.46	64.45	64.71	65.30	0.032805	7.63	22.70	35.39	1.50

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Scour Analysis			SHEET NO. 3 OF 5
	COMPUTED BY: V. Dery	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/8/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Scour Depth

$$\frac{Y_s}{Y_1} = 0.73 + 0.14\pi F_r^2 \qquad \text{(Ref 3.1)}$$

where Y_1 = depth of flow, ft Y_s = scour depth, ft
F_r = Froude No.

Based on results of hydraulic analysis of Mirehaven Arroyo (Ref. 3.2), the maximum depth of flow in the vicinity of the berm along the northwest corner of the reservoir site is 1.12' (River Section 440 – Ref. 3.2) with a Froude Number of 1.77. The max Fr number is 1.97 with a depth of flow of 0.84' (River Section 400) – See Table 1.

Section 440

$$Y_s = 1.12(0.73 + 0.14\pi(1.77)^2)$$
$$= 2.36'$$

Section 400

$$Y_s = 0.84(0.73 + 0.14\pi(1.97)^2)$$
$$= 2.05'$$

Use a max. scour depth of 3 feet plus an additional 2 feet to design rock apron for berm and impact-type stilling basin.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: 4W Reservoir Detention Pond			SHEET NO. 1 OF 7
	COMPUTED BY: VDeng	CHECKED BY: DM	JOB/TASK NO. 99012-02	DATE: 10/27/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 Subject

4W Reservoir Detention Pond

2.0 Purpose

Size detention pond to store rainfall from a 100-year, 24-hr storm event.

3.0 References

3.1 Section 22.2, Hydrology of the COA Development Process Manual, 1997.

3.2 Sediment and Erosion Design Guide, AMAFCA, Nov. 1994.

3.3 Open Channel Hydraulics, Chow, 1959.

3.4 Calculation Set – Outlet Pipe for 4W Reservoir Detention Pond, 10/26/99.

3.5 Geotechnical Investigation Proposed 4.3 Million Gallon Steel Reservoir and Pump Station, Alb., N.M., Vinyard & Assoc., Inc., Aug. 25, 1999.

P:\ACAD\REV-SHT

HEC-RAS Plan: Plan 21 River: MIREHAVEN ARROYO Reach: SOUTHERN BRANCH (Continued)

Reach	River Sta	Max Chl Dpth	Hydr Depth	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(ft)	(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SOUTHERN BRANCH	360	0.98	0.62	160.00	62.69	63.67	63.96	64.59	0.037358	7.88	21.68	35.21	1.59
SOUTHERN BRANCH	340	0.76	0.65	160.00	61.92	62.68	63.01	63.73	0.046573	8.28	19.78	30.49	1.75
SOUTHERN BRANCH	320	1.02	0.70	160.00	61.15	62.17	62.41	62.97	0.026781	7.54	23.93	34.42	1.38
SOUTHERN BRANCH	310.*	0.82	0.62	160.00	60.77	61.59	61.92	62.63	0.043755	8.33	20.15	32.59	1.71
SOUTHERN BRANCH	300	0.73	0.59	160.00	60.39	61.12	61.44	62.15	0.048996	8.18	20.00	33.70	1.78

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe for 4W Res. Det. Pond			SHEET NO. 5 OF 11
	COMPUTED BY: V. Deng	CHECKED BY: DM	JOB/TASK NO. 99012-03	DATE: 11/21/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

$Q_p = (0.61 \times 4.7 \times 1.04) + (0.93 \times 4.7 \times 0.03)$

$= 3.11$ cfs

Bulking: $1.15(3.11) = 3.6$ cfs

Total Flow from Developed Land Area:

$16.4 + 3.6 = 20$ cfs

Compare to Flow from Undeveloped Land Area
Assume Existing Land Treatment is type B:

$Q_p = 2.03$ cfs/acre $(1.15)(4.57 + 1.07)$

$= 13.2$ cfs < 20 cfs

The max. rate storm water runoff
can be metered from detention pond is:

$20 - 13.2 = \underline{\underline{6.8 \text{ cfs}}}$

7.3 Depth of Flow, do and Velocity,

$$d_o = 1.33\left(\frac{n \times Q}{\sqrt{S}}\right)^{3/8}$$

$$= 1.33\left(\frac{0.013 \times 9.6}{\sqrt{0.020}}\right)^{3/8}$$

$= 1.26'$ use an 18" pipe

7.4 Outlet Velocity
Determine using Pipe Culvert Analysis Computer Program, Version 1.7

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Outfall Pipe for 4W Rear. Det. Pond			SHEET NO. 4 OF 11
	COMPUTED BY: V. Deng	CHECKED BY: DWD	JOB/TASK NO. 99012-03	DATE: 11/21/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Peak Flow, Qp from Basin I (See Figure 1)

Based on 100-year, 6-hr Rainfall

$Q_p = C \cdot I \cdot A$

Coefficient C

For Land Treatment C, $C_C = 0.61$ (COA, DPM 1997)
" " " D, $C_D = 0.93$

Areas, A

For Land Treatment C, $A_C = 3.80$ ac.
" " " D, $A_C = 0.77$ ac
4.57 ac.

Intensity, I

For Zone 1, $I = 4.7''$

Total $Q_p = (C_C \times I \times A_C) + (C_D \times I \times A_D)$
$= (0.61 \times 4.7 \times 3.80) + (0.93 \times 4.7 \times 0.77)$
$= 14.26$ cfs

Assume additional 15% due to bulking from sediment

$Q = 1.15(14.26)$
$= 16.4$ cfs

Peak Flow, Qp from Basin II

Areas, A

For Land Treatment C, $A_C = 1.04$ ac
" " " D, $A_D = 0.03$ ac.
1.07 ac.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: 4W Reservoir Detention Pond			SHEET NO. 5 OF 7
	COMPUTED BY: VDeley	CHECKED BY: DMD	JOB/TASK NO. 99012-02	DATE: 10/27/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

Slope length from base of reservoir (at grade) to pond inlet is 275'; slope length from reservoir to southern edge of pond is ~ 230'; and slope length from top of berm along eastern side of property to southeast corner of pond ~ 200'. Therefore, ave. slope length is approx. 235'. Slope varies from 1% to 12%. Therefore use an average slope of 6%.

$$LS = \left(\frac{235}{72.6}\right)^{0.5}\left(0.065 + 0.0454 \cdot 6 + 0.0065 \cdot 6^2\right)$$

$$= 1.03$$

V_W = runoff volume, acre-ft
= 0.47 acre-ft

Q_p = 14.3 cfs (Ref. 3.4)

$$Y_s = 285\left(0.47 \times 14.3\right)^{0.56} 0.17 \times 1.03 \times 0.20 \times 1$$

$$= 29 \text{ tons}$$

Assuming a density for the sediment of 100 pcf

$$V = \frac{29 \times 2000}{100}$$

$$= \underline{580 \text{ cf}}$$

P:\AGAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: 4W Reservoir Det. Pond.			SHEET NO. 4 OF 7
	COMPUTED BY: VDeny	CHECKED BY: DWD	JOB/TASK NO. 99012-02	DATE: 10/27/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.4 Volume for 100-yr, 24-hr event

$$V_{360} = E\,(\text{Total Area})$$

$$= \frac{1.16(4.57)}{12}$$

$$= 0.44 \text{ acre-ft}$$

$$V_{1440} = 0.44 + \frac{0.77(2.66-2.20)}{12}$$

$$= 0.47 \text{ acre-ft}$$

7.5 Sediment Yield, Y_s

$$Y_s = 285(V_w Q_p)^{0.56} K \cdot LS \cdot C_2 \cdot P \quad \text{(MUSLE EQUATION)}$$

$K = 0.17$ (Fine Sand – Table B.1 – Ref. 3.2)

$$LS = \left(\frac{\lambda}{72.6}\right)^n (0.065 + 0.0454\,S + 0.0065\,S^2)$$

λ = average slope length, ft

S = ave. slope

n = 0.3 for slopes ≤ 3%

= 0.4 " " = 4%

= 0.5 " " ≥ 5%

$P = 1$ (no terracing)

$C_2 = 0.20$ table B.2 Ref. 3.2.

Q_p = 100-yr peak discharge (6-hr event)

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: 4W Reservoir Detention Pond			SHEET NO. 3 OF 7
	COMPUTED BY: DLeng	CHECKED BY: DM	JOB/TASK NO. 99012-02	DATE: 10/27/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Precipitation Zone = 1 (West of Rio Grande) (Ref. 3.1)

$P_{60} = 1.87''$

$P_{360} = 2.20''$

$P_{1440} = 2.66''$

$P_{4\,DAYS} = 3.12''$

$P_{10\,DAYS} = 3.67''$

7.2 Land Conditions

Pre-Development	Treatment B	4.62 acres	
Post-Development	Treatment B	0 acres	
	" C	3.80 acres	
	" D	0.77 acres	
		4.57 acres	

7.3 Weighted Excess Precipitation, E (Ref 3.1)

$$E = \frac{\cancel{E_A A_A}^{\,0} + \cancel{E_B A_B}^{\,0} + E_C A_C + E_D A_D}{\cancel{A_A} + \cancel{A_B} + A_C + A_D}$$

$E_B = 0.67''$

$E_C = 0.99''$

$E_D = 1.97''$

$$E = \frac{0.99(3.80) + 1.97(0.77)}{4.57}$$

$= 1.16''$

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: 4W Reservoir Detention Pond			SHEET NO. 2 OF 7
	COMPUTED BY: VDeng	CHECKED BY: DW	JOB/TASK NO. 99012-02	DATE: 10/27/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

4.0 Assumptions

4.1 The soils at the Reservoir Site are classified as very lightly cemented, poorly graded sand and slightly silty sand with occasional layers of silty sand and sandy gravel. (Ref. 3.5)

4.2 Existing Terrain is undeveloped and sparsely vegetated with native grasses, shrubs and small trees.

5.0 CRITERIA/REQUIREMENTS

5.1 Storage Volume will be based on the 100-yr, 24-hr storm event per COA, DPM Chapter 22.2.

5.2 An emergency spillway will be included in the design to control direction of flow if water overtops the pond. The flow will be directed toward the southern branch of the Mirehaven Arroyo.

5.3 Sediment buildup will be accounted for in the pond storage requirements.

6.0 Sketches – See Figure 1.

P:\ACAD\REV-SHT

N
5600
5608.2
90
95
5600
05
10
Scale: 1" = 50'
NOTE:
OUTER DACH IS E.G.L.
163+00
164+00
165+00
166+00
167+00
168+00
169+00
170+00
171+00
24575.42
cuft

FIGURE 2

PWDN 35

CITY OF ALBUQUERQUE
BERNALILLO COUNTY
ALBUQUERQUE METROPOLITAN
FLOOD CONTROL AUTHORITY

DRAINAGE REPORT
FOR 4W RESERVOIR SITE

PREPARED BY
LEEDSHILL-HERKENHOFF, INC.
FOR
WESTLAND DEVELOPMENT CO., INC.

HYDROLOGY SECTION

January 2000

LEEDSHILL-HERKENHOFF, INC.
an ASCG Company
500 Copper Ave. N.W.
Albuquerque, New Mexico
(505) 247-0294

LH Project No. 99012

SEALS PAGE

The Engineer-of -Record does hereby certify that the technical material and data contained in the specifications were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of New Mexico, is affixed below.

Victoria A. Dery

Victoria A. Dery, P.E.

13654

License No.

VICTORIA ALETHA DERY
NEW MEXICO
13654
1.6.00
REGISTERED PROFESSIONAL ENGINEER

TABLE OF CONTENTS

		Page
I.	SITE LOCATION AND ACCESS	2
II.	SITE SELECTION PROCESS	3
III.	PROPERTY OWNERSHIP	4
IV.	SITE CHARACTERISTIC	5
V.	HYDROLOGIC AND HYDRAULIC ANALYSIS	6
	A. Post Development Conditions	6
	B. AHYMO_97 Computer Analysis	6
	C. HEC-RAS Computer Analysis	7
VI.	SCOUR DEPTH ANALYSIS	8
VII.	PROPOSED IMPROVEMENTS	9
	A. General	9
	B. Storm water Detention Pond	10
	C. Impact-Type Stilling Basin	10
	D. Upland Interceptor Ditch	11
	E. Erosion and Scour Protection	11
VIII.	EROSION CONTROL MEASURES	12
	A. Temporary Erosion Control Measures During Construction	12
	B. Permanent Erosion Control Measures After Construction	12

ATTACHMENTS

A-1 Revised Site Development Plans
A-2 Calculations

I. SITE LOCATION AND ACCESS

In accordance with the Westland Master Plan and the City of Albuquerque (COA) Water Master Plan, the 4W Reservoir will be located on an undeveloped, 9.64-acre area of land in Atrisco Terrace Open Space in Zone J7. This area is approximately 1.3 miles west of 98th Street, N.W., and one mile north of I-40. A vicinity map indicating the location of the site is included on Sheet ELUC4 of Attachment A-1.

The reservoir will be constructed on the northern face of a hill with its highest elevation at elevation 5630. Space will be provided on this site for construction of a future pump station that will pump water from 4W Reservoir to a future, elevated storage tank in an upper pressure zone.

Access to the site will be via a temporary gravel road to be constructed on undeveloped land currently owned by Westland Development Co., Inc. The road will be maintained by Westland until the land is annexed by the COA.

II. SITE SELCTION PROCESS

The site for the reservoir has to meet the following requirements and criteria established in the COA's and Westland's master plans.

- The overflow elevation of the steel reservoir must be at 5600 feet.
- The reservoir must have a standard effective water depth of 24 feet and a storage capacity of 4.3 million gallons.
- The site must be physically located in the COA-designated pressure Zone 5W.
- The site must be accessible by streets planned for the Westland development area.
- The transmission line that conveys water to the reservoir must be located within the utility corridor provided within the right-of-way.
- The reservoir tank must be located such that it can be hidden or at least partially hidden from view of the planned residential areas.
- It is preferable that the site be located outside of the "View Area" of the Petroglyph National Monument.

Several sites within the Westland Development Area were evaluated on the basis of the stated requirements and criteria. By process of elimination, the best site included the 9.64-acre area of land in Atrisco Terrace Open Space. While this site meets all of the requirements and criteria, it possesses a few constraints that limit the options for management of on-site runoff and reservoir overflow. These constraints include:

- the limited amount of space available for storm water detention;
- the close proximity of the site to the existing arroyo to the north and west;
- the presence of a small, tributary upland watershed with steepening grade to the south; and
- the absence of electrical power in the site vicinity for operation of an irrigation system and electrical equipment for reservoir level control. Solar energy will have to be used to power these systems.

III. PROPERTY OWNERSHIP

The 9.64-acre area of land proposed for the reservoir site is currently owned by Westland. Upon completion of the reservoir and acceptance by Water Utility Division (WUD), the COA will purchase the facility from Westland. At that time, Water Utility Division will operate and manage the facility.

IV. SITE CHARACTERISTICS

The site is characterized by steep, undeveloped terrain with deeply encised arroyos in alluvial plains and sandy hills sparsely vegetated with native grasses, shrubs and small trees. The site is currently undisturbed. Native vegetation survives on annual rainfall. Ground slopes vary from 4 to 30%. Based on results of a geotechnical investigation performed by Vinyard and Associates, soils at the reservoir site are sandy to silty sand at depth. On-site drainage flows eastward and northeastward to a series of AMAFCA detention basins that parallel I-40.

The reservoir site is adjacent to the 100-year floodplain of a branch of the Mirehaven Arroyo as shown on Sheet ELUC4C of Attachment A-1. The site is also downstream of a 4.3-acre watershed that historically drains northeasterly towards the arroyo.

FEMA map?

The arroyo is predominantly smooth and straight with a small degree of meander. The main channel is relatively flat with a bottom width of 25 to 30 feet in the vicinity of the reservoir site. The main channel banks are shallow, steep, sparsely vegetated and covered with small stones over 10 to 20% of the area. The overbanks are slightly more vegetated and not as steep as the main channel banks.

Based on a site survey and photographs taken of the arroyo, the channel reach in the vicinity of the reservoir site appears to be in a state of aggradation. There is no evidence of bank erosion and scour. However, a few hundred feet upstream there is some minimal, localized scour along the southern bank of the channel.

The arroyo drains an 84-acre watershed upstream of the site. This watershed contains a mixture of land treatments, with the predominant forms being types B and C due to the steepness of the terrain and sparseness of vegetation.

V. HYDROLOGIC AND HYDRUALIC ANALYSES

In accordance with the Bernalillo County Drainage Ordinance 96-5 and Drainage Submittal Checklist, the potential for offsite flows to impact the site were analyzed since the site is adjacent a branch of the Mirehaven Arroyo and downstream of a 4.3-acre watershed. In quantifying the offsite flows, post development conditions were considered in the hydrologic analysis. The 100-year, 6-year rainfall event was used to determine the peak flow in the arroyo at the vicinity of the reservoir site. Based on direction from the Bernalillo County Drainage Engineer (Brad Catanach, P.E.), the Energy Grade Line (EGL) was determined to establish the limits of grading and placement of drainage improvements and structures adjacent to the arroyo.

A. Post Development Conditions

At post development conditions, the 84-acre watershed will be reduced to a 62-acre watershed due to the construction of a storm sewer in the proposed arterial street that will border the western boundary of Atrisco Terrace (see Sheet ELUC4C of Attachment A-1). With the exception of the land that will be used for the reservoir site, the surface runoff characteristics of the 62-acre watershed will remain undeveloped in its designation as Open Space.

B. AHYMO_97 Computer Analysis

The AHYMO_97 computer program was used to model hydrologic conditions in the 62-acre watershed. On a 1"=200' topographic map of the site region, the watershed was divided into 5 major basins which was subdivided into 9 smaller sub-basins. Each sub-basin was further subdivided into the appropriate land treatment areas (see Sheet ELUC4C of Attachment A-1).

As shown on Sheet ELUC4C, most of the sub-basins are comprised of type B and/or C land treatments. A couple of the uppermost sub-basins include a small percentage (10% to 20%) of type A, in addition to type B and C land treatments. The lowest sub-basin which includes the reservoir site is comprised of 0.8 acre of type D land treatment (or 17% impervious area) due to the steel reservoir, driveway and future pump station, and 3.8 acres of type C land treatment.

The headwaters of the watershed are at elevation 5725 which is at the edge of the future arterial street that will border the western boundary of Atrisco Terrace Open Space. The tailwater of the watershed is at elevation 5555 which is approximately 9 feet below the elevation of the proposed outfall of the detention pond drain.

In accordance with Section 22.2 of the COA Development Process Manual (DPM), the 100-year, 6-hour rainfall event was used as the design storm for development of the hydrographs. Since the native materials in the basin of the Mirehaven Arroyo are characterized as erodible (AMAFCA, 1994) a bulking factor or 1.15 (or 15%) was used in the computer model to account for sediment transport in the basins. In addition, flows from Sub-Basin 10509 which includes the proposed reservoir and future pump station were metered from the detention pond at a rate of 1 cfs. The results of the analysis which are provided in Attachment A-2 indicate that the peak flow at the tailwaters of the watershed will be approximately 160 cfs.

2 cfs/ac

C. HEC-RAS Computer Analysis

The HEC-RAS computer program was used to analyze hydraulic conditions of the arroyo in the site vicinity. The channel cross sections start a few hundred feet upstream of the southwest corner of the reservoir site and end a few hundred feet downstream of the proposed stilling basin.

The results of the HEC-RAS analysis, which are provided in Attachment A-2, indicate that the flow regime in the channel is supercritical; flow depths and EGL's are approximately one foot and two feet above the channel bottom, respectively; and velocities range from 7.1 to 10.3 fps. Velocities slow down to approximately 7 fps downstream of the bend in the channel which is adjacent to the northwest corner of the reservoir site.

The EGL is plotted on the Grading and Drainage Plan provided in Attachment A-2. As shown on the Plan, all grading and drainage structures, with the exception of the stilling basin and riprap protection between the stilling basin and the opposite bank of the main channel (arroyo) are inside the property boundary.

VI. SCOUR DEPTH ANALYSIS

To define erosion protection requirements for the site due to potential channel meander, a scour depth analysis of the arroyo was conducted in accordance with the AMAFCA Sediment and Erosion Design Guide (1994). The calculations that provide the basis for these requirements are included in Attachment A-2. The results of the analysis indicate that scour could lower the existing channel bottom elevation by up to three feet.

VII. PROPOSED IMPROVEMENTS

A. General

The proposed improvements will consist of the construction of the 4.3 million gallon, above ground steel reservoir, associated underground utilities and appurtenances, site grading, drainage control features, landscaping, fencing and paved access road, as shown on Sheet ELUC4 of Attachment A-1. Adequate space will be provided on site for a pump station to be constructed 10 to 20 years in the future. As shown on Sheet ELUC4 (Site Grading and Drainage Plan), the site is constrained in area by the existing arroyo to the north and west, the proposed right-of-way to the east, and the steepening grade of the existing terrain to the south.

The existing site will be graded such that all surface runoff originating from the developed areas of the site, with the exception of the southwest and northeast corners of the site, totaling 1.1 acres, will be collected and conveyed to a storm water detention pond at the northwest corner of the site. A v-ditch will be excavated around the perimeter of the reservoir for collection and conveyance of on-site runoff to the pond. The northwest corner and east side of the site will be bermed to partially hide the reservoir from view and control on-site runoff.

Since it is not practical nor feasible to construct a large enough detention pond to store reservoir overflow in the rare event that the reservoir level controller malfunctions or becomes inoperable, the overflow at the full inflow or transfer rate of 29.4 cfs will be conveyed by a reservoir overflow drain (ROD) to the arroyo. The flow velocities in the ROD will be reduced at the pipe outfall via an impact-type stilling basin designed and constructed in accordance with the dimensional criteria outlined in the Bureau of Reclamation's Design of Small Dams (1987).

Upland of the site is a 4.3-acre watershed (Sub-Basin 10306) which drains in the northeasterly direction towards the arroyo. To prevent off-site runoff from flowing down the three horizontal to one vertical (3H:1V) sideslope surrounding the reservoir, a 20-foot-wide interceptor ditch will be constructed at the top of the slope. This ditch will convey off-site runoff towards the arroyo which historically receives this runoff farther down the channel (approximately 1000 feet downstream).

Surface runoff from the undeveloped portion of the site will continue to flow to the north and east across the adjacent undeveloped land and into the existing arroyo. The proposed site hydrology and surface runoff configuration will contribute a maximum of 4.6 cfs to the arroyo which historically receives 13.1 cfs from this area. The reduction in flow will be due to the proposed detention pond.

The berms, interceptor ditch and pipe drain outfalls, and stilling basin will be protected from erosion and scour by rock aprons.

Fencing will be provided along the toe of the developed areas with the exception of the berm, upland interceptor ditch, pipe outfalls and stilling basin. The fencing is located on top of the berm on the northwest corner of the site and away from the upland interceptor ditch to prevent impedance

of off-site flows. The fencing is also located upland of the pipe outfalls and stilling basin to prevent impedance of on-site flows that will discharge into the existing arroyo. At the southwest corner of the site, the fencing fabric will be installed one foot above finished grade to allow on-site flows originating from the undeveloped areas to continue draining in their historic pattern. Along the eastern side of the site where surface runoff will continue to drain as sheet flow, the fencing fabric will be installed three inches above existing grade.

B. Storm Water Detention Pond

The storm water detention pond will be constructed at the northwest corner of the site and sized to contain the full 100-year, 24-hour rainfall volume plus sediment volume, totaling 21,000 cubic feet. The pond will be designed and constructed to provide 2,794 cubic feet excess capacity along with an emergency spillway to convey storm water volumes in excess of the 100-year, 24-hour event directly to the arroyo. The pond will include an 18-inch reinforced concrete pipe (RCP) with a 4-inch diameter aluminum orifice plate located at the bottom of the pond to provide controlled release of storm water volume collected from Sub-Basin 10509. The orifice plate will be bolted to a reinforced concrete headwall with wingwalls as detailed on Sheet ELUC4A. A three-foot high chain link fence lined with silt fencing on the upstream side of the chain link will be installed across the opening of the concrete box created by the headwall and wingwalls at the 18-inch RCP inlet. This will serve to prevent most windblown and waterborne material and debris from blocking the pipe inlet. However, the fence is low enough to allow entry into the concrete box for maintenance.

The pond bottom is designed for complete drainage of the pond during storm events. Therefore, regular maintenance to remove sediment build-up on the bottom of the pond will be required to facilitate drainage to the pipe inlet.

Runoff collected in the pond will be released at a controlled rate of approximately 1 cfs, which will fully drain the pond within 24 hours or less. Runoff from this drain will discharge into the arroyo.

C. Impact-Type Stilling Basin

At the outfall of the ROD, a reinforced concrete, impact stilling basin will be constructed to reduce the flow velocities before discharging into the arroyo. The basin will be designed and sized for the maximum depth of flow at the outlet of the ROD and the Froude No. The stilling basin will be constructed within the property boundary and outside the limits of the EGL of the arroyo.

D. Upland Interceptor Ditch

The upland interceptor ditch will be designed and constructed to convey off-site runoff flowing at a rate of 13 cfs towards the arroyo. The ditch will be 20 feet wide at the base with 3H:1V sideslopes. The outlet of the ditch will be lined with a rock apron for energy dissipation and erosion control.

E. Erosion and Scour Protection

In order to protect the site from erosion and scour due to potential channel meander, the sideslopes of the on-site berm will be lined with riprap. The riprap is sized (d_{30} = 6 inches) for the calculated depths of flow and velocities in the arroyo for the 100-year, 6-hour rain storm. The riprap will extend two feet below the maximum calculated scour depth of three feet for a total depth of 5 feet below the existing channel bottom elevation. The riprap will be underlain by a 6-inch layer of bedding material to preclude settlement of the rock into the native materials.

A 5-foot deep rock apron will also be placed around the perimeter of the stilling basin and at the outfall of the storm water detention pond drain for scour protection and erosion control. Based on evidence that clean water will transport large volumes of sediment, a single reservoir overflow event has the potential for causing significant headcutting in the channel bank. Therefore, the apron will extend from the lip of the basin to two feet below the calculated scour depth elevation in the arroyo and will be underlain by a bedding layer as shown on Sheet ELUC4 of Attachment A-1. Because a significant portion of the erosion protection at the outlet of the basin will be outside of the property boundary and a lesser portion within the limits of the EGL, Westland will be responsible for maintenance of the off-site drainage improvements until ownership is transferred to COA Open Space.

VIII. EROSION CONTROL MEASURES

A. Temporary Erosion Control Measures During Construction

During earthmoving activities and construction of the reservoir, detention pond and drain lines, on-site erosion will be controlled by the installation of temporary silt fencing along the southern and eastern property lines. The contractor will be required to construct and maintain this silt fencing to prevent transport of sediment off site and into the existing arroyo. Prior to excavation of the hillside for construction of the steel reservoir, the contractor will construct the storm water detention pond and grade the site so that it conveys on-site runoff from lesser storms (i.e., 10-year design storm) towards the pond. The contractor will also construct the upland interceptor ditch to divert off-site flows away from the construction site.

To control on- and off-site dust emissions during construction, the contractor will be required to water the site and haul roads as necessary to prevent the air-borne release of soil particles.

B. Permanent Erosion Control Measures After Construction

Upon completion of the proposed improvements, all areas of the site, including sloped surfaces of the detention pond, berms, 3H:1V cut slope surrounding the reservoir, upland interceptor ditch, and area for the future pump station will be reseeded with a native seed mix as specified on Sheet ELUC3 of Attachment A-1. The inlet of the detention pond will be lined with grouted riprap. As discussed in Section 7.5, the berms, outlets of the interceptor ditch, detention pond drain, reservoir underdrain and stilling basin, and an 80-foot section of arroyo will be lined with riprap.

ATTACHMENT A-1
REVISED SITE DEVELOPMENT PLANS

(At End of Document)

ATTACHMENT A-2
CALCULATIONS

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION Mirehaven Hydrologic Analysis of Arroyo Basin			SHEET NO. 1 OF ~~29~~ 27
	COMPUTED BY: VDeng	CHECKED BY: [illegible]	JOB/TASK NO. 99012-02	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 SUBJECT

Hydrologic Analysis of the Mirehaven Arroyo Basin in the Vicinity of the 4W Reservoir Site

2.0 Purpose

Determine the peak flow in the Mirehaven Arroyo near the northwest corner of the proposed detention Pond for the 4W Reservoir Site.

3.0 References

3.1 Chapter 22, COA Development Process Manual, 1997.

3.2 AHYMO™ (AHYMO_97) Computer Program User's Manual, August 1997.

3.3 Topographic map of Westland Master Plan area based on aerial survey conducted by Thomas R. Mann & Assoc., Inc., Fall 1997.

3.4 Bernalillo County Storm Drainage Ordinance No. 96-5.

3.5 Detention Pond Sizing Calculation Set, V. Deng, 11/7/99.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analy. of Mirehaven Arroyo			SHEET NO. 2 OF ~~29~~ 27
	COMPUTED BY: VDenz	CHECKED BY: DKD	JOB/TASK NO. 99012	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

4.0 Assumptions

4.1 Bernalillo County soil infiltration values (Land factors) will be used for computations.

4.2 Downstream peak flow of the Mirehaven Arroyo (Southern Branch) will be determined based on the assumption of fully developed watershed per BC Drainage Ordinance 96-5, Section II, G, line 29. Fully developed conditions includes construction of storm sewer in the future streets (Westland Master Plan) as shown in Figure 1. Storm sewer will intercept flow from developed residential areas located west of the Artisan Terrace Open Space

4.3 A bulking factor of 15% or 1.15 shall be applied to the flow rates to account for sediment transport in the channel.

4.4 Based on site survey and photographs taken of channel slopes in vicinity of 4W Reservoir site, assume overbank slopes have a Mannings n coefficient of 0.04, main channel slopes are 0.035 and channel bottom is 0.03.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrol. Analy. of Mirehaven Ar.			SHEET NO. 3 OF ~~29~~ 27
	COMPUTED BY: UDerg	CHECKED BY: DHS	JOB/TASK NO. 99012	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

5.0 Criteria / Requirements

5.1 Peak discharge in Mirehaven Arroyo will be based on the 100-yr, 6-hr storm event.

5.2 The on-site detention pond will be designed to be emptied in 24-hours or less. The pond will also be designed to store (detain) the 100-yr. 24hr. storm.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analy. of Mirehaven			SHEET NO. 4 OF 27
	COMPUTED BY: VDerry	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches

6.1 Drainage Basins – See Figures 1 and 2

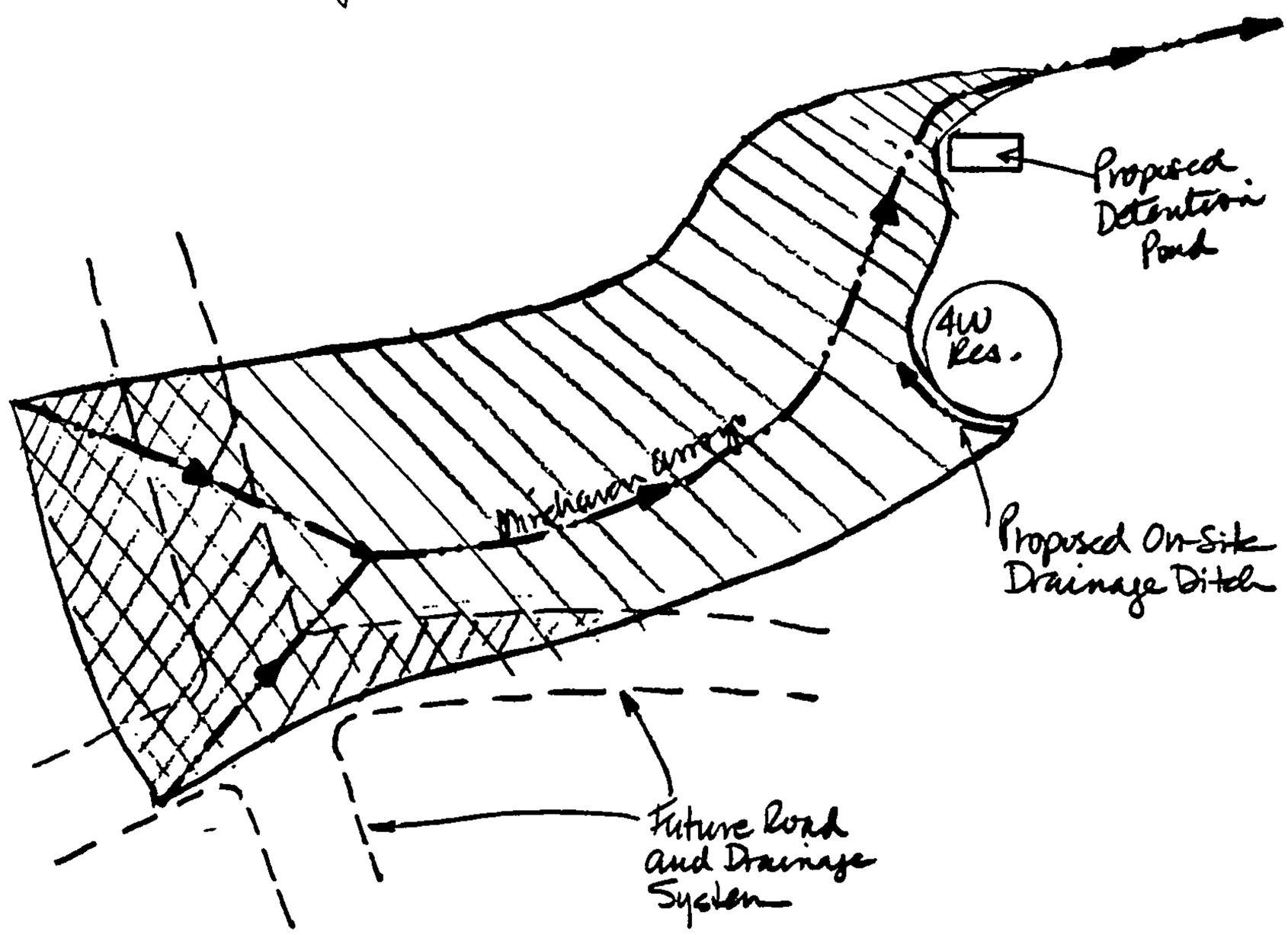


FIGURE 3

Existing 84-acre watershed tributary to Mirehaven Arroyo in vicinity of 4W Res. Site

Area that will be removed from watershed after construction of new road and drainage system

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analy. of Mirehaven			SHEET NO. 5 OF ~~28~~ 27
	COMPUTED BY: V. Deng	CHECKED BY: DHD	JOB/TASK NO. 99012	DATE: 11/6/99

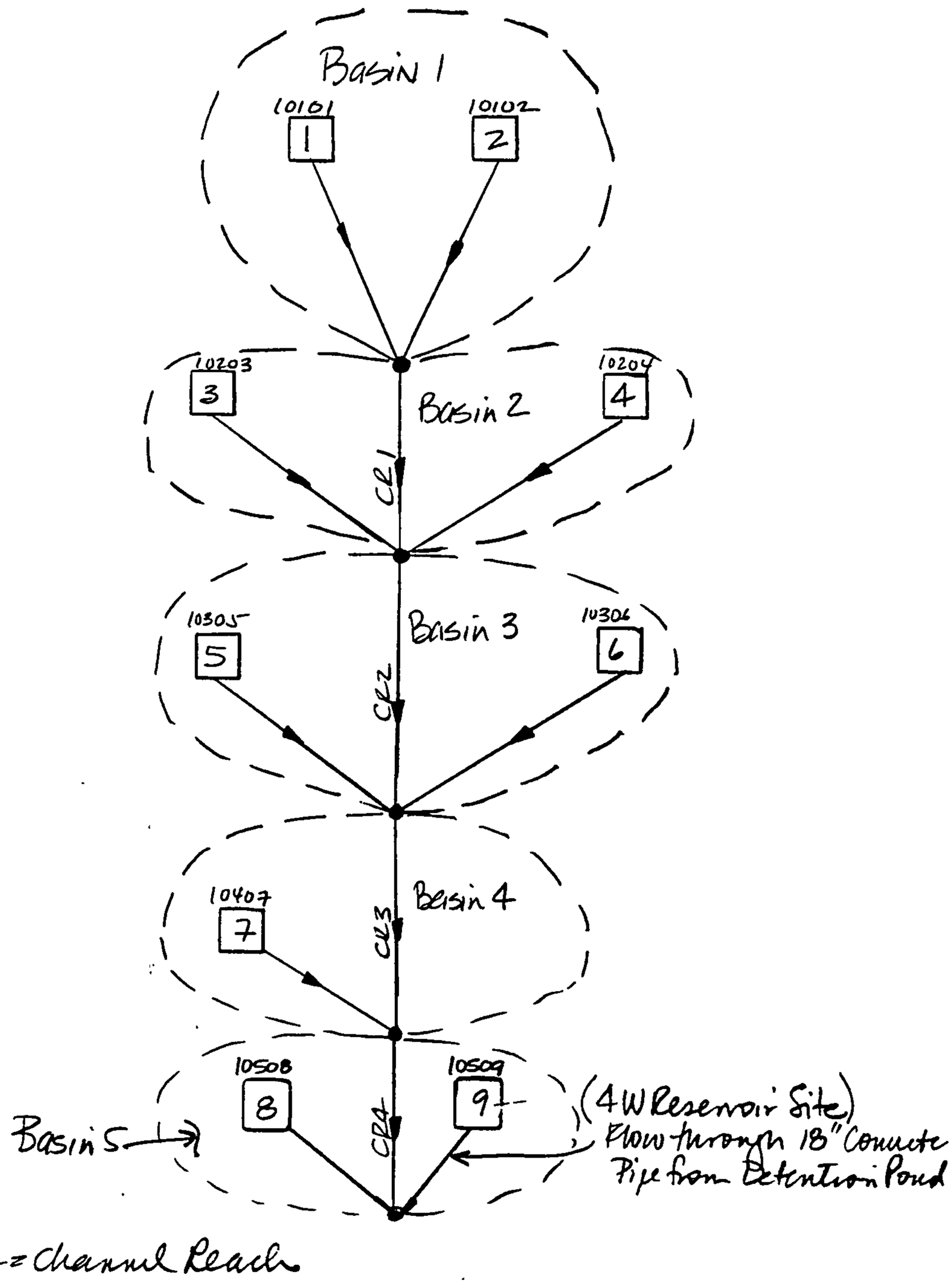
IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Basin Areas & Land Treatments

SEE FIGURE 1



CR = Channel Reach

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analy. of Mirehaven			SHEET NO. 6 OF ~~29~~ 27
	COMPUTED BY: VDeng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

SUB-BASIN ID	(AC) DRAINAGE AREA	LAND USE % A	B	C	D
10101	6.77	1.25 (19%)	3.40 (50%)	2.12 (31%)	0
10102	9.91	0	9.91 (100%)	0	0
10203	4.44	0.46 (10%)	0.81 (18%)	3.18 (72%)	0
10204	5.64	0	4.85 (86%)	0.78 (14%)	0
10305	19.13	0	3.00 (16%)	16.13 (84%)	0
10306	4.14	0	0.70 (17%)	3.44 (83%)	0
10407	6.08	0	2.04 (34%)	4.04 (66%)	0
10508	1.31	0	0.21 (16%)	1.10 (84%)	
10509	4.57	0	0	3.80 (83%)	0.77 (17%)
total	61.99	1.71	24.92	34.59	0.77

7.2 Channel Reach in Sub-basins

SUB-BASIN ID	Total Reach Length ft	L (Sheet Flow) ft	Elev (high) ft.	SHEET FLOW Elev (low) ft.	S (Sheet flow) ft/ft.	K (Sheet flow)
10101	910	50	5725	5720	0.10	0.7
10102	670	0	N/A	N/A	N/A	N/A
10203	1380	210	5725	5715	0.048	0.7
10204	510	⊘	⊘	⊘	⊘	⊘
10305	1305	⊘	⊘	⊘	⊘	⊘
10306	1135	⊘	⊘	⊘	⊘	⊘
10407	470	⊘	⊘	⊘	⊘	⊘

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analysis of Wrehaven			SHEET NO. 7 OF ~~29~~ 27
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.2 Channel Reaches, cont.

SUB-BASIN ID	L1 (Channelized flow)	Elev. (high)	Elev. (low)	S1	K1
	← Channel No. 1 →				
10101	410	5720	5680	0.098	2
10102	670	5695	5660	0.052	2
10203	1170	5715	5640	0.064	2
10204	810	5660	5640	0.039	2
10305	1305	5640	5590	0.038	2
10306	750	5679	5615	0.085	2
10407	470	5590	5570	0.043	2
	L2			S2	K2
	← Channel No. 2 →				
10101	450	5680	5660	0.044	2
10102	0	N/A	N/A	N/A	N/A
10203	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
10204	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
10305	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
10306	265	5615	5610	0.019	2
10407	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analy. of Mirehaven			SHEET NO. 8 OF ~~28~~ 27
	COMPUTED BY: V. Deng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/6/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.2 Channel Reaches, cont.

	← Channel No. 3 →				
SUB-BASIN ID	L3 (Channel Bed Flow)	Elev. (High)	Elev (Low)	S3	K3
10101	Ø	Ø	Ø	Ø	Ø
10102	Ø	Ø	Ø	Ø	Ø
10203	Ø	Ø	Ø	Ø	Ø
10204	Ø	Ø	Ø	Ø	Ø
10305	Ø	Ø	Ø	Ø	Ø
10306	120	5610	5590	0.167	2
10407	Ø	Ø	Ø	Ø	Ø
10508	270	5570	5555	0.056	2
10509	600	5630	5567	0.105	2

P:\ACAD\REV-SHT

P:\ACAD\REV-SHT

7.3 Channel Reach Configurations

Basin	Channel Reach	Bottom Width (ft)	Manning's n	Main Channel Sideslopes (H:V) Left	Main Channel Sideslopes (H:V) Right	Manning's n	Overbank Sideslopes* (H:V) Left	Overbank Sideslopes* (H:V) Right
2	1	28	0.03	2:1	2:1	0.035	8:1	8:1
3	2	30	0.03	4:1	4:1	0.035	7:1	7:1
4	3	25	0.03	5:1	5:1	0.035	10:1	10:1
5	4	30	0.03	4:1	4:1	0.035	8:1	8:1

* Use Manning's n of 0.04 for overbank slope

LEEDSHILL - HERKENHOFF, INC.
ENGINEERS ARCHITECTS
ALBUQUERQUE • SANTA FE
COMPUTATIONS

NAME OF PROJECT/CALCULATION: Rio Grande Analysis of MA
COMPUTED BY: VDeng
CHECKED BY: DMD
JOB/TASK NO: 99012
DATE: 11/14/99
SHEET NO. 9 OF 27

1.0 SUBJECT | 2.0 PURPOSE | 3.0 REFERENCES | 4.0 ASSUMPTIONS | 5.0 CRITERIA / REQUIREMENTS | 6.0 SKETCHES | 7.0 CALCULATIONS | 8.0 CONCLUSIONS | 9.0 ATTACHMENTS

IDENTIFY/ADDRESS THESE ELEMENTS | REVISION # | SUPERSEDES CALC TITLE | CHECKED BY: | DATED

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydrologic Analysis of MA			SHEET NO. 10 OF ~~28~~ 27
	COMPUTED BY: V. Deny	CHECKED BY: DRD	JOB/TASK NO. 99012	DATE: 11/14/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.4 Outflow-Storage Characteristics of 4W Detention Pond

Assume max. outflow from pond will be based on 3.5" orifice plate on 18" ϕ culvert pipe and max. head of 4' @ Elev. 5571

$$* \; Q = CA\sqrt{2gH}$$

where $C = 0.85$

$A = \frac{1}{4}\pi d^2 = 0.0668$ sf

H (ft)	Q* (cfs)	Elev. (ft)	Det-Pond Storage Vol. (acre-ft)
0	0	5567	0
1	0.46	5568	0.0970
2	0.64	5569	0.2175
3	0.79	5570	0.3634
4	0.92	5571	0.5387

7.5 AHYMO Computer Analysis (See output file)

$Q_{peak} = 160$ cfs

8.0 <u>Conclusions / Recommendations</u>

Conduct hydraulic analysis of Mirehaven Arroyo (Southern Branch) based on 160 cfs for Post Development Conditions.

P:\ACAD\REV-SHT

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =12/11/1999
INPUT FILE = J:\WESTLAND\99012\MIRE13.DAT USER NO.= AHYMO-S-9702c01000LH2-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 NOTATION
START										TIME= .00
LOCATION		BERNALILLO COUNTY								
RAINFALL TYPE= 1										RAIN6= 2.200
COMPUTE NM HYD	100.00	-	1	.01060	14.27	.396	.70052	1.533	2.103	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
COMPUTE NM HYD	101.00	-	2	.01550	23.12	.634	.76749	1.533	2.331	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
ADD HYD	102.00	1& 2	3	.02610	37.39	1.030	.74028	1.533	2.238	
ROUTE	200.00	3	4	.02610	37.63	1.030	.74030	1.533	2.253	
COMPUTE NM HYD	201.00	-	5	.00690	12.84	.362	.98340	1.500	2.908	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
COMPUTE NM HYD	202.00	-	6	.00880	13.82	.381	.81218	1.500	2.453	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
ADD HYD	203.00	5& 6	7	.01570	26.66	.743	.88741	1.500	2.653	
ADD HYD	204.00	4& 7	8	.04180	64.13	1.774	.79554	1.533	2.397	
ROUTE	300.00	8	9	.04180	63.81	1.774	.79556	1.533	2.385	
COMPUTE NM HYD	301.00	-	10	.02990	60.04	1.711	1.07295	1.500	3.138	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
COMPUTE NM HYD	302.00	-	11	.00650	13.02	.370	1.06869	1.500	3.129	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
ADD HYD	303.00	10&11	12	.03640	73.06	2.081	1.07218	1.500	3.136	
ADD HYD	304.00	12& 9	13	.07820	135.55	3.855	.92431	1.533	2.708	
ROUTE	400.00	13	14	.07820	135.91	3.855	.92432	1.533	2.716	
COMPUTE NM HYD	401.00	-	15	.00950	17.98	.506	.99888	1.500	2.958	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
ADD HYD	402.00	15&14	16	.08770	153.64	4.361	.93239	1.533	2.737	
ROUTE	500.00	16	17	.08770	153.81	4.361	.93239	1.533	2.740	
COMPUTE NM HYD	501.00	-	18	.00710	16.37	.505	1.33338	1.500	3.602	PER IMP= 17.00
SEDIMENT BULK										PK BF = 1.15
ROUTE RESERVOIR	502.00	18	19	.00710	.84	.504	1.33020	2.233	.184	AC-FT= .427
ROUTE	503.00	19	20	.00710	.84	.504	1.33008	2.233	.184	
ADD HYD	504.00	20&17	21	.09480	154.38	4.864	.96209	1.533	2.545	
COMPUTE NM HYD	505.00	-	22	.00200	4.02	.114	1.07294	1.500	3.144	PER IMP= .00
SEDIMENT BULK										PK BF = 1.15
ADD HYD	506.00	22&21	23	.09680	158.34	4.979	.96447	1.533	2.556	
FINISH										

4W Res. Tank + Future Pump Station

use 160 cfs

ans

17

```
AHYMO PROGRAM (AHYMO_97) -                    - Version:  1997.02c
     RUN DATE (MON/DAY/YR) = 12/11/1999
     START TIME (HR:MIN:SEC) = 15:54:57     USER NO.= AHYMO-S-9702c01000LH2-AH
     INPUT FILE = J:\WESTLAND\99012\MIRE13.DAT

START                TIME=0.0
LOCATION             BERNALILLO COUNTY
     Bernalillo County soil infiltration values (LAND FACTORS) used for computations.
     Land Treatment     Initial Abstr.(in)    Unif. Infilt.(in/hour)
          A             0.65                  1.67
          B             0.50                  1.25
          C             0.35                  0.83
          D             0.10                  0.04

* WESTLAND DEVELOPMENT, 4W RESERVOIR, MIREHAVEN ARROYO FLOODPLAIN
* ANALYSIS
* 100-YR, 6-HR RAINFALL
* COMPUTE THE RAINFALL DISTRIBUTION FOR THE ENTIRE PROJECT
*
RAINFALL             TYPE=1   RAIN QUARTER=0.0   RAIN ONE=1.87
                     RAIN SIX=2.20 RAIN DAY=2.66 DT=0.033333

                COMPUTED 6-HOUR RAINFALL DISTRIBUTION BASED ON NOAA ATLAS 2 - PEAK AT 1.40 HR.
                DT =    .033333 HOURS       END TIME =     5.999940 HOURS
                   .0000   .0016   .0033   .0050   .0067   .0085   .0103
                   .0122   .0141   .0160   .0180   .0201   .0222   .0243
                   .0266   .0289   .0312   .0337   .0362   .0388   .0415
                   .0443   .0472   .0502   .0534   .0567   .0601   .0637
                   .0675   .0715   .0758   .0810   .0865   .0924   .1051
                   .1335   .1773   .2400   .3257   .4384   .5820   .7607
                   .9789  1.1808  1.2652  1.3365  1.4000  1.4577  1.5108
                  1.5602  1.6063  1.6495  1.6902  1.7285  1.7648  1.7991
                  1.8316  1.8624  1.8917  1.9194  1.9458  1.9519  1.9576
                  1.9631  1.9683  1.9732  1.9780  1.9826  1.9870  1.9912
                  1.9953  1.9993  2.0031  2.0068  2.0105  2.0140  2.0174
                  2.0207  2.0240  2.0272  2.0303  2.0333  2.0363  2.0392
                  2.0420  2.0448  2.0476  2.0502  2.0529  2.0554  2.0580
                  2.0605  2.0629  2.0653  2.0677  2.0701  2.0724  2.0746
                  2.0769  2.0791  2.0812  2.0834  2.0855  2.0876  2.0896
                  2.0916  2.0936  2.0956  2.0976  2.0995  2.1014  2.1033
                  2.1052  2.1070  2.1088  2.1106  2.1124  2.1142  2.1159
                  2.1176  2.1193  2.1210  2.1227  2.1244  2.1260  2.1276
                  2.1292  2.1308  2.1324  2.1340  2.1355  2.1371  2.1386
                  2.1401  2.1416  2.1431  2.1446  2.1461  2.1475  2.1489
                  2.1504  2.1518  2.1532  2.1546  2.1560  2.1573  2.1587
                  2.1601  2.1614  2.1627  2.1641  2.1654  2.1667  2.1680
                  2.1693  2.1705  2.1718  2.1731  2.1743  2.1756  2.1768
                  2.1780  2.1793  2.1805  2.1817  2.1829  2.1841  2.1852
                  2.1864  2.1876  2.1887  2.1899  2.1911  2.1922  2.1933
                  2.1945  2.1956  2.1967  2.1978  2.1989  2.2000

*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10101
*
COMPUTE LT TP        LCODE=1   NK=3  ISLOPE=1
                     LENGTH=50  FT   SLOPE=0.10  K=0.7
                              LENGTH=410 FT   SLOPE=0.098 K=2
                     LENGTH=450 FT   SLOPE=0.044 K=2


     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                                  LENGTH (FT)    ADJUSTED SLOPE (FT/FT) COMPOSITE K
     SHEET FLOW PORTION              50.0           .058474              .7000
     SHALLOW FLOW PORTION           860.0           .050592             1.9842
     CHANNEL FLOW PORTION             .0            .000000              .0000
     TOTAL BASIN                    910.0           .051025             1.8128


     TIME OF CONCENTRATION (HRS)=   .0617     TIME TO PEAK (HRS)=   .0412     LAG TIME (HRS)=   .0463


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME
(HRS)=   .1500

COMPUTE NM HYD       ID=1  HYD=100  DA=0.0106  PER A=19 PER B=50
                     PER C=31 PER D=0  TP=0.0  MASSRAIN=-1
     TIME TO PEAK (hrs)=   .1333

     K =   .129447HR    TP =   .133333HR    K/TP RATIO =   .970852     SHAPE CONSTANT, N =  3.638237
```

13

```
UNIT PEAK =   26.258    CFS   UNIT VOLUME =    .9998        B =   330.28       P60 = 1.8700
AREA =       .010600 SQ MI    IA =    .48200 INCHES    INF =   1.19960 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

*
SEDIMENT BULK          CODE=1      BULK FACTOR=1.15
*
PRINT HYD              ID=1   CODE=10

                                   PARTIAL HYDROGRAPH   100.00

          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
TIME      FLOW
           HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS
HRS       CFS
           .000        .0         1.000        .0         2.000       1.3         3.000        .1
4.000       .0
           .333        .0         1.333        .4         2.333        .5         3.333        .0
           .667        .0         1.667       8.0         2.667        .2         3.667        .0

    RUNOFF VOLUME =       .70052 INCHES      =        .3960 ACRE-FEET
    PEAK DISCHARGE RATE =      14.27 CFS  AT   1.533 HOURS   BASIN AREA =   .0106 SQ. MI.

*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10102
*
COMPUTE LT TP          LCODE=1   NK=1  ISLOPE=1
                       LENGTH=670 FT SLOPE=0.052 K=2

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                                LENGTH (FT)    ADJUSTED SLOPE (FT/FT)COMPOSITE K
     SHEET FLOW PORTION              .0           .000000              .0000
     SHALLOW FLOW PORTION          670.0           .048674             2.0000
     CHANNEL FLOW PORTION            .0            .000000              .0000
     TOTAL BASIN                   670.0           .048674             2.0000

     TIME OF CONCENTRATION (HRS)=   .0422     TIME TO PEAK (HRS)=   .0281     LAG TIME (HRS)=   .0316

          TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
          REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME
(HRS)=   .1500

*
COMPUTE NM HYD         ID=2  HYD=101 DA=0.0155 PER A=0 PER B=100
                       PER C=0 PER D=0  TP=0.0  MASSRAIN=-1
     TIME TO PEAK (hrs)=   .1333

     K =   .131024HR    TP =   .133333HR    K/TP RATIO =   .982685     SHAPE CONSTANT, N =  3.593454
     UNIT PEAK =   38.024    CFS   UNIT VOLUME =    1.000        B =   327.09       P60 = 1.8700
     AREA =      .015500 SQ MI    IA =    .50000 INCHES    INF =   1.25000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

*
SEDIMENT BULK          CODE=1   BULK FACTOR=1.15
*
PRINT HYD              ID=2   CODE=10

                                   PARTIAL HYDROGRAPH   101.00

          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
TIME      FLOW
           HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS
HRS       CFS
           .000        .0         1.000        .0         2.000       2.1         3.000        .2
4.000       .0
           .333        .0         1.333        .5         2.333        .9         3.333        .1
           .667        .0         1.667       12.9        2.667        .4         3.667        .0

    RUNOFF VOLUME =       .76749 INCHES      =        .6345 ACRE-FEET
    PEAK DISCHARGE RATE =      23.12 CFS  AT   1.533 HOURS   BASIN AREA =   .0155 SQ. MI.

*
* ADD SUB-BASIN 10101 TO 10102
```

```
ADD HYD                ID=3  HYD=102 ID I=1  ID II=2
*
PRINT HYD              ID=3  CODE=10
```

PARTIAL HYDROGRAPH 102.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.000	.0	2.000	3.4	3.000	.3
.333	.0	1.333	.8	2.333	1.4	3.333	.1
.667	.0	1.667	20.9	2.667	.6	3.667	.0
4.000	.0						

RUNOFF VOLUME = .74028 INCHES = 1.0305 ACRE-FEET
PEAK DISCHARGE RATE = 37.39 CFS AT 1.533 HOURS BASIN AREA = .0261 SQ. MI.

```
*
* ROUTE SUB-BASINS 10101 AND 10102 THROUGH EXISTING CHANNEL REACH 1
*
COMPUTE RATING CURVE  CID=1  VS NO=2.4  NO SEGS=5  MIN ELEV=5655 FT
                      MAX ELEV=5665 FT  CH SLP=0.5 FP SLP=0.10
                      N=0.04   SEG DIST=50 FT  N=-0.035  SEG DIST=10 FT
                      N=-0.03  SEG DIST=28 FT  N=-0.035  SEG DIST=10 FT
                      N=0.04  SEG DIST=50 FT
                      DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                      0    5665  50    5660  60    5655  88   5655
                      DIST ELEV  DIST  ELEV
                      98   5660  148   5665
```

RATING CURVE VALLEY SECTION 2.4

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
5655.00	.00	.00	.00
5655.53	15.29	342.87	30.11
5656.05	31.69	1108.68	32.21
5656.58	49.20	2218.76	34.32
5657.11	67.82	3647.71	36.42
5657.63	87.54	5383.72	38.53
5658.16	108.38	7421.09	40.63
5658.68	130.32	9757.47	42.74
5659.21	153.37	12392.59	44.84
5659.74	177.53	15327.50	46.95
5660.26	203.35	18656.18	53.27
5660.79	234.16	22405.58	63.80
5661.32	270.52	26515.60	74.33
5661.84	312.41	31007.64	84.86
5662.37	359.85	35900.30	95.38
5662.90	412.82	41210.68	105.91
5663.42	471.34	46954.98	116.44
5663.95	535.40	53148.74	126.96
5664.47	605.00	59806.98	137.49
5665.00	680.14	66945.02	148.00

```
*
COMPUTE TRAVEL TIME   ID=4 REACH=1  NO VS=1  L=510  SLP=0.039
```

TRAVEL TIME TABLE
REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0063
1.053	31.693	1108.68	.0040
1.579	49.202	2218.76	.0031
2.105	67.819	3647.71	.0026
2.632	87.545	5383.72	.0023
3.158	108.378	7421.09	.0021
3.685	130.320	9757.47	.0019
4.211	153.370	12392.59	.0018
4.737	177.529	15327.50	.0016
5.264	203.351	18656.18	.0015
5.790	234.163	22405.58	.0015
6.316	270.517	26515.60	.0014
6.843	312.411	31007.64	.0014
7.369	359.847	35900.30	.0014
7.896	412.824	41210.68	.0014
8.422	471.342	46954.98	.0014
8.948	535.402	53148.74	.0014
9.475	605.003	59806.98	.0014

```
                                  10.001     680.145    66945.02        .0014
*
ROUTE                    ID=4 HYD=200  INFLOW ID=3   DT=0.033333
*
PRINT HYD                ID=4 CODE=10
```

PARTIAL HYDROGRAPH 200.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.000	.0	2.000	3.4	3.000	.3
4.000	.0						
.333	.0	1.333	.6	2.333	1.4	3.333	.1
.667	.0	1.667	21.7	2.667	.6	3.667	.0

RUNOFF VOLUME = .74030 INCHES = 1.0305 ACRE-FEET
PEAK DISCHARGE RATE = 37.63 CFS AT 1.533 HOURS BASIN AREA = .0261 SQ. MI.

```
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10203
*
COMPUTE LT TP            LCODE=1   NK=2  ISLOPE=1
                         LENGTH=210  FT SLOPE=0.048 K=2
                         LENGTH=1170 FT SLOPE=0.064 K=2
```

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	.0	.000000	.0000
SHALLOW FLOW PORTION	1380.0	.052149	1.9982
CHANNEL FLOW PORTION	.0	.000000	.0000
TOTAL BASIN	1380.0	.052149	1.9982

TIME OF CONCENTRATION (HRS)= .0840 TIME TO PEAK (HRS)= .0560 LAG TIME (HRS)= .0630

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

```
*
COMPUTE NM HYD           ID=5  HYD=201 DA=0.0069 PER A=10 PER B=18
                         PER C=72  PER D=0  TP=0.0  MASSRAIN=-1
```

TIME TO PEAK (hrs)= .1333

K = .116200HR TP = .133333HR K/TP RATIO = .871500 SHAPE CONSTANT, N = 4.075881
UNIT PEAK = 18.640 CFS UNIT VOLUME = .9997 B = 360.20 P60 = 1.8700
AREA = .006900 SQ MI IA = .40700 INCHES INF = .98960 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR = 1.15000 AT PEAK FLOW.

```
*
SEDIMENT BULK            CODE=1    BULK FACTOR=1.15
*
PRINT HYD                ID=5  CODE=10
```

PARTIAL HYDROGRAPH 201.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	1.000	.0	2.000	1.3	3.000	.1
.333	.0	1.333	.6	2.333	.4	3.333	.0
.667	.0	1.667	7.0	2.667	.2	3.667	.0

RUNOFF VOLUME = .98340 INCHES = .3619 ACRE-FEET
PEAK DISCHARGE RATE = 12.84 CFS AT 1.500 HOURS BASIN AREA = .0069 SQ. MI.

```
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10204
*
COMPUTE LT TP            LCODE=1   NK=1  ISLOPE=1
                         LENGTH=510  FT SLOPE=0.039 K=2
```

```
Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS
                              LENGTH (FT)      SLOPE (FT/FT)       COMPOSITE K
SHEET FLOW PORTION                  .0           .000000             .0000
SHALLOW FLOW PORTION            510.0            .039000            2.0000
CHANNEL FLOW PORTION                .0           .000000             .0000
TOTAL BASIN                     510.0            .039000            2.0000

TIME OF CONCENTRATION (HRS)=   .0359     TIME TO PEAK (HRS)=   .0239     LAG TIME (HRS)=   .0269

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME
(HRS)=   .1500

*
COMPUTE NM HYD          ID=6  HYD=202 DA=0.0088 PER A=0 PER B=86
                        PER C=14  PER D=0  TP=0.0  MASSRAIN=-1
TIME TO PEAK (hrs)=   .1333

K =   .127506HR    TP =   .133333HR    K/TP RATIO =   .956297     SHAPE CONSTANT, N =  3.695249
UNIT PEAK =   22.065    CFS   UNIT VOLUME =    .9996       B =   334.31      P60 = 1.8700
AREA =      .008800 SQ MI    IA =    .47900 INCHES    INF =   1.19120 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

*
SEDIMENT BULK           CODE=1   BULK FACTOR=1.15
*
PRINT HYD               ID=6  CODE=10

                                PARTIAL HYDROGRAPH   202.00

          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
TIME      FLOW
           HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS
HRS       CFS
          .000        .0         1.000        .0         2.000       1.2         3.000        .1
4.000       .0
          .333        .0         1.333        .3         2.333        .5         3.333        .0
          .667        .0         1.667       7.7         2.667        .2         3.667        .0

RUNOFF VOLUME =      .81218 INCHES     =        .3812 ACRE-FEET
PEAK DISCHARGE RATE =      13.82 CFS  AT   1.500 HOURS   BASIN AREA =   .0088 SQ. MI.

*
* ADD FLOWS FROM SUB-BASINS 10203 AND 10204
*
ADD HYD                 ID=7 HYD=203  ID I=5  ID II=6
*
PRINT HYD               ID=7  CODE=10

                                PARTIAL HYDROGRAPH   203.00

          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
TIME      FLOW
           HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS
HRS       CFS
          .000        .0         1.000        .0         2.000       2.5         3.000        .2
4.000       .0
          .333        .0         1.333        .9         2.333        .9         3.333        .1
          .667        .0         1.667      14.7         2.667        .4         3.667        .0

RUNOFF VOLUME =      .88741 INCHES     =        .7431 ACRE-FEET
PEAK DISCHARGE RATE =      26.66 CFS  AT   1.500 HOURS   BASIN AREA =   .0157 SQ. MI.

*
* ADD HYDROGRAPHS FOR CHANNEL REACH 1 AND SUB-BASINS 10203 AND 10204
*
ADD HYD                 ID=8  HYD=204 ID I=4  ID II=7
*
PRINT HYD               ID=8  CODE=10

                                PARTIAL HYDROGRAPH   204.00

          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
```

TIME HRS	FLOW CFS	HRS	CFS	HRS	CFS	HRS	CFS
	.000	1.000	.0	2.000	6.0	3.000	.4
4.000	.0						
	.333	1.333	1.5	2.333	2.3	3.333	.2
	.667	1.667	36.4	2.667	1.0	3.667	.1

RUNOFF VOLUME = .79554 INCHES = 1.7735 ACRE-FEET
PEAK DISCHARGE RATE = 64.13 CFS AT 1.533 HOURS BASIN AREA = .0418 SQ. MI.

```
*
* ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 2
*
COMPUTE RATING CURVE  CID=2  VS NO=3.5  NO SEGS=5  MIN ELEV=5610 FT
                      MAX ELEV=5620 FT  CH SLP=0.25 FP SLP=0.143
                      N=0.040  SEG DIST=35 FT  N=-0.035  SEG DIST=20 FT
                      N=-0.030 SEG DIST=30 FT  N=-0.035  SEG DIST=20 FT
                      N=0.040  SEG DIST=35 FT
                      DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                      0    5620  35    5615  55    5610  85   5610
                      DIST ELEV  DIST  ELEV
                      105  5615  140   5620
```

RATING CURVE VALLEY SECTION 3.5

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
5610.00	.00	.00	.00
5610.53	16.90	264.43	34.21
5611.05	36.02	869.57	38.42
5611.58	57.35	1768.27	42.63
5612.11	80.90	2951.58	46.84
5612.63	106.66	4419.70	51.05
5613.16	134.64	6176.69	55.27
5613.68	164.84	8228.62	59.48
5614.21	197.26	10582.70	63.69
5614.74	231.89	13246.79	67.90
5615.26	268.94	16365.12	73.69
5615.79	309.67	19960.75	81.06
5616.32	354.28	23920.40	88.43
5616.84	402.76	28258.61	95.80
5617.37	455.13	32988.16	103.17
5617.90	511.37	38121.01	110.54
5618.42	571.50	43668.70	117.91
5618.95	635.50	49642.46	125.28
5619.47	703.38	56053.30	132.64
5620.00	775.14	62912.64	140.00

```
*
COMPUTE TRAVEL TIME   ID=9 REACH=2   NO VS=1 L=1305 SLP=0.038
```

TRAVEL TIME TABLE
REACH= 2.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0162
1.053	31.693	1108.68	.0104
1.579	49.202	2218.76	.0080
2.105	67.819	3647.71	.0067
2.632	87.545	5383.72	.0059
3.158	108.378	7421.09	.0053
3.685	130.320	9757.47	.0048
4.211	153.370	12392.59	.0045
4.737	177.529	15327.50	.0042
5.264	203.351	18656.18	.0040
5.790	234.163	22405.58	.0038
6.316	270.517	26515.60	.0037
6.843	312.411	31007.64	.0037
7.369	359.847	35900.30	.0036
7.896	412.824	41210.68	.0036
8.422	471.342	46954.98	.0036
8.948	535.402	53148.74	.0037
9.475	605.003	59806.98	.0037
10.001	680.145	66945.02	.0037

```
*
ROUTE                 ID=9 HYD=300   INFLOW=8  DT=0.033333
*
PRINT HYD             ID=9  CODE=1
```

HYDROGRAPH FROM AREA 300.00

```
RUNOFF VOLUME =       .79556 INCHES      =       1.7736 ACRE-FEET
PEAK DISCHARGE RATE =      63.81 CFS  AT   1.533 HOURS   BASIN AREA =   .0418 SQ. MI.


*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10305
*
COMPUTE LT TP          LCODE=1   NK=1  ISLOPE=1
                       LENGTH=1305 FT  SLOPE=0.038 K=2

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                                LENGTH (FT)      SLOPE (FT/FT)       COMPOSITE K
     SHEET FLOW PORTION              .0           .000000             .0000
     SHALLOW FLOW PORTION         1305.0           .038000            2.0000
     CHANNEL FLOW PORTION            .0           .000000             .0000
     TOTAL BASIN                  1305.0           .038000            2.0000


     TIME OF CONCENTRATION (HRS)=   .0930     TIME TO PEAK (HRS)=   .0620     LAG TIME (HRS)=   .0697


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME
(HRS)=   .1500

*
COMPUTE NM HYD         ID=10  HYD=301 DA=0.0299  PER A=0  PER B=16
                       PER C=84 PER D=0 TP=0.0 MASSRAIN=-1
     TIME TO PEAK (hrs)=   .1333

     K =   .109914HR    TP =   .133333HR    K/TP RATIO =   .824357     SHAPE CONSTANT, N =  4.331026
     UNIT PEAK =   84.468    CFS   UNIT VOLUME =    1.000       B =   376.67      P60 = 1.8700
     AREA =      .029900 SQ MI    IA =    .37400 INCHES    INF =    .89720 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

*
SEDIMENT BULK          CODE=1    BULK FACTOR=1.15
*
PRINT HYD              ID=10  CODE=1

                                   HYDROGRAPH FROM AREA   301.00


    RUNOFF VOLUME =     1.07295 INCHES      =       1.7110 ACRE-FEET
    PEAK DISCHARGE RATE =      60.04 CFS  AT   1.500 HOURS   BASIN AREA =   .0299 SQ. MI.


*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10306
*
COMPUTE LT TP          LCODE=1   NK=3  ISLOPE=1
                       LENGTH=750 FT  SLOPE=0.085 K=2
                       LENGTH=265 FT  SLOPE=0.019 K=4
                       LENGTH=120 FT  SLOPE=0.167 K=2

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                                LENGTH (FT)    ADJUSTED SLOPE (FT/FT)COMPOSITE K
     SHEET FLOW PORTION              .0           .000000             .0000
     SHALLOW FLOW PORTION          870.0           .057813            1.9991
     CHANNEL FLOW PORTION          265.0           .019000            4.0000
     TOTAL BASIN                  1135.0           .048751            2.2441


     TIME OF CONCENTRATION (HRS)=   .0636     TIME TO PEAK (HRS)=   .0424     LAG TIME (HRS)=   .0477


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME
(HRS)=   .1500

*
COMPUTE NM HYD         ID=11  HYD=302  DA=0.0065  PER A=0 PER B=17
                       PER C=83 PER D=0  TP=0.0 MASSRAIN=-1
```

```
TIME TO PEAK (hrs)=   .1333

K =   .110165HR    TP =   .133333HR    K/TP RATIO =   .826242     SHAPE CONSTANT, N =  4.320124
UNIT PEAK =   18.329    CFS   UNIT VOLUME =    .9996       B =   375.98       P60 = 1.8700
AREA =       .006500 SQ MI    IA =    .37550 INCHES    INF =    .90140 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

*
SEDIMENT BULK          CODE=1   BULK FACTOR=1.15
*
PRINT HYD              ID=11   CODE=1

                                   HYDROGRAPH FROM AREA   302.00

RUNOFF VOLUME =     1.06869 INCHES     =        .3705 ACRE-FEET
PEAK DISCHARGE RATE =      13.02 CFS  AT   1.500 HOURS   BASIN AREA =   .0065 SQ. MI.

*
* ADD FLOWS FROM SUB-BASINS 10305 AND 10306
*
ADD HYD                ID=12 HYD=303  ID I=10  ID II=11
*
PRINT HYD              ID=12  CODE=10

                                   HYDROGRAPH FROM AREA   303.00

          TIME      FLOW           TIME      FLOW           TIME      FLOW           TIME      FLOW
TIME      FLOW
           HRS       CFS            HRS       CFS            HRS       CFS            HRS       CFS
HRS       CFS
          .000        .0          1.000        .0          2.000       8.2          3.000        .3
4.000       .0
          .333        .0          1.333       4.5          2.333       2.4          3.333        .1
          .667        .0          1.667      39.2          2.667        .9          3.667        .0

RUNOFF VOLUME =     1.07218 INCHES     =       2.0814 ACRE-FEET
PEAK DISCHARGE RATE =      73.06 CFS  AT   1.500 HOURS   BASIN AREA =   .0364 SQ. MI.

*
* ADD HYDROGRAPHS FOR SUB-BASINS 10305 AND 10306 AND CHANNEL REACH 2
ADD HYD                ID=13   HYD=304    ID I=12    ID II=9
*
PRINT HYD              ID=13   CODE=10

                                   HYDROGRAPH FROM AREA   304.00

          TIME      FLOW           TIME      FLOW           TIME      FLOW           TIME      FLOW
TIME      FLOW
           HRS       CFS            HRS       CFS            HRS       CFS            HRS       CFS
HRS       CFS
          .000        .0          1.000        .0          2.000      14.5          3.000        .7
4.000       .0
          .333        .0          1.333       5.4          2.333       4.8          3.333        .3
4.333       .0
          .667        .0          1.667      79.1          2.667       1.9          3.667        .1

RUNOFF VOLUME =      .92431 INCHES     =       3.8550 ACRE-FEET
PEAK DISCHARGE RATE =     135.55 CFS  AT   1.533 HOURS   BASIN AREA =   .0782 SQ. MI.

*
*ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 3
*
COMPUTE RATING CURVE  CID=3  VS NO=4.7  NO SEGS=5  MIN ELEV=5575 FT
                      MAX ELEV=5585 FT  CH SLP=0.20 FP SLP=0.10
                      N=0.040  SEG DIST=50 FT  N=-0.035  SEG DIST=25 FT
                      N=-0.03  SEG DIST=25 FT  N=-0.035  SEG DIST=25 FT
                      N=0.040  SEG DIST=50 FT
                      DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                      0    5585  50    5580  75    5575  100  5575
                      DIST ELEV  DIST  ELEV
                      125  5580  175   5585

                                RATING CURVE VALLEY SECTION  4.7
                                    WATER       FLOW        FLOW        TOP
                                   SURFACE      AREA        RATE        WIDTH
```

ELEV	SQ FT	CFS	FT
5575.00	.00	.00	.00
5575.53	14.54	200.70	30.26
5576.05	31.86	671.02	35.53
5576.58	51.95	1385.47	40.79
5577.11	74.80	2345.31	46.05
5577.63	100.43	3557.74	51.32
5578.16	128.83	5032.30	56.58
5578.68	159.99	6779.57	61.85
5579.21	193.93	8810.65	67.11
5579.74	230.64	11136.86	72.37
5580.26	270.47	13922.81	80.27
5580.79	315.49	17198.28	90.80
5581.32	366.06	20839.82	101.33
5581.84	422.17	24867.10	111.86
5582.37	483.81	29297.42	122.38
5582.90	551.00	34146.91	132.91
5583.42	623.73	39430.98	143.44
5583.95	702.00	45164.50	153.96
5584.47	785.82	51362.01	164.49
5585.00	875.17	58038.38	175.00

```
*
COMPUTE TRAVEL TIME   ID=14 REACH=3  NO VS=1  L=470  SLP=0.043
```

TRAVEL TIME TABLE

REACH= 3.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0058
1.053	31.693	1108.68	.0037
1.579	49.202	2218.76	.0029
2.105	67.819	3647.71	.0024
2.632	87.545	5383.72	.0021
3.158	108.378	7421.09	.0019
3.685	130.320	9757.47	.0017
4.211	153.370	12392.59	.0016
4.737	177.529	15327.50	.0015
5.264	203.351	18656.18	.0014
5.790	234.163	22405.58	.0014
6.316	270.517	26515.60	.0013
6.843	312.411	31007.64	.0013
7.369	359.847	35900.30	.0013
7.896	412.824	41210.68	.0013
8.422	471.342	46954.98	.0013
8.948	535.402	53148.74	.0013
9.475	605.003	59806.98	.0013
10.001	680.145	66945.02	.0013

```
*
ROUTE                 ID=14  HYD=400  INFLOW HYD=13  DT=0.033333
*
PRINT HYD             ID=14  CODE=1
```

HYDROGRAPH FROM AREA 400.00

RUNOFF VOLUME = .92432 INCHES = 3.8550 ACRE-FEET
PEAK DISCHARGE RATE = 135.91 CFS AT 1.533 HOURS BASIN AREA = .0782 SQ. MI.

```
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10407
*
COMPUTE LT TP         LCODE=1   NK=1  ISLOPE=1
                      LENGTH=470 FT  SLOPE=0.043 K=2
```

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	.0	.000000	.0000
SHALLOW FLOW PORTION	470.0	.042753	2.0000
CHANNEL FLOW PORTION	.0	.000000	.0000
TOTAL BASIN	470.0	.042753	2.0000

TIME OF CONCENTRATION (HRS)= .0316 TIME TO PEAK (HRS)= .0210 LAG TIME (HRS)= .0237

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME

```
(HRS)=    .1500

     *
     COMPUTE NM HYD          ID=15  HYD=401  DA=0.0095  PER A=0 PER B=34
                             PER C=66  PER D=0  TP=0.0   MASSRAIN=-1
          TIME TO PEAK (hrs)=    .1333

          K =    .114438HR    TP =    .133333HR    K/TP RATIO =    .858285     SHAPE CONSTANT, N =  4.143841
          UNIT PEAK =    25.981    CFS   UNIT VOLUME =     .9998      B =   364.65      P60 = 1.8700
          AREA =       .009500 SQ MI    IA =     .40100 INCHES    INF =     .97280 INCHES PER HOUR
          RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

        BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.15000 AT PEAK FLOW.

     *
     SEDIMENT BULK           CODE=1    BULK FACTOR=1.15
     *
     PRINT HYD               ID=15  CODE=1

                                          HYDROGRAPH FROM AREA   401.00


        RUNOFF VOLUME =       .99888 INCHES      =         .5061 ACRE-FEET
        PEAK DISCHARGE RATE =      17.98 CFS  AT   1.500 HOURS   BASIN AREA =    .0095 SQ. MI.


     *
     * ADD HYDROGRAPHS FOR SUB-BASIN 10407 AND CHANNEL REACH 3
     *
     ADD HYD                 ID=16   HYD=402    ID I=15   ID II=14
     *
     PRINT HYD               ID=16   CODE=10

                                          HYDROGRAPH FROM AREA   402.00

          TIME      FLOW            TIME      FLOW            TIME      FLOW            TIME      FLOW
TIME      FLOW
           HRS       CFS             HRS       CFS             HRS       CFS             HRS       CFS
HRS       CFS
          .000        .0            1.000       .0            2.000      16.7           3.000        .8
4.000       .0
          .333        .0            1.333      5.1            2.333       5.5           3.333        .3
4.333       .0
          .667        .0            1.667     91.3            2.667       2.2           3.667        .1

        RUNOFF VOLUME =       .93239 INCHES      =       4.3611 ACRE-FEET
        PEAK DISCHARGE RATE =     153.64 CFS  AT   1.533 HOURS   BASIN AREA =    .0877 SQ. MI.


     *
     *ROUTE FLOWS THROUGH EXISTING CHANNEL REACH 4 IN SUB-BASIN 10508
     *
     COMPUTE RATING CURVE  CID=4  VS NO=5.8  NO SEGS=5  MIN ELEV=5555 FT
                           MAX ELEV=5565 FT  CH SLP=0.25 FP SLP=0.125
                           N=0.040  SEG DIST=20 FT  N=-0.035  SEG DIST=50 FT
                           N=-0.03  SEG DIST=30 FT  N=-0.035  SEG DIST=50 FT
                           N=0.040  SEG DIST=60 FT
                           DIST ELEV  DIST  ELEV  DIST  ELEV  DIST ELEV
                           0    5565  20    5560  70    5555  100  5555
                           DIST ELEV  DIST  ELEV
                           150  5560  210   5565

                                RATING CURVE VALLEY SECTION  5.8
                                   WATER       FLOW        FLOW        TOP
                                  SURFACE      AREA        RATE       WIDTH
                                   ELEV        SQ FT       CFS         FT
                                 5555.00        .00         .00        .00
                                 5555.53      18.56      279.03      40.53
                                 5556.05      42.66      962.31      51.05
                                 5556.58      72.31     2041.71      61.58
                                 5557.11     107.49     3540.47      72.11
                                 5557.63     148.22     5487.42      82.64
                                 5558.16     194.49     7912.92      93.16
                                 5558.68     246.30    10847.61     103.69
                                 5559.21     303.65    14321.90     114.22
                                 5559.74     366.54    18365.80     124.75
                                 5560.26     434.83    23351.85     134.22
                                 5560.79     507.70    29305.38     142.64
                                 5561.32     585.00    35893.29     151.06
                                 5561.84     666.73    43119.02     159.48
                                 5562.37     752.89    50986.23     167.91
                                 5562.90     843.49    59499.21     176.33
```

5563.42	938.52	68662.96	184.75
5563.95	1037.98	78483.05	193.17
5564.47	1141.88	88965.55	201.59
5565.00	1250.21	100117.60	210.00

```
*
COMPUTE TRAVEL TIME   ID=17 REACH=4  NO VS=1  L=270  SLP=0.037
```

TRAVEL TIME TABLE

REACH= 4.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0033
1.053	31.693	1108.68	.0021
1.579	49.202	2218.76	.0017
2.105	67.819	3647.71	.0014
2.632	87.545	5383.72	.0012
3.158	108.378	7421.09	.0011
3.685	130.320	9757.47	.0010
4.211	153.370	12392.59	.0009
4.737	177.529	15327.50	.0009
5.264	203.351	18656.18	.0008
5.790	234.163	22405.58	.0008
6.316	270.517	26515.60	.0008
6.843	312.411	31007.64	.0008
7.369	359.847	35900.30	.0008
7.896	412.824	41210.68	.0008
8.422	471.342	46954.98	.0008
8.948	535.402	53148.74	.0008
9.475	605.003	59806.98	.0008
10.001	680.145	66945.02	.0008

```
*
ROUTE                 ID=17  HYD=500  INFLOW HYD=16  DT=0.033333
*
PRINT HYD             ID=17  CODE=1

                          OUTFLOW HYDROGRAPH RESERVOIR   500.00


    RUNOFF VOLUME =       .93239 INCHES      =       4.3611 ACRE-FEET
    PEAK DISCHARGE RATE =     153.81 CFS  AT   1.533 HOURS   BASIN AREA =   .0877 SQ. MI.


*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10509
*
COMPUTE LT TP         LCODE=1   NK=1  ISLOPE=1
                      LENGTH=600 FT  SLOPE=0.105 K=2

     Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

     SCS UPLAND METHOD FACTORS
                                LENGTH (FT)    ADJUSTED SLOPE (FT/FT) COMPOSITE K
     SHEET FLOW PORTION              .0           .000000              .0000
     SHALLOW FLOW PORTION          600.0          .058887             2.0000
     CHANNEL FLOW PORTION            .0           .000000              .0000
     TOTAL BASIN                   600.0          .058887             2.0000

     TIME OF CONCENTRATION (HRS)=   .0343     TIME TO PEAK (HRS)=   .0229     LAG TIME (HRS)=   .0258


     TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
     REVISED VALUES: TIME OF CONCENTRATION (HRS)=   .2000     TIME TO PEAK (HRS)=   .1333     LAG TIME
(HRS)=   .1500

Site *COMPUTE NM HYD        ID=18  HYD=501  DA=0.0071  PER A=0 PER B=0
                            PER C=83  PER D=17 TP=0.0   MASSRAIN=-1
     TIME TO PEAK (hrs)=   .1333

     K =   .072666HR    TP =   .133333HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   4.7641    CFS   UNIT VOLUME =    .9969       B =   526.28      P60 = 1.8700
     AREA =      .001207 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .105893HR    TP =   .133333HR    K/TP RATIO =   .794199     SHAPE CONSTANT, N =  4.514851
     UNIT PEAK =   17.155    CFS   UNIT VOLUME =    .9997       B =   388.14      P60 = 1.8700
     AREA =      .005893 SQ MI    IA =    .35000 INCHES    INF =    .83000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333
```

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR = 1.15000 AT PEAK FLOW.

```
*
SEDIMENT BULK          CODE=1    BULK FACTOR=1.15
*
PRINT HYD              ID=18  CODE=1
```

OUTFLOW HYDROGRAPH RESERVOIR 501.00

RUNOFF VOLUME = 1.33338 INCHES = .5049 ACRE-FEET
PEAK DISCHARGE RATE = 16.37 CFS AT 1.500 HOURS BASIN AREA = .0071 SQ. MI.

```
*
* ROUTE FLOWS FROM SUB-BASIN 10509 THROUGH DETENTION POND
*
ROUTE RESERVOIR        ID=19  HYD NO=502 INFLOW ID=18   CODE=5
                       OUTFLOW (CFS)   STORAGE (AC FT)   ELEV (FT)
                       0               0                 5567
                       0.46            0.0970            5568
                       0.64            0.2175            5569
                       0.79            0.3634            5570
                       0.92            0.5387            5571
```

* * * * * * * * * * * * * * * * * *

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
.00	.00	5567.00	.000	.00
.17	.00	5567.00	.000	.00
.33	.00	5567.00	.000	.00
.50	.00	5567.00	.000	.00
.67	.00	5567.00	.000	.00
.83	.00	5567.00	.000	.00
1.00	.00	5567.00	.000	.00
1.17	.01	5567.00	.000	.00
1.33	2.11	5567.08	.007	.04
1.50	16.37	5568.31	.134	.52
1.67	8.56	5569.59	.303	.73
1.83	4.41	5570.07	.377	.80
2.00	2.52	5570.28	.412	.83
2.17	1.15	5570.35	.426	.84
2.33	.61	5570.35	.426	.84
2.50	.36	5570.33	.421	.83
2.67	.22	5570.28	.413	.83
2.83	.14	5570.23	.404	.82
3.00	.09	5570.18	.394	.81
3.17	.06	5570.12	.384	.81
3.33	.05	5570.06	.374	.80
3.50	.03	5570.00	.364	.79
3.67	.03	5569.93	.353	.78
3.83	.02	5569.86	.343	.77
4.00	.02	5569.79	.333	.76
4.17	.02	5569.72	.323	.75
4.33	.02	5569.65	.313	.74
4.50	.02	5569.59	.303	.73
4.67	.02	5569.52	.293	.72
4.83	.02	5569.45	.284	.71
5.00	.02	5569.39	.274	.70
5.17	.02	5569.33	.265	.69
5.33	.02	5569.26	.256	.68
5.50	.03	5569.20	.247	.67
5.67	.03	5569.14	.238	.66
5.83	.03	5569.08	.230	.65
6.00	.03	5569.02	.221	.64
6.17	.01	5568.96	.213	.63
6.33	.00	5568.89	.204	.62
6.50	.00	5568.82	.196	.61
6.67	.00	5568.75	.187	.59
6.83	.00	5568.68	.179	.58
7.00	.00	5568.62	.171	.57
7.17	.00	5568.55	.164	.56
7.33	.00	5568.49	.156	.55
7.50	.00	5568.43	.148	.54
7.67	.00	5568.37	.141	.53
7.83	.00	5568.31	.134	.52
8.00	.00	5568.25	.127	.50
8.17	.00	5568.19	.120	.49
8.33	.00	5568.14	.113	.48
8.50	.00	5568.08	.107	.47
8.67	.00	5568.03	.100	.46

8.83	.00	5567.97	.094	.45
9.00	.00	5567.91	.088	.42
9.17	.00	5567.85	.082	.39

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
9.33	.00	5567.80	.077	.37
9.50	.00	5567.75	.072	.34
9.67	.00	5567.70	.068	.32
9.83	.00	5567.65	.063	.30
10.00	.00	5567.61	.059	.28
10.17	.00	5567.57	.056	.26
10.33	.00	5567.54	.052	.25
10.50	.00	5567.50	.049	.23
10.67	.00	5567.47	.046	.22
10.83	.00	5567.44	.043	.20
11.00	.00	5567.41	.040	.19
11.17	.00	5567.39	.038	.18
11.33	.00	5567.36	.035	.17
11.50	.00	5567.34	.033	.16
11.67	.00	5567.32	.031	.15
11.83	.00	5567.30	.029	.14
12.00	.00	5567.28	.027	.13
12.17	.00	5567.26	.025	.12
12.33	.00	5567.25	.024	.11
12.50	.00	5567.23	.022	.11
12.67	.00	5567.22	.021	.10
12.83	.00	5567.20	.020	.09
13.00	.00	5567.19	.018	.09
13.17	.00	5567.18	.017	.08
13.33	.00	5567.17	.016	.08
13.50	.00	5567.16	.015	.07
13.67	.00	5567.15	.014	.07
13.83	.00	5567.14	.013	.06
14.00	.00	5567.13	.012	.06
14.17	.00	5567.12	.012	.06
14.33	.00	5567.11	.011	.05
14.50	.00	5567.10	.010	.05
14.67	.00	5567.10	.010	.05
14.83	.00	5567.09	.009	.04
15.00	.00	5567.09	.008	.04
15.17	.00	5567.08	.008	.04
15.33	.00	5567.08	.007	.03
15.50	.00	5567.07	.007	.03
15.67	.00	5567.07	.006	.03
15.83	.00	5567.06	.006	.03
16.00	.00	5567.06	.006	.03
16.17	.00	5567.05	.005	.03
16.33	.00	5567.05	.005	.02
16.50	.00	5567.05	.005	.02
16.67	.00	5567.04	.004	.02
16.83	.00	5567.04	.004	.02
17.00	.00	5567.04	.004	.02
17.17	.00	5567.04	.004	.02
17.33	.00	5567.03	.003	.02
17.50	.00	5567.03	.003	.01
17.67	.00	5567.03	.003	.01
17.83	.00	5567.03	.003	.01
18.00	.00	5567.03	.003	.01
18.17	.00	5567.02	.002	.01
18.33	.00	5567.02	.002	.01
18.50	.00	5567.02	.002	.01

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
18.67	.00	5567.02	.002	.01
18.83	.00	5567.02	.002	.01
19.00	.00	5567.02	.002	.01
19.17	.00	5567.02	.002	.01
19.33	.00	5567.02	.002	.01
19.50	.00	5567.01	.001	.01
19.67	.00	5567.01	.001	.01
19.83	.00	5567.01	.001	.01

PEAK DISCHARGE = .837 CFS - PEAK OCCURS AT HOUR 2.23
MAXIMUM WATER SURFACE ELEVATION = 5570.360
MAXIMUM STORAGE = .4265 AC-FT INCREMENTAL TIME= .033333HRS

*
PRINT HYD ID=19 CODE=1

OUTFLOW HYDROGRAPH RESERVOIR 502.00

25

RUNOFF VOLUME = 1.33020 INCHES = .5037 ACRE-FEET
PEAK DISCHARGE RATE = .84 CFS AT 2.233 HOURS BASIN AREA = .0071 SQ. MI.

*
* ROUTE FLOWS FROM DETENTION POND THROUGH 18-INCH DRAIN PIPE
*
COMPUTE RATING CURVE CID=5 VS NO=1 CODE=-1 SLP=0.020
DIA=1.5 FT N=0.013

RATING CURVE PIPE SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	MAX WIDTH FT
.00	.00	.00	.00
.08	.04	.08	.67
.16	.10	.34	.92
.23	.18	.79	1.09
.31	.27	1.41	1.22
.39	.37	2.21	1.32
.47	.47	3.15	1.39
.55	.58	4.22	1.44
.63	.70	5.40	1.48
.70	.81	6.65	1.50
.78	.93	7.96	1.50
.86	1.05	9.30	1.50
.94	1.16	10.62	1.50
1.02	1.27	11.90	1.50
1.09	1.38	13.11	1.50
1.17	1.48	14.18	1.50
1.25	1.57	15.08	1.50
1.33	1.66	15.72	1.50
1.41	1.72	15.98	1.50
1.50	1.77	15.98	1.50

*
COMPUTE TRAVEL TIME ID=20 REACH=5 NO VS=1 L=108.3 SLP=0.020

TRAVEL TIME TABLE
REACH= 5.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	15.292	342.87	.0013
1.053	31.693	1108.68	.0009
1.579	49.202	2218.76	.0007
2.105	67.819	3647.71	.0006
2.632	87.545	5383.72	.0005
3.158	108.378	7421.09	.0004
3.685	130.320	9757.47	.0004
4.211	153.370	12392.59	.0004
4.737	177.529	15327.50	.0003
5.264	203.351	18656.18	.0003
5.790	234.163	22405.58	.0003
6.316	270.517	26515.60	.0003
6.843	312.411	31007.64	.0003
7.369	359.847	35900.30	.0003
7.896	412.824	41210.68	.0003
8.422	471.342	46954.98	.0003
8.948	535.402	53148.74	.0003
9.475	605.003	59806.98	.0003
10.001	680.145	66945.02	.0003

*
ROUTE ID=20 HYD=503 INFLOW=19 DT=0.03333
Hydrograph incermental time change from DT= .033333 hours to DT= .033330 hours
*
PRINT HYD ID=20 CODE=1

OUTFLOW HYDROGRAPH RESERVOIR 503.00

RUNOFF VOLUME = 1.33008 INCHES = .5037 ACRE-FEET
PEAK DISCHARGE RATE = .84 CFS AT 2.233 HOURS BASIN AREA = .0071 SQ. MI.

*
* ADD HYDROGRAPHS FOR CHANNEL REACH 4 AND 18-INCH DRAIN PIPE
*
ADD HYD ID=21 HYD=504 ID I=20 ID II=17
*
PRINT HYD ID=21 CODE=10

Why detention pond? why not release undev. Q?

OUTFLOW HYDROGRAPH RESERVOIR 504.00

TIME HRS	TIME FLOW HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
	.000	.0	4.000	.8	7.999	.5	11.999	.1
15.998	.0							
	.333	.0	4.333	.7	8.333	.5	12.332	.1
16.332	.0							
	.667	.0	4.666	.7	8.666	.5	12.665	.1
16.665	.0							
	1.000	.0	5.000	.7	8.999	.4	12.999	.1
16.998	.0							
	1.333	4.5	5.333	.7	9.332	.4	13.332	.1
17.332	.0							
	1.666	93.7	5.666	.7	9.666	.3	13.665	.1
17.665	.0							
	2.000	17.8	5.999	.6	9.999	.3	13.999	.1
17.998	.0							
	2.333	6.4	6.333	.6	10.332	.2	14.332	.1
18.331	.0							
	2.666	3.0	6.666	.6	10.666	.2	14.665	.0
18.665	.0							
	3.000	1.7	6.999	.6	10.999	.2	14.998	.0
18.998	.0							
	3.333	1.1	7.333	.5	11.332	.2	15.332	.0
19.331	.0							
	3.666	.9	7.666	.5	11.665	.1	15.665	.0
19.665	.0							

RUNOFF VOLUME = .96209 INCHES = 4.8643 ACRE-FEET
PEAK DISCHARGE RATE = 154.38 CFS AT 1.533 HOURS BASIN AREA = .0948 SQ. MI.

```
*
* COMPUTE HYDROGRAPH FOR SUB-BASIN 10508
*
COMPUTE LT TP          LCODE=1   NK=1  ISLOPE=1
                       LENGTH=270 FT  SLOPE=0.056 K=2
```

Tc AND Tp COMPUTED BY UPLAND/LAG TIME PROCEDURE

SCS UPLAND METHOD FACTORS

	LENGTH (FT)	ADJUSTED SLOPE (FT/FT)	COMPOSITE K
SHEET FLOW PORTION	.0	.000000	.0000
SHALLOW FLOW PORTION	270.0	.050496	2.0000
CHANNEL FLOW PORTION	.0	.000000	.0000
TOTAL BASIN	270.0	.050496	2.0000

TIME OF CONCENTRATION (HRS)= .0167 TIME TO PEAK (HRS)= .0111 LAG TIME (HRS)= .0125

TIME TO PEAK COMPUTED TO BE LESS THAN 0.133333 HOUR MINIMUM VALUE.
REVISED VALUES: TIME OF CONCENTRATION (HRS)= .2000 TIME TO PEAK (HRS)= .1333 LAG TIME (HRS)= .1500

```
*
COMPUTE NM HYD         ID=22 HYD=505  DA=0.0020  PER A=0 PER B=16
                       PER C=84  PER D=0  TP=0.0  MASSRAIN=-1
```

TIME TO PEAK (hrs)= .1333

K = .109914HR TP = .133333HR K/TP RATIO = .824357 SHAPE CONSTANT, N = 4.331026
UNIT PEAK = 5.6500 CFS UNIT VOLUME = .9982 B = 376.67 P60 = 1.8700
AREA = .002000 SQ MI IA = .37400 INCHES INF = .89720 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR = 1.15000 AT PEAK FLOW.

```
*
SEDIMENT BULK          CODE=1  BULK FACTOR=1.15
*
PRINT HYD              ID=22  CODE=1
```

OUTFLOW HYDROGRAPH RESERVOIR 505.00

RUNOFF VOLUME = 1.07294 INCHES = .1144 ACRE-FEET
PEAK DISCHARGE RATE = 4.02 CFS AT 1.500 HOURS BASIN AREA = .0020 SQ. MI.

```
*
* ADD HYDROGRAPHS FOR SUB-BASIN 10508, CHANNEL REACH 4 AND 18-INCH
* DRAIN PIPE
*
ADD HYD                ID=23  HYD=506  ID I=22   ID II=21
*
PRINT HYD              ID=23  CODE=10
```

OUTFLOW HYDROGRAPH RESERVOIR 506.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	.8	8.000	.5	12.000	.1
.333	.0	4.333	.7	8.333	.5	12.333	.1
.667	.0	4.667	.7	8.667	.5	12.667	.1
1.000	.0	5.000	.7	9.000	.4	13.000	.1
1.333	4.7	5.333	.7	9.333	.4	13.333	.1
1.667	95.9	5.667	.7	9.667	.3	13.667	.1
2.000	18.3	6.000	.6	10.000	.3	14.000	.1
2.333	6.6	6.333	.6	10.333	.2	14.333	.1
2.667	3.0	6.667	.6	10.667	.2	14.667	.0
3.000	1.7	7.000	.6	11.000	.2	15.000	.0
3.333	1.1	7.333	.5	11.333	.2	15.333	.0
3.667	.9	7.667	.5	11.667	.1	15.667	.0

```
RUNOFF VOLUME =       .96447 INCHES      =       4.9792 ACRE-FEET
PEAK DISCHARGE RATE =     158.34 CFS  AT   1.533 HOURS   BASIN AREA =   .0968 SQ. MI.


*
FINISH

NORMAL PROGRAM FINISH          END TIME (HR:MIN:SEC) = 15:54:59
```

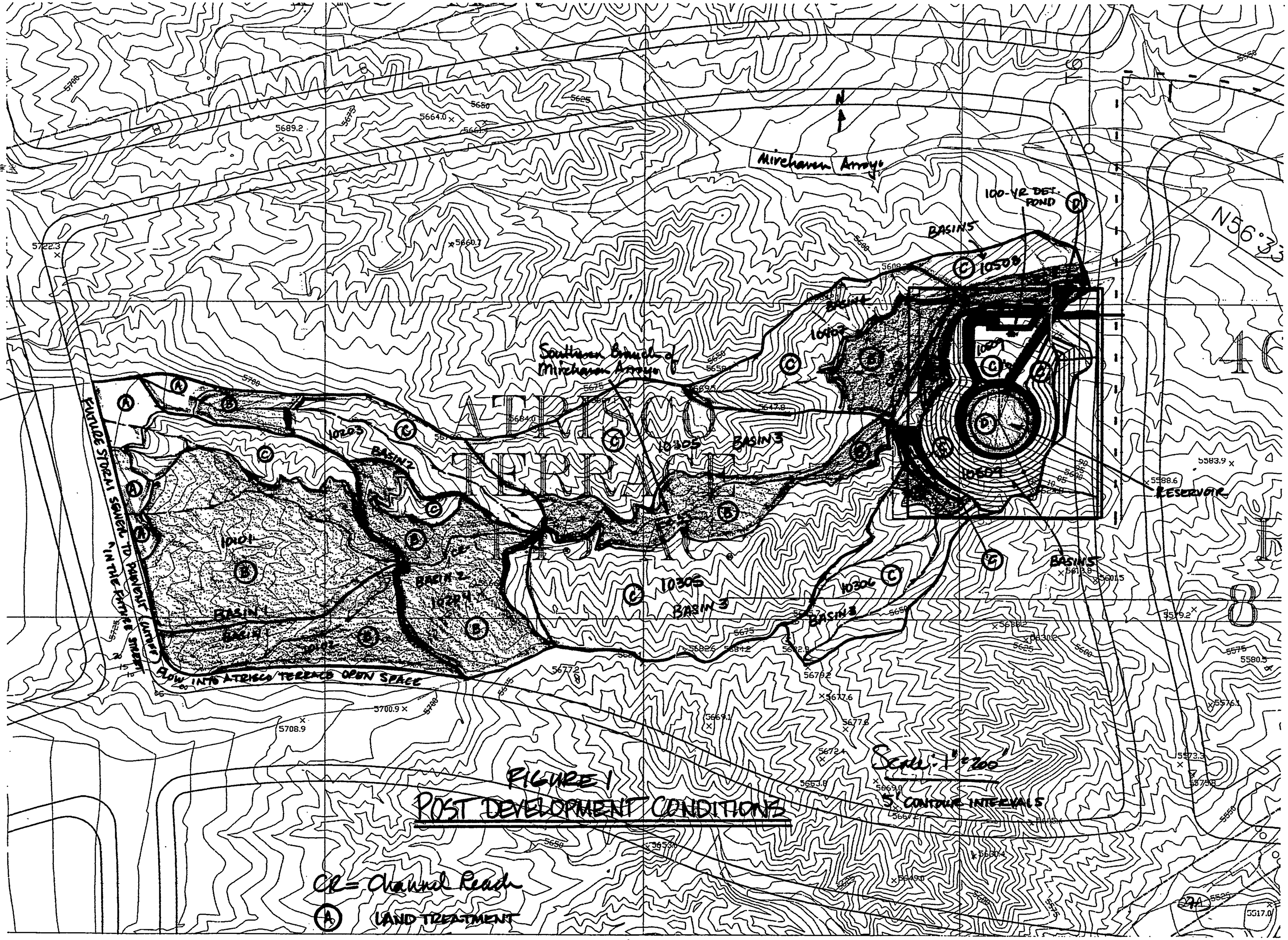


FIGURE 1
POST DEVELOPMENT CONDITIONS

Elev (FT)	Area (SF)	Ave Area	Storage Volume (Cum) (cf)	Storage Volume (acre-ft)
67	3643	0	0	0
68	4805	4224	4224	0.0970
69	5696	5251	9475	0.2175
70	7014	6355	15,830	0.3634
71	8254	7634	23,464	0.5387

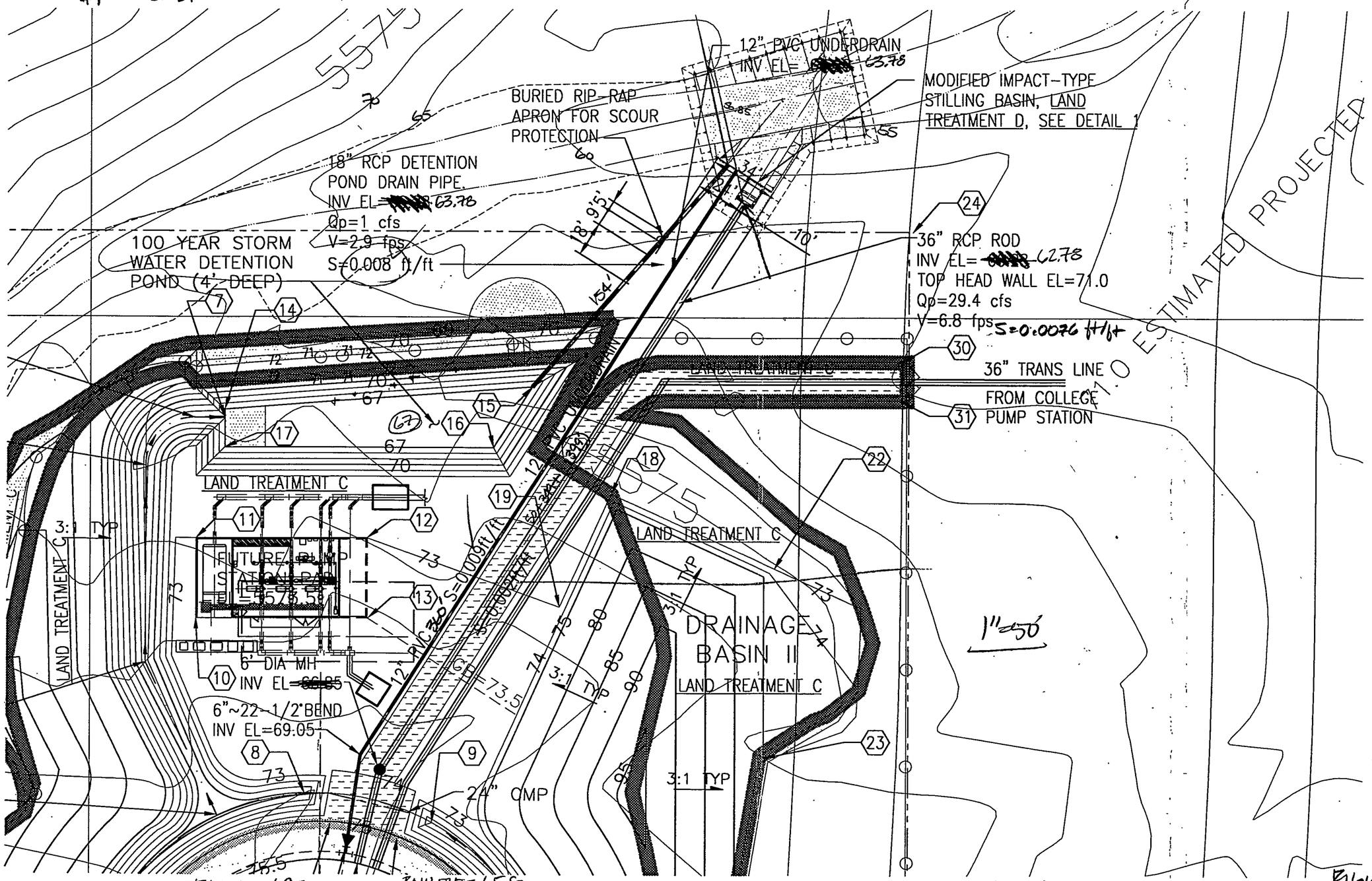
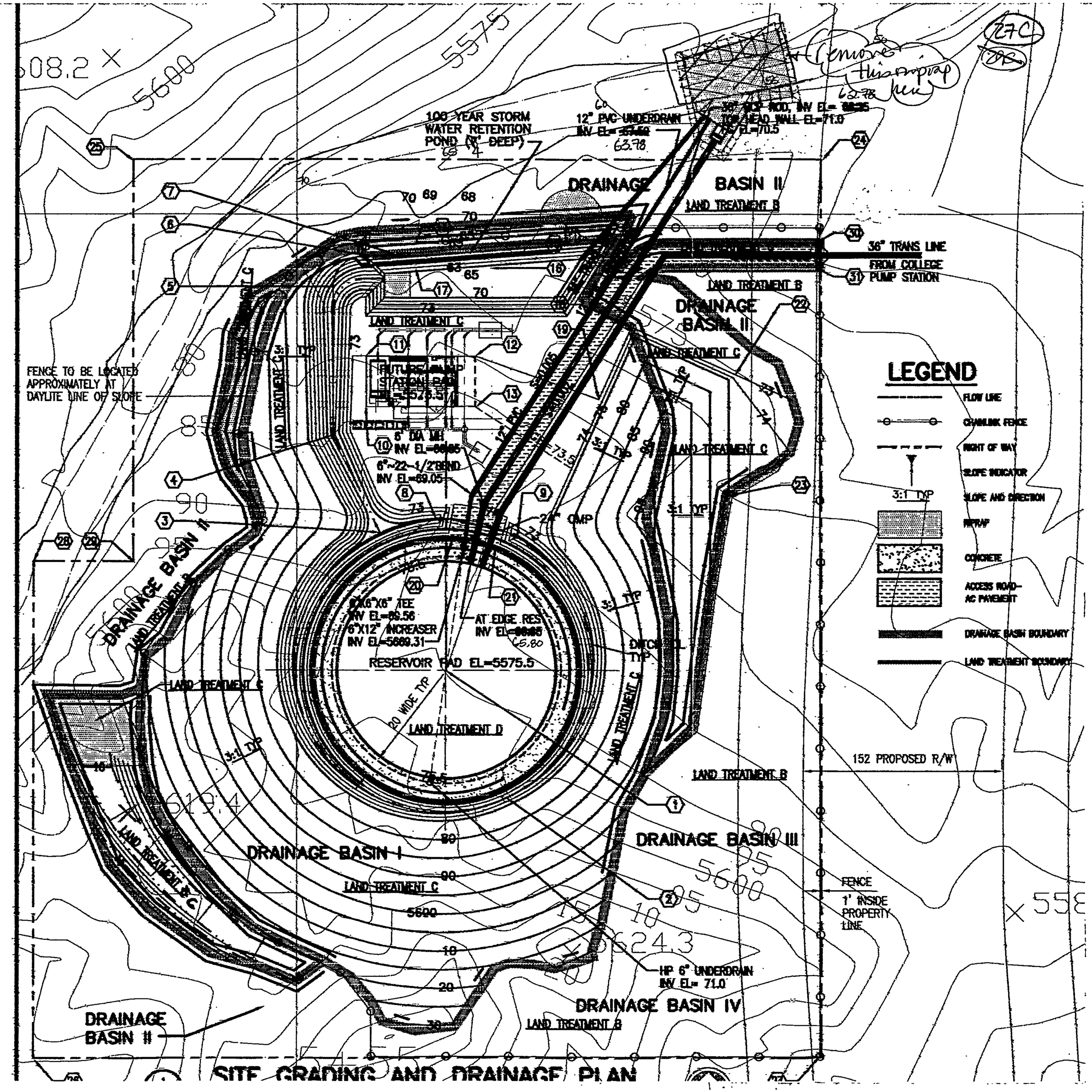


FIGURE 2

55.06

C:\WESTLAND\99012\DWG\WATER\C301REV.dwg Fri Nov 19 11:28:04 1999



SITE GRADING AND DRAINAGE PLAN

4W RESERVOIR - UPLAND INTERCEPTOR DITCH
Worksheet for Trapezoidal Channel

Project Description	
Project File	j:\westland\calcs\uid.fm2
Worksheet	4W RESERVOIR - UPLAND INTERCEPTOR DITCH
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.020000	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	20.00	ft
Discharge	13.00	cfs

(from Hydrologic Analysis of Murietta Arroyo – Sub. Basin 10306)

Results		
Depth	0.24	ft
Flow Area	4.95	ft²
Wetted Perimeter	21.51	ft
Top Width	21.43	ft
Critical Depth	0.23	ft
Critical Slope	0.021646	ft/ft
Velocity	2.63	ft/s
Velocity Head	0.11	ft
Specific Energy	0.35	ft
Froude Number	0.96	
Flow is subcritical.		

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION Hydraulic Analysis of Mirehaven Arroyo			SHEET NO. 1 OF 98
	COMPUTED BY: VDezy	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

1.0 SUBJECT

Channel Hydraulics in Mirehaven Arroyo @ 4W Reservoir Site

2.0 Purpose

Establish the energy grade line (E.G.L.) of the Mirehaven Arroyo based on the peakflow (Qp) determined in the previous calculation set. This will be used to ensure that the 4W Reservoir site is not in the 100-yr floodplain of the arroyo nor within the limits of the E.G.L.

3.0 References

3.1 Hydrologic Analysis of the Mirehaven Arroyo Basin in the Vicinity of 4W Reservoir Site, 11/6/99, V. Dezy.

3.2 Water Surface Profiling, HEC-RAS Computer Program from Haested Methods, 1997. HEC-RAS V2.1

3.3 Topographic map of site and arroyo @ scale of 1" = 50' and 5-foot contour intervals by Thomas Mann., 1997.

3.4 Bernalillo County Storm Drainage Ordinance No. 96-5.

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of MA			SHEET NO. 2 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 1/17/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

4.0 Assumptions

4.1 Analysis of hydraulic conditions in the Mirehaven Arroyo will be based on postdevelopment conditions with a peak discharge of 160 cfs.

4.2 Based on a site survey and photographs taken of the channel slopes in the vicinity of the 4W Reservoir site, the following mannings n coefficients were assumed for the channel slopes:

right and left overbanks – 0.04
right and left channel banks – 0.035
main channel (bottom width) – 0.03

The channel in the vicinity of the proposed location of the reservoir and detention pond appears to be in aggradation. The main channel is about 25 – 30' wide, relatively free of debris and weeds, no pools (deep or otherwise), and contains small stones. The overbanks are weedier and stonier.

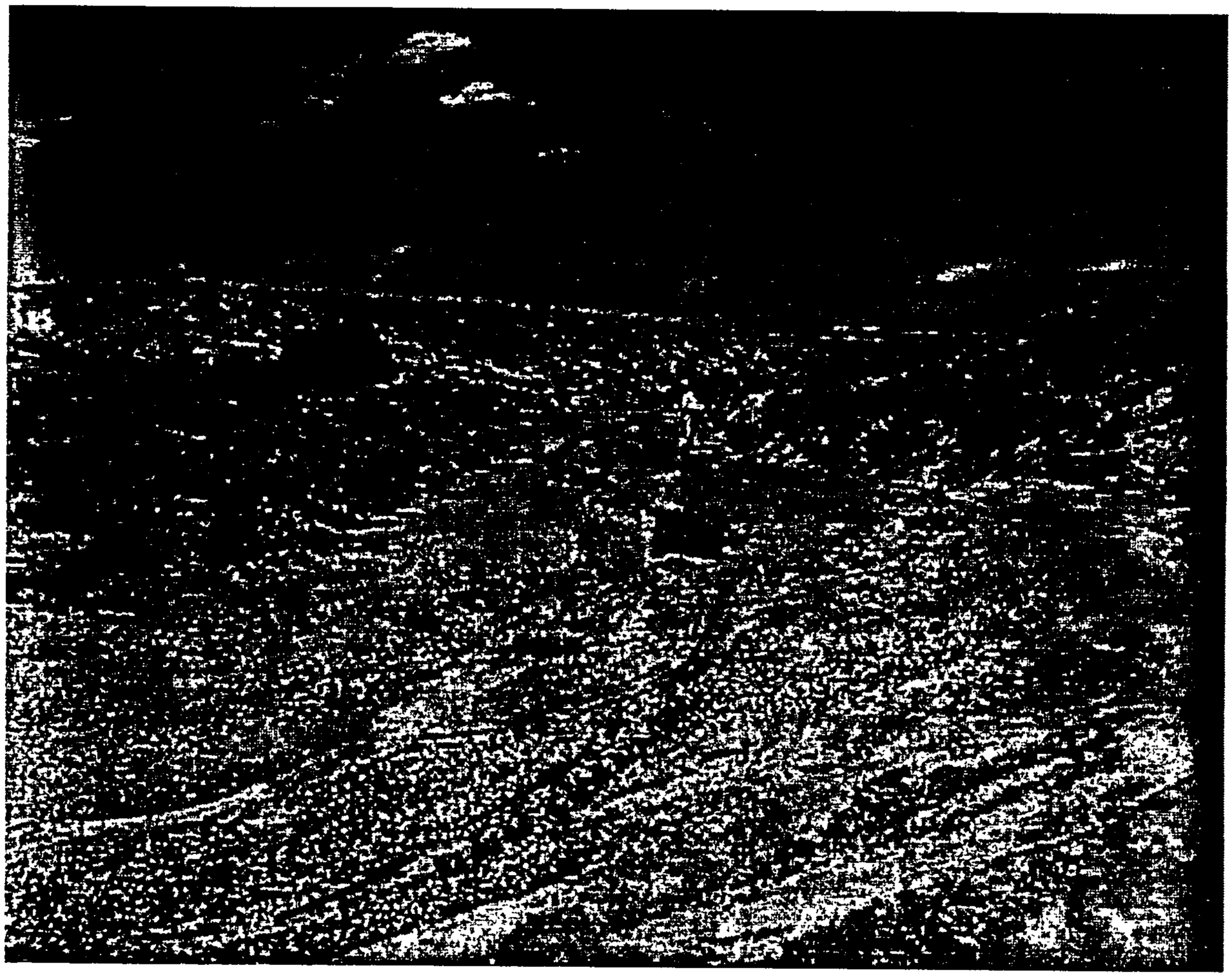
P:\ACAD\REV-SHT

Table 7-2 *(Continued)*
Values of Manning's Roughness Coefficient N (After Chow, 1959)

Type of Channel and Description	Minimum	Normal	Maximum
C. Excavated or Dredged			
c. Dragline excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. Natural Streams			
D-1. Minor streams (top width at flood stage < 100 Ft)			
a. Streams on plain			
1. Clean straight, full stage no rifts or deep pools	0.025	**0.030**	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	use 0.040	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
b. Mountain streams, no vegetation in channel, banks unusually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070

© 1997 Haestad Methods Inc., 37 Brookside Road, Waterbury, CT 06708 (203) 755-1666. All rights reserved.

4



Near river Station 1000 to 560*

See Figures 1 & 2 for locations of River Stations

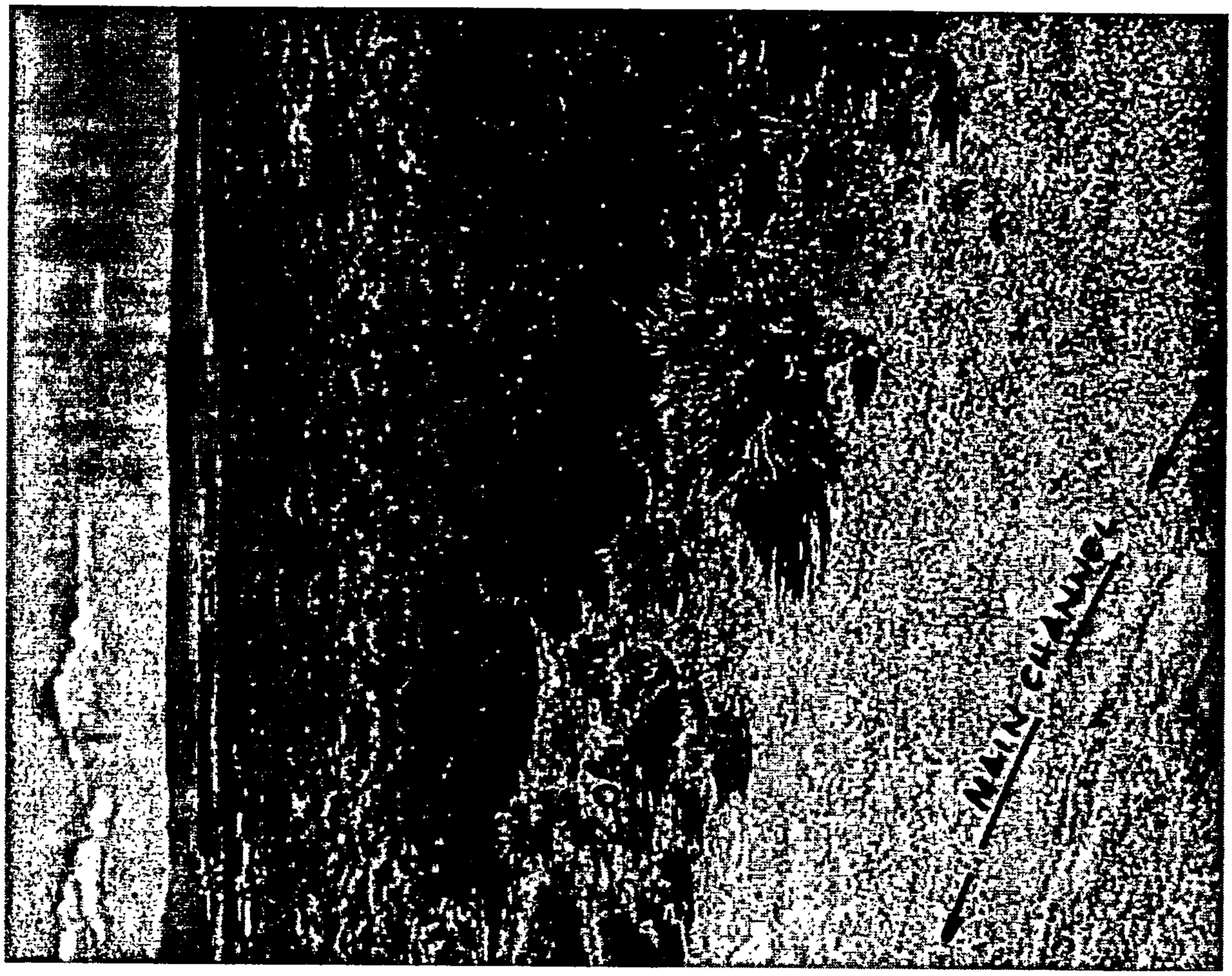
5

Near River Station: 640 to 540

6

Near River Station 540

7



Near River Station 500

8

Near River Station: 540 to 300

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analysis of MA			SHEET NO. 9 OF 98
	COMPUTED BY: VDerry	CHECKED BY: DWD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

5.0 Criteria / Requirements

5.1 No grading is permitted within the limits of the E.G.L. of the channel

5.2 No drainage Improvements are permitted outside of the property boundary without a drainage easement

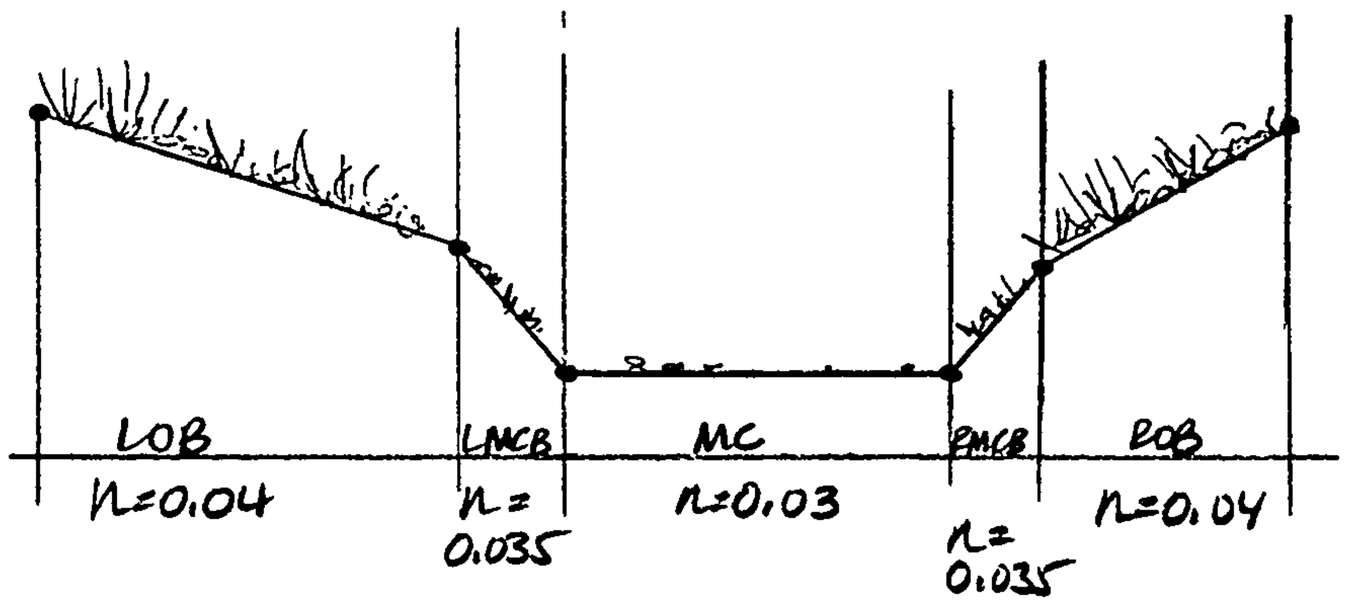
P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analy. of MA.			SHEET NO. 10 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DMD	JOB/TASK NO. 99012	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

6.0 Sketches



LOB = Left Overbank
LMCB = Left Main Channel Bank
MC = Main Channel
RMCB = Right Main Channel Bank
ROB = Right Overbank

P:\ACAD\REV-SHT

LEEDSHILL – HERKENHOFF, INC. ENGINEERS ARCHITECTS ALBUQUERQUE • SANTA FE COMPUTATIONS	NAME OF PROJECT/CALCULATION: Hydraulic Analy. of MA			SHEET NO. 11 OF 98
	COMPUTED BY: VDeng	CHECKED BY: DMS	JOB/TASK NO.	DATE: 11/7/99

IDENTIFY/ADDRESS THESE ELEMENTS	1.0 SUBJECT	2.0 PURPOSE	3.0 REFERENCES	4.0 ASSUMPTIONS	5.0 CRITERIA / REQUIREMENTS
	6.0 SKETCHES	7.0 CALCULATIONS	8.0 CONCLUSIONS	9.0 ATTACHMENTS	

REVISION #	SUPERSEDES CALC TITLE	CHECKED BY:	DATED

7.0 Calculations

7.1 Channel Cross-Sections & Geometry

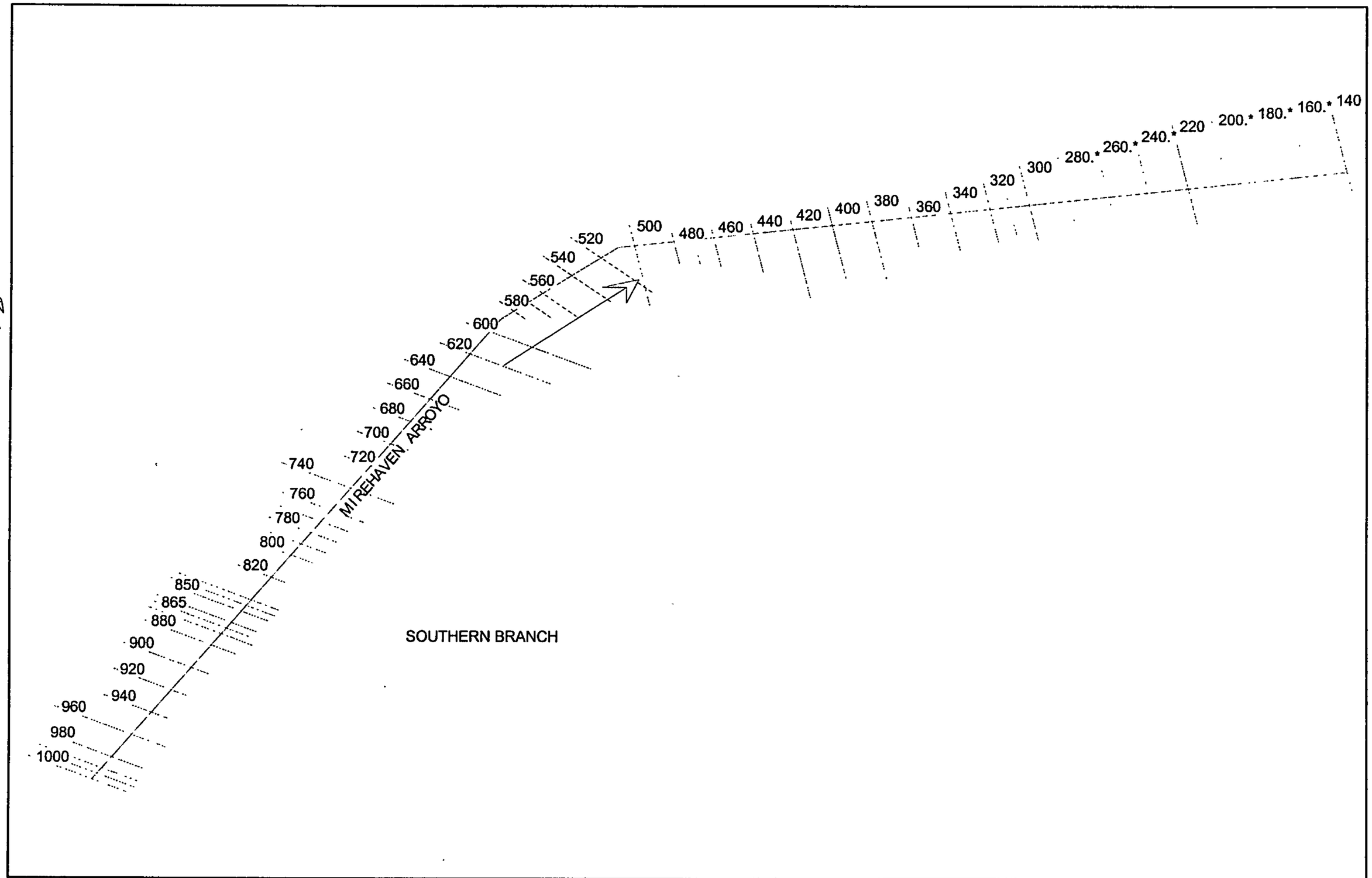
For locations of cross-sections, see Figures 1 and 2

(From Upstream ⇒ Downst.) (From Left Overbank ⇒ Right Overbank)

River Station	Station (ft)	Elev. (ft)	n Value	Description
1000	0	5595	0.04	Left Overbank (LOB)
	→ 60	5590.35	0.035	Left Main Channel Bank (LMCB)
	62	5590.15	0.03	Main Channel (MC)
	66	5590	0.03	MC
	81	5590	0.03	MC
	→ 88	5590.25	0.035	Right Main Channel Bank (RMCB)
	90	5590.44	0.04	Right Overbank (ROB)
	115	5595	0.04	ROB
995	0	95	0.04	LOB
	→ 61	90	0.035	LMCB
	63	89.87	0.03	MC
	74	89.79	0.03	MC
	→ 86	89.87	0.035	RMCH
	88	90	0.04	ROB
	118	95	0.04	ROB

P:\ACAD\REV-SHT

FIGURE 1



1 in Horiz. = 10 1 in Vert. = 1

Westland Development Co., Inc.

401 Coors Blvd. N.W.
Albuquerque, New Mexico 87121
(505) 831-9600
FAX (505) 831-4865
1-800-726-3250

March 28, 2000

Ms. Lisa Manwill, PE
Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect Avenue NE
Albuquerque, NM 87107

RE: Zone 4W Reservoir Drainage Easement

Dear Ms. Manwill:

Enclosed is a filed copy of the drainage easement required for the flood plain next to the new reservoir site. The site was approved by the ELUA and we are attempting to have the County signoff. This easement is required prior to signoff.

Please let me know if you have any questions.

Sincerely,

Leroy J. Chavez
Vice President of Development

Cc: Susan M. Calongne, P.E., City/County Floodplain Administrator
Victoria A. Dery, P.E., Leedshill-Herkenhoff, Inc.

ZAP _____

GRANT OF EASEMENT
FLOODWAY AND STORM DRAINAGE WORKS

WESTLAND DEVELOPMENT CO. INC. (name(s)) a N.M. Corporation (marital status), Grantor(s), being the owner(s) of the property described herein, for good and valuable consideration, the receipt of which is hereby acknowledged, hereby grants, bargains, sells and conveys to the ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY, a political subdivision of the State of New Mexico, (AMAFCA), its successors and assigns, the permanent right and easement for drainage, flood control and the conveyance and storage of storm water, and for the construction, reconstruction, operation and maintenance of, and access to, such appurtenant facilities as may be necessary on, in, under, over and across the following described real estate:

The land in which the foregoing rights and easement are granted is described as ZONE 4W RESERVOIR SITE FLOOD PLAIN, Bernalillo County, New Mexico, being more particularly described in Exhibit A attached hereto and incorporated herein by reference.

Except with the written approval of AMAFCA, no fence, wall, building, or other obstruction may be placed or maintained in said easement, and there shall be no alteration of the grades or contours in said easement. The granting of this easement shall not obligate AMAFCA to maintain any arroyo, drainage channel or other facility, nor shall this easement require AMAFCA to provide for the protection of property lying outside of the easement granted. AMAFCA shall only maintain property and/or improvements that it specifically agrees, by written agreement filed for public record, to maintain. Unless AMAFCA specifically so agrees to maintain property and/or improvements, all maintenance responsibility shall remain with the Grantor. Landscaping or maintenance work by the Grantor, within the easement hereby conveyed, shall not alter the present flowline, capacity, or permeability of the present flood way area, except in an emergency. If emergency work is performed, Grantor shall notify AMAFCA as soon as practical thereafter. AMAFCA will then determine if the emergency work can remain or must be removed or modified. Safe locations for structures built on lands adjacent to the easement described herein may be substantially outside of the described area.

TO HAVE AND TO HOLD the said right and easement for the uses and purposes aforesaid, unto AMAFCA, its successors and assigns, to run with the land forever. However, to the extent any portion of the above granted easement area is declared unnecessary for flood control or drainage by the Board of Directors of the Albuquerque Metropolitan Arroyo Flood Control Authority, said portion of the easement shall revert to the Grantor. Any such reversion shall be accomplished by way of a quitclaim deed to Grantor.

THERE IS RESERVED to the Grantors, their successors and assigns, the right to use said lands for open space and landscaping. Such open space and landscaping shall not interfere with

2000028440
5349186
Page: 1 of 4
03/23/2000 03:53P
Judy D. Woodward Bern. Co. EASE R 13.00 Bk-A3 Pg-8314

the rights and easements granted to AMAFCA. Other purposes, which will not interfere with the rights and easements hereby granted, may be permitted, provided that Grantor obtains AMAFCA's written licensed approval for such use, not to be unreasonably withheld.

WITNESS _____ hand__ and seal__ this 23rd day of March, ~~19~~ 2000.

GRANTORS:
WESTLAND DEVELOPMENT CO. INC.

Barbara Page
BARBARA PAGE, PRESIDENT + CEO

ACKNOWLEDGMENT FOR NATURAL PERSONS

STATE OF NEW MEXICO)
)s.s.
COUNTY OF BERNALILLO)

The foregoing instrument was acknowledged before me this _____ day of _____, 19___ by _____.

My commission expires:

_____ _____
Notary Public

ACKNOWLEDGMENT FOR CORPORATIONS/PARTNERSHIPS

STATE OF NEW MEXICO)
)s.s.
COUNTY OF BERNALILLO)

The foregoing instrument was acknowledged before me this 23 day of MARCH, 19___ by BARBARA PAGE, the PRESIDENT + CEO of WESTLAND DEVELOPMENT CO. INC

My commission expires:

Linda J. Blair
Notary Public

OFFICIAL SEAL
LINDA J. BLAIR
NOTARY PUBLIC, STATE OF NEW MEXICO
My Commission Expires 8/5/01

2000028440
5349186
Page: 2 of 4
03/23/2000 03:53P
Bk-A3 Pg-8314
Judy D. Woodward Bern. Co. EASE R 13.00

ZONE 4W RESERVOIR SITE
FLOOD PLAIN EASEMENT
LEGAL DESCRIPTION

WESTLAND DEVELOPMENT CO., INC. DATE: 03/08/00

BEING THAT CERTAIN PARCEL OF LAND SITUATED WITHIN THE TOWN OF ATRISCO GRANT AND ALSO BEING LOCATED IN PROJECTED SECTION 18, TOWNSHIP 10 NORTH, RANGE 2 EAST, NEW MEXICO PRINCIPAL MERIDIAN, COUNTY OF BERNALILLO, STATE OF NEW MEXICO AND BEING MORE PARTICULARLY DESCRIBED BY NEW MEXICO STATE PLANE GRID (CENTRAL ZONE) BEARINGS AND GROUND DISTANCES AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF THE ZONE 4W RESERVOIR PARCEL, FROM WHICH A BLM BRASS CAP MARKING AP NO. 8, TRACT 101-04 OF THE PETROGLYPH NATIONAL MONUMENT BEARS N 47° 00' 39" E, A DISTANCE OF 13,492.88 FEET;

THENCE, WEST, ALONG THE SOUTH BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 615.00 FEET TO THE SOUTHWEST CORNER OF THE ZONE 4W RESERVOIR PARCEL;

THENCE, NORTH, ALONG THE WEST BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 400.00 FEET TO A "WESTERLY CORNER" OF THE ZONE 4W RESERVOIR PARCEL AND THE POINT OF BEGINNING FOR THE FLOOD PLAIN EASEMENT;

THENCE, EAST, ALONG THE BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 46.77 FEET TO A POINT;

THENCE, S 26° 59' 17" W, A DISTANCE OF 103.07 FEET TO A POINT ON THE WEST BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL;

THENCE, NORTH, ALONG THE WEST BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 91.85 FEET TO THE POINT OF BEGINNING OF THE EASEMENT HEREIN DESCRIBED.

CONTAINING 2,148 SQUARE FEET (0.049 ACRES), MORE OR LESS.

TOGETHER WITH THE FOLLOWING DESCRIBED EASEMENT;

COMMENCING AT THE PREVIOUSLY MENTIONED "WESTERLY CORNER" OF THE ZONE 4W RESERVOIR PARCEL;

THENCE, EAST, ALONG THE BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 80.00 FEET TO A CORNER OF THE ZONE 4W RESERVOIR PARCEL;

THENCE, NORTH, ALONG THE WEST BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 63.46 FEET TO THE POINT OF BEGINNING FOR THE FLOOD PLAIN EASEMENT;

THENCE, N 23° 14' 10" E, A DISTANCE OF 127.80 FEET TO A POINT;

THENCE, N 36° 38' 47" E, A DISTANCE OF 60.85 FEET TO A POINT;

THENCE, N 56° 23' 22" E, A DISTANCE OF 97.44 FEET TO A POINT;

Judy D. Woodward Bern. Co. EASE R 13.00
2000028440
5349186
Page: 3 of 4
03/23/2000 03:53P
Bk-A3 Pg-8314

THENCE, S 89° 10' 18" E, A DISTANCE OF 69.29 FEET TO A POINT;

THENCE, N 59° 53' 58" E, A DISTANCE OF 89.26 FEET TO A POINT ON THE NORTH BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL;

THENCE, WEST, ALONG THE NORTH BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 187.30 FEET TO A POINT;

THENCE, S 51° 23' 47" W, A DISTANCE OF 121.28 FEET TO A POINT;

THENCE, S 27° 54' 00" W, A DISTANCE OF 68.90 FEET TO A POINT ON THE WEST BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL;

THENCE, SOUTH, ALONG THE WEST BOUNDARY OF THE ZONE 4W RESERVOIR PARCEL, A DISTANCE OF 124.98 FEET TO THE POINT OF BEGINNING OF THE EASEMENT HEREIN DESCRIBED.

CONTAINING 17,818 SQUARE FEET (0.409 ACRES), MORE OR LESS.

2000028440
5349186
Page: 4 of 4
03/23/2000 03:53P
Judy D. Woodward Bern. Co. EASE R 13.00 Bk-A3 Pg-8314

County of Bernalillo

State of New Mexico

BOARD OF COUNTY COMMISSIONERS
BARBARA J. SEWARD, CHAIR
DISTRICT 4
TOM RUTHERFORD, VICE CHAIR
DISTRICT 3
KEN SANCHEZ, MEMBER
DISTRICT 1
STEVE D. GALLEGOS, MEMBER
DISTRICT 2
LES HOUSTON, MEMBER
DISTRICT 5
JUAN R. VIGIL, COUNTY MANAGER

2400 BROADWAY, S.E.
ALBUQUERQUE, NEW MEXICO 87102
PUBLIC WORKS (505) 848-1500

MARK CARRILLO, ASSESSOR
JUDY D. WOODWARD, CLERK
IRA ROBINSON, PROBATE JUDGE
JOE BOWDICH, SHERIFF
ORLANDO VIGIL, TREASURER

April 12, 2000

Victoria A. Dery, P.E.
Leedshill-Herkenhoff, Inc.
500 Copper Ave NW
Albuquerque, New Mexico

RE: Drainage Report and Grading and Drainage Plans for 4W Reservoir Site (J7/D1) (PWDN-35) Engineer's Stamp Dated 3/1/00.

Dear Ms. Dery:

Based on the information provided with the submittal of March 3, 2000, the above referenced plan is approved for construction.

As you are aware, the Engineer's Certification is required for this site after construction is complete. Please provide the certification plan to the County and my office for our records.

If you have any questions, or if I may be of further assistance to you, please call me at 924-3982.

Sincerely,

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Brad Catanach, P.E., Bernalillo County Public Works Division
Lisa Manwill, P.E., Albuquerque Metropolitan Arroyo Flood Control Authority
File

PWEP176 SUSAN CALOGNE/FP

BERNALILLO COUNTY

PWD SUBMITTAL

Use for all PWD applications EXCEPT Street Excavation

PWDN 35

☑ NEW SUBMITTAL

☐ RESUBMITTAL

☐ FINAL SIGNOFF

TODAY'S DATE:

CASE NO: CSU-99-15

OWNER

OWNER: Westland Development Co., Inc. PHONE: ~~(505)~~ 831-9600

MAILING ADDRESS: 401 Coors Blvd. N.W. CITY: Alb. ZIP: 87121

J-7/D001

AGENT

AGENT / CONTRACTOR: Leedshill-Herkenhoff, Inc. PHONE: (505) 247-0294

MAILING ADDRESS: 500 Copper Avenue, N.W. CITY: Alb. ZIP: 87102

STATE LICENSE NO.: 13654 EXP DATE: 12/31/00 VOLUME: n/a CLASS: n/a

ARCHITECT/ENGINEER: Victoria A. Dery LICENSE NO.: 13654 PHONE: (505) 247-0294

SITE INFORMATION

SITE ADDRESS / DIRECTIONS: ~~1.3 miles west of 98th Street N.W. and 1 mile~~ north of I-40

ZONE ATLAS NO.: J7

LEGAL DESCRIPTION: See Attachment

LOT SIZE: 9.64 Acres

EXISTING BUILDING(S) AND USE: N/A

PROPOSED BUILDING(S): N/A

UPC #: 1-007-058-262-264-101-44

TYPE OF SUBMITTAL

- ☐ REPLAT
- ☐ MINOR SUBDIVISION
- ☐ MAJOR SUBDIVISION
- ☐ CONSTRUCTION DRAWINGS
- ☒ GRADING & DRAINAGE PLAN
- ☐ AS-CONSTRUCTED GRADING & DRAINAGE PLAN
- ☐ VARIANCE REQUEST
- ☐ LAND DIVISION
- ☐ TRAFFIC IMPACT ANALYSIS / TRAFFIC STUDY
- ☐ INFRASTRUCTURE LIST / DESIGN REVIEW
- ☐ SPECIAL USE PERMIT
- ☐ BARRICADING PERMIT
- ☐ BUILDING PERMIT
- ☐ INSPECTION
- ☐ OTHER (Specify): X Drainage Report

RECEIVED
JAN 20 2000
Bernalillo County
Public Works

The issuance of a permit or a review or approval of plan specifications, computations, and shop drawings, shall not be interpreted to be a permit for, or an approval of any variance or violation of any of the provisions of any COUNTY or STATE codes, ordinances, standards, or policies. Nor shall such issuance of a permit or approval of plans, specifications, computations, and shop drawings prevent any authorized COUNTY representative or COUNTY inspector form thereafter requiring the correction of errors in said plans, specifications, computations, or shop drawings or from stopping construction operations which are being carried on thereunder when in violation of any COUNTY or STATE codes, ordinances, standards, or policies.

☐ Owner ☒ Agent ☐ Contractor Signature: Victoria A. Dery Date: 1/6/00

COUNTY

BERNALILLO COUNTY USE ONLY

C/R's:

RECEIVED JAN 2 0 2000 HYDROLOGY SECTION

TOTAL FEE:

Receipt No.:

Received By: