



August 24, 2017

Carolyn Roan, PE, CFM
Water Resource Manager
Public Works
2255 West Berry Avenue
Littleton, Colorado 80120

Dear Ms. Roan:

RE: HEC-RAS Modelling of Drainageway D with 0.28' Foot Curb on West Side of Watson Lane

This letter presents the results of a HEC-RAS model of Drainageway D which incorporates a proposed rollover curb on the west side of Watson Lane. The basis of the model is the HEC-RAS modeling prepared for the "Conditional Letter of Map Revision Request for Drainageway D at Watson Lane", prepared by WRC Engineering, Inc., dated March 2008, with subsequent revisions. For this modeling effort, the elevations on the west side of Watson Lane were increased by 0.28 feet to represent the addition of a rollover curb per the City of Littleton's rollover curb design standard. In addition, the post project Drainageway D model was revised to represent the proposed grading of the north side of Drainageway D between Watson Lane and Brookhaven Lane to be performed as part of this project. The Watson Lane and Drainageway D models were iteratively run until the differences in the energy grade lines between the two models was 0.02' (use of fractions of cfs would be needed to have a difference of 0.00' which exceeds the accuracy of model input). The final model balance results in 78 cfs overtopping Watson Lane north of Drainageway D and the remaining 210 cfs being carried in the culverts under Watson Lane and overtopping Watson Lane at and south of Drainageway D. The model used for the referenced CLOMR report used a flow split of 98 cfs and 190 cfs, respectively. The results of the HEC-RAS model are presented below in comparison to the corrective effective model presented in the referenced CLOMR report.

720 SOUTH COLORADO BLVD.
SUITE 410 S
DENVER, CO 80246
303.757.3655



Table 1 – HEC-RAS Model Results Comparison of 100-Year Water Surface Elevations

| Cross-Section | Corrected Effective | Post-Project | Difference |
|---------------|---------------------|--------------|------------|
| 1 | 5317.50 | 5317.50 | 0.00 |
| 3 | 5321.28 | 5321.28 | 0.00 |
| 4 | 5321.27 | 5321.27 | 0.00 |
| 5 | 5321.28 | 5321.28 | 0.00 |
| 6 | 5321.29 | 5321.29 | 0.00 |
| 7 | 5321.30 | 5321.30 | 0.00 |
| 8 | 5321.29 | 5321.29 | 0.00 |
| 9 | 5321.35 | 5321.35 | 0.00 |
| 10 | 5321.33 | 5321.33 | 0.00 |
| 11 | 5321.38 | 5321.38 | 0.00 |
| 270 | 5322.92 | 5323.29 | 0.37 |
| 275 | 5322.92 | 5323.29 | 0.37 |
| 280 | 5322.92 | 5323.34 | 0.42 |
| 290 | 5323.91 | 5323.37 | 0.46 |
| 300 | 5323.06 | 5323.49 | 0.43 |
| 310 | 5323.19 | 5323.60 | 0.41 |
| 320 | 5323.19 | 5323.60 | 0.41 |
| 325 | 5323.12 | 5323.55 | 0.43 |
| 330 | 5323.26 | 5323.63 | 0.37 |
| 340 | 5323.61 | 5323.89 | 0.28 |
| 350 | 5323.63 | 5323.91 | 0.28 |
| 380 | 5324.20 | 5324.33 | 0.13 |
| 390 | 5324.89 | 5324.90 | 0.01 |
| 425 | 5330.07 | 5330.06 | -0.01 |



Attached are printouts of the HEC-RAS model input and results for both the revised Watson Lane model and the revised Drainageway D model (the downstream Drainageway D HEC-RAS model is not included as no changes were made to that model from the referenced CLOMR report). The results of the modeling shows that the proposed improvements to Drainageway D and the addition of the rollover curb on the west side of Watson Lane cause a rise in the 100-year water surface of less than the 0.5' allowed in a FEMA Zone A floodplain. If you have any questions, please do not hesitate to give me a call at 720-775-6406.

Sincerely,

A handwritten signature in black ink that reads 'Alan J. Leak'. The signature is written in a cursive, flowing style.

Alan J. Leak, P.E.
Principal

Enclosure

cc: Project Central File 02581 — Category Stormwater

WatsonLane.rep

HEC-RAS Versi on 4. 1. 0 Jan 2010
U. S. Army Corps of Engi neers
Hydrol ogi c Engi neeri ng Center
609 Second Street
Davi s, Cal i forni a

```
X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
XXXXXXXX XXXX      X      XXX XXXX XXXXXXX XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
X      X  XXXXXX      XXXX      X      X      X      XXXXXX
```

PROJECT DATA

Project Title: Watson Lane
Project File : WatsonLane.prj
Run Date and Time: 8/24/2017 9:23:00 AM

Project in English units

PLAN DATA

Plan Title: Plan 01
Plan File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR Submittal Drainageway
D\2017 Submittal\HEC-RAS Watson Lane\WatsonLane.p01

Geometry Title: Watson Lane - Lateral Weir plus .28 Feet
Geometry File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR
Submittal Drainageway D\2017 Submittal\HEC-RAS Watson Lane\WatsonLane.g01

Flow Title : Watson Lane Overflow
Flow File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR
Submittal Drainageway D\2017 Submittal\HEC-RAS Watson Lane\WatsonLane.f01

Plan Summary Information:

| | | | | | | |
|------------|----------------|---|----|--------------------|---|---|
| Number of: | Cross Sections | = | 10 | Multiple Openings | = | 0 |
| | Culverts | = | 0 | Inline Structures | = | 0 |
| | Bridges | = | 0 | Lateral Structures | = | 1 |

Computational Information

| | | |
|--------------------------------------|---|-------|
| Water surface calculation tolerance | = | 0.01 |
| Critical depth calculation tolerance | = | 0.01 |
| Maximum number of iterations | = | 20 |
| Maximum difference tolerance | = | 0.3 |
| Flow tolerance factor | = | 0.001 |

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

WatsonLane.rep

Description: Watson Lane
 Lateral structure position = Right overbank
 Distance from Upstream XS =
 Deck/Roadway Width = 20
 Weir Coefficient = 2.63
 Weir Flow Reference = Water Surface

Weir Embankment Coordinates num = 10

| Sta | El ev | Sta | El ev | Sta |
|-----|--------|-----|--------|-----|--------|-----|--------|-----|-------|-----|
| 0 | 5322.8 | 50 | 5322.8 | 100 | 5322.9 | 150 | 5323 | 200 | | |
| 250 | 5322.6 | 300 | 5322.6 | 350 | 5322.5 | 400 | 5322.5 | 450 | | |

Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Watson Lane
 REACH: Watson Lane RS: 9

INPUT

Description:

| Station | El ev | Data | num= | 9 | Sta | El ev | Sta | El ev | Sta |
|---------|-------|-------|--------|-------|---------|-------|---------|-------|-----|
| -8.4 | 5324 | 0 | 5321.9 | 2.24 | 5322 | 18.23 | 5322.66 | 22.71 | |
| 24.72 | 5323 | 27.01 | 5323 | 37.72 | 5323.02 | 57.72 | 5323.02 | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|------|-------|-----|-------|-------|-------|
| -8.4 | .035 | 0 | .035 | 37.72 | .035 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

| Left | Right | Left | Channel | Right | Coeff | Contr. |
|------|-------|------|---------|-------|-------|--------|
| 0 | 37.72 | 50 | 50 | 50 | | .1 |

.3

CROSS SECTION

RIVER: Watson Lane
 REACH: Watson Lane RS: 8

INPUT

Description:

| Station | El ev | Data | num= | 10 | Sta | El ev | Sta | El ev | Sta |
|---------|-------|-------|--------|-------|---------|-------|---------|-------|-----|
| -4.8 | 5324 | 0 | 5322.8 | 2.69 | 5322.85 | 7.87 | 5323 | 14.96 | |
| 18.3 | 5323 | 24.79 | 5323 | 34.54 | 5323 | 35.06 | 5323.12 | 55.06 | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|------|-------|-----|-------|-------|-------|
| -4.8 | .035 | 0 | .035 | 35.06 | .035 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

| Left | Right | Left | Channel | Right | Coeff | Contr. |
|------|-------|------|---------|-------|-------|--------|
| 0 | 35.06 | 50 | 50 | 50 | | .1 |

.3

WatsonLane.rep

CROSS SECTION

RIVER: Watson Lane
 REACH: Watson Lane RS: 7

INPUT

Description:

| Station | Elevation | Data | num= | 14 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|---------|-------|---------|-------|-----|
| -4 | 5324 | 0 | 5323 | 6.99 | 5323 | 8.51 | 5323 | 10.19 | |
| 13.19 | 5323 | 18.52 | 5323 | 20.53 | 5323 | 25.37 | 5323 | 26.22 | |
| 28.61 | 5323 | 30.11 | 5323 | 30.36 | 5323.26 | 50.36 | 5323.26 | | |

| Manning's n | Values | num= | 3 | Sta | n Val |
|-------------|--------|------|-------|------|-------|
| -4 | .035 | .035 | 30.36 | .035 | |

| Bank Sta: | Left | Right | Lengths: | Left | Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|------|---------|-------|-------|--------|
| Expan. | 0 | 30.36 | 50 | 50 | 50 | | .1 | |
| | .3 | | | | | | | |

CROSS SECTION

RIVER: Watson Lane
 REACH: Watson Lane RS: 6

INPUT

Description:

| Station | Elevation | Data | num= | 11 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|---------|-------|------|-------|-----|
| -4 | 5324 | 0 | 5323 | 3.59 | 5323 | 12.9 | 5323 | 17.04 | |
| 19.53 | 5323 | 20.14 | 5323 | 30.39 | 5322.43 | 31.65 | 5322 | 32.83 | |
| 52.83 | 5323.06 | | | | | | | | |

| Manning's n | Values | num= | 3 | Sta | n Val |
|-------------|--------|------|-------|------|-------|
| -4 | .035 | .035 | 32.83 | .035 | |

| Bank Sta: | Left | Right | Lengths: | Left | Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|------|---------|-------|-------|--------|
| Expan. | 0 | 32.83 | 50 | 50 | 50 | | .1 | |
| | .3 | | | | | | | |

CROSS SECTION

RIVER: Watson Lane
 REACH: Watson Lane RS: 5

INPUT

Description:

| Station | Elevation | Data | num= | 11 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|--------|-------|---------|-------|---------|-------|-----|
| -4.4 | 5324 | 0 | 5322.9 | 10.53 | 5322.97 | 12.74 | 5322.97 | 14.61 | |
| 16.59 | 5322.84 | 19.39 | 5322.6 | 29.81 | 5322 | 31.42 | 5321.4 | 32.92 | |

WatsonLane.rep

5322.88
52.92 5322.88

| | | |
|--------------------|-----------|------------|
| Manning's n Values | num= | 3 |
| Sta n Val | Sta n Val | Sta n Val |
| -4.4 .035 | 0 .035 | 32.92 .035 |

| | | | | | | |
|----------------|---------|----------|--------------|-------|-------|--------|
| Bank Sta: Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | | | | | | |
| | 0 32.92 | | 50 50 | 50 | | .1 |
| .3 | | | | | | |

CROSS SECTION

RIVER: Watson Lane
REACH: Watson Lane RS: 4

INPUT

Description:

| | | | | |
|---------|-----------|-------|--------|---------------|
| Station | Elevation | Data | num= | 14 |
| Sta | El ev | Sta | El ev | Sta |
| El ev | | | | |
| -5.6 | 5324 | 0 | 5322.6 | 19.64 5322.95 |
| 22.39 | 5323 | 24 | | |
| 5323 | | | | |
| 33.16 | 5323 | 33.46 | 5323 | 33.6 5322.91 |
| 35.12 | 5322 | 36.5 | | |
| 5321.09 | | | | |
| 36.65 | 5321 | 36.81 | 5321 | 38.53 5322.73 |
| 58.53 | 5322.73 | | | |

| | | |
|--------------------|-----------|------------|
| Manning's n Values | num= | 3 |
| Sta n Val | Sta n Val | Sta n Val |
| -5.6 .035 | 0 .035 | 38.53 .035 |

| | | | | | | |
|----------------|---------|----------|--------------|-------|-------|--------|
| Bank Sta: Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | | | | | | |
| | 0 38.53 | | 50 50 | 50 | | .1 |
| .3 | | | | | | |

CROSS SECTION

RIVER: Watson Lane
REACH: Watson Lane RS: 3

INPUT

Description:

| | | | | |
|---------|-----------|-------|---------|------------|
| Station | Elevation | Data | num= | 7 |
| Sta | El ev | Sta | El ev | Sta |
| El ev | | | | |
| -5.2 | 5324 | 0 | 5322.7 | 19.21 5323 |
| 21.53 | 5323 | 26.14 | | |
| 5322.58 | | | | |
| 28.23 | 5322.55 | 48.23 | 5322.55 | |

| | | |
|--------------------|-----------|------------|
| Manning's n Values | num= | 3 |
| Sta n Val | Sta n Val | Sta n Val |
| -5.2 .035 | 0 .035 | 28.23 .035 |

| | | | | | | |
|----------------|---------|----------|--------------|-------|-------|--------|
| Bank Sta: Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | | | | | | |
| | 0 28.23 | | 50 50 | 50 | | .1 |
| .3 | | | | | | |

CROSS SECTION

RIVER: Watson Lane

WatsonLane.rep

REACH: Watson Lane RS: 2

INPUT

Description:

| Station | Elevation | Data | num= | 13 | | | | | |
|---------|-----------|-------|---------|-------|---------|-------|------|-------|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| -5.6 | 5324 | 0 | 5322.6 | 19.43 | 5323 | 28.19 | 5323 | 28.8 | |
| 5323 | | | | | | | | | |
| 33.11 | 5322.3 | 36.04 | 5322 | 38.15 | 5321.25 | 38.17 | 5321 | 38.25 | |
| 5320.24 | | | | | | | | | |
| 38.76 | 5320 | 39.46 | 5322.59 | 59.46 | 5322.59 | | | | |

| Manning's n | Values | num= | 3 |
|-------------|--------|------|-------|
| Sta | n Val | Sta | n Val |
| -5.6 | .035 | 0 | .035 |
| 39.46 | | | |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 0 | 39.46 | | 50 | 50 | 50 | .1 |
| | | | | | | | .3 |

CROSS SECTION

RIVER: Watson Lane
REACH: Watson Lane RS: 1

INPUT

Description:

| Station | Elevation | Data | num= | 14 | | | | | |
|---------|-----------|-------|---------|-------|---------|-------|---------|-------|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 0 | 5322.7 | 6.93 | 5322.8 | 16.61 | 5323 | 19.86 | 5323 | 24.34 | |
| 5323.57 | | | | | | | | | |
| 27.72 | 5324 | 31.6 | 5324 | 33.55 | 5322.86 | 34.65 | 5322 | 35.44 | |
| 5321.7 | | | | | | | | | |
| 36.79 | 5321 | 37.61 | 5320.57 | 37.83 | 5322.65 | 57.83 | 5322.65 | | |

| Manning's n | Values | num= | 3 |
|-------------|--------|------|-------|
| Sta | n Val | Sta | n Val |
| 0 | .035 | 0 | .035 |
| 37.83 | | | |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 0 | 37.83 | | 0 | 0 | 0 | .1 |
| | | | | | | | .3 |

| Ineffective Flow | num= | 1 |
|------------------|-------|------|
| Sta L | Sta R | Elev |
| 0 | 27.72 | 5324 |
| | | F |

SUMMARY OF MANNING'S N VALUES

River: Watson Lane

| Reach | River Sta. | n1 | n2 | n3 |
|-------------|------------|------------|------|------|
| Watson Lane | 10 | .035 | .035 | .035 |
| Watson Lane | 9.9 | Lat Struct | | |
| Watson Lane | 9 | .035 | .035 | .035 |
| Watson Lane | 8 | .035 | .035 | .035 |
| Watson Lane | 7 | .035 | .035 | .035 |
| Watson Lane | 6 | .035 | .035 | .035 |

| WatsonLane.rep | | | | |
|----------------|---|------|------|------|
| Watson Lane | 5 | .035 | .035 | .035 |
| Watson Lane | 4 | .035 | .035 | .035 |
| Watson Lane | 3 | .035 | .035 | .035 |
| Watson Lane | 2 | .035 | .035 | .035 |
| Watson Lane | 1 | .035 | .035 | .035 |

SUMMARY OF REACH LENGTHS

Ri ver: Watson Lane

| Reach | Ri ver Sta. | Left | Channel | Ri ght |
|-------------|-------------|------------|---------|--------|
| Watson Lane | 10 | 50 | 50 | 50 |
| Watson Lane | 9.9 | Lat Struct | | |
| Watson Lane | 9 | 50 | 50 | 50 |
| Watson Lane | 8 | 50 | 50 | 50 |
| Watson Lane | 7 | 50 | 50 | 50 |
| Watson Lane | 6 | 50 | 50 | 50 |
| Watson Lane | 5 | 50 | 50 | 50 |
| Watson Lane | 4 | 50 | 50 | 50 |
| Watson Lane | 3 | 50 | 50 | 50 |
| Watson Lane | 2 | 50 | 50 | 50 |
| Watson Lane | 1 | 0 | 0 | 0 |

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

Ri ver: Watson Lane

| Reach | Ri ver Sta. | Contr. | Expan. |
|-------------|-------------|------------|--------|
| Watson Lane | 10 | .1 | .3 |
| Watson Lane | 9.9 | Lat Struct | |
| Watson Lane | 9 | .1 | .3 |
| Watson Lane | 8 | .1 | .3 |
| Watson Lane | 7 | .1 | .3 |
| Watson Lane | 6 | .1 | .3 |
| Watson Lane | 5 | .1 | .3 |
| Watson Lane | 4 | .1 | .3 |
| Watson Lane | 3 | .1 | .3 |
| Watson Lane | 2 | .1 | .3 |
| Watson Lane | 1 | .1 | .3 |

HEC-RAS Plan: Plan 01 River: Watson Lane Reach: Watson Lane Profile: 100-Year

| Reach | River Sta | Profile | Q Total (cfs) | Min Ch El (ft) | W.S. Elev (ft) | Crit W.S. (ft) | E.G. Elev (ft) | E.G. Slope (ft/ft) | Vel Chnl (ft/s) | Flow Area (sq ft) | Top Width (ft) | Froude # Chl |
|-------------|-----------|----------|------------------|-------------------|-------------------|-------------------|-------------------|-----------------------|--------------------|----------------------|-------------------|--------------|
| Watson Lane | 10 | 100-Year | 78.00 | 5320.60 | 5323.27 | | 5323.28 | 0.000136 | 0.84 | 101.57 | 65.96 | 0.10 |
| Watson Lane | 9.9 | | Lat Struct | | | | | | | | | |
| Watson Lane | 9 | 100-Year | 35.73 | 5321.90 | 5323.25 | | 5323.27 | 0.001544 | 1.21 | 31.54 | 63.10 | 0.27 |
| Watson Lane | 8 | 100-Year | 5.80 | 5322.80 | 5323.17 | 5323.07 | 5323.18 | 0.003012 | 0.78 | 8.06 | 56.54 | 0.31 |
| Watson Lane | 7 | 100-Year | 0.08 | 5323.00 | 5323.03 | 5323.03 | 5323.03 | 0.000772 | 0.10 | 0.77 | 30.24 | 0.11 |
| Watson Lane | 6 | 100-Year | 0.08 | 5322.00 | 5322.57 | | 5322.57 | 0.000054 | 0.10 | 0.81 | 4.43 | 0.04 |
| Watson Lane | 5 | 100-Year | 0.08 | 5321.40 | 5322.57 | | 5322.57 | 0.000001 | 0.02 | 4.93 | 12.72 | 0.00 |
| Watson Lane | 4 | 100-Year | 0.08 | 5321.00 | 5322.57 | | 5322.57 | 0.000001 | 0.02 | 3.40 | 4.21 | 0.00 |
| Watson Lane | 3 | 100-Year | 0.08 | 5322.55 | 5322.57 | 5322.57 | 5322.57 | 0.003163 | 0.11 | 0.44 | 21.45 | 0.20 |
| Watson Lane | 2 | 100-Year | 0.08 | 5320.00 | 5320.85 | | 5320.85 | 0.000096 | 0.16 | 0.49 | 0.80 | 0.04 |
| Watson Lane | 1 | 100-Year | 0.08 | 5320.57 | 5320.78 | 5320.78 | 5320.83 | 0.071677 | 1.84 | 0.04 | 0.41 | 1.01 |

Drai nagewayDPost. rep

HEC-RAS Versi on 4. 1. 0 Jan 2010
U. S. Army Corps of Engi neers
Hydrol ogi c Engi neeri ng Center
609 Second Street
Davi s, Cal i forni a

```
X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
XXXXXXXX XXXX      X      XXX XXXX XXXXXXX XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
X      X  XXXXXX      XXXX      X      X      X      XXXXX
```

PROJECT DATA

Project Title: Drai nageway D Post Project
Project File : Drai nagewayDPost. prj
Run Date and Time: 8/24/2017 9:18:37 AM

Project in English units

PLAN DATA

Plan Title: Post-Project
Plan File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR Submittal Drai nageway
D\2017 Submittal\Post Project Drai nageway D\Drai nagewayDPost. p07

Geometry Title: Post-Project
Geometry File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR
Submittal Drai nageway D\2017 Submittal\Post Project Drai nageway
D\Drai nagewayDPost. g03

Flow Title : Post-Project
Flow File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR
Submittal Drai nageway D\2017 Submittal\Post Project Drai nageway
D\Drai nagewayDPost. f04

Plan Summary Information:

| | | | | | | |
|------------|----------------|---|----|--------------------|---|---|
| Number of: | Cross Sections | = | 40 | Multiple Openings | = | 0 |
| | Culverts | = | 4 | Inline Structures | = | 0 |
| | Bridges | = | 0 | Lateral Structures | = | 0 |

Computational Information

| | | |
|--------------------------------------|---|-------|
| Water surface calculation tolerance | = | 0.01 |
| Critical depth calculation tolerance | = | 0.01 |
| Maximum number of iterations | = | 20 |
| Maximum difference tolerance | = | 0.3 |
| Flow tolerance factor | = | 0.001 |

Computation Options

| | |
|--------------------------------|----------------------------|
| Critical depth computed only | where necessary |
| Conveyance Calculation Method: | At breaks in n values only |
| Friction Slope Method: | Average Conveyance |
| Computational Flow Regime: | Subcritical Flow |

Drai nagewayDPost. rep

FLOW DATA

Flow Title: Post-Project

Flow File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR Submittal Drai nageway D\2017 Submittal\Post Project Drai nageway D\Drai nagewayDPost. f04

Flow Data (cfs)

| River | Reach | RS | 100-Year |
|----------------|-----------------|------|----------|
| Drai nageway D | Up. of Watson | 425 | 288 |
| Drai nageway D | Up. of Watson | 280 | 288 |
| Drai nageway D | Up. of Watson | 270 | 210 |
| Drai nageway D | Up. of Watson | 11 | 288 |
| Drai nageway D | Down. of Watson | 10 | 288 |
| Drai nageway D | Down. of Watson | 9 | 323 |
| Drai nageway D | Watson Lane | 2016 | 5 |
| Drai nageway D | Watson Lane | 2015 | 30 |
| Drai nageway D | Watson Lane | 2014 | 60 |
| Drai nageway D | Watson Lane | 2010 | 85 |
| Drai nageway D | Watson Lane | 2009 | 105 |
| Drai nageway D | Watson Lane | 2001 | 110 |

Boundary Conditions

| River | Reach | Profile | Upstream |
|----------------|--------------------|----------|----------|
| | Downstream | | |
| Drai nageway D | Watson Lane | 100-Year | |
| | Known WS = 5321.38 | | |
| Drai nageway D | Down. of Watson | 100-Year | |
| | Known WS = 5317.5 | | |

GEOMETRY DATA

Geometry Title: Post-Project

Geometry File : z:\Clayton Family Farm\CLOMR\HEC-RAS - CLOMR Submittal Drai nageway D\2017 Submittal\Post Project Drai nageway D\Drai nagewayDPost. g03

Reach Connection Table

| River Boundary | Reach | Upstream Boundary | Downstream |
|----------------|-----------------|-------------------|-------------|
| Drai nageway D | Up. of Watson | | Watson Lane |
| Drai nageway D | Watson Lane | Watson Lane | |
| Drai nageway D | Down. of Watson | Watson Lane | |

JUNCTION INFORMATION

DrainagewayDPost. rep

Name: Watson Lane
 Description:
 Energy computation Method

| Angle | Length across River | Junction Reach | Tributary River | Reach | Length |
|-------|---------------------|----------------|------------------|-----------------|--------|
| 0 | | Up. of Watson | to Drainageway D | Down. of Watson | 160 |
| 0 | | Up. of Watson | to Drainageway D | Watson Lane | 0 |

CROSS SECTION

RIVER: Drainageway D
 REACH: Up. of Watson RS: 425

INPUT

Description:

| Station | Elevation | Data | num= | 6 | Station | Elevation | Station | Elevation | Station |
|---------|-----------|------|--------|-----|---------|-----------|---------|-----------|---------|
| 780 | 5329.8 | 820 | 5329.3 | 870 | 5329.5 | 930 | 5329.2 | 1000 | 5330.7 |
| 1011 | 5331.2 | | | | | | | | |

| Manning's n | Values | num= | 3 | Station | n | Values |
|-------------|--------|------|----|---------|----|--------|
| 780 | .09 | 780 | .1 | 1011 | .1 | |

| Bank Expan. | Sta: Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-------------|-----------|-------|----------|--------------|-------|-------|--------|
| .3 | 780 | 1011 | | 140 | 240 | 280 | .1 |

CROSS SECTION

RIVER: Drainageway D
 REACH: Up. of Watson RS: 390

INPUT

Description:

| Station | Elevation | Data | num= | 7 | Station | Elevation | Station | Elevation | Station |
|---------|-----------|------|------|------|---------|-----------|---------|-----------|---------|
| 1000 | 5328 | 1105 | 5326 | 1120 | 5323 | 1140 | 5323 | 1150 | 5326 |
| 1275 | 5323 | 1290 | 5329 | | | | | | |

| Manning's n | Values | num= | 3 | Station | n | Values |
|-------------|--------|------|------|---------|-----|--------|
| 1000 | .04 | 1105 | .035 | 1150 | .04 | |

| Bank Expan. | Sta: Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-------------|-----------|-------|----------|--------------|-------|-------|--------|
| .3 | 1105 | 1150 | | 220 | 220 | 225 | .1 |

| Blocked Obstructions | num= | 1 | Sta L | Sta R | Elev |
|----------------------|------|---|-------|-------|------|
| | | | 1150 | 1290 | 5326 |

CROSS SECTION

Drai nagewayDPost. rep

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 380

INPUT

Description:

| Station | Elevation | Data | num= | 10 | Station | Elevation | Station | Elevation | Station |
|---------|-----------|--------|--------|--------|---------|-----------|---------|-----------|---------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 996 | 5326.8 | 999 | 5326 | 1000 | 5325.8 | 1032.5 | 5321.4 | 1038.5 | |
| 5321.3 | | | | | | | | | |
| 1038.5 | 5320.8 | 1043.5 | 5320.8 | 1043.5 | 5321.3 | 1052 | 5322 | 1071 | |
| 5327 | | | | | | | | | |

| Manning's n | Values | num= | 3 | Station | n Val |
|-------------|--------|------|-------|---------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 996 | .04 | 996 | .035 | 1071 | .04 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 996 | 1071 | | 108 | 108 | 108 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 350

INPUT

Description: UPSTREAM OF CULVERT - BROOKHAVEN TRAIL

| Station | Elevation | Data | num= | 8 | Station | Elevation | Station | Elevation | Station |
|---------|-----------|------|-------|------|---------|-----------|---------|-----------|---------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 1000 | 5326 | 1016 | 5325 | 1022 | 5324.1 | 1031 | 5324 | 1040 | |
| 5320.6 | | | | | | | | | |
| 1045 | 5320.6 | 1052 | 5321 | 1076 | 5327 | | | | |

| Manning's n | Values | num= | 3 | Station | n Val |
|-------------|--------|------|-------|---------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1000 | .035 | 1076 | .04 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 1000 | 1076 | | 12 | 12 | 12 | .6 |
| | .8 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 340

INPUT

Description: UPSTREAM OF CULVERT NEAR FACE - BROOKHAVEN TRAIL

| Station | Elevation | Data | num= | 7 | Station | Elevation | Station | Elevation | Station |
|---------|-----------|------|--------|------|---------|-----------|---------|-----------|---------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 1000 | 5326 | 1017 | 5324.8 | 1018 | 5320 | 1037 | 5320 | 1038 | |
| 5324.8 | | | | | | | | | |
| 1053 | 5325 | 1061 | 5327 | | | | | | |

| Manning's n | Values | num= | 3 | Station | n Val |
|-------------|--------|------|-------|---------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1017 | .035 | 1038 | .04 |

Drai nagewayDPost. rep

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
 Expan. 1017 1038 170 167 165 .6
 .8
 Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 1000 1017 5326 F
 1038 1061 5326 F

CULVERT

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 335

INPUT

Description: Culvert #4 (2 9' x 4' Boxes)

Distance from Upstream XS = 1
 Deck/Roadway Width = 165
 Weir Coefficient = 3
 Upstream Deck/Roadway Coordinates
 num= 9

| Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord |
|------|----|------|--------|------|------|----|------|--------|------|------|----|------|--------|------|
| 1000 | | 5326 | 5319.8 | | 1017 | | 5326 | 5319.8 | | 1017 | | 5326 | 5319.8 | |
| 1018 | | 5326 | 5319.8 | | 1037 | | 5326 | 5319.8 | | 1038 | | 5326 | 5319.8 | |
| 1038 | | 5326 | 5319.8 | | 1053 | | 5326 | 5319.8 | | 1061 | | 5327 | 5319.8 | |

Upstream Bridge Cross Section Data

Station Elevation Data num= 7

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta |
|--------|------|------|--------|------|------|------|------|------|
| 1000 | 5326 | 1017 | 5324.8 | 1018 | 5320 | 1037 | 5320 | 1038 |
| 5324.8 | | 1053 | 5325 | 1061 | 5327 | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|------|-------|------|-------|------|-------|
| 1000 | .04 | 1017 | .035 | 1038 | .04 |

Bank Sta: Left Right Coeff Contr. Expan.
 1017 1038 .6 .8

Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 1000 1017 5326 F
 1038 1061 5326 F

Downstream Deck/Roadway Coordinates

num= 11

| Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord |
|------|----|------|--------|------|------|----|------|--------|------|------|----|------|--------|------|
| 1000 | | 5326 | 5319.8 | | 1017 | | 5326 | 5319.8 | | 1018 | | 5326 | 5319.8 | |
| 1022 | | 5326 | 5319.8 | | 1022 | | 5326 | 5319.8 | | 1037 | | 5326 | 5319.8 | |
| 1038 | | 5326 | 5319.8 | | 1041 | | 5326 | 5319.8 | | 1041 | | 5326 | 5319.8 | |
| 1053 | | 5326 | 5319.8 | | 1061 | | 5327 | 5319.8 | | | | | | |

Downstream Bridge Cross Section Data

Station Elevation Data num= 6

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta |
|------|------|------|------|------|--------|------|--------|------|
| 1000 | 5325 | 1022 | 5325 | 1023 | 5319.8 | 1040 | 5319.8 | 1041 |
| 5325 | | 1087 | 5326 | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|-----|-------|-----|-------|-----|-------|
| | | | | | |

Drai nagewayDPost. rep

1000 .04 1022 .035 1041 .04

Bank Sta: Left Right Coeff Contr. Expan.
 1022 1041 .6 .8

Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 1000 1022 5325 F
 1041 1087 5325 F

Upstream Embankment side slope = 0 hori z. to 1.0 verti cal
 Downstream Embankment side slope = 0 hori z. to 1.0 verti cal
 Maximum allowable submergence for weir flow = .95
 Elevati on at whi ch weir flow begi ns = 5326
 Energy head used i n spi llway desi gn =
 Spi llway hei ght used i n desi gn =
 Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span
 Box2 Box 4 9
 FHWA Chart # 8 - flared wingwal ls
 FHWA Scale # 1 - Wingwal l flared 30 to 75 deg.
 Soluti on Cri teria = Hi ghest U. S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss
 Coef Exit Loss Coef
 0 167 .013 .013 0 .4

Number of Barrels = 2
 Upstream Elevati on = 5320
 Centerline Stati ons
 Sta. Sta.
 1023 1032
 Downstream Elevati on = 5319.8
 Centerline Stati ons
 Sta. Sta.
 1027 1036

CROSS SECTI ON

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 330

I NPUT

Descripti on: DOWNSTREAM OF CULVERT NEAR FACE - BROOKHAVEN TRAIL

| Stati on | Elevati on | Data | num= | 6 | | | | | |
|----------|------------|------|------|------|--------|------|--------|------|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 1000 | 5325 | 1022 | 5325 | 1023 | 5319.8 | 1040 | 5319.8 | 1041 | |
| 5325 | | | | | | | | | |
| 1087 | 5326 | | | | | | | | |

| Manni ng' s n | Val ues | num= | 3 | | |
|---------------|---------|------|-------|------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1022 | .035 | 1041 | .04 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
 Expan. 1022 1041 50 50 50 .6

.8

Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 1000 1022 5325 F
 1041 1087 5325 F

DrairagewayDPost. rep

CROSS SECTION

RIVER: Drairageway D
 REACH: Up. of Watson RS: 325

INPUT
 Description: DOWNSTREAM OF BROOKHAVEN TRAIL SPECIAL CULVERT

| Station | Elevation | Data | num= | 6 | | | | | |
|---------|-----------|------|-------|------|-------|--------|--------|--------|-------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 1000 | 5324.7 | 1003 | 5324 | 1008 | 5323 | 1018.5 | 5320.3 | 1035.5 | |
| 5320.3 | | | | | | | | | |
| 1050.5 | 5324.7 | | | | | | | | |

| Manning's n | Values | num= | 3 | | |
|-------------|--------|------|-------|--------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1000 | .035 | 1050.5 | .04 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|--------|----------|--------------|-------|-------|--------|
| Expan. | 1000 | 1050.5 | | 165 | 170 | 175 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drairageway D
 REACH: Up. of Watson RS: 320

INPUT
 Description: UPSTREAM OF CULVERT - BROOKHAVEN LANE

| Station | Elevation | Data | num= | 14 | | | | | |
|---------|-----------|------|-------|------|-------|------|--------|------|-------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 1370 | 5329 | 1380 | 5327 | 1385 | 5326 | 1435 | 5325 | 1458 | |
| 5324 | | | | | | | | | |
| 1462 | 5323 | 1466 | 5322 | 1510 | 5321 | 1534 | 5319.2 | 1541 | |
| 5319.2 | | | | | | | | | |
| 1548 | 5320 | 1552 | 5321 | 1614 | 5322 | 1626 | 5324 | | |

| Manning's n | Values | num= | 3 | | |
|-------------|--------|------|-------|------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1370 | .04 | 1510 | .035 | 1548 | .04 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 1510 | 1548 | | 210 | 160 | 125 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drairageway D
 REACH: Up. of Watson RS: 310

INPUT
 Description: UPSTREAM OF CULVERT - BROOKHAVEN LANE

| Station | Elevation | Data | num= | 15 | | | | | |
|---------|-----------|------|-------|------|-------|------|-------|------|-------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 1000 | 5326 | 1090 | 5325 | 1110 | 5325 | 1120 | 5323 | 1210 | |
| 5322 | | | | | | | | | |

Drai nageway D Post. rep

| | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| 1320 | 5321 | 1400 | 5320 | 1408 | 5319 | 1413 | 5319 | 1420 | |
| 5320 | 1422 | 5321 | 1432 | 5321 | 1487 | 5320 | 1520 | 5320 | 1540 |
| 5324 | | | | | | | | | |

Manning's n Values

| | | | | | |
|------|-------|------|-------|------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1400 | .035 | 1420 | .04 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 1400 | 1420 | | 260 | 125 | 110 | .6 |
| | .8 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 300

INPUT
 Description: UPSTREAM OF CULVERT NEAR CULVERT FACE - BROOKHAVEN LANE

| | | | | | | | | | |
|---------|-----------|--------|-------|------|-------|--------|-------|--------|------|
| Station | Elevation | Data | num= | 8 | | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | |
| El ev | 1000 | 5325.5 | 1028 | 5325 | 1060 | 5323.5 | 1061 | 5318.5 | 1088 |
| | 5318.5 | | | | | | | | |
| | 1089 | 5323.5 | 1099 | 5324 | 1140 | 5324 | | | |

Manning's n Values

| | | | | | |
|------|-------|------|-------|------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1060 | .035 | 1089 | .04 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 1060 | 1089 | | 78 | 78 | 78 | .6 |
| | .8 | | | | | | |

| | | |
|------------------|-------|-------|
| Ineffective Flow | num= | 2 |
| Sta L | Sta R | El ev |
| 1000 | 1060 | 5324 |
| 1089 | 1140 | 5324 |
| | | F |
| | | F |

CULVERT

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 295

INPUT
 Description: Culvert #3 (2 13' x 4' Boxes)

Distance from Upstream XS = 1
 Deck/Roadway Width = 76
 Weir Coefficient = 3
 Upstream Deck/Roadway Coordinates

| | | | | | | | | | | | |
|------|----|------|---------|------|----|------|---------|------|----|------|---------|
| num= | 8 | | | | | | | | | | |
| Sta | Hi | Cord | Lo Cord | Sta | Hi | Cord | Lo Cord | Sta | Hi | Cord | Lo Cord |
| 1028 | | 5325 | 5318.3 | 1060 | | 5324 | 5318.3 | 1060 | | 5324 | 5318.3 |
| 1061 | | 5324 | 5318.3 | 1088 | | 5324 | 5318.3 | 1089 | | 5324 | 5318.3 |
| 1089 | | 5324 | 5318.3 | 1099 | | 5324 | 5318.3 | | | | |

Upstream Bridge Cross Section Data

| | | | | | | | | |
|---------|-----------|------|-------|-----|-------|-----|-------|-----|
| Station | Elevation | Data | num= | 8 | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| El ev | | | | | | | | |

Drai nagewayDPost. rep

| | | | | | | | | |
|--------|--------|------|------|------|--------|------|--------|------|
| 1000 | 5325.5 | 1028 | 5325 | 1060 | 5323.5 | 1061 | 5318.5 | 1088 |
| 5318.5 | | | | | | | | |
| 1089 | 5323.5 | 1099 | 5324 | 1140 | 5324 | | | |

Manning's n Values num= 3

| | | | | | |
|------|-------|------|-------|------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 1000 | .04 | 1060 | .035 | 1089 | .04 |

Bank Sta: Left Right Coeff Contr. Expan.

| | | | | | |
|--|------|------|--|----|----|
| | 1060 | 1089 | | .6 | .8 |
|--|------|------|--|----|----|

Ineffective Flow num= 2

| | | | |
|-------|-------|-------|-----------|
| Sta L | Sta R | El ev | Permanent |
| 1000 | 1060 | 5324 | F |
| 1089 | 1140 | 5324 | F |

Downstream Deck/Roadway Coordi nates num= 5

| | | | | | | | | |
|--------|------|---------|--------|------|---------|--------|------|---------|
| Sta Hi | Cord | Lo Cord | Sta Hi | Cord | Lo Cord | Sta Hi | Cord | Lo Cord |
| 346.1 | 5325 | 5318.3 | 394.1 | 5324 | 5318.3 | 395.1 | 5324 | 5318.3 |
| 422.1 | 5324 | 5318.3 | 423.1 | 5324 | 5318.3 | | | |

Downstream Bridge Cross Section Data Station Elevati on Data num= 37

| | | | | | | | | | |
|---------|--------|---------|--------|---------|--------|---------|--------|--------|--------|
| Sta | El ev | Sta | |
| El ev | 0 | 5323.45 | 13.66 | 5323 | 30.53 | 5323 | 64.14 | 5322.1 | 65.82 |
| 5322 | 81.64 | 5322 | 82.84 | 5322 | 82.88 | 5322 | 109.98 | 5322 | 140.55 |
| 5322.63 | 144.19 | 5322.7 | 160.84 | 5323 | 164.15 | 5323 | 176.47 | 5323 | 183.31 |
| 5323.63 | 191.34 | 5324 | 195.4 | 5324 | 203.2 | 5324 | 217.15 | 5324.6 | 226.07 |
| 5325 | 230.11 | 5325 | 246.11 | 5325 | 249.25 | 5325.36 | 249.75 | 5325.4 | 260.09 |
| 5326 | 260.98 | 5325.98 | 277.15 | 5325.86 | 286.12 | 5325.92 | 307.68 | 5326 | 336.91 |
| 5325.33 | 342.24 | 5325.27 | 347.1 | 5325 | 394.1 | 5323.6 | 395.1 | 5318.3 | 422.1 |
| 5318.3 | 423.1 | 5323.6 | 507.1 | 5324 | | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-------|-------|-------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 0 | .04 | 394.1 | .035 | 423.1 | .04 |

Bank Sta: Left Right Coeff Contr. Expan.

| | | | | | |
|--|-------|-------|--|----|----|
| | 394.1 | 423.1 | | .6 | .8 |
|--|-------|-------|--|----|----|

Ineffective Flow num= 2

| | | | |
|-------|-------|--------|-----------|
| Sta L | Sta R | El ev | Permanent |
| 0 | 394.1 | 5323.5 | F |
| 423.1 | 507.1 | 5323.5 | F |

Upstream Embankment side slope = 0 hori z. to 1.0 verti cal
 Downstream Embankment side slope = 0 hori z. to 1.0 verti cal
 Maxi mum allowabl e submergence for wei r fl ow = .95
 Elevati on at whi ch wei r fl ow begi ns = 5324
 Energy head used i n spi ll way desi gn =
 Spi ll way hei ght used i n desi gn =
 Wei r crest shape = Broad Crested

Number of Culverts = 1

| | | | |
|--------------|-------|-------|------|
| Culvert Name | Shape | Ri se | Span |
| Box1 | Box | 4 | 13 |

FHWA Chart # 8 - flared wingwalls
 FHWA Scale # 1 - Wingwall flared 30 to 75 deg.

DRAINAGEWAY.DPOST.REP

SOLUTION CRITERIA = HIGHEST U.S. EG
 CULVERT UPSTREAM DIST LENGTH TOP N BOTTOM N DEPTH BLOCKED ENTRANCE LOSS
 COEF EXIT LOSS COEF
 0 78 .013 .013 0 .4

1
 NUMBER OF BARRELS = 2
 UPSTREAM ELEVATION = 5319.5
 CENTERLINE STATIONS
 STA. STA.
 1068 1081
 DOWNSTREAM ELEVATION = 5319.3
 CENTERLINE STATIONS
 STA. STA.
 401.85 415.35

CROSS SECTION

RIVER: DRAINAGEWAY D
 REACH: UP. OF WATSON RS: 290

INPUT

DESCRIPTION: DOWNSTREAM OF CULVERT NEAR CULVERT FACE - BROOKHAVEN LANE
 6.5 cfs

of 100-year flood flows through pipe
 STATION ELEVATION DATA num= 37
 STA ELV STA ELV STA ELV STA ELV STA ELV STA ELV
 ELV
 0 5323.45 13.66 5323 30.53 5323 64.14 5322.1 65.82
 5322
 81.64 5322 82.84 5322 82.88 5322 109.98 5322 140.55
 5322.63
 144.19 5322.7 160.84 5323 164.15 5323 176.47 5323 183.31
 5323.63
 191.34 5324 195.4 5324 203.2 5324 217.15 5324.6 226.07
 5325
 230.11 5325 246.11 5325 249.25 5325.36 249.75 5325.4 260.09
 5326
 260.98 5325.98 277.15 5325.86 286.12 5325.92 307.68 5326 336.91
 5325.33
 342.24 5325.27 347.1 5325 394.1 5323.6 395.1 5318.3 422.1
 5318.3
 423.1 5323.6 507.1 5324

MANNING'S N VALUES num= 3
 STA N VAL STA N VAL STA N VAL
 0 .04 394.1 .035 423.1 .04

BANK STA: LEFT RIGHT LENGTHS: LEFT CHANNEL RIGHT COEFF CONTR.
 EXPAN.
 394.1 423.1 85 85 85 .6

.8
 INEFFECTIVE FLOW num= 2
 STA L STA R ELV Permanent
 0 394.1 5323.5 F
 423.1 507.1 5323.5 F

CROSS SECTION

RIVER: DRAINAGEWAY D
 REACH: UP. OF WATSON RS: 280

INPUT

DESCRIPTION: UPSTREAM OF CULVERT - WATSON LANE
 DOWNSTREAM OF BROOKHAVEN LANE

Drai nagewayDPost. rep

SPECIAL CULVERT

| Station | Elevation | Data | num= | 11 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|--------|---------|--------|---------|--------|------|-------|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 551.22 | 5324 | 561.22 | 5323 | 576.26 | 5320.24 | 588.26 | 5320 | 593.5 | |
| 5318.69 | | 593.5 | 5317.56 | 598.5 | 5318.72 | 600.5 | 5319 | 622.5 | |
| 5323 | 625.5 | 5324 | | | | | | | |

Manning's n Values

| Sta | n Val | Sta | n Val | Sta | n Val |
|--------|-------|-------|-------|-------|-------|
| 551.22 | .035 | 593.5 | .035 | 598.5 | .035 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

| Left | Right | Left | Channel | Right | Coeff | Contr. |
|-------|-------|------|---------|-------|-------|--------|
| 593.5 | 598.5 | 135 | 135 | 135 | | .6 |

Ineffective Flow

| Sta L | Sta R | Elev | Permanent |
|--------|--------|------|-----------|
| 551.22 | 560.78 | 5325 | T |
| 626.8 | 625.5 | 5328 | T |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 275

INPUT

Description:

| Station | Elevation | Data | num= | 14 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|--------|---------|--------|---------|--------|---------|--------|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 583.55 | 5324 | 593.55 | 5323 | 604.27 | 5320.32 | 616.27 | 5320.08 | 623.27 | |
| 5318.33 | | 623.27 | 5317.35 | 628.27 | 5318.33 | 632.27 | 5319 | 638.27 | |
| 5320 | 642.27 | 5321 | 646.27 | 5322 | 650.27 | 5323 | 659.27 | 5324 | |

Manning's n Values

| Sta | n Val | Sta | n Val | Sta | n Val |
|--------|-------|--------|-------|--------|-------|
| 583.55 | .035 | 623.27 | .035 | 628.27 | .035 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

| Left | Right | Left | Channel | Right | Coeff | Contr. |
|--------|--------|------|---------|-------|-------|--------|
| 623.27 | 628.27 | 135 | 135 | 135 | | .1 |

Ineffective Flow

| Sta L | Sta R | Elev | Permanent |
|--------|--------|------|-----------|
| 583.55 | 590.79 | 5325 | T |
| 656.85 | 659.27 | 5328 | T |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 270

INPUT

Description: UPSTREAM OF CULVERT NEAR CULVERT FACE - WATSON LANE
 BT DATA BASED

ON NEW PLAN OF WATSON LANE

| Station | Elevation | Data | num= | 16 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|------|------|-----|------|------|------|------|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |

Drai nagewayDPost. rep

| | | | | | | | | | |
|---------|-----|------|-----|---------|-----|---------|-----|---------|-----|
| 5320 | 647 | 5324 | 651 | 5323 | 655 | 5322 | 700 | 5321 | 705 |
| | 709 | 5319 | 715 | 5317.97 | 715 | 5317.21 | 731 | 5317.21 | 731 |
| 5317.85 | 735 | 5319 | 745 | 5320 | 751 | 5321 | 756 | 5322 | 761 |
| 5323 | 770 | 5324 | | | | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 647 | .035 | 715 | .035 | 731 | .035 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

| | | | | | | | | |
|--|-----|-----|--|----|----|----|--|----|
| | 715 | 731 | | 78 | 78 | 78 | | .6 |
|--|-----|-----|--|----|----|----|--|----|

Ineffective Flow num= 2

| | | | |
|--------|--------|---------|-----------|
| Sta L | Sta R | Elev | Permanent |
| 647 | 694.22 | 5325.96 | T |
| 765.98 | 770 | 5328.76 | T |

CULVERT

RIVER: Drai nageway D
 REACH: Up. of Watson RS: 140.5

INPUT

Description:
 Distance from Upstream XS = 7
 Deck/Roadway Width = 64
 Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates num= 17

| Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord |
|-------|----|--------|----|------|-------|----|----------|----|------|-----|----|----------|----|------|
| 0 | | 5323 | | 5317 | 50 | | 5323 | | 5317 | 172 | | 5322.5 | | 5317 |
| 198 | | 5322.5 | | 5317 | 316 | | 5322.5 | | 5317 | 348 | | 5322.6 | | 5317 |
| 400 | | 5322.7 | | 5317 | 445 | | 5322.9 | | 5317 | 467 | | 5323 | | 5317 |
| 503 | | 5322.9 | | 5317 | 543 | | 5322.8 | | 5317 | 587 | | 5322.7 | | 5317 |
| 599 | | 5322.7 | | 5317 | 600 | | 5322.715 | | 5317 | 600 | | 5322.715 | | 5317 |
| 633.2 | | 5323.2 | | 5317 | 778.5 | | 5323.2 | | 5317 | | | | | |

Upstream Bridge Cross Section Data Station Elevation Data num= 16

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta |
|---------|------|------|------|---------|------|---------|------|---------|
| 647 | 5324 | 651 | 5323 | 655 | 5322 | 700 | 5321 | 705 |
| 5320 | 709 | 5319 | 715 | 5317.97 | 715 | 5317.21 | 731 | 5317.21 |
| 5317.85 | 735 | 5319 | 745 | 5320 | 751 | 5321 | 756 | 5322 |
| 5323 | 770 | 5324 | | | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 647 | .035 | 715 | .035 | 731 | .035 |

Bank Sta: Left Right Coeff Contr. Expan.

| | | | | | |
|--|-----|-----|--|----|----|
| | 715 | 731 | | .6 | .8 |
|--|-----|-----|--|----|----|

Ineffective Flow num= 2

| | | | |
|--------|--------|---------|-----------|
| Sta L | Sta R | Elev | Permanent |
| 647 | 694.22 | 5325.96 | T |
| 765.98 | 770 | 5328.76 | T |

Downstream Deck/Roadway Coordinates

DrainagewayDPost. rep

| num= 14 | | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord |
|---------|--------|-----|----|------|----|------|-------|--------|------|----|------|-----|--------|------|----|------|
| 100 | 5323 | | | | 0 | | 150 | 5323 | | | 0 | 272 | 5322.5 | | | 0 |
| 298 | 5322.5 | | | | 0 | | 416 | 5322.5 | | | 0 | 448 | 5322.6 | | | 0 |
| 500 | 5322.7 | | | | 0 | | 545 | 5322.9 | | | 0 | 567 | 5323 | | | 0 |
| 603 | 5322.9 | | | | 0 | | 643 | 5322.8 | | | 0 | 687 | 5322.7 | | | 0 |
| 699 | 5322.7 | | | | 0 | | 733.2 | 5323.2 | | | 0 | | | | | |

Downstream Bridge Cross Section Data

| Station | | Elevation Data | | num= 10 | | Sta | Elev | Sta | Elev | Sta |
|---------|------|----------------|------|---------|------|-----|------|-----|------|-----|
| 100 | 5322 | 105 | 5321 | 108 | 5320 | 112 | 5319 | 115 | 5317 | 115 |
| 129 | 5317 | 134 | 5318 | 140 | 5319 | 146 | 5320 | 160 | 5322 | 160 |

Manning's n Values

| Sta | n Val | Sta | n Val | Sta | n Val |
|-----|-------|-----|-------|-----|-------|
| 100 | .04 | 100 | .035 | 160 | .04 |

| Bank Sta: | Left | Right | Coeff | Contr. | Expan. |
|-----------|------|-------|-------|--------|--------|
| | 100 | 160 | .1 | .3 | |

Upstream Embankment side slope = 0 hori z. to 1.0 verti cal
 Downstream Embankment side slope = 0 hori z. to 1.0 verti cal
 Maximum allowable submergence for weir flow = .95
 Elevation at which weir flow begins = 5322.5
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span

Culvert #1 Circular 2.5
 FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall

| Solution Criteria = | Highest U. S. EG | Culvert Upstrm Dist | Length | Top n | Bottom n | Depth Blocked | Entrance Loss |
|---------------------|------------------|---------------------|--------|-------|----------|---------------|---------------|
| Coef | Exit Loss Coef | 7 | 64 | .013 | .013 | 0 | .2 |

Number of Barrels = 5
 Upstream Elevation = 5317.19

| Centerline Stations | Sta. | Sta. | Sta. | Sta. | Sta. |
|---------------------|--------|--------|--------|--------|--------|
| | 717.73 | 720.23 | 722.73 | 725.23 | 727.73 |

| Downstream Elevation = | 5317.09 | Centerline Stations | Sta. | Sta. | Sta. | Sta. | Sta. |
|------------------------|---------|---------------------|------|-------|------|-------|------|
| | | | 125 | 127.5 | 130 | 132.5 | 135 |

CROSS SECTION

RIVER: Drainageway D
 REACH: Up. of Watson RS: 11

INPUT

Description: DOWNSTREAM OF CULVERT NEAR CULVERT FACE - WATSON LANE

| Station | | Elevation Data | | num= 10 | | Sta | Elev | Sta | Elev | Sta |
|---------|------|----------------|------|---------|------|-----|------|-----|------|-----|
| 100 | 5322 | 105 | 5321 | 108 | 5320 | 112 | 5319 | 115 | 5317 | 115 |

Drai nageway D Post. rep

5322 129 5317 134 5318 140 5319 146 5320 160

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 | 160 | .04 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 160 | | 120 160 | 150 | | .1 |
| | | | | | | | .3 |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2016

INPUT

Description:

| | | | | | | | | | |
|---------|-----------|-------|-------|-----|--------|-------|---------|-------|---------|
| Station | Elevation | Data | num= | 8 | | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 100 | 5323 | 104.4 | 5322 | 105 | 5321 | 105.2 | 5320.65 | 115.2 | 5320.65 |
| 115.4 | 5321 | 116 | 5322 | 152 | 5322.4 | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 152 | .032 |

| | | | | | | | |
|-----------|------|-------|----------|------------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 152 | | 50.15 50.15 | 50.15 | | .1 |
| | | | | | | | .3 |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2015

INPUT

Description:

| | | | | | | | | | |
|---------|-----------|-------|-------|-------|--------|-------|---------|-------|---------|
| Station | Elevation | Data | num= | 8 | | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 100 | 5323 | 104.4 | 5322 | 105.7 | 5321 | 106.1 | 5320.37 | 116.1 | 5320.37 |
| 116.5 | 5321 | 119.5 | 5322 | 155 | 5322.5 | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 155 | .032 |

| | | | | | | | |
|-----------|------|-------|----------|----------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 155 | | 39.7 39.7 | 39.7 | | .1 |
| | | | | | | | .3 |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2014

Drai nagewayDPost. rep

INPUT

Description:

| Station | Elevation | Data | num= | 8 | | | | | |
|---------|-----------|-------|-------|-------|--------|-----|---------|-----|-------|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev |
| 100 | 5323 | 104.5 | 5322 | 106.5 | 5321 | 107 | 5320.15 | 117 | |
| 5320.15 | | | | | | | | | |
| 117.5 | 5321 | 122.3 | 5322 | 158 | 5322.5 | | | | |

Manning's n Values

| Sta | n Val | Sta | n Val | Sta | n Val |
|-----|-------|-----|-------|-----|-------|
| 100 | .032 | 100 | .032 | 158 | .032 |

| Bank Sta: | Left | Right | Lengths: | Left | Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|------|---------|-------|-------|--------|
| Expan. | | | | | | | | |
| | 100 | 158 | | 10 | 10 | 10 | | .1 |
| | .3 | | | | | | | |

CROSS SECTION

RIVER: Drai nageway D

REACH: Watson Lane RS: 2013

INPUT

Description:

| Station | Elevation | Data | num= | 4 | | | | |
|---------|-----------|------|--------|-----|--------|-----|--------|--|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | |
| 100 | 5322.6 | 100 | 5320.1 | 110 | 5320.1 | 110 | 5322.6 | |

Manning's n Values

| Sta | n Val | Sta | n Val | Sta | n Val |
|-----|-------|-----|-------|-----|-------|
| 100 | .032 | 100 | .032 | 110 | .032 |

| Bank Sta: | Left | Right | Lengths: | Left | Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|------|---------|-------|-------|--------|
| Expan. | | | | | | | | |
| | 100 | 110 | | 16.5 | 16.5 | 16.5 | | .1 |
| | .3 | | | | | | | |

CROSS SECTION

RIVER: Drai nageway D

REACH: Watson Lane RS: 2012

INPUT

Description:

| Station | Elevation | Data | num= | 4 | | | | |
|---------|-----------|------|---------|-----|---------|-----|--------|--|
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | |
| 100 | 5322.5 | 100 | 5320.01 | 110 | 5320.01 | 110 | 5322.5 | |

Manning's n Values

| Sta | n Val | Sta | n Val | Sta | n Val |
|-----|-------|-----|-------|-----|-------|
| 100 | .032 | 100 | .032 | 110 | .032 |

| Bank Sta: | Left | Right | Lengths: | Left | Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|------|---------|-------|-------|--------|
| Expan. | | | | | | | | |
| | 100 | 110 | | 10 | 10 | 10 | | .1 |
| | .3 | | | | | | | |

CROSS SECTION

RIVER: Drai nageway D

REACH: Watson Lane RS: 2011

Drai nagewayDPost. rep

INPUT

Description:

| Station | Elevation | Data | num= | 8 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|--------|-------|-------|---------|-------|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 5319.95 | 100 | 5323 | 104 | 5322 | 104.7 | 5321 | 105.1 | 5319.95 | 115.1 |
| 115.6 | 5321 | 118 | 5322 | 154.5 | 5322.4 | | | | |

| Manning's n | Values | num= | 3 | Sta | n Val |
|-------------|--------|------|-------|-------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 154.5 | .032 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 154.5 | | 78.5 | 78.5 | 78.5 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
REACH: Watson Lane RS: 2010

INPUT

Description:

| Station | Elevation | Data | num= | 8 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|--------|-------|-------|---------|-------|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 5319.52 | 100 | 5323 | 104 | 5322 | 106.3 | 5321 | 106.9 | 5319.52 | 116.9 |
| 117.5 | 5321 | 120 | 5322 | 153.7 | 5322.6 | | | | |

| Manning's n | Values | num= | 3 | Sta | n Val |
|-------------|--------|------|-------|-------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 153.7 | .032 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 153.7 | | 98 | 98 | 98 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
REACH: Watson Lane RS: 2009

INPUT

Description:

| Station | Elevation | Data | num= | 8 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|---------|--------|--------|-------|-------|---------|-------|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 5318.99 | 100 | 5324 | 106.79 | 5323 | 110.65 | 5322 | 114.6 | 5320.99 | 114.6 |
| 124.6 | 5319 | 124.6 | 5320.99 | 128.74 | 5322 | | | | |

| Manning's n | Values | num= | 3 | Sta | n Val |
|-------------|--------|------|-------|--------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 128.74 | .032 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|--------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 128.74 | | 10 | 10 | 10 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2008

INPUT

Description:

| | | | | | | | | |
|---------|-----------|------|---------|-----|---------|-----|-------|--|
| Station | Elevation | Data | num= | 4 | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | |
| 100 | 5322 | 100 | 5318.85 | 110 | 5318.85 | 110 | 5322 | |

| | | | | | |
|-------------|--------|------|-------|-----|-------|
| Manning's n | Values | num= | 3 | | |
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 110 | .032 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 110 | | 16.5 | 16.5 | 16.5 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2007

INPUT

Description:

| | | | | | | | | | |
|---------|-----------|------|--------|------|--------|---------|--------|---------|--------|
| Station | Elevation | Data | num= | 6 | | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | |
| El ev | 100 | 5323 | 100.79 | 5322 | 100.79 | 5318.85 | 110.79 | 5318.85 | 110.79 |
| 5321 | 111.66 | 5323 | | | | | | | |

| | | | | | |
|-------------|--------|------|-------|--------|-------|
| Manning's n | Values | num= | 3 | | |
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 111.66 | .032 |

| | | | | | | | |
|-----------|------|--------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 111.66 | | 18.5 | 18.5 | 18.5 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2006

INPUT

Description:

| | | | | | | | | | |
|---------|-----------|--------|--------|---------|--------|------|--------|---------|--------|
| Station | Elevation | Data | num= | 9 | | | | | |
| Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | |
| El ev | 100 | 5323 | 103.7 | 5322 | 107.75 | 5321 | 108.75 | 5320.74 | 108.75 |
| 5318.74 | 118.75 | 5318.7 | 118.75 | 5320.74 | 119.79 | 5321 | 123.79 | 5322 | |

| | | | | | |
|-------------|--------|------|-------|--------|-------|
| Manning's n | Values | num= | 3 | | |
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 123.79 | .032 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | | | | | | | |

Drai nageway D Post. rep

| | | | | | | |
|--|-----|-------|-----|-------|--------|-------|
| | Sta | n Val | Sta | n Val | Sta | n Val |
| | 100 | .032 | 100 | .032 | 111.32 | .032 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

Expan. 100 111.32 10 10 10 .1

.3

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2002

INPUT

Descripti on: Station Elevati on Data num= 8

| | | | | | | | | | |
|--------|--------|-------|------|-------|------|-------|------|-------|------|
| Sta | Elev | Data | num= | 8 | | | | | |
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 100 | 5323 | 100.4 | 5322 | 101.4 | 5321 | 104.5 | 5320 | 104.8 | |
| 5318.4 | | | | | | | | | |
| 114.8 | 5318.4 | 115.5 | 5320 | 124.1 | 5322 | | | | |

Manni ng' s n Val ues num= 3

| | | | | | |
|-----|-------|-----|-------|-------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 124.1 | .032 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

Expan. 100 124.1 47 47 47 .1

.3

CROSS SECTION

RIVER: Drai nageway D
 REACH: Watson Lane RS: 2001

INPUT

Descripti on: Station Elevati on Data num= 9

| | | | | | | | | | |
|---------|--------|-------|---------|--------|------|--------|---------|-----|------|
| Sta | Elev | Data | num= | 9 | | | | | |
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 100 | 5324 | 102.2 | 5323 | 110.45 | 5321 | 114.9 | 5320.11 | 115 | |
| 5318.11 | | | | | | | | | |
| 125 | 5318.1 | 125.1 | 5320.11 | 131.7 | 5321 | 139.07 | 5322 | | |

Manni ng' s n Val ues num= 3

| | | | | | |
|-----|-------|-----|-------|--------|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .032 | 100 | .032 | 139.07 | .032 |

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.

Expan. 100 139.07 10 48 90 .3

.5

CROSS SECTION

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 10

INPUT

Descripti on: DOWNSTREAM OF WATSON LANE SPECIAL CULVERT
 Station Elevati on Data num= 13

| | | | | | | | | | |
|-----|------|------|------|-----|------|-----|------|-----|------|
| Sta | Elev | Data | num= | 13 | | | | | |
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |

Drai nagewayDPost. rep

| El ev | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val | Sta | n Val |
|-----------------------|-------|--------|-------|--------|-------|--------|-----|--------|-----|-------|
| 100 | 5322 | | 120 | 5321 | 128 | 5320 | 134 | 5319 | 154 | |
| 5318 | 158 | 5318.2 | 159 | 5316.7 | 168 | 5316.7 | 169 | 5318.3 | 186 | |
| 5318.8 | 195 | 5318.9 | 196 | 5320 | 199 | 5321 | | | | |
| Manni ng' s n Val ues | | | | num= | 3 | | | | | |
| Sta | n Val | Sta | n Val | Sta | n Val | | | | | |
| 100 | .04 | 100 | .035 | 199 | .04 | | | | | |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 199 | | 120 | 100 | 90 | .1 |
| | .3 | | | | | | |

CROSS SECTI ON

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 9

INPUT

Descr i pt i on:

| Stati on | El evati on | Data | num= | 16 | Sta | El ev | Sta | El ev | Sta |
|----------|-------------|--------|------|-------|-----|--------|-----|--------|-----|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 100 | 5322 | | 113 | 5320 | 126 | 5318 | 139 | 5316 | 189 |
| 5316 | 208 | 5318 | 237 | 5318 | 247 | 5318.2 | 248 | 5316.6 | 259 |
| 5316.8 | 260 | 5318.2 | 266 | 5317 | 281 | 5319 | 293 | 5320 | 295 |
| 5321 | 301 | 5322 | | | | | | | |

| Manni ng' s n Val ues | | | | num= | 3 | | | | | |
|-----------------------|-------|-----|-------|------|-------|--|--|--|--|--|
| Sta | n Val | Sta | n Val | Sta | n Val | | | | | |
| 100 | .04 | 100 | .035 | 295 | .04 | | | | | |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 295 | | 350 | 260 | 260 | .1 |
| | .3 | | | | | | |

CROSS SECTI ON

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 8

INPUT

Descr i pt i on:

| Stati on | El evati on | Data | num= | 7 | Sta | El ev | Sta | El ev | Sta |
|----------|-------------|--------|------|--------|-----|-------|-----|-------|-----|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 100 | 5322 | | 160 | 5321 | 223 | 5321 | 286 | 5321 | 329 |
| 5320 | 355 | 5319.5 | 422 | 5319.9 | | | | | |

| Manni ng' s n Val ues | | | | num= | 3 | | | | | |
|-----------------------|-------|-----|-------|------|-------|--|--|--|--|--|
| Sta | n Val | Sta | n Val | Sta | n Val | | | | | |
| 100 | .04 | 286 | .035 | 422 | .04 | | | | | |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 286 | 422 | | 270 | 200 | 220 | .1 |

. 3

CROSS SECTION

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 7

INPUT

Description:

| Station | Elevation | Data | num= | 12 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|-----|-------|-----|-------|-----|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 5317 | 100 | 5322 | 109 | 5320 | 116 | 5318 | 120 | 5317 | 243 |
| 5320 | 253 | 5318 | 278 | 5320 | 297 | 5322 | 359 | 5322 | 385 |
| | 399 | 5320 | 424 | 5322 | | | | | |

| Manning's n | Values | num= | 3 |
|-------------|--------|------|-------|
| Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 |
| | | 297 | .04 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 297 | | 185 | 350 | 235 | .1 |

. 3

| Blocked Obstructions | num= | 1 |
|----------------------|-------|-------|
| Sta L | Sta R | El ev |
| 359 | 424 | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 6

INPUT

Description:

| Station | Elevation | Data | num= | 8 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|-----|-------|-----|-------|-----|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |
| 5317 | 100 | 5322 | 117 | 5320 | 125 | 5318 | 186 | 5317 | 194 |
| | 247 | 5318 | 365 | 5320 | 456 | 5322 | | | |

| Manning's n | Values | num= | 3 |
|-------------|--------|------|-------|
| Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 |
| | | 247 | .04 |

| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Expan. | 100 | 247 | | 185 | 270 | 220 | .1 |

. 3

CROSS SECTION

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 5

INPUT

Description:

| Station | Elevation | Data | num= | 8 | Sta | Elev | Sta | Elev | Sta |
|---------|-----------|-------|------|-------|-----|-------|-----|-------|-----|
| El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta | El ev | Sta |

Drai nageway D Post. rep

| | | | | | | | | | |
|------|-----|------|-----|------|-----|------|-----|------|-----|
| 5317 | 100 | 5322 | 111 | 5320 | 118 | 5318 | 122 | 5317 | 195 |
| | 205 | 5318 | 214 | 5320 | 399 | 5322 | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 | 214 | .04 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 214 | | 185 | 210 | 180 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 4

INPUT

Description: Station Elevation Data num= 12

| | | | | | | | | | |
|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|
| El ev | Sta |
| 5314 | 100 | 5322 | 109 | 5320 | 118 | 5318 | 123 | 5316 | 131 |
| 5318 | 134 | 5312 | 170 | 5312 | 179 | 5314 | 186 | 5316 | 192 |
| | 203 | 5320 | 345 | 5322 | | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 | 192 | .04 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 192 | | 240 | 200 | 120 | .1 |
| | .3 | | | | | | |

CROSS SECTION

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 3

INPUT

Description: UPSTREAM OF OUTFALL PIPE - GOLF COURSE num= 12

| | | | | | | | | | |
|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|
| El ev | Sta |
| 5314 | 100 | 5322 | 111 | 5320 | 117 | 5318 | 124 | 5316 | 132 |
| 5318 | 138 | 5312 | 211 | 5312 | 222 | 5314 | 229 | 5316 | 236 |
| | 387 | 5320 | 521 | 5322 | | | | | |

Manning's n Values num= 3

| | | | | | |
|-----|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 | 236 | .04 |

| | | | | | | | |
|-----------|------|-------|----------|--------------|-------|-------|--------|
| Bank Sta: | Left | Right | Lengths: | Left Channel | Right | Coeff | Contr. |
| Expan. | 100 | 236 | | 120 | 120 | 140 | .1 |
| | .3 | | | | | | |

CULVERT

DRAINAGEWAY.DPOST. REP

RIVER: DRAINAGEWAY D
 REACH: DOWN. OF WATSON RS: 2

INPUT

DESCRIPTION:

DISTANCE FROM UPSTREAM XS = 1
 DECK/ROADWAY WIDTH = 118
 WEIR COEFFICIENT = 2.6

UPSTREAM DECK/ROADWAY COORDINATES

| num= 9 | | | | | | | | | | | | | | |
|--------|----|----------|----|------|-----|----|------|----|------|------|----|----------|----|------|
| Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord |
| 100 | | 5322 | | 5312 | 106 | | 5321 | | 5312 | 130 | | 5320.2 | | 5312 |
| 160 | | 5320.2 | | 5312 | 195 | | 5321 | | 5312 | 236 | | 5321.873 | | 5312 |
| 236 | | 5321.873 | | 5312 | 242 | | 5322 | | 5312 | 1000 | | 5322 | | |

UPSTREAM BRIDGE CROSS SECTION DATA

| STATION ELEVATION DATA num= 12 | | | | | | | | | |
|--------------------------------|------|-----|------|-----|------|-----|------|-----|------|
| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
| 100 | 5322 | 111 | 5320 | 117 | 5318 | 124 | 5316 | 132 | |
| 5314 | | 138 | 5312 | 211 | 5312 | 222 | 5314 | 229 | 5316 |
| 5318 | | 387 | 5320 | 521 | 5322 | | | | |

| MANNING'S N VALUES num= 3 | | | | | |
|---------------------------|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 100 | .04 | 100 | .035 | 236 | .04 |

| BANK STA: | LEFT | RIGHT | COEFF CONTR. | EXPAN. |
|-----------|------|-------|--------------|--------|
| | 100 | 236 | .1 | .3 |

DOWNSTREAM DECK/ROADWAY COORDINATES

| num= 8 | | | | | | | | | | | | | | |
|--------|----|--------|----|------|-----|----|--------|----|------|-----|----|------|----|------|
| Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord | Sta | Hi | Cord | Lo | Cord |
| 0 | | 5322 | | 5312 | 100 | | 5322 | | 5312 | 106 | | 5321 | | 5312 |
| 130 | | 5320.2 | | 5312 | 160 | | 5320.2 | | 5312 | 195 | | 5321 | | 5312 |
| 242 | | 5322 | | 5312 | 253 | | 5322 | | 5312 | | | | | |

DOWNSTREAM BRIDGE CROSS SECTION DATA

| STATION ELEVATION DATA num= 3 | | | | | |
|-------------------------------|------|-----|--------|-----|------|
| Sta | Elev | Sta | Elev | Sta | Elev |
| 0 | 5321 | 120 | 5313.2 | 253 | 5320 |

| MANNING'S N VALUES num= 3 | | | | | |
|---------------------------|-------|-----|-------|-----|-------|
| Sta | n Val | Sta | n Val | Sta | n Val |
| 0 | .04 | 0 | .035 | 253 | .04 |

| BANK STA: | LEFT | RIGHT | COEFF CONTR. | EXPAN. |
|-----------|------|-------|--------------|--------|
| | 0 | 253 | .1 | .3 |

UPSTREAM EMBANKMENT SIDE SLOPE = 0 HORIZ. TO 1.0 VERTICAL
 DOWNSTREAM EMBANKMENT SIDE SLOPE = 0 HORIZ. TO 1.0 VERTICAL
 MAXIMUM ALLOWABLE SUBMERGENCE FOR WEIR FLOW = .95
 ELEVATION AT WHICH WEIR FLOW BEGINS = 5320.2
 ENERGY HEAD USED IN SPILLWAY DESIGN =
 SPILLWAY HEIGHT USED IN DESIGN =
 WEIR CREST SHAPE = BROAD CRESTED

NUMBER OF CULVERTS = 1

| CULVERT NAME | SHAPE | RISE | SPAN |
|--------------|----------|------|------|
| CULVERT #1 | CIRCULAR | 4 | |

FHWA CHART # 1 - CONCRETE PIPE CULVERT

Drai nagewayDPost. rep

FHWA Scale # 1 - Square edge entrance with headwall

Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss
 Coef Exit Loss Coef

0 120 .013 .013 0 .2
 1
 Upstream Elevati on = 5313.4
 Centerline Stati on = 168
 Downstream Elevati on = 5313.2
 Centerline Stati on = 126.5

CROSS SECTI ON

RIVER: Drai nageway D
 REACH: Down. of Watson RS: 1

INPUT

Descripti on: SECTIONS 3 TO 9 REVISED TO SHOW DEVELOPED CONDITIONS AT GOLF COURSE SITE

Stati on Elevati on Data num= 3
 Sta Elev Sta Elev Sta Elev
 0 5321 120 5313.2 253 5320

Manni ng' s n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .04 0 .035 253 .04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr.
 Expan. 0 253 0 0 0 .1
 .3

SUMMARY OF MANNING' S N VALUES

Ri ver: Drai nageway D

| Reach | Ri ver Sta. | n1 | n2 | n3 |
|---------------|-------------|---------|------|------|
| Up. of Watson | 425 | .09 | .1 | .1 |
| Up. of Watson | 390 | .04 | .035 | .04 |
| Up. of Watson | 380 | .04 | .035 | .04 |
| Up. of Watson | 350 | .04 | .035 | .04 |
| Up. of Watson | 340 | .04 | .035 | .04 |
| Up. of Watson | 335 | Culvert | | |
| Up. of Watson | 330 | .04 | .035 | .04 |
| Up. of Watson | 325 | .04 | .035 | .04 |
| Up. of Watson | 320 | .04 | .035 | .04 |
| Up. of Watson | 310 | .04 | .035 | .04 |
| Up. of Watson | 300 | .04 | .035 | .04 |
| Up. of Watson | 295 | Culvert | | |
| Up. of Watson | 290 | .04 | .035 | .04 |
| Up. of Watson | 280 | .035 | .035 | .035 |
| Up. of Watson | 275 | .035 | .035 | .035 |
| Up. of Watson | 270 | .035 | .035 | .035 |
| Up. of Watson | 140.5 | Culvert | | |
| Up. of Watson | 11 | .04 | .035 | .04 |
| Watson Lane | 2016 | .032 | .032 | .032 |
| Watson Lane | 2015 | .032 | .032 | .032 |
| Watson Lane | 2014 | .032 | .032 | .032 |
| Watson Lane | 2013 | .032 | .032 | .032 |
| Watson Lane | 2012 | .032 | .032 | .032 |
| Watson Lane | 2011 | .032 | .032 | .032 |

| | | Drai nageway | DPost. rep | |
|-----------------|------|--------------|------------|------|
| Watson Lane | 2010 | .032 | .032 | .032 |
| Watson Lane | 2009 | .032 | .032 | .032 |
| Watson Lane | 2008 | .032 | .032 | .032 |
| Watson Lane | 2007 | .032 | .032 | .032 |
| Watson Lane | 2006 | .032 | .032 | .032 |
| Watson Lane | 2005 | .032 | .032 | .032 |
| Watson Lane | 2004 | .032 | .032 | .032 |
| Watson Lane | 2003 | .032 | .032 | .032 |
| Watson Lane | 2002 | .032 | .032 | .032 |
| Watson Lane | 2001 | .032 | .032 | .032 |
| Down. of Watson | 10 | .04 | .035 | .04 |
| Down. of Watson | 9 | .04 | .035 | .04 |
| Down. of Watson | 8 | .04 | .035 | .04 |
| Down. of Watson | 7 | .04 | .035 | .04 |
| Down. of Watson | 6 | .04 | .035 | .04 |
| Down. of Watson | 5 | .04 | .035 | .04 |
| Down. of Watson | 4 | .04 | .035 | .04 |
| Down. of Watson | 3 | .04 | .035 | .04 |
| Down. of Watson | 2 | | | |
| Down. of Watson | 1 | Cul vert | | |
| | | .04 | .035 | .04 |

SUMMARY OF REACH LENGTHS

Ri ver: Drai nageway D

| Reach | Ri ver Sta. | Left | Channel | Right |
|-----------------|-------------|----------|---------|-------|
| Up. of Watson | 425 | 140 | 240 | 280 |
| Up. of Watson | 390 | 220 | 220 | 225 |
| Up. of Watson | 380 | 108 | 108 | 108 |
| Up. of Watson | 350 | 12 | 12 | 12 |
| Up. of Watson | 340 | 170 | 167 | 165 |
| Up. of Watson | 335 | Cul vert | | |
| Up. of Watson | 330 | 50 | 50 | 50 |
| Up. of Watson | 325 | 165 | 170 | 175 |
| Up. of Watson | 320 | 210 | 160 | 125 |
| Up. of Watson | 310 | 260 | 125 | 110 |
| Up. of Watson | 300 | 78 | 78 | 78 |
| Up. of Watson | 295 | Cul vert | | |
| Up. of Watson | 290 | 85 | 85 | 85 |
| Up. of Watson | 280 | 135 | 135 | 135 |
| Up. of Watson | 275 | 135 | 135 | 135 |
| Up. of Watson | 270 | 78 | 78 | 78 |
| Up. of Watson | 140.5 | Cul vert | | |
| Up. of Watson | 11 | 120 | 160 | 150 |
| Watson Lane | 2016 | 50.15 | 50.15 | 50.15 |
| Watson Lane | 2015 | 39.7 | 39.7 | 39.7 |
| Watson Lane | 2014 | 10 | 10 | 10 |
| Watson Lane | 2013 | 16.5 | 16.5 | 16.5 |
| Watson Lane | 2012 | 10 | 10 | 10 |
| Watson Lane | 2011 | 78.5 | 78.5 | 78.5 |
| Watson Lane | 2010 | 98 | 98 | 98 |
| Watson Lane | 2009 | 10 | 10 | 10 |
| Watson Lane | 2008 | 16.5 | 16.5 | 16.5 |
| Watson Lane | 2007 | 18.5 | 18.5 | 18.5 |
| Watson Lane | 2006 | 20 | 20 | 20 |
| Watson Lane | 2005 | 10 | 10 | 10 |
| Watson Lane | 2004 | 16.5 | 16.5 | 16.5 |
| Watson Lane | 2003 | 10 | 10 | 10 |
| Watson Lane | 2002 | 47 | 47 | 47 |
| Watson Lane | 2001 | 10 | 48 | 90 |
| Down. of Watson | 10 | 120 | 100 | 90 |

| | | Drai nageway | DPost. rep | |
|-----------------|---|--------------|------------|-----|
| Down. of Watson | 9 | 350 | 260 | 260 |
| Down. of Watson | 8 | 270 | 200 | 220 |
| Down. of Watson | 7 | 185 | 350 | 235 |
| Down. of Watson | 6 | 185 | 270 | 220 |
| Down. of Watson | 5 | 185 | 210 | 180 |
| Down. of Watson | 4 | 240 | 200 | 120 |
| Down. of Watson | 3 | 120 | 120 | 140 |
| Down. of Watson | 2 | Cul vert | | |
| Down. of Watson | 1 | | 0 | 0 |

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
 River: Drai nageway D

| Reach | River Sta. | Contr. | Expan. |
|-----------------|------------|----------|--------|
| Up. of Watson | 425 | .1 | .3 |
| Up. of Watson | 390 | .1 | .3 |
| Up. of Watson | 380 | .1 | .3 |
| Up. of Watson | 350 | .6 | .8 |
| Up. of Watson | 340 | .6 | .8 |
| Up. of Watson | 335 | Cul vert | |
| Up. of Watson | 330 | .6 | .8 |
| Up. of Watson | 325 | .1 | .3 |
| Up. of Watson | 320 | .1 | .3 |
| Up. of Watson | 310 | .6 | .8 |
| Up. of Watson | 300 | .6 | .8 |
| Up. of Watson | 295 | Cul vert | |
| Up. of Watson | 290 | .6 | .8 |
| Up. of Watson | 280 | .6 | .8 |
| Up. of Watson | 275 | .1 | .3 |
| Up. of Watson | 270 | .6 | .8 |
| Up. of Watson | 140.5 | Cul vert | |
| Up. of Watson | 11 | .1 | .3 |
| Watson Lane | 2016 | .1 | .3 |
| Watson Lane | 2015 | .1 | .3 |
| Watson Lane | 2014 | .1 | .3 |
| Watson Lane | 2013 | .1 | .3 |
| Watson Lane | 2012 | .1 | .3 |
| Watson Lane | 2011 | .1 | .3 |
| Watson Lane | 2010 | .1 | .3 |
| Watson Lane | 2009 | .1 | .3 |
| Watson Lane | 2008 | .1 | .3 |
| Watson Lane | 2007 | .1 | .3 |
| Watson Lane | 2006 | .1 | .3 |
| Watson Lane | 2005 | .1 | .3 |
| Watson Lane | 2004 | .1 | .3 |
| Watson Lane | 2003 | .1 | .3 |
| Watson Lane | 2002 | .1 | .3 |
| Watson Lane | 2001 | .3 | .5 |
| Down. of Watson | 10 | .1 | .3 |
| Down. of Watson | 9 | .1 | .3 |
| Down. of Watson | 8 | .1 | .3 |
| Down. of Watson | 7 | .1 | .3 |
| Down. of Watson | 6 | .1 | .3 |
| Down. of Watson | 5 | .1 | .3 |
| Down. of Watson | 4 | .1 | .3 |
| Down. of Watson | 3 | .1 | .3 |
| Down. of Watson | 2 | Cul vert | |
| Down. of Watson | 1 | .1 | .3 |

HEC-RAS Plan: Post Project River: Drainageway D Reach: Up. of Watson Profile: 100-Year

| Reach | River Sta | Profile | Q Total (cfs) | Min Ch El (ft) | W.S. Elev (ft) | Crit W.S. (ft) | E.G. Elev (ft) | E.G. Slope (ft/ft) | Vel Chnl (ft/s) | Flow Area (sq ft) | Top Width (ft) | Froude # Chl |
|---------------|-----------|----------|------------------|-------------------|-------------------|-------------------|-------------------|-----------------------|--------------------|----------------------|-------------------|--------------|
| Up. of Watson | 425 | 100-Year | 288.00 | 5329.20 | 5330.06 | | 5330.16 | 0.059282 | 2.55 | 112.80 | 190.01 | 0.58 |
| Up. of Watson | 390 | 100-Year | 288.00 | 5323.00 | 5324.90 | | 5325.36 | 0.009848 | 5.43 | 53.07 | 35.84 | 0.79 |
| Up. of Watson | 380 | 100-Year | 288.00 | 5320.80 | 5324.33 | | 5324.46 | 0.001876 | 2.87 | 100.41 | 50.01 | 0.36 |
| Up. of Watson | 350 | 100-Year | 288.00 | 5320.60 | 5323.91 | | 5324.17 | 0.003543 | 4.13 | 69.73 | 32.40 | 0.50 |
| Up. of Watson | 340 | 100-Year | 288.00 | 5320.00 | 5323.89 | 5321.92 | 5324.11 | 0.001911 | 3.74 | 77.04 | 20.62 | 0.34 |
| Up. of Watson | 335 | | Culvert | | | | | | | | | |
| Up. of Watson | 330 | 100-Year | 288.00 | 5319.80 | 5323.63 | 5321.87 | 5323.91 | 0.002603 | 4.24 | 67.92 | 18.47 | 0.39 |
| Up. of Watson | 325 | 100-Year | 288.00 | 5320.30 | 5323.55 | | 5323.70 | 0.001795 | 3.07 | 93.92 | 41.32 | 0.36 |
| Up. of Watson | 320 | 100-Year | 288.00 | 5319.20 | 5323.60 | | 5323.61 | 0.000098 | 1.02 | 390.53 | 164.00 | 0.09 |
| Up. of Watson | 310 | 100-Year | 288.00 | 5319.00 | 5323.60 | | 5323.60 | 0.000016 | 0.45 | 1017.55 | 421.01 | 0.04 |
| Up. of Watson | 300 | 100-Year | 288.00 | 5318.50 | 5323.49 | 5320.02 | 5323.56 | 0.000403 | 2.06 | 139.72 | 29.00 | 0.17 |
| Up. of Watson | 295 | | Culvert | | | | | | | | | |
| Up. of Watson | 290 | 100-Year | 288.00 | 5318.30 | 5323.37 | 5319.83 | 5323.43 | 0.000387 | 2.03 | 141.68 | 206.87 | 0.16 |
| Up. of Watson | 280 | 100-Year | 288.00 | 5317.56 | 5323.34 | | 5323.38 | 0.000395 | 2.11 | 174.96 | 65.67 | 0.15 |
| Up. of Watson | 275 | 100-Year | 288.00 | 5317.35 | 5323.29 | | 5323.33 | 0.000378 | 2.17 | 176.10 | 62.15 | 0.16 |
| Up. of Watson | 270 | 100-Year | 210.00 | 5317.21 | 5323.29 | 5318.97 | 5323.30 | 0.000061 | 1.05 | 255.40 | 113.76 | 0.07 |
| Up. of Watson | 140.5 | | Culvert | | | | | | | | | |
| Up. of Watson | 11 | 100-Year | 288.00 | 5317.00 | 5321.38 | | 5321.45 | 0.000715 | 2.11 | 136.42 | 52.52 | 0.23 |