SECTION 5:
PROJECT EXAMPLE

5.0 PROJECT EXAMPLE

Project # 3042
Example Estates

The following application of the Stream Impact Assessment Methodology described in this Manual is provided for a hypothetical residential project to demonstrate the ease with which all required assessments (existing conditions, impacts, and compensation) can be quickly and easily performed.

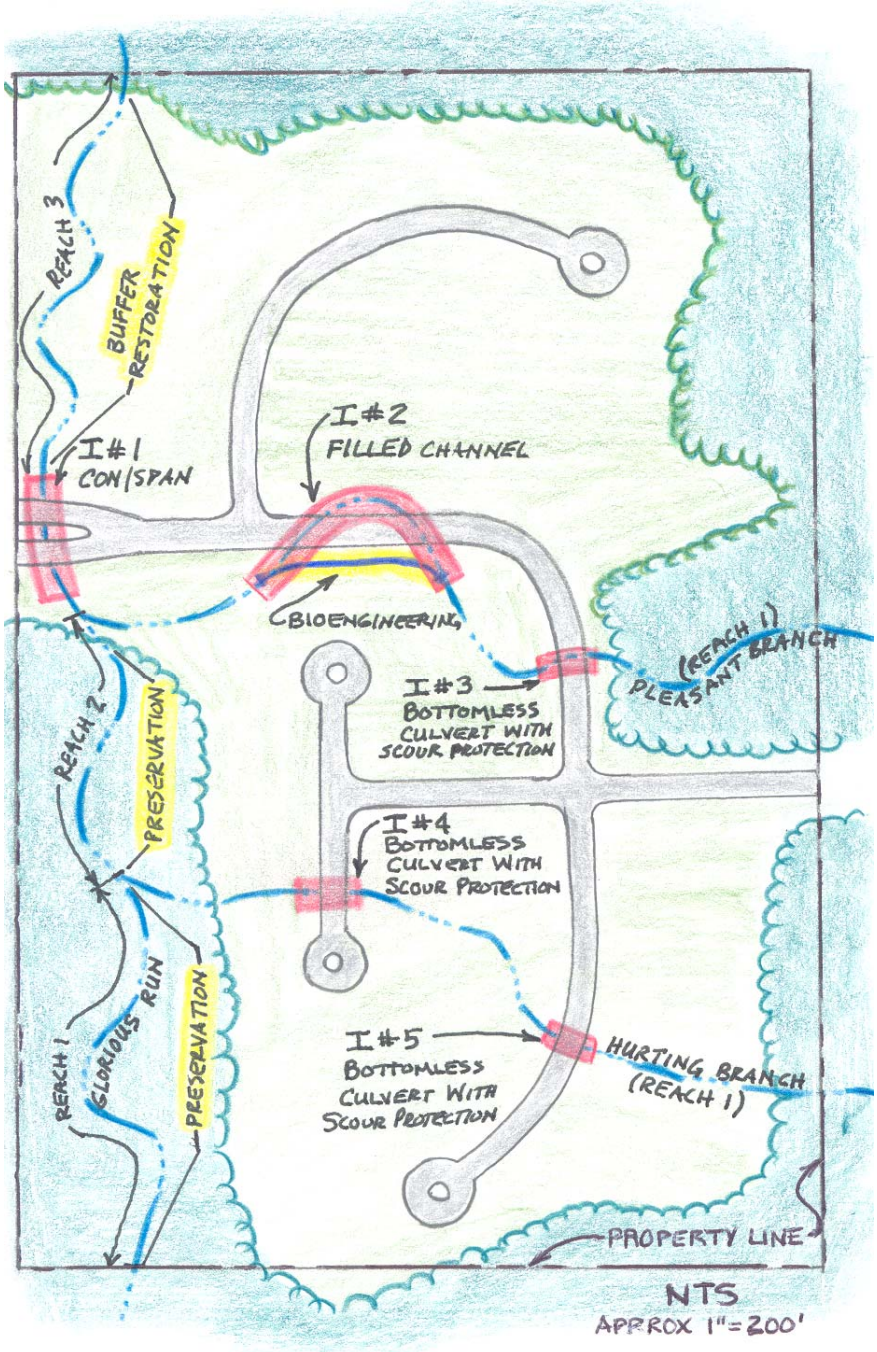
As depicted on the opposite page, several streams are located on the property such that complete avoidance is not practicable. As a result, several types of impacts and associated compensation for those impacts are proposed.

This example shows the steps of assessing the stream reaches, calculating the value of the impacts, determining the value of the proposed compensation activities and determining if the proposed compensation is sufficient to mitigate for the proposed impacts.

Photographs of each stream reach are provided, along with a completed stream assessment form for each reach, so you can employ the assessment method and compare your results with our determination. Impacts and compensation are similarly depicted and assessed for your use in this example.

5.1 EXAMPLE ESTATES

FIGURE 5-1: SITE PLAN OF EXAMPLE ESTATES



GLORIOUS RUN - REACH 1: This reach has an optimal channel condition, riparian buffer, and in-stream habitat; good benthos, and channel alteration is negligible/none.

GLORIOUS RUN - REACH 2: This reach has a marginal channel condition; riparian buffer and in-stream habitat are optimal; fair benthos, and channel alteration is negligible/none.

GLORIOUS RUN - REACH 3: This reach has a marginal channel condition, in-stream habitat, and riparian buffer; poor benthos, and channel alteration is negligible/none.

PLEASANT BRANCH - REACH 1: This reach has an optimal channel condition, suboptimal riparian buffer; marginal in-stream habitat; poor benthos, and channel alteration is negligible/none.

HURTING BRANCH - REACH 1: This reach has a poor channel condition, suboptimal riparian buffer; marginal in-stream habitat; good benthos, and channel alteration is negligible/none.

NOTES:

FORM 1-1: STREAM ASSESSMENT FIELD FORM

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name: GLORIOUS RUN - R1 Team: MSM, SRP, KLS

A Man-Made Channels. (Use the assigned RCI)

1.	Piped Channel	0
2.	Open Channel - concrete	0.25
3.	Open Channel - gabions, riprap	0.50
4.	Open Channel - naturalized	*apply Natural Channel Methodology*

B Natural Channel Methodology

Evaluate the following parameters using the definitions provided, Sections 1.2.1 - 1.2.4.

1. Channel Condition

- ❍ *Severe*
- ❍ *Poor*
- ❍ *Marginal*
- ❍ *Suboptimal*
- ⊗ *Optimal*

2. Riparian Buffer

- ❍ *Poor*
- ❍ *Marginal*
- ❍ *Suboptimal*
- ⊗ *Optimal*

3. In-Stream Habitat

- ❍ *Poor*
- ❍ *Marginal*
- ⊗ *Optimal*

4. Benthic Condition

- ❍ *Poor*
- ❍ *Fair*
- ⊗ *Good*

Benthic Condition Source

- ⊗ *Default*
- ❍ *Site Observation (refer to benthic condition worksheet)*

5. Channel Alterations

- ❍ *Severe*
- ❍ *Moderate*
- ❍ *Minor*
- ⊗ *Negligible/ None*

C Reach Condition Index (RCI)

After evaluating the parameters, use the Reach Flow Charts (pages 48 - 67) to determine the RCI.

Reach Condition Index (RCI) (0 - 6) 6.0

D Other Required Information

Reach Length: 525 (feet)

Drainage Area : 225 (acres)

Summarize the RCI information for each assessment reach in FORM 1-2.

FORM B-1: BENTHIC MACROINVERTEBRATE WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name/Reach No.: _____ Team: MSM, SRP, KLS

GLORIOUS RUN - R1

Taxa	Number	Taxa	Number
Eccoptura sp.	5	Crangonyx sp.	12
Amphinemoura sp.	7	Lirceus sp.	8
Baetis sp.	2	Viviparus sp.	4
Drunella sp.	3	Sphaerium sp.	2
Hydropsyche sp.	10	Chironomidae	15
Pycnopsyche sp.	4	Tipula sp.	8
Neophylax sp.	8		
Corydalus sp.	2		
Boyeria sp.	3		
Calopteryx sp.	1		
Psephenus sp.	6		

Total Number of Taxa (T) 17

Total Number of Benthic Macroinvertebrates (N) 100

Test Metrics/Indices:

_____
_____
_____
_____

In-Stream Habitat	*Benthic Condition*
❍ *Poor*	❍ *Poor*
❍ *Marginal*	❍ *Fair*
⊗ *Optimal*	⊗ *Good*

If benthic condition parameter is other than default (i.e. corresponding in-stream habitat parameter), explain here:

_____
_____
_____
_____
_____

FORM 1-1: STREAM ASSESSMENT FIELD FORM

Project # : 3042-EXAMPLE ESTATES Date: 03/28/2005

Stream Name: GLORIOUS RUN - R2 Team: MSM, SRP, KLS

A Man-Made Channels. (Use the assigned RCI)

1.	Piped Channel	0
2.	Open Channel - concrete	0.25
3.	Open Channel - gabions, riprap	0.50
4.	Open Channel - naturalized	*apply Natural Channel Methodology*

B Natural Channel Methodology

Evaluate the following parameters using the definitions provided in Sections 1.2.1 - 1.2.4.

1. Channel Condition

- ❍ *Severe*
- ❍ *Poor*
- ⊗ *Marginal*
- ❍ *Suboptimal*
- ❍ *Optimal*

2. Riparian Buffer

- ❍ *Poor*
- ❍ *Marginal*
- ❍ *Suboptimal*
- ⊗ *Optimal*

3. In-Stream Habitat

- ❍ *Poor*
- ⊗ *Marginal*
- ❍ *Optimal*

4. Benthic Condition

- ❍ *Poor*
- ⊗ *Fair*
- ❍ *Good*

Benthic Condition Source

- ⊗ *Default*
- ❍ *Site Observation (refer to benthic condition worksheet)*

5. Channel Alteration

- ❍ *Severe*
- ❍ *Moderate*
- ❍ *Minor*
- ⊗ *Negligible/ None*

C Reach Condition Index (RCI)

After evaluating the parameters, use the Reach Flow Charts (pages 48 - 67) to determine the RCI.

Reach Condition Index (RCI) (0 - 6) = 4.0

D Other Required Information

Reach Length: 350 (feet)

Drainage Area : 400 (acres)

Summarize the RCI information for each assessment reach in FORM 1-2.

FORM B-1: BENTHIC MACROINVERTEBRATE WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name/Reach No.: _____ Team: MSM, SRP, KLS

GLORIOUS RUN - R2

Taxa	Number	Taxa	Number
Acroneuria sp.	6		
Epeorus sp.	5		
Baetis sp.	9		
Cheumatopsyche sp.	13		
Hydropsyche sp.	9		
Synurella sp.	3		
Pysella sp.	8		
Corbicula sp.	5		
Oligochaeta	11		
Chironomidae	23		
Turbellaria	13		

Total Number of Taxa (T) 11

Total Number of Benthic Macroinvertebrates (N) 94

Test Metrics/Indices:

_____
_____
_____
_____

In-Stream Habitat	*Benthic Condition*
❍ *Poor*	❍ *Poor*
⊗ *Marginal*	⊗ *Fair*
❍ *Optimal*	❍ *Good*

If benthic condition parameter is other than default (i.e. corresponding in-stream habitat parameter), explain here:

_____
_____
_____
_____
_____

FORM 1-1: STREAM ASSESSMENT FIELD FORM

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name: GLORIOUS RUN - R3 Team: MSM, SRP, KLS

A Man-Made Channels. (Use the assigned RCI)

1.	Piped Channel	0
2.	Open Channel - concrete	0.25
3.	Open Channel - gabions, riprap	0.50
4.	Open Channel - naturalized	*apply Natural Channel Methodology*

B Natural Channel Methodology

Evaluate the following parameters using the definitions provided, Sections 1.2.1 - 1.2.4.

1. Channel Condition

- ❍ *Severe*
- ❍ *Poor*
- ⊗ *Marginal*
- ❍ *Suboptimal*
- ❍ *Optimal*

2. Riparian Buffer

- ❍ *Poor*
- ⊗ *Marginal*
- ❍ *Suboptimal*
- ❍ *Optimal*

3. In-Stream Habitat

- ⊗ *Poor*
- ❍ *Marginal*
- ❍ *Optimal*

4. Benthic Condition

- ⊗ *Poor*
- ❍ *Fair*
- ❍ *Good*

Benthic Condition Source

- ⊗ *Default*
- ❍ *Site Observation (refer to benthic condition worksheet)*

5. Channel Alteration

- ❍ *Severe*
- ❍ *Moderate*
- ⊗ *Minor*
- ❍ *Negligible/ None*

C Reach Condition Index (RCI)

After evaluating the parameters, use the Reach Flow Charts (pages 48 - 67) to determine the RCI.

Reach Condition Index (RCI) (0 - 6) = 2.2

Other Required Information

Reach Length: 550 (feet)

Drainage Area : 625 (acres)

Summarize the RCI information for each assessment reach in FORM 1-2.

FORM B-1: BENTHIC MACROINVERTEBRATE WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name/Reach No.: _____ Team: MSM, SRP, KLS

GLORIOUS RUN - R3

Taxa	Number	Taxa	Number
Cheumatopsyche sp.	33		
Oligochaeta	41		
Chironomidae	65		
Corbicula sp.	17		

Total Number of Taxa (T) 4

Total Number of Benthic Macroinvertebrates (N) 156

Test Metrics/Indices:
(T) + (EPT)2 = 5
% EPT Taxa = 21%
% Chironomidae = 41%

In-Stream Habitat	*Benthic Condition*
⊗ *Poor*	⊗ *Poor*
○ *Marginal*	○ *Fair*
○ *Optimal*	○ *Good*

If benthic condition parameter is other than default (i.e. corresponding in-stream habitat parameter), explain here:

FORM 1-1: STREAM ASSESSMENT FIELD FORM

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name: PLEASANT BRANCH Team: MSM, SRP, KLS

A Man-Made Channels. (Use the assigned RCI)

1. Piped Channel	0
2. Open Channel - concrete	0.25
3. Open Channel - gabions, riprap	0.50
4. Open Channel - naturalized	*apply Natural Channel Methodology*

B Natural Channel Methodology

Evaluate the following parameters using the definitions provided, Sections 1.2.1 - 1.2.4.

1. Channel Condition

- ❍ *Severe*
- ❍ *Poor*
- ❍ *Marginal*
- ❍ *Suboptimal*
- ⊗ *Optimal*

2. Riparian Buffer

- ❍ *Poor*
- ❍ *Marginal*
- ⊗ *Suboptimal*
- ❍ *Optimal*

3. In-Stream Habitat

- ❍ *Poor*
- ❍ *Marginal*
- ⊗ *Optimal*

4. Benthic Condition

- ⊗ *Poor*
- ❍ *Fair*
- ❍ *Good*

Benthic Condition Source

- ❍ *Default*
- ⊗ *Site Observation (refer to benthic condition worksheet)*

5. Channel Alteration

- ❍ *Severe*
- ❍ *Moderate*
- ❍ *Minor*
- ⊗ *Negligible/ None*

C Reach Condition Index (RCI)

After evaluating the parameters, use the Reach Flow Charts (pages 48 - 67) to determine the RCI.

Reach Condition Index (RCI) (0 - 6) = 4.7

D Other Required Information

Reach Length: 1000 (feet)

Drainage Area : 200 (acres)

Summarize the RCI information for each assessment reach in FORM 1-2.

FORM B-1: BENTHIC MACROINVERTEBRATE WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name/Reach No.: PLEASANT BRANCH Team: MSM, SRP, KLS

Taxa	Number	Taxa	Number
Hydropsyche sp.	33		
Oligochaeta	42		
Chironomidae	85		

Total Number of Taxa (T) 3

Total Number of Benthic Macroinvertebrates (N) 160

Test Metrics/Indices:

In-Stream Habitat	*Benthic Condition*
❍ *Poor*	⊗ *Poor*
❍ *Marginal*	❍ *Fair*
⊗ *Optimal*	❍ *Good*

If benthic condition parameter is other than default (i.e. corresponding in-stream habitat parameter), explain here:

The water in this reach was discolored and had a pungent odor, which may have resulted from the sewage treatment plant upstream of this reach. Additionally, there was a noticeable algal bloom and sewage fungus in the water. Furthermore, this reach supported only 3 taxa, all of which are known to be pollution tolerant. In our opinion, the above observations indicate that this stream reach has poor benthic condition.

FORM 1-1: STREAM ASSESSMENT FIELD FORM

Project # : 3042-EXAMPLE ESTATES Date: 03/28/2005

Stream Name: HURTING BRANCH Team: MSM, SRP, KLS

A Man-Made Channels. (Use the assigned RCI)

1.	Piped Channel	0
2.	Open Channel - concrete	0.25
3.	Open Channel - gabions, riprap	0.50
4.	Open Channel - naturalized	*apply Natural Channel Methodology*

B Natural Channel Methodology

Evaluate the following parameters using the definitions provided, Sections 1.2.1 - 1.2.4.

1. Channel Condition

- ❍ *Severe*
- ⊗ *Poor*
- ❍ *Marginal*
- ❍ *Suboptimal*
- ❍ *Optimal*

2. Riparian Buffer

- ❍ *Poor*
- ❍ *Marginal*
- ⊗ *Suboptimal*
- ❍ *Optimal*

3. In-Stream Habitat

- ⊗ *Poor*
- ❍ *Marginal*
- ❍ *Optimal*

4. Benthic Condition

- ❍ *Poor*
- ❍ *Fair*
- ⊗ *Good*

Benthic Condition Source

- ❍ *Default*
- ⊗ *Site Observation (refer to benthic condition worksheet)*

5. Channel Alteration

- ❍ *Severe*
- ❍ *Moderate*
- ❍ *Minor*
- ⊗ *Negligible/ None*

C Reach Condition Index (RCI)

After evaluating the parameters, use the Reach Flow Charts (pages 48 - 67) to determine the RCI.

Reach Condition Index (RCI) (0 - 6) = 3.5

D Other Required Information

Reach Length: 825 (feet)

Drainage Area : 150 (acres)

Summarize the RCI information for each assessment reach in FORM 1-2.

FORM B-1: BENTHIC MACROINVERTEBRATE WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Stream Name/Reach No.: HURTING BRANCH Team: MSM, SRP, KLS

Taxa	Number	Taxa	Number
Taeniopteryx sp.	10	Crangonyx sp.	11
Peltoperla sp.	15	Lirceus sp.	7
Ephemera sp.	6	Ferissa sp.	4
Drunella sp.	8	Sphaerium sp.	2
Stenonema sp.	10	Chironomidae	7
Triaenodes sp.	2	Tipula sp.	3
Molanna sp.	1	Oligochaeta	5
Corydalus sp.	2		
Nepa sp.	1		
Calopteryx sp.	2		
Psephenus sp.	8		

Total Number of Taxa (T) 18

Total Number of Benthic Macroinvertebrates (N) 104

Test Metrics/Indices:

In-Stream Habitat		Benthic Condition
⊗ Poor		❍ Poor
❍ Marginal		❍ Fair
❍ Optimal	x	❍ Good

If benthic condition parameter is other than default (i.e. corresponding in-stream habitat parameter), explain here:

The Virginia Department of Environmental Quality's (VDEQ) biological water quality monitoring data shows that this stream has a Stream Condition Index (SCI) rating of "Good". Additionally, this stream reach supported a diverse macroinvertebrate community, including representatives from 18 taxa, several of which are pollution sensitive. Therefore, it is our opinion that this stream has good benthic condition, even though a recent reservoir breach degraded the in-stream habitat..

FORM 1-2: SUMMARY OF STREAM ASSESSMENTS

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Team : MSM, SRP, KLS

Stream Name	Reach Name	Drainage Area DA	Length L	RCI
		(acres)	(feet)	
GLORIOUS RUN	1	225	525	6.0
	2	400	350	4.0
	3	625	550	2.2
PLEASANT BRANCH	1	200	1000	4.7
HURTING BRANCH	1	150	825	3.5

IMPACT 1 - Conspan with a natural stream bed and only temporary impacts during construction.

IMPACTS 3, 4, 5 - Bottomless culverts with scour protection.

FORM 2-1: IMPACT ASSESSMENT WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Team : MSM, SRP, KLS

IMPACT #	Drainage Area DA	RCI	Impact Factor IF	Length L_I	Impacts I
	(A)		(B)	(C)	I = A * B * C
	(acres)			*(feet)*	*(SCUs)*
1 - CON/SPAN	600	2.2	0.25	140	77
2 - FILL CHANNEL	200	4.7	1.00	300	1410
3 - BOTTOMLESS	175	4.7	1.00	65	305.5
4 - BOTTOMLESS	150	3.5	1.00	60	210
5 - BOTTOMLESS	125	3.5	1.00	55	192.5
				TOTAL IMPACTS (I_T) [1] =	2195

[1] Total Impacts ($\mathbf{I_T}$) = Total Required Mitigation Credits.

RESTORATION 1 - Riparian buffer restoration with the removal of invasive species, deep disking, and replanting with native plant stock.

RESTORATION 2 - Bioengineering and relocation of an Urban/ suburban stream.

FORM 3-1: STREAM PRESERVATION WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Team : MSM, SRP, KLS

Stream/Reach Name	Drainage Area DA	RCI	PF	Length L_P	Mitigation Credits $P_R = RCI \times PF \times L_P$
	(acres)			*(feet)*	*(SCU)*
GLORIOUS RUN - R1	225	6.0	0.05	525	157.5
GLORIOUS RUN - R2	400	4.0	0.03	350	42

TOTAL PRESERVATION MITIGATION CREDITS (P_T) = 199.5

FORM 3-2: RESTORATION COMPENSATION SUMMARY WORKSHEET

Project # : 3042 -EXAMPLE ESTATES Date: 03/28/2005

Team : MSM, SRP, KLS

Stream/Reach Name	Restoration Type	Drainage Area DA	RF_T	Length L_R	Restoration Credits $S_R = RF_T \times L_R$
		(acres)		*(feet)*	*(SCU)*
1 - GLORIOUS - R3	REMOVE NON-NATIVE, DISK, SEED, TREES/ SHRUBS	625	1.25	550	687.5
2 - PLEASANT - R1	BIOENGINEER BANK STABILIZATION	200	4.5	225	1012.5
TOTAL RESTORATION (S_T) =					1700

FORM 3-3a: WEIGHTED DRAINAGE AREAS FOR IMPACTED STREAMS (DA_{WI}) - CALCULATION WORKSHEET

Stream/Reach Name	Impact #	Length L_I	Drainage Area DA	DA * L_I
		(feet)	(acres)	(ft-ac)
GLORIOUS RUN - R3	1	140	600	84,000
PLEASANT BRANCH - R1	2	300	200	60,000
PLEASANT BRANCH - R1	3	65	175	11,375
HURTING BRANCH - R1	4	60	150	9,000
HURTING BRANCH - R1	5	55	125	6,875
	$\Sigma (L_I) =$	620		⇣
			$\Sigma (DA * L_I) =$	171,250

$$DA_{WI} = \frac{\Sigma (DA * L_I)}{\Sigma L_I} = \frac{171,250}{620} = 276.2 \text{ acres}$$

FORM 3-3b: WEIGHTED DRAINAGE AREA FOR STREAM COMPENSATION (DA_{WC}) - CALCULATION WORKSHEET

Stream/Reach Name	Restoration Type	Length [a] L_P or L_R	Drainage Area DA	DA* L
		(feet)	(acres)	(ft-ac)
GLORIOUS RUN - R3	PLANTING	550	625	343,750
PLEASANT BRANCH - R1	N.C.D. W/O STRUCTURES	225	200	45,000
GLORIOUS RUN -R1	PRESERVATION	525	225	118,125
GLORIOUS RUN - R2	PRESERVATION	325	400	130,000
	$\Sigma (L) =$	1625		⇣
			$\Sigma (DA_{WC} * L) =$	636,875

$$DA_{WC} = \frac{\Sigma (DA * L)}{\Sigma L} = \frac{636,875}{1625} = 391.9 \text{ acres}$$

[a] Use applicable Length of Restoration or Length of Preservation

FORM 3-4: STREAM COMPENSATION SUMMARY

Project #: 3042 - EXAMPLE ESTATES Date: 03/28/2005

Stream Name: GLORIOUS RUN (INC. PLEASANT AND HURTING BRANCHES) Reach: _____

A Un-weighted Stream Compensation Total

Total Preservation Credits, P_T = 199.5 (Form 3-1)

Total Restoration Credits, S_T = 1,700 (Form 3-2)

Total Unweighted Compensation, C_T = 1,899.5 ($C_T = P_T + S_T$)

B Weighted Stream Compensation Total

Weighted Drainage Area for Impacted Streams, (DA_{WI})

DA_{WI} = 276.2 acres (Form 3-4a)

Weighted Drainage Area for Stream Compensation, (DA_{WC})

DA_{WC} = 391.9 acres (Form 3-4b)

$$CF = \begin{cases} 0.53, & \text{for } (DA_{WI}/DA_{WC}) < 0.2 \\ (DA_{WI}/DA_{WC})^{0.39}, & \text{for } 0.2 \leq (DA_{WI}/DA_{WC}) \leq 3.0 \\ 1.53, & \text{for } (DA_{WI}/DA_{WC}) > 3.0 \end{cases}$$

$CF = (DA_{WI}/DA_{WC})^{0.39}$ = 0.71

Total Weighted Compensation, $C_{WT} = C_T / CF$ = 2,675 SCUs

C Compensation Requirements

Compensation Required, I_T = 2,195 SCUs (Form 2-1)

Compensation Provided, C_{WT} = 2,675 SCUs (Form 3-4, Section B)

- If TOTAL Compensation Provided ≥ Compensation Required, Compensation Requirements are satisfied.
- If TOTAL Compensation Provided is < Compensation, additional Compensation is Required. Record below:

  Additional SCUs Required _____ SCUs (if $C_{WT} - I_T < 0$)

  Surplus SCUs Provided: 480 SCUs (if $C_{WT} - I_T > 0$)

NOTES: