QUANTIFYING FUNCTIONAL LOSS USING THE DEBIT CALCULATOR

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Stream Debits and Credits
Section 404 of Clean Water Act

Debit is a unit of measure (e.g. a functional or areal measure or other suitable metric) representing the loss of aquatic functions at an impact or project site.

The Corps uses stream debits to assess a loss of function along a stream segment associated with a permitted activity.

Credit is a unit of measure (e.g. a functional or areal measure or other suitable metric) representing the accrual or attainment of aquatic functions at a compensatory mitigation site.

The Corps uses stream credits to measure an increase in function, for instance development of a mitigation area or a restoration project. (33 CFR 332.2)

Calculating Functional Lift and Loss

QUANTITY (linear feet of stream)

X CSQT CONDITION SCORE (% function)

FUNCTIONAL FEET

Functional lift or loss is (ΔFunctional Feet)

= Proposed FFS- Existing FFS

The delta can be either positive or negative. The delta is the unit of measure representing the loss or accrual of aquatic functions at an impact or project site.

Stream Debits – CSQT Debit Calculator Workbook

COMP v1 includes Appendix A – Stream Debit Calculation Guide which provides a step-by step instructions on how project impacts and functional loss can be evaluated.

The CSQT Debit Calculator Workbook will be used as the basis for the approach to debiting and should be used to assess project impact sites and anticipated stream losses.

To calculate debits, this procedure uses the existing condition of the stream and the anticipated functional loss within a given length (reach) of stream caused by the permitted activity.

Stream Debits - CSQT Debit Calculator Workbook

Challenges with calculating debits:

- Existing condition data may not always be available
- Post-project condition may not always be accurately estimated
- Permitted impacts are typically not monitored after construction, making it difficult to validate a proposed score.
- Collection of data can be time/money intensive.

The Debit Calculator Workbook can calculate functional loss even when a prospective permittee opts to not collect existing conditions data or if data to inform proposed condition scores is not available.

The Stream Debit Calculation Guide lays out three options to calculate functional loss using the CSQT Debit Calculator workbook.

Three Options for Stream Debits

Debit Option	Existing Condition Score (ECS)	Proposed Condition Score (PCS)
1	Assess existing condition using Quantification Tool worksheet	Estimate proposed condition using Quantification Tool worksheet
2	Assess existing condition using Quantification Tool worksheet	Use Debit Tool worksheet
3	Default score in Debit Tool worksheet	Use Debit Tool worksheet

Calculating Functional Loss: Debit Option 1

The Quantification Tool worksheet is used to calculate the existing and proposed condition scores.

Information needs:

- Existing and proposed stream lengths
- Existing condition assessment
- Detailed project design reports, modeling results, drawings, field investigations, etc. to accurately predict the post-project condition within the Reach Hydrology & Hydraulics and the Geomorphology categories (and Physicochemical and Biological categories if impacts will affect these functions).

Best Use: when detailed information to predict the proposed post-project score is available.

Calculating Functional Loss: Debit Option 1

Step 1: Determine the parameters and metrics that will be used to assess the reach (See parameter selection in CSQT User Manual Chapter 2)

Step 2: Complete the Project Assessment worksheet (see User Manual Section 1.2.a.)

Step 3: Complete the Quantification Tool worksheet, including the Site Information and Reference Selection section, the Existing Condition Assessment section and the Proposed Condition Assessment section (see User Manual Section 1.2.c)

Link to Stream Debit Example 1

Calculating Functional Loss using Debit Option 1

Existing Condition:

Existing Condition Score = 0.36
Existing Stream Length = 500 Ft
Functional Foot = 180 FF

Estimate Proposed Condition

Proposed Condition Score = 0.26
Proposed Stream Length = 500 Ft
Functional Foot = 130 FF

Proposed Loss of FF = 180 FF – 130 FF = 50 FF

Calculating Functional Loss: Debit Option 2

The Quantification Tool worksheet is used to calculate an existing condition score (same as Option 1)

The Debit Tool worksheet is used to estimate the proposed, post-impact condition score and calculate functional loss.

Information needs:

- Existing and proposed stream lengths
- Existing condition assessment
- Impact Severity Tier

Best Use: This method is best suited for users who are able to evaluate the existing condition, but do not have accurate data and information to inform the proposed condition within the CSQT

Calculating Functional Loss: Debit Option 2

Step 1:`Determine the metrics that will be used to assess the reach (See Parameter Selection in Section 2.3). Users must consult with the Corps to determine the parameters necessary to evaluate impacts.

Step 2: Complete the Project Assessment worksheet (see Section 1.2.a).

Step 3: Complete the Site Information and Reference Selection and Existing Condition Assessment sections of the Quantification Tool worksheet (see Sections 1.2.c and 4.2).

Step 4: Complete the Debit Tool worksheet (Section 4.5).

Link to Stream Debit Example 2, but first let's talk a little about what the debit tool is.

Debit Tool Steps

1. Determine existing and proposed stream lengths to be impacted.
2. Perform a function-based assessment of proposed impact site.
3. Use SQT to calculate the Existing Condition Score.
4. Determine Impact Severity Tier.
5. Calculate Proposed Condition Score.
6. Calculate Loss (Debits) in Functional Feet.

Impact Severity Tiers and PCS Calculation

To use the debit tool, the user is willing to accept certain assumptions about the overall condition of the reach and/or about the severity of the impact.

The two primary assumptions we make when we use the Debit Tool involve the Impact Severity Tiers and the Existing Conditions Score.

Impact Severity Tiers

Tier	Description (Impacts to function-based parameters)	Example Activities
0	No permanent impact on any of the key function based parameters.	Bio-engineering of stream banks
1	Impacts to riparian vegetation and/or lateral stability.	Bank stabilization and utility crossings.
2	Impacts to riparian vegetation, lateral stability, and bed form diversity.	Utility crossings, bridges, bottomless arch culverts
3	Impacts to riparian vegetation, lateral stability, bed form diversity, and floodplain connectivity	Bottomless arch culverts, small channelization/grading projects
4	Impacts to riparian vegetation, lateral stability, bed form diversity, and floodplain connectivity. Potential impacts to temperature, processing of organic matter, macroinvertebrate and fish communities.	Channelization, Arch culverts, weirs/impoundments
5	Loss of all aquatic functions	Pipes/relocation, fill of channels from mining or development

Impact Severity Tier and PCS Calculation Data Based Assumptions

Impact severity tiers 1 – 3:

- The equation is based on a maximum existing condition score of 0.60.
- The maximum existing condition score considers functions within Reach Hydrology & Hydraulics, and Geomorphology. In these tiers, there is no anticipated permanent functional loss to physicochemical or biology functions.

Impact severity tiers 4 -5:

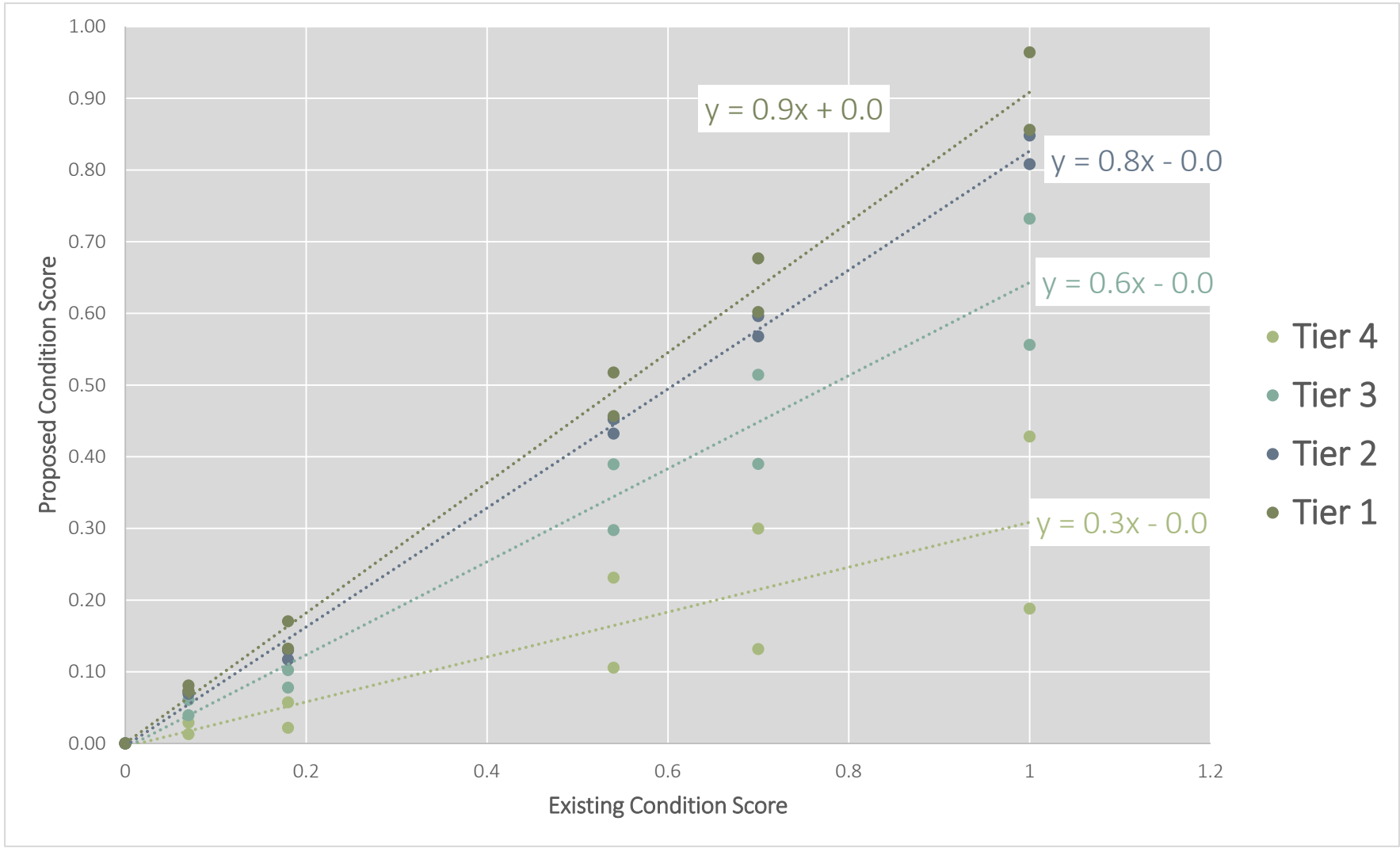
- The equation is based on a maximum existing condition score of 1.00.
- The maximum existing condition score considers the potential for permanent loss in all categories, including physicochemical and biology.

Note: The Debit Tool worksheet uses a default existing condition score of 0.80 (0.48 for Tiers 1-3) unless data are provided in the existing condition assessment of the Quantification Tool worksheet.

Proposed Condition Score (PCS)

Impact Severity Tier	PCS
5 – Loss of all aquatic functions	0
1 – 4	PCS Curves

Proposed Condition Score Calculation



PCS Calculation

Impact Severity Tier	PCS Equation	Percent Loss
1	PCS = 0.83 * ECS	17
2	PCS = 0.65* ECS	35
3	PCS = 0.37 * ECS	63
4	PCS = 0.27 * ECS	73
5	PCS=0	100%

Link to Stream Debit Example 2 now that we understand a bit more about what the debit tool is.

Calculating Functional Loss using Debit Option 2

Existing Condition:

Existing Condition Score = 0.36
Existing Stream Length = 500 Ft
Functional Foot = 180 FF

Estimate Proposed Condition

Proposed Condition Score = 0.13
Proposed Stream Length = 500 Ft
Functional Foot = 65 FF

Proposed Loss of FF = 180 FF – 65 FF = 115 FF

Calculating Functional Loss: Debit Option 3

The Debit Tool worksheet is used with a default existing condition score (0.80) to estimate the proposed, post-impact condition score and calculate functional loss.

Information needs:

- Existing and proposed stream lengths
- Impact Severity Tier

Best Use: This option is available for users who are unable to perform an assessment of the project reach prior to impact. This option is the fastest and easiest method for determining functional loss.

Calculating Functional Loss: Debit Option 3

The following steps are needed to complete debit option 3:

1. Complete the Project Assessment worksheet (see User Manual Section 1.2.a.)

2. Complete the Debit Tool worksheet (User Manual Section 4.5.)

Link to Stream Debit Example 3

Calculating Functional Loss using Option 3

Existing Condition:

Existing Condition Score = 0.48
Existing Stream Length = 500 Ft
Functional Foot = 240 FF

Estimate Proposed Condition

Proposed Condition Score = 0.18
Proposed Stream Length = 500 Ft
Functional Foot = 90 FF

Proposed Loss of FF = 240 FF – 90 FF = -150 FF

Comparing debits from each of the three options

Option 1: Debit = -154 FF
Based off field data collection and use of the CSQT for existing and proposed conditions.
More work, lower score, but based off quantifiable data collection.

Option 2: Debit = -115 FF
Based off field data collection and use of the CSQT for existing conditions data, but use of the Debit Tool (and it's assumptions concerning Impact Assumptions and PCS).
Less work, higher score

Option 3: Debit = -150
Based off only the debit tool and no data collection is required.
Least work, highest score.