| Job No. 7131 | NAISMITH ENGINEERING, INC. | SHEET 1 |
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| Description: Example Calculations for Pollutant Loading Comparison | | Date: 1/5/2005 |
| Regional Water Quality Plan – Barton Springs Segment | | By: GAJ |

# BACKGROUND INFORMATION

**FOR INTERIM REVIEW**
Not for Construction, Bidding, or Permit Purposes

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2 Pages of Calculations

## Pollutant Loadings

Pollutant Loadings per unit area from undeveloped land are represented by the variable P.
Pollutant Loadings per unit area from developed land are represented by the variable P' and are related to P by the following equation:

$$L' = L \times C$$

Where C is a factor representing the magnitude of increase in that pollutant.
The total unit pollutant loading for a tract of land which is partially developed would be represented by the following equation:

$$L_{total} = A_P \times L + A_I \times L'$$

Where $A_P$ represents the undeveloped (pervious) fraction of the area and $A_I$ represents the developed (impervious) fraction of the area.

## BMP Effectiveness

Water quality protection best management practices (BMPs) are to be employed on the developed portion.
The pollutant removal reduction rating of a BMP is quantified by the following equation:

$$E_R = 1 - (E_{BMP}/100)$$

Where $E_{BMP}$ is the BMP removal efficiency in percent.

# POLLUTANT LOADING ESTIMATES

## Assumptions

A tract of land is to be developed at 15% Impervious Cover (IC). Correspondingly, $A_P = 0.85$ and $A_I = 0.15$.
Studies indicate that for suspended pollutants, $C_s = 5.1$ and for dissolved pollutants, $C_d = 2.6$.
Studies indicate that some BMPs with removal efficiencies of 70%, 80% and 90% are suitable for use at the site.
Correspondingly, $E_{R70} = 0.3$, $E_{R80} = 0.2$, $E_{R90} = 0.1$
A goal for the developed condition is no net increase in pollutant loadings.

## Uncontrolled Condition

### Suspended Pollutants

For suspended pollutants, the unit pollutant loading for the developed tract would be:

$$L_{total} = A_p \times L + A_I \times L' = A_P \times L + A_I \times L \times C_s$$

$$L_{total} = 0.85 \times L + 0.15 \times L \times 5.1 = \mathbf{1.615\ L}$$

This represents an approximately 62% increase in suspended pollutant loadings from the site.

### Dissolved Pollutants

For dissolved pollutants, the unit pollutant loading for the developed tract would be:

$$L_{total} = A_p \times L + A_I \times L' = A_P \times L + A_I \times L \times C_d$$

$$L_{total} = 0.85 \times L + 0.15 \times L \times 2.6 = \mathbf{1.24\ L}$$

This represents an approximately 24% increase in dissolved pollutant loadings from the site.

## Controlled Condition

### Suspended Pollutants

For suspended pollutants, the unit pollutant loading for the developed tract, with a 70% efficient BMP would be:

$L_{total} = A_P \times L + A_I \times L' \times E_R = A_P \times L + A_I \times L \times C_s \times E_{R70}$

$L_{total} = 0.85 \times L + 0.15 \times L \times 5.1 \times 0.3 =$ **1.0795 L**

This represents an approximately 8% increase in suspended pollutant loadings from the site, indicating that a BMP with 70% removal efficiency does not meet the goal of no net increase in loading.

With an 80% efficient BMP, the unit pollutant loading for the developed tract would be:

$L_{total} = A_P \times L + A_I \times L' \times E_R = A_P \times L + A_I \times L \times C_s \times E_{R80}$

$L_{total} = 0.85 \times L + 0.15 \times L \times 5.1 \times 0.2 =$ **1.003 L**

This represents an approximately 3% increase in suspended pollutant loadings from the site, indicating that a BMP with 80% removal efficiency does not meet the goal of no net increase in loading.

With a 90% efficient BMP, the unit pollutant loading for the developed tract would be:

$L_{total} = A_P \times L + A_I \times L' \times E_R = A_P \times L + A_I \times L \times C_s \times E_{R90}$

$L_{total} = 0.85 \times L + 0.15 \times L \times 5.1 \times 0.1 =$ **0.9265 L**

**This represents an approximately 7% decrease in suspended pollutant loadings from the site, indicating that a BMP with 90% removal efficiency will achieve the goal of no net increase in loading.**

### Dissolved Pollutants

For dissolved pollutants, the unit pollutant loading for the developed tract, with a 90% efficient BMP would be:

$L_{total} = A_P \times L + A_I \times L' \times E_R = A_P \times L + A_I \times L \times C_d \times E_{R90}$

$L_{total} = 0.85 \times L + 0.15 \times L \times 2.6 \times 0.1 =$ **0.889 L**

**This represents an approximately 11% decrease in dissolved pollutant loadings from the site, indicating that a BMP with 90% removal efficiency is required to achieve the goal of no net increase in loading.**