Appendix E: Supporting Information for NPDES Permit Writers

EPA's TMDL for temperature in the Umpqua River basin assesses the impacts of point source discharges required to obtain National Pollutant Discharge Elimination System (NPDES) permits and establishes wasteload allocations for current and future discharges. However, EPA is not the permitting authority for facilities in the State of Oregon. This appendix provides equations that the Oregon Department of Environmental Quality (ODEQ) permitting program typically uses to implement wasteload allocations consistent with a TMDL. ODEQ may rely upon these equations, as necessary, when issuing NPDES permits consistent with the EPA Umpqua River Basin Temperature TMDL assigned wasteload allocations.

WLA attainment equation

When evaluating current discharge, use **Equation 11** to calculate the excess thermal loading (ETL). The ETL was compared against the TMDL wasteload allocation (WLA) to assess attainment.

$$ETL = (T_E - T_C) \cdot Q_E \cdot C_F \qquad \text{\textbf{Equation 11}}$$

where,

$ETL =$ The daily excess thermal load (kilocalories/day), expressed as a rolling seven-day average.

$T_C =$ The point of discharge applicable river temperature criterion (°C) (T_c)

$T_E =$ The daily maximum effluent temperature (°C)

$Q_E =$ The daily mean effluent flow (cfs or MGD)

$C_F =$ Conversion factor for flow in cubic feet per second (cfs): 2,446,665

$$\left(\frac{1 \text{ m}}{3.2808 \text{ ft}}\right)^3 \cdot \frac{1000 \; kg}{1 \; m^3} \cdot \frac{86400 \; sec}{1 \; day} \cdot \frac{1 \; kcal}{1 \; kg \; \cdot 1°\text{C}} = 2,446,665$$

Conversion factor for flow in millions of gallons per day (MGD): 3,785,411

$$\frac{1 \; m^3}{264.17 \; gal} \cdot \frac{1000 \; kg}{1 \; m^3} \cdot \frac{1000000 \; gal}{1 \; million \; gal} \cdot \frac{1 \; kcal}{1 \; kg \; \cdot 1°\text{C}} = 3,785,441$$

Calculating current change in temperature

Equation 2a2a is used to assess the change in temperature based on point source effluent discharge, river flow, and the applicable temperature criteria.

$$\Delta T_{Current} = \left(\frac{Q_E}{Q_E + Q_R}\right) \cdot (T_E - T_C)$$ **Equation 2a2**

where,

$\Delta T_{Current} =$ The current river temperature increase (°C) above the applicable river temperature criterion using 100% of river flow.

$Q_E =$ The daily mean effluent flow (cfs).

When effluent flow is in million gallons per day (MGD) convert to cfs:

$$\frac{1 \text{ million } gallons}{1 \ day} \cdot \frac{1.5472 \ ft^3}{1 \text{ million gallons}} = 1.5472$$

$Q_R =$ The daily mean river flow rate, upstream (cfs).

When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$T_E =$ The daily maximum effluent temperature (°C)

$T_C =$ The point of discharge applicable river temperature criterion (°C). When the minimum duties provision at OAR 340-041-0028(12)(a) applies T_C = the 7DADM measured at the facility intake.

Calculating acceptable effluent temperatures

Equation 3a is used to calculate the daily maximum effluent temperatures (°C) acceptable under the allocated portion of the human use allowance (ΔT) and the wasteload allocation (WLA).

$$T_{E\_WLA} = \frac{(Q_E + Q_R) \cdot (T_C + \Delta T) - (Q_R \cdot T_C)}{Q_E}$$ **Equation 3a** (using ΔT)

$$T_{E\_WLA} = \frac{(WLA)}{Q_E \cdot C_F} + T_C$$ **Equation 3a** (using WLA)

where,

$T_{E\_WLA} =$ Daily maximum effluent temperature (°C) allowed under the wasteload allocation.

When T_{E_WLA} is > 32 deg-C, T_{E_WLA} = 32 deg-C as required by the thermal plume limitations in OAR 340-041-0053(2)(d)(B).

$WLA =$ Wasteload allocation (kilocalories/day) from <mark>Error! Reference source not found.</mark> (see TMDL document).

$\Delta T =$ The assigned portion of the human use allowance at the point of discharge. Represents the maximum temperature increase (°C) above the applicable river temperature criterion using 100% of river flow not to be exceeded by each individual source from all outfalls combined. When the minimum duties provision at OAR 340-041-0028(12)(a) applies, ΔT = 0.0.

$Q_E =$ The daily mean effluent flow (cfs).

When effluent flow is in million gallons per day (MGD) convert to cfs:

$$\frac{1 \text{ million } gallons}{1 \ day} \cdot \frac{1.5472 \ ft^3}{1 \text{ million gallons}} = 1.5472$$

$Q_R =$ The daily mean river flow rate, upstream (cfs).

When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$T_{C,i} =$ The point of discharge applicable river temperature criterion (°C) (T_c); or when the minimum duties provision at OAR 340-041-0028(12)(a) applies $T_{C,i}$ = the 7DADM measured at the facility intake (T_i).

$C_F =$ Conversion factor for flow in cubic feet per second (cfs): 2,446,665

$$\left(\frac{1 \ m}{3.2808 \ ft}\right)^3 \cdot \frac{1000 \ kg}{1 \ m^3} \cdot \frac{86400 \ sec}{1 \ day} \cdot \frac{1 \ kcal}{1 \ kg \ \cdot 1°C} = 2,446,665$$

Calculating acceptable effluent flows

Equation 4 is used to calculate the daily mean effluent flow (cfs) acceptable under the allocated portion of the human use allowance (ΔT) and the wasteload allocation (WLA).

$$Q_{E\_WLA} = \frac{(Q_R \cdot T_C) - ((T_C + \Delta T) * Q_R)}{T_C + \Delta T - T_E}$$ **Equation 4a** (using ΔT)

$$Q_{E\_WLA} = \frac{(WLA)}{(T_E - T_C) * C_F}$$ **Equation 4b** (using WLA)

where,

$Q_{E\_WLA} =$ Daily mean effluent flow (cfs) allowed under the wasteload allocation.

$WLA =$ Wasteload allocation (kilocalories/day) from <mark>Error! Reference source not found.2</mark> (see TMDL document).

$\Delta T =$ The assigned portion of the human use allowance at the point of discharge. Represents maximum temperature increase (°C) above the applicable river temperature criterion using 100% of river flow

not to be exceeded by each individual source from all outfalls combined. When the minimum duties provision at OAR 340-041-0028(12)(a) applies, $\Delta T = 0.0$.

$T_E =$ The daily maximum effluent temperature (°C).

$Q_R =$ The daily mean river flow rate, upstream (cfs).

When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$T_{C,i} =$ The point of discharge applicable river temperature criterion (°C) (T_c); or when the minimum duties provision at OAR 340-041-0028(12)(a) applies $T_{C,i}$ = the 7DADM measured at the facility intake (T_i).

$C_F =$ Conversion factor for flow in cubic feet per second (cfs): 2,446,665

$$\left(\frac{1\ m}{3.2808\ ft}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1°C} = 2{,}446{,}665$$