Updated: 23 October 2017

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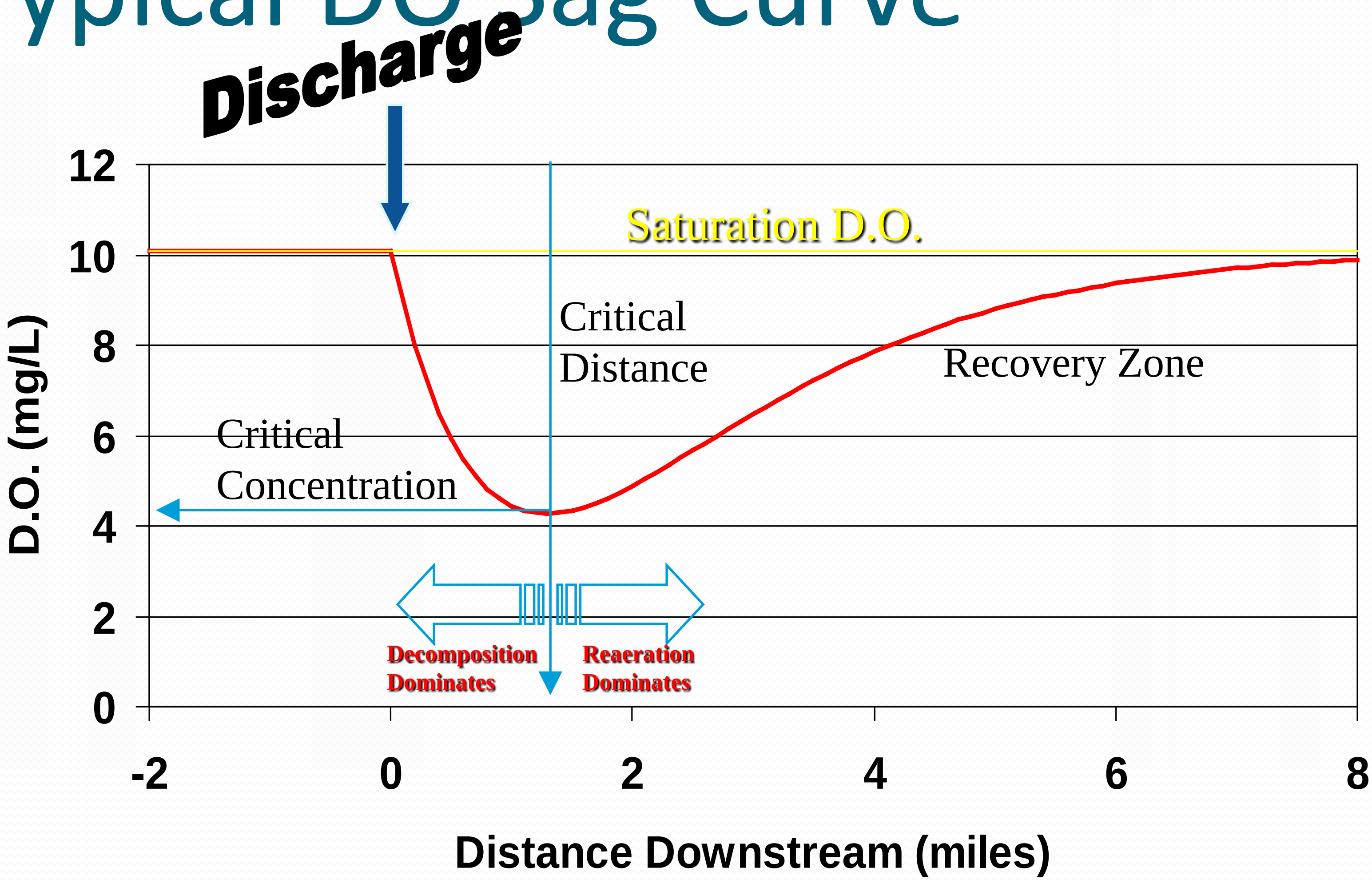
CEE 577: Surface Water Quality Modeling

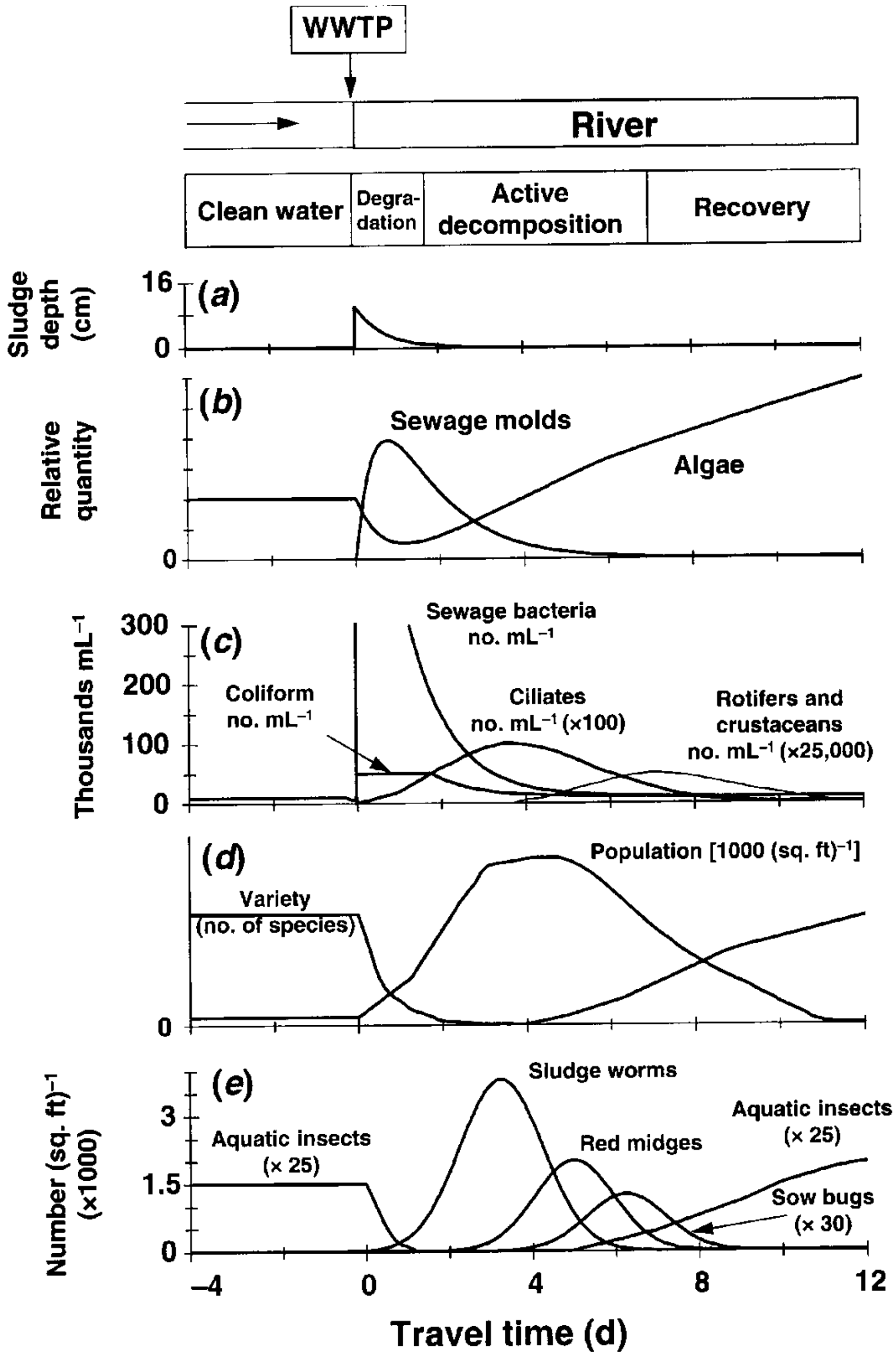
Lecture #14

Gas Transfer & Reaeration

(Chapra, L20 & L21)

Typical DO Sag Curve





Effect of WWTP Effluent on Stream Biota

- From Chapra, Figure 19.3 (pg.350)

Gas Transfer: Equilibria

Henry's Law

$$C_A = K_H p_A$$

where,

C_A = concentration of species A at equilibrium, [mol/L or mg/L]

K_H = Henry's Law constant for species A, [mol/L-atm or mg/L-atm]

p_A = partial pressure gas A exerts on the liquid, [atm]

Gas Transfer: kinetics

- For a typical water system, the change in concentration of the gas with time can be expressed as:

where,

$$\frac{dC}{dt} = -k_L a(C_s - C_t)$$

$k_L a$ = gas transfer coefficient, [time^{-1}]
C_t = concentration at time t, [mol/L or mg/L]
C_s = saturation concentration from Henry's Law.

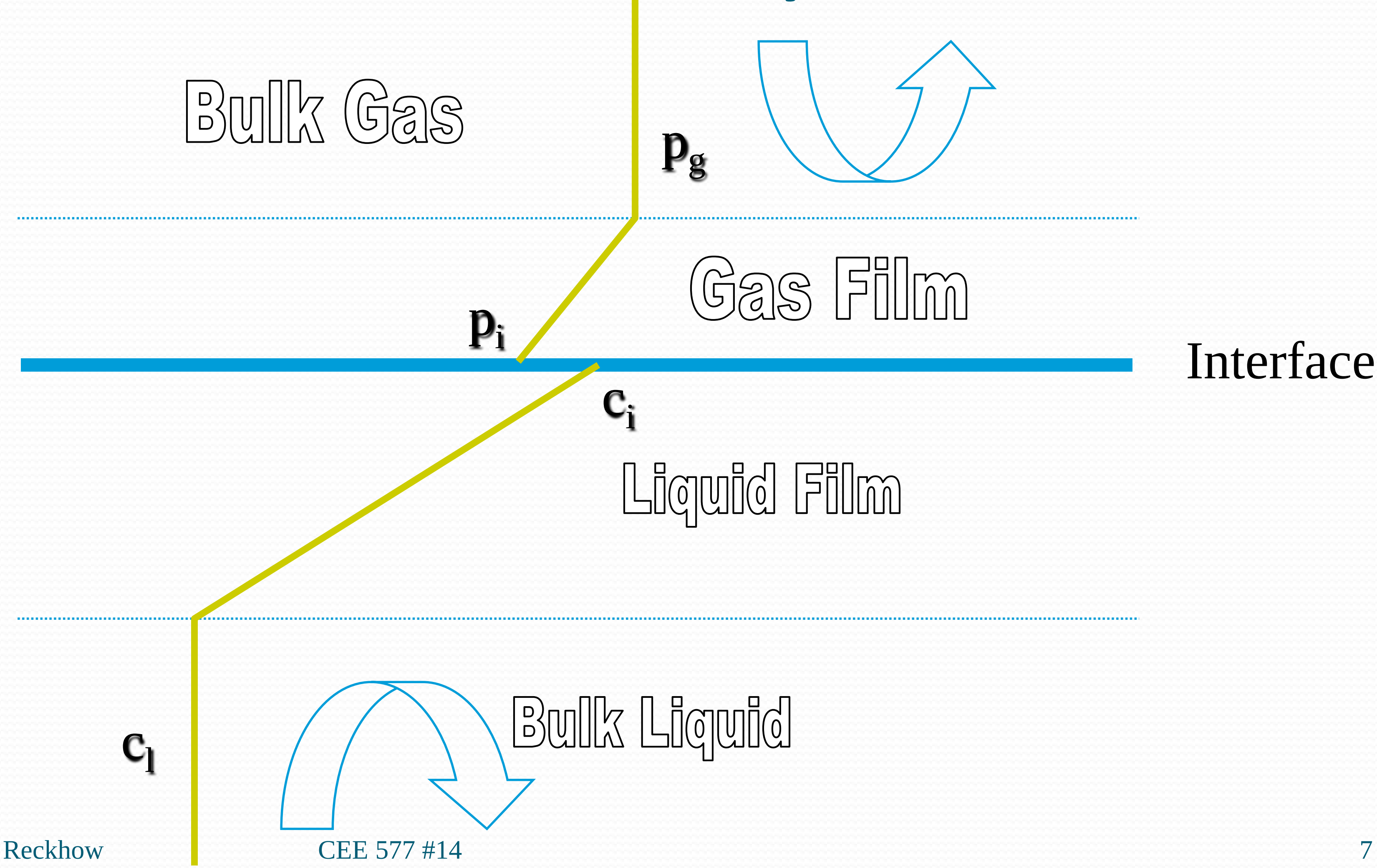
- $k_L a$ is actually the gas transfer coefficient k_L times the specific surface area, a, where a is the bubble surface area divided by the bubble volume. It is quite difficult to determine the two parameters separately. Since they are normally used together a separate determination is not necessary.

Analyzing Gas Transfer Data

The above equation can be separated and integrated from C = C_o at t = 0 to C = C_t at t = t, yielding:

$$\ln \frac{(C_s - C_t)}{(C_s - C_o)} = -k_L a t$$

The two film theory



- To next lecture