


Water Quality Standard for Temperature

- Goal: Protect aquatic organisms from adverse warming caused by anthropogenic activities.
- Water temperatures influenced:
 - solar radiation
 - stream shade
 - ambient air temperatures
 - channel morphology
 - groundwater inflows
 - stream velocity, volume, and flow
- Anthropogenic activities include:
 - discharge of heated water
 - water withdrawals
 - reduced vegetative stream shading
 - altered stream width or depth



Temperature Standard

- Biologically-based numeric criteria
 - Spawning: 13.0°C
 - Core cold water habitat: 16.0°C
 - Rearing and migration: 18.0°C
 - Migration corridors 20.0°C
- Natural Thermal Potential (NTP)
- Human Use Allowance (HUA)

Reasons for temperature modeling

TMDLs

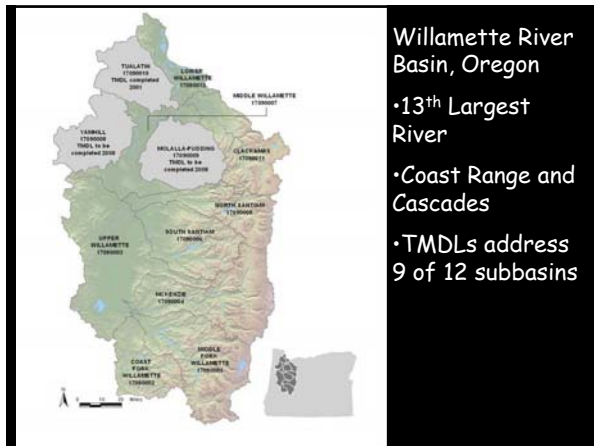
- EPA/ODEQ must develop TMDLs to address 303(d) listed waters
 - 303(d) List based on Biologically-based Numeric Criteria
 - Total Maximum Daily Loads (TMDLs)
 - TMDL = WLAs + LAs + background
- Models needed to:
 - determine NTP temperatures
 - calculate wasteload allocations for point sources
 - evaluate impact of load allocations for non-point sources
- NTP
 - River restored to natural conditions and all anthropogenic heat loads eliminated
 - Natural flow, system potential shade, no point sources

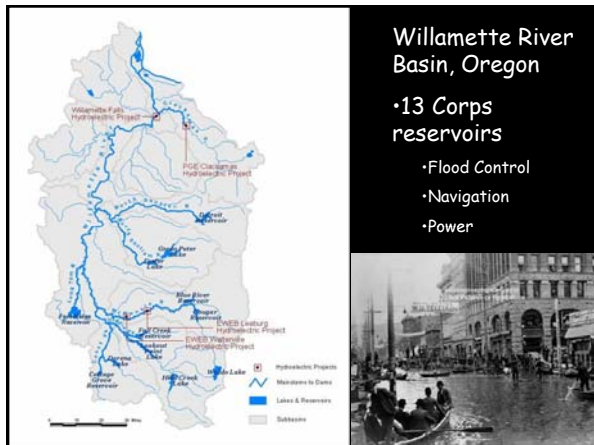
Reasons for temperature modeling

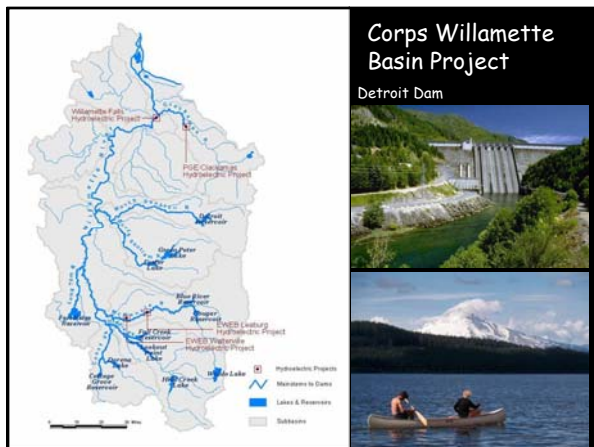
401 Water Quality Certifications

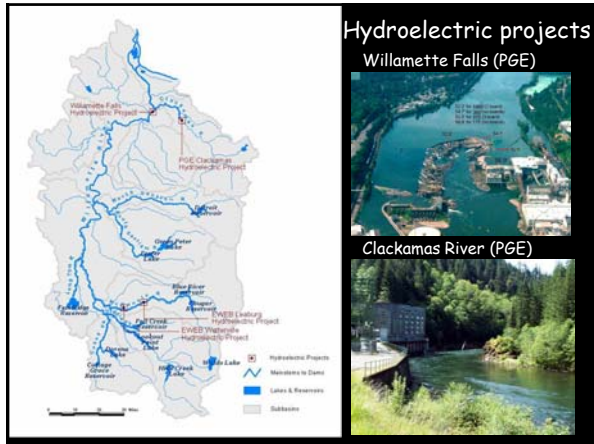
- Determinations by DEQ that a federally licensed or permitted activity that may result in a discharge to waters of the state will not cause water quality standards violations
- The federal permit in question may not be issued without this determination in accordance with Section 401 of the CWA
- FERC relicensing of hydroelectric projects

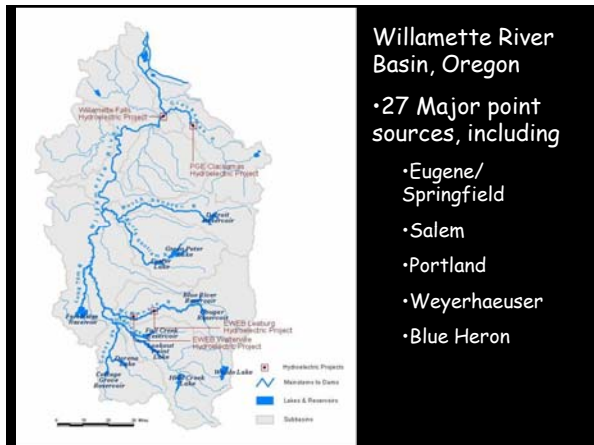


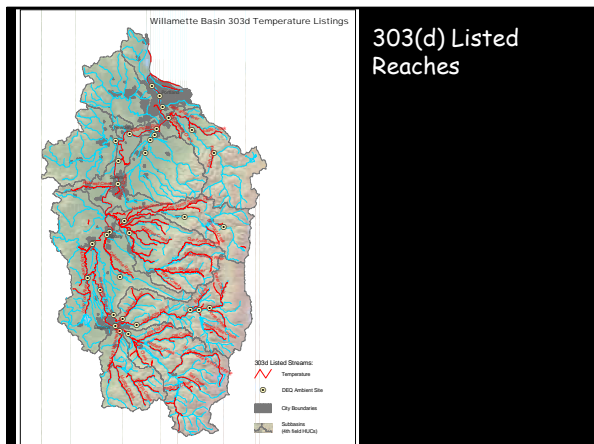








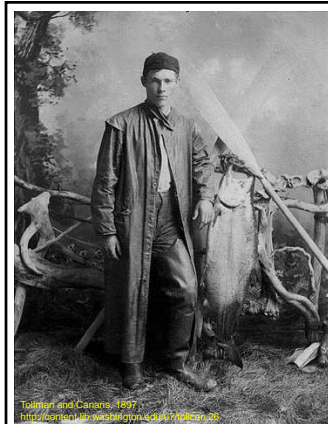




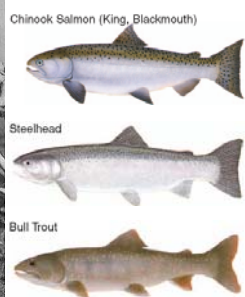


Bases for 303(d) Listings

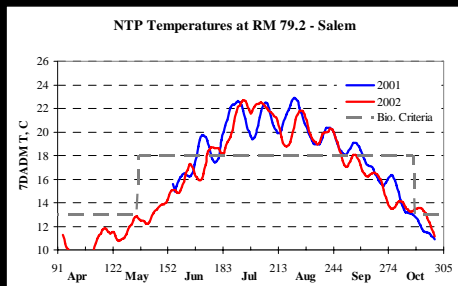
River Mile	Criteria	Frequency of Exceedence	Maximum Measured
7.0	20°C	68% (34 of 50)	26°C
13.2		61% (37 of 61)	26°C
34.4		62% (23 of 37)	27°C
48.6		60% (36 of 60)	27°C
71.9	18°C	82% (37 of 45)	
84.0		65% (11 of 17)	27.5°C
119.3		72% (41 of 57)	24.5°C
131.4		62% (29 of 47)	24°C



Beneficial uses most sensitive to temperature



Applicable Criteria NTP vs. Biological Criteria



Willamette River System Model

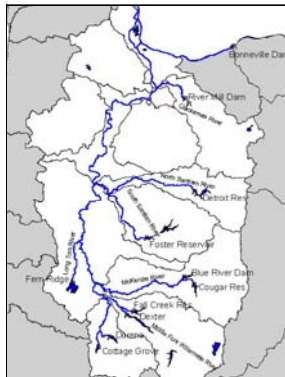
Purposes:

- NTP
- Point source impacts
- Hydroelectric impacts
- Shade sensitivity
- Boundary Q and T sensitivity (reservoirs)



Willamette River System Model

- 9 CE-QUAL-W2 Models
 - Lower Willamette and Columbia
 - Middle Willamette
 - Upper Willamette
 - Coast and Middle Forks
 - McKenzie
 - Long Tom
 - Lower Clackamas
 - Santiam and N Santiam
 - S Santiam
- Calibration: '01 and '02



Willamette River System Model

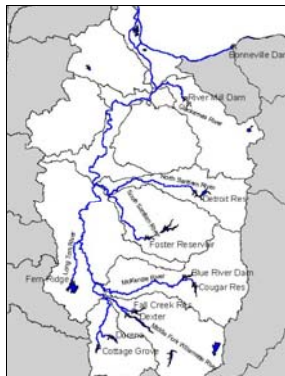
W2 vs. Heat Source

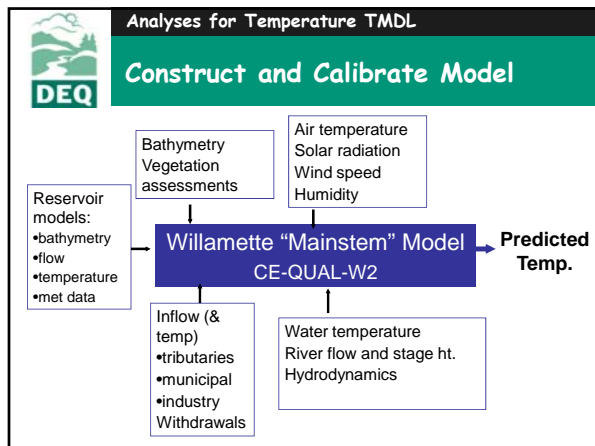
Advantages of W2

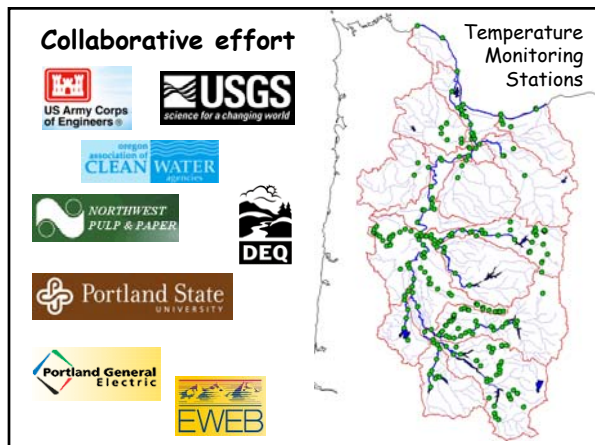
- 2-Dimensional
 - Stratification
 - Newberg Pool and tidal reaches
 - Reservoirs
- Faster (Full season)
- Branching
- Additional parameters (DO, etc.)

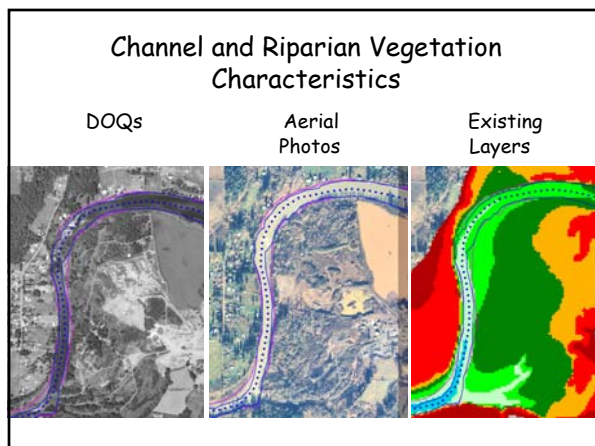
Advantages of HS

- Ease of use
- Integration w/Shade models (TTools)
- Stable for small streams









Channel and Riparian Vegetation Characteristics



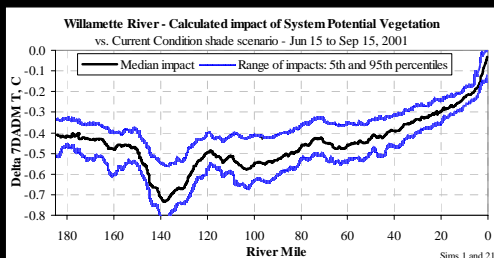
Potential Vegetation Characteristics via Geomorphic Units (for NTP)



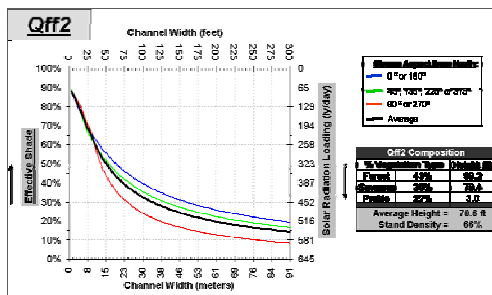
Code	Description	% Forest, Savanna, and Prairie	Ht (m)	Density (%)
601	Qalf Forest	52	21.5	75%
602	Qalf Savanna	28	21.9	50%
603	Qalf Prairie	20	0.9	75%

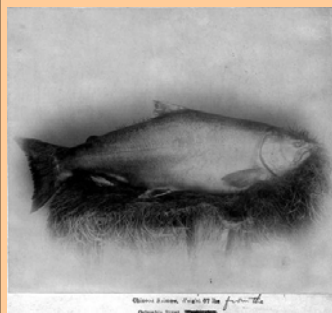
Qalf – Alluvium of smaller streams

Sensitivity to Shade



Anthropogenic Solar Radiation Load Allocation = Zero
(Vegetative Shade > Site Potential)

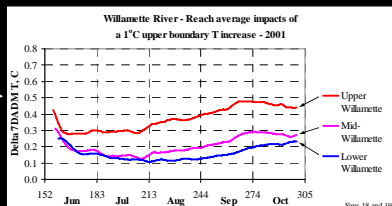




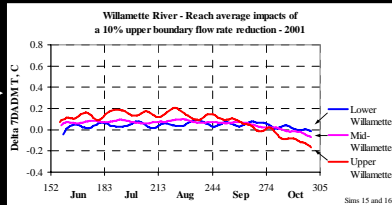
Sensitivity analyses:

- Flow
- Upper boundary temperature
- Point sources
- Utilities (PGE and EWEB)

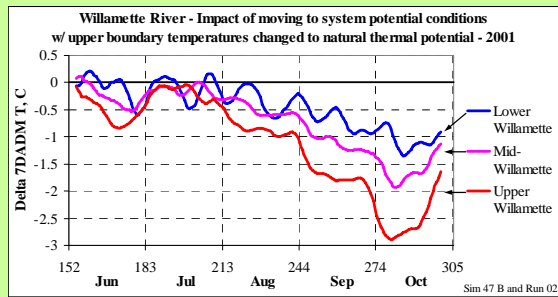
Sensitivity to upper boundary temperature



Sensitivity to upper boundary flow



Combined impact - NTP





- Next steps:
- Petitions for Reconsideration
 - Utilities
 - Pt Sources
 - Lawsuits



- Next steps:
- Reserve Capacity Loans
 - Heat load trading
 - Reevaluate in 2012



Next steps:

- River Modeling (Corps)
 - Reservoir reaches
 - Determine NTP
- Reservoir Modeling (Corps)

