<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:10</td>
<td>Marine data (DO &amp; N) update</td>
</tr>
<tr>
<td>10:40</td>
<td>WWTP &amp; tributary data updates</td>
</tr>
<tr>
<td>11:00</td>
<td>“What-if” scenarios and communication plan</td>
</tr>
<tr>
<td>11:20</td>
<td>Benthic flux, sediment trap, met station, ADCP, modeling schedule updates</td>
</tr>
<tr>
<td>11:55</td>
<td>Set next meeting, etc</td>
</tr>
</tbody>
</table>
“What-if” Scenario Comments

- Natural conditions
- 2025
- Tertiary nitrogen treatment
- Tributary improvements
- Sensitivity to central basin
“What-if” Scenario Comments

• Look at all benefits of reducing air deposition

• Complete the calibration and the sensitivity analysis first

• Be careful in setting baselines and loads in context

• In model, add loads to determine the “breakpoint” for the undesirable response
“What-if” Scenario Comments

• Account for those who have already made reductions in N loads

• Consider forestry impacts
Objective: Special focus on informing key decision makers / stakeholders of the South Puget Sound Dissolved Oxygen Study.

Who: You, your organizations, city councils, county councils, etc.
Technical Advisory Committee
October 29, 2007
Julia Bos (& several techs)
360-407-6674
jbos461@ecy.wa.gov
www.ecy.wa.gov/puget_sound/dissolved_oxygen_study.html
Marine Data Update

- Field & Lab Summary
  “Whew!”
- 2007 D.O. Condition
- Nitrogen Time series
  - Boundary Stations
  - Select South Sound Stations
Field Collection

• 16 Central Sound Boundary Station “Liberty” cruises (July 06 – Oct 07)
• 11 condensed South Sound “Skookum” cruises (Aug 06 – Oct 07)
• 6 intensive South Sound “Barnes” cruises (Jul, Sep, Dec 06, Apr, Jun, Sep 07)
  • >10,000 chemistry samples
  • ~0.25 million CTD data points
Lab Analysis

√ Dissolved Oxygen
__ Chlorophyll (Sept 2007)
__ Dissolved Nutrients (June 2007)
__ Total Nitrogen & Phosphate (June 2007)
__ Alkalinities (Sept 2007)
__ Phytoplankton Biovolume (provider search)
__ Carbon (lab failure)
  *PCN – ok – utilization?
  *DOC – 6-7 month loss, all affected?
Sept. Bottom Oxygen

Albertson, Bos 2007
Climate Impacts on DO?

<table>
<thead>
<tr>
<th>Year</th>
<th>DJF</th>
<th>JFM</th>
<th>FMA</th>
<th>MAM</th>
<th>AMJ</th>
<th>MJJ</th>
<th>JJA</th>
<th>JAS</th>
<th>ASO</th>
<th>SON</th>
<th>OND</th>
<th>NDJ</th>
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<tbody>
<tr>
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<td>-0.1</td>
<td>0.1</td>
<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>0.9</td>
<td>1.1</td>
<td>1.3</td>
<td>1.5</td>
<td>1.3</td>
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<td>0.6</td>
<td>0.1</td>
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<td>0</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.6</td>
<td>0.5</td>
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<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.8</td>
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<tr>
<td>2005</td>
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<td>0.5</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.3</td>
<td>0.2</td>
<td>0</td>
<td>0</td>
<td>-0.2</td>
<td>-0.4</td>
<td>-0.7</td>
</tr>
<tr>
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<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
<td>0.9</td>
<td>1.1</td>
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<td>2007</td>
<td>0.8</td>
<td>0.3</td>
<td>0.1</td>
<td>-0.1</td>
<td>0</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.6</td>
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</table>

Warm (red) and cold (blue) episodes based on a threshold of +/- 0.5°C for the Oceanic Niño Index [3 month running mean of SST anomalies], based on the 1971-2000 base period. For historical purposes cold and warm episodes (blue and red colored numbers) are defined when the threshold is met for a minimum of 5 consecutive overlapping seasons.
Dissolved Nitrogen
(NO₃ + NO₂ + NH₄)

Edmonds East
Dissolved Nitrogen (NO$_3$ + NO$_2$ + NH$_4$)

Edmonds West
Dissolved Nitrogen (NO3 + NO2 + NH4)

Alki West
Dissolved Nitrogen
(NO3 + NO2 + NH4)

Rich Passage

DIN (µM)

Jul-06 Aug-06 Oct-06 Nov-06 Jan-07 Mar-07 Apr-07 Jun-07 Aug-07
Dissolved Nitrogen (NO3 + NO2 + NH4)

Case South

DIN (µM)

0 5 10 15 20 25 30 35 40 45 50

Jul-06 Aug-06 Oct-06 Nov-06 Jan-07 Mar-07 Apr-07 Jun-07 Aug-07
Dissolved Nitrogen (NO₃ + NO₂ + NH₄)

Carr South

DIN (µM)

Jul-06 Aug-06 Oct-06 Nov-06 Jan-07 Mar-07 Apr-07 Jun-07 Aug-07
Data Compilation & Report

• Processing, Compilation & QA/QC
  - now until Jan. 2008
• Data Requests
  - finalized data available early 2008
    (*phytoplankton)
• Report – Spring 2008
South Puget Sound Monitoring and Modeling

Mindy Roberts
Technical Advisory Committee
October 29, 2007
Presentation overview

• Monitoring results Part 1
  – WWTPs
  – Tributaries

• Monitoring results Part 2
  – Velocity profiles (ADCPs)
  – Sediment flux study
  – Meteorological stations
WWTPs (8/06-8/07)

<table>
<thead>
<tr>
<th>Nitrogen species</th>
<th>Conc (mg/L)</th>
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<tr>
<td>TPN</td>
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<tr>
<td>DTPN</td>
<td>22.4</td>
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<tr>
<td>NO23N</td>
<td>2.96</td>
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<tr>
<td>NH3N</td>
<td>14</td>
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</table>

- 8/06-9/06
- 10/06-12/06
- 1/07-3/07
New plants added Aug-Oct07

Original 17 plants  Additional 12 plants

DIN (SWRO): 5150 kg/d  DIN (SWRO): 5.9 kg/d
WWTP tasks

• Request daily discharge 6/06-10/07
• Compile loads from Central Sound plants
• Evaluate effluent variability
  – Sludge dewatering
  – Method to extrapolate from measured data
• Develop WWTP time series for model
Tributary inflows

Puget Sound

Case Inlet

Tacoma Narrows

Budd Inlet

Carr Inlet

Puget Sound

(ambient)
River DIN

DIN (kg/d)

PUYALLUP R
NISQUALLY R
DESCHUTES R

No data yet
Monitoring Part 2

ADCP data
Sediment Flux data
(Sediment traps, met stations, modeling)
ADCP transects

- June 2007 – testing
- July 2007 – transects through Budd, Eld, Carr, Case Inlets
- Aug-Oct 2007 – bottom mounts in Carr, Case, Budd
- Sept 2007 – transects around Hope Island
- Oct-Dec 2007 – bottom mounts around Hope Island

www.ecy.wa.gov/biblio/0703101add1.html
June 2007 ADCP

- Surface transects in Dana Passage
  - Test need for multiple passes
  - Quantify maximum depth
- Pass 1 (12:41): 16,000 m$^3$/s
- Pass 2 (12:55): 15,700 m$^3$/s
  - RSD = 1.9%
- Max depth 70 m
July 2007 ADCP transects

Flood tide conditions
7/10 – 9:24 - 13:29
7/11 – 10:13 - 14:25
Carr and Case (m³/s)
Sept 2007 ADCP

- Transects around Hope Island
Flood tide patterns

- Low tide 11:59
- High tide 18:02
- Surveys conducted 13:10-16:34
Hope Island patterns

- Bottom mounts
- 10/18/07 through December
Sediment Flux Study

- Four inlets
- Three depths
- Three events
  - 9/10/07
  - 9/24/07
  - 10/22/07
- EPA $100k
  - Evans-Hamilton

www.ecy.wa.gov/biblio/0703101add2.html
Benthic flux chambers

Approx 12" x 12" x 24" Aquarium, Inverted

Buoy

One-Way Valve

Sampling Port

Metal Cables or Rope for Hoisting

Acrylic Divider with Holes for Hydrolobes

2" Metal Flange Mounted to Aquarium
Budd and Case (9/10/07)
Water nutrient concentrations

Budd Inlet (5 m)
Change in DIN by depth and inlet

- **Conc (mg/L)**
- **Depth (m)**

- **Eld**
- **Carr**
- **Budd**
- **Case**

Depth (m): 5, 15, 25
Conc (mg/L): 0.000, 0.050, 0.100, 0.150, 0.200, 0.250, 0.300
Initial DIN by depth and inlet

![Graph showing Initial DIN by depth and inlet with concentrations in mg/L and depths in meters. The graph compares concentrations for different depths and species: Carr, Budd, Case, and Eld.]
DO change over time

Winkler DO

Delta DO (mg/L)

DO/time (mg/L/hr)

BUDD  CARR  CASE  ELD

Δ DO/time (mg/L/hr)

Δ Delta DO (mg/L)
Seasonality of SOD?

9/10/07

9/24/07
Sediment traps

• 25-m depths in Budd, Eld, Case, Carr
• 4 x 2-month deployments at mid depth
• Mass, TOC, TN, TP (g/m²/d)
• QAPP Addendum #3: www.ecy.wa.gov/biblio/0703101add3.html
Marine modeling status

- Finalized grid
- Compiling input time series Jun-Dec 2006
  - Meteorology
  - River inputs (flow)
  - Boundary conditions
- Compiling output data for comparison
- Model runs December-February
Upcoming Dates

- Data report Mar08
- Hydrodynamic report Mar08
- Water quality modeling 2008
- Technical report development 2009
Change in orthophosphate

- Eld
- Carr
- Case
- Budd

- Concentration (mg/L)
- Depth (m)

- 0.000
- 0.050
- 0.100
- 0.150
- 0.200
- 0.250
- 0.300
- 0.350
- 0.400

- 5
- 15
- 25
September 2007 ADCP (CASE4)
Sept-Oct 2007 ADCP (BTE5)