WELLS (WEL) National Estuarine Research Reserve Water Quality Metadata
January-December 2004
Latest Update: August 13, 2020

I. Data Set & Research Descriptors

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2). Entry verification:

The data are directly downloaded in the YSI-PC6000 format (as a .dat file) and the Comma Delimited format (as a .csv file) from the dataloggers to a PC lap-top. The data are reviewed using the PC6000 software (Eco-Watch). Graphs and basic statistics are then generated with the Eco-Watch program and the information is viewed out for each data file. These graphs are used to determine any obvious data outliers and sonde and/or probe malfunction. All downloaded data files from the dataloggers (both raw unedited .dat and .csv files) are then transferred via disk to a Dell Inspiron 4100 (before September 2004), or Panasonic CF-28 (after September 2004), where all files are reviewed and formatted for CDMO and stored. Here the raw unedited .csv data files are imported into Microsoft Excel 2000. After a complete month of data has been recorded, each file is ready to review, which requires several steps. The NERR CDMO Excel macros contained in the file “EQWinFormat.xls” are used for all data. Back up copies of all files are stored on a Maxtor One-Touch external hard drive, and the Wells NERR server.

The CDMO supplied macros are explained in the following quote from the CDMO NERR SWMP Data Management Manual (Version 5.1):
“The EQWin format macro will perform the following tasks:
a) Automatically check that the parameters are in the correct order (see Chapter 6 Overview of data collection for correct order).
b) Create a corrected timestamp column that reports the hours and minutes to the exact half- or quarter-hour and removes seconds.
c) Convert depth values recorded in feet to meters.
d) Format each parameter value to the correct number of decimal places.
e) Assign the file an identifying station code.”

Data is then put into a single Excel file, viewed, graphed and reviewed for discontinuities and any other anomalies. EQWin software is used to conduct further data checks, with the use of CDMO supplied queries. Anomalous data are investigated for validity based on field observations, instrument diagnostics and external checks by a YSI model 85 handheld. Data which are clearly erroneous are then removed from the data file, with deletions noted in section 12 below.

Data which appear to be anomalous but cannot be verified as such are left in the dataset, and documented in section 11 below.

The use of the Version 5.0 of the National Estuarine Research Reserve (NERR) CDMO System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in March 2004 when they became available. Data review and validation followed the subsequent CDMO NERR SWMP Data Management Manual (Version 5.1) released in December 2004.

3). Research objectives:

The Webhannet River estuary is located in proximity to heavily used beaches in Wells, Maine. It has a shoreline that is highly developed with residential and commercial structures. The estuary receives water from a 14 sq. mi. watershed that is well forested. We are measuring variations in hydrologic variables in the Webhannet River estuary at the Head of Tide and at the Inlet. Data from Head of Tide will integrate surface and ground water inputs (from both point and non-point sources) from the freshwater watershed into the estuary. Data from the Inlet will integrate surface and ground water inputs from the freshwater watershed and the estuarine watershed. Differences in data between the Head of Tide and the Inlet will indicate inputs from the estuarine portion of the watershed (on the ebb tide), and inputs from the Gulf of Maine on the flood tide. The instruments will track runoff events via salinity, and will measure pollutant-carrying sediment particles via turbidity. Our working hypothesis is that the freshwater watershed is the primary source of sediment and therefore potential NPS pollutants in the estuary. These two variables will indicate the potential for non-point source pollutants to enter the estuary, and whether they are of upland, estuarine, or Gulf of Maine origin. Other variables measured by the data loggers (DO, temperature, pH, specific conductivity, and water level) will provide important baseline data to track changes in the estuary's physicochemical parameters over the long term. These variables can be affected by changes in human water use, and by natural or human induced changes in inlet and river channel morphology, climate, and organic loadings. The Inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site. The Head of Tide site is relatively un-impacted, located just east of the Route One Bridge, and is our roving site. We also collect data at the Mile Road site, which is our creek site, as well as the Little River Mouth site, which is our comparative system site.

4). Research Methods

The Wells NERR YSI monitoring program began in April 1995 at one site (Head of Tide site-HT) and May 1995 at a second site (Inlet site-IN) in the Webhannet River estuary. Two additional sites were added in 2002, Mile Road (ML) site began in March in the Webhannet River estuary and Little River Mouth (LM) in April in the Merriland/Branch/Little River Estuary. For 2004, the Mile Road (ML) site was eliminated and a new site at Skinner Mill (SM) in the Merriland/Branch/Little River Estuary was added. Three data loggers (IN, LM, HT) are installed with bottom moorings, as described below. One data logger (SM) is installed horizontally. All data loggers have 1/4 inch black vector mesh wrapped on the outside of the probe protective housing (using rubber bands) of the sonde guard to prevent fouling and unwanted animals. All deployment structures (PVC tubes) described below are labeled with the Wells NERR information.

*IMPORTANT CHANGE TO ALL SITES: In 2004, the YSI Extended Deployment System was used at for all deployments. This system consists of a small brush that sweeps all the probes (except for depth) prior to each reading, greatly reducing the

problem of biofouling. The Extended Deployment System is reflected in the “EDS” in the sonde model number.

*IMPORTANT CHANGES TO NOTE AT THE INLET SITE (IN): At the beginning of the year, we did not have a vented-level logger as we have had in the past, and were using a non-vented level logger (model 6600EDS). (See section 6 of this document for exact deployment periods and models used.) In addition, a telemetry unit had been installed several years prior to this deployment period (2004). By the start of 2004, this telemetry station was obsolete and no longer in use. The use of a non-vented logger at the beginning of the year meant that the logger was installed without connecting to the old telemetry unit. When a vented level logger became available and was installed for the first time in 2004 on 5 May 2004 12:00, the vented cable was attached to the telemetry unit, only for the purpose of venting the level sensor. (See section 9 of this document for Depth disclaimer regarding vented and non-vented loggers.) From that point, several periods of missing data occur (see sections 11 and 13 of this document for anomalous/suspect and missing data, respectively.) After much troubleshooting, it was determined that sporadic voltage arriving from the telemetry unit solar panel was preventing the YSI sonde from utilizing the power from the fresh batteries installed in the logger. The logger collected data sporadically, only when the voltage from the unused telemetry unit was sufficient to power the logger. This interference was eliminated for the remainder of the year on 13 July 2004 10:30 by leaving the vented cable unattached to the telemetry unit, with the cable end enclosed in a waterproof but not airproof bag, allowing the vented level to receive air pressure changes.

The Inlet site (IN) deployment methods are different than the other sites (SM, ML, LM), due to the installation of a YSI telemetry unit in 1998. A 23 foot, 4 inch diameter high grade PVC tube was installed against a dock piling. Four steel flat bars with bolts were used to attach this 23 foot PVC tube against the dock piling. A 3 by 1.5 inch PVC transducer was glued on the inside bottom of the PVC tube to allow the sonde to sit exactly 1.0 meter (3.28 ft) off the bottom. Several vertical holes, representative of the sonde guard, were cut out the circumference near the bottom of the PVC pipe to allow water flow to the probes. An "L" shaped steel bar with two end-holes is placed through two created slits about a half of foot from the top of the PVC tube. A stainless steel wire (1/16") is attached to the sonde bail using two stainless steel clips; and to one end of the "L" shaped steel bar for sonde deployment and retrieval. A marine lock is attached through the other end of the "L" shaped steel bar to hold the bar, wire, and sonde in place and for security. A PVC threaded cap screws in to the threaded top of the PVC tube, also for security. A hole was created in the PVC cap to allow the sonde to hook up with the telemetry unit using the 50 foot vented cable

Two other sites, Head of Tide (HT) and Little River Mouth (LM) are deployed similarly, except for sonde height off the bottom (see below). These sites use a 5 foot, 4 inch diameter high grade PVC tube. The PVC tube is attached to a 12 foot, heavy steel sign post using a stainless steel bolt at the bottom of the tube, a stainless steel cable wrap at the top, and several thick electrical cable ties in between. The steel sign post was pounded in about 6 feet into the river bottom, such that the bottom of the PVC tube was flat on the river bottom. The PVC tube has one 3 by 1.5 inch PVC transducer glued on the inside bottom of the PVC tube to allow the sonde to sit exactly at a certain height off the bottom (see below). Several vertical holes, representative of the sonde guard, were cut out the circumference near the bottom of the PVC pipe to allow water flow to the probes. An "L" shaped steel bar with two end-holes is placed through two created slits about a half of foot from the top of the PVC tube. A stainless

steel wire (1/16") is attached to the sonde bail using two stainless steel clips; and to one end of the "L" shaped steel bar for sonde deployment and retrieval. A marine lock is attached through the other end of the "L" shaped steel bar to hold the bar, wire, and sonde in place and for security. A flotation buoy is tied to the PVC tubes incase the deployment structure ever gets dislodged. The deployment depth for these sites is such that the probe-end of the data logger is secured 0.30 meters (1.0 ft) off the bottom.

The Skinner Mill (SM) site, located just below the crossing of Skinner Mill Road with the Merriland River, a tributary to the Merriland/Branch/Little River estuary is a new site for 2004. Due to low water levels and a rock substrate, the sonde was installed horizontally. It uses a 5 foot, 4 inch diameter high grade PVC tube with several longitudinal holes cut to allow water flow to and through the sonde guard. The tube was attached to two steel trapezoidal weights (window weights) which held the probes 10 inches off the bottom of the stream. Although every effort was made to place the sonde in the same place each deployment, it was not immovable. Thus, depth data may not exactly correspond from one deployment to the next, or even during deployments if the sonde had to be moved due to exceptionally high or low water (the timing and direction of all these movements are noted below).

The deployment depth for each site is such that the probe-end of the data logger is secured 0.30 meters (1.0 ft) off the bottom. Water levels at these sites can be very low when low tide and low river flow occur together. It is not unusual that the sonde level sensor is out of the water, but the sensors themselves, being approximately 17 cm lower, are very rarely at risk of being out of water.

Deployment and Data Intervals:
Two to four week variable sampling periods were chosen for all data sondes due to limitations created by the life of the dissolved oxygen membrane, probe fouling, limited battery power, and to minimize risk of lost data in the event of a malfunction. Measurements of temperature, specific conductivity, salinity, percent saturation, dissolved oxygen, depth, pH, and turbidity are recorded at 30 minute intervals throughout the deployment period.

Calibration and Standards Used:
After the deployment period, the data logger is brought back into the Wells Reserve Laboratory for downloading, cleaning, and calibration. These procedures are carried out to the methods described in the YSI Operating Manual. Calibration standards are used for specific conductivity (10 mS/cm), pH (buffer solutions of pH 4, 7, and 10), and turbidity (123 NTU). The pH standards are purchased from Fisher Scientific. Conductivity and turbidity standards are purchased from YSI, Inc. The dissolved oxygen membranes are replaced and sit 6-24 hours before each deployment. During periods when we have an idle YSI logger, the deployments are continuous (retrieved logger is immediately swapped with a newly deployed logger). If no idle logger is available (for example, it is away for repair), after approximately 6-24 hours of down time for cleaning, maintenance and recalibration, the YSI Data logger is redeployed for another sampling period.

QA/QC of Instruments:
At each deployment and retrieval, a YSI Model 85 handheld unit collects temperature, DO mg/L, DO %, and salinity. These parameters are recorded on the calibration/deployment/retrieval data sheets and compared to the YSI data. In addition, at the end of each deployment, the data is immediately downloaded and a graph viewed of the data to look for periods of missing or anomalous data. “Post-calibration” data (using calibration standards) are also recorded, to

verify that the probes are still measuring accurately after retrieval. The use of the newest (Version 3.0) National Estuarine Research Reserve (NERR) System-Wide Monitoring Program (SWMP) YSI 6-Series Multi-Parameter Water Quality Monitor Standard Operating Procedures began in December 2000 when they became available.

5). Site location and character

The Wells National Estuarine Research Reserve is located in York County, within the Town of Wells, on the coast of southern Maine and faces the Atlantic Ocean. The Wells NERR is approximately 31 km (20 miles) south of Portland, Maine and 110 km (70 miles) north of Boston, Massachusetts. The Reserve encompasses 1,690 acres along the Gulf of Maine coastline of tidally-flushed wetlands, riparian and transitional upland fields and forests within the Little River Estuary and the larger Webhannet River Estuary. Both estuaries arise in the sandy glacial outwash plain about eight miles inland. Both rivers empty into Wells Bay, a sandy basin stretching for approximately ten miles along the Atlantic coast. Bordering each river's inlet are double spit barrier beaches attached to the mainland. The backbarrier system in the Webhannet River Estuary is approximately 5 sq. km and is composed of large intertidal marshes (predominantly S. patens and S. alterniflora), intertidal sand and mud flats, and tidal channels. The watershed for the Webhannet River estuary covers an area of 35 sq. km and has a total of 6 streams, brooks or creeks, which enter the estuary. These tributaries flow across sand and gravel deposits near the headwaters and the impermeable sandy muds of the Presumpscot Formation in the lower reaches. The watershed for the Little River estuary covers an area of 84 sq. km and has a total of 2 tributaries. The backbarrier system in the Little River Estuary is approximately 2.51 sq. km and is composed of large intertidal marshes (predominantly S. patens and S. alterniflora), intertidal sand and mud flats, and tidal channels. The Webhannet River is connected to the ocean via Wells Inlet, which has a spring tidal prism of 28,200,000 cub. m (Ward 1993). The Little River is connected to the ocean by an unstructured, double spit system and is one of the few tidal inlets along the southern Maine coast that is not stabilized by either natural outcrops or artificial jetties. The force and volume of tidal action affect the salinity level of both rivers. In the Wells region, the annual mean wave height is almost 20 inches. These estuarine systems are dominated by semi-diurnal tides having a range of 8.5 to 9.8 feet. The volume of freshwater influx into both estuaries is moderate to low (on the order of 0.5 cubic meters/second), especially in the summer, because of the rivers' relatively small drainage areas and the presence of deep glacial deposits. The relatively low flows from these two rivers taken in with the 20 inch per year average runoff of the area surrounding the estuaries combine to form a fresh water flow which is dwarfed by tidal flushing. Twelve-foot tides dwarf the freshwater flow into the Webhannet estuary, which has a drainage area of 14.1 square miles. The Merriland River and Branch Brook meet south of Route 9 to form the Little River which drains an area of 10.75 sq. miles. The Webhannet estuary, fed by both Blacksmith and Depot Brooks, is adjacent to the harbor and greatly developed land. It offers a valuable opportunity for comparison with the relatively pristine Little River estuary. The land use of the Webhannet estuary include a total of 15% for wetland, fresh water, and tidal marsh; a total of 63.7 % for woodland; and a total of 18.6% for developed land compared to a total of 5.7% development in the Little River estuary (WNERR RMA 1996; Holden 1997).

The following information regarding annual weather patterns in the area was supplied by Maine State Climatologist Professor Gregory A. Zielinski extracted from "Monthly Station Normals of Temperature, Precipitation, Heating and Cooling Degree Days 1971-2000", Climatography of the United States No. 81,

National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC. and "Daily Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000", Climatography of the United States No. 84: "Average monthly temperatures range from 21.6F in January to 66.7F in July with daily highs averaging just below freezing in January and lows around 11F. Daily highs in July average around 76F and daily lows around 57F. The sea breeze often keeps daily highs lower during the summer than areas inland. Annual average temperature is 44.6F. Annual precipitation is 47.07 inches, including the water equivalent of snowfall, with monthly averages ranging from 3.01 inches in July to 4.77 inches in October. August receives just 3.02 inches on average. Annual snowfall is around 66 inches." According to Zielinski, "cool ocean temperatures keep down the number of afternoon showers and especially thunderstorms resulting in low summer precipitation amounts."

There are two sampling sites in the Webhannet River estuary. These are located at the Head of Tide (HT) and at the Webhannet Harbor Inlet (IN). The tidal range at each of these sites is 2.6-2.9 meters.

The Head of Tide site (43 deg 17' 54.25227" N Latitude, 70 deg 35' 13.82728" W Longitude) is located 4 miles south of the Wells Reserve, just downstream of the Webhannet Falls (freshwater) and 10 feet east of Route One. Route One is used heavily with traffic all year, especially during the summer tourist months. This site has soft mud, sand, and a rocky substrate, and the low and high tide depth is relatively shallow. The salinity range here is 0-31 ppt, with a mean of 3.6 ppt. These headwaters of the Webhannet are relatively undeveloped. This site is located just 10 feet east of the Route One bridge, and is our roving site.

The Skinner Mill (SM) site is located approximately 20 meters downstream from the intersection of the Merriland River (tributary to Merriland/Branch/Little River estuary) and Skinner Mill Road (at 43 deg 20' 47.69" N Latitude, 70 deg 33' 14.21" W Longitude). This site is approximately 3 meters downstream from the Watershed Evaluation Team (Educational water quality program at Wells NERR) site L5. The site is also located approximately 8 meters downstream from a former mill site with cobbles and very low remnants of a dam. This location is at the transition point from medium to sparse residential developments upstream in the watershed to undeveloped, protected salt marsh. Depths typically range from 0.4 to 0.8 meters. Substrate is rock, salinities are always less than 1 ppt. Originally, the site was thought to have some tidal influence, although the data appears to show otherwise.

The Inlet site is located 1.5 miles south of the Wells Reserve, at the Wells Harbor pier (43 deg 19' 12.44804" Latitude, 70 deg 33' 13.82728" Longitude). The mouth of the Webhannet estuary forms an extensive wetland/salt marsh area which is surrounded by development. Wells Harbor, which was most recently dredged in 1971, has moorings for approximately 200 commercial fishing and recreational boats. The mouth of the river flows between two jetties to the Atlantic Ocean. This channel was dredged in 1974. This site has a predominately sand substrate and is characterized by strong current during incoming and outgoing tides. The maximum depth of the Inlet site is 3 meters. The salinity range here is 7-35 ppt, with a mean of 31 ppt. The Inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site.

The Little River Mouth site is located 0.4 miles from the Wells Reserve (N 43 deg 20.413 Latitude, W 70 deg 32.441 Longitude). Due to problems with heavy sediment movement in the inlet of the Little River, we were forced to relocate the site in 2003, just off the bank of the marsh, in the main channel of the

river, upstream from the previous year's sites. The tidal range of the Little River estuary is 2.6-3.0 meters (Mariano and FitzGerald, 1988). Depth typically ranges from 0.5 to 1.5 meters, with greater range occasionally seen at some spring tides and storm events. The Little River site exists in a shallow and relatively pristine system with a sandy to mud bottom and a salinity range of 0-32 ppt. There are two major freshwater inputs, the Merriland and Branch Brook Rivers, which converge to form the Little River.

6). Data collection period:

Deployment and retrieval dates and times, model YSI 6-series sonde used for 2004:

BEGAN	ENDED	SONDE MODEL
Inlet Site (site code: IN)		
12/31/03, 17:30	01/22/04, 11:30	6600EDS
01/22/04, 12:30	02/20/04, 12:00	6600EDS
02/20/04, 12:30	03/09/04, 13:00	6600EDS
03/09/04, 13:30	04/03/04, 11:00	6600EDS*
04/03/04, 11:30	05/04/04, 11:30	6600EDS
05/04/04, 12:00	05/26/04, 12:00	6600EDS-SV*
06/04/04, 11:00	06/16/04, 11:00	6600EDS-SV*
06/16/04, 12:00	07/06/04, 14:00	6600EDS-SV*
07/06/04, 15:00	07/12/04, 08:00	6600EDS-SV*
07/13/04, 11:00	07/21/04, 13:30	6600EDS-SV
07/21/04, 15:00	08/06/04, 14:00	6600EDS-SV
08/06/04, 15:00	08/17/04, 12:30	6600EDS-SV
08/17/04, 13:00	09/03/04, 11:30	6600EDS-SV
09/03/04, 12:00	09/30/04, 13:30	6600EDS-SV
09/30/04, 14:00	10/27/04, 10:30	6600EDS-SV
10/27/04, 11:00	11/17/04, 15:00	6600EDS-SV
11/17/04, 15:30	12/10/04, 11:00	6600EDS-SV
12/10/04, 11:30	12/22/04, 08:00	6600EDS-SV
12/22/04, 08:30	01/10/05, 13:30	6600EDS-SV

* = extended periods of missing data, see sections 12 and 13 of this document.

Head of Tide Site (site code: HT)		
* no deployment January through May due to ice		
05/05/04, 12:00	05/25/04, 12:30	6600EDS
05/26/04, 13:00	06/17/04, 09:30	6600EDS
06/18/04, 14:00	07/08/04, 09:30	6600EDS
07/09/04, 10:30	07/26/04, 08:00	6600EDS
07/27/04, 11:00	08/11/04, 15:00	6600EDS
08/11/04, 16:00	09/04/04, 09:00	6600EDS
09/04/04, 09:30	09/30/04, 14:00	6600EDS
10/01/04, 10:30	10/21/04, 07:00	6600EDS
10/21/04, 07:30	11/12/04, 15:00	6600EDS
11/12/04, 15:30	12/09/04, 12:00	6600EDS
12/09/04, 12:30	12/21/04, 10:00	6600EDS

Skinner Mill Site (site code: SM)		
* no deployment January through April due to ice		
04/02/04, 12:00	05/03/04, 13:00	6600EDS
05/04/04, 10:30	05/26/04, 13:00	6600EDS
05/27/04, 16:30	06/17/04, 09:30	6600EDS
06/18/04, 11:00	07/13/04, 11:00	6600EDS
07/14/04, 14:00	08/03/04, 12:30	6600EDS

08/04/04, 13:00	08/17/04, 13:00	6600EDS
08/17/04, 13:30	09/10/04, 10:00	6600EDS
09/10/04, 17:00	10/04/04, 15:30	6600EDS
10/05/04, 10:00	10/30/04, 14:00	6600EDS
10/30/04, 14:30	11/15/04, 14:00	6600EDS
11/15/04, 15:00	12/13/04, 12:30	6600EDS
12/13/04, 13:00	12/21/04, 09:30	6600EDS

Little River Mouth Site (site code: LM)
* no deployment January through March due to ice

03/16/04, 15:30	04/12/04, 13:00	6600EDS
04/13/04, 14:30	05/10/04, 11:00	6600EDS
05/11/04, 13:00	06/09/04, 13:00	6600EDS
06/10/04, 13:00	06/23/04, 11:00	6600EDS
06/24/04, 11:00	07/19/04, 08:00	6600EDS
07/20/04, 09:00	08/04/04, 09:30	6600EDS
08/04/04, 10:00	08/20/04, 10:00	6600EDS
08/20/04, 10:30	09/08/04, 11:30	6600EDS
09/08/04, 12:00	10/04/04, 09:30	6600EDS
10/05/04, 10:30	10/26/04, 15:00	6600EDS
10/26/04, 15:30	11/17/04, 09:30	6600EDS
11/17/04, 10:00	12/14/04, 10:00	6600EDS
12/14/04, 10:30	12/21/04, 14:30	6600EDS

7). Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program:

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page http://cdmo.baruch.sc.edu/. Data are available in text tab-delimited format.

8). Associated researchers and projects

WELLS NATIONAL ESTUARINE RESEARCH RESERVE RESEARCH AT THE RESERVE for 2004 (Please visit our website: www.wellsreserve.org/research.htm for further information on the Wells NERR research program):

The Research Program at the Wells NERR conducts and supports research, monitoring, workshops, and research/resource management planning of relevance at local, regional and national levels. The overall aim of our work is to produce science-based information needed to sustain or restore Gulf of Maine coastal habitats and resources, especially those found in salt marsh estuaries and watersheds. During 2003-2004 many different studies involving scores of scientists, students, staff and volunteers focused on several related themes: 1) the quality of water resources in salt marsh estuaries and watersheds 2) land conservation strategies to protect coastal watersheds 3) factors controlling salt marsh accretion, erosion and plant community vigor 4) the value of salt marsh as habitat for fish, shellfish and birds, 5) restoration of salt marsh habitat degraded through human actions, and 6) understanding the ecology and functions of salt marsh habitat.

Estuarine Water Resource Quality

Water quality is monitored continuously at several stations with automated instruments as part of a NERRS systemwide monitoring program, as well as bimonthly at 15-20 stations through our WET volunteer monitoring program. The WET program also monitors two important biological parameters: fecal coliform bacterial contamination (an indicator of human health risk) and phytoplankton productivity (an indicator of estuarine health). These data have 1) allowed us to identify several bacterial "hot spots" that we will be working to eliminate, 2) are used to identify and open areas safe for shellfishing, and 3) have uncovered a relation between tides and low dissolved oxygen (a stressful condition for marine life) that needs further study. Our water quality work has contributed to the designation of several Priority Watersheds in coastal Southern Maine by the Maine Department of Environmental Protection.

Seacoast Watershed Information Manager (Project S.W.I.M.)

The Seacoast Watershed Information Manager (Project S.W.I.M.) will be an online resource to help local planners and the public evaluate, conserve, and restore coastal watershed resources along the Maine and New Hampshire seacoast by developing a website that describes the region and its resources, provides access to GIS data and other relevant information, and includes a decision-support tool that examines the impact of growth and development on water resources. It will include:

- A Narrative that informs local resource planners and the public by describing development impacts, water resources, and land use.
- Socioeconomic Analysis focused on water resource use as it relates to human activities.
- Land Use Change Assessments focusing on shoreland and permeability.
- A Data Clearinghouse providing users access to key data needed for local and regional-scale resource management.
- A GIS-based Decision Support Tool to help communities manage and protect water resources by considering how water supply, water quality and land use change are affected by land use planning decisions.

The Project focuses on the coastal watersheds from the Cocheco and Salmon Falls River in New Hampshire to the Kennebunk River in Maine. These 15 watersheds include 38 municipalities and cover 1,800 square miles. The Wells National Estuarine Research Reserve is the lead partner with support from NOAA's Coastal Services Center Landscape Characterization and Restoration Program and the Great Bay National Estuarine Research Reserve.

Salt Marsh Habitats and Communities

Factors that control the dynamics and vigor of salt marsh plant communities and marsh peat formation consequently determine the ability of a salt marsh to persist in the face of sea level rise. Through a combination of experimental manipulations and long term monitoring, a number of multi-year studies are currently producing data to answer questions concerning the sustainability of salt marsh habitats in this region. These studies are looking at nutrient-plant relations, plant community responses to physical and hydrologic disturbance, and the relative contribution of short-term natural events (e.g. storms) and human activities (dredging, tidal restriction) on patterns of sediment accretion and erosion. The Reserve's marshes and beaches are already among the best studied sites in the U.S. with regard to long term accretion and erosion (over thousands of years).

HABITAT VALUE FOR FISH, SHELLFISH AND BIRDS

The Reserve combines long-term monitoring with periodic surveys and short-term experiments to identify species and measure trends and changes in populations of fish, crustaceans, clams and birds. We have 10 years of data on upland and shore birds with which to assess the status of resident and migratory avian populations, and several years of wading bird data that we use as a gross level indicator of salt marsh health, which appears to be stable. Our periodic larval, juvenile and adult fish surveys have produced the best available data for fish utilization of salt marsh estuaries in the Gulf of Maine. Since 1994 we have been conducting surveys and field experiments to look at the survival and growth of hatchery seed, juvenile and adult softshell clam with regard to habitat characteristics and predation by the invasive green crab. Benthic invertebrates have been sampled from a number of marshes from Wells to Casco Bay in hopes of gaining a better understanding of invertebrate assemblage and their value to higher trophic levels.

Salt Marsh Degradation and Restoration

Salt marsh ecosystems in the Gulf of Maine have sustained themselves in the face of sea-level rise and other natural disturbances for nearly five thousand years. Since colonial times large areas of salt marsh (up to half of the total area) have been lost through diking, draining and filling. Today, the remaining marshland is fairly well protected from outright destruction, but during the past 100 years, and especially since the 1950's, salt marshes have been divided into fragments by roads, causeways, culverts and tide gates. Most of these fragments have severly restricted tidal flow, leading to chronic habitat degradation and greatly reduced access for fish and other marine species. Since 1991, the Wells Reserve has been studying the impact of these restrictions on salt marsh functions and values, and the response of salt marshes to tidal restoration. We have been working to promote an awareness of the damage being done and the benefits of salt marsh restoration throughout the Gulf of Maine.

Research Program Update: In addition to the Reserve-sponsored projects outlined above, numerous visiting investigators will be involved in on-site research.

Topics include: the effects of land use, sea level, and climate on estuarine productivity; the relationship between soil nutrients and plant community patterns; the influence of soil salinity on plant community interactions; the effect of tidal restriction on marsh peat accretion; the comparative ecology of fringe marshes and back barrier marshes; habitat use by upland birds, and the ecology of lyme disease.

"Ecological Functions of Fringing Salt Marshes Susceptible to Oil Spills in Casco Bay, Maine". We examined the ecological function of 9 different fringing marsh systems in Casco Bay that ranged from undisturbed to disturbed. Physical parameters measured included sedimentation rates, total suspended solids, and tidal range. Biological parameters included primary production, macroinvertebrate community composition and secondary production (4cm sediment cores), and resident and transient nekton community composition (fyke net). The project is still under way.

"BENTHIC HABITAT CORRELATES OF JUVENILE FISH DISTRIBUTION IN THE BIGELOW BIGHT AND ADJACENT ESTUARIES: LINKAGES BETWEEN FISH, HABITATS, SUBSTRATE AND HUMAN ACTIVITY". This recent project was a collaboration between the Wells N.E.R.R. and several members of the local fishing community. Through the use of beam trawls, gill nets, fish traps, van veen ponar, and a sediment profile imager (SPI camera), we are attempting to correlate benthic habitat type to juvenile groundfish and invertebrate assemblages in estuarine, near shore, and offshore habitat. Stations were also established near dredge spoil dump sites as well as sewage outflow to determine the impacts of human activity on the coast to benthic habitat.

The Wells NERR Research Department also worked on the following project: In partnership with the York Rivers Association and the Town of York, the Wells Reserve conducted a survey of the York River watershed. In this survey, volunteers looked for sources of pollution within a 250-foot buffer of the river and its tributaries (erosion, trash and debris and runoff from roads and lawns could have a negative impact on water quality). Most pollutants entering water bodies come from such undefined sources. Therefore, this type of survey is the best way to begin to address the problems of pollution in a water body. The idea of the project was to work with the community and landowners to help them understand the problems that come from these types of pollution and learn activities they might be able to do on their own land that would help prevent this pollution from entering the water. The results of the survey will become part of a Watershed Management Plan to improve and restore the water quality of the York River.

The Wells NERR Research Dept. is involved with the following CICEET* Projects:

Project Title: Estuarine Responses to Dredging: Analysis of Sedimentary and Morphological Change in Back Barrier Marsh to Aid Local Management and Develop a Regional Management Tool Principal Investigator (s): Michele Dionne, Wells NERR, ME; Duncan Fitzgerald, Boston University; Joe Kelley, University of Maine; David Burdick and Larry Ward, University of New Hampshire
Management Issue: Coastal management tool for assessing the impacts of dredging in estuaries. Project Summary: An adequate supply of sediment is essential for maintaining salt marshes. Human activities, such as channel dredging and tidal restriction due to road construction, can alter water flows in estuaries and result in dramatic changes in salt marsh sediment supply, affecting the speed of salt marsh erosion. The objective of this project is to determine the impact of dredging and tidal restriction on salt marshes in the Wells NERR. A digital coastal management guide will be created on CD ROM, providing coastal managers

with useful conceptual models for predicting the impacts of dredging and other activities that affect water flow and sediment deposition in salt marshes.

June Ficker Project Title: Monitoring avian productivity and survivorship

Outside Researchers: Theresa Theodose, Ph.D., University of Southern Maine Project Title: Relationships between soil nutrient availability and species composition of a high salt marsh in southern Maine.

David Burdick, Ph.D. and Roelof Boumans, Ph.D. University of New Hampshire, University of Maryland Project Title: Sediment dynamics in salt marshes: functional assessment of accretionary biofilters

Peter Rand, M.D., Chuck Lubelczyk, Robert Smith, M.D. Maine Medical Center Project Title: Ecological determinants of the spread of the tick vector of Lyme disease and other pathogens.

II. Physical Structure Descriptors

9). Variable sequence, range of measurements, units, resolution, and accuracy; dissolved oxygen and Depth Qualifiers:

Sequence of both 6600EDS and 6600EDS-SV dataloggers:
Date, Time, Temperature, Specific Conductivity, Salinity, dissolved oxygen %, dissolved oxygen mg/L, Level (for water depth), pH, Turbidity, Battery voltage

NOTE: Chlorophyll data was also collected for the IN site from May 5, 2004, until the end of the year. CDMO has requested that the data not appear in our dataset. Please contact the Wells NERR directly for this data.

Following specifications for 6600EDS and 6600EDS-SV data loggers are taken from YSI 6-Series Environmental Monitoring Manual, Appendix M (undated).

Date
Sensor Type: NA
Range: 1-12, 1-31, 00-99 (Mo,Day,Yr)
Resolution: 1 mo, 1 day, 1 yr
Accuracy: NA

Time
Sensor Type: NA
Range: 0-24, 0-60, 0-60 (Hr,Min,Sec)
Resolution: 1 hr, 1 min, 1 s
Accuracy: NA

Temperature
Sensor Type: Thermistor
Range: -5 to 45 (c)
Resolution: 0.01 C
Accuracy: +/-0.15C
Depth: 200 m

Specific Conductivity
Sensor Type: 4 electrode cell with autoranging
Range: 0-100(mS/cm)
Resolution: 0.001 mS/cm to 0.1 mS/cm (range dependent)
Accuracy: +/-0.5% of reading + 0.001mS/Cm

Depth: 200 m

Salinity
Sensor Type: calculated from conductivity and temperature
Range: 0-70 ppt
Resolution: 0.01 ppt
Accuracy: +/-1.0% of reading or + 0.1 ppt whichever is greater

Dissolved oxygen, % saturation
Sensor Type: Rapid pulse – Clarke type, polarographic
Range: 0 – 500% air saturation
Resolution: 0.1% air saturation
Accuracy: 0-200% air saturation, +/-2% of the reading or 2% air saturation, whichever is greater; 200-500% air saturation, +/-6% of reading
Depth: 200 m

Dissolved oxygen, mg/L (calculated from % air saturation, temperature and salinity)
Sensor Type: Rapid pulse – Clarke type, polarographic
Range: 0 – 50 mg/L
Resolution: 0.01 mg/L
Accuracy: 0-20 mg/L, +/-2% of the reading or 2 mg/L, whichever is greater; 200-20-50 mg/L, +/-6% of reading
Depth: 200 m

Level for 6600EDS shallow (non-vented):
Sensor Type: stainless steel strain gauge
Range: 0 – 30 ft (9.1 m)
Resolution: 0.001 ft (0.001 m)
Accuracy: +/-0.06 ft (0.018 m)

Level for 6600EDS-SV (vented):
Sensor Type: stainless steel strain gauge
Range: 0 – 30 ft (9.1 m)
Resolution: 0.001 ft (0.001 m)
Accuracy, 0-10ft: +/-0.01 ft (0.003 m)
Accuracy, 10-30ft: +/-0.06 ft (0.018 m)

pH
Sensor Type: Glass combination electrode
Range: 0-14 units
Resolution: 0.01 units
Accuracy: +/-0.2 units
Depth: 200 m

Turbidity (probe model 6136)
Sensor Type: Optical, 90 degree scatter, with mechanical cleaning
Range: 0-1000 NTU
Resolution: 0.1 NTU
Accuracy: +/- 5% of reading or 2 NTU (whichever is greater), relative to calibration standards
Depth: 66 m

Chlorophyll (not included in the dataset)
Sensor Type: Optical, fluorescence, with mechanical cleaning
Range: 0-400µg/L Chl; 0-100 Percent Full Scale (%FS) Fluorescence Units
Resolution: 0.1 µg/L Chl; 0.1 %FS

Accuracy: No specifications provided
Depth: 66 m

DISSOLVED OXYGEN QUALIFIER: The reliability of the dissolved oxygen (DO) data after 96 hours post-deployment for non-EDS (Extended Deployment System) data sondes may be problematic due to fouling which forms on the DO probe membrane during some deployments (Wenner et al. 2001). Many reserves have upgraded to the YSI 6600 EDS data sondes, which increases DO accuracy and longevity by reducing the environmental effects of fouling. The user is therefore advised to consult the metadata and to exercise caution when utilizing the DO data beyond the initial 96-hour time period. However, this potential drift is not always problematic for some uses of the data, i.e. periodicity analysis. It should also be noted that the amount of fouling is very site specific and that not all data are affected. The Research Coordinator at the specific NERR site should be contacted concerning the reliability of the DO data because of the site and seasonal variation in the fouling of the DO sensor.

DEPTH QUALIFIER: The NERR System-Wide Monitoring Program utilizes YSI data sondes that can be equipped with either depth or water level sensors. Both sensors measure water depth, but by convention, level sensors refer to atmospherically vented measurements and depth refers to non-vented measurements. Standard calibration protocols for the non-vented sensor use the atmospheric pressure at the time of calibration. Therefore, changes in atmospheric pressure between calibrations appears as changes in water depth. The error is equal to approximately 1.03cm for every 1 millibar change in atmospheric pressure. This error is eliminated for level sensors because they are vented to the atmosphere throughout the deployment time interval. If proper atmospheric pressure data are available, non-vented sensor depth measurements can be corrected for deployments between calibrations. Readings for both vented and non-vented are automatically compensated for water density changes due to variations in temperature and salinity. The Research Coordinator at the specific NERR site should be contacted in order to obtain information regarding atmospheric pressure data availability.

10). Coded variable indicator and variable code definitions:

Site definitions:

Sampling Station: Inlet at Webhannet River Mouth, at Wells Harbor
Sampling Site Code: IN
Station Code: welinwq

Sampling Station: Head of Tide of Webhannet River
Sampling Site Code: Sampling Site Code: HT
Station Code: welhtwq

Sampling Station: Little River Mouth (Merriland/Branch/Little River estuary)
Sampling Site Code: LM
Station Code: wellmwq

Sampling Station: Skinner Mill (on Merriland R, tributary to Merriland/Branch/Little R estuary)
Sampling Site Code: SM
Station Code: welsmwq

File definitions: 3 letter NERR site code (WEL for Wells NERR); 2 letter YSI deployment site code (see above); data type code (WQ for water quality), year of

deployment (ex: welhtwq2004 = Head of Tide water quality data for 2004).

11). Anomalous/Suspect Data:
January: No anomalous/suspect data.

February: No anomalous/suspect data.

March: No anomalous/suspect data.

April
Skinner Mill (SM) site: The following Turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
welsmwq 4/4/2004 06:00 1581 NTU

Skinner Mill (SM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welsmwq 4/4/2004 07:30 194 NTU
welsmwq 4/4/2004 08:30 270 NTU

May
Webhannet Inlet (IN) site: The following turbidity data point is considered suspect because it are out of the range of the sensor. Unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
welinwq 5/26/2004 08:00:00 1031

Head of Tide at Webhannet (HT) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welhtwq 5/30/2004 20:00 0113 NTU
welhtwq 5/24/2004 16:00 0113 NTU

Little River Mouth (LM) site: The following Turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
wellmwq 5/25/2004 21:30 1907 NTU

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
wellmwq 5/1/2004 8:00 0178 NTU

Skinner Mill (SM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welsmwq 5/23/2004 03:30 154.1 NTU

June
Webhannet Inlet (IN) site: The following turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
welinwq 6/20/2004 09:01:00 1451
welinwq 6/21/2004 16:31:00 1021
welinwq 6/21/2004 19:01:00 1426
welinwq 6/24/2004 11:31:00 1465
welinwq 6/24/2004 13:01:00 1019
welinwq 6/24/2004 21:01:00 1471
welinwq 6/25/2004 23:31:00 1477
welinwq 6/26/2004 06:01:00 1458
welinwq 6/26/2004 07:31:00 1458
welinwq 6/26/2004 09:31:00 1453
welinwq 6/26/2004 15:31:00 1441
welinwq 6/26/2004 23:01:00 1021
welinwq 6/27/2004 06:01:00 1408
welinwq 6/27/2004 08:31:00 1444
welinwq 6/27/2004 13:31:00 1466
welinwq 6/27/2004 21:31:00 1315
welinwq 6/27/2004 22:31:00 1261
welinwq 6/28/2004 02:01:00 1453
welinwq 6/28/2004 05:31:00 1422
welinwq 6/28/2004 07:31:00 1422
welinwq 6/28/2004 09:01:00 1424
welinwq 6/28/2004 11:01:00 1437
welinwq 6/28/2004 11:31:00 1013
welinwq 6/28/2004 15:01:00 1453
welinwq 6/28/2004 18:01:00 1421
welinwq 6/29/2004 14:01:00 1451
welinwq 6/29/2004 16:31:00 1458
welinwq 6/29/2004 22:01:00 1047
welinwq 6/30/2004 04:31:00 1457

Webhannet Inlet (IN) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welinwq 6/20/2004 23:30 0402
welinwq 6/21/2004 00:30 0840
welinwq 6/21/2004 04:00 0418
welinwq 6/21/2004 04:30 0135
welinwq 6/21/2004 05:30 0566
welinwq 6/21/2004 15:30 0348
welinwq 6/22/2004 07:00 0124
welinwq 6/23/2004 12:00 0324
welinwq 6/24/2004 11:00 0154
welinwq 6/24/2004 15:30 0489
welinwq 6/24/2004 19:30 0383
welinwq 6/24/2004 22:30 0457
welinwq 6/25/2004 10:30 0546
welinwq 6/25/2004 16:30 0567
welinwq 6/25/2004 19:00 0248
welinwq 6/25/2004 23:00 0241

welinwq 6/26/2004 01:30 0140
welinwq 6/26/2004 12:30 0247
welinwq 6/26/2004 18:30 0205
welinwq 6/26/2004 20:30 0195
welinwq 6/27/2004 15:00 0489
welinwq 6/28/2004 01:30 0844
welinwq 6/28/2004 02:30 0501
welinwq 6/29/2004 01:30 0267
welinwq 6/29/2004 06:00 0293
welinwq 6/29/2004 06:30 0348
welinwq 6/29/2004 14:30 0996
welinwq 6/29/2004 19:00 0854
welinwq 6/29/2004 20:30 0479
welinwq 6/30/2004 01:00 0485
welinwq 6/30/2004 02:00 0908
welinwq 6/30/2004 03:00 0222
welinwq 6/30/2004 05:00 0178
welinwq 6/30/2004 23:00 0166

Webhannet Inlet (IN) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. This deployment shows turbidity minimums in the -12 range, respectively, very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings.
welinwq 06/19/04 20:00 to 06/30/04 23:30

Head of Tide at Webhannet (HT) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During calibration, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The readings are sporadic throughout the following times:
welhtwq 06/18/04 14:00 - 06/30/04 19:30

Little River Mouth (LM) site: The following Turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
wellmwq 6/21/2004 12:00 2139 NTU
wellmwq 6/23/2004 0:30 2055 NTU

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually

high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
wellmwq 6/16/2004 4:30 0295 NTU

Little River Mouth (LM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The negative readings are sporadic throughout the following times:
wellmwq 6/10/2004 16:30 – 6/30/2004 23:30

Little River Mouth (LM) site: The following DO% and DO mg/L data are suspect because a large discontinuity appears at the beginning of this period and all following data for that deployment are much lower than previous data. In addition, the post-calibration test indicates a problem with the probe. The data were not deleted because there is no documented cause of this anomalous data, and they do show a regular periodicity which indicates that the relative values may valid, although the absolute values are erroneous.
wellmwq 6/18/2004 14:00 – 6/23/2004 11:00

Little River Mouth (LM) site: The following DO% and DO mg/L data are suspect because several large discontinuities appear, both at the beginning of this period and during it. In The data were not deleted because there is no documented cause of this anomalous data, and they do show a regular periodicity which indicates that the relative values may valid, although the absolute values are erroneous. At post-calibration, the DO probe was noted as torn, although this appears to happen at the end of the suspect data period, since subsequent data for this deployment (which were deleted) show very high fluctuations without clear periodicity.
wellmwq 6/26/2004 14:30 – 7/7/2004 00:00

July
Webhannet Inlet (IN) site: The pH values for the following deployments appear to be about 0.2 – 0.3 units below the previous and following deployments, which have very consistent peaks. A slightly inaccurate calibration might be the cause for the first deployment data discontinuity, since the post calibration check at pH 7 was 6.83. However, the second deployment post calibration check was 7.01 which would indicate a good calibration. Another possibility is a pH probe near the end of its useful life, since the pH mV were borderline (-51.6 at pH 7, which should be 0 +/-50) at the first deployment. No pH mV data is recorded for the second deployment. The same sonde and pH probe was used for both deployments.
welinwq 07/06/04 15:00 - 07/12/04 08:00
welinwq 07/13/04 11:00 - 07/21/04 13:30

Webhannet Inlet (IN) site: The following turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)

welinwq 7/1/2004 19:01:00 1469
welinwq 7/1/2004 19:31:00 1469
welinwq 7/1/2004 21:01:00 1462
welinwq 7/2/2004 00:31:00 1464
welinwq 7/2/2004 06:01:00 1479
welinwq 7/2/2004 17:01:00 1506
welinwq 7/2/2004 19:01:00 1482
welinwq 7/3/2004 11:31:00 1453
welinwq 7/3/2004 13:31:00 1458
welinwq 7/3/2004 19:01:00 1492
welinwq 7/4/2004 10:31:01 1467
welinwq 7/6/2004 19:59:40 1042
welinwq 7/8/2004 19:29:40 1130

Webhannet Inlet (IN) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welinwq 7/1/2004 23:00 0160
welinwq 7/2/2004 13:30 0675
welinwq 7/3/2004 18:30 0338
welinwq 7/4/2004 17:30 0219
welinwq 7/4/2004 20:30 0468
welinwq 7/4/2004 21:00 0244
welinwq 7/4/2004 21:30 0817
welinwq 7/8/2004 14:00 0207
welinwq 7/8/2004 16:30 0223
welinwq 7/8/2004 20:30 0185
welinwq 7/9/2004 03:30 0139
welinwq 7/9/2004 04:00 0195

Webhannet Inlet (IN) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. This deployment shows turbidity minimums in the -12 NTU range, very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings.
welinwq 07/01/04 00:00 to 07/31/04 23:30

Head of Tide at Webhannet (HT) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The readings are sporadic throughout the following times:

welhtwq 07/01/04 04:30 - 07/31/04 21:00

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
wellmwq 7/14/2004 9:30 2120 NTU
wellmwq 7/15/2004 3:30 0581 NTU
wellmwq 7/19/2004 2:00 0173 NTU
wellmwq 7/28/2004 13:00 0242 NTU
wellmwq 7/31/2004 13:00 0222 NTU

Little River Mouth (LM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The readings are sporadic throughout the following times:
wellmwq 7/01/2004 00:00 – 7/31/2004 23:30

Little River Mouth (LM) site: For suspect DO% and DO mg/L data, see June for a period which spans into July.

Skinner Mill (SM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welsmwq 7/13/2004 11:00 287.4 NTU

Skinner Mill (SM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are in the –6 to –1 NTU range, and are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The negative readings are sporadic throughout the following times:
welsmwq 7/16/2004 13:30 - 7/31/2004 23:30

August

Webhannet Inlet (IN) site: The pH values for the following deployment appears to be about 0.2 – 0.3 units below the previous and following deployments, which have very consistent peaks. This deployments shows pH drifting slightly lower from approximately 8/13/04 0:00 until the end of deployment. This deployment also shows a good post calibration check at 7.03. Another possibility is a pH

probe near the end of its useful life, since it shows borderline pH mV (-45.7 at pH 7, which should be 0 +/-50).
welinwq 08/06/04 15:00 - 08/17/04 12:30

Head of Tide at Webhannet (HT) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During calibration, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. Negative readings are sporadic throughout the following times:
welhtwq 08/09/04 15:00 - 08/31/04 23:30

Little River Mouth (LM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The readings are sporadic throughout the following times:
wellmwq 8/01/2004 00:00 – 8/31/2004 23:30

Little River Mouth (LM) site: The following Turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
wellmwq 8/3/2004 15:30 1098 NTU

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
wellmwq 8/9/2004 3:30 0200 NTU
wellmwq 8/9/2004 5:30 0107 NTU
wellmwq 8/18/2004 23:30 0199 NTU
wellmwq 8/27/2004 6:30 0281 NTU
wellmwq 8/28/2004 13:00 0108 NTU

Skinner Mill (SM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on

more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. The readings are sporadic throughout the following times:
welsmwq 8/01/2004 00:00 - 8/03/2004 12:30

Skinner Mill (SM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
welsmwq 8/17/2004 12:00 106.0 NTU
welsmwq 8/13/2004 02:30 330.8 NTU

September
Head of Tide at Webhannet (HT) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During calibration, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. Negative readings are sporadic throughout the following times:
welhtwq 09/01/04 03:00 - 09/04/04 09:00

Webhannet Inlet (IN) site: The dissolved oxygen data from the following deployment should be considered suspect. During this deployment 522 out of 1300 (or 40%) of dissolved oxygen readings were out of range of the sensor and were deleted (see section 12). The readings which are in range are plausible, and are only considered suspect due to the high numbers of out of range readings. The remaining readings are otherwise plausible. The post calibration check was unacceptable at 74.9 %DO, however, it was noted that the DO membrane o-ring was accidentally removed by the technician during retrieval, which would account for the poor post calibration check.
welinwq 09/03/04 12:00 - 09/30/04 13:30

Webhannet Inlet (IN) site: The following turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
welinwq 9/5/2004 14:00:00 1203
welinwq 9/5/2004 23:00:00 1214
welinwq 9/5/2004 23:30:00 1214
welinwq 9/30/2004 11:30:00 1191

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
wellmwq 9/1/2004 20:00 0173 NTU

Little River Mouth (LM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. Negative readings are sporadic throughout the following times:
wellmwq 9/02/2004 13:00 – 09/30/2004 22:00

October
Head of Tide at Webhannet (HT) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During calibration, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. Negative readings are sporadic throughout the following times:
welhtwq 10/01/04 10:30 - 10/31/04 23:30

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.
wellmwq 10/8/2004 15:30 0230 NTU
wellmwq 10/17/2004 23:30 0206 NTU

Little River Mouth (LM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. Negative readings are sporadic throughout the following times:
wellmwq 10/01/2004 01:30 – 10/26/2004 15:00

Skinner Mill (SM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on

more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings.
welsmwq 10/5/2004 10:00 - 10/27/2004 05:00

November
Head of Tide at Webhannet (HT) site: At the following times, which correspond to the last reading of one deployment and the first reading of a new deployment, a discontinuity in dissolved oxygen % and mg/L occurs. The previous deployment shows DO readings that seem show slightly discontinuity of about -2% from 11/4/2004 04:00, and then appear to drift slightly lower starting at approximately 11/10/2004 16:00 until the end of deployment. Pre and post deployment calibrations for both deployments appear within acceptable limits, and no membrane problems were noted. The cause of this discontinuity is therefore unknown.
welhtwq 11/12/2004 15:00 089.9%DO 11.8mg/L DO (end of one deployment)
welhtwq 11/12/2004 15:30 103.2%DO 13.6mg/L DO (beginning of next deployment)

Head of Tide at Webhannet (HT) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings.
welhtwq 11/01/04 00:00 - 11/12/04 15:00

Little River Mouth (LM) site: The following turbidity data are slightly anomalous, because they show negative numbers slightly lower than what are normally expected. Normally, small negative numbers (approximately -1.0 NTU) can be expected due the standard YSI calibration procedure in which to the calibration cup supplied with the sonde is slightly too close to the probe. This calibration procedure depends on the calibration cup being screwed on by only one thread. During the periods below, it is likely that the calibration cup was screwed on more than one thread, bringing the cup even closer to the probe. These data are very likely due to the calibration cup being screwed on more than one thread. Post-calibration readings indicate a fully functioning probe. According to YSI, this error is not multiplied at higher readings. Negative readings are sporadic throughout the following times:
wellmwq 11/20/2004 18:00 – 11/23/2004 23:00

Little River Mouth (LM) site: The following Turbidity data are considered suspect because they are out of the range of the sensor. These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor. (Note that for parameters other than turbidity and chlorophyll, out of range data is deleted.)
wellmwq 11/15/2004 0:00 1313 NTU

Little River Mouth (LM) site: The following turbidity data are considered suspect because they are isolated high readings (above 100). These unusually high readings could be due to biological activity, such as a crab or fish obstructing the optical sensor.

wellmwq 11/29/2004 8:00 0417 NTU
wellmwq 11/29/2004 14:30 0170 NTU

December
Skinner Mill (SM) site: At the following point, a dissolved oxygen discontinuity appears and persists. This discontinuity spans the last reading of one deployment and the first reading of the next deployment. The previous deployment calibration appears OK, and the post calibration was 102.7%, which is also acceptable. No membrane problems were found with either deployment, although the DO does seem to drift slightly higher throughout the period of the first deployment. Calibration and post-calibration data (104.4%) for the subsequent deployment do not indicate a problem with the probe. Thus, the reason for this discontinuity is unclear.
welsmwq 12/13/2004 12:30 113.4%DO 15.5 mg/L DO
welsmwq 12/13/2004 13:00 101.1%DO 13.8 mg/L DO

12). Deleted data:

Webhannet Inlet (IN) site: It appears from the data and post calibration check that the conductivity probe failed on 3/3/2004 at 9:30. All specific conductivity, salinity, dissolved oxygen (mg/L only) and depth data were deleted from that point until the end of that deployment:
welinwq 3/3/2004 09:30 to 3/9/2004 13:00

Webhannet Inlet (IN) site: The following dissolved oxygen data were deleted because they were out of the range of the sensor. See Suspect Section for more detail.
welinwq 7/16/2004 00:30
welinwq 7/26/2004 23:00 - 7/27/2004 02:00
welinwq 9/4/2004 23:00 - 23:30
welinwq 9/5/2004 04:00 - 11:30
welinwq 9/5/2004 22:00 - 9/6/2004 00:30
welinwq 9/6/2004 08:30 - 13:00
welinwq 9/6/2004 20:30 - 9/7/2004 01:00
welinwq 9/7/2004 11:00 - 14:00
welinwq 9/7/2004 22:30 - 9/8/2004 02:00
welinwq 9/8/2004 11:00 - 14:30
welinwq 9/8/2004 21:30 - 9/9/2004 05:00
welinwq 9/9/2004 06:00 - 16:30
welinwq 9/9/2004 22:30 - 9/10/2004 04:30
welinwq 9/10/2004 11:30 - 16:00
welinwq 9/11/2004 01:30 - 06:00
welinwq 9/11/2004 13:00 - 9/12/2004 08:30
welinwq 9/12/2004 11:30 - 18:30
welinwq 9/13/2004 02:30 - 08:00
welinwq 9/13/2004 09:00 - 20:00
welinwq 9/14/2004 02:30 - 09:00
welinwq 9/14/2004 10:30 - 20:00
welinwq 9/15/2004 03:00 - 08:00
welinwq 9/15/2004 16:00 - 20:00
welinwq 9/16/2004 05:00 - 08:30
welinwq 9/16/2004 17:30 - 20:30
welinwq 9/17/2004 07:00 - 09:00
welinwq 9/17/2004 19:00 - 21:30
welinwq 9/18/2004 04:30 - 11:00
welinwq 9/18/2004 12:00 - 22:30
welinwq 9/19/2004 07:30 - 11:00

welinwq 9/19/2004 20:30 - 9/20/2004 00:00
welinwq 9/20/2004 08:00 - 12:00
welinwq 9/20/2004 20:00 - 9/21/2004 00:30
welinwq 9/21/2004 09:00 - 15:30
welinwq 9/21/2004 20:30 - 9/22/2004 01:30
welinwq 9/22/2004 10:00 - 16:00
welinwq 9/22/2004 22:00 - 9/23/2004 02:00
welinwq 9/23/2004 03:00 - 03:30
welinwq 9/23/2004 11:30 - 15:30
welinwq 9/24/2004 00:00 - 04:00
welinwq 9/24/2004 12:30 - 16:30
welinwq 9/25/2004 00:00 - 04:30
welinwq 9/25/2004 13:00 - 16:30
welinwq 9/26/2004 02:00 - 05:00
welinwq 9/26/2004 15:30 - 17:30
welinwq 9/27/2004 04:30 - 06:30
welinwq 9/27/2004 15:30 - 18:30
welinwq 9/28/2004 04:00 - 07:00
welinwq 9/28/2004 17:00 - 19:30
welinwq 9/29/2004 05:30 - 08:00
welinwq 9/29/2004 19:30 - 20:00
welinwq 9/30/2004 07:00 - 08:30
welinwq 12/3/2004 23:00 - 12/4/2004 01:30
welinwq 12/16/2004 03:30 - 12/17/2004 00:00
welinwq 12/17/2004 23:30 - 12/18/2004 01:00
welinwq 12/18/2004 13:00
welinwq 12/19/2004 01:00
welinwq 12/19/2004 13:30 - 14:00
welinwq 12/20/2004 01:00 - 02:00
welinwq 12/21/2004 03:00
welinwq 12/21/2004 13:00 - 16:30
welinwq 12/22/2004 02:00 - 04:30

Little River Mouth (LM) site: The following DO% and DO mg/L data were deleted because they show extreme fluctuation with a well-defined starting point and no clear pattern, and the DO membrane was noted as torn at the end of the deployment.
wellmwq 7/7/2004 00:30 – 7/19/2004 08:00

Little River Mouth (LM) site: The following DO% and DO mg/L data were deleted because they were out of range of the sensor. Note that these data occur during a period of suspect data (see section 12).
wellmwq 6/18/2004 22:30
wellmwq 6/18/2004 23:00

Skinner Mill (SM) site: All data in the following period were deleted because it was determined that the probes were out of the water due to unusually low water flow.
welsmwq 4/28/2004 17:30 - 4/29/2004 13:00

13). Missing data:

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. For more details on deleted data, see the Deleted Data Section (12.). If additional information on missing

data are needed, contact the Research Coordinator at the reserve submitting the data.

Webhannet Inlet (IN) site: Note that on 03/15/2004 at 18:30, water leaked into the battery compartment and corroded the terminals, and the sonde stopped recording data for the rest of the deployment, which ended at 04/03/04, 11:00.

Webhannet Inlet (IN) site: Note that during the following deployments, connection of the YSI sonde to an unused Marisys telemetry unit for the purposes of venting the level sensor in the sonde resulted in sporadic power failures. Apparently, as soon as the YSI sonde detected voltage coming from the telemetry unit (from its solar panel), the sonde ignored its internal batteries from that point forward. There are large sections of missing data due to this fact.

Deployed	Retrieved	Sonde model
05/04/04, 12:00	06/03/04, not recorded	6600EDS-SV
06/04/04, 11:00	06/16/04, 11:00	6600EDS-SV
06/16/04, 12:00	07/06/04, 15:30	6600EDS-SV
07/06/04, 15:00	07/12/04, 08:00	6600EDS-SV

14). Post deployment information

End of Deployment “post-calibration” readings in the following standard solutions:

DO% is recorded in calibration cup with few millimeters of water and two tiny sponges in bottom.
SpCond (specific conductivity) solution is 10 mS/cm.
pH solution is 7.0
turb (turbidity) and chl (chlorophyll) recorded in deionized water (pre-deployment calibrated to 0.0)

Note: nr = not recorded; na = not applicable
Following text is tab-delimited.

site	date	SpCond	DO%	DOchg	level	pH	turb	chl	
IN	1/22/2004	10.54	83.6	nr	-0.126		6.93	-4.0	na
IN	2/20/2004	10.13	100.2	48.2	0.120	7.10	-0.3	na	
IN	3/9/2004	5.9	99.7	50.2	0.079	7.04	-1.7	na	
IN	4/3/2004	9.98	92.8	58.4	-0.283		7.07	-0.2	na
IN	5/4/2004	9.96	105.4	nr	0.049	7.00	0.1	na	
IN	6/4/2004	9.905	79.3	72.7	-0.001		6.71	0.2	-10.5
IN	6/16/2004	9.911	106.1	49.2	0.002	7.24	1.8	nr	
IN	7/6/2004	9.349	99	43.1	-0.001		7.02	-2.9	nr
IN	7/12/2004	10.65	100.5	49.2	-0.001		6.83	-0.3	nr
IN	7/21/2004	9.749	94.7	48.2	0.004	7.01	-0.2	-0.2	
IN	8/5/2004	9.424	100.6	49.2	-0.001		6.90	0.0	-0.2
IN	8/16/2004	9.743	102	46.1	-0.001		7.03	-0.3	-1.0
IN	9/3/2004	10.66	99.5	49.2	0.004	7.05	-0.1	0.3	
IN	9/30/2004	10.6	74.9	58.4	-0.001		7.08	3.7	nr
IN	10/27/2004	11.02	96.9	46.1	0.000	7.06	-1.6	0.4	
IN	11/17/2004	9.97	105.3	42	-0.001		7.10	-0.5	nr
IN	12/10/2004	9.903	101.7	44.1	-0.001		7.07	0.5	0.1
IN	12/22/2004	9.865	102.7	62.1	-0.002		7.01	2.1	0.8
IN	1/10/2005	10.09	99.7	52.3	0.000	6.97	0.6	-0.8	

NOTES on IN post deployment information:
3/9/2004: SpCond never stabilized.

6/4/2004: DO% never stabilized, kept dropping.
9/30/2004: the DO probe o-ring came off during handling when logger was retrieved.

HT	5/25/2004	9.959	101.8	50.2	0.011	6.96	-0.1	na	
HT	6/17/2004	9.717	99.6	46.1	0.030	7.03	4.8	na	
HT	7/8/2004	9.661	101.1	46.1	0.016	7.08	-1.5	na	
HT	7/26/2004	9.969	102.3	nr	0.121	6.95	-1.7	na	
HT	8/11/2004	9.764	103.3	nr	0.028	7.17	0.3	na	
HT	9/4/2004	10.65	100.8	46.1	0.076	6.69	-1.6	na	
HT	9/30/2004	9.72	104.4	53.3	0.026	6.89	0.3	na	
HT	10/21/2004	10.99	101.9	52.3	0.023	6.96	-0.4	na	
HT	11/12/2004	9.934	96	49.2	0.067	6.99	-0.6	na	
HT	12/9/2004	10.06	102.7	52.3	0.092	7.03	-1.5	na	
HT	12/21/2004	10.14	100.8	53.3	0.071	7.07	-0.5	na	
LM	4/12/2004	9.99	103.5	nr	0.018	7.08	-1.2	na	
LM	5/10/2004	9.89	102.8	55.3	0.007	7.04	0.0	na	
LM	6/9/2004	9.583	95.4	51.2	-0.085		7.02	4.4	na
LM	6/23/2004	9.672	78.4	38.1	-0.028		7.06	-0.3	na
LM	7/19/2004	10.4	72.7	19.6	-0.111		7.05	1.0	na
LM	8/4/2004	9.598	94.5	38	-0.035		6.94	-0.5	na
LM	8/20/2004	9.323	100.7	nr	0.054	7.13	0.2	na	
LM	9/8/2004	10.84	97.2	49.2	0.065	7.13	0.1	na	
LM	10/4/2004	9.683	106.4	46.1	0.035	7.10	-0.4	na	
LM	10/26/2004	9.784	102.8	49.2	0.040	6.96	-3.1	na	
LM	11/17/2004	9.938	100.2	53.3	0.040	7.06	0.1	na	
LM	12/14/2004	9.73	99.5	51.2	0.150	7.13	-0.3	na	
LM	12/21/2004	10.01	96.7	46.1	0.041	7.02	0.5	na	

NOTES on LM post deployment information:
7/19/2004: DO membrane had torn mid-deployment (see also section 12 for deleted data).

SM	5/3/2004	9.17	101.1	47.1	-0.002		6.98	-0.1	na
SM	5/26/2004	9.86	101.2	nr	0.043	7.02	-0.1	na	
SM	6/17/2004	9.73	101	48.2	0.083	7.07	3.5	na	
SM	7/13/2004	10.35	101.7	nr	0.028	7.10	-0.6	na	
SM	8/3/2004	9.818	99.7	49.2	0.015	7.04	-0.7	na	
SM	8/17/2004	9.944	100.8	nr	0.102	7.07	0.1	na	
SM	9/10/2004	9.75	102.9	48.2	0.070	6.95	1.2	na	
SM	10/4/2004	9.747	99.7	48.2	0.026	7.03	4.3	na	
SM	10/30/2004	9.9	100.7	46.1	-0.135		6.97	-3.2	na
SM	11/15/2004	9.627	102.7	50.2	0.135	6.99	3.4	na	
SM	12/15/2004	10.01	104.4	50.2	-0.311		7.05	-0.2	na
SM	12/21/2004	10.11	100.7	52.3	0.187	7.01	-0.4	na	

15). Other Remarks/Notes:

On 08/13/2020 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2006, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified

and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

There were a few instances at this NERR site where turbidity recorded small negative values (-0001 and -0002). Because turbidity has a range of accuracy of +/-2 NTU, the technician did not edit or deleted these values in any way.

Webhannet Inlet (IN) site: Specific conductivity (and salinity which is calculated from it) show slight variations from deployment to deployment, and the following table provides supplemental information regarding this fact. This was probably due to the reuse of specific conductivity standard. Reuse of the standard can result in gradual dilution of the standard, since deionized water clings to the probes (particularly the inside of the temperature/conductivity probe where it is difficult to dry) and is introduced to the standard. The first readings of the year. Below, readings from a handheld YSI model 85 (used as an external check when deploying and retrieving dataloggers) are compared to the nearest sonde reading. Readings which were within 1 ppt are not listed below. Note that these readings may have been taken up to 30 minutes apart, since the loggers only record on the hour and half hour, while the logger may be set at any time. Note also that the conductivity solution has an published accuracy of +/- 1%, the probe has a published accuracy of +/- 0.5%, and the YSI model 85 has a published accuracy of +/- 2%, for a sum of +/- 3.5% (or 1.12 ppt at 32 ppt).
12/31/03, 17:30 to 01/22/04, 11:30 handheld: 32.5 ppt, sonde: 34.1 ppt (data from end of 2003)
04/03/04, 11:30 to 05/04/04, 11:30 handheld: 33.2 ppt, sonde: 32.0 ppt
05/04/04, 12:00 to 06/03/04, not recorded handheld: 33.2 ppt, sonde: 31.9 ppt
07/06/04, 15:00 to 07/12/04, 08:00 handheld: 31.8 ppt, sonde: 33.8 ppt
07/13/04, 11:00 to 07/21/04, 13:30 handheld: 32.3 ppt, sonde: 31.0 ppt
09/03/04, 12:00 to 09/30/04, 13:30 handheld: 31.7 ppt, sonde: 34.1 ppt
09/30/04, 14:00 to 10/27/04, 10:30 handheld: 32.8 ppt, sonde: 35.2 ppt
10/27/04, 11:00 to 11/17/04, 15:00 handheld: 33.3 ppt, sonde: 32.2 ppt
12/10/04, 11:30 to 12/22/04, 08:00 handheld: 33.2 ppt, sonde: 31.7 ppt
12/22/04, 08:30 to 01/10/05, 13:30 handheld: 30.5 ppt, sonde: 32.5 ppt

Webhannet Inlet (IN) site: pH levels in May and June were lower than normal, however we believe there are biological explanations for these lowered pH values. (For example, the low DO could indicate high amounts of respiration by plankton or bacteria.) This area is prone to low DO, presumably from plankton blooms, which would also create lower pH.

The Skinner Mill (SM) site was a new site this year. It was intended to represent a “head of tide” environment, although it was discovered during the course of the year that it was essentially a riverine site, with no discernable tidal influence. As a result, this site will be discontinued next year in favor of a tidally influenced site.

Skinner Mill (SM) site: This was a very low water site with rocky substrate which prevented the installation of a fixed, vertical pole in the stream. Consequently, deployment of the logger occurred in a horizontal PVC tube, with sensors 18-26 cm from stream bottom (depending on their location on the sonde). Every attempt was made to place and anchor the deployment tube in the same spot at each deployment. However, it is possible that unusual deployment conditions resulted in the sonde being in slightly different locations. In addition, high water flow or debris in the water column may have caused the deployment tube to shift during deployment. As a result, it is important to note when the logger

was switched (see section 6 for discrete deployment times, across which depths may not correlate precisely). Other discontinuities are noted below, with explanations.

welsmwq 04/04/2004 13:00 – A depth discontinuity of 0.34 meters occurs due to the repositioning of the logger by the technician, when part of the deployment tube was seen in very shallow water.

welsmwq 04/21/2004 09:00 – A depth discontinuity of 0.07 meters occurs due to the repositioning of the logger by the technician, when part of the deployment tube was seen in very shallow water.

welsmwq 04/29/2004 13:30 – A depth discontinuity of unknown meters occurs due to the repositioning of the logger by the technician, when the sensors were seen out of the water. Some prior data has been deleted (see section 12 of this document).

welsmwq 09/10/2004 17:00 – 9/13/2004 08:00 – During this period, the logger was accidentally deployed at a more shallow depth than normal, by approximately 0.22 meters. At the end of this period, the placement was corrected and from 9/13/2004 08:30 until the end of deployment the location at the normal location.

welsmwq 10/07/2004 09:30 - A depth discontinuity of -0.11 meters occurs and persists throughout the remainder of the deployment. Reason unknown, but suspected to be a shift in the position of the deployment tube due to debris or current flow. There is also a small discontinuity of specific conductivity at this point, which is of unknown cause.

welsmwq 12/12/2004 10:30 – A depth discontinuity of -0.11 meters occurs and persists throughout the remainder of the deployment. Reason unknown, but suspected to be a shift in the position of the deployment tube due to debris or current flow.