Wells (WEL) National Estuarine Research Reserve Meteorological Metadata
January-December 2003
Latest Update: **October 11, 2023**

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification:

a) Data Input Procedures

The 15-minute, 1-hour average, and 24-hour meteorological data were downloaded from each instrument on the weather station to a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program was loaded into the CR10X and controls the sensors and data collection schedule (see 2b of the Entry Verification section for the data collection schedule). The CR10X then interfaced with the PC208W software supplied by Campbell Scientific. This software was located on a computer to which the data was uploaded (every 15 minutes) via a short haul modem to a computer located at the Coastal Ecology Center. The data was saved as a raw data file (LF_RAW.dat) onto a separate hard drive and backed up.

Once an entire month of data was available, the CDMO Weather Data Management Program (WDMP) was used to convert the files to an Access database.* This program was developed in Visual Basic to interface with the NERRS data collection schedule (see 2b of the Entry Verification section for the data collection schedule). The WDMP will automatically input and convert the monthly raw data file into and Access Database. There are three main steps the WDMP performs. First, it converts the comma delimited monthly raw data file into an Access Database. Secondly, it checks the data against a predetermined set of error criteria (see Part C of this section). Finally, it produces error and summary reports. Any anomalous data were investigated and are

noted below in Anomalous Data section.

*During November 2003, we changed our data management program from the WDMP to EQWin---files are exported from PC208W or LoggerNet in a comma-delimited format (.DAT) and opened in Microsoft Excel for pre-processing with the EQWin format macro (EQWinFormat.xls) that was developed by the CDMO to reformat the header columns, insert station codes, insert a date column (mm/dd/yyyy), correct the time column format and reformat the data to the appropriate number of decimal places. The pre-processed file is then ready to be copied into the EQWin weather.eqi file where the data are QA/QC checked and archived in a database. EQWin queries, reports and graphs are used to discover data set outliers (values which fall outside the range that the instrument is designed to measure) and large changes in the data. EQWin is also used to generate statistics, view graphs, create customized queries and reports of the data, cross query the water, weather and nutrient data and finally export the data to the CDMO. Any anomalous data are investigated and noted below in the Anomalous Data/Suspect Data section. Any data corrections that were performed are noted in the Deleted Data section below.

The Centralized Data Management Office converted all SWMP weather data collected with CR10X program versions prior to version 4.0 which was distributed in October 2003. This was necessary in order to merge the old data format (12 array output) with the new data format found in version 4.0 (3 array output). The new format produces averages, maximums and minimums every fifteen minutes (array 15), every hour (array 60) and every day (array 144) for any sensors hooked up to the CR10X. Specifically, the 150 and 151 fifteen minute data were converted to the new 15 array; the hourly 101, 102, 105 and 106 data were converted to the new 60 array; and the daily 241, 242, 243, 244, 245 and 246 data were converted to the new 144 array. With the new format, the use of 55555's to code for deleted data and 11111's to code for missing data has been abandoned. Hence, all 55555's or 11111's contained in the SWMP weather data collected prior to Version 4.0 of the CR10X program were removed and left blank.

The most common reported errors/anomalies in 2003 were:

1) 15 minute air temp difference is greater than 3.0 degrees C.
2) 15 minute sample rainfall amount differences of over 5mm from previous sample.
3) Air Pressure is greater than 1040 or less than 980.

All errors of these types were double checked with other data that could support such "anomalous" weather changes and noted in the sections that follow. When power-down events occurred, we lost the earlier 5-second data for those calendar days, resulting in incorrect values of those days' 24-hour average, maximum and minimum values. Therefore, those days' 24-hour values were deleted. Any data corrections that were performed are noted in the

Data Correction section below. Both raw data files and Access and EQWin databases were saved to the DCP server with daily tape back-up.

Jim Dochtermann error checked and compiled the 2003 weather data.

b) Data Collection Schedule

i) Data are collected in the following formats (i-Viii with prior to installation of the NERR_4.CSI program):

1) 15 minute data are instantaneous readings except for PAR and precipitation data that are totalized from 5 second samples sorted by date and time. (Arrays 150 and 151)
2) Hourly averages (Arrays 101 and 102) are calculated from 5 second samples sorted by date and time except for PAR and precipitation data that are hourly totals calculated from 15 minute totals (Arrays 105 and 106).
3) Daily average (arrays 241 and 242), maximum with time, and minimum with time (arrays 243 and 244) are calculated from 5 second samples sorted by date and time except for PAR and precipitation data which are 24 hour totals calculated from hourly totals (arrays 245 and 246).

ii) 15 minute sample point parameters: Date, Time, Air Temperature (°C), Relative Humidity (%), LiCor (PAR), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (Array 150); Rainfall (mm) (Array 151)

iii) Hourly average parameters: Date, Time, Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb) (Array 101); Wind Speed (m/s), Wind Direction, Wind Speed Maximum (Array 102)

iv) Hourly total parameters: LiCor (PAR) (Array 105); Rainfall (mm) (Array 106)

v) Daily Average parameters: Date, Time, Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb) (Array 241); Wind Speed (m/s), Wind Direction, Wind Direction Standard Deviation (using Yamartino's Algorithm) (Array 242)

vi) Daily Total parameter: LiCor (PAR) (Array 245); Rainfall (mm) (Array 246)

vii) Daily Maximum parameters: Date, Time, Air Temperature (°C), Time, Relative Humidity (%), Time, LiCor (PAR), Time, Barometric Pressure (mb), Time, Wind Speed (m/s), Time, Battery Voltage, Time (Array 243)

viii) Daily Minimum parameters: Date, Time, Air Temperature (°C), Time, Relative Humidity (%), Time, LiCor (PAR), Time, Barometric Pressure (mb), Time, Wind Speed (m/s), Time, Battery Voltage, Time (Array 244)

ix) With installation of the new NERR_4.CSI program, the following parameters were collected every 15 minutes, hourly and daily:

Year, Julian Date, Time, Average (c), Temperature Maximum Temperature (c), Maximum Temperature Time, Minimum Temperature (c), Minimum Temperature Time, Relative Humidity Average (%), Relative Humidity Max (%), Relative Humidity Max Time, Relative Humidity Min (%), Relative Humidity Min Time, Barometric Pressure Average (mb), Barometric Pressure Max (mb), Barometric Pressure Max Time, Barometric Pressure Min (mb), Barometric Pressure Min Time, Wind Speed Average (m/s) Wind Direction Average (degrees), Wind Speed Std Dev (m/s), Wind Speed Maximum (m/s), Wind Speed Maximum Time, Wind Speed Minimum (m/s), Wind Speed Minimum Time, Precipitation Total (mm), PAR Total (millimoles/M2), Voltage Average (volts), Total Radiation (Langleys/Minute), Cumulative Rainfall (mm)

c) Error/Anomalous Data Criteria

Air Temp:

- 15 min sample greater than max for the day
- 15 min sample less than the min for the day
- 15 min sample greater than 3.0 °C from the previous 15 minutes
- Max and Min values not recorded for the day
- 1-hour average greater than 10% above the greatest 15 min sample recorded in the hour

Relative Humidity:

- Changed by more than 25% from the previous 15 minutes
- Max and Min values not recorded for the day
- 1-hour average greater than 10% above the greatest 15 min sample recorded in the hour

Rainfall:

- Precipitation greater than 5 mm in 15 minutes
- No precipitation for the month

Wind Speed:

- Wind speed greater than 30 m/s
- Wind speed less than 0.5 m/s

Wind Direction:

- Wind direction greater than 360 degrees
- Wind direction less than 0 degrees

Pressure:

- Pressure greater than 1040 mb or less than 980 mb
- Pressure changes greater than 5 mb per hour
- Max and Min values not recorded for the day
- 1-hour average greater than 10% above the greatest 15 min sample recorded in the hour

Time:

- 15-minute interval not recorded

For all data:

- Duplicate interval data

3) Research Objectives

The principal objective is to record long-term meteorological data for Wells, in order to supplement SWMP water quality YSI data and research data, and to observe any environmental changes or trends over time.

4) Research Methods

The Campbell Scientific weather station (CR10X datalogger) is programmed to measure parameters every 5 seconds to produce 15 minute, hourly and daily averages of measurements, including air temperature, relative humidity, barometric pressure, LiCor (solar radiation), rainfall, wind speed and wind direction. Prior to installation of the new CR10X NERR_4.CSI, program, an instantaneous sample is taken every 15 minutes and that data is stored in array 150. Data are downloaded to a desktop computer from the datalogger via the SC32A interface. On-site weather conditions are measured to verify the accuracy of the readings by the sensors. Sensors on the weather station are inspected for damage or debris periodically. Sensors are sent back to Campbell Scientific for calibration at a minimum of every two years.

The data are analyzed using the Weather Data Management Program where a database and error report is created for each month from the raw data files. The error reports are used to assist in the QA/QC of the data. Data are then edited in Access and recompiled in the WDMP. In November 2003, we finished using the WDMP and began using EQWin. All collected data are quality checked immediately after the monthly downloads using EQWin. All edits and errors are documented in the metadata.

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 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 mud of the Presumpscot Formation in the lower reaches. 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 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. The estuarine system is 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 freshwater flow that 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 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."

The weather station is located (43 deg 20.244 Latitude, 70 deg 33.000 Longitude) on a 32' telephone pole surrounded by mowed grass.

The temperature and humidity probes are located on the north side of the pole at a height of 10'. To the NW of the pole is the Coastal Ecology Center, a 20' high, 111' long building, at a distance of 37', running NE/SW. Further to the NW (153' from the pole) is the library, in a 25' high wing of the barn. The barn itself is 223' from the station and runs NE/SW. It is 38' high and is the largest obstruction in the area. The rain gauge is located 9' southeast of the weather station pole and is situated on a post with the top of the funnel is 10' from the ground.

There are three SWMP water quality sampling sites in the Webhannet River estuary. These are located at the Head of Tide, Mile Road, and at the Inlet. The tidal range at each of these sites is 2.6-2.9 meters.

The Head of Tide site is located 4 miles south of the Wells Reserve, just downstream of the Webhannet Falls (freshwater) and 10 feet east of Route One (43 deg 17' 54.25227" Latitude, 70 deg 35' 13.82728" Longitude). 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 Mile Road site is located 3.5 miles south of the Wells Reserve, on Mile Road roughly 300' north of the bridge (N43 deg 18.300' Latitude,W 70 deg 34.583 Longitude). This site has soft mud and a rocky substrate, and the low and high tide depth is relatively shallow. The salinity range here is 3.6-33.4 ppt, with a mean of 27.0 ppt.

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 .4 miles of the Wells Reserve. Due to problems with heavy sediment movement in the inlet of the Little River, we were forced to relocate the site (see 2002 metadata). We designated a new location for the 2003 sampling season (N 43 deg 20.413 Latitude, W 70 deg 32.441 Longitude). It is located just off the bank of the marsh, in the main channel of the river, upstream from the previous year's sites.The first location attempted in 2002

(N 43 deg 20.176 Latitude, W 70 deg 32.497 Longitude) was located in the main channel of the river, just inland of a spit, beside a bank. The second location attempted in 2002 (N 43 deg 20.083 Latitude, W 70 deg 32.585 Longitude) was located 1/8 mi. southwest of the first site, within an inlet, just inland of a spit. The second site was located in an area of much lower current than the first site and often drains completely during low tides. It was also placed within a pool next to incipient low marsh peat that retains calm water during low tides. Both sites were abandoned in 2002. The tidal range of the Little River estuary is 2.6-3.0 meters (Mariano and FitzGerald, 1988). The Little River sites existed 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

Weather data has been collected at the Wells NERR since December 1996. Data was collected for the entire year in 2003.

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 the 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/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 weather data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Section 1 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 format and Access data tables.

8) Associated researchers and projects

WELLS NATIONAL ESTUARINE RESEARCH RESERVE RESEARCH AT THE RESERVE for 2002(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 2000-2001 twenty-three different studies (involving 79 scientists, students, and staff from the Reserve, 26 academic institutions and 19 resource management groups) 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, and 5) restoration of salt marsh habitat degraded through human actions.

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.

Coastal Conservation Strategies

In response to requests for support from the conservation community to increase the quantity, quality and ecological integrity of conserved lands in our region research staff organize and facilitate meetings, workshops, and communications for 18 partner conservation groups. A

key element of the Project is the Conservation Resource Center, a Reserve staffed GIS facility with a growing database able to provide maps of property, natural features and other data needed to develop effective conservation goals and strategies. The Project is nearing completion of conservation lands maps for 13 Southern Maine coastal towns, and is undertaking an initiative to develop coastal watershed conservation strategies for 12 coastal watersheds within these towns. The Reserve has a particular interest in educating communities about the ecologic and economic benefits of land conservation, especially along estuarine and riverine shorelines.

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 8 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. In the coming year we plan to develop a long-term monitoring program for finfish that will be coordinated with other sites within the Gulf of Maine and along the east coast. 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.

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 severely 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.

• The Wells NERR Research Dept. is working on the following projects: "Ecological processes, energy pathways, and the impact of human activities on Maine marsh-estuarine secondary production: a salt marsh panne model". We used stable isotopic tracers (15N additions and naturally abundant 13C) coupled with secondary production measurements (nekton, invertebrates) to track energy flow on the high marsh surface in southern Maine salt marsh systems. The project is still under way.

"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 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 an dinvertebrate assemblages in estuarine, nearshore, and offshore habitat. Stations were also established near dredge spoil dump sites as well as sweage outflow to determine the impacts of human activity on the coast to benthic habitat. The project is still under way.

• The Wells NERR Research Dept. also completed the work 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 (information on CICEET can be found on the website http://www.ciceet.unh.edu):

I. 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.

II. Project Title: Microbial Source Tracking in Two Southern Maine Watersheds. A two year project written by Maine Sea Grant associate Kristen Whiting-Grant, and funded by Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET), involving Wells NERR, UNH Jackson Estuarine Lab (JEL), USM Muskie School, AmeriCorps and the Maine Conservation Corps. We are pioneering the use in Maine of genetic analysis as a means of determining the source species associated with bacterial contamination in the Webhannet and Little River Estuary. Volunteers collect water samples from streams and the estuaries, staff test for and isolate E. coli. At JEL, a genetic technique (ribotyping) creates a genetic fingerprint of the bacteria which is compared to known sources. The project is still underway.

Wells NERR Past Graduate Research Fellowships (GRF's):
1)Patrick Ewanchuck and Mark Bertness, Ph.D.; Brown University
Project Title: Patch persistence and seedling dynamics in a Southern Maine marsh and the process and pattern in western Atlantic salt marsh plant communities: a biogeographical perspective.
2)Lindsay Whitlow, University of Michigan
Project Title: Integration of individual behavior and community dynamics to determine mechanisms by which the invasive green crab impacts populations of the native soft-shell clam.
3)Pamela Morgan, University of New Hampshire
Project Title: Functions and values of salt marshes in northern New England: a comparison of fringing marshes and back barrier marshes.

Other Onsite Research:
Michele Dionne, Wells NERR, Nancy McReel, Chuck Lubelczyk
Project Title: Effect of herbivory by deer on forest regeneration

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) Sensor specifications, operating range, accuracy, date of last calibration

CSI LiCor Quantum Sensor
Model # LI190SB
Stability: <±2% change over one year
Operating Temperature: -40 to 65°C
Sensitivity: typically 5 µA per 1000µmoles s-1 m-2
Light spectrum wavelength: 400 to 700 nm
Date of last calibration: 10-17-01

CSI Wind Sentry
Model # 03001
Range: 0-50 m/s; 360° mechanical
Date of last calibration: 10-17-01

CSI Temperature and Relative Humidity
Model #: HMP45C
Operating Temperature: -40 to +60°C
Temperature Measurement Range: -40 to +60°C
Temperature Accuracy: ± 0.2 °C @ 20°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: +/-2% RH (0-90%) and +/-3%(90-100%)
Uncertainty of calibration: ± 1.2% RH
Date of Last calibration: 10-17-01

CSI Barometric Sensor
Model #PTB101B
Operating Range: Pressure: 600-1060 mb
Temperature: -40 to +60C
Humidity: non-condensing
Accuracy: ±0.5 to 6.0 mb (+20 to 60C)
Stability: ± 0.1 mb per year
Date of Last calibration: 10-17-01

Met One Tipping Bucket Rain Gauge
Model #: 385/385M
Range: 0.1 mm
Accuracy: ±0.5%<0.5"(1.27 cm)/hr rate
±2.0%<3.0"(7.62 cm)/hr rate
Date of Last calibration: 10-17-01

10) Coded variable code definitions

LF = Laudholm Farm

11) Data anomalies/Data corrections

Arrays:
During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

January 2003

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	9	9	515	Pressure is greater than 1040 or less than 980 on 9 (9) 515 (979.58)
150	9	9	530	Pressure is greater than 1040 or less than 980 on 9 (9) 530 (979.7)
150	9	9	545	Pressure is greater than 1040 or less than 980 on 9 (9) 545 (979.83)
150	9	9	600	Pressure is greater than 1040 or less than 980 on 9 (9) 600 (979.83)
150	9	9	615	Pressure is greater than 1040 or less than 980 on 9 (9) 615 (979.7)
150	9	9	630	Pressure is greater than 1040 or less than 980 on 9 (9) 630 (979.7)
150	9	9	645	Pressure is greater than 1040 or less than 980 on 9 (9) 645 (979.83)
150	9	9	700	Pressure is greater than 1040 or less than 980 on 9 (9) 700 (979.83)
150	9	9	715	Pressure is greater than 1040 or less than 980 on 9 (9) 715 (979.95)

The following data are suspect due to the offset being output when there was no wind recorded. This datum can be interpreted as 0:

Array	CalD	JulD	Time	Error Message
150	30	30	1830	Wind direction is greater than 360 or less than 0 on 30 (30) 1830 (-.09506)

February 2003

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	21	52	1600	Air temp difference from 21 (52) 1600 (11.596) to 21 (52) 1615 (7.2514) is greater than 3.0 degrees C
150	23	54	1430	Pressure is greater than 1040 or less

than 980 on 23 (54) 1430 (979.64)
150 23 54 1445 Pressure is greater than 1040 or less than 980 on 23 (54) 1445 (979.39)
150 23 54 1530 Pressure is greater than 1040 or less than 980 on 23 (54) 1530 (979.76)
150 23 54 1545 Pressure is greater than 1040 or less than 980 on 23 (54) 1545 (979.76)
150 23 54 1600 Pressure is greater than 1040 or less than 980 on 23 (54) 1600 (979.27)
150 23 54 1615 Pressure is greater than 1040 or less than 980 on 23 (54) 1615 (979.76)
150 23 54 1700 Pressure is greater than 1040 or less than 980 on 23 (54) 1700 (979.88)

The following data are suspect due to the offset being output when there was no wind recorded. This datum can be interpreted as 0:
Array CalD JulD Time Error Message
150 1 32 515 Wind direction is greater than 360 or less than 0 on 1 (32) 515 (-.09505)

March 2003

The following data appear to be correct:
Array CalD JulD Time Error Message
150 19 78 1330 Air temp difference from 19 (78) 1330 (-1.3994) to 19 (78) 1345 (3.552) is greater than 3.0 degrees C
150 19 78 1345 Air temp difference from 19 (78) 1345 (3.552) to 19 (78) 1400 (.54175) is greater than 3.0 degrees C
150 21 80 1145 Air temp difference from 21 (80) 1145 (11.204) to 21 (80) 1200 (6.9875) is greater than 3.0 degrees C
150 26 85 1600 Air temp difference from 26 (85) 1600 (9.6072) to 26 (85) 1615 (6.465) is greater than 3.0 degrees C
150 29 88 1930 Air temp difference from 29 (88) 1930 (11.412) to 29 (88) 1945 (15.29) is greater than 3.0 degrees C
150 17 76 1515 Pressure difference from 17 (76) 1515 (1004.7) to 19 (78) 1215 (1028.3) is greater than 5 mb

April 2003

The following data appear to be correct:
Array CalD JulD Time Error Message
150 15 105 1445 Air temp difference from 15 (105) 1445 (26.079) to 15 (105) 1500 (29.15) is greater than 3.0 degrees C
150 15 105 1800 Air temp difference from 15 (105) 1800 (25.427) to 15 (105) 1815 (21.757) is greater than 3.0 degrees C
150 15 105 1830 Air temp difference from 15 (105) 1830 (20.089) to 15 (105) 1845 (16.818) is greater than 3.0 degrees C
150 15 105 2115 Air temp difference from 15 (105)

2115 (8.3285) to 15 (105) 2130 (19.833) is greater than 3.0 degrees C
150 16 106 145 Air temp difference from 16 (106)
145 (11.722) to 16 (106) 200 (14.801) is greater than 3.0 degrees C
150 16 106 1145 Air temp difference from 16 (106)
1145 (27.081) to 16 (106) 1200 (17.136) is greater than 3.0 degrees C
150 16 106 1200 Air temp difference from 16 (106)
1200 (17.136) to 16 (106) 1215 (13.467) is greater than 3.0 degrees C
150 27 117 1345 Air temp difference from 27 (117)
1345 (17.784) to 27 (117) 1400 (13.908) is greater than 3.0 degrees C
150 28 118 1545 Air temp difference from 28 (118)
1545 (20.187) to 28 (118) 1600 (24.195) is greater than 3.0 degrees C
150 28 118 1700 Air temp difference from 28 (118)
1700 (23.517) to 28 (118) 1715 (19.705) is greater than 3.0 degrees C
150 28 118 2200 Air temp difference from 28 (118)
2200 (8.2776) to 28 (118) 2215 (17.104) is greater than 3.0 degrees C
150 15 105 2115 Rel hum difference from 15 (105)
2115 (84.291) to 15 (105) 2130 (39.844) is greater than 25%
150 16 106 1145 Rel hum difference from 16 (106)
1145 (29.369) to 16 (106) 1200 (61.608) is greater than 25%
150 28 118 2200 Rel hum difference from 28 (118)
2200 (83.182) to 28 (118) 2215 (43.062) is greater than 25%

The following erroneous data was caused by an undocumented and unexplained glitch or power down that caused the CR10X to reset and record erroneous hourly averages and daily averages. Data were edited accordingly for arrays 101 and 102 at time 1100 and 2300 and arrays 241, 242,243,and 244 at time 2400, for 1 (91) and arrays 101 and 102 at time 1100 and arrays 241, 242, 243, and 244 at time 2400, for 6 (96):

Array CalD JulD Time Error Message
101 1 91 1100 Technician changed 101 Array from 1 (91) 1100 to 1 (91) 1100
102 1 91 1100 Technician changed 102 Array from 1 (91) 1100 to 1 (91) 1100
101 1 91 2300 Technician changed 101 Array from 1 (91) 2300 to 1 (91) 2300
102 1 91 2300 Technician changed 102 Array from 1 (91) 2300 to 1 (91) 2300
101 6 96 1100 Technician changed 101 Array from 6 (96) 1100 to 6 (96) 1100
102 6 96 1100 Technician changed 102 Array from 6 (96) 1100 to 6 (96) 1100
241 1 91 2400 Technician changed 241 Array from 1 (91) 2400 to 1 (91) 2400
241 6 96 2400 Technician changed 241 Array from 6 (96) 2400 to 6 (96) 2400
242 1 91 2400 Technician changed 242 Array from 1 (91) 2400 to 1 (91) 2400

242 6 96 2400 Technician changed 242 Array from 6 (96)
2400 to 6 (96) 2400
243 1 91 2400 Technician changed 243 Array data from 1 (91)
2400 to 1 (91) 2400
243 6 96 2400 Technician changed 243 Array data from 6 (96)
2400 to 6 (96) 2400
244 1 91 2400 Technician changed 244 Array data from 1 (91)
2400 to 1 (91) 2400
244 6 96 2400 Technician changed 244 Array data from 6 (96)
2400 to 6 (96) 2400

May 2003

The following data appear to be correct:
Array CalD JulD Time Error Message
150 1 121 2245 Air temp difference from 1 (121) 2245
(9.7409) to 1 (121) 2300 (14.621) is greater than 3.0 degrees C
150 2 122 15 Air temp difference from 2 (122) 15
(15.54) to 2 (122) 30 (10.66) is greater than 3.0 degrees C
150 3 123 2300 Air temp difference from 3 (123) 2300
(4.6236) to 3 (123) 2315 (7.639) is greater than 3.0 degrees C
150 7 127 1015 Air temp difference from 7 (127) 1015
(17.593) to 7 (127) 1030 (14.045) is greater than 3.0 degrees C
150 10 130 1530 Air temp difference from 10 (130) 1530
(21.374) to 10 (130) 1545 (16.763) is greater than 3.0 degrees C
150 19 139 900 Air temp difference from 19 (139) 900
(23.774) to 19 (139) 915 (18.631) is greater than 3.0 degrees C
150 21 141 630 Air temp difference from 21 (141) 630
(15.13) to 21 (141) 645 (18.27) is greater than 3.0 degrees C
150 28 148 1530 Air temp difference from 28 (148) 1530
(15.119) to 28 (148) 1545 (12.046) is greater than 3.0 degrees C
150 29 149 1515 Air temp difference from 29 (149) 1515
(21.57) to 29 (149) 1530 (17.763) is greater than 3.0 degrees C
150 29 149 1745 Air temp difference from 29 (149) 1745
(15.719) to 29 (149) 1800 (19.863) is greater than 3.0 degrees C

June 2003

The following data appear to be correct:
Array CalD JulD Time Error Message
150 23 174 845 Air temp difference from 23 (174) 845
(19.457) to 23 (174) 900 (15.646) is greater than 3.0 degrees C
150 25 176 730 Air temp difference from 25 (176) 730
(21.581) to 25 (176) 745 (24.71) is greater than 3.0 degrees C

July 2003

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	5	186	345	Air temp difference from 5 (186) 345 (22.782) to 5 (186) 400 (18.173) is greater than 3.0 degrees C
150	5	186	830	Air temp difference from 5 (186) 830 (24.289) to 5 (186) 845 (28.626) is greater than 3.0 degrees C
150	5	186	915	Air temp difference from 5 (186) 915 (30.153) to 5 (186) 930 (26.346) is greater than 3.0 degrees C
150	5	186	1215	Air temp difference from 5 (186) 1215 (28.478) to 5 (186) 1230 (32.416) is greater than 3.0 degrees C
150	6	187	1730	Air temp difference from 6 (187) 1730 (30.668) to 6 (187) 1745 (24.596) is greater than 3.0 degrees C
150	12	193	1930	Air temp difference from 12 (193) 1930 (18.717) to 12 (193) 1945 (22.592) is greater than 3.0 degrees C
150	23	204	1515	Air temp difference from 23 (204) 1515 (20.504) to 23 (204) 1530 (24.979) is greater than 3.0 degrees C
150	25	206	400	Air temp difference from 25 (206) 400 (19.536) to 25 (206) 415 (16.191) is greater than 3.0 degrees C
150	25	206	1800	Air temp difference from 25 (206) 1800 (28.082) to 25 (206) 1815 (23.211) is greater than 3.0 degrees C
150	26	207	1845	Air temp difference from 26 (207) 1845 (23.762) to 26 (207) 1900 (19.222) is greater than 3.0 degrees C
150	27	208	1030	Air temp difference from 27 (208) 1030 (26.3) to 27 (208) 1045 (23.295) is greater than 3.0 degrees C
151	22	203	1900	Precip difference from 22 (203) 1900 (.762) to 22 (203) 1915 (12.7) is greater than 5 mm

August 2003

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	16	228	1530	Air temp difference from 16 (228) 1530 (29.672) to 16 (228) 1545 (24.936) is greater than 3.0 degrees C
150	16	228	1545	Air temp difference from 16 (228) 1545 (24.936) to 16 (228) 1600 (21.068) is greater than 3.0 degrees C
151	13	225	1345	Precip difference from 13 (225) 1345 (12.192) to 13 (225) 1400 (2.794) is greater than 5 mm

September 2003

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	5	248	1615	Air temp difference from 5 (248) 1615 (22.697) to 5 (248) 1630 (19.426) is greater than 3.0 degrees C
151	4	247	745	Precip difference from 4 (247) 745 (.508) to 4 (247) 800 (6.604) is greater than 5 mm

151 4 247 815 Precip difference from 4 (247) 815 (2.286) to 4 (247) 830 (9.144) is greater than 5 mm
151 4 247 830 Precip difference from 4 (247) 830 (9.144) to 4 (247) 845 (1.27) is greater than 5 mm
151 16 259 530 Precip difference from 16 (259) 530 (1.778) to 16 (259) 545 (7.366) is greater than 5 mm
151 23 266 1545 Precip difference from 23 (266) 1545 (5.334) to 23 (266) 1600 (12.192) is greater than 5 mm
151 23 266 1600 Precip difference from 23 (266) 1600 (12.192) to 23 (266) 1615 (4.572) is greater than 5 mm

The following 15 min and 1 hour data for wind speed are suspect due to a possible, but undocumented, sensor malfunction or disturbance. Daily averages, and max and min data are also suspect:

Array CalD JulD Time Error Message
102 13 256 1800 Wind speed is less than 0.5 m/s from 13 (256) 1800 to 14 (257) 600
102 14 257 1900 Wind speed is less than 0.5 m/s from 14 (257) 1900 to 15 (258) 800

October 2003

The following data appear to be correct:

Array CalD JulD Time Error Message
150 15 288 1300 Air temp difference from 15 (288) 1300 (16.78) to 15 (288) 1315 (12.839) is greater than 3.0 degrees C
150 25 298 800 Air temp difference from 25 (298) 800 (3.5008) to 25 (298) 815 (6.7743) is greater than 3.0 degrees C

November 2003

For the month of November there were several negative LiCor (PAR) values (796 values with a range of -0.1 to -1.3). While these may be due to a small error with the sensor due to it needing to be switched out for calibration, data were retained.

The following data appear to be correct:

Array CalD JulD Time Error Message
150 1 305 1115 Air temp difference from 1 (305) 1115 (20.521) to 1 (305) 1130 (16.847) is greater than 3.0 degrees C
150 1 305 1130 Air temp difference from 1 (305) 1130 (16.847) to 1 (305) 1145 (21.652) is greater than 3.0 degrees C

December 2003

For the month of December there were several negative LiCor (PAR) values (796 values with a range of -0.2 to -0.6). While these may be due to a small error with the sensor due to it needing to be switched out for

calibration, data were retained.

12) Deleted data:

Arrays:
During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

All deleted data are denoted by blank spaces.

January 2003
All LiCor data for entire month is incorrect due to a wrong multiplier
in the csi program. All 15 min (150), 1 hour (105) and daily averages (245),
and max (243) and min (244) data have been deleted and replaced with 55555.

February 2003
All LiCor data for entire month is incorrect due to a wrong multiplier
in the csi program. All 15 min (150), 1 hour (105) and daily averages (245),
and max (243) and min (244) data have been deleted and replaced with 55555.

March 2003
All LiCor data from 1 (60) time 15 to 19 (78) time 1200 is incorrect due
to a wrong multiplier in the csi program. All 15 min (150), 1 hour (105) and
daily averages (245), and max (243) and min (244) data within this time range
have been deleted and replaced with 55555. All LiCor data for rest of the month
is accurate due to installation of new dld program to CR10X datalogger.

April 2003
None

May 2003
None

June 2003
None

July 2003
None

August 2003
None

September 2003
None

November 2003
None

December 2003
None

13) Missing data:

Arrays:
During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

All deleted data are denoted by blank spaces.

January 2003
None

February 2003
None

March 2003
The following missing data are due to data being erased when technician installed new dld program to correct LiCor data:

Array	CalD	JulD	Time	Error Message
150	17	76	1530	Missing 150 Array data (15 minute data) from 17 (76) 1530 to 19 (78) 1200
101	17	76	1600	Missing 101 Array data (Hourly Averages) from 17 (76) 1600 to 19 (78) 1200
102	17	76	1600	Missing 102 Array data (Hourly Average Wind Parameters) from 17 (76) 1600 to 19 (78) 1200
241	17	76	2400	Missing 241 data (Daily Averages) from 17 (76) 2400 to 19 (78) 2400
242	17	76	2400	Missing 242 data (Daily Average Wind Parameters) from 17 (76) 2400 to 19 (78) 2400
243	17	76	2400	Missing 243 data (Daily Max/Time Values) from 17 (76) 2400 to 19 (78) 2400
244	17	76	2400	Missing 244 data (Daily Min/Time Values) from 17 (76) 2400 to 19 (78) 2400

101 19 78 1300 Technician changed 101 Array data from 19 (78) 1300 to 19 (78) 1300
102 19 78 1300 Technician changed 102 Array from 19 (78) 1300 to 19 (78) 1300
241 19 78 2400 Technician changed 241 Array from 19 (78) 2400 to 19 (78) 2400
242 19 78 2400 Technician changed 242 Array from 19 (78) 2400 to 19 (78) 2400
243 19 78 2400 Technician changed 243 Array data from 19 (78) 2400 to 19 (78) 2400
244 19 78 2400 Technician changed 244 Array data from 19 (78) 2400 to 19 (78) 2400

April 2003
None

May 2003
None

June 2003
None

July 2003
None

August 2003
None

September 2003
None

October 2003
None

November 2003
The following missing data are due to the datalogger overwriting data in the storage module:

CalD	JulD	Time		CalD	JulD	Time
4	308	13:45	TO	9	313	14:30
20	324	15:30	TO	21	325	13:45

December 2003
The following missing data are due to the datalogger overwriting data in the storage module:

CalD	JulD	Time		CalD	JulD	Time
2	336	14:45	TO	5	339	14:40
16	350	15:00	TO	25	359	09:15

14) Other Remarks

On 10/11/2023 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 2007, 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.

Arrays:
During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

Precipitation:
During the initial years of NERRS SWMP weather data collection the CR10X programming was inconsistent in how precipitation values were recorded. For most reserves, zeros were not recorded when rainfall had not occurred between 2001-2003, instead no rainfall was represented by a blank cell. The CDMO verified which datasets were impacted by this issue for the 2001-2006 datasets and inserted zeros when the metadata indicated that no precipitation occurred and data were not missing for other reasons. In some cases, zero values for precipitation data were evaluated and removed where the metadata confirmed that no rainfall should have been in the dataset. The pre-2007 data did not go through a thorough QAQC process again at that time (in addition to previous QAQC); however, if discrepancies were noticed between what was documented in the metadata and what was in the dataset, additional updates may have been made. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout early 2023.

The Centralized Data Management Office converted all SWMP weather data collected with CR10X program versions prior to version 4.0 which was distributed in October 2003. This was necessary in order to merge the old data format (12 array output) with the new data format found in version 4.0 (3 array output). The new format produces averages, maximums and minimums every fifteen minutes (array 15), every hour (array 60) and every day (array 144) for any sensors hooked up to the CR10X. Specifically, the 150 and 151 fifteen minute data were converted to the new 15 array; the hourly 101, 102, 105 and 106 data were converted to the new 60 array; and the daily 241, 242, 243, 244, 245 and 246 data were converted to the new 144 array. With the new format, the use of 55555's to code for deleted data and 11111's to code for missing data has been abandoned. Hence, all 55555's or 11111's contained in the SWMP weather data collected prior to Version 4.0 of the CR10X program were removed and left blank.

LiCor:
Prior to the installation of the new NERR_4.CSI program on 11/04/2003, all values less than 0 were altered in the raw data to read 0. These values may indicate an incorrect multiplier, calibration problems, or a sensor malfunction. Because these values are changed in the raw data, we cannot confirm that they are all valid data points.

Relative Humidity:
Prior to the installation of the new NERR_4.CSI program on 11/04/2003, all values over 100% were altered in the raw data to read 100%. These values may indicate super saturated air, calibration problems, or a sensor malfunction. Because these values are changed in the raw data, we cannot confirm that they are all valid data points.

Rain Events: (Monthly totals for January, February,August,November and December are not available or not complete due to missing data.)

January

Date	Rain Amount (mm)
1	6.858
2	3.302
3	.762
4	1.778
5	.254
6	1.016
8	.254
9	3.556
10	1.016
27	.254

Monthly Total 19.0

February

Date	Rain Amount (mm)
1	3.810
2	27.432
4	7.366
7	3.048
8	.508
12	1.016
17	1.016
18	2.032
22	20.574
23	14.478

Monthly Total 81.3

March

Date	Rain Amount (mm)

2	26.924
5	6.096
13	2.032
15	2.032
20	5.334
21	22.606
26	3.302
27	.508
29	8.382
30	18.542
31	.254

Monthly Total 96.0

April

Date	Rain Amount (mm)
2	2.540
3	2.540
4	3.556
5	5.588
8	.254
11	12.192
12	1.016
21	.762
22	10.160
23	5.080
24	3.302
26	32.512
27	.254

Monthly Total 79.8

May

Date	Rain Amount (mm)
1	.254
2	1.524
6	2.540
8	3.302
9	3.048
11	9.144
12	9.144
13	2.794
14	1.778
21	7.112
23	.254
24	6.858

25	4.064
26	30.226
27	.254
28	.254
29	1.270
31	2.540

Monthly Total 86.4

June

Date	Rain Amount (mm)
1	16.256
5	6.350
7	3.556
11	1.778
13	3.048
14	7.874
18	4.826
19	2.286
20	1.270
22	6.350
23	1.524
27	.508

Monthly Total 55.6

July

Date	Rain Amount (mm)
9	.762
10	.254
11	10.160
16	15.240
18	.508
19	.762
22	13.970
23	2.032
24	1.270

Monthly Total 45.0

August

Date	Rain Amount (mm)
1	27.940
2	10.160
3	2.794
4	11.938
6	.254
7	4.318

8	5.842
9	5.080
10	.254
11	1.524
12	.254
13	31.750
16	2.032

Monthly Total 104.1

September

Date	Rain Amount (mm)
1	.254
2	6.858
3	.254
4	31.496
15	.254
16	33.782
17	.254
19	10.668
23	26.924
26	7.874
27	.508
28	2.032
29	.508

Monthly Total 121.7

October

Date	Rain Amount (mm)
1	.762
4	11.938
5	.254
11	.254
12	23.114
15	41.402
21	1.524
23	5.080
27	22.860
28	1.524
29	34.290

Monthly Total 143.0

November

Date	Rain Amount (mm)
2	1.016
3	7.112

4	1.524
11	2.286
13	4.572
21	1.27
24	.508
25	1.016
28	10.668
29	5.334

Monthly Total 35.3

December

Date	Rain Amount (mm)
6	.508
7	.508
11	18.288
12	.508
14	5.334
15	16.256
25	3.556
26	.254

Monthly Total 45.2