Town of Newport

205j Project

Final Report

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Prepared by:

EasternCarolinaCouncil

233 Middle Street, Ste. 300
New Bern, NC 28560

Table of Contents

Introduction/Project Overview

Before beginning a discussion of the Town's stormwater system, it is important to understand what stormwater is and why proper management is important. Stormwater is the portion of rain that does not infiltrate into the ground. In other words, it is the portion of rain that runs across the surface and into a water body. In areas like Newport that have very little elevation change from the highest point in town to the lowest points, it is often difficult to generate enough elevation change in a stormwater system to effectively and efficiently drain the stormwater. In areas of the stormwater system that were either poorly designed or that have fallen into disrepair from lack of maintenance, frequent flooding can result.

Although they are the most obvious, water removal and flood prevention are not the only functions of a stormwater system. As the water flows from its origin to its outfall into a water body, it is actually treated by the stormwater system. Suspended particles collect on the bottom of the retention ponds and ditches, pollutants stick to plants and other materials as they move through the system, and the temperature of the stormwater is regulated to prevent thermal pollution. Water quality will be addressed in more detail in Section 5 of this report.

As more areas of the Town develop, the amount of pervious surface is reduced. The water that was able to infiltrate where the new impervious surfaces are located will become stormwater. More development typically means more stormwater and more stormwater means better management practices will become necessary.

This project was undertaken to map the existing stormwater system and educate homeowner's associations and citizens about the need for stormwater infrastructure maintenance. The education component will be accomplished through meetings with homeowner's associations and educational fliers that will be distributed to the Town's residents.

Ownership and Maintenance Discussion

It is a well-known issue in Newport that the ownership and maintenance responsibility of stormwater infrastructure is unclear in many areas of the Town. Ownership and maintenance responsibility falls on one of the following parties: NCDOT, the Town of Newport, homeowner's associations, and private property owners.

The portions of the stormwater system that fall under the responsibility of NCDOT are obvious due to them being within the right of ways of State-maintained highways. Despite this fact, several structures were identified as being in poor condition and in need of repair. According to Town staff, the need for the repairs has been reported several times but has not occurred.

The portions of the stormwater system that are the responsibility of the Town are not as clear. Stormwater infrastructure that lies within Town owned property and right of ways of Town maintained streets are easily identified as the Town's responsibility. The Town has been granted some easements and performs periodic maintenance on the stormwater infrastructure within these easements. These easements are a very small portion of the overall system.

The portions of the stormwater system that fall within the boundary of planned developments and subdivisions are the responsibility of the development's homeowner's association. The Town should periodically inspect these portions of the system and notify the association of any needed corrective actions. In theory, this should provide for the perpetual maintenance of stormwater infrastructure in these developments. The reality is that many of these homeowner's associations have been dissolved or are otherwise defunct. There are currently two remaining active homeowner's associations within the Town. The maintenance responsibility of this infrastructure falls on the individual property owners when the homeowner's association no longer exists.

The portions of the stormwater system that are located on private property and outside of easements are the responsibility of the individual property owners. The condition and level of maintenance of this part of the system varies on each property. Some homeowner's do a good job maintaining their ditch while others have never performed any maintenance on their ditch. It is likely that many of the Town's residents do not know that they are responsible for the maintenance of their ditches. The maintenance of private ditches appears to be limited to vegetation removal in most cases. Over time, the silt that falls out of the stormwater will collect in these ditches and reduce the volume of water that they can carry.

Current and Alternative Management Methods

Currently, the Town maintains their portion of the stormwater system and relies on voluntary compliance on the part of private citizens and homeowner's associations. Historically, this method was successful; however, as new developments occur, the system ages and the lack of private maintenance reduces the system's capacity. More careful management and oversite of the stormwater system is, or will be, necessary. If the Town wants to continue with the current system of voluntary compliance, Town staff could work with individual property owners to correct issues from lack of maintenance or even try to organize volunteers to do ditch clean-up days. Church, school and scout groups would be good places to try to recruit volunteers for this effort.

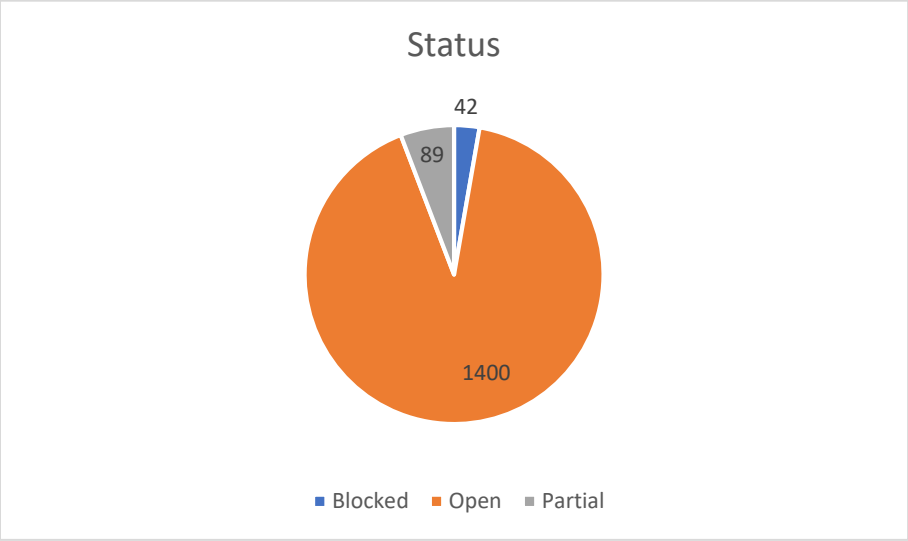
The Town could use a stormwater ordinance to mandate maintenance of ditches on private property. For this system to work, Town staff would be responsible for doing periodic inspections of the entire system and notifying property owners of deficiencies in maintenance. If the deficiencies were not corrected after notification the Town would need to use enforcement procedures to ensure compliance.

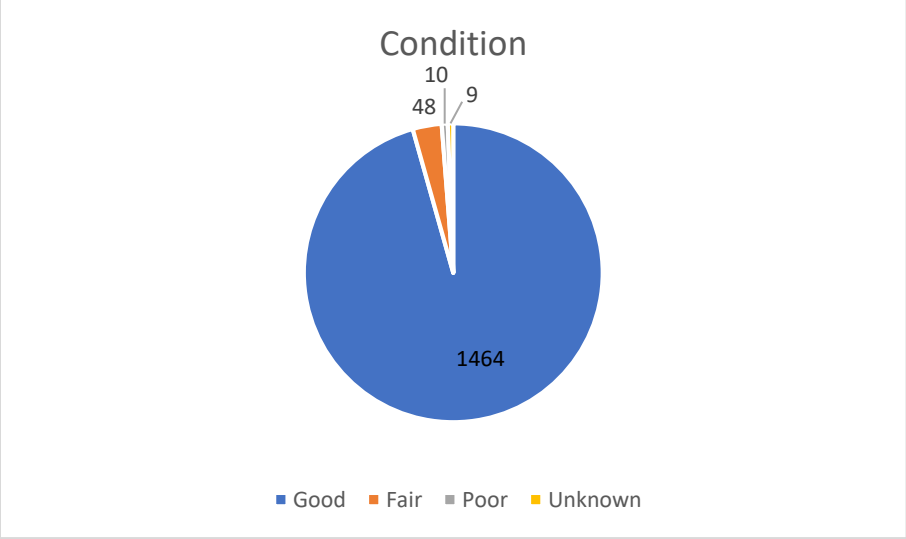
The third option is to establish a stormwater utility. Stormwater utilities can collect fees to use for management and maintenance of the stormwater system. In this scenario, the Town would work with property owners to acquire easements for all stormwater infrastructure and assume maintenance for the entire system. The ability to collect fees protects the general fund and provides for a better long-term outcome and stable funding source than the funding of specific stormwater projects through a capital improvements plan. There are several fee structures the utility could choose to employ. The most common fee structure is a rate per square foot of impervious surface on each property. Commercial and residential properties are often charged different rates within this fee structure. Other fee structures include a flat rate per capita, dividing the system into drainage zones (mini-watersheds), and fees based on the actual infrastructure on each property. The School of Government did a stormwater fee study across the state, and found, "The amounts charged for a residential property with 2,455 square feet of impervious area range from $0.75 to as high as $10.18 per month." With the condition of the current system, fees would likely need to be slightly higher at the creation of the utility but could be lowered as the system is brought back into proper maintenance.

Discussion of Areas That Need Improvement

The areas that need improvement are based on field observations taken during dry conditions while completing the GPS survey. These observations are not an engineering opinion and do not address sizes, flows, capacity, or functionality of the system.

There are 1,531 culverts in the town. Of these, 89 are partially blocked and 42 are completely blocked. The condition of each was also noted: 1,464 are good, 48 are fair, 10 are poor, and 9 are unknown due to them being buried.





In addition to the culverts, other features were identified that need attention: 6 junction boxes are buried, one line has collapsed, and one ditch is completely clogged. A set of work maps will be provided to Public Works identifying these features.

Current and Historical Water Quality Trends

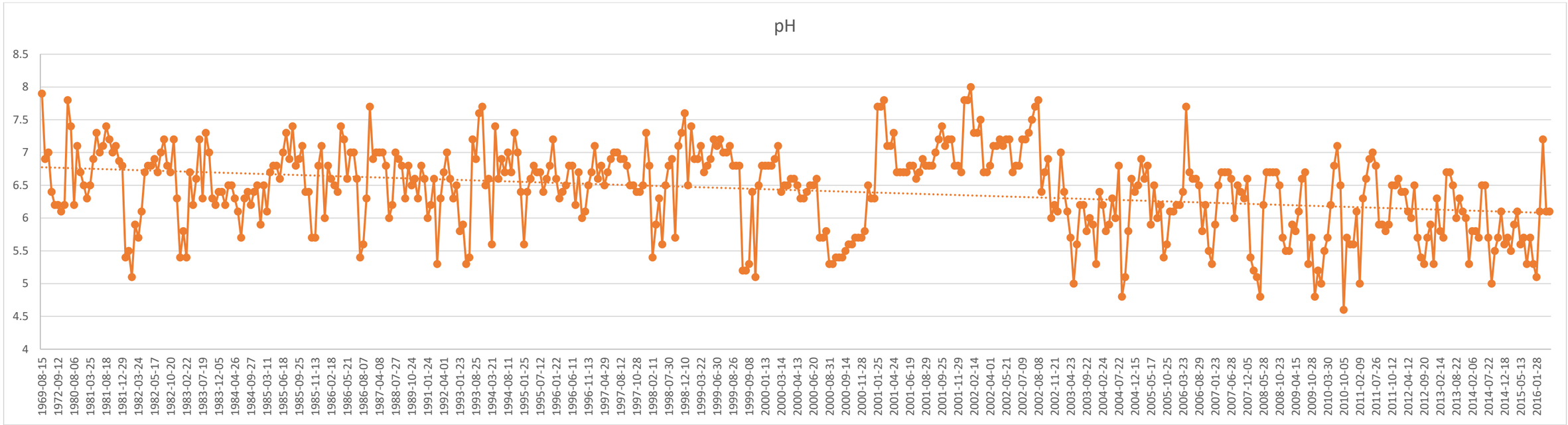
As mentioned previously, a properly functioning stormwater system treats the stormwater as it moves through the system. New development creates new impervious surfaces and increases the amount of stormwater the system must move and treat. Over time the effects of increasing stormwater are evident in the environmental indicators of the receiving waterbody. Data from the 1960's and 1970's to 2016 was analyzed for several environmental indicators to see if the long-term effects of development were apparent. The monitoring site is located at the intersection of the Newport River and Chatham Street. This location does not isolate the Town, so development upstream of the Town will also affect the condition of the water quality at the test site. Six environmental indicators (pH, dissolved oxygen, temperature, turbidity, fecal coliform, and total suspended solids) were evaluated and three (pH, dissolved oxygen, and turbidity) show long-term trends that are typical of the conversion of pervious surfaces to impervious surfaces within the watershed. These three will be discussed below and charts will be included on the following pages.

The long-term trend in pH at this monitoring station shows that the Newport River is becoming more acidic. The most likely reasons for a waterbody to become more acidic are sulfur dioxide and nitrogen oxide air pollution causing acid rain and leaching of acid from decaying organic matter. Acid rain is a result of industry and burning of fossil fuels in cars and power plants. As population increases, so will the amount of acid rain-causing air pollution. This type of pollution can travel great distances, so any change seen in Newport is potentially caused by growth miles upwind. Acid leaching from decaying organic matter will increase when water is forced into a concentrated channel instead of allowing it to infiltrate where it falls.

The amount of dissolved oxygen in a waterbody can have a significant impact on the plants and animals that live in the waterbody. If the available oxygen becomes too low, aquatic ecosystems can collapse. Fertilizers and other chemicals entering the waterbody can cause rapid growth of plants and algae. As these plants die and decompose, the microorganisms that feed on the decaying plant material consume large amounts of oxygen and deplete the oxygen supply. Extreme depletion of oxygen in water bodies can cause fish kills. The long-term trend of dissolved oxygen levels in the Newport River indicates dissolved oxygen levels are falling.

Turbidity is the amount of suspended particles in a waterbody. High turbidity can prevent sunlight from penetrating the water and limit plant growth. It can also result in sediment covering plants and other stream bottom features. Turbidity is caused by sediment entering the waterbody. This sediment can be from unprotected

construction sites/soil disturbances, flooding, and erosion. Proper construction, stabilization, and maintenance of stormwater infrastructure is vital to controlling the turbidity in a waterbody. The long-term trend in turbidity shows increasing levels.


pH
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
1969-08-15
1972-09-12
1980-08-06
1981-03-25
1981-08-18
1981-12-29
1982-03-24
1982-05-17
1982-10-20
1983-02-22
1983-07-19
1983-12-05
1984-04-26
1984-09-27
1985-03-11
1985-06-18
1985-09-25
1985-11-13
1986-02-18
1986-05-21
1986-08-07
1987-04-08
1988-07-27
1989-10-24
1991-01-24
1992-04-01
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2011-02-09
2011-07-26
2011-10-12
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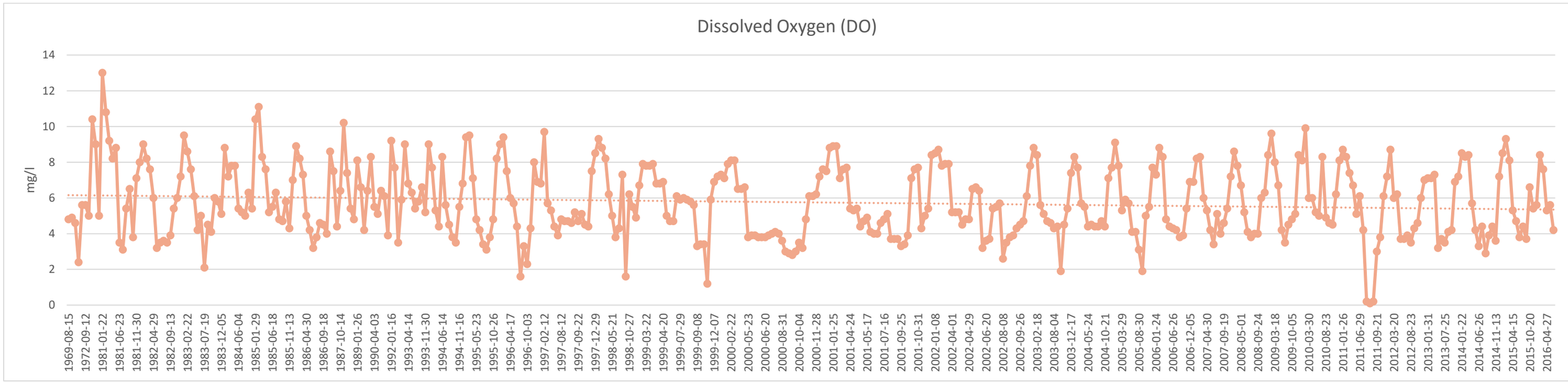
2014-07-22
2014-12-18
2015-05-13
2016-01-28


Dissolved Oxygen (DO)
mg/l
14
12
10
8
6
4
2
0
1969-08-15
1972-09-12
1981-01-22
1981-06-23
1981-11-30
1982-04-29
1982-09-13
1983-02-22
1983-07-19
1983-12-05
1984-06-04
1985-01-29
1985-06-18
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1986-04-30
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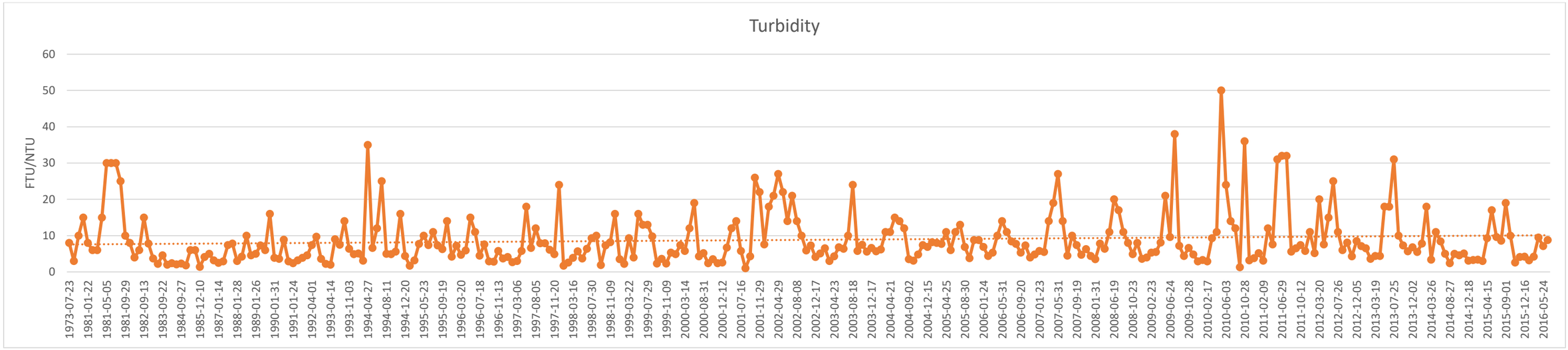
Turbidity
FTU/NTU
60
50
40
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1973-07-23
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2015-12-16
2016-05-24

Emergency Management Plan Review

Neither the Town's Emergency Management Plan nor the Carteret County Emergency Operations Plan mention stormwater explicitly. They mention maps of low-lying flood areas but do not give specific details about managing a flood or other stormwater emergency. The county plan includes information about oil and hazardous material incident response, but it does not mention the impact that this type of event can have on a stormwater system.

The primary hazards that could involve the stormwater system can be divided into two broad categories: flooding/inundation and contamination. Within the flooding/inundation category, risks include heavy rain caused flooding, flooding due to a blockage or other damage to the stormwater system, tropical storm/hurricane events (including storm surge), and tsunami. Contamination could include train derailment, motor vehicle or industrial accidents that result in a hazardous material spill, and intentional or unintentional illicit discharge.

The Town of Newport is especially vulnerable to flooding, storm surge and tsunami impacts due to its near sea-level elevation and lack of elevation change within the Town. This same lack of elevation change causes stormwater within the system to move slowly and presents an opportunity, if reported or found quick enough, to capture spilled material and illicit discharges before the material reaches the receiving water body.

These items should be considered as the Town updates its Emergency Management Plan in the future. FEMA has a publication called the Guide for All-Hazard Emergency Operations Planning which is designed to help jurisdictions develop their emergency management/operations plans. The sections that are pertinent to the above-mentioned hazards are attached to this report.

Attachment B
Flooding and Dam Failure

The Hazard

Nature of the Hazard

Flooding occurs when normally dry land is inundated with water (or flowing mud). Flooding may result from: bodies of water overflowing their banks, including artificial ones like dams and levees; structural failure of dams and levees; rapid accumulation of runoff or surface water; hurricane-caused storm surges or earthquake-caused tsunamis; or erosion of a shoreline. (Coastal flooding and erosion are not treated in this attachment.) Typically, the two parameters of most concern for flood planning are suddenness of onset--in the case of flash floods and dam failures--and flood elevation in relation to topography and structures. Other factors contributing to damage are the velocity or "energy" of moving water, the debris carried by the water, and extended duration of flood conditions. Flooding can happen at any time of the year, but predominates in the late Winter and early Spring due to melting snow, breakaway ice jams, and rainy weather patterns.

Risk Area

All States and territories are at risk from flooding. Apart from a rainy climate, local risk factors, usually present in combination, include:

Rivers, Streams, and Drainageways

These are bodies of water often subject to overflowing. The size of the stream can be misleading; small streams that receive substantial rain or snowmelt, locally or upstream, can overflow their banks. High-velocity, low elevation flooding can be dangerous and damaging. Six inches of moving water can knock a person off his or her feet; 12 inches of water flowing at 10 miles per hour carries the force of a 100 mile-per-hour wind, although the force would be distributed differently on obstacles.

Dams and Levees

There are 74,053 dams in the United States, according to the 1993-1994 National Inventory of Dams. Approximately one third of these pose a "high" or "significant" hazard to life and property if failure occurs. Structural failure of dams or levees creates additional problems of water velocity and debris.

Steep Topography

Steep topography increases runoff water velocity and debris flow. Lack of vegetation to slow runoff is another factor. Alluvial fans, making up twenty to thirty percent of the Southwest region, show these characteristics and face the additional complication of shifting drainage patterns and erosion.

Cold Climatic Conditions

Apart from snowmelt, 35 northern States face flooding problems associated with ice jams. In the Spring, ice breaks away and then collects at constriction points in rivers and streams (i.e., bends, shallows, areas of decreasing slope, and bridges); by trapping water behind it and then later giving way, an ice jam heightens flood levels both upstream and downstream. Ice jams occur in the Fall with "frazil ice" (when a swift current permits formation of ice cover, but ice is carried downstream and attaches to the underside of ice cover there) and in Winter when channels freeze solid.

Identifying Hazards

A jurisdiction's susceptibility to floods--riverine floods, ice jam floods, debris jam floods, flash floods--will in most cases be a matter of historical record, as will flood elevations. (However, planners must be alert to development upstream or extensive paving over of the ground that used to absorb runoff.) The NWS maintains a list of communities with potential flash flood problems, and stream flow data for large watersheds is kept by the USGS in cooperation with State and local agencies. Results of the Corps of Engineers' dam survey, as well as subsequent work done by many States, should be available to permit plotting of dams with an evaluation of the risk they pose. Planners have access to the National Flood Insurance Program's (NFIP) Flood Insurance Rate Maps (FIRM) and Flood Hazard Boundary Maps (FHBM), USGS topographic maps, and soil maps prepared by the Soil Conservation Service to use as base maps.

Estimating Vulnerable Zones

Using the NFIP's maps and Flood Insurance Studies (FIS) as a base, the planning team--consulting with an engineer for technical analysis--should plot dams and levees as applicable, then adjust inundation levels behind levees and progressively downstream of the dam. Where ice jams are a problem, base flood fringe boundaries should be broadened to account for higher potential flood elevations. Also, despite shallow flood elevations, it is important to map alluvial fans as high risk areas. Note, too, that areas prone to flash flooding from small streams and drainage ways may not always have been mapped as such by the NFIP. See FEMA 116, *Reducing Losses in High Risk Flood*

Hazard Areas: A Guidebook for Local Officials for discussion of models and additional bibliography.

Flooding and Dam Failure Unique Planning Considerations

This section contains a listing of the functional annexes that typically would require the preparation of a hazard-specific appendices for flooding and dam failure. It also identifies the unique and/or regulatory planning considerations that should be examined by the planning team and used, as appropriate, when preparing appendices for flooding and dam failure.

Direction and Control

The extent of the initial response will depend on warning time, which varies with the cause of the flooding and the distance a jurisdiction is from the origin of the flooding. Intense storms may produce a flood in a few hours or even minutes for upstream locations, while areas downstream from heavy rains may have from 12 hours to several weeks to prepare. Flash floods occur within six hours of the beginning of heavy rainfall, and dam failure may occur within hours of the first signs of breaching, but floods from snowmelt can take months to develop.

The EOPs of jurisdictions located downstream of a heavy flood source should address the following planning considerations in one or more appendices to a direction and control annex:

Floodfighting

Relevant floodfighting considerations include:

- Obtaining and keeping current a list of all dams in or near the jurisdiction, by location and name.
- Coordination with a dam's staff during disaster or disaster threat situations to facilitate expeditious notification and the exchange of information.
- Maps that identify the likely areas to be inundated by flood waters.
- Identification of potential locations for the placement of temporary levees and inclusion of this information on the appropriate maps.

- Obtaining a labor force to perform flood fighting tasks associated with building a levee (e.g. fill and place sand sandbags to prevent flooding).

- Obtaining assistance from the U.S. Army Corps of Engineers to build temporary emergency levees.

Search and Rescue

Conduct aerial and waterborne search and rescue once flooding occurs. Include provisions for the rescue of stranded animals and the disposal of dead ones.

Continuity of Operations

Address the relocation of government resources, vital records, and equipment to assure continuation of services and to prevent damage or loss.

Inspection and Condemnation

Structures left standing may still have been weakened by water pressure and debris flows. Building interiors will be filled with mud and filth, and some building materials will be waterlogged.

Therefore, it will be necessary to inspect buildings and other structures to determine whether they are safe to inhabit after a flood has occurred. Activities may include:

- Identifying buildings and structures that may threaten public safety.

- Designating those buildings and structures that may be occupied.

- Identifying/marking those buildings and structures that are to be condemned.

Warning

The NWS is responsible for most flood warning efforts in the United States. For large river systems, hydrological models are used by River Forecast Centers. For many--not all--smaller streams, the NWS has developed a system called ALERT (Automated Local Evaluation in Real Time) that does not rely on volunteer observers. However, some communities may still need to use volunteer observers to monitor water levels, the effectiveness of the levee system, or even to back up automated systems. The following planning considerations should be addressed, if appropriate, in one or more appendices to a warning annex:

Automated Warning

Include a listing that identifies location and telephone numbers for all automated dam and river warning devices within or upstream of the jurisdiction, if available.

Use of Volunteers

If the jurisdiction relies on a volunteer warning network an appendix should describe:

- Composition and locations of each team in the network.
- How and when the network teams are activated (e.g., automatically with an NWS flood watch or as directed by the Emergency Manager).
- The type of information to be reported and the frequency of reporting.
- The means established to facilitate reporting.
- How warning information is passed on to response organization members.
- How the warning data received will be disseminated as emergency public information.

Dam Failure

In jurisdictions that are vulnerable to flooding from dam failure, an appendix should include provision for:

- Alerting the Warning Coordinator and other key members of the emergency management staff when the local authorities receive notification that a problem exists or may occur at the dam.
- Disseminating emergency warning information (to the public and other key response personnel) received from the dam's emergency management staff. Typically, a warning message should address a serious situation that could develop (alert) or inform the audience when an excessively high runoff occurs or a dam failure threatens (warning).
- Coordinating with the PIO to facilitate the timely warning of the

population at risk from dam failure.

Emergency Public Information

Public information begins with communication of risks to the community, to potential home buyers, and to applicants for construction permits. Knowledge of being in a flood zone, of being downstream of a dam, of being protected by an inadequate levee, and the like, may rivet attention on the rest of the public information strategy. The population should be educated about what the levels of warning imply, should know how to interpret a predicted flood level as it relates to their property, and should be informed about expedient loss-reduction measures they can apply to their property.

Provisions must be made to prepare and disseminate notifications, updates, and instructional messages as a follow-up to the original warning. The following planning considerations should be addressed, if appropriate, in one or more appendices to an EPI annex:

When Floods Develop Slowly

For flood emergencies that develop slowly enough to permit evacuation, provide the public information and instruction on:

- Expected elevation of the flood waters, and instructions on when to evacuate.
- Where to obtain transportation assistance to evacuate.
- Designated travel routes and departure times.
- Status of road closures (what routes must be avoided due to probable inundation).
- What to take or not to take to shelters (including options available for companion animals).
- Location of mass care shelters and other assistance centers.

Transition to Recovery

As the initial response shifts to recovery, provide residents returning to their homes information on safety precautions associated with:

- Sanitary conditions.
- Unsafe drinking water.
- Use of utilities.
- Electric fields created in water by downed power lines.

Evacuation

If fast- and slow-developing floods are possible in a jurisdiction, protective action decisions must be based on the estimated time necessary for evacuation and the availability of shelter space above the estimated flood elevation. When complete evacuation is not feasible, citizens need to know where high ground is; when evacuation is feasible, planning should have accounted for routes facing possible inundation. In evacuation planning for floods, consideration must be given not only to critical facilities and custodial institutions but also to recreational areas prone to flooding, whether because the site is physically isolated or because visitors isolate themselves from communication.

Particular attention should be paid to critical facilities that are low-lying or in the path of projected debris flows. Transportation routes subject to flooding should also be noted, given the potential impact on evacuation and relief efforts.

The following planning considerations should be addressed, if appropriate, in one or more appendices to an evacuation annex:

- Maps that detail probable flood inundation areas and designated evacuation routes.
- Pickup points and government provided transport to move evacuees.
- Provisions for moving the residents of custodial facilities (hospitals, jails, mental health facilities, nursing homes, retirement homes, etc.).
- Coordination and implementation of mutual aid agreements with adjacent jurisdictions to facilitate evacuation.

Mass Care

The following planning considerations should be addressed, if appropriate, in one or more appendices to a mass care annex:

Space/ Capacity

Relevant considerations include:

- Identification of a sufficient number of mass care facilities to accommodate the estimated number of people that may be evacuated.
- Availability of shelter space for a prolonged (up to 90 day) period.

Safe Location of Facilities

This involves designating shelters for use that are located on high ground (beyond the worst case inundation estimates).

Health and Medical

The following planning considerations should be addressed, if appropriate, in one or more appendices to a health and medical annex:

- Provisions to keep people informed of the health and sanitary conditions created by floods: flood waters may carry untreated sewage, dead animals, disinterred bodies, and hazardous materials.
- Monitoring water quality and sanitary conditions.

Resource Management

The following planning considerations should be addressed, as appropriate, in one or more appendices to a resource management annex:

- Provisions for purchasing, stockpiling or otherwise obtaining essential flood fighting items such as sand bags, fill, polyethylene sheeting, and pumps (of the right size and type, with necessary fuel, set-up personnel, operators, and tubing/pipes).
- Resource lists that identify the quantity and location of the items mentioned above, as well as points of contact (day, night, and weekend) to obtain them.

Attachment C
Hazardous Materials

Given the technical nature of the HAZMAT threat, it is essential that the National Response Team's NRT-1, *Hazardous Materials Emergency Planning Guide*, and the Environmental Protection Agency's (EPA) *Technical Guidance for Hazard Analysis* be used as the principal source documents for addressing HAZMAT planning needs. Other helpful guides include the *Handbook of Chemical Analysis Procedures*, co-published by the Department of Transportation (DOT), EPA, and FEMA, and the planning section of the *Guidelines for Public Sector Hazardous Materials Training*, coordinated by FEMA under an agreement with DOT. The planning team should use the guides and this attachment to help facilitate the completion of the hazard analysis and to identify unique planning requirements that should be addressed in the EOP.

The Hazard

Working Definition of Hazardous Materials

Definition of a risk area for hazardous materials depends on defining "hazardous materials." Many Federal laws and regulations exist to help the planner do just that; however, since the various lists overlap and serve different purposes (identifying acceptable quantities for "wastes" and "pollutants," reportable quantities for "emergency releases," etc.), this chapter will use the term "hazardous materials" in a broad sense to include:

- Explosive, flammable, combustible, corrosive, oxidizing, toxic, infectious, or radioactive materials
- that, when involved in an accident and released in sufficient quantities,
- put some portion of the general public in immediate danger from exposure, contact, inhalation, or ingestion.

Off-site planning for radiological accidents at nuclear power plants is addressed in Tab 1 to Attachment F. Radiological protection planning for the nuclear conflict threat is addressed in Tab 2 to Attachment F. Planning for the release of lethal unitary chemical agents and munitions is addressed in Attachment E.

For a discussion of the different lists of hazardous materials, see EPA's A Review of Federal Authorities for Hazardous Materials Accident Safety*, Chapter*

4. Note that substances not on these lists may still be hazardous.

Risk Areas

Areas at risk for hazardous materials transportation incidents lie along highways, rail lines, pipelines, rivers, and port areas. A large number of States also are potentially involved with nuclear waste incidents, given the routing for shipments. Jurisdictions with facilities that produce, process, or store hazardous materials are at risk, as are jurisdictions with facilities for the treatment, storage, or disposal of hazardous wastes. These risks are compounded by natural hazards (e.g., earthquakes, floods) or, for highway transportation of hazardous materials, poor weather conditions. In addition, other kinds of facilities (e.g., for natural gas) may contribute to risks posed by hazardous materials facilities.

Locating Hazardous Materials

This section discusses information made available to planners under Federal law. States and localities may have additional or more stringent information requirements, and planners may wish to check with their State Emergency Response Commission (SERC), State Environmental Protection Agency, State Department of Transportation, Public Service Commission, Radiological Health Division of the State Health Department, and the like for additional information. Area Committees established under the auspices of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the Oil Pollution Act (OPA) may provide additional resources in identifying areas at risk from a hazardous materials incident.

At Fixed Facilities

EPCRA, or Title III of the Superfund Amendments and Reauthorization Act (SARA), requires facilities to notify the SERC and LEPC if they have present any of the substances designated by the EPA as an "extremely hazardous substance" when the amount on hand exceeds the EPA-defined "threshold planning quantity." Facilities must submit to the appropriate LEPC, local fire department, and SERC a list of the "hazardous chemicals" (as defined by the Occupational Safety and Health Administration, or OSHA) on site in excess of threshold quantities or the OSHA-required material safety data sheets (MSDS) on each of these chemicals. In addition, facilities must provide the appropriate LEPC, local fire department, and SERC with an inventory form containing general, aggregate ("Tier I") information on amounts of the chemical present at the facility and their location, or (upon a request made to the facility by the LEPC, fire department, or SERC) more specific ("Tier II") information. LEPCs

may complete the general picture of the fixed facility hazard by obtaining data from EPA's Toxic Chemical Release Inventory and by reviewing previous notifications of accidental releases of "hazardous substances" in excess of "reportable quantities" (as defined in 40 CFR 302). Interviews with facility emergency coordinators, fire and law enforcement personnel, and news reporters also may be used to obtain needed information.

On Transport Routes

The LEPC is entitled to information from facilities subject to SARA Title III that may be necessary for emergency planning, and the LEPC is required by SARA Title III to address routes for transportation of extremely hazardous substances in emergency planning. Facility emergency coordinators may provide information on frequency of shipments, form and quantity of shipments, and routes. Representatives of trucking, rail, air freight, and shipping industries also may assist. Planners should know of State and local route designations for hazardous materials shipments. Information is available from the Department of Energy (DOE) or the Nuclear Regulatory Commission on nuclear waste shipment routes, and from DOT on the routes for and volume of shipments involving "highway route controlled quantities" (HRCQ) of radioactive material.

Estimating Vulnerable Zones

Having plotted the location of facilities and transportation routes with the potential for hazardous materials incidents, planners can estimate vulnerable zones. The widest area of vulnerability would be for an airborne release. For airborne releases of acutely toxic chemicals, vulnerable zones would be plotted as circles around facilities--given uncertainty about wind direction--and as corridors along land transportation routes. Calculating the radii for these circles and corridors depends on knowing what concentration represents a "level of concern" for health effects, the quantity of material likely to be released, the likely rate of release, physical state of the material, elevation at which the release occurs, wind speed, and surrounding topography or construction. In determining vulnerable zones, planners will want to use both worst case and more probable scenarios for the potential releases. Planners should take advantage of any hazard assessments completed by facilities themselves, as these can provide valuable information.

> *The Risk Management Program under the Clean Air Act, Section 112(r), will require facilities to conduct hazard assessments for a selected list of about 140 toxic chemicals. The facilities are not required to have completed these hazard assessments until May 1999.*

Determining Vulnerability

Once vulnerable zones have been plotted, planners can assess the possible consequences of potential hazardous materials incidents. In particular, planners should look at what critical facilities (e.g., hospitals, utilities and treatment plants, broadcast stations, police and fire stations, emergency operating centers) lie within the vulnerable zones; they should also note what facilities house people with special evacuation needs (e.g., schools, prisons, hospitals and nursing homes). SARA Title III requires identification of facilities subject to additional risk due to their proximity to facilities that may release hazardous materials. Beyond the facility level, planners should consider the demographics of the population in the area (particularly with regard to age and language use) and the potential for property damage in the zone. They should also note the potential for contamination of drinking water supplies and other environmental consequences. The vulnerable facilities, bodies of water, and other features should also be shown on a vulnerability map.

Assessing Risk

Finally, planners will want to estimate the probability of incidents and the severity of their consequences, in order to focus preparedness and prevention efforts. Probability estimates may be simply qualitative (i.e., "low," "medium," or "high"); in any case they can be based on the historical record of releases and incidents, on general transportation accident statistics for roads (and for airports and railways), on fault tree analyses or hazard operability studies shared by facilities, as well as on professional opinion. SARA Title III requires the LEPC to identify facilities (e.g., for natural gas) that, due to their proximity to facilities that may release hazardous materials, may contribute to risk; these should be considered in assessing risk. Potential consequences may be estimated from case studies of the worst incidents involving particular hazardous materials.

Hazardous Materials Unique Planning Considerations

This section contains a listing of the functional annexes that typically would require the preparation of a hazard-specific appendix for hazardous materials. It also identifies many of the unique and/or regulatory planning considerations that should be examined by the planning team and used, as appropriate, when preparing appendices specific to hazardous materials. Note that, whatever the HAZMAT planning provisions adopted by the jurisdiction, SARA Title III requires that HAZMAT emergency planning include training programs and schedules for response and medical personnel, as well as methods and

schedules for exercising the provisions.

Direction and Control

For this hazard, OSHA's Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910) requires that *an* ICS be used for on-scene management of response activities. A description of ICS is provided in Attachment A to Chapter 5. SARA Title III requires a community's plan to include the designation of a community emergency coordinator and facility emergency coordinators, who shall make determinations necessary to implement the plan.

Response Actions

Response actions are triggered when the organization that is responsible for managing HAZMAT response operations is notified. Response is initiated when an incident or accident report is received from an operations center in a facility that stores, manufactures, or uses hazardous materials or when a police officer, fireman, or member of an emergency services organization is informed of an emergency situation involving HAZMAT. SARA Title III requires HAZMAT planning to address methods for determining the occurrence of a release and the area or population likely to be affected, procedures for timely notification of the community emergency coordinator by facility emergency coordinators, and methods and procedures to be followed in response to a release.

Therefore, provisions should be made, as appropriate, to describe the on-scene management structure and address the following planning considerations in one or more appendices to a direction and control annex:

- Identify and designate special technical experts (chemists, toxicologists, occupational health physicians, etc. to augment the response organization. Where appropriate, private sector response organizations (chemical manufacturers, commercial cleanup contractors, etc.) should be part of the response organization.

- Notify response organizations, public officials, and appropriate local and State organizations that are directly involved in the response.

    - From the initial incident report, disseminate as much information as possible.

- If possible, identify the hazardous material involved and the severity (degree of threat to people, property, environment, etc.) of the accident before exposing response personnel to possible health hazards.

  – For transportation accidents information sources include placards, container labels, cargo manifests, and shipping papers. These items provide initial information that can be checked against the *North American Emergency Response Guidebook*; shipping papers should also include an emergency contact number. Also, if the above information is not visible or available, an interview with the vehicle operator could provide the information needed.

  – For fixed facility accidents, this information should be readily available from the responsible party.

➢ Initiate a response to the situation in accordance with the jurisdiction's ICS concept of operations for responding to HAZMAT accidents. Critical actions to address include:

- Upon arrival at the incident site, identifying the IC and notifying the EOC of the identity of the IC and the location of the ICP.

- Ensuring response personnel have and don the appropriate protective gear (clothing and breathing apparatus).

- Ensuring response personnel approach the incident site from upwind and obtain the following information, if not already known:

  – The time of the release.

  – The quantity released.

- Characteristics of the immediately endangered area (e.g., body of water or dense residential/commercial district nearby).
- Color and odor of vapors (if readily noticeable), and any health effects noted.
- Direction and height of any vapor cloud or plume (observed and computer-projected).
- Weather and terrain conditions.
- Entry of material into the environment (water, drains, soil).
- Action already initiated by personnel at the scene.

- Ensuring unnecessary people at the site are moved away (in a crosswind direction) and denied entry. For transportation incidents, the *North American Emergency Response Guidebook* contains recommended initial isolation zone distances for substances with poisonous vapors that are not burning and additional instructions in case of fire.

- Establishing a Protective Action Zone, if necessary. This is an area in which people can be assumed to be at risk of harmful exposure, and in need of either in-place protective shelter or evacuation.

- Containing the hazardous material. For liquids, it may be necessary to use ditches or dikes to contain spread, so that removal may take place later. It also may be necessary to cover some materials with tarps to prevent vapors from rising.

Additional Notifications

Various Federal laws and regulations on hazardous materials require notifications from the responsible party (employer, transporter, facility manager)--not necessarily from local or State agencies. Local and State

agencies may establish their own reporting requirements as well. The following are typical notifications jurisdictions may be responsible for or interested in ensuring:

- *Chemical Releases*. Notification should be made to the National Response Center by the responsible party. Legal provisions also may exist for notification of specific State and local authorities.

  - *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).* For hazardous substances identified in the CERCLA list, a release that equals or exceeds the reportable quantity (as defined in 40 CFR 302) must be reported to the National Response Center.

  - *Emergency Planning and Community Right-to-Know Act (SARA Title III)*. Releases of Extremely Hazardous Substances (under section 302 of the Act) or of CERCLA hazardous substances must be made known to the SERC and the LEPC's community emergency coordinator by the facility owner or operator. In a transportation accident, this requirement is satisfied by contacting 911 or, if 911 is unavailable, the local telephone operator.

  - *Clean Water Act*. For hazardous substances (as listed in 40 CFR 116.4) released into water in excess of reportable quantities (established in 40 CFR 117.3), dischargers must make an immediate report to the National Response Center. Notification must also be made to the Nuclear Regulatory Commission if radioactive material spilled in a waterway exceeds the reportable quantity.

- *General Transportation Accidents.* Notifications are as above. In addition, the *North American Emergency Response Guidebook* recommends contacting the Chemical Manufacturer's Association's Chemical Transportation Emergency Center (CHEMTREC) with initial requests for assistance.

- *Involving Radioactive Materials*. Typically, notification should be made to the State Department of Public Health so that detection and monitoring can take place. For incidents involving nuclear weapons, notification should be made to the nearest military base and to the Joint Nuclear Accident Coordinating Center (JNACC).

- *Involving Infectious (Etiological) Agents.* Local and/or State health departments should be notified. Officials in these departments have the responsibility for notifying the Emergency Response Coordinator for the CDC.

Reentry to Areas Directly Affected by the HAZMAT Release

Address the types of detection devices and systems that will be used to determine when a toxic cloud has cleared a particular area and if the concentration of the hazardous material in soils, drinking water, and sewage systems are at a safe enough level to permit return. Also address concerns such as:

- Control of access to the area until it is safe. Only those people directly involved in emergency response operations should be allowed to enter.

- Arrangements for ongoing site control, monitoring of the environment, and compliance with State and Federal regulations regarding disposal of the wastes.

- Protocol for determining the appropriate time to allow evacuees and the general public to re-enter the area.

Decontamination and Cleanup

Relevant actions to be addressed are:

- Establish "zones" for controlling contamination (hot zone, transition zone, and clean zone).

- Provide for handling and disposal of:

  - Contaminated soil, water, and other items that could not be adequately decontaminated.

- Contaminated clothing.

Request for Federal Assistance

If the situation exceeds the capability of the responsible State and local authorities, assistance can be obtained through the National Response Center. In accordance with the NCP, upon receiving notification, the National Response Center notifies the appropriate Federal On-Scene Coordinator (OSC), who monitors private and State actions, provides support and advice, and may intervene to direct operations in rare instances when the situation exceeds the capability of the responsible party or State and local government (or when the "responsible party" would be the Department of Defense (DOD) or DOE). Assistance may include support by the National Strike Force, including strike teams for oil spill response and a Public Information Assistance Team; Radiological Emergency Response Teams; salvage teams; scientific support coordinators; and other specialized resources.

For peacetime radiological emergencies, the Federal Radiological Emergency Response Plan (FRERP) provides a mechanism for DOE to dispatch Radiological Assistance Program (RAP) teams in response to a State request for monitoring assistance.

Warning

SARA Title III requires that HAZMAT emergency planning address procedures for timely notification to the public that a release has occurred; this depends on facilities making immediate notification to State and local authorities. HAZMAT accidents generally occur without warning, and the speed at which events develop and effects spread varies from incident to incident. For small-scale occurrences, public notification may be made door-to-door, through mobile public address systems, or with portable megaphones. For larger-scale occurrences, a jurisdiction-wide warning system should be used. The following considerations should be addressed, if appropriate, in an appendix to a warning annex:

- If used, description of and responsibility for activating a HAZMAT warning system and its mode of operation (how it is activated, where located, number of warning devices (sirens, horns, whistles, etc.) in the system.

- How **timely** warning information will be disseminated to the public, including immediate notification to local and State authorities.

Emergency Public Information

The flow of accurate and timely emergency information is critical to the protection of lives and property immediately following a HAZMAT release. This section deals with the provisions that should be included in the plan for the preparation and dissemination of notifications, updates, and instructional messages as a follow-up to initial warning. The following planning considerations should be addressed, if appropriate, in one or more appendices to an EPI annex:

- Informing the public of health hazards associated with the HAZMAT involved in the accident.

- Providing personal protective actions instructions, including:

  - Survival tips for people on what to do immediately after a HAZMAT release has occurred.

  - Instructions for in-place protection (when to stay, where to stay, and what to do) when that option is chosen.

  - Event-specific evacuation instructions and information (routes, road closures, available transportation) when that option is chosen.

Note that LEPCs also will be working toward ensuring that area residents are informed of risks in the area, of first aid measures and in-place protective actions they can take, and of what to do if an evacuation is ordered in response to a hazardous materials incident.

Evacuation

SARA Title III requires HAZMAT emergency planning to address evacuation, including provisions for a precautionary evacuation and alternative traffic routes. Hazardous materials evacuation planning is little different from evacuation planning in general. The most important difference is that initial movements should be crosswind. Another difference is that some transportation incidents

may involve "selective evacuation" of a small area. The IC's authority to order such an evacuation should be clarified in the appendix, and provision should be made for the necessary coordination with the jurisdiction's EOC.

The following planning considerations should be addressed, if appropriate, in one or more appendices to an evacuation annex:

- Maps that identify primary and alternate evacuation routes for risk zones around locations that present a significant threat to the public.
- Pickup points and government provided transport to move evacuees.
- Provisions for moving special needs population (residents of custodial facilities such as hospitals, jails, mental health facilities, nursing homes, retirement homes, etc.) in a HAZMAT situation.
- Tracking extent of evacuations ordered by the IC(s) during response operations.

Evacuation may not be always necessary or advisable: **In-place protection** may be the preferred option. For some chemical hazards, using wet towels and shutting off air circulation systems may suffice; sometimes the cloud may move past more quickly than the evacuation can be effected. Also, if the hazardous materials incident results from another hazard event (such as an earthquake or a flood), any protective action decision will have to factor in additional concerns. If appropriate, an appendix or tab should be prepared that outlines the criteria that will be used to determine when to rely on in-place protection instead of evacuation to protect the public at risk. The following concerns should be addressed:

- Health risks (respiratory and skin) associated with duration of exposure.
- Speed of onset and persistence of the HAZMAT.
- Use of barriers (overhead protection, closing windows and doors, seeking shelter in home basements, etc.) to reduce exposure.

Mass Care

Any HAZMAT appendix to a mass care annex should address the location of shelters, to be upwind and/or out of range of the release. (In-place protective actions might be taken.)

Health and Medical

The following planning considerations should be addressed, if appropriate, in one or more appendices to a health and medical annex:

- Provisions for keeping people informed of the health risks created by a HAZMAT release.
- Designation of medical facilities that:
  - Have the capability to decontaminate and medically treat exposed persons.
  - Dispose of contaminated items (clothing, medical supplies, and other waste material).
- Monitoring of water quality and sanitary conditions in the areas affected by the HAZMAT release.
- Provisions for continued medical surveillance of personnel performing decontamination tasks (including radiological monitoring, if appropriate).

Resource Management

SARA Title III requires HAZMAT emergency planning to include a description of emergency equipment and facilities in the community and at each facility in the community subject to Title III, along with identification of persons responsible for the equipment and facilities. The following planning considerations should be addressed, as appropriate, in one or more appendices to a resource management annex:

- Provisions for purchasing, stockpiling or otherwise obtaining essential HAZMAT response items such as spare or replacement protective gear for response personnel, detection devices and sampling equipment (for water, soil, etc.), decontamination supplies, etc.

- Provisions for identifying agencies and contractors that could be involved in cleanup operations and related tasks (including storage, cleaning, and reconditioning of response equipment and supplies).

- Resource lists that identify the quantity and location of the items mentioned in the first bullet, above, along with points of contact (day, night, and weekend).

Attachment D
Hurricane

The Hazard

Nature of the Hazard

The term "hurricane" describes a severe tropical cyclone and sustained winds of 74 miles per hour (mph) or greater that occurs along the Gulf or East Coasts, in the Caribbean, or in the Pacific along the west coasts of Mexico and California or near Hawaii. Tropical cyclones in other areas of the world will have different names (e.g., typhoon).

The hurricane season runs from the first of June until the end of November. Yet hurricanes have occurred in every month of the year.

Hazard Agents

The primary hazard agents associated with a hurricane are the high, sustained winds; flooding from storm surge or heavy rains; battering from heavy waves; and a variety of secondary hazards:

- *High Winds*. The high winds impose significant loads on structures, both direct wind pressure and drag, and tend to propel loose objects at high velocity.

- *Flooding*. The hurricane can cause many different types of flooding. Along the coast the flooding may occur from storm surge, wind-driven water in estuaries and rivers, or torrential rain. The flooding can be still water flooding or velocity flooding caused by wave action associated with wind driven water along the coast. The rainfall associated with a hurricane is on the order of 6 to 12 inches, with higher levels common. The rain may precede landfall by hours and may persist for many hours after landfall, causing severe flooding.

- *Heavy Waves*. The storm may generate waves up to 25 feet high. These can batter the coastline, causing devastating damage to the shoreline itself and to structures near the shore. The velocity of the water moving back and forth undermines the foundations of building and piers by removing the soil from around them. Debris driven inland by

the waves can cause severe structural damage;

persons exposed to the moving water and debris are likely to receive severe injuries.

- *Secondary Hazards*. Hurricanes can also cause numerous secondary hazards. Tornadoes and electric power outages are common. Contamination of water supplies, flooding of sewage treatment facilities, and even dam failure may occur.

Estimating the Force of Hurricanes

The Saffir-Simpson scale is a widely recognized and accepted practical tool planners rely on to estimate the destructive forces associated with hurricanes. This scale classifies hurricanes into five categories based on wind speed and describes the destructive forces caused by wind, storm surge, and wave action for each category. The categories are listed below.

Hurricane Category	Wind Speed (mph)
1	74-95
2	96-110
3	111-130
4	131-155
5	156+

A copy of the Saffir-Simpson scale is located at the end of this attachment, as Table 6-D-1. It should be used to obtain detailed information on each storm category.

Risk Area

To determine the risk area, each jurisdiction's planning team in the hurricane high-risk States should use the Hurricane Evacuation Technical Data Report, if available; FISs and FIRMs; and other local information sources such as maps and historical data on previous hurricanes and other storms that have caused injuries and/or loss of life, property damage, and disruption of essential services.

Assessment of Risk

A vulnerability assessment should be prepared. The assessment identifies the population, facilities, property, land area, etc. that are vulnerable to the hazard agents associated with a hurricane. The assessment provides the planning team

the essential data it needs to determine the **hurricane category** for which the jurisdiction should prepare. **It is vital that the team plan for the highest category of hurricane that is likely to strike the jurisdiction.** The assessment should:

- Include a narrative description that identifies the parts of the jurisdiction that are subject to flooding caused by a storm surge. Also, maps that pictorially display this information.
- Identify the population at risk.
- Identify essential services (fire, police, utility substations/plants, etc.) and special custodial facilities at risk (hospitals, nursing homes, jails and juvenile correction facilities, etc.).
- Identify government resources such as essential equipment, tools, stockpiles, vital records, etc., that may need to be moved to a safe location.
- Identify facilities that must be evacuated such as trailer parks, campgrounds, etc.

Hurricane Unique Planning Considerations

This section contains a listing of the functional annexes that typically would require the preparation of a hazard-specific appendix for hurricanes. It also identifies many of the unique and/or regulatory planning considerations that should be examined by the planning team and used, as appropriate, when preparing hurricane-specific appendices.

General: Response Schedule

For this hazard a Hurricane Response Schedule is used in each of the hazard-specific appendices to describe the emergency response actions that should be accomplished when responding to a hurricane. The schedule establishes phases for the approaching hurricane, describes the activities to be completed during each phase, and sets the priority for the activities to be completed. Each phase covers a discrete period of time and details the specific actions that should be completed during the phase.

Time Phases

Usually, phases correspond to hours before the estimated time of arrival of gale/hurricane force winds, immediate response actions after landfall of hurricane force winds, through termination of all response activities. Typical phases include:

- *Awareness*. 72-60 hours before the arrival of gale force winds (32-63 mph).
- *Stand-by*. 60-48 hours before the arrival of gale force winds. It is likely that a tropical storm watch would be issued during this period.
- *Response*. 48 hours before arrival of gale force winds through termination of the emergency. Hurricane watches and warnings would be issued by the NWS during this period.

Keying Actions to Time Phases

Each phase in the schedule:

- Describes actions to be taken in the phase.
- Identifies the official responsible for the action.
- Defines the hours needed before arrival of gale force winds to carry out the activity.
- Describes the priority of the action to be taken.
- Contains other critical information that tasked organizations need to perform their assigned responsibilities.

Direction and Control

Initial actions are started before the beginning of the awareness phase when it appears likely that a specific storm could threaten the jurisdiction. They continue through the response phase. Therefore, provisions should be made, as appropriate, to address the following planning considerations in one or more appendices to a direction and control annex:

- Determine when response organizations should:
  - Be placed on stand-by, partial activation, or full activation.

- Suspend or curtail day-to-day functions and services and focus on emergency response tasks.

➢ Ensure response organizations can continue to perform assigned operational tasks throughout all three phases (e.g. secure, disperse, or relocate operations centers, vehicles, equipment, vital records, and other essential resources).

➢ Determine timing for taking action on the following critical concerns:

- Alerting the public.
- Closing schools and businesses.
- Restricting access to the risk area.
- Opening mass care facilities.
- Ordering an evacuation.

➢ Assign specific tasking to each response organization for each phase. Critical concerns include:

- Decision for and timing to:
  - Initiate coordination and implement mutual aid agreements with other jurisdictions.
  - Suspend non-emergency government services and operations.
  - Release non-emergency government employees from work.
- Reporting status/observations to the EOC.

Warning

Since hurricanes are typically slow-moving storms, sufficient warning time will be available to allow those people at risk to evacuate and find a safe place to stay before the storm reaches land.

The following provisions for notifying the public should be addressed, if appropriate, in one or more appendices to a warning annex.

- Roles and responsibilities of government spokespersons during each phase.
- Coordination with the NWS and media representatives to ensure timely and consistent warning information is provided.

Emergency Public Information

This section deals with the provisions that should be made to prepare and disseminate notifications, updates, and instructional messages to follow up on the initial warning.

The following planning considerations should be addressed, if appropriate, in one or more appendices to an EPI annex:

- Instructions for preparing homes/businesses (inside and outside) to weather the storm.
- Hurricane-specific survival tips for those who choose not to evacuate (e.g., remember that the eye of the storm is not the end of the storm).
- Instructions on implementing any hurricane-specific provisions for evacuation (e.g., when and where to go).
- Locations of mass care facilities that have been opened.

Evacuation

Where available, hurricane evacuation studies conducted by the States, the U.S. Army Corps of Engineers, the National Hurricane Center, and FEMA should be used to obtain vital evacuation planning data. The information gained from such studies and the risk assessment should be used to develop the planning instructions that will be relied upon to carry out an evacuation for those people at risk. These planning instructions detail the time-phased actions to be taken to evacuate people and relocate, if practical, essential services, special custodial

facilities, and government resources from the risk area. All actions must be completed before the landfall arrival of gale force winds.

The following planning considerations should be addressed, if appropriate, in one or more appendices to an evacuation annex:

- Identifying specific evacuation zones. These zones delineate the natural and manmade geographic features of the areas(s) to be evacuated.

- Designating evacuation routes for each zone.

- Estimating the number of people requiring transportation support to evacuate the risk area.
- Specifying the clearance times needed to conduct a safe and timely evacuation under various hurricane threats. Consider the following complications that could impede or delay evacuation before finalizing the time-phased actions:

    - Heavy rains and localized flooding may slow traffic movement.

    - Bridge approaches may flood before evacuation can be completed.

    - Evacuees will need time to close up their homes and businesses, secure their boats, gather the essentials (medicines, food, clothing, etc.) to take with them, fill their vehicle with gas, etc.

    - Special custodial facility managers will need time to mobilize their staff, close up the facility, and make the necessary arrangements to move the resident population.

    - Traffic entering the evacuation zone to secure homes, businesses, boats, etc.

    - Evacuees from other jurisdictions passing through the zone and occupying the same evacuation route(s).

- The need for special modes of transportation (ferries and air transport) to evacuate people from barrier islands.

Mass Care

The following planning considerations should be addressed, if appropriate, in one or more appendices to a mass care annex:

Location of Mass Care Facilities

These safety considerations should be addressed:

- Ensure the facilities designated for use are located outside of the Category 4 storm surge inundation zone.
- Ensure the facilities are located outside of the 100 or 500 year floodplain, as deemed appropriate.
- Ensure the facilities are not vulnerable to flooding due to dams or reservoirs that overflow.

Structural Survivability

Ensure each facility designated for use has been certified as capable of withstanding the wind loads specified by the American Society of Civil Engineers or the American National Standards Institute guidelines. If it is necessary to use uncertified facilities, ensure that a structural engineer knowledgeable of the criteria contained in the guidelines cited, identifies and ranks the facilities that offer the best protection available.

Resource Management

The following planning considerations should be addressed, if appropriate, in one or more appendices to a resource management annex:

- Provisions for purchasing, stockpiling, or otherwise obtaining essential hurricane response items such as ice machines, water purification systems, polyethylene sheeting, sand bags, fill, pumps (of the right size and type, with necessary fuel, etc.), generators, light sets, etc.
- Resource lists that identify the quantity and location of the items mentioned above, as well as points of contact (day, night, and weekend) for obtaining them.