



## 7.0 HURREVAC/Decision Tools

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### 7.1 Decision Tools

#### 7.1.1 Purpose

This chapter describes the HURREVAC computer program. HURREVAC is a hurricane evacuation decision making tool that uses clearance times in conjunction with National Hurricane Center (NHC) advisories to help state and local emergency managers determine when and if evacuations should begin. More information on this program may be found at the HURREVAC website at [www.hurrevac.com](http://www.hurrevac.com).

#### 7.1.2 Background

Hurricanes do not always approach land from a direction perpendicular to the coastline and, in fact, more frequently cross the coastline on an angular track. In that case, with a hurricane 24 hours from the coast, an error of 10 degrees in the predicted hurricane track can easily mean a 100-mile error in the point of eye landfall.

In the same way, forecast errors can affect the time of landfall. When a hurricane approaches a coastline at an acute angle, an error in forecast landfall position will cause an error in the forecast distance it must travel to reach the coast. This could possibly result in a significant error in forecast time of eye landfall. The forward motion of hurricanes can also accelerate and decelerate, causing the exact time of landfall to be even more problematic. Prior to mid-1980, hurricane evacuation decision-making and mobilization was dependent upon forecast time and location of eye landfall. Because of the potential forecast errors (see Chapter 2, Forecasting Inaccuracies), a decision aid was needed that would help compensate for those errors by relating evacuation operations to the overall hurricane threat, rather than focusing on the location of the eye. The Decision Arc Method was created for that purpose. Originally, a manual decision making tool, it is now incorporated into hurricane evacuation decision aid software.

Emergency management officials should review all available hurricane evacuation related software offered today. Some of these programs incorporate hurricane evacuation study data, including some form of the Decision Arc Method. Computer assistance is nearly indispensable for performing needed calculations and displaying important information and relationships. However, emergency management officials should be familiar with the concepts of sound evacuation decision making and timing and should not rely solely on the outputs of any hurricane tracking software.



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Figure 7-1: HURREVAC

## 7.2 HURREVAC

### 7.2.1 History

HURREVAC stands for “HURRICANE EVACUATION” and is a restricted-use computer program funded by FEMA and USACE for government emergency managers to track hurricanes and assist in evacuation decision-making for their communities. This real-time data analysis tool allows state and local emergency management officials to make prudent and informed decisions based on information developed during the FEMA Hurricane Evacuation Studies (HES) process and real-time forecast data distributed by the National Weather Service (NWS) and the Tropical Prediction Center/National Hurricane Center (NHC).

HURREVAC was originally developed for the State of South Carolina in late 1988 and was first used in South Carolina and Georgia during the 1989 season for Hurricane Hugo. Through 1996 a separate program was prepared for each individual HES study area as the storm tide inundation, sheltering and clearance time data became available. Through the HES process, stand-alone versions of HURREVAC were developed and used for some study regions throughout the coastal United States.



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Between 1995 and 1997, a companion program, the HURREVAC Inland Winds, was developed for use by coastal and inland counties alike to address the high wind conditions that can be generated by a tropical cyclone event. Many of the data and functions in the Inland Winds program were based in large part on the Wind Decay Model developed by Mark DeMaria and John Kaplan. The Inland Winds program also served as the prototype for many of the graphics conventions used in the follow on version of HURREVAC.

The next major platform for HURREVAC was released in 1998 and targeted Windows 95/98/NT. This consolidated program (called HurWin95) was adaptable for each state through the use of plug-ins for evacuation times and inundation graphics. It also combined coastal HURREVAC and the HURREVAC Inland Winds program into one new program.

The scope and capabilities the program continued to grow and several years later it took on a new name of Hurrevac2000. Hurrevac2000's launch marked the beginning of East and Central Pacific storm tracking capability as well as the incorporation of rainfall forecasts--the first of a number of inland flooding tools that have been added over the years.

In 2007 FEMA and USACE, together with Sea Island Software, began to explore HURREVAC modernization. Users of the program were surveyed and a 5-year strategic plan developed. Reprogramming of HURREVAC for Microsoft's .NET platform began in 2008 and the Hurrevac2010 platform fully replaced the old program beginning in 2012.

### 7.2.2 Overview for Using HURREVAC

HURREVAC is a display program only; it is not a model and therefore does not generate any information that is not derived from the NHC advisory package. Without the advisory package from the NHC, HURREVAC lacks the basic information with which to produce any of the tropical cyclone plots or most of the other decision making data inherent to the program. Marine advisories on tropical storms are normally issued by the NHC every six hours at the same time every day, namely at 5 AM, 11 AM, 5 PM and 11 PM during daylight savings time, or 4 AM, 10 AM, 4 PM and 10 PM standard time. As the storm gets within radar range, intermediate advisories that update the initial positions of the eye are also issued.

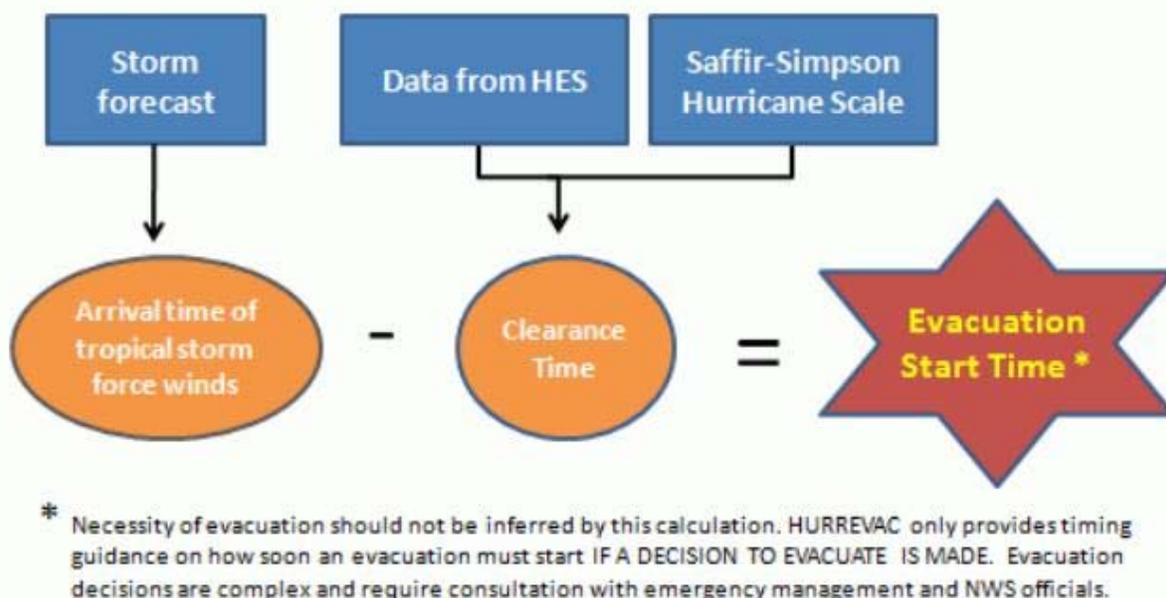
HURREVAC tracks hurricanes using the NHC's Forecast Advisories. The software translates forecast track and wind extent information from the NHC's text-based products into interactive maps and reports that are used to chart the progress of an advancing storm. The program also assembles rainfall, flood, tide, and river forecast information from various sources to assist users in evaluating inland flooding threats.



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The most key feature of HURREVAC, however, is its ability to keep to the local emergency manager apprised of how many hours (or days) a community has for preparation and planning in advance of a threatening storm. As new forecast information becomes available, HURREVAC continually updates and reports on the community's evacuation start time, or last possible time by which an evacuation could be initiated if it is to be completed before the arrival of the storm hazards.

The decision to evacuate a community is not always an easy or obvious one and the advantage of fine-tuning the Evacuation Start Time in HURREVAC is that protective action decisions are based on the closest (and therefore most accurate) projections for the storm track, intensity, and size. HURREVAC does not make the decision to evacuate, it is merely one tool that state and local emergency managers and other response officials can use to help in the hurricane decision-making process. Evacuation decisions are very complex and should only be made after consultation with all officials involved in the process, from NHC and the Weather Service, to state and local officials.



**Figure 7-2:** HURREVAC Evacuation Wind Timing Determination

To determine the arrival time of tropical storm force winds, the program takes a worst-case scenario of a direct hit in which the forecasted forward speed and wind extents from the official forecast are retained, but the forecast track is straightened and redirected to the community of interest. If a community is in, or on the periphery of the average forecast error swath depicted in HURREVAC, this direct to point approach is indeed prudent. Based upon storm intensity (SS



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Category) and various local factors, a clearance time (or number of hours to evacuate, see Chapter 6) is selected from a matrix of times extracted from this HES. Subtracting the number of clearance time hours from the forecast arrival of the first hazards (usually considered the forecast arrival of tropical storm winds) generates the evacuation start time.

This HURREVAC evacuation start time represents the latest hour an evacuation decision should be initiated. This time does not take into account the impacts of the storm's forward movement speeding up; traffic accidents; major construction on an important evacuation route; conducting an evacuation during nighttime hours; or any other potential occurrences that may serve to decrease the amount of operational time or increase clearance times, or both.

### 7.3 Using HURREVAC: The Basics

#### 7.3.1 Workspace Layout

Figure 7-3 below depicts a normal screen seen by the user during a HURREVAC session. The screen is subdivided into components, each with its own function.

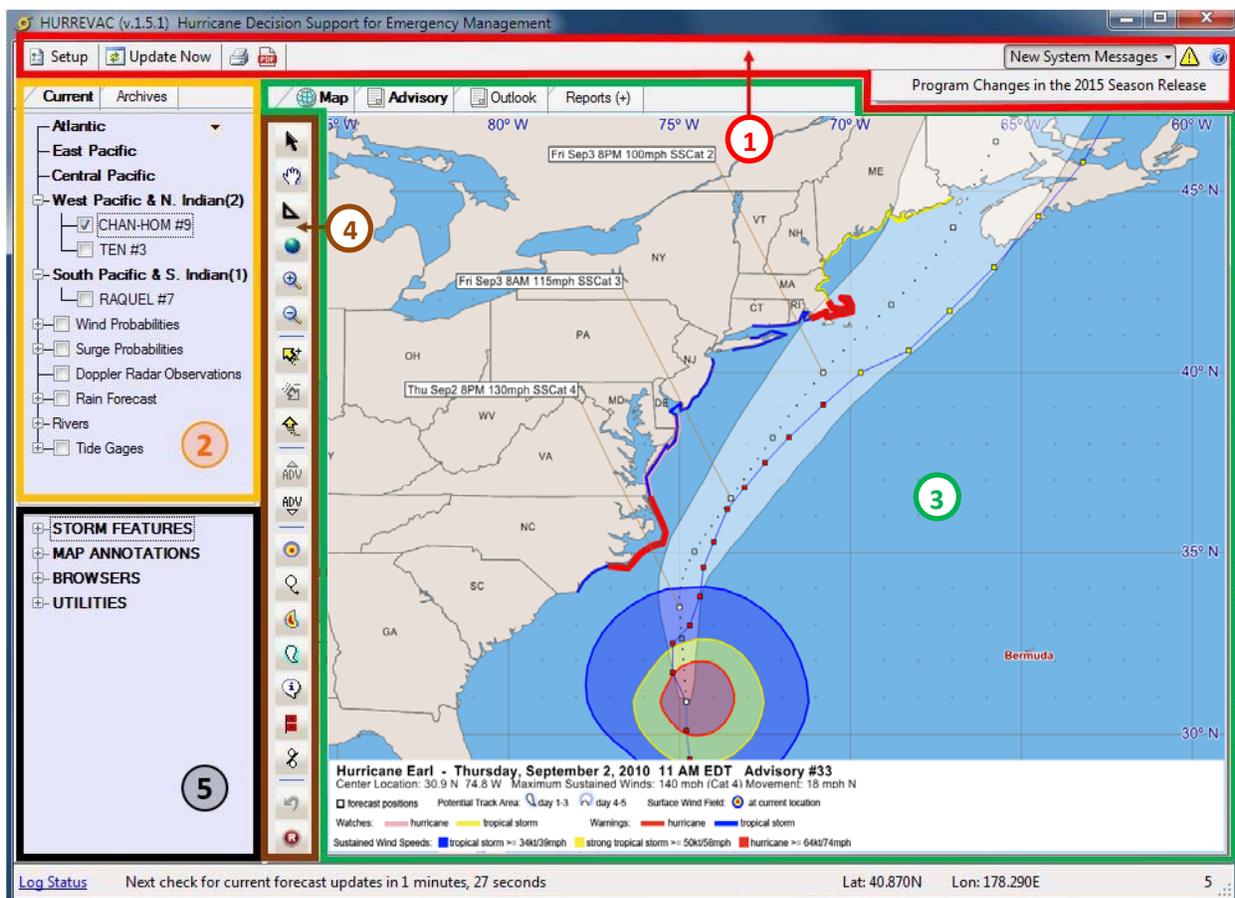


Figure 7-3: HURREVAC Workspace



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### **Program Header (1- Red)**

Includes tools that allow the user to manage program setup, update forecast data, print, and create a Storm Summary PDF Document. Also includes system messaging capabilities that are used to broadcast information from HURREVAC's technical support staff or the National Hurricane Program when special situations arise having to do with operation of the software.

### **Current/Archive Data Tabs (2 - Orange)**

"Current" tab allows user to access current forecast information, including: selecting and loading a current storm, rainfall forecast data, river gage data, flood outlook data, tide gage data, Doppler radar observations, probabilistic storm surge data, and wind probability data. "Archives" tab allows user to access similar data for historic storms and forecasts, along with saved data files.

### **Map Display/Data Display Window (3 - Green)**

Displays map and map legend, forecast text for advisory, tropical weather outlook text, reports menu, and reports. User can change what is shown using tabs above the window.

### **Map Tools (4 - Brown)**

Allows user to control what is shown in the "Map Display Window". Options include zoom in/zoom out, pan, zoom to user pre-defined map views, measure distances, move storm along forecast track, change advisories, turn on/off wind and potential track graphics, turn on/off advisory labels and watch/warning graphics, turn on/off 120-hr wind speed probabilities, move back and forward through previous map views, and reset map graphics. This area is covered in more detail in section 7.3.2 below.

### **Toolbox (5 - Black)**

Allows user to access additional map display options, add annotation to the map display, access evacuation clearance time and storm surge map browsers, change evacuation options settings, access the clearance time arc, and export/import applicable data, among other options/functions.

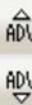
### **7.3.2 Map Tools**

Moving the mouse over a button in HURREVAC will cause a pop-up annotation to appear with a description of the specific map tool function. Many of the important functions and capabilities, including map navigation, are found along the side of the main map display. Table 7-1 below details the various buttons and their accompanying features.



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**Table 7-1: Map Tools and Function Descriptions**

	Zoom (Black Arrow): Draw a box on map with left mouse button to zoom in
	Pan (White Hand): Move the map by holding down left mouse button and moving mouse
	Measure (Triangle): To measure distance, click left mouse button on map at start/end point
	Map Extent (Globe): Toggle between user defined full (left click) and local (right click) map view
	Zoom In/Out (Magnifying Glass with + or – symbol): Left click to zoom in/out 20% of current view, right click to zoom in/out 40% of current view
	Move storm graphics and legend data forward or back within the forecast period for the current loaded storm and advisory (Yellow Arrows): Left click to move forward/back 1 hour, right click to move forward/back 6 hours. Bottom button moves storm forward automatically.
	Change Advisory (ADV with up/down arrows): These buttons cycle through previous or historic advisories for the storm you have loaded. Left click to move forward or back 1 advisory. Right click to move forward or back 3 advisories.
	Hourly Forecast: Turn on/off the hourly wind field (Colored Circle) or potential location showing forecast uncertainty (White Circle). See legend in map display window for more details.
	Entire Forecast: Turn on/off 72 hour wind forecast (Colored Swath) or potential track (White Cone) here there is a 66% chance that the center of the storm will pass through during the next 3 (white) or 5 (hollow) days.
	Advisory Labels (Text Bubble): Left click for advisory labels on map. Right click for label settings.
	Watches/Warnings (Warning Flag): Left Click to add watch/warning graphics to map
	Wind Probability Locations (Percent Sign): Show location based probability labels on map
	Forward and Back (Blue Arrow): Left click to cycle back through previous map views and right click to cycle forward through previous map views.
	Reset (Red Circle): Left click to restore map display to default graphics. Right click to configure your own defaults.

### 7.3.3 Context menu and Shortcut Keys

Right mouse button clicking inside the main menu accesses a context menu that gives the user more functions and display options. Keyboard shortcuts are also available for certain functions noted below as (CTRL). Table 7-2 below lists the functions and capabilities that can be accessed.



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**Table 7-2:** Context Menu and Keyboard Shortcuts

Zoom to Working Storm (CTRL-Z)	Zoom to the selected storm of interest.
Select Forecast Hour	Select a specific forecast hour to display.
Select Advisory	Select a specific advisory to display.
Annotate Text Here	Annotate text on the map.
Move Nearest Text Here	Move the nearest text to a different location on the map.
Delete Nearest Text	Delete the nearest text that has been annotated on the map.
Delete ALL Text	Delete all text that has been annotated on the map.
Place Wind Tag Here (CTRL-W)	Place a wind tag at the location of the pointer that will display the wind direction and speed when impacted by the storm's hourly wind ranges.
Delete Nearest Wind Tag	Delete the nearest wind tag displayed on the map.
Delete ALL Wind Tags	Delete all wind tags displayed on the map.
Wind Timing Report This Location	Creates a 72-hour Wind Timing Report for the specified location on the map, which displays hour-by-hour forecasted wind detail information for the area.
Wind Probabilities Report This Location	Creates a 5-day Wind Probabilities Report for the specified location on the map, which displays the probabilities of onset of sustained tropical storm force wind, strong tropical storm force wind, and hurricane force wind speeds during the forecast period. ("Wind Probabilities" graphic must be turned on in the "Current" or "Archives" tabs).
Wind Probabilities Report This Location - Graph	Displays a 5-day graph showing the percent chance of maximum sustained tropical storm force wind, strong tropical storm force wind, and hurricane force wind at different times during the forecast period for the specified location on the map. ("Wind Probabilities" must be active in the "Current" or "Archives" tabs).
Surge Probabilities This Location	Creates a 78-hour Surge Probability Report for the specified location on the map, which displays the water depth in height above ground level (including actual tidal fluctuation) that has a 10% chance of being exceeded. These values are on the high end of the range of surge depths that could still possibly occur. ("Surge Probabilities" graphic must be turned on in the "Current" or "Archives" tabs).
Surge Probabilities This Location - Graph	Displays a 78-hour graph showing the water depth (with actual tide) in feet above ground level with a 10% chance of being exceed at the specified location on the map. These values are on the high end of the range of surge depths that could still possibly occur. ("Surge Probabilities" graphic must be turned on in the "Current" or "Archives" tabs).
Show Range Marks Here	Displays range marks in order to illustrate how far away the storm is from a location of interest. The default interval is 100 statute miles, but can be changed under the "Setup" menu, "Default Map" tab.
Advisory Labels	Adjust the location of or reset the location of Advisory Labels.
Move Storm Info Box Here	Move the Storm Info Box to a specified location. Storm information must be removed from the legend by unchecking the box in the Map Annotations heading in the toolbox.
Create Point Of Interest Here	Create a Point of Interest at a specified location, with a specific name. Additional options for adding, editing, and importing points of interest are available under the "Setup" menu, "Points of Interest" tab.



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### 7.4 HURREVAC Program Setup

The “Setup” function can be accessed from a button in the upper left hand corner of the program.

Selecting that button will open a window with 7 tabs each addressing different aspects of the program.

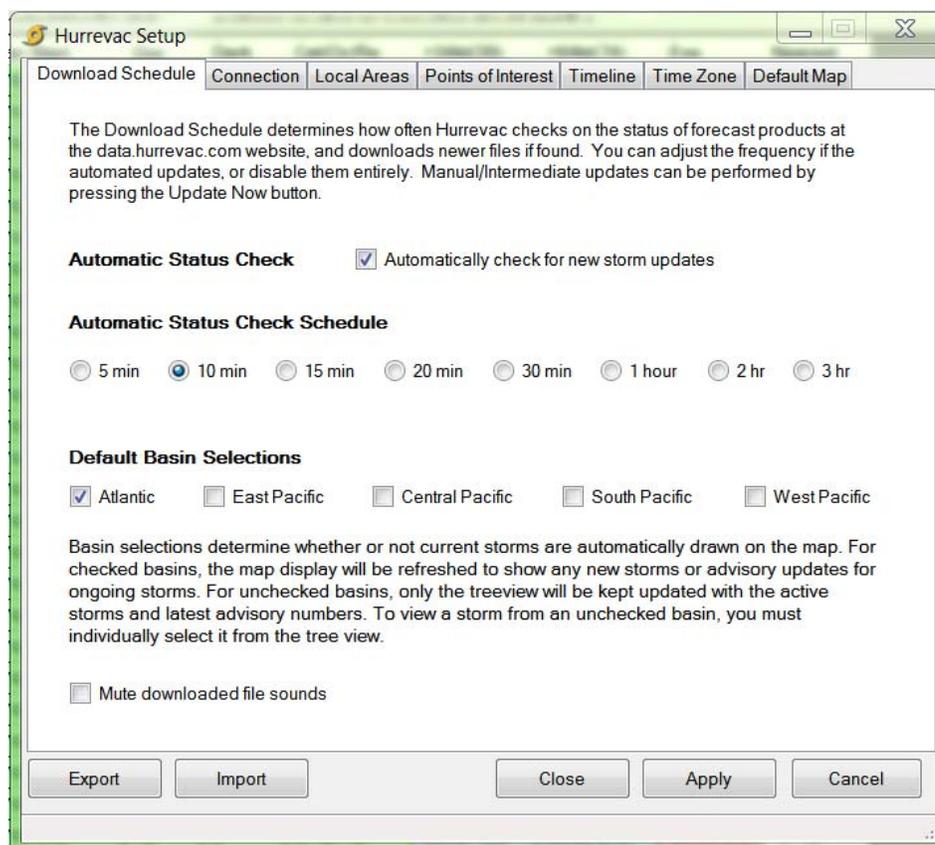
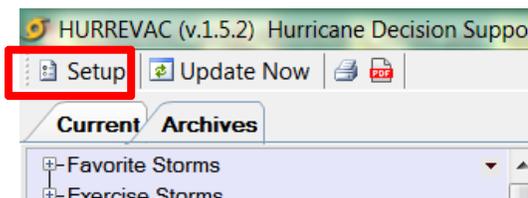


Figure 7-4: HURREVAC Setup Opening Window

#### 7.4.1 Download Schedule Tab

Figure 7-4 displays the default Setup window that appears, which opens with the “Download Schedule” tab on top. The selections shown above for this tab are the default choices; therefore, for the New England communities, there is probably not a need to change them.

Clicking on the subsequent tabs across the top of this window will access new choices from the setup menu. For the purposes of this chapter we will bypass discussing the “Connection” tab since it is very unlikely that its use will be necessary for most users.



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### 7.4.2 Local Areas Tab

This tab provides an opportunity for the user to specify which community, or collection of communities is most important in the preparation of the various evacuation timing and other reports discussed later on in this chapter. When the program is installed, the appropriate subdivisions for 36 states, territories, or other countries (Bermuda and Jamaica) and their latest clearance time data are incorporated in the program files. When the “Local Areas” option is used in any other reports, only those communities designated in this setup tab will be displayed. Figure 7-5 displays the setup menu for the “Local Areas” tab.

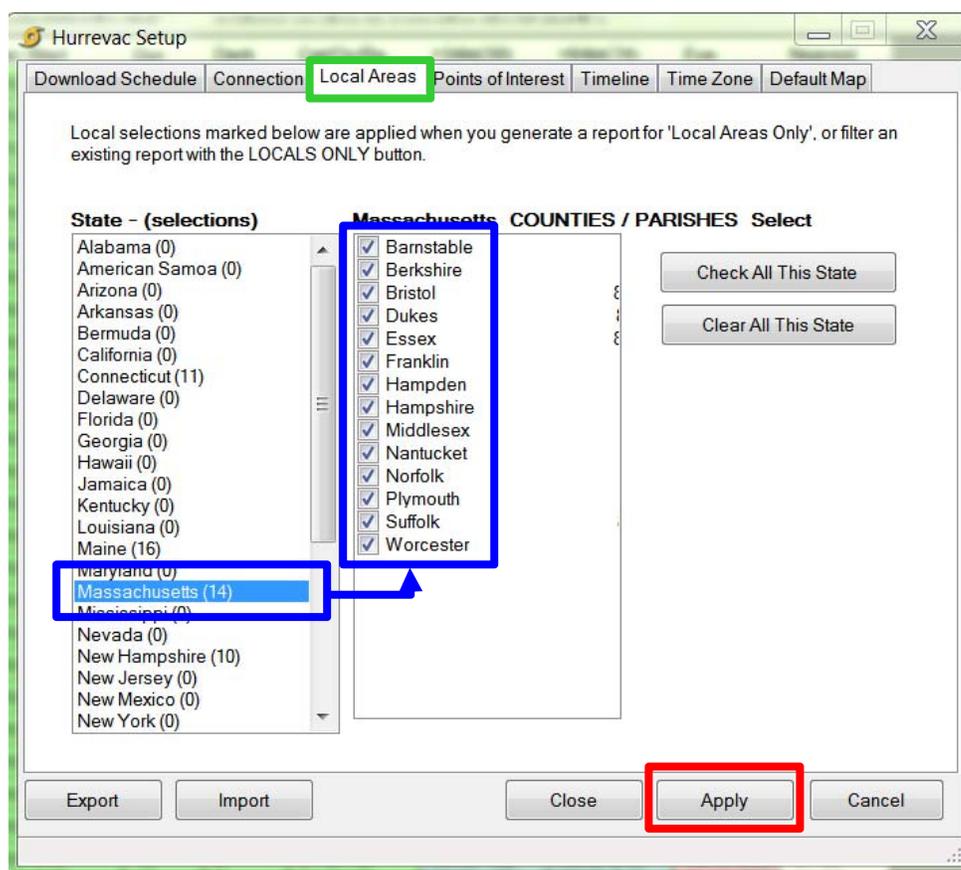


Figure 7-5: Local Areas Tab

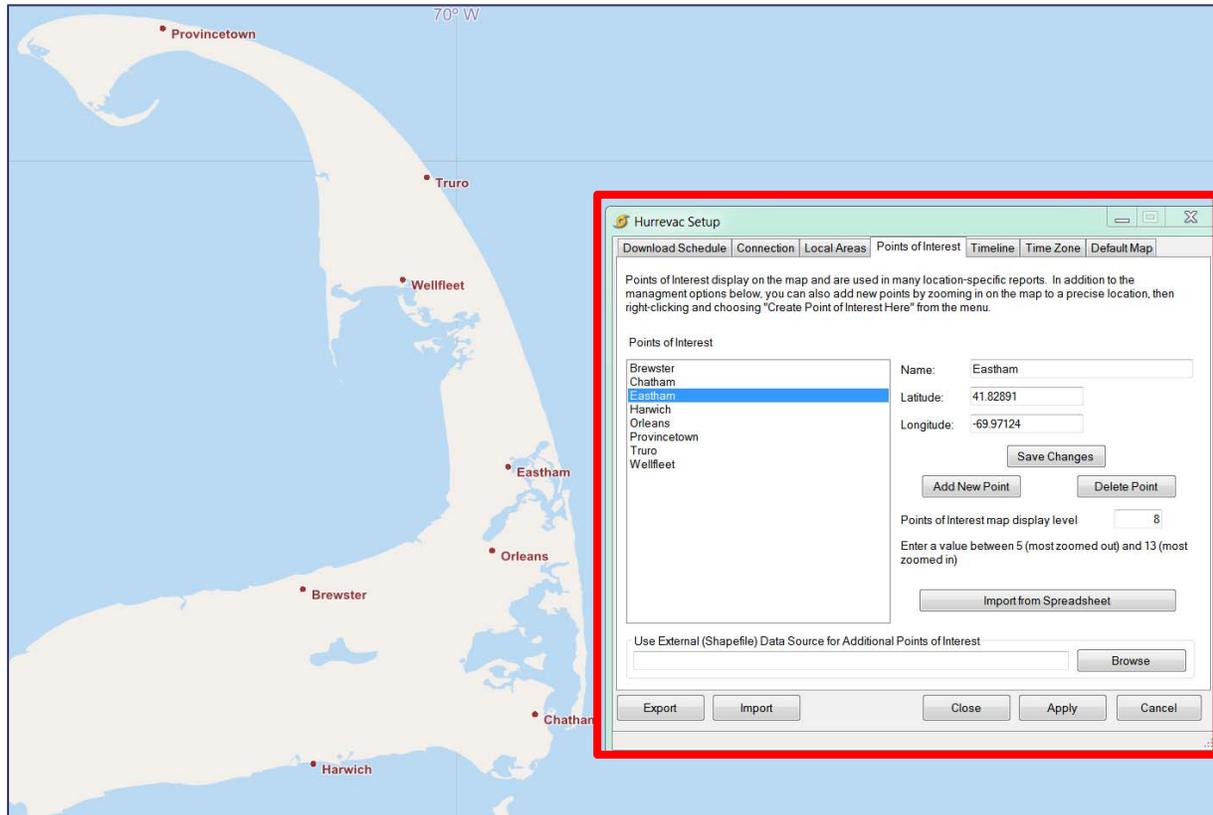
As a state is selected in the left hand window, their associated subdivisions (counties only) appear in the right hand window. Check the boxes next to each county that should be displayed, and once all choices have been made, click on “Apply”. The counties for more than one state can be chosen; the number of which will appear in the parentheses next to the state. Only those counties with a check mark will be featured in the “Local Areas” level reports. Notice in the figure above, Connecticut, Maine, Massachusetts and New Hampshire all have counties designated for inclusion in the “Local Areas” reports.



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### 7.4.3 Points of Interest

The “Points of Interest” (POI) setup tab is a manager for user-selected points posted on the main HURREVAC map. The user designates these POI by right mouse button clicking on the main map at the desired location. A context menu will appear and at the bottom will be a “Create Point of Interest Here” selection. Each POI designated and named through this process will be listed in the window shown below (red box in the Figure 7-6).



**Figure 7-6:** Main Map with Points of Interest and Accompanying Setup Table

Various POI parameters can be managed from this setup menu, including the importing of spreadsheets and other means of incorporating these points using automated means. Once these points are created, various wind and wind timing tables for those specific locations (either single or multiple) can be generated from the “Reports” tab.

These POI are a particularly useful feature for New England states since the main HURREVAC map only delineates counties and not towns or communities; this way their specific locations can be plotted and used more readily on the map. These POI can also be used to pinpoint the location of shelters, EOCs, bridges and other critical infrastructure.



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### 7.4.4 Timeline

Inherent to the HURREVAC program is a feature that allows an operational timeline to be directly linked to the forecast arrival of storm related thresholds such as 34, 50 or 64 knot winds, closest approach of the eye, as well as the evacuation start time. Once a community establishes discrete activities for preparing its populations and infrastructure for the approach of a tropical cyclone (e.g., opening shelters, shuttering town hall, etc.) and associates those tasks to the hours before and after the above referenced thresholds, that plan can be incorporated into HURREVAC. Once incorporated, HURREVAC can alert users to the time to begin each action in concert with the forecast arrival time of the appropriate threshold.

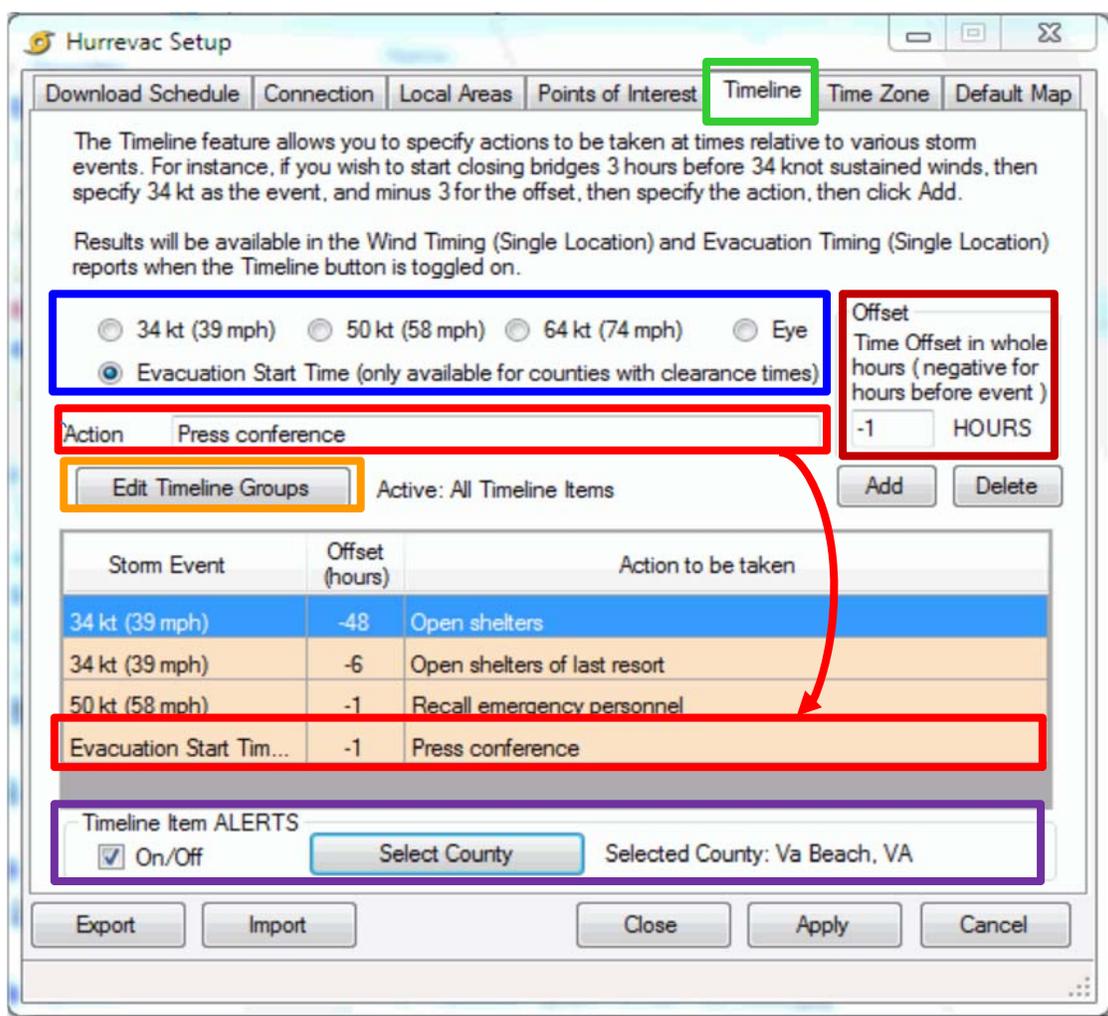


Figure 7-7: Timeline Setup Menu

Like the POI setup menu, the "Timeline" tab is a manager in that it allows the user to organize and modify the discrete activities in the operational plan, as well as specify the initiation parameters. Once the operational task is typed into the "Action" window (red box in Figure 7-7

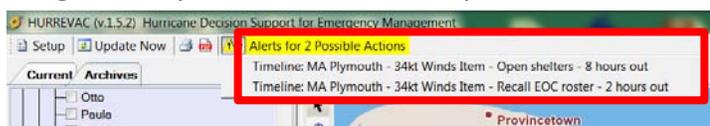


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above), the threshold chosen (blue box), the time offset value entered (brown box) and “Apply” is selected, it is listed in the large window below (blue box) with the other activities. The threshold associated with that task, as well as its time offset is entered in the brown box in the Figure above.

Among the other associated functions with this setup menu selection is “Edit Timeline Groups” the button (in orange box in Figure above) for which is just below the “Action” entry window in Figure 7-7 above. The purpose of timeline groups is to maintain collections of timeline action items that can be activated as needed. Only one timeline group will be in active use at any one time, but individual items can be assigned to any number of groups. This can be applied so that certain specific activities in the timeline can be directly associated to responsible agencies, or ESFs.

Also found in this setup menu is a button labeled “Timeline Item Alerts” located just below the central display window (See purple box in Figure 7-7 above). Timeline-associated actions can also be monitored while tracking the progress of a storm from one advisory to the next. In order for timeline items to be included, a single county of interest must be specified. The alerts on timeline-specific items then begin when the county falls inside of the 72-hour forecast wind swath. Clicking on the item in the Alert dropdown menu activates the Wind Timing Single Area report for that county.



### 7.4.5 Time Zone

Under most conditions, this setup menu tab is not necessary because the time zone setting in HURREVAC matches the internal clock for the computer on which it is loaded. This option exists in case the user must prepare a map or report for a distant location and needs to use the local time zone without changing your computer's setting.

### 7.4.6 Default Map Settings

Use this tab to set preferences for how the Default FULL SIZE Map and the Default LOCAL Map are displayed when the program is opened, or the local map is activated. Selections will be saved upon exit from the program. These maps can easily be accessed through left and right clicks to the Globe button near the top of the Map Toolbar (see Table 7-1 and Figure 7-3 above).





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### 7.5 Wind Forecast - Timing and Probability Reports

#### 7.5.1 Opening the Wind Timing and Wind Probability Reports

To view reports, the user must have loaded a storm. Storms can be loaded from the “Current” tab (for a storm that is currently occurring) or the “Archives” tab (for historical storms). Locate the storm name using the “Forecast Basin” navigation tree. When the storm is found, check the box next to the storm name. The user should see a box appear around the storm name, and the location of the latest/last advisory for that storm should be plotted on the map. The map legend should show the name of the storm, and information about the advisory. If multiple storms are checked on, click on the name (text to the right of the checkbox) of the one storm you wish to view in the map legend and reports. Figure 7-8 below is a display of the window that appears when the Reports tab is selected.

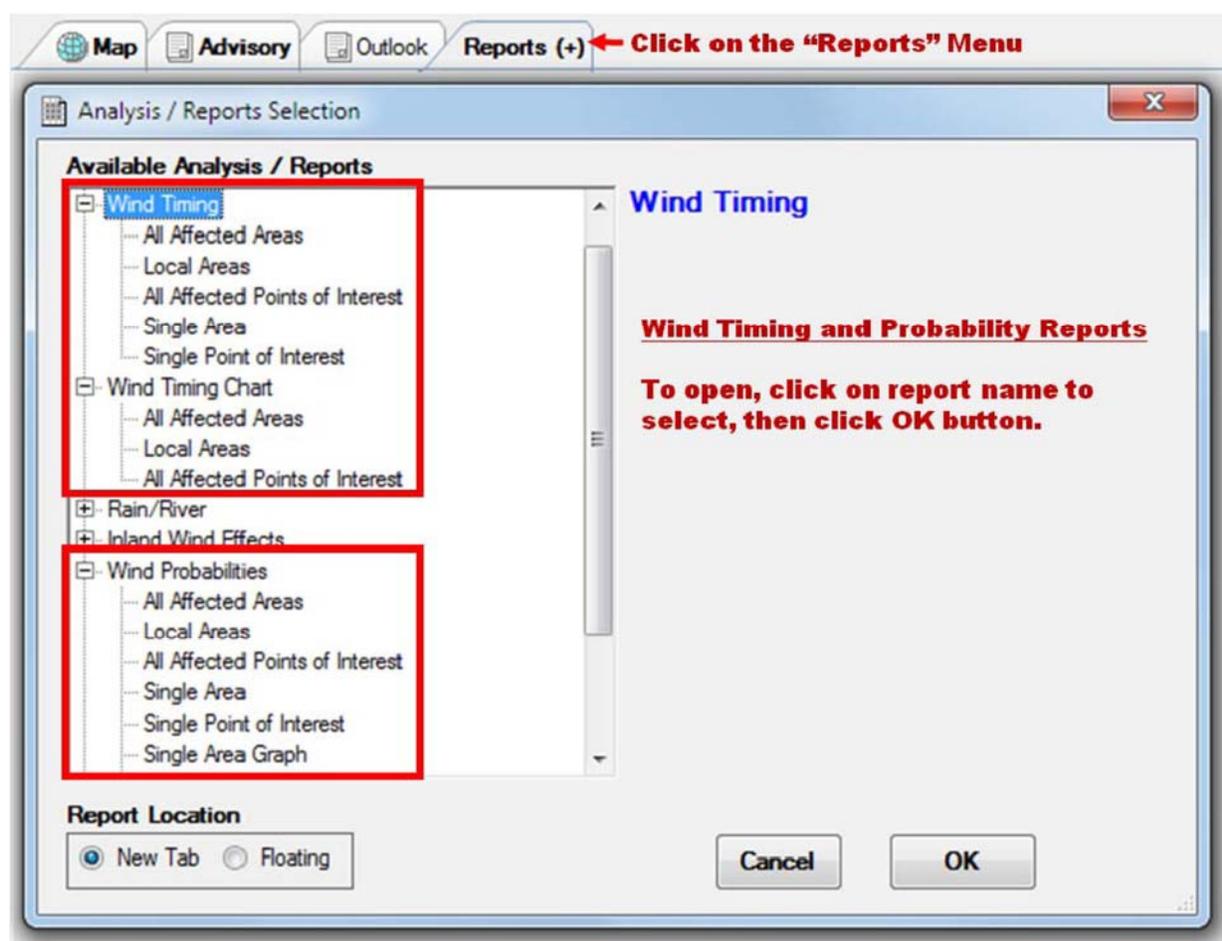


Figure 7-8: Reports Tab Window



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### 7.5.2 Wind Timing for Single Area/Point of Interest Report

User selects a single community or single point of interest to produce an hour by hour report, going out 72 hours from the time of the selected advisory. The report shows the potential wind speeds at that location for each hour in the forecast period. Wind reports are color coded by wind intensity: Blue indicates sustained tropical storm force wind, Yellow indicates sustained strong tropical storm force wind, and Red indicates sustained hurricane force wind.

### 7.5.3 Wind Timing All Affected Areas/Local Areas/All Affected Points of Interest Report

This report populates with wind forecast information for all areas (communities) or points of interest that are forecasted to experience at least tropical storm force winds based on the forecast from the selected advisory. Projected start and end times for tropical storm, strong tropical storm, and hurricane force winds are listed along with the projected speed and time of the peak wind. By selecting "Local Areas Only", this report can be narrowed down to just the local communities of interest selected by the user in the "Setup" menu.

A wind timing chart is also available under the reports menu. The chart-based layout allows the user to visualize possible wind conditions over time for multiple locations. All wind timing reports and charts are based on the deterministic forecast and do not account for forecast uncertainty; therefore they are not recommended for use to support decision making until the storm is close to landfall. When the storm is further out, timing reports/charts should only be used for general information and situational awareness. Wind probability reports/data (discussed below) account for forecast uncertainty and should be used when the storm is further out.

### 7.5.4 Wind Probabilities Single Area Report

When wind probability graphics have been turned on under the "Current" or "Archives" tab, this report populates with wind probability information for a location selected by the user. The report lists the percent chance of Tropical Storm, Strong Tropical Storm, and Hurricane force wind speeds being experienced at the selected location. The probability data goes out 120 hours, starting at the time the wind probability product was issued. Results are displayed in 6 hour time periods. The number outside of the parentheses is the percent chance of that wind speed beginning during that particular 6 hour time period. The number in parentheses is the percent chance of that wind speed beginning within the cumulative time from the start of the forecast period up to that particular time in the forecast period. The last two columns explain the exact individual and cumulative time periods that apply for each row in the report.



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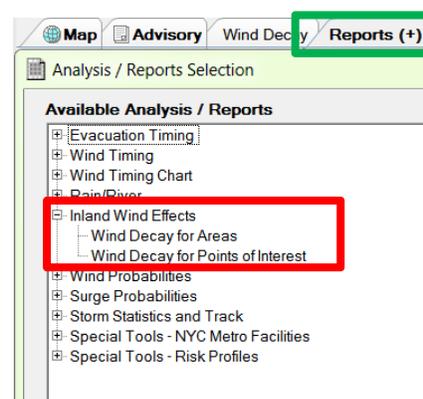
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### 7.5.5 Wind Probabilities All Affected Areas/Local Areas Report/All Affected Points of Interest Report

When wind probability graphics have been turned on under the “Current” or “Archives” tab, this report can be populated with wind probability information for all areas or points of interest that have a chance of experiencing at least tropical storm force winds during the 120 hour forecast period. Results are broken into 12 or 24 hour time periods. The number outside of the parentheses is the percent chance of that wind speed beginning during that particular 6 hour time period. The number in parentheses is the percent chance of that wind speed beginning within the cumulative time from the start of the forecast period up to that particular time in the forecast period. By selecting “Local Areas Only” or “Affected Points of Interest”, this report can be narrowed down to just the local communities of interest or points of interest selected by user in the “Setup” menu.

### 7.5.6 Inland Wind Decay for Areas / Points of Interest

The Wind Decay Report describes the maximum distance certain categories of wind can penetrate inland, given the storm strength and forward speed. These wind decay models are particularly important for determining winds over areas far inland from the coastline, and for planning purposes. In the last few hours before landfall, the specific NHC Wind Swath and Wind Timing Report should be used instead of the wind decay models. In the “Reports” tab expand the “Inland Wind Effects” to access both of these reports.





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### 7.6 Evacuation Timing Features

#### 7.6.1 Opening the Evacuation Timing Reports

The Evacuation Timing reports can be accessed using the same Reports tab. The Evacuation Timing reports are the first choice of reports once the Reports tab window opens as shown below in Figure 7-9.

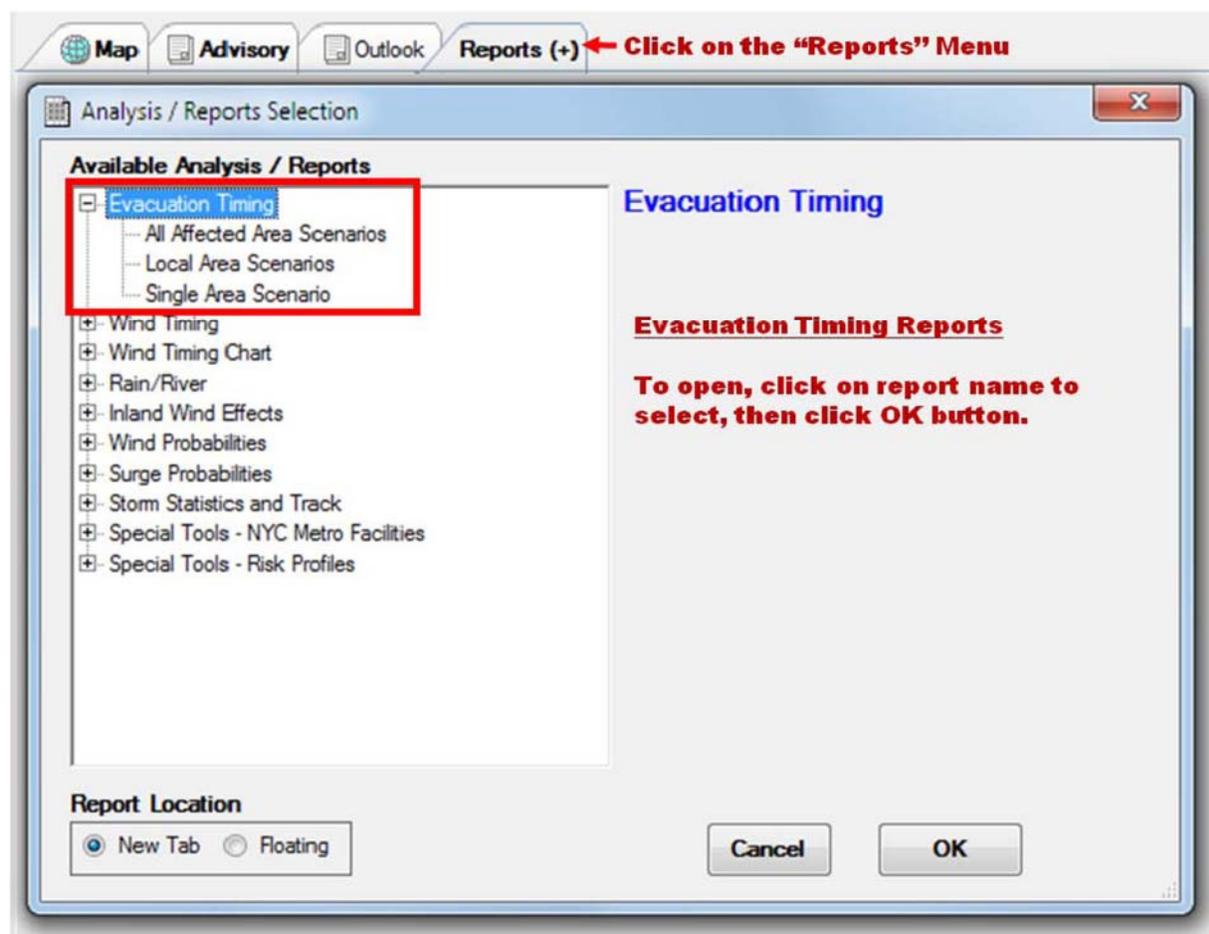


Figure 7-9: Evacuation Timing Menu Tree in the Reports Tab Window

#### 7.6.2 Evacuation Timing Single Area Scenario

This report populates with evacuation timing guidance/information for a single county or parish and evacuation scenario selected by the user. The report lays out an hour by hour timeline that highlights a time during the forecast period where an evacuation would need to start if applicable. The report also highlights the timing of wind and eye arrival, and possible preparation actions. HURREVAC does not tell the user whether or not to order an evacuation. The evacuation start time is intended to tell the user that if an evacuation is going to be ordered, around this highlighted time is when the evacuation needs to start in order to



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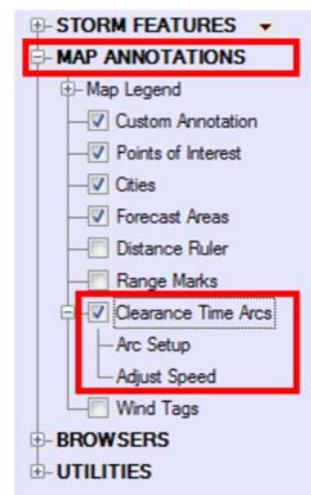
complete it prior to the arrival of hazardous conditions. The evacuation start time is calculated by identifying the arrival time of tropical storm force winds and subtracting back the evacuation clearance time for the selected location. The arrival time of tropical storm force winds is based on a direct hit scenario on the selected county, as opposed to being based on the actual forecast track. This results in a conservative representation of the tropical storm force wind arrival time, but does not account for uncertainty in the forward speed, size, and intensity forecast. Evacuation clearance times used by HURREVAC are taken from the Hurricane Evacuation Study for that location.

### 7.6.3 Evacuation Timing All Affected Areas/Local Areas

This report populates with evacuation timing information for all counties/parishes that fall within the “potential track” area plus “fringe winds”. The “fringe winds” area represents the possible extent of tropical storm force wind impacts if the center of the storm was to move along the left or right side of the “potential track” (also known as the “error cone”). The report lists the evacuation start time (if applicable) for all counties/parishes and all evacuation scenarios, along with the length of the evacuation clearance time for each scenario.

### 7.6.4 Clearance Time Arc

The “Clearance Time Arcs” feature under the “MAP ANNOTATIONS” menu option in the toolbox allows the user to see a graphic representation (on the map display) of where the storm will be located around the time that an evacuation (if applicable) would need to start. The user has to first select a community and evacuation scenario from the "Arc Setup" menu. The user must then check the box next to Clearance Time Arcs" for the arc to draw on the map display. A circle will be drawn around the selected community. When the storm is moved along the forecast track for the selected advisory, an evacuation would need to start around the time (shown in the legend) that the edge of the tropical storm force wind field touches the clearance time arc circle. The clearance time arc is based on the forecasted forward speed and the evacuation clearance time. It is not based on a direct hit scenario calculation of the arrival time of tropical storm force winds.

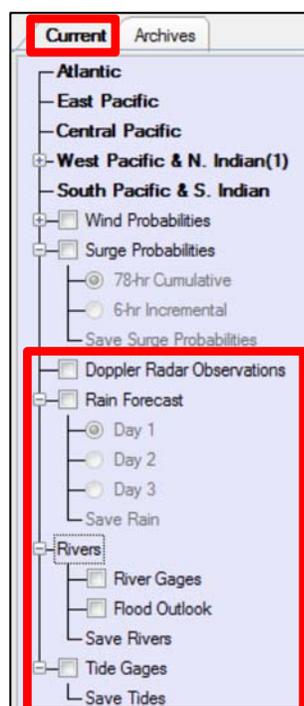




## 7.0 HURREVAC/Decision Tools

### 7.7 Other Forecast Data

The following forecast data options found on the "Current" tab are available year-round, even when no tropical cyclones are active.



#### 7.7.1 Doppler Radar Observations

By clicking on the "Doppler Radar Observations" layer in the "Current" tab, a Doppler radar layer will be displayed. This data will update automatically every 10 minutes.

#### 7.7.2 Rain Forecast

The rainfall forecast graphic can be displayed by checking the box next to "Rain" on the "Current" tab navigation menu. Expand the box next to "Rain" to choose to view the graphical forecast for Day 1, Day 2, or Day 3 of the forecast period. The map legend provides information on how the color scale relates to forecasted rainfall amounts, and the time period that the forecast graphic is valid. There is also a "Rainfall" report available under the "Reports" menu. The report lists the rainfall forecast for each impacted county/parish or point of interest in Day 1, Day 2, and Day 3 increments along with the 3-day cumulative forecasted rainfall.

#### 7.7.3 River Data and Forecasts

By expanding the "Rivers" menu, the user can check the "River Gages" box to display the location of supported river gages on the map display. The gage locations appear as squares and circles on the map display. Clicking on a circle will cause the "River Gage" browser to appear. The "River Gage" browser provides information on the last recorded water level at the gage, and will also display forecasted water levels when available. Other reference information is available, including the flood stages that have been established for the gage, the highest historical crests that have been recorded, a description of impacts that occur when the water level reaches certain heights, and a static map of the Federal Emergency Management (FEMA) Special Flood Hazard Area (SFHA) (if available). Not all of this information is available for every gage. The National Oceanic and Atmospheric Administration's (NOAA) Advanced Hydrologic Prediction Service (AHPS) is the source of the river gage data.

#### 7.7.4 Tide Gages

By checking the box next to "Tide Gages" on the "Current" tab menu, the location of supported NOAA National Ocean Service (NOS) tide gages will be plotted on the map display. The gage locations appear as white circles on the map display.

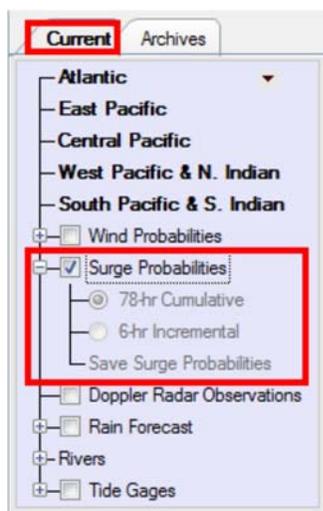


## 7.0 HURREVAC/Decision Tools

Clicking a circle will cause the “Tide Gage” browser to appear. The “Tide Gage” browser provides information on the last recorded water level at the gage, and will also display predicted water levels. The “Tide Gage” browser also includes output data from the SLOSH model, which is the model used by the National Hurricane Center to predict storm surge impacts from tropical systems. When a storm is approaching, the "Operational" option in the “Tide Gage” browser will list the probabilistic storm surge elevation that has only a 10% chance of being exceeded. That elevation will be plotted on top of predicted tides to show how the storm tide level will be impacted by the timing of the storm. When the "Planning" option is selected, the user can browse through the results of planning level storm simulations conducted to determine the highest calculated surge heights that are possible at that location. The results are broken into storms with certain forward speed and angle of approach characteristics (Maximum Envelope of Water or MEOW), and the highest calculated surge heights for a given Category regardless of forward speed and angle of approach (Maximum of MEOWs or MOM).

### 7.7.5 Probabilistic Storm Surge Data

“Surge Probabilities” is a forecast information layer included in HURREVAC for coastal areas from Texas to Maine that could experience storm surge-associated flooding from an approaching tropical system within the next 78 hours. The source of this data is the National Hurricane Center’s Probabilistic Surge product, known as “P-Surge”. P-Surge is created using



SLOSH, the storm surge model that the National Hurricane Center uses to forecast storm surge from hurricanes. P-Surge takes the official hurricane forecast from the National Hurricane Center for the approaching storm and uses error statistics from past hurricane forecasts to simulate potential storm surge from many statistically possible track, size, forward speed, and intensity scenarios that could still occur. The resulting information is provided in HURREVAC in both graphical and report format. The timeframe for the data is 78 hours, although the SLOSH model runs are not typically begun until a storm is within 48 hours of landfall and watches/warnings are issued. Therefore the P-Surge data is not available until a watch or warning is in place, 48 hours from the potential impact of the storm.

Inundation risk is reported as water depths above ground level with a 1 in 10 chance of being exceeded, which provides a conservative view of the surge impact from the approaching storm that could be possible for a given location. The data already accounts for the impacts of tide on the reported water level above ground.



## 7.0 HURREVAC/Decision Tools

To turn on the graphic, check the box next to "Surge Probabilities" on the "Current" tab. Then choose to view either the "78-hr Cumulative" graphic or the "6-hr Incremental" graphic. The "78-hr Cumulative" graphic will report the highest water depth above ground that has a 1 in 10 chance of being exceeded over the next 78 hours. The "6-hr Incremental" graphic reports the highest depth above ground that has a 1 in 10 chance of being exceeded during each 6 hour increment of the 78-hour forecast period. To cycle through the 6 hour increments, use the "Storm Surge Tools" that can be found on the program header. The legend at the bottom of the map display window will provide information on the how the color scale relates to water depth, and also provides the time period that the data being viewed is valid.

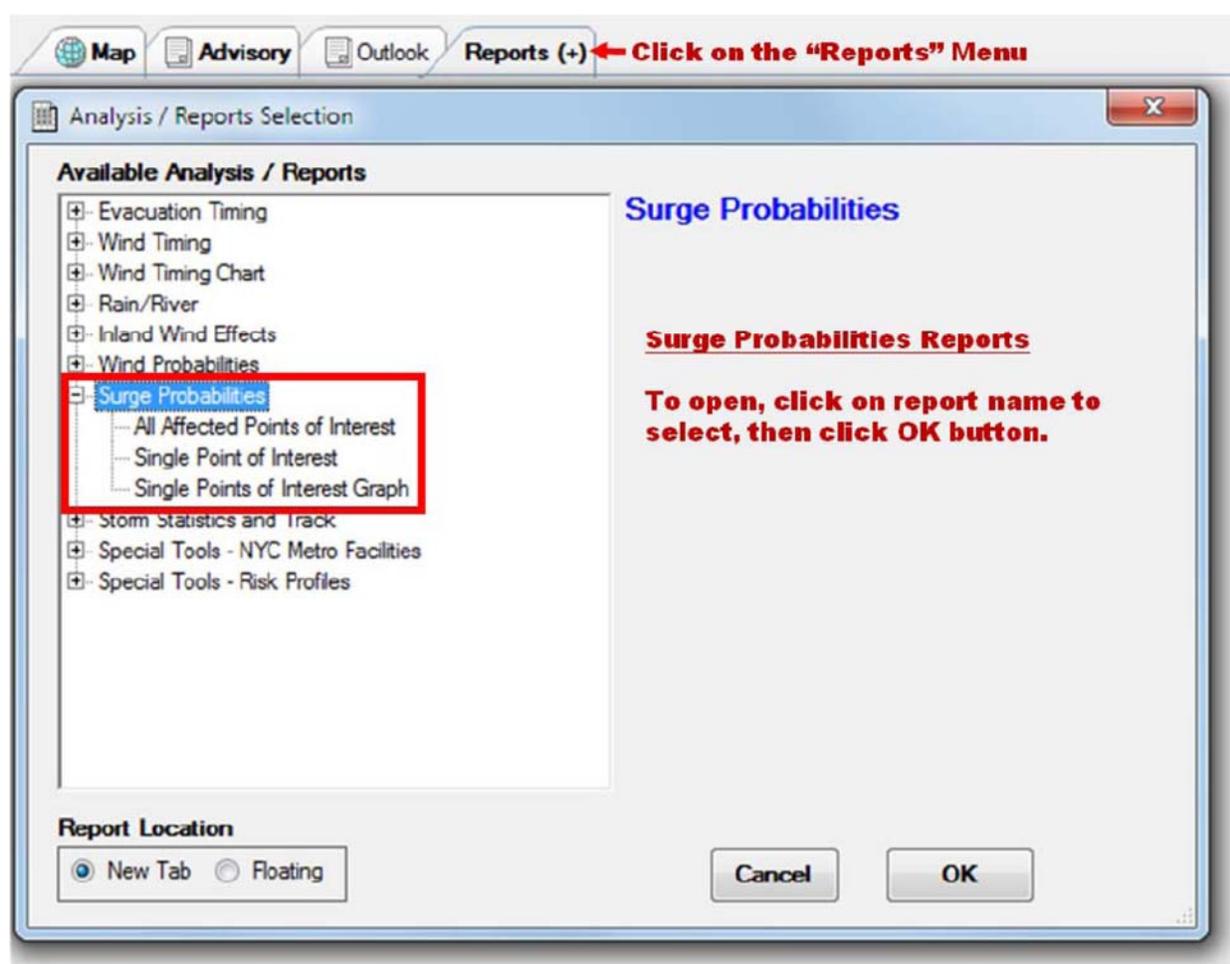


Figure 7-10: Surge Probabilities Report

When the graphic is turned on, the data can also be viewed in report format. Figure 7-10 above displays the window in which the surge probabilities reports can be selected. To view this data in report format, the user must either establish a specific "point of interest", or simply right click on the map display at the desired location and choose "Surge Probabilities This Location"



## 7.0 HURREVAC/Decision Tools

from the menu. Once a point of interest has been established, the surge probability report can be accessed from the reports menu. Expand "Surge Probabilities" and then choose "Single Point of Interest". For each 6 hour portion of the 78 hour forecast period, the report will provide the water depth above ground that has a 1 in 10 chance of being exceeded for both that specific 6 hour time block, as well as water depth above ground that has a 1 in 10 chance of being exceeded for the cumulative time from the beginning of the forecast period to the end of that specific 6 hour increment.

### 7.8 Browsers/Utilities

#### 7.8.1 Evacuation Clearance Time Browser

By clicking on "Evacuation Clearance Times" under the "BROWSERS" menu option in the toolbox, the user can display all of the evacuation clearance times that were calculated for a given county as part of the Hurricane Evacuation Study for each state. Choose a State and then a community, and a report tab will populate with all times that were calculated for all evacuation scenarios. The year of the Hurricane Evacuation Study that produced these times is listed at the top of the report. Note that an evacuation clearance time is the total time it will take to complete the evacuation, from the time the first vehicle leaves until the last vehicle reaches the evacuation endpoint. It is not the time that it will take each individual vehicle to evacuate.

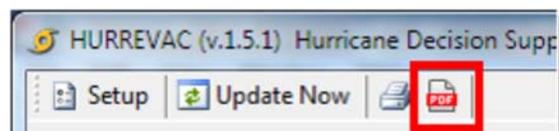


#### 7.8.2 Export to GIS

By expanding the "Export/Import" option on the "UTILITIES" menu option in the toolbox, the user can access the "Export to GIS" feature. This allows the user to export any graphics that are currently shown on the map display to a GIS shapefile. The GIS shapefile can be saved at any location specified by the user. The shapefile can then be brought into local GIS software. Note that the GIS user will need to have an understanding of how to symbolize data in GIS software if the user would like the graphics to appear in the same color scheme as they do in HURREVAC.

#### 7.8.3 Storm Summary PDF

By clicking on the "Storm Summary PDF" button on the program header, the user can create a PDF document that contains a summary of information based on the selected advisory. The PDF file can be saved locally and distributed to others via email or other means. The PDF file contains information about the current position, intensity, and forward speed of the storm, and a map showing exactly what is shown in the map display window when the PDF is created. There is an option of including wind forecast and evacuation





## 7.0 HURREVAC/Decision Tools

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timing data for a selected location, and/or the actual advisory text issued by the National Hurricane Center. Because the map shown on the PDF comes from what is shown in the map display window, the user should set their preferred view and graphics on their map display window prior to creating the “Storm Summary PDF”.

### 7.9 Accessing and Interpreting Important Decision Making Functions

Examples of important functions and features in HURREVAC are provided below as a guide for users and concentrate on hazard identification and evacuation decision-making during real hurricane events. The operations described below are based on Hurricane Earl 2010, Advisory 34 (Thursday, September 2nd at 5 PM). Please note that times shown are in Eastern Daylight Time (EDT).

#### 7.9.1 Determining the Relative Risk of Experiencing Landfall in a Community over the 120 Hour Forecast Period

One of the most important features in HURREVAC is the representation of the Average Forecast Error over the 120-hour forecast period for each advisory. HURREVAC graphically displays this uncertainty in the forecast track as a slightly transparent white cone superimposed on the forecast track for any given advisory.

The average forecast error cone displays the likely across-track error of where the eye could potentially be located along the 120 hour forecast track. However, there is also an along-track error that also may result in the tropical storm force winds (when an evacuation should theoretically be halted) arriving earlier or later than the timeframes in the forecast. HURREVAC displays both components of the forecast uncertainty on the map and factors both types of error in a report.

In Figure 7-11 below the average forecast error cone is depicted on the map as the light swath bisecting the image from lower left to upper right. The forecast track is shown as dots, each representing a forecast hourly position in the center of the average forecast error swath. In this image, the closest point of approach for the Earl’s eye is forecast to be approximately 40 miles southeast of Harwich at 1 AM of September 4<sup>th</sup>, 32 hours into the advisory (#34). Nonetheless, based on the western edge of the average forecast error cone, the eye during that timeframe could be located anywhere between Mattapoisett and Manomet. The radius of maximum winds (the hurricane force wind field) could extend 40 miles further westward from there.



## 7.0 HURREVAC/Decision Tools

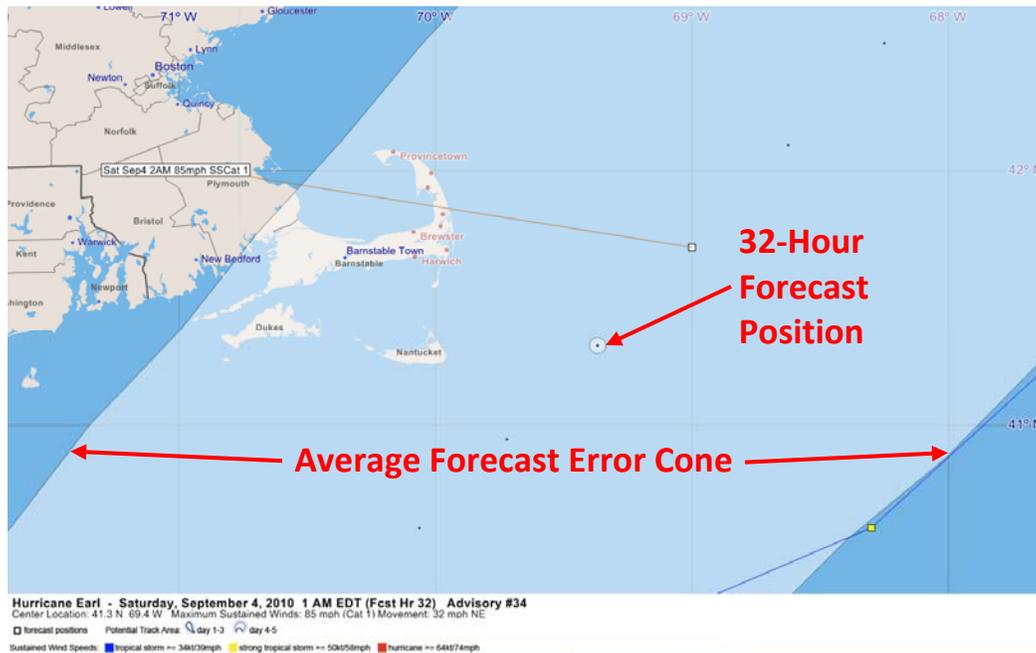


Figure 7-11: Average Forecast Error Cone Map Graphic

Figure 7-12 depicts both components of the average forecast error, the across-track, as well as the along-track. This image is depicting the total extent of where the eye could be located at the 32-hour forecast position. Any location within the white transparent ellipse has an equal chance of having the eye pass over it as the actual point representing the 32-hour position.



## 7.0 HURREVAC/Decision Tools

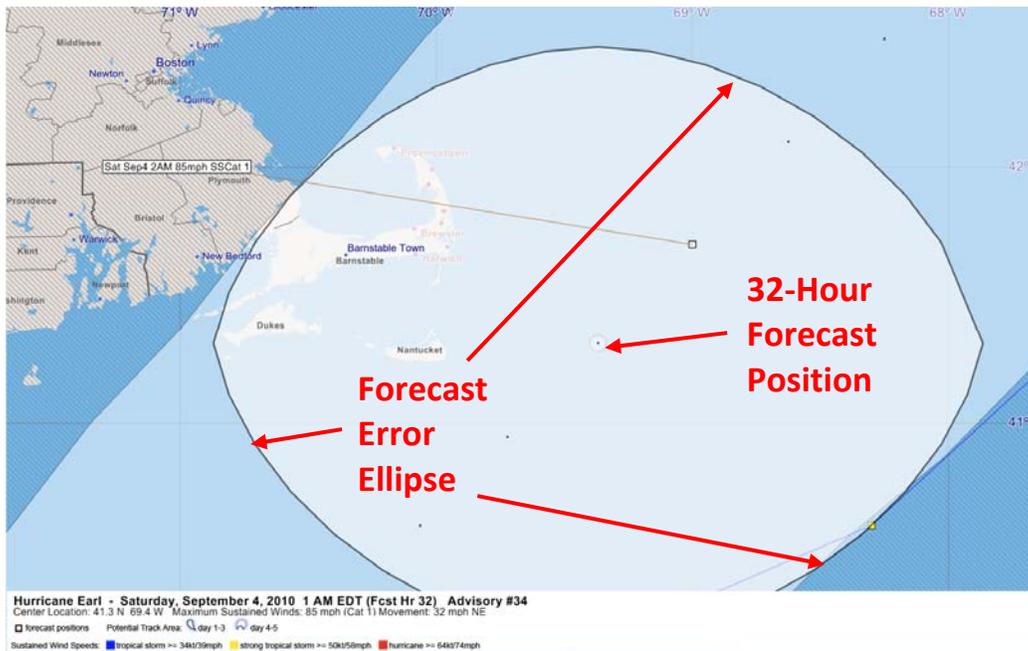


Figure 7-12: Average Forecast Error Ellipse Map Graphic

Finally, as stated previously HURREVAC will prepare a report that lists all of those communities situated in the average forecast error cone. The report also factors in along-track uncertainty by detailing the earliest and latest times that peak winds could affect the jurisdiction, which is shown in the red box here to the right.

Map Advisory Error Swath Reports (+)

**Report for Hurricane Earl**  
 Based on Advisory 34 Issued 9/2/2010 5 PM EDT (Old Advisory)  
 Error Swath Affected Areas ( 7 Items)

**Meaning Of Report**  
 The communities (in parentheses) that are within the official forecast error cone. These are the locations which are likely to be threatened by the storm.

**Cautionary Note:**  
 You should consider taking action if you are within the potential track area and your decision criteria is reached.

Location	Time Of Peak	May Be As Early As	OR As Late As	Winds Possible
MA Plymouth	Around 09/04 00E	09/03 21E	09/04 03E	Max Winds (near Eye)
MA Bristol	Around 09/04 00E	09/03 21E	09/04 03E	Max Winds (near Eye)
MA Dukes	Around 09/04 00E	09/03 21E	09/04 03E	Max Winds (near Eye)
MA Nantucket	Around 09/04 00E	09/03 21E	09/04 03E	Max Winds (near Eye)
MA Barnstable	Around 09/04 01E	09/03 22E	09/04 04E	Max Winds (near Eye)
ME Hancock	Around 09/04 07E	09/04 04E	09/04 10E	Max Winds (near Eye)
ME Washington	Around 09/04 08E	09/04 05E	09/04 11E	Max Winds (near Eye)



## 7.0 HURREVAC/Decision Tools

### 7.9.2 Determining Which Community Has the Highest Forecasted Peak Wind

Open the "Wind Timing All Affected Areas" report. Sort the report by Peak Wind (click on column heading or the "Strongest" sort button). The answer is Nantucket County, MA. Figure 7-13 below displays the report with the answer. At the bottom of the report form are sort buttons for Earliest (which community will receive winds first), Strongest (the choice made for this display), and Alphabetical.

Map Advisory **Wind Timing All** Reports (+)

**Report for Hurricane Earl**  
**Based on Advisory 34 Issued 9/2/2010 5 PM EDT (Old Advisory)**  
[Wind Timing All Affected Areas \(88 items\)](#)

**Meaning Of Report**  
 This list represents wind arrival and departure details for all locations that are currently forecast to have tropical storm or greater winds during the next 72 hours.

**Cautionary Note:**  
 This information is quite specific and is subject to large forecast errors. You should NOT use these wind forecasts until just before landfall and then only as a guide.

Location	34kt(39mph)	50kt(58mph)	64kt(74mph)	64ktEND(dur)	50ktEND(dur)	34ktEND(dur)	Peak Wind
MA Nantucket	09/03 17E	09/03 21E	09/03 22E	09/04 02E [04]	09/04 03E [06]	09/04 05E [12]	70kt (81mph) 09/03 23E
NC Dare	09/02 18E	09/02 23E	09/03 03E	09/03 06E [03]	09/03 08E [09]	09/03 11E [17]	69kt (79mph) 09/03 04E
MA Barnstable	09/03 17E	09/03 22E	09/04 00E	09/04 02E [02]	09/04 04E [06]	09/04 05E [12]	65kt (75mph) 09/04 00E
MA Dukes	09/03 17E	09/03 21E			09/04 02E [05]	09/04 04E [11]	62kt (71mph) 09/03 23E
NC Hyde	09/02 18E	09/03 00E			09/03 07E [07]	09/03 10E [16]	62kt (71mph) 09/03 03E

Figure 7-13: Wind Timing All Affected Areas Table

### 7.9.3 Determining the Projected Wind Speed Forecast for Nantucket, MA at Each Hour in the Forecast Period

Open the "Wind Timing Single Area" report for Nantucket, MA. The "Date/Time" and "Wind Speed" columns provide the wind speed that is projected for each hour in the forecast period. In Figure 7-14, the red box provides the date, time and peak wind speeds at each hour of the forecast. This data is only as accurate as the forecast from the NHC.



## 7.0 HURREVAC/Decision Tools

Map Advisory Wind Timing All **Wind Timing (Nantucket, MA)** Reports (+)

**Report for Hurricane Earl**  
**Based on Advisory 34 Issued 9/2/2010 5 PM EDT (Old Advisory)**  
**Wind Forecast Details - Single County/Parish (MA Nantucket)**

Date/Time (hr)	Wind Speed	From Direction	34kt distance	50kt distance	64kt distance	Eye distance	Hour
09/03/10 15EDT	less than 34kt	(110)	45 miles	132 miles	176 miles	242 miles	22
09/03/10 16EDT	less than 34kt	(110)	21 miles	109 miles	152 miles	217 miles	23
09/03/10 17EDT	36kt ( 41mph)	(110)	0 miles	84 miles	125 miles	190 miles	24
09/03/10 18EDT	41kt ( 47mph)	(110)	0 miles	60 miles	101 miles	166 miles	25
09/03/10 19EDT	45kt ( 51mph)	(100)	0 miles	35 miles	77 miles	142 miles	26
09/03/10 20EDT	49kt ( 56mph)	(100)	0 miles	9 miles	52 miles	116 miles	27
09/03/10 21EDT	55kt ( 63mph)	(090)	0 miles	0 miles	28 miles	91 miles	28
09/03/10 22EDT	62kt ( 71mph)	(080)	0 miles	0 miles	5 miles	66 miles	29
09/03/10 23EDT	67kt ( 77mph)	(050)	0 miles	0 miles	0 miles	41 miles	30
09/04/10 00EDT	68kt ( 78mph)	(010)	0 miles	0 miles	0 miles	25 miles	31
09/04/10 01EDT	67kt ( 77mph)	(340)	0 miles	0 miles	0 miles	32 miles	32
09/04/10 02EDT	59kt ( 67mph)	(320)	0 miles	0 miles	14 miles	58 miles	33
09/04/10 03EDT	47kt ( 54mph)	(310)	0 miles	12 miles	49 miles	89 miles	34
09/04/10 04EDT	37kt ( 42mph)	(310)	0 miles	48 miles	86 miles	122 miles	35
09/04/10 05EDT	less than 34kt	(300)	23 miles	84 miles	123 miles	155 miles	36

Figure 7-14: Wind Timing Single Area Table

Notice that in this table (blue rectangle), the forecast arrival time of tropical storm winds is forecast for 5 PM on September 3, 2010, or 24 hours into the forecast period. Based on this forecast, evacuations would need to be completed no later than this time.

### 7.9.4 Determining the Evacuation Start Time for Wareham, MA, Based on a Cat 2 Direct Hit Scenario

Open the “Evacuation Timing Single Area Scenario” report for Plymouth County, Wareham Scenario, MA. Find the “EVAC START TIME” in the “Possible Action” column. Figure 7-15 below shows the report table that appears.

A Direct Hit scenario indicates that HURREVAC has shifted the advisory forecast track on a direct path to Fall River. This Direct Hit scenario is appropriate given that Wareham is within the average forecast error cone at this advisory. Despite the forecast track being moved, the forecast for the wind range sizes and the forward movement of the hurricane remain consistent with those figures provided in the NHC advisory.



## 7.0 HURREVAC/Decision Tools

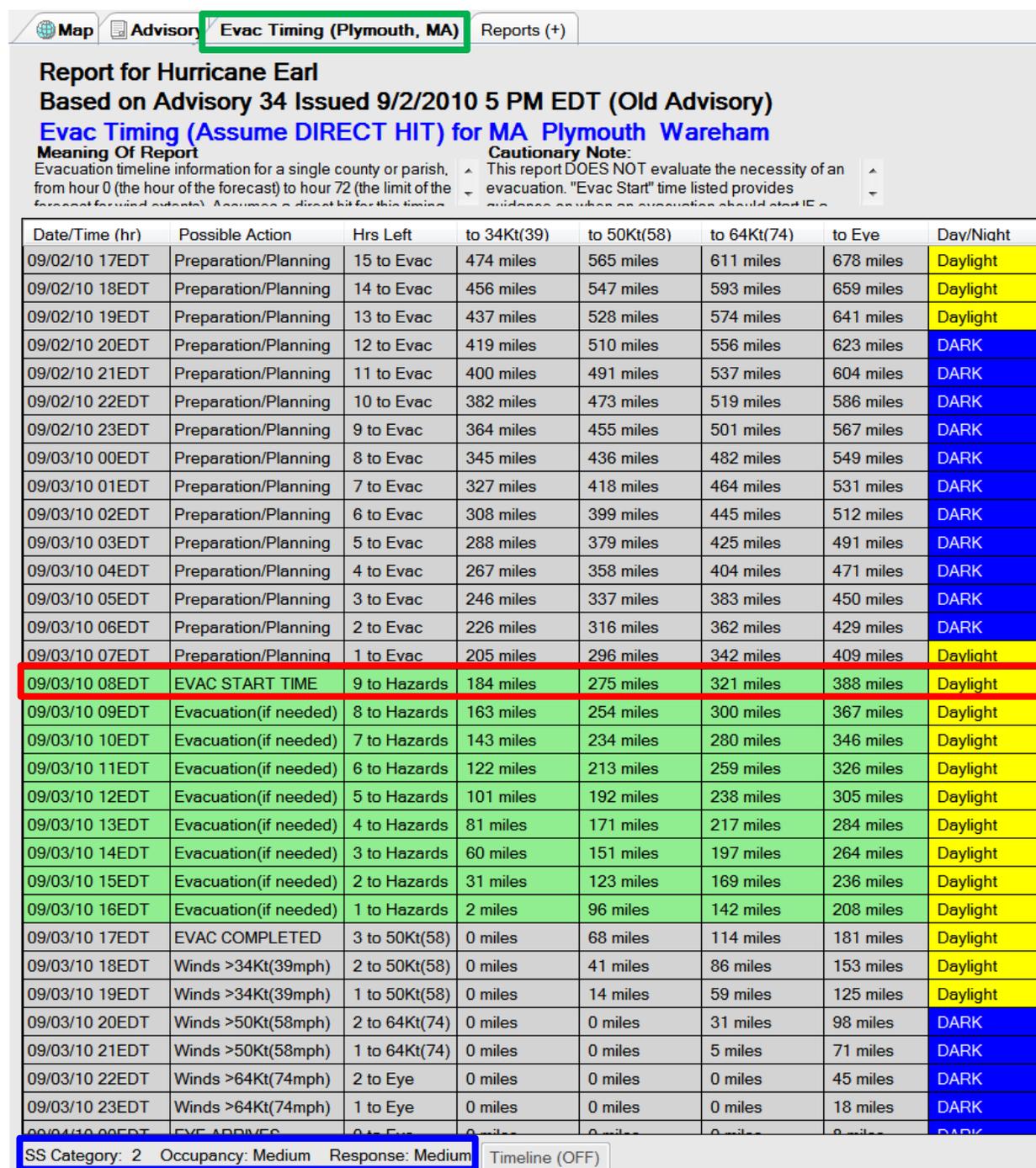


Figure 7-15: Evacuation Timing Results Table

The "Evac Start Time" is at 8 AM on September 3rd, or in 15 hours from the advisory issuance time of 5 PM, September 2nd. The scenario used to determine the clearance time is shown in the blue box at the bottom.



## 7.0 HURREVAC/Decision Tools

In order to change the scenario for the Evacuation Timing function, in the bottom right hand corner of the Evacuation Timing table above (of which only a portion is actually shown) are two additional buttons:

“Evac” and “Refresh”. Clicking on the Evac button will open a new window as shown here. Select the desired scenario by clicking inside the appropriate radio button. To change the scenario for only one community,

Location	Scenario	Cat	Occ.	Resp.	SB	Total Evac Hrs.
MA Plymouth	Plymouth	3	Medium	Medium	0	26.1
MA Plymouth	Rochester	3	Medium	Medium	0	9.7
MA Plymouth	Scituate	3	Medium	Medium	0	10.8
MA Plymouth	Wareham	3	Medium	Medium	0	11
MA Suffolk	Dorset	3	Medium	Medium	0	13.0
MA Suffolk	Chelsea	3	Medium	Medium	0	15.1
MA Suffolk	Revere	3	Medium	Medium	0	15.1
MA Suffolk	Winthrop	3	Medium	Medium	0	15.1

**Saffir-Simpson Category ( defaults to max NHC forecast for this advisory )**

SS Cat 1  
  SS Cat 2  
  SS Cat 3  
  SS Cat 4  
  SS Cat 5

**Tourist Occupancy**

Low  
  Medium  
  High  
  Worst/Extreme

**Response**

Immediate  
  Rapid  
  Medium  
  Slow

Optional Safety Buffer (SB) in hours

Hours  
  Use  
  Do Not Use

Evacuation Start Time ALERTS

On / Off  
   
 0 evacuation scenarios selected

Use Setup | Plugins to add or remove Options

Note: Forcing SS Cat to other values will be only temporary and will revert when advisory is changed

highlight the community by clicking on its name in the large window (blue rectangle), select “Apply To Selected” (red box) and then “OK”. Otherwise, to change the scenario for all listed communities, choose “Apply To All” (green box) and “OK”. When this window disappears, select the “Refresh” button and the new scenario will appear along the bottom of the Evacuation Timing table.

For state agencies and officials, evacuation timing details for multiple communities can

simultaneously be calculated and seen in a table. In this case, select “Local Area Scenarios” from the “Evacuation Timing” menu tree and click on “OK”. The resulting table (see Figure 7-16 below) lists all of the communities designated as local, as well as their evacuation decision times, clearance times, evacuation scenarios and other relevant information.

The screenshot shows a software window titled "Analysis / Reports Selection". On the left, there is a tree view under "Available Analysis / Reports". The "Evacuation Timing" folder is expanded, and "Local Area Scenarios" is selected. On the right, there is a text area with the following content:

**Evacuation Timing**  
**Local Area Scenarios**

**Meaning Of Report:**  
Evacuation timeline information for select counties or parishes with evacuation clearance times available. Assumes a direct hit for the purpose of calculating the start time for a potential evacuation.

**Cautionary Notes:**  
This report DOES NOT evaluate the necessity of an evacuation. "Evac Start" time listed provides guidance on when an evacuation should start if a decision to evacuate is made. Evacuation decisions are complex and should be made only after consultation with emergency management and NWS officials.

At the bottom, there are radio buttons for "Report Location": "New Tab" (selected) and "Floating". There are also "Cancel" and "OK" buttons.



## 7.0 HURREVAC/Decision Tools

Map Advisory **Evac Timing Local** Reports (+)

### Report for Hurricane Earl

Based on Advisory 34 Issued 9/2/2010 5 PM EDT (Old Advisory)

#### Evacuation Timing for Local Areas Only In Error Cone (51 Items)

**Meaning Of Report**  
Evacuation timeline information for select counties or parishes with evacuation clearance times available. Assumes a direct hit for the purpose of calculating the start

**Cautionary Note:**  
This report DOES NOT evaluate the necessity of an evacuation. "Evac Start" time listed provides guidance on when an evacuation should start if a

Location	Evac. Type	Evac Start	Dur.	Dark	Cat/Oc/Re	>34kt(39)	>64kt(74)	Eye	Nearest
MA Barnstable	Harwich	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Wellfleet	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Brewster	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Chatham	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Truro	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Eastham	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Provincetn	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Orleans	09/02 00E[Past]	40	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Plymouth	Marshfield	09/02 15E[Past]	26	11	3 / M / M	09/03 17E	09/03 22E	09/04 00E	69 mi.
MA Plymouth	Duxbury	09/02 15E[Past]	26	11	3 / M / M	09/03 17E	09/03 22E	09/04 00E	69 mi.
MA Plymouth	Plymouth	09/02 15E[Past]	26	11	3 / M / M	09/03 17E	09/03 22E	09/04 00E	69 mi.
MA Barnstable	Bourne	09/02 17E[Past]	23	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Sandwich	09/02 18E	22	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Dennis	09/02 18E	22	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Barnstable	09/02 18E	22	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Barnstable	Mashpee	09/02 18E	22	11	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Plymouth	Hull	09/02 18E	23	11	3 / M / M	09/03 17E	09/03 22E	09/04 00E	69 mi.
MA Nantucket	Nantucket	09/02 18E	22	11	3 / M / M	09/03 16E	09/03 21E	09/04 00E	23 mi.
MA Barnstable	Yarmouth	09/02 22E	18	9	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Plymouth	Kingston	09/02 23E	18	8	3 / M / M	09/03 17E	09/03 22E	09/04 00E	69 mi.
MA Barnstable	Falmouth	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 22E	09/04 00E	39 mi.
MA Dukes	Tisbury	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 21E	09/03 23E	51 mi.
MA Dukes	WstTisbury	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 21E	09/03 23E	51 mi.
MA Dukes	Aquinnah	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 21E	09/03 23E	51 mi.
MA Dukes	OakBluffs	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 21E	09/03 23E	51 mi.
MA Dukes	Chilmark	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 21E	09/03 23E	51 mi.
MA Dukes	Edgartown	09/03 01E	15	6	3 / M / M	09/03 16E	09/03 21E	09/03 23E	51 mi.
MA Plymouth	Hingham	09/03 02E	15	5	3 / M / M	09/03 17E	09/03 22E	09/04 00E	69 mi.
MA Bristol	Dartmouth	09/03 05E	11	2	3 / M / M	09/03 16E	09/03 21E	09/04 00E	74 mi.
MA Bristol	Westport	09/03 05E	11	2	3 / M / M	09/03 16E	09/03 21E	09/04 00E	74 mi.
MA Bristol	Fairhaven	09/03 05E	11	2	3 / M / M	09/03 16E	09/03 21E	09/04 00E	74 mi.

Figure 7-16: Evacuation Timing All Local Areas Results Table

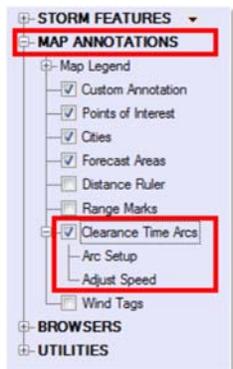


## 7.0 HURREVAC/Decision Tools

### 7.9.5 Determining the Evacuation Start Time for Newport, RI, Based on a Cat 1 Using the Clearance Time Arc Method

Another method for determining the start time for an evacuation based on clearance times is to use the Clearance Time Arc, which is a slightly different approach from the one discussed above (Direct Hit Scenario). The Clearance Time Arc operates from the assumption that, rather than the storm moving in a direct line to the community or point of interest, the hourly location of the tropical cyclone's eye remains consistent with the forecast track provided in the latest advisory. The hourly wind ranges also remain true to the NHC forecast, but the forward movement of the storm can also be varied.

The size of the Clearance Time Arc is determined by multiplying the clearance time by the forward speed of the storm which then provides the radius from the point of interest. The concept is that as the tropical cyclone is moved forward along the forecast track and the hour at which the tropical storm wind ellipse touches the decision arc is the latest start time for an evacuation. For example, a tropical cyclone moving at 10 miles an hour forward speed, and a community with a 10 hour clearance time would generate a clearance time arc with a radius of 100 miles. The outside edge of the tropical storm wind ellipse touching the 100 mile clearance time arc would determine the hour at which the evacuation should begin.



To access this function, expand the "Map Annotation" tree in the toolbox window of HURREVAC and check the "Clearance Time Arcs" box. Clicking on the "Arc Setup" will open the window that allows the user to choose the desired community and/or scenario for consideration. Up to 10 evacuation scenarios can be selected and displayed on the map simultaneously. In this example, when Rhode Island is highlighted in the left "Arc Setup" window, followed by the designation of the Newport scenario in the right window and then "Save" is selected, the map appears with an ellipse drawn around that community.

In Figure 7-17 below, the clear ellipse with the blue circumference represents the clearance time arc while the tropical storm wind range is shown as a blue filled ellipse (with yellow and red filled ellipses contained therein). Notice that the tropical storm wind range is touching the clearance time arc. In the data label located at the bottom of the map, the red boxes indicate the time as 11 AM on Sept 3 which corresponds to the 18 hour forecast position. Therefore, Newport has 18 hours from the 5 PM (Advisory 34) on September 2<sup>nd</sup> to complete preparations for a category 1 evacuation scenario. Also at the bottom of the data label are the assumptions that created the clearance time arc displayed on the map (i.e., 6 hour clearance time with an average forward speed of 18 miles per hour).



## 7.0 HURREVAC/Decision Tools

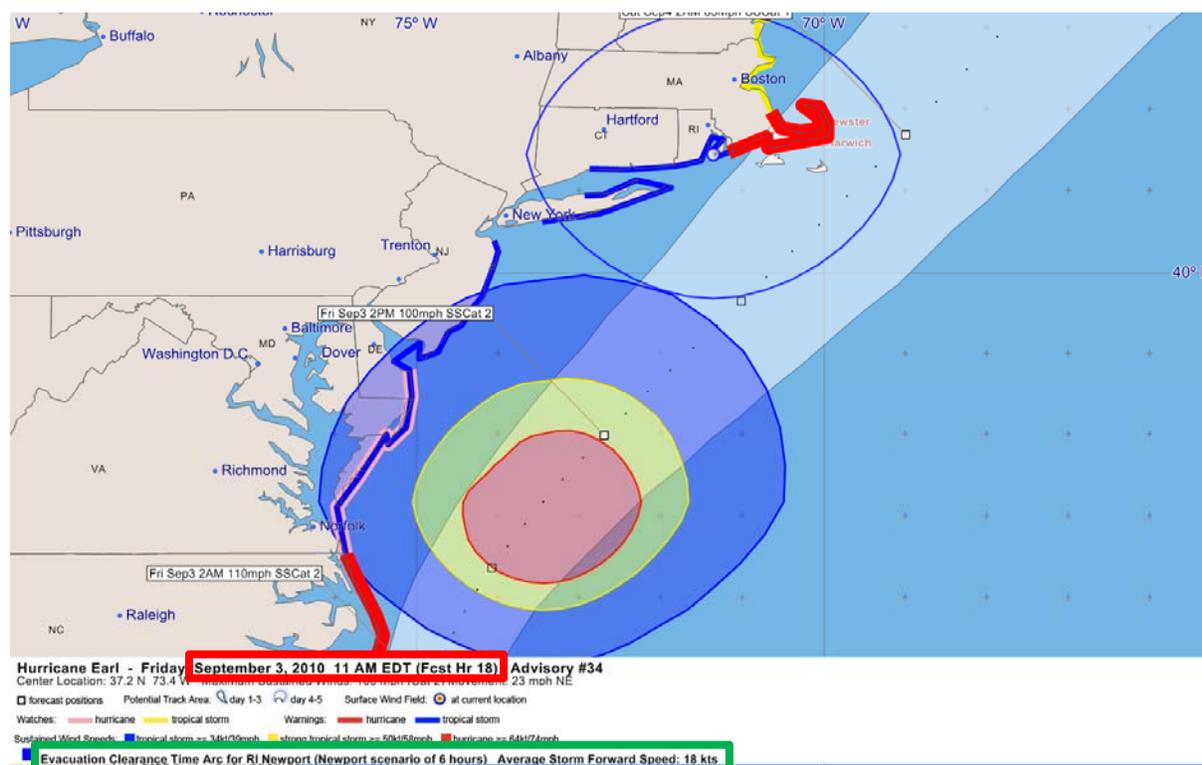


Figure 7-17: Decision Arc on HURREVAC Map

### 7.10 Other Features of HURREVAC

There are many other features and functions in HURREVAC that are not discussed in this chapter. This discussion has just touched on the major capabilities provided by the software and how the data can be used for evacuation decision making and tropical cyclone preparedness. Despite the emphasis in this chapter on operations during actual hurricane events, there are other planning tools that can be applied to effect better tropical cyclone preparedness and response plans.

To learn more on all of the features in HURREVAC, the [www.hurrevac.com](http://www.hurrevac.com) website is an excellent resource. The website has downloadable versions of the software user’s manual, tutorials and other documents to better acquaint the user to all of the capabilities provided by this program. Figure 7-18 below is the opening screen of the HURREVAC website (in 2015), with hyperlinks to many of the other resources and support documents.



## 7.0 HURREVAC/Decision Tools

**HURREVAC**  
A Storm Tracking and Decision Support Tool  
for Government Emergency Managers

[Register](#) [Download](#)

**Program Information**

- Key Features
- What's New for 2015
- HURREVAC History
- Latest Versions

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- Contact Us

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- User Guides & Tutorials
- Training Events
- Hurricane Exercises

**Outside Links**

- Agency Sponsors
- Hurricane Forecasting
- Evacuation Studies

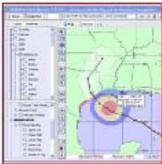
**HURRICANE MAPPING**  
SEA ISLAND SOFTWARE

Sea Island Software also produces [HurricaneMapping.com](http://HurricaneMapping.com), a site for ArcGIS and Google Earth users which is subscription- based and offers easy integration of hurricane data, in real-time, into your GIS system.

### Welcome

HURREVAC is the decision support tool of the National Hurricane Program, administered by FEMA, the USACE, and the NOAA National Hurricane Center.

This web site provides program access and technical support for eligible users in government emergency management. It is maintained by Sea Island Software, the contractor tasked with development, operation, and maintenance of the HURREVAC program.



### Getting Started With HURREVAC

Need more information or training on HURREVAC? Start with a [program overview](#) or [training videos](#). If you don't yet have the software, please visit the [registration page](#) to apply for program access.



[Users Manual](#)



[Reference Guide](#)

(Alternate versions for [Northeast states](#) and for [Hawaii](#))

**» Announcements**

Recordings of [2015 training videos](#) are now available.

October 30th - A final update for the 2015 season (HURREVAC Version 1.5.3) has just been released.



Click this button inside of Hurrevac to download the latest version.

[Click here to read about what's new for 2015, including the changes in Version 1.5.3](#)

**» Troubleshooting**

Having trouble downloading the latest forecast information in HURREVAC? See [Tech Note 5](#) for help.

Figure 7-18: HURREVAC Website Main Page



## 7.0 HURREVAC/Decision Tools

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### 7.11 Obtaining HURREVAC

The process of downloading HURREVAC program can be started from the [www.hurrevac.com](http://www.hurrevac.com) website. This program is a free U.S. Government program produced by FEMA and the USACE for the emergency management community, and is not for public distribution, or use.

Consequently each user must register and is subject to a vetting process to ascertain whether they should have access to the

program. The image to the right is the opening page of the [www.hurrevac.com](http://www.hurrevac.com) website with the registration button shown.



In order to qualify for HURREVAC, you must be an active member of the government emergency management community--meaning that you are directly involved in hurricane evacuation decision-making for the residents in your state or community when a hurricane threatens. Examples of eligible users are hurricane evacuation decision-makers in FEMA, Corps of Engineers, National Weather Service, State Emergency Management Agencies, and community Emergency Management Agency offices.

State and county agencies other than the State Emergency Management Agency and County/Local Emergency Management Agency offices will need confirmation from those EM offices that you indeed do help those offices in hurricane evacuation decision-making and need the program for that purpose. Without such approval and confirmation, registration will be refused. Once the registration process is successfully completed, the applicant will receive an e-mail with download instructions and other guidance for installing the program.

Maintenance and support for this program is through the Internet. All software and data updates, of which there are at least one per hurricane season, are accomplished via e-mails from Sea Island Software. For this reason, registration is particularly important, since that is the only means by which the user will be notified of modifications and improvements to the program and its associated data.