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## SEPTA

dvrpc

# SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY RESILIENCY PROGRAM

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OCTOBER 23, 2017

# EXTREME WEATHER IN PHILADELPHIA

# EXTREME FLOODING

- 21 SCHUYLKILL RIVER FLOODS @ NORRISTOWN IN RECORDED HISTORY
- 13 (62%) OF THE FLOODS HAVE OCCURRED SINCE 2003

SPRING MILL STATION
MAY 1, 2014
(UNNAMED EVENT)

| RANK | CREST | DATE |
|---|---|---|
| 1 | 25.10 ft | 6/23/72 |
| 2 | 22.00 ft | 9/17/99 |
| 3 | 21.00 ft | 8/24/33 |
| **4** | **20.83 ft** | **5/1/14** |
| 5 | 19.76 ft | 8/28/11 |
| 6 | 19.30 ft | 9/13/71 |
| 7 | 19.13 ft | 6/28/06 |
| 8 | 19.00 ft | 1/20/96 |
| 9 | 18.40 ft | 8/19/55 |
| 10 | 18.30 ft | 10/1/10 |
| 11 | 18.00 ft | 10/19/91 |
| 12 | 17.92 ft | 10/9/05 |
| 13 | 19.60 ft | 12/5/93 |
| 14 | 16.28 ft | 6/21/03 |
| 15 | 16.06 ft | 9/7/11 |
| 16 | 16.06 ft | 4/3/05 |
| 17 | 16.00 ft | 9/18/04 |
| 18 | 15.37 ft | 9/29/04 |
| 19 | 14.35 ft | 3/11/11 |
| 20 | 14.15 ft | 11/23/11 |
| 21 | 13.55 ft | 12/08/11 |

# CONTEXT FOR RESILIENCY PLANNING

- IS THIS GOING TO HAPPEN MORE OFTEN IN THE FUTURE?
- IF SO, WHAT DO WE DO ABOUT IT?


# KEY CLIMATE-RELATED VULNERABILITIES

## GROUPED BY SEPTA FUNCTIONAL AREAS

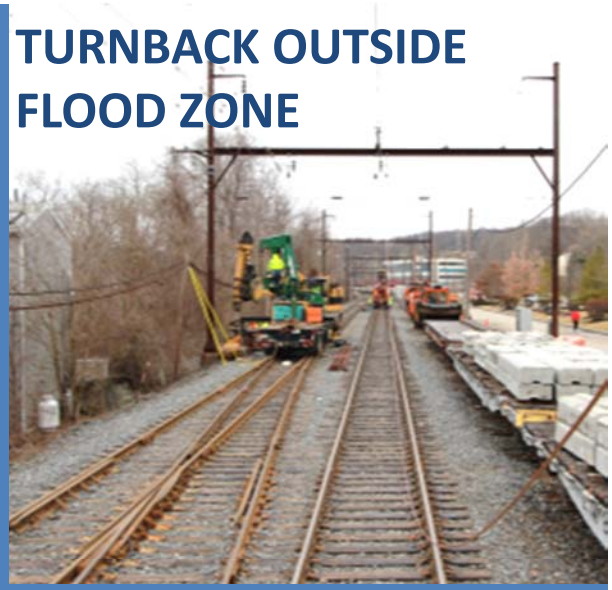
| CLIMATE VARIABLE | HEAT | HEAVY RAIN | SNOW | TROPICAL STORM |
|---|---|---|---|---|
| **POWER** | • Power Outages<br>• Sagging Wires | • Catenary Damage<br>• Labor Demands | • Power Outage<br>• Wire Failures | • Power Outage<br>• Catenary Damage<br>• Labor Demands |
| **BUILDINGS & BRIDGES** | • HVAC Equipment | • Flooding Damage<br>• Pumping Demand | • Slip & Falls<br>• Budget Demand<br>• Loss of Parking | • Flooding Damage<br>• Pumping Demand<br>• Roof Damage |
| **TRACK & CIVIL ENGINEERING** | • Track Buckling<br>• Labor Demands for Inspection | • Culvert Damage<br>• Washouts<br>• Speed Restriction | • Downed Trees<br>• Labor Demands<br>• Broken Track | • Flooding Damage<br>• Washouts<br>• Debris<br>• Gate Damage |
| **SIGNALS & COMMUNICATIONS** | • Speed Restriction<br>• Failing Switches | • Signal Damage | • Signal Failure & Power Outage | • Signal Damage |
| **POLICY & ADMINISTRATION** | • Labor Conditions<br>• Service Disruption | • Service Disruption | • Service Disruption<br>• Slippery Platforms | • Extensive Service Disruption<br>• Labor Demands |

# RESILIENCY STRATEGIES UNDERWAY: CAPITAL

**SLOPE STABILIZATION**

**RAISED SIGNAL HUTS**

**TURNBACK OUTSIDE FLOOD ZONE**



**EMERGENCY GENERATORS**

# Regional Power Outage Emergency Response Plan

Task List - Operations Division

| Line | Task |
|---|---|
| BSS: | • Locate all of the trains in the BSS tunnel.<br>• Communicate with Train Engineers about water levels in the tunnels.<br>• Once all of the trains in the tunnel are located, start evacuating trains.<br>• After a train is evacuated, the Train Engineer shall verify that the train is secure before leaving the train.<br>• After all train evacuations are complete and the passengers are out of the BSS Tunnels, direct the SEPTA Transit Police to specific stations to lock them up for property protection. |
| MFSE: | • Locate all of the trains in the MFSE tunnel as well the elevated track.<br>• Communicate with Train Engineers about water levels in the tunnels.<br>• Once all of the trains are located, start evacuating trains. The evacuation of trains in the tunnel takes priority over trains on the elevated portions of the track.<br>• After a train is evacuated, the Train Engineer needs to verify that the train is secure before leaving the train.<br>• After all train evacuations are complete and the passengers are out of the MFSE Tunnels, direct the SEPTA Transit Police to specific stations to lock them up for property protection. |
| NHSL & Trolley Routes 101/102: | • Locate all of the trains on each line.<br>• Once trains are located, start communicating with train engineers regarding the evacuation of the trains.<br>• Commence evacuating trains on the NHSL & Trolley Routes 101/102.<br>• After a train is evacuated, the Train Engineer must verify that the train is secure before leaving the train.<br>• After all train evacuations are complete, send Revenue Services out to the stranded trains on the Trolley Routes 101/102.<br>• Send Revenue Services out to the stranded trains on the NHSL, with the understanding that the terrain in the area may provide prevent Revenue Services from getting the cash boxes off the trains. |
| Trolleys: | • Locate all of the trains in the tunnels as well as street level.<br>• Once all of the trains are located, start communicating with Train Engineers on evacuation of the trains.<br>• The evacuation of trolleys in the tunnel has priority over the evacuation of other trains.<br>• After a train is evacuated, then the Train Engineer needs to verify that the train is secure before leaving the train.<br>• After all of the trolley cars are evacuated on street level track, communicate with Revenue Services on which trolleys to retrieve the cash boxes from. |
| Buses & Trackless Trolleys: | • Locate all of the buses and trackless trolleys.<br>• Trackless trolleys can travel 60-75 miles on their backup Emergency Power Units, and should finish the current route that they are on and then return to their normal depot.<br>• Send all available buses along RRD lines, NSHL, Trolley Routes 101/102, the BSS and the MFSE to help with moving evacuated passengers to places of refuge. |
| RRD: | • Locate all of the trains in the tunnel as well as the rest of the system.<br>• Communicate with Train Engineers about water levels in the tunnel.<br>• Once all of the trains are located then start evacuating trains.<br>• Trains in the tunnel have priority over the other trains on the system.<br>• Prep the six diesel engines for mobilization to recover stranded trains on the RRD. Make sure that each diesel engine is equipped with couplers and/or tow bars.<br>• After a train is evacuated, the Train Engineer shall verify that the train is secure before leaving the train.<br>• Follow the running orders and rescue trains off of the RRD to the various yards along the RRD System.<br>• After all train evacuations are complete and the passengers are out of the RRD Tunnels, direct the SEPTA Transit Police to specific stations to lock them up for property protection. |

# RESILIENCY STRATEGIES UNDERWAY: CAPITAL: THE SIMPLE THINGS

RAISED CURBS AT VENTS

STEEL PLATE REINFORCEMENT

# RESILIENCY STRATEGIES UNDERWAY: CAPITAL: REMOTE MONITORING

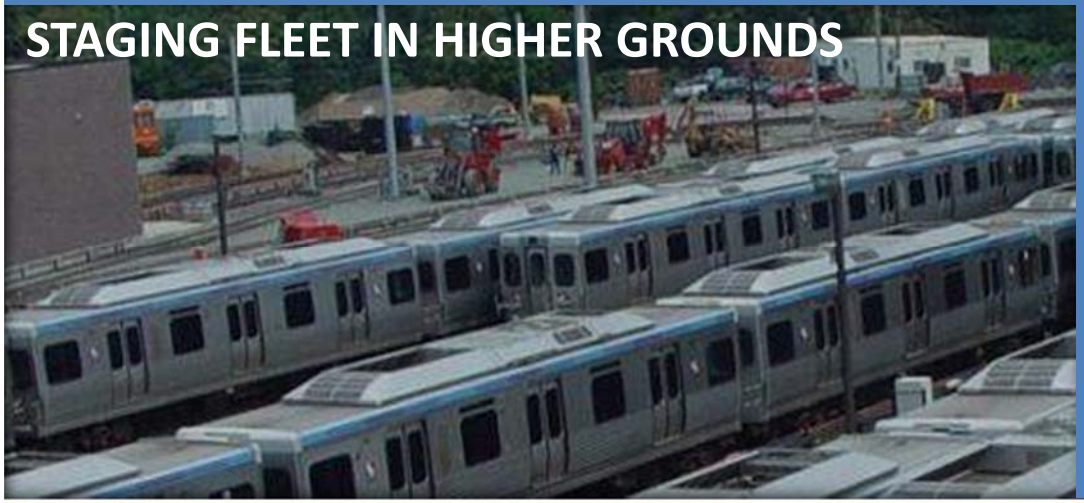
**SHARON HILL EARLY FLOOD WARNING SYSTEM**

# RESILIENCY STRATEGIES UNDERWAY: OPERATING & MAINTENANCE

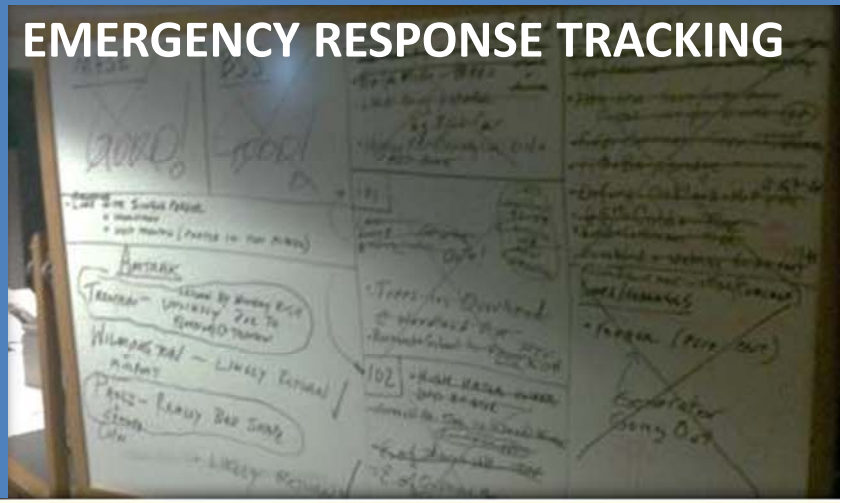
**DILIGENT TREE-TRIMMING**

**SANDBAGGING VENTWELLS**

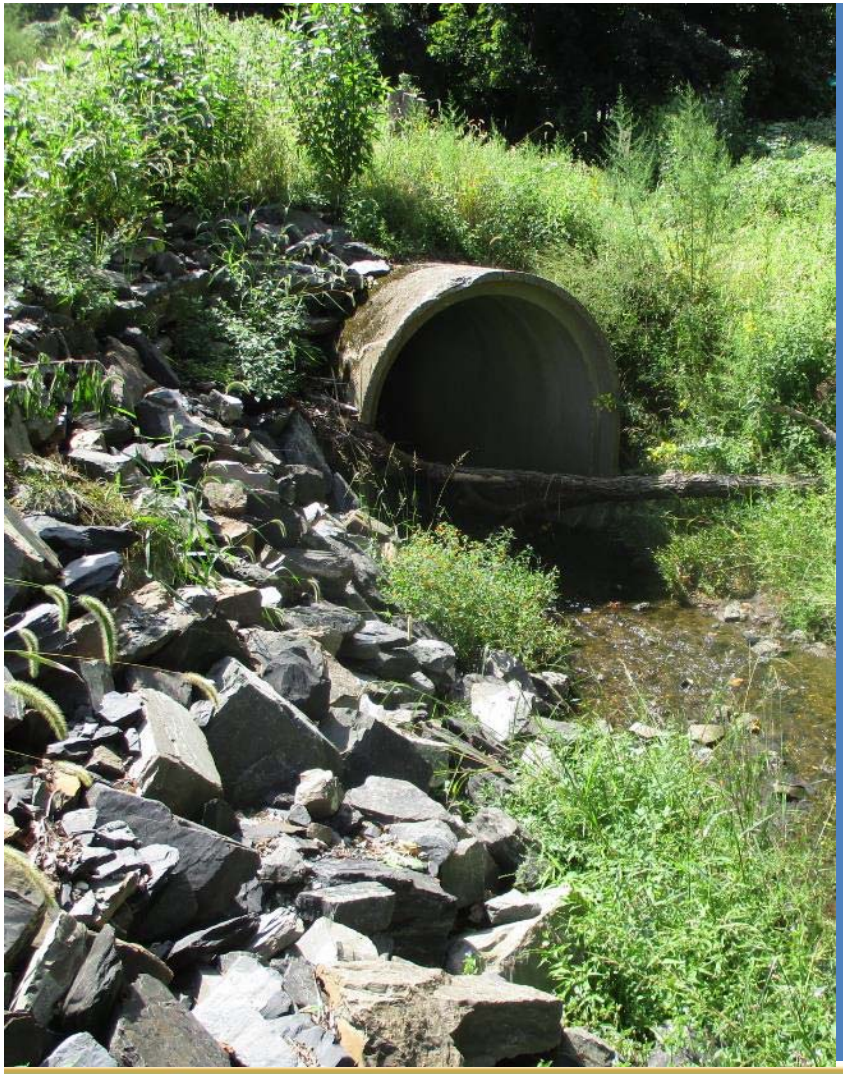
**STAGING FLEET IN HIGHER GROUNDS**



**EMERGENCY RESPONSE TRACKING**



# RESILIENCY STRATEGIES UNDERWAY: OPERATING & MAINTENANCE



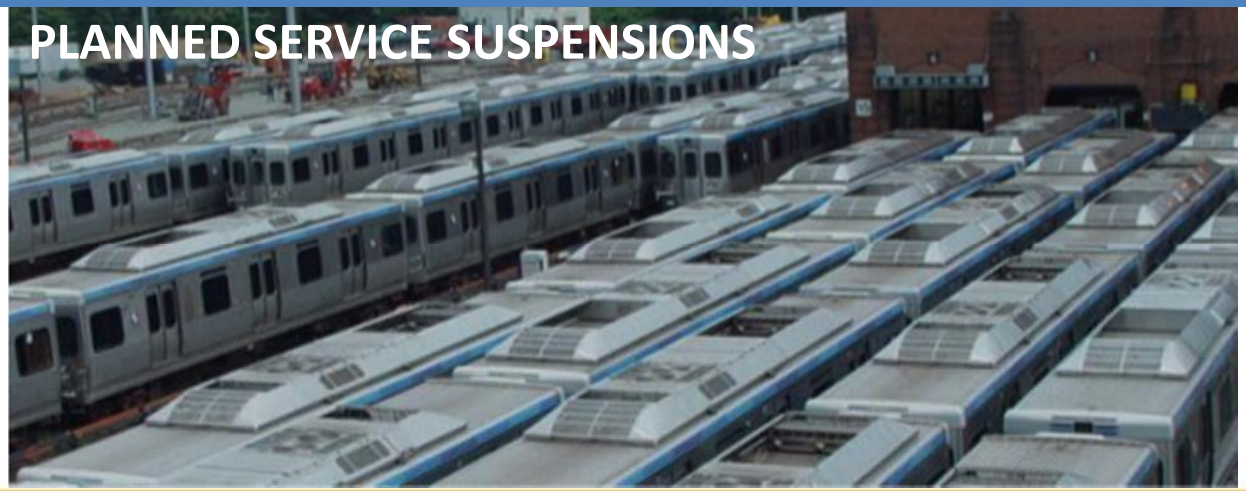
**PRE-STORM BRIDGE AND CULVERT INSPECTIONS**

# RESILIENCY STRATEGIES UNDERWAY: ADMINISTRATIVE

## CORE FIRST, RESTORE OUTWARD

## CUSTOMER COMMUNICATIONS

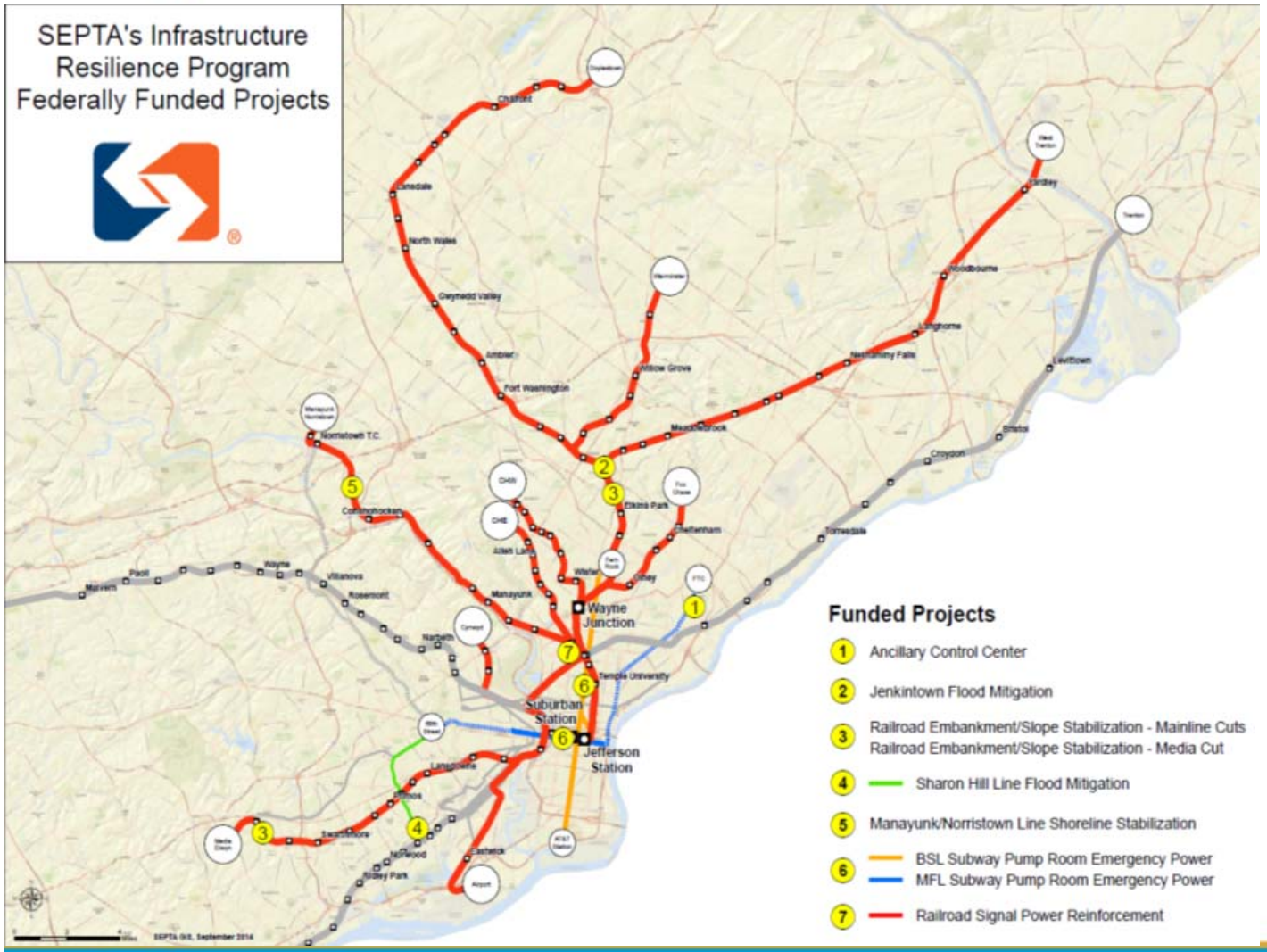

## PLANNED SERVICE SUSPENSIONS



# DISASTER RELIEF APPROPRIATIONS ACT 2013

- **Hurricane Sandy Relief Fund**
- **SEPTA selected to receive $86,758,000**
  - **Railroad Signal Power Reinforcement**
  - **Ancillary Control Center**
  - **Railroad Embankment Slope Stabilization**
  - **Subway Pump Room Emergency Power**
  - **Sharon Hill Line (MSHL) Flood Mitigation**
  - **Manayunk/Norristown Shoreline Stabilization**
  - **Jenkintown Area Flood Mitigation**

# DISASTER RELIEF APPROPRIATIONS ACT 2013




**7 PROJECTS,**
**$115.7M**
**$87M (75%) GRANT**
**SYSTEM-WIDE IN SCOPE**

# DISASTER RELIEF APPROPRIATIONS ACT 2013



# RESILIENCY PRIORITIES

NOT JUST SGR – LONG-TERM RESILIENCY IS KEY

- High-Priority Projects:
  - Back Up Power
  - Relocated Railcar Storage
  - Drainage Improvements
  - Slope/Embankment Stabilization
- Immediate Benefits to Operational Reliability

# QUESTIONS?

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