x	Capital
	O&M

2015 – Tunnel Maintenance Business – Gas Operations

Project/Program Title	**Hudson Avenue Head Houses Facility Storm Hardening**
Project Manager	Glen Katz
Project Engineer	Jed Khandji
Project Number	1118-01
Status of Project	Engineering
Estimated Start Date	January 2015
Estimated Completion Date	**December 2015**
Work Plan Category	Safety & System and Component Upgrade

Work Description:

Con Edison Facilities such as the Hudson Avenue Tunnel which crosses the East River with utilities between Hudson Avenue Brooklyn and Jackson Street Manhattan Head Houses was inundated with severe flood waters from East River due to Super Storm Sandy in 2012. In the wake of Super Storm Sandy and to avoid citywide damage and significant disruption to tunnel utility services that could lead to power outages, steam and gas interruption, from future storm occurrences, the Hudson Avenue Tunnel Head Houses in Brooklyn and Manhattan will require significant storm hardening of structural walls, utilities boxes, oil water separator equipment, building roof and equipment hardening. Con Edison Tunnel Maintenance Group put into place a storm hardening program for this tunnel aimed at protecting critical infrastructure in the event of such disasters related to 100 year occurrence storms. The design benchmarks were based on flood data from authoritative sources including FEMA 2013 maps and Super Storm Sandy actual above ground water levels. The objective of this project is to harden the perimeter of the Hudson Avenue Head House and protect its equipment from salt water damage, flotation, destruction due to wave action and flood hydraulic head pressure by reinforcing the existing walls, installing new wind resistant ventilation louvers, providing emergency egress and reinforcing the roofing structure to weather rain and wind events associated with anticipated high magnitude storms. The existing aboveground oil water separator will be secured to eliminate environmental concerns and maintain operation of the submersible pumps. The objective of this project relating to hardening the Jackson Street Head House is to demolish the existing structure and construct a new reinforced head house to meet required design basis standards for preventing water intrusion into the tunnel and protect its equipment. This includes installing flood proof hatch doors that provide access to the breezeway. As part of this effort the integrity of the seawall will be evaluated and any deficiencies addressed. Con Edison's commitment is to design projects to FEMA 2013 plus 3 feet, with wind consideration that meets the NYC Building Code, at a minimum, to address considerations of the impact from future climate change.

The storm hardening concept studies associated with this hardening effort have been completed. The current plan is to complete the detailed design engineering for the Hudson Avenue Tunnel Head Houses in 2014 for construction in 2015.

Justification Summary:

The anticipated storm surge flood waters, will reach the current entry door ways, vents, and piping penetrations. This flooding exposes the tunnel to flood waters and inundation through the shafts of the tunnel from both head houses. The tunnel currently facilitates routing below the East River the following utilities: 2 – 24" steam mains, 6 – 345kV electric feeders, and 1- 138kV electric feeder. The current drainage sump pumps will not be able to handle the volume of these significant flood waters. In turn, equipment

within the tunnel is subject to damage, and inoperability. This includes, fire panels, electrical switching panels, elevator motors and controls, security, light and power panels. Salt water intrusion into the tunnel will severely impact the life cycle of all electrical and mechanical equipment located on within the tunnel and its associated support equipment.

Supplemental Information:

- Alternatives: Various permanent, deployable and administrative measures are being considered to best address the unique situation for this tunnel at both head houses. However, to deploy emergency measures such as inflatable seals or sand bagging will require manpower to implement at a time when personnel are already busy preparing for the impending event.

- Risk of No Action: Citywide damage and significant disruption to the services that are facilitated by this tunnel will lead to power and steam service outages that may last several days to weeks. Storm hardening is aimed at protecting critical infrastructure in the event of such disaster.

- Non-financial Benefits: See above

- Summary of Financial Benefits (if applicable) and Costs: $8,425,027

- Technical Evaluation/Analysis: Concept study was completed in 2013 assessing the required FEMA 2013 storm flood elevations and their impact on all structures and equipment at each head house.

- Project Relationships (if applicable): Similar hardening projects are being evaluated with respect to other vulnerable tunnels.

- Basis for Estimate: Conceptual design studies reviewed the scope related to hardening this tunnel and developed a budgetary cost estimate for the anticipated storm hardening reinforcement of the Hudson Avenue Head House and reconstruction of the Jackson Street Head House.

Total Funding Level ($000):

Request ($000):

Request 2015	Request 2016
$8,425,027	

[a]**Request by Elements of Expense**

EOE	2015	2016
Labor	**$1,179,890**	
M&S		
A/P	**$4,523,967**	
Other		
Overheads	**$2,721,170**	
Total	**$8,425,027**	

[a] All contingencies were developed in accordance with the Con Edison "Estimating Cost Contingency" Guidelines.

x	Capital
	O&M

2015 – Tunnel Maintenance Business – Gas Operations

Project/Program Title	**11th Street Conduit Head Houses Facility Storm Hardening**
Project Manager	Glen Katz
Project Engineer	Jed Khandji
Project Number	1118-02
Status of Project	Engineering
Estimated Start Date	January 2015
Estimated Completion Date	**December 2015**
Work Plan Category	Safety & System and Component Upgrade

Work Description:

Con Edison Facilities such as the 11th Street Conduit which crosses the Newtown Creek with utilities between Brooklyn and Queens was inundated with severe flood waters from rising levels of Newtown Creek that connects to the East River due to Super Storm Sandy in 2012. In the wake of Super Storm Sandy and to avoid citywide damage and significant disruption to tunnel utility services that could lead to power outage interruption, from future storm occurrences, the 11th Street Conduit Head Houses in Brooklyn and Queens will require significant storm hardening of structural walls, utilities boxes, oil water separator equipment, building roof and equipment hardening. Con Edison Tunnel Maintenance Group put into place a storm hardening program for this tunnel aimed at protecting critical infrastructure in the event of such disasters related to 100 year occurrence storms. The design bench marks were based on flood data from authoritative sources including FEMA 2013 maps and Super Storm Sandy actual above ground water levels. The objective of this project is to harden the perimeter Head House of the 11th Street Conduit – Brooklyn and protect its equipment from salt water damage, flotation, and destruction due to wave action and flood hydraulic head pressures. This includes reinforcing the existing walls of the structure, installing new wind resistant ventilation louvers, installing watertight bulkhead doors and hatches, providing emergency egress and reinforcing the roofing structure to weather rain and wind events associated with anticipated high magnitude storms. The existing aboveground oil water separator will be secured to eliminate environmental concerns and maintain operation of the submersible pumps. As part of this hardening, we are including the restoration of emergency backup power generation to maintain tunnel operability in the event of power loss during a storm event or otherwise. The objective of this project relating to hardening the Queens Head House for this tunnel is to prevent water intrusion by relocating the entry door above the design flood elevation, and reinforce the roofing structure to weather high magnitude storms. Wind resistant ventilation louvers will also be installed. The head house and equipment hardening is to meet required design basis standards for preventing water intrusion into the tunnel and protect its equipment. Con Edison's commitment is to design projects to FEMA 2013 plus 3 feet, with wind consideration that meets the NYC Building Code, at a minimum, to address considerations of the impact from future climate change.

The storm hardening concept studies associated with this hardening effort have been completed. The current plan is to complete the detailed design engineering for the 11th Street Tunnel Head Houses in 2014 for construction in 2015.

Justification Summary:

The anticipated storm surge flood waters will reach the current entry door ways, vents, and piping penetrations. This flooding exposes the tunnel to flood waters and inundation through the shafts of the tunnel from both head houses. The tunnel currently facilitates routing below the Newtown Creek the

following utilities: 3 – 345kV electric feeders. The current drainage sump pumps will not be able to handle the volume of the anticipated significant flood waters. In turn, equipment within the tunnel is subject to damage and inoperability because of intruding salt water. This includes, elevator control panels, electrical switching panels, elevator motors and controls, security, light and power panels and emergency power generator. Salt water intrusion into the tunnel will severely impact the life cycle of all electrical and mechanical equipment located on and within the tunnel and its associated support equipment.

Supplemental Information:

- Alternatives: Various permanent, deployable and administrative measures are being considered to best address the unique situation for this tunnel at both head houses. However, to deploy emergency measures such as inflatable seals or sand bagging will require manpower to implement at a time when personnel are already busy preparing for the impending event.

- Risk of No Action: Citywide damage and significant disruption to the services that are facilitated by this tunnel will lead to power service outages that may last several days to weeks. Storm hardening is aimed at protecting critical infrastructure in the event of such disaster.

- Non-financial Benefits: See above

- Summary of Financial Benefits (if applicable) and Costs: $2,241,724

- Technical Evaluation/Analysis: Concept study was completed in 2013 assessing the required FEMA 2013 storm flood elevations and their impact on all structures and equipment at each head house.

- Project Relationships (if applicable): Similar hardening projects are being evaluated with respect to other vulnerable tunnels.

- Basis for Estimate: Conceptual design studies reviewed the scope related to hardening this tunnel and developed a budgetary cost estimate for the anticipated storm hardening reinforcement of both the Queens and Brooklyn Head Houses.

Total Funding Level ($000):

Request ($000):

Request 2015	Request 2016
$2,241,724	

[a]**Request by Elements of Expense**

EOE	2015	2016
Labor	**$341,571**	
M&S		
A/P	**$1,123,417**	
Other		
Overheads	**$776,736**	
Total	**$2,241,724**	

[a] All contingencies were developed in accordance with the Con Edison "Estimating Cost Contingency" Guidelines.

x	Capital
	O&M

2015 – Tunnel Maintenance Business – Gas Operations

Project/Program Title	**Flushing Tunnel Head Houses Facility Storm Hardening**
Project Manager	Glen Katz
Project Engineer	Jed Khandji
Project Number	1118-03
Status of Project	Engineering
Estimated Start Date	January 2015
Estimated Completion Date	**December 2015**
Work Plan Category	Safety & System and Component Upgrade

Work Description:

Con Edison Facilities such as the Flushing Tunnel which crosses under the Flushing River with utilities between Corona and College Point Queens was inundated with severe flood waters from rising levels of Flushing River that connects to Flushing Bay and in turn to the Long Island Sound, due to Super Storm Sandy in 2012. In the wake of Super Storm Sandy and to avoid citywide damage and significant disruption to tunnel utility services that could lead to power outage and gas service interruptions from future storm occurrences, the Flushing Tunnel Head Houses – College Point and Corona Head Houses will require significant storm hardening including structural rebuilding, integration of electrical and communication utilities boxes and overall physical layout hardening. Con Edison Tunnel Maintenance Group put into place a storm hardening program for this tunnel aimed at protecting critical infrastructure carried through this tunnel in the event of such disasters related to 100 year occurrence storms. The design bench marks were based on flood data from authoritative sources including FEMA 2013 maps and Super Storm Sandy actual above ground water levels. The objective of this project is to rebuild the head houses associated with each shaft and protect its equipment from salt water damage, and destruction due to wave action and flood hydraulic head pressures exerted on flood prone structures. This includes building new structures on caissons to weather rain and wind events associated with anticipated high magnitude storms. The College Point Head House will include new wind resistant louvers, new vent fans, and an emergency egress. Electrical and utilities boxes will be relocated to the interior or above the design flood elevation. As part of this hardening, we are including the restoration of emergency backup power generation to maintain tunnel operability in the event of power loss during a storm event or otherwise. The new Corona Head House will incorporate new wind resistant louvers. The head houses and equipment hardening is to meet required design basis standards for preventing water intrusion into the tunnel and protect its equipment. Con Edison's Commitment is to design projects to FEMA 2013 plus 3 feet, with wind consideration that meets the NYC Building Code, at a minimum, to address considerations of the impact from future climate change.

The storm hardening concept studies associated with this hardening effort have been completed. The current plan is to complete the detailed design engineering for the Flushing Tunnel Head Houses in early 2015 for construction in 2015.

Justification Summary:

The anticipated storm surge flood waters will reach the current entry doorways, vents, and piping penetrations. This flooding exposes the tunnel to flood waters and inundation through the shafts of the tunnel from both head houses. The tunnel currently facilitates routing below the Flushing River the following utilities: 1 – 20" NYF Transmission Gas Main, 1 - 16" HP Gas Main, and 2 – 27 kV Electric feeders. The current drainage sump pumps will not be able to handle the volume of the anticipated significant

flood waters. In turn equipment within the tunnel is subject to damage, and inoperability because of intruding salt water and flotation issues. This includes possible damage to electrical panels, security panels, light and power panels and communication equipment. Salt water intrusion into the tunnel will severely impact the life cycle of all electrical and mechanical equipment located on and within the tunnel and its associated support equipment.

Supplemental Information:

- Alternatives: Various permanent, deployable and administrative measures are being considered to best address the unique situation for this tunnel at both head houses. However, to deploy emergency measures such as inflatable seals or sand bagging will require manpower to implement at a time when personnel are already busy preparing for the impending event.

- Risk of No Action: Citywide damage and significant disruption to the services that are facilitated by this tunnel will lead to power and gas service outages that may last several days to weeks. Storm hardening is aimed at protecting critical infrastructure in the event of such disaster.

- Non-financial Benefits: See above

- Summary of Financial Benefits (if applicable) and Costs: $5,246,254

- Technical Evaluation/Analysis: Concept study was completed in 2013 assessing the required FEMA 2013 storm flood elevations and their impact on all structures and equipment at each head house.

- Project Relationships (if applicable): Similar hardening projects are being evaluated with respect to other vulnerable tunnels.

- Basis for Estimate: Conceptual design studies reviewed the scope related to hardening this tunnel and developed a budgetary cost estimate for the anticipated storm hardening reconstruction for both head houses.

Total Funding Level ($000):

Request ($000):

Request 2015	Request 2016
$5,246,254	

[a]**Request by Elements of Expense**

EOE	2015	2016
Labor	**$670,167**	
M&S		
A/P	**$3,001,953**	
Other		
Overheads	**$1,574,134**	
Total	**$5,246,254**	

[a] All contingencies were developed in accordance with the Con Edison "Estimating Cost Contingency" Guidelines.