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March 10, 2015
VIA FED EX

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Subject: NEUP NJ Loop 325 Highlands Region Year 1 Post-Construction Monitoring Report

Please find enclosed two (2) hard copies and one (1) CD of the March 10, 2015 Year 1 Post-Construction Monitoring Report for the Loop 325 New Jersey Highlands Region portion of the Northeast Upgrade Project (NEUP).

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YEAR 1 POST-CONSTRUCTION MONITORING
Tennessee Gas Pipeline Company, L.L.C.
NEUP PROJECT - LOOP 325
HIGHLANDS REGION
Passaic and Bergen Counties, New Jersey



Prepared for: Tennessee Gas Pipeline Company, L.L.C.
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December 29, 2014

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1.0 Introduction

Tennessee Gas Pipeline Company, L.L.C. (“Tennessee”) developed a Comprehensive Mitigation Plan (“CMP”) in support of the Loop 325 (“Project”) segment of the Northeast Upgrade Project (“NEUP” or “Project”). Loop 325 consists of an approximately 7.6-mile section of 30-inch diameter loop pipeline originating in West Milford Township, traversing to the east into Ringwood Borough, and terminating in Mahwah Township (Figure 1-1). The entire Loop 325 alignment is located within the Preservation Area of New Jersey’s Highlands Region (the “Highlands”). Due to the sensitive resources that comprise the Highlands, Tennessee developed the CMP¹ for implementation during construction and operation of the Project, identifying the specific resources and the measures designed to avoid, minimize, and mitigate adverse impacts to the Highlands resources. In accordance with the CMP, Tennessee committed to monitor the success of restoration activities and provide an annual report to document the status of restoration of the Highlands resource areas in the Highlands region for three years following completion of construction or until such time as restoration is determined to be successful.

This Post-Construction Monitoring Report was prepared by AK Environmental LLC (“AK”) on behalf of Tennessee to provide results of monitoring for the Project that occurred in September and October 2014 relative to the CMP. The report is structured to include the purpose and objectives of the study (Section 2.0), a study area description (Section 3.0), monitoring methods (Section 4.0), and results from the monitoring event (Section 5.0). This report includes results from the initial monitoring event, while results from subsequent monitoring events will be provided under separate cover.

¹ Highlands Applicability Determination. Highlands Preservation Area. Comprehensive Mitigation Plan (CMP). Northeast Upgrade Project – Loop 325 West Milford Township, Ringwood Borough, and Mahwah Township, Passaic and Bergen Counties, New Jersey. October 2013.

2.0 Purpose and Objectives

The purpose of monitoring for the Project is to assess the condition of vegetation and the success of restoration. The purpose of this report is to provide the results of field monitoring, compare findings to the pre-determined success criteria, document areas of successful revegetation, and minimize the need for redundant monitoring of successful areas during subsequent years. The report includes data on percent cover achieved and problem areas (*e.g.*, weed invasion issues and poor revegetation).

The objectives and success criteria associated with the post-construction monitoring as outlined in the CMP include:

1. Monitor and record the success of revegetation in the Highlands resource areas for the first three (3) years post-construction, or until wetland revegetation is successful. The cover of herbaceous and/or woody species is to be at least 75 percent survival and 75 percent of the type, density, and distribution of the vegetation in adjacent buffer areas that were not disturbed by construction.
2. Monitor restoration planting densities within areas of temporary disturbance as compared to the seeding recommendation outlined in the New Jersey No Net Loss (“NNL”) Reforestation Act for all land (whether State-owned or not) within the Highlands Region. Long-term monitoring of reforestation is to confirm the establishment of forest habitat of sufficient integrity and stem survival (80% survival for seedlings, 90% survival for whips, 95% survival for balled and burlapped [“B&B”] individuals).
3. Evaluate Wanaque River (milepost “MP” 1.96) and Ringwood Creek (MP 3.04) stream channels to ensure that stone size selected for final substrate restoration is of sufficient size and weight that it will not become displaced by high volume / velocity flow events within the waterbody. Conduct monitoring within the summer / fall after spring runoff has occurred. This objective will be considered successful if no displacement of stone has occurred in Wanaque River or Ringwood Creek stream channels as a result of spring runoff and significant precipitation events.
4. Conduct post-construction monitoring of all upland forested areas affected by construction for a minimum of three (3) years to assess the condition of vegetation and the success of restoration. Upland vegetation is to be similar to adjacent vegetation based on quantitative sampling to determine the type and quantity of tree and shrub species naturally colonizing and re-sprouting in areas disturbed by construction.
5. Identify the presence of non-native (invasive) species and determine if there is a need for treatment or additional restoration measures. Reduce the levels of invasive species to a non-dominant position during the first five (5) years following construction. Invasive species are to be controlled to a level such that uplands are not dominated by the invasive species listed in the CMP to a point where the function of the system is compromised.
6. Monitor the Highlands resource areas on an annual basis post-construction to identify any evidence of sinkhole development and implement any measures necessary to prevent further solution of the soils.
7. Document restoration and mitigation activities associated with the access roads utilized for construction.

8. Prepare a report suitable for filing with the New Jersey Department of Environmental Protection (“NJDEP”) Highlands Water Protection and Planning Council identifying the status of the revegetation efforts on a yearly basis for three years post-construction.

If there are areas that are not showing signs of re-establishing native vegetation during the third growing season following construction, Tennessee will develop and implement (in consultation with a professional landscape ecologist and/or other state and federal regulatory agencies, as needed) a plan to revegetate the buffer with native species. Revegetation efforts will continue until revegetation is successful.

3.0 Study Area Description

The monitoring program included a survey of all disturbed workspaces within Federal Energy Regulatory Commission-approved permanent rights-of-way and temporary workspaces (collectively, “ROWS”) for the Project, including all upland areas, temporarily used access roads, and wetlands and waterbodies, as delineated prior to construction. Appendix A1 to this report provides the Loop 325 Alignment Sheets showing the project alignment and temporary workspaces, along with the natural resources identified. Appendix A2 to this report provides the Loop 325 Landscape Restoration Plan sheets showing the planting scheme within the Project area.

The Project was placed in service on November 1, 2013. Restoration activities, including final grading to pre-construction contours, seeding, and mulching, were completed from MP 0.00 to Shepherd Pond Road (MP 4.60) in Fall 2013. Although the Project was in-service as of November 1, 2013, certain Project construction activities at the Mahwah Meter Station continued after that date and were completed in Fall 2014. The travel lane along the eastern three-mile portion of Loop 325, between Shepherd Pond Road (MP 4.60) and the Mahwah Meter Station (MP 7.60), continued to be maintained during construction of the meter station as this portion of the ROW was utilized for construction-related access to the Mahwah Meter Station. Monitoring of activities, installed erosion controls, and environmental signage along the Project continued as per the CMP components and in accordance with Project permit requirements. The last approximate 3 miles of Loop 325 (MP 4.60 to MP 7.60) were most recently restored as of Fall 2014 following completion of construction activities at the meter station. Restoration tree and shrub plantings were scheduled for late Fall 2014 following the completion of restoration of Project construction areas. As a result, restoration tree and shrub plantings had not been initiated on Loop 325 at the time of the initial post-construction monitoring.

4.0 Methods

During the first post-construction monitoring year, the ROW was monitored along the entire Loop 325 segment, except where crossed by Horizontal Directional Drill (HDD). Areas crossed by HDD (MP 0.03 to MP 0.96) were not impacted on the ground surface during construction and were, therefore, not subject to monitoring. All portions of the ROW were walked by a two-person (minimum) team led by a qualified biologist experienced in wetland delineation and linear natural gas pipeline projects. The NEUP Environmental Inspector for the Loop 325 segment accompanied the biologist and provided general ROW support regarding access and known areas where there are concerns with the status of restoration, including areas recently returned to original grade.

Potential problem areas were identified during site visits and categorized as high, medium or low. Remediation is recommended for high priority areas, whereas continued monitoring is recommended for low priority areas. Medium priority areas fall in the middle and may be recommended for remediation or continued monitoring.

4.1 Wetland Monitoring

Reforestation plantings were not initiated in wetlands prior to the Fall 2014 monitoring event. As a result, the following tasks were completed during the Fall 2014 monitoring of wetlands:

- Observed and noted hydrological conditions such as inundation and saturation;
- Observed soils for hydric condition and compaction;
- Estimated the percent cover of hydrophytes, and the distribution of hydrophytes between off-ROW and on-ROW wetland areas;
- Visually estimated wetland shape, topography, and area reduction or increase compared to preconstruction conditions (as shown on construction alignment sheets) by the end of the 3-year monitoring period;
- Visually inspected the restoration of all waterbody crossings located within wetlands;
- Photo-documented each restored wetland; and,
- Noted other pertinent observations such as wildlife use, eroded or unstable areas, noxious and invasive plants, and potential third party impacts.

AK monitored areas previously identified as wetlands during pre-construction surveys and subsequently impacted by construction. The assessment of successful revegetation of each wetland was based on criteria in the CMP. Specifically, wetland revegetation shall generally be considered successful if cover of herbaceous and/or woody species is at least 75 percent similar in type, density, and distribution of vegetation in adjacent wetlands undisturbed by construction. Problems noted with any of the attributes collected for wetlands resulted in the resource being identified as a problem area (*i.e.*, not restored) and the appropriate priority level for remedial action assigned.

Future wetland monitoring will employ the following tasks in addition to the tasks identified above:

- Establish transects within each wetland; and,
- Count the number of dead and live stems within each transect.

4.2 Waterbody Monitoring

The following tasks were implemented during waterbody monitoring:

- Visually inspected the restoration of all waterbody crossings (*i.e.*, percent cover of adjacent vegetation, bed, banks, and flow);
- Photo-documented representative conditions of each restored area; and,
- Noted other pertinent observations such as wildlife use, eroded or unstable areas, noxious and invasive plants, and potential third party impacts.

AK monitored waterbodies previously identified during pre-construction surveys and subsequently impacted by construction. The assessment of successful revegetation of each waterbody was based on criteria in the CMP. Problems noted with any of the attributes collected for waterbodies resulted in the resource being identified as a problem area (*i.e.*, not restored) and the appropriate priority level for remedial action assigned.

4.3 Open Water Buffer (Transition Area) Monitoring

Reforestation plantings were not initiated in transition areas prior to the Fall 2014 monitoring event. As a result, the following tasks were completed during the Fall 2014 monitoring of transition areas:

- Observed for signs of erosion;
- Observed for sign of vegetative cover, or lack of vegetative cover within the ROW; and,
- Noted areas of invasive/noxious species (see Section 4.5).

Future transition area monitoring will employ the following tasks in addition to the tasks identified above:

- Establish transects perpendicular to the ROW at each one-tenth mile location; and,
- Count the number of dead and live stems within each transect.

4.4 Upland Forest Monitoring

Reforestation plantings were not initiated in uplands areas prior to the Fall 2014 monitoring event. As a result, the following tasks were completed during the Fall 2014 monitoring of uplands:

- Observed for signs of erosion;
- Observed for sign of vegetative cover, or lack of vegetative cover within the ROW; and,
- Noted areas of invasive/noxious species (see Section 4.5).

Future upland area monitoring will employ the following tasks in addition to the tasks identified above:

- Count the number of dead and live stems.

4.5 Invasive Species Monitoring

For invasive plant species monitoring, areas were noted where non-native/invasive species dominated the ROW. Significant communities were documented by GPS and photographed. For invasive communities within upland portions of the ROW, a data sheet was completed. For invasive communities within wetlands or waterbodies, notes were included on the wetland and riparian monitoring data forms. Data collected included the percent cover within the ROW and coverages outside and adjacent to the new ROW. Adjacent invasive species communities indicated that invasive species were present prior to pipeline installation.

4.6 Access Road Monitoring

The following tasks were implemented to monitor the restoration of construction access roads:

- Visually inspected access roads;
- Photo-documented representative conditions of each restored area to show presence of erosion control devices (“ECDs”), adjacent resources, etc.; and,
- Noted other pertinent observations such as eroded or unstable areas, noxious and invasive plants, and potential third party impacts.

4.7 Sinkhole Monitoring

The Highlands resource areas were inspected for evidence of cracks in the soil structure and subsidence of the soil which may develop into a sinkhole.

5.0 Post-Construction Monitoring Results By Year

This report provides a summary of findings for the initial post-construction monitoring event conducted in September and October 2014. A summary of the findings is provided in the text below along with recommendation for corrective action, if necessary. Corrective actions are designated as maintenance activities that will keep the Project moving toward successful recovery or as remediation to address mitigation shortfalls that need to be addressed in a separate plan developed in coordination with the regulatory agencies.

Results from monitoring sessions are summarized in Tables 1 to 6. Reforestation plan sheets showing the planting scheme within the Project area are provided in Appendix A2. Appendix B provides lists of planted tree species. Appendix C provides Field Change Documentation; Appendix D provides Data Tables of Features, by Year; and Appendix E provides Data Sheets with Photos, by Year of the wetlands and waterbodies.

Restoration tree and shrub plantings were initiated on Loop 325 in October 2014, subsequent to the initial post-construction monitoring. Therefore, at the time of the Fall 2014 monitoring event, there were no upland plantings, buffer plantings or forested wetland plantings completed. Post-construction monitoring of restoration plantings will be included in subsequent reports.

5.1 Wetland Monitoring, Fall 2014

As of the Fall 2014 monitoring event, all palustrine emergent (“PEM”) wetlands impacted by construction have been returned to original contours and/or recently temporarily re-seeded to prevent erosion in non-saturated wetlands. Permanent seeding of wetlands was scheduled later in the Fall of 2014. Some vegetation within the wetlands is naturally occurring from the adjacent root and seed crop. The palustrine forested and scrub-shrub wetland (“PFO” and “PSS”) plantings had not been planted as of the initial monitoring effort; the next monitoring effort will include data from these wetlands. As noted in Section 3.0 above, the last approximate 3 miles of Loop 325 was most recently returned to existing contours. Wetlands located between MP 0.00 and Shepherd Pond Road (MP 4.60) are therefore further along in the restoration process.

Appendix D, NEUP Loop 325 Restored Wetlands Data Table, Fall 2014, includes information compiled from data sheets filled out in the field during the monitoring event. It includes the location, soils, hydrology, vegetation, problem areas, and proposed problem area remediation. Table 1 below provides a summary of the data within Appendix D, comparing the success criteria within permits and within construction and mitigation plans.

Along Loop 325, twenty-nine PEM wetlands were monitored. Twenty-two of those wetlands were identified as being on track toward successful restoration. Wetlands noted as being “on track” are redeveloping wetland characteristics as defined by U.S. Army Corps of Engineers (“USACE”). These characteristics include hydric soils, dominant hydrophytic vegetation, and wetland hydrology.

The seven wetlands not currently on track for restoration have either just recently been returned to pre-existing contours and re-seeded, or have a problem area that needs to be remedied, such as invasive species treatment or monitoring for potential regrading. One of these seven wetlands,

W008 (MP 4.84 to MP4.91), did not have vegetative cover at the time of the monitoring event. The other two wetlands recently re-seeded with temporary vegetation, W018 (MP 6.34 to MP 6.42) and W029 (MP 6.88 to MP 7.01), had some indication of vegetative germination. Two wetlands, W040 (MP 3.21 to MP 3.29) and W091 (MP 3.08 to MP 3.20), did not appear to have hydrology restored as of the initial monitoring period. Hydrophytic vegetation did not appear to be thriving yet as well. If during the next monitoring event (Spring 2015), the hydrology and hydrophytic vegetation indicators do not improve, these two wetlands should be considered for regrading. These two wetlands also contained invasive species and are recommended for treatment. The remaining two wetlands contained invasive species and are recommended for treatment, including W093 (MP 1.89 to MP 1.96) and W094 (MP 1.46 to MP 1.69). These wetlands are discussed further in Section 5.5 Invasive Species Monitoring. All of the wetlands will need to have the temporary ECDs removed once they become revegetated.

Table 1. Post-Construction Wetland Monitoring Summary, Year 1 (Fall 2014).

Description		Total Wetlands
Wetlands monitored (PEM portions)		29
Wetlands on track for successful restoration		22
Wetlands restored (meeting all success criteria)		N/A as of Fall 2014 monitoring
Wetlands not on track for restoration ¹		7
Wetlands with ECDs in place		29
Problem areas	Wetlands requiring invasive species treatment	2
	Wetlands monitored for potential regrading	2
	Compacted soils	0
Success Criteria	Wetlands with <75% cover-all vegetation ²	9
	Wetlands with <75% cover-hydrophytes ²	21
	Wetlands impacted by third party	0
	Hydric soils	26
	Trees >5'	N/A as of Fall 2014 monitoring
¹ These wetlands are not yet restored due to either maintenance needed, or lack of hydrophytic vegetation re-establishment		
² Highlands CMP requirement		

5.2 Waterbody Monitoring, Fall 2014

Appendix D, NEUP Loop 325 Waterbodies Data Table, Fall 2014, includes data compiled from data sheets filled out in the field during the monitoring event. It includes the location, grade, hydrology, erosion, ECDs, vegetation, problem areas, and proposed problem area remediation. Table 2 below provides a summary of the data within Appendix D, comparing the success criteria within permits and within construction and mitigation plans. Sixteen waterbodies were monitored. All sixteen waterbodies are on track to successful restoration, however in order to be fully restored, all temporary ECDs need to be removed and streambanks need to be fully stabilized. There were no erosion issues identified or streams observed with unstable banks.

Seven of the sixteen streams have problem areas that need to be remedied due to presence of invasive species. The seven streams were classified as medium priority problem areas because the percent cover of invasive species was 20% or greater. These streams include: S002 (MP 3.67), S004 (MP 4.30), S006 (MP 4.58), S039 (MP 2.06), S042 (MP 2.18), S058- second crossing (MP 3.29), and S059A (MP 1.96). Additionally, stream S056 (MP 2.55) was classified as low priority due to 3% invasive species coverage. This stream was not classified as a problem area, but will continue to be monitored for percent coverage next year.

The Wanaque River tributary-S059A (MP 1.96) and Ringwood Creek tributary- S057 (MP 3.04) were evaluated for substrate stone size and weight. The stone appeared to be of sufficient size and similar to other rock upstream and downstream of the ROW crossing. The rock will not likely become displaced by high volume or velocity flow events. As of the Fall 2014 monitoring effort, no displacement of stone has occurred in the tributaries to the Wanaque River or Ringwood Creek as a result of precipitation events. The Wanaque River tributary crossing was protected by ECDs and a temporary timber mat bridge was laid across for the tree planters to use at the time the monitoring took place. No water was flowing within the Wanaque River tributary at the time of monitoring. The Ringwood Creek tributary crossing is also protected by ECDs, however, normal flow was occurring at the crossing at the time of monitoring.

Table 2. Post-Construction Waterbody Monitoring Summary, Year 1 (Fall 2014).

Description		Total Waterbody Crossings
Streams monitored		16
Streams restored (meeting all success criteria)		0
Streams not restored		16
Streams with ECDs in place		16
Problem areas	Streams needing invasives/noxious weeds treatment	7
	Streams with erosion	0
	Streams with unstable banks	0
	Streams with grade not restored	0
	Streams with hydrology not restored	0

5.3 Open Water Buffer (Transition Area) Monitoring, Fall 2014

There were no transition area tree plantings in place during the initial Fall 2014 monitoring event. The plantings are scheduled to be completed in late 2014 and will be evaluated during the 2015 monitoring event.

Table 3. Post-Construction Open Water Buffer (Transition Area) Summary, Year 1 (Fall 2014).

Description		Total
Tube	Live	N/A as of Fall 2014
	Dead	
B&B	Live	
	Dead	
Tub	Live	
	Dead	

5.4 Upland Forest Monitoring, Fall 2014

Reforestation plantings had not been initiated in upland areas during the Fall 2014 monitoring event. The plantings are scheduled to be completed in late 2014 and will be evaluated during the 2015 monitoring event.

Table 4. Post-Construction Upland Forest Area Summary, Year 1 (Fall 2014).

Description		Total
Tube	Live	N/A as of Fall 2014
	Dead	
B&B	Live	
	Dead	
Tub	Live	
	Dead	

5.5 Invasive Species Monitoring, Fall 2014

Invasive plant species populations were identified within uplands, wetlands, and riparian zones. Appendix D, NEUP Loop 325 Invasive Species Data Table, Fall 2014, lists resources and upland areas where invasive communities thrived, along with the percent coverages within the ROW and outside the ROW, and if treatment or monitoring is recommended. A photo log of invasive species locations is included in Appendix F. Table 5 below is a summary of the data collected and provided in Appendix D. For this report, the Highlands Council suggests that density and cover of non-nuisance vegetation be similar in density and cover to adjacent undisturbed land. There is no specific percent cover threshold. Treatment in these areas is recommended if invasive species coverage exceeds 15%.

Invasive species were found growing at eight of the streams crossed on Loop 325. The invasive species located at stream crossings include: *Microstegium vimineum* (Japanese stiltgrass), *Typha latifolia* (cattail), and *Phragmites australis* (common reed). Seven of the stream crossings have

percent coverages ranging from 20% to 35% cover. These streams should be treated when feasible and include: S002 (MP 3.71), S004 (MP 4.30), S006 (MP 4.58), S039 (MP 2.06), S042 (MP 2.18), S058- second crossing (MP 3.22), and S059A (MP 1.96). One stream, S056 (MP 2.55), should be monitored for spread of invasive species as it currently has 3% cover of invasive species. Four other streams did not have invasives growing within the ROW; however they were observed growing outside the ROW, and these areas will be monitored next year (Spring 2015).

Fifteen wetlands were observed to have invasive species coverage ranging from 3% to 75%. The same invasive species listed above were observed within the wetland crossings. Twelve wetlands are within the low treatment priority range and are recommended to be monitored during the next season as they have percent coverages ranging from 3% to 15%: W002, W003, W004, W036, W040, W067, W069A, W069, W070, W085, W088, and W095. Three wetlands require treatment for invasive species, including W091, W093, and W094. These wetlands are classified as medium to high priority areas and have between 20% and 75% coverage by invasive species. Invasive species were also located outside the ROW at four wetlands, and should be monitored for encroachment next year (Spring 2015).

Table 5. Post-Construction Invasive Species Monitoring Summary, Year 1 (Fall 2014).

Treatment Priority	Wetlands Total	Waterbodies Total
Low-Monitor Next Season	12	1
Medium-Action Required	2	7
High-Immediate Action Required	1	0

5.6 Access Road Monitoring, Fall 2014

The majority of the access roads used during Loop 325 construction were existing paved or gravel roadways. A photo log of each road is included in Appendix G. In general, there were no immediate concerns noted during the Fall 2014 monitoring event along access roads. There were no signs of erosion on the roads. No impacts were identified at resource crossings. Existing road culverts and ECDs were in place to protect adjacent resources. Table 6 below provides a summary of the data collected. Removal of ECDs at AR-50, AR-21.05, AR-70, AR-71 AR-60, AR-65 and AR-80 is recommended. The following are problem areas that need to be remedied:

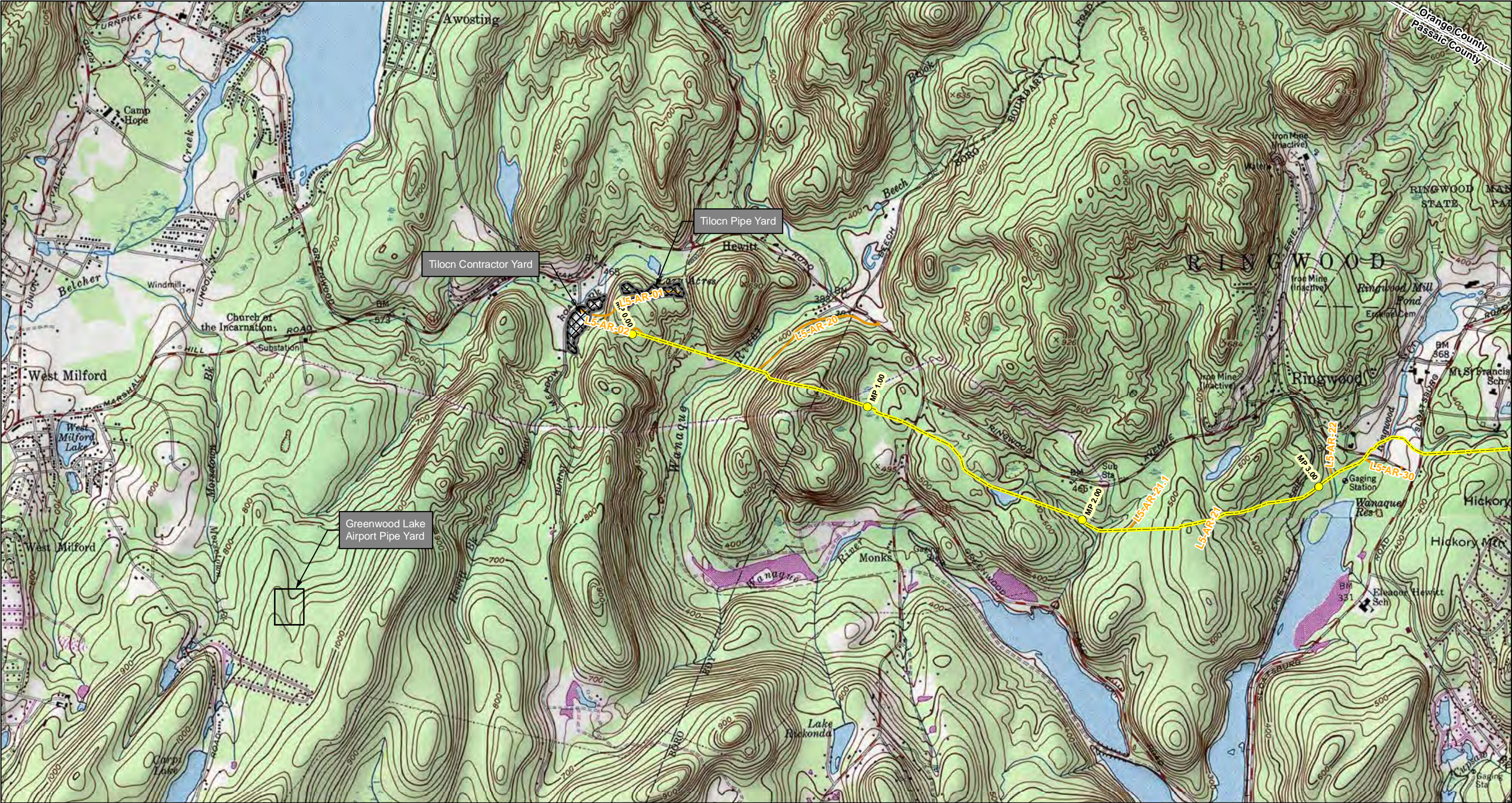
- Invasive species located at AR-21.05 and AR-80. Likely pre-existing.

Table 6. Post-Construction Access Road Restoration Summary, Year 1 (Fall 2014).

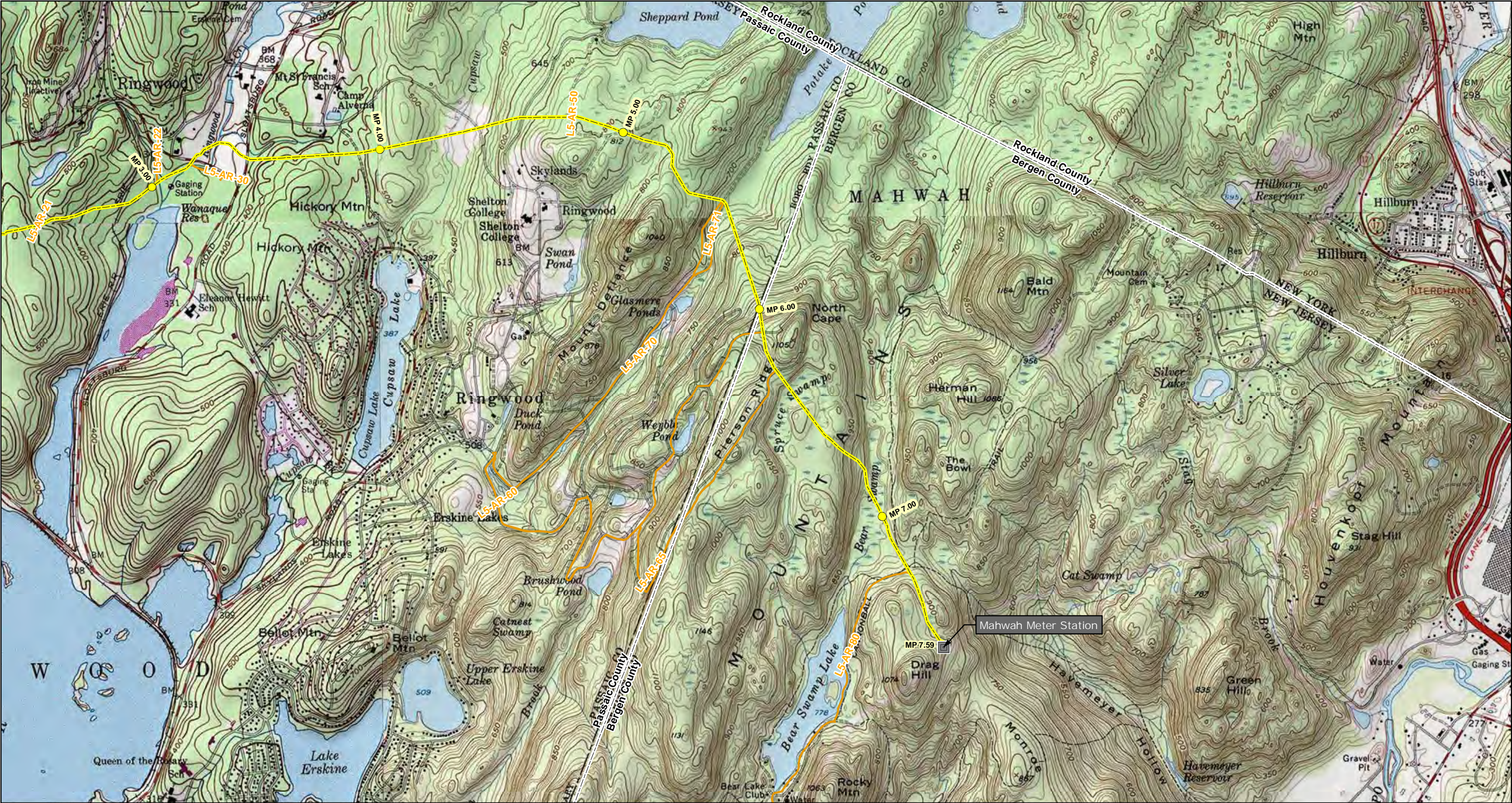
Description		Access Roads Total
Access Roads Monitored		14
Access Roads Restored		7
Access Roads with ECDs in place		7
Problem Areas	Access Roads with erosion	0
	Access Roads with invasive species	2 (edges of roadway, likely pre-existing)



5.7 Sinkhole Monitoring, Fall 2014

The Highlands resource areas were also monitored during Fall 2014 to identify any evidence of sinkhole development and implement any measures necessary to prevent further subsidence of the soils. However, there were no observations of sinkholes or subsidence during the initial monitoring session. Loop 325 will continue to be monitored for sinkholes during subsequent monitoring events.



Map Location 	Map Index 	Legend <ul style="list-style-type: none">NEUP CenterlinesCompressor StationCounty BoundaryPipe YardsAccess Roads <p>Data Source: USGS, PASDA, NJDEP Map Projection: NAD 1983 UTM Zone 18N Foot US USGS Quad: Greenwood Lake, Slootsburg</p> <p>0 250 500 1,000 1,500 2,000 Feet</p> <p>1:24,000 1 inch = 2,000 feet</p>	<p>Tennessee Gas Pipe Line Company USGS Site Location Northeast Upgrade Project - Loop 325</p> <p>Passaic County, NJ</p> <p>Sheet 1 of 2</p>	<div></div> <p>Figure 1-1</p> <p>Date: April 2011</p> <p>Project #: 60136976 300</p>
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