5.0 ENVIRONMENTAL CONSEQUENCES

The environmental consequences of constructing and operating the Millennium Pipeline Project are analyzed in this section. Since the impacts on environmental resources vary in duration and significance, four levels of impact duration were considered. These include temporary, short-term, long-term, and permanent impacts. Temporary impacts generally occur during the construction period, and the resource would recover during or immediately after construction. Short-term impacts may last from the time of construction to about 3 years following construction. Impacts are considered long-term if the resource would require more than 3 years after construction to recover. Permanent impacts are those changes to the resource that involve aboveground structures or areas where the resource would not recover for the life of the project.

Section 5 of this FEIS is organized to provide a description of: (1) the general construction and operational impact that could be expected for each resource, and (2) the site-specific concerns and proposed and recommended mitigation. Mitigation measures included in this section, by resource classification, are either proposed by Millennium or recommended by us based on an analysis of potential environmental impact of project construction. We base our conclusions on the following assumptions:

Millennium would comply with all applicable laws and regulations;

2. the pipeline would be constructed as described in section 2.0 of this FEIS, including the procedures contained in Millennium's ECS (appendix E1), our Plan and Procedures, and Millennium's Black Dirt Plan (appendix E2) [1/], and

Millennium would implement the mitigation measures included in its application, supplements, and any additional staff-recommended mitigation measures that may be required by the Commission as described in this FEIS.

5.1 GEOLOGY

5.1.1 General Construction and Operational Impact

Rock Excavation and Blasting

Construction and operation of the Millennium Pipeline Project should not materially alter the geologic conditions of the project area. The primary effects from construction would include disturbances to the natural topography along the pipeline right-of-way from grading and trenching during construction. The average depth for pipeline trenching would be 5 to 6 feet. In areas where bedrock is at or near the ground surface, blasting may be necessary to excavate the pipeline trench. Shallow bedrock would commonly be encountered along ridges, steeper slopes, and river banks and bottoms. Areas where blasting may be required are listed in table 4.1.1-1. These areas total 48.3 miles, with most blasting anticipated in the counties of Steuben (4.0 miles), Delaware (5.3 miles), and Westchester (29.9 miles).

One residence within 50 feet of the construction area at MP 365.0 would be within an area of potential blasting. Some blasting may be used in the Sprain Ridge Park (MPs 414.6 to 416.1) on the 9/9A Proposal in Westchester County. However, potential blasting only would be near residential and commercial development in Westchester County between MPs 417.3 and 421.3 where the pipeline would be installed in the streets.

Millennium's ECS would be modified by certain recommended conditions in this FEIS. Millennium would be required to file with the Secretary the revised ECS before construction for review and approval of the Director of the Office of Energy Projects.

Rock excavation can often be accomplished by ripping or by mechanical breakdown of relatively soft, weathered, or broken rock with the use of toothed tools in conjunction with bulldozers, trench excavators, and/or backhoes. Blasting should only be used as a last alternative in the event that hard microcrystalline rock is encountered and cannot be avoided. Blasting would be performed by a licenced blasting contractor in accordance with all Federal, state, and local regulations. Title 39 of the New York State Code governs the use of explosives in New York, and some municipalities may have additional codes. These regulations include limitations on size of explosive charges, safe handling, shipping and storage, and proximity of houses and other structures. Millennium states that it would comply with all valid county and municipal construction requirements, including any requirements for blasting.

If blasting is not controlled properly, it can cause damage to structures, existing pipelines, wells, and springs. Millennium states that with the landowner's permission, it would conduct pre- and post-construction water quality testing on wells, and pre- and post-blasting inspections of structures, within 150 feet of the construction work area where blasting is required. Millennium has included a provision in its ECS that requires 1-week prior notice, with confirming notice at least 24 hours, before blasting. When notified, people may decide to leave their homes during the blasting. The minimum distance from the blast area for non-construction personnel would depend on the size of the charge and the location; typically this is a distance of 200 feet. See discussion below and in section 5.8.4 for additional precautions where blasting is required along the 9/9A Proposal.

For protection of adjacent pipelines during blasting, Millennium would follow the procedures established by the Southwest Research Institute in studies conducted for the American Gas Association. These studies have determined the hoop stresses [2/] imposed on a pipeline by nearby blasting activities. Hoop stresses caused by blasting, in addition to the hoop stress induced by the flowing product, are required to be below the hoop stress for the maximum allowable operating pressure of the pipeline.

Temporary effects of blasting could include hazards posed by uncontrolled fly-rock, and nuisances caused by noise, increased dust, and venting of gasses following blasts. Proper use of blast matting and time-delayed charges would minimize potential fly-rock hazards, while noise, dust, and gas venting would be temporary local phenomena with no long-term impacts. Millennium states that a qualified blasting contractor would perform all blasting to minimize the potential for damage. Blasting mats would be used to minimize fly rock, and seismographs would be used, as necessary, to monitor the blasts adjacent to existing pipelines, underground utilities, or buildings near the construction work area. Some rock excavated by blasting may not be suitable for pipeline backfill and would either be stockpiled along the right-of-way, with the landowner's permission, or hauled off and disposed of. Landowners are not required to accommodate rock storage on their properties. The only extra work areas Millennium identified for rock storage would be between MPs 365.6 and 376.6 (totaling 34,900 feet [6.6 miles]) within the Sterling State Forest, the Sterling Forest Corporation ski area, and Harriman State Park (see section 5.8.3.2 for additional discussion).

Mineral Resources

Impact on exploitable mineral resources would be minimal. No mineral resources unique to the region would be crossed by the pipeline. Potential impact on any mineral resource production adjacent to the pipeline could include a reduction in the reserves of the area, together with attendant economic losses to the owner caused by limitations on the possible future expansion of the affected quarry, pit, or mine. If a landowner feels that compensation is due for lost mineral resources, then this issue would be negotiated between Millennium and the landowner during right-of-way procurement. These negotiations would also include clearance between the pipeline right-of-way and the boundary of future mining activity. Since 87

2/ Hoop stress is a combination of the internal and external circumferential stress imposed on the pipeline.

percent of the land segment of the proposed route would be adjacent to existing utility corridors, where mineral resources have been previously precluded from development, pipeline construction would not be expected to affect the excavation of future exploitable reserves (see table 4.1.2-1). Of the five active or reclaimed gravel pits or quarries, three would be crossed in areas where the pipeline would be adjacent to existing right-of-way (MPs 224.4, 264.5, and 272.9) and two would be within 1,500 feet of the pipeline at MP 95.0. Millennium states that it has consulted with the landowners and with the New York Director of Mineral Resources and no specific concerns or requirements have been identified to date.

Oil and Natural Gas Fields and Other Utilities

Construction and operation of the pipeline and appurtenant facilities would not interfere with current and future exploitation of oil and natural gas resources because these resources occur at great depths. All of the developed natural gas fields in Lake Erie would be on the Canadian side of the crossing. A total of 15 gas and oil fields would be crossed by the pipeline on shore in New York (see table 4.1.2-1). Millennium would avoid existing oil and gas lines associated with these fields to the extent necessary and, through the state's One-Call program (see section 5.12.2) would notify land and resource owners of pipeline construction planned in the vicinity of their facilities.

Owners of existing pipelines near the construction right-of-way would be notified of work planned in the area of their facilities by Millennium through the state's One-Call program. These companies should stake their line and, if possible, witness the excavation of the pipeline trench. If the landowner is not present, and a leaking line is located, Millennium would attempt to locate the owner and notify them of the problem. The owner would then be allowed to make repairs, while Millennium's construction crews take the necessary spill precautions. Millennium would contact all utility owners before any necessary blasting and would request that an inspector from the company be present during construction.

Millennium would install its pipeline with a minimum of 12 inches of clearance from any other pipeline or underground structure. Where these clearances cannot be attained, suitable precautions, such as installation of protective material or casing, would be used. If, during pipeline construction, the free span of the existing line is sufficient to induce stress on the foreign pipe, it would be supported with timbers, sandbags, or similar temporary materials. If any foreign pipeline is inadvertently ruptured during pipeline construction, containment and cleanup would be performed in accordance with the procedures identified in Millennium's Spill Prevention, Containment, and Control Plan (SPCC Plan) which is included in its ECS in appendix E1. Since the pipeline would not cross active or abandoned coal mines, contaminated mine runoff would not pose a potential hazard.

Geologic Hazards

Geologic hazards that can impact pipeline construction and operation include landslides, earthquakes, and karst terrain.

Landslides do not pose a widespread hazard in the project area. Any impact would be related to natural processes or adverse geologic conditions that could be aggravated by pipeline construction. Artificial cutting along slopes, artificial loading by construction equipment along the proposed right-of-way, and abnormally high precipitation may increase landslide susceptibility. Landsliding in the project area is limited to shallow earth flows, soil creep, and minor debris avalanches. Earth flow hazards exist along river banks where alluvial deposits are easily eroded by river scour. Soil creep is an almost imperceptibly slow downslope mass movement that can potentially accelerate to slope slumps or slides. Although soil creep would not be of short-term concern to the pipeline, if unchecked, it might bend and weaken the pipeline over time. Creep would be most significant on sidehill installations in thick glaciolacustrine deposits and in thin mantles of outwash underlain by glaciolacustrine material. Proper pre- and post-construction inspections would identify areas of risk, and continued monitoring along slopes would likely identify any significant landslide hazards before they were to develop. Furthermore, use of the two-toning[3/] construction technique and strict adherence to the erosion control, revegetation, and right-of-way maintenance procedures (included in appendix E1) would minimize any potential for mass wasting and consequent slope instability.

Seismicity includes surface faulting, ground shaking, and earthquake-induced phenomena such as soil liquefaction. Surficial faulting poses the greatest seismic hazard to natural gas pipelines. No faults with surficial faulting within the past 10,000 years would be crossed by any segment of the pipeline (Howard et al., 1978). While numerous earthquakes resulting in slight-to-moderate ground shaking have been reported in the project vicinity, no adverse impact on the pipeline would be anticipated since modern natural gas pipelines exhibit good inherent ductility.

Several commenters were concerned that a repetition of the 1985 Ardsley earthquake in Westchester County would rupture the pipeline. Although this event was the largest earthquake in southeastern New York in the past 50 years, the mainshock had a magnitude of about 4. Underground pipelines could be damaged in an event with a magnitude of about 6, and would certainly be damaged in the highest level event with a magnitude of 7.75. Another commenter mentioned the proximity of the Ramapo fault to the Franklin D. Roosevelt Veteran's Hospital (approximate MP 390.4). As stated in section 4.1.3 of this FEIS, no surficial displacement has occurred along the Ramapo fault during the last 10,000 years. Seismic hazard would be limited to a large-scale catastrophic earthquake. The likelihood of such an earthquake during the design life of the pipeline facilities is remote. See section 5.12.4 for discussion of USDOT safety requirements related to seismic events.

Severe ground vibrations in cohesionless saturated soils can cause temporary increases in pore water pressure. This phenomenon may cause soils to liquefy. Due to the small percentage of susceptible soils and the seismic history of the project area, liquefaction should not affect construction and operation of the pipeline and appurtenant facilities.

Subsidence from either karst development or underground mining could result in loss of bearing, weakening or even rupturing underground pipelines. Millennium identified shallow carbonate rock formations that may be susceptible to solution and development of karst topography at MP 87.3, and between MPs 330.3 and 340.1, MPs 340.5 and 341.2, MPs 349.5 and 352.0, MPs 353.1 and 353.6, and MPs 355.4 and 362.4. However, geologic hazard due to subsidence is remote. Only very large rapidly forming sinkholes would be a significant concern to welded steel pipelines. Such sinkholes are not known to exist in the project area. Furthermore, sinkhole development near the surface would be identified through aerial inspections, ground patrol, and leak detection surveys. If properly filled and stabilized, any cavity at or near the surface should not pose a hazard to pipeline construction or operation.

5.1.2 Site-Specific Impact

Millennium identified one area at Chautauqua Creek (MP 42.9) where the banks are very steep with wet gravelly soils that may be susceptible to landslide. Millennium states that landslide mitigation may include benching the slopes (e.g., two-toning) or the use of additional right-of-way width. However, while safety and spoil storage space requirements would need to be considered, the construction work area requirements would be minimized as much as possible because of the unique features of the gorge. See further discussion and recommendation for the Chautauqua Creek Gorge in section 5.5.2 and table 5.8.3.2-1.

3/ Two-toning is often used in side hill construction and involves cutting the side slope and using the fill to establish two level work spaces on the side hill, one for equipment passage and one for the trench.

We received several comments regarding the proposed route's potential to affect unique geologic formations in the Rock City State Forest. The pipeline would cross the NYSDEC's State Reforestation Land 8, which contains an area known as Rock City near MP 90.5. A comment letter received from the State University of New York at Buffalo's Department of Geology stated that this portion of the proposed route is in the vicinity of the type locality for the Salamanca Conglomerate stratigraphic unit. The Department of Geology has received state funding to perform a geologic study that includes the Salamanca Conglomerate, which is scheduled to begin in May of 2001.

Millennium estimates that the crossing length would be about 6,132 feet and that the construction work area would be about 800 to 1,000 feet north and west of the Rock City area and the associated geologic formations. 'Millennium has not identified any unique geologic features that would require blasting or other special construction procedures. Access has been denied by a nearby landowner who commented that his property (three parcels between approximate MPs 90.5 and 91.3) contained the "Rock City" geologic formations. Other landowners also expressed concern about the route in this area. Millennium would assess any unique geologic features and determine whether special construction techniques or mitigation measures are warranted after access to this property is granted.

Six route variations were identified to minimize impact in this area of new right-of-way (see discussion of Little Valley Route Variations in section 6.3.2). None offered a significant advantage over the proposed route. However, because the survey has not been completed on this segment, we recommend that:

- **Before construction, Millennium file with the Secretary of the Commission (Secretary) the results of surveys conducted in the area between MPs 90.5 and 91.3 when access is obtained, and any mitigation plans proposed to minimize impact on the "Rock City" geologic formations for review and written approval of the Director of the Office of Energy Projects (OEP).**

A landowner commented that he would like Millennium to remove an old existing oil pipeline near MP 227.0. Millennium stated that this pipeline is about 150 feet north of the proposed pipeline and that it has no plans to remove other pipelines. We cannot recommend removal of the oil pipeline since it would require disturbance outside of Millennium's construction work area, and its removal would not be required for installation of the proposed pipeline.

The owner of the bluestone quarry near MP 269.7 commented that construction of the pipeline would disrupt mining operations. Millennium stated that the pipeline would be about 1,250 feet south of this quarry. A commenter stated that the mine was temporarily closed by the NYSDEC, and the owner is in the process of completing requirements for the permits to reopen the quarry. There is a second non-active mining operation in the same area on Bryce Road. Access would be maintained on Bryce Road throughout construction. If the quarry is reactivated and should extend into the permanent right-of-way, the 50-foot-wide easement could not be mined. This would be taken into consideration during easement negotiations or subsequent damage payments.

The NYSDEC commented that disturbance of old and existing gas/oil production well lines, which are at or near the surface, could result in spills that could impact water quality. Millennium's ECS includes an SPCC Plan that addresses how Millennium would contain and cleanup inadvertent spills (see section V of the ECS in appendix E1). These procedures include the provision that the contractor's foreman and inspector's vehicles be equipped with spill kits containing absorbent materials for petroleum products. We believe that implementation of these procedures would allow for rapid containment and cleanup of spills, including those within oil/gas production fields.

5.2 SOILS

The impact of construction on soils can be effectively reduced through use of appropriate erosion control and revegetation plans. A number of comments were received during the scoping process on the issue of erosion control and the protection of agricultural land during construction. Millennium would implement the procedures identified in its ECS, which incorporates our Plan as well as specific recommendations made by the NYSDA&M (see appendix E1). In addition, Millennium has prepared a site-specific plan (the Black Dirt Plan) for construction and operation through the black dirt area in Orange County (see appendix E2). Implementation of the ECS, the Black Dirt Plan, and our Plan would minimize the potential for erosion, soil compaction, introduction of rock into topsoil, and poor or very poor revegetation.

Millennium would also employ at least one agricultural inspector for each spread in addition to the other environmental inspectors. The agricultural inspector would be qualified to handle all aspects of agricultural management and would be responsible for construction activities being done in accordance with the agricultural conditions of the ECS (section III.A through III.H) and other pertinent requirements. All erosion and sedimentation control permits required by the state would be filed with the Commission.

5.2.: General Construction and Operational Impacts

Pipeline construction and operation could adversely affect soils in several ways. Potential increases in soil erosion (from water and/or wind), loss of soil productivity through soil compaction, damage to soil structure, loss of soil fertility by inversion of soil horizons (i.e., mixing of topsoil and subsoil), and damage to drainage tile systems could result in poor or very poor revegetation, which is necessary for stabilization and restoration of the construction right-of-way. Most of New York's soils are glacially derived and have a thin (about 3 to 12 inches thick) layer of topsoil. The relatively high year-round moisture content of soils in the project area makes them susceptible to long-term damage from construction when wet, which can lead to a condition of soil plasticity (a liquid-like state of consistency). The discussion below focuses on impacts and mitigation to soils in general and in agricultural areas. The site-specific plan for the Black Dirt area is discussed in section 5.2.2.

Soil Erosion

Potentially, one of the most severe impacts on soils from pipeline construction is erosion. Many stages of pipeline construction, including vegetation clearing, grading, topsoil segregation, open trenching and backfilling destabilize the soil material and make it susceptible to water and wind erosion. The most susceptible time for erosion to occur is after initial vegetative clearing and grading and before reestablishment of a vegetative cover. A soil's susceptibility to erosion varies and is a function of its characteristics, such as soil texture, structure, topography (steepness of slope), amount of surface cover (vegetative or other), and climate. Erosion potential increases the longer soils are left bare. Erosion from water primarily occurs in loose soils on moderate to steep slopes. Many glacial till subsoils are proportionally high in silt and remain better bonded than sandier subsoils when exposed. However, gullying can occur along backfilled trenches with their destabilized spoil (subsoil and substrata) materials. Wind erosion can occur in dry, sandy soils where vegetative cover is difficult to establish and maintain. Soil erosion could also result from off-road vehicle traffic, resulting in ruts and gullies on the sloped portions of the right-of-way following construction.

Soil erosion for all affected soils can be reduced with both temporary and permanent erosion control practices. These controls include temporary and permanent structures such as slope breakers, sediment barriers, and trench barriers and breakers. An erosion hazard can also be reduced by stabilizing the soil surface with temporary and permanent planting and mulching, minimizing the time of soil disturbance, avoiding construction during periods of maximum runoff, and reestablishing contours and vegetative cover as soon as possible. Many potential impacts from soil erosion can be reduced by minimizing the duration of time between initial grading and backfilling and restoration of the right-of-way.

Soil Compaction and Damage to Soil Structure

The movement of heavy construction equipment back and forth along the construction right-of-way and access roads can result in soil compaction. This can have severe impact which can be problematic in agricultural and residential areas. Soil compaction damages soil structure and reduces pore space which impedes the movement of air and water to plant roots, resulting in loss of soil productivity and lower growth rates. Damage to soil structure makes soils more susceptible to erosion and inhibits natural drainage. When soils are wet, compaction and rutting invert or mix the fertile topsoil and the subsoil. Generally, soil is most prone to structural damage during the wettest part of the spring and fall seasons, or in areas of poor drainage. However, abundant year-round moisture in the Northeast makes the vast majority of glacial till, alluvial, and lacustrine soils prone to compaction and structural damage during and following each heavy rainstorm. Clodding and/or rutting at shallow depths complicates planting in agricultural areas and can increase the erosion potential.

Mitigation measures to reduce soil compaction and soil horizon inversion begin with scheduled avoidance of heavy construction and restoration during excessively wet spring and fall periods. Topsoil segregation and subsurface plowing (deep ripping and soil-profile shattering), particularly in agricultural areas, can help control and mitigate the multiple effects of soil compaction due to construction.

In agricultural areas where bedrock is less than 20 inches below the surface, the ECS requires Millennium to strip at least two-thirds of the subsoil from the construction work area and to store it separately from the conserved topsoil and the trench spoil. Alternatively, Millennium may replace subsoil in these areas with imported subsoil approved by the agricultural inspector. The imported subsoil would be used as cover over rock backfill to deter rock uplift caused by frost action. Millennium would also decompact soils in agricultural land in accordance with its ECS. Millennium's agricultural inspectors, in consultation with the NYSDA&M, would be responsible for determining if soil and weather conditions are suitable for construction or restoration activities in agricultural fields. This may include overwintering (see recommendation in section 5.2.2).

Loss of Soil Fertility

Trenching and backfilling, as well as the concentrated movement of construction equipment along the construction right-of-way, can result in mixing of topsoil and subsoil and can dilute the productivity of the soil by mixing the physical and chemical properties of the topsoil with the low fertility subsoil. This is especially true in the thin, glacially derived loams of the Northeast. In addition, construction activities, including trench blasting in shallow-to-bedrock soils, could introduce rock into topsoil and interfere with the operation of agricultural equipment.

Mitigation measures include topsoil segregation before trenching in cropland, hay, improved pasture land, wetlands (without saturated soils or standing water), and residential areas, and the removal of excess rock having a 4-inch or greater diameter from the disturbed portions of the soil profile (soil horizons) during the progressive phases of soil restoration as required in Millennium's ECS. However, even with careful topsoil segregation, some mixing of the topsoil and subsoil can occur during backfilling and restoration. Following construction, the rock content of the disturbed area would be comparable to the surrounding undisturbed areas. Fly-rock from blasting can be contained by matting or controlled blasting techniques. Although some loss of soil fertility may be expected immediately following construction, these measures can help minimize the severity and duration of the impact.

Noxious Weeds or Soil Pests

Construction equipment traveling from noxious weed-infested fields into previously weed-free areas could facilitate the dispersal of noxious weed seed and propagules, and could result in the establishment of noxious weeds in areas where none or relatively few existed before construction. The degree of this impact would depend on the species of weed, its prevalence in the area prior to construction, and the intensity of the construction-induced dispersal. During wetland delineation, Millennium identified wetlands with the exotic noxious weed purple loosestrife, phragmites, and Japanese knotweed. These species are invasive and have the potential to be spread to other wetlands and streams by construction activities (see section 5.7.3 for further discussion of purple loosestrife).

In response to concerns about the parasitic nematode, Millennium has consulted with the U.S. Department of Agriculture. None are believed to be present in the project area. If found, Millennium would implement appropriate mitigation in consultation with the appropriate agencies and the NYSDA&M as necessary to prevent the spread of noxious weeds or soil pests.

Poor Revegetation

Revegetation is necessary for the stabilization and restoration of the construction right-of-way. Revegetation potential is inhibited by soil erosion (from water and/or wind), loss of soil productivity through soil compaction, damage to soil structure, loss of soil fertility (i.e., mixing of topsoil and subsoil), damage to drainage tile systems, seeding methods, and planting conditions. The effect of construction on these factors could lead to poor or very poor revegetation potential.

Mitigation measures include soil additives and seeding requirements in accordance with written recommendations obtained from the local soil conservation authority or land management agencies. To minimize the time bare soils are exposed, Millennium is required to complete final grading within 10 calendar days of backfilling, weather and soil conditions permitting. If unsuitable soil conditions for final grading persist for more than 14 calendar days, temporary stabilization measures (including temporary seeding or mulching) would be completed. However, in no case would final grading be delayed beyond the next seeding season.

Millennium has contacted the local NRCS district office for recommendations regarding seed mix requirements. These would be included along with other appropriate agency recommendations or requirements, including those of the COE, on the construction alignment sheets. The proposed seeding mixes are listed in tables 2a, 2b, and 2c of the ECS (see appendix E1). Millennium would file additional correspondence received from agencies with the Commission.

Restoration work would be performed by personnel familiar with local horticultural and turf management practices. Postconstruction monitoring would continue until revegetation is successful and would be conducted for at least 2 years to determine the need for additional restoration. Any required mitigation (e.g., importing of additional topsoil, seeding) would be done by Millennium. Routine vegetative maintenance clearing would not be done more frequently than every 3 years, except to facilitate periodic corrosion and leak surveys.

Because off-road vehicles (ORV) can affect revegetation on the right-of-way and contribute to rutting and soil erosion, efforts would be made to control unauthorized ORV use of the right-of-way (see section 5.8.3).

Potential Changes to Drainage

Trenching and sidehill (cross slope) construction grading can alter the natural, lateral drainage pathways along the subsoil horizons of many glacial tills and other affected soils. This occurs when trenching obliterates the natural planes of drainage and are evidenced by concentrated points of seepage or drainage accumulation that are created or enlarged along the trench or the side cut. These impacts would be mitigated after the extent of damage has been observed as part of post-construction monitoring (see section III of the ECS).

Movement of heavy construction equipment along the construction right-of-way could cause breakage or misalignment of drain tiles. Trenching could also cause drain tile damage and obliterate old "stone drain" lines, affecting farm management (tillage, planting, and harvesting) by causing wet unworkable conditions. This would lower future crop production if such damage is not corrected. Although the location of old, yet functioning, stone drains can seldom be determined before construction, the mitigation of drain tile damage can be helped by locating the fields with drain tiles during preconstruction consultation with landowners and appropriate Federal, state, and local conservation agencies. Drain lines that may be affected by construction would then be clearly staked before construction. Tile damage from vehicular movement or trenching would be repaired by probing the tile to determine the extent of misalignment, or breakage, and replacing the damaged sections. Affected stone drains are usually difficult to detect until the damage is noted by concentrated seepage and saturation during or after construction. Damaged stone drain systems in the project area cannot be repaired and would be mitigated with replacement drain tile systems.

Millennium has contacted landowners and the local NRCS to identify the locations of drainage tiles and has identified those fields with drainage tiles on its construction alignment sheets. Millennium proposes to bury the pipeline with a minimum of 4 feet of cover to allow 1 foot of cover under the drainage tile, and to repair or replace any tiles that are broken or damaged (see section III of Millennium's ECS). All agricultural areas would be monitored for crop productivity for 2 years following construction, and appropriate mitigation (i.e., additional decompaction, additional rock removal, and/or installing additional drain tiles) would be done as necessary to correct for reduced crop productivity.

5.2.2 Site-Specific Impact

Millennium's CAS and associated CAS notes detail the placement of erosion controls, the locations of drainage tiles and topsoil segregation, and other site-specific construction requirements developed in consultation with the NYSDA&M, the NYSDEC, and others. The NYSDA&M's concerns include implementation of its agricultural mitigation standards, as outlined in its "Pipeline Right-of-Way Construction Projects – Agricultural Mitigation through the Stages of Project Planning, Construction/Restoration and Follow-Up Monitoring" and "Pipeline Construction-Trenching and Its Effects on Natural Subsurface Drainage, Impacts and Mitigation." These recommendations are incorporated into Millennium's ECS or the CAS.

In addition, Millennium would continue to work with NYSDA&M to make necessary adjustments to the pipeline route to take into account the unique soils and terrain crossed. These soils include those with long steep slopes on glacial till and/or shallow bedrock soils, those on moderate to steep slopes on lake-laid silty/clayey sediments, or those on mantles of glacial outwash underlain by lake-laid silty/clayey sediments. Millennium would file any route changes resulting from these consultations with the Secretary for the review and written approval of the Director of OEP before construction (see recommendations 4 and 5 in section 7.2).

The NYSDA&M identified several other concerns in its review. First, the NYSDA&M expects that as much as 20 percent of the land that Millennium classified as open land is actually used for agricultural purposes. Subtracting out the open land in Rockland and Westchester Counties, which is most probably open land because of the general rural-residential character of these counties, an additional 28 miles of agricultural land use could be affected by the pipeline crossing of the other counties. This would bring agricultural land to about 87.4 miles, or about 23 percent of the total land crossed by the pipeline. Millennium states that it would comply with our Plan, which requires topsoil segregation in annually cultivated or rotated agricultural land, hayfields, and other areas at the landowner's request. Therefore, any areas currently classified as open land that are actually used for agriculture under the definitions identified in Millennium's ECS and our Plan would be protected as agricultural land and Millennium would construct on and restore such lands accordingly.

The NYSDA&M also commented that a 35-foot separation should be required in agricultural areas where the pipeline would be placed adjacent to Columbia's Line A-5 and Line A-5 is not abandoned by removal (MPs 154.3 and 285.6). The NYSDA&M believes that future maintenance of the new pipeline, and Line A-5 if it were sold or operated for other purposes, may require digouts or replacements and that a 35-foot separation would allow these maintenance activities to be carried out without damage to the other pipeline. The NYSDA&M contends that, if Line A-5 is maintained in service, there would be insufficient space with the proposed 25-foot separation for full width topsoil segregation, spoil storage, and complete decompaction activities if either pipeline (and, in particular, the old pipeline) required maintenance during operation.

Millennium proposes to place its pipeline adjacent to either Columbia's Line A-5 or other pipelines for about 162.9 miles between Chautauqua and Delaware Counties (MPs 33.5 to 285.6). These areas include not only agricultural land, but wetlands, uplands, forest, and open land not used for agricultural (including pasture) purposes. About 50.6 miles of agricultural land and another 16.6 miles of open land (assuming about 20 percent of the open land is also used for agricultural purposes) would be crossed in this area for a total of about 67.2 miles of agricultural land (41 percent of the land crossed). From a design perspective, it would be difficult to consistently increase pipeline separation in agricultural land and then decrease pipeline separation in wetlands and other non-agricultural areas. To require a 35-foot separation in all areas where the new pipeline would be placed adjacent to Columbia's pipelines would increase construction right-of-way clearing requirements in forested areas and bring the construction work area closer to 59 residences. We believe that maintenance activities on the abandoned Line A-5, if it were put back in service, would not be significant and would be spread throughout the length of the pipeline. While the additional 10 feet of separation would provide additional working area, we believe that construction in agricultural land can be performed with a 25-foot separation between pipelines, and that the impact on other land uses resulting from a 35-foot separation would be unjustified considering the uncertainty of reactivation of the old pipeline, the need for maintenance on it, and the added impact this extra work space would cause. Further, pipelines have been routinely and safely constructed and operated with a 25-foot offset from active pipelines.

The NYSDA&M has recommended that the agricultural inspector would be responsible for altering the timetable of restoration if it was determined that overwintering soil stabilization methods are important to restoration success. Overwintering of soil would mean deferring final grading, decompaction, and planting until the next dry season rather than risk additional compaction by doing such activities in wet soils. Overwintering also protects topsoil by allowing for trench settling to take place before final grading. Such methods are suitable for thin glacially-derived agricultural soils.

Section VI.A.1 of our Plan states that every effort should be made to complete final cleanup of an area (including final grading and installation of permanent erosion control structures) within 10 days after backfilling the trench in that area. If the schedule cannot be met, final cleanup must be completed as soon as possible. If the agricultural inspector determines that final cleanup should be delayed and that portions of the construction work area must be overwintered, then a plan should be prepared that identifies the right-of-way stabilization procedures that would be used and the areas where overwintering would occur. Therefore, we recommend that:

- **Millennium modify its ECS to include a contingency plan, developed in consultation with the NYSDA&M, for overwintering agricultural areas and file it for review and written approval of the Director of OEP before construction. If the NYSDA&M agriculture inspector directs Millennium to delay final cleanup, Millennium should file a report with the Secretary identifying these locations by milepost.**

The NYSDA&M's other comments concerned Millennium's ECS and generally focused on additional clarification of specific sections of the ECS. These comments included three additional points regarding the labeling and/or footnoting of Figure 15 of the ECS:

In agricultural land where new construction occurs adjacent to an existing pipeline with grass ground cover, the area of unstripped topsoil (by the existing pipeline) having a visual barrier (layer) of straw and used for excess spoil storage, will undergo only the second phase of decompaction (i.e., "subsoil shattering") together with rock cleanup and surface tillage.

2. In agricultural lands, wherever topsoil is stored on unstripped topsoil, in both plowed or grass covered fields, only the second phase of decompaction (i.e., "subsoil shattering") will be applied together with rock cleanup and surface tillage.

3 In Figure 15, the portion labeled as "Lift & Lay New Pipeline Or Plowed Field" illustrates spoil material on a storage zone which is stripped of topsoil, and excess spoil material stored on the stripped construction zone. This portion of Figure 15 applies to both varieties of agricultural land (i.e., plowed or in grass ground cover) for "lift-and-lay" pipeline construction as well as "new" pipeline right-of-way with no existing adjacent pipeline; and it also applies to plowed fields where construction will occur adjacent to an existing pipeline. The necessary clarification could be provided by footnoting or modified labeling (e.g., Grass Ground Cover and Plowed Field for Lift & Lay Construction or New Pipeline Right-of-Way Construction, or For Plowed Field Adjacent to Existing Pipeline).

To ensure these comments are incorporated into Millennium's ECS, we recommend that:

- **Millennium continue consultations with the NYSDA&M regarding specialized construction procedures in agricultural areas that should be incorporated into the ECS. The finalized ECS should be filed with the Secretary, before construction, for review and written approval of the Director of OEP.**

There is a potential for soil chemistry to be adversely modified if large amounts of wood chips are spread on the right-of-way. This can alter the soil's carbon/nitrogen ratio and significantly slow revegetation. Millennium indicates that up to 2 inches of wood chips may be spread over the construction work area (section II.C.2 of the ECS). In our Plan, we recommend that, if wood chips are used as mulch, an additional slow-release nitrogen be added to the right-of-way to minimize the effect on the soil's carbon/nitrogen ratio (section V.F.3.d of the Plan). Millennium proposes to add 12 to 15 pounds of nitrogen (at least 50 percent of which would be slow release) per ton of chips to aid in revegetation. However, we have recommended that Millennium revise section II.C.2 of its ECS to reduce the amount of wood chips spread on the construction right-of-way. In accordance with its ECS and our Plan, revegetation would be considered successful only if perennial non-nuisance vegetation is similar in density to adjacent undisturbed land.

Black Dirt Plan

Since publication of the DEIS, Millennium has prepared a site-specific plan for the black dirt area in the Towns of Minisink and Warwick to address concerns identified by landowners and the NYSDA&M (see appendix E2). This Black Dirt Plan includes a route variation, in addition to the line change identified in the October 1998 filing, to address construction issues related to the crossing of Mission Land Road and the Pochuck Creek (see section 6.3.12). This Black Dirt Plan was developed in cooperation with and reviewed by the SHPO, NYSDA&M, Orange County Soil and Water Conservation District (SWCD), Orange County Cornell Cooperative Extension, the Wallkill Valley Drainage Improvement Association, and affected landowners. It is the result of numerous meetings and consultations. The NYSDA&M determined that the Black Dirt Plan (December 19, 2000) adequately addresses their concerns (NYSDA&M, 2001).

Geotechnical and geomorphological testing was conducted in March 1999. Six evenly-spaced soil cores were taken in the drained peat fields in three peat deposit concentration areas between approximate MPs 350.3 and 353.3 to obtain information on soil type, soil strength, and depth and age of peat deposits. The cores generally revealed an uppermost layer of fine sandy silt highly organic soil containing over 60 percent organic matter ranging between 5 to 8 feet thick. This layer is underlain by a layer of "green" peat containing 18 percent organic matter ranging between 3 to 8 feet thick. Below the peat layers are alluvial and lacustrine deposits. Groundwater occurred at depths of between 5 and 12 feet, and most commonly between 9 and 10 feet below surface.

The three peat-deposit concentration areas were located between the Pine Island Turnpike and the pipeline crossing of that road south of the Wallkill River (segment A, MPs 350.3 to 350.9); between Merritt Island Road and Mission Land Road (segment B, MPs 351.3 to 351.8); and between Pochuck Creek and Glenwood Road (segment C, MPs 352.3 to 353.3). Peat concentrations varied slightly in the three segments. In segment A, the lower peat layer overlays an extremely water-saturated clay ranging between 4 and 9 feet thick. In segment B, the lower peat layer is a relatively thin layer of gravelly sand and clay above the alluvial sands and clays. In segment C, the lower peat layer overlays alluvial sand that range up to 30 feet thick.

Millennium would use the push-pull (or pull-in) construction method in segment A, and the stove-pipe construction method in segments B and C. Soil layers would be segregated and separated by a plastic barrier. All spoil piles would be silt-fenced and covered to reduce loss by wind erosion. The concrete-coated pipe would be installed in a 9-foot-deep trench to allow at least 5 feet of cover over the pipe. Both Merritt Island and Mission Land Roads would be bored, as would the crossings of the Wallkill River, Pochuck Creek, the dike and pumping system at Pochuck Creek, and the drainage ditch east of Glenwood Road. There would be a minimum of 5 feet of cover under each stream and beneath the three drainage ditches that would be bored. No open-cut crossings of levees, dikes, or pumping systems are proposed.

Specialized equipment would be used to restore the construction work area to grade. Millennium would monitor the black dirt area for a period of 5 years after restoration and would repair or pay for repairing any fields crossed in this area that do not achieve approximate preconstruction annual crop yields during this period. Millennium would also compensate landowners in areas on or adjacent to the construction work area for crop yields that are decreased as a direct result of pipeline construction and would take necessary steps to restore yields to normal production.

On February 11, 2000, the NYSDA&M, COE, FWS, and one landowner (DeBuck) met with Millennium and discussed two options for one segment of pipeline between approximate MPs 352.4 and 353.3: (1) placing the pipeline within an existing drainage ditch; and (2) removing and replacing the existing pipeline from the center of the field. This segment would extend approximately 1,500 feet west and 2,800 feet east of County Road 26 (Glenwood Road) and would affect two landowners (DeBuck and Shapiro). Both landowners indicated a preference for installing the pipeline in the drainage ditch and converting the ditch to an access road for the landowners by covering the pipeline with a layer of clay, geotextile fabric, and 18 inches of gravel. Subsurface drainage would be installed to accommodate the loss of this section of drainage ditch. Offsite compensatory mitigation developed in consultation with the COE may be required for this taking of waters of the U.S.

Amish Farms

About 20 Amish farms would be crossed between approximate MPs 72.9 and 80.0. During field meetings in August and September 1999 between these landowners, NYSDA&M, the Cattaraugus County SWCD, Cornell Cooperative Extension of Cattaraugus County, and Millennium, the landowners cited numerous examples of farm field damage as a result of 1980 pipeline construction adjacent to Millennium's proposed route. Compaction, excess rock, and trench seepage and settling (often requiring installation of new drain lines) were the most frequently cited problems. These concerns are especially important because of the Amish culture's traditional use of non-mechanized implements in land tillage. Millennium indicated that it would repair field damage caused by pipeline construction performed by Columbia in this area.

Other concerns include reliance on shallow sources of gravity-flow water for home use, dairy facilities (including milk cooling), pastured livestock watering ponds, and ponds for supplying ice (for Amish ice houses and other cooling purposes) (see section 5.3.1.2). In addition, temporary fencing and gates would be required for pastured livestock, and no project activity would be allowed on Sunday on these properties.

The NYSDA&M, during field review with the NYSDEC, identified three parcels (03C07 and 03C08 [MP 72.9] and 03C49 [MP 80.0]) that included classified wetlands (see table I1 in appendix I, wetlands W083 and W094, respectively). Another parcel (03C47 [MP 79.9]) also included wetlands, but was determined to be an upland. The NYSDA&M recommends that: (1) the preexisting problems with poor right-of-way restoration be rectified during construction of the new pipeline; (2) proposed construction be completed in accordance with all requirements of Millennium's ECS and our Plan; (3) the wetland classification be modified; and (4) agricultural or upland construction and restoration techniques be used in parcels 03C07, 03C08, 03C49, and 03C47.

In its comments on the SDEIS, the NYSDA&M also recommended a minor route change on parcel 03C17 between approximate MPs 74.05 and 74.35. This modification was reviewed in the field with Millennium and the Cattaraugus SWCD in 1999. The modified alignment would begin at the pipeline crossing of State Route 241. To avoid the steep slope at State Route 241, construction across the farm's best crop field, and a stream crossing at the base of a slope, the new alignment would stay at the same elevation as State Route 241 and cross unimproved pasture (north of the crop field). The modified alignment would be between 200 and 300 feet north of the existing pipeline and would be about the same length.

Millennium may modify the pipeline route alignment within a property to address landowner needs without FERC review as long as the change does not affect a sensitive resource. If the landowner concurs with the route change recommended by the NYSDA&M, then this change can be made pursuant to recommendation 5 of this FEIS.

5.2.3 Aboveground Facilities

None of the three proposed measuring facilities or the Union Center Regulator Station would affect prime farmland soil. The Wagoner Station would require a 0.5 acre forested area adjacent to the existing Milford Compressor Station. The soils at the Wagoner Station site include the extremely stony Wurtsboro-Swartswood-Oquaga soil association. The Ramapo Station would be constructed on the site of an existing metering station, which would be removed. The Mount Vernon Station would be constructed on a 200-foot by 200-foot site in the parking lot of a property in Mount Vernon. The Union Center Regulator Station would require 0.7 acre, most of which would be within the permanent right-of-way.

5.3 WATER RESOURCES

5.3.1 Groundwater

5.3.1.1 General Construction and Operational Impact

Construction activities could result in impact on groundwater resources. However, most of the potential impact would be avoided or minimized by the use of both standard and specialized construction techniques.

Shallow aquifers could experience minor impact from changes in overland water flow and recharge caused by clearing and grading in the construction areas along the proposed alignment. Enhanced water infiltration provided by a well-vegetated cover would be temporarily reduced until the area is revegetated. Near surface soil compaction caused by the weight of heavy construction equipment could also reduce available pore space to transmit water to the subsurface. This impact would be short-term and would not be expected to significantly alter the groundwater resources because the construction right-of-way, in general, is a small portion of the total groundwater recharge area.

Trench dewatering may be required in areas where the proposed construction intersects groundwater. Dewatering activities may affect groundwater by decreasing water levels in the immediate area of the dewatering pumps or trenches or increasing water levels in the area where the pumped water is discharged. Because construction activities at a specific location are of relatively short duration, associated dewatering would only be a temporary activity with minimal impact. Our Procedures and Millennium's ECS require that all water produced from dewatering operations be discharged into well-vegetated upland areas or into containment structures. To promote recharge to the affected aquifer via infiltration or runoff to surface water bodies, all discharges should be within the same hydrogeologic regime or sub-basin from where the dewatering originated. Any deviations from discharging into the same hydrogeologic sub-basin would be noted on the CAS and any necessary approvals would be acquired in advance from the appropriate Federal and state agencies (see discussion in section 5.3.2 on hydrostatic testing). Use of these guidelines would result in minimal impact on the aquifer from dewatering activities.

Grade and trench blasting would be required where bedrock is exposed or less than 6 feet below the ground surface if other equipment cannot open a trench. Use of appropriate blasting procedures can minimize ground motion. This would then lessen the possibility of disrupting existing confining layers, creating new fracture openings or reducing or sealing existing fractures that would alter groundwater flow characteristics. Millennium would require its contractors to use procedures that would ensure that air blast and ground vibration limits are set at thresholds below levels at which blasting damage is likely to occur. Millennium would also identify provisions for correcting problems that may arise, including compensation for assessed damages and making provisions for repair with local contractors.

Landowners are often concerned about changes in water quality or flow of their water wells as a result of construction activities. Where water supplies are shallow, there could be some temporary and localized decreases in groundwater quality and recharge rates because of grading and trenching (which may require blasting) or near surface compaction during clearing or grading. These would be expected to be short term interruptions only and should not affect long term groundwater quality and recharge rates. Millennium would conduct pre- and post-construction water quality and quantity testing of wells and springs used for drinking water purposes within 150 feet of the construction work area where approved by landowners. Testing would include pump inspection, flow rate quantification, and collection of the following water quality parameters: coliform bacteriological cultures, total and dissolved lead, nitrates, nitrites, total and dissolved iron, total and dissolved manganese, sodium, pH, hardness, alkalinity, and turbidity. Temporary fencing would also be erected around all private water supply wells identified within the construction work area to minimize any impacts. If a water well or spring is damaged as a result of Millennium's activities, Millennium would provide a temporary water source, and repair or replace the well.

Groundwater levels could also change in bedrock aquifers during construction if previously sealed fractures at the surface are exposed during trench excavation to create more flowpaths for aquifer recharge that may result in local flooding of adjoining properties. Generally, this is not a widespread problem and would be corrected during restoration when the trench is backfilled and the right-of-way restored to pre-construction contours. If the trench is not constructed with adequate trench barriers (or "plugs", as identified in our Plan), new flowpaths could be created for groundwater migration along the pipeline trench. This would be addressed during construction by installation of trench barriers and breakers at specified intervals (a requirement of the ECS and the Plan) and by followup monitoring after construction.

Refueling of vehicles and storage of fuel, oils, lubricants or other related materials during the construction phase of the pipeline could create a potential contamination hazard to aquifers. Small, localized spills of these materials could occur during construction and could affect aquifer quality. Spills may also occur if an existing pipeline is ruptured during construction. Further contamination could continue to occur for a short time thereafter as precipitation passes through the affected soil and transports more material to the aquifer.

These types of impacts can be avoided or minimized by restricting vehicle refueling areas and maintenance and storage facility locations, and requiring immediate cleanup of any spills or leaks. Millennium has developed a SPCC Plan that outlines protective measures to minimize the possibility of a spill and the response measures to be followed in the event of a spill or leak (see section V of Millennium's ECS in appendix E). These measures include designation of fuel and hazardous materials storage areas, containment requirements for fuel depots, minimum setback distances from natural resource areas for specified refueling and maintenance activities, clean up materials that need to be on site, and spill reporting procedures. In those aquifer protection districts that have specific requirements, Millennium would follow the district-specific procedures which include prohibitions on refueling in specially designated areas, construction of silt fences and booms, or specification of the types of sorbent materials that should be available.

5.3.1.2 Site-Specific Impact

Aquifers

Millennium identified 13 major aquifer areas (including 7 NYSDEC recognized primary aquifers and 5 EPA designated sole source aquifers) that would be crossed for a total of approximately 92 miles (see table 4.3.1-1). No specific requirements for crossing these aquifer areas have been identified to date, and no impact on these aquifers would be expected from construction. The pipeline would also cross five aquifer protection areas (Mayville, Lower Cassadaga Valley, Town of Union/Villages of Johnson and Endicott, Hillcrest, and Chenango) and four public water supply watersheds, which may have more stringent site-specific protection requirements. Within each public supply watershed, Millennium would implement its SPCC Plan, as well as any local spill prevention and control plan, and would ensure that sorbents would be available in all vehicles working within the watershed. In addition, silt fence or booms would be installed around refueling area fences, and refueling would be restricted to the specified extra work areas in the watersheds listed below:

Ripley Public Water Supply Watershed, Ripley (MPs 37.7 to 39.9): Noble Road/Belson Road (approximate MP 37.7), Parker Road (approximate MP 39.0), and Douglas Road (approximate MP 39.8);

Westfield Public Water Supply Watershed, Westfield (MPs 41.7 to 43.6): Sherman Road (approximate MP 41.8), Ogden Road (approximate MP 43.4), and Bloomer Road (approximate MP 44.8);

We-Wah Lake Watershed, Tuxedo (MPs 368.2 to 369.3): Intersection of Route 7 and Sterling Road (approximate MP 369.3); and

Grassy Sprain Reservoir Watershed, Yonkers on the 9/9A Proposal (beginning at MP 416.5 for approximate 750 feet).

Millennium has contacted all towns that would be crossed by the pipeline by letter and by telephone regarding permit requirements and special features, such as protected aquifers and water supply watersheds. Any requirements would be included in the revised CAS that would be completed before construction. Any new correspondence on the other public water supply watersheds and resulting changes on the CAS would be filed with the Commission before construction.

One commenter noted that the Croton Primary Aquifer, which underlies the Croton River and adjacent land, supplies water to residents of Briggs Landing and Warren Roads (approximate MP 394.5 on the 9/9A Proposal). Based on site reconnaissance and aerial photography, Millennium found no potable water wells and no residences within 150 feet of the construction work area at this location. The groundwater level in this aquifer is reported by the Village of Croton-on-Hudson to be shallow. However, with implementation of the proposed mitigation, we expect no conflicts or significant impact.

Several commenters on the 9/9A Proposal noted that many areas along the pipeline are subject to flooding and have a high water table. Most of the 9/9A Proposal would be in areas that are either potentially flood-prone or have a possible high water table. We do not believe that pipeline construction or operation would significantly alter the hydroperiod in these areas. In areas subject to erosion via flooding, Millennium would install the pipeline at an adequate depth to prevent damage to the pipe. Construction in areas subject to flooding, those that have a high water table, and/or wetland crossings would be in accordance with Millennium's ECS and the requirements of the COE and NYSDEC. These areas would be restored to pre-existing contours to ensure that water-carrying and absorption capacity would be maintained. Millennium would also design the pipe to have sufficient negative buoyancy (typically concrete coating or set-on weights) to prevent operation or maintenance concerns.

Blasting may be required in areas where municipal water mains are crossed in Westchester County. Millennium is currently coordinating with the local municipalities on the location of these mains and on developing appropriate mitigation measures in these areas.

SPCC Plan

In response to our recommendations in the DEIS, Millennium revised its ECS so that it includes the following: containment dikes would have capacity for at least 100 percent of the maximum storage volume; refueling areas would be located hydraulically down gradient and outside of aquifer protection areas, wherever possible, and if located within an aquifer protection area, the refueling area would be lined; all equipment would be inspected daily for leaks before work within an aquifer protection area; and all vehicles working within aquifer protection areas and public water supply watersheds would have sorbents to cleanup spills that might occur.

In its comments on the DEIS, the DOI stated that the aquifer protection districts should be identified on the CAS and that equipment should be checked every day for leaks regardless of whether the equipment would be working within an aquifer protection district. Another commenter stated that private wells should be tested and monitored for contamination if a spill were to occur upgradient of the capture zone of the well. We believe that this concern would be addressed by implementation of Millennium's SPCC Plan, and the requirement below that Millennium report any water quality complaints and how these were resolved. However, we agree that additional measures could be included in the SPCC Plan to clearly identify water protection districts and minimize the potential for contamination of water supply sources. Therefore, we recommend that:

- **Millennium identify aquifer protection districts and watersheds on its CAS; and**
- **Millennium expand its SPCC Plan to specifically include the following:**

  a. **a requirement that all construction equipment be inspected daily for leaks before work;**

  b. **a listing of specific water supply, municipal, or state officials to be contacted in the event of a reportable spill; and**

  a listing of the requirements of local or state officials concerning construction in aquifer protection areas and public water supply watersheds.

Private Water Wells

Based on consultations with landowners, Millennium identified 235 groundwater wells on properties crossed by the construction work area (see table 4.3.1-2). These are shown on the construction alignment sheets, and their exact location in relation to the construction work area would be verified during easement acquisition before construction. In addition to these wells, Millennium states that any residential or agricultural water supply identified within 150 feet of the construction work area would be subject to the same protective measures identified in the preceding section. However, some residential water supplies in the western part of New York are sited within perched aquifer systems. Penetration of the underlying aquiclude materials (low permeability materials that create the perched water conditions) would promote drainage of the perched water to deeper materials (overburden or bedrock) and potentially reduce well yields. Therefore, we recommend that:

- **Millennium file with the Secretary the location by milepost of all drinking water wells and springs within 150 feet of the construction work area and their distance from the construction work area, before construction. In addition, Millennium should specify which wells would be within perched water systems.**

If blasting is necessary in the vicinity of any agricultural or potable water supplies, Millennium would conduct pre- and post-blast well sampling within 150 feet of the construction area if requested by the owner. In accordance with Millennium's ECS, landowners would be contacted 1 week before blasting is to take place with at least 24-hour confirming notice (section II.H.2). In the unlikely event that blasting activities temporarily or permanently impair water quality or yield, Millennium would provide a temporary water source, and repair or replace the well, or compensate the landowner. However, to ensure that all issues relating to potential impact on water wells would be identified and addressed, we recommend that:

- **Millennium include in its weekly construction progress reports any complaints concerning water supply yield or quality and how each was resolved. Within 30 days**

of placing the facilities in service, Millennium should file a summary report identifying all potable water supply systems damaged by construction and how they were repaired.

One landowner (Mr. Supa) in Broome County (approximate MP 242.0) has repeatedly expressed concern that his spring-fed water supply system would be interrupted or destroyed by construction along the back (southern edge) of his property (see comment responses in appendices O and P). The water supply system was developed in 1992 and supplies water by gravity to the house and barn at 48 pounds of pressure. Mr. Supa stated that the spring provides "soft water," indicating it is not a deep spring. The drinking water supply system includes a spring outlet (e.g., where the water comes out of the ground) and a 1,000-gallon cistern, which are located downgradient from and outside of the construction work area. Also on the property are a separate 0.5-acre pond that is fed by its own spring and a second seasonal spring.

Millennium does not anticipate impacts on the spring and cistern. Millennium states that, based on field observations and topographic maps, there is an approximate 30-foot change in elevation between the construction work area and the drinking water supply spring, and that the spring outlet would be about 75 feet from the construction work area and downgradient. Millennium believes that the water source for this spring and the several others noted on the Supa property is a buried shale layer and states that field evidence supports that this shale layer is well below the bottom of the trench, which would be about 8 feet deep in this area.

We visited this property in 1999 and confirmed that the spring and cistern is at the base of the slope on which the powerline, and proposed pipeline, are located. We also looked at several route variations in this area (see section 6.3.7, Union Center Variations).

To minimize all potential impacts on this water supply system, Millennium is considering a minor realignment that would move the construction work area further upslope and south of the powerline right-of-way. This minor realignment would avoid the seasonal spring, and would move the edge of the construction work area about 165 feet away from the spring and cistern (see discussion in section 6.3.7, Union Center Variations). We have recommended this variation.

Amish Farms

During its review of the project, the NYSDA&M identified an area in western Cattaraugus County between MPs 74.6 and 80.0 where the pipeline would cross several properties owned by Amish farmers. The affected parcels are on the south side of Seager Hill Road, between State Route 241 and County Route 40. According to the NYSDA&M, the natural lateral drainage across the subsoil horizons and shallow, impermeable bedrock result in shallow springs upon which the Amish generally depend for water supplies. The NYSDA&M believes that pipeline construction may alter these natural spring drainage pathways and affect the natural water source/supply on some Amish farms.

The NYSDA&M recommended six measures to develop site-specific information and mitigation plans for construction activities on the affected Amish farms. These measures include: continued consultation to determine the need to supplement individual water supplies during construction; development of an inventory of specific water systems that would be crossed by the pipeline; development of site-specific plans for the re-establishment of water supplies; consideration of minor route variations if vulnerable water sources are identified; finalization of restoration plans following review of actual construction disturbances; and monitoring the re-established farm water source/supply locations to ensure continued yields. In August and September 1999, the NYSDA&M met with the landowners, Millennium, the Cattaraugus County SWCD, and the Cornell Cooperative Extension of Cattaraugus County. Issues associated with the springs on Amish land were discussed and mitigation identified where appropriate (see table 5.3.1-1).

In its comments on the SDEIS, the NYSDA&M made some adjustments and additions to its recommendations on parcels 03C21, 03C23, 03C24, 03C25, 03C26, 03C33/03C34, and 03C42. These include three modifications to the route that have been designated as Keith Road Reroute (parcel 03C026), School House Reroute (parcel 03C33/03C34), and Miller Pond Reroute (parcel 03C42).

Millennium continues to develop its construction plans for the parcels that would be crossed between MPs 74.6 and 80.0. Pursuant to our recommendation 5 in section 7.2, Millennium would file the finalized plans for any route changes made to meet landowner needs with the Secretary before construction.

Millennium has committed to identifying water wells and springs located within 150 feet of the construction work area, and to repair any systems damaged by construction. In addition, Millennium would work with landowners to identify and protect specific resources on affected parcels. We believe that the NYSDA&M's concerns would be addressed on a project-wide basis and that the measures discussed above (see also our recommendations in discussion of private water supply wells above) would be adequate to protect water supply systems on the Amish farms located between MPs 74.6 and 80.0.

5.3.2 Surface Water

5.3.2.1 General Construction and Operational Impact

Pipeline construction and hydrostatic testing could affect surface waters in a variety of ways. Clearing and grading of stream banks, blasting, in-stream trenching, trench dewatering, and backfilling could result in modification of aquatic habitat, increased sedimentation, turbidity, decreased dissolved oxygen concentrations, stream warming, releases of chemical and nutrient pollutants from sediments, and introduction of chemical contamination, such as fuel and lubricants.

The greatest potential impacts on surface waters would result from suspension of sediments caused by in-stream construction and by erosion of cleared stream banks and right-of-way. The extent of the impact would depend on sediment loads, stream velocity, turbulence, stream bank composition, and sediment particle size. These factors would determine the density and downstream extent of the turbid plume of sediment. Turbidity resulting from suspension of sediments due to in-stream construction or erosion of cleared right-of-way areas would reduce light penetration and the corresponding photosynthetic oxygen production. Re-suspension of deposited organic material and inorganic sediments would cause an increase in biological and chemical intake of oxygen, also resulting in a decrease of dissolved oxygen.

Clearing and grading of the stream banks would expose large areas of soil to erosional forces and would reduce riparian vegetation along the cleared section of the stream. The use of heavy equipment for construction may compact near-surface soils, an effect that could result in increased runoff into waterbodies. The increased runoff could erode stream banks, resulting in increased turbidity levels and sedimentation rates of the receiving waterbody. Impact on water temperatures would be expected to be minimal because of the limited length of stream bank canopy that would be cleared for the pipeline crossing. See section 5.3.2.3 for recommendations.

Refueling of vehicles and storage of fuel, oil, or other fluids near surface waters may create a potential for contamination due to accidental release. If a spill were to occur, immediate downstream users of the water would experience a degradation in water quality. Acute and chronic toxic effects on aquatic organisms could result from such a spill. The potential for spills would be reduced by implementation of the required SPCC Plan (see section 5.3.1.1 and section V of Millennium's ECS). The NYSDEC's section 401 Water Quality Certificate (issued December 1999) includes a condition that Millennium require all contractors involved with stream crossings to have oil booms and other sheen control devices available on site and that the contractors be trained in use of these devices (see condition 5.A and 5.B in appendix K).

TABLE 5.3.1-1

NYSDA&M Recommended Mitigation for Water Resources on Amish Land

Parcel Number/ Station Number	Approximate MP	Recommended Mitigation
03C19 3941+75	74.6	Monitor spring source(s) to farm pond to determine potential impact during and after construction. Cattaraugus County SWCD will field review and outline drain line mitigation, if needed (e.g., install interceptor tile line from right-of-way to pond).
03C21 3951+58	74.8	Water source is downslope from and north of the pipeline and 12 feet below surface. Same source also serves as water supply for 03C23 and 03C24. Locate depth of initial bedrock layer upslope along pipeline corridor. If less than 12 feet, develop mitigation plan with Cattaraugus SWCD.
03C23 3985+32	75.5	See 03C21
03C24 3993+25	75.6	See 03C21
03C25 4004+39	75.8	Pond with ice house fed by 3 springs, of which 2 would be crossed by pipeline. Develop an interceptor drain line and sediment control mitigation plan with Cattaraugus County SWCD and landowner to maintain water supply.
03C26 4002+51	76.2	Complex system of springs, pond with ice house and tile drain lines would be significantly impacted on original alignment. Move pipeline from the south side of existing pipeline to north side beginning at east end of 03C25, through 03C26 to east side of Keith Road at west edge of 03C28 (see Keith Road Reroute). Install interceptor tile lines (designed by Cattaraugus County SWCD) to ensure water supply to pond. Mark water line (about 3 feet below surface) so that it is left intact during construction.
03C28 4038+46	76.5	Water supply not verified. Mitigation pending consultation with landowner during subsequent field visit.
03C29 4041+58	76.6	Pipeline would cross spring water supply. Develop mitigation plan with Cattaraugus County SWCD.
03C30 4049+32	76.7	Home and barn water supply may be affected. Need to locate depth of bedrock . Develop mitigation plan with Cattaraugus County SWCD, if required.
03C33/03C34 4067+82	77.0	Pipeline would cross installed shallow spring water supply to Amish schoolhouse (03C33) and spring livestock water supply (03C34). Beginning on west side of Harris Road (at parcel 03C31), move the pipeline to the north side of the schoolhouse and water supply and then continue on the north side of the existing pipeline until parcel 03C35 (see Schoolhouse Reroute).
03C35 4089+21	77.1	Pipeline would cross spring water supply (tiled and non-tiled) to pond. Cattaraugus SWCD to develop mitigation plan.
03C42 4184+06	79.2	New pond for livestock watering and ice for cooling located on pipeline centerline. Move pipeline to north side (crossover existing pipeline) (see Miller Pond Reroute).
03C43/03C45 4195+55	79.4	About 8 recently installed drain lines (about 3 to 4 feet below surface) originate near the Line A-5 right-of-way and outlet towards the southeast. Employ modern drain line repairs. Cattaraugus County SWCD will assess drainage during monitoring phase and provide technical assistance, as needed.
03C49 4225+95	80.0	Water percolates and seeps along existing Line A-5. Install interceptor drains along Line A-5 when drain mitigation is done on the new pipeline.

Adverse effects on water quality could also result from the re-suspension of pollutants from previously contaminated sediments during in-stream excavation activities (Macek et al., 1977). The amount of contamination released from resuspended sediments would depend on the existing concentration and on the sorptive capacity of the surrounding sediments. The use of dry crossing construction techniques to cross streams would substantially reduce downstream migration of resuspended contaminants.

Millennium would verify pipeline integrity by hydrostatic testing, which is conducted by pressurizing the pipeline with water and checking for pressure losses resulting from leakage. About 126,920,000 gallons of water would be needed for hydrostatic testing. Withdrawal of test water from streams and rivers could temporarily affect downstream users and aquatic organisms (primarily fish) if the diversion constituted a large percentage of the source's total flow. Impacts could include temporary disruption of surface water supplies, temporary loss of habitat for aquatic species, increased water temperatures, depletion of dissolved oxygen levels, and temporary interruption of spawning, depending on time of withdrawal and current downstream users. In general, these impacts would be minimized by obtaining hydrostatic test water from waterbodies with sufficient flow to supply required test volumes without significantly affecting downstream flow. Impacts on spawning would further be avoided by performing hydrostatic testing during non-spawning periods (July 1 through September 3 or December 1 through March 3).

Potential impacts resulting from the discharge of hydrostatic test waters into streams and upland vegetated areas would be generally limited to erosion of soils and some subsequent degradation of water quality from increased turbidity and sedimentation. High velocity flows could cause erosion of the stream banks and stream bottom, resulting in temporary release of sediment. Continued erosion of the discharge area could occur if it is not properly stabilized with erosion control devices. Such erosion would be minimized by the use of energy dissipation devices, control of discharge velocity, and proper location of water discharge following testing. A listing of Millennium's proposed hydrostatic test water sources and discharge locations is provided in table 5.3.2.3-6.

5.3.2.2 Waterbody Construction and Mitigation Procedures

In response to concerns raised by Federal, state, and local agencies regarding the potential environmental impact of construction of pipeline projects in general, we developed our Procedures (see FERC website at www.ferc.gov) to provide a minimum level of protection for surface waters affected by pipeline projects. Applicable waterbodies include any streams or rivers with perceptible flow at the time of crossing and other permanent waterbodies, such as ponds and lakes. During development of the Procedures, we evaluated the effectiveness of various crossing methods (including open-cut and dry crossing methods) in mitigating potential impact on surface waters. The Procedures specify construction windows, in-stream construction duration constraints, sediment control procedures, and various fluming requirements to minimize potential impact from construction while providing an appropriate level of protection for a range of waterbody types. Waterbodies classified by the state as sensitive, high quality, or of exceptional value because of the presence of rare species, scenic qualities, recreational values, or important fisheries may require additional mitigation. Some of the more important aspects of the Procedures are summarized below:

> Minor waterbodies (less than or equal to 10 feet wide) supporting coldwater and significant warmwater fisheries would be crossed using a "dry crossing" or flume technique. A dry crossing involves placement of sand bags or other suitable structures in the waterbody channel to funnel stream flow into a flume pipe and past the work area. Trenching is conducted in a dry streambed under the flume pipe, thereby reducing the volume of sediment available for transport. In-stream construction work (except blasting) should be completed within 24 hours.

Intermediate waterbodies (greater than 10 feet wide and less than or equal to 100 feet wide) would be crossed using either a dry crossing or a "wet crossing" (e.g., open-cut trenching) technique in which pipeline installation would be conducted in the water. If a wet crossing is used, in-stream construction work beginning with trenching should be completed within 48 hours unless blasting is required.

Detailed, site-specific construction procedures for crossing each major waterbody (greater than 100 feet wide) would be developed and filed with the Secretary.

Sediment barriers would be installed and maintained on stream banks immediately after initial ground disturbance adjacent to all waterbody crossings.

All construction equipment (except that used by clearing crews) would be required to cross all minor waterbodies with a state-designated fishery classification, and all intermediate waterbodies, on one of three types of temporary bridge: equipment pads and culvert(s), clean rockfill and culvert(s), or a flexi-float or portable bridge.

All stream banks would be stabilized and temporary sediment barriers would be installed immediately or, if stream bank soils are saturated, within 24 hours of completing the waterbody crossing. Sediment barriers would be maintained at all stream banks until revegetation of the right-of-way has been judged successful.

Grading of stream banks for installation of the pipeline and equipment bridges introduces large areas of disturbed earth near the waterbody that are often left exposed for long periods of time. Typically, streams are crossed using specialized tie-in construction crews that complete the crossing before or after the main pipeline crew. While equipment bridges would need to be installed across the waterbody to allow construction equipment access along the right-of-way, soil exposure can be reduced by limiting grading and clearing activities along stream banks. To minimize the amount of disturbed stream buffer areas before the actual stream crossing, Millennium would limit grading to only the area needed to install the equipment bridge and any temporary work space. Any additional grading to the water's edge would be timed so that grading immediately precedes the actual pipeline trenching and installation process.

The NYSDEC, in its section 401 Water Quality Certificate issued for the project in December 1999, requires that Millennium ensure that equipment bridges are constructed so that soil cannot fall into the stream through cracks in the bridge structure. Equipment bridges would be installed and removed within the timing restrictions set forth in the CAS unless the NYSDEC approves a change. The NYSDEC also required that Millennium would restore all stream crossing areas, except for the temporary access roads and at the Hudson River, to pre-existing contours and grades for a distance of 50 feet from the edge of the stream within 24 hours of backfilling the trench.

To allow us to monitor Millennium's implementation of its ECS and our Procedures, our Procedures require that Millennium prepare a schedule identifying when trenching or blasting would occur within each waterbody greater than 10 feet wide, or within any coldwater fishery, and that Millennium file this schedule with the Commission. The schedule would be updated to provide at least 14 days advance notice of the crossing, with 48-hour advance notice for any changes within the 14-day period.

We believe that implementation of the specifications in Millennium's CAS and ECS (which incorporates our Procedures), specifically with regard to construction time windows, erosion control, stream bank stabilization, revegetation, and hydrostatic testing, would minimize impacts on waterbodies that would be crossed by the pipeline. However, because the water quality of surface waters, including surface water discharges and the dredging and filling of waters of the U.S., is regulated by the COE, EPA, and NYSDEC, further water quality protection measures have been required by the NYSDEC in its section 401 Water Quality Certificate and may be required by other agencies. To construct and operate the proposed facilities, Millennium would obtain all applicable permits and comply with the requirements of these permits. These requirements may include site-specific waterbody construction plans or analysis of water samples for various water quality parameters after hydrostatic testing and before discharge. Section 2.7 contains a more detailed discussion of regulatory requirements for this project. Section 5.3.2.3 discusses additional mitigation for site-specific waterbody crossings.

5.3.2.3 Site-Specific Impact

The pipeline would cross a total of 507 waterbodies, of which 493 (97 percent of all waterbodies) would be crossed using dry crossing techniques (e.g., directional drill, conventional bore, dry ditch, or a combination of these techniques). This includes all of the intermittent streams and 294 of the 308 perennial waterbodies. Of the 14 perennial waterbodies that would be at least partially open cut, 3 are between 42 and 96 feet wide, 9 are between 140 and 2,500 feet wide, and 2 are more than 2,500 feet wide (Lake Erie and Hudson River). The East Branch Delaware River (512 feet) would be crossed using a combination conventional bore and open cut/diversion. A summary of Millennium's proposed crossing methods is provided in table 5.3.2.3-1. Of the waterbodies that would be open cut, only Lake Erie, the Hudson River, the Cohocton River, and the East Branch Delaware River would require more than 4 days to cross.

Millennium proposes to abandon the existing pipeline in place at waterbody crossings between MPs 37.2 and 285.6, except for 25 waterbodies between MPs 112.9 and 132.1 where the existing pipeline would be removed (see comment C in table H1 in appendix H). The pipeline would be removed as part of construction of the proposed pipeline. However, the existing pipeline also would be removed in locations where it is exposed during trenching.

TABLE 5.3.2.3-1

Summary of Proposed Waterbody Crossing Techniques

	Intermittent	Perennial	Total
Dry construction techniques:			
Dam and pump or steel dam and culvert	0	279	279
Dam and pump or steel dam and culvert, if flowing; otherwise open cut a/	197	0	197
Conventional bore	1	11	12
Directional drill	0	3	3
Aerial	0	1	1
Lay over culvert 1	0	1	
Open cut b/	0	13	13
Combination bore and open cut	0	1	1
TOTAL	**199**	**308**	**507**

a/ Intermittent streams that have no flow at the time of crossing would be open cut.
b/ Includes Lake Erie which would be open cut, except for the shoreline which would be directionally drilled.

The existing pipeline also would be removed at all waterbody crossings between MPs 285.6 and 376.4, except for the East Branch Delaware and Ramapo Rivers (MPs 287.0 and 370.0, respectively) where the existing pipeline would be abandoned in place. At all locations where the existing pipeline would be removed, removal of the old pipeline and installation of the new pipeline would be within the specified timing windows and at the same time as installation of the new pipeline. The NYSDEC commented that the pipe should be left in place at all waterbodies since removal may violate New York water quality standards and the pipe represents no known hazards. While use of the existing trench may reduce environmental impacts in areas where there is rock and would avoid additional right-of-way requirements, we have no objections to leaving the pipe in place particularly where the pipeline would be installed by conventional bore (Neversink and Wallkill Rivers, and Pochuck Creek) or directional drill (Chenango and Ramapo Rivers). However, we are aware that a landowner has requested that the pipe be removed from Pochuck Creek (MP 352.4) because it is exposed and Millennium has agreed to remove it. Because the Neversink River contains the federally endangered dwarf wedge mussel, we have recommended that the pipe be abandoned in place (see the BA issued January 2001 for the Millennium Pipeline Project).

The NYSDEC noted that 41 of the proposed dry crossings (e.g., dam and pump) involve streams that are more than 30 feet wide at the crossing and that unanticipated failures or adverse weather events would result in water quality violations. To address this concern, Millennium would require that contractors provide 100 percent redundancy in pumping capacity at the site of any waterbody crossing where a dam and pump is required. All pumping operations would be monitored constantly during working hours and periodically during non-working hours. Malfunctioning pumps would be replaced as soon as possible. Millennium's environmental inspectors assigned to monitor the crossing would have stop work authority. Environmental inspectors would also monitor weather conditions before and during all waterbody crossing construction and would include forecasts from the National Weather Service in their records. No construction would begin in a particular waterbody if more than 1 inch of precipitation is forecast during the expected period of in-stream construction activities. If an unforecast precipitation event occurs that might adversely affect water quality, the environmental inspectors would have the authority to require that construction activities proceed around the clock until the crossing is completed. In its section 401 Water Quality Certificate, the NYSDEC required that (except for the Hudson River) no crossing may be started if there is a 40 percent or greater chance of precipitation predicted by the National Weather Service for the area for the expected period of in-stream construction, unless the environmental inspector authorizes construction to begin.

The NYSDEC was also concerned about crossing multiple tributaries of the same stream. Millennium stated that it would require contractors to schedule waterbody construction activities so that no more than one perennial tributary to any stream would be crossed at the same time. This requirement would be included in the CAS.

Millennium received its section 401 Water Quality Certificate from the PADEP for the Lake Erie crossing on March 29, 2000 (see appendix L). Millennium also received its section 401 Water Quality Certificate from the NYSDEC on December 8, 1999 (see appendix K). Although the COE has not yet completed its project review, we find that the proposed crossing procedures and specified mitigation would substantially minimize the impact on waterbodies.

Major Waterbody Crossings

The pipeline would cross 21 major waterbodies (including Lake Erie [32.9 miles], the Hudson River [2.1 miles], and 2 ponds) that are more than 100 feet wide at the crossing location. Table 5.3.2.3-2 identifies each of these major waterbodies and the proposed construction crossing method. Millennium has filed site-specific open-cut crossing plans for each of the major waterbody crossings that would be open-cut, except for the pond at MP 235.2. At this pond and the Indian Kill Reservoir (MP 367.1), only the shorelines would be open cut, and the pipe would be laid on the bottom with no excavation.

TABLE 5.3.2.3-2

Major Waterbody Crossing Techniques

County/ Milepost	Waterbody	Crossing Width (ft)	Proposed Crossing Method	Water Quality Classification a/
0.0	Lake Erie b/	173, 976 (32.9 mi)	Jet sled/barge; directional drill the shoreline	CWF (PA) A (NY)
Chatauqua				
41.0	Tributary Lake Erie c/	160	Dam and pump	C
60.3	Tributary Cassadaga Creek c/	113	Dam and pump	C
Cattaraugus				
111.2	Olean Creek d/	180	Open cut - 6/1 to 11/30	
Allegany				
137.3	Genesee River c/	130	Steel dam and culvert - 6/1 to 9/15	A(T)
Steuben				
181.4	Cohocton River d/	203	Open cut - 6/1 to 9/15	C
Tioga				
230.3	Owego Creek c/	122	Conventional bore - 6/1 to 9/15	C(T)
235.2	Pond e/	140	Open cut	C
Broome				
249.8	Chenango River c/, d/	275	Directional drill, if feasible - 6/1 to 9/15	B
263.2	Susquehanna River c/	369	Conventional bore - 6/1 to 11/30	B
Delaware				
276.0	West Branch Delaware River c/, d/	270	Conventional bore - 6/1 to 9/15	B(T)
287.0	East Branch Delaware River c/, d/	512	Conventional bore/Open cut with diversion - 6/1 to 9/15	C(T)
Sullivan				
307.0	Callicoon Creek c/	190	Steel dam and culvert - 6/1 to 9/15	C(T)
330.0	Mongaup River (Rio Reservoir) d/	675	Open cut - 10/15 to 11/30	B(T)
341.0	Neversink River d/, f/	129	Conventional bore - 6/1 to 9/15	A(T)
Orange				
352.4	Pochuck Creek c/, d/	113	Conventional bore - 6/1 to 11/30	C
357.0	Wheeler Creek d/	345	Open cut - 6/1 to 11/30	D
367.1	Indian Kill Reservoir d/	2,500	Open cut/no trench - 6/1 to 11/30	A
Rockland				
387.5	Pond d/	485	Open cut	D
Rockland/Westchester				
387.9	Hudson River d/	10,900 (2.1 mi)	Open cut - 9/1 to 11/15	SB
Westchester				
396.8	Croton River	290	Directional drill	SC

a/ See table H2 in appendix H for water quality and fishery classifications.
b/ Site-specific crossing plan filed for the directional drill of the shoreline.
c/ Alternate contingency plan filed for the crossing.
d/ Site-specific crossing plan filed for the proposed crossing method. See table 5.3.2.3-3 for description of proposed open-cut plan.
e/ Man-made pond with no specific concerns identified by the landowner for the crossing. No site-specific plan has been filed.
f/ The Neversink River contains two channels, one about 72 feet wide and the second about 57 feet wide.

Although three other waterbodies (Tributary State Drainage Ditch [MP 72.9], and Cayuta [MP 215.0] and Rutgers [MP 344.0] Creeks) are identified as being more than 100 feet wide in table H1 in appendix H, Millennium stated that the actual crossing would be less than 100 feet since associated wetlands were included in the crossing width. Two of these waterbodies would be crossed using dry crossing techniques: Tributary State Drainage Ditch (dam and pump, if flowing, otherwise an open cut) and Cayuta Creek (steel dam and culvert). Rutgers Creek would be crossed using an open cut in accordance with the filed site-specific plan (see discussion below on open-cut crossings).

The Millennium Pipeline Project would be within the Pittsburgh, Pennsylvania, and the Buffalo and New York City, New York COE Districts. The COE has determined that the pipeline would cross navigable waterways and that the project is subject to section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act. Lake Erie, the West and East Branches Delaware River, Hudson River, and Croton River are considered navigable waterbodies by the COE. The COE also mentioned that the Genesee Valley Canal, and the abandoned Chemung and Chenango Canal are section 10 waterbodies. These canals would not be crossed by the pipeline.

Impact on navigation in Lake Erie and the Hudson River would not be significant since only a short segment of the waterbody would be affected at any one time, and navigation could proceed around the construction activities. The West Branch Delaware River would be crossed by conventional bore, and there would be no effect on navigation. The East Branch Delaware River would be crossed using a combination of a conventional bore and an open cut. Navigation may be somewhat restricted (e.g., in the immediate vicinity of construction equipment) but should not be significantly affected because the open cut would be completed in a few days.

In-Stream Sediment Filters

Millennium proposes to use in-stream sediment filter devices (SEDIMAT™ or their equivalent) and turbidity curtains to minimize downstream sedimentation at selected waterbodies (see note A in table H1 in appendix H). The SEDIMAT™ is a flat 4 foot by 10 foot pad that is laid directly in the streambed downstream of the area that would be disturbed. In 1992, it was tested at eight different streams in central and western New York. Seven of the sites were disturbed for pipeline installations; the eighth was disturbed by extensive hand shoveling. Stream widths varied from 10 to 75 feet, stream depth between 6 to 24 inches, and water velocity from 0.8 to 3.3 feet per second. Before construction, the average percent of sediment fines in the streambed was 12.2 percent just downstream of the crossing site. After construction, it rose slightly to 14.7 percent. Where the mats were not used, the average percent of sediment fines rose from 11.5 to 24 percent. According to the manufacturer, SEDIMAT™ are effective in streams with velocities up to about 3 feet per second.

The turbidity curtain is essentially a floating silt fence that filters or minimizes the amount of silt migration from construction activities within the streambed. Turbidity curtains are effective in streams with velocities up to about 1 foot per second. However, use of either the SEDIMAT™ or the turbidity curtain has limitations. Although an individual SEDIMAT™ can trap and remove between 500 and 1,000 pounds of sediment, some silts tend to settle out on top of the mats requiring care in their removal to avoid displacing the silt. Removal of turbidity curtains often results in the displacement of the trapped sediments and short-term downstream turbidity. Millennium states that Columbia successfully used turbidity curtains and oil-sorbent booms to minimize downstream visible plumes during trenching and backfilling in Owego Creek for a pipeline replacement.

Millennium proposes to cross 13 major waterbodies using an open cut and 1 using a combination conventional bore and open cut/diversion (East Branch Delaware River). Millennium believes the in-stream sediment filters under normal flow conditions would be expected to be effective for 6 of the open-cut waterbodies: Cassadaga Creek (MP 59.9), State Drainage Ditch (MP 72.9), the ponds (MPs 235.2 and 387.5), Rutgers Creek (MP 344.0), and Indian Kill Reservoir (MP 367.1). Sediment filters may also be effective at other crossings under reduced flow conditions. The NYSDEC indicated that use of the sediment curtains may minimize turbidity to the extent that water quality standards may be met in some of the waterbodies. Our experience is that turbidity curtains have some value in still water (i.e., ponds or lakes), but are of limited value in flowing water. Also, extreme care is necessary when removing sediment-laden curtains to avoid dispersion of the collected sediments. However, there have been improvements in the design of these curtains that may improve their overall performance in flowing water. Consequently, we believe that Millennium's proposed use of in-stream sediment filters may be appropriate in certain situations, given our understanding of their limitations.

Open-Cut Crossings

Including the 93.3-mile-long Lake Erie crossing (32.9 miles of which would be in U.S. waters), a total of 14 waterbodies would be at least partially open cut. Of these, two would be more than 10,000 feet wide at the crossing (Lake Erie and the Hudson River), one would be 2,500 feet wide, eight would be between 140 and 675 feet wide, and three would be between 42 and 96 feet wide. All three intermediate waterbodies (between 10 and 100 feet wide) proposed for an open cut are Class C waters (Cassadaga Creek, State Drainage Ditch, and Catatonk Creek). However, we have recommended that Millennium cross Cassadaga Creek using a dry crossing method, if flows are low enough, to minimize impact on the clubshell and northern riffleshell (see section 5.6). Millennium proposes to use in-stream sediment filters at all three crossings. Millennium has filed site-specific crossing plans for all waterbodies that would be open cut, except for one man-made pond at MP 235.2 (see table 5.3.2.3-3). These plans include the recommendations of the NYSDEC and COE.

The site-specific plans indicate that the time frame for all open-cut crossings (except Lake Erie, and the Cohocton, East Branch Delaware, and Hudson Rivers) would be 2 days to excavate the trench, 1 day to install the pipe, and 1 day to backfill the trench. At the Cohocton River, 4 days would be required for the crossing (e.g., in-stream work) and 4 days would be required for flow diversion and restoration. While this is reasonable for waterbodies more than 100 feet wide, three of the waterbody crossings are between 42 and 96 feet wide and, in accordance with our Procedures, should be completed within 48 hours. Therefore, we recommend that:

- **Millennium should file with the Secretary a site-specific plan to complete the open-cut crossings of Cassadaga Creek (MP 59.9), State Drainage Ditch (MP 72.9), and Catatonk Creek (MP 228.1) within 48 hours, prior to construction, or it should file a site-specific plan explaining why more time is needed for the crossings for review and written approval of the Director of OEP.**

The NYSDEC originally expressed concerns with the open-cut crossings of Olean Creek, Cohocton River, Catatonk Creek, and the Mongaup River/Rio Reservoir because water quality standards could be violated. The NYSDEC requested an analysis of turbidity and sedimentation at each of the open-cut waterbody crossings that would include estimates of the duration and magnitude of elevated turbidity, the depth and linear extent of sediment deposition, and the potential for cumulative impacts within each drainage basin and subbasin. Following further consultation with the NYSDEC, Millennium filed revised crossing plans to minimize turbidity. These plans are summarized in table 5.3.2.3-3, and include the drainage basin and subbasin for each open-cut waterbody, including the East Branch Delaware River. Based on these revised plans with additional conditions, the NYSDEC issued a section 401 Water Quality Certificate on December 8, 1999.

TABLE 5.3.2.3-3

Summary of Site-Specific Open-Cut Crossing Plans

County/ Approximate Milepost	Waterbody	Width	Basin	Sub-Basin	Summary of Site-Specific Crossing Plan a/
0.0 - 32.9	Lake Erie	32.9 mi	Lake Erie		See section 5.3.3.
Chautauqua					
59.9	Cassadaga Creek	42 ft	Allegheny River	Conewango Creek	Excavate trench using backhoe or dragline from centerline of waterbody. Also, see recommendation in section 5.6 for a dry crossing if flows are low enough.
72.9	State Drainage Ditch	96 ft	Allegheny River	Conewango Creek	Excavate trench using backhoe or dragline from centerline of waterbody.
Cattaraugus					
111.2	Olean Creek	180 ft	Allegheny River	Olean Creek	Time window - June 1 through November 30. No equipment bridge. Excavate trench using a crane with an environmental bucket after soil samples are taken to below trench depth to confirm feasibility. Backfill trench using environmental bucket. Backfill top 1 foot of trench with gravel or washed native cobble. If required by NYSDEC: (1) wash environmental bucket within contained equipment washing area before releasing from construction work area; (2) do not discharge equipment wash water from work area; and (3) retain used wash water and treat as contaminated, and store for transportation and disposal in accordance with Federal and state laws. Segregate all spoil removed from the river and protect with silt fence and cover to prevent runoff during rain and at the end of each day.
Steuben					
181.4	Cohocton River	203 ft	Susquehanna River	Chemung River	Time window - June 1 through September 15. No equipment bridge. Before instream trenching, divert water into partially existing channel on the east side that would be regraded for this purpose. Restore flow to main channel when construction complete and restore the temporary channel. Excavate trench using a dragline or backhoe.
Tioga					
228.1	Catatonk Creek	74 ft	Susquehanna River	Owego Creek	Time window - June 1 through November 30. No equipment bridge. Limit equipment crossing of waterbody to single pass for backhoe to excavate trench, single pass of sideboom to install pipe, and single pass of backhoe to backfill trench. Install jersey barriers to divert flow to west side of channel while the east side is trenched, and on the east side while the west side is trenched. Backfill in a similar manner. Excavate using dragline. Begin construction only after stream flows are below 70 percent level for June.
235.2	Pond	140 ft	Susquehanna River	Nanticoke Creek	Man-made pond with no specific concerns identified by landowner. Pipe would be laid on the bottom. No site-specific plan filed.

TABLE 5.3.2.3-3 (cont'd)

County/ Approximate Milepost	Waterbody	Width	Basin	Sub-Basin	Summary of Site-Specific Crossing Plan a/
Delaware					
287.0	E. Branch Delaware River	512 ft	Delaware River	E. Branch Delaware River	Time window - June 1 through September 15. Jack bore the eastern approximate 200 feet of the crossing. Install the remaining segment using open-cut methods after water flow has been diverted from the construction work area using Jersey barriers. Final bore pit location to be approved by NYSDEC before construction. Riprap west bank (18 inches or larger) up to 150 feet in length as determined necessary by the environmental inspector. Backfill top 1 foot of open cut trench using clean gravel or native cobble.
Sullivan					
330.0	Mongaup/Rio Reservoir	675 ft	Delaware River	Mongaup River	Time window - October 15 through November 30 (due to presence of bald eagles). Coordinate with Mirant (formerly, Southern Energy) to construct during limited water releases from upstream Mongaup Falls dam. No additional tree clearing within designated 50-foot buffer zone. Stockpile spoil in water leaving open channel and access to boat launch ramp at all times. Install temporary boat launch (15 feet wide and surfaced with gravel) and appropriate fencing and signs. No equipment bridge. Work all equipment off barges. Refueling within 100 feet of water's edge limited to barge equipment. Barge pulled to bank for refueling and additional spill containment material would be readily available. Environmental inspector would routinely inspect equipment parked within 100 feet of water's edge for evidence of leaks. Contractor would take action the same day a leak is discovered. Backfill top 1 foot of trench with clean gravel or native cobble. Relocate existing valve set to MP 330.2.
Orange					
344.0	Rutgers Creek	143 ft	Hudson River	Wallkill River	Time window - June 1 through November 30. Install instream sediment devices. Excavate trench using backhoe or dragline.
357.0	Wheeler Creek	345 ft	Hudson River	Wallkill River	Time window - June 1 through November 30. No equipment bridge.
367.1	Indian Kill Reservoir	2,500 ft	Hudson River	Ramapo River	Time window - June 1 through November 30. Use push pull construction to install pipe. Excavate trench only within 50 feet of water's edge. Use barge-mounted backhoe or dragline to remove rocks from pipe installation area. No equipment bridge. Lay concrete-coated pipe on reservoir bottom, except for water's edge where pipe would be a minimum of 3 feet below reservoir bottom. Install silt curtain around trench near water's edge during excavation and backfilling. Only equipment on barges would be refueled within 100 feet of water's edge. Barge would be pulled to bank for refueling and additional spill containment material would be readily available. Environmental inspector would routinely inspect equipment parked within 100 feet of water's edge for evidence of leaks. Contractor would take action the same day a leak is discovered.

TABLE 5.3.2.3-3 (cont'd)

County/ Approximate Milepost	Waterbody	Width	Basin	Sub-Basin	Summary of Site-Specific Crossing Plan a/
Rockland					
387.5	Pond	485 ft	Hudson River		No equipment bridge. Equipment crossing of waterbody limited to single pass for backhoe to excavate trench, single pass of sideboom to install pipe, and single pass of backhoe to backfill trench. Excavate trench using backhoe or dragline.
387.9	Hudson River	2.1 mi	Hudson River		See section 5.3.4.

a/ Unless otherwise noted, all site-specific plans include the following provisions: (1) all construction and maintenance activities would be in compliance with Millennium's ECS; (2) all extra work areas would be at least 50 feet from the water's edge; (3) grade spoil would be stockpiled at least 10 feet from the edge of water (topography permitting); (4) limited access areas would be used only to remove in-stream sediment devices; (5) in-stream sediment devices would be used downstream of trench to minimize turbidity and sedimentation impacts, would be installed before any instream activities, and would be placed about 40 and 60 feet downstream of trench or as directed by the environmental inspector; (6) pipeline would be pulled across the waterbody in 1 day; (7) trench would be backfilled using mechanical placement; (8) trench size may be up to 50 feet wide at the top and 10 feet at the bottom (depending on river bottom characteristics); (9) time frame for construction (except for Lake Erie, Cohocton River, East Branch Delaware River, and the Hudson River) would be 2 days to excavate the trench, 1 day to install the pipe, and 1 day to backfill the trench; (10) restoration would begin immediately after the trench is backfilled; (11) wetland boundaries and other areas of environmental concern would be field marked by the environmental inspector before construction and would supercede those indicated on the plans; (12) the top 12-inches of topsoil would be removed and stockpiled at spoil pile areas that are in wetlands; (13) full joints of pipe would be used unless otherwise directed by the construction engineer; (14) concrete coated pipe would be installed under the waterbody and a minimum of 5 feet past the top banks; (15) pipe would be installed under the stream at the minimum shown, except in rock where top of pipe may be laid a minimum of 3 feet below stream; (16) crossing would be in accordance with applicable permits and regulations; and (17) all girth welds would be 100 percent radiographically inspected.

NOTE: Millennium would also open cut intermittent streams if dry at the time of the crossing.

None of the waterbodies currently proposed for an open cut were determined to be feasible for completion of a conventional bore or directional drill (see discussion below on the different construction crossing techniques that were considered, along with directional drill).

Conventional Bore Construction Technique

The conventional bore of the waterbodies would be similar to that used for crossing under roads and railroads. For waterbodies, the technique would involve excavating a bore pit about 20 feet wide and 60 feet long on one side of the crossing, augering a hole through casing about 5 feet below the stream bed, inserting the pipe through the casing, and removing the casing. With the exception of the west bank of the East Branch Delaware River, the bore and receiving pits would be at least 10 feet from the water's edge. The receiving pits would be approximately 20 feet wide and 30 feet long. The staging for spoil from the bore pits and receiving pits would be 100 feet wide and 200 feet long. The spoil piles are estimated to be 50 feet wide by 100 feet long by 15 feet high. Spoil from the bore hole would be hauled away to an approved disposal facility that would not be within wetlands or other waters of the U.S. For waterbody crossings, there is the potential that if the bore hole is too shallow, the stream bottom may collapse into the leading edge of the bore hole and flood the bore pits preventing the completion of the bored crossing. Other problems that could be encountered with a bored crossing which could cause failure include: impenetrable subsurface material which prohibits completion of the hole, too much water in the bore pit that cannot be pumped out and would prohibit completing the tie-in welds and would pose a safety risk to workers, and slumping soil which prevents keeping the bore hole open.

Millennium proposes to use conventional boring techniques to cross 12 waterbodies: Bemus Creek (MP 55.6), Great Valley Creek (MP 94.7), Wrights Creek (MP 95.8), Canisteo River (MP 171.5), Owego Creek (MP 230.3), Nanticoke Creek (MP 240.7), Susquehanna River (MP 263.2), West Branch Delaware River (MP 276.0), Neversink River (MP 341.0), Wallkill River (MP 350.7), Pochuck Creek (MP 352.4), and Intermittent Ditch to Eurich Ditch (MP 353.9). In addition, Millennium proposes to cross the East Branch Delaware River using a combination of conventional bore and open cut/diversion (see table 5.3.2-3 and additional discussion in Open-Cut Crossings above).

At the East Branch Delaware River, Millennium proposes to use a combination of a partial conventional bore and a diversion around the portion that cannot be bored since Millennium does not expect to be able to complete a bore of the entire crossing. About 200 feet would be bored, and the remainder open cut. Since the water level in the East Branch Delaware River is controlled by releases at the Pepacton Reservoir, Millennium would request that the release be controlled so as to lower the water level in the river during construction and would contact appropriate agencies in New York and Pennsylvania. Water flow would then be diverted away from the construction work area using Jersey barriers, and that segment of the river would be open cut. Millennium proposed the modified bore construction technique at this waterbody to reduce impacts on the stream and its fishery resources. Several commenters noted that the river is recognized for its trout fishing and supports a well-developed fishery-based economy.

Horizontal Directional Drill Construction Technique

Millennium proposes to directionally drill the Chenango (MP 249.8), Ramapo (MP 370.0), and Croton (MP 369.8) Rivers. The COE commented that all waterbodies be considered for a horizontal directional drill and requested the estimated cost of trenching versus directional drilling for all waterbodies where a directional drill is not discounted for technical reasons.

Millennium responded that a number of site-specific factors affect the viability of a directional drill. These include geology, topography, pipeline alignment at the crossing, the need for an adequate staging area for the drill rig and pipe string, and the surrounding built environment. In addition, this technique requires that there are no bends between the exit and entry holes. Because the pipe in a directional drill must be installed free of stress, Millennium stated that each drill would need to be a minimum of between 1,200 and 1,600 feet in length for a 36-inch-diameter pipe with a maximum length of between 4,000 and 4,500 feet under ideal soil and construction staging conditions. However, directional drills of about 1 mile in length have been completed in ideal conditions. Millennium stated that for a 36-inch-diameter pipe under less than ideal conditions, anything beyond 3,500 feet would be considered beyond the state of the art of the industry. Based on these constraints, Millennium determined that of the 147 waterbodies that it originally proposed for an open cut, a directional drill would be infeasible for 62 waterbodies.

Millennium completed a preliminary cost comparison of an open cut versus a directional drill for seven of the major or sensitive waterbodies (see table 5.3.2.3-4).

TABLE 5.3.2.3-4

Cost Comparison of an Open Cut versus a Directional Drill for the Genesee, Cohocton, Chenango, Susquehanna, West Branch Delaware, Wallkill, and Ramapo Rivers

Waterbody	Open Cut Estimate	Drilled Estimate (good soils)	Ratio of Drill Cost (good soils) versus Open Cut Cost	Drilled Estimate (poor soils)	Ratio of Drill Cost (poor soils) versus Open Cut Cost
Genesee River a/	$ 171,121	$1,295,696	7.57	$1,680,000	9.82
Cohocton River b/	168,000	1,008,000	6.00	1,670,000	10.00
Chenango River c/	181,650	1,089,900	6.00	1,816,000	10.00
Susquehanna River a/	318,643	2,429,430	7.62	3,150,000	9.89
W. Branch Delaware River a/	168,000	1,008,000	6.00	1,680,000	10.00
Wallkill River a/	168,000	1,008,000	6.00	1,680,000	10.00
Ramapo River c/	210,000	1,260,000	6.00	2,100,000	10.00

a/ Currently proposed for a dry crossing (e.g., steel dam and culvert, conventional bore).
b/ Currently proposed for an open-cut crossing.
c/ Currently proposed for a directional drill, if feasible.

Millennium also provided a generic cost comparison of a conventional versus directional drill crossing by two separate drilling contractors (Michels Pipeline Construction, Inc. and Laney Directional Drilling through Henkle & McCoy). A conventional open-cut crossing would be about $105 per foot. A directional drill would be between $630 and $738 per foot drilled under ideal soil conditions [4/] and $1,050 per foot under poor soil conditions. [5/] In addition, Millennium provided estimates from Michels Pipeline Construction, Inc. on specific waterbody crossings (see table 5.3.2.3-5). These costs were based on a single attempt to complete the crossing using a directional drill. Costs for a guaranteed directional drill would be higher. Millennium estimates that, because of the geology in the southern tier of New York, about half of the crossings would require two or more attempts to successfully complete the drill and that 15 percent of the crossings would ultimately need to be completed using conventional open-cut crossing techniques. These costs were not included in the estimate.

4/ Ideal conditions refer to conducive soils (sand, clay, or consolidated material) at the drill depth.

5/ Poor conditions refer to rock, gravel, and unconsolidated material at the drill depth.

TABLE 5.3.2.3-5

Cost Comparison of a Conventional versus a Directional Drill Waterbody Crossing at Selected Waterbodies

Waterbody	Approximate Milepost	Drill Length (feet)	Conventional Open Cut	Directional Drill	Additional Cost for Directional Drill
Genesee River	137.3	1,600	$ 171,121	$ 1,295,696	$ 1,124,575
Owego Creek	230.3	1,600	172,974	1,295,696	1,122,722
Susquehanna River	263.2	3,000	318,643	2,429,430	2,110,787
Neversink River	341.0	1,640	186,751	3,181,793	2,995,042

In our experience, a directional drill works well under the proper conditions. However, we have seen instances where an open cut was ultimately required after repeated attempts to complete a drill hole failed (collapse of the hole) or the pipe could not be pulled completely through the hole. In some cases, the pipe became stuck in the hole, and could not be withdrawn and had to be abandoned in place. Although we have seen directional drills completed in less than ideal conditions, we have also seen instances where extensive excavation was required along the drill path to retrieve drilling equipment that became lodged in the drill hole, where more than one hole had to be drilled before the drill could be successfully completed, and where sink holes developed along the drill path. A directional drill does not work well in all situations and can result in additional environmental impact on land and in wetlands, specifically where extraordinary measures are required to compensate for poor soil conditions. Given the costs and the inherent problems with a directional drill, we believe that a directional drill should be considered and recommended where there are recognized environmental concerns, such as fisheries or water quality issues, and there is a reasonable likelihood that it can be successfully completed.

Millennium studied the feasibility of directionally drilling ten waterbodies: Olean Creek, and the Genesee, Cohocton, Chenango, Susquehanna, West Branch Delaware, East Branch Delaware, Mongaup, Wallkill, and Ramapo Rivers. Except for the Wallkill (MP 350.7) and Ramapo (MP 370.0) Rivers, all of these crossings would be major waterbody crossings. Although Millennium originally proposed to directionally drill three of the rivers (the Chenango, West Branch Delaware, and Ramapo Rivers), borings completed in late 1998 indicated that only the Chenango and Ramapo Rivers are considered feasible, although problematic, for a directional drill. Soil borings on the west bank of the West Branch Delaware River (MP 276.0) identified subsurface boulders which Millennium determined would preclude the possibility of a successful directional drill. Millennium currently proposes to cross the West Branch Delaware River using a dry construction method (e.g., conventional bore).

The preliminary findings indicated that three crossings (Olean Creek, East Branch Delaware River, and Mongaup River/Rio Reservoir) were infeasible due to the geology at each crossing location. At Olean Creek (MP 111.2) and East Branch Delaware River (MP 287.0), visual review of the surface indicated near-surface solid rock would impede the use of horizontal drilling techniques for the proposed crossings. At the Mongaup River (MP 330.0), the surface area is composed of many boulders that would make it unsuitable for drilling. Millennium determined that the open-cut crossing method would be better suited for two crossings (Olean Creek and Mongaup River/Rio Reservoir) since the presence of rock would not prevent an open-cut crossing. The East Branch Delaware River would be crossed using a dry construction technique (conventional bore and open cut with diversion). Millennium has not proposed any additional feasibility testing for directional drilling at these sites.

At the Susquehanna River (MP 263.2), visual review of the area indicated no near surface geology that would preclude the use of horizontal directional drilling. However, the west bank contains bedrock and glacial rubble that could significantly affect the cost and potential successful completion of a directional drill. In addition, the floodplains adjacent to the river are known to contain numerous archeological resources.

In its preliminary investigation, Millennium determined that the valley configuration is such that a directional drill would necessitate a steeply angled and abrupt approach from the west side and a gradual, long pullout on the east side. Millennium maintains that such an approach and pullout would impact unnecessarily the archeological deposits present in both floodplains. Millennium currently proposes to cross the Susquehanna River using a dry construction technique (e.g., conventional bore).

Of the remaining three waterbodies evaluated for a horizontal directional drill, Millennium proposes to cross the Wallkill River using a conventional bore, open cut the Cohocton River, and cross the Genesee using a dry construction technique (steel dam and culvert). Millennium had an independent contractor (Michels Pipeline Construction, Inc.) provide a second opinion on the feasibility of completing a directional drill at both the Genesee and Cohocton Rivers. The contractor responded that both crossings have "a very low probability of successful installation by directional drilling."

In response to concerns from the NYSDEC and the COE and other comments on the DEIS, Millennium modified its originally proposed crossing techniques to use dry crossing methods for all but 14 of the waterbody crossings (see previous discussion on open-cut crossings). The feasibility of using a directional drill crossing for these waterbodies was considered. Both Lake Erie and the Hudson River crossings are too wide to be crossed by this technique. However, a directional drill of the shoreline is proposed at Lake Erie and was considered but rejected at the Hudson River (see discussion in sections 2.3.1 and 2.3.3, respectively). The two unnamed ponds (MPs 235.2 and 387.5) were not considered candidates because the former would not be excavated (e.g., the pipe would be laid on the bottom) and the latter is an industrial pond on the Bowline Generating Station property.

Three crossings (Cohocton River, Mongaup River/Rio Reservoir, and Rutgers Creek) were eliminated from consideration because of geologic constraints. Three other crossings (Catatonk and Wheeler Creeks, and Indian Kill Reservoir) were eliminated because of steep topography. Cassadaga Creek, State Drainage Ditch, and Olean Creek were eliminated for a combination of cost and geologic constraints.

The NYSDEC, in its section 401 Water Quality Certificate, requires that Millennium use a closed environmental bucket for Olean Creek, a high quality (Class A) stream that is used as a public water supply for the Town of Olean. Since the creek is known to contain contaminated sediments, the NYSDEC has also required sampling and additional mitigation if contaminated sediments are found (condition 6 of the section 401 Water Quality Certificate in appendix K and the proposed mitigation identified in table 5.3.2.3-3).

Millennium proposes to cross the Croton River and associated wetland using a horizontal directional drill based on geotechnical investigations and an engineering evaluation conducted in June 2000. This would avoid disturbance of the river, its habitat, and fish and wildlife species using the habitat, and the associated NYSDEC-regulated wetland H-3 along the river. Millennium's site-specific crossing plan shows an approximate 1,500-foot-long drill with the drill rig set up on the south bank along with bentonite storage, frac tank, and associated equipment. The pipe would be staged on the north bank, outside of the Croton River wetlands, and within a grass covered parking area for the Van Cortlandt Manor. Noise impacts associated with directional drilling are discussed in section 5.11.2.

Based on the information provided by Millennium and the requirements in the NYSDEC section 401 Water Quality Certificate, we believe that the proposed crossing methods with the proposed and recommended mitigation would minimize environmental impact on these waterbodies.

Contingency Plans

Millennium has prepared contingency plans for six of the major waterbody crossings that are proposed for a conventional bore (Owego Creek, Susquehanna River, West and East Branch Delaware River, and Pochuck Creek) or a directional drill (Chenango River). If the bore fails at the Neversink River, Millennium proposes to move 10 feet and attempt the bore again. Millennium does not currently propose to use its initial crossing method (e.g., coffer dam) as a contingency plan. Millennium has not provided contingency plans for the intermediate waterbodies (Bemus, Great Valley, Wrights, and Nanticoke Creeks; Intermittent Ditch to Eurich Ditch; and Canisteo and Wallkill Rivers) or the Ramapo and Croton Rivers which would be directionally drilled. Therefore, we recommend that:

- **Millennium should file with the Secretary a contingency plan for the crossing of each waterbody if the directional drill (Ramapo River, MP 370.0; Croton River, MP 396.8) or conventional bore (Bemus Creek, MP 55.6; Great Valley Creek, MP 94.7; Wrights Creek, MP 95.8; Canisteo River, MP 171.5; Nanticoke Creek, MP 240.7; Wallkill River, MP 350.7; and Intermittent Ditch to Eurich Ditch - MP 353.9) is unsuccessful. Prior to construction, Millennium should file with the Secretary for review and written approval of the Director of OEP, a plan with the set of criteria it will use to identify when a horizontal directional drill or bore is unsuccessful. This should be a site-specific plan that includes scaled drawings identifying all areas that would be disturbed by construction. Millennium shall file this plan concurrent with its application to the COE and NYSDEC for a permit to construct using this plan. The Director of OEP must review and approve this plan in writing before construction of the alternate crossing plan.**

The COE noted that the Genesee River has a flood control berm at the crossing and the crossing plan should address restoration of the berm to preconstruction conditions. Millennium is still consulting with the COE on a restoration plan. Therefore, we recommend that:

- **Millennium should consult with the COE and expand the site-specific crossing plan for the Genesee River (MP 137.3) to include construction and restoration mitigation measures to protect the integrity of the flood control berm. The revised plan and COE comments should be filed with the Secretary for review and written approval by the Director of OEP before construction.**

Microtunnel Jacking Construction Technique

Microtunneling, another dry construction technique, is a horizontal cutting and jacking process where a vertical shaft would be excavated on both sides of the waterbody to below the depth of the planned microtunnel. On the entry side, the excavation would have to be long and wide enough to contain the tunnel jacking equipment, tunneling head, and the pipe to be jacked. The resulting excavation could be as large as 20 feet by 60 feet, and at least 40 feet deep. On streams with high banks or in steep valleys, these excavations could be even larger or deeper. The bottom and sides of the shaft are usually lined with concrete or otherwise sealed to prevent water intrusion. Space would be required on the surface for the slurry system and tanks, control and power supply for the equipment, and spoil from the excavation. A complete set of soil borings and tests must be made to select the proper cutting head, torque of driver, and maximum attainable drive length. If rock and boulders cause the drive length to be short, an additional pit excavation would be required in the middle portion of the crossing. Shallower crossings, such as at stream crossings, would be more difficult because care must be taken to prevent slurry from coming to the surface as a result of required slurry pump pressure.

The microtunnel jacking technique is used when horizontal directional drilling cannot be used or when the crossing is too long or deep for conventional boring. The size and amount of equipment and the space required for the microtunnel jacking technique normally make it the option of last resort for pipeline construction. A representative of a microtunnel contractor advised Millennium that a minimum tunneling distance of 400 feet is required for this technique to be considered feasible. The cost of a microtunnel is about 10 times the cost of the open-cut technique.

While the horizontal microtunnel jacking technique may be "technically feasible" in the narrow sense that the crossing may ultimately be accomplished, we believe that it offers no environmental advantage for stream crossings on the project because of the preparation time involved in putting a tunneling system into place, and the space needed for the equipment required to excavate and prepare the pits, perform the tunneling operation, and store excavated spoil. While costs would be similar to that for directional drilling in poor soils, the microtunnel jacking technique would accomplish the same end result with greater potential environmental impact, and we do not recommend its use.

Public Water Supplies

The pipeline would cross five waterbodies within 3 miles of active public water intakes:

Belson Creek at MP 38.1 (about 2.6 miles upstream of the supply intake for the Alford Reservoir);

Olean Creek at MP 111.2 (about 1.6 miles upstream of the supply intake for Olean);

Genesee River at MP 137.3 (about 0.3 mile downstream of the active primary intake and 1.5 miles upstream of the inactive secondary intake for Wellsville);

Indian Kill Tributary at MP 367.0 (about 0.2 mile upstream of the community water intake for Indian Kill); and

Indian Kill Reservoir at MP 367.1 (water supply for Tuxedo).

Millennium proposes to open cut Olean Creek. Indian Kill Reservoir would be crossed by placing the pipeline on the bottom of the reservoir; no trenching would occur except on the banks. Belson Creek, Genesee River, and Indian Kill Tributary would be crossed using dry construction techniques. The NYSDEC indicates, that with the exception of Olean Creek, water quality standards would likely be met and has included additional requirements for the crossing of Olean Creek in its section 401 Water Quality Certificate (see table 5.3.2.3-3).

The use of dry-crossing techniques would eliminate most of the potential for increased turbidity associated with open-cut crossings. Since specialized dredging equipment would be used to trench Olean Creek (see table 5.3.2.3-3) and no trenching would occur in the Indian Kill Reservoir, direct impact on surface water supplies would be limited to the time required to construct across these waterbodies. These impacts would consist of an increase in suspended sediments. Other temporary impacts associated with clearing and restoration activities would be minimized by installation and maintenance of erosion control devices in accordance with the Millennium's ECS (see appendix E1) and our Procedures (see the FERC's website at www.ferc.gov). These include provisions for refueling construction equipment at least 100 feet from all waterbodies and wetlands to reduce the potential for impact associated with spills of hazardous liquids. Millennium would also implement its SPCC Plan, which contains specific procedures to be implemented in the event of a spill or if refueling must be conducted less than 100 feet from any waterbody. Implementation of the NYSDEC recommendations at Olean Creek (see table 5.3.2.3-3) and the mitigation measures described above would limit impacts on this water supply. Therefore, we believe impacts on water supplies would be minimal and temporary.

Aqueducts

The pipeline would cross four aqueducts in Westchester County: the Old Croton Aqueduct (MP 397.4), New Croton Aqueduct (MP 401.2, 410.3, and 413.8), Delaware Aqueduct (MP 418.1), and Catskill Aqueduct (MP 418.2). The Old Croton Aqueduct is no longer in use, but is listed on the NRHP and is a National Historic Landmark (see discussion in section 5.9, cultural resources). It is within a protective berm in a stream valley at the crossing location. There is a stream culvert at its base. Millennium proposes to cross the aqueduct and berm using a site-specific crossing plan and would work with the NYSOPRHP (the property owners and administrators) to develop a crossing plan for the associated state park.

Millennium has contacted the NYCDEP about the depth of the New Croton Aqueduct at the three crossing locations. According to correspondence received from the NYCDEP, the aqueduct depths are 95, 40, and 140 feet, respectively (aqueduct station numbers 322+00, 732+00, and 895+00). The Delaware Aqueduct would be crossed approximately 190 feet from shaft 23 in a section where the aqueduct is about 350 feet below ground. See section 5.3.5 for discussion of the Catskill Aqueduct.

Contaminated Sediments

Millennium identified the potential for contaminated sediments at eight waterbodies (Olean, Genesee, Cohocton, Chenango, West and East Branches Delaware, Neversink, and Hudson Rivers). The recorded concentrations were upstream of the Genesee, Cohocton, Neversink, and Hudson Rivers crossings and downstream of the Chenango, and West and East Branches Delaware Rivers crossings. The Genesee River would be crossed using a steel dam and culvert. The Chenango, West Branch Delaware, and Neversink Rivers would be crossed using either conventional bore or directional drill. The East Branch Delaware River would be crossed using a combination conventional bore and open cut/diversion. The Cohocton River would be crossed using an open cut. See discussion in section 5.3.4 for the Hudson River.

The NYSDEC also identified concerns about contaminated sediments at Olean Creek, which is listed as a "priority" waterbody and would be open cut. The reported contaminants are priority organics emanating from resource extraction activities, primarily oil wells. Because the proposed crossing is within that segment identified as a "priority" waterbody, it is possible that the sediments may be contaminated. Millennium, in its site-specific plan, has indicated that it would use special precautions at the creek, such as washing the backhoes and segregating the spoil removed from trench in the creek (see table 5.3.2.3-3), as required by the NYSDEC. In its section 401 Water Quality Certification, the NYSDEC required that Millennium conduct a geotechnical evaluation of soils showing grain size and distribution at the crossing location. Soils would also be analyzed for polycyclic aromatic hydrocarbons, total organic carbon, and grain size. All trenching operations in Olean Creek must be done using a closed environmental bucket and equipment sized and operated in such a manner to minimize the resuspension and transport of sediments into the water column (see condition 6 of the NYSDEC section 401 Water Quality Certification in appendix K).

Hydrostatic Testing

Millennium identified 39 waterbodies that would be used as source and/or discharge locations for hydrostatic test water (see table 5.3.2.3-6). Any other water used for hydrostatic testing of components of the pipeline would be obtained from local water companies or landowners. Millennium estimates that about 126,920,000 gallons of water would be required to test the pipeline.

Withdrawal of hydrostatic test water would be done at a rate such that there would be no perceptible change in downstream water levels or flow rates. The NYSDEC section 401 Water Quality Certificate requires that withdrawal may not reduce stream flow by more than 10 percent at the time of withdrawal. Water would be withdrawn and discharged within the same watershed, except for water withdrawn from the

Croton River (Hudson River watershed) that would be discharged into the Bronx River (Bronx River watershed) on the 9/9A Proposal. Millennium states that it would develop a plan to treat water before its release into a watershed different from the one from which it is withdrawn, if the NYSDEC determines that the water is contaminated with micro-organisms. The NYSDEC has not yet included the 9/9A Proposal in its 401 Water Quality Certificate.

Millennium identified the Neversink River as a proposed source and discharge for hydrostatic test water. This river provides habitat for known populations of the federally endangered dwarf wedge mussel. In accordance with its ECS and our Procedures, Millennium would obtain written permission from the appropriate Federal, state, and/or local permitting agencies before withdrawal from or discharge into state-designated high quality streams or public water supply streams. See additional discussion in section 5.6.3. Test water would not be withdrawn from any source that could result in degradation of its state-designated water uses.

Discharge of Hydrostatic and/or Trench Water

In accordance with our Procedures and its ECS, Millennium would screen all intake hoses and would implement protective measures to minimize erosion during discharge of test-water. If hydrostatic test water is discharged directly into any waterbody, Millennium would acquire all necessary permits before starting this activity. Hydrostatic test water may also be discharged into well-vegetated upland areas and/or through sediment filter devices or sediment traps. In general, these discharges would not take place within 50 feet of waterbodies or wetlands. If it is necessary to discharge within 50 feet of waterbodies or wetlands due to topographic conditions, additional sediment filter devices would be used, as needed, to prevent sediment from entering waterbodies or wetlands.

No chemicals would be introduced into hydrostatic test water. However, methanol may be injected into the pipe to evaporate excess water that may remain after discharge of hydrostatic test water. Millennium states that any excess methanol would be collected and disposed in accordance with applicable state and local regulations. No methanol would be discharged into waters of the U.S.

The NYSDEC commented that hydrostatic test water discharge and trench dewatering may violate New York water quality standards for temperature. Millennium states that hydrostatic test water should be discharged at or very near withdrawal temperatures since the test procedure itself does not alter water temperatures. Although hydrostatic test water temperature may equilibrate to the temperature of the pipeline during the test, this temperature should be at or near subsurface temperatures at the pipeline depth of 4 to 10 feet.

Millennium's ECS states that water impounded in the trench would not be released directly or by overland flow into any waterbody or wetland and would be discharged through sediment filter traps or devices. If hydrostatic test water or pumped water from trenches or bore bits must be discharged in such a way as to reach any waterbody or wetland either directly or by overland flow, Millennium would monitor water temperatures in the receiving body to verify that the state's water quality standards for temperature are not violated. We believe these measures would adequately protect waters of the U.S. from adverse effects associated with hydrostatic discharge and dewatering.

TABLE 5.3.2.3-6

Proposed Hydrostatic Test Water Source and Discharge Locations

County	Approximate Milepost	Waterbody	Source	Discharge a/	Source Volume (gallons) b/
Chautauqua	32.9	Lake Erie c/	Yes	Yes	26,760,000
	41.0	Tributary Lake Erie	No d/	Yes	0
	59.9	Cassadaga Creek	Yes	Yes	7,360,000
	69.0	Clear Creek	Yes	Yes	1,060,000
Cattaraugus	73.0	State Drainage Ditch	Yes	Yes	5,710,000
	94.7	Great Valley Creek	Yes	Yes	4,360,000
	111.2	Olean Creek	Yes	Yes	5,500,000
Allegany	132.1	Knight Creek	Yes	Yes	1,380,000
	137.3	Genesee River	Yes	Yes	7,390,000
	165.4	North Branch Tuscarora Creek	Yes	Yes	1,630,000
	171.5	Canisteo River	Yes	Yes	2,600,000
	181.4	Cohocton River e/	Yes	Yes	200,000
	182.1	Meads Creek e/	Yes	Yes	5,480,000
Chemung	202.9	Newtown Creek	Yes	Yes	3,170,000
	215.0	Cayuta Creek	Yes	Yes	3,480,000
Tioga	228.1	Catatonk Creek e/	Yes	Yes	580,000
	230.3	Owego Creek e/	Yes	Yes	2,730,000
Broome	240.7	Nanticoke Creek	Yes	Yes	2,390,000
	249.8	Chenango River	Yes	Yes	3,540,000
	263.2	Susquehanna River	Yes	Yes	3,390,000
Delaware	276.1	West Branch Delaware River	Yes	Yes	2,990,000
	287.4	East Branch Delaware River	Yes	Yes	3,120,000
Sullivan	299.3	Basket Creek	Yes	Yes	1,990,000
	306.8	Callicoon Creek	Yes	Yes	2,910,000
	317.9	Smith Mill Brook	Yes	Yes	3,200,000
	330.0	Mongaup Reservoir	Yes	Yes	2,830,000
	340.8	Neversink River	Yes	Yes	1,700,000
	347.2	Rutgers Creek	Yes	Yes	920,000
	350.7	Wallkill River e/	Yes	Yes	440,000
	352.4	Pochuck Creek e/	Yes	Yes	4,560,000
	359.5	Tributary Wawayanda Creek	No f/	Yes	0
	366.8	Tributary Indian Kill Reservoir	No g/	Yes	0
	369.7	Ramapo River	Yes	Yes	4,680,000
Rockland	387.5	Minisceongo Creek e/	Yes	Yes	100,000
Rockland/Westchester	387.9	Hudson River e/	Yes	Yes	1,980,000
Westchester	396.8	Croton River	Yes	Yes h/	1,500,000
	406.9	Saw Mill River	Yes	Yes h/	2,100,000
	414.5	Sprain Brook Reservoir	Yes	Yes h/	3,200,000
	421.2	Bronx River	No h/	Yes	0

a/ Discharge location would be the final destination after upland filtering.
b/ Volumes listed are approximate and equate to the pipeline fill volume with no contingencies for cleaning/flushing water, possible hydrotest failure, or extra water to vent air. Section length does not correspond to hydrotest section lengths.
c/ Includes entire Lake Erie pipeline (93.3 miles).
d/ Source water would be withdrawn from Lake Erie.
e/ Volumes are interchangeable for rivers within ± 1 mile of each other.
f/ Source water would be withdrawn from Rutgers Creek, the Wallkill River, and/or Pochuck Creek.
g/ Source water would be withdrawn from the Ramapo River.
h/ Some source water would be discharged into the Bronx River. The Bronx River would not be used for source water.

5.3.3 Lake Erie

The pipeline would cross a total of about 32.9 miles of Lake Erie within U.S. waters and 60.4 miles within Canadian waters.

Water quality in Lake Erie is primarily influenced by point and nonpoint sources of pollution in the U.S. and Canada. The primary constituent which affects water quality in the lake is phosphorous, which comes from both point sources such as municipal treatment plants, and nonpoint sources such as agricultural runoff. Increased levels of phosphorous can contribute to eutrophication of the water column, which is characterized by biological imbalances such as algal blooms and excessive weed growth. International controls on phosphorous input, enacted in the late 1970s, reduced phosphorous loading into Lake Erie by a total of 85 percent between 1972 and 1985 (ITC, 1987). Charlton et al. (1995) reported that this decrease in phosphorous input has reduced the total phosphorous load to the lake by 50 percent.

Turbidity within Lake Erie is due to inorganic material and microorganisms suspended within the water column. Turbidity is generally highest in the late fall (up to 44.8 milligrams per liter [mg/l]; Rathke and Edwards, 1985), due to wave action associated with fall storms. The western portion of the lake also tends toward higher turbidity due to large sediment inputs from the Detroit, Maumee, and Portage Rivers and high algal productivity. During the summer months, stratification of the water column occurs as the upper layers of water are heated while cooler water settles to the bottom of the lake, causing suspended organic and inorganic materials to settle to the bottom. During this period, TSS may be as dilute as 1 mg/l throughout the water column (Raul Pelagos, Inc., 1997). However, the mean TSS concentration in the west, central, and eastern basins is 19.9, 6.6, and 5.3 mg/l, respectively (Bolsenga and Herdendorf, 1993). The highest turbidity level reported in near-shore waters is 263 mg/l (Great Lakes Laboratory, 1981).

Lake Erie would be crossed by directionally drilling the shoreline and using conventional underwater construction by mechanical jetting for the lake crossing. Lake Erie is classified as a coldwater fishery in Pennsylvania and a Class A (high quality) waterbody in New York. The NYSDEC has requested that construction be restricted to the period between June 1 and September 15, which is more restrictive than our Procedures (June 1 to September 30 for coldwater fisheries and June 1 to November 30 for warmwater fisheries). Millennium has requested a variance to extend the timing window to between mid April and November because of the presence of hard shale at the landfall that may increase the difficulty and duration of the directional drill. Millennium has not indicated if it would require a variance for construction of the offshore segment of Lake Erie. Variances from our timing windows would be allowed upon written site-specific notification by the appropriate state agency.

Temporary disruption of sportfishing, commercial traffic, boating and other recreational activities would be expected to occur due to the physical disturbance, noise and turbidity resulting from water-based construction activities. For example, construction would interfere with sportfishing and recreational boating by restricting access to portions of the project area for safety reasons. However, the impacts would be minimal as most of the lake would remain open for boat transit.

Directional Drill at Landfall

Millennium proposes to directionally drill the Lake Erie landfall for a number of environmental reasons including bluff instability, the high energy of the near shore zone that would result in difficult restoration, greater ice scour potential in the near shore that increases the risk of pipeline damage, and direct impacts from trenching which include turbidity and siltation on the sensitive biological resources in the near shore. The pipeline would be directionally drilled from onshore and would exit in waters 20 to 30 feet deep in Lake Erie.

Millennium states that the directional drill of the landfall would involve drilling a pilot hole from the shore to exposed bedrock about 2,620 feet offshore at a water depth of about 25 feet. The exposed bedrock continues for another 1,560 feet offshore before being overlain by very coarse till material (boulders and gravel). Exposed bedrock and coarse till material continues for another 2,870 feet before becoming fine bottom substrate (silt and clay) at a water depth of about 56 feet. Some blasting (estimated at about 0.6 mile) may be required in this area.

At the end of the directional drill, the drill opening would transition to the open trench and the exit hole would be the disposal site for the drilling fluids and drill spoil. The NYSDEC commented that alternative methods of disposal of these wastes should be considered. Drilling fluids used in directional drill construction are mostly composed of fresh water modified with a viscosifier. The viscosifier used almost exclusively in drilling fluids is a naturally occurring clay (bentonite) that is typically found in Wyoming and South Dakota and is classified as a non-hazardous waste by the NYSDEC and the EPA. Polymers (such as polyanionic cellulose, sodium carboxymethyl cellulose, and starch) are added to the bentonite to enhance (or increase) the yield. For use in drilling fluids, Wyoming bentonite yields in excess of 85 barrels per ton. The addition of polymers to produce a high yield bentonite can increase the yield to 200 barrels per ton of material. Typically, directional drill fluids are high yield bentonite composed of less than 4 percent viscosifier by volume, with the remaining components water and drilled spoil.

Millennium estimates that the drilling fluids (composed of about 2,000 cubic yards of spoil, 4,000 cubic yards of extended bentonite, and 24.2 million gallons of water) would be discharged from the exit hole and would remain in suspension as a turbidity plume before eventually settling out. Based on turbidity plume modeling for current velocities ranging from 0.4 to 8 inches per second and on the assumption that the settled drilling mud would not be resuspended and dispersed by stronger currents, Millennium estimates that the thickness of drilling mud deposits on the fine bottom substrate (located about 4,430 feet from the exit hole and 7,050 feet from the shore) would range between 0.0047 and 0.094 inches. Millennium further states collection of the drilling fluids from the bottom of the lake would be impractical since the majority of the material is water and only about 4 percent by volume is actual bentonite. Millennium estimates that the maximum length and width of visible plume (TSS greater than 35 mg/l) that could occur during drilling mud loss at the exit hole are 4 miles and 1.9 miles, respectively.

Jet Sled Construction

Jet sled construction would be a continuous (24-hour a day) operation and would be done from a lay barge. Millennium anticipates that the contractor would use jetting equipment available from the Gulf of Mexico, the North Sea, or elsewhere, and that it would assess the intended equipment as part of its evaluation of construction proposals for the crossing. Excavation of the trench to the recommended trench depth would require at least two passes with at least 2 to 3 days between passes. Following installation of the pipeline, the trench would be allowed to backfill naturally since backfilling of the trench is not a requirement of design, nor essential for environmental or safety aspects of the installed pipeline. Natural backfilling would begin immediately after the pipe is installed in the trench.

Jet systems have individual characteristics (i.e., sled design, jet pump power, compressor/water reduction capacity) and are capable of certain progress in specific soil conditions. Generally, the larger the jet system, the greater its ability to remove soil and form the trench. The first pass with the jet sled is typically the most productive, with subsequent passes achieving less lowering because of the increased volume of spoil to be dispersed as the trench widens. For a deep trench, as much as 10 feet deep, the first pass may achieve a 4- to 5-foot lowering of the pipeline while the last pass might only lower the pipeline by 12 inches or less. Each pass would remove the same volume of soil to form the trench, but because of the broadening of the trench at the top with each pass, the vertical deepening of the trench becomes less. Thus, as the trench depth increases, the return (in terms of incremental trench depth) diminishes on a per pass basis.

The jet sled would provide the required trench depth without moving the pipeline after it is laid. If the required trench depth is not achieved after the first pass, subsequent passes would be made until the desired depth is achieved. The sled nozzles, jetting arms and the pumping equipment may be modified during this process to optimize jet sled performance as the trenching progresses. The pipeline would not be moved from its as-laid position into a parallel trench at any point after the commencement of the jetting operation.

Based on the geophysical/geotechnical study undertaken in 1998, Canadian Seabed Research Ltd. identified four surficial "geological" units along the pipeline route between MP 0.0 (the U.S.-Canadian border) and MP 32.9 (the Lake Erie landfall in Ripley, New York). The first unit, between MP 0.0 and about MP 24.0, consists of layered glaciolacustrine fines (mainly layered silts/clays) with a veneer of sand, silt/clay, and mussels. The second unit, between about MP 24.0 and about MP 32.0, consists mainly of fine to very fine sand with silt/clay. The narrow third unit consists of silt/clay, sand, gravel, cobble and some boulder and is restricted to near the U.S. shore. This unit is less than 16 feet thick and thins out towards shore to reveal the underlying bedrock, which comprises the fourth unit.

The following guidelines are typically used in the offshore pipeline industry

1,500 pounds per square foot (psf) soil shear strength – readily jetted
2,000 psf soil shear strength – jettable with most machines at normal rates
3,000 psf soil shear strength – jettable with large systems at lower rates

The soil characteristics along the entire route (except for the rock area near U.S. shore) fall within these ranges based on surveys conducted along the Lake Erie route that included a representative program of grab and core samples (Raul Pelagos, Inc., 1997) and cone penetration tests at 40 locations to a minimum depth of 15 feet (ConeTec, 1998). Millennium believes that the required trench depths can be achieved with a jet sled with the appropriate ancillary power for the greatest majority of the pipeline route. For example, one of the more powerful jetting barges in the Gulf of Mexico is capable of burying pipe as large as 60 inches in diameter, to a maximum depth of 16 feet, in water depth to a maximum of 260 feet.

In the rock area near the U.S. shore and other isolated locations, blasting or mechanical excavation (by cutterhead suction, bucket dredging equipment, or other equipment deemed appropriate by the installation contractor) may be required. There could also be short sections of the route that may not conform accurately to the geotechnical data gathered during the survey investigations to date, such as the presence of stiffer soils or buried boulders. Such localized areas may require additional effort (extra passes with the jet sled) or other measures (e.g., a diving team with hand-held equipment) to achieve the design trench depth.

Based on the low average undrained shear strength of the sediments (from less than 500 to 1,000 psf) and the presence of relatively unconsolidated sands along the route, natural backfilling of the trench should be rapid from sloughing and suspended sediment deposition. The natural backfilling process would be accelerated during the storm events in the fall (October to December) before the lake freezes and would be expected to result in significant backfilling of the trench by the end of the storm events during the following spring (March to May) after the lake ice begins to break up.

5.3.3.1 Ice Scour

Another concern related to open trench construction would be the potential for pipeline damage from ice scour along the bottom of Lake Erie. Ice scour is a feature of seabeds where a trough is found in the seabed as a result of icebergs or pressure ridges that have touched, penetrated, and moved forward through the seabed. [6/] Because of the widespread occurrence of ice scour in most polar regions and off the east coast of Canada, this phenomenon has been subjected to intensive research to develop the appropriate design for oil and gas pipelines. The central and eastern basins of Lake Erie normally develop ice cover by late January and retain some ice through April. National Fuel, in particular, commented extensively on the potential hazards of ice scour on the pipeline in Lake Erie.

C-CORE Analysis

To address these concerns, C-CORE completed a report for TransCanada that focused on three primary objectives that could affect the integrity of the pipeline in Lake Erie: (1) an evaluation of the risk of ice damage associated with scour events; (2) an assessment of the risk of damage from trawl doors, dropped objects, and anchors; and (3) recommendations for pipeline depth that would be required to meet safety criteria (C-CORE, 1998). C-CORE estimated that ice scour could be expected over about 75 percent of the pipeline route.

C-CORE used data from the original side scan sonar and other surveys of the pipeline route; data from the Ontario Hydro cable surveys conducted in 1980 and 1982; data from the USGS scour surveys conducted in the 1990s offshore of Ohio; and available information on ice, soil, and environmental conditions in Lake Erie. These data were used to develop models to measure the risk of pipeline damage from ice scour and took into consideration pipeline diameter and proposed design specifications for 3-inch concrete coating and a trench depth of 6.5 feet. The pipeline trench depth analysis was based on expected distributions of scour depth, width, and potential sub-scour deformation along the pipeline route; the effect of the scours and scouring effects on pipeline stresses; and the likely frequency with which gouging ice features would cross the pipeline. The entire pipeline route across Lake Erie was divided into 12 sections of approximately similar water depth, soil type, and ice conditions to account for varying rates and depths of gouging and soil properties. A design scour depth with an annual probability of exceedance was then determined for each section. The model for the interaction between pressure ridges and the seabed included the effects of ice geometry, soil strength, scour geometry, and sub-scour deformations. A structural model was also developed, using the finite element method, to analyze the response of a buried pipeline subjected to an ice scour event. The C-CORE report concluded that:

> The 10-year design scour depth ranged between 1.3 and 3.3 feet, while the 100-year design scour depth ranged between 2.5 and 4.5 feet. A minimum trench depth of 7.3 feet was recommended near the landfalls in Canada and the U.S.
>
> A thick boundary of 1.5 feet would be required between the pipe crown and the 1 to 100-year scour base to satisfy the axial tensile strain criteria in hard soils. The boundary could be reduced to 8 inches in softer soils. Recommended trench depths ranged from 6.5 to 9.5 feet.
>
> A thick boundary of 3.3 feet would be required between the pipeline and the 1 to 10-year scour base to satisfy the effective stress criteria. In softer soils, the boundary could be reduced to 1.5 feet. Recommended trench depths ranged from 6.5 to 10 feet.
>
> The recommended depth of burial would satisfy seabed incursions associated with fishing activities (such as trawl board drag over the pipeline in Canadian waters). It was considered impossible to designate a practical depth for dropped objects. The risk for a dragged anchor

A pressure ridge is a refrozen or partially refrozen pile-up of ice blocks formed from floating ice sheets that are pushed against one another. A pressure ridge can develop in ice covered water where the ice buckles and overrides adjacent ice to the extent that the ridge formed by this process touches the seabed.

to affect the pipeline is in 500 years. The risk for a dropped anchor to affect the pipeline is 1 in 50,000 years.

National Fuel filed two technical reports that were prepared by Intec Engineering, Inc. (1998a, 1998b) for BP Exploration Alaska, Inc. in March 1999. The reports were prepared to address the potential for ice scour damage on 10.7-inch-diameter pipelines that are proposed for the Northstar Development Project. This project is located about 6 miles offshore of Point Skorkersen in the Beaufort Sea, off of northeast Alaska. The reports indicate that this area has relatively mild ice scour that is similar to that in Lake Erie. National Fuel stated that Northstar proposes 7 to 9 feet of cover over its pipelines and would mechanically backfill the trench to protect its pipelines from potential ice scour. By contrast, Millennium proposed a minimum of 3.3 feet of cover and would allow the trench to backfill naturally from localized slumping of the trench sediment immediately behind the jetting operation.

In July 1999, C-CORE completed an evaluation of the potential for ice scour caused by pressure ridges along the proposed pipeline crossing of Lake Erie. Specific trench depths were recommended for six zones (F, G, H, I, J, and ALF, see table 5.3.3.1-1) along the pipeline route in the U.S. portion of Lake Erie based on water depth, soil strength, and scour frequency and depth, taking into account the pipeline design. These depths were 6.6 feet (zones F and G) and 9.2 feet (zones H, I, and J). Zone ALF was the directional drill.

We reviewed the C-CORE reports (1998 and 1999), the two technical reports filed by National Fuel, and National Fuel's comments on the DEIS concerning the issue of ice scour. While this review raised several issues which are discussed below, we did not find the Beaufort Sea reports particularly relevant to the Lake Erie study. Both reports state that ice scour is a highly variable phenomenon that is dependent upon a particular set of variables which are location-dependent and that the potential for ice scour can vary significantly over relatively short distances. Therefore, it is inappropriate to compare the Beaufort Sea ice scour design procedures to those needed in Lake Erie, except in a general context. National Fuel also asserts that ice scour data can only be useful if multiple mapping events of the same feature are used, which was not done in the C-CORE report. Our other comments and Millennium's response are provided below.

Although C-CORE used a statistical approach to determine the likelihood of ice source effect, the database was limited to exclude several of the more severe historic ice scour events (apparently because the information sources were not as verifiable as desired). In addition, the study appeared to rely heavily on recent information from 1997 and 1998. While this data may provide some of the highest quality data available, it also represents data from a fairly mild winter. This supports National Fuel's comment that the model is overly optimistic in terms of the "design" ice scour event.

Millennium responded that C-CORE employed a consistent and accepted probabilistic approach for ice scour considerations. The recommended trench depths for the proposed pipeline are the maximum depths required to mitigate against ice scour damage and prevent loss of service, based on the predicted pipeline response to ice scour events with an annual probability of less than 10^{-2} (0.01 or 1 percent), or for a return period of not less than 100 years. The one in 100-year return period is the industry standard used to determine the maximum environmental loads during operation that are random in nature (such as icescour loads), and is codified in the applicable North American reference specifications 7/ and in the European standards which are often cited for the design of offshore pipelines. 8/

C-CORE's review of ice scour processes in Lake Erie found significant differences in the ice cover, lake bed soils, scour frequency, and scour depths in various parts of the lake. For example, the deepest observed scour in Lake Erie (as measured by others) is in Canadian waters on the east side of Long Point in the vicinity of Nanticoke, about 40 miles north of Millennium's proposed pipeline route. However, the combination of soft soil, environmental and ice conditions encountered at the site of this scour in the eastern part of Lake Erie are not representative of ice scoured areas along the proposed route. For this reason, this observation was not included in C-CORE's ice scour database.

C-CORE considered extreme scour features by basing its analysis on data from two route surveys along the pipeline corridor. For the surveyed corridor measuring approximately 0.6 mile in width, the deepest measured scour was found to be 1.7 feet. However, C-CORE's method of modeling determined 100-year scour depths to range between 4 feet and 4.6 feet for most of the pipeline route between Canada and the U.S. Similarly, C-CORE determined a 100-year scour depth of 2.6 feet for the deepest portion of the route, located in the Eastern Basin, for which in fact no trace of any scours was observed in the survey data (e.g., Zones F and G which represent about three-quarters of the route in U.S. waters).

Ice scours on the lakebed survive over time. The surveys of the proposed route identified several hundred ice scours that were formed over several decades, encompassing ice conditions representative of the historical record. It was also observed that some of the features that were at one time believed to be scours are in fact erosional features, such as gullies, based on their appearance in higher-resolution survey records. A correlation between the physical appearance of these features and those identified by repetitive mapping during Ontario Hydro and USGS surveys was used to estimate scour ages and hence annual recurrence rates.

The C-CORE report used statistical averages for several of its model inputs rather than inputs that would depict an extreme ice scour event. While this is a valid approach for environmental risk studies, it is typically less applicable for engineering design calculations. In such cases, worst case scenarios are more appropriate. By not using the "worst case" parameters for all input variables in its ice scour model, the C-CORE results may not represent the worst case situation.

Millennium responded that C-CORE, a leader in the field of ice engineering and research, used a method for determining extreme scour depths for the Lake Erie crossing that is well established and scientifically accepted world wide, and that represents the state of the art. The methodology involves fitting an exponential probability distribution to the measured scour depths and using recurrence rates estimated along the route to determine the 100-year scour depths used in the pipeline design.

C-CORE's 100-year scour depths are predictions of extreme, low probability scour events and used a 100-year ice scour depth in combination with average scour widths. C-CORE stated that this choice allowed for an appropriate 100-year design event for each of the zones of similar water depth, soil type, and ice conditions. Using a 100-year scour depth in combination with an extreme scour width would result in an event more severe than the 100-year event and would be an overly conservative approach. C-CORE's

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7/ American National Standard, ASME B31.8 – Gas Transmission and Distribution Piping Systems, Clause A841.3 Operational Design Considerations (1996) and Canadian Standards Association, Z662-99 – Oil and Gas Pipeline Systems, Clause 11.2.3.3.3 Functional Loads During Operations (1999).

8/ Det Norske Veritas -- Rules for Submarine Pipeline Systems, section 4, part C. Environmental Loads (1996) and British Standards Institution – Code of Practice for Pipelines, part 3. Pipelines subsea design, construction and installation, Annex B – Environmental considerations, Clause B.1.2 Return periods (1996).

comprehensive pipeline response analysis indicates that distress to the pipeline does not increase significantly for larger scour widths as compared to the average widths used for the design events.

Millennium concluded that it cannot identify any evidence to support deeper trench depths. Furthermore, Millennium believes that the trench depths recommended by C-CORE are already very conservative, that the recommended trench depths are the maximum depths required for the pipeline specification, and that C-CORE's analysis is based on accepted methodology.

While we believe the conclusions of the C-CORE report are reasonable since they were based on site-specific data from Lake Erie, we also believe that all prudent measures should be implemented to avoid the risk of damage to the pipeline from ice scour. Therefore, we requested the COE, a cooperating agency for the EIS, to complete an independent analysis of the ice scour studies through the COE's CRREL.

CRREL Analysis

We asked the CRREL to assist us in the assessment of Millennium's work on three topics related to the Lake Erie crossing: (1) the potential for pipeline damage by ice scour; (2) the adequacy of the sampling program to identify contaminated sediments; and (3) the adequacy of the modeling for turbidity and sediment deposition resulting from trench excavation. In response to our request, researchers at U.S. Army Engineer Research and Development Center (ERDC) assessed these topics. ERDC's assessment focused on the pipeline zones in U.S. waters and was conducted in collaboration with Millennium, its partners, and the Pittsburgh District, COE (CRREL, 2000) (see the Records and Information Management System [RIMS] at the FERC's website at www.ferc.gov for this report). The following discussion summarizes the findings of the ERDC staff on the ice scour issue. Their findings on the adequacy of Millennium's sampling program and on Millennium's sedimentation and turbidity modeling are included in separate sections.

High winds on Lake Erie can fracture and pile ice into large ridges. Ice scour occurs when the keels of these ridges drag along the lakebed. To avoid damage, a pipeline must be designed to withstand the forces from an ice scour expected once in 100 years. The design trench depth must place the pipe crown sufficiently below the scour depth to keep pipe deformations within acceptable limits.

Determination of the 100-year ice scour depth was the only issue that required additional analyses to satisfy the concerns of the ERDC reviewers. The original analyses relied solely on data from a single survey along the pipeline route. The ERDC review resulted in two main changes: only new scours were used to determine the scour-depth probability distribution, and scour data from comprehensive surveys near the pipeline route were included. These changes increased the estimated 100-year scour depth by 25 percent, from 4.0 feet (the C-CORE estimate) to 5.0 feet (CRREL estimate), in pipeline zones nearest to the U.S. shore (zones H, I, and J). In these zones the design trench depth was increased from 9.2 to 11.2 feet (see table 5.3.3.1-1). Ice scour is not a design issue in zones F and G, so it does not control the design of trench depth in these areas, and the original trench depth of 6.6 feet is adequate even if it was. The additional benchmark analyses conducted during the ERDC review increase confidence in the estimated scour rates, the scour-depth distribution, and the resulting 100-year scour depths.

The ERDC review included the pipe-soil interaction model used to determine the design trench depths given the 100-year scour depth for each zone. This finite-element model relies on results from centrifuge tests and field observations, and it represents the state of the art. Conservative choices regarding normal incidence angle and keel-pipe load transfer through native soil increase confidence in the model results.

TABLE 5.3.3.1-1

Trench Depths in Lake Erie

Zone	Approximate Milepost	Average Water Depth (ft.)	CRREL Recommended Trench Depth (ft)
F	0.0 to 4.9	86	6.6
G	4.9 to 22.8	93	6.6
H	22.8 to 24.7	68	11.2
I	24.7 to 28.6	62	11.2
J	28.6 to 31.7	38	11.2
ALF	31.7 to 32.9	25 a/	6.6

a/ Water depth at directional drill exit hole.

The design of the pipeline includes a margin of safety between the maximum tensile strain caused by the 100-year scour (2.5 percent) and the strain needed to rupture the pipe (about 3.8 percent). Millennium would monitor the pipeline continuously for changes in conditions that could signal damage and would close valves at each side of the lake if a leak occurs. In addition, Millennium would conduct internal and external inspections of the pipeline at approximately 3-year intervals (depending on ice conditions) to detect possible damage and to assess the design for ice scour protection. It would also establish procedures (as required by regulation) for emergency response and repair of the pipeline.

Millennium has agreed to install its pipeline at the depths recommended in the CRREL study and would construct, operate, and maintain its pipeline in accordance with the USDOT regulations in Title 49, CFR 192. We believe these depths are sufficient to protect the pipeline from ice scour.

5.3.3.2 Turbidity and Sediment Deposition

In-lake construction activities would result in temporary increases in suspended solids. The time that the particles would remain suspended depends on their settling velocities and water turbulence, and the distance of travel by the sediments from the source to the point of deposition depends on the current velocity. Colloidal and flocculated materials in particular would remain suspended and would travel further down current before resettlement.

Van Arkel (1997) originally modeled the expected suspension and deposition attributable to jetting the trench across Lake Erie. In response to comments on the DEIS and to account for changes to Millennium's proposed trench depth to protect the pipeline from ice scour, Millennium completed additional turbidity plume and sediment deposition modeling. Additional modeling was based on the zones and trench depths identified by the CRREL study and taking into account the sediment grain size of the composite sediment core samples collected along the zones, where available (table 5.3.3.2-1).

TABLE 5.3.3.2-1

Average Particle Size and Water Depth Along the Lake Erie Route

Zone	Approximate Milepost	Average Water Depth (ft)	Average Particle Size (mm)
F	0.0 to 4.9	86	0.01
G	4.9 to 22.8	93	0.02
H	22.8 to 24.7	68	0.06
I	24.7 to 28.6	62	0.1
J	28.6 to 31.7	38	0.1
ALF	31.7 to 32.9	25 a/	Bedrock

a/ Water depth at directional drill exit hole.

Millennium also completed modeling on the CRREL recommended trench depths in January 2001 The model included the following assumptions about jet sled operations:

Rate of travel:	500 feet per hour
Recommended trench depth:	6.6 feet for Zones F and G
	11.2 feet for Zones H, I, and J
Trench width (top):	34 feet for Zones F and G
	30 feet for Zones H and J
	45 feet for Zone I
Trench width (bottom):	7.9 feet
Trench cross-section:	138 feet^2 for Zones F and G
	212 feet^2 for Zones H and J
	295 feet^2 for Zone I
Nozzle diameter:	16 inches
Nozzle height:	10 to 15 feet
Nozzle offset:	6 to 10 feet
Nozzle angle:	45 degrees above horizontal
Hours of operation:	Continuous
Discharge velocity:	5 to 10 feet per second
Discharge concentration:	10 to 200 grams per liter

In addition, since the jet sled operation may require multiple passes to achieve the recommended trench depths, the model conservatively assumed that the entire volume of soil from the trench would be removed with only two passes (e.g., each pass would remove half of the soil volume). There would be at least 2 to 3 days between each pass. If more than two passes would be required, the resulting plumes would be expected to be of lesser extent and duration. The duration of the plume (i.e., the time required for the plume to dissipate once the jet sled operation has stopped) was approximated by the travel time from the jet sled to the distance where the plume criterion was found (i.e., distance divided by ambient velocity).

Millennium stated that an analysis of the effects of wave and wind drift could not be directly represented in the model. Because the currents in large lakes are primarily controlled by wind, the wind effects are included by examining different current speeds. The wave effects would only be noticed if the sediment is discharged at the surface, since mixing due to wave action is limited to the top few meters of the water column. Since the turbidity plume would be at the lake bottom, the wave effects are negligible. In addition, the size of the waves are affected by wind speed, direction, duration, and fetch. To represent all these parameters in the model would increase the complexity of the model and introduce more uncertainty.

The mixing action of waves has been included in the model as the dispersion coefficient, based on literature values for lakes that are similar in size to Lake Erie.

Table 5.3.3.2-2 presents the results of the modeling based on the above assumptions and shows the length and width of the turbidity plumes that would exceed TSS concentrations of 35 mg/l, 1,000 mg/l, and 10,000 mg/l, and their duration before concentrations would drop below the specified levels for the five zones with sediment substrate during each pass. Differences in the predicted extent of the plume's areal coverage within the five zones were attributed to differences in the sediment grain size distribution and the required trench depth for each zone.

Millennium's modeling (see table 5.3.3.2-2) indicated that a visible sediment plume (TSS>35 mg/l) could cover an area of between 1,388.8 and 3,701.2 acres at the surface and an area of between 1,228.8 and 4,761.6 acres at the bottom in Zones F and G (MPs 0.0 to 22.8). In Zone H (MPs 22.8 to 24.7), between 76.4 and 159.1 acres would be affected at the surface and between 49.3 and 99.4 acres at the bottom. In Zones I and J (MPs 24.7 to 31.7), between 8.0 and 48.0 acres would be affected at the surface, and between 8.0 and 24.7 acres would be affected at the bottom. Duration of the plumes at the surface ranged between 25 and 47 hours in Zones F and G and between 2 and 10 hours in Zones H, I, and J. A denser plume (TSS > 10,000 mg/l) in Zones F through J could affect an area of between 0.1 and 1.0 acre at the surface and between 0.4 and 3.2 acres at the bottom for up to a maximum of 5 hours. Sedimentation due to construction activities across all of Lake Erie may affect about 1.3 percent of the lake.

The plume would follow construction across the lake and would not be sustained at any location. Previous studies show that TSS concentrations of 1,000 mg/l would have no lethal effects on most fish species. Some species prefer turbid water for cover, although others may suffer feeding impairment (e.g., visual feeders) and/or increased gill clearing. A concentration of 10,000 mg/l represents the approximate threshold mortality level for some fish species exposed for 24 hours or longer. This is also the threshold mortality level that must be sustained for more than 5 days to be lethal to zooplankton and clams. The duration of the plume at 10,000 mg/l is estimated at 5 hours or less. Short-term suspended sediment concentrations of 20,000 to 100,000 mg/l showed no lethal effect on fish species (Wallen, 1951).

We asked CRREL to assess the adequacy of Millennium's modeling for turbidity and sediment deposition. ERDC's review of Millennium's modeling of turbidity and sediment deposition focused on modeling methods and choice of sediment settling velocity. Modeling by ERDC showed that the originally predicted turbidity plume is conservative.

TABLE 5.3.3.2-2

SUMMARY OF TURBIDITY PLUME MODELING FOR JET SLED DISCHARGE AT THE BOTTOM AND SURFACE OF LAKE ERIE

Ambient Current Velocity	Plume Dimensions at 35 mg/l TSS Maximum Length	Plume Dimensions at 35 mg/l TSS Maximum Width	Plume Dimensions at 35 mg/l TSS Plume Duration (hr)	Plume Dimension at 1,000 mg/l TSS Maximum Length	Plume Dimension at 1,000 mg/l TSS Maximum Width	Plume Dimension at 1,000 mg/l TSS Plume Duration (hr)	Plume Dimensions at 10,000 mg/ITSS Maximum Length	Plume Dimensions at 10,000 mg/ITSS Maximum Width	Plume Dimensions at 10,000 mg/ITSS Plume Duration (hr)
Zone F - MP 0 to 4.9									
Jet Sled Discharge at Bottom									
0.16 ft/s	6.2 miles	1.2 miles	55	1.0 mile	525 feet	9	660 feet	49 feet	1
0.03 ft/s	1.9 miles	1.6 miles	88	3,170 feet	1,640 feet	28	525 feet	262 feet	5
Suction Hose Discharge at Surface									
0.6 ft/s	15.5 miles	1,970 feet	39	4,225 feet	98 feet	2	330 feet	<16 feet	<1
0.1 ft/s	3.9 miles	1.2 miles	59	4,225 feet	660 feet	12	430 feet	66 feet	
Zone G - MP 4.9 to 22.8									
Jet Sled Discharge at Bottom									
0.16 ft/s	5.0 miles	3,700 feet	44	4,225 feet	390 feet	7	525 feet	39 feet	1
0.03 ft/s	1.6 miles	1.2 miles	70	2,620 feet	1,310 feet	22	525 feet	197 feet	5
Suction Hose Discharge at Surface									
0.6 ft/s	9.9 miles	1,640 feet	25	4,225 feet	98 feet	2	330 feet	<16 feet	<1
0.1 ft/s	3.1 miles	3,700 feet	47	3,170 feet	525 feet	9	430 feet	49 feet	1
Zone H - MP 22.8 to 24.7									
Jet Sled Discharge at Bottom									
0.16 ft/s	1.0 mile	820 feet	9	2,070 feet	262 feet	4	660 feet	66 feet	1
0.03 ft/s	1,640 feet	1,310 feet	14	820 feet	525 feet	7	330 feet	164 feet	3
Suction Hose Discharge at Surface									
0.6 ft/s	2.5 miles	525 feet	6	4,225 feet	131 feet	2	660 feet	<16 feet	<1
0.1 ft/s	3,170 feet	1,050 feet	10	1,310 feet	330 feet	4	525 feet	82 feet	2
Zone I - MP 24.7 to 28.6									
Jet Sled Discharge at Bottom									
0.16 ft/s	2,625 feet	410 feet		1,310 feet	164 feet	3	525 feet	66 feet	<1
0.03 ft/s	660 feet	525 feet		410 feet	262 feet	4	197 feet	131 feet	2
Suction Hose Discharge at Surface									
0.6 ft/s	1.2 miles	330 feet		2,625 feet	82 feet		660 feet	23 feet	<1
0.1 ft/s	1,640 feet	525 feet		820 feet	197 feet		330 feet	66 feet	<1
Zone J - MP 28.6 to 31.7									
Jet Sled Discharge at Bottom									
0.16 ft/s	1,640 feet	330 feet		820 feet	131 feet		410 feet	52.5 feet	<1
0.03 ft/s	525 feet	390 feet		262 feet	197 feet		164 feet	98 feet	2
Suction Hose Discharge at Surface									
0.6 ft/s	3,960 feet	197 feet		2,070 feet	82 feet		660 feet	23 feet	<1
0.1 ft/s	1,050 feet	330 feet		525 feet	131 feet		262 feet	66 feet	<1

Table 5.3.3.2-3 summarizes anticipated sedimentation based on sediment deposition after two passes by the jet sled. Using the suggested trench depth dimensions from the CRREL review, Millennium modeled the expected sediment deposition associated with construction in the various zones.

TABLE 5.3.3.2-3

Summary of Predicted Sediment Deposition in Lake Erie

Zone	Approximate Milepost	CRREL Revised Trench Depth (ft)	Deposit Thickness (in) Minimum a/	Deposit Thickness (in) Maximum b/	Maximum Distance (ft) of a Deposit Thickness Greater Than 0.08 inch
F	0.0 to 4.9	6.6	1.0	4.3	3,300
G	4.9 to 22.8	6.6	6.9	9.2	3,300
H	22.8 to 24.7	11.2	7.4	16.0	4,920
I	24.7 to 28.6	11.2	6.7	27.0	4,920
J	28.6 to 31.7	11.2	4.8	20.0	4,920

a/ Based on best case (no ambient current and low initial plume velocity).
b/ Based on worst case (high ambient current and initial plume velocity).

The PADEP expressed concerns about the effects of the project on dissolved oxygen levels in Lake Erie and requested additions to Millennium's monitoring plan that would accurately determine the current speed and direction in the lake's hypolimnion. [9/] In addition, the PADEP requested that the plan provide for separate monitoring of the turbidity plumes in the hypolimnion and epilimnion.[10/] Finally, the PADEP requested a description of the mitigative actions that Millennium would take if the observed turbidity plumes exceeded the predicted plumes. The PADEP issued its 401 Water Quality Certification for the project on March 29, 2000 (see appendix L). The certification includes project-specific requirements, such as monitoring in accordance with a Monitoring Plan for Pennsylvania Waters and adherence to the requirements of the Preparedness, Prevention and Contingency Plan to prevent spills of fuels and lubricants.

5.3.3.3 Potential for Encountering Contaminated Sediments

Chemical constituents that may affect water quality within the lake include metals and toxic organic compounds. Open lake concentrations of cadmium, copper, iron, and selenium in the water have been observed in excess of objectives established in 1978 by the ITC. Most of these metals occur in the particulate phase; their levels are therefore influenced by both total input and resuspension of contaminated sediments. Notable organic toxins that have been found to exceed target concentrations of the Canadian Ministry of the Environment provincial water quality objectives include PCBs and dieldrin (Stevens and Neilson, 1989). Although both PCBs and aldrin (the biological precursor to dieldrin) were banned in the 1970s; their continued elevated levels may be a result of continued atmospheric deposition, contributions of runoff, and sediment resuspension.

The high biological productivity that characterizes Lake Erie may promote processing of heavy metals and other contaminants. Metals and hydrophobic organic components may be taken up by suspended

9/ The part of a lake below the thermocline (the region in a thermally stratified body of water which separates warmer oxygen-rich surface water from cold oxygen-poor deep water and in which temperature decreases rapidly with depth) made up of water that is stagnant and of essentially uniform temperature except during the period of overturn.

10/ The part of a lake above the thermocline.

organisms, diluted within the large biomass, and then buried as the organisms settle to the bottom of the lake. Metals within the water column also have a tendency to sorb to suspended particles and settle to the bottom.

Releases of high concentrations of organic and inorganic contaminants from sediments during trenching may lead to increased bioaccumulation,[11/] producing sublethal effects on growth and reproduction and thus, a decrease in biological productivity of less tolerant organisms. Based on the low concentrations of chemical parameters in the sediment, the large dilution capacity of the project waters, and the transitionary nature of the jetting activities, only localized short-term degradation of water quality would be expected. Any chemical releases would be small, and their effects would be localized and temporary, with rapid dispersion by mixing and sorption processes to ambient levels. Considering the short duration of exposure, the probability of any significant bioconcentration of contaminants by fish is low. Similarly, no net impact would likely result from contaminant resusupension on benthic macroinvertebrates because these organisms are in contact over their life span with the chemical constituents in the sediments (interstitial waters).

To minimize the potential for sediment contamination, Millennium selected the pipeline route to avoid areas of fine recent sediment deposition and maximize the crossing of non-depositional areas (i.e., those with glacial till or coarser-grained sediment). This determination was based on a comprehensive review that concluded that elevated contaminant concentrations were likely to occur in the finer sediments of the depositional basins in the lake (Fitchko, 1997). Once the corridor was established, surficial sediment samples were collected along a grid system for the analysis of an indicator contaminant (e.g., mercury). In the 33 samples collected on the U.S. side of Lake Erie, mercury levels ranged from <0.04 to 0.19 μg/g. Mercury levels were below the detection limit of <0.04 μg/g in 26 of the 33 samples. These mercury concentrations were below the Ontario sediment quality guideline for lowest effect level of 0.2 μg/g and well below the U.S. EPA bulk chemical composition guideline for polluted sediment of greater than 1 μg/g. These levels in the surficial sediments represent natural (background) concentrations of mercury. Based on the low mercury levels, the concentrations of other chemical parameters were expected also to be low, indicating that sediment quality along the route corridor would likely not be a problem.

Subsequently, a comprehensive sediment quality sampling program was developed and submitted to the COE, Pittsburgh District, for review and comment. The program involved the collection of recent sediments (i.e., from the water/sediment interface to the interface with the underlying glaciolacustrine sediment) at five locations along the proposed route on the U.S. side of the lake including one at the Ripley landfall. Sufficient sediment volume was to be collected to facilitate bulk chemical composition analysis and elutriate testing (e.g., by washing away the lighter or finer particles). If little or no recent sediment were present, the glaciolacustrine sediment was to be collected for analysis. During sample collection, recent sediments could not be discerned from the underlying sediments; as a result, the samples collected were composited with sediment depth for analysis.

The following parameters were analyzed: grain size (percent sand, percent silt, percent clay), percent loss on ignition, total organic carbon, total Kjeldahl nitrogen, ammonia, cyanide, metals, arsenic, mercury, oil and grease, pesticides/PCBs, chlorinated organics, polyaromatic hydrocarbons, acid and base extractables, and volatile priority pollutants. Sediment quality along the pipeline route on the U.S. side of Lake Erie has been shown to be generally acceptable. Based on its review of the analytical data, the COE indicated that elutriate testing of the sediment was not required.

In addition, the sediment core samples collected were subsampled at 3-cm intervals to a depth of about 1 foot for analysis of mercury as an indicator contaminant. This depth of sediment has been shown to

11/ Bioaccumulation is the total accumulation by an organism of a chemical from its combined exposure. The combined exposure may be the exposure the organism has to water, food, or sediment that contains the toxic material.

represent the deposition of recent (post-1890) sediments in the central basin of Lake Erie. Mercury levels in the subsamples were consistently below the analytical detection limit of <0.063 to <0.074 µg/g, indicating that contaminants have not been buried by more recent uncontaminated sediments.

Surficial sediment samples collected along the pipeline corridor sampling grid near the historic mercury "hotspot" northeast of Erie had mercury levels ranging between <0.04 and 0.19 µg/g, below the Ontario sediment quality guideline for lowest effect level of 0.2 µg/g. Moreover, the composite core sample, as well as the core subsamples at 3-cm intervals to a depth of 33 cm, collected at Sampling Location 2 near the "hotspot," had mercury levels below the detection limit. Based on the sediment quality data, Millennium did not identify route variations (to avoid contaminated areas) or changes in construction methods (to minimize contaminant resuspension).

The ERDC's review of Millennium's sediment-sampling program sought to resolve issues concerning the depth and intensity of sampling and the use of mercury as an indicator contaminant. The ERDC determined that no additional sampling or analyses are needed due to increased trench depths because the extra material excavated would be uncontaminated.

5.3.3.4 Pipeline Repair in Lake Erie

Millennium states that it would develop a plan and manual for handling emergencies for its portion of the Lake Erie crossing, based on the partners' experience with offshore pipelines. This plan would include a monitoring and remediation plan and would be filed with the Commission before construction.

Millennium estimates that pipeline repair in Lake Erie would require 14 days from the time of break detection to the time the pipeline would be returned to service when there is no ice cover. The repair and replacement pipe welds would be made using a welding frame and a diving/repair vessel. Approximately 6 days would be required to mobilize and qualify the diver/welders, mobilize the welding frame and repair vessel, and set up at the site. The remaining time includes the actual welding time, non-destructive testing, dewatering the pipeline, and repressuring for operation. When there is ice cover, the repair procedure would require about 21 days. The increased time is the result of mobilizing an ice breaker vessel, breaking up and moving the ice, and additional time required for set up and underwater work due to cold weather conditions. Table 5.3.3.4-1 summarizes repair procedures and times.

TABLE 5.3.3.4-1

Lake Erie Offshore Repair and Time Requirements

Activity	Repair - No Ice Cover	Repair - With Ice Cover
Source, mobilize, qualify diver-welders	6 days a/	7 days a/
Mobilize welding frame	1 day a/	1 day a/
Mobilize ice breaker	–	2 days a/
Break/move ice mass	–	4 days a/
Mobilize suitable diving/repair vessel	3 days a/	3 days
Set up at site	1 day a/	2 days
Complete welds, etc.	3 days	4 days
Dewater pipe	4 days	4 days
Pressure up	1 day	1 day
TOTAL	**14 days**	**21 days**

a/ Operations would occur simultaneously.

Conclusion

Based on the information presented above, we conclude that the Lake Erie crossing can be constructed as proposed and that the plume and sediment modeling adequately identify potential environmental impacts. The PADEP issued its section 401 Water Quality Certification (see appendix L) on March 29, 2000, and its determination that the project would be consistent with the Pennsylvania coastal zone management plan on April 6, 2000. We also find that ice scour issues have been reasonably addressed. However, we note that the most significant impacts on Lake Erie (e.g., the short-term turbidity plume and the longer term impact of sediment deposition along the pipeline trench) could be partially moderated by reduced jet sled speeds or other means. Therefore, we recommend that:

- **Before construction, Millennium should file with the Secretary for review and written approval by the Director of OEP, the finalized plan for the Lake Erie crossing. The plan should include:**

  a. **the trench depth recommendations determined by the CRREL analysis;**

  b. **the manual for handling emergency repair of the pipeline in Lake Erie;**

  c. **finalized construction procedures, including schedules and timing, procedures those for minimizing and monitoring dispersion of the turbidity plume and sediment deposition, and a description of the mitigative actions that Millennium would take if the observed turbidity plumes exceed the predicted plumes; and**

  d. **specific information on the discharge rate of spoil in the lake bottom in modeled zones F, G, H, I, and J after the construction contractor and jet sled equipment have been selected.**

Pipeline construction would continue from the Canadian/U.S. border in Lake Erie to a landfall in Canada with additional onshore construction in Canada. This construction is proposed by TransCanada and St. Clair and will be reviewed by the NEB. The NEB has a regulatory review process similar to that of the FERC, and a permit is required from the NEB for construction of that portion of the project that is under its jurisdiction (see section 1.4). Since St. Clair and TransCanada withdrew their application for the Canadian facilities in August 2001 pending redesign of its facilities to accommodate the changed market, we recommend that:

- **Millennium should not begin construction of any portion of the project until it files with the Secretary a copy of the appropriate permits from the Canadian NEB regarding construction of the Canadian portion of the project.**

5.3.4 Hudson River

The Hudson River is a designated American Heritage River because of its important role in American history. At the proposed crossing location, this part of the Hudson River at Haverstraw Bay has been designated as an EFH for red hake, winter flounder, windowpane, bluefish, Atlantic butter fish, fluke, and Atlantic herring.

The proposed crossing would be 2.1 miles long, making directional drilling infeasible as a construction option. However, the shallow, slow-moving water and sandy bottom at the crossing location would facilitate the use of the open-cut construction method. In response to agency concerns about the use of a conventional dredging techniques, Millennium now proposes to use an open-water, lay-barge construction method. This would involve installing the pipeline continuously, storing the dredge spoil in barges, and backfilling the trench using bottom-dump barges as discussed in greater detail below.

Discussed below are the various alternative construction techniques that could be used in a dredging operation (including a discussion of the originally proposed conventional dredging technique), the currently proposed lay-barge dredging construction method, predicted plume and TSS with both methods, and the potential for encountering contaminated sediments at the crossing.

Alternative Construction Techniques

Millennium originally proposed to use a conventional open-cut, bottom-pull construction method, which raised a number of concerns with Federal and state agencies about the magnitude of the environmental impact on Haverstraw Bay. This led to an analysis of different options that could be used to construct across the bay that would reduce the overall level of impact.

<u>Conventional Open-Cut, Bottom-Pull Construction Method</u>

A conventional open-cut, mechanical dredge, bottom-pull construction method involves dredging the trench to the required depth, pulling the pipe across the river and into the trench, and then backfilling the trench.

To meet a 3-month construction window, two dredge plants/barges would be used to excavate the trench and then install the pipeline. The pipe used to construct the crossing would be encased in concrete for protection and to ensure negative buoyancy. The trench would be up to 130 feet wide at the top in the shipping channel, up to 70 feet wide at the top in other areas outside of the shipping channel, and about 10 feet wide at the bottom. Trench depth would be about 20 feet in the shipping channel and 10 feet in areas outside the shipping channel. Assuming a side slope of 3:1, about 200,000 cubic yards of material would be excavated from the trench. The trench would be excavated over a period of about 60 days, the pipe installed in 5 days, and the trench backfilled over a period of about 30 days.

Spoil would be stockpiled on each side of the trench. To ensure that fish movement in shallow areas (within about 350 feet and 250 feet of the west and east shores, respectively) would not be blocked, breaks would be installed in spoil piles and spoil would not be placed above the waterline. Each dredge bucket would be brought to the surface for repositioning and to lower underwater resistance before being dropped back to the bottom to deposit the spoil along the trench. This procedure would be repeated during backfilling. During dredging and backfilling operations, turbidity curtains would be used to reduce sediment transport. Following backfilling, the minimum cover over the pipeline would be 15 feet in the shipping channel and 5 feet outside the shipping channel. If sufficient backfill material is not available to reach this depth, cover material that meets COE specifications would be imported and delivered to the trench with hopper barges that have bottoms which can be opened over the trench. Cover would be redistributed as necessary using mechanical means.

This construction method would involve disturbance across the entire 2.1-mile-long crossing of the bay throughout the 90 days of construction. Agency concerns centered around the sedimentation and turbidity that would result from the extended time during which the dredged material would be stockpiled in the river and the trench would remain open (about 3 months) and from the use of open-bucket dredges to excavate and backfill the trench. We rejected this method as a viable option for crossing the Hudson River because of the potential impacts on sensitive fish and wildlife resources.

Hydraulic Dredging

This option would avoid stockpiling the spoil in the river and the associated turbidity related to wave action and tidal influences on the stockpiled material (tidal range is about 3 feet). Hydraulic dredging would require loosening the material to be removed, mixing it with water, and then pumping it as a slurry through a floating pipeline to an upland or in-river disposal area. The slurry is typically about 10 percent excavated material and 90 percent water. About 700,000 cubic yards of material would need to be excavated assuming a conventional dredging method is used with the same side slope (3:1), and trench depth (10 feet outside the navigation channel, 20 feet in the navigation channel), but allowing for a 20-foot-wide trench at the bottom because of how the hydraulic dredge works. Completing the crossing within a 3-month time window could be affected because of the disposal requirements and the lack of hydraulic dredging equipment in the region. If only one hydraulic dredge is used, construction could take up to 7 months.

Another issue associated with the use of hydraulic dredging is the disposal area. Millennium estimates that the storage and dewatering of 700,000 cubic yards of material could require as much as 50 acres of land; if multiple dredges were used, the land requirements could increase to as much as 100 acres. Since there are no disposal sites at the crossing location on either shore that could handle this volume of material, material would have to be trucked further inland. Although material could be stored in the river, sedimentation would be significantly increased both during excavation and backfill because the sediments suspended by the hydraulic action would take longer to settle out. Short-term turbidity would be expected to be higher than with the use of mechanical dredging. Since this option provided no environmental benefits, we eliminated it from further consideration.

Use of Barges for Spoil Storage

This option would also avoid in-river storage of dredged materials and was evaluated as part of the overall dredging plans. Assuming the conventional dredging method is used, excavation would be expected to require the removal of about 200,000 cubic yards of material in-situ for a conventional bottom-pull dredge construction method. The excavated material would have to be dewatered and the decanted water released into the Hudson River. Using a standard coal barge with a 23,000-cubic-foot (850-cubic-yard) capacity, the storage of 200,000 cubic yards of spoil would require 235 barges which would need to be anchored in Haverstraw Bay while maintaining passage in the shipping channel. The number of barges required could be reduced to 133 barges with use of shallow-draft barges with a 1,500-cubic-yard capacity and to 43 barges with the use of large bottom-draft barges with a 4,600-cubic-yard capacity. Millennium estimates that, because of the additional handling time, use of barges to store spoil for the entire crossing would lengthen the construction time by about 1 month. Although this option was not practical for the conventional dredging method, we incorporated use of some barges into the currently proposed open-cut, lay-barge construction method described below.

Reducing Dredge Bucket Size and/or Dredge Cycle Time

This option could reduce TSS associated with dredging the trench. Millennium analyzed this option as part of the modeling study completed by GAI Consultants, Inc. (1998) on the conventional dredging method. The analysis predicted that the resultant TSS concentrations would be significantly reduced by decreasing the dredge bucket size and/or by reducing the cycling time. However, reducing the bucket size and/or dredging cycle time (e.g., the number of times a dredge cycle is completed in a given time period) would increase the overall time needed to construct a conventional bottom-pull dredge. While this option provided no significant environmental benefit for a conventional bottom-pull dredge because it could extend the construction period, we incorporated a modification of it into the currently proposed open-cut, lay-barge construction method described below.

Use of Closed-Bucket Dredges

This option could also reduce TSS. Millennium contacted manufacturers and found that several different closed-bucket models are available. All would be expected to reduce turbidity when lifting the dredged material, thus reducing total TSS concentrations during construction. However, sidecasting and backfilling would still generate some turbidity. Data from one manufacturer claimed that TSS concentrations would be less than 30 percent over background concentrations. However, use of closed- bucket dredge units could increase the amount of time required to excavate and backfill the trench using a conventional bottom-pull dredge by as much as 20 percent, or from about 90 days (3 months) to 108 days (3.6 months). However, we incorporated use of closed-bucket dredeges into the currently proposed open-cut, lay-barge construction method described below.

Horizontal Directional Drill of the Shorelines

This option would avoid disturbance of the Hudson River shorelines. It would require setting up drilling equipment on both shorelines. The pipe for the west shore would be welded on a barge and then staged (laid) on the riverbottom before being pulled back through the drill hole to the west bank. Because of the rock/soil interface, the pipe for the east shore would be staged on the east bank and then pulled through the drill hole from the bank to the exit hole in the river. The two segments would then be welded to the rest of the river crossing pipe.

Millennium does not believe that a directional drill of the shorelines is a feasible or reasonable option for the following reasons:

> On the west bank, the relative consistency of the soils may make maintenance of the exit hole very difficult and would pose a substantial risk to the successful completion of the drill. The directional drill would require staging of the drilling equipment on the west bank and about 3,000 feet of pipe in the river east of the exit hole.
>
> On the east bank, significant grading within the Franklin D. Roosevelt Veteran's Hospital would be required to prepare a relatively level 1-acre work space for the staging of the directional drilling equipment.
>
> Directional drilling includes the use of drilling mud, which consists of about 5 percent bentonite and the rest water. Normally, the drilling mud is circulated between the drill and the exit holes. In this case, once the pilot hole is completed, drilling fluid would be discharged continuously into the riverbed at the exit holes until pipe installation is complete. Millennium estimates that drilling fluid, consisting of about 1,800 cubic yards of bentonite, 900 cubic yards of drilled spoil, and 255,000 barrels of fresh water would be discharged at each exit hole (a total discharge of 5,400 cubic yards into the river).
>
> The sequential crossing of the Hudson River/Haverstraw Bay by means of two directionally drilled shore approaches and a lay barge in the middle would likely increase the duration of construction from 3 to 4.5 months.

Since this option provided no significant environmental benefit, we eliminated it from further consideration.

Open-Cut Lay-Barge Construction (Proposed Method)

Millennium currently proposes a lay-barge construction method that would involve continuous excavation of the trench and immediate installation of the pipeline following dredging. This method would require a lay barge, a pipe supply barge, a crane dredge, and bottom-dump barges. The construction work area would be about 1,300 feet in length to accommodate the equipment, and the trench would be excavated with a single-dredge rig using a closed bucket (instead of two dredge units using open buckets, as previously proposed). Individual joints of pipe about 40 feet long would be stored on a supply barge (stationed alongside the lay barge) and then moved to the lay barge one by one. The pipe would be welded into pipe strings on the lay barge and then lowered into the river as the barge is moved forward. In the shallow water near the shoreline, the pipe string would be welded on the lay barge and pulled into the trench using a winch on the shore.

The 1,300-foot length for the construction work area is based on a contractor's estimate of equipment staging and placement in the queue to complete the trench excavation, spoil storage, pipe welding and laying, and backfill in an efficient manner. This length would provide enough space for all the sequential operations to take place without hindering or slowing down other operations. Since all dredge materials would be stored on barges and the entire installation would proceed sequentially across the river, the area directly impacted by construction of the trench at any one time would be about 150 feet by about 1,300 feet (assuming the worst case - a trench bottom width of 10 feet, a trench depth of 20 feet, and a trench side slope of 3 to 1 for installation in the shipping channel). Installation in areas outside of the shipping channel would directly affect a slightly smaller area: about 100 feet by 1,300 feet at any given time. Millennium anticipates that it would take about 2 weeks to complete work in each 1,300-foot segment assuming a 10-hour workday. If a second 10-hour shift were added, construction activities in the Hudson River could be completed more quickly. This would represent a significant reduction in impact when compared to the conventional dredging method where the entire construction right-of-way across Haverstraw Bay (between 70 and 150 feet by 2.1 miles) would be affected for up to 3 months.

Millennium proposes to use a closed bucket, such as the cable-arm clamshell, for all dredging operations, and would use a 6-cubic-yard closed bucket in the shallow shore water and a 22-cubic-yard closed bucket for dredging in deeper water to minimize sedimentation while still completing construction within the 3-month window. Although use of one closed-bucket dredge unit for excavation and storage of the spoil on the barges would require more time than would two open-bucket dredge units and stockpiling the spoil in the river, the larger closed-bucket dredge (22-cubic-yard) would reduce the time required for excavation in the longer deep water segments.

Barges would be obtained by the river crossing contractor, most likely from companies that have fleets in the Hudson River or New York City waterway region. Millennium anticipates that the contractor would use large, bottom-dump barges (measuring about 240 feet long and 54 feet wide, with a maximum fully loaded draft of 15 feet and a capacity of 4,600 cubic yards) and smaller, shallow-draft bottom-dump barges (measuring 190 feet long and 40 feet wide, with a maximum fully loaded draft of 10 feet and a capacity of 1,500 cubic yards). Typically, the bottom-dump barge uses a hydraulic mechanism (although some are mechanical) to open the bottom and dump the contents. Millennium estimates that about 17 barges of various types would be deployed at any one time. This assumes that 5 shallow-draft barges and an additional 4 large barges would be required for the initial 1,300-foot segment near the shallow shorelines (about 22,220 cubic yards of spoil), and that 17 large barges would be required for the 1,300-foot segment in the shipping channel (about 77,315 cubic yards of spoil) where the most material would need to be dredged and stored. At the banks of the river, some spoil may be stored in the river where the spoil cannot be moved onshore and it is too shallow for the barges.

Predicted Plume and TSS Impacts

Proposed Open-Cut Lay-Barge Construction Method

Millennium states that modeling of construction impacts was performed using models presently used by the COE to evaluate the effects of dredging. The modeling of the lay-barge dredge construction method estimated the extent of the visible plume and the thickness of sediment deposition that would result from the dredging and backfilling of the Hudson River/Haverstraw Bay. The model results were broken down into four components: (1) dredging in shallow water using a 6-cubic-yard closed bucket, (2) backfilling in shallow water using a 6-cubic-yard closed bucket, (3) dredging in deep water using a 22-cubic-yard closed bucket, and (4) backfilling in deep water using a bottom-dump barge. The results are summarized in table 5.3.4-1.

TABLE 5.3.4-1

Summary of Predicted Impact for the Hudson River Crossing Using a Lay-Barge Dredging Construction Method

Factor	1-Dredging in Shallow Water	2-Backfill in Shallow Water	3-Dredging in Deep Water	4-Backfill Deep Water
Length of each component a/	1,000 ft	1,000 ft	9,900 ft	9,900 ft
Estimated steady-state visible plume width (normal to flow) by length (in the the direction of flow)	60 x 35 ft	90 x 170 ft	90 x 460 ft	500 x 400 ft
Estimated visible plume b/	2,100 ft^2 0.05 ac	15,300 ft^2 0.35 ac	41,400 ft^2 0.95 ac	200,000 ft^2 c/ 4.59 ac
Days to complete construction	16 days	19 days	36 days	26 days
Average production rate per day	65 ft	53 ft	275 ft	2 dumps
Total area affected on any given day d/	2,700 ft^2 0.06 ac	16,100 ft^2 0.37 ac	227,700 ft^2 5.23 ac	400,000 ft^2 9.18 ac
Thickness of redeposited plume sediment e/	2.2 in	1.3 in	0.2 in	3.0 in

a/ Modeling based on 10,900 feet (2.1 miles) of in-water construction.
b/ Estimated plumes for Components 1 through 3 assume the dredge operates over a 50-foot length of trench before moving forward and the plume dimension (normal to flow) was increased by this width to account for the moving source. The estimates do not include an interaction between the plumes since they should be sufficiently far apart.
c/ An estimated total of 52 barge dumps would be required for the crossing at an average of 2 barge dumps per day.
d/ Includes all areas covered by a visible turbidity plume for any length of time.
e/ Within the aerial extent of the plume for components 1, 2, and 3; and within 150 feet of the trench for component 4.

The modeling predicted a visible plume (> 35 mg/l) ranging between 60 and 90 feet wide by between 35 and 460 feet long during dredging and a plume ranging between 90 and 500 feet wide by between 170 and 400 feet long during backfill. The total area affected by operation on any given day ranged between 0.06 acre and 5.23 acres depending on the operation (e.g., components 1 through 3). Periodic impacts involving about 9.18 acres would occur during backfill of the deep water component (e.g., component 4).

The total area that would be impacted by the crossing was then calculated by multiplying the length of the visible plume by the trench length for each area (1,000 feet for Component 2 and 9,900 feet for Component 3) and then summing the results of the calculations. This resulted in a total projected impact of 4,724,000 square feet (108.5 acres) although the plume generated on consecutive days would overlap, such that some areas would be affected on successive days. Haverstraw Bay is estimated to average about 2.6 miles wide (13,940 feet) by 4.2 miles long (22,000 feet) for a total of about 7,040 acres. Proposed construction would affect about 1.5 percent of the bay over the duration of the crossing.

The modeling indicates that TSS concentrations would not exceed 1,000 mg/l above ambient conditions within 30 feet of the dredging or backfilling operations. Suspended sediments would disperse to concentrations between 500 mg/l and 35 mg/l above ambient conditions within the mixing zone (i.e., the area within the visible plume and outside 30 feet from the dredging operation). Concentrations less than 35 mg/l above ambient conditions would be expected beyond the visible plume. To further reduce turbidity and sedimentation, Millennium states that it would use silt curtains during backfilling, as necessary and if required by Federal and state agencies. Millennium has developed a Sampling Plan for Monitoring Cross-Hudson Pipelaying Operations (Sampling Plan) (see appendix M). The NYSDEC in its section 401 Water Quality Certificate identified 26 other site-specific conditions for the Hudson River/Haverstraw Bay crossing (see appendix K, conditions 7A through 7Z). These conditions include detailed specifications on sampling protocol and reporting.

We requested that the COE evaluate the modeling and turbidity estimates generated by Millennium. The COE forwarded the materials to its Waterways Experiment Station (WES), the organization that developed the models used by Millennium, for technical review. The WES concluded that the techniques used and the data employed represent the current state-of-the-practice for turbidity predictions from dredging operations as proposed in the construction of the pipeline crossing. Further, the assumptions and data used in the predictions were reasonable and conservative. The WES ran its own simulations using the same models and found very good agreement with Millennium's results. Millennium's turbidity predictions were actually somewhat higher for three of the four construction components (dredging in shallow water, backfilling in shallow water, and dredging in deep water). The WES predictions of the plume size for the fourth component, backfilling in deep water, were the same as Millennium's predictions. However, WES predicted that the plume might be visible for 1 to 2 hours following dumping from a barge instead of the 30 minutes originally predicted by Millennium. Finally, the WES reviewed the predicted loss of material and the depth of burial/sedimentation outside the construction trench and found that Millennium's predicted loss and burial overestimated the expected impact. We believe that Millennium's modeling efforts and subsequent predictions of the turbidity plume are appropriately conservative for a sensitive habitat such as Haverstraw Bay.

Modeling Comparison to Originally Proposed Construction Method

Modeling completed for the originally proposed conventional bottom-pull dredge construction method predicted a visible plume about 330 feet wide by 5,100 feet long during excavation (assuming TSS would have to be 70 mg/l to be visible). On a daily basis, the plume would cover an area of about 38 acres. As trenching progresses across the bay, the visible plume would follow active trenching. Dredging operations would increase TSS concentrations to about 160 to 379 mg/l at a distance of about 165 feet from the dredging site. The TSS concentrations during backfilling of the pipeline would be expected to be similar to the plume during excavation. However, the length of the plume during backfilling would be expected to be twice the size of the plume during excavation because backfilling would proceed at twice the distance each day. The visible plume on any given day during backfilling would cover an area of about 77 acres. Millennium estimated that about 70,907,000 square feet (1,627.8 acres) or about 23 percent of the bay would be affected by the bottom-pull dredge method. The significantly greater TSS concentrations that would result from this conventional construction method were a contributing factor in rejecting this method after the publication of the DEIS.

Contaminated Sediments

Millennium conducted sediment sampling in the Hudson River near the crossing location and found trace levels of metals and other chemical contaminants. These are likely to be present in similar concentrations in the general vicinity of the pipeline route and would be disturbed during dredging. However, most of the sediments would be retained in the barges and then resettled within or close to the trench. Releases of organic and inorganic contaminants from excavated sediments during construction activities would be expected to increase bioaccumulation and decrease biological productivity of the fish and invertebrate communities present in the immediate vicinity of the proposed crossing. In general, based on the EPA marine acute criteria, acute impacts on aquatic life are not expected beyond the predicted visible plume which would have a maximum coverage of about 4.6 acres in the deep water construction component.

The NYSDEC commented that additional cores should be collected at the crossing location because of the known presence of PCBs near the project site. Millennium proposes to collect two additional sediment cores before construction across the Hudson River in compliance with the NYSDEC's section 401 Water Quality Certificate (see appendix K, condition 7.E). The Village of Croton-on-Hudson commented that the 1999 U.S. EPA's assessment of the Lower Hudson River found that PCB concentrations in the water and sediments generally exceeded standards established to be protective of the environment. PCBs have migrated into the Lower Hudson River from the two capacitor manufacturing plants in Hudson Falls and Fort Edward, about 105 miles north of the proposed crossing in Haverstraw. Aquatic life is present at the proposed crossing location, although there are advisories against commercial fishing of striped bass and several other species in the lower Hudson River. Disturbance of the sediments is not likely cause mortality of the species that inhabit this reach of the Hudson River. The NYSDEC has also required Millennium to implement a Hudson River Sampling Plan that would be used during construction to monitor and adjust construction practices and mitigation measures (such as the use of silt curtains) so that adverse water quality impacts would be avoided to the extent possible (see appendix K, conditions 7.H through 7.O).

Timing of Construction

As a result of Millennium's collaborative process with the NYSDOS, NYSDEC and NMFS, Millennium proposes to cross the Hudson River/Haverstraw Bay between September 1 and November 15 to minimize adverse impacts on fisheries. Millennium originally proposed construction during the winter months (November 1 to January 31) when biological rates (i.e., food consumption and metabolic rates) are at their lowest. While the winter construction window would minimize impact on recruitment and spawning since most species spawn in the spring and early summer when water temperature rises, it may have an adverse effect on fish using the bay as juvenile or adult overwintering grounds (i.e., striped bass, American shad, federally endangered shortnose sturgeon).

The NMFS, NYSDEC, and NYSDOS have commented on a preferred time window for construction of the Haverstraw Bay crossing. The NMFS initially indicated that October through December would be most appropriate for dredging activity because of the sensitive aquatic resources of the bay, including the endangered shortnose sturgeon, the striped bass, and species with designated EFH. The NMFS later indicated that it could not support any time period for new dredging (NMFS, 2000). However, on September 14, 2001, the NMFS issued its biological opinion about the project's affect on the Federally endangered shortnose sturgeon and the incidental take statement, with recommendations, which authorizes the take of one shortnose sturgeon during the September 1 through November 15 construction period (NMFS, 2001). For additional information see the Shortnose Sturgeon section below.

The NYSDOS commented that dredging from October through December would protect fish spawning and early development periods that extend from April through August for most anadromous species in the area. The NYSDOS specifically recommended against construction between April 1 and August 31, although there was some flexibility about dredging in August (NYSDOS, 1999). In late February, 2001, after review of the EFH Assessment, the NYSDOS recommended that dredging be limited to September 1 through November 15 (NYSDOS, 2001).

The NYSDEC provided the most substantial comments and provided a table of use of Haverstraw Bay by significant aquatic biota for each month of the year. The NYSDEC concluded that the most appropriate time frame for construction would be May through July with some flexibility on the period in July (NYSDEC, 2000a). However, the NYSDEC also indicated that it found no obstacle to crossing Haverstraw Bay/Hudson River if that crossing were to occur within a 10 week period between September 1 and November 15 (NYSDEC, 2000b).

We believe it is critical to protect the overwintering uses of Haverstraw Bay and also important to minimize impacts on aquatic biota that are there during spring and summer. We concluded that a late summer to autumn period would be the least disruptive to the endangered shortnose sturgeon, EFH, and state species of concern, and recommended that construction of the Hudson River/Haverstraw Bay occur between August 1 and October 31 (see BA and EFH Assessment dated January 2001). However, we defer to the recommendation of the NYSDOS and NYSDEC and have no objection to a September 1 through November 15 construction window.

Conclusion

The FWS, NMFS and NYSDOS objected to Millennium's original proposal, and expressed significant concern for potential impacts on the highly sensitive ecological resources at the proposed crossing. The crossing would be within designated EFH for seven species of fish, habitat for the endangered shortnose sturgeon, and the New York coastal zone. The NYSDOS will complete its analysis of the project to determine coastal zone consistency. Similarly, the NMFS would use the EIS to complete its review.

Compared to Millennium's original proposal, the currently proposed lay-barge dredge method would significantly reduce environmental impacts on the Hudson River and Haverstraw Bay. With the revised proposed construction method, most impacts would be temporary. We note that the NYSDEC has approved the proposed project by issuing its section 401 Water Quality Certificate.

We have evaluated alternate construction methods for crossing the Hudson River and Haverstraw Bay, and conclude that using the currently proposed open-cut lay-barge construction method, with the mitigation measures identified by Millennium and the conditions included in the NYSDEC's section 401 Water Quality Certificate, would result in the least overall environmental impact of all the construction methods considered. However, we are concerned about impacts on the river's water quality, habitat, and biological resources from exposure to potentially contaminated sediments, even if the exposure is only temporary, and about completing construction within the September 1 to November 15 time window. Therefore recommend that:

- **Prior to construction, Millennium should file with the Secretary: 1) the finalized Hudson River Sampling Plan developed to meet the NYSDEC's section 401 Water Quality Certificate, and 2) a work plan and schedule for the Hudson River crossing showing completion of construction activities within the September 1 to November 15 time window, including contingency plans for delays due to weather, equipment malfunction, or other work slowdowns. All monitoring data collected during construction of the Hudson River should be filed with the Secretary at the same time it is submitted to the NYSDEC.**

5.3.5 Catskill Aqueduct

The pipeline would cross the Catskill Aqueduct at MP 418.2 in Yonkers, Westchester County. The original alignment along the ConEd power lines would have been parallel to a segment of the aqueduct between MPs 399.7 and 401.6. However, this parallel segment would be avoided by the 9/9A Proposal.

The NYCDEP has expressed continuing concern regarding the pipeline crossing in Yonkers. Because the top of the aqueduct is only buried about 8 feet deep in this area, the NYCDEP is concerned that a failure of the pipeline could result in an interruption of water supplied to New York City via the Catskill Aqueduct. The NYCDEP also commented that Millennium had not developed a construction plan that provided adequate protection for the aqueduct during pipeline construction and operation. The NYCDEP also requested an independent engineering analysis of the crossing design.

In response to concerns about the crossing of the aqueduct at MP 418.2, Millennium met with NYCDEP officials on several occasions to discuss the issues that have been raised. As a result, Millennium has prepared a conceptual crossing plan for the crossing of the aqueduct to ensure that the aqueduct would be protected in the remote event that the pipeline ruptured at the crossing location (see figure 5.3.5-1). The conceptual crossing plan includes the following design features:

> Millennium would construct a steel-reinforced concrete barrier between the pipeline and the aqueduct (which consists of three separate conduits) at the crossing location. Millennium states that this concrete barrier would be designed to withstand the maximum pressure that would result in the remote event of a pipeline rupture and to fully protect the aqueduct. Millennium further states that the shape of the barrier would deflect pressure and debris up away from the aqueduct providing further protection.
>
> Millennium would install supporting concrete columns extending from the proposed concrete barrier to the bedrock underlying the aqueduct as an added measure of protection. These structural supports would be designed so that: (a) any downward forces resulting from a pipeline rupture would be transmitted to and absorbed by the bedrock, and (b) no such forces would be exerted on the aqueduct. Millennium states that together with the proposed steel reinforced concrete shield between the pipeline and the aqueduct, this structure would effectively bridge the aqueduct while providing a barrier between the facilities to eliminate any effects of a pipeline failure.
>
> Millennium proposes to install a heavy wall, high tensile steel pipe at the crossing with a design and safety factor above that required by USDOT (design factor of 0.4 and a safety factor of 2.5).
>
> Millennium would install a telemetry system to continuously monitor the pipeline crossing for any changes in pressure.

Additional safeguards that are part of the overall design of the pipeline include use of the latest technology available to coat the pipe and protect it with a cathodic protection system. To further ensure pipeline integrity, Millennium's standard procedures would use permanent launchers and receivers to periodically inspect the inside of the pipeline, including this crossing, with intelligent pipeline pigs that would provide ample early warning of any changes in pipeline condition. Millennium's standard procedures include scheduled periodic patrols of its right-of-way in the vicinity of the crossing to prevent any encroachment. Millennium would be advised of any planned excavation to be performed by a third party in the vicinity of the crossing under New York's "One-Call" program.

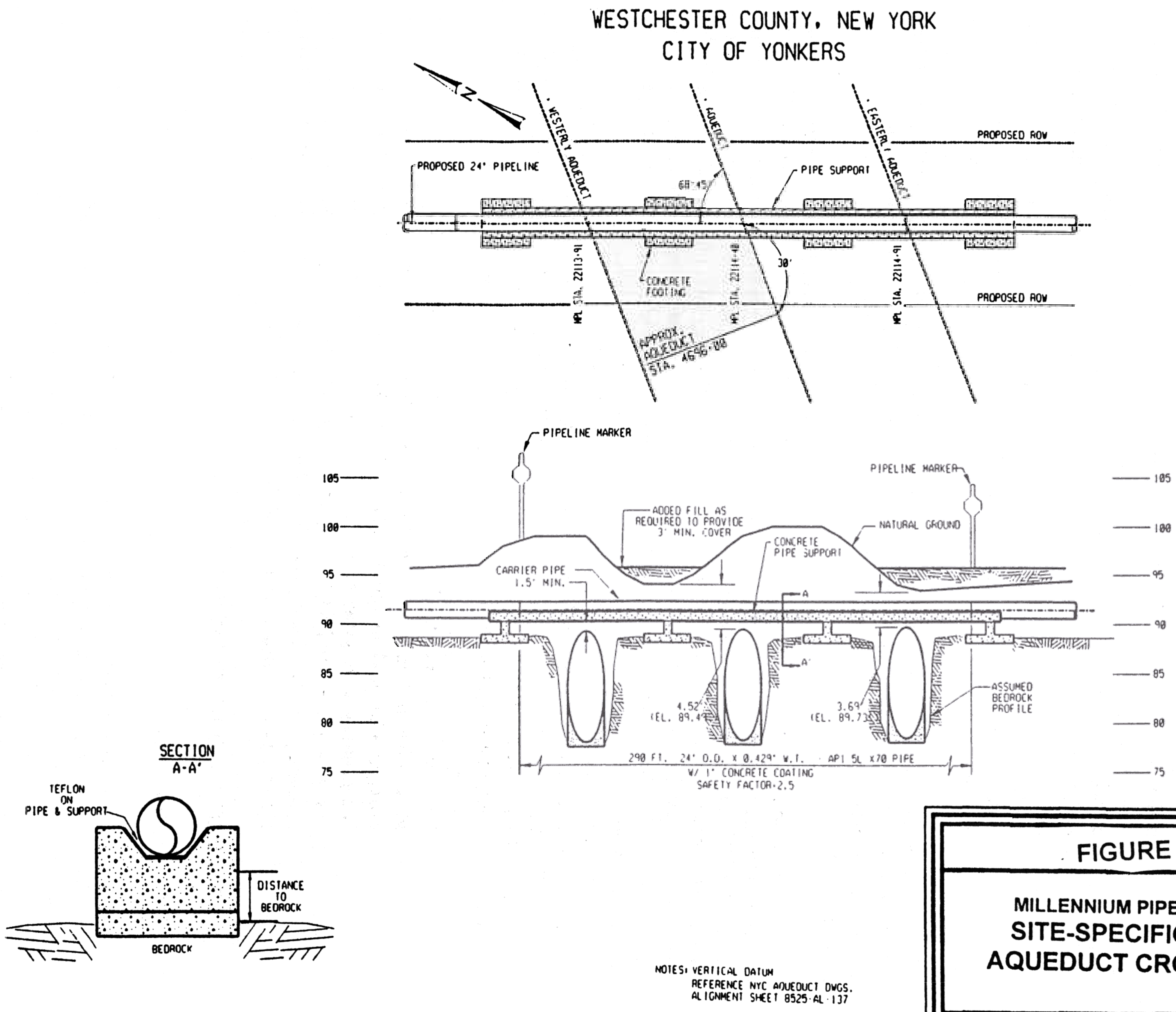

FIGURE 5.3.5-1

MILLENNIUM PIPELINE PROJECT
SITE-SPECIFIC CATSKILL AQUEDUCT CROSSING PLAN

NOT TO SCALE

Millennium believes that these protective measures, in combination, would eliminate the risk of any damage to the aqueduct as a result of a pipeline rupture during operation. Millennium has also agreed to additional measures designed to maximize the protection of the aqueduct during construction. These measures include:

following all of the NYCDEP's blasting guidelines,

performing no blasting within 150 feet of the crossing site,

adhering to the 10-ton load limit requested by the NYCDEP when crossing the aqueduct with equipment, and

notifying the NYCDEP of construction activities at the crossing site in advance so that the NYCDEP can monitor the installation of the pipe and the concrete protective structures if it desires.

Millennium met with the NYCDEP in November 2000, and during that meeting, presented and discussed a draft Request For Proposal (Draft RFP) to complete an independent analysis of Millennium's proposed conceptual crossing plan for the Catskill Aqueduct crossing. The NYCDEP committed in that meeting to provide comments on the Draft RFP.

In its comments on the SDEIS, the NYCDEP reiterated its concern that a gas pipeline explosion would have potentially catastrophic impacts on the delivery of water to the City of New York and communities north of the city. The NYCDEP stated that a rupture would result in a loss of water and water pressure thereby posing an immediate threat to human health, creating severe problems in sanitation, inhibiting the ability to adequately fight fires, and causing localized flooding. The NYCDEP met with Millennium in January 2001 and discussed the feasibility of shifting the crossing location outside of the Sprain Brook Parkway right-of-way to increase the vertical separation between the pipeline and the aqueduct. Also discussed were the permit requirements to allow site access for site investigation work for the site-specific crossing design. The NYCDEP requested that the crossing analysis and concurrence by an independent consultant be completed before the decision on the crossing location is finalized. Millennium states that it has retained an engineering consultant to complete a technical review of the design and is working on obtaining site access. To ensure that the NYCDEP's concerns are addressed at the crossing, we recommend that:

- **Prior to construction, Millennium should file with the Secretary the results of any alternative crossing locations developed in consultation with the NYCDEP, the site-specific crossing plan and design for the Catskill Aqueduct (approximate MP 418.2), the independent engineering assessment of the proposed site-specific crossing plan, and any comments from the NYCDEP on the alternative crossing locations and the site-specific crossing plan. The final Catskill Aqueduct crossing plan should be filed with the Secretary for review and written approval of the Director of OEP.**

5.4 FISHERIES AND WILDLIFE RESOURCES

5.4. Fisheries Resources

Potential impacts on streams from pipeline construction have been widely studied. These studies have generally indicated short-term impacts on coldwater and warmwater streams and no long-term adverse effects on water temperature, pH, dissolved oxygen, benthic invertebrate populations, or fish populations (Vinikour et al., 1987; Reid and Anderson, 1998). The studies indicate that in-stream TSS concentrations increase during construction, but decrease after construction activities are completed.

5.4 General Construction and Operational Impacts

Impact on fishery resources, such as sedimentation and turbidity, acoustic shock, destruction of stream cover, introduction of water pollutants, or entrainment of fish, could result from construction activities. To minimize these potential impacts, Millennium would adhere to the protective measures outlined in its ECS, which incorporates our Procedures. In addition to these protective measures, other Federal, state, or local agencies may require Millennium to follow more stringent procedures (see appendix K, the NYSDEC's section 401 Water Quality Certificate).

Sedimentation and Turbidity

Increased sedimentation and turbidity from construction have the greatest potential to adversely affect fisheries resources. However, impact on fisheries from construction-induced sedimentation and turbidity would be reduced to short-term, temporary disturbances if the measures contained in the ECS and Procedures are followed. These include the following requirements.

> Construction of stream crossings would be limited to the period of June 1 through September 30 for coldwater fisheries, unless otherwise permitted or further restricted by state agencies. In New York, the NYSDEC has recommended a June 1 through September 15 construction window for most crossings. This restriction would minimize sedimentation and turbidity induced by seasonal high flow volumes, limiting impact on spawning areas that may be present in or downstream of crossing areas.
>
> Trench spoil from minor and intermediate waterbody crossings would be stored in upland areas at least 10 feet from the streambanks and would be protected with silt fence, hay bales, or other erosion control devices that would prevent or reduce sediment runoff from entering the stream.

As previously discussed, the use of directional drilling or dry-crossing construction techniques would eliminate most of the potential for construction activities to increase sedimentation and turbidity in waterbodies. Standard wet-crossing (open-cut) techniques could elevate the concentration of suspended solids, but the elevated levels would be relatively high for only short periods and short distances downstream of the crossing. Overall, the impact of construction on benthic macroinvertebrates and fish would be minimal and short term. Increased suspended sediment concentration levels during construction could increase invertebrate drift and reduce fish feeding for brief periods. However, Millennium is required by our Procedures to complete most in-stream work in less than 48 hours at each individual stream. Therefore, impact would be temporary, and suspended sediment concentrations would return to background levels soon after construction in each stream is completed.

Turbidity resulting from suspension of sediments during in-stream construction or erosion of cleared right-of-way areas could reduce light penetration and photosynthetic oxygen production. Additionally, resuspension of organic and inorganic materials can cause an increase in biological and chemical uptake of oxygen, resulting in a decrease in dissolved oxygen. Ponds, lakes, reservoirs, and slow-moving streams that have thick organic sediment deposits often experience a decrease in oxygen at the sediment-water interface, particularly during the summer months when bacterial respiration is high and chemical oxidation is greatest (Wetzel, 1983). Resuspension of this type of sediment could result in localized depletion of oxygen throughout the water column, which could temporarily displace fish from the affected area. As previously mentioned, warmwater fishes have survived short-term TSS concentrations of between 20,000 and 100,000 mg/l.

Acoustic Shock

Some stream crossings may require blasting of bedrock, which, due to acoustic shock, could be harmful to fish in the immediate vicinity of the explosion. The degree of impact would depend on the type of explosive, blasting technique, fish species, and timing. Teleki and Chamberlain (1978) conducted experiments on the survival of various species following detonation of charges placed in bedrock or mud of a lake bottom. Based on data presented by Teleki and Chamberlain (1978), laterally compressed fish (e.g., bluegill) were the most sensitive to blast-related acoustic shock and would suffer 95 percent mortality within 213 feet of the detonation, decreasing to 10 percent mortality at 472 feet of the detonation. The least sensitive fish were those with more evenly rounded body forms (e.g., suckers, trout) which would suffer 95 percent mortality within 174 feet of the blast, dropping rapidly to 10 percent mortality at 194 feet. Teleki and Chamberlain (1978) suggest that active construction in the stream area (i.e., drilling for the blast charges) would scare most fish out of the area prior to construction.

Millennium would use scare charges in streams with important fisheries if recommended by the state. The NYSDEC, in its section 401 Water Quality Certificate, requires that blasting in Lake Erie or any other waterbody be conducted only during the time periods identified in the CAS and that all blasting be conducted using inserted delays of a fraction of a second per hole and stemming (e.g., rock is placed into the top of the bore hole to damp the shock wave reaching the water column, thereby reducing fish mortalities from blasting). Further, the NYSDEC requires that sonar be used, where requested by the NYSDEC regional habitat protection manager, to detect the presence of fish. No blasting would be allowed during passage of schools of fish.

Cover Loss

Streambank vegetation, in-stream logs, rocks, and undercut banks provide important cover for fish. Some in-stream and shoreline cover would be altered or lost at the stream crossings and fish that normally reside in these areas would be displaced. However, these effects would be relatively minor because of the small area affected at each stream. In addition, the Procedures limit vegetation maintenance on streambanks and allow for long-term revegetation of all shoreline areas with native herbaceous and woody plant species, except for a 10-foot-wide corridor over the pipeline.

Other Impacts

Other potential effects of construction include interruption of fish migration and spawning, entrainment of fish, and mortality from toxic substance (fuel) spills. Entrainment of fish during hydrostatic testing would not likely occur during withdrawal of water, since intakes would be screened as required by the Procedures. However, fish larvae, eggs, and young-of-the-year could be entrained if present in the source water. The timing restrictions in our Procedures and those that may be requested by other resource agencies are designed to minimize this likelihood since construction activities are largely restricted to times outside of fish spawning periods.

Direct spills into streams could be toxic to fish, depending on the type, quantity, and concentration of the spill. To reduce the potential for direct surface water contamination, Millennium would refuel equipment and store fuel and other potentially toxic materials at least 100 feet from waterbodies or would implement the special precautions outlined in its SPCC Plan.

5.4.1.2 Site-Specific Impact

Of the 95 perennial and 31 intermittent waterbodies that Millennium identified as designated trout waters or streams suitable for trout spawning, nine may require trench blasting: Bear Brook (MP 286.0), Tributary Sands Creek (MP 287.0), Tributaries East Branch Delaware River (MPs 288.0 and 289.0), Gee Brook (MP 291.0), Hoolihan Brook (MP 297.0), Tributary Basket Creek (MP 298.0), Tributary Delaware River (MP 300.0), and Shin Hollow Brooks (MP 342.0). Only three of these streams are perennial (Hoolihan Brook, Tributary Basket Creek, and Shin Hollow Brooks), and all trout streams would be crossed using a dry crossing method if flow is present at the time of construction. According to our Procedures (see section V.B.7.d and V.B.8.c) the 24- or 48-hour clock for completing an open cut through minor or intermediate waterbodies, respectively, does not include the time that may be needed for blasting.

Timing restrictions would be observed between June 1 and September 15 for 198 waterbody crossings (130 perennial and 68 intermittent), between June 1 and November 30 for 153 waterbody crossings (106 perennial and 47 intermittent), between October 15 and November 30 for 3 waterbody crossings, and other restrictions for the crossings of Best Hollow Creek (June 1 to September 30) and the Hudson River (September 1 to November 15) (also see additional discussion below). In total, timing restrictions would be applied to 356 waterbody crossings. The only open-cut crossing of a designated trout stream would be the Mongaup River/Rio Reservoir (MP 330.0), which would be expected to take a maximum of about 4 days. The East Branch Delaware River (MP 287.0) would be crossed using a combination conventional bore and open cut/diversion, and water would be diverted around the open-cut segment. All the identified mitigation measures for construction through waterbodies would reduce impacts on fisheries (also see section 5.3.2).

The 9/9A Proposal would cross the Croton River within the area designated as the Croton River and Bay Significant Coastal Fish and Wildlife Habitat by the NYSDOS, as Significant Habitats and Habitat Complexes of the New York Bight Watershed by the FWS, and as a component of the Haverstraw Bay/Lower Hudson River designated EFH by the NMFS. This area is a productive year-round habitat for resident fish species and serves as a resting, foraging, and nursery area for estuarine and migratory species. It is identified as an important local fishery for striped bass and as being important for largemouth bass, alewife, blueback herring, and carp. However, the Croton River and Bay have been subjected to considerable habitat disturbances, including filling of wetlands for waste disposal, discharges of stormwater runoff, and industrial and residential development. Millennium plans to cross the Croton River and tidal wetlands with a horizontal directional drill. A successful directional drill would avoid direct impacts on the river and its associated EFH and tidal wetlands.

The 9/9A Proposal would involve 11 crossings of one trout stream: the Saw Mill River and its tributaries (see table H1 in appendix H). Special largemouth and smallmouth bass regulations apply to 27 of the waterbody crossings. Millennium would use dry construction techniques (e.g., dam and pump) for these crossings and would cross warmwater streams only between June 1 and November 30 and coolwater streams between June 1 and September 15.

Lake Erie

The physical disruption of lake bottom habitat by mechanical jetting trench excavation would likely have a localized impact on aquatic communities on the surface of and within the substrate. The extent of disruption impact would depend on the type of bottom substrate, the extent of the disturbed area, resultant turbidity and sedimentation, and the timing of construction. The greatest impact would occur at the excavation site, and its magnitude would decrease with distance from the trench as the impacts of turbidity and sedimentation lessen. Organisms living in and on the bottom along the centerline would suffer high mortality because of the forces of mechanical disruption. Less mobile organisms adjacent to the trench may suffer high mortality from burial under deposited sediments. Mobile organisms would likely move out of the area during construction, avoiding direct impact but may face competitive and predatory impacts in the temporary habitat. Further afield, but within the plume, organisms may experience a short period where respiration and feeding are impaired by the elevated suspended sediments, but not enough to cause measurable adverse effects.

The physical disruption of sediment habitat by jetting would affect benthic faunal communities. Sediment deposition from trenching would typically be limited to within 300 feet on either side of the trench, with a maximum predicted sediment depth of about 2.5 inches near the trench. Once construction is complete, recolonization by benthic communities would be rapid, since most of the species present in the project area are tolerant of disruption. However, it is possible that recovery could take anywhere from several weeks to a year under typical conditions. In the area of the drilling mud release, much of the deposited mud is not likely to remain in place because of the relatively high energy environment of the outer shoreline. Following one season of stormy weather, and allowing for recolonization mechanisms, benthos would most likely recover in areas initially covered with drilling mud within one year or less.

Trench excavation and associated siltation may disrupt fish spawning activities and affect the early life stages of fish (e.g., eggs, fry, and young-of-the-year) in the pipeline crossing area. Fish species most likely affected would be those that spawn their eggs over the bottom substrate (such as alewife, white perch, and walleye) and fish that construct nests in the substratum (such as smallmouth bass and other centrarchids). However, all of these fish species spawn in the nearshore zone at water depths less than 26 feet. Since the nearshore zone would be directionally drilled and the drill would exit in bedrock in waters that are about 25 feet deep, impact on fish spawning activities from trench excavation by jetting would be limited.

Although it is expected that at least two passes would be required to install the pipeline in the trench by jetting, these passes would be 2 to 3 (or more) days apart. The predicted 1,000 mg/l TSS concentration should elicit few, if any, adverse behavioral or physical effects on fish (see section 5.3.3 for predicted TSS concentrations). A number of fish species prefer turbid waters or use turbid water for cover when other cover is not available, especially in open lake waters. This predicted TSS concentration may elicit feeding impairment, particularly in visual feeders, and/or increased coughing (gill clearing) frequency. However, because of the relatively short duration of potential exposure (between 1 and 28 hours) before the plume dissipates to TSS levels below 1,000 mg/l, no effect on fish growth or condition would be anticipated. Moreover, fish are mobile and can avoid areas with high TSS concentrations that may potentially affect their well-being.

The predicted 10,000 mg/l TSS concentration value represents an approximate threshold mortality level for some fish species exposed for 24 hours or longer. Since the durations of the plume with TSS concentrations greater than 10,000 mg/l are estimated to be 5 hours or less, substantial fish mortality due to turbidity is not anticipated. However, fish that prefer offshore habitats would be temporarily displaced from the project vicinity.

The effects of lighting on fish vary by species. Research performed on potential fish protection measures for water intakes and hydroelectric projects suggests that mercury vapor lights (common outdoor overhead lighting) can have a slight attractant effect on certain species of clupeids. Other species (such as salmonids) may have a slight tendency to avoid these lights, and others (such as centrarchids) may not be affected at all. Other types of lights, such as strobe lights tend to create either an avoidance effect or no effect. It is unknown what aspect of the mercury vapor lights results in an attraction behavior. It may be that because some species of zooplankton are attracted to light, fish that feed on zooplankton approach illuminated areas for better foraging. Fish that prey on other fish may then be attracted to illuminated areas. The literature suggests that this effect is fairly localized and that fish beyond about 50 feet remain unaffected. Given the open water aspects of the crossing in Lake Erie, there are likely to be minimal impacts on fishes, other than some tendency to avoid the immediate area of construction at night. The potential for attraction to lights is reduced because most species of fish are likely to avoid areas of underwater construction with noises such as that created by the jet sledding operation.

Because only a very small portion (about 798 acres in the United States) of Lake Erie (10,000 square miles) would be affected by construction, impact on recreational and commercial fishing would be minor. However, the DOI commented that a compensatory mitigation plan be developed for unavoidable impacts on Lake Erie and suggested the possibility of creation of a trout spawning reef. Millennium stated that some blasting may be required for a short distance (about 0.6 mile) in the United States near the shoreline at water depths between 30 and 50 feet. Blast rubble could be used for the creation or enhancement of lake trout spawning habitat, if appropriate. Millennium states that it would continue to consult with the COE, NYSDEC, PADEP, and NYSDOS regarding this possibility.

Hudson River/Haverstraw Bay

The project would be within or adjacent to a designated Significant Coastal Fish and Wildlife Habitat that is part of the state's Coastal Management Program in Haverstraw Bay and the Significant Habitat of the New York Bight Watershed (NYSDEC, 1999; FWS, 1997). The purpose of the state designation is to protect, preserve, and where practicable restore the habitat so as to maintain its viability. Haverstraw Bay has been designated as an EFH for red hake, winter flounder, windowpane, bluefish, Atlantic butter fish, fluke, and possibly the Atlantic herring. Millennium proposes to cross the Hudson River/Haverstraw Bay between September 1 and November 15 using an open-cut lay-barge construction technique to minimize impacts on fishery resources. See additional discussion in section 5.3.4.

Potential impacts on the Hudson River fisheries include direct contact with construction equipment, construction effects associated with increased turbidity and sedimentation, potential re-introduction of solid or soluble contaminants from the bottom substrate, and effects on benthic food organisms (see section 5.3.4). Most adverse effects would be limited to the immediate vicinity of the dredging and the time it takes for the disturbed area to return to preconstruction conditions. Generally, fish would avoid the disturbance created by the dredging and backfilling operations and rarely become entrapped by the bucket. Because of the relatively small total area of the bay that would be affected (1.5 percent), the short length of active construction (about 1,300 feet), and the relatively short time to fabricate and install the pipe within the 1,300-foot construction work area (about 5 days in open water), impact on fisheries would be short-term and limited to the alteration of benthic invertebrate communities in the direct path of construction. However, benthic organisms have been found to recover rather rapidly from construction disturbance (see section 5.4.1.1).

The footprint of the dredged area would be about 0.2 percent of the designated Significant Coastal Fish and Wildlife Habitat in Haverstraw Bay. In addition, the designated habitat in Haverstraw Bay is only a portion of a larger area of designated significant habitat that includes Croton Bay and Tappan Zee south to Piermont Marsh. This larger area is characterized as having similar physical habitat with contiguous functionality. The broad expanse of this habitat is an important factor in its designation as significant habitat.

Pipeline construction would have a temporary effect on a very small portion of the designated habitat and the total available functional habitat of Haverstraw Bay. Construction activities would occupy a very small portion of the water column and estuary bottom, and the effects would be limited to temporary disturbance and restoration of the substrate. There would be no mechanism that could cause a significant long-term change in the physical, biological, or chemical parameters of Haverstraw Bay. Because no structure would remain in the water after construction, there would be no long-term impact on the parameters that define the habitat.

Food chain relationships and predator/prey relationships would not be altered because there would be no significant change in the population size of any species in the bay. The effects of pipeline construction on living resources would be a temporary reduction of benthic infauna and some epibenthos in the footprint of the trench and a temporary redistribution of epibenthos and fishes during construction. The small temporary reduction of benthic infauna and epibenthos directly due to dredging would not alter feeding relationships, which are ecosystem-wide characteristics. Epibenthic organisms would return to the trench footprint soon after backfilling, providing a food source for fish that may enter the area.

Based on review of available fish distribution data, Millennium indicated that the bluefish would be the only EFH-designated species likely to occur in any substantial numbers in the vicinity of the construction work area. Bluefish spawn in offshore marine waters and drift in offshore currents until they are juveniles, then they move into estuaries. Only bluefish juveniles and adults have designated EFH in Haverstraw Bay. Since the bluefish is a pelagic, open water species that has little contact with the substrate and is a sight feeding predator, it is likely that it would avoid the construction work area and associated areas of turbidity. No EFH species and only one shortnose sturgeon were collected during sampling conducted along the pipeline route in November 2000.

To further mitigate adverse impact on Haverstraw Bay, the NYSDEC included conditions in its section 401 Water Quality Certificate that require site-specific monitoring during all phases of construction, the exclusive use of an "environmental bucket" (e.g., closed bucket) dredge, the use of barges to avoid stockpiling the trench material in the river, and many additional conditions related to construction (see appendix K, conditions 7.A through 7.Z). The NYSDEC believes that if these conditions are strictly adhered to, monitored and enforced, the impact resulting from trench excavation and backfilling should be minimized.

Millennium's site-specific plan for the Hudson River crossing includes a requirement that barges have a supply of absorbent materials on board and that, before being refueled, a containment boom would be installed around the barge. This boom would be stored on the barges for use if a spill occurs while in the river. The storage tank on the barges would be mounted over a metal containment area that would be high enough to contain any or all fluids that could spill from the storage tank. Any accumulated fluid would be immediately stored in containers for disposal at an approved site.

5.4.2 Wildlife Resources

5.4.2. General Construction and Operational Impact

Construction and operation of the Millennium Pipeline Project would result in temporary and permanent alteration of wildlife habitat, as well as direct impact on wildlife such as disturbance, displacement, and mortality. The clearing of right-of-way vegetation would reduce cover, nesting, and foraging habitat for some wildlife. During construction of the proposed facilities, the more mobile species would be temporarily displaced from the construction right-of-way and surrounding areas to similar habitats nearby. Some wildlife displaced by construction would return to the newly disturbed area and adjacent, undisturbed habitats soon after completion of construction. Less mobile species, such as small mammals, reptiles, and amphibians, as well as bird nests located in the proposed right-of-way, could be destroyed by construction activities. Routine maintenance activities on the permanent right-of-way would have similar but less extensive effects on wildlife species in the area, depending on the time of year. However, the overall impact on general wildlife would not be significant because of the short duration of the activities and availability of undisturbed similar habitats adjacent to the right-of-way from which the affected species could return and recolonize the disturbed right-of-way.

In forested areas, the principal impact on wildlife of the increased or new right-of-way clearing would be a change in species using the right-of-way from those favoring forest habitats (e.g., northern flying squirrel, barred owl, downy woodpecker) to those using edge habitats and more open areas (e.g., white-tailed deer, American kestrel, white-footed mouse). Many species adapt well to this habitat reversal and take advantage of the increased populations of small mammals that prefer open areas. Predatory species such as the red-tailed hawk, coyote, and gray fox commonly use utility rights-of-way for hunting.

Although the project may be advantageous for some species, it would create new cleared right-of-way or widen existing cleared rights-of-way, which may affect some forest interior species, or species that prefer large tracts of unbroken forest. The breeding success of some forest interior bird species (e.g., warblers and thrushes) has been shown to be limited by the size of available unbroken forest tracts (Robbins, 1979; Robbins et al., 1989). For these species, additional loss of forest habitat in tracts of already marginal size could further reduce breeding success. The cleared rights-of-way may also encourage population expansion of parasitic species, such as the brown-headed cowbird which parasitize songbird species. The potential for this type of impact would be greatest where the pipeline would traverse smaller, isolated woodlots (Galli et al., 1976). It may also encourage population expansion of exotic species, such as the English sparrow and European starling, which compete with many native species.

The loss of forest habitat and the creation of open early successional and induced edge habitats in these woodlots could decrease the quality of habitat for forest interior species for distances up to 300 feet from the right-of-way (Anderson et al., 1977; Temple, 1986). This may reduce the density and diversity of forest interior species in a corridor much wider than the actual cleared right-of-way. It is not likely that a permanently cleared 50-foot-wide right-of-way would impede the movement of most forest interior species, although it could reduce the breeding habitat of these species. In addition, the proposed route would be within or adjacent to existing cleared

The pipeline would cross 0.7 mile of the Doris Duke Wildlife Sanctuary (based on actual station number calculations) in the Sterling Forest between MPs 364.9 and 365.8. Construction would be in the lift and lay segment of the project and would affect about 7.5 acres of land (6.1 acres for the construction right-of-way and 1.4 acres for staging areas), of which about 3.4 acres would be forest. We identified no route variation that would avoid the sanctuary without increased environmental impact on the Sterling Forest or adjacent parks (see section 3.6.2). Although extra work areas are often necessary for safe construction on slopes, work areas can often be minimized.

Millennium would finalize site-specific plans for crossing the Mongaup River WMA and the Doris Duke Wildlife Sanctuary in consultation with the NYSDEC, and the NYSOPRHP and the PIPC, respectively, which would minimize the impact of construction on these areas to greatest extent practicable. Therefore we recommend that:

- **Millennium develop construction and restoration plans for the Mongaup WMA (MP 323.8 to MP 330.2) and the Doris Duke Wildlife Sanctuary (MP 364.9 to MP 365.8) in consultation with the NYSDEC, and NYSOPRHP and PIPC, respectively. The final plans should be filed with the Secretary before construction.**

Waterfowl concentration areas occur along the Hudson River/Haverstraw Bay (MP 387.9) and Croton River (MP 395.3). According to the NYNHP, the project would be within or adjacent to a designated Significant Coastal Fish and Wildlife Habitat that is part of the state's Coastal Management Program at Haverstraw Bay (NYSDEC, 1999). Potential construction-related impacts on waterfowl concentration areas include temporary changes to water quality from increased siltation and sedimentation resulting from ground disturbances such as trenching activities. Millennium states that it would coordinate with the FWS, NYSDEC, and other appropriate agencies regarding mitigation measures including restrictions on time-windows for construction during peak migration within these areas.

The DOI commented that other wildlife areas may include nearby birdwatch areas, such as the hawk watch site near the AT (MP 363.5). In response to the DOI concerns, Millennium states that it would be willing to consider the creation of wildlife enhancement areas along the construction right-of-way and that any plans pertaining to the creation of wildlife enhancement areas would be developed and sited in consultation with the FWS, the COE, the NYSDEC, and landowners, but no such plans have yet been developed. Therefore, we recommend that:

- **If Millennium develops wildlife enhancement areas in consultation with the FWS, COE, NYSDEC, and landowners, it should identify the locations of these wildlife enhancement areas on the CAS and file them with the Secretary before construction.**

5.5 VEGETATION

5.5.1 General Construction and Operational Impact

The primary impact on vegetation would be the temporary and permanent alteration of vegetative cover on the right-of-way. In all areas, the construction right-of-way would be cleared of vegetation and then graded to create a level and safe working surface for construction equipment. Forest vegetation in upland areas would be cut at ground level and stacked along the edge of the right-of-way (with landowner approval) or removed to an approved disposal site. Stumps would be removed as needed to maintain a level work surface and either cut flush with the ground using a stump grinder or disposed of by burying in non-agricultural, -wetland, or -residential areas; windrowing along the construction work area; or hauling to an approved landfill (see section II.D.1 of the ECS). Slash and other vegetative debris would be disposed of in accordance with section II.C.1 of the ECS (also see section 2.3.2 of this FEIS) and generally would be stockpiled adjacent to the construction work area (but not within the project would result in no effect on the northern wild monkshood;

with implementation of Millennium's proposed conservation measures, our recommended conservation measures, and the ECS (which incorporates our Plan and Procedures), the project would result in no adverse effect on five species (dwarf wedge mussel, clubshell, Northern riffleshell, bald eagle, and bog turtle); and

even with proposed conservation measures identified by Millennium and recommended by us, the project may affect the shortnose sturgeon, and could result in a "take" of the shortnose sturgeon as defined in section 9 of the ESA.

The FWS reviewed our BA and issued comments in response to it on March 20, 2001. The FWS generally concurred with our determinations of effect for the dwarf wedge mussel, clubshell, Northern riffleshell, and bald eagle. The FWS commented that additional information on dwarf wedge mussels in the East and West Branches of the Delaware River should be provided by Millennium, in order to further evaluate the potential impacts there. Millennium performed the requested survey in May 2001, and found no dwarf wedge mussels. The FWS determined that the survey was adequate and that the project is unlikely to affect the dwarf wedge mussel or its habitat (FWS, 2001c). The FWS additionally commented that Millennium should contact FWS and the NYSDEC during the fall of 2001, to determine the need for further consultation regarding the bald eagle, in the event that any additional nests are established in the vicinity of the project area.

For the bog turtle, the FWS requested additional information regarding the construction measures at a specific wetland (Wetland 9, see BA), to avoid adverse impacts to the bog turtle. The FWS stated that if Millennium can demonstrate that the impacts could be avoided, the FWS would concur with the determination that the FERC made. Millennium has stated it would reduce the workspace so that no trees would be removed in this wetland and no construction activities would be undertaken within the forested area. The construction alignment sheets would be revised to show the reduced construction work area. We believe this addresses the FWS's concern.

The NMFS reviewed our BA and issued comments in response to it on April 4, 2001. The NMFS determined that additional information was necessary before it could proceed with formal consultation for the shortnose sturgeon. The NMFS provided a list of specific information that it needed. In a June 1, 2001 letter to NMFS, the FERC staff responded to each of the NMFS's concerns (available for viewing on RIMS), with one possible exception regarding construction across the Hudson River where the NMFS requested an "explanation of how construction of the pipeline can be completed within the recommended work window (September 1 to November 15), given the BA states that construction will take three months to complete".

Our assessment of the time needed to complete the Hudson River crossing was based on the assumption that Millennium would use only one work crew (shift), and that it would take about 3 months. However, since Millennium could use more than one shift, the time could be reduced enough to complete the crossing within the recommended work window of September 1 to November 15.

On June 15, 2001, the NMFS responded in a letter to the FERC, and stated it had received all the information it needed to initiate formal consultation, and the start date would be June 1, 2001. On September 14, 2001, the NMFS submitted its biological opinion (BO) and an incidental take statement (ITS) to the FERC, concluding the section 7 formal consultation process. See further discussion on the ITS and the shortnose sturgeon in section 5.6.3 below.

Millennium has indicated that the project would not be economically viable unless it crosses the Hudson River and is completed to the proposed terminus in Mount Vernon, New York. Due to the sensitivity of the biological resources that would be adversely impacted by construction of the Millennium Pipeline Project, and the

the project would result in no effect on the northern wild monkshood;

with implementation of Millennium's proposed conservation measures, our recommended conservation measures, and the ECS (which incorporates our Plan and Procedures), the project would result in no adverse effect on five species (dwarf wedge mussel, clubshell, Northern riffleshell, bald eagle, and bog turtle); and

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Millennium has indicated that the project would not be economically viable unless it crosses the Hudson River and is completed to the proposed terminus in Mount Vernon, New York. Due to the sensitivity of the biological resources that would be adversely impacted by construction of the Millennium Pipeline Project, and the uncertainty of when the applicant will receive final authorization to begin construction from both the United States and Canada, there is a possibility that reinitiation of section 7 consultation may be required. Although the FERC has completed its section 7 consultation requirements with the FWS and NMFS, if there are modifications to the proposed construction (i.e., dredging in the Hudson River outside the window of September 1 to November 15), or if a new species is listed or critical habitat is designated that may be affected by the proposal, FERC would need to reinitiate section 7 consultation. Therefore, we recommend that:

If its facilities are not constructed within 1 year from the date of issuance of the certificate, Millennium should consult with the FWS and NMFS to determine if additional Endangered Species Act section 7 consultations or surveys are required.

General Construction and Operational Impact

The general construction and operational impacts of the project as discussed in sections 5.4.1, Fishery Resources, and 5.4.2, Wildlife Resources, also apply to endangered and threatened fish and wildlife species. However, because the distribution and abundance of endangered and threatened species are limited, any impact could affect the size or viability of these populations. Habitat availability is believed to be the primary limiting factor of some endangered or threatened species. Therefore, the loss or alteration of suitable habitat could contribute to the decline of some species' populations. Specific potential effects of the project on endangered and threatened species and their habitats are discussed in the following section.

Adverse impacts on federally listed species are considered significant and would require additional mitigation if project construction or operation would result in:

direct mortality of an individual of a listed species;

loss of existing or proposed critical habitat; or

temporary alteration or loss of habitat that could result in avoidance by a listed species or that could cause increased mortality or lowered reproductive success.

Federally Listed Endangered and Threatened Species

Shortnose Sturgeon

The shortnose sturgeon occurs in the Hudson River between the George Washington Bridge in Manhattan and the Federal Lock and Dam in Troy, New York. In particular, the Haverstraw Bay area provides seasonal foraging and wintering habitat for this species (NMFS, 1997). In the Hudson River, monitoring data suggest that sturgeon numbers have been increasing (Bain, 1995; 1997). Section 4.6.1 provides a more detailed review of the life stages, habitat, and dispersion of the shortnose sturgeon.

The 2.1-mile-long crossing of the Hudson River and Haverstraw Bay (between MPs 387.9 and 390.0) would require some type of mechanical dredging construction technique. In October 1999, Millennium proposed an open-cut lay-barge construction method that would limit the amount of the construction work area to about 1,300 feet at any one time (see section 5.3.4). This method would involve excavating a trench section within the 1,300-foot-long construction work area, temporarily storing the excavated material in barges, continuously welding and laying the pipe on a moving lay-barge, and backfilling the trench using bottom-dump barges as soon as the pipe is laid. Once begun, the process would continue sequentially with trenching, pipe make-up, and backfilling activities moving concurrently across the river. Millennium proposes to complete construction between September 1 and November 15.

The modeling predicted a plume ranging between 60 and 90 feet wide by between 35 and 460 feet long during dredging and a plume ranging between 90 and 500 feet wide by between 170 and 400 feet long during backfill. The total area affected by operation on any given day ranged between 0.06 acre and 5.23 acres depending on the operation. Periodic impacts associated with the plume and involving about 9.18 acres would occur for approximately 1 to 2 hours twice a day during backfill of the deep water component. The total area that would be affected by the crossing was estimated at 108.5 acres, or a maximum of 1.5 percent of the bay over the duration of the crossing (see section 5.3.4 for additional discussion of predicted impacts). The WES reviewed Millennium's calculations and performed its own simulations using the same model, and found very good agreement with Millennium's results.

The NYSDEC has included a number of conditions in its section 401 Water Quality Certificate that relate specifically to the Hudson River and minimizing impact from sedimentation and turbidity (see appendix K, condition 7). We believe that the proposed open-cut lay-barge construction method, if implemented in accordance with the NYSDEC conditions and our additional recommendations, would minimize overall impact on the fisheries in Haverstraw Bay and the shortnose sturgeon.

We have also reviewed and analyzed one system alternative and two alternative crossing locations across the Hudson River. We found that all alternatives had numerous disadvantages and recommended none of them. See section 6.2.1 and 6.2.2 for further discussion of these alternatives.

Millennium originally proposed a construction window of November 1 through January 31 when the segment of the sturgeon's population overwintering in Haverstraw Bay is relatively inactive. The intent was to avoid or minimize impact on the species. However, the NMFS indicated that the sturgeon may be more vulnerable during this period because the fish are relatively sluggish, and would be less likely to move out of the area immediately affected by construction (NMFS, 1999).

As part of its October 1999 filing, Millennium stated that, based on its consultations with responsible Federal and state agencies, it believed that a construction window between July 1 and September 30 would best minimize fisheries impacts while at the same time meeting the November 1 in-service date. However, Millennium also stated that it would construct the crossing during any 3-month window established by Federal and state agencies. In addition to the shortnose sturgeon, there are other important fish and invertebrate species (i.e., striped bass, white perch, Atlantic sturgeon, American shad, tomcod, and blue crab) that use Haverstraw Bay and the Hudson River (see section 5.4.1.2 for additional discussion of the fisheries in Haverstraw Bay).

Based on information provided during an interagency meeting in November 1999, several different construction windows were identified for the crossing. The NMFS and NYSDOS recommended October, November, and December. The NYSDOS specifically recommended against construction between April 1 and August 31, although it indicated that there may be some flexibility about construction in August. It subsequently recommended a September 1 to November 15 window (NYSDOS, 2001). The NMFS, in consultation with the NYDOS and NYSDEC, recommended a fall construction window, between September 1 and November 15, since it would protect some key shortnose sturgeon habitat uses (NMFS, 2001). The NYSDEC stated that recent fisheries data support the May 1 to July 31 construction window, which it required in its section 401 Water Quality Certificate (see appendix K). The NYSDEC modified its evaluation of a construction window and stated that it had no objection if construction were to occur within a 10-week period between September 1 and November 15 (NYSDEC, 2000). We have no objection to construction during this time period.

On September 14, 2001, the NMFS submitted its biological opinion and an incidental take statement to the FERC, concluding that the proposed action may adversely affect, but is not likely to jeopardize the continued existence of the federally endangered shortnose sturgeon. The ITS provides reasonable and prudent measures the NMFS considers to be necessary or appropriate to minimize the take of shortnose sturgeon, along with the terms and conditions that must be complied with to implement the reasonable and prudent measures. The ITS authorizes the take of one shortnose sturgeon from either injury or mortality, and includes three non-discretionary terms and conditions that must be complied with, as well as four discretionary conservation recommendations. To comply with section 7 of the ESA, we recommend that:

- **Prior to construction, Millennium should include all of the terms and conditions of the NMFS' incidental take statement on its final site-specific Hudson River crossing plan, and file the plan with the Secretary for review and written approval from the Director of OEP. The terms and conditions are:**

  a. **Trained NMFS-approved observers must be present on the dredge and backfill barge for the duration of the project;**
  b. **If any whole shortnose sturgeon (alive or dead) or sturgeon parts are taken incidental to the project, Carrie McDaniel (978-281-9388) or Mary Colligan (9789-281-9116) must be contacted within 24 hours of the take. An incident report for shortnose sturgeon take (for a copy see the NMFS's September 14, 2001 biological opinion, available for viewing on FERC's internet site at www.ferc.gov; go to the "RIMS" link and follow instructions to access the document) should also be completed by the observer, and sent to Carrie McDaniel via fax (978-281-9394) within 24 hours of the take. Every incidental take (alive or dead) should be photographed and measured, if possible; and**
  c. **Silt curtains should be bottom weighted, and run surface-to-bottom around the area being backfilled in order to effectively minimize suspended sediment concentrations.**

  In addition, if facilities are not constructed within 1 year from the date of issuance of the certificate, Millennium should consult with the FWS and NMFS to determine if additional consultations or surveys are required.

Dwarf Wedge Mussel

The endangered dwarf wedge mussel could be affected by the pipeline at the proposed crossing of the lower Neversink River in Orange County. In its comments on the BA, the FWS stated that populations were documented in the main stem of the Delaware River in August 2000 (FWS, 2001). Millennium conducted surveys in May 2001 in the vicinity of the proposed crossing and found no dwarf wedge mussels. Millennium submitted the report on the survey to the FWS on June 25, 2001, and filed it with the FERC on June 26, 2001. We believe that there would be minimal adverse impact on this species. The FWS concurs (FWS, 2001c).

In its comments on the project, TNC emphasized that the largest population of the dwarf wedge mussel in the state would be affected by construction at the proposed crossing and recommended moving the crossing location downstream to avoid this population (TNC, 1998). Although we looked at a variation 1,640 feet south as well as one north of the crossing, we concluded that overall environmental impact would be increased on residential and commercial properties, and on forested areas east of the Neversink River where new right-of-way clearing would be required. The dwarf wedge mussel may occur throughout this area, from the State Route 209 bridge to below the Neversink Road bridge, and a variation may just transfer impact from one location to another. In addition, any route variation would need to incorporate the existing Huguenot Meter Station, where the Millennium pipeline would make deliveries (see section 3.6.2 for additional discussion).

Millennium conducted preliminary investigations of a directional drill of the Neversink River and concluded that a directional drill at the proposed crossing location would be infeasible, primarily because of cost and topographic considerations. Millennium presently proposes to construct the Neversink River crossing using a conventional bore (i.e., dry construction technique) and would not install an equipment bridge across the river.

If the bored crossing of the Neversink River at this location fails, Millennium proposes to move the crossing 10 feet and re-bore the crossing.

However, the FWS commented that if an accidental disturbance to the streambed occurred during the bored crossing of the Neversink River, then all construction must stop immediately and formal consultation with the FWS and other agencies would be required. Further, if the conventional bore technique fails entirely, an alternative location would need to be determined in consultation with the FERC, FWS, NYSDEC, and TNC. The FWS stated that no physical disturbance of the streambed at the proposed crossing would be acceptable and that it would require Millennium to either attempt a directional drill there or move to an alternative crossing location. The FWS indicated that an open cut at the proposed crossing would be an unacceptable contingency plan and would require initiating formal consultation under the ESA. No take would be permitted (FWS, 1999). The NYSDEC, in its section 401 Water Quality Certificate required that Millennium develop a management plan for the Neversink River that would include notifying the NYSDEC at least 5 days before vegetation clearing for construction and within 7 days of the completion of restoration. To minimize impact on this species, we recommend that:

- **No construction can begin between MP 339.9 (intersection of Peenpack Trail and Martin Road) and MP 341.7 (Shinhollow Road) until the bore of the Neversink River is successfully completed. Millennium should also abandon the existing pipeline crossing of the Neversink River in place.**

- **In the event that a bore cannot be completed at the proposed Neversink River crossing location (MP 341.0), Millennium should develop a contingency plan in consultation with the FWS, NYSDEC, and TNC. The Plan, at a minimum, should:**

  a. **identify an alternative crossing location, and/or alternative route and construction methods (if required);**
  b. **include an analysis of the environmental impacts associated with construction of the contingency plan (i.e., definition of the impact area or construction work areas); and**
  include a survey of the entire construction work area and area of potential effect by a biologist qualified to identify dwarf wedge mussels, as required.

  All survey work must use FWS-approved methodologies, and must be completed before the start of any alternative construction activity in the project segment between MP 339.9 and 341.7. The mitigation plan and all associated consultation documentation should be filed with the Secretary for review and written approval by the Director of OEP before construction.

With a successful conventional bore of the Neversink River, no installation of an equipment bridge across the river, and no disturbance caused by the removal of the existing pipeline, adverse impact on the dwarf wedge mussel would be avoided. If the bore fails, the implementation of the recommended contingency plan would be required. We believe the proposed action would not adversely affect or jeopardize the continued existence of this species, and an acceptable contingency plan would be developed that would avoid any adverse effects on this species and its continued existence. The FWS concurs that if the Neversink River is successfully bored, the proposed crossing is not likely to adversely affect the dwarf wedge mussel (FWS, 2001a).

Clubshell and Northern Riffleshell

The Millennium pipeline would cross Cassadaga Creek (MP 59.9) and seven of its tributaries between MPs 58.4 and 60.6, and five tributaries of Conewango Creek, including State Drainage Ditch, between MPs 72.9

and 74.3. Four of these waterbodies are categorized as intermittent and unsuitable for fish propagation and survival (MPs 59.2, 59.3, 72.9 and 73.0). In August 2000, after consultations with the FWS, Millennium conducted surveys for these two species in Cassadaga Creek (MP 59.9) and State Drainage Ditch (MP 72.9). No clubshell or Northern riffleshells were found, and no further surveys were required (FWS, 2001a). However, the FWS, in its comments on the BA, requested that Millennium cross Cassadaga Creek using either a flume or dam and pump, if water levels are low enough to allow this construction technique. The FWS also requested that Millennium restrict all instream work to the period between July 1 and November 30. We agree and recommend that:

- **If flows are low enough, Millennium should use a flume or a dam and pump construction technique for the crossing of Cassadaga Creek (MP 59.9) and should complete all instream work between July 1 and November 30.**

Bald Eagle

The Millennium Pipeline Project would cross seven known bald eagle nesting or wintering areas. Project effects on the bald eagles using these activity areas could occur from three aspects of project construction and maintenance: (1) right-of-way tree clearing and maintenance within a bald eagle activity area could remove bald eagle perching, roosting, and/or nesting habitat; (2) construction of waterbody crossings within the bald eagle activity areas could adversely affect bald eagle feeding activity; and (3) the presence of construction equipment and personnel within a bald eagle activity area could disturb and result in the temporary displacement of bald eagles in the immediate area.

The clearing and removal of trees within any of the bald eagle activity areas may affect perching or roosting habitat for the species. However, these effects would be localized, and there is ample adjacent forest. Since perching and roosting is not a limiting factor for the bald eagle in these activity areas and most of the clearing would take place adjacent to existing rights-of-way, the forest cleared for the project should not adversely affect bald eagle habitat.

The adverse effects on aquatic resources from open-cut crossings of waterbodies are due primarily to direct and indirect impacts from trenching and elevated levels of suspended solids. Generally, these effects have been found to be spatially limited to the immediate vicinity of the crossing location and temporally limited from days to months following completion of construction activities. Alteration of benthic macroinvertebrate and fish distributions would be short term with recovery of the benthic macroinvertebrate communities occurring within 2 to 12 months (Reid and Anderson, 1998). Fish displaced from the vicinity of the waterbody crossing would return to the area within several weeks of restoration of the construction work area. The only waterbodies proposed for open cut in known eagle habitat are the East Branch Delaware (a conventional bore and open trench with diversion crossing), and the Mongaup and Hudson Rivers (open cut). These rivers all support large populations of biological resources and the impact of open-cut crossings on prey of bald eagles would be temporary and localized, with adequate foraging opportunities nearby. Additionally, the extent of turbidity created by construction in the stream would not significantly affect foraging opportunities since eagles prey on food at the water surface, which would still be visible even in highly turbid water. Therefore, the proposed construction would not significantly restrict feeding opportunity or limit food availability for bald eagles, although turbidity can interfere with overall hunting since eagles also follow prey by sight in deeper water and wait until it surfaces.

Construction activities may temporarily affect bald eagle distributions within all of the identified activity areas. Construction equipment, vehicles, and construction personnel would be present in each of the activity areas during construction. Construction equipment noise would be generated, and the level of human activity in these areas would be significantly increased. Several recent publications have examined the effects of various human activities on bald eagles. These studies have been prompted primarily by issues pertaining to management of public lands containing both bald eagle populations and recreational opportunities. Typically, bald eagles are displaced (flushed) from perches by human activity (Steidl and Anthony, 1996; Stalmaster and Kaiser, 1998). The rate of displacement and the distance that birds are displaced appears to be related to a large number of variables, including the distance at which the human activity is first visible, how near human activity is to the eagle, the type of disturbance, the age of the eagle, the general background rate of human activity in the area, the time of day, and the type of activity the eagle is engaged in.

Bald eagles were generally found to react more strongly to hikers than to vehicles of various sorts (motorized boats, non-motorized boats, and airplanes) (Stalmaster and Kaiser, 1998). Eagles that were disturbed were generally found to be displaced by 300 to 600 feet (Steidl and Anthony, 1996). Stalmaster and Kaiser found that overwintering eagles perched along a shoreline were generally displaced away from the shoreline by human disturbance. They also found some indication that feeding activity may be interrupted by repeated human disturbance. At this time, there is no predictive model for estimating bald eagle responses to human disturbance. However, it is expected that construction activities may temporarily displace bald eagles away from the project areas during construction.

The NYSDEC stated that no adverse effects are anticipated to occur to the bald eagle at the Chautauqua Creek, Cannonsville River, Delaware River, Lebanon Lake, Neversink River, or Hudson River activity areas and did not recommend any specific compensation measures. The pipeline would cross the Mongaup River bald eagle activity area for a distance of about 1.6 miles within a lift and lay section of the project and within the Mongaup WMA. This area contains active bald eagle nests and is also an important overwintering location because sections of the Rio Reservoir remain ice-free during the winter, thereby providing feeding opportunities for the bald eagles. Bald eagles congregate in the vicinity of the reservoir beginning in early December. Overwintering bald eagles were observed adjacent to the project area during field surveys.

Millennium proposes to replace the permanent boat launch at the Mongaup River/Rio Reservoir after completing pipeline construction across this waterbody. The FWS stated that the current boat launch is near a bald eagle nest and roosting area, and the new boat launch should be built so that it does not disturb the eagles or the nest and roost areas in this area (FWS, 1999b). We have recommended that Millennium file site-specific mitigation plans for all properties identified in table 5.8.3.2-1, including the Mongaup WMA, for review and written approval of the Director of OEP (see section 5.8.3.2). However, we recommend that:

- **Millennium should consult with the FWS regarding the site-specific plan being developed with the NYSDEC for the new permanent boat launch facility at the Mongaup River/Rio Reservoir (MP 330.0) to protect bald eagles and their habitat. Millennium should file the final plan and all comments received from the NYSDEC and FWS on the new boat launch facility with the Secretary before construction.**

The NYSDEC requested that there be no construction in areas adjacent to the Mongaup River between December 1 and July 31 to avoid the nesting and overwintering periods in this activity area. Millennium proposes to construct within this bald eagle activity area from August 1 to November 30. However, the FWS recently requested that Millennium coordinate with the FWS on the construction time schedule due to potential construction impacts on timber rattlesnakes in the vicinity of the Mongaup River crossing (FWS, 1999b). Millennium stated that it would schedule construction within a time period agreed upon by the FWS and NYSDEC.

We believe that the Millennium Pipeline Project could have limited adverse effects on the bald eagle nesting and winter habitats as a result of project construction, especially where blasting is required. Therefore, we recommend:

- **If blasting is required in designated bald eagle activity areas when bald eagles are present, Millennium should develop with the NYSDEC and FWS a construction plan that includes the potential amount, location, and schedule of the required blasting. The finalized**

construction plans, and all associated consultation documentation, should be filed with the Secretary for review and written approval by the Director of OEP before construction.

With implementation of our recommended mitigation described above, we believe the proposed action would not adversely affect or jeopardize the continued existence of the bald eagle. Based on current information on the distribution of nest sites and wintering areas, and the conservation measures identified above, the FWS agrees that the proposed project is not likely to adversely affect the bald eagle (FWS, 2001a). However, the FWS did recommend that Millennium contact the FWS and NYSDEC to determine if there are any additional nests in the project area. Therefore, we recommend that:

- **Millennium shall contact the FWS and NYSDEC in the fall 1 year before the start of construction to determine if any additional bald eagle nests have been found in the vicinity of the project area. Documentation of the results of this consultation should be filed with the Secretary for review and written approval by the Director of OEP before construction.**

Bog Turtle

Millennium consulted the NYSDEC and requested identification of suitable habitat for the bog turtle in the vicinity of the proposed project. The NYSDEC indicated that there are no known areas where the pipeline would significantly impact the bog turtle and that no surveys for this species would be required (NYSDEC, 1998a).

In response to FWS comments, Millennium conducted field surveys of 18 wetlands within two segments of the right-of-way where the FWS believed populations of bog turtles may occur. Millennium also conducted a field meeting with the FWS and NYSDEC in August 1999 to identify potential bog turtle habitat at the surveyed sites. Only one site (Wetland 9) was found with suitable bog turtle habitat in a small forested portion of one wetland. The FWS indicated that if this area could be avoided, then no additional surveys would be required for the bog turtle. Millennium stated that it would reduce the work space area so that no trees would be removed in this wetland and no construction activities would be undertaken within the forested area. The CAS will be revised to show the reduced construction work area. With NYSDEC and FWS approval of the modified construction plan for the site, we believe the proposed project would not adversely affect or jeopardize the continued existence of the bog turtle. The FWS concurs that if Millennium is able to avoid impacting suitable bog turtle habitat in Wetland 9, the project would not be likely to adversely affect the bog turtle (FWS, 2001c).

Northern Wild Monkshood

Because the northern wild monkshood is not known or likely to occur within the project area, we believe the project would not affect the species or any suitable habitat of the species. The FWS concurs (FWS, 1999).

5.6.4 Other Special Status Species

Seventeen special status species that may be affected by the Millennium Pipeline Project (other than federally listed endangered and threatened species) include seven Federal species of concern and ten state listed species (see table 4.6.2-1).

Millennium, in consultation with the NYSDEC, identified 14 locations where the timber rattlesnake could be affected by pipeline construction. Millennium incorporated a line change in Sullivan County to avoid impact on one known den site. To further minimize impact on this species, Millennium proposes to comply with the NYSDEC's recommendations to either restrict construction to the period between November 1 and March 15, or hire a snake monitor if construction would occur between March 16 and October 31. The snake monitor would be qualified to find rattlesnakes within the construction work area and to remove them safely and unharmed to nearby release sites. The snake monitor would collect and relocate rattlesnakes in accordance with a permit issued by the NYSDEC that would specify approved snake handling techniques and protocol. Millennium also met with the NYSDEC concerning the potential impacts on the timber rattlesnakes associated with moving loose boulders during construction activities. As a result of this meeting, Millennium proposes to remove all loose boulders from the construction work area that provide potential timber rattlesnake habitat between October 1 and May 7, as recommended by the NYSDEC. We believe this would minimize impact on this species.

The NYSDEC has commented that there would be no areas where the pipeline should have important impacts on the Blanding's turtle, which is known to occur in Sullivan, Orange, Rockland, and Westchester Counties, and that surveys would not be required (NYSDEC, 1998a).

Millennium has not conducted surveys or proposed mitigation for the other special status species. The FWS stated that Millennium should conduct surveys to determine the presence of four Federal species of concern mussels (green floater, swollen wedge mussel, yellow lampmussel, and bean villosa) and evaluate potential impacts of the project on these species (FWS, 1999a). The NYSDEC was concerned about the bean villosa, longhead darter, and green floater. Millennium proposes to conduct field surveys for the bean villosa and longhead darter in Olean Creek and for the green floater in Catatonk Creek. Since the Susquehanna River would be conventionally bored, Millennium does not propose to survey for the green floater at this location. The NYSDEC, in its section 401 Water Quality Certificate, required completion of the proposed surveys, submittal of the plans for these surveys no later than 30 days before the surveys are scheduled to begin, submittal of the results of the surveys within 14 days of completion, and proposed mitigation measures if the species are found (see appendix K, condition 3.E). According to the FWS, Millennium proposes to relocate downstream any mussels found at the crossing at Olean Creek and to relocate upstream any mussels found at Catatonk Creek (FWS, 2001b). The FWS indicated that the crossings would be completed between July 1 and November 30 to avoid impacts to spawning mussels (FWS, 2001b). Surveys for the green floater would be required if the bore fails at the Susquehanna River.

To ensure that special status species are protected, we recommend that:

- **Millennium continue consultations with the FWS and NYSDEC regarding any other requirements for surveying, monitoring, or avoiding special status species (the bean villosa, long head darter, and green floater) or their habitats. The results of these consultations, including copies of all correspondence, and proposed mitigation should be filed with the Secretary before construction for review and written approval by the Director of OEP.**

5.7 WETLANDS

5.7.1 General Construction and Operational Impacts

The primary impact of pipeline construction and right-of-way maintenance activities on wetlands would be temporary and permanent alteration of wetland vegetation. Construction would also diminish the recreational and aesthetic value of wetlands crossed. These effects would be greatest during and immediately following construction. In emergent wetlands, the impact of construction would be relatively brief, since the herbaceous vegetation would regenerate quickly. In forested and scrub-shrub wetlands, the impact would be long term due to the extended regeneration period of the vegetative types and maintenance of the right-of-way.

Other types of impacts associated with construction of the pipeline could include temporary changes to wetland hydrology and water quality. Failure to segregate topsoil in wetlands could result in the mixing of the topsoil with the subsoil. This could result in altered biological activities and chemical conditions in wetland soils and could impact the reestablishment of wetland plants. In addition, compaction and rutting of wetland soils could result from the temporary stockpiling of soil and the movement of heavy machinery. This could alter the hydrologic patterns of the wetlands and would result in decreased seed germination and seedling survival. During construction, surface drainage patterns and hydrology could be temporarily altered and there could be an increased potential for the trench to act as a drainage channel. Increased siltation and turbidity may result from trenching activities. Trenching could penetrate or remove impervious soil layers under the wetland and, consequently, drain perched water tables. This in turn could result in drier soil conditions which could inhibit the reestablishment of wetland vegetation. Disturbance of wetlands could minimally affect the wetland's capacity to control erosion and floods.

5.7.2 Wetland Construction and Mitigation Procedures

To minimize the potential environmental impact on wetlands, Millennium would implement the mitigation methods in its ECS during construction and restoration in all jurisdictional wetlands (see appendix E1). The ECS incorporates our Procedures and includes the following requirements.

> Hazardous materials, chemicals, fuels, and lubricating oils would not be stored within a wetland or within 100 feet of a wetland boundary.
>
> All extra work areas would be located at least 50 feet away from wetland boundaries; if topographic conditions do not permit a 50-foot setback, extra work areas would be located at least 10 feet from the wetland's edge.
>
> Construction equipment operating within the right-of-way would be limited to that equipment necessary for clearing, excavation, pipe installation, backfilling, and restoration activities. All non-essential equipment would use upland access roads to the maximum extent practicable.
>
> Equipment operating within saturated wetlands would operate on wide tracks, balloon tires, timber pads, or prefabricated construction mats.
>
> Temporary erosion controls would be installed immediately after the initial disturbance of soil and would be inspected and maintained regularly until final stabilization. Erosion controls would be installed across the construction right-of-way on any slopes leading into wetlands and along the edge of the construction right-of-way within wetland boundaries.
>
> Vegetation would be cut at ground level, leaving existing root systems in place to promote revegetation. Stumps would only be removed from the trenchline and, if removal is required for safety concerns, along the working side of the right-of-way.
>
> The uppermost 1 foot of wetland topsoil would be segregated from the underlying subsoil in areas disturbed by trenching, except in areas with standing water or saturated soils, or where no topsoil layer is evident. The topsoil would be restored over the trench after construction is complete.
>
> Within forested wetlands, native trees and shrubs would be planted to restore the temporary and non-maintained right-of-way to preconstruction conditions. See table 2c and figure 25 of the ECS.
>
> Routine vegetative maintenance would be confined to a corridor 30 feet wide, centered over the pipeline. Millennium may selectively remove trees and shrubs within 15 feet of the pipeline that are greater than 15 feet in height. A 10-foot-wide corridor, centered over the pipeline, may be maintained in an herbaceous state. See figure 26 of the ECS.

The wetland crossing procedures in the ECS would be implemented in all jurisdictional wetlands, unless the wetland is used for agriculture and agricultural procedures apply. Construction through wetlands would also comply, at a minimum, with individual Section 404 permit conditions. Section 404 of the CWA is administered by the COE for all discharges of dredged or fill material or mechanical land clearing and excavation in waters of the United States including wetlands, streams, and navigable waterways.

Section 404(b)(1) guidelines restrict discharges of dredged or fill material where a less environmentally damaging, practicable alternative exists. When wetland impacts are proposed, the COE would require that all appropriate and practicable actions be taken to avoid or mitigate those impacts. For the COE to determine if appropriate and practicable measures have been taken, Millennium must demonstrate that it has avoided wetland impacts through the selection of the least environmentally damaging practicable alternative and has taken appropriate and practicable steps to minimize wetland impacts, including compensatory mitigation for unavoidable impacts (COE, 1990). See sections 3.4 and 5.7.3 for discussion of route variations to avoid or minimize impacts on wetlands.

As part of the COE review and permitting process, Millennium will be required to develop a mitigation plan. Any restoration or mitigation plans developed during the permitting process would be filed with the FERC along with agency correspondence. In addition to COE permitting requirements, Millennium has applied for and received its section 401 Water Quality Certificate from NYSDEC (see appendix K). The certificate includes the condition that Millennium restore all wetland crossing areas, except for temporary access roads, to pre-existing contours and grades within the wetland and for a distance of 100 feet from the edge of the wetland, within 48 hours of backfilling the trench.

In its comments on the DEIS, the DOI suggested that Millennium conduct topographic surveys of wetlands before construction to assist in the final restoration of affected wetlands. Millennium stated that, before construction, the existing grade both within and adjacent to the construction work area would be documented. Following construction, Millennium would regrade the construction work area to match the adjacent grade, and any special features noted during the preconstruction survey would be restored. The specifications for adequate restoration require that the final grade be within 6 inches of preconstruction grade. However, we believe that in some wetlands a difference of 6 inches may be significant and could alter the original hydrologic patterns of affected wetlands. Millennium stated that, if wetland areas are not restored appropriately, it would take the necessary steps to correct any problem areas, ensure that affected wetlands are properly graded, and restore the original hydrologic patterns. However, we believe that restoring wetland hydrology during final restoration would be more efficient and potentially less damaging than making repairs later. Access to repair wetland hydrology after restoration could result in destabilizing revegetating portions of the right-of-way. Therefore, we recommend that:

- **Millennium employ at least one wetland specialist per construction spread. The wetland specialist should be familiar with the existing hydrologic patterns of the affected wetlands within the construction work area and should be present during final grading of these wetlands. The wetland specialist should have the authority to direct any modifications to the final grade, as necessary, to ensure that the original hydrologic patterns of affected wetlands are restored to the fullest extent practicable.**

We believe that, with Millennium's adherence to these measures, topographic surveys of wetlands would not be required and the hydrologic patterns of affected wetlands would be restored.

5.7.3 Site-Specific Impact

Millennium has identified and delineated the boundaries of wetlands along the pipeline route. Construction of the Millennium Pipeline Project would temporarily disturb about 414.3 acres of wetlands for the construction right-of-way and extra work areas (see table 5.7.3-1). Millennium revised its calculations of crossing lengths and NWI classifications of some wetlands in response to comments from the FWS regarding discrepancies between Millennium's wetland vegetation types and those directly observed or reported on the NWI maps. These adjustments are included in the tables in appendix I of the FEIS.

TABLE 5.7.3-1

Wetlands Affected by Construction and Operation

NWI Classification a/	Number Crossed	Total Length Crossed (ft)	Acreage Affected b/ Temporary	Acreage Affected b/ Permanent
PEM	478	153,601	295.3	174.4
PFO	104	38,248	71.6	43.8 c/
PSS	74	21,434	39.7	24.6
POW	17	5,553	7.7	5.0
E2EM d/	0	0	0.0	0.0
TOTAL	**673**	**218,836** (41.4 miles)	**414.3**	**247.8**

a/ Classification:
P = Palustrine
EM = Emergent
FO = Forest
SS = Scrub-shrub
OW = Open water
E2 = Estuarine Intertidal

b/ Construction impacts based on a 75-foot-wide construction right-of-way and the extra work areas. Permanent impacts based on a 50-foot-wide operational right-of-way.

c/ In accordance with Millennium's ECS, Millennium would only maintain a 10-foot-wide corridor centered on the pipeline and would selectively cut only those trees greater than 15 feet tall within a 30-foot-wide corridor, thus reducing the amount of forested wetland maintained in a herbaceous or scrub-shrub state to 25.1 acres.

d/ The 375-foot-long crossing of this wetland would be avoided by the horizontal directional drill of the Croton River.

Of the total 414.3 acres of wetlands that would be disturbed during construction, about 71.6 acres (17 percent) of these wetlands are classified as forested wetland or other wetlands with a major forest component. Two of the 104 forested or predominantly forested wetlands would be crossed on new right-of-way at MP 36.9 (391 feet) and MP 37.1 (146 feet) in areas where the pipeline would not be adjacent to any other existing rights-of-way. Both wetlands are within the pipeline segment that was rerouted for the Lake Erie landfall in Ripley and would be near the Belson Creek watershed. Impact on Belson Creek is a concern to residents in this area because it supplies water for the Town of Ripley (see section 3.4 and 6.3.2 for discussion of the original route in this area). Any variation in this area to avoid the wetlands would move the pipeline closer to Belson Creek.

The other forested wetlands would be crossed adjacent to existing rights-of-way, where actual forest clearing would be less than 75 feet because of the partial use for construction of 25 to 50 feet of the previously cleared right-of-way for construction (see table C1 and typical right-of-way cross-sections in appendix C). Following construction, about 43.8 acres of previously forested wetland would be retained for the operational right-of-way. However, in accordance with its ECS, Millennium would maintain only a 10-foot-wide corridor centered on the pipeline in a herbaceous state and would selectively cut only those trees that are greater than 15 feet tall from within a 30-foot-wide corridor centered on the pipeline. This would reduce the amount of forested wetland maintained in a herbaceous or scrub-shrub state to 26.3 acres. Millennium also proposes to replant trees within the temporary construction right-of-way in accordance with its mitigation plan that is under development with the COE.

The remaining 342.7 acres (83 percent) of the wetlands affected by construction are classified as non-forested wetlands and include scrub-shrub (39.7 acres; 10 percent), emergent (295.3 acres; 71 percent) wetlands, and open water (7.7 acres; 2 percent), or a mixture of these wetland types.

Millennium identified a total of 208 temporary extra work areas that would be within or partially within wetlands (see appendix I2). These extra work areas include staging areas for road and stream crossings, extra work space at pipeline crossovers, and topsoil storage areas in cultivated fields that are also classified as wetlands. A total of 41.6 acres of wetlands would be affected and are included in the totals in table 5.7.3-1. These extra work areas have been modified in response to our comments regarding greater use of upland areas instead of wetland areas, or minimizing or avoiding use of extra work space in wetlands. We have reviewed these extra work areas and found them reasonable. Millennium also identified 39 locations where the construction work area would be within 50 feet of wetlands. In accordance with our Procedures and Millennium's ECS, these wetlands would be protected by sediment barriers as necessary to avoid construction impacts on them. All wetlands within temporary extra work areas would be allowed to entirely revert to preconstruction conditions.

Millennium stated that it would use an additional 25 feet of existing right-of-way on the non-working side of the construction right-of-way for access to the construction right-of-way by light vehicles (e.g., primarily for construction personnel) and for storage of spoil in agricultural land and wetlands. This additional right-of-way would only be used where the pipeline would be adjacent to Columbia's existing right-of-way and would total about 253.4 miles between MPs 41.7 and 376.4. While we recognize the need for additional work space in wetlands to allow for topsoil segregation and the advantages of reducing the number of vehicles using a saturated construction right-of-way, we believe that a 75-foot-wide right-of-way is adequate and do not believe an additional 25 feet is essential in all wetland areas that would be crossed adjacent to the existing pipeline right-of-way. Therefore, we recommend that:

- **Millennium should not use an additional 25 feet of Columbia's existing right-of-way in wetlands crossed between MPs 41.7 and 376.4.**

We received a comment from the DOI suggesting that Millennium delineate wetlands with orange construction fencing before construction, and that Millennium incorporate this measure into its ECS. In accordance with section B.1. of Millennium's ECS, all affected wetlands within the construction work area would be marked with signs, prior to construction, and these signs would be maintained throughout the duration of construction. Further, in accordance with section V.A. of Millennium's ECS and section VI.C.2.i. of our Procedures, construction equipment, vehicles, and hazardous materials would not be parked, serviced, or stored within 100 feet of any wetland. In addition, equipment refueling would not be conducted within 100 feet of any wetland boundary. We believe that with the signage of affected wetlands within the construction work area and adherence to the measures contained in both Millennium's ECS, and our Procedures, construction-related impacts on wetlands would be minimized.

About 87 of the wetlands that would be affected by construction would be either entirely or partially within agricultural fields. Topsoil segregation and other measures employed to protect agricultural soils would be used in these wetlands (see section 2.3.3 and section III of Millennium's ECS). Construction would affect a total of approximately 82.2 acres of these farmed wetlands (about 30.3 acres would be entirely within agricultural fields, and 51.9 acres would be partially in agricultural fields). The overall impact of pipeline construction on these wetlands would be minimal because these wetlands do not support a predominance of native wetland vegetation, and essentially no clearing of wetland vegetation would occur.

Millennium identified 51 small wetlands that it proposes to fill permanently as part of project construction between MPs 38.5 and 347.9, affecting a total of 0.4 acre. These wetlands are linear in shape and vary in length from 25 to 75 feet and in width from 3 to 5 feet. All are within Columbia's existing, maintained pipeline right-of-way and were created over time as a result of improper grading techniques and inadequate maintenance practices.

Each wetland is located directly over Columbia's existing pipeline in depressional areas where soil has settled and water collects. The source of water appears to be solely from precipitation and/or surface runoff. Millennium proposes to regrade these small depressional wetland areas to the approximate surrounding contour and reseed them with an upland seed mix. Millennium would consult with the COE to develop compensation plans for this wetland loss, if necessary.

In its ECS, Millennium stated that the top 12 inches of soil would be conserved from graded areas, the trench, and areas designated for temporary storage of non-wetland soils in wetlands without standing water or saturated soils. The ECS further states that subsoil may be placed on 6 inches of mulch for retrieval during backfilling operations. This practice may be necessary in areas where side slopes would be within wetland boundaries and the right-of-way would need to be graded to provide a level travel way for the safe operation of construction equipment. Millennium has not specified what type of mulch would be used or where this practice may be required. Therefore, we recommend that:

- **Millennium should use a non-seed carrying barrier (such as straw or fabric), determined in consultation with the NYSDEC and COE, to separate wetland and non-wetland subsoils, where non-wetland subsoil from grading operations would be stored in wetlands. The barrier materials should be visible to the equipment operator when it is exposed during restoration. Millennium should file the milepost location of the areas where these barriers are used in its weekly construction report.**

The DOI commented that underlying aquiclude materials provide a supporting hydrology for perched wetland habitats and that these areas should be identified. The DOI stated that Millennium should develop techniques to minimize impacts on perched wetlands and suggested that trench breakers be installed in these areas so that water would flow above the fragipan or aquiclude material. We believe that determining whether a wetland is hydrologically sustained by a fragipan or aquiclude is difficult before construction and would not be practical for a project of this magnitude. Millennium states that it does not expect to encounter aquicludes or impermeable fragipan during construction, and, if perched wetlands were encountered and damaged by construction, it would restore the aquiclude with clay.

Although we are not convinced that perched wetlands would not be encountered, we conclude that Millennium would identify and restore these wetlands. To ensure successful wetland restoration, Millennium's ECS requires monitoring of the success of wetland revegetation annually for the first 3 years after construction and, if unsuccessful, continuing revegetation efforts until wetland revegetation is successful (section VI.C of Millennium's ECS). Millennium would also monitor restoration in accordance with its mitigation plan that is under development with the COE. If construction activities affect a perched wetland by altering the hydrology, the change of hydrology would likely be apparent by the change in the postconstruction vegetative community. Millennium would then be responsible for the successful restoration of these wetlands or mitigation for their loss.

The pipeline would cross 38 NYSDEC-regulated wetlands with a total of 57 crossings and a total crossing length of 6.7 miles (see table 4.7-1). About 67.0 acres of these wetlands would be affected by construction, of which 40.3 acres would be retained for operation of the pipeline. Our Procedures limit the nominal construction right-of-way in wetlands to 75 feet, plus extra work areas where required for road, railroad, or stream crossings or for topsoil segregation where wetlands are actively used for agricultural production. There would be no construction activity outside of the construction work area. Millennium developed site-specific plans for crossing state-regulated wetlands in consultation with the NYSDEC in the spring and summer of 1999. We have reviewed these site-specific crossing plans and find them to be acceptable. We believe that if Millennium constructs its project in accordance with its site-specific crossing plans and the measures contained in its ECS, impacts on NYSDEC-regulated wetlands would be minimized.

Both the NYSDEC and COE requested an evaluation of alternatives to avoid each wetland (including the use of routing around them or boring under them). Table I3 in appendix I identifies each regulated wetland and the results of Millennium's preliminary evaluation of the use of a directional drill for crossing under these wetlands. See discussion of directional drill costs, and advantages and disadvantages in section 5.3.2.3 (Horizontal Directional Drill Construction Technique).

To further reduce wetland impacts, we examined the feasibility of avoiding crossings of NYSDEC-regulated wetlands and also those predominantly forested wetlands that would be greater than 500 feet long. Cumulatively, the review covered about 70 wetlands, or a little more than 10 percent of the total wetland crossings. Because the majority of wetland crossings overlap or are contiguous with an existing cleared corridor, avoiding a wetland would often require clearing more acres of vegetation and establishing a new cleared corridor through either wetland or upland areas. Generally, following an existing corridor through forested areas is preferable to establishing a new corridor, because a portion of the cleared corridor can be used for some of the construction and permanent rights-of-way. Many of the crossings would affect linear wetlands associated with streams. In these instances, the wetland crossing is unavoidable and can only be minimized by shifting the location of the crossing to reduce the wetland crossing length. Other constraints to avoiding wetlands include existing residential development, roads, and unfavorable topography. Since the advantages of these types of route change are normally negated by the additional impacts on other resources and the creation of a new right-of-way that would deviate from the existing right-of-way, we found no environmentally preferable alternative to these wetland crossings.

We received a comment from the NYSDEC indicating that site-specific values and benefits of NYSDEC wetlands that would be crossed by the proposed pipeline should be addressed in the EIS. We believe that a site-specific discussion of the values, benefits, and specific effects of the project on each NYSDEC-regulated wetland crossed would be excessive and not appropriate for the EIS. Section 5.7.1 describes the typical potential impacts of pipeline construction on the wetlands within the construction work area. Appendix E1 contains the mitigation measures that would be used to minimize impacts on these wetlands.

Wetland functions would be affected by construction, although the construction and restoration procedures in appendix E1 would reduce the loss of overall functions primarily by preserving the original ground surface grade and maintaining tree stumps for revegetation in forested wetlands. The biggest change in function would occur in forested wetlands. Removal of trees from a wetland may increase the performance of some functions and decrease others. The ability of wetlands to maintain long-term surface water storage, for example, may be enhanced when trees are removed. Water would be stored longer because evapotranspiration would be suppressed in the absence of vegetation. Conversely, negative effects on other functions, particularly related to wildlife habitat, would result from removing vegetation.

The measures contained in appendix E1 limit post-construction vegetation maintenance in the right-of-way to about 30 feet centered over the pipeline. For the remaining portion of the construction right-of-way, the functional conversions would not be sustained over time. The wetland vegetation community would eventually transition back into a forested community with functions similar to those performed by the wetland prior to construction in areas used for temporary right-of-way. Consequently, affected wetland communities would lose only those functions unique to forested wetlands and only for the period of years equal to the time required for reforestation.

We understand that this represents a loss of specific wetland functions, but not functionality. The COE through the section 404 Permit process and NYSDEC through its section 401 Water Quality Certificate process may require mitigation as compensation for this loss of function over time although neither has required such analyses to date. We do not feel that any additional analysis or mitigation, beyond what would be required by the COE and NYSDEC, is necessary.

The NYSDEC commented that steep slopes that terminate at stream crossings and associated wetlands should be considered as environmentally sensitive areas. As such, Millennium should provide specific siltation and erosion control plans for these areas. Our Procedures and the ECS require that sediment control devices be placed across the entire construction right-of-way immediately upslope of any wetland boundary and along the edge of the construction work area where necessary to prevent sediment flow into wetlands that are adjacent to the construction work area. We believe that erosion control concerns would be adequately mitigated through the implementation of these mitigation measures.

The NYSDEC also commented that Millennium should provide a list of locations where there would be both stream and wetland impacts. Table I2 in appendix I identifies extra work areas in wetlands for stream and road crossings, and for topsoil segregation in farmed wetlands.

The NYSDEC also commented that Millennium did not identify ponding from beaver activity in the construction work area during its surveys. We asked Millennium to clarify this, and it reported that, when an inventory of the proposed alignment was performed, beaver activity was not observed. Beavers are a transient species, and the location of their activity may change. Areas where beavers may be active at the time of construction may not necessarily be coincident to locations where their activity is presently observed. For example, Millennium states that wetland W034, a palustrine scrub-shrub and emergent wetland (MP 47.9), showed no signs of beaver activity during a field visit on June 11, 1999; however, during a subsequent field visit on June 16, 1999, the water elevation had changed by about 2 feet, and evidence of beaver activity was observed.

Beaver activity contributes to the modification of wetland hydrology and this activity can create both positive and negative attributes in the landscape. Modification of hydrology can create and destroy wetland habitats (Mitch and Gosselink, 1986). Beavers require a permanent water supply and can control water depth and stability by constructing dams along waterbodies (Allen, 1983). These dams have the potential to impound water across large areas of land, creating wetlands where none had previously existed. Conversely, if water is impounded near a forested or scrub-shrub area, vegetation may die back leaving standing dead shrub or tree trunks and allowing herbaceous and aquatic plant species to dominate the area (Reschke, 1990). The habitat that would be created in this situation would be classified as either a dead scrub-shrub or dead forested wetland habitat (Cowardin, 1979).

Millennium indicated that it understands that the NYSDEC is interested in minimizing effects on beaver populations during construction. During field visits to regulated wetlands, the NYSDEC indicated that the siphoning of beaver ponds before construction was the preferred method of dealing with the presence of the ponds within the construction work area. Beaver activity at wetlands W464, a palustrine emergent, shrub-scrub, and forested wetland complex associated with Oquaga Creek (MP 272.2), and W506, an open water and palustrine emergent system (MP 292.1), would be handled in this way (see section B.1. of Millennium's ECS). At these locations, this method would result in temporary dewatering of beaver ponds and their associated wetland habitats, but no long-term effects on the beaver population or their habitat are anticipated. During restoration, the siphons would be removed and the water level within the beaver pond and associated wetland would gradually return to normal. However, the COE disagrees since this could have devastating effects on the breeding and overwintering of other species if the ponds dry up in early to mid summer and fall. The COE recommends that any siphoning or draining be limited to the construction work area or as permitted through the COE.

Millennium stated that a small beaver dam is located within the permanent right-of-way at wetland W221 (MP 173.6). This is a palustrine emergent, scrub-shrub, and open water wetland complex. Millennium stated that NYSDEC representatives indicated that it would be possible to remove this beaver dam since it was abandoned, and the size of the beaver population in the Goodhue Creek valley is such that beavers may return to this location in the future. This area would be returned to its original grade, and the wetland characteristics would remain unchanged. The beaver dam would not be restored.

Millennium also indicated that beaver lodges have not been identified within the proposed construction work area. If, at the time of construction, they are identified, Millennium would coordinate further with the NYSDEC and the COE to determine the appropriate action to be taken. We find this to be acceptable and believe that impacts on beaver ponds and their associated wetland habitats would be minimized with the implementation of the NYSDEC's recommendations regarding siphoning and Millennium's ECS.

We reviewed Millennium's wetland determination forms and noted that it identified invasive plant species such as purple loosestrife, phragmites, and Japanese knotweed in wetlands that would be crossed by the proposed project. Mowing or cutting of these invasive species does not destroy the root stalks and creates pieces that may resprout. Seeds, viable propagules, and rhizome fragments may attach to construction equipment and be conveyed to other wetlands. Under section VI.D.7 of our Procedures that are incorporated by reference into Millennium's ECS, Millennium is required to coordinate with the state to develop strategies to control the spread of exotic plant species such as purple loosestrife, phragmites, and Japanese knotweed.

All 12 of the wetlands that would be crossed along the 9/9A Proposal are adjacent to highway, road, and/or bicycle paths. These include 4 forested wetlands (Wetlands W08WCR, 160 feet; W10WCR, 160 feet; W03WCR, 65 feet; and W11WCR, 490 feet), and 2 forested/emergent wetlands (Wetlands W06WCR, 860 feet; and W02WCR, 135 feet). Total avoidance of these wetlands would require moving construction-related impacts into adjacent residential areas or upland forested areas, thus eliminating many of the advantages of partial use of existing utility and transportation corridors. Millennium states that it evaluated several alternatives for the alignment of the project in Westchester County in an attempt to avoid wetland impacts. In many cases, wetlands have formed at drainage blocks and within man-made drainageways along the various transportation corridors considered. The alignment of this portion was chosen to take advantage of the existing corridors and to minimize the creation of new right-of-way through a densely populated area. Therefore, alternatives that totally avoided wetlands while maximizing use of existing transportation corridors and avoided existing development were limited. We found no alternatives that offered a clear environmental advantage over the proposed route.

Millennium attempted to avoid locating temporary work areas (other than the construction right-of-way) within 50 feet of wetlands and waterbodies to the greatest extent possible. However, there are two locations (MPs 401.37 and 401.41) along the 9/9A Proposal where temporary work areas would be within 50 feet of wetlands and/or waterbodies. At these locations, Millennium states that topographic conditions or existing facilities preclude moving the additional work space out of the wetlands. Millennium would minimize impacts at these locations by maintaining at least 15 feet of undisturbed vegetation adjacent to the wetland and waterbody and installing a sediment filter device at the edge of the construction work area prior to clearing. Site-specific details concerning temporary work areas would be included on the CAS.

The 9/9A Proposal would also cross the buffer zones of five NYSDEC-regulated wetlands: Wetland H-3 at MP 396.3, Wetland O-18 at MP 400.0, Wetland O-24 at MP 400.5, Wetland O-16 at MPs 402.2 and 402.8, and Wetland O-9 at MP 402.5. Since these wetlands would not be affected by construction and Millennium's ECS requires that sediment barriers be installed along the edge of the construction work area as necessary to prevent sediment flow into adjacent wetlands, there would be no significant impact on these wetlands.

5.8 .AND USE, RECREATION/PUBLIC INTEREST AREAS, AND VISUAL RESOURCES

5.8. Land Use

5.8 General Construction and Operational Impact

Land use impacts would generally result from the clearing of land for the installation of the pipeline, the metering and regulating stations, and from the maintenance of the pipeline right-of-way and aboveground facilities. Temporary work areas would be required in areas of steep side slopes; for crossings of major rivers,