1.0 INTRODUCTION

Part II of this Supplemental Draft Environmental Impact Statement (SDEIS) addresses major issues identified in comments on the Draft Environmental Impact Statement (DEIS) where we could clarify or update important information about the originally proposed Millennium Pipeline Project as proposed by the Millennium Pipeline Company, L.P. (Millennium). It includes issues associated with the black dirt area in Orange County, New York; water resources (e.g. Amish land, surface waters, Lake Erie, the Hudson River, and Catskill Aqueduct); coastal zone management consistency; major route alternatives at the Hudson River; and route variations. The vertical line presented in the margin identifies text that has been modified in this SDEIS and differs from the corresponding text in the DEIS. This also indicates where changes have been proposed by Millennium between the time of the publication of the DEIS and this SDEIS.

2.0 UPDATED PROJECT INFORMATION

2.1 BLACK DIRT AREA

Most of the project area is underlain by bedrock formations of interbedded sandstone and shale. The depth of soil material to bedrock varies. The shallowest locations range from about 14 inches to 5 feet. Soils are predominantly glacial tills (i.e., glacial drift made up of varying proportions of clay, silt, sand, gravel, cobbles, and boulders) in the higher elevations, on slopes, and on tops of slopes. Many of these glacial tills contain a naturally formed "fragipan" or a brittle horizon which is low in porosity (poor permeability) and which restricts vertical drainage resulting in lateral or cross-horizon drainage within the soil profile. The fragipan also contributes to the occurrence of a perched, seasonally high water table with saturated surface and upper subsoil conditions. Soils, which do not have a distinct fragipan in the subsoil but which are shallow to bedrock, are also limited in vertical drainage because of the impermeability of the bedrock. Soils in the lower (valley) elevations include glacial tills, glacial outwash (sandy-gravelly loams), and alluvial sediment deposits that can be subject to cutbank caving or sloughing when trenched.

Some of the valleys also contain deposits of glacial lake-laid sediments with a relatively high water table. Organic muckland soils, with island inclusions of glacial tills, are found in a unique portion of the Hudson Hills physiographic region known as the "black dirt" area between mileposts (MPs) 350.3 and 353.3. This area is comprised of peat deposits that have developed over thousands of years and are centered in the Wallkill and Pochuck River drainages in the Pine Island area in Warwick, Goshen, and Minisink in Orange County, New York. This area has an extremely high water table with organic deposits reaching a thickness of 30 feet in the deepest areas before reaching a distinct substrata or parent material. A complex system of dikes, primary and secondary drainage ditches, and levees are used to drain some 17,000 acres of these soils for agricultural use, including a variety of vegetable crops. The fields drained by this system contain precise contours that drain into the drainage ditches. These soils are especially vulnerable because they have multiple-surface horizons that need to be carefully segregated, and because they are susceptible to subsidence and rapid decomposition when disturbed.

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 State of New York Department of Agriculture and Markets (NYSDA&M) (see appendix IIA). This Archeological and Construction Work Plan for the Proposed Millennium Pipeline Project Black Dirt Area (Black Dirt Plan) includes a route variation, in addition to the one identified in the October 1997 filing, to address construction issues related to the crossing of Mission Land Road and the Pochuck Creek (see section 4.10). This Black Dirt Plan was developed in cooperation with and reviewed by the New York state historic preservation officer (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 pre-construction 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, U.S. Army Corps of Engineers (COE), U.S. Fish and Wildlife Service (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.

2.2 WATER RESOURCES

2.2.1 Groundwater

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 2.2.1-1). Millennium continues to develop its construction plans for the parcels crossed between MPs 74.6 and 77.1. Therefore, we recommend that:

> **Prior to construction, Millennium should file with the Secretary of the Commission (Secretary) for review and written approval by the Director of Office of Energy Projects (OEP), the finalized plans for construction across the Amish farms between MPs 74.6 and 80.0.**

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. In the April 1999 DEIS, we also recommended that Millennium provide a final listing of drinking water wells and springs within 150 feet of the construction work area, and that it include in its weekly construction progress reports any complaints concerning water well yield or quality and how each was resolved. Therefore, we believe that the NYSDA&M's concerns would be addressed on a project-wide basis and that the measures discussed above would be adequate to protect water supply systems on the Amish farms located between MPs 74.6 and 80.0.

TABLE 2.2.1-1

NYSDA&M Recommended Mitigation of 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 12 feet below surface and north of pipeline. Pipeline would cross between the source and developed spring houses. Locate depth of initial bedrock layer. If less than 12 feet, develop mitigation plan with Cattaraugus SWCD.
03C25 4004+39	75.8	Pond with ice house fed by 3 springs, of which 2 would be crossed by pipeline. Develop mitigation plan with Cattaraugus County SWCD and landowner to maintain water supply.
03C26 4002+51	75.8	Install interceptor tile lines (designed by Cattaraugus County SWCD) to insure 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 spring water supply to Amish schoolhouse (03C33) and spring livestock water supply (03C34). 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.
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 on pipeline centerline. Move pipeline to north side (crossover existing pipeline).
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.

2.2.2 Surface Waters

Excluding the waterbodies crossed by the 9/9A Proposal (which are addressed in Part I), the pipeline would cross a total of 476 waterbodies including 282 perennial (including Lake Erie) and 194 intermittent waterbodies (see appendix IIB). These crossings include 20 major waterbody crossings (waterbodies, including lakes and ponds, that are greater than 100 feet wide at point of crossing), 237 intermediate crossings (waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at point of crossing), and 219 minor crossings (waterbodies less than or equal to 10 feet wide at point of crossing). One of the major waterbodies (the Neversink River, MP 341.0) contains two channels at the point of crossing, one about 72 feet wide and the second about 57 feet wide.

All of the waterbody crossings are in New York, except for the 32.9-mile-long Lake Erie crossing which is mostly in Pennsylvania state waters. Of the 20 major waterbody crossings, 15 would be rivers or creeks (Tributary Lake Erie, Genesee, Cohocton, Chenango, Susquehanna, West and East Branches Delaware, Neversink, and Hudson Rivers; Tributary Cassadaga, Olean, Owego, Callicoon, Pochuck, and Wheeler Creeks), 1 would be a lake (Lake Erie), 2 would be reservoirs (Mongaup/Rio Reservoir and Indian Kill Reservoir), and 2 would be ponds.

Six of the waterbodies are designated or listed in either the Nationwide Rivers Inventory or New York State inventory for their wild, scenic, or recreational values (Chautauqua Creek; and Genesee, Cohocton, West Branch Delaware, East Branch Delaware, and Wallkill Rivers).

The waters of New York are classified and protected on the basis of their existing or expected best use (New York State Department of Environmental Conservation [NYSDEC], 1994). These waters include classifications "AA", "A", "B", and those class C designated as trout (T) or trout spawning (TS) streams. These waters are collectively referred to as protected waters and are subject to the stream protection restrictions of the NYSDEC Protection of Waters program. A total of 115 trout or trout spawning streams would be crossed by the pipeline and are identified in table B1 in appendix IIB.

Six drainage basins would be crossed by the Millennium Pipeline Project (see table 2.2.2-1). The water quality within these drainage basins is generally good, with very good water quality in the Allegheny and Delaware River basins and lower water quality in the lower reaches of the Hudson River drainage basin due mostly to urban development (EPA, 1997). The Delaware River basin is extensively used for public water supplies and includes three major reservoirs that are part of the water supply for New York City.

TABLE 2.2.2-1

Drainage Basins Crossed

Drainage Basin	Approximate Number of Miles Crossed	Number of Waterbodies Crossed	Number of Major Waterbodies
Lake Erie Basin	43.9	15	2
Allegany River Basin	83.9	125	2
Genesee River Basin	23.2	25	1
Susquehanna River Basin	117.4	145	5
Delaware River Basin	74.6	94	5
Hudson River Basin	74.3	72	5
TOTAL	**417.3**	**476**	**20**

Millennium proposes to cross 463 waterbodies (97 percent of all waterbodies) 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 269 of the 282 perennial waterbodies. Of the 13 perennial waterbodies that would be open cut, three are between 42 and 96 feet wide, eight are between 140 and 2,500 feet wide, and two are over 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 2.2.2-2. 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.

TABLE 2.2.2-2

Summary of Proposed Waterbody Crossing Techniques

	Intermittent	Perennial	Total
All waterbodies - Dry construction techniques:			
Dam and pump or steel dam and culvert	0	255	255
Dam and pump or steel dam and culvert, if flowing; otherwise open cut	193	0	193
Conventional bore	1	11	12
Directional drill	0	2	2
Combination bore and open cut	0	1	1
All waterbodies - Open cut a/	0	13	13
TOTAL	**194**	**282**	**476**

a/ Lake Erie would be open cut, except for the shoreline which would be directionally drilled.

Millennium proposes to abandon the existing pipeline in place at waterbody crossings between MPs 37.2 and 285.6, except for 26 waterbodies where the existing pipeline would be removed (see comment C in table B1 in appendix IIB). However, the existing pipeline also would be removed in locations where it is exposed during trenching.

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. 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 Biological Assessment [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 over 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. 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 construction alignment sheets (CAS).

Millennium received its section 401 Water Quality Certificate from the Pennsylvania Department of Environmental Protection (PADEP) for the Lake Erie crossing on March 29, 2000 (see appendix IIC). Millennium also received its section 401 Water Quality Certificate from the NYSDEC on December 8, 1999 (see appendix IID). Although the COE has not yet completed its project review, we believe that the proposed crossing procedures and specified mitigation would minimize impact on waterbodies to the greatest extent practical.

Major Waterbody Crossings

The pipeline would cross 20 major waterbodies (including Lake Erie [32.9 miles], the Hudson River [2.1 miles], and 2 ponds) that are over 100 feet wide at the crossing location. Table 2.2.2-3 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.

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 over 100 feet wide in table B1 in appendix IIB, 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).

TABLE 2.2.2-3

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	A
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 - 7/1 to 9/30	SB

a/ See table IIB-2 in appendix IIB 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 2.2.2-4 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.

The Millennium Pipeline Project would be within the Pittsburgh, Pennsylvania, and 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, and the Hudson River are considered navigable waterbodies by the COE.

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 IIB-1 in appendix IIB). 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 Gas Transmission Corporation (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 waterbodies using an open cut and 1 waterbody 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 open cut. Of these, two would be over 10,000 feet in width 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). 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 2.2.2-4). 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 over 100 feet wide, three of the waterbody crossings are between 42 and 96 feet wide and, in accordance with our Wetland and Waterbody Construction and Mitigation Procedures (Procedures), should be completed within 48 hours. Therefore, we recommend that:

> **Millennium should attempt 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, or prior to construction, file with the Secretary an explanation for 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 NYSDEC, Millennium filed revised crossing plans to minimize turbidity. These plans are summarized in table 2.2.2-4, 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.

None of the waterbodies currently proposed for an open cut were determined to be feasible for completion of a conventional bore or directional drill.

TABLE 2.2.2-4

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 2.2.3.
Chautauqua 59.9	Cassadaga Creek	42 ft	Allegheny River	Conewango Creek	Excavate trench using backhoe or dragline from centerline of waterbody.
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 the 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 2.2.2-4 (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 Southern Energy to construct during limited water releases from upstream Mongaup Falls dam. No additional clearing of trees within designated 50-foot buffer zone. Stockpile spoil in water leaving an 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 of barges. Refueling within 100 feet of water's edge limited to equipment on barges. Barge to 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. 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 method to install pipe. Excavate trench only within 50 feet of water's edge. Use barge-mounted backhoe or dragline to remove rocks from the 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 2.2.2-4 (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 2.2.4.

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.

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. 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 2.2.2-3 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

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 provided a preliminary cost comparison of an open cut versus a directional drill for seven of the major or sensitive waterbodies that were not eliminated for a directional drill for technical reasons (see table 2.2.2-5). Millennium considered three crossings (the Genesee, Cohocton, and Wallkill Rivers) not to be feasible for directional drilling because of the excessive cost associated with this construction method.

TABLE 2.2.2-5

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 [1/] and $1,050 per foot under poor soil conditions.[2/] In addition, Millennium provided estimates from Michels Pipeline Construction, Inc. on specific waterbody crossings (see table 2.2.2-6). 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.

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

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

TABLE 2.2.2-6

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 four 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 archaeological 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 archaeological 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 open cut the Cohocton River, and cross the Genesee and Wallkill Rivers 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). Of these, the East Branch Delaware River would be crossed using a combination of conventional bore and open cut diversion which, if successful, would result in a dry crossing. The feasibility of using a directional drill crossing for the remaining 13 waterbodies that would be open cut was also 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 2.2.3 and 2.2.4, 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 (see condition 6 in appendix IID and the proposed mitigation identified in table 2.2.2-4).

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 all 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 River 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) 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. This should be a site-specific plan that includes scaled drawings identifying all areas that would be disturbed by construction. Millennium should 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 four waterbodies within 3 miles of active public water intakes:

Belson Creek at MP 38. (about 2.6 miles upstream of the supply intake for the Alford Reservoir);

Olean Creek at MP .2 (about .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. (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 2.2.2-4).

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 2.2.2-4) 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 Environmental Construction Standards (ECS) (see appendix E in Part I of this SDEIS) and our Procedures (see the FERC's website at www.ferc.fed.us). 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 Spill Prevention, Containment, and Control Plan (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 2.2.2-4) and the mitigation measures described above would limit impacts on this water supply. Therefore, we believe impacts to water supplies would be minimal and temporary.

2.2.3 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 (International Trade Commission [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, total suspended solids (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 U.S. Environmental Protection Agency (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. (For a description of the jet sled construction technique see section 2.3 of the Millennium Pipeline Project DEIS, April 1999.) 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 eduction capacity, etc.) 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, 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.

2.2.3.1 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.[3/] 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 Gas Supply Corporation (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 Pipelines Ltd. (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 U.S. Geological Survey (USGS) scour surveys conducted in the 1990's 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.

3/ 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.

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 to effect the pipeline is 1 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) 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 ice scour

loads), and is codified in the applicable North American reference specifications [4/] and in the European standards which are often cited for the design of offshore pipelines [5/].

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 which 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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4/ 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).

5/ 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 Environmental Impact Statement (EIS), to complete an independent analysis of the ice scour studies through the COE's Cold Regions Research and Engineering Laboratory (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 RIMS at the FERC's website at www.ferc.fed.us 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 2.2.3.1-1). 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.

TABLE 2.2.3.1-1

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 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.

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 U.S. Department of Transportation (USDOT) regulations in Title 49, Code of Federal Regulations (CFR) 192. We believe these depths are sufficient to protect the pipeline from ice scour.

2.2.3.2 Turbidity and Sediment Deposition

Temporary increases in suspended solids would be expected as a result of in-lake construction activities. The time that the particles remain suspended depends on their settling velocities and water turbulence. 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 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 (see table 2.2.3.2-1).

TABLE 2.2.3.2-1

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. Since 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, which is based on literature values for lakes that are similar in size to Lake Erie.

Table 2.2.3.2-2 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 2.2.3.2-2) 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.

The plume would follow construction across the lake and would not be sustained at any location. Previous studies have indicated 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. The 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 2.2.3.2-2

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			Plume Dimension at 1,000 mg/l TSS			Plume Dimensions at 10,000 mg/lTSS		
	Maximum Length	Maximum Width	Plume Duration (hr)	Maximum Length	Maximum Width	Plume Duration (hr)	Maximum Length	Maximum Width	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	1
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		330 feet	<16 feet	<1
0.1 ft/s	3.1 miles	3,700 feet	47	3,170 feet	525 feet		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		660 feet	66 feet	1
0.03 ft/s	1,640 feet	1,310 feet	14	820 feet	525 feet		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		660 feet	<16 feet	<1
0.1 ft/s	3,170 feet	1,050 feet	10	1,310 feet	330 feet		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	5	1,310 feet	164 feet		525 feet	66 feet	<1
0.03 ft/s	660 feet	525 feet	6	410 feet	262 feet		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

A summary of anticipated sedimentation is provided in table 2.2.3.2-3 and is based on sediment deposition after two passes by the jet sled. Using the suggested trench depth dimensions from CRREL review, Millennium modeled the expected sediment deposition associated with construction in the various zones.

TABLE 2.2.3.2-3

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 regarding 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 [6/]. In addition, the PADEP requested that the plan provide for separate monitoring of the turbidity plumes in the hypolimnion and epilimnion.[7/] 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 IIC). 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.

2.2.3.3 Potential for Encountering Contaminated Sediments

Chemical constituents which 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 which have been found to exceed target concentrations of the Canadian Ministry of the Environment provincial water quality objectives include polychlorinated biphenols (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.

6/ 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.

The part of a lake above the thermocline.

The high biological productivity which characterizes Lake Erie may promote processing of heavy metals and other contaminants. Metals and hydrophobic organic components may be taken up by suspended 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,[8/] 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 since 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 micrograms per gram (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.

8/ 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.

In addition, the sediment core samples collected were subsampled at 3-centimeter (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 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.

2.2.3.4 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 2.2.3.4-1 summarizes repair procedures and times.

TABLE 2.2.3.4-1

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 believe that the Lake Erie crossing could 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 IIC) 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 believe that the 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 plan and manual for handling emergency repair of the pipeline in Lake Erie;**
>
> **c. finalized construction procedures, including those for minimizing and monitoring dispersion of the turbidity plume and sediment deposition a description of the mitigative actions that Millennium would take if the observed turbidity plumes exceeded 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 Pipelines Ltd. and is being reviewed by the Canadian National Energy Board (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 Part I of this SDEIS, sections 1.1 and 1.4). Therefore, we recommend that:

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

2.2.4 Hudson River

The Hudson River is a designated American Heritage River because of its important role in American History. This designation provides communities along the river with better access to existing programs and resources of the Federal government and encourages private funding of local efforts. The designation currently does not impose any other regulations or restrictions.

The pipeline would cross the Hudson River (MP 387.9) in Haverstraw Bay between Bowline Point in Haverstraw and the Veteran's Administration Hospital in Cortlandt, a crossing of about 2.1 miles. The crossing would be about 11.3 miles north of Nyack, New York, and the Tappan Zee Bridge. Haverstraw Bay has a tidal range of about 3 feet, extensive shallow areas (15 feet or less), and a dredged navigation channel about 32 feet deep. It varies in width from 2 to almost 4 miles and extends for about 6 miles along the Hudson River from Stony Point to Croton Point. The bay is brackish during much of the year, with salinities varying from 0 to 10 parts per thousand. Freshwater flow varies by season, with the highest inflow in the spring.

The saltwater/freshwater interface moves up and down the Hudson River in response to the volume of freshwater flow from the upstream portion of the river, and its location is highly dependent on the amount of precipitation that occurs within the watershed. Generally, the interface moves downstream from the vicinity of Newburgh Bay (about 20 miles north of Haverstraw Bay) in response to spring snowmelt runoff. In normal years, the interface would pass through Haverstraw Bay sometime in March or April. The downstream limit of this movement is generally near or downstream of the Tappan Zee Bridge (about 7 miles south of Haverstraw Bay). However, the NYSDEC indicated that the interface is unpredictable and can range from New York harbor in the spring to Poughkeepsie in the summer (a distance of about 70 miles). After the high springtime runoff stops, the saltwater/freshwater interface gradually moves upstream as the volume of freshwater from the upper Hudson River gradually decreases. The interface generally passes through Haverstraw Bay again in May or June. By August, the interface normally reaches the vicinity of Newburgh Bay again. Summer and fall rainstorms may make the interface move downstream episodically, but the interface typically remains in the Newburgh Bay area until winter and the subsequent spring when the cycle is repeated.

According to the New York National Heritage Program (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 (NYSDEC, 1999). The bay has been designated as an essential fish habitat (EFH) for red hake, winter flounder, windowpane, bluefish, Atlantic butter fish, fluke, and Atlantic herring. It also provides habitat for the federally endangered shortnose sturgeon and threatened bald eagle.[9/]

9/ The EFH Assessment and Biological Assessment for the Millennium Pipeline Project were issued in January 2001

The Hudson River at the proposed crossing location has waters classified by the NYSDEC as saline salt water (SB). The best use for waters classified as SB are primary and secondary contact recreation and fishing (see table IIB-2 in appendix IIB). Waters classified as SB are also suitable for fish propagation (NYSDEC, 1994). However, there is a health advisory for fish and blue crab consumption due to the potential presence of heavy metals, pesticides, herbicides, semi-volatile organic compounds, and PCBs.

The approximate 200-mile-long stretch of the Hudson River from Hudson Falls to the Battery in New York City was placed on the Superfund's National Priority Site list in 1984. The designation was based on the discharge of an estimated 209,000 to 1.3 million pounds of PCBs by General Electric from two capacitor manufacturing plants in Hudson Falls and Fort Edward. The upper Hudson River, approximately 40 miles between Hudson Falls and Troy (and about 105 miles north of the proposed crossing in Haverstraw Bay), is the major focus of investigations based on studies that identified 40 hot spots (sediments with greater than 50 parts per million of PCBs) and 5 remnant deposits (river sediments exposed when the level of the river was lowered due to the removal of the Fort Edward Dam in 1973). In 1976, all fishing was banned in the upper Hudson River and commercial fishing of striped bass and several other species were banned in the lower Hudson River. In 1991, remediation was conducted in the upper Hudson River, and, in 1995, catch and release fishing was again allowed in the upper Hudson River. In December 2000, the EPA finished its Feasibility Study that included a proposed remedy for the upper Hudson River. The comment period on that study was recently extended to August 2001.

PCB concentrations in the river vary considerably depending on the river's flow, the depositional characteristics of various reaches, and the distance to the source release. However, PCB concentrations tend to be relatively low in Haverstraw Bay and no PCBs were detected in the samples collected by Millennium at the proposed crossing location.

Schnabel Engineering conducted sediment sampling for Millennium in the Hudson River near the crossing location (Schnabel Engineering, 1998). Arsenic, barium, cadmium, chromium, lead, mercury, and silver were detected in some of the sediment samples. Metal concentrations were highest in the upper 10 feet of sediment and in the western portion of Haverstraw Bay. The total chromium and lead are in water-soluble forms while the mercury is not in a water-soluble form. Ten different semi-volatile organic compounds (SVOCs) were detected in sediments from the western portion of the bay and 1 SVOC was detected in sediments from the navigation channel. SVOCs were not detected in sediments from the eastern portion of the bay.

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.

Conventional Open-Cut, Bottom-Pull Construction Method

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 to 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 would likely increase the amount of time required to excavate and backfill the trench using a conventional

bottom-pull dredge by about 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 workspace 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 Method (Proposed Method of Construction)

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. A trench section of about 1,300 feet in length 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 trenching section 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. 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.

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 2.2.4-1.

TABLE 2.2.4-1

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 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 IIE). The NYSDEC in its section 401 Water

Quality Certificate identified 26 other site-specific conditions for the Hudson River/Haverstraw Bay crossing (see appendix IID, 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 to aquatic life are not expected beyond the predicted visible plume which has a maximum length of 460 feet 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 2 additional sediment cores before construction across the Hudson River in compliance with the NYSDEC's section 401 Water Quality

Certificate (see appendix IID, condition 7.E). 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 IID, condition 7.H through 7.O).

Timing of Construction

To minimize adverse impacts to fisheries, Millennium proposes to cross the Hudson River/Haverstraw Bay over a 3-month period between July 1 and September 30. This construction window represents a change from that presented in the DEIS, where Millennium 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, federally endangered shortnose sturgeon, American shad).

The National Marine Fisheries Service (NMFS), NYSDEC, and New York State Department of State (NYSDOS) commented on the preferred time window for construction of the Haverstraw Bay crossing. The NMFS 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. However, the NMFS later indicated that it could not support any time period for new dredging (NMFS, 2000).

The NYSDOS commented that dredging 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).

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 have 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 recommend that construction of the Hudson River/Haverstraw Bay occur between August 1 and October 31 (see BA and EFH Assessment dated January 2001).

Conclusion

The FWS, NMFS and NYSDOS objected to Millennium's original proposal, and expressed significant concern for potential impacts to 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 stated that it will complete its analysis of the project to determine coastal zone consistency following publication and review of the EIS. Similarly, the NMFS would use the EIS, along with our EFH Assessment and BA (both issued January 2001) to complete its review.

We believe that 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 and construction would be completed within a 3-month construction window. 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 to the river's water quality, habitat, and biological resources from exposure to potentially contaminated sediments, even if the exposure is only temporary, and therefore recommend that:

> **Prior to construction, Millennium should file with the Secretary for review and written approval by the Director of OEP, the results of the analysis of the additional sediment cores for the Hudson River and the finalized Hudson River Sampling Plan developed to meet the NYSDEC's section 401 Water Quality Certificate. Millennium should also file with the Secretary correspondence with other Federal and state agencies about this analysis and plan. 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.**

2.2.5 Catskill Aqueduct

The pipeline would cross the Catskill Aqueduct south of the 9/9A Proposal at MP 418.2 in Yonkers, Westchester County. The original alignment along the Consolidated Edison Corporation (ConEd) power lines would have been aligned 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 New York City Department of Environmental Protection (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 and that Millennium had not developed a construction plan which 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 modified site-specific 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 2.2.5-1). The site-specific 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.

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:

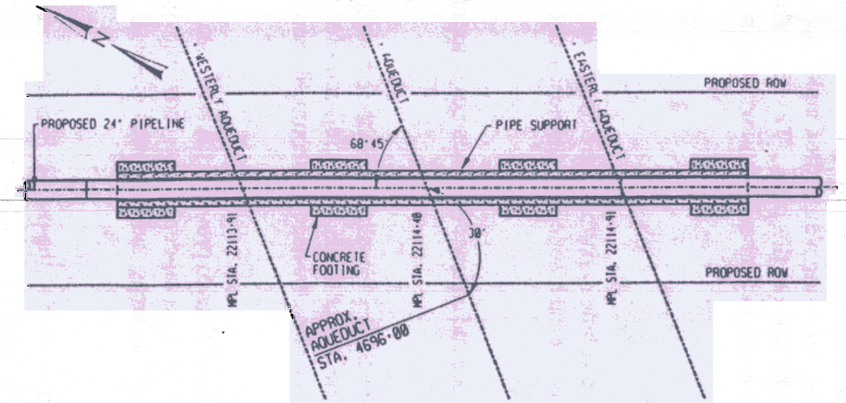
following all of the NYCDEP's blasting guidelines,

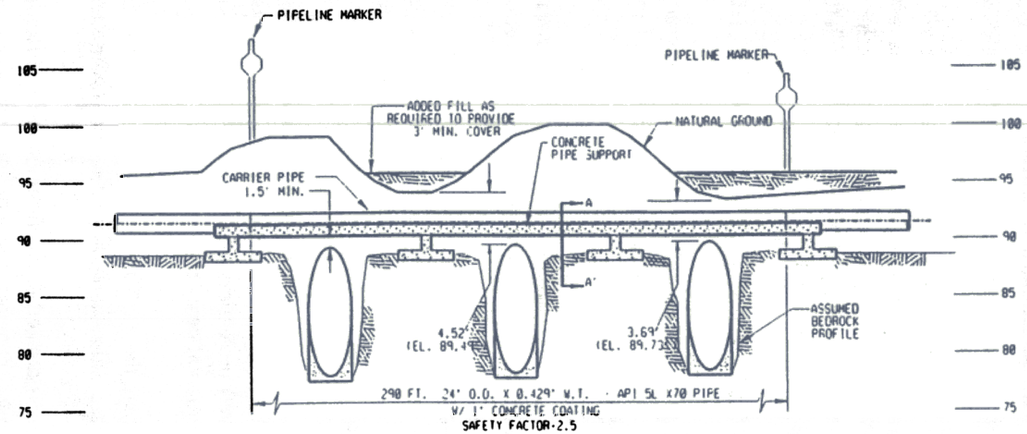
performing no blasting within 150 feet of the crossing site,

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.

WESTCHESTER COUNTY, NEW YORK
CITY OF YONKERS





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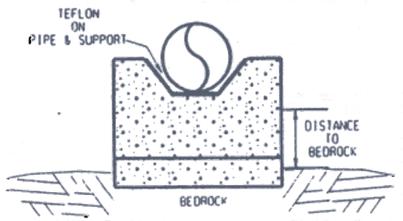

NOTES: VERTICAL DATUM
REFERENCE NYC AQUEDUCT DWGS.
ALIGNMENT SHEET 8525-AL 137

FIGURE 2.2.5-1

SITE-SPECIFIC CATSKILL AQUEDUCT CROSSING PLAN

NOT TO SCALE	SHEET 1

Millennium most recently met with the NYCDEP in November 2000. During that meeting, a draft Request For Proposal (Draft RFP) to complete an independent analysis of Millennium's proposed crossing plan for the Catskill Aqueduct crossing was presented and discussed. The NYCDEP committed in that meeting to provide comments on the Draft RFP by the end of the month. Once the NYCDEP's comments are addressed, Millennium would retain a consultant to perform the analysis. Millennium anticipates that the design and construction package would be completed and filed with the Commission by spring 2001. 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 the independent engineering assessment of its proposed crossing plan of the Catskill Aqueduct at MP 418.2 and any comments from the NYCDEP on the plan. The final Catskill Aqueduct crossing plan should be filed with the Secretary for review and written approval of the Director of OEP.**

2.3 COASTAL ZONE MANAGEMENT CONSISTENCY

The national Coastal Zone Management (CZM) Program is a voluntary partnership between the Federal government and the U.S. coastal states, and was authorized by the Coastal Zone Management Act of 1972 (CZMA). Its primary goals are to:

> preserve, protect, develop and, where possible, restore and enhance the resources of the nation's coastal zone for this and succeeding generations;
>
> encourage and assist the states to exercise effectively their responsibilities in the coastal zone to achieve wise use of land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and aesthetic values as well as the needs for compatible economic development;
>
> encourage the preparation of special area management plans to provide increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas and improved predictability in governmental decision-making; and
>
> encourage the participation, cooperation, and coordination of the public, Federal, state, local, interstate and regional agencies, and governments affecting the coastal zone.

In 1990, Congress created the Coastal Zone Enhancement Program under the CZMA which provides incentives for states to make changes in any of eight areas of national significance. The eight areas are wetlands protection, coastal hazards, cumulative and secondary impacts of development, public access to the coast, special area management planning, ocean governance, marine debris, and government and energy facility siting.

Any Federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of a coastal state's federally approved CZM Program. Because the pipeline would be located within the designated coastal zone in Pennsylvania (Lake Erie) and in New York (Lake Erie, the Hudson River at Haverstraw Bay, and Croton-on-Hudson and the Croton River on the 9/9A Proposal), Millennium must provide evidence that the pipeline would be consistent with the federally approved CZM plans.

Pennsylvania

Millennium filed with the PADEP for a consistency determination for the segment of coastal zone in Pennsylvania in August 1999. No part of the project would be on land in Pennsylvania, and the only affected area within the coastal zone would be in Lake Erie. No impacts are anticipated on cultural resources or endangered and threatened species for the Millennium project area within the designated Pennsylvania coastal zone. Millennium received its coastal zone consistency determination from the PADEP on April 6, 2000.

New York

Millennium initiated CZMA consultation and filed a CZM consistency certification with the NYSDOS in November 1998 for the segments of pipeline within the coastal zone of New York. Millennium responded to NYSDOS comments on its filing in March 1999, and discussed various aspects of its proposed crossing of the Hudson River again with the NYSDOS in August and September 1999. On June 27, 2000, Millennium provided an updated CZM consistency certification to the NYSDOS that included the 9/9A Proposal (see appendix IIF). Millennium is also coordinating with the COE, NMFS, FWS, and NYSDEC as part of other required Federal and state permit processes. The NYSDOS has not completed its review of the project, since it requires receipt of the EIS to begin its evaluation (NYSDOS, 1999).

The NYSDOS requires that an EIS prepared for an action in a coastal area must include an identification of the CZM Program's applicable state policies, a discussion of the effects of the proposed action on such policies, and its consistency with them. The following discussion identifies the New York CZM Program's 44 policies, and provides a summary of the project as it is relevant to each. For further details regarding a specific project component on each policy, see appendix IIF.

Project Need

Millennium states that the proposed project would provide: an economic and efficient means to transport U.S. and Canadian gas to growth markets in the eastern U.S.; a significant source of clean-burning natural gas; a greater diversity of supply for existing customers and a new source of supply for markets not currently served with natural gas; and an expanded competitive base supply for emerging markets, including local distribution companies. The Commission will ultimately determine the need for the project based on consideration of all aspects of the proposal, including the customers, cost, financing, rates, engineering, economic risk, and environmental impact (see part I, section 1.1).

Alternatives Considered

At Lake Erie, several system alternatives and two major route alternatives were identified to avoid crossing the lake, and two routes were evaluated by Millennium across the lake. At the Hudson River, two alternate crossing locations and two potential routes to one of the alternate crossings were identified and evaluated (see part II, section 3.0 for further discussion of Hudson River alternatives). In addition, a number of alternative construction techniques were evaluated for the Hudson River crossing to minimize potential environmental impacts to aquatic habitat and biological resources (see part II, section 2.2.4).

Development Policies 1 through 6

These policies (Waterfront Revitalization, Water-Dependent Uses, Major Ports, Small Harbors, Public Services, and Permit Procedures) are primarily directed at waterfront uses, and preserving and enhancing these areas for commercial, industrial, cultural, recreational, and other compatible water uses. The onshore portions of the Lake Erie and Hudson River crossings would not be constructed in areas currently used for ports, commercial

shipping, recreational boating, or other water-based activities, and the proposed construction would not involve development of water-dependent uses, or preclude them in the future. During installation of the pipeline across the Hudson River, there may be disruption to water-based traffic on the Federal navigation channel through Haverstraw Bay. However, this impact would be limited to the 3-month construction window and there would be no long term impact. Millennium has contacted the Coast Guard to coordinate the activity in the shipping channel. The Coast Guard indicated that it only has routine navigation and safety concerns at this time. These concerns would be addressed through local notice to mariners, and voice safety broadcasts during construction.

For the coastal zone component on the 9/9A Proposal in the vicinity of the Village of Croton on Hudson, Millennium would comply with the approved Local Waterfront Revitalization Program (LWRP). The two primary coastal zone issues associated with the 9/9A Proposal would be those segments of the pipeline that cross the shoreline park between the west side of the Metro North Commuter Railroad Company railroad tracks and the Hudson River (approximate MPs 394.3 to 395.3) and along the abandoned segment of U.S. Route 9 adjacent to the Van Cortlandt Manor property and the Croton River (MP 396.8). According to Millennium, the proposed route through Croton-on-Hudson was preferred by village officials since any other route through the village would significantly increase traffic congestion. In general, the pipeline would be installed underground and the LWRP policies associated with facilitating water-dependent development (Policies 1 through 6) would not be applicable. In response to Policy 1, Millennium stated it would enhance the shoreline park, but has not provided any details yet. Therefore, we recommend that:

> **Prior to construction, Millennium should develop a plan in consultation with the Village of Croton-on-Hudson regarding its LWRP, to enhance the shoreline park in the vicinity of the pipeline crossing; and file the plan with the Secretary.**

Fish and Wildlife Policies 7 through 10

These policies (Significant Habitats, Pollutants, Recreational Resources, and Commercial Fisheries) are directed at preserving and enhancing the survival of fish and wildlife populations. The proposed project would not expand or preclude recreational use of fish and wildlife areas in coastal areas (Policy 9), or further develop commercial finfish, shellfish, or crustacean resources in coastal areas (Policy 10). Consistency with Policy 7 and Policy 8 are summarized below, and discussed in greater detail in appendix IIF; part II, sections 2.2.3 and 2.2.4; and the EFH Assessment and BA issued January 2001.

Policy 7 is directed at protecting habitats that: 1) are essential to the survival of a large portion of a particular fish or wildlife population, 2) support populations of rare and endangered species, 3) are relatively rare within a coastal region, 4) support fish and wildlife populations with significant commercial and/or recreational value, and 5) would be difficult or impossible to replace. Policy 8 is directed at protection of fish and wildlife resources in the coastal area from the introduction of hazardous wastes. The greatest potential to conflict with compliance and consistency with these policies would be from project activities that could have direct or indirect potential adverse impacts to these fish and wildlife resources. Direct impacts could occur during construction from dredging and backfilling the trench, and the introduction or reintroduction of pollutants and sediment during these activities could have either direct and indirect impacts. Each project component within a coastal zone is discussed below.

Lake Erie

The Lake Erie crossing has not been identified as being within a significant coastal fish and wildlife habitat. The nearshore segment has limited foraging habitat for migratory diving waterfowl because of the steep bluffs and absence of coastal wetlands at the landfall. The nearshore's rocky bottom substrate provides potential spawning and nursery habitat for fish. Impact on these habitats would be avoided by the directional drill of the

nearshore that would extend from the Lake Erie landfall to exposed bedrock about 2,620 feet offshore in water depths of about 25 feet. Some blasting may be required between the directional drill exit hole and the softer substrates located about 0.8 mile from the exit hole.

The rest of the Lake Erie crossing would be installed using a jet sled (see part II, section 2.2.3). Millennium states that best management practices would be developed for offshore construction activities in Lake Erie. These would include procedures to reduce the possibility for accidental release of wastes and materials into lake waters, provisions for leak and spill containment, and would be consistent with Marine Contingency Plans for Spills of Oil and Other Noxious Substances developed for Lake Erie. We have recommended that Millennium prepare an offshore SPCC Plan before construction as part of its finalized Lake Erie construction plan (see part II, section 2.2.3). Sediments along the proposed route are generally uncontaminated and trenching should only have a temporary and insignificant effect on water quality (see part II, section 2.2.3).

Hudson River

At the Hudson River, the pipeline would cross the northern part of a designated Significant Coastal Fish and Wildlife Habitat. Haverstraw Bay also includes designated EFH for species with Federal management plans and is known to contain overwintering populations of the federally endangered shortnose sturgeon (see part II, section 2.2.4). Despite past disturbances and development, Haverstraw Bay contains considerable fish and wildlife habitat, and provides the most extensive area of shallow estuarine habitat in the lower Hudson River. The bay provides nursery and feeding habitat for several fisheries, including striped bass, American shad, white perch, bay anchovy, Atlantic menhaden and blue crab.

Migratory birds use Haverstraw Bay for foraging and resting during spring (March to April) and fall (September to November) migrations, and some gulls and waterfowl use it as overwintering habitat. The federally threatened and state endangered bald eagle has been occasionally observed along the shore and on ice floes in the Hudson River, and is known to use area in the bay during winter for foraging.

Millennium's proposed method to install the pipeline in Haverstraw Bay would involve installing the pipe continuously using a closed-bucket dredge, and storing dredge spoil in bottom-dump barges. Construction would be completed in about 3 months, with disturbance localized to one 1,300-foot-long segment at any one time. In the deep water, one 1,300-foot-long segment would take about 2 weeks to complete (see part II, section 2.2.4).

Millennium proposes a July 1 to September 30 construction window, which would avoid disturbance to overwintering fish populations (including the shortnose and Atlantic sturgeons) and bald eagle winter habitat. Millennium believes this window appears to best minimize impact on other fish species that use the bay while still allowing for a November 1 in-service date pending further consultation with Federal and state agencies. However, on December 8, 1999, the NYSDEC issued its section 401 Water Quality Certificate with a condition limiting construction to the period between May 1 and July 31. This construction window was based on current on-going fishery data collected in the Hudson River and represented the NYSDEC's best professional judgement of the time period when construction would have the least impact on fisheries in Haverstraw Bay/Hudson River. However, on July 27, 2000, the NYSDEC stated that it re-examined its data and finds no obstacle to a construction period between September 1 and November 15. We recommended a construction period between August 1 and October 31 based on our overall analysis of EFH and threatened and endangered species impacts (see part II, section 2.2.4; and the BA and EHF Assessment issued January 2001).

Parameters considered in Millennium's analysis of likely effects included the range of physical, biological, and chemical parameters. Potential impacts on fish and wildlife resources may include exposure to contaminants released from sediments during trenching and backfilling operations, or from accidental spills or leaks from lubrication and fueling of construction equipment and poor maintenance or housekeeping practices. Sediment

quality sampling conducted along the route indicates that the sediments contain trace amounts of a variety of metals and SVOCs. Potential impacts to water quality would be minimized by use of the closed-bucket, storage of the spoil on barges, and use of bottom-dump barges to backfill the trench. We have recommended that Millennium file the results of its sediment core analysis, the Hudson River Sampling Plan, and consultations with appropriate agencies prior to the beginning of construction. Millennium also proposes to develop a dredging operations monitoring plan to assure that impacts are minimized to the greatest extent possible.

9/9A Proposal

Since Millennium would install erosion controls and install the pipeline in accordance with the procedures identified in its ECS, SPCC Plan, and our Upland Erosion Control, Revegetation and Maintenance Plan (Plan) and Procedures, the pipeline would be consistent with coastal zone policies directed at minimizing runoff and degradation of water quality, and fish and wildlife habitat. In addition, since the pipeline would be installed under the Croton River and associated wetland using a directional drill, there would be no impact on these habitats. While there would be temporary disturbance within the waterfront park during construction, Millennium plans to complete construction within a 4-week period at this location. Once construction is completed, there would be no long term impact on this coastal area (see part I, section 5.7.3).

Flooding and Erosion Hazards Policies 11 through 17

These policies (Siting Structures, Natural Protective Features, 30-Year Erosion Control Structures, No Flooding or Erosion Increases, Natural Coastal Processes, Use of Public Funds, and Non-Structural Control Measures) are directed at protecting shorelines, natural features on the shorelines (such as beaches, bluffs, or dunes), and structures within floodplains. For Policy 11, the only above ground building proposed for construction in a coastal zone area would be on the west bank of the Hudson River at MP 387.7, within the Bowline Point Generating Station industrial complex. A block valve would be installed in the floodplain there, but Millennium states the valve cannot be moved out of the floodplain since it is at the designated connection point for gas service to the Bowline Generating Station. Siting the block valve there would not affect flood storage and would have minimal threats to humans from flooding. For Policy 12, the only barrier island, beach, bluff or dune area would be at Lake Erie, but there would be no impact on the bluff or nearshore areas there, since it would be directionally drilled. For Policies 13, 14 and 15, the only construction of permanent erosion control devices or effect on existing ones would be at the Hudson River, where Millennium may place rock rip-rap or another appropriate device to stabilize the river banks. Millennium would implement the erosion control measures in its ECS and our Plan and Procedures to minimize all potential impacts from erosion on coastal areas. The project would not interfere with natural processes that supply beach materials to adjacent lands, or cause increased erosion to such land. For Policy 16, no public funds would be used in the proposed project. For Policy 17, Millennium would implement its ECS and our Plan and Procedures, that include best management practices used during construction to protect natural resources and property from flooding.

General Policy 18

This policy is directed at safeguarding the vital economic, social, and environmental interests of the state to protect valuable coastal resource areas. Millennium states that the project would provide a source of clean-burning natural gas and a vital energy infrastructure to a large section of the state. Safeguarding of the social and environmental interests of the state is being addressed through the Federal National Environmental Policy Act process as part of Federal and state review and permitting of the project. Also see appendix IIF for supplemental information provided by Millennium supporting the need for its project.

Public Access Policies 19 and 20

These policies (Water-Related Recreation Resources and Public Foreshore) are directed at providing public access to coastal areas. Currently, there is no public access to areas affected by construction at the Lake Erie or the Hudson River crossings. While public access there is not proposed as part of the project, it would not be precluded in the future by construction or operation of the project. Public access would be restricted during the proposed 21-day construction period for the 9/9A Proposal at the Croton-on-Hudson's waterfront park and Croton Yacht Club. Access would be maintained to the yacht club and there would be no interruption to boating traffic on the Hudson River. Millennium states that after construction, public access to the site would be restored to preconstruction conditions and certain park facilities could be enhanced. Millennium also states it would comply with the LWRP by consulting with Croton-on-Hudson officials regarding this. Since this has not occurred yet, we recommended that it be completed prior to beginning construction (see Policy 1 above).

Recreation Policies 21 and 22

These policies (Water-Dependent/Water-Enhanced Recreation and Multiple-Use Development) are directed at such uses as boating, swimming, fishing, and other activities which are enhanced by a coastal location such as pedestrian and bicycle trails, picnic areas, or scenic overlooks. The directional drill for the Lake Erie crossing would be in an agricultural field. The Hudson River crossing would start within an industrial area on the west bank (Bowline Generating Plant) and end on the east bank at the Franklin D. Roosevelt Veteran's Hospital. The proposed project would not involve shoreline development at these areas, and no current or potential future recreational activities or uses would be affected. For the 9/9A Proposal, Millennium would comply with the LWRP and would maintain access to the waterfront park and Croton Yacht Club.

Historic and Scenic Resources Policies 23 through 25

These policies are directed at protecting structures or areas of historic, archeological, or cultural significance, and preventing impairment of significant state or other quality scenic resources. Millennium has conducted cultural resources surveys of all project areas for which it received survey permission. The Franklin D. Roosevelt Veterans' Hospital, a National Register of Historic Places (NRHP)-listed property, is located on the east bank of the Hudson river where the proposed pipeline would come onshore. The Commission is in the process of executing a programmatic agreement with the New York SHPO, National Park Service, and the Advisory Council on Historic Preservation to fulfill the Commission's obligations under section 106 and determine project impact on cultural resources.

Lake Erie

In August and September 1997, Racal Pelagos, Inc. conducted a marine geophysical survey of the initially proposed route between Port Stanley, Canada, and landfall near North East, Pennsylvania. In August 1998, Canadian Seabed Research Ltd. conducted a supplemental marine geophysical survey for the revised pipeline route from Port Stanley to landfall near Ripley, New York. The revised route included relocation of the drill exit on the Canadian side, a reroute around a sub-sea mound in the middle of the lake (in Canadian water), and the relocation of the landfall to Ripley. Both surveys involved collection of side scan sonar, sub-bottom profiles, and magnetometer traces. The 1997 survey also included sediment samples; the 1998 survey included lake-bottom bathymetry and an offset track line along the entire primary centerline. Based on these surveys, there are no underwater archeological or cultural resources along the Lake Erie route, and no historic or listed structures located within the project area (Policy 23).

No scenic resources of statewide significance would be affected at Lake Erie (Policy 24) nor would the project adversely impact the overall scenic quality of the coastal area (Policy 25).

Hudson River

In November 1997, Ocean Surveys, Inc. conducted a geophysical survey of the pipeline crossing of the Hudson River between West Haverstraw in Rockland County and the Franklin D. Roosevelt Veteran's Hospital in Westchester County, New York. The survey involved the collection of digital side scan sonar, hydrographic, seismic reflection profiles, and magnetic intensity data within a 2,000-foot-wide corridor. In August 1998, a supplemental geophysical survey was conducted between Bowline Point and the Veteran's Hospital. Based on sonar and magnetometer data analysis, there are sonar targets which may represent either cultural resources, natural material, or debris associated with historical to recent occupation in this section of Haverstraw Bay. Although none of these targets appear to be significant, further investigation of these targets would be done as part of ongoing cultural resources surveys (Policy 23).

Several segments of the Hudson River waterfront have been identified as "Statewide Areas of Scenic Significance" due to their visual appeal, presence of scenic vistas or visible historic structures, or lack of shoreline development. The closest identified scenic area, the Hudson Highlands, is near Stony Point more than 2 miles north from the proposed crossing.

The coastal zone area, by definition, extends from the shore to the horizon line. On the west side of the Hudson River and south of the proposed crossing, the pipeline would cross High Tor State Park and the High Tor ridge, which is the western horizon in the Hudson River viewshed. The pipeline would be constructed adjacent to an existing powerline right-of-way which crosses the ridge at a right angle, thus screening the right-of-way from most visual perspectives.

On the west bank, the mainline valve and delivery point to the Bowline Generating Station would be within the station property and would not represent a change in the visual character of the area. On the east bank of the Hudson River, a mainline valve would be constructed within 50 feet of the shoreline and within the grounds of the Franklin D. Roosevelt Veteran's Hospital, a NRHP-listed site. The pipeline would be adjacent to a powerline corridor through hospital property, and the valve would be visible from the upper floors and from nearby George's Island. Millennium is currently consulting with the New York SHPO to determine if visual screening of the valve would be required (Policy 24).

The Haverstraw Bay shoreline in the vicinity of the proposed crossing is developed with a mix of industrial facilities (a power generating facility, a gypsum processing plant and dock, several oil terminals and tank farms, and marinas) and residences (single family and cluster housing) that are visible to the horizon line. The river is used by freighters and barges carrying fuel and crushed rock. Neither the mainline valves on the shoreline nor the dredging equipment used to the install the pipeline would represent a new visual element in this section of the bay (Policy 25).

9/9A Proposal

The north side of the directional drill across the Croton River would be within the Van Cortlandt Manor National Historic Landmark. Millennium initiated consultation with the management of the historic site (staff of the Historic Hudson Valley) to coordinate construction activities (Policy 23). No existing historic structures would be disturbed. Cultural resource surveys and a final report have not been completed yet. Since the pipeline would be installed underground and no aboveground structures would be built there, no scenic resources would be impaired and the scenic quality of the coastal area would not be modified (Policies 24 and 25).

Agricultural Lands Policy 26

This policy is directed at conservation of important agricultural land (e.g., prime farmland, unique farmland, and farmland of statewide importance) within the state's coastal area. The soils that would be crossed within the designated coastal zone for Lake Erie are classified as prime farmland soils. The directional drill of Lake Erie would be staged in an area used for corn production. Topsoil segregation would be used and construction would be consistent with our Plan and Millennium's ECS. Although agricultural uses could be precluded for one season in areas used for construction, agricultural uses would continue following construction. The pipeline location was sited to avoid established vineyards along the Lake Erie shore. Millennium would implement its ECS and our Plan to conserve and protect agricultural lands there. The Hudson River crossing and 9/9A Proposal would not be in areas used for any agriculture.

Energy and Ice Management Policies 27 through 29

These policies are directed at ensuring that facilities are consistent with coastal management policies. Policy 28 (Ice Management Practices) and Policy 29 (Energy Resources Development) would not be applicable to the project, since no ice management practices would be required and no energy resources from Lake Erie or other coastal zone areas would be developed.

Policy 27 is directed at the need for major energy facilities and the compatibility of the facility within the coastal zone. Millennium states that this project is classified as a major energy facility that is entitled to preference under the CZM Act. As a major energy facility the project would satisfy the "public energy needs" of New York and the northeast U.S. region in a number of different respects. First, the project would satisfy growing market demands, as evidenced both by executed contracts for the pipeline's capacity and the forecasts of various experts. Second, the project would provide low-cost Canadian gas supplies to one of the highest-priced gas markets in the U.S. (New York). Third, the project would improve electric power reliability and advance clean air objectives by serving new and existing gas-fired power plants along New York's southern tier. Fourth, the project would improve the reliability of gas service to New York by upgrading the existing natural gas infrastructure through the addition of more capacity, deliverability, delivery points, and interconnections. Fifth, the project would provide gas producers and gas storage developers in western New York with increased access to markets.

Millennium states that it has taken public need and environmental issues into consideration and that the project has been designed to use the best available construction technology to result in the least environmental impact. Millennium states that the Hudson River crossing would be necessary because half of the capacity of the project would be delivered to the proposed delivery point for Millennium's shippers on the east side of the Hudson River in Mount Vernon, New York, and to a potential end user International Business Machines (IBM) in Yorktown, New York. Millennium concludes that the proposed project would be consistent with this policy.

Water and Air Resources Policies 30 through 44

These policies are directed at meeting water and air quality standards. Policy 31 (LWRP Policies and Constraints), Policy 32 (Innovative Sanitary Waste Systems), Policy 34 (Discharge of Waste Materials from Vessels into Coastal Waters), Policy 39 (Solid Waste Management), Policy 40 (Effluent Discharge), Policy 41 (State and National Air Quality Standards), Policy 42 (Clean Air Act Reclassifications), and Policy 43 (Acid Rain Precursors) would not be applicable to the project. For further details regarding specific project components and each policy, see appendix IIF.

State and National Water Quality Standards Policy 30

There would be no discharge of pollutants (including, but not limited to, toxic and hazardous substances) into coastal waters. At the Lake Erie crossing, all reasonable measures would be taken to prevent or minimize the discharge of contaminated dredged material, if any, during pipeline construction activities. 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, little degradation of water quality due to chemical release from resuspended sediment would be expected. Any chemical releases would be expected to be small, and their effects localized and temporary, because of the expected rapid dispersion by mixing and sorption processes. At the Hudson River crossing, the river is classified as a saline surface water with three narrative water quality standards: 1) taste-, color-, and odor-producing toxic, and other deleterious substances (none in amounts that would adversely affect the taste, color or odor, or otherwise impair the water for its best use); 2) turbidity (no increase that would cause a substantial visible contrast); and 3) suspended, colloidal, and settleable solids (none from sewage, industrial or other wastes that would cause deposition or impair the water for its best use). Millennium anticipates that these narrative standards may be exceeded during construction only in the immediate vicinity of the dredging site within the visible plume and for short periods of time. Millennium would comply with all of the NYSDEC section 401 Water Quality Certificate conditions which include monitoring of the physical and chemical water parameters (see appendix IIE). This would ensure adherence to Policy 30.

Stormwater Runoff/Combined Sewers Policy 33

The project would not involve construction of any combined sewer overflows, and Millennium would implement its ECS and our Plan and Procedures, that include best management practices used during and after construction to ensure the control of stormwater runoff draining into coastal waters.

Dredging and Dredge Spoil Disposal Policy 35

Compliance with this policy was previously discussed in regard to dredging activities in the responses to Policies 7 and 8. Additionally, at the Hudson River, lay-barge dredging and backfilling operations would not require the disposal of dredged material. At Lake Erie and the 9/9A Proposal, construction impacts on the shoreline and nearshore zone would be avoided by use of a directional drill. Further offshore in Lake Erie, blasting, cutting or ripping of the shale bedrock would be required for a short distance, about 0.6 miles. Millennium has agreed to use some of this rock material for artificial reefs to be constructed in consultation with appropriate Federal and state agencies. This material would not affect coastal processes. Trench excavation by mechanical jetting would occur at water depths in excess of 50 feet and would not affect natural coastal processes or increase the potential of erosion of adjacent land. Adherence to Millennium's section 401 Water Quality Certificate would ensure compliance with this policy.

Shipment and Storage of Petroleum or other Hazardous Materials Policy 36

The proposed Millennium Pipeline would transport natural gas through areas within coastal zones, but the facilities would be constructed and operated in compliance with all FERC and USDOT regulations, so the proposed activity would prevent or at least minimize any inadvertent spills into coastal waters, and the cleanup of such spills would be immediate. Thus, the policy would be complied with.

Non-point Pollution Discharges Policy 37

The proposed project would not involve the non-point discharge of nutrients, organics, and eroded soils into coastal waters during construction or operation of the project. Millennium would implement its ECS and our Plan and Procedures, that include best management practices used during and after construction to ensure against

unintended occurrences of non-point pollution discharges into coastal waters. Adherence to Millennium's section 401 Water Quality Certificate would further ensure compliance with this policy.

Surface Water and Groundwater Supplies Policy 38

Millennium would implement its ECS and our Plan and Procedures, that include best management practices used during and after construction to ensure that the quality and quantity of groundwater and surface water supplies are conserved and protected. Adherence to Millennium's section 401 Water Quality Certificate would further ensure compliance with this policy.

Preserve and Protect Tidal and Freshwater Wetlands Policy 44

Except for the open water component of the Hudson River, no state or Federally-mapped freshwater wetlands would be disturbed. The proposed crossing is north of the NYSDEC limit (the Tappan Zee Bridge) for tidal wetlands (Article 25) jurisdiction. At Lake Erie no tidal or freshwater wetlands would be affected since the nearshore would be directionally drilled. In general, Millennium would implement its ECS and our Plan and Procedures, that include best management practices used during and after construction to ensure that any wetlands crossed by the pipeline would be preserved and protected. Adherence to Millennium's section 401 Water Quality Certificate would further ensure compliance with this policy.

No freshwater wetlands would be crossed by the 9/9A Proposal within the designated coastal zone, although the pipeline would cross the buffer zone of NYSDEC regulated Wetland H-3 along the parking lot for the railroad station at Croton-on-Hudson and along the abandoned railroad bed on the north bank of the Croton River. These wetland would not be affected by construction.

Conclusion

Based on consultations with the NYSDOS, the Lake Erie crossing appears to be consistent with New York CZM policies (NYSDOS, 1999). The revised construction method for the Hudson River crossing (using a closed-bucket, lay-barge dredge during a construction time window that would minimize potential impacts to a variety of federal- and state-sensitive fishery resources) represents a significant improvement over the original bottom-pull dredge construction method. However, the NYSDOS is responsible for determining the proposed project's consistency with New York coastal zone management policies. Therefore, we recommend that:

> **Prior to beginning construction of any project facilities, Millennium should file with the Secretary a determination of consistency with the New York State Coastal Zone Management Plan.**