PRESIDENT’S MESSAGE

The National Trust for Historic Preservation has just distributed their “Summary of Results of the Maritime Heritage Survey” carried out in 1984, and their report discussing the needs of maritime preservation, “Maritime America: A Legacy at Risk.” I was pleased to see that so many of the respondents — 18 of them — were canal societies, and that there’s no doubt that canals, locks, and canal boats are “maritime resources.” We canallers need to support the National Trust in their effort to make sure that the country’s historic maritime resources are properly inventoried, researched, preserved and appreciated. Also, as the Keokuk Museum Commission noted in the survey, “We need to make the public aware that there is an inland river heritage every bit as important as the sea.” That goes for canals, too!

Another quote was from the Canal Society of New Jersey, which wanted to see more canal-related projects. “Canals have been neglected and the time to change this has come. Canals, the waterways, the buildings and especially the boats must be protected. There is not one of our original boats preserved anywhere intact; our canal, the Lehigh Coal and Navigation Company’s, was one of the longest in operation: 102 years. I think it’s about time we preserved at least one wooden hull canal boat type from America’s towpath canal era.”

Author of the report is Marcia Myers, Vice-President for Maritime Preservation, National Trust for Historic Preservation, 1785 Massachusetts Avenue, N.W., Washington, D.C. 20036. She also has available a 14-minute slide show narrated by staunch supporter Walter Cronkite. Don’t forget, we also have our own ACS Canal Boat Committee Chairman, VP Bill McElvee, who would like to keep up with your latest canalboat projects, prospects, and problems.

Those of you who have the 1988 edition of QUIMBY’S BOATING GUIDE (319 N. 4th St., 666 Security Bldg., St. Louis, Missouri 63102) will see a new section, on the Muskingum River Navigation, thanks to David Ross’s ACS Navigable Canals Committee. He hopes next time to include the Kentucky River Navigation, another canalized river which so far has been kept alive by river buffs. We need your help on these and other canals and navigations which are, or should be, navigable.

I was pleased to meet members Bill Dzombak and Barnett Golding far their home states, at the Virginia Canals & Navigation Society annual meeting. Don’t forget, if you get down to Richmond, let me know so we can talk shop and show you the canal sights!

Bill Trout

MORRIS CANAL PLANE TO BE REBUILT

What made New Jersey’s 102 mile long Morris Canal unique were its 23 inclined planes, such as this one located at Port Colden. Boats were floated into a railway carriage and pulled up a steep hill by wire ropes. A similar plane at Waterloo, N.J. is now slated for restoration. (Photo from the book THE MORRIS CANAL by James Lee)

By Bruce J. Russell

Sooner or later it had to happen. Considering the increased interest in New Jersey’s CANAL ERA it was only a matter of time before proposals would be made to restore to working order one of the unique Morris Canal Inclined Planes. The Plane selected for restoration is Plane Number Four west, located just east of Waterloo Village, near Stanhope, New Jersey.

Waterloo Village was established in the 1960’s in Sussex County. Designed to be a living museum of 18th and 19th Century Life in New Jersey, it was an immediate success, attracting thousands of visitors on weekends, not to mention special school trips. The remains of the Morris Canal pass directly through Waterloo, and at this location there was an inclined plane. While the tracks are long since gone, the profile of the incline is clearly visible as well as the ruins of part of a turbine chamber.

The full scale rebuilding of Plane 4 West will not be as difficult as some might imagine. According to Percival Leach, founder of Waterloo Village and one of its officials, blueprints, plans, and photographs are in existence which will guide the restorers at every stage of their work, expected to take about 3 years. Leach made the announcement concerning the rebuilding in April of this year, and already he has begun to assemble a team of consultants who are experts at projects of this type.

According to Leach, “Plane 4 West will be fully restored to operating order, using long buried machinery parts as models, and archival blueprints and photographs to replicate a link in the transportation system that was once a wonder of the nation. We envision a completely functioning lock and plane system. It will be equipped with a traditional canal boat towed by mules. The plane will carry boat passengers up and over the crest of the hill, just as in the past it hauled boat captains, their families, and commercial cargoes heading for eastern markets.” His remarks were followed by those of James Lee, the state’s foremost Morris Canal historian and author of several books on the waterway. According to Lee, “Waterloo Village is an ideal place for a restoration of this kind. It is the only canal village left in New Jersey. It has the water and the plane inclination is fully intact. The rail tracks and sleepers are present in several spots. It’s fully restorable. What makes it so suitable is that the old general store is still on the lock with its cargo hold intact.” Lee also explained that the Morris Canal was the only canal in the world that had hydraulic inclined planes to raise and lower boats over the hilly terrain that lay in its meandering path. Although as built it utilized waterwheels, turbines were considered a technological improvement and were thus installed about 1855. No other canals anywhere in the world used this exact mechanism.

In recent weeks workmen at Waterloo have cleared away trees and brush from the trough of the plane which can be seen rising from the

(Continued on Page Two)
MAINLINE CANAL “CLEAN-UP”

Part of the Conoy Township volunteer working group which turned out for the April 2nd “canal clean-up” party, shown enjoying a picnic lunch in the Falmouth social hall after a morning of hard work. Canal Committee includes Ken Brandt, Marge Smith, Tom Campbell, Ron Gainer, and Margaret Reynolds.

CANAL PLANE TO BE RE-BUILT

(Concluded from Page One)

bank of Waterloo Lake opposite the village to the crest of the 80 foot high hill. Tom Rick, who has the engineering contract to do the detailed engineering study necessary to restore the plane plus one lock chamber, said work is expected to begin this summer. He anticipated that major construction would take about two years. Rick is president of Manitou Machine Works Inc. of Cold Spring, New York, a small firm specializing in classic millwork and water turbine machinery for hydro-electric plants. He states, “It’s going to take a lot of engineering to bring Plane 4 West to the condition it was in at the time the Morris Canal was abandoned in 1924. Our hope is to restore the lower level canal for a quarter of a mile, the lock at the bottom of the stilling basin, and one half of a mile of the upper canal. He further explained that a canal boat arriving at Waterloo Village and heading east would be maneuvered from the lock to the stilling basin where it would be floated aboard a half-submerged, heavy oak, cradle car with wheels on iron rails. The car would be winched by wire cable to the top of the plane and lowered into the upper canal to continue on its journey. In order to bring all of this back to life, such things as a cable drum plus the actual turbine would be required. Rick explained that the turbine used at Plane 4 West may still be buried at the bottom of the pit under tons of debris thrown in for safety reasons when the Morris Canal was closed in 1924. He states, “By now it’s probably useless, except as a relic. But even if the machinery is lost, we have photos and drawings. The NJ State archive on the Morris Canal in Trenton is quite complete.” In the event an existing water turbine is required to be used as a model to fabricate a new one, there are two in existence. One is at Jim Lee’s partially restored plane, and the other is on permanent display on the shore of Lake Hopatcong in a small park.

Fabrication of a new turbine as well as rails, a set of wire ropes, and other pieces of machinery to make Plane 4 West operational again should not be an insurmountable problem. Likewise the building of a canal boat and a railway carriage could be done without any great difficulty since photos and plans of both exist.

A group of dedicated residents of Conoy Township, Lancaster County, (Pa.) are hard at work restoring a section of the old Eastern Division Mainline Canal as a hiking-biking trail. The lead group is known as the “Canal Committee” of the Conoy Township Park and Recreation Commission. Cooperating in this volunteer project are the Bainbridge Fire Company, the Falmouth Civic Association, the Falmouth United Methodist Church, the Conoy Lunkers, the Conoy Lions Club, and the Bainbridge Jaycees. Boy Scouts and Girl Scouts. They have the active support of State Congressman Kenneth E. Branst, and the advice and consultation of William H. Shank, ACS Newsletter Editor.

The several-mile long section of canal was recently deeded to Conoy Township by the Amtrak Company, successor to the Pennsylvania Railroad Company, operators of the canal in its hey-day. Included in the transfer are two canal locks, two aqueducts and a well preserved canal pier and towpath.

On April 2, 1988, the Conoy Canal Committee invited the general public in the area to a “get acquainted party” to start work on the canal clean-up at Collins Lock in the Village of Falmouth. A large group came out for the occasion, including Bill Shank, from York, Pa. and Bill Gerber, ACS Vice President, Chelmsford, Massachusetts.

The volunteer group at work cutting the brush and trees around Collins Lock at Falmouth, Pa., just below Three-Mile Island.
NEW CANAL BOOKS

FOX-WISCONSIN "PORTAGE" 1673-1987 — By Frederica Kleist. This 52-page booklet traces the history of the "Portage" in Wisconsin from the time of Father Marquette, priest and explorer in 1673, to the present time. Included are the history of the Fox River Navigation and the Portage Canal, as well as recent restoration work, also the new "Ice Age Trail". Well illustrated. Price $11.95, plus 60¢ tax plus 90¢ mailing/cost, from the author: Frederica Kleist, 528 West Cook Street, Portage, Wisconsin 53901.

MOHAWK RIVER BOATS AND NAVIGATION BEFORE 1820 — By Robert E. Hager. A 98-page, well researched and well written account of Bateaux and Durham Boats which traveled the Mohawk River in upper New York State before the Erie Canal was built. There are a number of drawings showing full details of these early boats, their size and construction. Also a description and map of the first canals built to make the Mohawk navigable. Price $7.95 plus $1.00 postage. Write: Canal Society of New York State (attention of J. Hutchins) P.O. Box 1156, Latham, NY 12110.

THE WELLAND CANALS — The Growth of Mr. Merrit's Ditch — By Roberta M. Styran and Robert R. Taylor, with John N. Jackson. This beautiful "picture book", tracing the history of the four Welland Canals is one which anyone with any interest in the Welland, past or present, will want. The text includes a well-written history and 238 excellent photos, maps and sketches. A handsome 8½" x 11½" book of 198 pages. Price $19.95, mailing cost included. Write: The publisher. The Boston Mills Press, 132 Main Street, Erin, Ontario NOB 1TO, Canada.

MOSTLY CANALLERS — By Walter D. Edmonds. This collection of 24 short stories, originally published in 1934, represents some of the best of Edmonds ficional works from the days of the old Erie Canal. At the time, "Atlantic Monthly" wrote: "Upstate New York has provided Edmonds with an unforgettable store of characters one would like to know." A number of the stories are award-winning. "New York Times" states: "The stories, all of them, are readable, and together with the novels are brilliant as well as thorough in their historical recreativity." Republished by Syracuse University Press, 1600 Jamesville Avenue, Syracuse, New York 13244 this 467-page paperback sells for just $12.95.

THE AGED PILOT MAN — By Mark Twain. "One of the ablest poems of the age." This epic poem is probably based on the "Raging Canal", an old Erie Canal ballad. Republished in six-page booklet form (with original illustrations) by the Virginia Canals and Navigations Society, care of Richard A. Davis, VCNS Sales, Rt. 2, Box 254, Lexington, Virginia 24450. A donation of $1.00 is suggested.

THE JAMES RIVER BATEAU FESTIVAL TRAIL — By W.E. Trout Ill. This 8-½" x 14", 32-page booklet contains a series of topographic maps of the James River between Lynchburg and Richmond, published by the Virginia Canals and Navigations Society as a guide to boatingmen (particular bateau operators). Many interesting notes are printed directly on the maps. Write Richard A. Davis, VCNS Sales, Rt. 2, Box 254, Lexington, Virginia 24450. A donation of $4.00 is suggested.

MOVING FREIGHT ON THE MISSISSIPPI

A "Towboat" on the Mississippi, pushing a fleet of freight barges. On the lower Mississippi, "tows" like this are common. On the upper Mississippi the number and size of the "barge tow" is limited by the length and width of the locks.

"The Metamora Gristmill, Metamora, Indiana" is a 2-½ page illustrated article by Jim Fox in the Spring issue of OLD MILL NEWS. Pictured is the mill wheel, in the lock in Whitewater Canal State Historic Site. The mill has been restored to operation and is open free to the public every day but Monday and some holidays.

Canal patch recently developed by the Canal Society of Ohio for all its members.

New York Canal Records in Milwaukee. "New materials at the Local History Collection of the Milwaukee Public Library include 'Selected Records Relating to New York State Canals,' 13 cubic feet of records dating from 1851-1892." (From the April newsletter of the Association for Great Lakes Maritime History, Editor, ACS member David T. Gliek.)
BY TUG-BOAT THRU THE ERIE CANAL (Part II)

We pass a work boat and barges of the New York Department of Transportation on the Erie Canal. Note the dredging equipment towering above the trees on the bank.

By Gerard Chapman

After we passed through Lock No. 17, with the highest lift on the system, I finally went to bed while the mate drove on through the night from midnight to six the next morning. My bunk, about three feet wide, was the upper of two in the Mate's cabin, and only a steel bulkhead separated it from the engine room. The pounding of the engine was heard and felt throughout the vessel, and especially severely in that confined space, but after more than 40 hours of wakefulness, I was tired enough to sleep fitfully — and by the next two nights I had become sufficiently acclimated to its presence to sleep well.

FRIDAY

When the cook rang his bell at 5:30 and I prepared to vacate the cabin for the Mate when the watch changed at six, we were in the summit level (420 feet above sea level) beyond Lock 20. In the basin at Rome we moored the scow and, turning about, ran back down through the locks to pick up the other scow just above Lock 16. This time we went through No. 17 by daylight. At Little Falls, it is situated in a rocky gorge and from a distance suggests a fortress high on a hill. It has the highest lift in the system which, at 40's feet, exceeds that of any lock on the Panama Canal. It also has the only vertically travelling, or lift, gate (also called a "Guillotine Gate"). Seen from within, the lock is a vast cavern with sheer concrete walls towering far above the float.

All the locks on the Barge Canal are 328 feet between gates, with an available length in the chamber of 300 feet: width is 45 feet, with 12 feet of water over the sill. Gates are of the mitre type, akin to a pair of casement windows. Barges and scows are about 43½ feet wide, calling for a high degree of skill on the part of the pilot to guide it into the lock without undue bumping and scraping. The combined barge and tug — the float — is about 300 feet long and care is necessary to avoid ramming the gates. Both our pilots — Capt. MacDonald and Mate Gillikin — had light touches indeed upon the controls and were experts at "threading the needle." When entering a lock they contend with hazards such as cross currents from the adjacent dam, a curved approach to a lock, and high winds. When I expressed admiration for his skill, Gillikin said, "All that I know about this business I learned from the Skipper, and we've been together on this vessel for many years."

It was evident that each had complete confidence in the other.

Back up the canal with scow No. 121 we went, passed the other one moored at Rome, and began to descend from the summit level at Lock 21. This portion of the Canal, as with the summit level, no longer followed the Mohawk River but was a dug channel with few curves, no islands, and a regular shoreline. It was, accordingly, much less interesting in scenic attributes and rather monotonous. The Mohawk River wandered in and out, entering at one side and within a short distance, leaving over a spillway on the opposite side.

The undeviating straightforward of the canal, its regular shoreline and its constant width gave rise, however, to an interesting phenomenon not observed elsewhere: standing waves which pursued the float at equal speed with it. Directly abreast of the tug the water would recede from the shore, exposing the rock rip-rap momentarily, and then a surging wave of crested white water would inundate the rocks far above the normal waterline. Birds would often fly onto the exposed rocks, looking for food, then have to spring out of the way of the overwhelming wave.

In both canalized river and dug portions of the canal one frequently sees the yellow-and-blue dredges of the Department of Transportation of the State working to keep the channel at its prescribed depth and free of obstructions. Hydraulic dredges draw muck from the bottom, pumping it through large pipes supported on pontoons, to low-lying land bordering the canal; the water runs back into the canal, leaving an alluvial deposit of fertile soil which the State leases to farmers for crops. Alternately, clamshell buckets scoop rocks or muck from the channel, which are conveyed by barge for dumping elsewhere.

The summit level and beyond was home territory to Capt. MacDonald, who lives in Rome. His wife and other relatives and friends were at Lock 20, 21 and 22 to see him and his tow, since this was his first trip up this way in almost two years. The conversations about family and friends in the soft summer evening made it seem like a homecoming celebration.

SaturDay

When Frank rang his bell at 5:30, we had gained Lock 1 on the Oswego Canal. We were still going down hill and would continue until reaching the level of Lake Ontario, at 244 feet above the sea, the lowest of the five Great Lakes.

This canal, branching from the Oneida River beyond Lock 23, follows the course of the Oswego River. There are seven dams with associated locks, numbered from Lock 1 to 8. The aspect of the canal seems quite different from that of the Erie; even its rural stretches seem more built up, with waterfront homes and boats. Following the river, it too twists and turns and has islands, but church spires and factory chimneys appear at the far end of a reach. Much of the canal is bridged between Niagara-Mohawk powerhouses situated at the dams, or factories on the river banks. All give the impression of great age — of being holdovers from the nineteenth century. The constructed lockside areas do not permit the spacious green, manicured lawns of the Erie; there is barely room for the lockhouses. And overhead there are many more railway and highway bridges to cause the pilot to run with his domain refracted into its shell much of the time.

Finally, in close succession, we descended through Locks 5 to 8 to emerge upon the harbor at the Port of Oswego in L. Ontario. There we moored scow 121 alongside the Port Authority wharf and started back up the canal.

On this passage we crossed Oneida Lake in the late afternoon under bright skies and with a following wind. Under full throttle the tug outran the waves, plunging her bow into the big ones and tossing water far to either side. An oil barge, Morania 300, coming the other way and
broasting the waves, threw white spray high enough to obscure itself momentarily.

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With a 21 mile run from Brewerton at the western end of the lake to Sylvan Beach on the east, the Mate set the tug on automatic pilot and sat back to take his ease. "Watch how well she holds the course," he suggested. "Even though the tail wind tends to make us yaw, the automatic pilot will compensate and keep us on course within about three degree either side." And so it was; the gyrocompass, which both indicates the bearing and activates the corrective action of the automatic pilot, showed almost no deviation from the desired course.

When navigating the narrow canals, the human pilot seldom takes his hands from a short steering lever, as it requires constant small adjustment to keep the long tow aligned with the axis of the waterway. Susceptible of very small adjustment by the Sperry non-follow-up steering system, the hydraulically actuated, large rudder exerts virtually instant effect upon the heavy tow. Only a small deviation from the straight-and-narrow could run the ship onto a shoal or into the mud. In his six hours of duty the pilot must make literally thousands of tiny corrections to keep out of trouble. And so he welcomes an opportunity such as offered by Oneda Lake to avail himself of the respite afforded by the Sperry Automatic Pilot, which works in conjunction with the steering system but which deactivates the steering lever. He can monitor the setting of the rudder from a gauge showing its angle in degrees right or left. Although keeping his eye upon the buoys marking the course across the lake, Clayton Gillkin could relax and talk. His speech is mildly Southern and answering to my query, he said: "I live in Moorehead City, N.C. My wife and I operate a small bar and lunch counter, which she tends while I'm away. I fly down for my two weeks off and fly back again and in either place the change in work is a welcome variation. My wife and I like to travel and we have a camper. We hope to get enough time to drive up north — up here — and see some of the country beyond the canal. Our little girl is old enough to travel now and we'd like to show her something new and different."

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A big man who habitually wears a visored cap set rakishly on his head, Gillkin pointed out the other instrumentation and controls. A gauge indicates propeller revolutions forward or backward; there is a magnetic compass; a large lever controls the raising or lowering of the pilot's house; there is a radio set, unused on this trip. Buttons can start or stop the engine without intervention by the engineer. For so small a vessel, the Margot Moran possesses an imposing array of modern controls and instrumentation appropriate to navigation on all the types of water: narrow canals, broad bays, and open lake or ocean.

Out of the Oswego and into the Erie we proceeded, ascending to the summit level again and about 7:30 p.m. we tied onto scow 120 at Rome. Then it was back down through the now-familiar route, affording a chance for Bob Volz, Chief Engineer, to show me his domain below decks. His engine room was spotless, with "a place for everything and everything in its place." Wearing a pair of acoustical earmuffs I could understand him quite clearly despite the din of the laboring engine. Bob was proud of his Fairbanks-Morse machine developing 1,280 horsepower and one of only a few made, since it was not a popular design. With eight cylinders it has 16 opposing pistons instead of cylinder heads and most engineers consider it too complicated. But Bob finds it easy to maintain, and he got his job with Moran because he is an expert on that type of engine.

He pointed out all the auxiliary apparatus: steering gear, electrical generator, batteries for use when the engine is shut down; compressed air tank for starting the engine; pressurized tanks of drinking water and ordinary water from the lake or canal; the electrical distribution panel; fuel tanks with capacity for a week's operation or longer; and other essential components of a self-contained floating power plant and residence for nine men.

Alternating six-hour watches with Ben Larson, Assistant Engineer, Bob Volz admitted that life during a tour of duty was exacting and confining. "But," he said, "it's a good life. I like the work and Moran is a good company to work for. We are well paid and, actually, with two weeks on and two off, we work only a half a year. Where most shore-bound men work a whole year for a two-week vacation, I have two weeks off every month. I live in a waterfront house in Florida and have a boat, with time to use it. I fly home and fly back to work, wherever the vessel might be at the time. The scenery changes, and the air fare is deductible!"

Charged with general maintenance of the tug, Volz oversees all the equipment, and had been chipping rust during the trip so that the deckhands could apply fresh paint to keep the boat looking trim.

It was evening in Sylvan Beach as we approached the lake for the third time. The lights were bright and the Saturday evening crowds all but surrounded us as we floated past; we seemed almost a part of that traditional weekly convocation. We started across Oneida Lake about 11 p.m. under the light of a brilliant, almost full, moon which cast a long silvery track upon the rippling water. The glow of Sylvan Beach faded astern, lights winkled all around the horizon and we throbbed along under the guidance of the automatic pilot. When the watch changed at midnight I reluctantly left the enchanting scene and retired for the night.

SUNDAY

Down through the succession of locks in the Oswego Canal we came to the harbor once again, and there I left the tug to return home. While waiting for the bus I climbed to old Fort Ontario, overlooking the bay, and saw the Margot Moran stand out into Lake Ontario past the breakwater, turn west while towing the two scows in tandem, and on its final lap, head toward Charlotte, port for Rochester.

We are happy to welcome into the ranks of LIFE MEMBERS of the American Canal Society: Arthur Sweezen III of Canton Center, Connecticut and John P. Grossman of North Tonawanda, New York. This now brings total membership in this special group to sixty-three.
Recently restored and cleaned-up lift lock on the Eastern Division below Middletown.

A full bus-load of members of the Pennsylvania Canal Society traveled out of our headquarters at the Penn-Harris Convention Center in Camp Hill, Pa., on Saturday, April 23rd, 1988 to see a number of well preserved ruins along three different central Pennsylvania Canals.

First stop in the morning was the Aqueduct on the Eastern Division Canal at the south end of Bainbridge; then the Collins Lock a few miles further north at Falmouth. Next we visited the Middletown Lock, quite recently restored by a local historical group, and then viewed the junction of the Eastern Division and Union Canal in Middletown.

One of the best preserved locks on the Susquehanna Division is the Mahantongo Lock. The canal crossed the creek of the same name on an Aqueduct, just above this lock, whose piers are still standing.

After traveling along a watered section of the Eastern Division in Steelton, we drove north to Clarks Ferry Bridge and then along the entire length of the Wiconisco Canal. We stopped for our picnic lunch at the canal park in Millersburg, where the Lykens Valley Railroad delivered coal to canal boats in the north terminal basin of the Wiconisco.

Following this we enjoyed a trip east-west across the Susquehanna on the 150-year old Millersburg Ferry, only operating ferry in this part of the country. On the west bank of the Susquehanna we visited Lock Five of the Susquehanna Division Canal, then north to the Mahantongo Lock (and Aqueduct) returning along the Susquehanna Division to Duncan's Island, where this Division joined the Juniata Division, west to Lewistown and Hollidaysburg. Enroute we caught several excellent views, (both sides of the river), of the world's longest stone-arch railroad bridge at Rockville.

The entire weekend was planned by Bob Keritz, President of PCS, who also presided at the two evening meetings and the Saturday banquet at the Penn Harris.
THE WICONISCO CANAL

By Robert Kentz

The Wiconisco Canal is perhaps one of the most overlooked canals in Pennsylvania. Its short run of 12.26 miles from Clarks Ferry to Millersburg, nevertheless provided an important transportation link to the major coal fields of Dauphin County. Tanner’s description of the canal is as follows:

"It extends from Wiconisco Creek, at the western terminus of the Lykens Valley Railroad to the pool of Clark’s Ferry Dam, at Duncan’s Island. Length = 12.25 miles, it has one guard and six lift locks; three aqueducts, two culverts, one dam, five weirs, and 18 bridges. It descends 35 feet."

The seven locks had the following lifts:
Lock #1 at Clarks Ferry ................. 1.85 feet
Lock #2 .................................. 8.15 feet
Lock #3 .................................. 5.99 feet
Lock #4 .................................. 5.79 feet
Lock #5 .................................. 5.03 feet
Lock #6 at Halifax ....................... 5.38 feet
Lock #7 at Millersburg ................. 9.41 feet

The Canal was started in 1838 under the direction of Anthony Warford. It ran until 1890 when it was transferred to the Northern Central Railroad Company. It was acquired by the Pennsylvania Canal Company in 1872. The Flood of 1889 caused considerable damage to the canal and hastened its closure in 1890.

It is interesting to note that the canal was completed by a private company in 1845. By act of the legislature July 13, 1842, The Wiconisco Canal Company was incorporated to take over the entire works to the canal. Here was a case where the Wiconisco Canal was taken from state ownership and placed under private control and operation.

Today only a few sections of the Wiconisco Canal remain. There is a fine culvert in Halifax. In Millersburg the canal is preserved by a town park.

Inglenook Aqueduct, on the Wiconisco Canal is an exceptionally wide structure, so strong that the main highway now runs over it.

The location of the Pump House and lock #7 is in this park. The remains of two aqueducts may also be viewed from Rt. 147.

The real jewel of the canal is to be found at the Inglenook Aqueduct. The Aqueduct is one of the best preserved in the state. It is a prime candidate for the National Historic Engineering Record. The structure consists of three spans covering 110 feet. The Aqueduct today supports all the daily traffic on Rt. 147.

A highlight of the PCS Tour was our leisurely ride on the 150-year-old Millersburg Ferry. Our group is shown leaving the Ferry on the west bank of the Susquehanna.

Well-preserved masonry of the Bainbridge Aqueduct, first stop on the PCS Tour.
THE AMAZING PONTCSYLLTE AQUEDUCT

Wonder of the Waterways

By Bruce J. Russell

The canal system of England and Wales was built between the 1760s and the early 1800s as a means of furnishing economical transportation for those commodities such as coal and iron ore needed to fuel the British industrial revolution.

By 1780 canals were being built all over England, and since so much good quality coal was located in the Welsh mountainous region it was only a matter of time before the canals would penetrate into these areas. Nevertheless to plan a waterway to tap the Welsh coal resources, and to actually build it were two different things.

Work began on the Llangollen Canal in 1790 which was designed to penetrate the northern portion of Wales, providing a convenient way to get much needed coal to its logical markets in the industrial region around Manchester.

The most challenging obstacle to the construction of the Llangollen Canal was the valley of the River Dee. The first solution was to construct two flights of locks to get the canal from the top of the valley to its bottom and up on the other side. This method was deemed impractical as the time it would take for the canal boats to descend one flight and ascend the other was far too long and tremendous quantities of water would be used in the operation of the many individual locks.

In 1795 it was decided to construct a 126-foot high aqueduct at canal level on both sides of the valley. Although a structure of such magnitude had never been built in the British Isles, there were similar ones in Europe. During the Roman era numerous aqueducts had been constructed for the purpose of insuring a supply of water for entire cities.

Thomas Telford had established a reputation for himself as one of Britain’s greatest engineers, and in 1795 this brilliant Scotsman was hired by the directors of the Llangollen Canal to build an aqueduct across the Valley of the Dee. Telford decided to incorporate the use of arches for the Aqueduct, but in a radical departure from all other aqueducts he chose to build them out of metal rather than stone. Masonry would be employed for the piers, most of which would exceed 120 feet in height. However the arches, at their summit, would be fabricated out of wrought iron, as would be the trough carrying the water upon which the loaded canal boats would travel. Although the entire aqueduct could have been made out of stone, the use of two materials was far more practical. Among other things it would reduce the weight of the structure, and would also result in easier maintenance.

An all stone option had been chosen, there would always be the problem of water seeping down into tiny crevices and then freezing.

Telford arranged for a contract to be awarded to William Hazeldine who owned a large foundry in Shrewsbury, England to cast the giant metal sections which when bolted together would form the arches and trough of the aqueduct. (The name “Pontcysylte,” pronounced Pong-sill-te, in the Welsh language simply means “water bridge.”) One by one the huge plates were forged and then transported by canal and horse-drawn wagons to the site. (The Llangollen Canal had been completed to the eastern end of the valley by this time.) A quarry was set up at a nearby rock outcropping in order to obtain stone for the blocks which would be used in building the tail piers. In the days before the use of poured concrete, the art of the stonemason was very highly developed, and by using saws and chisels, blocks of almost any size and dimension could be made by skilled cutters and craftsmen. As the enormous blocks were quarried and fashioned into shape they were dragged to the Pontcysylte site and numbered in proper sequence. A total of 19 piers were made. Before they were erected Telford had to take extraordinary steps to ensure that they were resting on firm footings in the river valley.

Several hundred men were involved in the building of the Pontcysylte Aqueduct in addition to those digging the Llangollen Canal itself. Giant cranes were utilized to lift the heavy blocks into position and finally the iron sections for the arches. As the work progressed people came from great distances to observe and to heap praise on Thomas Telford, the chief engineer. By 1803 the work was essentially complete. However the last hurdle to be cleared was the method of keeping the metal trough watertight. Especially at the joints between the bolted segments. (Welding had not been perfected) Several materials and methods were tried, but the one discovered to be most satisfactory was a mixture of ox blood and linen.

We are indebted to “Waterways News”, March 1988, for this photo of the method now in use to check the basic soundness of the Pontcysylte Aqueduct structure. Stats (UK) Limited has been engaged to carry out a visual and photo study of this two-century-old structure and in the process they were utilizing a visual inspection method known as “abselling” (similar to mountain climbing) which permitted Stats to conclude their initial survey in three days!
SLOPED LEVELS
By William Ozombok

The February issue of American Canals (No. 64, page 12) contains the statement that canal channels were not "level", but were sloped, one inch per mile. I find that assertion impossible to accept, for a number of reasons.

First, an obvious reason: a slope of one inch per mile is a fall of 0.0002 inch per foot. That's less than the thickness of a sheet of paper. We're talking about a flat roof, dooks, and on my flat roof water doesn't go anywhere — except straight down, into my sitting room. My experience with slopes of low gradient is that the flow of water is not determined by the slope of the "ground" but by leakage. My 'sloped level' roof leaks almost as much as canals did.

A surveyor's line of sight may be determined to be horizontal by "leveling" the instrument to within a few thousandths of a foot, but we must not confuse the precision of optical sighting with the ability to produce, on the surface of puddled clay, a "level" that slopes one inch per mile. Even if mud could be rolled that precision (even with a laser beam, a nice field can not be leveled with that precision), that pristine clay surface would not long remain in that ideal state. The bottom of a canal was a bumpy mess of puddled clay, random sediments, pond fillies, and who knows what else. It surely is too much to expect to maintain a slope of one inch per mile when it was almost impossible to keep the canal open at all.

Furthermore, the flow of water in a canal is not affected by any slope on the bottom or any irregularity on the surface contour of the bottom, as Figure 1 shows.

There is only one situation in which a sloping bottom could promote the flow of water in a canal: a "densely current" could slide down such a slope if the density of water were different at different places in the canal, as Figure 2 illustrates.

Density gradient (convective) flows occur even if the canal bottom is or is not flat, level, horizontal, smooth or bumpy: if fluid flows motion, the only requirement is some means to create a difference in density, unequal solar heating, or difference in salinity or in suspended solids, will do.

When we speak of canal "levels" — just what are we talking about? We all know that the surface of a lake is not flat (even in the absence of a wind) but in fact follows the curvature of the earth, which is about 8 inches per mile, as Figure 3 illustrates. That rudimentary fact complicates any discussion of "levels". The surface of a body of water (in a lake or canal) can be treated as a horizontal plane only if the water surface is "not very wide" because, as Figure 4 shows, a curved surface can be approximated by a series of straight lines, and the shorter the straight line chords, the less difference there is between flat plane and the actual, curved surface of the water.

In a canal, if the distance between two locks is one mile, the water surface at one end of that one-mile canal level (point B) is 8 inches below a horizontal line drawn tangent to the water surface at the other end of that canal level (point A). Experience confirms that water is not moving in the canal between those two locks: because the water is "level" in the sense that water at point A is at the same elevation as the water at point B — that is, points A and B are both at the same elevation above sea level or the center of the earth — water at both sites has fallen as far as possible (given the restraining walls of the canal prism) toward the center of the earth, under the influence of gravitational attraction.

There is no need to complicate our discussion even more by trying to take into account the variations of gravity with latitude and longitude, nor need we address the problems associated with using a surveyor's instrument to attain the precision required to level a rice field, or slope a long level on a canal so that the elevation of the canal bottom at point B is one inch lower than the elevation at point A. That exercise is a useless digression, if, in the first place, sloping the bottom has nothing to do with causing water to flow "down" the canal.

Three factors governed the flow of water in a canal: the first was leakage; the second was the setting (elevation) of the top plank in a waste weir located anywhere between locks; the third was evaporation. Obviously, operation of locks caused water to move into the canal from reservoirs and feeders.

(Editor's Note: We would be glad to have any additional comments from our readers on this matter of "sloped levels" in our historic, or currently operating, canals.)

AMERICAN CANALS, NO. 65 - May 1988
The Columbia (Pa.) Canal Basin, southern terminus of the Pennsylvania Canal Company system, circa 1894. It is thought this picture was made about the time of the closing of the Susquehanna and Tidewater Canal. The tremendous stock piles of Nanticoke coal to the right, and the backup of loaded Pennsylvania canal boats in the foreground may be indicative of the chaos which developed when these boats could no longer deliver their cargoes by water to Baltimore and Philadelphia.

By William H. Shank, P.E.

The May 1894 flood did such damage to the S. & T. Canal that the Reading Railroad, lessees of the canal, decided in 1895 not to invest any further money in repairs and abandoned the property to the original owners, who also declined to repair the canal.

By this time the Pennsylvania Canal Company had become the main user of the S. & T. Canal to transport coal and lumber from upper central Pennsylvania to tidewater and thence to their markets in Baltimore and Philadelphia. When the S. & T. closed, the Pennsylvania Canal Company was caught with 58 of its boats in Chesapeake Bay, and to recover them advanced $6000 to the S. & T. Company to put just enough water into the canal to bring the empty boats back to Pennsylvania. This was done. However, the most serious problem for the Pennsylvania Canal Company, was the fact that their only navigable outlet to Chesapeake Bay was gone. This, plus flood damage to their own canal lines in Pennsylvania, forced the decision by the stockholders of the Pennsylvania Canal Company to abandon all further operations as of April 11, 1901. Water was maintained in some portions of the system for the use of local municipalities and industry, but boat navigation ceased.

The Power Companies take Over

In the early days of the Twentieth Century the infant electrical industry was trying to introduce its product into the factories and homes in the eastern metropolitan areas. Many of the first electric power plants were fueled by coal. However the invention of a practical, water-powered turbo-generator turned the attention of power engineers to the lower Susquehanna River. The unusually steep gradient in the sixty miles below York Haven, if properly harnessed, could be a source of power to generate electricity.

When it became clear that neither the Pennsylvania Main Line Canal nor the Susquehanna and Tidewater Canal would ever again be rejuvenated, the new power companies began acquiring river shorelands, including some of the former canal right-of-ways.

The York Haven Water and Power Company

This company was incorporated in 1895, and after land and water rights had been purchased, began in 1907 to construct a hydroelectric plant utilizing the fall of the York Haven rapids, entrapped by a diversion dam reaching 8000 feet upstream. 16,000 cubic feet per second of water are drawn into huge turbines which produce 20,000 kilowatts of electricity. When the plant went into full operation in 1904 it became the third largest hydroelectric plant of its kind in the world. It began immediately serving York, Steelton, Harrisburg and Middletown and is today part of the Metropolitan Edison system in central Pennsylvania.

Holtwood Dam

The second hydroelectric facility on the lower Susquehanna went into operation in 1910 and was enlarged in 1914 and 1924. This turbine-operated hydro plant generates 101,000,000 kilowatts, while an additional coal-fired plant on the east shore end of the dam generates an extra 102,000,000 kilowatts. The two plants are owned and operated by the Pennsylvania Power and Light Company.

Conowingo Dam

This mighty structure, built in 1928 several miles below the Mason-Dixon Line, harnessed a water-level differential of approximately ninety feet to develop an original generating capacity of 252,000 kilowatts. An expansion in 1964 brought its total capacity up to 512,000 kilowatts. An interesting feature of its construction was a special railroad, laid along the old S. & T. Canal tow path, to bring building materials and turbines from a connection with the Pennsylvania Railroad in Havre de Grace. The rails of this track may still be seen at many points south of the dam. This facility is operated by the Philadelphia Electric Company, which also operates the Muddy Run Pump-Storage generating plant 12 miles upstream.

Safe Harbor Dam

This most recent of the power dams on the lower Susquehanna was built in the early 1930’s and additional generating facilities were installed in 1933, 1934 and 1940. It is all hydroelectric, putting forth 228,000 kilowatts. It is owned and operated by the Safe Harbor Water Power Corporation, which in turn is owned by the Pennsylvania Power and Light Company and the Baltimore Gas and Electric Company. It is here that most of the original maps of the Susquehanna and Tidewater Canal are stored.

Recreational Sites Created

Canal buffs decry the fact that many of the old S. & T. Canal Locks and channel have been “drowned out” by these power dams, but credit must be given to the power companies for preserving at least a few canal relics in name or actuality. One of the best of these is Lock Twelve Park, about one mile below Holtwood Dam and just north of the west end of the Norman Wood Bridge. In this multi-acre park area, owned and operated by the Pennsylvania Power and Light Company, are the well-preserved and stabilized remains of Lock Twelve itself, plus a restored Lime Furnace and the foundations of an old lumber mill, originally
run by water power. The park is open to the public without charge and includes picnicking facilities, rest rooms and running water. Another, smaller park area operated by P.P. & L., is Lock Two Park, six miles below Wrightsville (the lower end of the "Five-Mile Long Level") where there is a boat-launch built on the filled-in lock. Further South, Philadelphia Electric Company has provided a Fisherman’s Gallery just below Conowingo Dam, where a variety of anadromous fish, such as American Shad, Hickory Shad, and Herring are caught in April, May and June, as they come upstream to spawn. Other species are available year-round. Above Conowingo Dam some 9000 acres of open water are available for fishing and boating. Here Largemouth Bass, Smallmouth Bass and Walleyes reign as premium game fish. Most of the tributary streams are stocked with Trout by the states of Maryland and Pennsylvania.

Susquehanna State Park

This park maintains a well-preserved section of the old S. & T. Canal Channel, including river access to Lock Eight and the Port Deposit Outlet Lock. There is also a boat launch nearby and a water-powered grist mill, which has been completely restored to operating condition. Remains of a small canal aqueduct and the old Deer Creek Guard Lock may also be seen at the north end of the park.

Susquehanna Museum of Havre de Grace

In recent years much attention has been focused upon the Outlet Lock area at Havre de Grace. It has been the starting point for many field trips by the Pennsylvania Canal Society, the Smithsonian Associates, and has aroused much interest on the part of the Maryland Historical Trust, which has an easement on the property.

Best-preserved of all remaining relics of the S. & T. Canal, the Outlet Lock Complex was built originally on fill-ground in the river. It included a well-built, cut-masonry lock, a two-story lockhouse on the land side of the lock, a swing-bridge across the lock, a storage warehouse on the river side of the lock, and along the river, docking facilities for boats and towing craft bound to and from Baltimore and Philadelphia.

The large canal basin, located north of the Outlet Lock, and with waterlevel originally some five feet above mean-tide level in the river, though now dry, is an area being considered by the Maryland Department of Natural Resources as a "holding pond" for young shad (after rewatering) where they can grow and periodically be released to restock the river at this point.

In 1972 a group of local citizens formed an organization known as "The Susquehanna Museum of Havre de Grace Incorporated," whose objectives were to stabilize and restore this important historic site. Much work has already been done by this energetic group, both on a voluntary basis and with professional help.

First, this organization arranged to transfer ownership of the Outlet Lock property from the Philadelphia Electric Company to the City of Havre de Grace (1970). Then, with state and federal funding and volunteer labor, they restored and rebuilt the Lockhouse and dedicated it as a Canal Museum (1982).

Then they rebuilt, in its original location, an operating replica of the old swing bridge which now once again spans the lock, securing State and federal funding to assist them.

On December 12, 1985, a meeting was held in the Lockhouse to discuss the possible rewatering of the old canal basin and the rebuilding of the outlet lock from the basin to the Susquehanna River. The meeting was called by C. Jay O’Dell, Tidewater Administrator for Maryland Department of Natural Resources, who is interested in providing a "growing area" for very young Shad in the old canal basin. The Shad would be trucked in from fish hatcheries and released to the river, through the lock, after reaching a length of about two inches.

A meeting was held on July 25, 1986, also at the lockhouse, to discuss further progress of the planning for the basin and lock de-silting, plus a determination of the water level to be sought in the basin, and the method of maintaining it. It was later determined that pumping water from the river would be the most practical method of water retention.

(Concluded on Page Twelve)
S. & T. CANAL

In Susquehanna State Park, Lapidum, Maryland, is this restored and operating grist mill on the banks of a well-preserved section of the S. & T. Canal. An "overshot" waterwheel provides power for the mill.

(Concluded from Page Eleven)

During the summer of 1986, with the help of the Maryland Conservation Corps, a portion of the lower part of the outlet lock was desalted to a depth of seven feet in preparation for pulling one of the lower lock gates for study and ultimate duplication as the new, working gates are built. There was also a review of the tentative plans for the shade pond, as submitted by Frederick Ward Associates at a meeting September 10th at the lockhouse.

First Lock Gate Pulled

On November 4th, 1986, using a boom-crane supplied (and operated) by the owner of an adjacent marina, and a local volunteer diver, the southwest lock-gate in the outlet lock was pulled from the silt which had preserved it for the past hundred years. It was deposited on the bank of the lock for measurement, photographing and further study.

Final engineering design plans, and construction bid specifications were completed in September of 1987 by Frederick Ward Associates. A "Shallow Water Design" was adopted, with a maximum water depth of five feet. This design will permit the complete drainage of the one and one-half acre basin for fish release and maintenance.

Panama Canal "NO LONGER VITAL"

ACS Member Walter L. Messick has sent us the following item as written by Mike Billington for the Fort Lauderdale News and Sun-Sentinel. March 13, 1986:

PANAMA CITY, Panama — Looking more like a department store than a ship, the "Kentucky Highway" out of Kobe, Japan slid through the Miraflores locks on its nine-hour journey through the Panama Canal to the Atlantic Ocean.

"The Kentucky Highway" carries cars, lots of them. Like other Japanese car carriers, it is a huge, ungainly vessel. It is also very efficient. And by using it and others like it to ship cars to the United States, Japanese automakers have been able to dominate much of the American car market for several years.

But do Japanese automakers need the Panama Canal to keep their shipping costs down? No. The fact is, despite all the rhetoric about its importance, the Panama Canal is no longer very important commercially or militarily.

Commercially, the canal lost much of its luster in 1973 when the OPEC embargo sent oil prices through the roof.

The wicket-gates of this 140-year old lower gate of the Outlet Lock at Havel de Gracce were well-preserved under silt in the bed of the lock. The restored swing bridge is visible in the background.

Governor Schaefer Visits the Project

Governor W.D. Schaefer of Maryland paid a personal visit to the project site on November 2, 1987. He has encouraged and promoted the development of the shad basin for the restoration of American Shad in Chesapeake Bay. Also in November a full operating and construction agreement for the facility was signed by the Mayor of Havre de Grace, the Director of the Maryland Historical Trust and the Maryland Department of Natural Resources Secretary. The Maryland Board of Public Works approved the entire project on December 29, 1987.

Lock Desilting and Final Gate Removal

Desilting of the canal lock was resumed on November 10, 1987 through the efforts of the Susquehanna Museum and a local marina owner. At the close of the season, the only lock desilting not completed was under the turning bridge, and at the northern end of the lock. The work done permitted the pulling of the remaining gates in the southeast corner of the lock, and the two gates at the north end of the lock. The entire operation was completed on November 24, 1987. It was discovered that the gates of pipes in the upper and lower sections of the lock are identical in design.

(For additional details of the Havre de Grace project see AMERICAN CANALS #66 and #59.)

Military, it lost strategic importance when the U.S. Navy began building aircraft carriers in the 1960s that were too large for the canal's locks.

"Is the canal strategically vital? I don't think so. Not really, not anymore," said one U.S. State Department source. As long as we are, the Pentagon was recommending that it be turned over to the Panamanians because its strategic usefulness was nearing an end.

In fact, military experts said then that the presence of U.S. troops was the biggest threat to the canal because they made it a target of aggression. Additionally, the experts concluded that the biggest single threat to the canal was the possible sabotage to it by Panamanian nationalists upset with the U.S. presence here.

The Navy now has aircraft carriers stationed on both the East and West coasts, the State Department source said. "Because of that, the military value of the canal is much less than it was.

A lot has been made recently of the fact that the U.S. Southern Command is based in Panama City. From there, the command controls U.S. military actions throughout Latin America and the Caribbean.

The State Department source discounted the importance of the location of the Southern Command in Panama.

"It's here because it's convenient, but to be honest, it could just as easily be based in Miami or a dozen other places," the source said. "We live in an age of faster-than-sound airplanes, nuclear missiles, and telephones. The physical location of a headquarters is no longer as important as it once was."

Commercially, the OPEC oil embargo virtually sealed the fate of the canal and destroyed its dominant position in international trade.

"Canal traffic grew steadily every year from World War II until 1973," said Donald G. Schmidt, the deputy director of the Panama Canal Commission's Office of Executive Planning. He added that "we got hit with the oil shock and we suffered the same as everyone else did."

Until then, he said, oil-carrying ships had been a major source of traffic and income for the canal. But with the embargo, that traffic fell off dramatically. It recovered slightly when oil was discovered on Alaska's North Slope in 1977. But, once the Alaskan Pipeline and a similar Panamanian pipeline were completed in 1992, oil tankers and oil disappeared from the canal.

"That was the last big year, in fact it was the biggest year the canal ever had in terms of both volume of traffic and oil," Schmidt said.

After 1982, he said, "We suffered a tremendous dropoff. We have been regaining some of the volume gradually, year by year, but now that's due mainly to the fact that interest rates have been low and car sales are up as a result."

The canal will probably average only about 2 to 2½ percent annual growth from now until 1999 when it is turned over to Panama under the terms of the Torrijos-Carter treaty.

"And truthfully, some years will probably be flat," Schmidt said.

In addition to pipelines, which now carry everything from oil to grain, the canal's main competition comes from the so-called "land-bridge" from Long Beach, Calif., to New York City. The land-bridge has wiped out much of the canal's competitive advantage.

(Editor's Note: The opinions expressed by Mike Billington are his own. We would be glad to hear from any ACS members who have strong feelings, pro or con, about giving away the Panama Canal to the government of Panama in the year 2000.)