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A Current Perspective on Flooding in Millburn and Union Townships

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Introduction

With the formation of both a Mayors' Council and a Stormwater Advisory Board to address the Rahway River's problems, and in the light of studies of abatement options being done by the Army Corps of Engineers, it is imperative to understand precisely just where, how, and why inundations arise in Millburn (and its neighbor Union Township), and what might be done about them *locally* as part of an overall watershed-wide abatement plan, with each Township contributing. The idea for this study occurred as soon as I started to observe the river after volunteering to chair a "floodplain renovation" subcommittee of the Advisory Board.

I realized that the intense current interest in flooding provides Millburn with a unique opportunity to link abatement with the unfinished relocation of various Township offices and facilities, and to meet downtown's clear and present need for more public space that is sheltered from the traffic on two intersecting County roads. It also provides Union with an opportunity to cooperate with Millburn to reduce flood effects in the "South Mountain" residential area of Millburn, and in its own commercial area southeast of the East Branch. More generally, it supplies incentive for linking flood abatement with the extension and completion of a system of Greenways from the Arthur Kill to South Orange and Verona.

Summary of Conclusions

Millburn can simultaneously redevelop *and* solve its downtown flood problem on the West Branch once and for all by joining the flood abatement project with the intended relocation of Township offices and facilities, and expanding the narrow gorge through downtown to the east to remove the choke points that increase the flood profile. Widening the channel would require buying and demolishing the 5 or 6 buildings close to the east bank and, depending on design, maybe some on the west bank. Part of the resulting space can be used to put in a true river-walk and other badly needed pedestrian amenities, possibly served by a high level pedestrian bridge spanning both the river and Main Street. The two inconveniently located power substations in the downtown area can be moved.

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V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

The obvious corollary to consideration of channel widening in downtown Millburn is the conclusion that Millburn does not need a major detention basin in the South Mountain Reservation in order to solve its self-inflicted downtown flood problems on the West Branch.



Fig. 1 Rahway River, West Branch Channel, in Millburn

Millburn and Union Townships must get together and cooperate to abate the flooding on their East Branch border. There is room for a partial flood plain extension on the east bank in the area between Franklin Street and Valley Avenue, containing woods belonging to Millburn and a playing field belonging to Union. A new short berm can define a broader channel, protect the field, and reduce the flood profile at the “Joint Meeting” pipe crossing.

It appears to be hard to determine whether Millburn’s “South Mountain” residential area floods mostly from river overflow, or from runoff into storm sewers that cannot discharge when the river level rises behind the “levees”, the fortified bank along Ridgewood Road and the old berm behind Oval Road and Haran Circle. Accounts from residents are incomplete, contradictory, and inconclusive, but site inspection points to runoff as the principal problem, with greatly increased diesel-backed pump capacity as the solution. A careful study of just how and where the flooding develops here during a major storm would help suggest and justify additional abatement measures.

From “Joint Meeting” to the confluence of the Branches at Rt. I-78 the main problem is silting: large banks of mud and gravel impede flow and reduce clearance under the highway bridges. Their removal would extend the flood plain in an essentially vacant area, provide detention volume, and supply material for additional or higher berms, or for raising the low portion of I-78 west of the bridges. The area could also be made into a recreational Greenway route that joins up with similar areas upstream and downstream.

Where Does It Flood, and Why?

The major problem areas are as follows:

1. Downtown Millburn: Overflow of the West Branch of the Rahway inundates the business area in the center of town (Essex Street, Millburn Avenue, and Main Street) by overflow of the West Branch of the Rahway. In this area the West Branch has been channeled into a deep but narrow masonry “gorge” with an S-curve in it (see Fig. 1, above), followed by two bridges and a dam, all of which are choke points.



Fig. 2 Refurbished “Joint Meeting” pipe crossing seen from Union Twp. side

2. The “South Mountain” residential area: High water levels on the East Branch of the Rahway, in combination with street runoff, inundate Millburn homes in the area of the “Joint Meeting” sanitary pipe crossing (see Fig. 3, below). These levels result from the fact that the channel of the East Branch from Vauxhall Bridge to the pipe crossing is very narrow with high steep banks. How much of the flooding is the result of overflow on the west bank, and how much is un-discharged street runoff? Here the new concrete bank/wall and the old berm may be breached by water rising in the narrow channel; and when the river channel is full, the one-way culverts emptying street runoff lock up, and the pumps set up to take over are overwhelmed. The problem is made worse by the penetration of flood waters resulting from faulty sanitary sewers in an area that should have been left as flood plain. The crossing has recently been cleaned out from the Millburn side, and the choking effect reduced by dredging out the silt and gravel, and removing vegetation; it is now the widest part of the river in this

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

area. The former choke point created by silt at the sewage pipe crossing had flooded industrial, commercial, and recreational sites in Union Township on the south-east bank.



Fig. 3 Cleared pipe crossing seen from Millburn side

3. The confluence of East and West Branches: The two branches join just south of I-78, and inundate I-78, parts of Union and Springfield Townships, and industrial sites in Millburn. The area is a very rough “Greenway”, characterized by many large silt/gravel deposits that obstruct river flow, especially under the bridges and beyond.

There is a fourth minor threat of flooding from Van Winkle Brook before it passes into Springfield.

The problems in downtown are directly attributable to water depth buildup behind a series of “choke points” that seriously impede flow in a river branch already confined to an unrealistic narrow course. Those in “South Mountain” appear to be chiefly the result of a narrow channel upstream and build-up of water from storm sewers unable to discharge through the banks into the swollen river, with river overflow affecting both Union Township and Millburn. In the I-78 area the problems are due to silting, to a roadbed that is only a few feet above the river, and to insufficient bridge clearance prior to and after the confluence.

In short, two of Millburn’s flooding problems are largely of its own doing, created over years of permissive development that encroached onto the natural flood plain and reduced the river to a ditch. In “South Mountain” they are now exacerbated by inadequate pumping capacity. The I-78 problems are due partly to the highway authorities’ laying the roadbed too low, not anticipating inundation, and also to subsequent neglect of the channel.



Fig. 4 View downstream from near Hudson City Bank. Flood plain extension to the left is being suggested.



Fig.5 East Branch at highway bridges near confluence

Downtown: Status and Discussion

From the railway bridge down to Millburn Avenue the West Branch flows in a kind of gorge consisting of a largely concrete floor with rock masonry sides, ending at the new County Bridge across Millburn Avenue. In its lower reaches it narrows significantly and also becomes less deep, thereby forming a constriction. More importantly, it goes through a sigmoid curve under a concrete span supporting a building that reaches all the way to the west bank.

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

Even without the trees, rocks, and debris that piled up along here during Hurricane Floyd, this passage is a major choke point that



Fig. 6 Start of the Millburn "Gorge": View upstream from Essex Avenue bridge

slows the flow and raises the water level behind it. The span leaves an opening for water flow that is roughly semi-elliptical, 30 feet wide, 7 feet high in midstream, narrowing to 2 feet at the gorge's sides. Together, the bottleneck under the building, and the change in fluid flow direction forced by the sigmoid curve, reduce the speed of flow, causing the depth upstream to rise.

During Irene I personally observed that the gorge between Fidelity Investments and PNC Bank was overflowing with reddish-brown liquid, the color originating as a combination of vegetable duff and mud from the South Mountain Reservation. And overflow it did, right through the alley where Sono Restaurant was previously located, out onto Millburn Avenue and beyond.



Fig. 7 View of S-curve and "Futter's Bridge" from Millburn Avenue bridge



Fig. 8 Close up of S-curve constriction

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

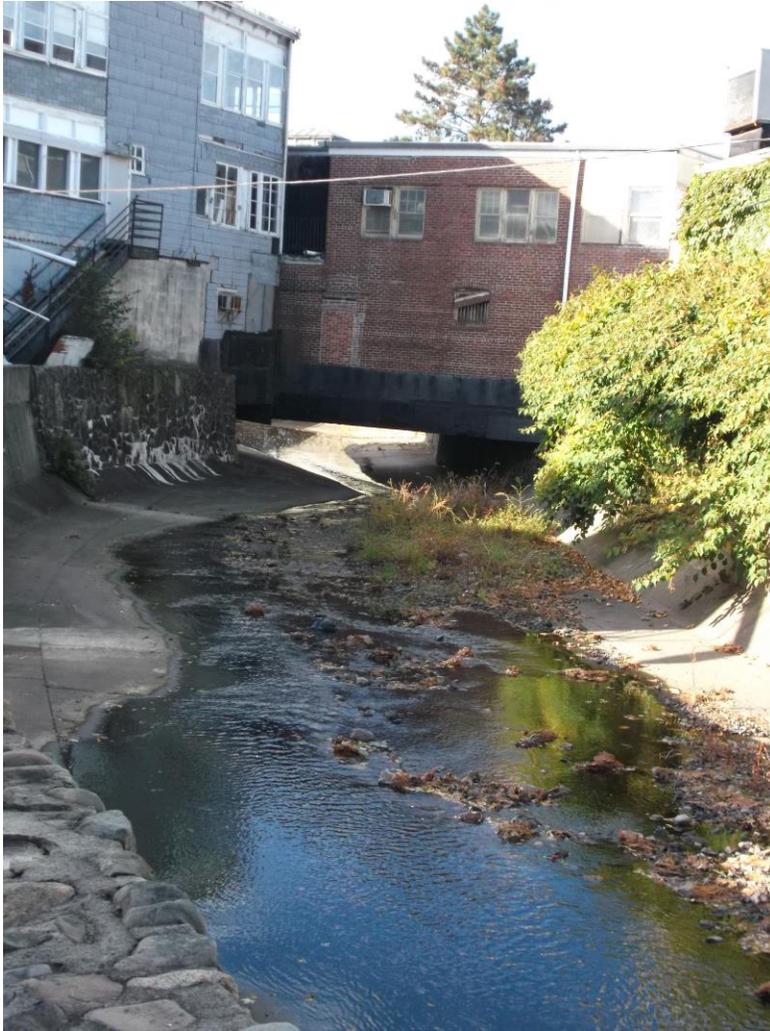


Fig. 9 Looking under the Futter building (brick on black bridge.)

The Millburn Avenue Bridge also has a choking effect, which has been lessened by its reconstruction to two large spans instead of four small ones. However, both Floyd and Irene spilled water onto Millburn Avenue at this bridge.

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships



Fig. 10 Millburn Avenue Bridge seen from downstream

Further downstream the little foot bridge in Taylor Park is another choke point; high water just flows around the short span on both sides, with one side flooding Main Street. The semi-ellipse of arched space for water to flow through is 25.5 feet wide; the height, from the river bottom to the top of the arch, is about 8 feet.

The next choke point is the now gateless dam holding back the Taylor Park pond. It is unable to pass a substantial volume, and as a result, water flows around it over the low sloping berm north of the playground, and floods St. Stephen's Church. It is of interest to know whether and how it's proposed reconstruction, now in progress, shall lessen these effects. I visited the site on September 23, 2013, and received a complete account of the project from the contractor. A new dam is going in, a concrete arc just upstream from the old bridge with the gates. The gates are gone, rotted off, and the mechanisms that raised them are to be removed. The reconstruction includes a buried tube drawing water from the center of the pond, and by-passing the dam on the east. The small size of its access hatch suggests that it cannot carry a large volume at a high flow rate; so it is a low-capacity central exit, from the middle of the pond, protected by gratings from blockage by vegetation.

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships



Fig. 11 Choke point at foot bridge in Taylor Park



Fig. 12 Bridge's outer spans to remain half-blocked

It appears to me that this reconstruction shall do only a little to reduce the choking effect of the bridge, because the holes under the bridge through which the water must pass shall be only slightly larger than before. Also, raising a short berm on the west bank would have helped stop

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

the inundation of Main Street and St. Stephen's Church; unfortunately this option is not in the plans. So the opportunity to eliminate this significant choke point is being lost.



Fig. 13 Taylor Park dam under reconstruction

The final choke point of significance is at the Ridgewood Avenue Bridge, and is due to the low clearance of the bridge above the river bed.

IMPORTANT POINT: Every one of these choke points shows up clearly on the Flood Profile data sheets for the West Branch of the Rahway River, put out for Essex County, by the Federal Emergency Management Agency. The relevant pages are 140P and 139P, where most choke points are identified by name. The data suggests that the largest choking effect is due to the first two listed above: together, the S-curve under "Futter's bridge" and the Millburn Avenue Bridge contribute a jump of about 15 feet to the profile!

From Ridgewood Avenue to the Fandango dam, the West Branch apparently has a channel deep and broad enough to cause no problems. From interviews with residents of Lakeside Village adjacent to the dam I learned that the Village had only minor flooding problems. From the Village to the confluence with the East Branch, however, is another story; the bank on the Willow Street side is flat and is only a foot or two above the river. Businesses fronting on Willow Street have been flooded, but it is not clear whether this inundation was due to water in the West Branch on its way down, or to water from both branches backing up because of slow flow up ahead at the bridges on both sides of the confluence, and beyond.

Downtown: Finally, a (Radical ?) Plan

One possible approach to improvement on the West Branch in downtown Millburn is to incorporate flood abatement into a whole restructuring of the downtown area, simultaneously taking into account the putative relocation of Town Hall and the Department of Public Works, reviving plans for a real river-walk, and increasing the amount of pedestrian-friendly space.

The idea would be to abandon the concrete ditch or gorge that presently causes problems, to widen the river channel mostly east from the RR Bridge to Taylor Park dam, and to use that east bank to locate a genuine river-walk area, possibly connecting it to the Town Hall/Public Works area by a high-level pedestrian bridge spanning both the river and Main Street.

The simple fact is that there are exactly 7 or 8 buildings located near the present gorge (or sitting across it!) whose removal would free up the banks (mostly the east bank) for channel widening, river-walk design, and downtown makeover. An architect's dream! The current resounding calls for flood abatement provide a unique chance for Millburn Township to take control of its downtown development into its own hands, to reverse the old policies of "river edge development" by ridding itself of outdated features that have been *de facto* grandfathered in for decades, and can be identified as the principal sources of problems. Their removal under fair, generous, but firm conditions represents a minimal loss in return for major improvements and opportunities: widening the channel would permanently end the kind of needless floods Millburn endured with Floyd and Irene, and would provide a new background for the Township's improvement of downtown.

What is proposed here is not an entirely new idea. We are sure that it has been considered, kicked around, and rejected several times in the past. This study was undertaken in the conviction that, in addition to expecting outside assistance from agencies like the Army Corps of Engineers, each municipality in the Rahway watershed should determine what it could do in its own bailiwick to further overall abatement. Ridding itself of the gorge is probably the largest contribution Millburn could make; linking it to municipal redevelopment provides a win-win strategy.

This is not the place for a detailed discussion of the political, fiscal, and engineering feasibility of this idea. But to show that we are not unmindful of the problems it faces, we note that:

- 1.) The plan would have to pass the test of live public comment and reaction, and receive various approvals from government agencies.
- 2.) It would need thorough examination by urban planners and civil engineers to make known its cons as well as its pros. It would require adoption by enough of the Township's leaders with the political will to think the ideas through, and have them properly designed, engineered, funded, and put in place.

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships



Fig. 14 Two buildings in the path of an eastward extension of river channel

3.) In order to improve the Township for everyone, the plan would call on a few to accept remuneration for properties that have enjoyed special positions and privileges for decades, but now are bottlenecks and obstacles.

4.) To be sure, such a plan shall not be welcomed everywhere in Millburn. It involves the acquisition of property from owners who may be unwilling sellers, but who have nevertheless been profiting essentially at the expense of the public and of other owners in town who would not be flooded if the river channel were more natural.

“South Mountain”: Status and Discussion

To understand the flood problems affecting this residential area (and the commercial area on the opposite bank) it is really necessary to widen the scope of the inquiry to include the entire portion of the East Branch from Vauxhall to the confluence. There is a whole list of reasons why the problem here is complex:

- (i. The East Branch is the boundary between Millburn and Union Townships, and downstream, also between Union and Springfield. So in addition to having to obtaining permits from various agencies, almost any project of flood abatement here must be accepted by two or even three municipalities. And at the confluence where the highway I-78 crosses the Branches, the State of New Jersey gets involved.
- (ii. There is some question where the Millburn-Union boundary lies in the stretch of river just downstream from the temple Congregation B’nai Israel. Some years ago the Township Forester made paint marks on trees standing on the east bank some tens of

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

feet away from the river, to indicate the correct boundary; these marks have now been supplemented with plastic signage reading “Millburn Township Forested Area.” Land use along the East Branch from Vauxhall to the confluence varies between residential, industrial or business, and a sort of rough, messy greenway. So remedies appropriate at a point on one bank may be impossible or undesirable on the opposite bank.

- (iii. As noted earlier, the East Branch channel between Vauxhall and the pipe crossing is narrow with high banks leading to elevated water levels. Broadening it would substantially decrease the flood profile just above the crossing, where “South Mountain” is most vulnerable.
- (iv. The floods in this East Branch strip affect both Millburn and Union, so one would think that these Townships would do well to cooperate in solving their joint problems. However, recent discussions with the Union Township Engineering Department indicate that in spite of the major inundation of Home Depot and other businesses by Irene, Union currently has little interest in undertaking abatement in this area. As things stand, however, each Township has done flood work on its own side of the river. Union built a grassy berm running from Franklin Street to Valley Road, where there is a big diesel-driven pump system to get storm water over the berm. And there is a (standard, possibly privately installed) barrier of interlocking driven steel piles holding up part of the east bank just upstream from the “Joint Meeting” pipes. In Millburn a similar but clearly older berm protects Oval Road and Haran Circle, and a fortified stone and concrete bank topped by a wall runs from the Congregation B’nai Israel temple to Gilbert Place and protects Ridgewood Road.
- (v. There seems to be a general lack of information about how a flood actually develops in this area. When I started to study the river in this area I first tried to get this kind of information from officials at the various Townships’ Engineering Departments, but this was not easy. They are working people, and just getting an appointment for a site inspection could be a chore. Some took me on tours of inspection; others declined to participate in site inspections, but were willing to talk in a conference room. I then tried to find out from residents and business owners where the flood water came from, where it first appeared or penetrated, how it traveled, etc. It is remarkable how little attention most people there paid until the water was underfoot. However, in Millburn’s South Mountain area I found a contractor with 20 years of local experience, working on one of the houses right by the river, and he reported that the East Branch did not spill over the wall on the west bank into South Mountain in the Gilbert Place and Ridgewood Road area; instead, the area gets flooded by storm sewers unable to empty into the river, in other words, by local runoff. This contractor was contradicted by local residents.
- (vi. In Union I got accounts that were either not believable or contradicted by other interviews. Alex Smith, head of Maplecrest Ford on Valley Road in Union, said he had seen 4-feet of water at his dealership, claiming that it all came from the streets, and that none of it came from the East Branch in his backyard. Given the local topography, his scenario seemed improbable, if not impossible. He also said that the flooding increased noticeably after the advent of Home Depot on Rt. 124. In contrast, the foreman of the

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

granite counter top concern near the “Joint Meeting” pipe crossing said the water reached his place through the forested area after the nearby playing field filled up. This suggests that the Union pump effluent flooded the field, or, more likely, that Millburn’s fortified bank forced the rising East Branch to spill eastward across the Millburn Township Forested Area and into the playing field.

The strip of the East Branch between “Joint Meeting and the two bridges on I-78 just upstream of the confluence is a kind of rough, neglected Greenway bounded on the Millburn side by the high, old, wooded berm mentioned in (vii.), and on the Union side by a steep bank. There is considerable space here, clearly enough for some flood abatement measures. At one point an empty swale heads toward the river, surrounded by residences. It is dammed by the old berm running parallel to the river, and there is a one-way culvert in the berm allowing water to exit toward the river, but not back up. There is also an electrically driven pump to empty the swale when the river level is too high.

- (vii. I have not been able to determine yet whether the swale floods from runoff brought by storm sewers, by the river’s breaching the berm, or both. Residents of Oval Road and Haran Circle report that the river does rise to near the top of the berm, but I found no sign of eroding flow down the other side, possibly because the flood waters rise at about the same rate on both sides of the berm.
- (viii. In the South Mountain area it is important (but difficult) to separate the role of runoff in flooding from that of river overflow. As the river rises in its channel, the storm sewers can no longer empty into the channel and begin to back up and cause local flooding; this could happen even if the river stayed entirely within its channel and did not overflow either the “fortified” bank or the berms by Oval Road and Haran Circle. Does anyone know whether this happens? Of course, as the river rises further the local floods due to the backed up storm drains may be joined and amplified by overflow. So we must ask, are the South Mountain problems initially or primarily caused by the storm sewers? In what order do things get bad?



Fig. 15 Ridgewood Road: "Fortified" bank topped by wall, with narrow channel on right

- (ix. It is standard practice to pump storm water over the berms that define river channels, and Millburn does have two electrical pump stations located in the South Mountain area, one at the “Joint Meeting” pipe crossing on Gilbert Place, and another in the swale between Oval Road and Haran circle. It is possible that these two electric pumps are insufficient for an area as big as South Mountain during major precipitation even when the power does not fail. A site inspection along the Springfield-Union boundary, courtesy of Springfield Assistant Engineer Mardini, showed that Springfield has three large pump stations between Rt. I-78 and the border with Cranford. Union’s nearby is diesel.
- (x. So I have been left with making a lot of guesses based on topography; when the next big storm arrives I shall be out there myself to observe what really happens where.

“South Mountain” and Union Township: Ideas

From Vauxhall to I-78 the East Branch flows roughly along the boundary between Millburn and Union Townships. This contiguity means that any major channel work or floodplain restoration would involve consensus from both Townships, as well as NJDEP and other agencies. I say “roughly” because Millburn currently owns a forested area on the east bank between the river and the berm, extending from near the end of Ridgewood Road and Congregation B’nai Israel toward the playing field and Valley Road. It is obvious that Union and Millburn need to cooperate here, first at the executive or mayoral level, then at the engineering. The possible improvements suggested by our study consist of extending the floodplain to the east as far as the Union berm, adding a branch to the berm to protect the playing field.

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

From Congregation B’nai Israel to “Joint Meeting” the East Branch is in a narrow channel with high steep sides. So it is unlikely, although still possible, that even during large storms this area gets flooded by river overflow that starts opposite the fortified bank and wall built by Millburn on the west. It undoubtedly gets water from the Union pump discharging storm from the east side of their berm.



Fig. 16. Union Twp. diesel unit on berm



Fig. 17 Union Twp. berm and pump

V. Benes: A Current Perspective on Flooding in Millburn and Union Townships

That being so, why not use it to renovate the flood plain? At high precipitation times the water rises here anyway and reaches the playing field and Valley Avenue. The Union pump also discharges into a ditch running across the area to the river. Creating an extra arm or channel here, which only comes into play during flood time, would reduce the flood profile at the “Joint Meeting” choke point. Most of the large trees presently on the site could be left standing on a series of “occasional islands,” high spots between the channel and the river, and the new berm branch would define the limits of the flood plain. The area could easily be part of the extended Greenway on its way to Maplewood. Why compromise open space in the South Mountain Reservation when you can improve it by extending the flood plain?

Given the conflicting descriptions they provided, it is not clear what could be done to help the businesses on the Union side of the East Branch from the end of the berm on Valley Avenue to the Ford dealership. The berm branch suggested above would help the granite place, but until more is known about the sources and mechanisms of flooding here, it is not possible to say at once whether river overflow, or runoff, accumulating from the south-east with nowhere to go, is the main problem. On the Millburn side, the same questions arise: Does the East Branch breach the fortified bank and wall to its west, or the high berm downstream from “Joint Meeting”, and if so where? Is overflow or runoff the main problem? In both cases, careful sequential observation during a major storm is needed.

“Joint Meeting” to I-78: Discussion and Action

The area is a jumble of silt banks, small swales, and fallen trees, with commercial properties lining the Union side, and the old narrow berm protecting residences in the South Mountain area. As elsewhere, the historic urge to build right up to the river’s edge has created problems. The disparity in land use on the two banks, and the lack of space make it hard to design improvements. There is no perceptible river gradient, as there is above the pipe crossing, so water flow is sluggish. The area varies in width, with the swales providing some options for expanding the flood plain. But several residential properties reach the river, and commercial interests abound on the Union side.



Fig. 18 Large gravel bar in East Branch near confluence with West

The silt bars become prominent as one approaches the bridges for I-78, where they substantially reduce the clearance below the bridges, and continue in the wider area just downstream of the highways. This whole confluence area would profit from a major dredging operation, which could simultaneously broaden the flood plain, increase flow, provide detention volume, and supply silt and gravel for raising some of the berms in this area, or in a nearby area such as Lenape Park. It is clear the State DOT should think seriously about raising the bed of I-78 in the low area from east of the confluence to the higher ground in Springfield. Assistant Engineer Sam Mardini of Springfield has remarked that this area, properly used, can provide volumes of capacity and material.

* * *

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