Summary Only

Stormwater Analysis

East Branch Blind Brook

Village of Rye Brook

Westchester County New York

November 7, 2002

Prepared by:

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Scope and Methodology:

This study is an examination of the drainage in the East Branch Blind Brook watershed. This study encompasses approximately 520± acres contained within twenty-two* sub-watershed areas identified in our May 2002 report. The study is divided into two main areas, the upper northeast portion and the south/southwest portion, each containing eleven sub-watershed areas. The northeast portion includes the tributary area north and east of Acker Drive, while the south/southwest portion contains the balance of the overall tributary area.

The sub-watersheds included are described below and are shown on the accompanying drainage map.

Northeast Section

ARBORS- 29.9 acres

BBHS- Blind Brook High School – 15.79 acres

EDGEWOOD- Edgewood Drive – 28.89 acres

HLB- Hillandale Road / Beechwood Boulevard – 43.39 acres

LKN- Little Kings North – North of Little Kings Lane/ south and east of Hillandale Road- 10.71 acres

LKS- Little Kings South – Little Kings Lane/ north of Loch Lane/ east of Hillandale Road- 29.44 acres

ML-E- Meadowlark Road (eastern end) / Oriole Place (eastern end)– 13.03 acres

ML-W Meadowlark Road (western end) / Eagles Bluff/ Oriole Place (western end)- 59.15 acres

* It should be noted that the one sub-watershed area identified previously in our May 2002 report as VHN or Village Hall North has been deleted from the study area. Field reconnaissance, which included dye testing of drain lines, determined that this area and a portion of the Blind Brook High School is directed to the east, out of the East Branch watershed.

RR-N Rock Ridge Drive North – 10.39 acres

RR-S Rock Ridge Drive South – Rock Ridge Drive / Jacqueline Lane / Ridge Drive - 14.8 acres

WOODLANDS – Woodlands Drive 30.44 acres

South/Southwest Section

ARGYLE ROAD- 11.7 acres

BERKLEY DRIVE- 32.55 acres

BBE- Betsy Brown Road (east)- 12.3 acres

BBW- Betsy Brown Road (west)- 15.6 acres

HF-N- Hidden Falls (northern area)- 53.39 acres

HF-S- Hidden Falls (southern area)- 13.53 acres

KNOLLWOOD DRIVE- 17.31 acres

NEUTON AVENUE – 15.8 acres

RENHYL AVENUE- 20.3 acres

RB-N- Ridge Boulevard (northern area) – 27.8 acres

RB-S- Ridge Boulevard (southern area) – 14.2 acres

The drainage analysis was performed utilizing HydroCad®, a TR-20 based computer model. The 100, 25 and 2 year, Type –III storm events were modeled and the results are contained herein.

The framework for the model was established based on topographical features shown on the Village of Rye Brook and City of Rye "Blind Brook Watershed" topographical maps. Sub-watershed boundaries were established, land uses identified within those sub-watersheds, and drainage flow paths located. Additionally extensive field reconnaissance, including dye testing of drain lines, was performed to locate and map previously unmapped drainage infrastructure. Additional topographic data was obtained by conducting field surveys along major channel paths, including invert elevations for major culverts and pipes. Extensive research was performed with the assistance of Village Staff in obtaining copies of pertinent design plans, reports and maps that contained useful data.

Each sub-watershed area was examined as follows.

The Westchester County Soil Survey Maps were superimposed on plots of the sub-watershed areas. An analysis of the impervious and pervious areas contained within *each* soil type was completed. The primary soil types contained in this watershed are hydrologic soil types "B" and "C", with small areas of "D"; and "Unclassified Soil". The "B" soil is the most 'absorptive' of these soils and produces less runoff than the others. Each successive soil type is less absorptive and produces more runoff. All "Unclassified Soils" were rated as "C" to produce a more conservative analysis. The type of use within each soil type is assigned a Complex Number (CN) value. A compilation of uses within all soil types, produces a weighted CN value for the entire sub-watershed. *[See worksheets in the back of this report.]*

The Time of Concentration (Tc) is determined for each sub-watershed area. The Tc is based on calculating the "longest flow path" time wise within each sub-area. Flow paths generally follow drainage swales, streams and pipe conveyances. *[See worksheets in the back of this report.]*

All of the above data is then input for each sub-watershed contained within the model. HydroCad® graphically denotes sub-watershed areas as polygons. Peak rates of runoff can now be determined for any chosen storm event.

The next step is the linking or "reach routing" of each individual sub-watershed to pre-determined Design Points (DP) which are established for the purpose of the analysis of the peak rate of runoff at critical areas.

Existing drainage infrastructure, stream corridors, major culverts and comprehensive private and municipal drainage systems, establish the "reaches" between the various sub-watersheds. HydroCad® graphically denotes reaches as squares.

Of the four DP's chosen, three are located in the Northeast Section and the other in the South/Southwest Section.

DP-1 – At the discharge point of the culvert located downstream of the five street traffic circle in the Hillandale/Beechwood/Loch Lane area.

DP-2 - At the confluence of the stream that flows west from DP-1 and the stream that flows from the north, roughly parallel to Rock Ridge Drive.

DP-3 - At the upstream side of the twin culverts under Acker Drive.

DP-4 – At the entry to the Hidden Falls pond.

[See accompanying map.]

Discussion of Analysis:

Initially, the peak rates of runoff were calculated for the existing condition. The model assumed all inlet conditions (ie. entrances to culverts and drain lines) to be clear and free of obstruction since routine maintenance can establish these conditions. All channels and streams however were modeled considering their *existing* conditions.

Design Point 1:

The peak rate of runoff in cubic feet per second (CFS) at DP 1 for the 100, 25 and 2 year storms respectively is 201.22 , 159.03 and 67.31 CFS, far in excess of the approximately 35 CFS *full bank* carrying capacity of the existing 3 foot wide, 4 foot deep stone lined channel that receives this discharge. The capacity of the dual pipe conveyance (24 inch diameter and the 60 inch X 35 inch pipe) from the pond located on the Phillips' property to DP 1 is adequate even for the 100-year storm event. Again we caution, this is assuming clear inlet conditions. *[Inlet conditions and suggested improvements are discussed below.]*

The drain line located in the rear yards of the homes on the north side of Loch Lane can handle flows during the 2-year storm event but has its capacity exceeded during the 25 and 100 year storm events. This results in ponding at the inlet and flooding of portions of the rear yards during the higher storm frequencies.

The natural detention area located north of Little Kings Lane experiences ponding during the 25 year and greater storm events. The stream channel and adjoining area is covered with landscaping and forest debris, impeding good hydraulic flow characteristics. This area immediately north of Little Kings Lane is currently under separate study and improvements are being proposed.

The Arbors detention basin functions within the parameters of its original design. A 30-inch diameter drain line conveys the runoff from the basin control structure directly to DP 1, with the exception of a small amount of flow that is directed via an 8-inch diameter pipe to a pond on a private residence located on Hillandale Road. The pond release is tributary to the LKS sub-watershed area.

Design Point 2:

The peak rate of runoff in cubic feet per second (CFS) at DP 2 for the 100, 25 and 2 year storms respectively is 451.72 , 330.69 and 126.01 CFS. This includes the routing of the runoff from DP 1. The Main Channel [MainCH] conveys the runoff from the ML-W and ML-E and RR-N sub-watersheds to the design point in a southerly direction roughly parallel to Rock Ridge Road.

Design Point 3:

The peak rate of runoff in cubic feet per second (CFS) at DP 3 for the 100, 25 and 2 year storms respectively is 573.85 , 416.9 and 158.12 CFS. The Main Channel South [MainCHS] conveys the runoff from DP 1, DP 2, RR-S and Woodland to the DP3.

Design Point 4:

The peak rate of runoff in cubic feet per second (CFS) at DP 4 for the 100, 25 and 2-year storms respectively is 679.97, 457.12 and 146.12 CFS.

Findings- Northeast Section

Maintenance

The field reconnaissance found that a program to clean catch basins, drain pipes, major culverts and waterways is warranted immediately. During the field surveys, findings included catch basins completely clogged with debris and silt; drain lines with substantially reduced capacity due to obstructions, channels and streams with reduced hydraulic capacity due to landscaping debris, forest litter and overgrowth. The culvert entrances downstream of the Phillips' pond, and the stream itself, must be stabilized with rip-rap material to eliminate erosion. The pond should be dredged and the weir rehabilitated. A debris guard should be installed that pushes debris clear of the entrance to the culvert thereby allowing flow to continue. The present debris grate does not allow for maximum entrance flow into the culvert. Seasonal inspection and maintenance must be performed so that debris, fallen tree branches, etc., are promptly removed.

It is suggested that a maintenance and cleaning program be instituted commencing at the most downstream portion of this watershed area, DP 3 at the Acker Drive culverts, and proceeding north along the Main Channel South and the Main Channel, then east along the East Channel. Obstructions, natural and person-made, should be cleared from the channel. Landscaping debris, fallen trees and overgrowth should be cleared beyond the bank limits. Once the channels are cleared, the program can branch into all the sub-watershed areas commencing with the pipes and catch basins closest to the watercourses until the last structure at the top of the furthest upstream watershed is cleaned. Drain lines should be water-jetted and catch basins sumps vacuumed to remove all silt. Each catch basin should be examined to determine if the grate needs to be reset to provide for maximum inflow of stormwater. Outlet hoods should be installed in the majority of the catch basins to prevent floatables from entering the stream.

Considerations should be given to crowning roads to force curb line stormwater flow on those roadways that are relatively flat. The crowning can be achieved by providing an asphalt shim course when the road is scheduled for repaving. In concert with this, the need for additional catch basin inlets and curbing should be evaluated. For example Woodland Drive, Beechwood Boulevard and Loch Lane would benefit from a crowned road and the directing of stormwater flow to a drainage system. The elimination of excessive overland flow not only helps reduce flooding it also prolongs the life of the pavement.

Major Infrastructure Improvements:

Analysis was performed to identify improvements that may aid in the reduction of flooding by improving hydraulic characteristics in the Northeast Section of the study area. Improving the flow characteristics in this section will also help improve conditions downstream.

East Channel

A flow improvement was modeled for the East Channel which flows southwesterly from the five street traffic circle in the Hillandale/Beechwood neighborhood. Improvement of this channel without any other improvements will not substantially increase the peak rate of runoff downstream of the channel. This is due to the fact that the stormwater runoff currently overbanks the channel and creates a floodway. The model indicates a 12 foot wide by 4 foot deep U-shape channel with a full bank capacity exceeding 300 CFS would convey all studied storm events. This channel would considerably improve the hydraulics for all the discharges to it and eliminate the overbank situation that currently occurs even in some of the minor storm events.

Proposed Detention Basin - 1

The addition of a detention basin located north of the Main Channel , generally west of the Edgewood Drive cul-de-sac, was placed in the model. *[See accompanying map.]* HydroCad® graphically denotes detention basins as triangles. This basin denoted as "PDB -1" would be placed in an approximately

one to one and one-half acre footprint. It would be designed to attenuate the peak rate of runoff from the ML-W and ML-E watersheds and release a lesser flow over a period of time. This detention basin would require a dam permit from the New York State Department of Environmental Conservation (NYSDEC) due to the volume of runoff that would be detained. The dam design would meet all the requirements set forth under the state guidelines. The implementation of a detention basin in this upstream location reduces the peak rate of runoff at DP 2 for the 100, 25 and 2-year storm frequencies by 19.3% to 21.9%. It reduces the peak rate of runoff at DP 3 by 17.7% to 18.5%. The reduction in the peak rate of runoff at DP 2 allows flows from DP 1 and the East Channel to be conveyed with reduced downstream effects. *[A summary chart follows this analysis.]*

The model analysis for both the East Channel improvement and the Detention Basin are included in the calculations labeled *"With Proposed Basin PDB – 1"*, located after the *"Existing Conditions"*.

Loch Lane Drain Line Bypass

A drainage bypass was analyzed carrying flow from the storm drain from Little Kings Lane along King Street to Loch Lane, then west along Loch Lane to DP1. This bypass would remove the flow currently discharging from the culvert located adjacent to King Street, from the drain line located in the rear properties of the houses on Loch Lane. As noted in the *Discussion* section above, the capacity of that drainage system is exceed during a 25 and 100 year storm event. The 30-inch King Street drain line conveys the flow from BBHS and LKN thru the Phillips' pond.

The bypass drain line would consist of approximately 1500 linear feet of 36-inch drain pipe commencing at DP1 running east / northeast along Loch Lane, then north along King Street to the headwall of the aforementioned 30-inch King Street pipe. Small existing drain lines located along the path of this bypass line could be redirected into this pipe thereby providing relief to the existing rear yard drainage system. Removing the BBHS and LKN runoff from the existing Loch Lane drainage system removes approximately 31 CFS from the system during a 100 year storm and would allow the existing drainage system to handle the 25 year storm event. It also reduces the overall tributary area of the Phillips' pond.

The installation of this improvement is incumbent on completing the East Channel improvement and the detention basin described above. The detention basin eliminates any increase in the peak rate of runoff that occurs at DP 2 and DP 3 once this bypass drain line is installed. The implementation of the Loch Lane Bypass with the Proposed Detention Basin 1 reduces the peak rate of runoff at DP 2 for the 100, 25 and 2-year storm frequencies by 14.0% to 24.4%. It reduces the peak rate of runoff at DP 3 by 13.7% to 19.7%. These reductions are less than those proposed with just the detention basin, but are still substantially less than existing conditions. *[A summary chart follows this analysis.]*

The model analysis for both the East Channel improvement and the Detention Basin are included in the calculations labeled *"With Proposed Basin PDB – 1 and 36 Inch Drain Line – Loch Lane Bypass"*.

Proposed Detention Basin - 2

Although not contained in the drainage calculations, it is recommended that a second detention basin be installed in the BBHS sub-watershed area. *[See accompanying map.]* This basin will serve to control runoff from the area formally used as the "leaf dump" and a portion of the Blind Brook High School property. Any future improvement or change of use in this area will result in an increase in the peak rate of runoff. Attenuating the peak rate of runoff to a rate less than existing will serve to improve the stream water levels in the LKN sub-watershed.

Summary - Peak Rate of Runoff

DESIGN POINT 1

Storm Frequency (Years)	Existing Condition (CFS)	With Proposed Detention Basin (CFS)	Change +/- (%)	With Proposed Detention Basin & 36" Bypass (CFS)	Change +/- (%)
100	201.22	201.22	0.0%	223.28	11.0%
25	159.03	159.03	0.0%	180.68	13.6%
2	67.31	67.31	0.0%	64.99	-3.4%

DESIGN POINT 2

Storm Frequency (Years)	Existing Condition (CFS)	With Proposed Detention Basin (CFS)	Change +/- (%)	With Proposed Detention Basin & 36" Bypass (CFS)	Change +/- (%)
100	451.72	364.33	-19.3%	388.36	-14.0%
25	330.69	266.16	-19.5%	283.23	-14.4%
2	126.01	98.40	-21.9%	95.26	-24.4%

DESIGN POINT 3

Storm Frequency (Years)	Existing Condition (CFS)	With Proposed Detention Basin (CFS)	Change +/- (%)	With Proposed Detention Basin & 36" Bypass (CFS)	Change +/- (%)
100	573.85	472.49	-17.7%	495.22	-13.7%
25	416.9	351.56	-15.7%	370.75	-11.1%
2	158.12	128.92	-18.5%	126.98	-19.7%

South / Southwest Section

Discussion of Analysis:

The hydrographs for the peak rates of runoff at DP 3 were imported into the computer model for this portion of the study. DP 3 of the Northeast Section model is located at the inlet entrance of the Acker Drive culverts, the beginning reach of this portion of the study. The imported hydrographs, denoted as *"LINKS"*, include the results of the 100, 25 and 2-year storm events. The assumption was made that inlet conditions (i.e. entrances to culverts and drain lines) are clear and free of obstruction since routine maintenance can establish that condition. All channels and streams however were modeled considering *existing* conditions.

Main Channel

Although one overall DP is included in this portion of the watershed, the four following critical culvert crossing locations were analyzed independently: The Acker Drive culverts, the Betsy Brown Road culverts, the Argyle Road culverts and the Ridge Boulevard culvert. The first three locations actually have a series of culverts installed at varying times in an attempt to improve flow conditions. The Ridge Boulevard culvert is a single conveyance.

Each configuration is detailed as follows:

- Acker Drive culvert configuration consists of twin – 66 inch diameter corrugated metal pipe (CMP) culverts with a reverse slope. Reverse slopes result when a pipe's upstream inlet is lower than its downstream outlet. The undesirable result is reduced flow capacity of the pipes.

- Betsy Brown Road culvert configuration consists of twin - 48 inch diameter CMP culverts, one with a minimal slope and the other with a reverse slope. The third conveyance is a 2.5 foot X 3.0 foot concrete box culvert with a minimal slope. The upstream inlet elevations of these three conveyances range within six inches of each other.

- Argyle Road culverts consist of one – 4 foot X 4 foot concrete box culvert at minimal slope, and two – 48 inch diameter CMP pipes, also at minimal slope.

- Ridge Boulevard culvert consists of one – 66 inch diameter concrete culvert.

In this model each of the first three culvert crossings were modeled as a "Pond". The purpose of this was to allow a "routing" of the stormwater flow through the pipes at each crossing, producing a corresponding upstream ponding water surface elevation for the various storm events.

It must be noted that the base data input for this pond modeling relied solely on existing topographical information for volume calculations. A complete and comprehensive topographical and route survey will need to be performed for further examination of possible mitigation at these crossing should it be required.

Western Subarea

The western portion of this portion of the watershed includes the Berkley Drive, BB-W and BB-E watersheds. These three watersheds are tributary to the storm drainage piping in North Ridge Street. This system discharges into the main channel in the vicinity of the intersection of Ridge Boulevard and North Ridge Street. Extensive field reconnaissance was performed along North Ridge Street to determine existing flow characteristics of surface stormwater flow and the subsurface conveyance systems. Records and plans of historical and current vintage, obtained from the Westchester County Department of Public Works and the Village of Rye Brook were used to document existing conditions.

Downstream Subarea

The remainder of the area includes the five most southern watersheds; HF-N, HF-S, RB-S, Neuton Avenue and Renhyl Avenue. HF-N and HF-S encompass the Hidden Fall complex, and the areas north and northwest of the complex. A fairly comprehensive storm water system exists within the complex conveying runoff to the pond located on the site. The rate of release of the stormwater runoff from this pond is controlled by a weir in the dam located at the southern end of the pond. The other three watersheds encompass residential neighbors served by a stormwater drainage system.

The model Design Point (DP 4) as discussed previously is the entry point into the pond. Although routing through the pond was not part of the scope of this project, data from these six watersheds was input for the purpose of identifying tributary areas to the pond and determining an estimate of the overall peak rates of runoff entering the pond. Additionally, this data set can be utilized should the scope of any future drainage analysis be extended downstream of the Hidden Falls pond.

Findings – South / Southwest Section

Maintenance

A situation exists similar to that which exists in the Northeast Section. Again, field reconnaissance revealed catch basins, drain pipes and major culverts and waterways in need of maintenance. A program to facilitate the removal of sediment and debris from catch basins, drain lines and waterways is warranted. The encroachment of landscaping debris into the main channel behind private homes needs to be addressed in a short-term scenario, with an ultimate solution to improve the channel hydraulics.

The Westchester County owned drain line in North Ridge Road should be completely inspected for accumulated sediment and debris. Issues related to sediment laden runoff from the Blind Brook Estates project during and after construction warrants this investigation.

Major Infrastructure Improvements:

Main Channel

As noted previously, the analysis included modeling of the 100, 25 and 2 year storm events. However, given the overall constraints of existing infrastructure and the limitations on design solutions imposed by the unavailability of open space in the South / Southwest Section, solutions may only be possible for the 25 and 2 year storm events.

The Acker Drive, Betsy Brown Road and Argyle Drive culverts and the channels between them do not exhibit overall good flow characteristics. The relatively flat slope throughout the entire run of this main channel, coupled with reverse pipe slopes and constricted channels, result in flooding along the rear yards. Some of these culvert crossings and the area upstream of them, actually act as mini detention basins, reducing the peak rate of flow tributary to the inlet of the Ridge Boulevard culvert.

For example, the peak rate of runoff tributary to the inlet of the Acker Drive culverts during a 25-year storm event is approximately 409 cubic feet per second (cfs). The 303 cfs capacity of the culverts at that crossing result in the "back up" or detaining of stormwater runoff upstream of Acker Drive. Flow is therefore released over a period of time at a peak rate of approximately 303 cfs. This scenario is repeated, although with a negligible reduction in the peak rate of runoff, at Betsy Brown Road culverts from 303 cfs to 294 cfs.

Increasing the size of the Acker Drive culverts and correcting poor hydraulic characteristics would serve to eliminate or reduce the "back up". However, it would also eliminate the attenuation of the peak rate of flow, thereby exacerbating downstream conditions at the Betsy Brown Road and Argyle Road culverts. Subsequently upgrading the flow conditions at those two downstream crossing would move the problem to the Ridge Boulevard culvert.

Currently the Ridge Boulevard culvert has the capacity to carry the 100-year storm event. This would fail to be the case with an increase in the peak rate of runoff from the upstream watersheds. At all three culvert crossings stormwater "backs up" outside the banks of the tributary channels, encumbering rear yards, flooding lower elevations, and presenting issues of health and safety.

Part of the solution to lower the flood elevations upstream of these three culvert crossings may be in the overall reduction of the peak rate of runoff entering this portion of the system from the Northeast Section. Proposed Detention Basin No. 1 has the potential to reduce the peak rate of runoff entering the Acker Drive culvert by 17.7%, 15.7% and 18.5%, respectively for the 100 year, 25 year and 2 year storm event. With the Loch Lane Bypass in place the reductions are 13.7%, 11.1% and 19.7%.

The overall reduction in the peak rate of runoff reduces the scale of any "improvement" in the lower reaches of the entire East Branch Blind Brook conveyance system. It also allows for "localized" culvert improvements that could increase culvert and channel carry capacity up to "pre" detention basin rates.

A detailed topographic and route survey from the inlet of the Ridge Boulevard culvert to the inlet of the Acker Drive culverts would be the basis for design improvements along this channel. With the reduction in the peak rates of runoff due to the development of Proposed Detention Basin No. 1, improvements could be considered for the culvert crossings of Acker Drive, Betsy Brown Road and Argyle Road and the channels in between. Improvements to these culverts could be made without exacerbating conditions at the Ridge Boulevard culvert.

With these improvements, consideration can be given to changing the flow characteristics of the main channel from Acker Drive to the Ridge Boulevard culvert. A preliminary modeling scenario indicates a concrete "U" channel with its smooth flow characteristics would increase the hydraulic efficiency and reduce the water surface elevations.

Upgrading the three major culvert crossings and construction improvements along the Main Channel will result in the increase in the peak rate of runoff tributary to the Ridge Boulevard culvert. This increase cannot be mitigated downstream due to land constraints and flow volumes. Therefore, any of these improvements must be done in conjunction with the improvements proposed in the Northeast Section portion of this study.

Western Subarea

As noted, run-off from the Western Subarea, encompassing the Berkley Drive, BB-W and the BB-E watersheds, is collected by a storm drain system in North Ridge Street. The Westchester County Department of Public Works is in the process of upgrading the roads, curbs and sidewalks, outside the limits of this study, north of the Hutchinson River Parkway. Westchester County Department of Public Works has indicated that future design work may extend south of the Parkway and within the limits of this study. The overall system conveys runoff (surface and via drain line) along North Ridge Street thereby avoiding entry into the Main Channel. The integrity of maintaining this flow characteristic is a high priority to insure that the Main Channel does not receive any additional runoff. Also, completion of the work associated with Blind Brook Estates must be performed to insure the integrity of the system as designed is maintained, and that sediment flow is excluded from entry into the County drainage system. As noted previously, this storm line should be completely inspected and cleaned of accumulated sediment and debris.

Downstream Subarea

No major improvements to overall drainage systems of these areas is deemed necessary at this time. There is *no* regional component to this subarea. Each watershed is tributary to the watercourse discharging into the Hidden Falls pond, or downstream of the pond. An assessment of individual "very localized" ponding and flooding can be performed. Improvement issues here would be the addition of catch basins, the extension of drain lines, and the maintenance of positive drainage within road beds. Removal of silt from the Hidden Falls pond and stabilizing slopes around the pond should be performed.

Conclusion and Cost Estimates:

The model developed for this watershed allows for various scenarios. Alternatives identified for the North Section portion of the study will provide mitigation for most of the flooding currently experienced in that area, while reducing peak rates of flow discharged to the South Section portion of the study area. These should prove to be cost effective. Improvements to the South Section of the study area will have to await implementation of the measures suggested for the North Section.

A budget estimate was compiled for each of the alternatives and for the remediation work discussed. We caution that a more definitive cost estimates will be developed once preliminary design plans are prepared.

Phillips' Pond -

Dredge pond of accumulated silt, rehabilitate weir. **$25,000**

Rip-rap 150 ± linear feet of channel, stabilization of 250 ± linear feet of slope at an average height of five feet, installation of debris rack. **$25,000**

East Channel Improvement-

Installation of 300 linear feet of concrete "U" channel, 12 foot wide with varying depth to meet grade. **$120,000**

Detention Basin No. 1 -

Construction of basin, outlet control, restoration and planting. **$200,000**

Loch Lane By-Pass –

Installation of 1,500 linear feet of 36" diameter smooth flow CMP including restoration of pavement and landscaped areas. **$120,000**

Detention Basin No. 2 -

Construction of basin, outlet control, restoration and planting. **$50,000**

Hidden Falls Pond-

Dredge pond of accumulated silt, rehabilitate weir. **$100,000**

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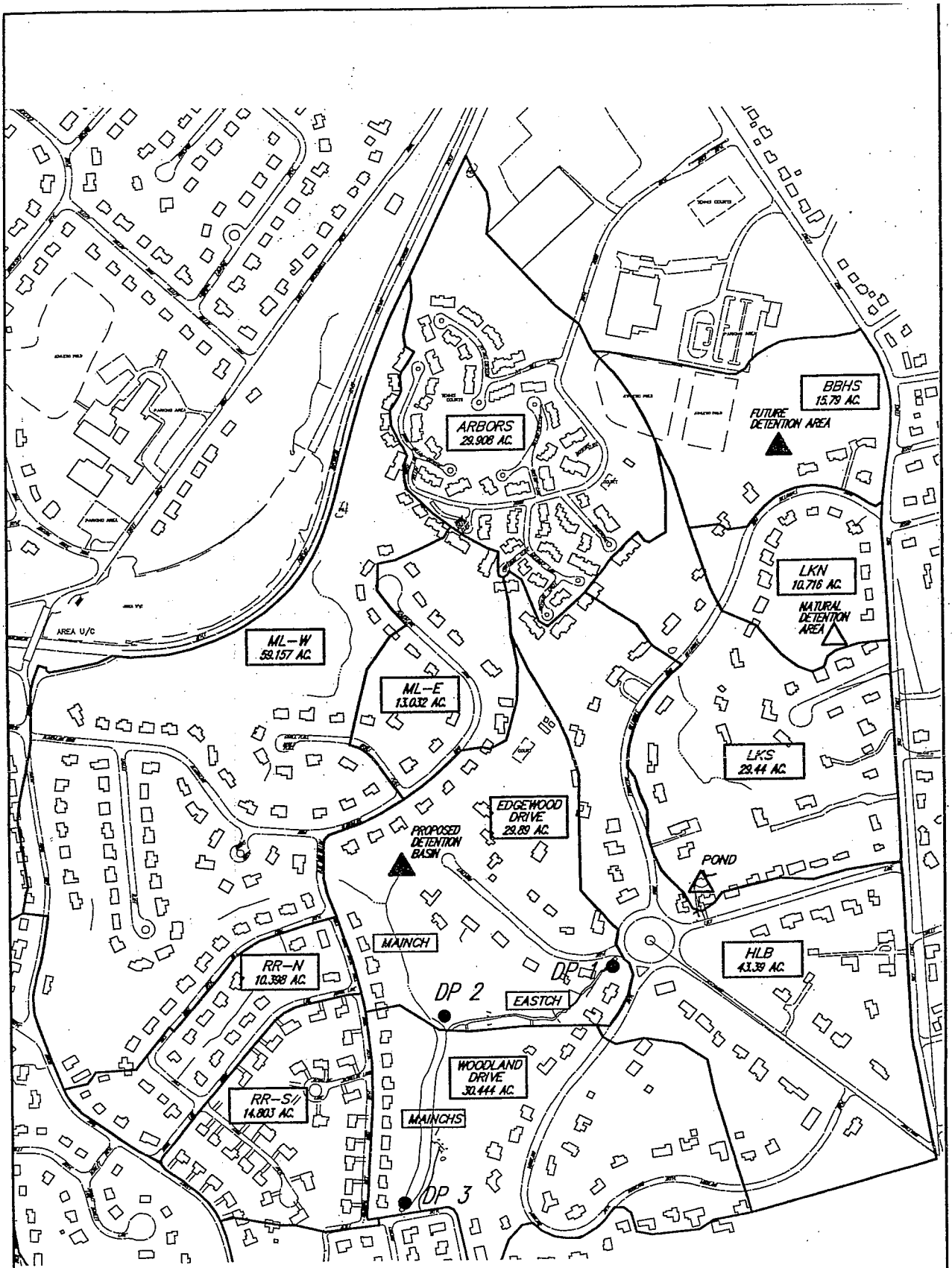

WATERSHEDS
EAST BRANCH
BLIND BROOK NORTHEAST SECTION

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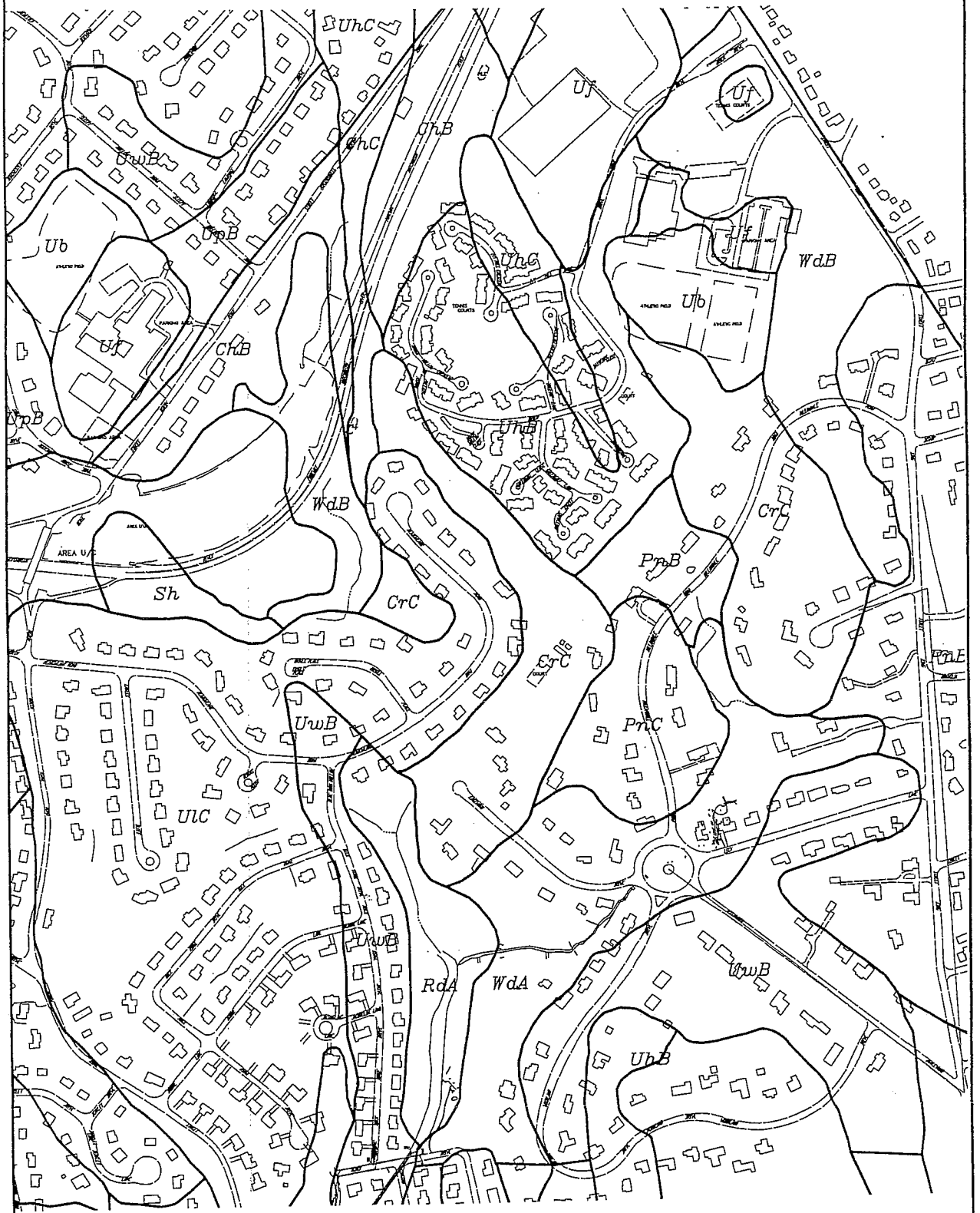
SCALE: 1" = 500'



SOILS
EAST BRANCH
BLIND BROOK NORTHEAST SECTION

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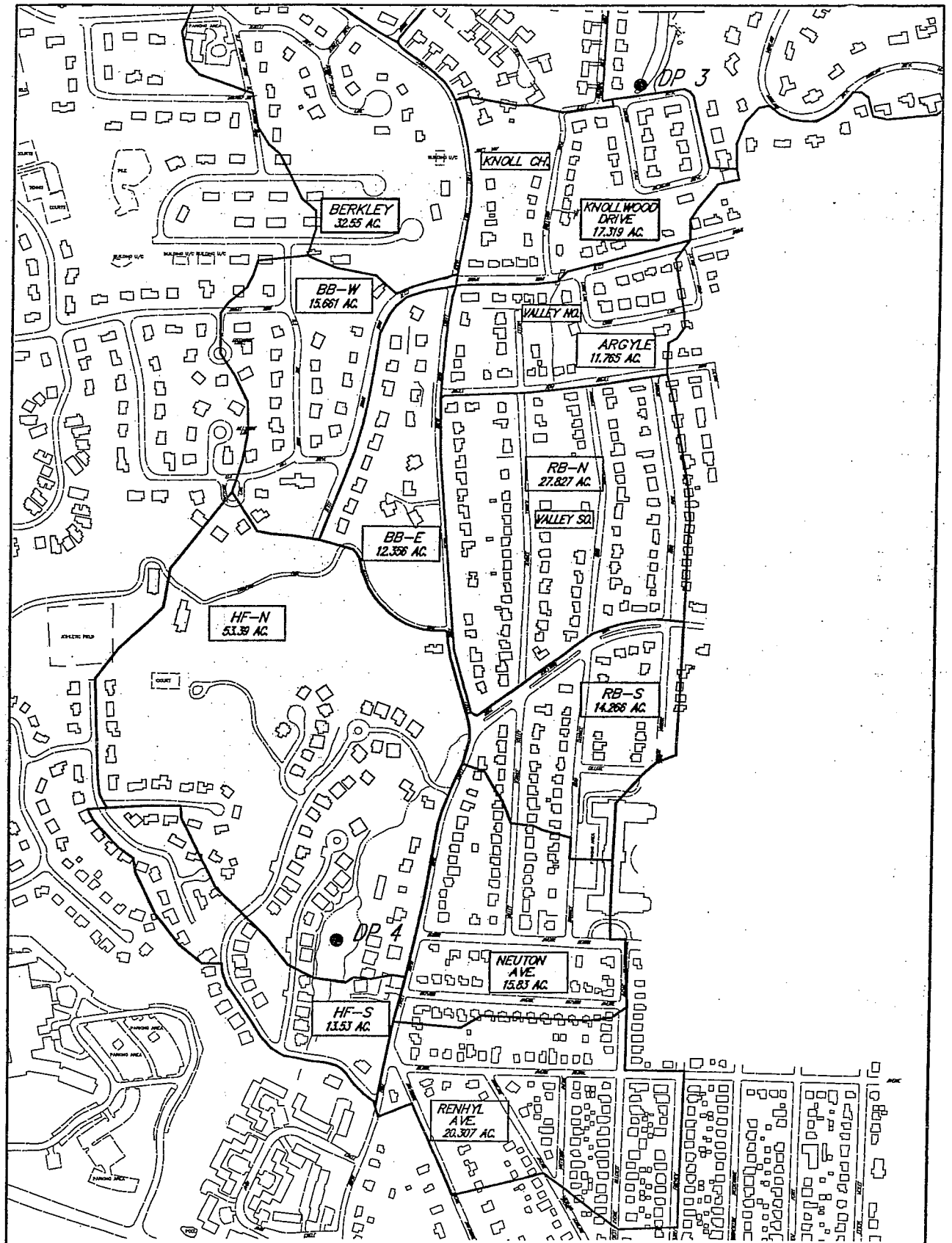
SCALE: 1" = 500'



WATERSHEDS
EAST BRANCH
BLIND BROOK SOUTH/SOUTHWEST SECTION

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200 White Plains Road, Tarrytown, NY 10591
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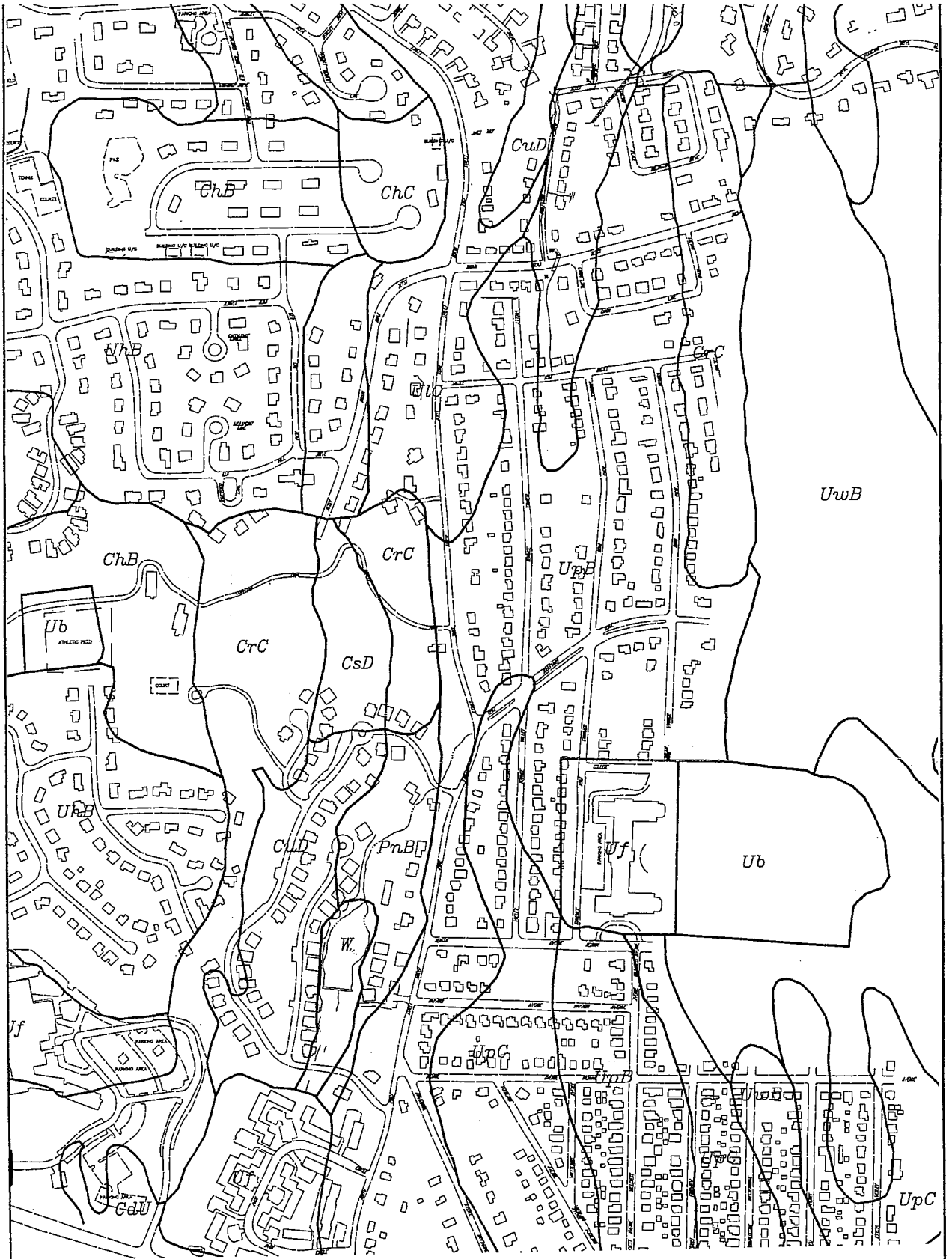
SCALE: 1" = 500'



SOILS
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BLIND BROOK SOUTH/SOUTHWEST SECTION

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