Town of Yarmouth
STORM WATER MANAGEMENT PLAN

AUGUST 1995

Beasy Nicoll Engineering Limited

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TOWN OF YARMOUTH
STORM WATER MANAGEMENT

1.0 EXECUTIVE SUMMARY

1.1 The Town of Yarmouth lies in the South West corner of the Province and is exposed to the moisture laden South West and West winds prevailing in spring through fall. These winds pass over the Gulf of Maine and the open Atlantic Ocean. In winter the prevailing wind is generally North to North West and is drier but colder.

The average annual rainfall is 1259mm (49.5 ins.). The daily rainfall (24 hrs.) can reach as high as 80mm (3¼ ins.)

There are two principal watersheds in the Town area and these run North-South approximately. They are:

- Broad Brook Watershed
- Lake Milo/Harbour Watershed

1.2 Broad Brook Watershed

.1 Upstream of Starrs Road, Broad Brook originates in the Pleasant Street - Brooklyn area and meanders down through open country (combination wooded - grassland). Immediately upstream of Starrs Road, Broad Brook has been diverted into a deep drainage ditch between the Kent Retail facility and Highway 101/Starrs Road.

.2 Starrs Road to Forest Street.

* Generally the brook runs along a flat topographical grade of approximately 0.5%.
* Fairly confined valley which provides storage in severe weather conditions.
* A number of street crossings occur.

.1 **Starrs Road.**
Roadway is on a high embankment about 3 metres (10 ft.) above stream level. A 1050mm (42") diameter culvert has been provided, together with an additional 1200mm (48") diameter culvert at a higher level. Flood backup is unlikely to affect properties in this area.

.2 **Burton Avenue.**
This is a gravel street which terminates at the cemetery boundary. Installed is a 1050mm (42") diameter culvert which is partially submerged. The street is only abut 1 metre above the stream and on either side is a flat swampy area which will flood in severe weather and flow over Burton Avenue. These flood plain areas receive the fast drainage run-off from the paved areas of the Kent and adjacent retail facilities on Starrs Road.

.3 **Parade Street.**
Between Burton and Parade the stream valley is wide on the West side and principally a swampy area, again acting as flood storage in severe weather. On the East side is the rising Cemetery land.
Road level is about 2.5 metres (8 ft.) above general ground level. Under Parade Street is an old stone built culvert, 1 metre wide and 1.5 metres (3 ft. by 5 ft.) high in poor condition. Into this culvert runs an old stone built culvert which is laid beneath Parade Street, eastwards towards the cemetery gate and which receives flow from the roadside ditches, Haley Road area and the mini industrial park.

.4 **Forest Street.**
Road level is about 3 metres (10 ft.) above the general ground level. Installed are two culverts, 1200mm (48") diameter and 900 (36") diameter. Upstream of Forest Street, the stream valley rises sharply on the East side but is flat on the West side. This provides flood storage. Downstream of Forest Street, the stream grade is steeper, about 1%, until it reaches the flat swamp area on the North side of South East Street, (downhill of the new Ball fields).

.3 Forest Street down to Wymans Road.

* Generally very flat topographical grade of approximately 0.2%.
  Wide shallow valley which provides flood plain storage.

* Various street crossings, fitted with culverts, which divide the flood plain into a number of storage reservoirs, such as

.1 **South East Street.**
Road grade is only about 1 metre (3 ft.) above general ground level. Installed are 2 culverts 1200 x 1050mm (48" and 36") diameter, both partially submerged. Road overflow occurs in severe rainstorm on saturated ground and spring run-off. (Rainstorm 1 in 2 years)

.2 **Argyle Street.**
Road grade is approximately 1.2 metres (4 ft.) above ground level. Installed with box culvert 1800mm wide and 1200mm high (6 ft. x 4 ft.).

.3 **Old CNR Track Bed.**
High embankment but culvert top has been removed, eliminating this restriction.

.4 **Regent Street.**
General road grade is only about 0.6 metres (2 ft.) above ground level - a swampy area. Installed with box culvert, 3300mm wide and 1200mm high (11 ft. x 4 ft.) and partially submerged. Regent Street is a gravel road in this area - outside Town limits. Road overflows in heavy rainstorm on saturated ground, (1 in 2 years). This culvert and adjacent swamp areas are outside Town limits.

.4 <u>Solution</u>

The problem of flooding of Broad Brook in severe weather cannot be eliminated without an extensive and expensive infrastructure project of dredging and deepening the channel, starting downstream beyond Wymans Road. A better solution is to accept the present natural state and use the flood plain as natural storage for flood water. As development proceeds in the area, development controls can prevent construction within the flood plain, and storm water controls can be incorporated in other areas to minimize the faster run-off impact.

At present the only improvements seen to be needed are:

.1 Replace culvert under Parade Street.
.2 Provide additional culvert under Forest Street.
.3 Replace and provide additional culverts under South East Street.
.4 Provide additional culvert under Argyle Street.

.5 <u>Flood Plain</u>

The most critical flood plain is the area lying between Forest Street in the North and the old CNR track bed to the South. The predicted flood levels for a 1 in 100 year storm indicates the 16.0 metre elevation while a 1 in 5 year storm will cause water to rise to about 15.5 metres. As a result the flood plain level should be set at 16.0 metre elevation and development control instituted to prevent construction in the area below this level.

In the section upstream from Forest Street towards Starrs road, flood plain levels should be set as follows:

- Forest to Parade - 21.0 metre elevation
- Parade to Starrs - 23.0 metre elevation

1.3 <u>Havelock Drive Subdivision</u>

This subdivision off Argyle Street is within the Broad Brood watershed. Unfortunately the lower end (West end) of Havelock Drive is adjacent to the flood plain of Broad Brook. The main floor elevations of the houses in this area, <u>except for two</u>, appear to be above the predicted flood levels, but their basements are not. Consequently there is a high risk of basement flooding.

Drainage in this subdivision is provided by roadside ditches and culverts. In Argyle Street there is a larger 750mm (30") diameter storm water drain. Unfortunately this pipe will back up during flood conditions in Broad Brook. Outflow ditches have been dug from the lowest corners of Havelock Drive and Belmont Crescent out towards the flood plain. Belmont Crescent is at a much higher elevation with no risk of flooding from Broad Brook.

There is no straight forward solution to the problem of the homes in the low level area. The focus of a solution should be towards minimizing the risk of flooding.

The possibilities are:

.1 Eliminate roadside ditch along the low section of Havelock Drive by installing a branch line from the 750mm (30") diameter line in Argyle Street and providing catchbasins. This, together with curb and gutter, would intercept overland flow down the hill towards these properties.

.2 Provide an additional relief point to the 750mm (30") diameter drain on Argyle Street in the flood plain area.

.3 Construct a low rise berm (levee) about 1 metre high, behind the risk prone properties to contain the flood plain and isolate them from the rising water level.

.4 Restrict future building in this area.

1.4 Milo Estates

This is a new development area lying between Prospect and Hibernia Streets. Main drainage is by a small stream which starts on high ground in the Pleasant Street area, runs down behind properties on the North side of Hibernia to discharge into Lake Milo. As subdivision development progresses in Milo Estates, the rate of run-off from streets and roofs increases and causes higher storm flow in the stream. This development along Herrington Street is a major influence. A planned school development at Hibernia/Pleasant will also have a major impact if controls are not instituted.

The old culverts 600mm x 900mm (24" x 36") diameter under Main Street out to Lake Milo require replacement, and the stone culvert (36" x 36") under the old DAR track bed. Deep water is occurring at the 1050mm (42") diameter culvert under Brunswick Street extension and water backup at the DAR track culvert.

The principal solution in this watershed is to create a holding pond on the high ground near Pleasant, and replace culverts under Main Street and DAR track bed by a new outfall pipe from Lake Milo up to Brunswick Street.

1.5 Vaughne Estates

There is no natural stream in this area as drainage was overland to Lake Milo. Subdivision development has produced faster run-off and street and roadside ditch layout has resulted in a circuitous path for drainage flow. In addition the Vocational School with its adjacent facilities and major parking lots produces a fast run-off which now affects Sprucewood Drive.

Installed is a main 750mm (30") diameter outfall under Main Street and the Lakeside Park into Lake Milo. Into this runs a storm drain from Hibernia Street (in turn Sprucewood), and from the ditches in Vaughne Estates. The latter is collected along a ditch (flat grade) beside the old DAR track bed and down through a new 750mm (30") diameter culvert installed between Main Street and the DAR track bed (through Church property).

Also, flow down Chestnut turns sharply along Brunswick Street and contributes to the volume of storm water in Vaughne Estates. Backup occurs in the ditch at the turn (Chestnut/Brunswick) with the low grade along Brunswick.

Small size culverts 400mm (16") diameter) in Vaughne Estates create backup (storage) in the roadside ditches. This results in deep water situations.

The principal solution is to extend the 750mm (30") diameter culvert up the old DAR track bed to Brunswick (collect storm water on Brunswick), then on up to Sprucewood to collect Vocational School drainage and upper areas of Sprucewood.

A branch pipe should be run along Brunswick (Chestnut to Vaughne Court) to convey storm water from Chestnut and future development East (uphill) of Brunswick.

The outfall culvert under Main Street and the Lakeside Park will require replacement.

1.6 Herbert Street - Marsha Avenue

The land in the area of Marsha Avenue (between Brunswick and Pleasant) is flat and swampy in wet weather. It drains across Starrs Road towards Herbert Street and eventually downhill to the waterfront at Vancouver Street.

Back in the 1970's, a 900mm (36") diameter storm sewer was installed up Gardner, the lower section of Herbert Street and along Huntington to the low point (original stream bed location). A drainage ditch passes behind and between properties over to Herbert Street (Motor Mart area). A branch 600mm (24") diameter pipe runs between Motor Mart and Canadian Tire properties over to Starrs Road. Another 450mm (18") diameter storm drain runs along Carol Avenue and then a 375mm (15") diameter has been constructed to Lynette Crescent and Marsha Avenue. The depth of this branch is insufficient to properly drain the Marsha Avenue area.

The drainage ditch between Huntington and Herbert lacks capacity and is subject to flooding - drainage comes from the large paved areas of Zellers Mall (West half), Canadian Tire, Motor Mart and the retail and services areas along Starrs Road (Pleasant to Marsha).

The solution in this watershed is to:

.1 Extend the 900mm (36") diameter storm pipe up Herbert to the low point (existing ditch and culvert intersection),

.2 Replace the storm pipe across to Starrs Road at Motor Mart with a larger 750mm (30") diameter pipe and thence onwards to the Marsha Avenue area at a deeper depth (3 metres).

.3 Extend a branch pipe up Herbert to Pleasant Street to pick up the Zellers Parking Lot and other areas.

.4 Reconnect sanitary connections from the existing storm drain, to the sanitary sewer, thus allowing the storm drain to be disconnected from the trunk sanitary sewer on Water Street and be discharged direct to the harbour. This will reduce the storm water load on the pumping stations and the sewage treatment plant.

1.7 **Starrs Road (Zellers Parking Lot)**

The east section of the large paved parking lot around the major Zellers/Sobeys Mall drains to a 600mm (24") diameter storm drain, installed across Starrs Road and for a short distance (150 metres approximately) along the Clements Avenue Right of Way. This pipe discharges into the flat scrub undeveloped land south of Starrs Road between Clements Right of Way and Pleasant. This contributes to the continued wetness of that area and in time finds its way across Pleasant Street in to the Marsha Avenue area (section 1.3).

This solution is to extend this storm drain along the Clements Avenue Right of Way and along the James Street Right of Way to discharge into the Broad Brook Valley. This would eliminate the discharge into the undeveloped area, and also provides a drainage opportunity for that area.

1.8 **Parade Street (East of Broad Brook)**

The old storm sewer which runs eastwards from the Broad Brook culvert requires to be replaced. The new storm drain will have adequate capacity to drain the natural stream run (beside the new seniors home), the roadside ditches and future development adjacent to Parade Street and the new industrial park above Haley Road. To remove the storm water impact of the industrial park on the roadside ditches and culverts, the new storm sewer should be extended up as far as Haley Road.

1.9 **James Street Extension**

As mentioned in Section 1.6 above, the flat swampy area East of Pleasant (Fire Hall/Works Dept. to Starrs Road), drains poorly. This area can be provided with better drainage by construction of a storm water drain, connecting into the extension proposed in 1.6 above. This can be run back as far as Pleasant Street to drain the roadside ditches (and future curb and gutter with catchbasins).

2.0 TOWN AREA

2.1 The Town of Yarmouth contains two principal watershed areas within its limits, as shown on the area Map No. SW1. The ridge which forms the boundary between the two, runs roughly south-north on an alignment following approximately Pleasant Street.

West of the ridge, natural drainage is into the harbour estuary with the land in the north end of Town above Chestnut Street into Lake Milo, which in turn flows into the harbour at Vancouver Street.

East of this ridge, there is a shallow valley in which runs Broad Brook, and further eastward is another ridge roughly east of Haley Road (towards the Airport and across Hardscratch Road). This ridge is approximately on the Town's eastern boundary.

The area within the town limits covers about 930 hectares (2300 acres) and of this the Broad Brook watershed occupies approximately 505 hectares (1248 acres), just over half.

2.2 The topography of the Town undulates in the East-West direction. It rises fairly rapidly from the harbour, average slope 12% up to Main Street, then plateaus towards the ridge east of Pleasant Street. In the north end where Main Street runs alongside Lake Milo, the general rise runs up at an average slope of about 5% to the watershed at Pleasant Street.

Over the ridge along Pleasant Street, there is a shallow slope eastwards down to the Broad Brook, and continuing eastwards there is a steady rise up to the ridge in the Haley Road area - at the eastern town limits.

2.3 The downtown area - the original old Town of Yarmouth - is densely built up and the drainage system installed caters for both sanitary waste and storm water flows. These sewers discharged into the harbour up until the 1989-92 period when the pollution control program was implemented. A main trunk sewer was installed along Water Street, into which flows are intercepted and conveyed to the sewage treatment plant at the south end of Town. Currently, storm flows in excess of four times the dry weather daily flow (sanitary plus infiltration water) overflow directly to the harbour, through 5 storm water outfalls.

2.4 The newer areas of Town have roadside ditches and culverts for storm water and, where practical, make use of the existing natural watercourses, and Broad Brook itself.

2.5 The general topography in a north-south direction is relatively flat through the town. This is because the ridges and watersheds run north-south with the main undulation in an east-west direction as classified above.

In the Broad Brook valley, which runs north-south, the topography flows gently downhill from north-south, from the high ground at Brooklyn to its outlet on the shoreline at Kelleys Cove south of the Town. The gradient of Broad Brook is shallow at about 0.5% from its source down to the Forest Street area. Between Starrs Road and Forest Street, the watershed has a very flat area adjacent to the stream and this results in flood water retention in very wet weather. This section is swampy and wet. Once the stream passes Forest Street its grade is even shallower at about 0.2%. This results in a larger flood plain situation in the southern section of the Town area, particularly between Forest Street and Regent Street (outside the southern town limits). This impact is discussed in a later section.

3.0 RAINFALL

3.1 The Town of Yarmouth lies at southwestern extremity of the Province and as a result is exposed to the moisture laden south west winds from the Grand Banks and westerly from over the Gulf of Maine. Storm fronts moving up the Atlantic Eastern Seaboard tend to impact on the area. In wintertime the prevailing winds tend to be drier and colder from the North West. However, a wind direction change can occur in winter to the milder South West and as a result rainfall can occur on frozen snow covered ground - commonly referred to as a "January Thaw".

3.2 Rainfall records are compiled by Environment Canada at two local stations - Yarmouth Airport and Dayton - the former lies at the eastern town boundary, the latter is just north of the Town area. Rainfall intensity curves, (intensity against time) with annual probabilities have been complied for the Airport location.

3.3 The average annual rainfall is recorded at 1259mm (49.5") and in a 24 hour period normally can reach as high as 80mm (3¼"). As an example, the summary sheet for 1994 monthly rainfall is given on Fig. 3.1. However, a severe storm in 1953 produced 96mm in 24 hours, while another in 1959 produced 172.5mm (6¾").

3.4 Rainfall intensity is the predominant factor in storm water management. Related to this is also the state of the ground. A heavy downpour on relatively dry open ground will have minimal effect, but the same rain on saturated ground will have a much greater impact, as there is no ground absorption capability.

Similarly, in wintertime, heavy rain on frozen ground, which also has no absorbing capability, will create more severe conditions, particularly when combined with melting snow.

In addition, run-off from paved areas, streets, etc., and roofs is almost 100% due to their impervious nature and this is independent of the season.

Short, sharp, intense downpours of rain create significant impact on small areas such as subdivisions, and shopping mall parking lots, etc. On large areas, such as the Broad Brook watershed, a steady rain over a larger period of time (24 hrs) is more significant, particularly if it is followed by heavy rainfall. Conversely, a heavy rainfall on dry ground will have negligible impact on the Brook.

YARMOUTH RAINFALL INTENSITIES:

based on Environment Canada Statistics for Yarmouth Airport

A) Intensity Curve Data:

1. Metric - mm/hr once in:

Duration:	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5 mins	71.7	88.8	100.2	114.6	125.2	135.8
10 mins	58.6	75.7	87.0	101.2	112.0	122.5
15 mins	50.3	67.6	79.0	93.5	104.3	114.9
30 mins	36.6	47.6	54.8	64.0	70.8	77.5
1 hr	24.4	32.2	37.3	43.9	48.7	53.5
2 hr	15.2	19.8	22.8	26.7	29.5	32.4
6 hr	8.0	9.8	10.9	12.4	13.5	14.6
12 hr	5.0	5.8	6.3	7.0	7.5	8.0
24 hr	2.8	3.3	3.6	4.0	4.3	4.6

2. Imperial - ins/hr once in:

Duration:	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5 mins	2.8	3.5	3.9	4.5	4.9	5.3
10 mins	2.3	3.0	3.4	4.0	4.4	4.8
15 mins	2.0	2.7	3.1	3.7	4.1	4.5
30 mins	1.4	1.9	2.2	2.5	2.8	3.1
1 hr	1.0	1.3	1.5	1.7	1.9	2.1
2 hr	0.6	0.8	0.9	1.1	1.2	1.3
6 hr	0.3	0.4	0.4	0.5	0.5	0.6
12 hr	0.2	0.2	0.2	0.3	0.3	0.3
24 hr	0.1	0.1	0.1	0.2	0.2	0.2

B) Maximum Recorded Intesities:

mms of rain

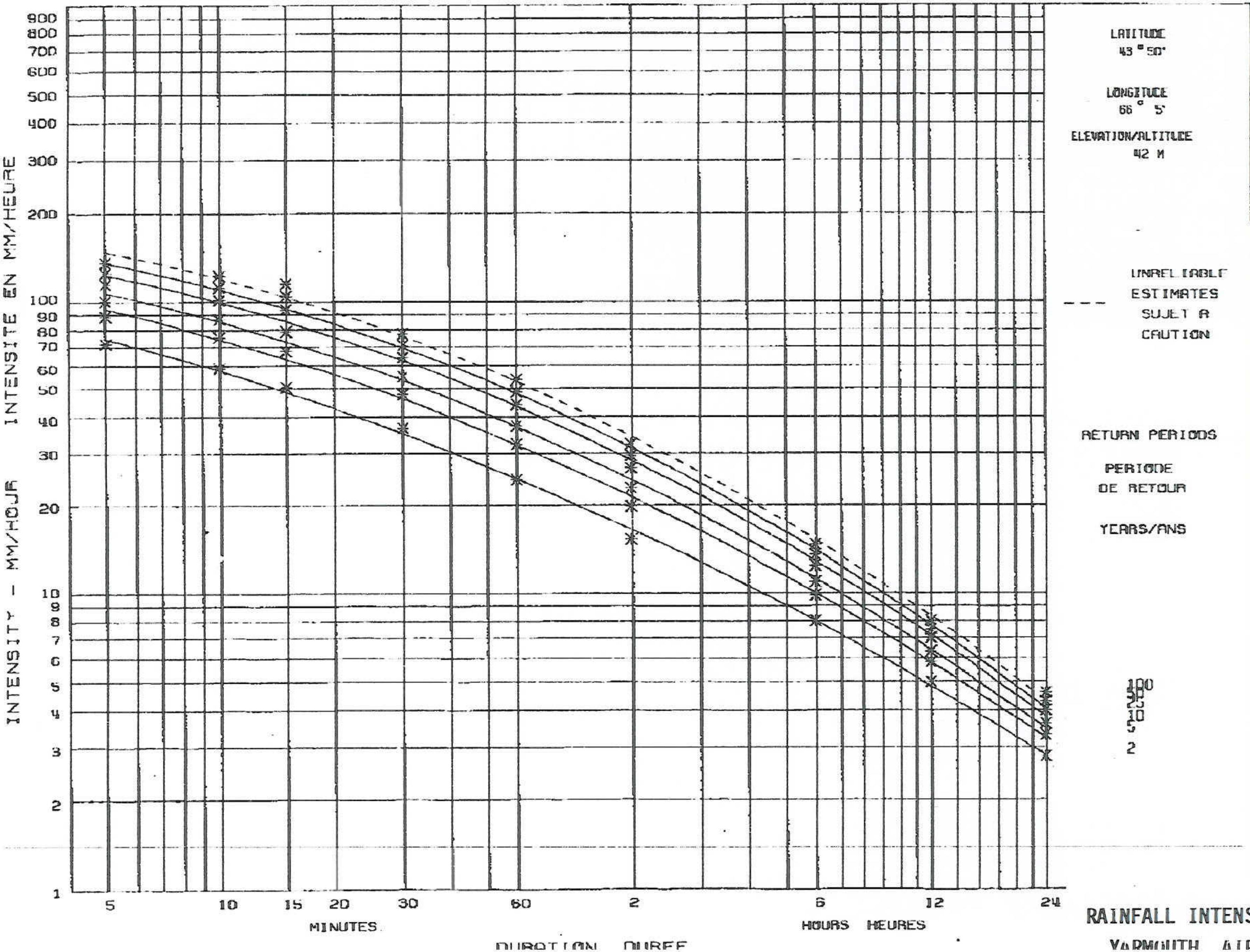
Month	Duration: 5 mins	10 mins	15 mins	30 mins	60 mins	24 hrs *	* year of occurenc
Jan	4.4	6.6	9.4	10.7	13.0	71.1	1880
Feb	3.7	6.3	6.8	8.2	13.4	61.4	1979
March	2.2	4.0	5.2	7.7	10.9	96.0	1953
April	5.3	6.6	8.6	11.7	16.0	72.4	1973
May	5.4	10.1	11.5	14.2	17.0	78.7	1976
June	10.4	19.1	26.2	28.2	28.2	80.8	1903
July	7.0	12.5	16.8	22.9	38.4	92.5	1967
August	8.1	13.5	18.1	22.4	25.9	114.3	1927
Sept	7.4	14.7	22.1	35.7	52.6	103.8	1987
Oct	6.1	9.1	11.9	20.3	34.0	172.5	1959
Nov	6.8	11.5	12.4	16.9	20.7	111.3	1950
Dec	4.6	6.9	10.2	17.0	19.8	110.7	1967

FIGURE 3.1

SHORT DURATION RAINFALL INTENSITY-DURATION FREQUENCY DATA FOR-
DONNEES SUR L'INTENSITE, LA DUREE ET LA FREQUENCE DES CHUTES DE PLUIE DE COURTE DUREE A YARMOUTH AIRPORT NS

GUMBEL-METHOD OF MOMENTS
METHODE DES MOMENTS

BASED ON RECORDING RAIN GAUGE DATA FOR THE PERIOD-
BASEES SUR LES DONNEES DU PLUVIOGRAPHES POUR LA PERIOD 1971 - 1990 20 YEARS/AN



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SERVICE DE L'ENVIRONNEMENT ATMOSPHERIQUE - ENVIRONNEMENT CANADA

RAINFALL INTENSITY CURVES
YARMOUTH AIRPORT

4.0 WATERSHED ASSESSMENTS

4.1 Watershed Areas (Dwg. No. SW1)

.1 As described previously, the Town area has two principal watersheds - Harbour/Lake Milo and Broad Brook.

For the purpose of watershed assessment, the harbour/Lake Milo area was subdivided into 10 smaller watersheds, each delineated by the outfall of the main existing sewer and drainage ditch systems. These areas are shown on the plan No. SW1.

.2 For the downtown area, namely areas 4-9 inclusive, storm drainage is achieved through the combined pipe system. Since the founding of the Town 100 years ago, and even longer since the first organized settlement, the drainage system has grown with the Town. During that time and up until about 30 years ago, only one drainage pipe was installed to carry both sanitary waste and storm run-off. The old sewers comprised both stone built, clay, and concrete pipes which at one time discharged direct to the harbour. These pipes are operating satisfactorily and appropriate repairs are made as needed. To replace this system with separate pipes for both storm and sanitary flows would be extremely expensive and cannot be cost justified. An ongoing phased program could be implemented if and when major street reconstruction is carried out.

Except in short, heavy downpours which create flash flooding, there are no major problems in these areas. Consequently, Storm water assessment for these areas has not been carried out, leaving this study to focus on other areas which do have identifiable problems. Similarly, area 10, which is the Vancouver Street area, storm run-off drains directly into the harbour and Lake Milo.

4.2 Simulation Modelling

Computer simulation is a numeric modelling tool, which is used to assess and predict storm flows in watersheds, and existing storm drainage systems. In this study, modelling was carried out with the use of a commercial software program,

- Eagle Point Hydraulic and Hydrology modules - which simulate and produce storm water impacts for various rainfall intensities, such as:
  - . watershed run-off flow
  - . surface water profiling - prediction of flood levels, etc.
  - . storm sewer and culvert capacity assessment.

This program which is in general use in the United States and by a number of Agencies and Consultants in Atlantic Canada, incorporates the standard procedures for storm water assessment, as developed by the U.S. Soil Conservation Service (SCS) and the U.S. Corps of Engineers: e.g.,

- Run-off Hydrograph alternatives by the Rational, SCS, and Santa Barbara methods.
- Design storms of various durations - incorporated for this study are rainfall intensity curves produced by Environment Canada for Yarmouth Airport.
- Water surface profiles by HEC-2, open channel and closed culvert hydraulics, critical and supercritical regions for flood levels.
- Pipe and Culvert flows for storm water by HEC-12, energy balance, partial, full or surcharged methods.
- Channel routing by Muskingum, Modified Att-Ku and Converse methods.

Various watershed analysis output summaries and charts are contained in Appendix A.

4.3 Broad Brook Watershed (Area 11 - Dwg. No. SW2)

.1 This is the largest drainage basin within the Town area (505 hectares - 1248 acres) and the only one which does not discharge directly to salt water until it is well outside the town limits. The watershed starts on high ground at Brooklyn, just outside the Town's southern boundary on Pleasant Street and runs southwards through the eastern half of the Town area and eventually discharges into salt water at Kelly Cove south of Sandbeach, about 2½km from the Town limits.

For this study, assessment was carried out as far downstream as the culvert under Wymans Road - about 1½km. south of the Town limits. This is the downstream limit of the flood plains which affect the Town. The predicted flows at various street crossings and for various 24 hr. storms are listed on Table 4.1.

The watershed is divided into a number of distinct sections - ref. Dwg. No. SW2.

.2 Brooklyn to Starrs Road

This area is generally a mix of open pasture land and heavily wooded. The stream itself starts in a pond east of the Pleasant/Prospect Street intersection and meanders down for about a kilometre until it reaches the commercial development on Starrs Road. At this point, it has been diverted into a deep (3 metres) drainage ditch alongside Highway 101 by the construction of commercial development.

BROAD BROOK WATERSHED

- ESTIMATED FLOOD DISCHARGES - 24 Hr PERIOD.

1. Imperial - cu. ft. per second

LOCATION	STORM RETURNS: 2 YEAR	5 YEAR	10 YEAR	100 YEAR	CULVERT CAPACITY	STATUS
Starrs Rd.	115	138	154	206	550	O K
Burton Ave	99	126	147	218	86	Floods 1/ 2
Parade St.	147	185	212	299	183	Floods 1/10
Forest St	181	231	265	376	267	Floods 1/100
South East St.	265	338	388	551	143	Floods 1/ 2
Argyle Street	296	378	433	616	320	Floods 1/ 5
Regent Street	366	478	554	808	223	Floods 1/ 2
Wymans Rd.	358	471	551	819	711	Floods 1/100
Corresponding Rainfall: 24 hr Return						
ins	2.68	3.12	3.41	4.34		
mm	68	79	87	110		

2. Metric - cu. metres per second

LOCATION	STORM RETURNS: 2 YEAR	5 YEAR	10 YEAR	100 YEAR	CULVERT CAPACITY	STATUS
Starrs Rd.	3.3	3.9	4.4	5.8	15.6	O K
Burton Ave	2.8	3.6	4.2	6.2	2.4	Floods 1/ 2
Parade St.	4.2	5.2	6.0	8.5	5.2	Floods 1/10
Forest St	5.1	6.5	7.5	10.6	7.6	Floods 1/100
South East St.	7.5	9.6	11.0	15.6	4.0	Floods 1/ 2
Argyle Street	8.4	10.7	12.3	17.4	9.1	Floods 1/ 5
Regent Street	10.4	13.5	15.7	22.9	6.3	Floods 1/ 2
Wymans Rd.	10.1	13.3	15.6	23.2	20.1	Floods 1/100

FIGURE 4.1

.3 Starrs Road to Forest Street

The stream meanders southwards for 870 metres through sparsely developed land, swamp and treed zones. Swamp areas lie between Starrs Road, Burton Avenue, & Parade Street and act as flood plain storage in times of severe wet weather. Generally, the grade is about 0.5%. Above the flood plain there is land available for development, although from Starrs to Parade, the cemetery property is located on the east side of the Brook.

.4 Forest Street to South East Street

Again, the stream flows through open land - partially developed - but the grade is steeper at about 1% for a distance of 600 metres approximately.

.5 South East Street to Argyle Street to old CNR Track Bed

At South East Street, the stream enters its principal flood plain, which extends from Forest Street in the north down to the old CNR track bed which is just south of the Town limits. This distance covers 2km and is a very flat, wide plain of grass and meadow with an average topo grade of only 0.2%. Thus, it becomes a flood storage plain in extremely wet weather (or in rainstorm and melting snow and ice). This area floods on occasions when rainfall generally is greater than 75mm on saturated ground.

.6 Old CNR Track to Regent Street to Wymans Road

This section is also very flat and wide with a similar shallow grade of about 0.2%. Generally, the stream meanders for about 550 metres through swampy land but about 400m above Wymans Road, it enters a narrow and slightly steeper (at about 1%) valley. This continues beyond Wymans Road and provides an effective outflow once storm water run-off passes through the swamp.

4.4 Havelock Subdivision

This residential subdivision lies within the Broad Brook Watershed and adjacent to the southside of Argyle Street & bounded in the east by Ellis Road. It occupies about 3 hectares (7 acres) of land within the Broad Brook watershed. The subdivision starts at the edge of the flood plan of Broad Brook and rises on a steady grade (about 5%) up to Ellis Road. Storm drainage is provided by roadside ditches and culverts, while in Argyle Street is installed a large 750mm (30 in.) dia. pipe.

Flooding does occur at the lowest end of the subdivision adjacent to the flood plain. During severe weather, storm water back-up in the system infills roadside ditches and affects the low lying properties, particularly basements.

4.5 **Milo Estates - Dwg. No. SW3**

This subdivision lies between Prospect and Hibernia streets at the north end of Town. The watershed area extending from Pleasant Street down to the harbour occupies about 18 hectares (40 acres). The easterly section, about 30% of the area, is gently sloping but the remainder falls rapidly to the lake.

The original drainage is a wet weather stream which originates in the south east corner on high ground at Brooklyn. This has been culverted under Brunswick Street, the old DAR track bed and Main Street out to Lake Milo. There is no flow in dry weather.

This area was originally open meadow and scrub land, but now the new residential subdivision of Milo Estates is gradually being developed eastward from Brunswick Street. Storm water discharge from roads, etc., is being fed into the existing stream, and with the faster run-off from paved areas, etc., is creating water back-up in the stream ditches upstream of the culverts, particularly at Brunswick and the track bed. The culvert under Main Street out to Lake Milo is a poor condition and requires replacement.

4.6 **Vaughne Estates - Dwg. No. SW3**

This subdivision lies to the south of Milo Estates, and between Hibernia and Chestnut streets. The area has a steady grade from Pleasant Street, falling westwards at an average 5% to Lake Milo. The area covering 32 hectares (80 acres) is a mix of old and new development - the latter being astride Brunswick, Vaughne Crescent and Sprucewood. Prior to these street developments, the older development was and is astride Hibernia, Chestnut, and along Main Street. There were no defined streams in the previously undeveloped area, but provision was made with culverts under the old DAR track to drain these upper lands. New subdivision development with drainage ditches and culverts has created a storm water impact within these areas. Drainage down Chestnut now flows to and around Vaughne Crescent. The total flow is then carried along the shallow grade ditch of the old DAR track bed, which will flood in severe wet weather. A new culvert was installed a few years ago from this track down to the main outfall culvert under Main Street to Lake Milo, which alleviated overload on the Hibernia Street system.

Drainage down Sprucewood Drive is conveyed around Brunswick to enter the system on Hibernia. A major impact on the Sprucewood ditch and pipe system comes from the Community College campus, located between Hibernia, Pleasant, and Sprucewood. The vast area of asphalt and roofs discharges through a drainage ditch out onto Sprucewood. This, in times of heavy rain, causes overflow on Sprucewood and backup at the entrance to the Hibernia culverts/pipes.

There is still further undeveloped land within this watershed.

4.7 <u>Gardner - Herbert - Marsha Avenue</u> - Dwg. No. SW5

Apart from the Broad Brook area, this watershed is the largest area, occupying about 30 hectares (70 acres), draining to the harbour.

Roughly, it is an L-shaped catchment, lying between Chestnut Street and Starrs Road with the L-leg extending southwards in an area bounded approximately by Starrs, Pleasant, Beacon, and Brunswick streets. This latter area has a very flat topography extending across Pleasant to the watershed boundary east of Pleasant Street. As a result, the land tends to be wet and swampy. A storm sewer was installed in the mid '70's from Herbert Street across to Marsha Avenue. This has limited effect of removing flood water but does not eliminate the wet areas.

The main watershed area between Chestnut and Starrs Road rises rapidly from the harbour a short distance to Main Street and then has a gentle rising slope to Pleasant Street. The area is an older residential development, but it also includes the extensive commercial development on Starrs Road between Brunswick and the Zellers Shopping Centre.

In the mid 1970's a large diameter 900m (3') storm sewer was installed from the harbour up Gardner, Herbert, Huntington, to a point on the original stream bed - the natural drainage for the area. The stream had been diverted into a drainage ditch around properties between Huntington and Herbert streets. The low point on Herbert lies opposite the Motor Mart/Canadian Tire.

From this point, a drainage ditch on Herbert runs up to Pleasant and collects drainage from that street and also the western part of the Zellers paved parking lot.

Another drainage pipe runs southwards between Canadian Tire and Motor Mart across to Starrs Road to pick up run-off from the commercial areas. Around the intersection of Starrs and Pleasant are extensive asphalt areas of shopping centres and service stations.

The main 900mm dia. pipe is large enough to accommodate run-off from the area but, unfortunately, at the time of installation sanitary connections were made, thus contaminating the storm water. This meant the outlet had to be connected to the Water Street intercepter sewer to ensure sewage went to the treatment plant. In times of heavy rain, water back-up occurs in the ditches of Herbert and Pleasant streets.

4.8 <u>Zellers Parking Lot</u> - Dwg. SW4

As mentioned in the previous section, the western section of the large parking lot around Zellers/Sobeys Mall drains out onto Pleasant Street. The eastern and larger section is graded to a 600mm (24") dia. outlet pipe installed under Starrs Road and along the Clements Avenue Right-of-Way for about 200 metres. This pipe discharges into the undeveloped area south of Starrs, a flat swampy area described in the previous section astride Pleasant Street. As a result, the discharge contributes to the continued wetness of the area - the flow eventually finds its way across Pleasant to the Marsha Avenue area, described previously or to a ditch/culvert system installed to the south around the Public Works Dept. and under Parade Street. This system discharges into the Broad Brook flood plain south of Parade.

In effect, the Pleasant Street - Marsha Avenue area - is a natural storm water detention area for the Zellers Mall area and this makes development difficult - it has considerable potential for development if the storm water impact is removed. Through this area runs the James Street Right-of-Way described later in Section 6.

4.9 <u>Parade Street</u> - Dwg. No. SW5

Within the Broad Brook watershed there is an area astride Parade Street, and lying to the east of the Brook. This area is only sparsely developed on Parade and has a steady grade uphill to Haley Road. Above Haley Road is the small industrial park which is located adjacent to Haley and Forest streets.

Presently, this section of Parade Street is serviced by an old rock built storm drain 500 metres long as far as the Cemetery gates where it picks up the roadside ditches and a natural drainage swale coming in from the south side. All surface drainage from the industrial park and the land up to the watershed ridge near the airport boundary comes down the roadside ditches. In heavy rainstorms the road and driveway culverts are inadequate and ponding results. Also, in the past the stone culvert has collapsed and caused flooding problems on adjacent properties including the cemetery.

5.0 FLOOD PRONE AREAS

5.1 Observations during heavy rainstorms (only a few over the period of this study in 1995) and discussions with Works Dept. staff indicate the following areas have on-going flood problems:

.1 Broad Brook

Broad Brook Flood Plain, particularly the main section between Forest Street and the old CNR track bed at the Town limits on the south side. The culverts under South East Street become surcharged and flow over the road occurs. Similarly, at Regent Street, south of the Town, and at Burton Avenue, near Starrs Road.

.2 Havelock Drive

The low section adjacent to the Broad Brook flood plain. The adjoining properties are affected by back-up in the ditches and pipes; this is caused by flooding in Broad Brook - flood plain storage.

.3 Milo Estates

The stream between properties on Hibernia and Herrington Street. Back-up occurs at the culverts under both Brunswick and the old DAR track bed and the stream ditch fills up in the backyards of the Herrington Street properties. This has been classified as a child hazard by the local residents.

.4 Vaughne Estates

Inadequate driveway culverts on Vaughne Crescent cause water ponding in the roadside ditches (about 1 metre deep) which is also a child hazard. The outflow ditch along the old DAR track is too shallow at its start and has a very flat grade towards Hibernia. As a result, washout and overflow occur.

At Chestnut and Brunswick, flow down the steep graded ditch on Chestnut turns 90° onto a relatively flat grade along Brunswick. This creates ponding in a shallow ditch (about 600mm - 2 ft.) and overflow over the roadway.

On Sprucewood, rapid flow from the Community College campus impinges on the roadside flow down Sprucewood, causes ponding and overflow over the street to affect the opposite properties. In addition, this large flow causes ponding at Brunswick/Hibernia prior to entering the Hibernia pipe system.

BROAD BROOK WATERSHED

Upstream of South East St.

Upstream of Argyle St.

Argyle St. Culvert

VAUGHNE and MILO ESTATES

Vaughne Crescent

Old D.A.R. Track Bed downhill of Vaughne Cresc.

Culvert at Brunswick St - Milo Estates

HERBERT STREET
AREA

Zellers Parking Lot

Pleasant St. - West Side

Herbert Street

.5 Herbert Street - Marsha Avenue

The critical location on Herbert Street is the low point at the entrance to the existing storm sewer system. Heavy flow from the Zellers Mall area (western section) has difficulty entering the culvert under Pleasant - back-up occurs and street overflow takes place. In turn, the roadside ditch down Herbert to the storm sewer back-up and ponds, and can overflow over Herbert Street.

In the Marsha Avenue area, the wet undeveloped areas become water saturated with an accumulation from Pleasant Street and adjoining areas - in turn affected by outflow from the Zellers Mall area (eastern portion).

.6 Clements Avenue Right-of-Way (Zellers Mall Run-Off)

A restricted inlet to the outfall pipe under Starrs Road causes ponding in the Mall parking lot during heavy rain. This has been up to the underside of automobiles. The outflow from this pipe discharges and creates ponding in the undeveloped land east of Pleasant Street (astride Jane Street right-of-way) and across to the Marsha Avenue area.

.7 Parade Street

East of Broad Brook, the old stone culvert is no longer able to handle storm run-off, coming down Parade Street from the upper areas (industrial park, etc.) and ponding places at risk the new seniors home uphill from Myrtle Street and the cemetery opposite.

It should be noted that the severity of flooding is weather and topography related. For instance, a short intense thunderstorm will impact on the Zellers Mall area significantly but have no effect on the Broad Brook - but in wintertime (January "thaw") rain on frozen ground does have a major impact on Broad Brook.

The worst scenario usually occurs when a heavy rainstorm hits after a day or more of continuous light rain or during spring run-off - at either time the ground has become saturated and there is no absorbent capacity on the ground. For example, in March 1994, a continuous heavy rain of 75m (3") in 24 hours caused extensive flooding during a period of melting snow and ice but the same rain in July 1995 only caused flooding at the constrained locations; e.g., Milo, Vaughne Estates, etc.

6.0 MITIGATION MEASURES

To alleviate most of the problems described in the previous sections the following mitigation measures are proposed.

6.1 Broad Brook Flood Plains

To effectively drain the flood plain would require an extensive earthworks channelling project, starting as far downstream as Sandbeach in order to achieve a satisfactory grade. This would involve channelling over a distance of about 5km., which is an impractical and expensive undertaking, not realistic.

The best and most practical solution is to leave the flood plain as it is and recognize its value for flood water storage during severe storms. During a 1 in 5 year storm, the roads at South East Street, Burton Avenue, and Regent Street will overflow. But these are not major streets and this can be accepted. During a severe 1 in 100 year storm (110mm - 4½ in. - or more in 24 hrs), Argyle and Forest streets will also overflow. This should be deemed acceptable as other impacts will be happening all over the Town area. The only significant flood drainage would be washout of the gravel shoulders - these can readily be repaired. Argyle and Forest streets, which are principal streets, could be raised across the flood plain by another 1 metre in elevation. But this cannot be cost justified at the present time but could be considered if the streets are to be upgraded.

The proposed mitigation measures at this time are:

.1 Institute development control to prevent building or other facility within the flood plain. The limits should be set at the following elevations:

- 16.0 metre contour for the main flood plain between Forest Street and the old CNR track bed.
  Regent Street

- 21.0 metre contour for the section between Forest and Parade streets

- 23.0 metre contour for the section between Parade Street and Starrs Road

.2 Institute development advisories for construction in the zone 2.0 metres above the elevations stated above. This will cover potential impact on basements of buildings whose main floor elevations are above flood plain levels, but whose basements may be up to 2.0 metres below with a consequent flood risk.

.3 Additional and/or replacement culverts as follows:

Parade Street - Replacement of the old stone culvert with a precast box culvert.
2400 x 1800mm (8 ft. x 6 ft.)

Forest Street - Provide an additional 900mm (36") culvert.

South East Street - Replace the existing 900mm (36") culvert, presently half submerged and provide two additional 450mm (18") culverts Grade difference South East Street to Flood Plain is marginal at 1 metre, and large diameter culverts cannot be installed.

Argyle Street - Provisional of an additional box culvert.
1200 x 1200mm (4 ft. x 4 ft.)

In other locations, the present culvert configuration can be classified as:

Starrs Road - Adequate.

Burton Avenue - Unused gravel road - deadend. Culvert can be upgraded if and when the road is developed.

Regent Road - Gravel road within the County area. It is not a major street, but provides secondary link to Wymans Road.

Wymans Road - Adequate and within County area.

6.2 Havelock Subdivision - Dwg. No. SW6

The ideal solution at the low lying section next to the Broad Brook Flood Plain is to relocate the homes that are at risk. Unfortunately, this is expensive and impractical.

Mitigation measures proposed are:

.1 Institute development control to prevent further building permits in the low lying area below 16.00m elevation, and building advisories in the 16.00 to 18.00m elevations.

.2 Construct a berm (a leveé) behind the dwellings at risk and along the edge of the flood plain. As the predicted maximum flood level is set at 16.00 metres elevation, this berm should be built to the 17.00 metre elevation and carried around to meet the natural 17.00 metre contour.

.3 The disadvantage of the proposed berm is the trapping of storm water coming down the hill through the subdivision and again affecting the low lying properties.

This can be alleviated by the installation of a large 600mm (24 in.) dia. interceptor pipe with curb, gutter and catchbasins on the low section of the street. This pipe would be connected to the main 750mm (30 in.) dia. pipe in Argyle Street . This pipe would not only intercept but act as a storage reservoir in times of flood in Broad Brook, as at such times, the large Argyle Street pipe will back up with reduced capacity.

6.3 Milo Estates - Dwg. No. SW3

The old culverts under Main Street (out to Lake Milo) and the DAR track bed require replacement.

Proposed measures are:

.1 Replace the Main Street outfall with a larger 1050mm (42") dia. pipe.

.2 Pipe the stream with a new 900mm (36") dia. pipe from Main Street up to and beyond Brunswick Street.

.3 To reduce the sudden run-off rush down the stream, redevelop an old pond near Pleasant Street into a storage pond on the higher ground by constructing a mini-dam with a restricted outlet. In times of dry weather, the storage pond would drain with no impact downstream. This area could be landscaped as a small park.

6.4 Vaughne Estates - Dwg. No. SW3

The major problem identified is inadequate culvert sizes and circuitous routing with shallow grades through the area.

Proposed measures are:

.1 Replace culvert under Main Street with a larger 900mm (36") dia. pipe to connect with 900mm dia. pipe outlet into Lake Milo.

.2 Replace existing 350mm (14") dia. pipe along Main to Hibernia with a larger 600mm (24") pipe. This intercepts flow down Hibernia and reduces storm water back-up at Hibernia/Main.

.3 Utilizing the recent 750mm (30") dia. pipe up to the DAR track bed through church property, extend this along the old DAR track turn around right-of-way up to Brunswick Street.

.4 Install a 600mm (24") branch storm drain, southwards along Brunswick to intercept the flow at Chestnut.

.5 Install a 600mm (24") branch up Sprucewood to the interception point with the outflow from the Community College.

Also, a request should be made to the N.S. Dept. of Education to intercept and pipe the drainage run-off from the Campus.

These measures will eliminate:

.1 Use of Vaughne Crescent and the DAR track bed to channel storm flow and eliminate ponding/overflow and erosion.

.2 Reduce flow in the Hibernia system and ponding/overflow on Sprucewood.

6.5 Herbert Street - Marsha Avenue - Dwg. No. SW4

.1 Make use of existing 900mm pipe system on Gardner and Herbert by:

- installing branch sanitary sewer on Brunswick to pick up sanitary laterals.
- disconnecting and reconnecting to sanitary sewer laterals on Huntington Street.
- disconnecting the storm sewer from the interceptor sewer at Water Street and connecting it directly to the storm overflow pipe. The 2 items above will remove sanitary sewage from the system.

.2 From Brunswick, extend the 900mm (36") dia. pipe up Herbert to the low point opposite Motor Mart/Canada Tire.

.3 Install a branch 450mm (21") pipe up Herbert to Pleasant and Zellers Mall area.

.4 Install a branch 600mm (24") pipe across to Starrs Road and thence along Marsha Avenue.

6.6 <u>Clements Avenue Right-of-Way - Zellers Parking Lot</u> - Dwg. No. SW4

.1 Reconfigure storm drain inlet at Zellers Parking lot.

.2 Extend existing 600mm (24") dia. pipe along the Clements Avenue Right-of-Way and turn it east along James Street Right-of-Way to discharge about the 23.00 metre elevation towards Broad Brook.

6.7 <u>Parade Street</u> - Dwg. No. SW5

.1 Broad Brook culvert replacement identified in Section 6.1.

.2 Replace old stone culvert, eastwards from Broad Brook with a new 600mm (24") dia. pipe and extend it up to Haley Road.

6.8 <u>James Street Right-of-Way</u> - Dwg. SW4

.1 Install a new pipe along the right-of-way eastwards from Pleasant Street to connect with the Clements Avenue extension (section 6.6 above).

This storm sewer will provide drainage to Pleasant Street and the undeveloped wet land east of that street across to Clements Avenue Right-of-Way. It will also reduce the impact on the Marsha Avenue area.

7.0 COST ESTIMATES

The preliminary cost estimates for the mitigation work outlined in the previous section are listed on the following pages.

STORM SEWERS AND CULVERTS UPGRADING

LOCATION	ITEM	LENGTH metres	ESTIMATE	TOTAL EST.
1.0 Broad Brook				
.1 Parade	Replacement Box 2400 x 1200mm	23	30,000.	
.2 Forest	Additional 900mm dia.	15	4,500.	
.3 South East St.	Replacement 900mm dia.	10	3,000.	
	Additional 450mm dia. - 2 units	10	2,000.	
.4 Argyle	Additional Box 1200 x 1200mm	11	8,500.	
				$ 48,000.
2.0 Havelock Subdivision				
.1 Havelock (West)	New 600 mm dia. pipe and catch basins	210	59,000.	
.2 Havelock S.W.	Replace culvert with 600mm dia.	10	2,000.	
.3 Havelock (West)	Curb and Gutter	210	7,000.	
.4 Havelock (West)	Protective Berm	300	30,000.	
				$ 98,000.
			Carried Forward	$146,000.

LOCATION	ITEM	LENGTH metres	ESTIMATE	TOTAL EST.
			Brought Forward	$146,000.
3.0 Milo Estates				
.1 Herrington	Holding Pond		30,000.	
.2 Brunswick to Main	New 900mm dia.	200	80,000.	
.3 Main	Replace outfall 1050mm dia.	75	40,000.	
			———	$150,000.
4.0 Vaughne Estates				
.1 DAR Track	New 900mm dia.	240	72,000.	
.2 Sprucewood	New 600mm dia.	210	58,000.	
.3 Brunswick /Chestnut- Vaughne Court	New 750mm dia.	240	72,000.	
.4 Main (to Hibernia)	Replace 350mm dia. with 600mm	55	15,500.	
.5 Main	Replace outfall 900mm dia.	60	25,000.	
			———	$242,500.
			Carried Forward	$538,500.

LOCATION	ITEM	LENGTH metres	ESTIMATE	TOTAL EST.
			Brought Forward	$ 538,500.
5.0 Herbert St. - Marsha Avenue				
.1 Herbert/ Huntington	Remove Sanitary connections (5) & install branch sanitary sewers	100	78,000.	
.2 Water	Disconnect storm sewer from Trunk sewer	-	50,500.	
.3 Herbert	New 900mm dia.	280	196,000.	
	New 675mm dia.	140	84,000.	
.4 Marsha	New 600mm dia. Herbert to Beacon	670	275,000.	
				$ 683,500.
6.0 Stairs Road - Zellers Mall				
.1 Clements	Storm Sewer Extension 600mm dia.	180	72,200.	
				$ 72,000.
7.0 Parade Street				
.1 Parade Broad Brook to Haley Rd.	Replacement Storm Sewer 600mm dia.	620	217,000.	
				$ 217,000.
8.0 James Street Extension				
.1 James St. ROW (Pleasant - Clements)	New 600mm dia.	300	120,000.	
				$ 120,000.
			Sub-total	$1,631,000.
			Contingency 20%	$ 326,000.
			Total Estimate	$1,957,000.

8.0 IMPLEMENTATION PRIORITIES

8.1 Based on observations during the course of the study and discussions with the Town Public Works Committee and Town Staff, it is proposed that the various mitigation measures be implemented in the following priority. Depending on funding available, a number could be combined into two or more construction contracts.

8.2 **Priority Listing:**

The following cost estimates individually contain a 20% contingency allowance, included at the end of Section 7.0 - Cost Estimates.

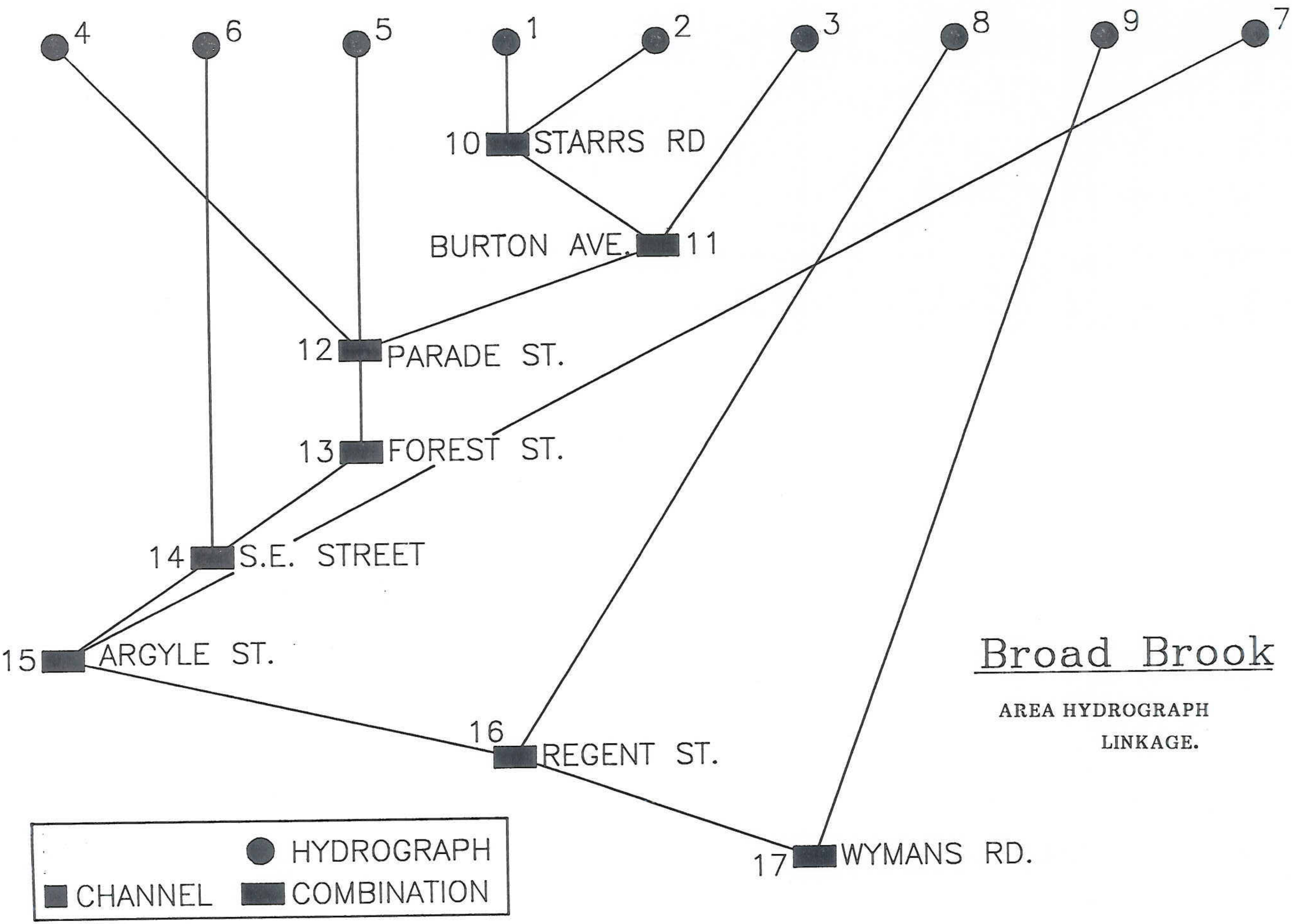
	LOCATION	ESTIMATE
1.	Milo Estates - new main drainage pipe, etc.	$ 180,000.
2.	Vaughne Estates - provide new main storm sewer	$ 291,000.
3.	Broad Brook - culvert replacement and additions	$ 58,000.
4.	Starrs Road - Zellers Mall outlet	$ 86,000.
5.	Parade Street - storm sewer replacement	$ 260,000.
6.	Havelock Drive	$ 118,000.
7.	Herbert Street 900/535mm. dia. extension	$ 336,000.
8.	Herbert/Gardner - storm sewer separation at Water Street	$ 154,000.
9.	Marsha Street - new branch storm sewer	$ 330,000.
10.	James Street Extension new storm drain	$ 144,000.
	Total Estimate......	**$1,957.000.**

APPENDIX

YARMOUTH STORM WATER MANAGEMENT

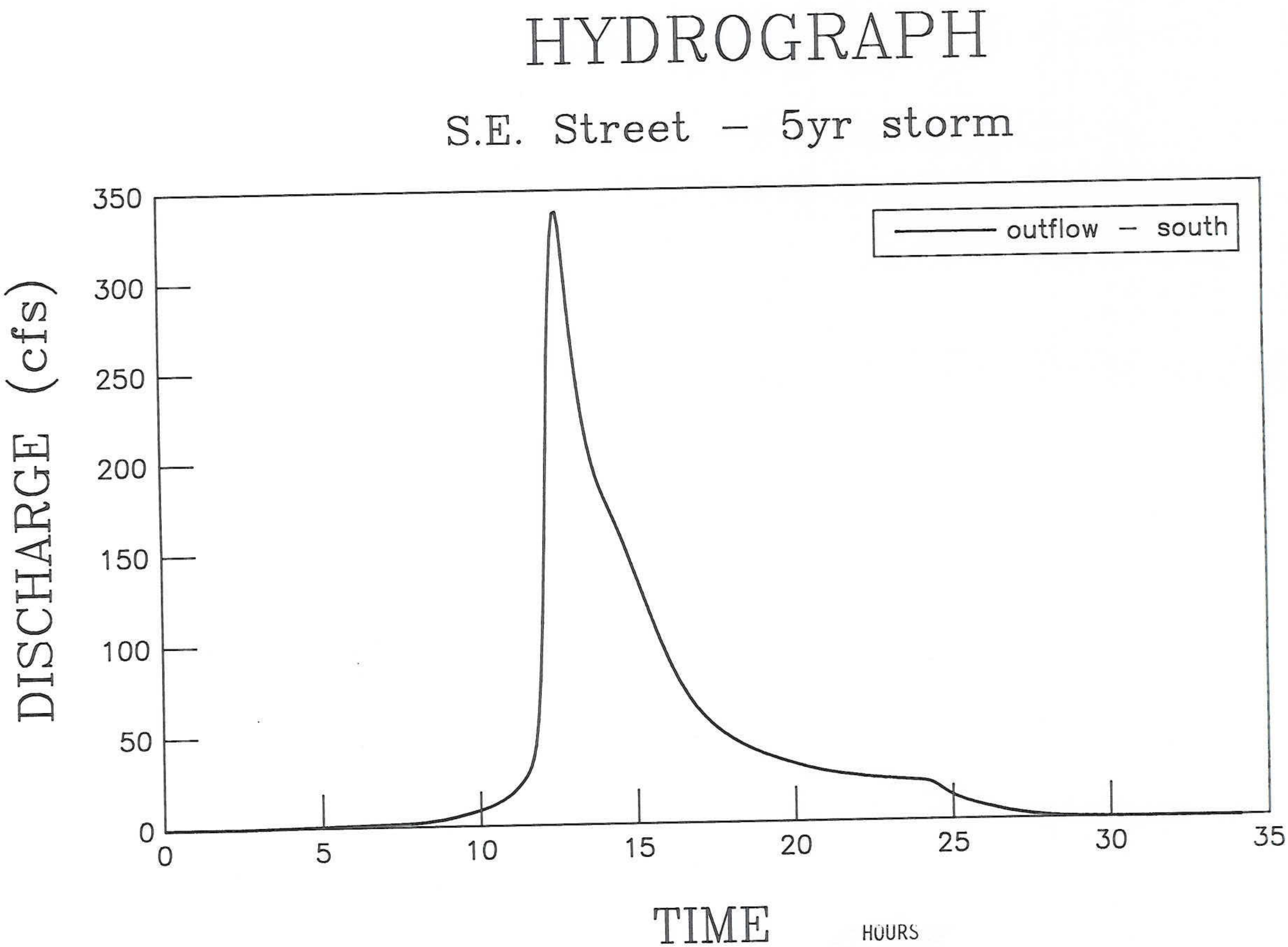
BROAD BROOK WATERSHED

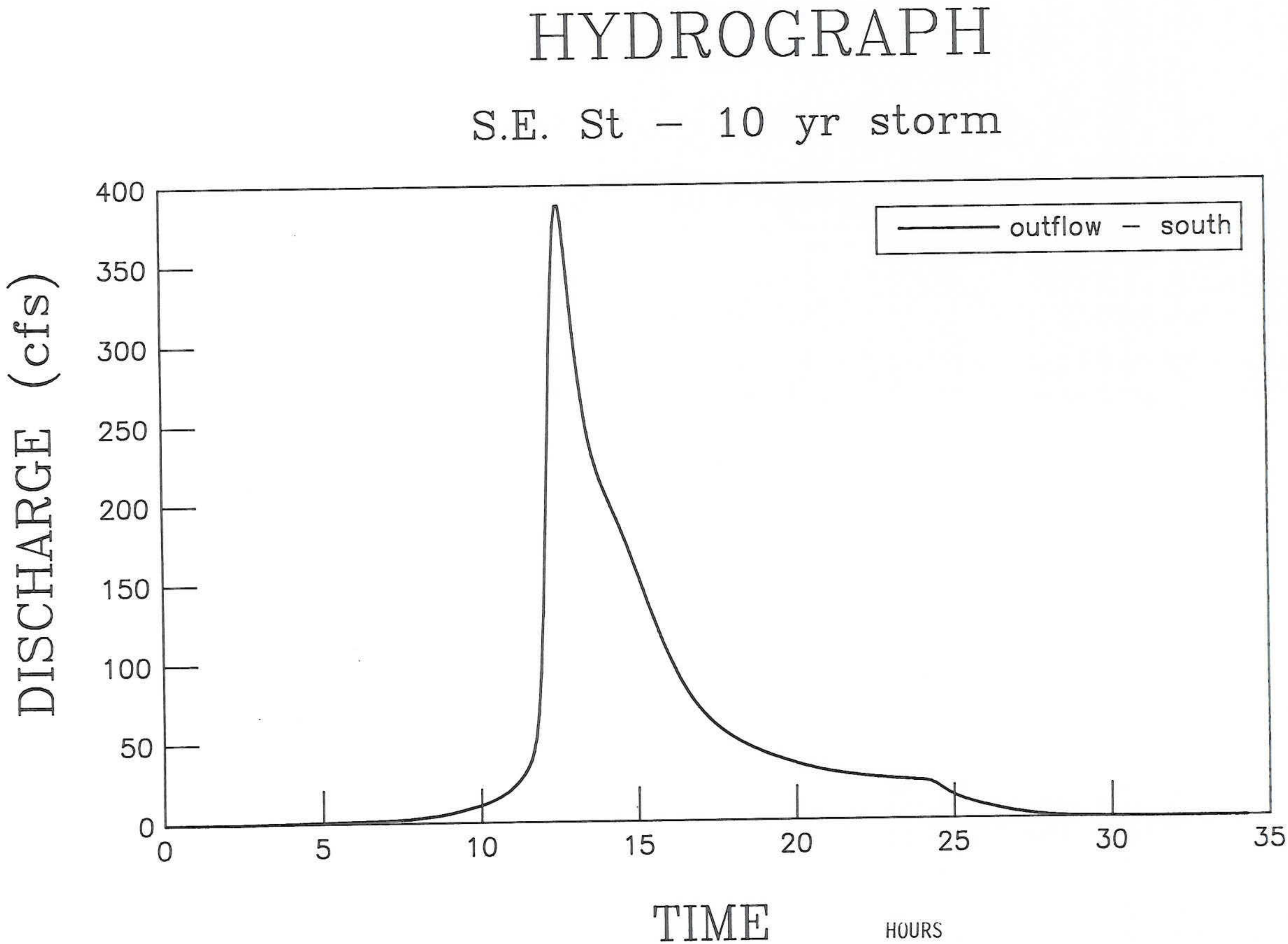
WATERSHED MODELLING

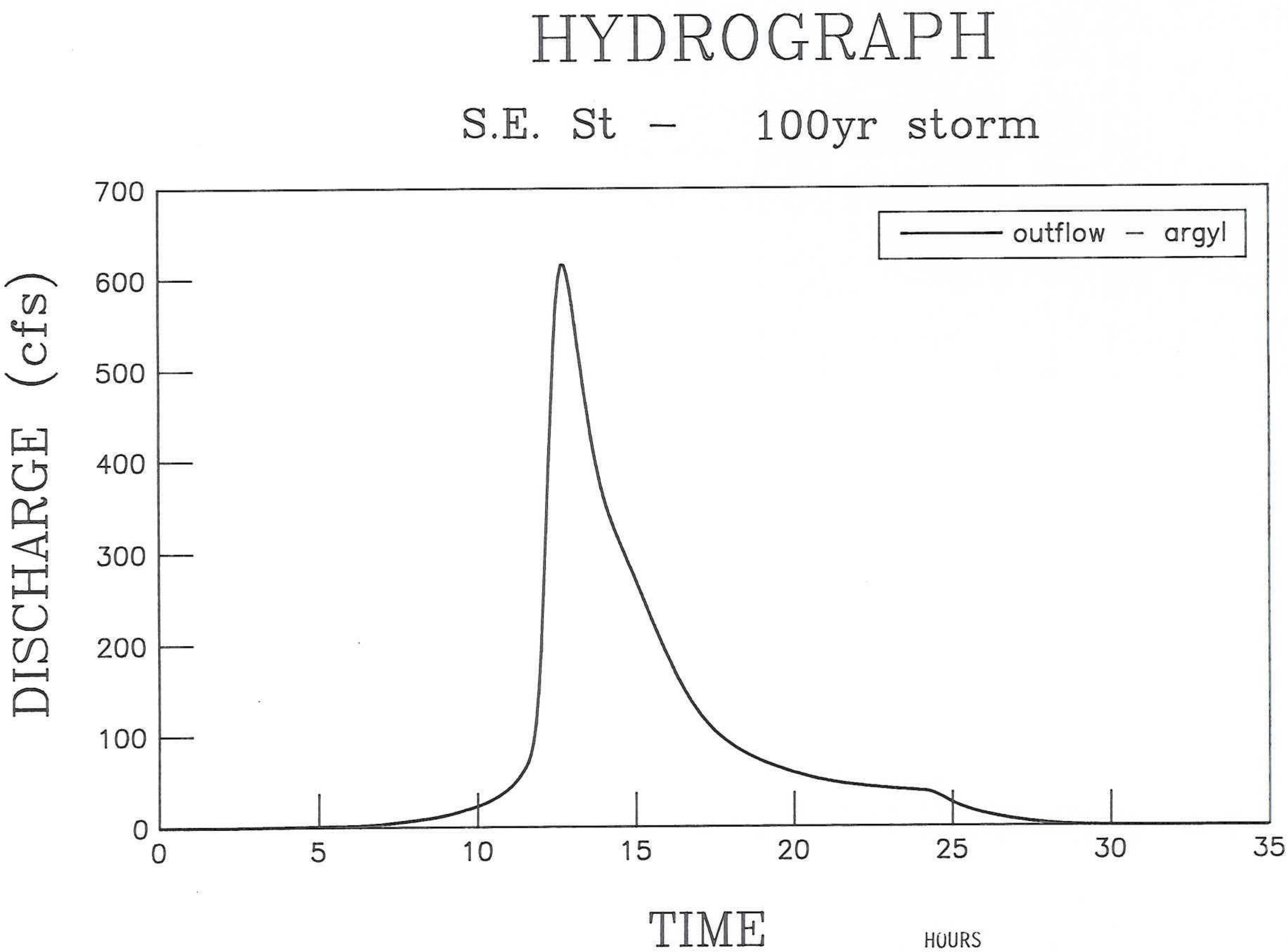


Broad Brook

AREA HYDROGRAPH LINKAGE.


HYDROGRAPH
S.E. Street - 5yr storm
outflow - south
DISCHARGE (cfs)
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
TIME
HOURS

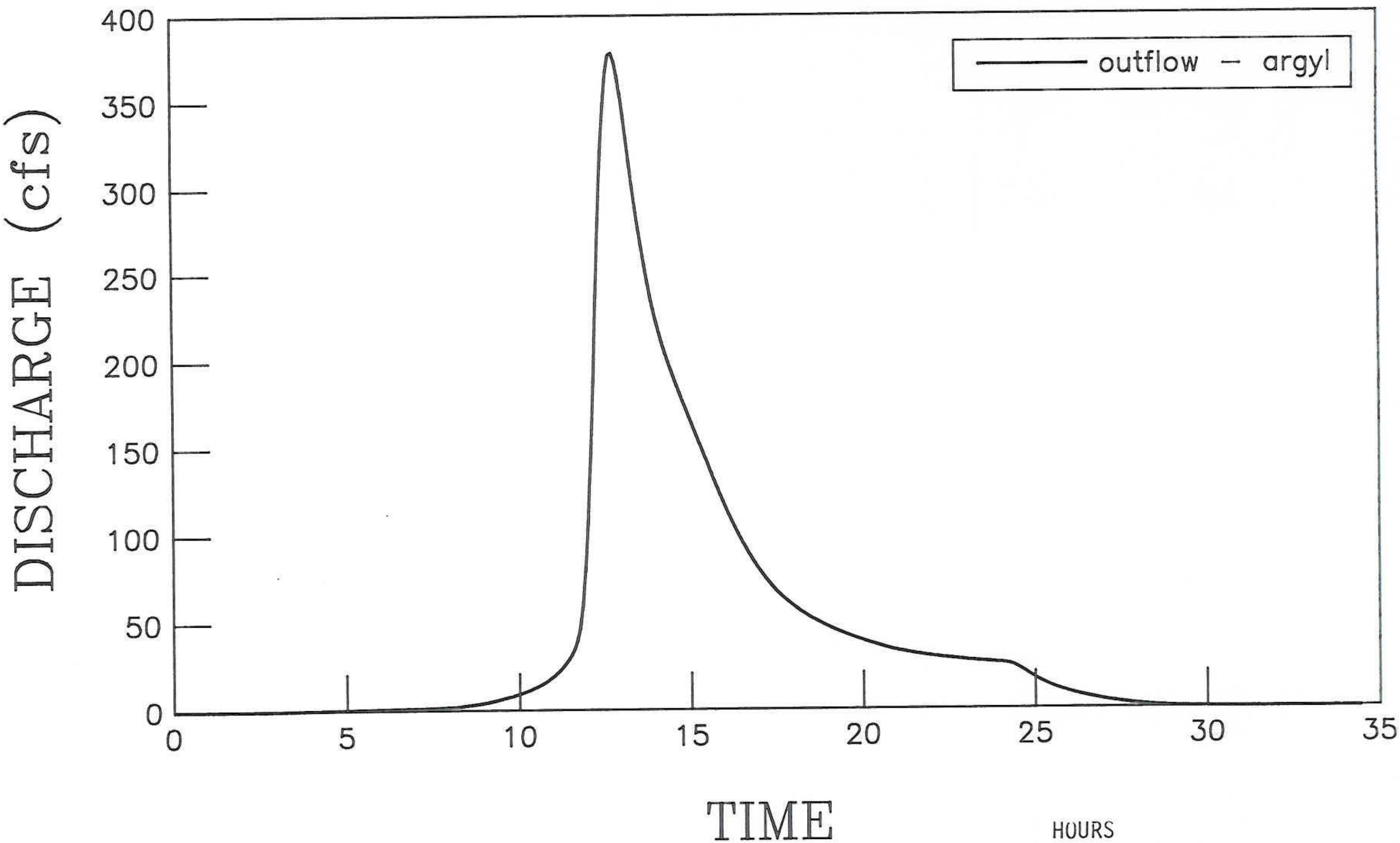

HYDROGRAPH
S.E. St – 10 yr storm
outflow – south
DISCHARGE (cfs)
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
TIME
HOURS

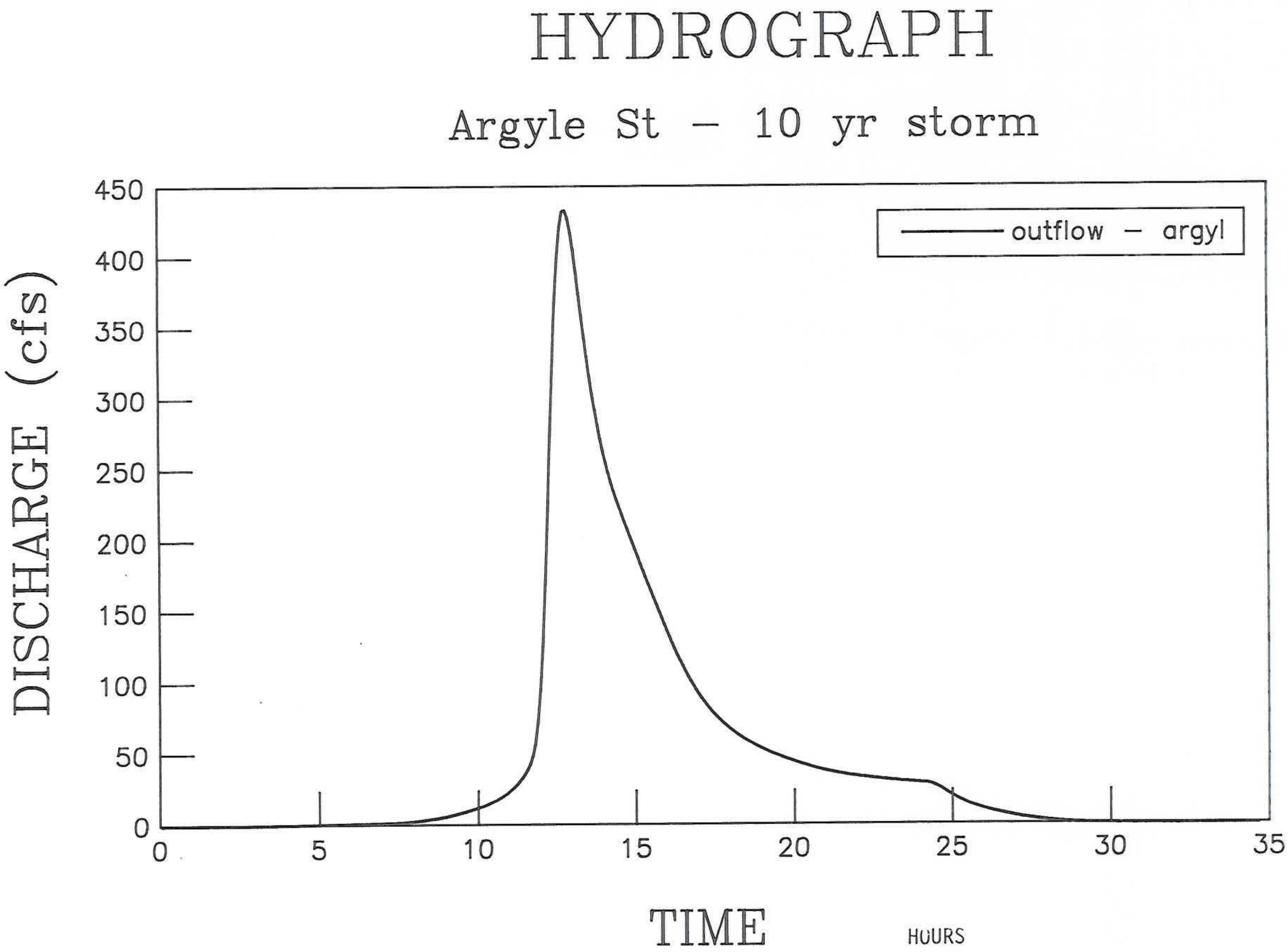


HYDROGRAPH
S.E. St - 100yr storm
outflow - argyl
DISCHARGE (cfs)
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
TIME
HOURS

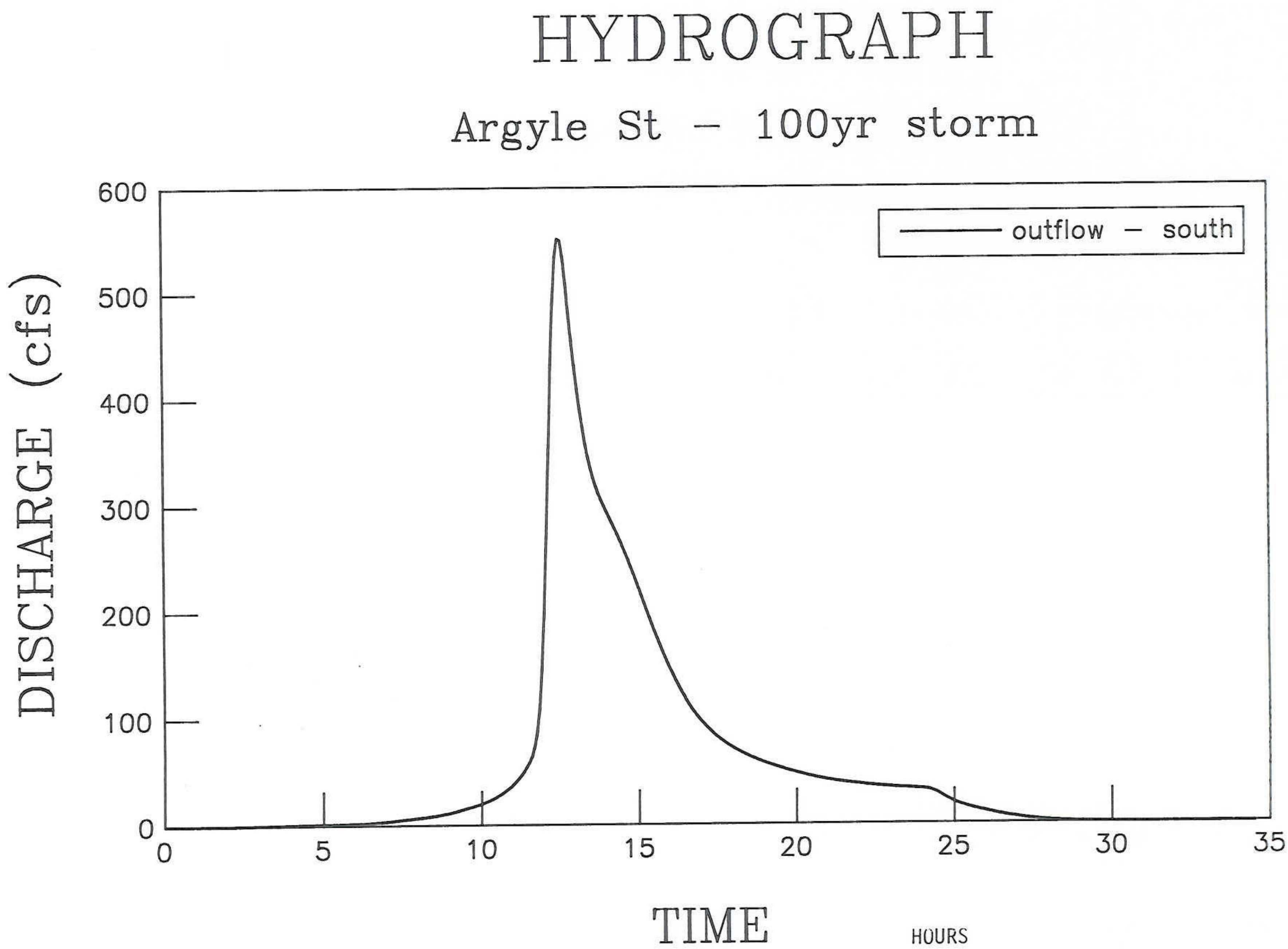
HYDROGRAPH

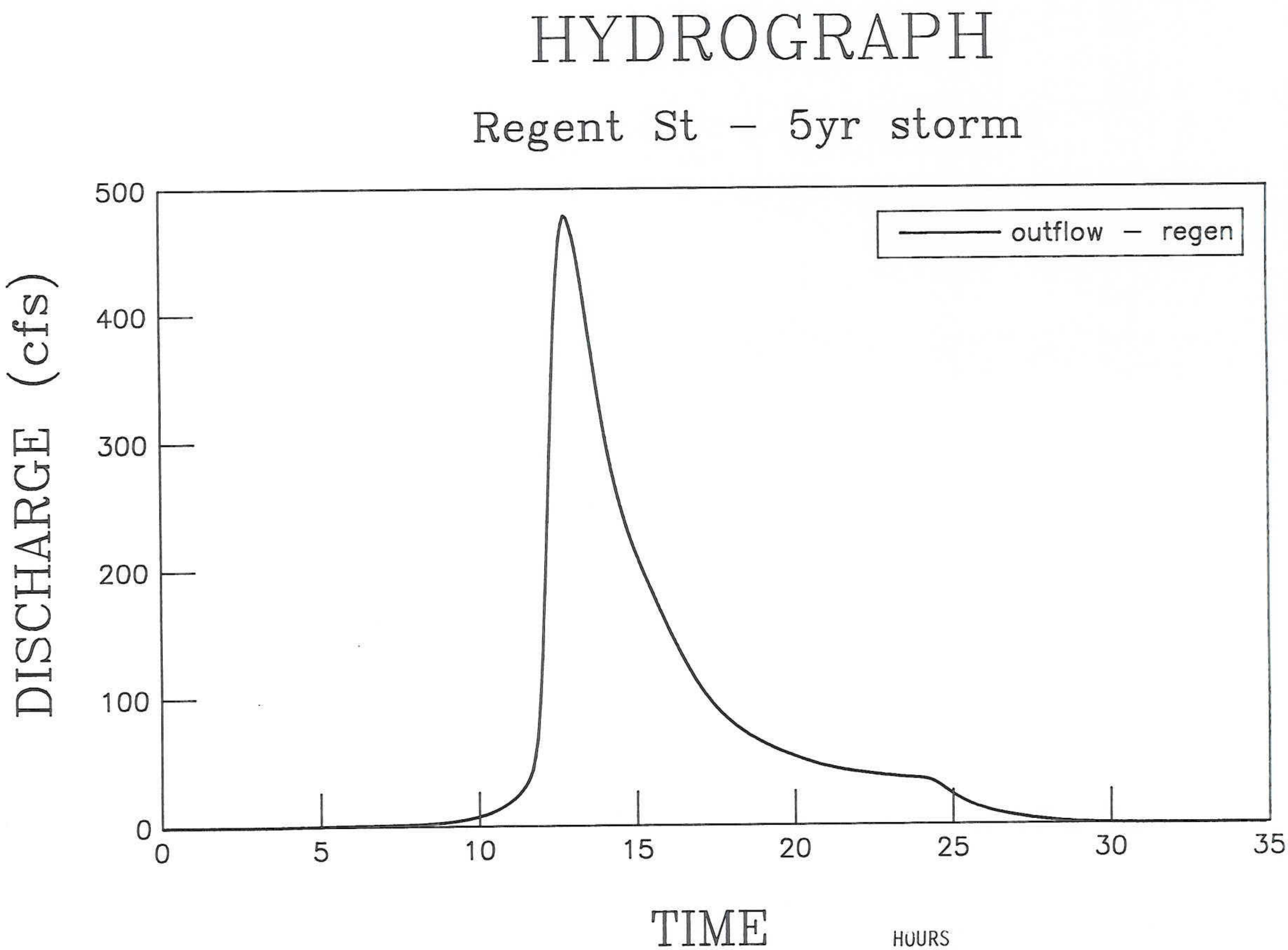
Argyle St - 5yr storm

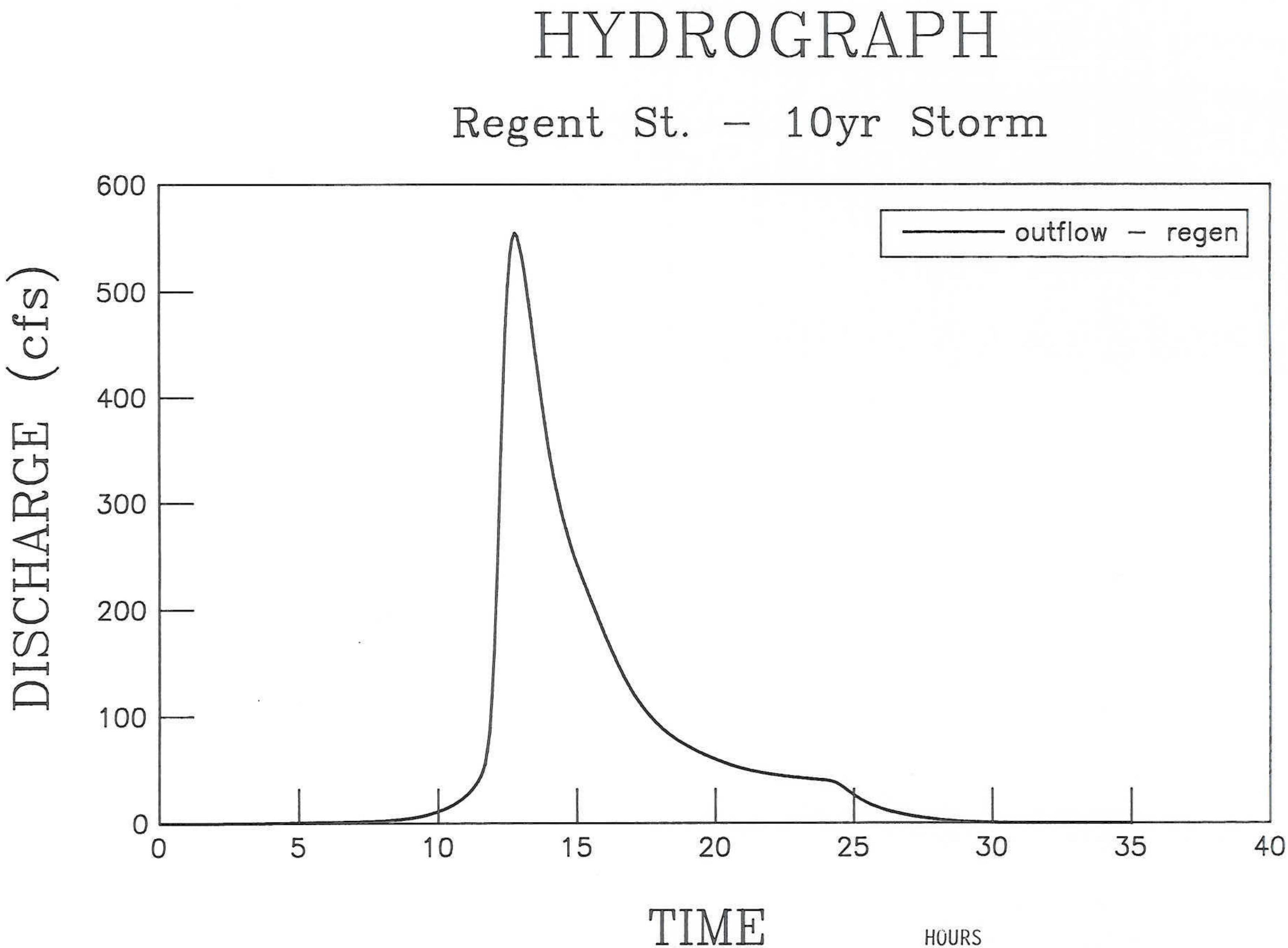




HYDROGRAPH
Argyle St - 10 yr storm
outflow - argyl
DISCHARGE (cfs)
0
50
100
150
200
250
300
350
400
450
0
5
10
15
20
25
30
35
TIME
HOURS


HYDROGRAPH
Argyle St - 100yr storm
outflow - south
DISCHARGE (cfs)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
TIME
HOURS

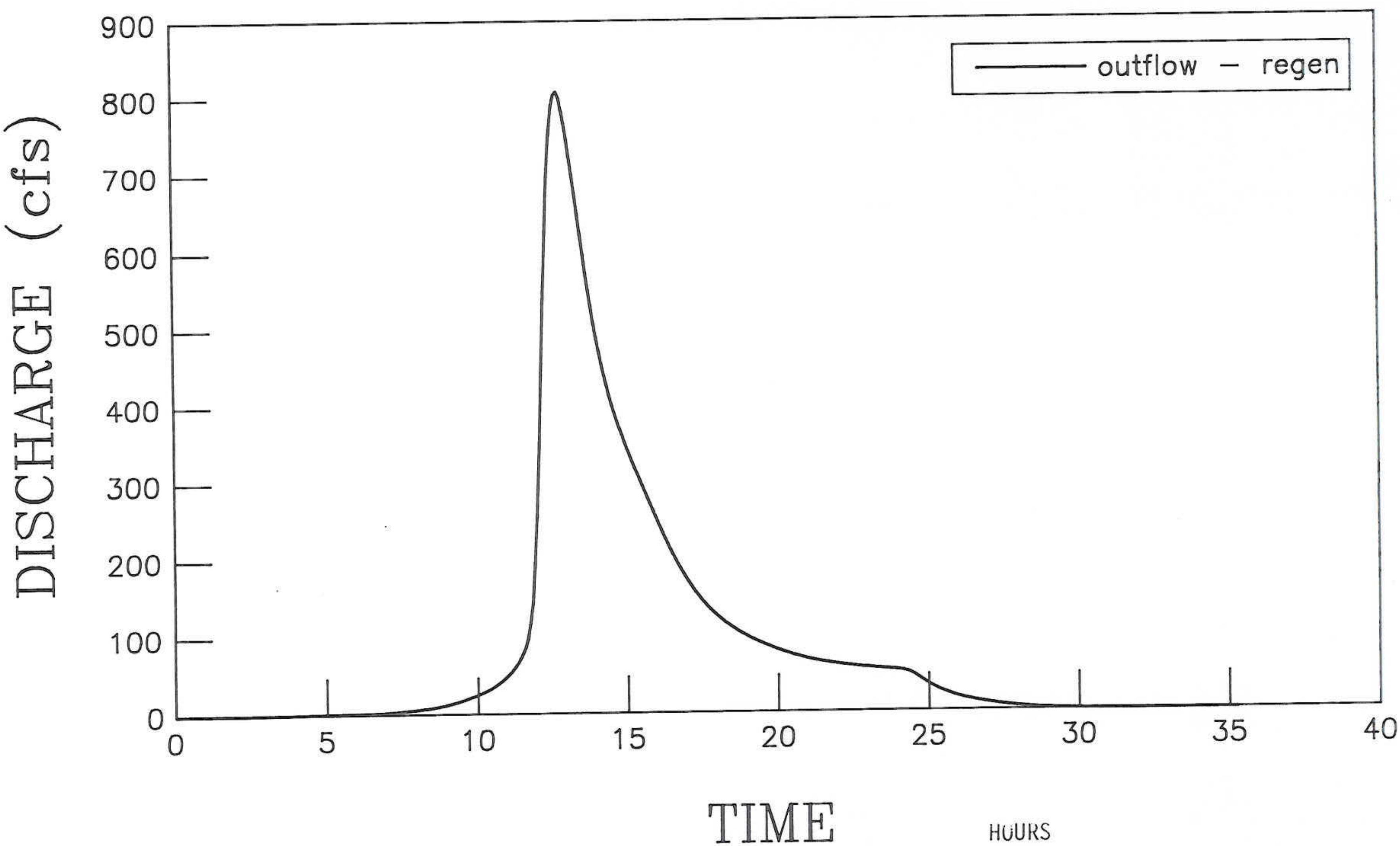

HYDROGRAPH
Regent St – 5yr storm
outflow – regen
DISCHARGE (cfs)
500
400
300
200
100
0
0
5
10
15
20
25
30
35
TIME
HOURS



HYDROGRAPH
Regent St. - 10yr Storm
DISCHARGE (cfs)
600
500
400
300
200
100
0
outflow - regen
0
5
10
15
20
25
30
35
40
TIME
HOURS

HYDROGRAPH

Regent St – 100yr storm



YARMOUTH STORM WATER MANAGEMENT

BROAD BROOK WATERSHED

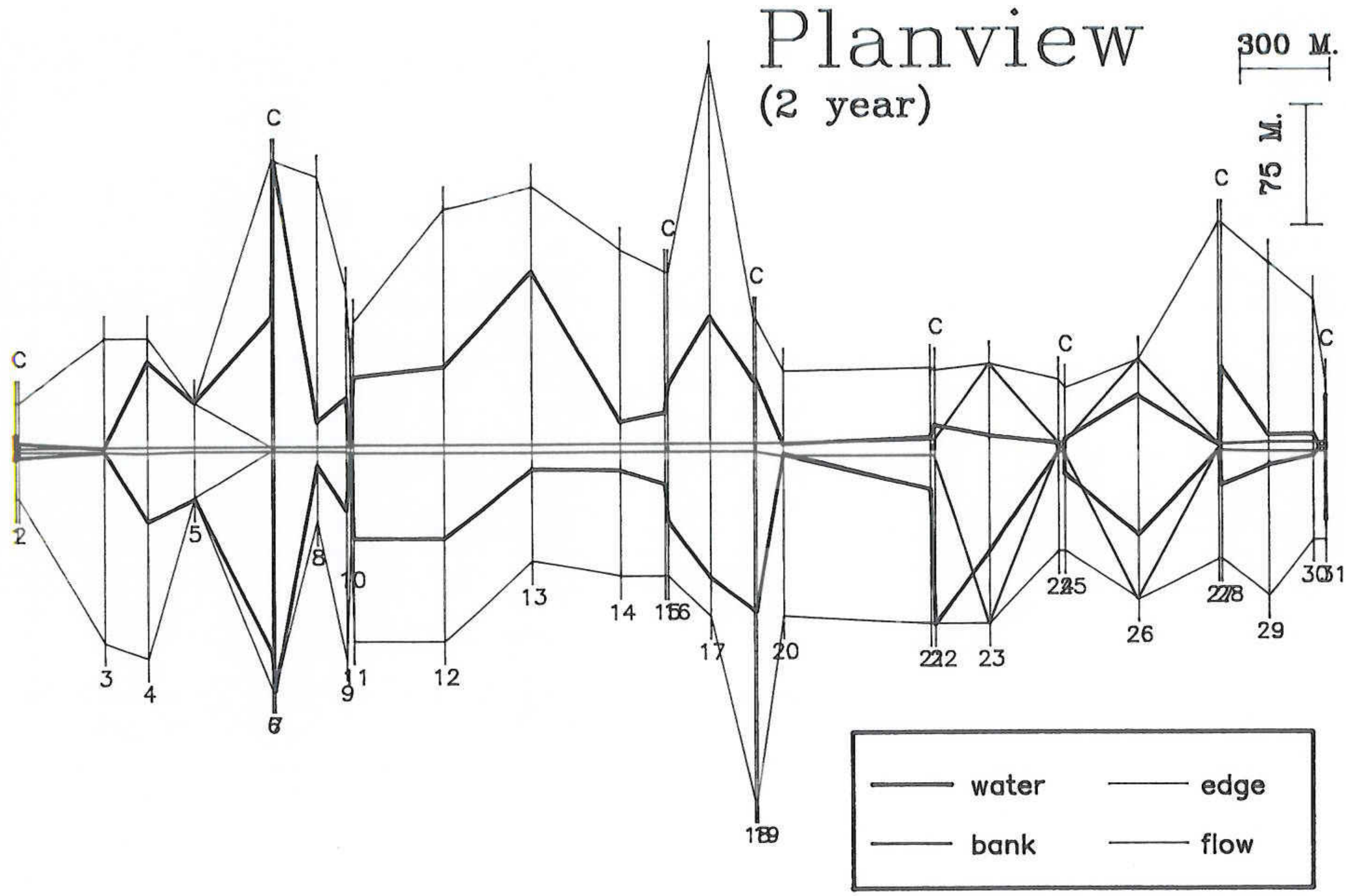
WATER SURFACE PROFILING

BROAD BROOK WATERSHED

WATER SURFACE PROFILING MODEL

CROSS SECTION LOCATIONS

CROSS SECTION	LOCATION
2	Wymans Road Culvert
7	Regent St Culvert
16	Argyle St Culvert
19	South East Culverts
22	Forest St Culverts
25	Parade St Culvert
28	Burton Ave Culvert
31	Starrs Rd Culvert


Planview
(2 year)
300 M.
75 M.
water
edge
bank
flow
C
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
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21
22
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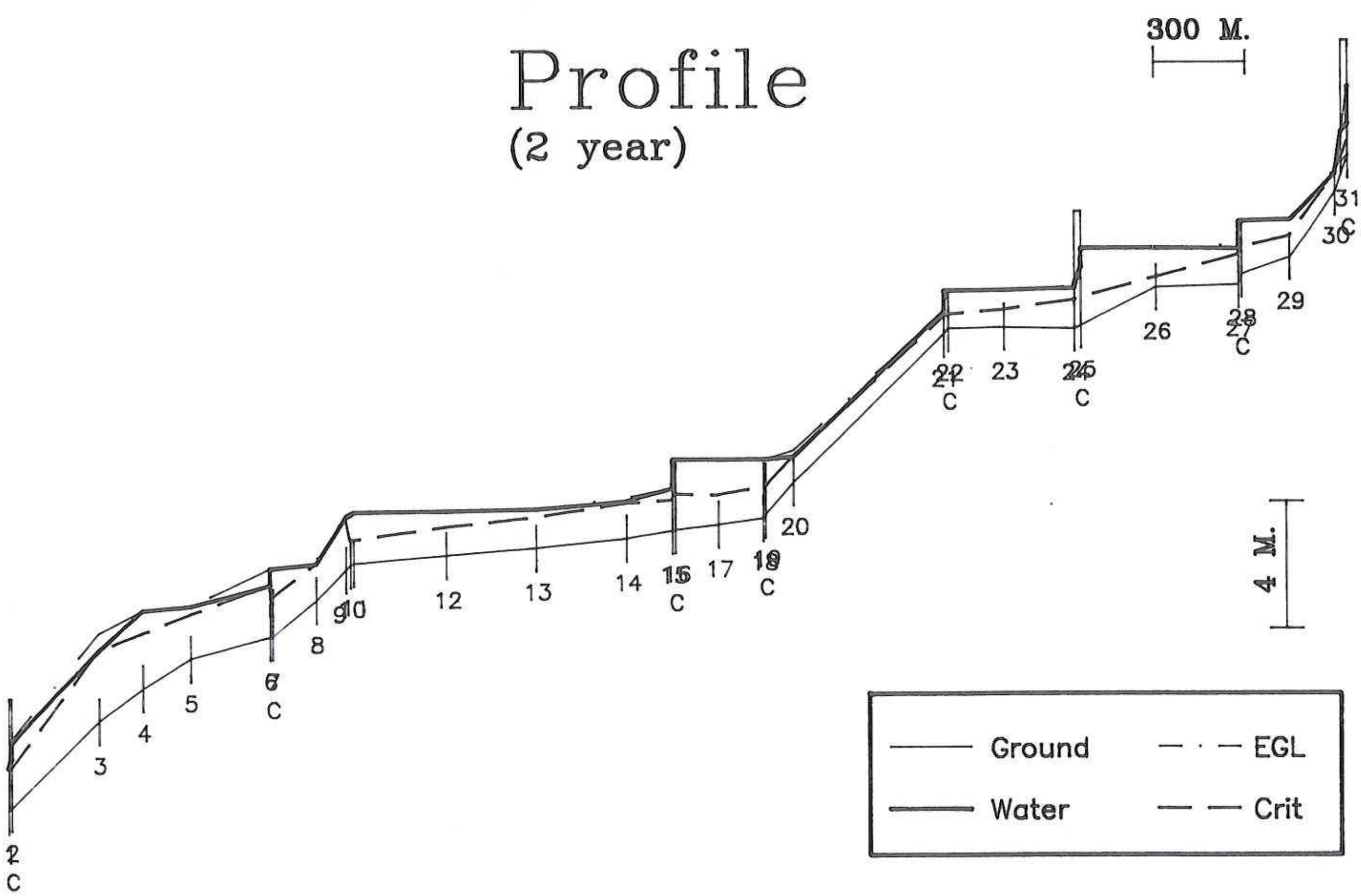
31


Profile
(2 year)
300 M.
4 M.
Ground
EGL
Water
Crit
C
1
2
3
4
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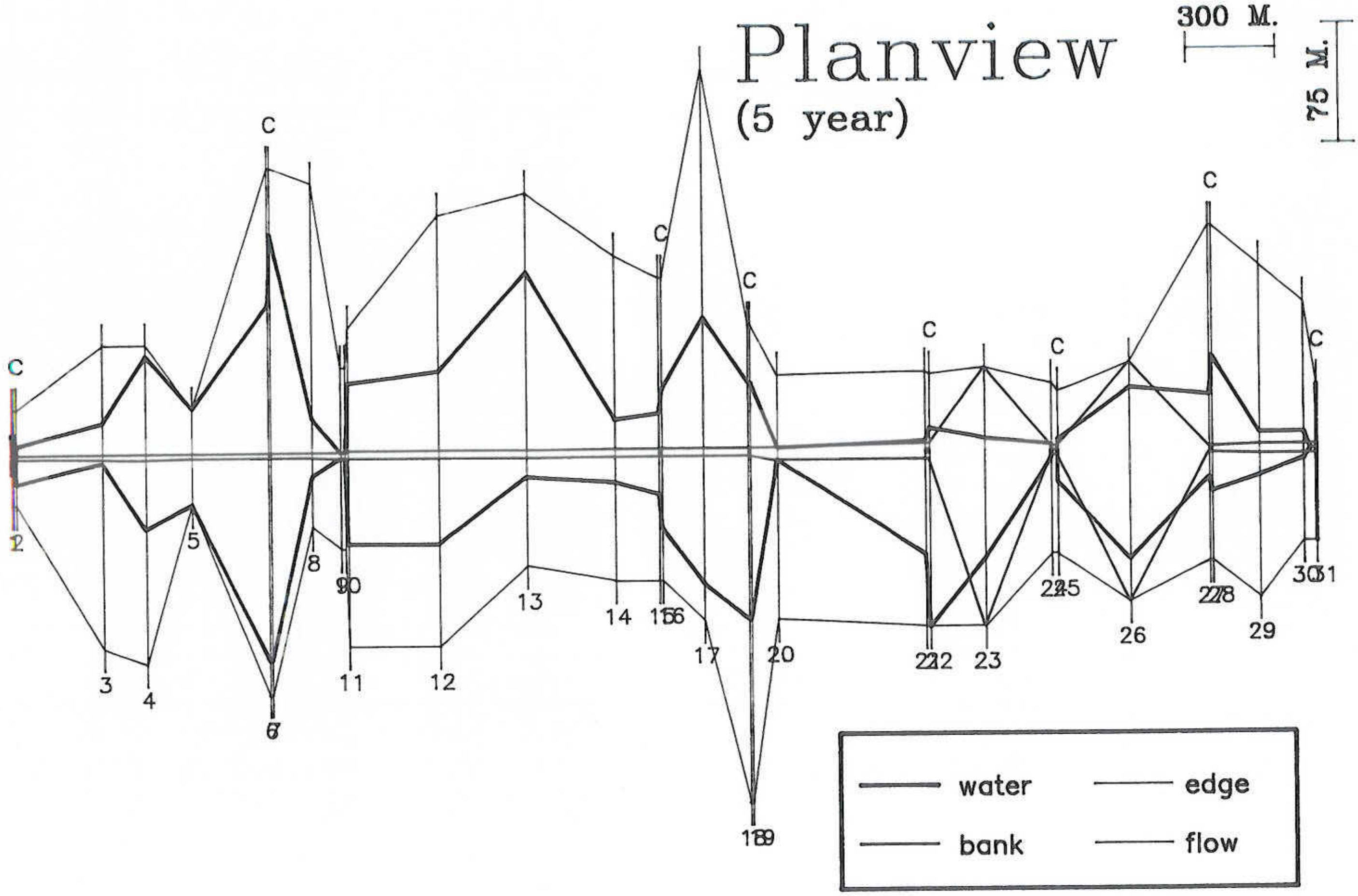
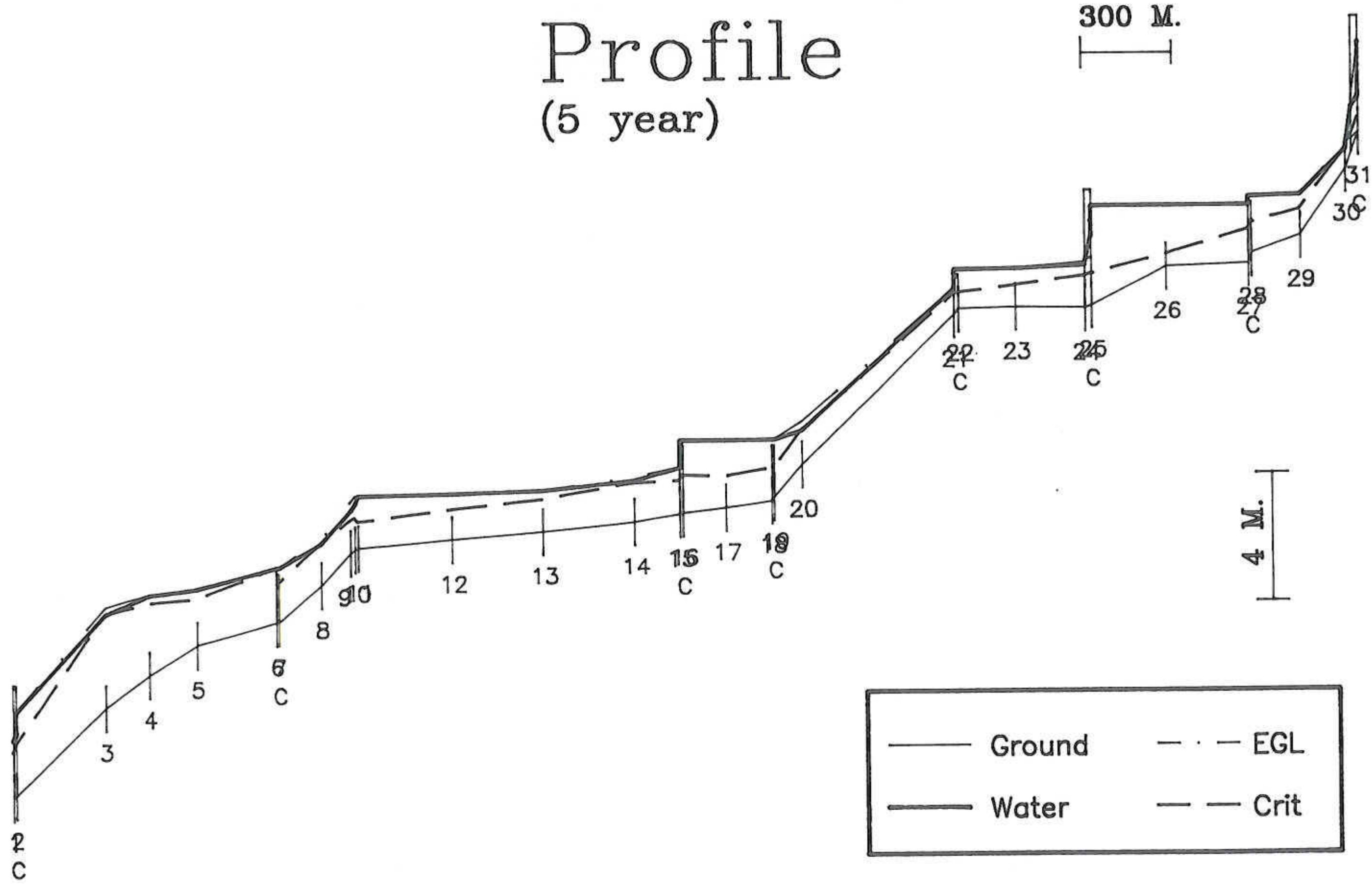
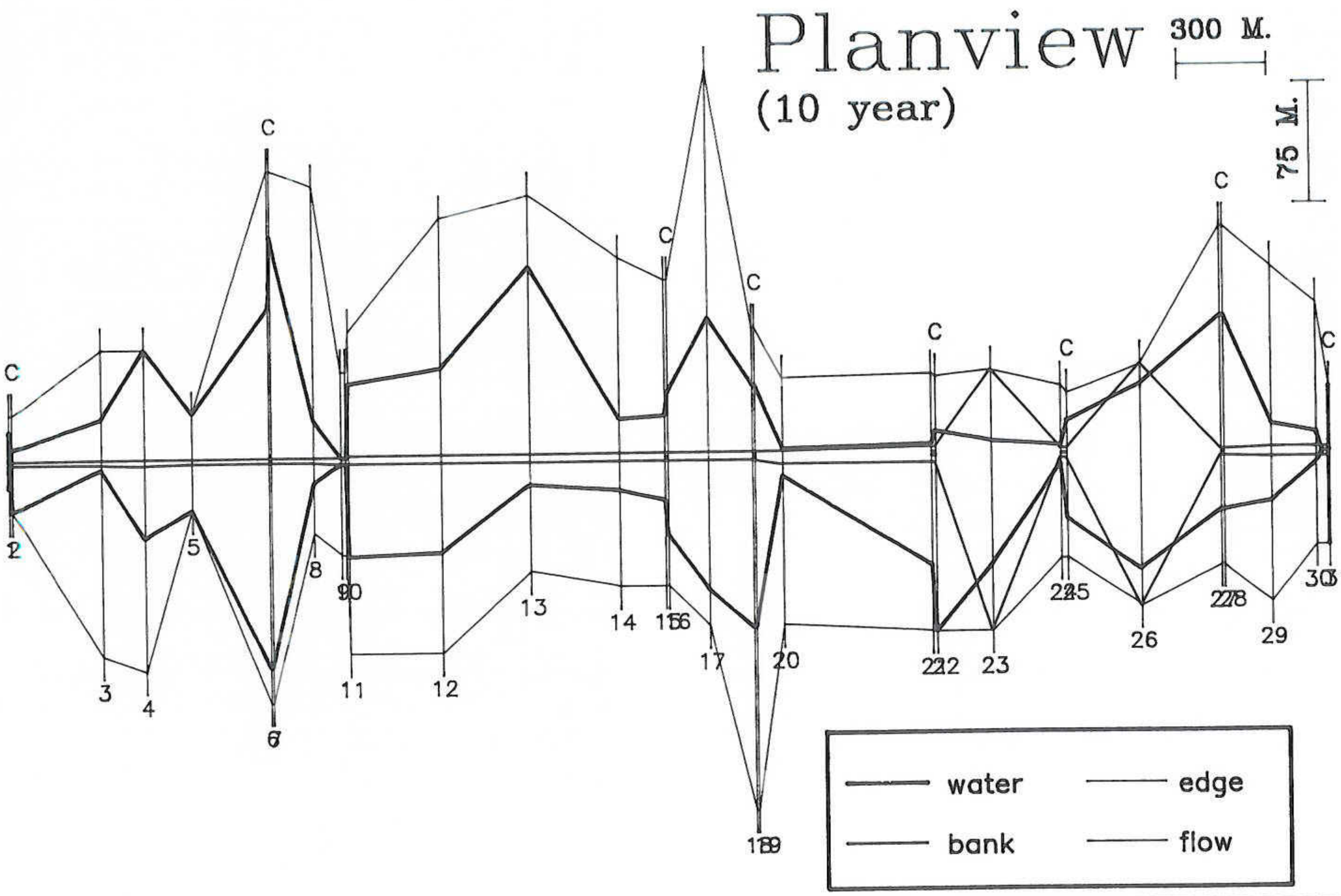
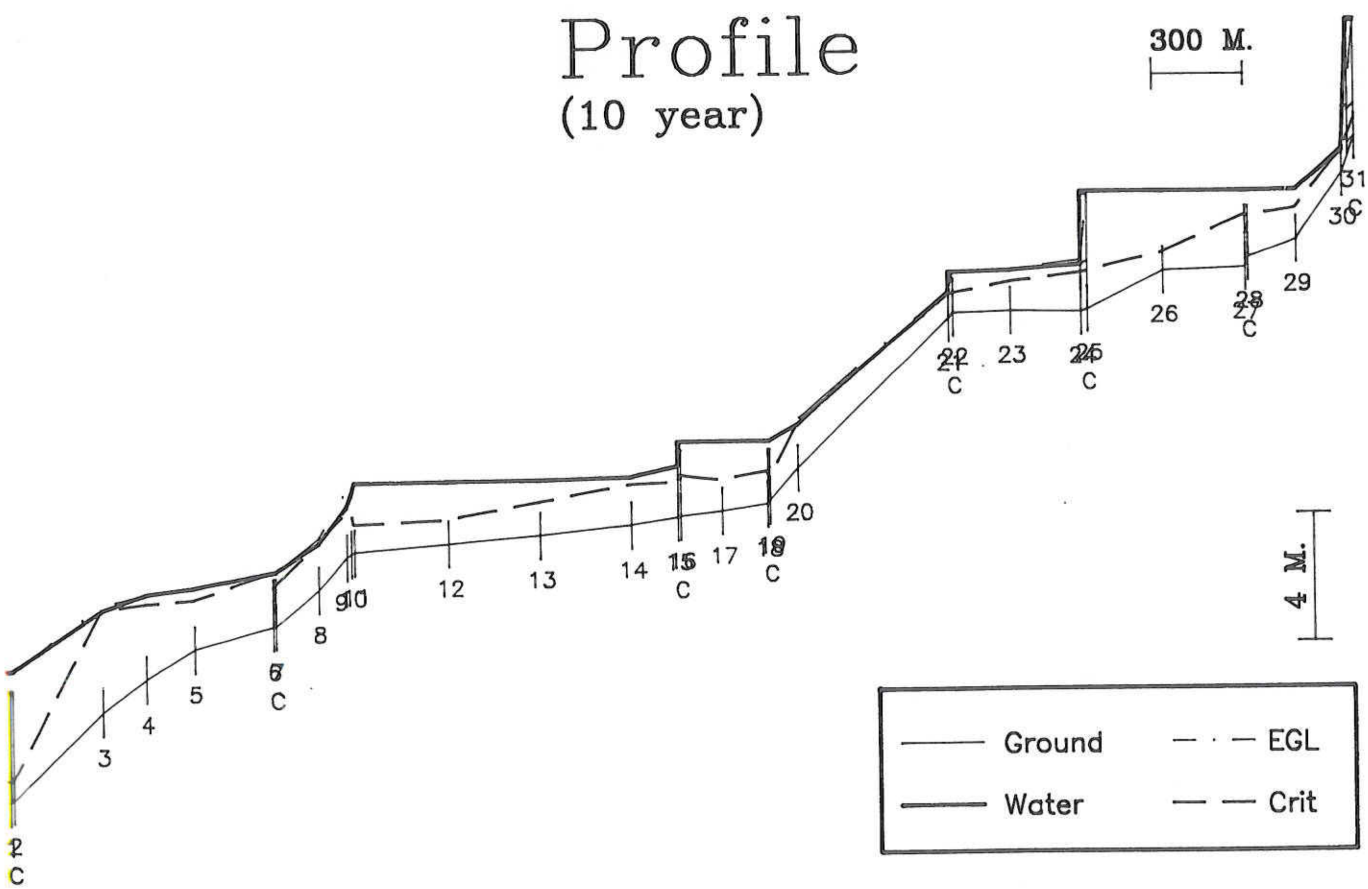
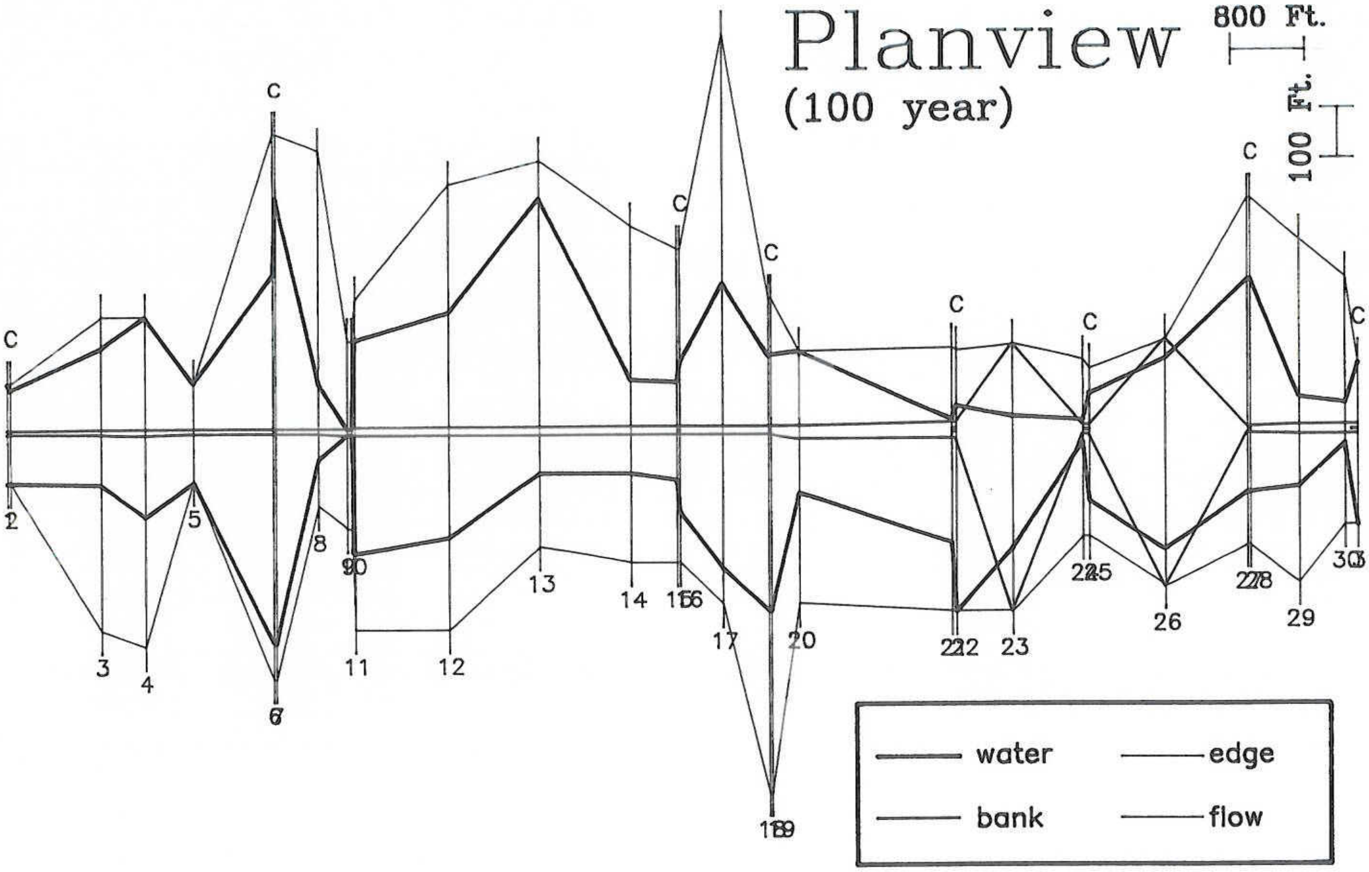

Planview
(5 year)
300 M.
75 M.
water
edge
bank
flow

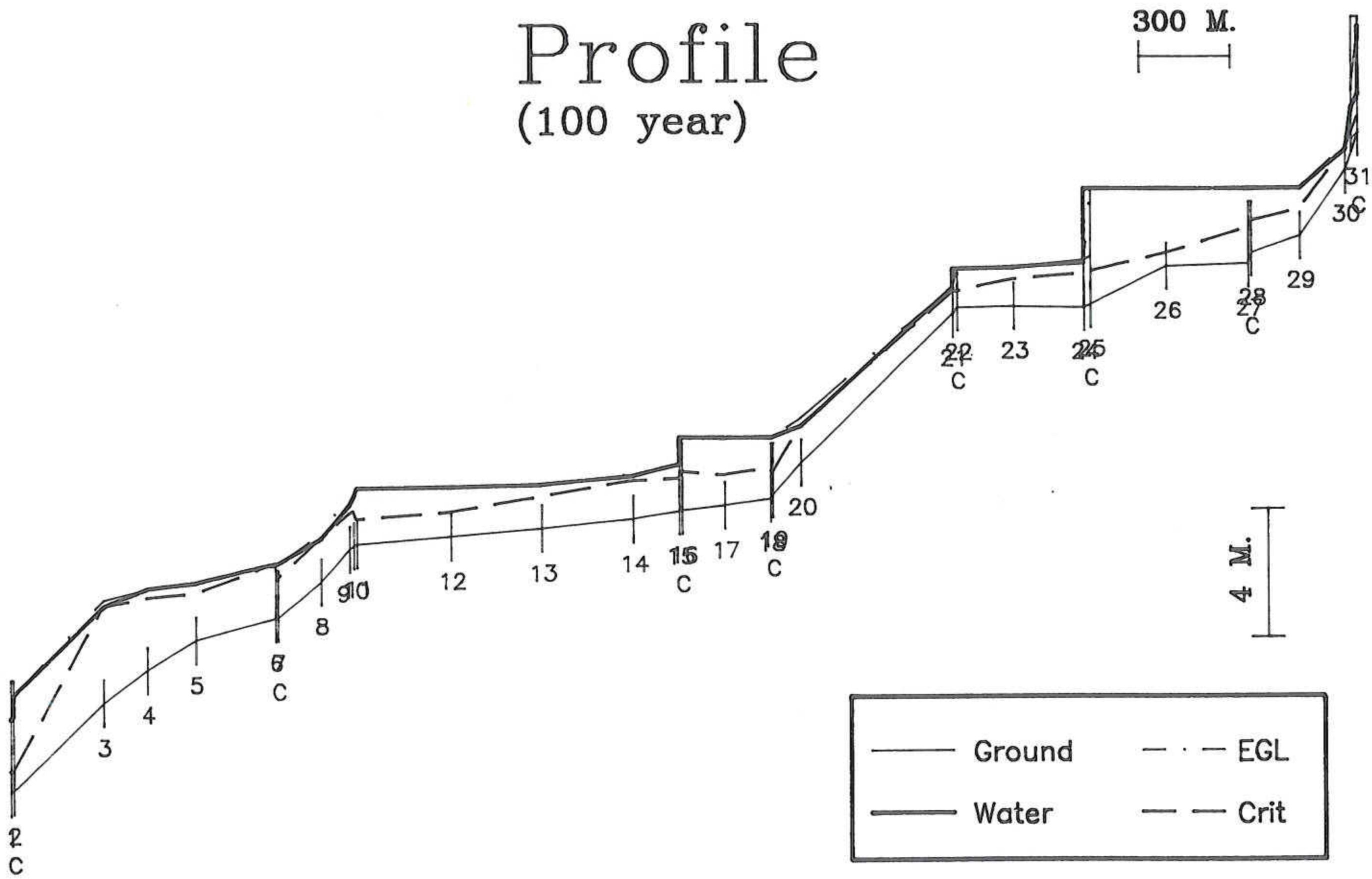

Profile
(5 year)
300 M.
4 M.
Ground
EGL
Water
Crit


Planview
(10 year)
300 M.
75 M.
water
edge
bank
flow


Profile
(10 year)
300 M.
4 M.
Ground
EGL
Water
Crit



Planview
(100 year)
800 Ft.
100 Ft.
water
edge
bank
flow



Profile
(100 year)
300 M.
4 M.
Ground
EGL
Water
Crit

ENGINEERING DATA SYSTEMS CORPORATION
Water Surface Profiling Summary Report

Date 05/18/95 Time 14:06:11
File BRDBK005.WPS Report Page 1
PROJECT: 5 yr storm

	WatSurf. m	Flow m	Crit. m	Energy m	Left m^3/s	Channel m^3/s	Right m^3/s	Channel m/s	Wetted m
1	7.50	2.78	6.13	7.51	3.89	3.66	5.99	0.50	45.00
2	7.87	3.08	6.36	7.88	5.28	2.54	5.72	0.57	39.48
3	10.38	2.89	10.38	10.60	0.27	11.26	2.01	2.30	25.36
4	10.97	2.47	10.72	10.99	3.90	5.90	3.73	0.94	108.83
5	11.17	1.74	10.86	11.18	6.64	2.84	4.05	0.82	60.00
6	11.80	1.70	11.80	11.80	9.80	0.92	2.81	0.27	222.86
7	11.80	1.69	11.35	11.80	8.91	0.83	3.80	0.24	266.27
8	12.55	1.31	12.55	12.70	2.53	6.58	4.43	2.36	36.55
9	13.56	1.31	13.26	13.85	0.00	10.70	0.00	2.37	3.59
10	13.78	1.43	13.36	14.02	0.00	10.70	0.00	2.17	3.62
11	14.02	1.62	13.22	14.02	4.67	2.49	3.54	0.35	100.95
12	14.07	1.43	13.58	14.07	4.58	1.89	4.23	0.36	108.63
13	14.16	1.28	13.89	14.17	0.39	2.22	8.09	0.51	128.21
14	14.45	1.29	14.37	14.54	1.61	7.16	1.93	1.65	39.33
15	14.83	1.44	14.42	14.85	2.93	4.94	2.83	0.87	50.80
16	15.67	2.25	14.61	15.68	0.31	7.00	3.39	0.19	86.99
17	15.68	2.10	14.56	15.68	5.67	1.02	4.01	0.12	166.50
18	15.68	1.90	14.81	15.68	6.24	1.23	2.10	0.16	147.80
19	15.68	1.78	14.81	15.68	6.29	1.16	2.12	0.16	147.81
20	15.97	1.07	15.97	16.24	0.00	9.57	0.00	2.29	7.79
21	20.34	0.80	20.16	20.37	1.65	2.88	2.01	1.02	71.24
22	20.94	1.22	20.22	20.94	4.10	1.23	1.21	0.23	124.40
23	20.96	1.20	20.43	20.97	0.00	5.24	0.00	0.21	74.95
24	21.07	1.35	20.72	21.14	0.00	5.23	0.00	1.22	8.43
25	22.92	3.11	20.78	22.92	0.09	5.00	0.15	0.16	26.34
26	22.92	1.92	21.38	22.92	0.00	3.57	0.00	0.03	107.63
27	22.92	1.83	22.14	22.93	0.41	2.30	0.86	0.51	51.13
28	23.18	1.77	22.36	23.18	0.74	1.25	1.58	0.25	84.73
29	23.23	1.28	22.77	23.24	0.00	3.73	0.17	0.62	26.74
30	24.63	0.63	24.63	24.74	0.00	3.71	0.20	1.47	16.84
31	28.00	2.83	25.61	28.00	1.08	1.82	1.01	0.04	98.00

ENGINEERING DATA SYSTEMS CORPORATION
Water Surface Profiling Summary Report

Date 05/18/95 | Time 14:07:35
File BRDBK010.WPS | Report Page 1
PROJECT: 10 yr storm

	WatSurf. m	Flow m	Crit. m	Energy m	Left m^3/s	Channel m^3/s	Right m^3/s	Channel m/s	Wetted m
1	7.00	2.28	5.39	7.02	3.88	5.32	6.49	0.91	35.00
2	7.73	2.94	5.38	7.75	5.22	3.34	7.13	0.79	38.94
3	10.46	2.97	10.46	10.67	0.44	11.80	3.44	2.29	31.51
4	11.02	2.52	10.74	11.04	4.20	6.73	4.76	0.82	117.28
5	11.21	1.78	10.89	11.23	7.71	3.09	4.89	0.86	60.00
6	11.80	1.70	11.80	11.80	11.36	1.07	3.26	0.31	222.86
7	11.80	1.69	11.37	11.81	10.32	0.96	4.40	0.28	266.41
8	12.59	1.35	12.59	12.75	3.11	7.15	5.43	2.46	39.05
9	13.63	1.38	13.36	13.97	0.00	12.26	0.00	2.57	3.60
10	13.89	1.54	13.46	14.16	0.00	12.26	0.00	2.30	3.65
11	14.16	1.76	13.19	14.16	0.78	7.85	3.63	0.22	107.76
12	14.18	1.54	13.40	14.19	1.34	6.61	4.31	0.24	114.63
13	14.24	1.36	13.88	14.24	0.00	2.51	9.75	0.30	134.97
14	14.51	1.35	14.35	14.55	0.00	9.49	2.77	1.04	44.04
15	14.86	1.47	14.40	14.88	0.00	9.09	3.17	0.56	52.44
16	15.70	2.28	14.64	15.71	0.38	7.98	3.89	0.21	88.17
17	15.71	2.13	14.52	15.71	3.28	4.83	4.15	0.11	168.42
18	15.71	1.93	14.76	15.71	3.52	5.33	2.13	0.14	149.91
19	15.71	1.81	14.60	15.71	3.54	5.30	2.14	0.14	149.91
20	16.06	1.16	16.06	16.31	0.04	10.94	0.01	2.25	16.64
21	20.35	0.81	20.19	20.39	2.09	3.19	2.23	1.09	75.30
22	20.95	1.23	20.24	20.95	4.73	1.40	1.38	0.26	124.52
23	20.98	1.22	20.60	20.99	0.00	7.50	0.00	0.28	76.66
24	21.14	1.42	20.78	21.22	0.04	5.94	0.02	1.28	10.89
25	23.45	3.64	20.84	23.45	2.47	3.18	0.36	0.17	60.40
26	23.45	2.45	21.41	23.45	0.00	4.16	0.00	0.02	115.38
27	23.45	2.36	22.21	23.45	0.11	2.07	1.99	0.11	120.58
28	23.45	2.04	22.42	23.45	0.11	2.02	2.04	0.11	120.63
29	23.46	1.51	22.80	23.47	0.81	2.91	0.43	0.49	48.11
30	24.66	0.66	24.66	24.78	0.11	3.98	0.26	1.62	18.88
31	28.52	3.35	25.66	28.52	2.31	0.71	1.34	0.04	98.00

ENGINEERING DATA SYSTEMS CORPORATION
Water Surface Profiling Summary Report

Date 05/18/95 Time 14:14:37
File BRDBK100.WPS Report Page 1
PROJECT: 100 yr storm

	WatSurf. m	Flow m	Crit. m	Energy m	Left m^3/s	Channel m^3/s	Right m^3/s	Channel m/s	Wetted m
1	8.80	4.08	5.39	8.80	8.15	3.98	11.07	0.35	60.00
2	8.80	4.01	5.38	8.81	12.89	2.24	8.06	0.38	56.11
3	10.66	3.17	10.66	10.80	1.38	12.46	9.04	2.17	82.41
4	11.13	2.63	10.84	11.15	6.73	8.02	8.13	0.89	121.15
5	11.34	1.91	10.96	11.36	11.27	3.90	7.71	0.98	60.00
6	11.80	1.70	11.80	11.80	16.57	1.56	4.76	0.45	222.86
7	11.82	1.71	11.40	11.82	15.00	1.38	6.50	0.40	268.88
8	12.70	1.46	12.70	12.87	5.08	8.91	8.89	2.76	45.67
9	13.82	1.57	13.65	14.34	0.00	17.44	0.00	3.20	3.65
10	14.22	1.87	13.75	14.58	0.00	17.44	0.00	2.66	3.73
11	14.58	2.18	13.26	14.58	2.05	9.78	5.61	0.20	128.87
12	14.59	1.95	13.40	14.59	2.56	8.37	6.52	0.20	136.04
13	14.61	1.73	13.92	14.61	0.00	3.25	14.19	0.19	166.30
14	14.67	1.51	14.43	14.71	0.00	12.61	4.83	0.94	56.94
15	14.99	1.60	14.49	15.01	0.00	12.65	4.79	0.62	59.55
16	15.77	2.35	14.72	15.77	0.62	11.24	5.58	0.28	90.63
17	15.77	2.19	14.56	15.77	4.68	6.79	5.98	0.14	172.55
18	15.78	2.00	14.81	15.78	5.11	7.42	3.08	0.18	154.53
19	15.78	1.88	14.60	15.78	5.13	7.38	3.10	0.18	154.53
20	16.28	1.38	16.28	16.44	2.28	12.87	0.46	1.93	1.89
21	20.35	0.81	20.28	20.42	2.95	4.53	3.16	1.55	75.24
22	21.00	1.28	20.32	21.00	6.85	1.89	1.90	0.33	125.00
23	21.05	1.29	20.67	21.05	0.00	10.65	0.00	0.34	80.25
24	21.21	1.49	20.94	21.34	0.14	8.24	0.09	1.61	13.62
25	23.50	3.69	20.99	23.51	3.53	4.39	0.54	0.24	64.77
26	23.51	2.51	21.55	23.51	0.00	8.47	0.00	0.04	116.10
27	23.51	2.42	22.72	23.51	0.26	4.06	4.15	0.20	128.74
28	23.51	2.10	22.69	23.51	0.19	2.89	3.09	0.15	128.83
29	23.52	1.57	22.94	23.54	1.43	3.98	0.76	0.63	54.13
30	24.73	0.73	24.73	24.85	0.28	4.90	0.66	1.70	24.52
31	28.89	3.72	25.70	28.89	3.09	0.90	1.84	0.04	98.00

YARMOUTH STORM WATER MANAGEMENT

MILO ESTATES

STORM SEWER MODELLING

YARMOUTH STORM WATER MANAGEMENT

VAUGHNE ESTATES

STORM SEWER MODELLING

STORM SEWER SUMMARY REPORT
Milo Estates - 5 yr Storm
FILE: MILO-05.STM

RAINFALL FILE: YARMETRC.RND

5 YEAR DESIGN STORM

I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	outfall line	0.0	0.00	0.00	108.25	0.00	0.00		600D	3.70	30	0.013	0.279	12.37	16.22
	DNLN = 0	183.5	0.30	63.83	30.25	4585.43	4585.43	614.0	600D	3.40		0.010	1.00	4.00	16.22
2	under Main St	0.0	0.30	0.00	108.25	0.00	0.00		600D	4.70	40	0.013	0.279	23.52	16.22
	DNLN = 1	183.5	0.30	63.79	30.26	4587.39	4587.39	921.0	600D	3.80		0.022	1.00	12.35	16.22
3	channel	0.6	0.30	10.00	74.95	39.01	0.00		600D	9.60	90	0.013	0.280	48.66	16.24
	DNLN = 2	183.5	0.30	63.70	30.29	4591.81	4591.81	1432.6	600D	4.70		0.054	1.00	23.49	16.24
4	under CNR	0.0	0.00	0.00	108.25	0.00	0.00		900H	9.80	10	0.013	0.020	60.67	5.65
	DNLN = 3	182.9	0.30	63.67	30.30	4577.46	4577.46	3259.9	900W	9.60		0.020	1.00	60.47	5.65
5	channel	0.5	0.30	10.00	74.95	30.34	0.00		600D	11.00	70	0.013	0.278	68.41	16.20
	DNLN = 4	182.9	0.30	63.60	30.32	4580.90	4580.90	769.7	600D	9.90		0.016	1.00	48.92	16.20
6	under Brunswick	7.4	0.30	15.00	65.30	397.60	0.00		1050D	11.50	20	0.013	0.014	80.64	5.28
	DNLN = 5	182.4	0.30	63.53	30.34	4571.64	4571.64	4318.3	1050D	11.00		0.025	1.00	80.36	5.28
7	upstream channe	175.0	0.30	63.00	30.51	4411.53	0.00		600D	35.40	500	0.013	0.283	211.12	15.60
	DNLN = 6	175.0	0.30	63.00	30.51	4411.53	4411.53	1342.4	600D	11.50		0.048	1.00	69.66	15.60

STORM SEWER SUMMARY REPORT
Milo Estates - 100 yr Storm
FILE: MILO-100.STM

RAINFALL FILE: YARMETRC.RND   100 YEAR DESIGN STORM   I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	outfall line	0.0	0.00	0.00	162.53	0.00	0.00		600D	3.70	30	0.013	0.799	27.98	27.45
	DNLN = 0	183.5	0.30	63.13	51.21	7763.22	7763.22	614.0	600D	3.40		0.010	1.00	4.00	27.45
2	under Main St	0.0	0.30	0.00	162.53	0.00	0.00		600D	4.70	40	0.013	0.800	59.95	27.46
	DNLN = 1	183.5	0.30	63.13	51.21	7763.99	7763.99	921.0	600D	3.80		0.022	1.00	27.97	27.46
3	channel	0.6	0.30	10.00	121.83	63.41	0.00		600D	9.60	90	0.013	0.800	131.92	27.46
	DNLN = 2	183.5	0.30	63.11	51.22	7765.28	7765.28	1432.6	600D	4.70		0.054	1.00	59.94	27.46
4	under CNR	0.0	0.00	0.00	162.53	0.00	0.00		900H	9.80	10	0.013	0.056	166.25	9.55
	DNLN = 3	182.9	0.30	63.11	51.22	7738.83	7738.83	3259.9	900W	9.60		0.020	1.00	165.69	9.55
5	channel	0.5	0.30	10.00	121.83	49.32	0.00		600D	11.00	70	0.013	0.795	188.36	27.37
	DNLN = 4	182.9	0.30	63.09	51.23	7740.34	7740.34	769.7	600D	9.90		0.016	1.00	132.73	27.37
6	under Brunswick	7.4	0.30	15.00	108.14	658.43	0.00		1050D	11.50	20	0.013	0.040	223.28	8.91
	DNLN = 5	182.4	0.30	63.09	51.24	7719.89	7719.89	4318.3	1050D	11.00		0.025	1.00	222.48	8.91
7	upstream channe	175.0	0.30	63.00	51.29	7415.15	0.00		600D	35.40	500	0.013	0.799	591.97	26.22
	DNLN = 6	175.0	0.30	63.00	51.29	7415.15	7415.15	1342.4	600D	11.50		0.048	1.00	192.30	26.22

STORM SEWER SUMMARY REPORT
VAUGHNE ESTATES - 5 yr storm
FILE: VAUGHNE.STM

RAINFALL FILE: YARMETRC.RND | 5 YEAR DESIGN STORM | I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	Ot/Fl to Main	0.0	0.00	0.00	108.25	0.00	0.00		900D	3.80	50	0.013	0.008	4.56	2.92
	DNLN = 0	35.1	0.38	33.31	44.98	1666.07	1666.07	1619.4	900D	3.40		0.008	1.00	4.16	2.92
2	along Main to H	3.5	0.30	22.00	55.53	160.56	0.00		700D	5.20	65	0.013	0.013	5.83	2.91
	DNLN = 1	18.9	0.45	32.92	45.27	1058.56	1058.56	1359.3	700D	3.80		0.022	1.50	4.99	2.75
3	up hibernia	0.0	0.00	0.00	108.25	0.00	0.00		700D	10.40	90	0.013	0.050	10.99	2.55
	DNLN = 2	14.8	0.47	32.26	45.78	877.41	877.41	2226.3	700D	5.20		0.058	1.50	6.47	2.28
4	up Hibernia - s	0.0	0.00	0.00	108.25	0.00	0.00		800D	10.40	90	0.013	0.002	11.69	1.77
	DNLN = 3	14.8	0.47	31.51	46.36	888.66	888.66	0.0	800D	10.40		0.000	0.00	11.48	1.77
5	Brunswick/Spruc	3.8	0.30	17.00	62.14	195.10	0.00		700D	12.20	75	0.013	0.013	12.68	2.05
	DNLN = 4	9.7	0.45	30.67	47.04	571.32	571.32	1434.9	700D	10.40		0.024	1.50	11.69	1.48
6	Sprucewood	3.4	0.30	6.00	85.26	239.49	0.00		600D	24.80	350	0.013	0.035	25.31	1.58
	DNLN = 5	3.4	0.30	6.00	85.26	239.49	239.49	1165.0	600D	12.20		0.036	1.50	13.00	0.85
7	Church Property	2.5	0.30	18.00	60.69	125.35	0.00		300D	32.25	315	0.013	0.220	94.40	9.07
	DNLN = 1	16.2	0.31	30.79	46.94	641.24	641.24	148.7	300D	24.80		0.024	1.00	25.10	9.07
8	DAR Track	3.2	0.30	5.00	88.34	233.54	0.00		600D	30.80	100	0.013	0.004	98.99	1.95
	DNLN = 7	13.7	0.31	29.93	47.65	552.47	552.47	1503.9	600D	24.80		0.060	1.50	98.59	1.95
9	Downhill Vaughn	0.5	0.50	5.00	88.34	60.82	0.00		300D	36.10	180	0.013	0.099	117.11	6.09
	DNLN = 8	10.5	0.31	29.44	48.07	430.24	430.24	141.3	300D	32.25		0.021	1.50	99.28	6.09
10	Vaughne Cresc S	0.7	0.30	15.00	65.30	37.76	0.00		700D	9.07	85	0.013	0.000	119.94	0.10
	DNLN = 9	0.7	0.30	15.00	65.30	37.76	37.76	2307.1	700D	3.80		0.062	1.50	119.94	0.10
11	Vaughne Cresc	3.2	0.30	13.00	68.82	181.95	0.00		700D	10.80	250	0.013	0.001	120.25	1.20
	DNLN = 9	9.3	0.30	18.59	59.87	459.98	459.98	769.6	700D	9.07		0.007	90.00	119.94	1.20
12	Vaughne Court	0.0	0.00	0.00	108.25	0.00	0.00		600D	13.30	60	0.013	0.000	126.80	0.00
	DNLN = 11	0.0	0.00	0.00	108.25	0.00	0.00	1253.3	600D	10.80		0.042	1.50	126.80	0.00
13	Brunswick	0.8	0.30	15.00	65.30	43.16	0.00		300D	16.10	90	0.013	0.049	131.25	4.30
	DNLN = 11	6.1	0.30	18.24	60.35	304.15	304.15	170.5	300D	13.30		0.031	1.00	126.80	4.30

STORM SEWER SUMMARY REPORT (continued)
VAUGHNE ESTATES - 5 yr storm
FILE: VAUGHNE.STM

RAINFALL FILE: YARMETRC.RND | 5 YEAR DESIGN STORM | I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
14	Chestnut	1.0	0.30	15.00	65.30	53.95	0.00		600D	14.80	170	0.013	0.001	132.38	1.00
	DNLN = 13	5.3	0.30	15.41	64.63	283.00	283.00	576.7	600D	13.30		0.009	1.50	132.19	1.00
15	Pleasant	0.7	0.30	15.00	65.30	37.76	0.00		300D	18.10	80	0.013	0.029	134.76	3.28
	DNLN = 14	4.3	0.30	15.00	65.30	231.98	231.98	196.3	300D	14.80		0.041	1.00	132.45	3.28
16	Pleasant	3.6	0.30	10.00	74.95	222.93	0.00		600D	17.40	190	0.013	0.001	135.48	0.79
	DNLN = 15	3.6	0.30	10.00	74.95	222.93	222.93	718.2	600D	14.80		0.014	1.50	135.30	0.79
17	Hibernia - sout	5.1	0.50	20.00	57.98	407.19	0.00		500D	28.11	400	0.013	0.029	29.27	3.36
	DNLN = 4	5.1	0.50	20.00	57.98	407.19	407.19	617.9	500D	17.40		0.027	1.50	17.70	3.36
18	Hibernia - nort	0.6	0.80	5.00	88.34	116.77	0.00		300D	32.60	210	0.013	0.023	33.19	2.24
	DNLN = 2	0.6	0.80	5.00	88.34	116.77	116.77	141.3	300D	28.11		0.021	1.50	28.32	2.24
19	Vocational Scho	2.5	0.90	30.00	47.59	294.91	0.00		500D	30.90	80	0.013	0.232	31.54	1.88
	DNLN = 5	2.5	0.90	30.00	47.59	294.91	294.91	1825.4	500D	12.20		0.234	1.50	13.00	1.50

STORM SEWER SUMMARY REPORT
VAUGHNE ESTATES - 100 yr storm
FILE: VAUGHNE.STM

RAINFALL FILE: YARMETRC.RND   100 YEAR DESIGN STORM   I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	Ot/Fl to Main	0.0	0.00	0.00	162.53	0.00	0.00		900D	3.80	50	0.013	0.013	4.94	4.58
	DNLN = 0	35.1	0.38	31.46	78.66	2913.74	2913.74	1619.4	900D	3.40		0.008	1.00	4.28	4.61
2	along Main to H	3.5	0.30	22.00	93.34	269.90	0.00		700D	5.20	65	0.013	0.020	7.29	4.78
	DNLN = 1	18.9	0.45	31.44	78.68	1839.67	1839.67	1359.3	700D	3.80		0.022	1.50	6.01	4.78
3	up hibernia	0.0	0.00	0.00	162.53	0.00	0.00		700D	10.40	90	0.013	0.023	11.08	3.95
	DNLN = 2	14.8	0.47	31.43	78.70	1508.41	1508.41	2226.3	700D	5.20		0.058	1.50	9.04	3.92
4	up Hibernia - s	0.0	0.00	0.00	162.53	0.00	0.00		1000D	10.40	90	0.013	0.002	12.46	1.94
	DNLN = 3	14.8	0.47	30.68	79.69	1527.55	1527.55	0.0	1000D	10.40		0.000	0.00	12.27	1.94
5	Brunswick/Spruc	3.8	0.30	17.00	103.46	324.82	0.00		700D	12.20	75	0.013	0.005	12.81	2.72
	DNLN = 4	9.7	0.45	30.67	79.71	968.12	968.12	1434.9	700D	10.40		0.024	1.50	12.46	2.52
6	Sprucewood	3.4	0.30	6.00	135.46	380.52	0.00		600D	24.80	350	0.013	0.035	25.47	1.88
	DNLN = 5	3.4	0.30	6.00	135.46	380.52	380.52	1165.0	600D	12.20		0.036	1.50	13.38	1.35
7	Church Property	2.5	0.30	18.00	101.27	209.17	0.00		300D	32.25	315	0.013	1.024	347.58	19.57
	DNLN = 1	16.2	0.31	18.00	101.27	1383.31	1383.31	148.7	300D	24.80		0.024	1.00	25.10	19.57
8	DAR Track	3.2	0.30	5.00	139.35	368.40	0.00		600D	30.80	100	0.013	0.021	369.15	4.41
	DNLN = 7	13.7	0.31	15.28	107.46	1245.86	1245.86	1503.9	600D	24.80		0.060	1.50	367.09	4.41
9	Downhill Vaughn	0.5	0.50	5.00	139.35	95.94	0.00		300D	36.10	180	0.013	0.496	459.99	13.63
	DNLN = 8	10.5	0.31	15.21	107.63	963.30	963.30	141.3	300D	32.25		0.021	1.50	370.63	13.63
10	Vaughne Cresc S	0.7	0.30	15.00	108.14	62.54	0.00		700D	9.07	85	0.013	0.000	474.18	0.16
	DNLN = 9	0.7	0.30	15.00	108.14	62.54	62.54	2307.1	700D	3.80		0.062	1.50	474.18	0.16
11	Vaughne Cresc	3.2	0.30	13.00	113.24	299.37	0.00		700D	10.80	250	0.013	0.004	475.18	2.15
	DNLN = 9	9.3	0.30	15.12	107.85	828.69	828.69	769.6	700D	9.07		0.007	90.00	474.18	2.15
12	Vaughne Court	0.0	0.00	0.00	162.53	0.00	0.00		600D	13.30	60	0.013	0.000	496.43	0.00
	DNLN = 11	0.0	0.00	0.00	162.53	0.00	0.00	1253.3	600D	10.80		0.042	1.50	496.43	0.00
13	Brunswick	0.8	0.30	15.00	108.14	71.47	0.00		300D	16.10	90	0.013	0.158	510.68	7.69
	DNLN = 11	6.1	0.30	15.08	107.93	543.95	543.95	170.5	300D	13.30		0.031	1.00	496.43	7.69

STORM SEWER SUMMARY REPORT (continued)
VAUGHNE ESTATES - 100 yr storm
FILE: VAUGHNE.STM

RAINFALL FILE: YARMETRC.RND — 100 YEAR DESIGN STORM — I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
14	Chestnut	1.0	0.30	15.00	108.14	89.34	0.00		600D	14.80	170	0.013	0.003	514.20	1.67
	DNLN = 13	5.3	0.30	15.02	108.08	473.25	473.25	576.7	600D	13.30		0.009	1.50	513.70	1.67
15	Pleasant	0.7	0.30	15.00	108.14	62.54	0.00		300D	18.10	80	0.013	0.079	520.73	5.43
	DNLN = 14	4.3	0.30	15.00	108.14	384.16	384.16	196.3	300D	14.80		0.041	1.00	514.42	5.43
16	Pleasant	3.6	0.30	10.00	121.83	362.35	0.00		600D	17.40	190	0.013	0.002	522.69	1.28
	DNLN = 15	3.6	0.30	10.00	121.83	362.35	362.35	718.2	600D	14.80		0.014	1.50	522.24	1.28
17	Hibernia - sout	5.1	0.50	20.00	97.15	682.22	0.00		500D	28.11	400	0.013	0.029	29.54	3.50
	DNLN = 4	5.1	0.50	20.00	97.15	682.22	682.22	617.9	500D	17.40		0.027	1.50	17.89	3.50
18	Hibernia - nort	0.6	0.80	5.00	139.35	184.20	0.00		300D	32.60	210	0.013	0.024	33.42	2.63
	DNLN = 2	0.6	0.80	5.00	139.35	184.20	184.20	141.3	300D	28.11		0.021	1.50	28.41	2.63
19	Vocational Scho	2.5	0.90	30.00	80.62	499.57	0.00		600D	30.80	80	0.013	0.228	31.61	2.13
	DNLN = 5	2.5	0.90	30.00	80.62	499.57	499.57	2960.5	600D	12.20		0.233	1.50	13.38	1.77

STORM SEWER SUMMARY REPORT
VAUGHNE ESTATES - New Layout 5 yr storm
FILE: NEWVAGHN.STM

RAINFALL FILE: YARMETRC.RND | 5 YEAR DESIGN STORM | I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	Ot/Fl to Main	0.0	0.00	0.00	108.25	0.00	0.00		1000D	3.70	50	0.013	0.006	4.42	2.67
	DNLN = 0	36.2	0.38	36.51	42.73	1621.70	1621.70	1857.5	1000D	3.40		0.006	1.00	4.12	2.67
2	along Main to H	3.5	0.30	22.00	55.53	160.56	0.00		500D	5.40	65	0.013	0.026	5.76	3.50
	DNLN = 1	15.0	0.30	36.50	42.74	529.63	529.63	610.6	500D	3.70		0.026	1.50	4.06	3.50
3	up hibernia	0.0	0.00	0.00	108.25	0.00	0.00		500D	10.60	90	0.013	0.058	10.80	4.16
	DNLN = 2	8.0	0.30	32.13	45.87	303.20	303.20	907.5	500D	5.40		0.058	1.50	5.60	4.16
4	up Hibernia - s	3.8	0.30	17.00	62.14	195.10	0.00		500D	12.40	75	0.013	0.021	12.78	1.92
	DNLN = 3	8.0	0.30	31.33	46.50	307.36	307.36	584.9	500D	10.60		0.024	1.00	11.21	1.57
5	Hibernia Souths	0.8	0.30	30.00	47.59	31.46	0.00		300D	36.10	160	0.013	0.151	36.68	3.19
	DNLN = 4	0.8	0.30	30.00	47.59	31.46	31.46	372.1	300D	12.40		0.148	1.00	12.46	3.19
6	Brunswick/Spruc	3.4	0.30	6.00	85.26	239.49	0.00		350D	25.05	350	0.013	0.038	26.11	3.25
	DNLN = 4	3.4	0.30	6.00	85.26	239.49	239.49	277.2	350D	12.40		0.036	1.50	12.65	3.25
7	Church Property	0.7	0.30	15.00	65.30	37.76	0.00		800D	6.55	85	0.013	0.033	6.98	4.99
	DNLN = 1	21.2	0.44	22.78	54.63	1396.25	1396.25	2420.2	800D	3.70		0.033	1.50	4.14	4.99
8	New Pipe DAR Tr	0.0	0.00	0.00	108.25	0.00	0.00		800D	14.60	250	0.013	0.032	14.99	4.67
	DNLN = 7	15.5	0.49	22.72	54.70	1140.35	1140.35	2373.4	800D	6.55		0.032	1.50	6.94	4.67
9	new pipe Brunsw	0.0	0.00	0.00	108.25	0.00	0.00		500D	18.90	90	0.013	0.048	19.20	4.49
	DNLN = 8	5.5	0.59	18.02	60.66	542.97	542.97	825.3	500D	14.60		0.048	1.00	14.90	4.49
10	new pipe up to	0.0	0.00	0.00	108.25	0.00	0.00		500D	25.53	70	0.013	0.095	25.77	5.81
	DNLN = 9	5.5	0.59	18.01	60.67	543.02	543.02	1161.6	500D	18.90		0.095	1.00	19.14	5.81
11	Vocational Scho	2.5	0.90	5.00	88.34	547.37	0.00		600D	30.80	100	0.013	0.069	32.73	4.67
	DNLN = 10	2.5	0.90	5.00	88.34	547.37	547.37	1410.1	600D	25.53		0.053	1.50	25.79	4.67
12	Sprucewood - ea	2.5	0.30	18.00	60.69	125.35	0.00		300D	32.25	315	0.013	0.019	32.54	2.40
	DNLN = 10	3.0	0.33	18.00	60.69	167.13	167.13	141.3	300D	25.53		0.021	1.00	26.47	2.36
13	Pleasant	0.5	0.50	5.00	88.34	60.82	0.00		300D	36.10	180	0.013	0.021	36.42	1.27
	DNLN = 12	0.5	0.50	5.00	88.34	60.82	60.82	141.3	300D	32.25		0.021	1.50	32.57	0.86

STORM SEWER SUMMARY REPORT (continued)
VAUGHNE ESTATES - New Layout 5 yr storm
FILE: NEWVAGHN.STM

RAINFALL FILE: YARMETRC.RND

5 YEAR DESIGN STORM

I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
14	DAR Track	3.2	0.30	13.00	68.82	181.95	0.00		400D	10.19	250	0.013	0.015	10.55	2.25
	DNLN = 7	5.0	0.30	15.03	65.25	269.56	269.56	251.2	400D	6.55		0.015	90.00	6.91	2.25
15	downhill Vaughn	0.0	0.00	0.00	108.25	0.00	0.00		300D	11.47	60	0.013	0.021	11.65	2.15
	DNLN = 14	1.8	0.30	15.01	65.28	97.08	97.08	141.3	300D	10.19		0.021	1.50	10.37	2.15
16	Vaughne Cresc.	0.8	0.30	15.00	65.30	43.16	0.00		300D	16.10	90	0.013	0.055	16.48	2.39
	DNLN = 15	0.8	0.30	15.00	65.30	43.16	43.16	219.3	300D	11.47		0.051	1.00	11.56	2.39
17	Vaughne Cresc.	1.0	0.30	15.00	65.30	53.95	0.00		300D	15.10	170	0.013	0.023	15.50	1.88
	DNLN = 15	1.0	0.30	15.00	65.30	53.95	53.95	141.3	300D	11.47		0.021	1.50	11.60	1.88
18	Vaughne Court	0.7	0.30	15.00	65.30	37.76	0.00		300D	18.10	80	0.013	0.047	18.43	2.20
	DNLN = 8	0.7	0.30	15.00	65.30	37.76	37.76	202.2	300D	14.60		0.044	1.00	14.69	2.20
19	Brunswick	3.6	0.30	10.00	74.95	222.93	0.00		600D	17.40	190	0.013	0.014	17.91	2.42
	DNLN = 8	9.3	0.44	22.71	54.71	619.28	619.28	745.3	600D	14.60		0.015	1.50	15.25	2.19
20	Chestnut	5.1	0.50	20.00	57.98	407.19	0.00		500D	28.11	400	0.013	0.027	28.45	3.48
	DNLN = 19	5.7	0.53	20.00	57.98	483.84	483.84	617.9	500D	17.40		0.027	1.50	17.73	3.48
21	Pleasant	0.6	0.80	5.00	88.34	116.77	0.00		300D	32.60	210	0.013	0.022	33.11	1.79
	DNLN = 20	0.6	0.80	5.00	88.34	116.77	116.77	141.3	300D	28.11		0.021	1.50	28.57	1.65
22	Hibernia norths	3.5	0.30	30.00	47.59	137.63	0.00		300D	36.10	780	0.013	0.040	36.95	2.95
	DNLN = 2	3.5	0.30	30.00	47.59	137.63	137.63	191.8	300D	5.40		0.039	1.50	5.59	2.95

STORM SEWER SUMMARY REPORT
VAUGHNE ESTATES - New Layout 100 yr storm
FILE: NEWVAGHN.STM

RAINFALL FILE: YARMETRC.RND   100 YEAR DESIGN STORM   I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	Ot/Fl to Main	0.0	0.00	0.00	162.53	0.00	0.00		1000D	3.70	50	0.013	0.008	4.70	3.50
	DNLN = 0	36.2	0.38	36.52	72.52	2752.04	2752.04	1857.5	1000D	3.40		0.006	1.00	4.32	3.65
2	along Main to H	3.5	0.30	22.00	93.34	269.90	0.00		500D	5.40	65	0.013	0.026	5.90	4.58
	DNLN = 1	15.0	0.30	36.50	72.54	898.93	898.93	610.6	500D	3.70		0.026	1.50	4.20	4.58
3	up hibernia	0.0	0.00	0.00	162.53	0.00	0.00		500D	10.60	90	0.013	0.058	10.87	4.78
	DNLN = 2	8.0	0.30	31.35	78.80	520.83	520.83	907.5	500D	5.40		0.058	1.50	5.67	4.78
4	up Hibernia - s	3.8	0.30	17.00	103.46	324.82	0.00		500D	12.40	75	0.013	0.021	12.87	2.73
	DNLN = 3	8.0	0.30	31.33	78.82	520.99	520.99	584.9	500D	10.60		0.024	1.00	11.26	2.65
5	Hibernia Souths	0.8	0.30	30.00	80.62	53.29	0.00		300D	36.10	160	0.013	0.153	36.90	3.78
	DNLN = 4	0.8	0.30	30.00	80.62	53.29	53.29	372.1	300D	12.40		0.148	1.00	12.48	3.78
6	Brunswick/Spruc	3.4	0.30	6.00	135.46	380.52	0.00		350D	25.05	350	0.013	0.040	26.59	3.96
	DNLN = 4	3.4	0.30	6.00	135.46	380.52	380.52	277.2	350D	12.40		0.036	1.50	12.75	3.96
7	Church Property	0.7	0.30	15.00	108.14	62.54	0.00		800D	6.55	85	0.013	0.033	7.22	5.48
	DNLN = 1	21.2	0.44	20.19	96.77	2473.06	2473.06	2420.2	800D	3.70		0.033	1.50	4.37	5.48
8	New Pipe DAR Tr	0.0	0.00	0.00	162.53	0.00	0.00		800D	14.60	250	0.013	0.032	15.17	5.30
	DNLN = 7	15.5	0.49	20.15	96.84	2018.91	2018.91	2373.4	800D	6.55		0.032	1.50	7.11	5.30
9	new pipe Brunsw	0.0	0.00	0.00	162.53	0.00	0.00		500D	18.90	90	0.013	0.048	19.40	4.61
	DNLN = 8	5.5	0.59	18.14	100.97	903.73	903.73	825.3	500D	14.60		0.048	1.00	15.10	4.61
10	new pipe up to	0.0	0.00	0.00	162.53	0.00	0.00		500D	25.53	70	0.013	0.095	25.86	6.54
	DNLN = 9	5.5	0.59	18.13	100.99	903.90	903.90	1161.6	500D	18.90		0.095	1.00	19.23	6.54
11	Vocational Scho	2.5	0.90	5.00	139.35	863.45	0.00		600D	30.80	100	0.013	0.074	33.24	5.24
	DNLN = 10	2.5	0.90	5.00	139.35	863.45	863.45	1410.1	600D	25.53		0.053	1.50	25.86	5.24
12	Sprucewood - ea	2.5	0.30	18.00	101.27	209.17	0.00		300D	32.25	315	0.013	0.042	39.62	3.94
	DNLN = 10	3.0	0.33	18.00	101.27	278.89	278.89	141.3	300D	25.53		0.021	1.00	26.51	3.94
13	Pleasant	0.5	0.50	5.00	139.35	95.94	0.00		300D	36.10	180	0.013	0.006	41.03	1.36
	DNLN = 12	0.5	0.50	5.00	139.35	95.94	95.94	141.3	300D	32.25		0.021	1.50	40.01	1.36

STORM SEWER SUMMARY REPORT (continued)
VAUGHNE ESTATES - New Layout 100 yr storm
FILE: NEWVAGHN.STM

RAINFALL FILE: YARMETRC.RND   100 YEAR DESIGN STORM   I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
14	DAR Track	3.2	0.30	13.00	113.24	299.37	0.00		400D	10.19	250	0.013	0.023	12.68	3.55
	DNLN = 7	5.0	0.30	15.08	107.94	445.88	445.88	251.2	400D	6.55		0.015	90.00	6.94	3.56
15	downhill Vaughn	0.0	0.00	0.00	162.53	0.00	0.00		300D	11.47	60	0.013	0.014	13.75	2.27
	DNLN = 14	1.8	0.30	15.06	107.99	160.60	160.60	141.3	300D	10.19		0.021	1.50	12.92	2.27
16	Vaughne Cresc.	0.8	0.30	15.00	108.14	71.47	0.00		300D	16.10	90	0.013	0.056	16.61	2.77
	DNLN = 15	0.8	0.30	15.00	108.14	71.47	71.47	219.3	300D	11.47		0.051	1.00	11.59	2.77
17	Vaughne Cresc.	1.0	0.30	15.00	108.14	89.34	0.00		300D	15.10	170	0.013	0.011	15.51	1.52
	DNLN = 15	1.0	0.30	15.00	108.14	89.34	89.34	141.3	300D	11.47		0.021	1.50	13.64	1.26
18	Vaughne Court	0.7	0.30	15.00	108.14	62.54	0.00		300D	18.10	80	0.013	0.048	18.54	2.52
	DNLN = 8	0.7	0.30	15.00	108.14	62.54	62.54	202.2	300D	14.60		0.044	1.00	14.71	2.52
19	Brunswick	3.6	0.30	10.00	121.83	362.35	0.00		600D	17.40	190	0.013	0.016	18.48	3.88
	DNLN = 8	9.3	0.44	20.10	96.95	1097.39	1097.39	745.3	600D	14.60		0.015	1.50	15.45	3.88
20	Chestnut	5.1	0.50	20.00	97.15	682.22	0.00		500D	28.11	400	0.013	0.027	28.61	4.14
	DNLN = 19	5.7	0.53	20.00	97.15	810.64	810.64	617.9	500D	17.40		0.027	1.50	17.95	4.13
21	Pleasant	0.6	0.80	5.00	139.35	184.20	0.00		300D	32.60	210	0.013	0.021	33.42	2.63
	DNLN = 20	0.6	0.80	5.00	139.35	184.20	184.20	141.3	300D	28.11		0.021	1.50	28.96	2.61
22	Hibernia norths	3.5	0.30	30.00	80.62	233.13	0.00		400D	36.00	780	0.013	0.040	37.09	3.38
	DNLN = 2	3.5	0.30	30.00	80.62	233.13	233.13	412.4	400D	5.40		0.039	1.50	5.62	3.38

YARMOUTH STORM WATER MANAGEMENT

HERBERT ST. - MARSHA AVE.

STORM SEWER MODELLING

STORM SEWER SUMMARY REPORT
Herbert - Marsha Storm sewer - 5 yr storm
FILE: HERBRT05.STM

RAINFALL FILE: YARMETRC.RND   5 YEAR DESIGN STORM   I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	EXIST MH1 - MH DNLN = 0	2.1 42.2	0.40 0.34	60.00 120.13	31.51 19.34	72.20 758.79	0.00 758.79	1198.9	900D 900D	19.35 19.00	80	0.013 0.004	0.006 1.00	19.96 19.51	1.65 2.03
2	MH 2 - 3 DNLN = 1	0.4 40.1	0.40 0.33	15.00 120.08	65.30 19.35	25.90 714.71	0.00 714.71	1198.9	900D 900D	19.70 19.35	80	0.013 0.004	0.005 1.00	20.27 19.89	1.68 1.80
3	MH 3 - 4 DNLN = 2	0.2 39.7	0.40 0.33	15.00 120.05	65.30 19.35	12.95 707.17	0.00 707.17	1198.9	900D 900D	20.05 19.70	80	0.013 0.004	0.005 1.00	20.63 20.21	1.64 1.93
4	MH 4 - 5 DNLN = 3	2.2 39.5	0.40 0.33	30.00 120.03	47.59 19.36	116.39 703.41	0.00 703.41	1198.9	900D 900D	20.18 20.05	30	0.013 0.004	0.007 1.25	20.75 20.54	1.66 1.97
5	MH 5 - 6 DNLN = 4	1.0 13.0	0.40 0.31	30.00 120.00	47.59 19.36	53.48 213.68	0.00 213.68	267.4	450D 450D	21.25 20.63	70	0.013 0.009	0.009 1.25	21.55 20.94	1.87 1.87
6	MH 6 - 7 DNLN = 5	12.0 12.0	0.30 0.30	120.00 120.00	19.36 19.36	191.93 191.93	0.00 191.93	768.5	500D 500D	24.10 21.20	70	0.013 0.041	0.049 1.00	24.81 21.37	3.26 3.26
7	MH 5 - 8 DNLN = 4	2.6 24.3	0.50 0.34	20.00 30.55	57.98 47.14	207.59 1077.52	0.00 1077.52	737.2	750D 750D	20.77 20.33	100	0.013 0.004	0.014 1.50	22.35 20.97	2.44 2.70
8	MH 8 - 9 DNLN = 7	1.8 21.7	0.40 0.32	20.00 30.51	57.98 47.17	111.78 909.38	0.00 909.38	737.2	750D 750D	21.21 20.77	100	0.013 0.004	0.010 1.00	23.39 22.43	2.06 2.06
9	MH 9 - 10 DNLN = 8	1.8 20.0	0.40 0.32	15.00 30.49	65.30 47.18	125.88 818.63	0.00 818.63	737.1	750D 750D	21.58 21.36	50	0.013 0.004	0.008 1.50	23.73 23.34	1.85 1.85
10	MH 10 - 11 DNLN = 9	1.4 18.2	0.40 0.31	15.00 30.48	65.30 47.20	100.70 727.87	0.00 727.87	737.3	750D 750D	21.91 21.58	75	0.013 0.004	0.006 1.50	23.95 23.50	1.65 1.65
11	MH 11 - 12 DNLN = 10	8.4 16.8	0.30 0.30	30.00 30.35	47.59 47.30	330.30 656.57	0.00 656.57	406.6	600D 600D	22.24 21.91	75	0.013 0.004	0.016 1.00	25.04 23.82	2.32 2.32
12	MH 12 - 13 DNLN = 11	2.4 8.4	0.30 0.30	30.00 30.20	47.59 47.42	94.37 329.13	0.00 329.13	406.6	600D 600D	22.61 22.24	85	0.013 0.004	0.004 1.00	25.50 25.15	1.16 1.16
13	MH 13 - 14 DNLN = 12	3.0 6.0	0.30 0.30	30.00 30.13	47.59 47.49	117.97 235.39	0.00 235.39	406.6	600D 600D	23.01 22.61	90	0.013 0.004	0.002 1.00	25.64 25.45	0.83 0.83

STORM SEWER SUMMARY REPORT (continued)
Herbert - Marsha Storm sewer - 5 yr storm
FILE: HERBRT05.STM

RAINFALL FILE: YARMETRC.RND

5 YEAR DESIGN STORM

I = 1346.520/ (Tc + 18.750) ^ 0.860

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
14	MH 14 - 15 DNLN = 13	3.0 3.0	0.30 0.30	30.00 30.00	47.59 47.59	117.97 117.97	0.00 117.97	406.6	600D 600D	23.40 23.01	90	0.013 0.004	0.001 1.00	25.66 25.61	0.42 0.42

STORM SEWER SUMMARY REPORT
Herbert - Marsha Storm sewer - 100 yr storm
FILE: HRBRT100.STM

RAINFALL FILE: YARMETRC.RND | 100 YEAR DESIGN STORM | I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	EXIST MH1 - MH	2.1	0.40	60.00	53.06	121.58	0.00		900D	19.35	80	0.013	0.009	20.33	1.88
	DNLN = 0	42.2	0.34	123.07	30.51	1196.80	1196.80	1198.9	900D	19.00		0.004	1.00	19.65	2.44
2	MH 2 - 3	0.4	0.40	15.00	108.14	42.88	0.00		900D	19.70	80	0.013	0.005	20.59	1.78
	DNLN = 1	40.1	0.33	122.32	30.67	1132.69	1132.69	1198.9	900D	19.35		0.004	1.00	20.18	1.85
3	MH 3 - 4	0.2	0.40	15.00	108.14	21.44	0.00		900D	20.05	80	0.013	0.006	20.88	1.84
	DNLN = 2	39.7	0.33	121.57	30.83	1126.36	1126.36	1198.9	900D	19.70		0.004	1.00	20.43	2.05
4	MH 4 - 5	2.2	0.40	30.00	80.62	197.16	0.00		900D	20.18	30	0.013	0.009	20.96	1.93
	DNLN = 3	39.5	0.33	121.28	30.89	1122.44	1122.44	1198.9	900D	20.05		0.004	1.25	20.68	2.37
5	MH 5 - 6	1.0	0.40	30.00	80.62	90.59	0.00		450D	21.25	70	0.013	0.020	22.44	2.15
	DNLN = 4	13.0	0.31	120.74	31.00	342.20	342.20	267.4	450D	20.63		0.009	1.25	21.03	2.29
6	MH 6 - 7	12.0	0.30	120.00	31.16	308.96	0.00		500D	24.10	70	0.013	0.038	24.67	1.92
	DNLN = 5	12.0	0.30	120.00	31.16	308.96	308.96	768.5	500D	21.20		0.041	1.00	22.03	1.57
7	MH 5 - 8	2.6	0.50	20.00	97.15	347.80	0.00		750D	20.77	100	0.013	0.031	24.16	3.81
	DNLN = 4	24.3	0.34	35.59	73.57	1681.64	1681.64	737.2	750D	20.33		0.004	1.50	21.06	3.85
8	MH 8 - 9	1.8	0.40	20.00	97.15	187.28	0.00		750D	21.21	100	0.013	0.024	26.72	3.24
	DNLN = 7	21.7	0.32	35.08	74.17	1429.80	1429.80	737.2	750D	20.77		0.004	1.00	24.36	3.24
9	MH 9 - 10	1.8	0.40	15.00	108.14	208.46	0.00		750D	21.58	50	0.013	0.019	27.56	2.93
	DNLN = 8	20.0	0.32	34.79	74.50	1292.63	1292.63	737.1	750D	21.36		0.004	1.50	26.60	2.93
10	MH 10 - 11	1.4	0.40	15.00	108.14	166.77	0.00		750D	21.91	75	0.013	0.015	28.63	2.62
	DNLN = 9	18.2	0.31	34.32	75.07	1157.77	1157.77	737.3	750D	21.58		0.004	1.50	27.47	2.62
11	MH 11 - 12	8.4	0.30	30.00	80.62	559.52	0.00		600D	22.24	75	0.013	0.042	31.40	3.70
	DNLN = 10	16.8	0.30	33.98	75.48	1047.64	1047.64	406.6	600D	21.91		0.004	1.00	28.28	3.70
12	MH 12 - 13	2.4	0.30	30.00	80.62	159.86	0.00		600D	22.61	85	0.013	0.011	32.83	1.88
	DNLN = 11	8.4	0.30	33.22	76.41	530.26	530.26	406.6	600D	22.24		0.004	1.00	31.92	1.88
13	MH 13 - 14	3.0	0.30	30.00	80.62	199.83	0.00		600D	23.01	90	0.013	0.006	33.32	1.36
	DNLN = 12	6.0	0.30	32.12	77.80	385.64	385.64	406.6	600D	22.61		0.004	1.00	32.81	1.36

STORM SEWER SUMMARY REPORT (continued)
Herbert - Marsha Storm sewer - 100 yr storm
FILE: HRBRT100.STM

RAINFALL FILE: YARMETRC.RND   100 YEAR DESIGN STORM   I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
14	MH 14 - 15 DNLN = 13	3.0 3.0	0.30 0.30	30.00 30.00	80.62 80.62	199.83 199.83	0.00 199.83	406.6	600D 600D	23.40 23.01	90	0.013 0.004	0.002 1.00	33.47 33.31	0.71 0.71

YARMOUTH STORM WATER MANAGEMENT

PARADE STREET

STORM SEWER MODELLING

STORM SEWER SUMMARY REPORT
Parade St Storm Culvert - 5 yr Storm
FILE: PARADE05.STM

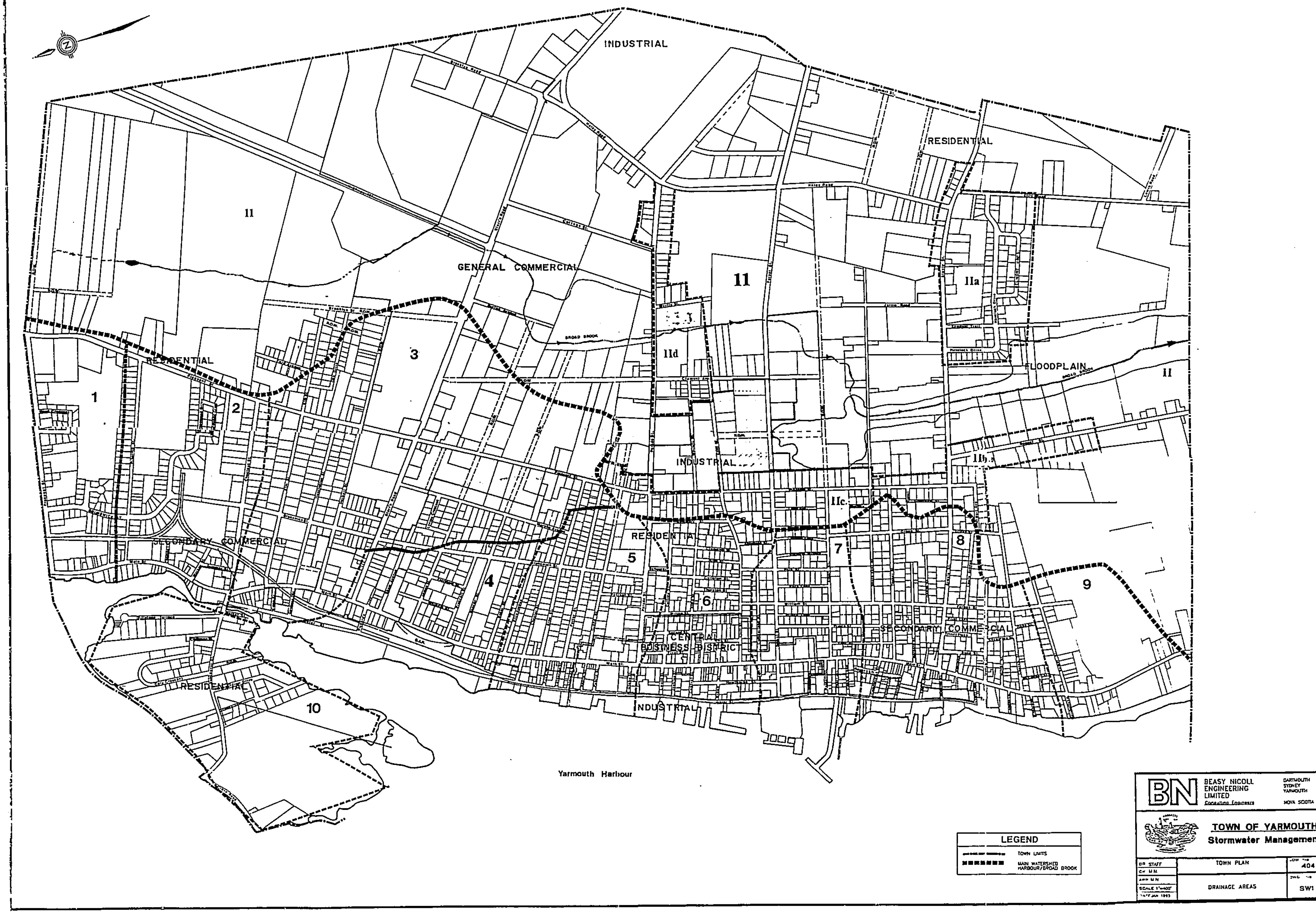
RAINFALL FILE: YARMETRC.RND 5 YEAR DESIGN STORM I = 1346.520/ (Tc + 18.750) ^ 0.860

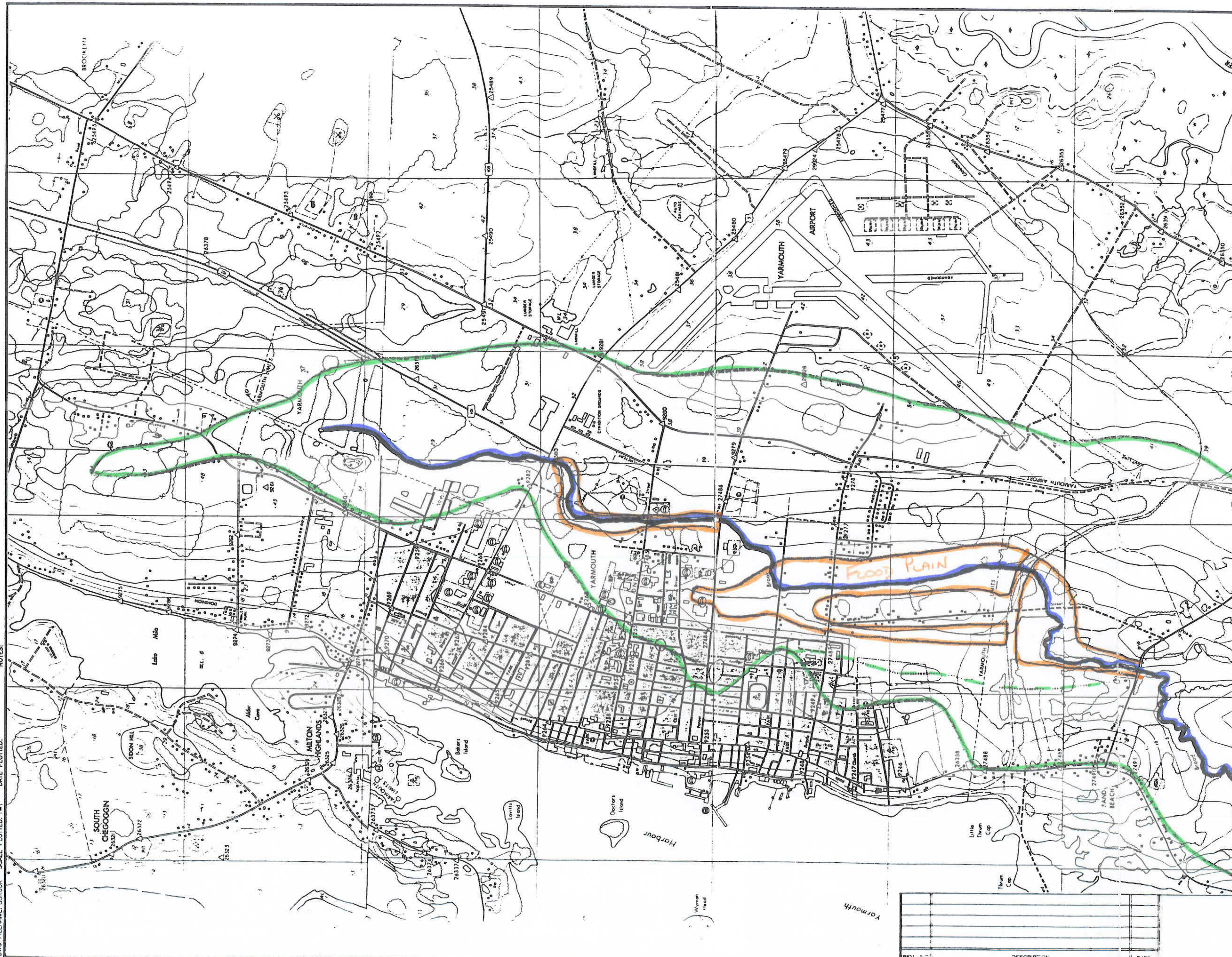
LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	BB to MYRTLE	1.2	0.30	30.00	47.59	47.19	0.00		600D	23.03	120	0.013	0.025	23.36	3.60
	DNLN = 0	24.1	0.37	90.10	23.85	579.36	579.36	975.7	600D	20.00		0.025	1.00	20.33	3.60
2	MYRTLE to Senio	2.0	0.30	30.00	47.59	78.64	0.00		600D	24.15	90	0.013	0.012	24.64	2.26
	DNLN = 1	22.9	0.37	90.08	23.86	555.83	555.83	684.9	600D	23.03		0.012	1.00	23.55	2.13
3	Seniors to COTT	5.0	0.30	60.00	31.51	130.16	0.00		600D	28.55	130	0.013	0.034	28.83	3.90
	DNLN = 2	20.9	0.38	90.06	23.86	516.50	516.50	1129.6	600D	24.15		0.034	1.00	24.43	3.90
4	COTTAGE to HALE	15.9	0.40	90.00	23.87	418.12	0.00		600D	33.25	250	0.013	0.019	33.87	1.96
	DNLN = 3	15.9	0.40	90.00	23.87	418.12	418.12	841.9	600D	28.55		0.019	1.00	29.16	1.48

STORM SEWER SUMMARY REPORT
Parade St Storm Culvert - 100 yr Storm
FILE: PARAD100.STM

RAINFALL FILE: YARMETRC.RND 100 YEAR DESIGN STORM I = 6403.110/ (Tc + 32.000) ^ 1.060

LINE ID		FLOW RATE INFO						PIPE INFO					HYDRAULIC INFO		
LINE#	DESCRIPTION DOWNLINE#	INC AR TOT AR (ha)	RUNOFFC WEIGHTD C	INLTIME Tc (min)	INLT I TOTL I (mm/h)	INC CIA TOT CIA (l/s)	INPUTQ TOTALQ (l/s)	UNIFORM FLOWCAP (l/s)	SIZE/ TYPE (mm)	INVERT UP/DOWN (m)	PIPE LEN (m)	NVAL INVSLOP (m/m)	HGLSLOPE JLC (m/m)	HYD GRD UP/DOWN (m)	VEL UP/DOWN (m/s)
1	BB to MYRTLE	1.2	0.30	30.00	80.62	79.93	0.00		600D	23.03	120	0.013	0.035	25.00	3.38
	DNLN = 0	24.1	0.37	90.11	39.30	954.67	954.67	975.7	600D	20.00		0.025	1.00	20.85	3.38
2	MYRTLE to Senio	2.0	0.30	30.00	80.62	133.22	0.00		600D	24.15	90	0.013	0.032	27.91	3.24
	DNLN = 1	22.9	0.37	90.08	39.31	915.93	915.93	684.9	600D	23.03		0.012	1.00	25.05	3.24
3	Seniors to COTT	5.0	0.30	60.00	53.06	219.19	0.00		600D	28.55	130	0.013	0.027	30.82	3.01
	DNLN = 2	20.9	0.38	90.06	39.32	851.14	851.14	1129.6	600D	24.15		0.034	1.00	27.25	3.01
4	COTTAGE to HALE	15.9	0.40	90.00	39.34	689.07	0.00		600D	33.25	250	0.013	0.019	35.36	2.44
	DNLN = 3	15.9	0.40	90.00	39.34	689.07	689.07	841.9	600D	28.55		0.019	1.00	30.56	2.44


INDUSTRIAL
RESIDENTIAL
11
GENERAL COMMERCIAL
11
11a
11d
FLOODPLAIN
11
RESIDENTIAL
1
2
3
INDUSTRIAL
11b
11c
SECONDARY COMMERCIAL
RESIDENTIAL
5
7
8
4
6
9
CENTRAL
BUSINESS DISTRICT
SECONDARY COMMERCIAL
RESIDENTIAL
10
INDUSTRIAL
Yarmouth Harbour
LEGEND
TOWN LIMITS
MAIN WATERSHED
HARBOUR/BROAD BROOK
BEASY NICOLL
ENGINEERING
LIMITED
Consulting Engineers
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA
TOWN OF YARMOUTH
Stormwater Management
DR STAFF
CK M.N.
APP M.N.
SCALE 1"=400'
TOWN PLAN
404
DRAINAGE AREAS
SW1



DWG FILENAME: BBROOK SCALE PLOTTED: 1=1 DATE PLOTTED:

NOTES:

LEGEND

- WATERSHED BOUNDARY
- SUBWATERSHED BOUNDARY

BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers

DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.		
APP. M.N.	BROAD BROOK	DWG. No. SW2
SCALE 1:10000		
DATE APR '95		

REV. NO.	DESCRIPTION	DATE


DRAINAGE WATERSHEDS
1. MILO ESTATES AREA (Prospect to Hibernia)
2. VAUGHNE ESTATES AREA (Hibernia to Chestnut)
11. BROAD BROOK
DRAINAGE LEGEND
STORMWATER PIPE
CULVERT
DITCH or CHANNEL
STREAM
WATERSHED BOUNDARY
PIPE SIZE
NORTH
NEW SCHOOL AREA
WATER RESEVOIR
IMPOUNDING POND
SWAMP
FROM VOCATIONAL SCHOOL
600x1200
300
400
450
600
750
900x900
1050
350
600x750
300
SCALE: 1:2000
BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA
TOWN OF YARMOUTH
Stormwater Management
DR. M.C.
CK. M.N.
APP. M.N.
SCALE 1=2000
DATE
WATERSHED AREAS
MILO AND VAUGHNE ESTATE AREAS
404
DWG. No.
SW3
REV. NO.
DESCRIPTION
DATE
NOTES:
DATE PLOTTED:
SCALE PLOTTED:
DWG FILENAME:

DRAINAGE WATERSHEDS

3. GARDNER – HERBERT
3A. ELM TO STARRS
3B. BRUNSWICK TO PLEASANT (MARSHA AVE.)
11. BROAD BROOK

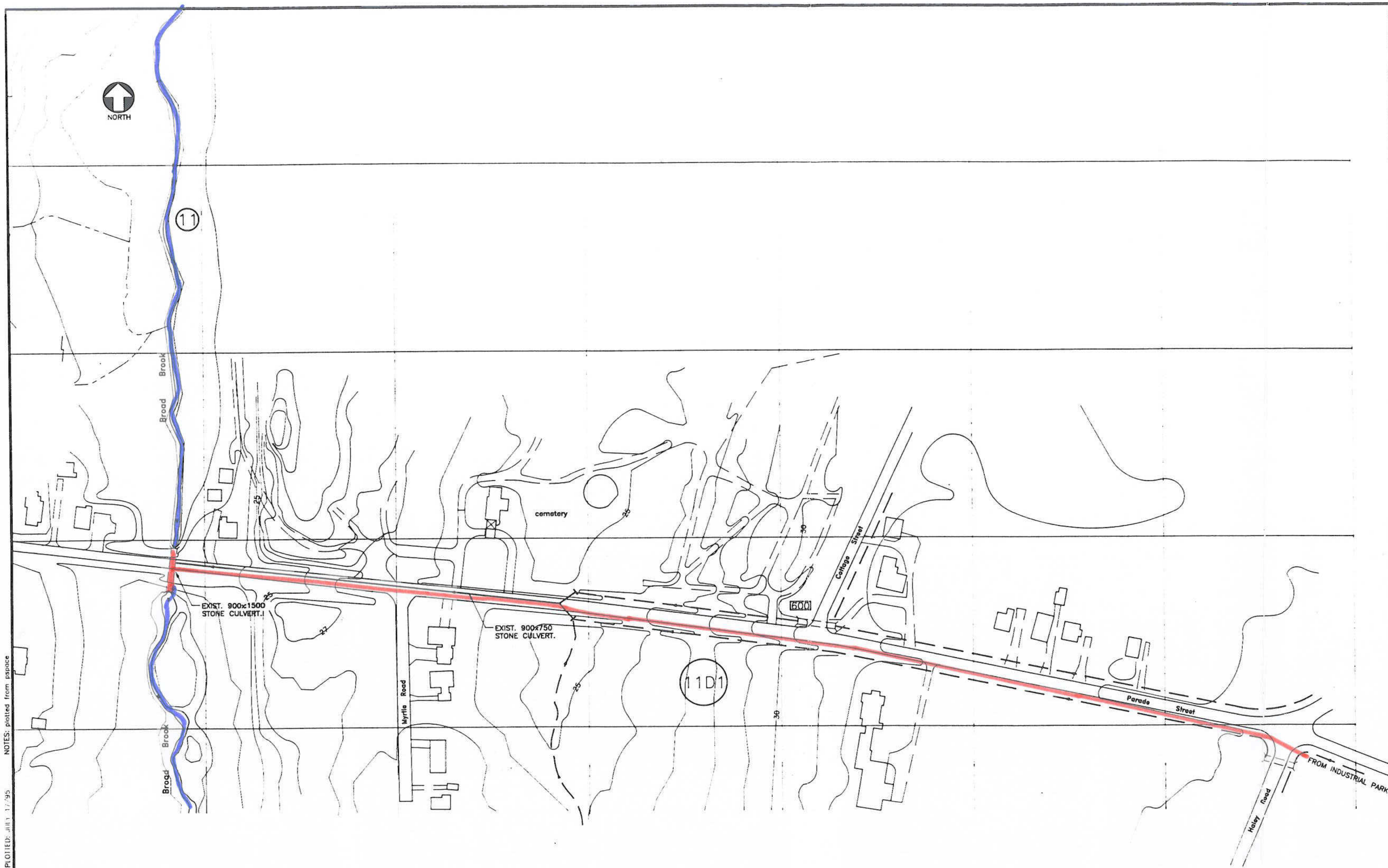
DRAINAGE LEGEND	
(symbol)	STORMWATER PIPE
(symbol)	CULVERT
(symbol)	DITCH or CHANNEL
(symbol)	STREAM
(symbol)	WATERSHED BOUNDARY
000	PIPE SIZE

REV. NO.	DESCRIPTION	DATE

BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.		
APP. M.N.	GARDNER–HERBERT–MARSHA	DWG. No. SW4
SCALE 1=2000		
DATE		



DRAINAGE WATERSHEDS

11. BROAD BROOK
11D1. PARADE STREET (EAST OF BROAD BROOK)

DRAINAGE LEGEND	
——◄——	STORMWATER PIPE
=====	CULVERT
---◆---	DITCH or CHANNEL
-·-◄-·-	STREAM
[000]	PIPE SIZE

SCALE : 1:1000

0m 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m

REV. NO.	DESCRIPTION	DATE

BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers

DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.		
APP. M.N.	PARADE STREET EAST OF BROAD BROOK	DWG. No. SW5
SCALE 1=1000		
DATE		

DWG FILENAME: SCALE PLOTTED: 1:1 DATE PLOTTED: JULY 17/95 NOTES: plotted from pspace

DRAINAGE WATERSHEDS

11. BROAD BROOK
11A. HAVELOCK SUBDIVISION

DRAINAGE LEGEND

- STORMWATER PIPE
- CULVERT
- DITCH or CHANNEL
- STREAM
- 000 PIPE SIZE

DWG FILENAME: [illegible] SCALE PLOTTED: 1:1 DATE PLOTTED: JULY 26 95 NOTES: plotted from pspace

REV. NO.	DESCRIPTION	DATE

BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.		
APP. M.N.	HAVELOCK SUBDIVISION	DWG. No. SW8
SCALE 1=1500		
DATE		

LEGEND

—·—·—	TOWN LIMITS
■■■■■■	MAIN WATERSHED HARBOUR/BROAD BROOK

BN BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers

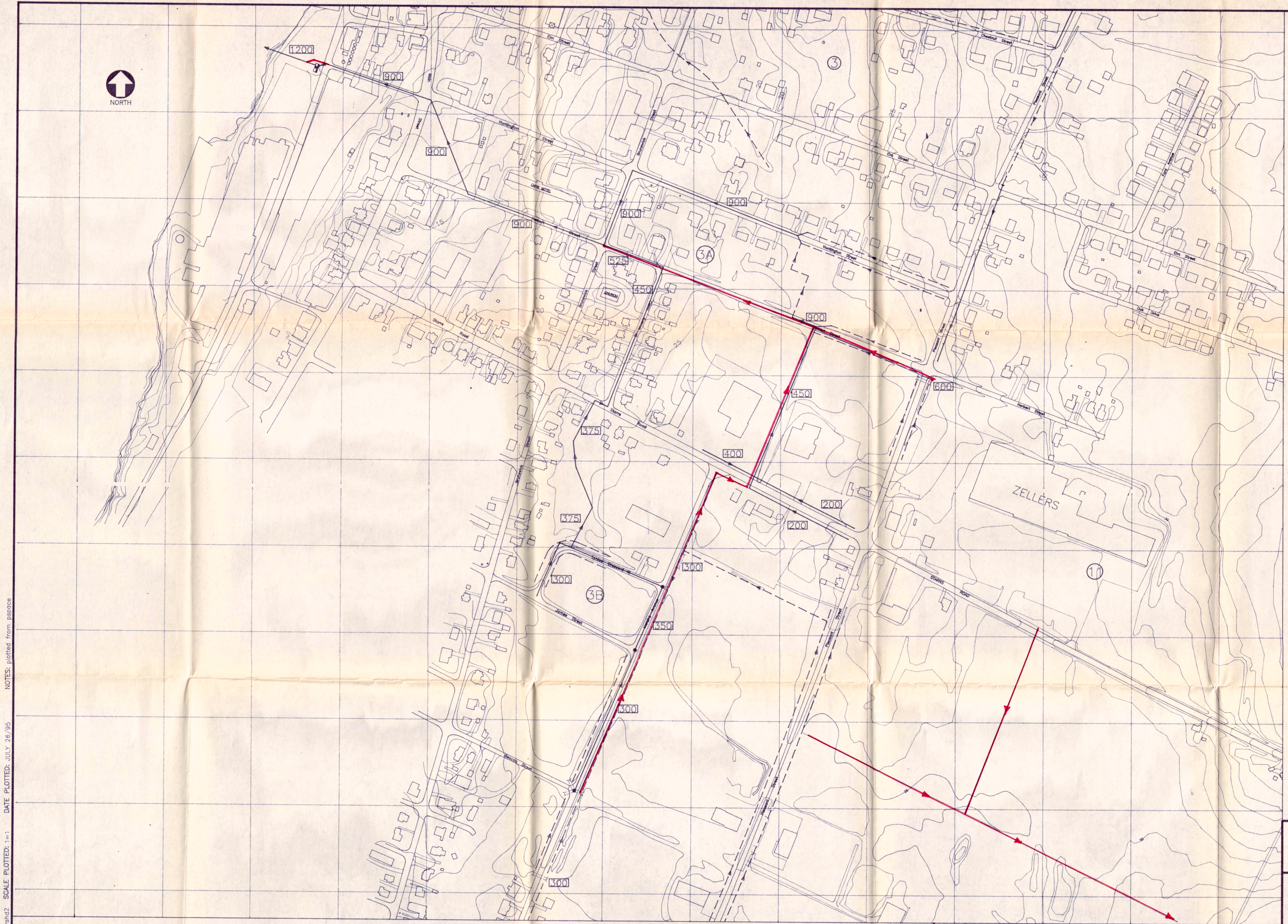
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

PROGRESS
TOWN OF YARMOUTH N.S.
INCORPORATED 1890

TOWN OF YARMOUTH
Stormwater Management

DR. STAFF	TOWN PLAN	JOB No. 404
CK. M.N.		
APP. M.N.	DRAINAGE AREAS	DWG. No. SW1
SCALE 1"=400'		
DATE JAN., 1995		

LEGEND
WATERSHED BOUNDARY
SUBWATERSHED BOUNDARY
Flood Plain
YARMOUTH AIRPORT
YARMOUTH
Harbour
MILTON HIGHLANDS
SOUTH CHEGOGGIN
SAND BEACH
BN BEASY NICOLL ENGINEERING LIMITED Consulting Engineers
DARTMOUTH SYDNEY YARMOUTH NOVA SCOTIA
TOWN OF YARMOUTH
Stormwater Management
DR. M.C.
CK. M.N.
APP. M.N.
SCALE 1:10000
DATE APR '95
WATERSHED AREAS
BROAD BROOK
JOB No. 4Q4
DWG. No. SW2
REV. NO.
DESCRIPTION
DATE
DWG FILENAME: BBROOK SCALE PLOTTED: 1=1 DATE PLOTTED: NOTES:



SCALE: 1:2000

0m 50m 100m 150m 200m 250m

DRAINAGE WATERSHEDS

3. GARDNER – HERBERT
3A. ELM TO STARRS
3B. BRUNSWICK TO PLEASANT (MARSHA AVE.)
11. BROAD BROOK

DRAINAGE LEGEND

——◄——	STORMWATER PIPE
=====	CULVERT
–·–◄–·–	DITCH or CHANNEL
–·–►–·–	STREAM
— · — ·	WATERSHED BOUNDARY
[000]	PIPE SIZE

REV. NO.	DESCRIPTION	DATE

BN BEASY NICOLL ENGINEERING LIMITED Consulting Engineers

DARTMOUTH SYDNEY YARMOUTH NOVA SCOTIA

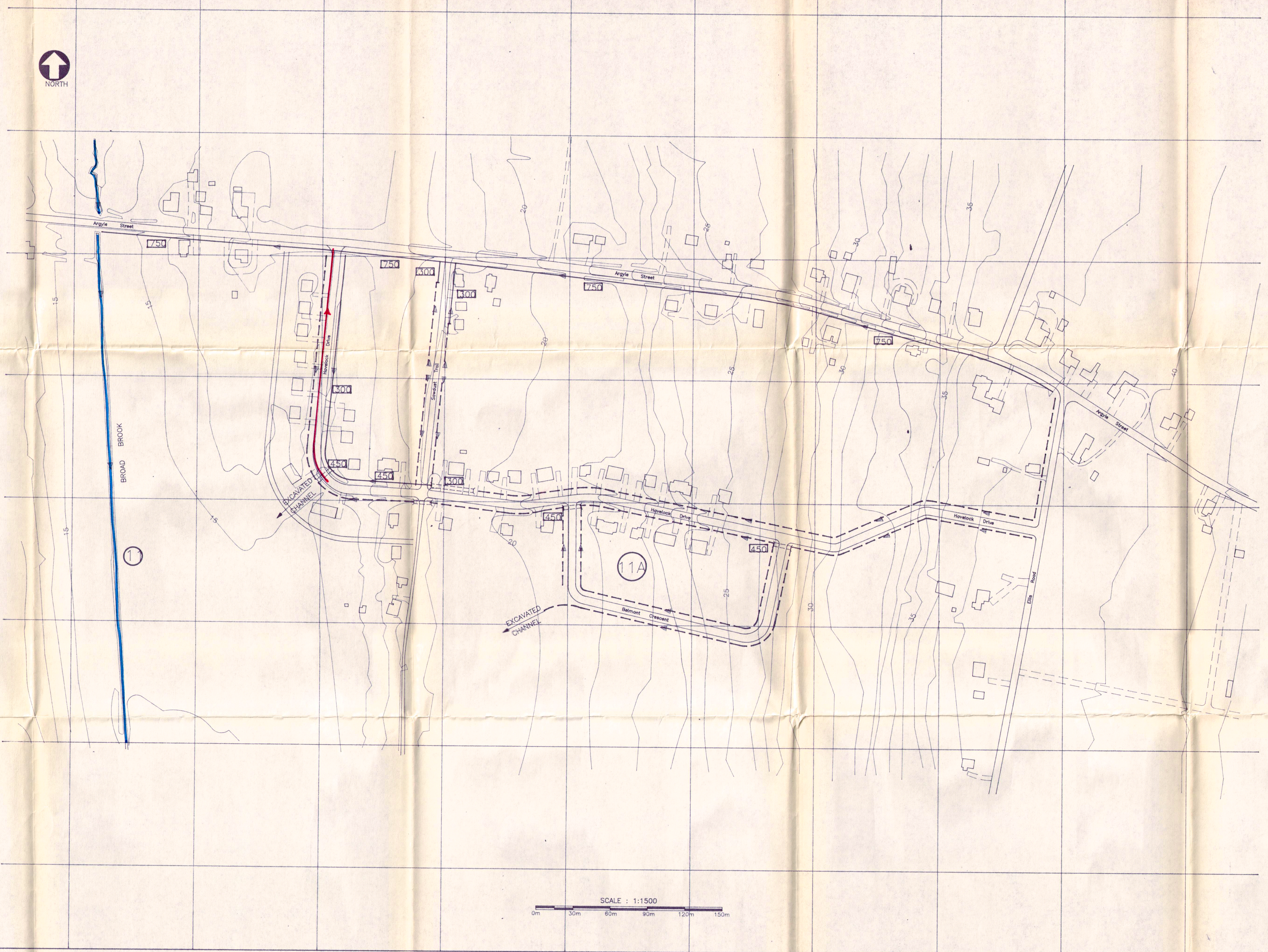
TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.	-	
APP. M.N.		DWG. No. SW4
SCALE 1=2000	GARDNER–HERBERT–MARSHA	
DATE		

DWG FILENAME: watshd2 SCALE PLOTTED: 1=1 DATE PLOTTED: JULY 26/95 NOTES: plotted from papce

DRAINAGE WATERSHEDS

11. BROAD BROOK
11A. HAVELOCK SUBDIVISION



DRAINAGE LEGEND

- STORMWATER PIPE
- CULVERT
- DITCH or CHANNEL
- STREAM
- 000 PIPE SIZE

REV. NO.	DESCRIPTION	DATE

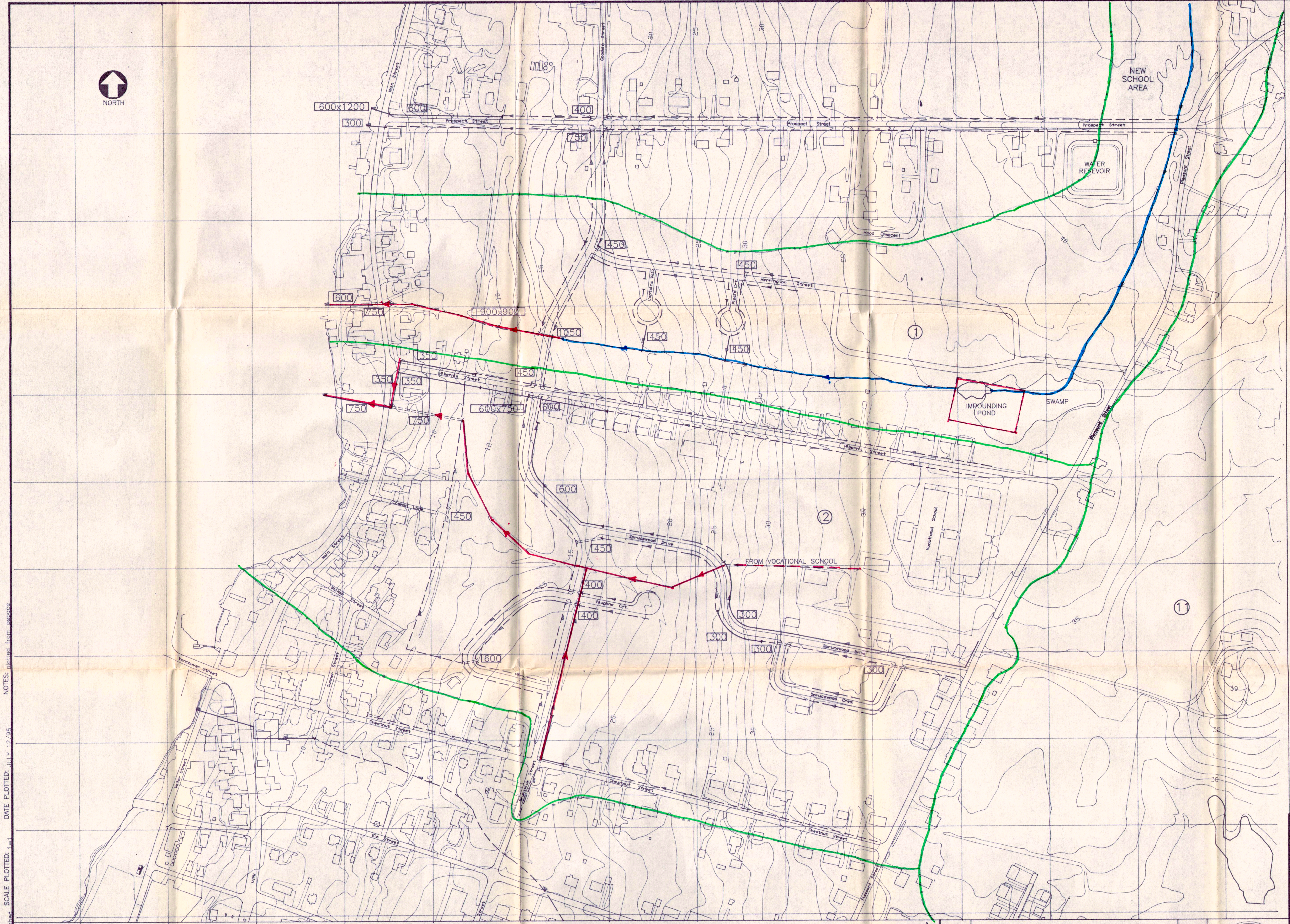
REGISTERED PROFESSIONAL ENGINEER
MURRAY NICOLL
PROVINCE OF NOVA SCOTIA

BN BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.		
APP. M.N.	HAVELOCK SUBDIVISION	DWG. No. SW6
SCALE 1=1500		
DATE		

DWG FILENAME: WATRSHED3 SCALE PLOTTED: 1=1 DATE PLOTTED: JULY 26/95 NOTES: plotted from paspace



DRAINAGE WATERSHEDS

1. MILO ESTATES AREA (Prospect to Hibernia)
2. VAUGHNE ESTATES AREA (Hibernia to Chestnut)
11. BROAD BROOK

DRAINAGE LEGEND

- STORMWATER PIPE
- CULVERT
- DITCH or CHANNEL
- STREAM
- WATERSHED BOUNDARY
- PIPE SIZE

SCALE: 1:2000
0m 50m 100m 150m 200m 250m

REV. NO.	DESCRIPTION	DATE

REGISTERED PROFESSIONAL ENGINEER MURRAY NICOLL PROVINCE OF NOVA SCOTIA

BN BEASY NICOLL ENGINEERING LIMITED Consulting Engineers — DARTMOUTH SYDNEY YARMOUTH NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.	WATERSHED AREAS	JOB No. 404
CK. M.N.		
APP. M.N.	MILO AND VAUGHNE ESTATE AREAS	DWG. No. SW3
SCALE 1=2000		
DATE		

DWG FILENAME: watershed SCALE PLOTTED: 1=1 DATE PLOTTED: JULY 12/95 NOTES: plotted from sepias

DRAINAGE WATERSHEDS

11. BROAD BROOK
11D1. PARADE STREET (EAST OF BROAD BROOK)

DRAINAGE LEGEND

- STORMWATER PIPE
- CULVERT
- DITCH or CHANNEL
- STREAM
- 000 PIPE SIZE

REV. NO.	DESCRIPTION	DATE

BEASY NICOLL ENGINEERING LIMITED
Consulting Engineers
DARTMOUTH
SYDNEY
YARMOUTH
NOVA SCOTIA

TOWN OF YARMOUTH
Stormwater Management

DR. M.C.
CK. M.N.
APP. M.N.
SCALE 1=1000
DATE

WATERSHED AREAS
PARADE STREET
EAST OF BROAD BROOK

JOB No. 404
DWG. No. SW5

DWG FILENAME: watershed SCALE PLOTTED: 1=1 DATE PLOTTED: JULY 17/95 NOTES: plotted from pspace