SANITARY SEWER PUMP STATION DESIGN REPORT

WENDY'S RESTAURANT

SITE PLAN

MAP 314 – LOT 3-A

Warren Avenue
Portland, Maine

prepared for:

WENDY'S INTERNATIONAL, INC
234 Littleton Road, Suite 1F
Westford, MA 01886

30 January 2002

KNA

Prepared By:

Keach-Nordstrom Associates, Inc.
Post Office Box 10622
10 Commerce Park North, Suite 3B
Bedford, New Hampshire 03110
(603) 627-2881
(603) 627-2915 (fax)
kna@tiac.com (email)

Proposed Pump Station

The proposed pump station has been designed to handle the flows from the proposed site and be compatible with the other two sites going into the existing force main.

Design Flow

The design flow was based on 10 CMR 241 and comes up to 2,330 gallons per day.

Grease Trap

Kitchen waste is piped into a grease trap prior to discharge into the pump station. The grease trap is sized per 10 CMR 241 and has an effective volume of over 1,880 gallons. The grease trap needs to be pumped when the volume of grease equals or is greater than half the volume.

Pump Chamber

The pump chamber is sized to pump approximately 20% of the design flow or 500 gallons per a dose. An additional volume above the second pump on of 580 gallons is provided representing 6-hour flow from the site.

Valve Chamber

The valve chamber is separate from the pump chamber and allows the isolation of one pump for service.

Pumps

Two Barnes 4SE3794L pumps with 6.5" impellers installed on non-sparking quick disconnect lifting rails are proposed. The pumps will be connected to an alternating duplex pump controller.

Multiple Pumps into one force main.

The site shares a four inch force main with two other sites. It is important that if any site turns its pump on that it will start to discharge and will not be blocked by flows from the other sites. It is also important that the resulting flow be greater than the inflow into the pump chamber so the chamber is emptying and not continuing to fill.

In the following section we determined that the existing pump delivers 85 +/- gpm through the existing four inch force main when pumping by itself. The proposed pump delivers 110 +/- gpm through the existing force main when pumping by itself. The existing and proposed pumps together deliver 130 +/- gpm with 80 +/- gpm from the proposed pump and 50 +/- gpm for the existing pump.

The proposed pump alone therefore produces a velocity of 2.63 +/- fps in the 4" force main and 4.37 +/- fps in the 3" force main. With both the proposed and existing pumps pumping the velocity in the 4" force main is 3.11 +/- fps and the velocity in the proposed 3" force main is 3.17 +/- fps.

Multiple Pump Methodology

This section discusses the mechanics behind the calculation of the above numbers. First the pump performance curve needs to be inputted into the computer. We entered in the flow for the pump with a 3.7 HP motor and 6.5" impeller at 1-foot head increments and listed the resulting flow rates. Using the piping from the pump to the common 4" force main, but not including the 4" force main, we calculated a head loss at each flow rate. The head loss produced by the piping at a given flow rate was subtracted from the head acting against the pump producing the flow rate resulting in a new head acting against the pump and piping when it produces the flow rate. We then stepped through one-foot head changes and interpolated to produce a new pump performance curve corrected for the piping losses.

We repeated the above process with both systems the existing and proposed. The only difference being the head losses due to piping which produce different effective pump curves. We then plotted the head losses in the 4" force main versus various flow rates. Where the two curves cross we can read off the flow rate and head loss in the 4" force main.

Since we have both pump systems with flow rate plotted versus head acting against the system we can add the flow rates of each pump at the same given head acting against the individual systems and come up with the resulting flow for both pumps acting against a common head. We plot this combination curve versus the head loss in the 4" force main and where they cross read off the flow rate and head loss in the 4" force main. Taking the head loss to the adjusted curve for each of the individual pump systems we can determine the flow that each of them contributes to the 4" force main.

Maintenance

The pump system is designed so it can be maintained without personnel entering the chambers. On site personnel should have a contact number to call for alarm conditions on the pump controller chamber. On a minimum of an annual basis the pump chamber and grease traps shall be pumped to remove any accumulated solids.

Emergency Operation

The system has been designed with 25% of design flow storage above second pump on to allow for flows during short power outages. The panel shall have accommodations for the connection of a portable generator to power the pumps during prolonged power outages.

KEACH-NORDSTROM ASSOCIATES, INC.
CIVIL ENGINEERING LAND PLANNING LANDSCAPE ARCHITECTURE
10 COMMERCE PARK NORTH SUITE 3B BEDFORD, NH 03110 PHONE (603) 627-2881

JOB Wendy's Portland 01-0316-1
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Sewer Design Flows
per 10 cmR 241
Restaurant 2 meals a day

20 gpd/indoor seat	×	94 seats	1,880 gpd
7 gpd/outdoor seat	×	0 seats	N/A
15 gpd/employee	×	30 employees/24hrs	450 gpd
			2,330 gpd

Grease Trap Sizing
per 10 cmR 241
eq 912.3

$Q = D \frac{HR}{2} GL\ ST\ LF$

D = 94 seats
HR = 10 hours open
GL = 2.5 gals per meal
ST = 2
LF = 0.8 stainless steel recessed cover

$Q = 94 \frac{10}{2} 2.5\ 2\ 0.8 = 1880$ gpd

use 2000 gallon tank with T baffle

KEACH-NORDSTROM ASSOCIATES, INC.
CIVIL ENGINEERING LAND PLANNING LANDSCAPE ARCHITECTURE
10 COMMERCE PARK NORTH SUITE 3B BEDFORD, NH 03110 PHONE (603) 627-2881

JOB Wendy's - Portland 01-0816-1
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____
CHECKED BY _____ DATE _____
SCALE _____

Pump Chamber Calculations

Use tank with 41.7 gal/inch

12" from bottom of chamber to pump off

use 500 gallon close 12" @ 41.7 gal/inch = 500 gallons

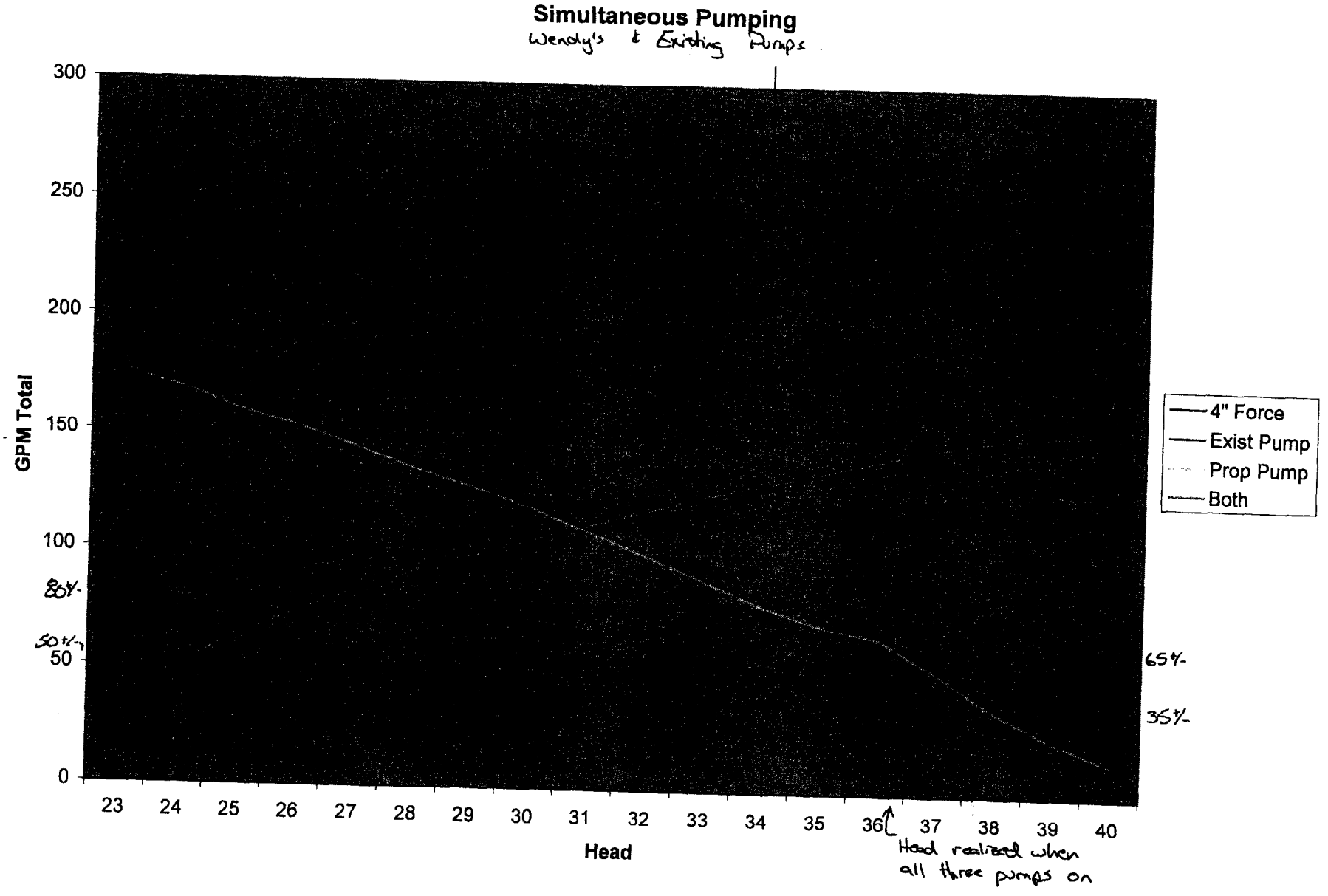
4" to high water alarm

6" to second pump on from 500 gallon close

14" for 6 hr reserve 582.4 gal

Use 2000 gallon tank as pump chamber

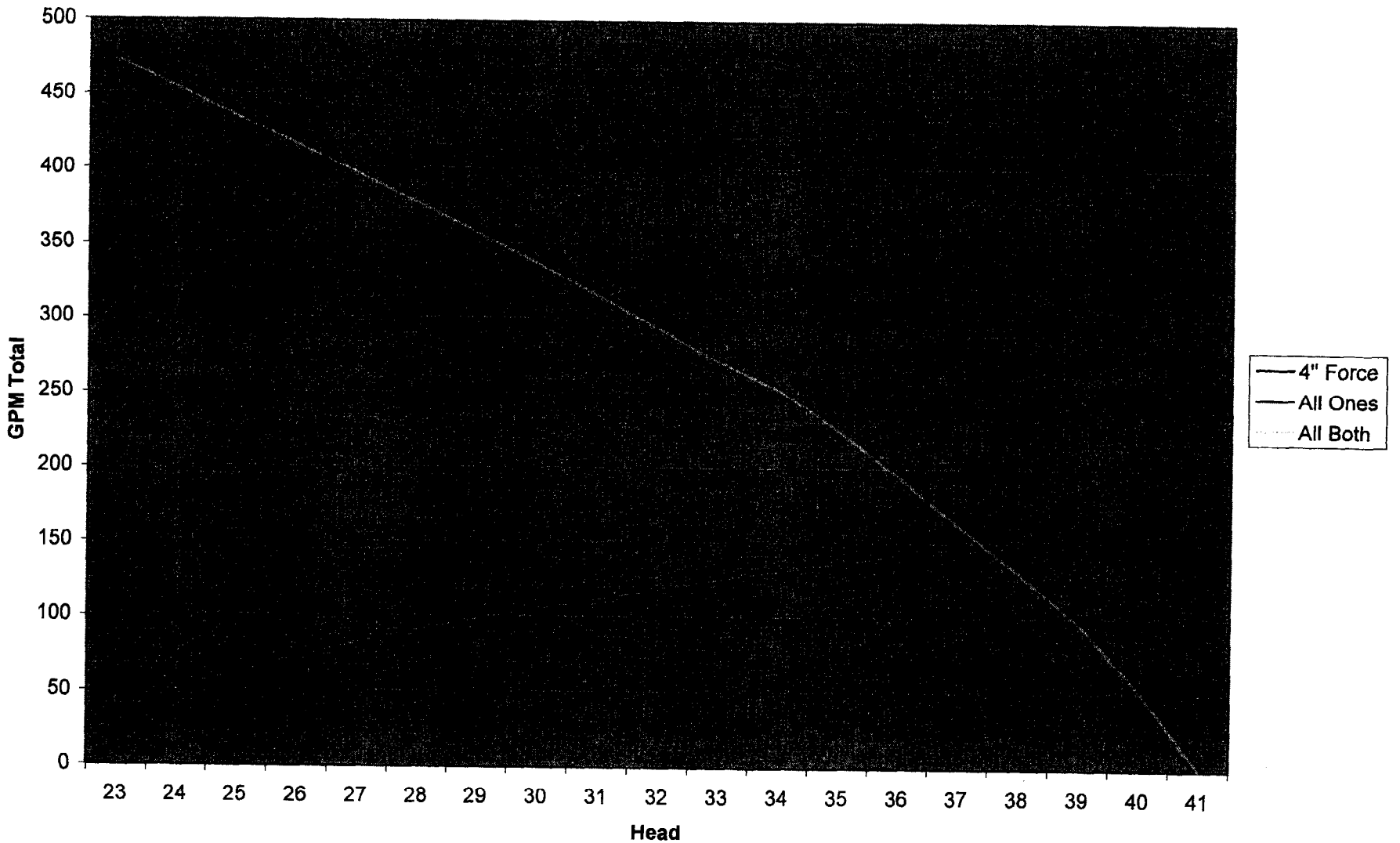
6"


Simultaneous Pumping
Wendy's & Existing Pumps
GPM Total
300
250
200
150
100
80%
50%
50
0
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
Head
Head realized when all three pumps on
4" Force
Exist Pump
Prop Pump
Both
65%
35%

6"

Simultaneous Pumping

All three site pumps



Flow Velocity & Friction Loss — SDR 26 Pipe 1"-12"

Gallons/Minute	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.	Velocity Ft./Second	Friction Loss Ft. Water/100 Ft.	Friction Loss PSI/100 Ft.
	½ in.			¾ in.																				
1							1 in.			1¼ in.			1½ in.			2 in.								
2							0.59	0.29	0.13	0.36	0.085	0.037	0.27	0.02	0.0087	0.17	0.01	0.004	2½ in.			3 in.		
5							1.48	0.91	0.39	0.90	0.27	0.117	0.68	0.14	0.059	0.44	0.045	0.020	0.30	0.025	0.011	0.20	0.01	0.0045
7							2.08	1.66	0.72	1.25	0.49	0.21	0.96	0.25	0.104	0.61	0.08	0.035	0.42	0.035	0.015	0.28	0.014	0.0063
10							2.96	3.16	1.37	1.79	0.92	0.40	1.36	0.47	0.20	0.87	0.16	0.069	0.59	0.06	0.026	0.40	0.02	0.009
15	4 in.			7.40	23.23	10.06	4.44	6.69	2.90	2.68	1.96	0.85	2.04	1.00	0.43	1.30	0.33	0.14	0.88	0.13	0.056	0.59	0.05	0.022
20	0.48	0.02	0.009	9.87	39.57	17.13	5.92	11.40	4.94	3.58	3.34	1.45	2.72	1.71	0.74	1.73	0.57	0.25	1.18	0.22	0.095	0.79	0.09	0.039
25	0.60	0.04	0.017	5 in.			7.40	17.23	7.46	4.47	5.04	2.18	3.40	2.59	1.12	2.16	0.86	0.37	1.47	0.34	0.15	0.99	0.13	0.056
30	0.72	0.05	0.022	0.47	0.02	0.009	8.88	24.15	10.46	5.36	7.07	3.06	4.08	3.63	1.57	2.60	1.21	0.52	1.77	0.47	0.20	1.19	0.18	0.078
35	0.84	0.07	0.030	0.55	0.03	0.013	10.36	32.13	13.91	6.26	9.41	4.07	4.76	4.83	2.09	3.03	1.61	0.70	2.06	0.63	0.27	1.39	0.24	0.10
40	0.96	0.09	0.039	0.63	0.03	0.013				7.15	12.05	5.22	5.44	6.18	2.68	3.46	2.06	0.89	2.35	0.81	0.35	1.59	0.31	0.13
45	1.08	0.11	0.048	0.71	0.04	0.017	6 in.			8.04	14.98	6.49	6.12	7.69	3.33	3.90	2.56	1.11	2.65	1.00	0.43	1.78	0.38	0.16
50	1.20	0.14	0.061	0.78	0.05	0.022	0.55	0.02	0.009	8.94	18.21	7.88	6.80	9.34	4.04	4.33	3.11	1.35	2.94	1.22	0.53	1.98	0.47	0.20
60	1.44	0.19	0.082	0.94	0.07	0.030	0.66	0.03	0.013				8.16	13.10	5.67	5.19	4.36	1.89	3.53	1.71	0.74	2.38	0.65	0.28
70	1.67	0.25	0.11	1.10	0.09	0.039	0.77	0.04	0.017				9.52	17.42	7.54	6.06	5.80	2.51	4.12	2.27	0.98	2.78	0.87	0.38
75	1.79	0.29	0.13	1.18	0.10	0.043	0.83	0.04	0.017				10.19	19.80	8.57	6.49	6.60	2.86	4.41	2.58	1.12	2.97	0.99	0.43
80	1.91	0.32	0.14	1.25	0.12	0.052	0.88	0.05	0.022				10.87	22.31	9.66	6.92	7.43	3.22	4.71	2.91	1.26	3.17	1.11	0.48
90	2.15	0.40	0.17	1.41	0.14	0.061	0.99	0.06	0.026	8 in.			12.23	27.75	12.02	7.79	9.25	4.01	5.30	3.62	1.57	3.57	1.38	0.60
100	2.39	0.49	0.21	1.57	0.18	0.078	1.10	0.07	0.030	0.66	0.03	0.012	13.59	33.73	14.61	8.66	11.24	4.87	5.89	4.39	1.90	3.97	1.68	0.73
125	2.99	0.74	0.33	1.96	0.27	0.12	1.39	0.11	0.047	0.83	0.037	0.015							7.36	6.65	2.88	4.96	2.54	1.10
150	3.59	1.04	0.45	2.35	0.37	0.16	1.66	0.16	0.069	0.98	0.04	0.017							8.83	9.31	4.03	5.95	3.56	1.54
175	4.19	1.39	0.60	2.74	0.50	0.22	1.94	0.21	0.091	1.14	0.06	0.026	10 in.						10.31	12.40	5.37	6.94	4.74	2.05
200	4.79	1.77	0.77	3.13	0.63	0.27	2.21	0.27	0.12	1.30	0.07	0.030	0.83	0.027	0.012							7.93	6.07	2.63
250	5.98	2.68	1.16	3.92	0.96	0.42	2.76	0.41	0.18	1.63	0.11	0.048	1.05	0.04	0.017							9.92	9.18	3.98
300	7.18	3.75	1.62	4.70	1.34	0.58	3.31	0.57	0.25	1.95	0.16	0.069	1.26	0.05	0.022	12 in.								
350	8.38	5.00	2.17	5.49	1.79	0.77	3.87	0.76	0.33	2.28	0.21	0.091	1.47	0.075	0.033	1.04	0.04	0.017						
400	9.57	6.39	2.77	6.27	2.28	0.99	4.42	0.97	0.42	2.61	0.27	0.12	1.68	0.09	0.039	1.19	0.04	0.017						
450	10.77	7.95	3.44	7.05	2.84	1.23	4.97	1.21	0.52	2.93	0.33	0.14	1.89	0.11	0.048	1.34	0.05	0.022						
500	11.96	9.66	4.18	7.84	3.45	1.49	5.52	1.47	0.64	3.26	0.41	0.18	2.10	0.14	0.061	1.49	0.06	0.026						
750				11.75	7.31	3.17				4.89	0.86	0.37	3.14	0.29	0.13	2.23	0.13	0.056						
1000										6.51	1.47	0.64	4.19	0.50	0.22	2.98	0.22	0.095						
1250													5.27	0.76	0.33	3.73	0.34	0.15						
1500													6.29	1.06	0.46	4.47	0.46	0.20						
2000																5.96	0.79	0.34						
2500																7.45	1.20	0.52						

NOTE: In larger diameters, particularly 6" and greater, Harvel recommends velocities be maintained at or below 5 feet per second.
ASTM 2241 does not show ½" and ¾". Calculated values for wall thickness in these sizes fall far below the .060 wall established as a reliable minimum for pressure pipe.

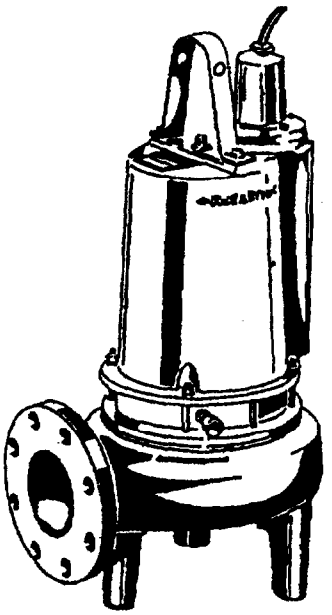
SECTION	1D
PAGE	4
DATE	2/97
REPLACES	1/96

BARNES® 4SE

SUBMERSIBLE NON-CLOG PUMPS
3" Spherical Solids Handling

Specifications:

DISCHARGE:		4" (102mm) 125 lb, Horizontal
LIQUID TEMPERATURE:		104°F (40°C) Continuous.
VOLUTE:		Cast Iron ASTM A-48, Class 30.
MOTOR HOUSING:		Cast Iron ASTM A-48, Class 30.
SEAL PLATE:		Cast Iron ASTM A-48, Class 30.
IMPELLER:	*Design:*	2 Vane, Open, With Pump Out Vanes On Back Side. Dynamically Balanced. ISO G6.3.
	Material:	Cast Iron ASTM A-48 Class 30.
SHAFT:		416 Stainless Steel
SQUARE RINGS:		Buna-N
DIAPHRAGM:		Buna-N
HARDWARE:		300 Series Stainless Steel
PAINT:		Air Dry Enamel.
SEAL:	*Design:*	Double Mechanical in Oil-Filled Pressure Equalized Reservoir.
	Material:	Rotating Face - Carbon Stationary Face - Ceramic Elastomer - Buna-N Hardware - 300 Series Stainless
CABLE ENTRY:		25 ft. (7.6M) Cord. Epoxy Sealed Housing with Secondary Pressure Grommet For Sealing And Strain Relief.
SPEED:		1150 or 1750 RPM (Nominal).
UPPER BEARING:		
	Design:	Sleeve
	Lubrication:	Oil
	Load:	Radial
LOWER BEARING:		
	Design:	Single Row, Ball
	Lubrication:	Oil
	Load:	Radial & Thrust
MOTOR:		
	Design:	NEMA L-Single Phase, NEMA B-Three Phase Torque Curve. Completely Oil-Filled, Squirrel Cage Induction.
	Insulation:	Class B.
SINGLE PHASE:		Permanent Split Capacitor (PSC). Includes Overload Protection In Motor.
THREE PHASE:		Tri Voltage 200-230/460; Require Overload Protection to be Included In Control Panel.
MOISTURE SENSOR:		N/O,Requires Relay in Control Panel.
TEMPERATURE SENSOR:		N/C,Requires Relay in Control Panel. For three phase units ONLY.
OPTIONAL EQUIPMENT:		Seal Material, Impeller Trims, Additional Cable, CSA Listed.



Series: 4SE 1.9 & 2.8HP
1150 RPM
Series: 4SE 2.8, 3.7, 5.0HP
1750 RPM

(OPTIONAL)
® Canadian Standards Association
File No. LR16567

Description:

SUBMERSIBLE NON-CLOG SEWAGE PUMP DESIGNED FOR TYPICAL RAW SEWAGE APPLICATIONS.

Sample Specifications: Section 1 Page 9.

CRANE®
A Crane Co. Company

PUMPS & SYSTEMS

Barnes Pumps, Inc
Distributor Sales & Service Dept.
420 Third Street/P.O. Box 603
Piqua, Ohio 45356-0603
Ph: (937) 615-3595
Fax: (937) 773-7157

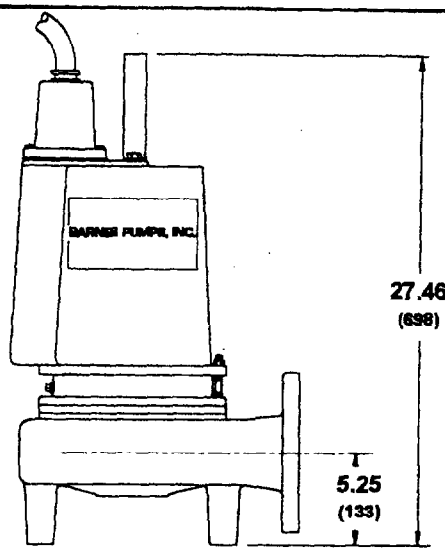
Barnes Pumps, Inc.
Bid-To-Spec & Project Sales
1485 Lexington Ave.
Mansfield, Ohio 44907-2674
Ph: (419) 774-1511
Fax: (419) 774-1530

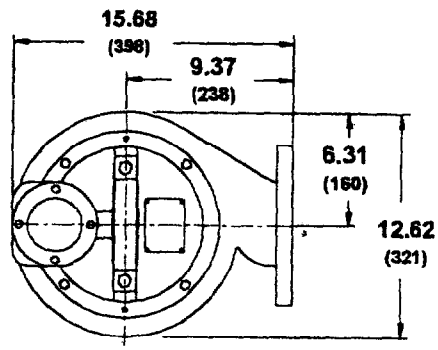
Barnes Pumps Canada, Inc.
83 West Drive
Bramalea, Ontario
Canada L6T 2J6
Ph: (905) 457-6223
Fax: (905) 457-2650

Submersible Wastewater Pump Association
SWPA
MEMBER

SECTION	1D
PAGE	5
DATE	2/97
REPLACES	6/96

inches (mm)





MODEL NO.	PART NO.	HP	VOLT	PH	RPM (NOM)	NEMA START CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD O.D.
4SE1926L	084602	1.9	230	1	1150	D	8.3	35.0	10/3	SO	0.690
4SE1996L	084604	1.9	200-230	3	1150	E/G	5.8/5.0	26.1/30.0	10/4	SO	0.750
4SE1946L	084605	1.9	460	3	1150	G	2.5	15.0	10/4	SO	0.750
4SE1956L	089300	1.9	575	3	1150	G	2.0	12.0	10/4	SO	0.750
4SE2826L	088825	2.8	230	1	1150	A	13.5	31.0	10/3	SO	0.690
4SE2896L	088826	2.8	200-230	3	1150	F/H	9.2/8.4	38.2/44.0	10/4	SO	0.750
4SE2846L	088827	2.8	460	3	1150	H	4.2	22.0	10/4	SO	0.750
4SE2856L	088828	2.8	575	3	1150	H	3.4	17.6	10/4	SO	0.750
4SE2824L	084606	2.8	230	1	1750	A	12.6	23.0	10/3	SO	0.690
4SE2894L	084608	2.8	200-230	3	1750	C/F	9.2/8.0	31.3/36.0	10/4	SO	0.750
4SE2844L	084609	2.8	460	3	1750	F	4.0	18.0	10/4	SO	0.750
4SE2854L	089301	2.8	575	3	1750	F	3.2	14.4	10/4	SO	0.750
4SE3724L	084610	3.7	230	1	1750	A	20.0	29.0	10/3	SO	0.690
4SE3794L	084611	3.7	200-230	3	1750	D/G	16.1/14.0	47.0/54.0	10/4	SO	0.750
4SE3744L	084612	3.7	460	3	1750	G	7.0	27.0	10/4	SO	0.750
4SE3754L	089302	3.7	575	3	1750	G	5.6	21.6	10/4	SO	0.750
4SE5024L	088821	5.0	230	1	1750	A	28.0	59.0	10/3	SO	0.690
4SE5094L	088822	5.0	200-230	3	1750	B/D	20.9/19.0	48.6/56.0	10/4	SO	0.750
4SE5044L	088823	5.0	460	3	1750	D	9.0	28.0	10/4	SO	0.750
4SE5054L	088824	5.0	575	3	1750	E	8.3	23.0	10/4	SO	0.750

Standard Units:
Moisture/Temperature sensor cable for all phase models is 18/5 SO, 0.476 OD.)
CSA Listed Units:
(Optional - CSA Listed Power Cable for 3 Phase models is 10/4 SOW, 0.745 O.D.)
(Optional - CSA Listed Temperature sensor cable for all phase models is 18/5 SOW, 0.476 O.D.)

IMPORTANT !

1.) PUMP MAY BE OPERATED "DRY" FOR EXTENDED PERIODS WITHOUT DAMAGE TO MOTOR AND/OR SEALS.
2.) THIS PUMP IS APPROPRIATE FOR THOSE APPLICATIONS SPECIFIED AS CLASS I DIVISION II HAZARDOUS LOCATIONS.
3.) THIS PUMP IS NOT APPROPRIATE FOR THOSE APPLICATIONS SPECIFIED AS CLASS I DIVISION I HAZARDOUS LOCATIONS.
4.) INSTALLATIONS SUCH AS DECORATIVE FOUNTAINS OR WATER FEATURES PROVIDED FOR VISUAL ENJOYMENT MUST BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE ANSI/NFPA 70 AND/OR THE AUTHORITY HAVING JURISDICTION. THIS PUMP IS NOT INTENDED FOR USE IN SWIMMING POOLS, RECREATIONAL WATER PARKS, OR INSTALLATIONS IN WHICH HUMAN CONTACT WITH PUMPED MEDIA IS A COMMON OCCURRENCE.

CRANE®
A Crane Co. Company

PUMPS & SYSTEMS

Barnes Pumps, Inc
Distributor Sales & Service Dept.
420 Third Street/P.O. Box 603
Piqua, Ohio 45356-0603
Ph: (937) 615-3595
Fax: (937) 773-7157

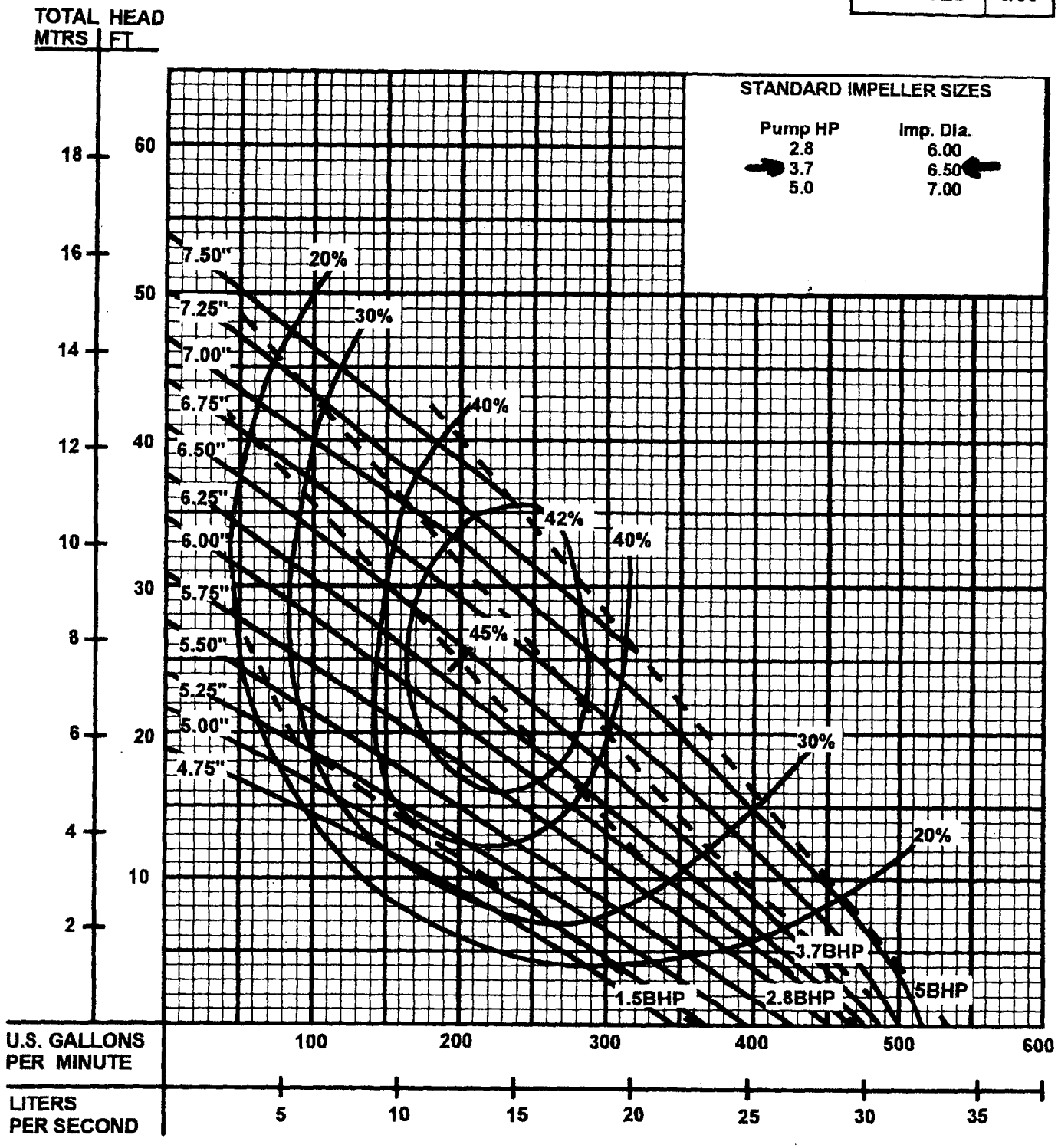
Barnes Pumps, Inc.
Bid-To-Spec & Project Sales
1485 Lexington Ave.
Mansfield, Ohio 44907-2674
Ph: (419) 774-1511
Fax: (419) 774-1530

Barnes Pumps Canada, Inc.
83 West Drive
Bramalea, Ontario
Canada L6T 2J6
Ph: (905) 457-6223
Fax: (905) 457-2650

Submersible Wastewater Pump Association SWPA MEMBER

PERFORMANCE CURVE
Series: 4SE, 2.8, 3.7 & 5.0HP, 1750RPM

SECTION	1D
PAGE	7
DATE	2/97
REPLACES	6/96



Testing is performed with water, specific gravity of 1.0 @ 68° F, other fluids may vary performance.

CRANE®

PUMPS & SYSTEMS

A Crane Co. Company

Barnes Pumps, Inc
Distributor Sales & Service Dept.
420 Third Street/P.O. Box 603
Piqua, Ohio 45356-0603
Ph: (937) 615-3595
Fax: (937) 773-7157

Barnes Pumps, Inc.
Bid-To-Spec & Project Sales
1485 Lexington Ave.
Mansfield, Ohio 44907-2674
Ph: (419) 774-1511
Fax: (419) 774-1530

Barnes Pumps Canada, Inc.
83 West Drive
Bramalea, Ontario
Canada L6T 2J6
Ph: (905) 457-6223
Fax: (905) 457-2650

STORMWATER MANAGEMENT REPORT

WENDY'S RESTAURANT

SITE PLAN

MAP 314 – LOT 3-A

Warren Avenue
Portland, Maine

prepared for:

WENDY'S INTERNATIONAL, INC
234 Littleton Road, Suite 1F
Westford, MA 01886

30 January 2002

KNA

Prepared By:

Keach-Nordstrom Associates, Inc.
Post Office Box 10622
10 Commerce Park North, Suite 3B
Bedford, New Hampshire 03110
(603) 627-2881
(603) 627-2915 (fax)
kna@tiac.com (email)

table of contents

A. Project Description:

The proposed Wendy's site plan is a commercial development of **Map 314 – Lot 3-A** located on Warren Avenue, Portland, Maine. The proposed development will utilize an existing lot, which is **2.57-acres**.

The proposed site development and improvements will consist of constructing a 1-story building with all associated infrastructures, including an access driveway, parking area, drainage system and underground utilities. The proposed building will consist of 3,260 SF. At present, the subject parcel is mainly shrub material with some pavement and wetland pockets on site. The site has an overall average slope of 0 % to 8 %.

B. SUMMARY OF RESULTS: *(See Attachments IV. 1. & 2.:Hydrology Computations for Pages)*

Existing Location	Discharge (cfs)	*(Page)*	**Proposed Location**	**Discharge (cfs)**	*(Page)*
25-YR:					
Subcatchment 1	0.98	*(51)*	**Subcatchment 10**	**1.45**	*(62)*
Subcatchment 2	1.85	*(51)*	**Subcatchment 20**	**0.35**	*(62)*
Subcatchment 3	3.20	*(51)*	**Subcatchment 30**	**1.59**	*(62)*
Subcatchment 4	2.48	*(51)*	**Subcatchment 40**	**2.64**	*(62)*
Subcatchment 5	1.53	*(51)*	**Subcatchment 50**	**1.37**	*(62)*
Subcatchment 6	0.93	*(51)*	**Subcatchment 60**	**0.69**	*(62)*
Subcatchment 7	0.46	*(51)*	**Subcatchment 70**	**1.59**	*(62)*
			Subcatchment 80	**1.23**	*(62)*
Pond 10	0.93	*(52)*	**Subcatchment 90**	**1.31**	*(62)*
Pond 20	1.91	*(52)*	Reach 1	1.26	*(63)*
			Reach 2	2.38	*(63)*
			Reach 3	3.90	*(63)*
			Reach 100	3.52	*(63)*
			Pond 1	1.31	*(64)*
			Pond 2	2.50	*(64)*
			Pond 3	3.96	*(64)*
			Pond 10	0.69	*(64)*
			Pond 20	2.13	*(64)*

Total Runoff: 3.76cfs (Warren Ave.)(Sub.1,2,&6)
0.46cfs(Westerly Property)(Sub.7)
7.21cfs(Northerly Wetland)(Sub.3,4,&5)

Total Runoff: 2.14cfs(Warren Ave.)(Sub.10&60)
0.35cfs(Westerly Property)(Sub.20)
9.12cfs(Northerly Property) (Sub.30,40, &50; Reach 100)

Total Pre-Development = 11.43 cfs

Total Post-Development = 11.61 cfs

II. Storm Drainage Analysis and Design

A. Methodology:

In accordance with the provisions and requirements of the Site Plan Review Regulations of the City of Portland, as well as generally accepted engineering practice, a twenty-five-year return frequency (25-YR) was used in all aspects of analysis and design for stormwater management improvements at the subject site, and to size the detention facility.

In appreciation of the benefits and limitations related to each of the various methods available to design professionals for estimating peak stormwater discharge volumes for use in analysis and design, the methodology of the U.S.D.A.-S.C.S. publication Urban Hydrology for Small Watersheds - Technical Release No. 55 (TR - 55) and TR-20 (Computer Program - Project Formulation Hydrology) was selected for use in the design of segments of closed drainage system. In implementing the methodology of TR-55 and TR-20 a HYDROCAD (Ver.4.52) stormwater modeling, hydrograph generating and routing computer program was utilized.

Estimates for Time of Concentration, used in analysis were made using the methodology contained within U.S.D.A.-S.C.S. publication Urban Hydrology for Small Watersheds - Technical Release No. 55 (TR - 55). In implementing the TR - 55 Method, a minimum Time of Concentration of 5 minutes was utilized for urbanized areas.

All design and analysis calculations performed using the referenced methodologies are attached to this report. These calculations document the catchment area, breakdown of surface type, time of concentration, rainfall intensity, peak discharge volume, peak velocity, and other descriptive design data for each watershed and pipe segment evaluated. In addition, the attached "Drainage Area Plans" graphically defines and illustrates the real extent of each watershed or catchment area investigated.

B. Pre-Development Drainage Conditions:

Presently the area that will be developed consists of a shrub brush field with some pavement and wetland pockets on site. The existing lot has seven Subcatchment areas (**1, 2, 3, 4, 5, 6, and 7**). The frontage of the parcel that fronts on Warren Avenue drains toward the drainage system on Warren Avenue. The majority of the property drains to the existing wetlands located along the northerly property line, however there is an area that drains off-site to the westerly property line. Subcatchment 1 drains Warren Avenue; Subcatchment 2 also drains to Warren Avenue. Subcatchments 3, 4, and 5 drain into the existing wetlands along the northerly property. Subcatchment 6 drains to the closed drainage system on Warren Avenue. Lastly Subcatchment 7 drains to a low point along the westerly property line. The total runoff peak generated by the 25-year storm is 11.43 CFS.

C. Post-Development Drainage Conditions:

The proposed development will consist of a single story building, parking area, and driveway. The majority of the proposed development runoff (**Subcatchments 30, 40, 50, 70, 80, and 90**) will drain to the existing wetlands along the northerly property line. The majority of the proposed site will be collected be catch basins 1, 2, and 3 and then discharged to Reach 100 before entering the wetlands. Subcatchment 20 will drain to the low point along the westerly property line. Subcatchments 10 and 60 collect runoff from Warren Avenue and discharge to the existing storm water drainage system. The total runoff peak generated by the 25-year storm is 11.61 cfs or an increase of 1%, which was directed to the existing wetlands. The post-development flow to the adjoining property and to Warren Avenue was decreased from pre to post development conditions.

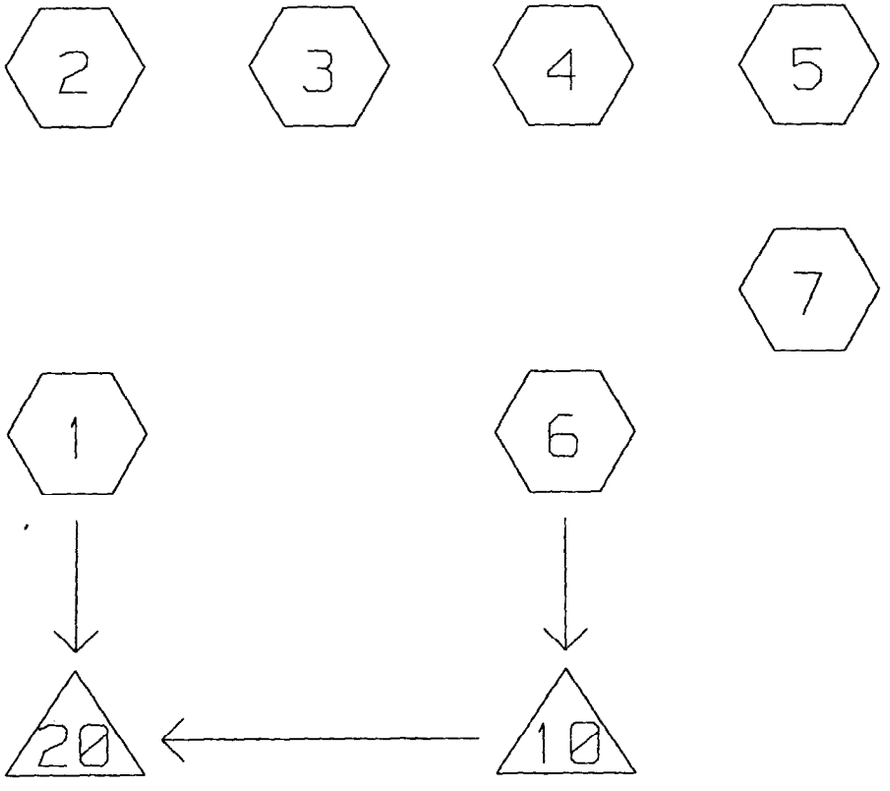
A. Temporary Erosion Control Measures:

As an integral part of the engineered design of this site, an erosion and sedimentation control plan has been developed with the intent of limiting the potential for soil loss and associated receiving water quality degradation, both during and after the construction period. As the project plans indicate, traditional temporary erosion and sedimentation control devices and practices, such as siltation fencing, haybaling and seeding have been specified for use during the construction period. In preparation of these provisions, reference was made to the Best Management Practices (B.M.P.) Methodology. Construction details for each temporary erosion control measure and practice specified have been added to the project plans. These plans also contain a number of erosion control notes, which are offered to the selected contractor in order to supplement the specified measures and practices to the extent practical.

IV. Attachments

Hydrology

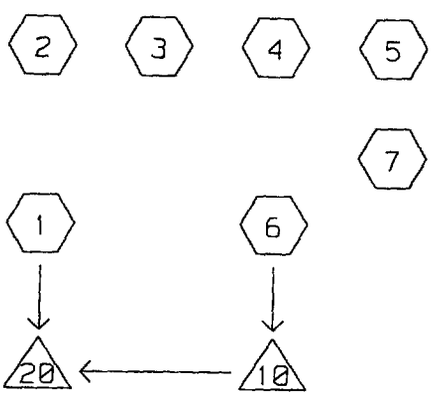
1. Pre-Development:25-YR



SUBCATCHMENT REACH POND LINK

Drainage Diagram for Wendy's Warren Ave. Pre-25-Year Storm
Prepared by Keach-Nordstrom Assoc. Inc. 6 Feb 02
HydroCAD 5.01 001045 (c) 1986-1998 Applied Microcomputer Systems

WATERSHED ROUTING ==========



SUBCATCHMENT 1	= Subcatchment 1	->	POND 20
SUBCATCHMENT 2	= Subcatchment 2	->	
SUBCATCHMENT 3	= Subcatchment 3	->	
SUBCATCHMENT 4	= Subcatchment 4	->	
SUBCATCHMENT 5	= Subcatchment 5	->	
SUBCATCHMENT 6	= Subcatchment 6	->	POND 10
SUBCATCHMENT 7	= Subcatchment 7	->	
POND 10	= Existing Catch Basin (Easterly)	->	POND 20
POND 20	= Existing Catch Basin (Westerly)	->	

RUNOFF BY SCS TR-20 METHOD: TYPE III 24-HOUR RAINFALL= 5.40 IN, SCS U.H.

RUNOFF SPAN = 10-20 HRS, dt= .10 HRS, 101 POINTS

SUBCAT NUMBER	AREA (ACRE)	Tc (MIN)	--GROUND COVERS (%CN)--	WGT'D CN	C	PEAK (CFS)	Tpeak (HRS)	VOL (AF)
1	.20	5.0	20%86 80%98	96	-	.98	12.02	.07
2	.49	8.0	100%86	86	-	1.85	12.08	.14
3	.85	8.0	96%86 4%98	86	-	3.20	12.08	.24
4	.62	8.0	79%86 21%98	89	-	2.48	12.08	.19
5	.37	8.0	59%86 41%98	91	-	1.53	12.07	.12
6	.21	5.0	71%86 29%98	89	-	.93	12.02	.06
7	.11	5.0	100%86	86	-	.46	12.02	.03

POND ROUTING BY STOR-IND METHOD

POND NO.	START ELEV. (FT)	FLOOD ELEV. (FT)	PEAK ELEV. (FT)	PEAK STORAGE (AF)	PEAK FLOW Qin (CFS)	PEAK FLOW Qout (CFS)	PEAK FLOW Qpri (CFS)	PEAK FLOW Qsec (CFS)	Qout ATTEN. (%)	Qout LAG (MIN)
10	51.8	54.8	52.3	0.00	.93	.92			1	.1
20	49.9	51.9	50.6	0.00	1.91	1.90			0	.1

SUBCATCHMENT 1 **Subcatchment 1**

PEAK= .98 CFS @ 12.02 HRS, VOLUME= .07 AF

ACRES	CN	
.04	86	Open Space - Poor Condition
.16	98	Warren Ave. Pavement
.20	96	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 2 **Subcatchment 2**

PEAK= 1.85 CFS @ 12.08 HRS, VOLUME= .14 AF

ACRES	CN	
.49	86	Open Space - Poor Condition

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	8.0

SUBCATCHMENT 3 **Subcatchment 3**

PEAK= 3.20 CFS @ 12.08 HRS, VOLUME= .24 AF

ACRES	CN	
.82	86	Open Space - Poor Condition
.03	98	Wetlands
.85	86	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	8.0

SUBCATCHMENT 4 **Subcatchment 4**

PEAK= 2.48 CFS @ 12.08 HRS, VOLUME= .19 AF

ACRES	CN	
.49	86	Open Space - Poor Condition
.13	98	Wetlands
.62	89	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	8.0

SUBCATCHMENT 5 **Subcatchment 5**

PEAK= 1.53 CFS @ 12.07 HRS, VOLUME= .12 AF

ACRES	CN	
.22	86	Open Space - Poor Condition
.15	98	Wetlands & Access Drive Pavement
.37	91	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	8.0

SUBCATCHMENT 6 **Subcatchment 6**

PEAK= .93 CFS @ 12.02 HRS, VOLUME= .06 AF

ACRES	CN	
.15	86	Open Space - Poor Condition
.06	98	Warren Ave. Pavement
.21	89	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 7 **Subcatchment 7**

PEAK= .46 CFS @ 12.02 HRS, VOLUME= .03 AF

ACRES	CN	
.11	86	Open Space - Poor Condition

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

POND 10 **Existing Catch Basin (Easterly)**

Qin = .93 CFS @ 12.02 HRS, VOLUME= .06 AF
Qout= .92 CFS @ 12.02 HRS, VOLUME= .06 AF, ATTEN= 1%, LAG= .1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
51.8	13	0	0
52.8	13	13	13
53.8	13	13	25
54.8	13	13	38

STOR-IND METHOD
PEAK STORAGE = 6 CF
PEAK ELEVATION= 52.3 FT
FLOOD ELEVATION= 54.8 FT
START ELEVATION= 51.8 FT
SPAN= 10-20 HRS, dt=.1 HRS
Tdet= .3 MIN (.06 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	51.8'	**24" CULVERT**

n=.013 L=200' S=.0025'/' Ke=.5 Cc=.9 Cd=.6

POND 20 **Existing Catch Basin (Westerly)**

Qin = 1.91 CFS @ 12.02 HRS, VOLUME= .13 AF
Qout= 1.90 CFS @ 12.02 HRS, VOLUME= .13 AF, ATTEN= 0%, LAG= .1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
49.9	13	0	0
50.9	13	13	13
51.9	13	13	25

STOR-IND METHOD
PEAK STORAGE = 9 CF
PEAK ELEVATION= 50.6 FT
FLOOD ELEVATION= 51.9 FT
START ELEVATION= 49.9 FT
SPAN= 10-20 HRS, dt=.1 HRS
Tdet= .2 MIN (.13 AF)

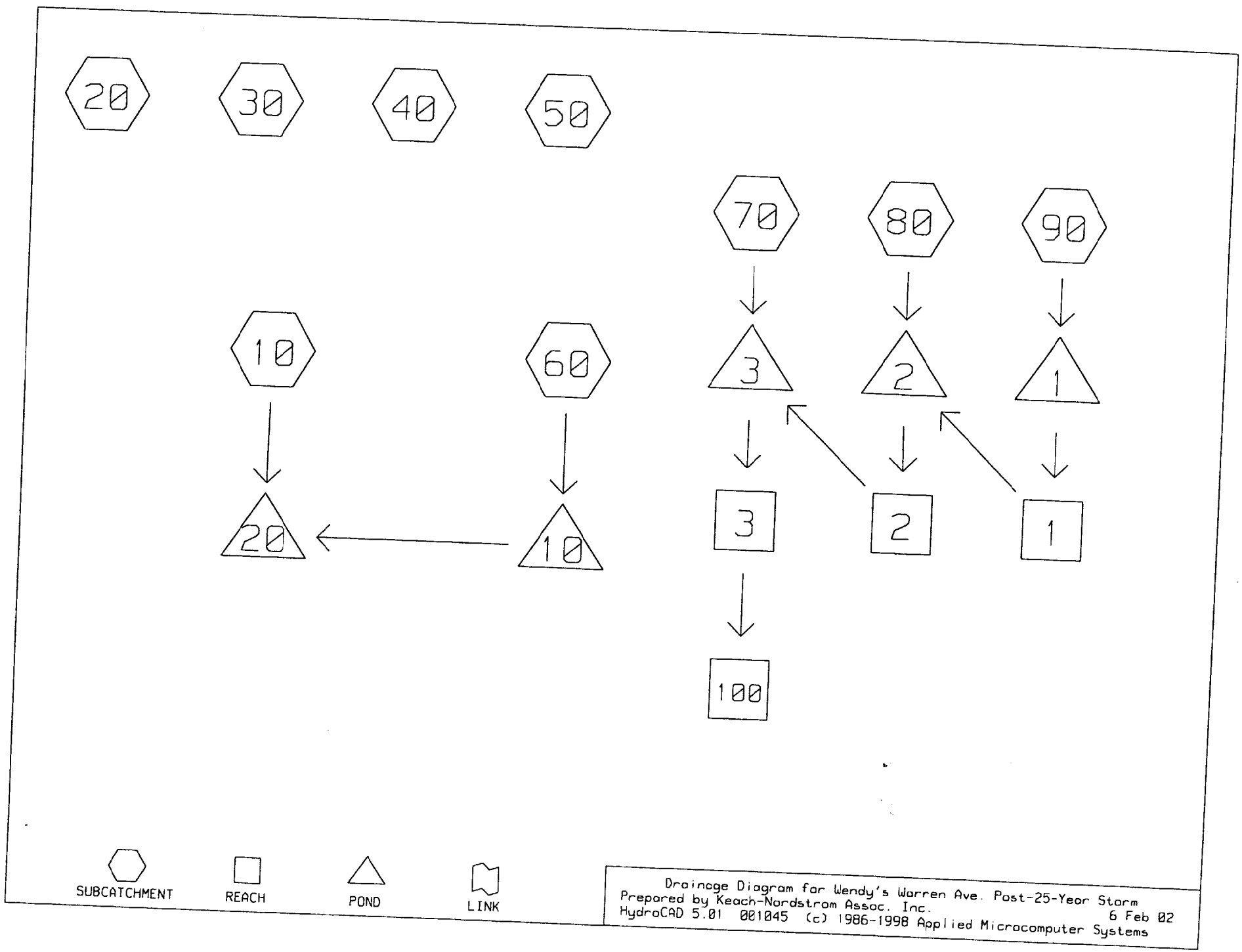
#	ROUTE	INVERT	OUTLET DEVICES
1	P	49.9'	**24" CULVERT**

n=.013 L=100' S=.0025'/' Ke=.5 Cc=.9 Cd=.6

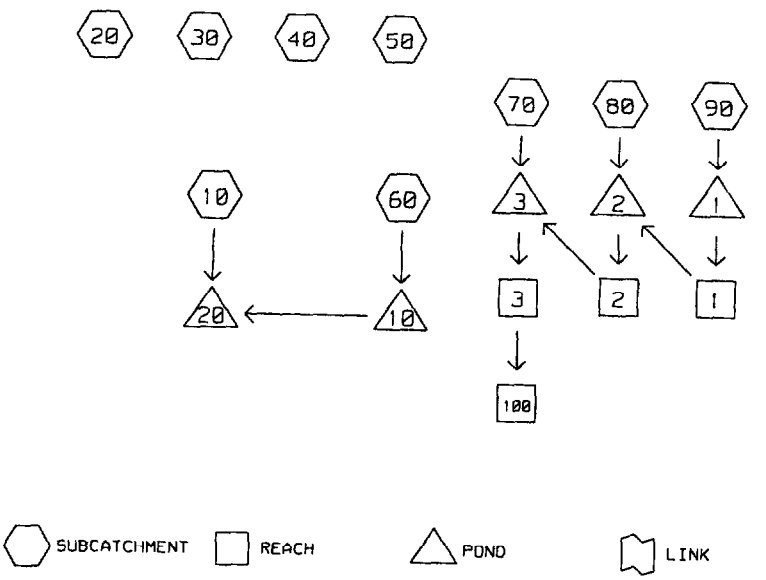
IV. Attachments

Hydrology

1. Post-Development: 25-YR


20
30
40
50
70
80
90
10
60
3
2
1
20
10
3
2
1
100
SUBCATCHMENT
REACH
POND
LINK
Drainage Diagram for Wendy's Warren Ave. Post-25-Year Storm
Prepared by Keach-Nordstrom Assoc. Inc.
6 Feb 02
HydroCAD 5.01 001045 (c) 1986-1998 Applied Microcomputer Systems

WATERSHED ROUTING ==========



SUBCATCHMENT 10	= Subcatchment 10	-> POND 20
SUBCATCHMENT 20	= Subcatchment 20	->
SUBCATCHMENT 30	= Subcatchment 30	->
SUBCATCHMENT 40	= Subcatchment 40	->
SUBCATCHMENT 50	= Subcatchment 50	->
SUBCATCHMENT 60	= Subcatchment 60	-> POND 10
SUBCATCHMENT 70	= Subcatchment 70	-> POND 3
SUBCATCHMENT 80	= Subcatchment 80	-> POND 2
SUBCATCHMENT 90	= Subcatchment 90	-> POND 1
REACH 1	= Proposed pipe from CB#1 to CB#2	-> POND 2
REACH 2	= Proposed pipe from CB#2 to CB#3	-> POND 3
REACH 3	= Proposed pipe from CB#3 to FES#1	-> REACH 100
REACH 100	= Discharge Swale	->
POND 1	= Catch Basin #1	-> REACH 1
POND 2	= Catch Basin #2	-> REACH 2
POND 3	= Catch Basin #3	-> REACH 3

POND 10 = Existing Catch Basin (Easterly) -> POND 20

POND 20 = Existing Catch Basin (Westerly) ->

RUNOFF BY SCS TR-20 METHOD: TYPE III 24-HOUR RAINFALL= 5.40 IN, SCS U.H.

RUNOFF SPAN = 10-20 HRS, dt= .10 HRS, 101 POINTS

SUBCAT NUMBER	AREA (ACRE)	Tc (MIN)	--GROUND COVERS (%CN)--	WGT'D CN	C	PEAK (CFS)	Tpeak (HRS)	VOL (AF)
10	.32	5.0	34%74 66%98	90	-	1.45	12.02	.10
20	.12	5.0	100%74	74	-	.35	12.02	.02
30	.40	5.0	70%86 8%98 23%74	84	-	1.59	12.02	.11
40	.66	8.0	73%86 20%98 8%98	89	-	2.64	12.08	.20
50	.33	8.0	55%86 45%98	91	-	1.37	12.07	.10
60	.15	5.0	60%86 40%98	91	-	.69	12.02	.05
70	.33	5.0	82%98 18%74	94	-	1.59	12.02	.11
80	.26	5.0	81%98 19%74	93	-	1.23	12.02	.08
90	.28	5.0	75%98 25%74	92	-	1.31	12.02	.09

REACH ROUTING BY STOR-IND+TRANS METHOD

REACH NO.	DIAM (IN)	BOTTOM WIDTH (FT)	DEPTH (FT)	SIDE SLOPES (FT/FT)		n	LENGTH (FT)	SLOPE (FT/FT)	PEAK VEL. (FPS)	TRAVEL TIME (MIN)	PEAK Qout (CFS)
1	18.0	-	-	-	-	.012	50	.0050	3.4	.2	1.26
2	18.0	-	-	-	-	.012	94	.0050	4.1	.4	2.38
3	18.0	-	-	-	-	.012	32	.0050	4.6	.1	3.90
100	-	5.0	1.0	.33	.33	.030	70	.0002	.5	2.2	3.52

POND ROUTING BY STOR-IND METHOD

POND NO.	START ELEV. (FT)	FLOOD ELEV. (FT)	PEAK ELEV. (FT)	PEAK STORAGE (AF)	PEAK FLOW Qin (CFS)	PEAK FLOW Qout (CFS)	PEAK FLOW Qpri (CFS)	PEAK FLOW Qsec (CFS)	---Qout--- ATTEN. (%)	---Qout--- LAG (MIN)
1	48.1	52.1	51.7	0.00	1.31	1.31			0	0.0
2	47.8	51.8	51.6	0.00	2.50	2.49			0	0.0
3	47.2	52.2	51.3	0.00	3.96	3.96			0	0.0
10	51.8	54.8	52.2	0.00	.69	.68			1	.1
20	49.9	51.9	50.7	0.00	2.13	2.12			0	.1

SUBCATCHMENT 10 **Subcatchment 10**

PEAK= 1.45 CFS @ 12.02 HRS, VOLUME= .10 AF

ACRES	CN	
.11	74	Open Space - Good Condition (New
.21	98	Warren Ave. Pavement
.32	90	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 20 **Subcatchment 20**

PEAK= .35 CFS @ 12.02 HRS, VOLUME= .02 AF

ACRES	CN	
.12	74	Open Space - Good Condition (New

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 30 **Subcatchment 30**

PEAK= 1.59 CFS @ 12.02 HRS, VOLUME= .11 AF

ACRES	CN	
.28	86	Open Space - Poor Condition
.03	98	Wetlands
.09	74	Open Space - Good Condition (New
.40	84	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 40 **Subcatchment 40**

PEAK= 2.64 CFS @ 12.08 HRS, VOLUME= .20 AF

ACRES	CN	
.48	86	Open Space - Poor Condition
.13	98	Wetlands
.05	98	New Pavement
.66	89	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	8.0

SUBCATCHMENT 50 **Subcatchment 50**

PEAK= 1.37 CFS @ 12.07 HRS, VOLUME= .10 AF

ACRES	CN	
.18	86	Open Space - Poor Condition
.15	98	Wetlands & Access Drive Pavement
.33	91	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	8.0

SUBCATCHMENT 60 **Subcatchment 60**

PEAK= .69 CFS @ 12.02 HRS, VOLUME= .05 AF

ACRES	CN	
.09	86	Open Space - Poor Condition
.06	98	Warren Ave. Pavement
.15	91	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 70 **Subcatchment 70**

PEAK= 1.59 CFS @ 12.02 HRS, VOLUME= .11 AF

ACRES	CN	
.27	98	Building & Pavement
.06	74	Open Space - Good Condition (New
.33	94	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 80 **Subcatchment 80**

PEAK= 1.23 CFS @ 12.02 HRS, VOLUME= .08 AF

ACRES	CN	
.21	98	Parking & Pavement
.05	74	Open Space - Good Condition (New
.26	93	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

SUBCATCHMENT 90 **Subcatchment 90**

PEAK= 1.31 CFS @ 12.02 HRS, VOLUME= .09 AF

ACRES	CN	
.21	98	Parking & Pavement
.07	74	Open Space - Good Condition (New
.28	92	

SCS TR-20 METHOD
TYPE III 24-HOUR
RAINFALL= 5.40 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
DIRECT ENTRY	**Segment ID:**	5.0

REACH 1 **Proposed pipe from CB#1 to CB#2**

Qin = 1.31 CFS @ 12.02 HRS, VOLUME= .09 AF
Qout= 1.26 CFS @ 12.02 HRS, VOLUME= .09 AF, ATTEN= 3%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.00
.2	.1	.17
.3	.3	.70
.5	.4	1.58
1.1	1.3	6.74
1.2	1.5	7.87
1.4	1.7	8.58
1.4	1.7	8.66
1.5	1.8	8.58
1.5	1.8	8.05

18" PIPE
n= .012
LENGTH= 50 FT
SLOPE= .005 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .40 FT
PEAK VELOCITY= 3.4 FPS
TRAVEL TIME = .2 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 2 **Proposed pipe from CB#2 to CB#3**

Qin = 2.49 CFS @ 12.02 HRS, VOLUME= .17 AF
Qout= 2.38 CFS @ 12.03 HRS, VOLUME= .17 AF, ATTEN= 4%, LAG= .8 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.00
.2	.1	.17
.3	.3	.70
.5	.4	1.58
1.1	1.3	6.74
1.2	1.5	7.87
1.4	1.7	8.58
1.4	1.7	8.66
1.5	1.8	8.58
1.5	1.8	8.05

18" PIPE
n= .012
LENGTH= 94 FT
SLOPE= .005 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .54 FT
PEAK VELOCITY= 4.1 FPS
TRAVEL TIME = .4 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 3 **Proposed pipe from CB#3 to FES#1**

Qin = 3.96 CFS @ 12.02 HRS, VOLUME= .28 AF
Qout= 3.90 CFS @ 12.03 HRS, VOLUME= .28 AF, ATTEN= 2%, LAG= .3 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.00
.2	.1	.17
.3	.3	.70
.5	.4	1.58
1.1	1.3	6.74
1.2	1.5	7.87
1.4	1.7	8.58
1.4	1.7	8.66
1.5	1.8	8.58
1.5	1.8	8.05

18" PIPE
n= .012
LENGTH= 32 FT
SLOPE= .005 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .71 FT
PEAK VELOCITY= 4.6 FPS
TRAVEL TIME = .1 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 100 **Discharge Swale**

Qin = 3.90 CFS @ 12.03 HRS, VOLUME= .28 AF
Qout= 3.52 CFS @ 12.10 HRS, VOLUME= .28 AF, ATTEN= 10%, LAG= 4.5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.0	0.0	0.00
.1	.5	.08
.2	1.1	.25
.3	1.8	.50
.4	2.7	.94
.6	4.1	1.72
.8	5.9	2.92
1.0	8.0	4.46

5' x 1' CHANNEL
SIDE SLOPE= .33 '/'
n= .03
LENGTH= 70 FT
SLOPE= .0002 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= .90 FT
PEAK VELOCITY= .5 FPS
TRAVEL TIME = 2.2 MIN
SPAN= 10-20 HRS, dt=.1 HRS

POND 1 **Catch Basin #1**

Qin = 1.31 CFS @ 12.02 HRS, VOLUME= .09 AF
Qout= 1.31 CFS @ 12.02 HRS, VOLUME= .09 AF, ATTEN= 0%, LAG= 0.0 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
48.1	13	0	0
49.1	13	13	13
50.1	13	13	25
51.1	13	13	38
52.1	13	13	50

STOR-IND METHOD
PEAK STORAGE = 45 CF
PEAK ELEVATION= 51.7 FT
FLOOD ELEVATION= 52.1 FT
START ELEVATION= 48.1 FT
SPAN= 10-20 HRS, dt=.1 HRS
4 x FINER ROUTING
Tdet= 4.9 MIN (.09 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	51.1'	**18" CULVERT** n=.012 L=50' S=.005'/' Ke=.5 Cc=.9 Cd=.6

POND 2 **Catch Basin #2**

Qin = 2.50 CFS @ 12.02 HRS, VOLUME= .17 AF
Qout= 2.49 CFS @ 12.02 HRS, VOLUME= .17 AF, ATTEN= 0%, LAG= 0.0 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
47.8	13	0	0
48.8	13	13	13
49.8	13	13	25
50.8	13	13	38
51.8	13	13	50

STOR-IND METHOD
PEAK STORAGE = 48 CF
PEAK ELEVATION= 51.6 FT
FLOOD ELEVATION= 51.8 FT
START ELEVATION= 47.8 FT
SPAN= 10-20 HRS, dt=.1 HRS
4 x FINER ROUTING
Tdet= 3.1 MIN (.17 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	50.8'	**18" CULVERT** n=.012 L=94' S=.005'/' Ke=.5 Cc=.9 Cd=.6

POND 3 **Catch Basin #3**

Qin = 3.96 CFS @ 12.02 HRS, VOLUME= .28 AF
Qout= 3.96 CFS @ 12.02 HRS, VOLUME= .28 AF, ATTEN= 0%, LAG= 0.0 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
47.2	13	0	0
48.2	13	13	13
49.2	13	13	25
50.2	13	13	38
51.2	13	13	50
52.2	13	13	63

STOR-IND METHOD
PEAK STORAGE = 52 CF
PEAK ELEVATION= 51.3 FT
FLOOD ELEVATION= 52.2 FT
START ELEVATION= 47.2 FT
SPAN= 10-20 HRS, dt=.1 HRS
4 x FINER ROUTING
Tdet= 2 MIN (.28 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	50.2'	**18" CULVERT** n=.012 L=32' S=.005'/' Ke=.5 Cc=.9 Cd=.6

POND 10 **Existing Catch Basin (Easterly)**

Qin = .69 CFS @ 12.02 HRS, VOLUME= .05 AF
Qout= .68 CFS @ 12.02 HRS, VOLUME= .05 AF, ATTEN= 1%, LAG= .1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
51.8	13	0	0
52.8	13	13	13
53.8	13	13	25
54.8	13	13	38

STOR-IND METHOD
PEAK STORAGE = 5 CF
PEAK ELEVATION= 52.2 FT
FLOOD ELEVATION= 54.8 FT
START ELEVATION= 51.8 FT
SPAN= 10-20 HRS, dt=.1 HRS
Tdet= .4 MIN (.05 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	51.8'	**24" CULVERT**

n=.013 L=200' S=.0025'/' Ke=.5 Cc=.9 Cd=.6

POND 20 **Existing Catch Basin (Westerly)**

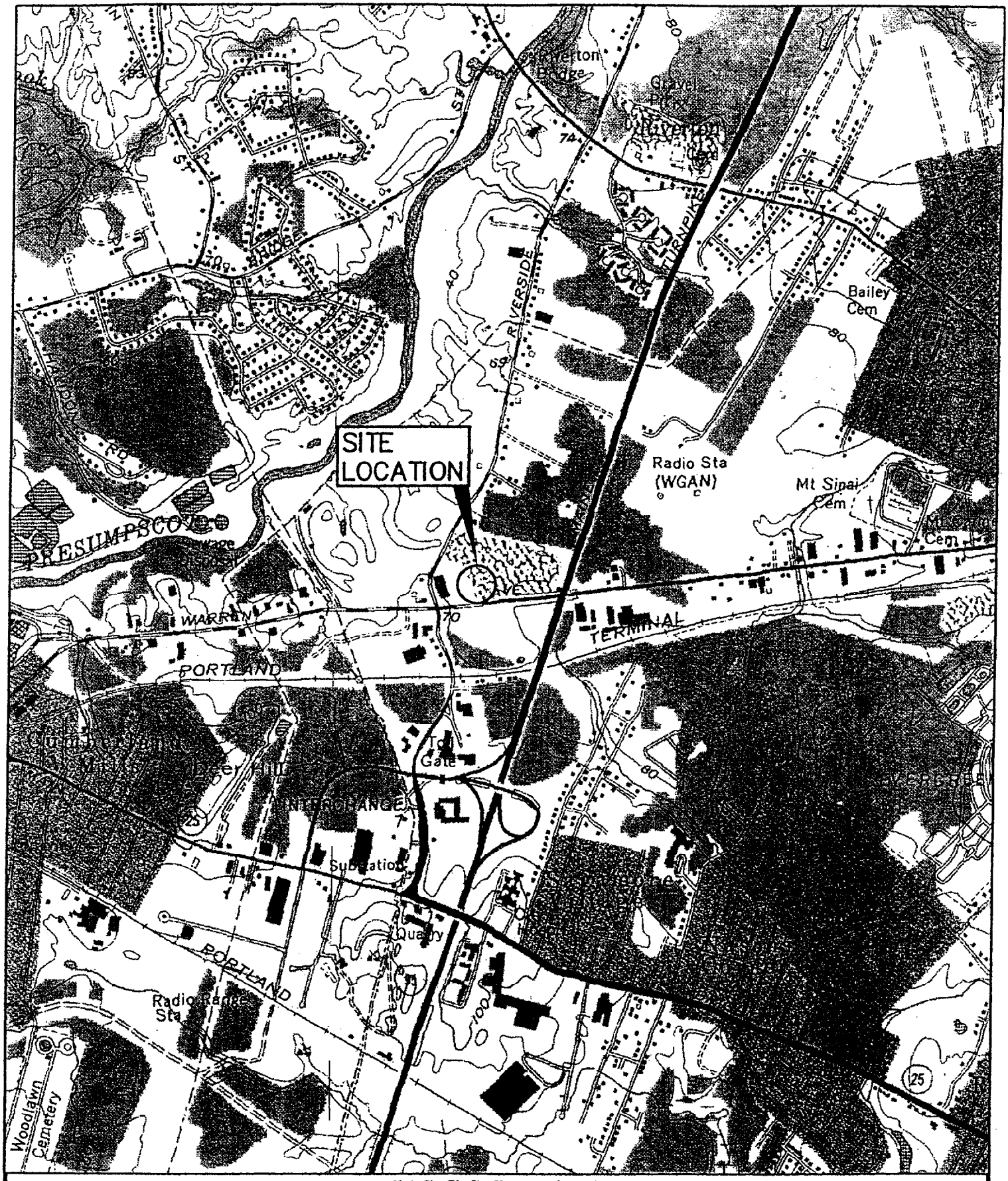
Qin = 2.13 CFS @ 12.02 HRS, VOLUME= .15 AF
Qout= 2.12 CFS @ 12.02 HRS, VOLUME= .15 AF, ATTEN= 0%, LAG= .1 MIN

ELEVATION (FT)	AREA (SF)	INC.STOR (CF)	CUM.STOR (CF)
49.9	13	0	0
50.9	13	13	13
51.9	13	13	25

STOR-IND METHOD
PEAK STORAGE = 10 CF
PEAK ELEVATION= 50.7 FT
FLOOD ELEVATION= 51.9 FT
START ELEVATION= 49.9 FT
SPAN= 10-20 HRS, dt=.1 HRS
Tdet= .2 MIN (.15 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	49.9'	**24" CULVERT**

n=.013 L=100' S=.0025'/' Ke=.5 Cc=.9 Cd=.6



U.S.G.S. Location Map

Wendy's Restaurant - Portland, Maine

U.S.G.S. West Portland, Maine-7.5 Minute Series (Topographic)

Design: JJB	Date: JAN. 2002
Draft: LAN	Job No.: 440
Checked: JJB	Scale: None

File Name: 440-LOCMAP.DWG

Gorrill-Palmer Consulting Engineers, Inc.

Traffic and Civil Engineering Services

PO Box 1237
26 Main Street
Gray, ME 04039

207-657-6910
FAX: 207-657-6912
E-Mail: gpce@maine.rr.com

Figure 1