

Brighton Township

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Phase I Evaluation Report

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- **Woodland Lake Sanitary Sewer Systems**
- **West Grand River Sanitary Sewer & Water Systems**
- **Clark Lake Sanitary Sewer Systems**
- **East Grand River Sanitary Sewer and Water Systems**
- **Fonda Lake (Brighton Twp. Portion) Sanitary Sewer Systems**
- **Lake of the Pines Sanitary Sewer Systems**



McNamee, Porter & Seeley, Inc.
July 31, 1998

BRIGHTON TOWNSHIP, MICHIGAN

Phase I Evaluation Report

**WOODLAND LAKE SANITARY SEWER SYSTEM
WEST GRAND RIVER SANITARY SEWER AND WATER SYSTEMS
CLARK LAKE SANITARY SEWER SYSTEM
EAST GRAND RIVER SANITARY SEWER AND WATER SYSTEMS
FONDA LAKE (BRIGHTON TWP. PORTION) SANITARY SEWER SYSTEMS
LAKE OF THE PINES SANITARY SEWER SYSTEM**

July 1998

CONTENTS

	Page
LIST OF TABLES AND FIGURES	iii
EXECUTIVE SUMMARY	iv
INTRODUCTION	1
DESCRIPTION OF ALTERNATIVES	1
<i>Gravity Sewer System</i>	1
<i>Low-pressure Sewer System</i>	1
PROJECTED SEWAGE FLOWS	5
CLARK LAKE AREA	6
Project Cost	6
WEST GRAND RIVER SANITARY SEWER AND WATER DISTRIBUTION	11
SANITARY SEWER	11
Project Cost	12
WATER SYSTEM	13
<i>Description of Alternatives</i>	13
Projected Water Flows	13
Project Cost	14
WOODLAND LAKE AREA	20
Project Cost	21
EAST GRAND RIVER SANITARY SEWER AND WATER DISTRIBUTION	24
Project Cost	24
WATER SYSTEM	24
<i>Description of Alternatives</i>	24
Projected Water Flows	24
Project Cost	25
FONDA LAKE	30
Project Cost	30
LAKE OF THE PINES	34
Project Cost	34
RECOMMENDATION	39
Woodland Lake	39
Clark Lake	39
West Grand River	39
East Grand River	39

CONTENTS (Continued)

Fonda Lake	39
Lake of the Pines	40
Water Districts	40

APPENDICES

Appendix A	Equivalent Annual Cost
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LIST OF TABLES AND FIGURES

Table
Sanitary Sewer Flow

Page
5

Figure

Page

EXECUTIVE SUMMARY

The following is the Phase I Evaluation Report for the East and West Grand River corridors; Woodland Lake; Fonda Lake; Clark Lake; and Lake of the Pines areas. Phase I consisted of evaluating the possible alternatives for providing sanitary sewer to the residences and businesses located within the Special Assessment District (SAD) for each of the areas, along with evaluating the possible water main routes and costs for the East Grand River and West Grand River SADs. Also included is an engineering opinion of probable project costs which summarizes the projected costs for each alternative.

Based on the information presented in this report, the following lists our recommendations for the sanitary sewer districts.

Special Assessment District	Recommended Sewer System
Woodland Lake	Low Pressure Sewer System
West Grand River	Low Pressure Sewer System
Clark Lake	Low Pressure Sewer System
East Grand River	Gravity Sewer System
Fonda Lake	Low Pressure Sewer System
Lake of the Pines	Low Pressure Sewer System

We have presented alternatives for providing water service to the East and West Grand River Corridors. The alternatives are dependent upon the source of the municipal water. The recommended alternative should be delayed until the water source for each alternative is determined.

INTRODUCTION

This Phase I report focused on the collection systems associated with each sanitary sewer district and the proposed water distribution system for the East and West Grand River corridors. The transmission main and wastewater treatment plan routes and locations will be performed under separate authorization.

DESCRIPTION OF ALTERNATIVES

Gravity Sewer System

A gravity sewer system consists of constructing a sewer main either in the public road right-of-way or within a public utilities easement. The sewer main will be constructed with a slope that will allow the sewage to flow to a low point where a pump station will be installed that will pump the sewage through a force main to discharge either into gravity sewer or another pumping station. Each lot will be provided a sanitary sewer lead from the main line to the edge of the road right-of-way or easement. After completion of the Township sewer project, each lot will be responsible for constructing a service lead from the house to the sewer lead.

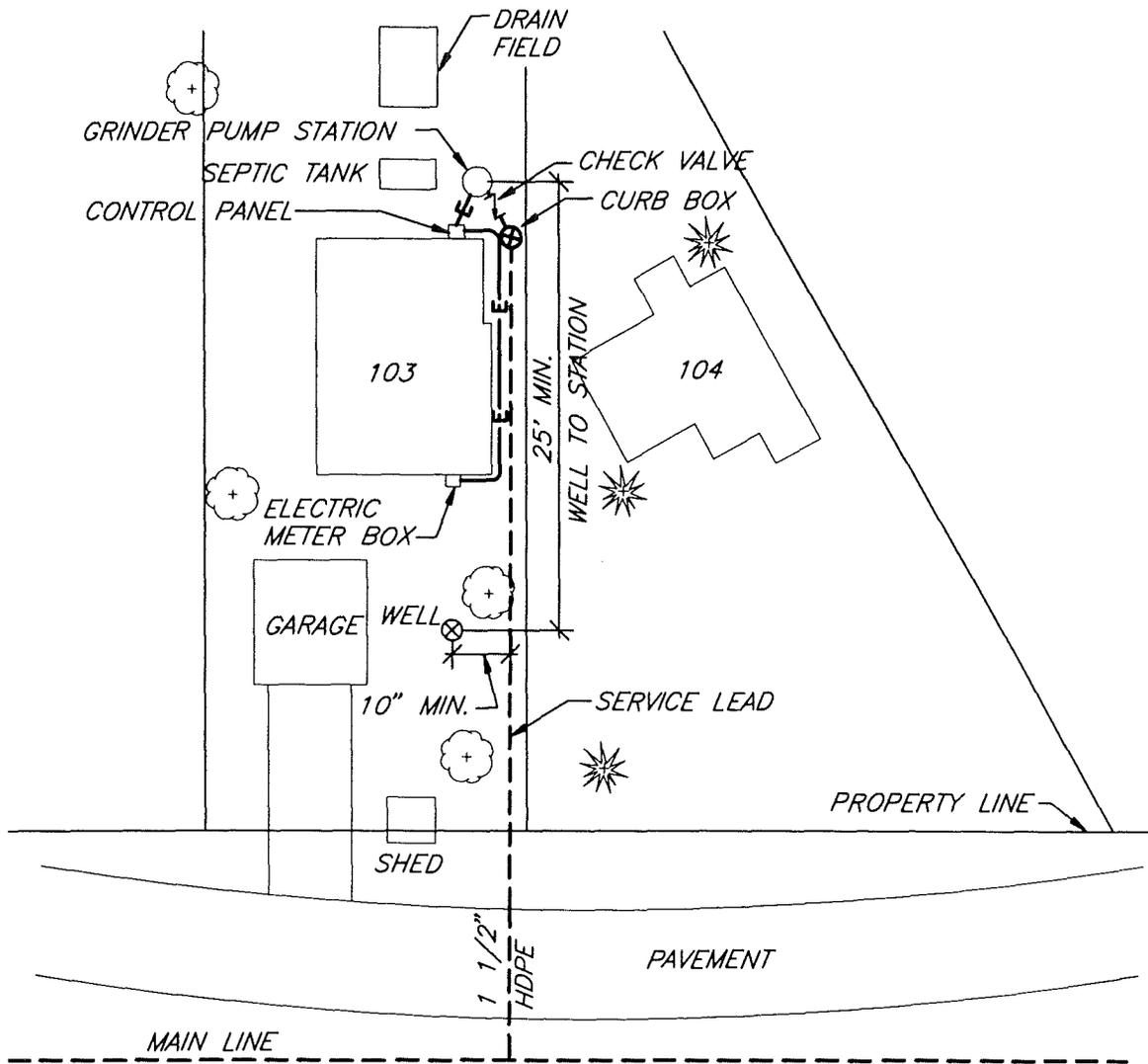
One advantage of a gravity sewer system is the operation and maintenance of the system. Sewage is transported away from each lot by a gravity sewer main and discharged to a common pumping station. The system operators have to maintain a minimum number of pumping stations. Each pumping station will have provisions for standby power for use during power outages. One disadvantage with gravity sewer systems is that the sewer main must be deep enough to keep the constant downward slope necessary to transport the sewage. Another disadvantage is that in general, an open-cut method of construction is required to install a gravity sewer system. Open-cut construction results in more disruption to the surface than a directionally drilled pressure sewer system.

Low-pressure Sewer System

A low-pressure sewer system consists of a small-diameter sewer main constructed within the road right-of-way or public utility easements with service leads and grinder pumps located at each lot. The grinder pumps will collect the sewage from the house or business, then discharge it through a service lead to the small-diameter pressure main. The pressure mains will transport the sewage to a common pumping station or directly to the wastewater treatment plant.

Low-pressure sewer systems can be constructed by either an open-cut method or a by directionally drilling sewer main. With the recent technologies, directional drilling has become a cost-effective

method for installing shallow, small-diameter sewer main. Directional drilling reduces the amount of disruption to the surface as compared to the open-cut method of constructing a gravity sewer system. Small excavations will still be required to install the grinder pump at the lot and at the road for the connection of the lead to the sewer main. Operation and maintenance of a low-pressure sewer system can be more costly, as maintaining all of the individual grinder pumps requires more work during times of power outages. The system operators have to pump down each individual grinder pump to reduce the chance of sewage backup in the homes. A copy of a typical service lead detail, grinder pump installation detail, and a service lead and pump station plan detail have been included in this section of the report.

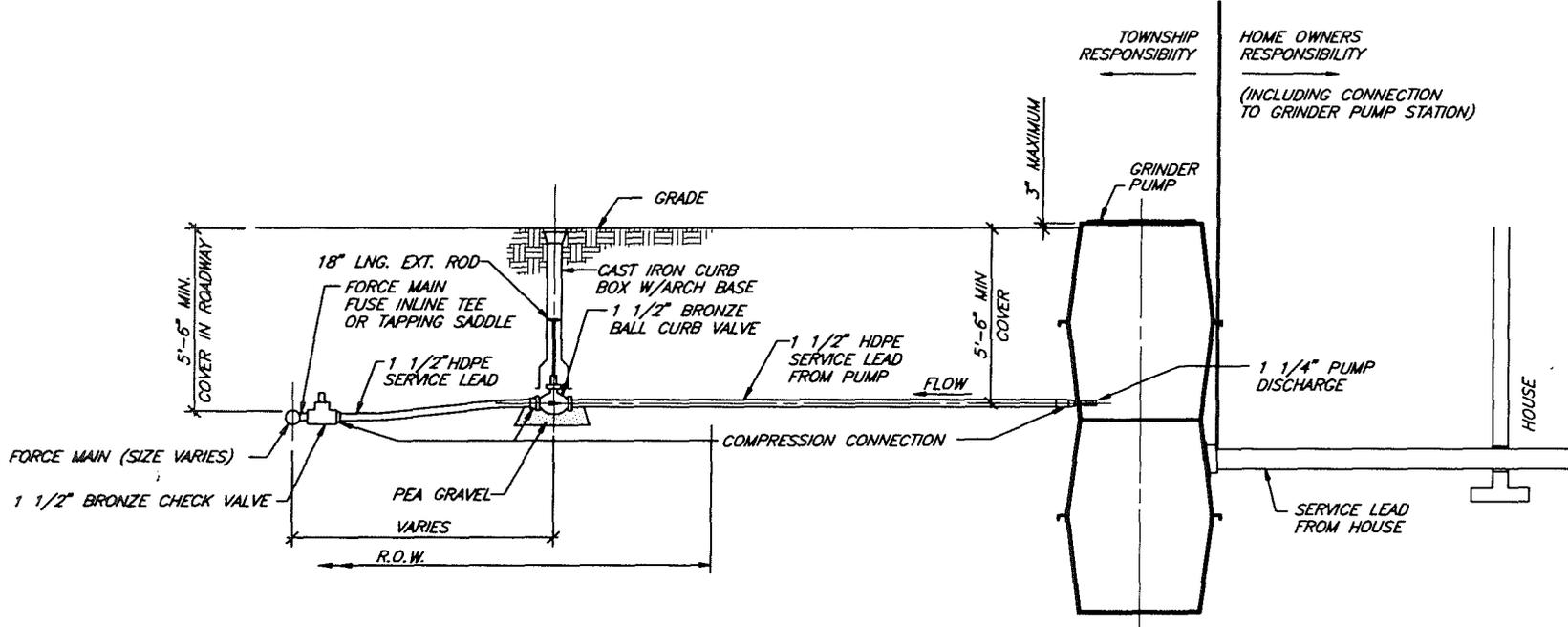


TYPICAL RESIDENTIAL SERVICE LEAD
& GRINDER PUMP STATION SITE PLAN

03-23-98 JBM 02

CADD PART | MPS\0115\00000\ SITEPLAN

McNAMEE PORTER & SEELEY INC.  FIRST-CHOICE FIRM SINCE 1914		BRIGHTON TOWNSHIP SANITARY SEWER SYSTEM		CONTRACT 0115.000.00
SCALE: NONE	DATE 03-23-98	<h1>SERVICE LEAD AND PUMP STATION PLAN</h1>		SHEET
DESIGNED JBM	CHECKED NJM			OF 1



TYPICAL SERVICE LEAD

NO SCALE

CONTRACT
0115.000.00

SHEET
OF 1

BRIGHTON TOWNSHIP
SANITARY SEWER SYSTEM

**TYPICAL SERVICE
LEAD DETAIL**



McNAMEE
FIRST-CHOICE FIRM
SINCE 1914

**McNAMEE
PORTER
& SEELEY
INC.**

DATE 03-23-98

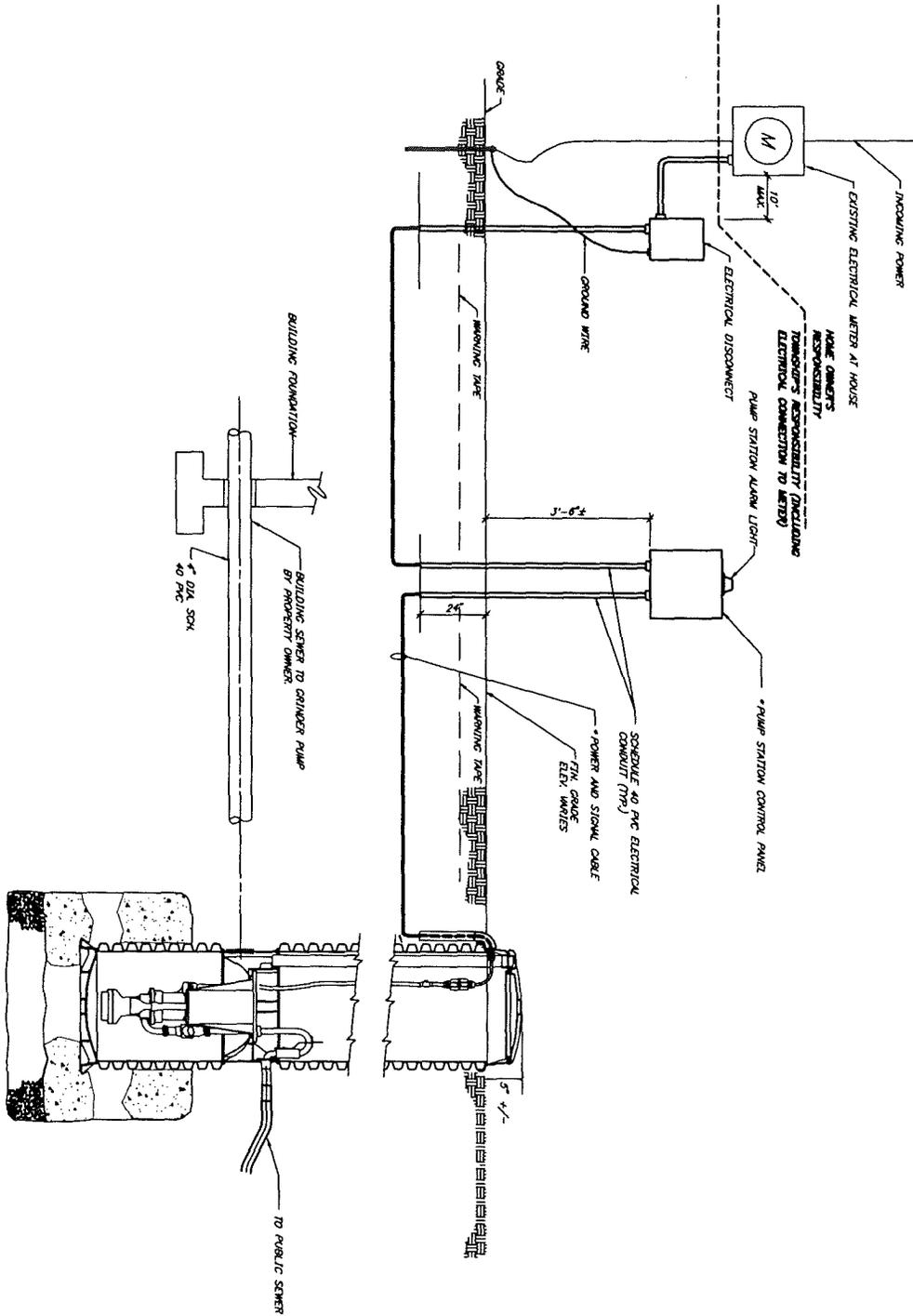
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SCALE: NONE

DESIGNED JBM

07-30-98 JBM 03

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& SEELEY
INC.



BRIGHTON TOWNSHIP
SANITARY SEWER SYSTEM

GRINDER PUMP STATION INSTALLATION DETAIL

CONTRACT
0115.000.00

SHEET

OF 1

SCALE: NONE

DATE 07-30-98

DESIGNED JBM

CHECKED NJM

The report has been subdivided into the individual Special Assessment Districts (SAD) with the proposed alternatives and cost breakdowns for each SAD included in their respective sections. A recommendation section that summarizes the alternatives for the sanitary sewer and water distribution systems is included at the end of the report.

PROJECTED SEWAGE FLOWS

The following table indicates the projected sewage flows from each of the sanitary sewer districts.

The number of residential equivalent units (REUs) included in each district was determined by aerial photographs, along with performing a field survey. An REU is a typical sewer flow generated from a single family home. Brighton Township staff were consulted to confirm the REUs projected for each of the commercial properties. Table 1 lists the areas and the projected sanitary sewer flows based on *Ten States Standards* factors of 100 gallons per day per capita and an assumption of 2.6 persons per REU.

**Table 1
Sanitary Sewer Flow**

Sanitary Sewer District	Existing REUs	Sewage Flow (GPD)
Clark Lake District	105	27,300
Woodland Lake District	503	130,780
West Grand River District	230	59,800
East Grand River District	202	52,520
Fonda Lake District	80*	20,800
Lake of the Pines District	255	66,300
Totals	1,375	357,500

* The REUs for the Fonda Lake district were determined by combining the single family homes and the commercial properties located within this district.

CLARK LAKE AREA

Clark Lake area consists of approximately 95 occupied residential lots and 10 vacant lots that are located on both sides of Clark Lake Road (Drawing A). The homes on the lake side are generally at a lower elevation than the homes on the opposite side of the road. Clark Lake Road is a winding, gravel road that is approximately 20 feet wide. Construction of a gravity sewer would be difficult and would result in deep (+30 feet) sewers to be able to provide sewer service to the homes on the lake side of Clark Lake Road. Excavating a 30-foot-deep sewer would result in a trench width of approximately 50 to 60 feet wide. Figure 1 shows the location of the proposed sanitary sewer route for the Clark Lake Sewer District.

The Clark Lake, West Grand River, and Woodland Lake areas have been analyzed together, as sizing of the sewer mains and pump stations is dependent upon the flow from the other areas. The proposed alternatives for each area are presented in the individual SADs. We have prepared two alternatives for these areas, a gravity system and a low-pressure system. The report discusses the advantages and disadvantages for both the gravity sewer and low-pressure sewer systems in each SAD. The costs presented in this section are for the Clark Lake District only.

PROJECT COST

The opinion of probable project cost for Alternative 1 (gravity sewers) is \$1,277,000 and for Alternative 2 (low pressure sewers) is \$916,000. The costs are presented in 1998 dollars. A unit price breakdown for each alternative is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

Due to the grade elevations and the orientation of the road, it is most cost-effective that Clark Lake be provided with a low-pressure sanitary sewer system.

An Equivalent Cost Analysis was also prepared to evaluate the equivalent annual cost (EAC) for each alternate using a 20-year life cycle with a six percent interest rate. The EAC is a theoretical number prepared for analysis purposes only, and should not be considered as a budgetary number.

District	EAC Alternate 1 Gravity Sewers	EAC Alternate 2 Pressure Sewers
Clark Lake	\$121,240	\$76,572

Based on the preceding cost analysis, the alternate using pressure sewers contains the lowest equivalent annual cost over a 20-year period.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

McNAMEE, PORTER & SEELEY, INC.

512 E. Grand River, Brighton, Michigan 48116

Telephone: (810) 220-2112

FAX: (810) 220-0094

PROJECT: Brighton Township Sewer Systems

DATE: July 30, 1998

LOCATION: Clark Lake

PROJECT NO. 0115,000.00

BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL

ESTIMATOR: J. Markstrom

WORK: Pressure Sewer System

CHECKED BY: J. Barber

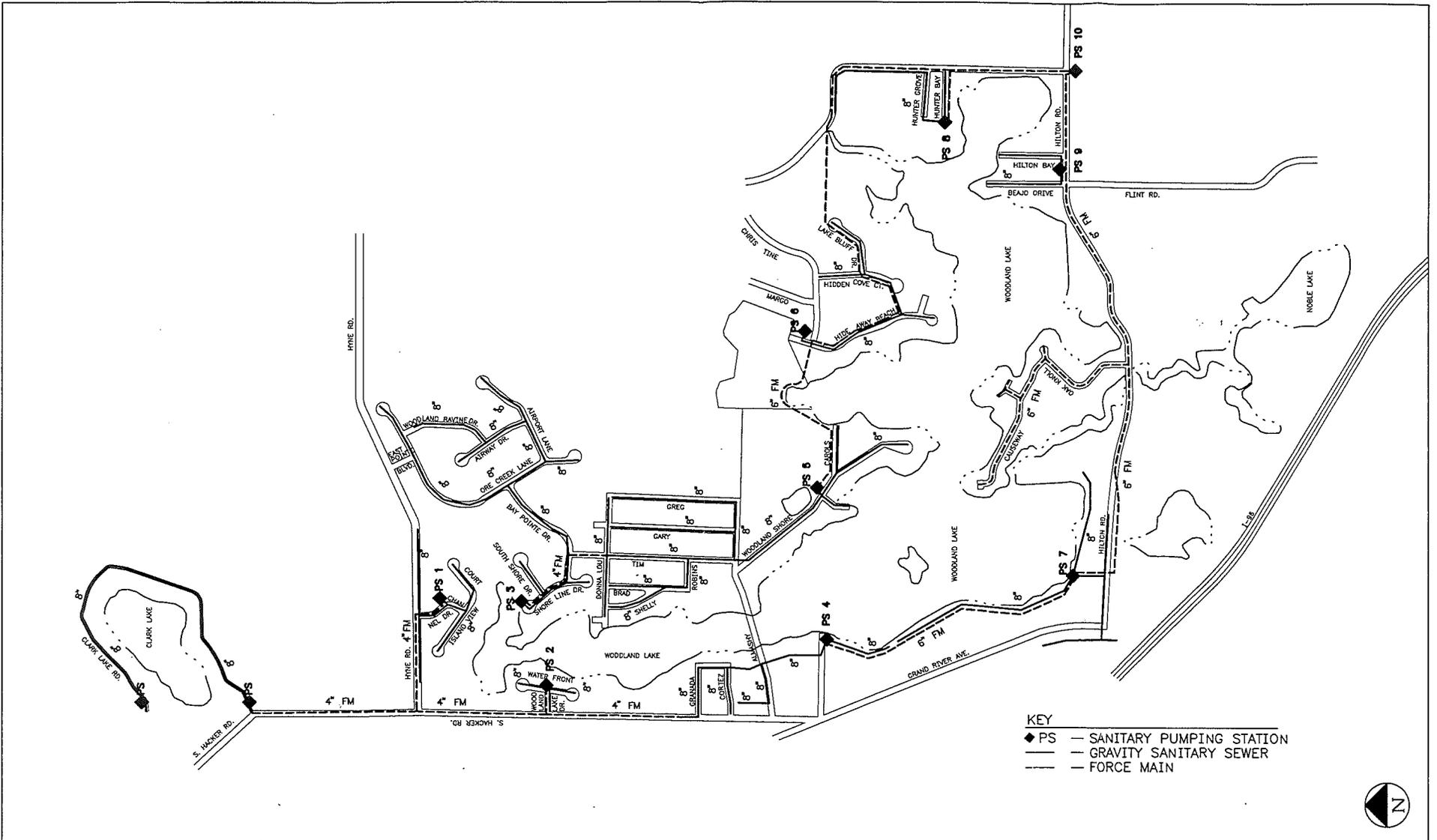
CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
PRESSURE SEWER					
1	2-inch HDPE Force Main Directionally Drilled	500	LF	\$15.00	\$7,500.00
2	4-inch HDPE Force Main Directionally Drilled	6,700	LF	\$18.00	\$120,600.00
3	Grinder Pump Stations	95	EA	\$4,000.00	\$380,000.00
4	Service Connections	95	EA	\$750.00	\$71,250.00
5	Flushing Connections	6	EA	\$1,100.00	\$6,600.00
6	Gate Valves	5	EA	\$800.00	\$4,000.00
7	1-1/2-inch Service Lateral (assume 100-ft per home)	9,500	EA	\$12.00	\$114,000.00
Construction Subtotal					\$703,950.00
Engineering, Legal and Administrative (30%)					\$212,050.00
Total Project Cost					\$916,000.00
GRAVITY SEWER					
1	8-inch PVC SDR 26 Gravity Sewer (0-30 ft)	5,000	LF	\$60.00	\$300,000.00
2	Sanitary Sewer Manholes (1 per 300 feet of sewer)	18	EA	\$2,500.00	\$45,000.00
3	8x6 Wye	10	EA	\$100.00	\$1,000.00
4	Granular Backfill	5,000	LF	\$5.00	\$25,000.00
5	Gravel Road Restoration	100,000	SF	\$5.00	\$500,000.00
6	6-inch Service Lead (assume 35 ft per house)	3,700	LF	\$30.00	\$111,000.00
7	Submersible Pumping Station	2	LS	\$175,000.00	\$350,000.00
8	4-inch Force Main	2,200	LF	\$18.00	\$39,600.00
Construction Subtotal					\$982,000.00
Engineering, Legal and Administrative (30%)					\$295,000.00
Total Project Cost					\$1,277,000.00

Clark Lake

07-08-98 LLO 04

/MPS/0115/00000/6/FIG-1.DWG



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SINCE 1914

DESIGNED: JBM DATE: 07-02-98

WEST GRAND RIVER/WOODLAND LAKE/CLARK LAKE

BRIGHTON TOWNSHIP, MICHIGAN

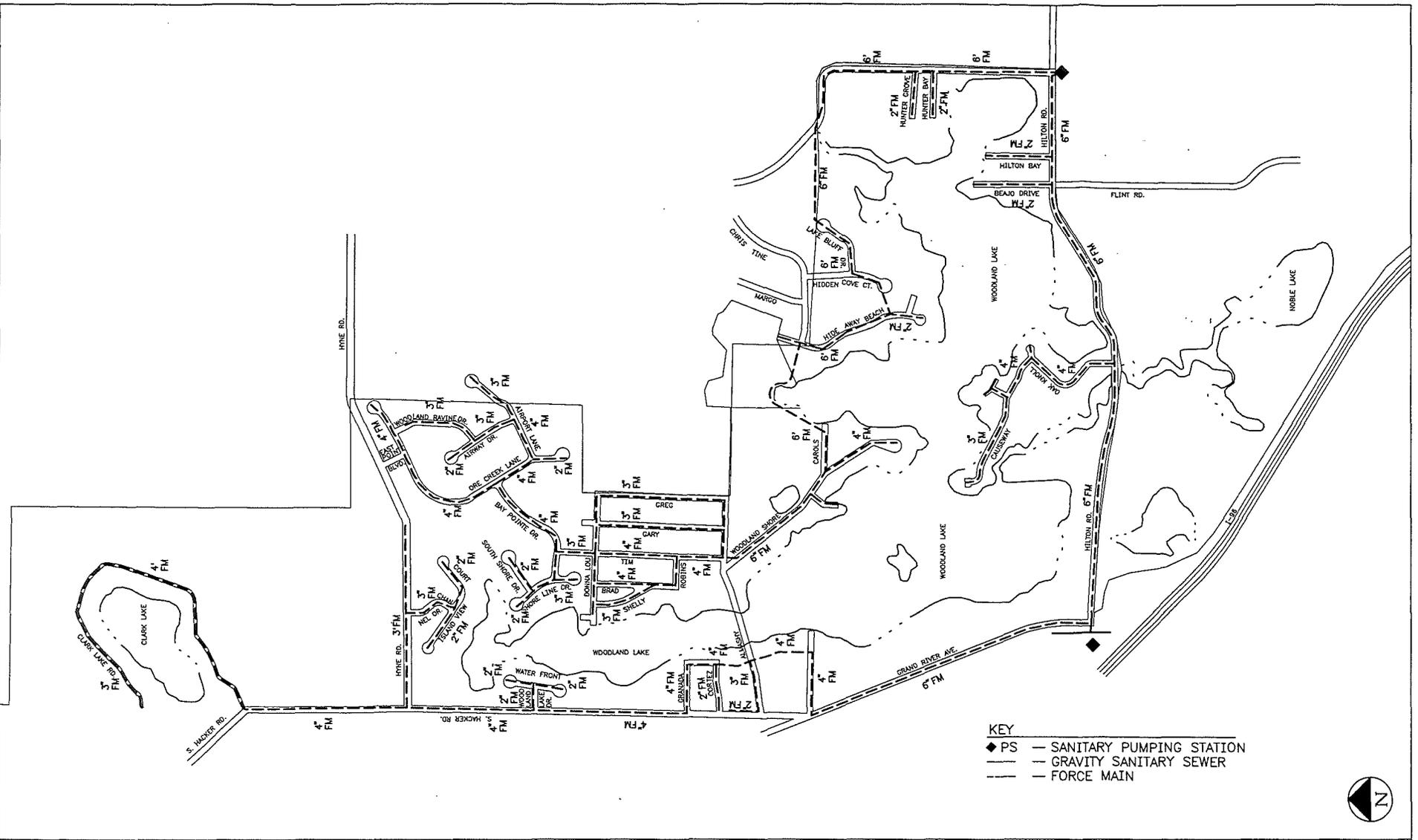
ALTERNATE NO.1
GRAVITY

FIGURE

1

07/08/88 LLO 04

/NPS/0115/00000/8/FIG-3.DWG



- KEY
- ◆ PS — SANITARY PUMPING STATION
 - — GRAVITY SANITARY SEWER
 - — FORCE MAIN



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& SEELEY
INC.

McNAMEE
FIRST-CHOICE FIRM
SINCE 1914

DESIGNED: JBM DATE: 07-02-98

WEST GRAND RIVER/WOODLAND LAKE/CLARK LAKE

BRIGHTON TOWNSHIP, MICHIGAN

ALTERNATE NO. 2
PRESSURE SEWER

FIGURE

2

WEST GRAND RIVER SANITARY SEWER AND WATER DISTRIBUTION

SANITARY SEWER

The West Grand River Area encompasses the area from the Genoa/Brighton Township boundary south of Almashy Road to the drain connecting Noble Lake and Woodland Lake along Hilton Road (Drawing B). A number of the businesses located on the west side of Grand River Avenue are connected to the Genoa Township sanitary sewer system, which runs along the Brighton/Genoa Township boundary. The remainder of the businesses on the west side will connect to the Brighton Township sewer system. The east side of Grand River Avenue contains both residential and commercial properties. The residential properties are generally located near the lake, while the commercial properties have frontage along Grand River Avenue. The land slopes from Grand River Avenue down to Woodland Lake. Both a low-pressure sewer system and a gravity sewer system have been evaluated for this sewer district. Figure 1 outlines the proposed routing of the gravity sewer system; Figure 2 indicates the routing of the proposed low-pressure sewer system.

The Clark Lake, West Grand River, and Woodland Lake areas have been analyzed together, as sizing of the sewer mains and pump stations is dependent upon the flow from the other areas. The proposed alternatives for each area are presented in the individual SADs. We have prepared two alternatives for these areas, a gravity system and a low-pressure system. The report discusses the advantages and disadvantages for both the gravity sewer and low-pressure sewer systems in each SAD. The costs presented in this section are for the West Grand River District only.

Providing a gravity sewer system through this district would be extremely difficult. To provide sewer service to both the residential properties along the lake and the commercial properties along the east side of Grand River, a gravity sewer main would have to be constructed between the homes and businesses. This would result in the acquisition of numerous easement for the sewer main line. Also, the closer to the water's edge that the sewer is constructed, the greater the cost for dewatering.

Constructing a low-pressure sewer system in this area would reduce the number of easements that are required for the construction of the main line. The majority of the sewer main line could be constructed within the Grand River right-of-way. Depending upon the location of the existing utilities and obstacles from the businesses, a few easements may have to acquired from the parcels located along Grand River. With this system, all lots in this district, with the exception of the Pizza Hut, Amoco Gas Station, Superior Olds, Arby's, and Big Acre, would be provided a grinder pump that would pump their sewage up to the main line located near Grand River. The remainder of the parcels

would be provided a gravity sewer system that would discharge into a pump station located near the Pizza Hut Restaurant. The pump station would pump the sewage through a force main under Grand River and discharge into the low-pressure sewer main on Hilton Road. The main reason for providing a gravity sewer system for these parcels is that fast food restaurants generate quite a bit of grease that would have a tendency to provide operational problems with a grinder pump station.

PROJECT COST

The opinion of probable project cost for Alternative 1 (gravity sewers) is \$2,958,000 and for Alternative 2 (low pressure sewers) is \$2,543,000. The costs are presented in 1998 dollars. A unit price breakdown for each alternative is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

An Equivalent Cost Analysis was also prepared to evaluate the equivalent annual cost (EAC) for each alternate using a 20-year life cycle with a six percent interest rate. The EAC is a theoretical number prepared for analysis purposes only, and should not be considered as a budgetary number.

District	EAC Alternate 1 Gravity Sewers	EAC Alternate 2 Pressure Sewers
West Grand River	\$172,100	\$121,800

Based on the preceding cost analysis, the alternate using pressure sewers has, in each case, the lowest equivalent annual cost over a 20-year period.

WATER SYSTEM

Description of Alternatives

The greatest concern with providing a water system to an area is to provide proper looping of the water main. Dead-end water mains with few connections have a tendency to allow the water to become stagnant, thus requiring more flushing of the water system. We have two proposed water main routes shown in Figures 8 and 9.

Two alternatives were considered for the water main routing through the West Grand River District. The first alternative involves constructing a water main on the east side of Grand River and the north side of Hilton Roads. In this alternative, we propose to connect to the existing City of Brighton's water main at both Conference Center Drive and Hacker Roads. The businesses on the west side of Grand River would be provided water service from the existing water main running north and south along the Genoa/Brighton Township boundary. The parcels on the east side of Grand River would be provided water service by a water main constructed along the east side of Grand River. As stated in the sewer portion of this report, depending upon the location of the existing utilities and above-grade obstructions in this area, a few easement may have to acquired by the Township for the construction of the water main. In this alternative, water will be provided by the City of Brighton water system.

The second alternative is prepared with the assumption that Brighton Township will provide water to this area by a Brighton Township water supply system. Additional water main is required with this alternative compared to Alternative 1 to complete a looped water system. With Alternative 2 a water main would have to be constructed on both sides of Grand River to provide the adequate fire protection and water service to all parcels. Once again, acquisition of easements may be necessary to construct the water main on both sides of Grand River.

PROJECTED WATER FLOWS

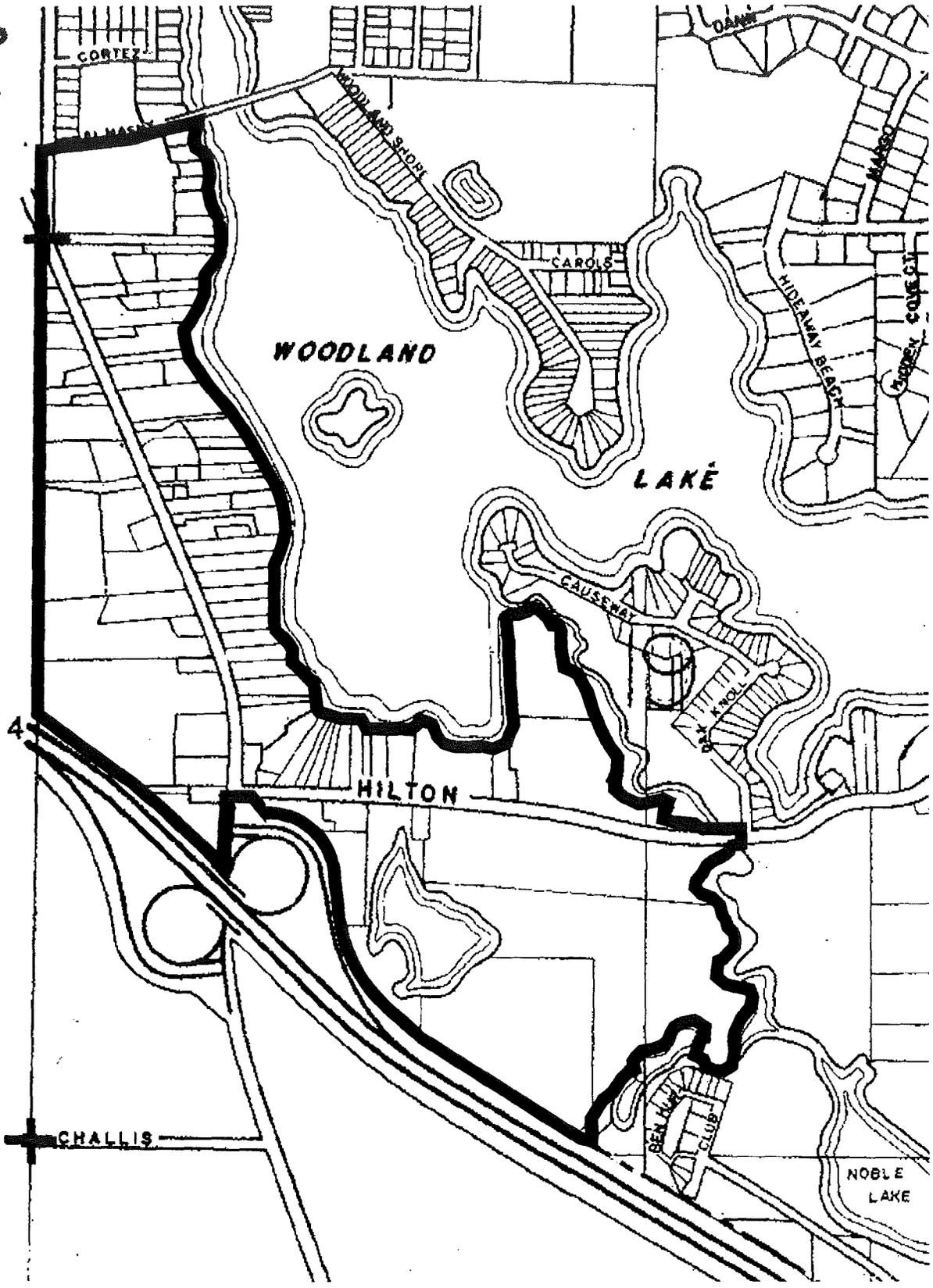
The following table indicates the projected water flows from each water district. The number of existing REUs is assumed to be the same as indicated in the Sanitary Sewer portion of this report and is shown in Table 4. The projected water usage listed below is based on the projected number of REUs for sanitary sewer service multiplied by 260 gallons per day per REU.

Water District	Existing REUs	Water Usage (GPD)
West Grand River District	230	59,800

PROJECT COST

The opinion of probable project cost for Alternative 1 is \$875,000 and for Alternative 2 is \$1,042,000. The costs are presented in 1998 dollars. The unit price breakdown for each alternative is included in this section.

The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.



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& SEELEY
INC.



BRIGHTON TOWNSHIP, MICHIGAN
SANITARY SEWER STUDY

CONTRACT
0115,000.00

WEST GRAND RIVER SANITARY SEWER DISTRICT

SCALE: NONE

DATE 07/09/98

DESIGNED JBM

CHECKED NJM

SHEET

C

OF

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

McNAMEE, PORTER & SEELEY, INC.

512 E. Grand River, Brighton, Michigan 48116

Telephone: (810) 220-2112

FAX: (810) 220-0094

PROJECT: Brighton Township Sewer Systems

DATE: July 30, 1998

LOCATION: West Grand River

PROJECT NO. 0115.000.00

BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL

ESTIMATOR: J. Markstrom

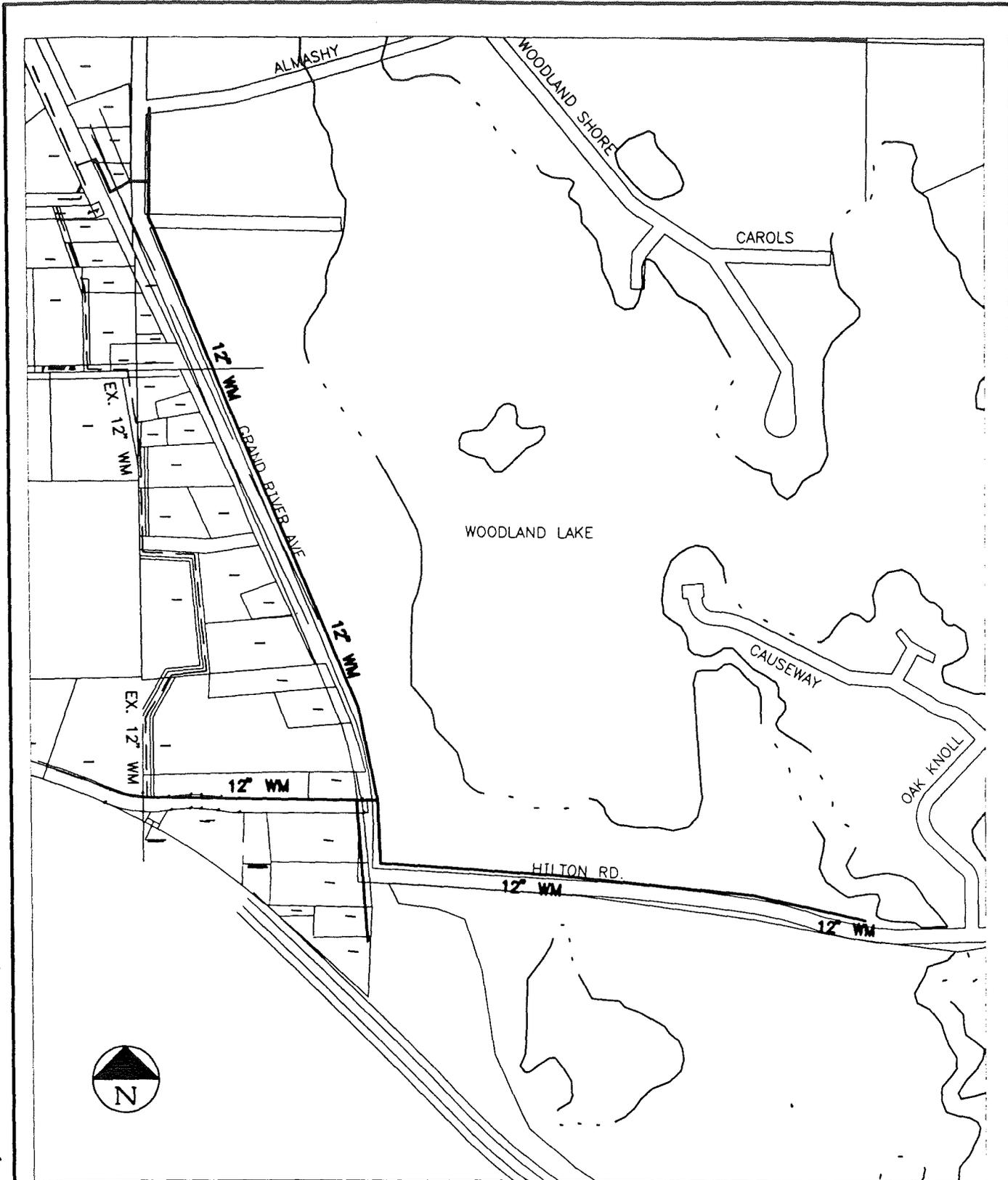
WORK: Gravity Sewer vs Pressure Sewer Analysis

CHECKED BY: J. Barber

CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
GRAVITY SEWER					
1	8-inch PVC SDR 26 Gravity Sewer (0-20 ft)	2,600	LF	\$45.00	\$117,000.00
2	Drive Restoration	3,450	SF	\$5.00	\$17,250.00
3	20-inch Casing Pipe Jack and Bore	100	LF	\$200.00	\$20,000.00
4	6-inch Service Lead (assume 35 ft per house)	1,155	LF	\$25.00	\$28,875.00
5	8x6 Wye	23	EA	\$100.00	\$2,300.00
6	4-inch Force Main	30	LF	\$18.00	\$540.00
7	Submersible Pump Stations	1	LS	\$375,000.00	\$375,000.00
8	Sanitary Sewer Manholes	9	EA	\$2,000.00	\$18,000.00
9	Grinder Pump Stations	60	EA	\$4,000.00	\$240,000.00
10	Service Connections	60	EA	\$750.00	\$45,000.00
11	1-1/2-inch Service Lateral (assume 100-ft per home)	6,000	EA	\$12.00	\$72,000.00
12	6-inch HDPE Force Main Directionally Drilled	6,900	LF	\$25.00	\$172,500.00
13	Flushing Connections	3	EA	\$1,100.00	\$3,300.00
14	Gate Valves	3	EA	\$800.00	\$2,400.00
15					
16	Construction Subtotal				\$1,114,165.00
17	Engineering, Legal, Administrative (30%)				\$334,835.00
18	Project Total				\$1,449,000.00
PRESSURE SEWER SYSTEM					
1	4-inch HDPE Force Main Directionally Drilled	1,430	LF	\$18.00	\$25,740.00
2	1-1/2-inch Service Lateral (assume 100-ft per home)	8,300	EA	\$12.00	\$99,600.00
3	Grinder Pump Stations	83	EA	\$4,000.00	\$332,000.00
4	Service Connections	83	EA	\$750.00	\$62,250.00
5	Flushing Connections	8	EA	\$1,100.00	\$8,800.00
6	Gate Valves	8	EA	\$800.00	\$6,400.00
7	6-inch HDPE Force Main Directionally Drilled	3,800	LF	\$25.00	\$95,000.00
8	8-inch PVC SDR 26 Gravity Sewer (0-20 ft)	1,000	LF	\$45.00	\$45,000.00
9	Submersible Pump Station	1	LS	\$175,000.00	\$175,000.00
10	20-inch Casing Pipe Jack and Bore	100	LF	\$200.00	\$20,000.00
11	6-inch Service Lead (assume 35 ft per commercial site)	350	LF	\$25.00	\$8,750.00
12	8x6 Wye	10	EA	\$100.00	\$1,000.00
13	Sanitary Sewer Manholes	4	EA	\$2,000.00	\$8,000.00
14	Construction Subtotal				\$879,540.00
15	Engineering, Legal, Administrative (30%)				\$264,460.00
16	Project Total				\$1,144,000.00

W. Grand River



07/13/98 JBM 01

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PORTER
& SEELEY
INC.



BRIGHTON TOWNSHIP, MICHIGAN
WEST GRAND RIVER SAD

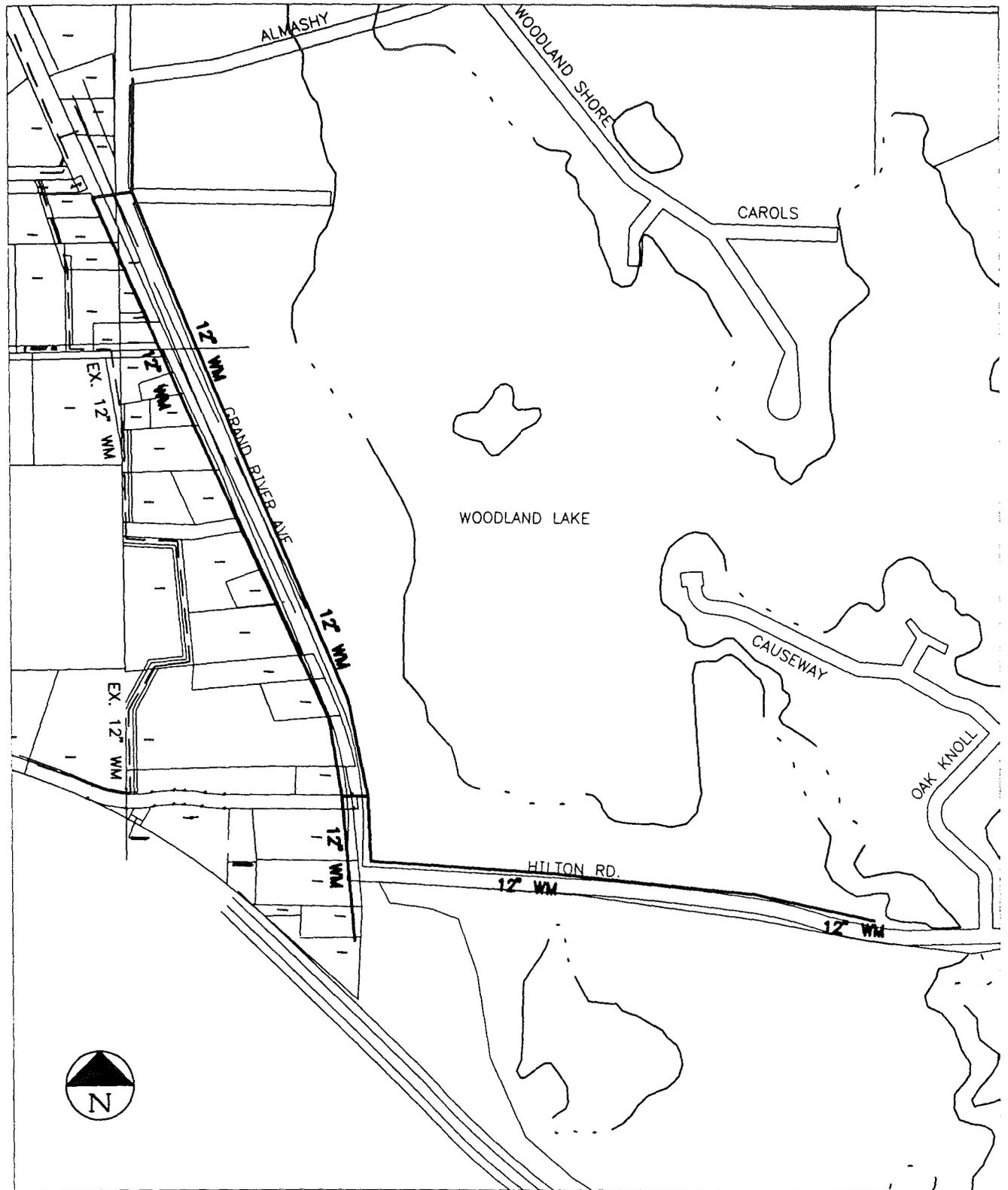
CONTRACT
0115.000.00

WEST GRAND RIVER
ALT. 1 WATER MAIN

SHEET
8

SCALE: NONE	DATE 07/13/98
DESIGNED JBM	CHECKED NJM

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07/13/98 JBM 01

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McNAMEE
PORTER
& SEELEY
INC.



BRIGHTON TOWNSHIP, MICHIGAN
WEST GRAND RIVER SAD

CONTRACT
0115.000.00

SCALE: NONE

DATE 07/13/98

WEST GRAND RIVER
ALT. 2 WATER MAIN

SHEET

9

DESIGNED JBM

CHECKED NJM

OF

WOODLAND LAKE AREA

The Woodland Lake District consists of the residential neighborhoods on the north and east side of Woodland Lake (Drawing C). Sewage flow from this area will run in two directions around Woodland Lake. The sewage generated from the lots that front Hacker and Hyne Roads will be directed around the east side of the lake and down Hacker Road. The sewage from the remainder of the lots will be directed around the west side of the lake and down to a common pumping station located at the corner of Hyne and Hunter Roads. Both a gravity sewer system and a low-pressure sewer system have been evaluated for this sanitary sewer district and are shown in Figures 1 and 2.

The Clark Lake, West Grand River, and Woodland Lake areas have been analyzed together, as sizing of the sewer mains and pump stations is dependent upon the flow from the other areas. The proposed alternatives for each area are presented in the individual SADs. We have prepared two alternatives for these areas, a gravity system and a low-pressure system. The report discusses the advantages and disadvantages for both the gravity sewer and low-pressure sewer systems in each SAD. The costs presented in this section are for the Woodland Lake District only.

This district consists of a number of individual subdivisions, a manufactured housing community, and individual residential parcels. Providing a gravity sewer system for this district would result in a number of sanitary sewer pumping stations to lift the sewage to another gravity sewer main. The homes located on the east side of Hacker Road from Hyne Road to Woodland Lake Drive are considerably lower in grade than Hacker Road. These parcels could not be provided sewer service by a gravity sewer; therefore, a grinder pump would have to be installed at each lot. There are two areas where a gravity sewer system could be constructed that would require a small pump station. These areas are the Hunter Grove and Hunter Bay area, and the Beajo Drive and Hilton Bay area. A gravity sewer system in these areas could be difficult due to the width of the existing roads and the topography of the land. The finish floor elevation for the homes along Hide Away Beach, Hidden Cove Court and Lake Bluff Drive vary significantly from the lake side to the opposite side of the road. The homes along the lake side sit near the lake, which would necessitate constructing a deep gravity sewer to provide a gravity sewer service from the house to the main line. At a minimum, ten to twenty homes in this area would have to be provided with a grinder pump to minimize the depth of the sewer.

A low-pressure sewer main can be constructed with only six feet of cover over the pipe, resulting in less disruption to the surface. As stated above, with the gravity sewer system there are still areas where

a grinder pump would have to be installed to provide sewer service. Providing low-pressure sewer to this district would result in a unified system of all the same materials. Operating a unified system is easier, as the operators do not need to first determine a problem is occurring in the gravity sewer portion or in a individual grinder pump.

PROJECT COST

The opinion of probable project cost for Alternative 1 (gravity sewers) is \$6,869,000 and for Alternative 2 (low pressure sewers) is \$6,218,000. The costs are presented in 1998 dollars. A unit price breakdown for each alternative is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

An Equivalent Cost Analysis was also prepared to evaluate the equivalent annual cost (EAC) for each alternate using a 20-year life cycle with a six percent interest rate. The EAC is a theoretical number prepared for analysis purposes only, and should not be considered as a budgetary number.

District	EAC Alternate 1 Gravity Sewers	EAC Alternate 2 Pressure Sewers
Woodland Lake	\$6595,400	\$529,900

Based on the preceding cost analysis, the alternate using pressure sewers has, in each case, the lowest equivalent annual cost over a 20-year period.

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

McNAMEE, PORTER & SEELEY, INC.

512 E. Grand River, Brighton, Michigan 48116

Telephone: (810) 220-2112 FAX: (810) 220-0094

PROJECT: Brighton Township Sewer Systems

DATE: July 30, 1998

LOCATION: Woodland Lake

PROJECT NO. 0115.000.00

BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL

ESTIMATOR: J. Markstrom

WORK: Gravity Sewer vs Pressure Sewer Analysis

CHECKED BY: J. Barber

CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
GRAVITY SEWER					
1	8-inch PVC SDR 26 Gravity Sewer (0-20 ft)	34,800	LF	\$45.00	\$1,566,000.00
2	Drive Restoration	41,700	SF	\$5.00	\$208,500.00
3	20-inch Casing Pipe Jack and Bore	100	LF	\$200.00	\$20,000.00
4	6-inch Service Lead (assume 35 ft per house)	17,605	LF	\$25.00	\$440,125.00
5	8x6 Wye	513	EA	\$100.00	\$51,300.00
6	2-inch Force Main	2,730	LF	\$15.00	\$40,950.00
7	4-inch Force Main	5,630	LF	\$18.00	\$101,340.00
8	Submersible Pump Stations	1	LS	\$735,000.00	\$735,000.00
9	Sanitary Sewer Manholes	125	EA	\$2,000.00	\$250,000.00
10	Grinder Pump Stations	81	EA	\$4,000.00	\$324,000.00
11	Service Connections	81	EA	\$750.00	\$60,750.00
12	1-1/2-inch Service Lateral (assume 100-ft per home)	8,100	EA	\$12.00	\$97,200.00
13	6-inch HDPE Force Main Directionally Drilled	13,900	LF	\$25.00	\$347,500.00
14	Flushing Connections	4	EA	\$1,100.00	\$4,400.00
15	Gate Valves	4	EA	\$800.00	\$3,200.00
16	3-inch HDPE Force Main Directionally Drilled	1,100	LF	\$16.00	\$17,600.00
17	Gravel Road Restoration	125,000	SF	\$5.00	\$625,000.00
18	Bit Road Restoration	2,900	LF	\$20.00	\$58,000.00
19	Church Pump Station and Service Lead	1	LS	\$75,000.00	\$75,000.00
20	Construction Subtotal				\$5,025,865.00
21	Engineering, Legal, Administrative (30%)				\$1,843,135.00
22	Project Total				\$6,869,000.00
PRESSURE SEWER SYSTEM					
1	2-inch HDPE Force Main Directionally Drilled	8,900	LF	\$15.00	\$133,500.00
2	3-inch HDPE Force Main Directionally Drilled	13,600	LF	\$16.00	\$217,600.00
3	4-inch HDPE Force Main Directionally Drilled	13,700	LF	\$18.00	\$246,600.00
4	1-1/2-inch Service Lateral (assume 100-ft per home)	58,300	EA	\$12.00	\$699,600.00
5	Grinder Pump Stations	583	EA	\$4,000.00	\$2,332,000.00
6	Service Connections	583	EA	\$750.00	\$437,250.00
7	Flushing Connections	40	EA	\$1,100.00	\$44,000.00

Woodland Lake

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

McNAMEE, PORTER & SEELEY, INC.

512 E. Grand River, Brighton, Michigan 48116

Telephone: (810) 220-2112 FAX: (810) 220-0094

PROJECT: Brighton Township Sewer Systems

DATE: July 30, 1998

LOCATION: Woodland Lake

PROJECT NO. 0115.000.00

BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL

ESTIMATOR: J. Markstrom

WORK: Gravity Sewer vs Pressure Sewer Analysis

CHECKED BY: J. Barber

CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
8	Gate Valves	63	EA	\$800.00	\$50,400.00
9	6-inch HDPE Force Main Directionally Drilled	15,600	LF	\$25.00	\$390,000.00
10	Church Pump Station and Service Lead	1	LS	\$75,000.00	\$75,000.00
11					
12	Construction Subtotal				\$4,625,950.00
13	Engineering, Legal, Administrative (30%)				\$1,655,050.00
14	Project Total				\$6,281,000.00

Woodland Lake

EAST GRAND RIVER SANITARY SEWER AND WATER DISTRIBUTION

The East Grand River area covers the commercial corridor along Grand River and Old US-23 from the City of Brighton line to US-23, and from I-96 south to the Green Oak Township line (Drawing D). This corridor is most effectively served through a gravity sewer system. Due to the number of commercial businesses along this corridor, a larger grinder pump station would be needed at each of the businesses, resulting in a greater construction cost. The existing topography of this area generally slopes from the northwest to the southeast. A pump station is proposed in the southeast corner of this corridor to collect all of the sewage generated from the East Grand River Area. Figure 3 indicates the location of the proposed gravity sanitary sewer route to provide sewer service to the East Grand River Sewer District.

PROJECT COST

The opinion of probable project cost for Alternative 1 (gravity sewers) is \$6,218,000. Due to the number of large commercial businesses in this area, a low pressure sewer system would be costly. The costs are presented in 1998 dollars. A unit price breakdown for the gravity sewer system is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

WATER SYSTEM

Description of Alternatives

The greatest concern with providing a water system to an area is to provide proper looping of the water main. Dead-end water mains with few connections tend to allow the water to become stagnant, thus requiring more flushing of the water system. We have prepared a proposed water main route for each district, and they are shown in Figure 10.

With the East Grand River system, we have prepared one alternative for providing an adequate water system. The major question is from what source is the water to be provided. With this alternative, a water main is proposed to be constructed down both sides of Grand River and Old US-23 along with on the south side of Weber. This alternative provides adequate fire protection to the businesses on all the streets, as the hydrants can be installed on both sides of the roads.

PROJECTED WATER FLOWS

The following table indicates the projected water flows from each of the water districts. The number of existing REUs is assumed to be the same as indicated in the Sanitary Sewer portion of this report and is

shown in Table 4 below. The projected water usage listed below is based on the projected number of REUs for sanitary sewer service multiplied by 260 gallons per day per REU.

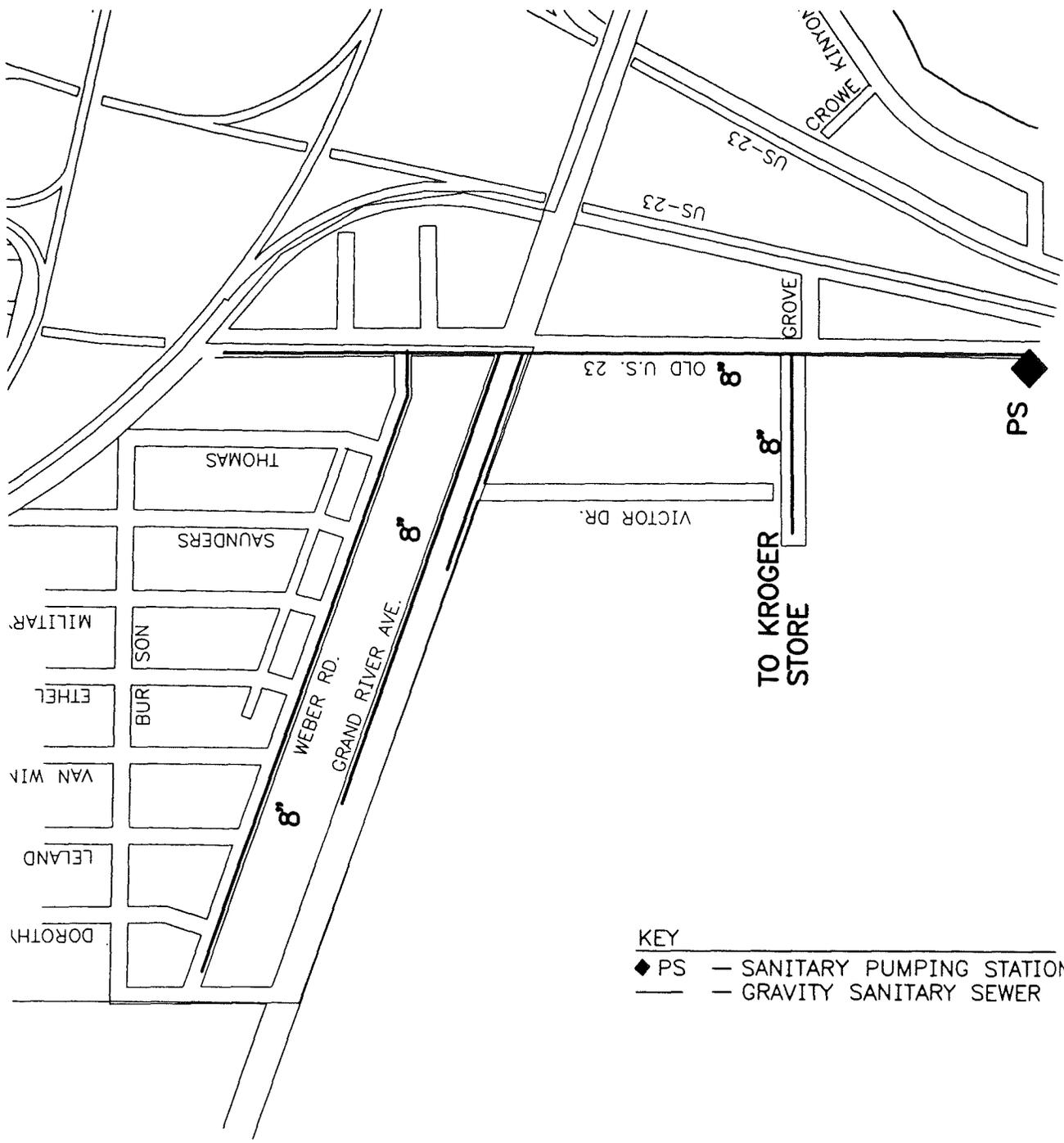
Water District	Existing REUs	Water Usage (GPD)
East Grand River District	202	52,520

PROJECT COST

The opinion of probable project cost for Alternative 1 is \$766,000. The costs are presented in 1998 dollars. The unit price breakdown for each alternative is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

07/20/98 JBM 01

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KEY
 ◆ PS — SANITARY PUMPING STATION
 — — GRAVITY SANITARY SEWER

TO KROGER STORE



McNAMEE
 PORTER
 & SEELEY
 INC.



BRIGHTON TOWNSHIP, MICHIGAN

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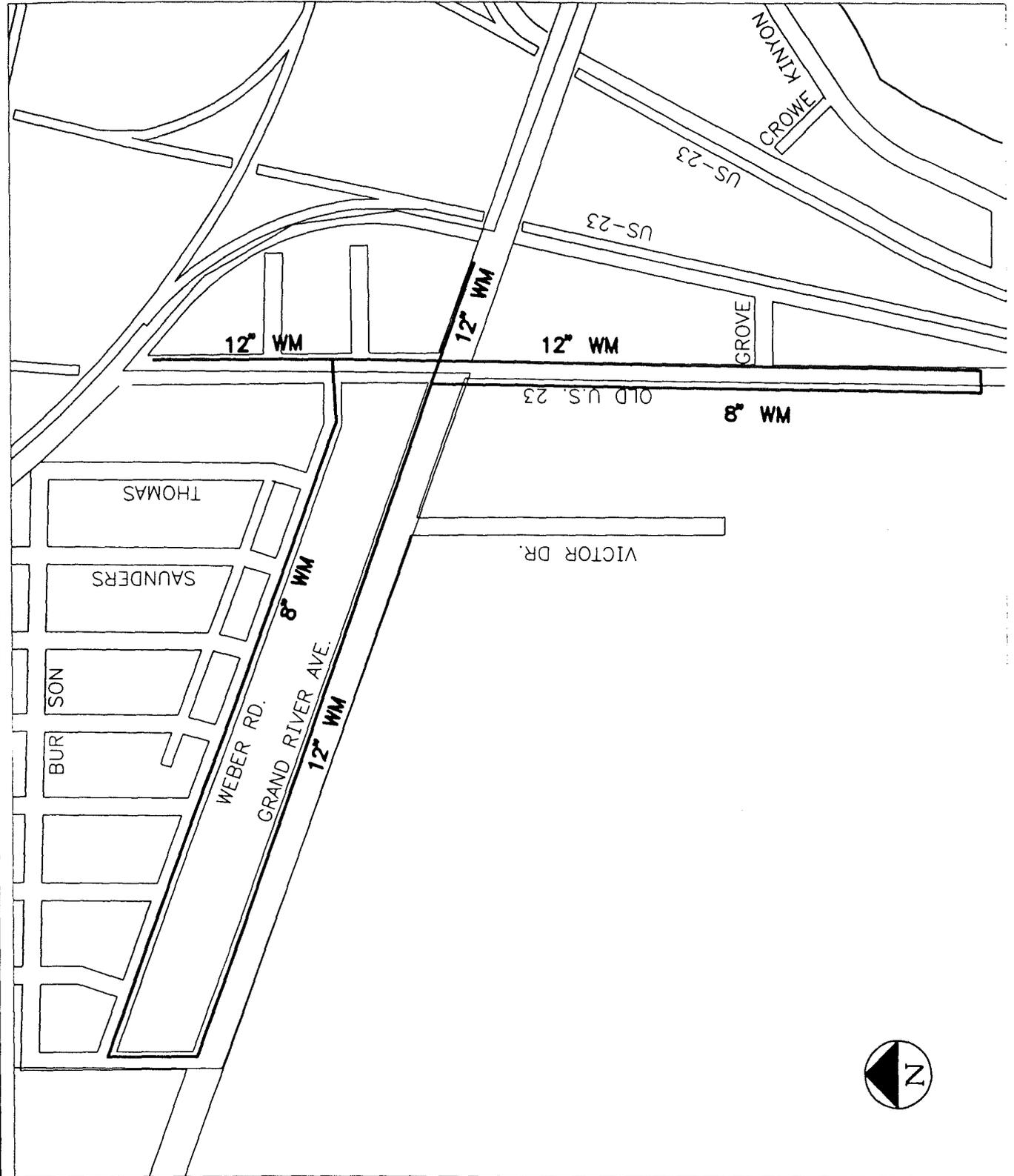
EAST GRAND RIVER
 GRAVITY SEWER SYSTEM

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SCALE: NONE	DATE 07/08/98
DESIGNED JBM	CHECKED NJM

07/13/98 JEM 01

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McNAMEE
PORTER
& SEELEY
INC.



BRIGHTON TOWNSHIP, MI
EAST GRAND RIVER SAD

CONTRACT
0115.000.00

EAST GRAND RIVER
ALT 1 WATER MAIN

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SCALE: NONE

DATE 07/13/98

DESIGNED JBM

CHECKED NJM

OF

FONDA LAKE

The Fonda Lake area consists of approximately 80 residential lots that surround the north side of Fonda Lake (Drawing E). This area contains a large grade differential from the road that surrounds the lake to the edge of water. One alternative is to construct a gravity sewer system down the roads that would discharge into a pumping station. The other alternative would be to provide sewer service to this area by a low-pressure sewer system. The proposed gravity sewer routing is shown in Figure 5, and the low-pressure sewer routing is found in Figure 6.

Similar to the Clark Lake District, deep gravity sewer mains would have to be constructed to provide sewer service to the homes along the water's edge; or a gravity sewer main would have to be constructed between the homes and the water, which would result in the acquisition of easements and significant dewatering.

The low-pressure sewer main could be constructed within the limits of the roads on the north side of the lake. Grinder pumps and service leads could then be installed to the homes on each side of the road and connected to the main within the road. Keeping the sewer within the limits of the road can reduce the number of easements needed to be acquired by the Township.

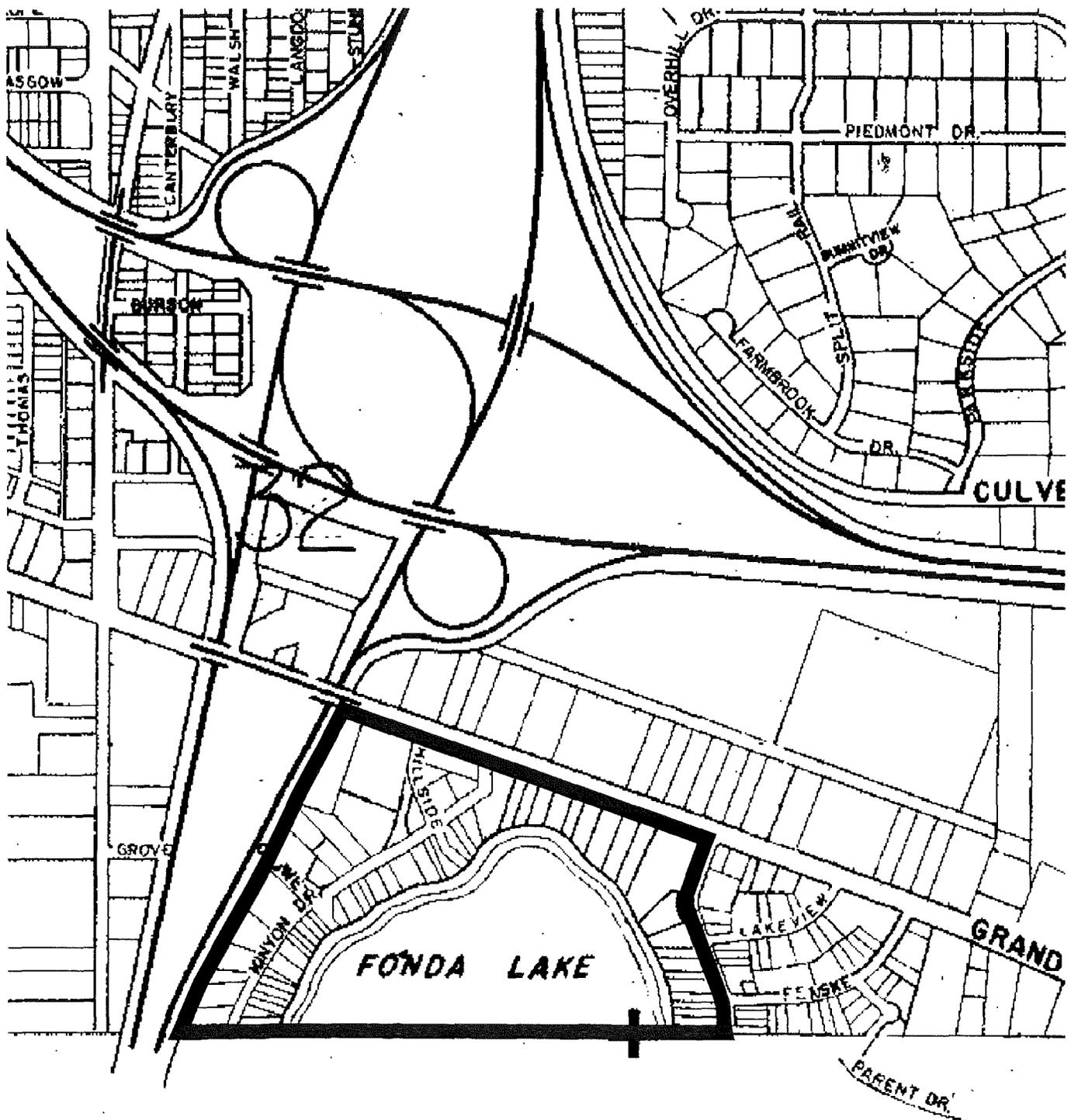
PROJECT COST

The opinion of probable project cost for Alternative 1 (gravity sewers) is \$667,000 and for Alternative 2 (low pressure sewers) is \$714,000. The costs are presented in 1998 dollars. A unit price breakdown for each alternative is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

An Equivalent Cost Analysis was also prepared to evaluate the equivalent annual cost (EAC) for each alternate using a 20-year life cycle with a six percent interest rate. The EAC is a theoretical number prepared for analysis purposes only, and should not be considered as a budgetary number.

District	EAC Alternate 1 Gravity Sewers	EAC Alternate 2 Pressure Sewers
Fonda Lake	\$76,300	\$59,700

Based on the preceding cost analysis, the alternate using pressure sewers has, in each case, the lowest equivalent annual cost over a 20-year period.



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McNAMEE
PORTER
& SEELEY
INC.



BRIGHTON TOWNSHIP, MICHIGAN
SANITARY SEWER STUDY

CONTRACT
0115.000.00

FONDA LAKE SANITARY SEWER DISTRICT

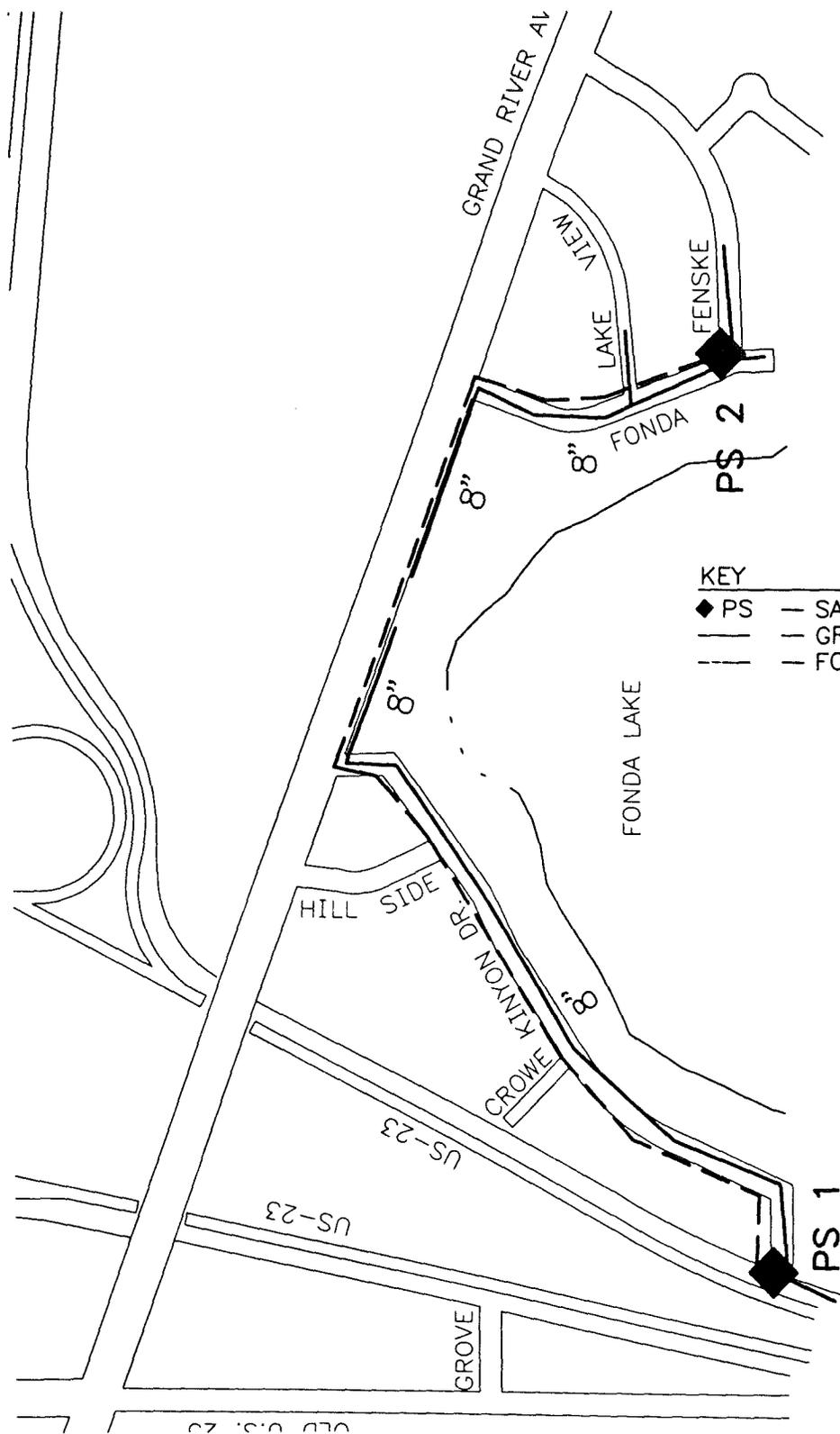
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SCALE: NONE
DESIGNED JBM

DATE 07/09/98
CHECKED NJM

07/08/98 LLO 03

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KEY

- ◆ PS — SANITARY PUMPING STATION
- — GRAVITY SANITARY SEWER
- - - - FORCE MAIN



McNAMEE
PORTER
& SEELEY
INC.



BRIGHTON TOWNSHIP, MICHIGAN

CDNTRACT
0115.000.00

FONDA LAKE AREA
GRAVITY SEWER SYSTEM

SHEET
4
OF

SCALE: NONE

DATE 07/08/98

DESIGNED JBM

CHECKED NJM

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

McNAMEE, PORTER & SEELEY, INC.

512 E. Grand River, Brighton, Michigan 48116

Telephone: (810) 220-2112 FAX: (810) 220-0094

PROJECT: Brighton Township Sewer Systems

DATE: July 30, 1998

LOCATION: Fonda Lake

PROJECT NO. 0115.000.00

BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL

ESTIMATOR: J. Markstrom

WORK: Gravity Sewer vs. Pressure Sewer

CHECKED BY: _____

CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
GRAVITY SEWER					
1	8-inch PVC SDR 26 Gravity Sewer (0-20 ft)	5,100	LF	\$45.00	\$229,500.00
2	Drive Restoration	11,500	SF	\$5.00	\$57,500.00
3	6-inch Service Lead (assume 35 ft per house)	2,695	LF	\$25.00	\$67,375.00
4	8x6 Wye	77	EA	\$100.00	\$7,700.00
5	60 GPM Pump Station (6-foot Diameter 20-ft Deep)	1	LS	\$125,000.00	\$125,000.00
6	Sanitary Sewer Manhole	13	EA	\$2,000.00	\$26,000.00
	Construction Subtotal				\$513,075.00
	Engineering, Legal, Administrative (30%)				\$153,925.00
	Project Cost				\$667,000.00
PRESSURE SEWER SYSTEM					
1	2-inch HDPE Force Main Directionally Drilled	1,100	LF	\$15.00	\$16,500.00
2	3-inch HDPE Force Main Directionally Drilled	2,600	LF	\$16.00	\$41,600.00
3	4-inch HDPE Force Main Directionally Drilled	1,400	LF	\$18.00	\$25,200.00
4	1-1/2-inch Service Lateral (assume 100-ft per home)	7,700	EA	\$12.00	\$92,400.00
5	Grinder Pump Stations	77	EA	\$4,000.00	\$308,000.00
6	Service Connections	77	EA	\$750.00	\$57,750.00
7	Flushing Connections	4	EA	\$1,100.00	\$4,400.00
8	Gate Valves	4	EA	\$800.00	\$3,200.00
	Construction Subtotal				\$549,050.00
	Engineering, Legal, Administrative (30%)				\$164,950.00
	Project Cost				\$714,000.00

Fonda

LAKE OF THE PINES

The Lake of the Pines Sanitary Sewer district consists of approximately 255 residential lots that surround Lake of the Pines (Drawing F). A gravity sewer system could be constructed within the road right-of-way and service leads brought to the edge of the property line. Due to the drop in topography of the homes along the lake, the gravity main may have to be constructed rather deep to provide adequate sewer service. Two pumping stations, one on each side of the lake to collect the sewage and transport back to Culver Road, are necessary for the gravity alternative. Figure 6 indicates the location of the gravity sewer and pumping stations.

The second alternative is to provide each residential lot with an individual grinder pump and to construct a low-pressure sewer system around the lake. The low-pressure sewer system would result in less disruption of the landscaping and would allow a shallower sewer main to be constructed. This system would provide for easier service to the homes along the lake that have walk-out basements with a bathroom in the lower level. The proposed low-pressure sewer route is outlined in Figure 7.

PROJECT COST

The opinion of probable project cost for Alternative 1 (gravity sewers) is \$2,087,000 and for Alternative 2 (low pressure sewers) is \$2,359,000. The costs are presented in 1998 dollars. A unit price breakdown for each alternative is included in this section. The values in the unit price breakdown include an engineering, legal and administrative fee of 30 percent to arrive at the total project cost.

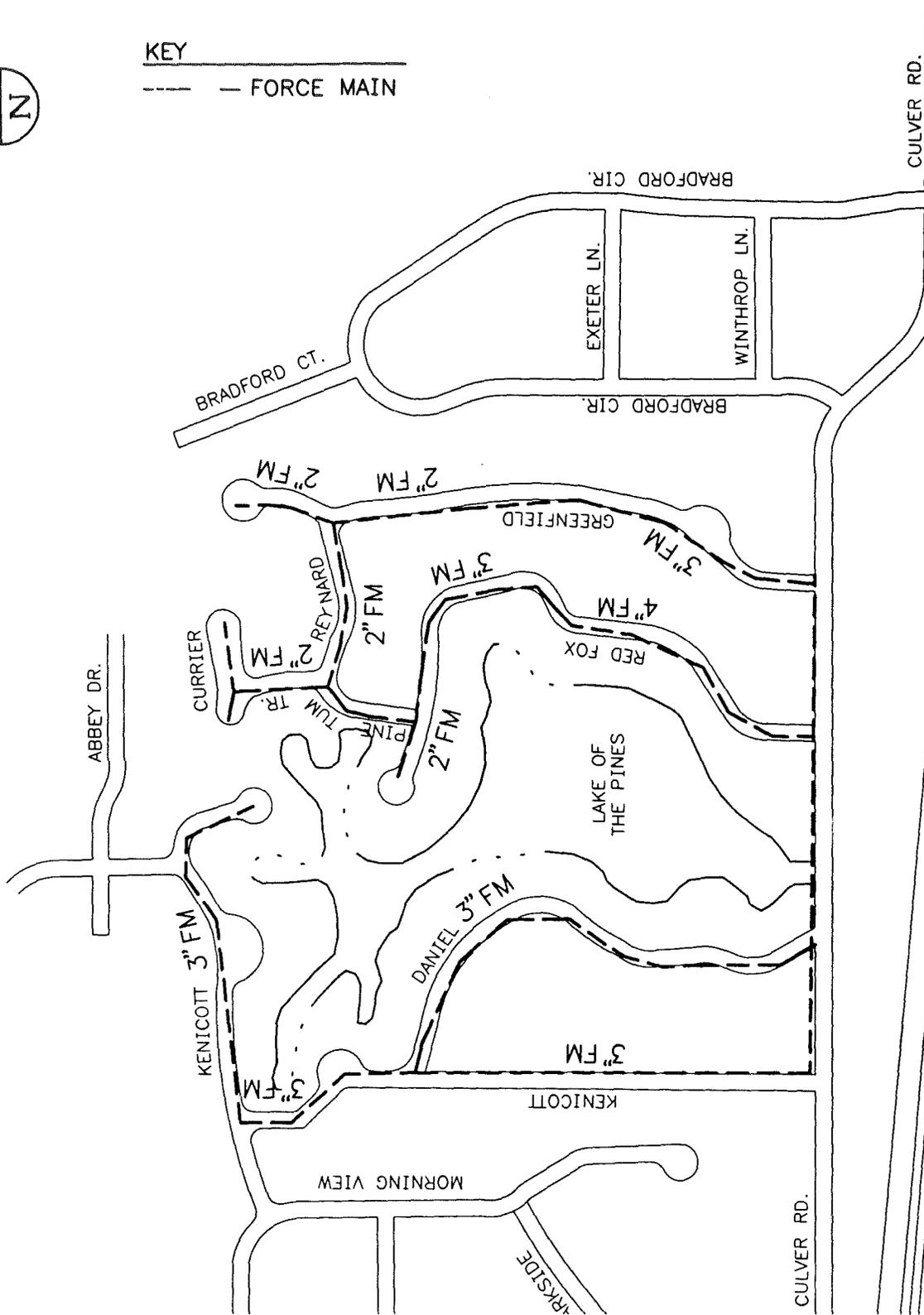
An Equivalent Cost Analysis was also prepared to evaluate the equivalent annual cost (EAC) for each alternate using a 20-year life cycle with a six percent interest rate. The EAC is a theoretical number prepared for analysis purposes only, and should not be considered as a budgetary number.

District	EAC Alternate 1 Gravity Sewers	EAC Alternate 2 Pressure Sewers
Lake of the Pines	\$253,400	\$197,500

Based on the preceding cost analysis, the alternate using pressure sewers has, in each case, the lowest equivalent annual cost over a 20-year period.



KEY
 --- FORCE MAIN



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McNAMEE
 PORTER
 & SEELEY
 INC.



BRIGHTON TOWNSHIP, MICHIGAN

CONTRACT
 0115.000.00

SCALE: NONE

DATE 07/06/98

LAKE OF THE PINES
 PRESSURE SEWER SYSTEM

SHEET

7

DESIGNED JBM

CHECKED NJM

OF

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

McNAMEE, PORTER & SEELEY, INC.

512 E. Grand River, Brighton, Michigan 48116

Telephone: (810) 220-2112 FAX: (810) 220-0094

PROJECT: Brighton Township Sewer Systems

DATE: July 30, 1998

LOCATION: Lake of the Plines

PROJECT NO. 0115.000.00

BASIS FOR ESTIMATE: CONCEPTUAL PRELIMINARY FINAL

ESTIMATOR: J. Markstrom

WORK: Gravity Sewer vs. Pressure Sewer

CHECKED BY: J. Barber

CURRENT ENR: _____

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
GRAVITY SEWER					
1	8-inch PVC SDR 26 Gravity Sewer (0-20 ft)	14,900	LF	\$45.00	\$670,500.00
2	Drive Restoration	30,000	SF	\$5.00	\$150,000.00
3	6-inch Service Lead (assume 35 ft per house)	9,100	LF	\$25.00	\$227,500.00
4	8x6 Wye	260	EA	\$100.00	\$26,000.00
5	4-inch Force Main	4,500	LF	\$18.00	\$81,000.00
6	90 GPM Pump Station (6-foot Diameter 25-ft Deep)	1	LS	\$175,000.00	\$175,000.00
7	100 GPM Pump Station (6-foot Diameter 25-ft Deep)	1	LS	\$175,000.00	\$175,000.00
8	Sanitary Sewer Manholes	50	EA	\$2,000.00	\$100,000.00
9	20-inch Casing Pipe Jack and Bore	150	LF	\$200.00	\$30,000.00
	Construction Subtotal				\$1,605,000.00
	Engineering, Legal, Administrative (30%)				\$482,000.00
	Project Cost				\$2,087,000.00
PRESSURE SEWER SYSTEM					
1	2-inch HDPE Force Main Directionally Drilled	2,025	LF	\$15.00	\$30,375.00
2	3-inch HDPE Force Main Directionally Drilled	9,460	LF	\$16.00	\$151,360.00
3	4-inch HDPE Force Main Directionally Drilled	2,700	Lf	\$18.00	\$48,600.00
4	6-inch HDPE Force Main Directionally Drilled	400	Lf	\$25.00	\$10,000.00
5	1-1/2-inch Service Lateral (assume 100-ft per home)	26,000	EA	\$12.00	\$312,000.00
6	Grinder Pump Stations	260	EA	\$4,000.00	\$1,040,000.00
7	Service Connections	260	EA	\$750.00	\$195,000.00
8	Flushing Connections	10	EA	\$1,100.00	\$11,000.00
9	Gate Valves	20	EA	\$800.00	\$16,000.00
	Construction Subtotal				\$1,814,335.00
	Engineering, Legal, Administrative (30%)				\$544,665.00
	Project Cost				\$2,359,000.00

RECOMMENDATION

This Phase I Evaluation Report presents both the capital cost and equivalent annual cost (EAC) for each of the sanitary sewer districts, and two alternatives for supplying sanitary sewer service. We offer the following recommendations for the Township's consideration relating to sanitary sewer service to the six sanitary sewer districts.

WOODLAND LAKE

The data presented in this report indicate that both the capital costs and the equivalent annual cost (EAC) are significantly less for a low-pressure sewer system than for a gravity sewer system. Maintaining the low-pressure sewer system over a 20-year life span proved to be more cost-effective. Therefore, we recommend a low-pressure sewer system for this sanitary sewer district.

CLARK LAKE

We recommend that the Clark Lake area be provided sanitary sewer service by means of a low-pressure sewer system. The significant difference in topography from one side of the road to the other would make a gravity sewer system extremely difficult to construct and maintain. The low-pressure sewer system is constructed at much shallower depths, thereby reducing the overall construction costs.

WEST GRAND RIVER

The data presented in this report indicate that both the capital costs and the equivalent annual cost (EAC) are significantly less for a low-pressure sewer system than for a gravity sewer system. The costs for maintaining the low-pressure sewer system over a 20-year life span proved to be more cost-effective. Therefore, we recommend a low-pressure sewer system for this sanitary sewer district.

EAST GRAND RIVER

Due to the number commercial properties along the East Grand River and Old US-23 Corridors, it is our recommendation that a gravity sewer system be installed that generally slopes from the northwest to southeast. The use of grinder pumps in this high-flow, high-use service area is not recommended. A pumping station which would collect the sewage from this area and discharge it into the transmission main would then be installed at the south end of Old US-23.

FONDA LAKE

The topography of the Fonda Lake Area is similar to the Clark Lake Area, where the homes on the lake are significantly lower than those across the road. Our data indicate that the capital cost for

constructing a gravity sewer system is slightly lower than a low-pressure sewer system. However, the EAC for the gravity sewer system is significantly greater over a 20-year period. Therefore, it is our recommendation that a low-pressure sewer system be provided for sewer service for the Fonda Lake sanitary sewer district.

LAKE OF THE PINES

Similar to Fonda Lake, the capital cost for constructing a gravity sewer system in the Lake of the Pines area is slightly lower than a low-pressure sewer system; however, the EAC for the low-pressure sewer system is anticipated to be approximately \$55,000 per year less than the gravity sewer system. Over the 20-year life cycle, the EAC will significantly offset the capital cost for the low-pressure sewer system. Therefore, we recommend a low-pressure system for this area.

WATER DISTRICTS

We have presented two alternative water main routes for each of the special assessment districts considering water service. Prior to our recommending an alternative, the Township should first consider which community will be providing water service.

The West Grand River District already contains a City of Brighton-maintained water main along the west side of the district. Utilizing the City's water would reduce the amount of water main required to be constructed to provide adequate water service to this district.

The East Grand River District alternatives presented are less determined by the water source. The major concern with this district is whether the Township would rather construct more water main to reduce the number of easements and provide better fire service, or construct water main on only one side of Grand River and Old US-23. The location of the water source has minimal impact on the costs presented for this district.

APPENDIX A
Equivalent Annual Cost

Equivalent Annual Cost

Equivalent Cost Analysis											
Item	Description	Woodland Lake		West Grand River		Lake of the Pines		Fonda Lake		Clark Lake	
		Gravity Sewers	Pressure Sewers	Gravity Sewers	Pressure Sewers	Gravity Sewers	Pressure Sewers	Gravity Sewers	Pressure Sewers	Gravity Sewers	Pressure Sewers
1	Land & Easements										
2	Sewers	\$2,916,415	\$1,731,300	\$414,515	\$291,890	\$1,105,000	\$563,335	\$330,575	\$180,100	\$451,600	\$248,700
3	Structures	\$453,600	\$962,800	\$246,000	\$202,800	\$140,000	\$416,000	\$50,000	\$123,200	\$185,000	\$152,000
4	Equipment	\$683,600	\$1,494,600	\$371,400	\$310,600	\$210,000	\$640,000	\$75,000	\$188,000	\$210,000	\$232,000
5	Subtotal	\$4,053,615	\$4,188,700	\$1,031,915	\$805,290	\$1,455,000	\$1,619,335	\$455,575	\$491,300	\$846,600	\$632,700
6	Contingencies @ 10%	\$405,362	\$418,870	\$103,192	\$80,529	\$145,500	\$161,934	\$45,558	\$49,130	\$84,660	\$63,270
7	Construction Total	\$4,458,977	\$4,607,570	\$1,135,107	\$885,819	\$1,600,500	\$1,781,269	\$501,133	\$540,430	\$931,260	\$695,970
8	Eng., Legal & Administrative @ 30%	\$1,337,693	\$1,382,271	\$340,532	\$265,746	\$480,150	\$534,381	\$150,340	\$162,129	\$279,378	\$206,791
9	Total Capital Cost	\$5,796,669	\$5,989,841	\$1,475,638	\$1,151,565	\$2,080,650	\$2,315,649	\$651,472	\$702,559	\$1,210,638	\$904,761
10	Salvage Value at 20 Years	\$1,976,649	\$1,520,180	\$371,709	\$276,534	\$733,000	\$546,001	\$223,345	\$169,660	\$363,460	\$225,220
11	Present Worth of Salvage Value	\$616,319	\$473,992	\$115,899	\$86,223	\$228,549	\$170,243	\$69,639	\$52,900	\$113,327	\$70,224
12	Total Annual O&M and Replacement	\$207,640	\$48,870	\$53,500	\$28,870	\$51,100	\$10,400	\$25,550	\$3,080	\$25,550	\$3,800
13	Present Worth O&M and Replacement	\$2,381,610	\$560,534	\$613,640	\$331,136	\$586,112	\$119,287	\$293,056	\$35,327	\$293,056	\$43,586
14	Total Present Worth	\$7,561,960	\$6,076,383	\$1,973,379	\$1,396,477	\$2,438,212	\$2,264,693	\$874,889	\$684,986	\$1,390,367	\$878,123
15	Equivalent Annual Cost	\$659,403	\$529,861	\$172,079	\$121,773	\$212,612	\$197,481	\$76,290	\$59,731	\$121,240	\$76,572
Item Descriptions											
1. to 4. Estimated											
5. Total of Items 1. to 4.											
6. Item 5. times 10%											
7. Total Items 5. and 6.											
8. Item 5. times 20%											
9. Total of Items 7. and 8.											
10. Land considered permanent, 50-yr. life for pipelines, 40-yr. life for structures and 20 yr. life for equipment with straight line depreciation over 20 years.											
11. Present value of future value @ 6% for 20 years (x 0.3118)											
12. Estimated based on \$40/year/grinder pump and \$70/day/pump station including electrical costs.											
13. Present value of future payment Series @ 6% for 20 years (x 11.4699)											
14. Total of Items 9. and 13. less Item 11.											
15. Item 14. over 20 years at 6% (x 0.0872)											