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# The Niagara Falls Water Board

# Frozen Waterline Investigation Report

## GGE 15-1032

*Prepared for:*
*The Niagara Falls Water Board*

*Prepared by:*
*Glynn Geotechnical Engineering*
*415 South Transit Street*
*Lockport, New York 14094*


September 2, 2015

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REPORT



APPENDICES

## EXECUTIVE SUMMARY

A study of the frozen waterlines, particularly the service laterals, has been completed by Glynn Geotechnical Engineering (GGE) on behalf of the Niagara Falls Water Board (NFWB). This study effort included **1.)** the review of reports of frozen waterlines for 2015, **2.)** engineering drawings for the reconstruction of 72nd Street, **3.)** finding of the excavation and examination of waterline services in ten (10) locations within the City of Niagara Falls and **4.)** consideration of historical temperature records for the winter of 2015.

It is our opinion, formulated from the study efforts that:

**1.)** During the month of February 2015 Western New York experienced the coldest temperatures on record. The average temperature for the entire month of February 2015 was 11.1 degrees Fahrenheit, whereas the average temperature for the month, prior to 2015, was 26.3 degrees Fahrenheit. The extremely low temperature period was the principal cause of the frozen waterlines.

**2.)** The reconstruction of 72nd Street decreased the insulation protection of the waterlines by the replacement of clayey soils with crushed stone by a factor of 30%.

**3.)** For the most part the original waterlines, mains and service laterals, in the City of Niagara Falls are not buried to the minimum recommended frost depth of 48 inches.

**4.)** The problem of frozen waterline lines was limited to the service lateral from the main to the curb box. The freezing conditions have not impacted the water mains.

**5.)** There are multiple conditions responsible for the various frozen waterlines.

## 1.0 INTRODUCTION

During the winter of 2014, and again in the winter of 2015, there have been numerous instances of frozen water services in the City of Niagara Falls, New York. The residences affected by the frozen water service condition have occurred in clusters as well as in scattered neighborhoods, including a number of residences on the 500 and 600 blocks of 72nd Street, where the street was reconstructed in 2013.

In an attempt to resolve the lack of water supply to residences the NFWB (owner of the water utilities) initiated a "drip program", wherein the homeowner keeps a faucet turned on to keep the water moving in the service line. In cases where the residence water service has already frozen, the NFWB established a temporary connection from a neighboring residence. In certain instances the service lines were thawed out by inserting a small steam pipe into the line.

Because the frozen water service issue was a significant problem in 2014 and reoccurred in 2015, the NFWB retained the services of GGE to conduct a study of the conditions and factors related to the problem in an attempt to understand the issues and formulate a solution. GGE examined the data related to the frozen water services, gathered by the NFWB, and investigated the underground conditions of several residential locations spread across the City. By means of test pits, GGE documented the depth of the water mains and the lateral piping from the connection of the service lateral at the water main to the curb box / valve. GGE has completed the field investigation effort and prepared this report of our findings.

## 2.0 INVESTIGATION PROCEDURE

In order to provide a representative cross section of the residential service lateral conditions, GGE reviewed the historical data regarding location and dates of freezing water lines and selected ten (10) sites for investigation. Sites were selected in an effort to represent a variety of scenarios throughout the City, including frozen and non-frozen line locations, early and late reporting dates, long and short service lateral lengths (from the valve box to the curb) and new and old roadway construction.

The investigation was performed by GGE's excavation subcontractor, J.R. Swanson Plumbing Company, Inc. (Swanson), from May 27 through July 22, 2015. The investigation effort was observed and directed by GGE engineers and geologists. Swanson performed the excavation using Kubota U55 tracked excavator and manual excavation with hand tools. The excavations were primarily backfilled with compacted 2 inch run of crusher stone. Clay soil was replaced directly over the waterline if encountered during excavation. Temporary cold patch asphalt was placed to match the existing roadway surface upon the completion of backfill operations. Excavation operation and investigation specifics were recorded by GGE on the Field Observation Reports included in Appendix J.

The sites selected by GGE, which were chosen in an effort to gain as much data as possible, are identified in Table 1.0 on the following page. The table provides the reason the location was selected for investigation and a comment about the particular findings at that location. Detailed cross sections of the underground conditions encountered during the investigation at each location are included in Appendix A. In addition to the test pit excavations performed at each of the ten (10) locations, GGE reviewed **1.)** the reconstruction plans for 72nd Street, **2.)** the insulating properties of clay soil and crushed stone and **3.)** common practices employed by plumbers to thaw frozen waterlines.

## TABLE 1.0
## CITY OF NIAGARA FALLS FROZEN WATERLINE STUDY
## EXCAVATION SITES
## GGE 15-1032

| PROFILE | LOCATION | SELECTION CRITERIA | COMMENTS |
|---|---|---|---|
| **P8** | **1).** 2926 Ontario Avenue | Reported frozen condition early during records, February 16, 2015: Within a cluster area. | 2'-9" Cover at main, main buried in stone. |
| **P5** | **2).** 1906 Welch Avenue | One of last locations to report frozen condition, March 1, 2015. | 2'-9" Cover at main, lots of clay cover. |
| **P2** | **3).** 511 72nd Street | Shallow valve box depth, located on 72nd Street. | 2'-5" Cover at main, less than 1" change in street elevation, mostly stone backfill. |
| **P1** | **4).** 602 72nd Street | Deepest valve box depth, located on 72nd Street. | 2'-9" Cover at main, approx 6" change in street elevation, mostly stone backfill. |
| **P6** | **5).** 1224 13th Street | Included on drip program, likely frozen in 2014. | 3'-2" Cover at main, lots of clay cover, not below frost depth. |
| **P3** | **6).** 490 77th Street | Included on drip program, likely frozen in 2014. | 3'-1", decrease to 2'-5", crosses storm sewer. |
| **P4** | **7).** 619 26th Street | Located in a cluster area. | 3'-5" Cover at main, 3'-0" cover at valve box, mostly stone backfill. |
| **P9** | **8).** 2929 20th Street | Random selection, new construction. | 3'-8" Cover at main, 5'-1" cover at valve box, mostly stone backfill. |
| **P10** | **9).** 571 77th Street | Any house, near cluster, did not freeze in 2015. | 3'-0" Cover at main 3'-2" cover at valve box, short side, 8"± clay backfill. |
| **P7** | **10).** 1358 Michigan Avenue | Away from a cluster, did not freeze in 2015. | 4'-1" Cover at main, 3'-11" at valve box, mostly clay backfill. |

Selection criteria attempts to choose locations that represent the full spectrum of conditions and locations distributed throughout the City.

## 3.0 INVESTIGATION FINDINGS

Results of the test excavations are shown on the profile drawings included under Appendix A. Findings from the test excavation were generally as anticipated.

The service laterals in the City of Niagara Falls are generally located on the top of the water main pipe. The geometry of this detail results in the service connection having 6 to 10 inches less backfill cover than the mainline and hence less frost protection.

Of the sites investigated, 80 % of the original water mains were located at a depth less than the recommended 48 inch frost depth, the remaining 20 % were located at depths of 50 and 55 inches. However, due to the connection of the service lateral made at the top of the water main, the burial depth of the service laterals was found to comply with the recommended burial depth at only one location, or 10 % of the time. In the two locations that did not report frozen piping last year, the service laterals were generally buried deeper than the majority of other sites (4'-1" and 3'-0"), the backfill included a considerable measure of clay backfill (2'-11" and 0'-8") and / or the residence was on the same side of the street as the water main and therefore only 5' from the street curb. Those investigated services, on the NFWB frozen service log, that were backfilled primarily with crushed stone or were found at a relatively shallow depth tended to be reported early during the crisis period.

The service at 490 77th Street was found to rest directly on the top of a storm sewer. The direct exposure to near ambient air temperatures indicates a situation that answers the riddle of why this service freezes.

The water main on 72nd Street, at the two investigated sites, was measured at 3' – 3" below the surface of the pavement. At these locations the street surface was lowered less than 1 inch at house 511 and approximately 6 inches at house 602. At house 511 the service lateral was measured at 2' - 5" below the street at the connection to the water main, whereas at house 602 the service lateral was found 2' - 9" below the street at the connection to the water main (Refer to profile drawings P1 and P2). Our investigation results revealed at house 511 there was only 1 inch of clay soil over the service lateral at the water main connection and at house 602 there was only 6 inches of clay soil over the service lateral at the water main connection.

## 4.0 EVALUATION OF FINDINGS

There are patterns associated with the frozen water services based on the findings of this study. Shallow depth of cover over the services lines, coupled with little to no clay backfill, was found in 50% of the excavated locations reporting a frozen water service in 2015. Of the remaining locations investigated, that reported a frozen water service in 2015, the depth of the lateral at the connection to the water main varied from 2' - 9" to 3' - 2".

Reconstruction of 72nd Street resulted in the replacement of approximately 17" of clay with crushed stone (refer to Exhibit 1 in Appendix B). Removal of the clay, which is an excellent insulating material, and replacement with crushed stone, which is a poor insulating material, resulted a 30 % loss of insulating value in the backfill over the main and lateral piping (refer to calculations in Appendix C). Although there were four homes along 72nd Street where the road was lowered by 6 inches, and hence the cover over the waterline decreased by this amount, there were seven homes that reported frozen waterlines where the street level was lowered by only 1 inch or less (refer to Table 2.0 in Appendix D). It is apparent therefore, that replacement of the clay soil with crushed stone was the principal factor causing the 25 residences on 72nd Street to experience frozen water services, not the lowering of the street grade.

## 5.0 RECOMMENDATIONS

The National Weather Service has forecast the 2016 winter temperatures will be a repeat of the 2014 and 2015 bitter cold. The Niagara Falls Water Board should make preparations during the next few months to deal with the inevitable frozen water service condition in the upcoming winter. The drip program should be continued, coupled with educating the public on how important it is to keep a steady stream of water running. Also, the NFWB should consider going out for proposals for 2 or 3 local plumbers to be on call to react to the anticipated demand for thawing pipes and making supply connections with neighbors. In the long term the NFWB should proceed to reduce the potential for repeated frozen water services by adopting a proactive program including the following efforts:

1.) Make sure the residential valve boxes are fully open.

2.) Promote an alternate street reconstruction design that does not diminish the insulation of the piping. Alternatively, lower water mains during street reconstruction if clay backfill is removed or lessened significantly.

3.) When work is performed on a service lateral relocate the service connection from the top of the water main to the bottom quadrant, thereby increasing the depth of cover over the service lateral by several inches. (See detail in appendix 5.0)

## 5.0 CONCLUSIONS

The primary source of frozen waterline conditions throughout the City of Niagara Falls within the past two years has been the bitter cold temperatures. As previously stated, the Western New York region has experienced some of the coldest temperatures on record. However, notwithstanding the colder than average temperatures, the following secondary conditions have served to directly influence the increased potential for waterlines to freeze:

1. The entire length of the service lateral, or a portion of the service lateral length, is buried above the prescribed frost depth of 48 inches for the City of Niagara Falls. In addition, 80 % of the water mains investigated were installed with less than 48 inches of cover over the top of the pipe.

2. The service lateral was backfilled with crushed stone, which exhibits poor insulating properties, as opposed to clay soil, which exhibits good insulating properties. This is very evident along 72nd Street where clay soils were removed during road reconstruction and replaced with crushed stone, therefore increasing the frost penetration potential.

3. The current location of the service lateral tap at the top of the water main results in a rise in elevation of the service lateral, providing greater freezing potential. When the opportunity arises the tap for the service lateral should be relocated to the side or bottom of the main at problem locations.

4. Service laterals that have to span the entire length of the street have a higher potential to freeze than service laterals that only run a short distance beneath the street. This is particularly an issue where insufficient cover or poor insulating backfill is present.

5. The location of the service lateral over the storm sewer provides for exposure to ambient air temperatures and increased freezing potential. The service lateral should always be installed beneath the storm sewer piping.

Sincerely,


Mark W, Glynn, P.E.
Consulting Engineer, Principal

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# Appendix A

## Waterline Service Lateral Profiles

### Frozen Waterline Investigation Report

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September 2, 2015

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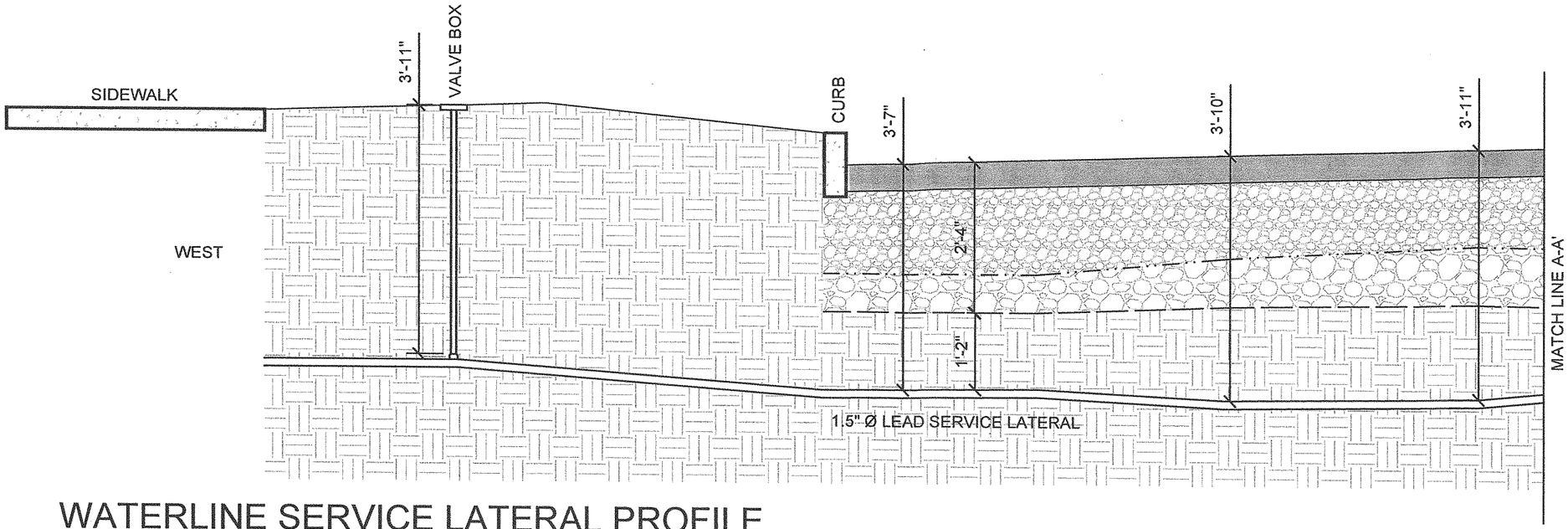


# WATERLINE SERVICE LATERAL PROFILE

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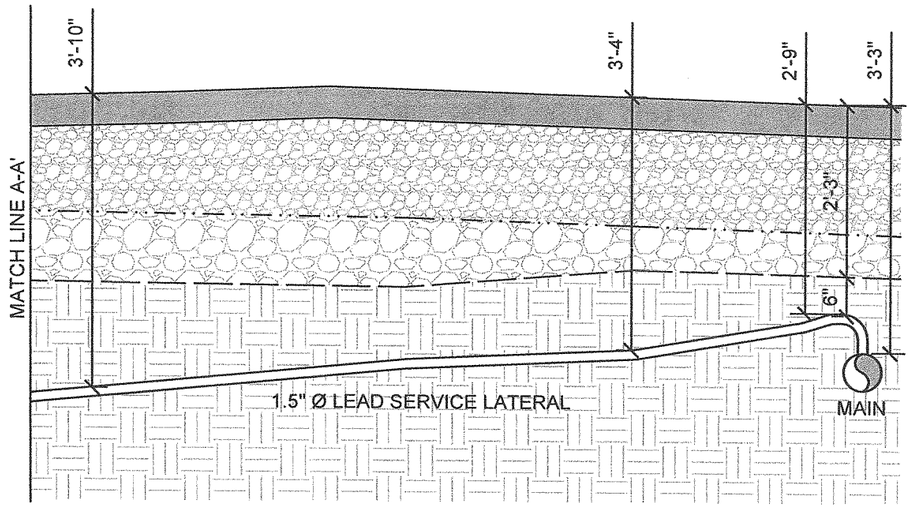


EAST

# WATERLINE SERVICE LATERAL PROFILE

SCALE: 1/2" = 1'-0" ON 11 X 17

## KEY

- 2" ROC STONE
- ROC STONE W/ COBBLES
- CLAY SOIL
- CONCRETE
- GEOGRID MAT
- GEOTEXTILE FABRIC
- ASPHALT PAVEMENT


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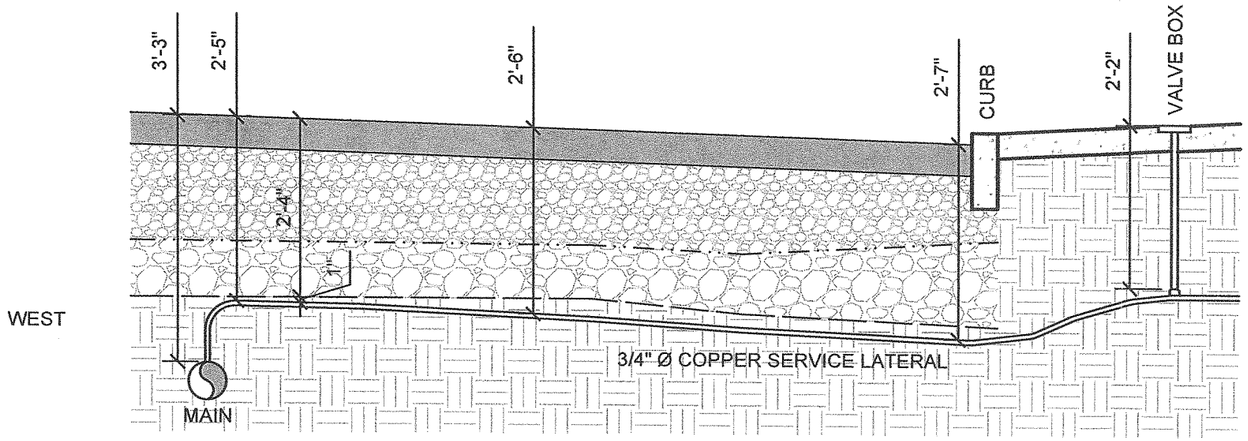
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 602 72ND STREET PROFILE

DWG: P1




# WATERLINE SERVICE LATERAL PROFILE

SCALE: 1/2" = 1'-0" ON 11 X 17

KEY

- 2" ROC STONE
- ROC STONE W/ COBBLES
- CLAY SOIL
- CONCRETE
- GEOGRID MAT
- GEOTEXTILE FABRIC
- ASPHALT PAVEMENT

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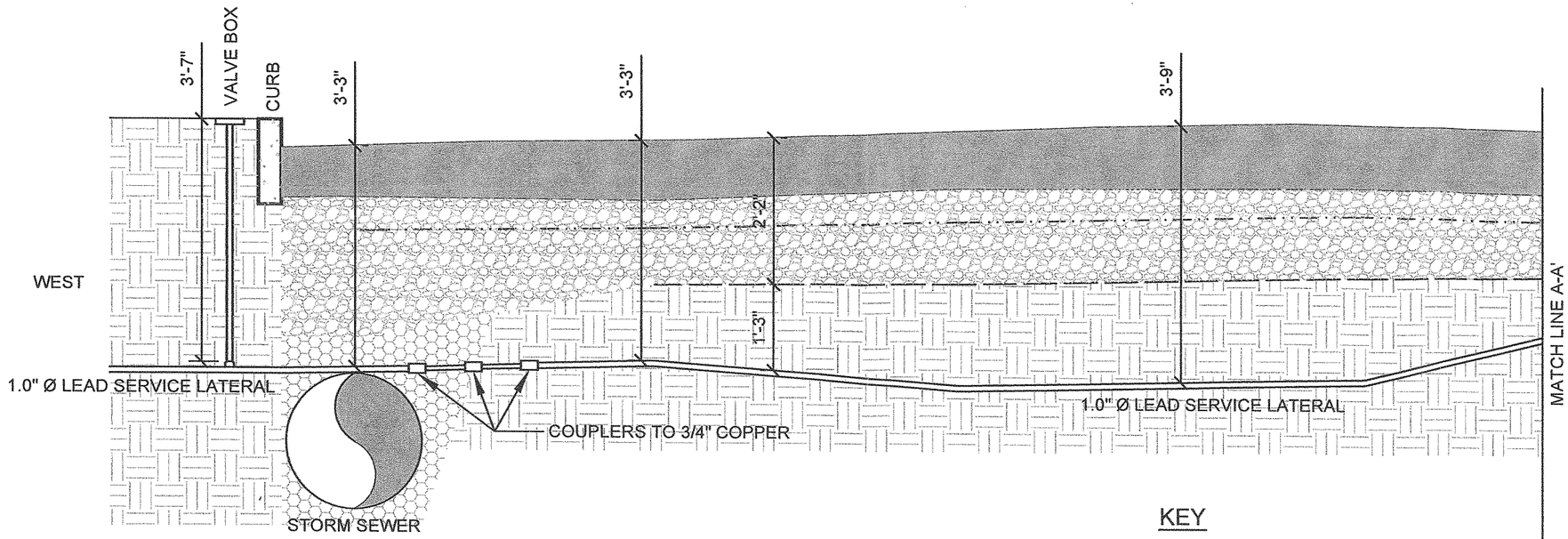
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 511 72ND STREET PROFILE

DWG: P2

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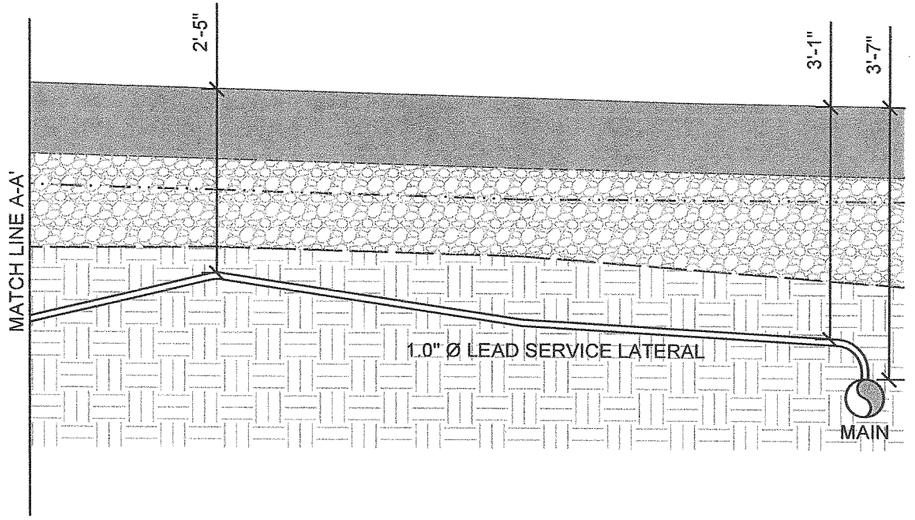


# WATERLINE SERVICE LATERAL PROFILE

SCALE: 1/2" = 1'-0" ON 11 X 17

KEY

- 2" ROC STONE
- ROC STONE W/ COBBLES
- CLAY SOIL
- CONCRETE
- GEOGRID MAT
- GEOTEXTILE FABRIC
- #1 STONE
- ASPHALT PAVEMENT


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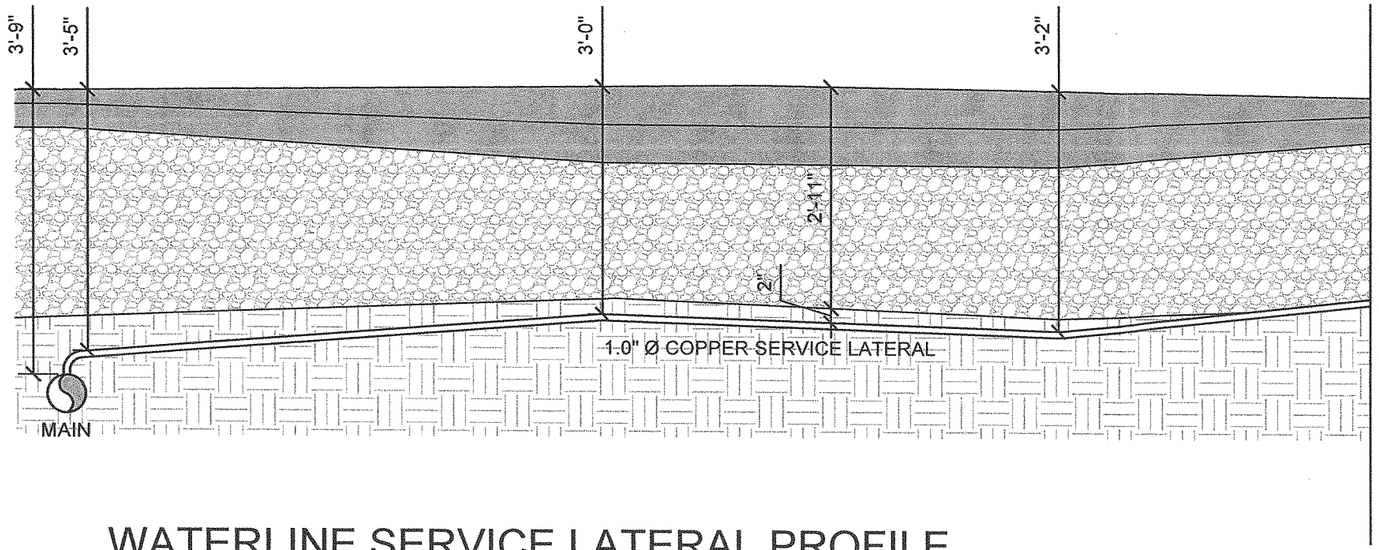
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 490 77TH STREET PROFILE

DWG: P3

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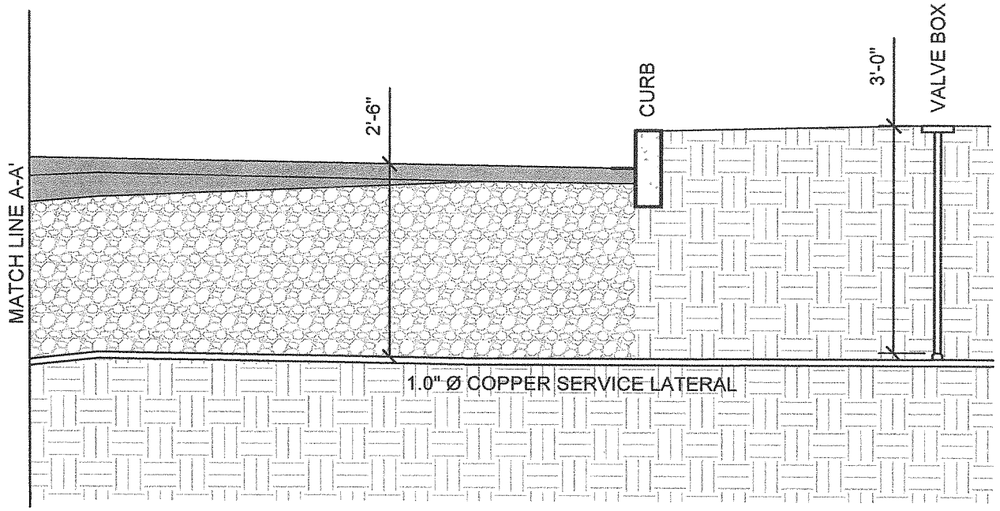


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- ROC STONE W/ COBBLES
- CLAY SOIL
- CONCRETE
- ASPHALT PAVEMENT

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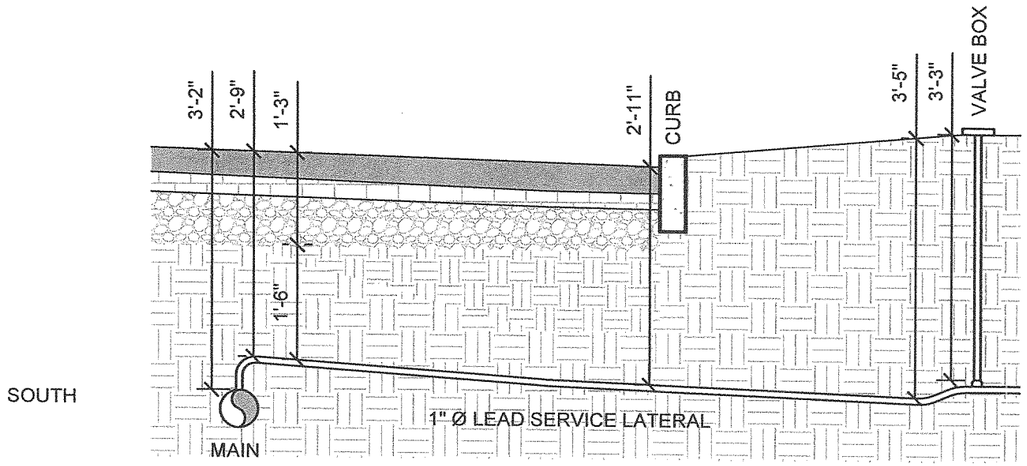
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 619 26TH STREET PROFILE

DWG : P4




# WATERLINE SERVICE LATERAL PROFILE

SCALE: 1/2" = 1'-0" ON 11 X 17

KEY

GRAVEL

CLAY SOIL

CONCRETE

ASPHALT PAVEMENT

BRICK

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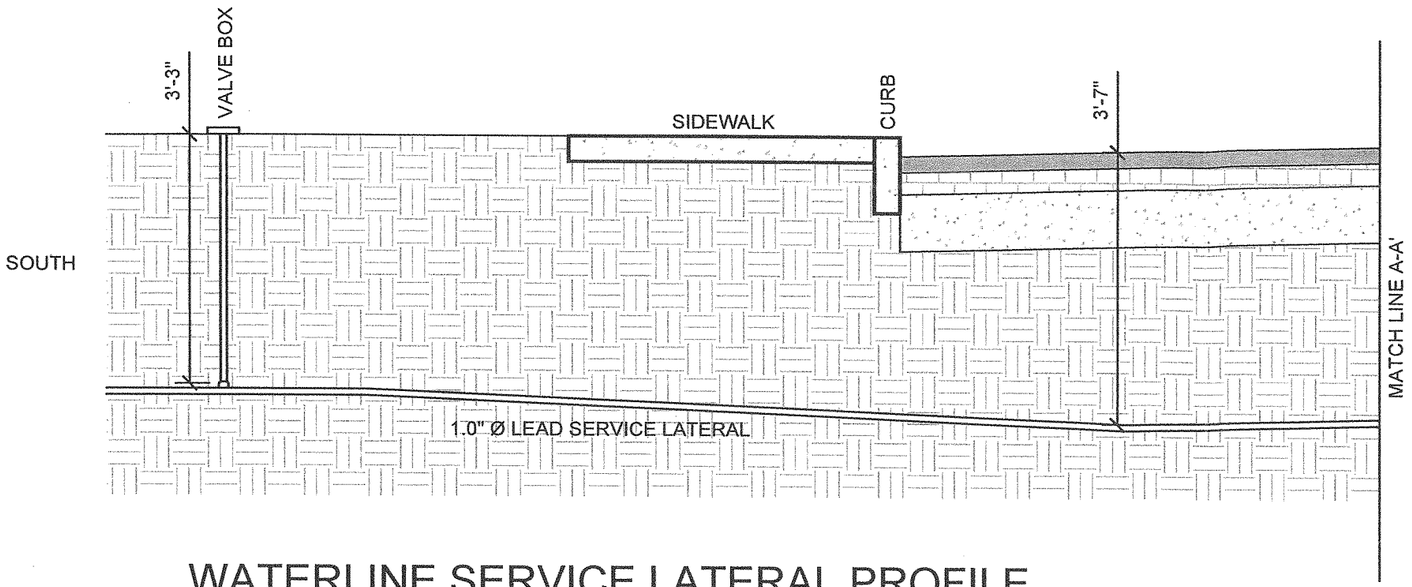
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 1906 WELCH AVENUE PROFILE

DWG: P5

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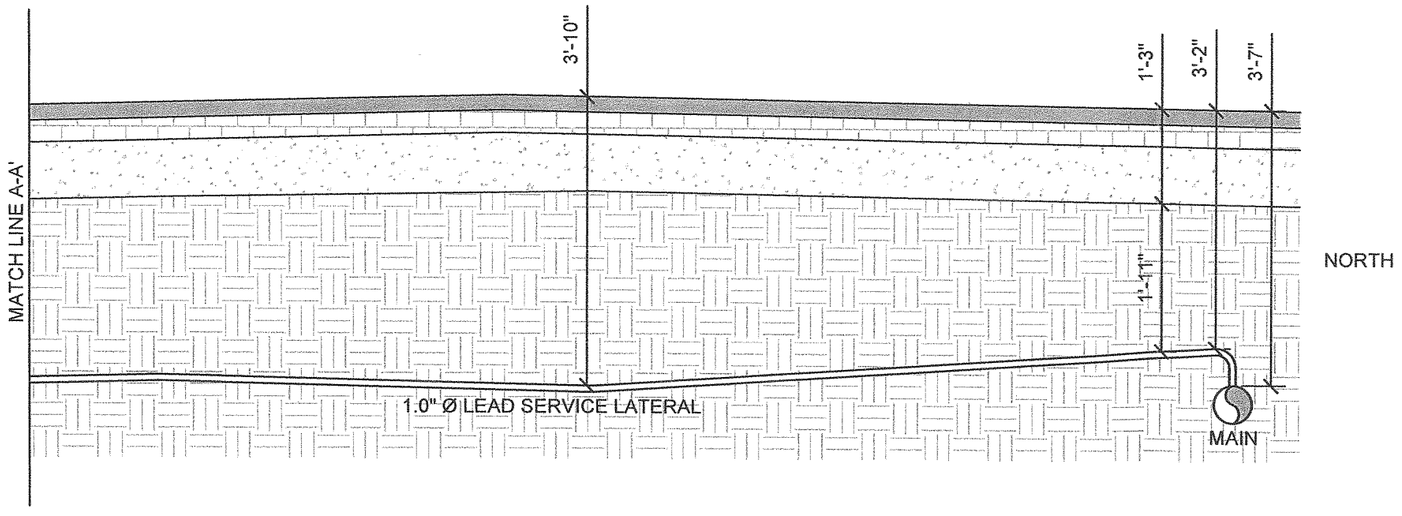


# WATERLINE SERVICE LATERAL PROFILE

SCALE: 1/2" = 1'-0" ON 11 X 17

KEY

- 2" ROC STONE
- CLAY SOIL
- CONCRETE
- BRICK
- ASPHALT PAVEMENT

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PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 1224 13TH STREET PROFILE

DWG : P6

NORTH

SOUTH

KEY

CLAY SOIL

CONCRETE

ASPHALT PAVEMENT

# WATERLINE SERVICE LATERAL PROFILE

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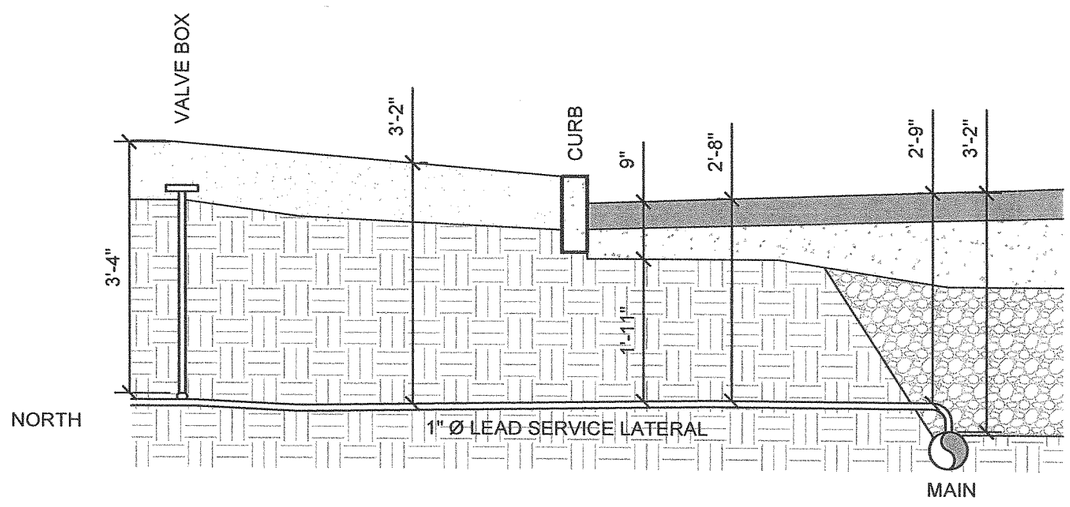
TITLE: 1358 MICHIGAN AVENUE PROFILE

DWG: P7




# WATERLINE SERVICE LATERAL PROFILE

SCALE: 1/2" = 1'-0" ON 11 X 17

KEY

- CLAY SOIL
- CONCRETE
- ASPHALT PAVEMENT
- TOPSOIL
- 3" ROC STONE

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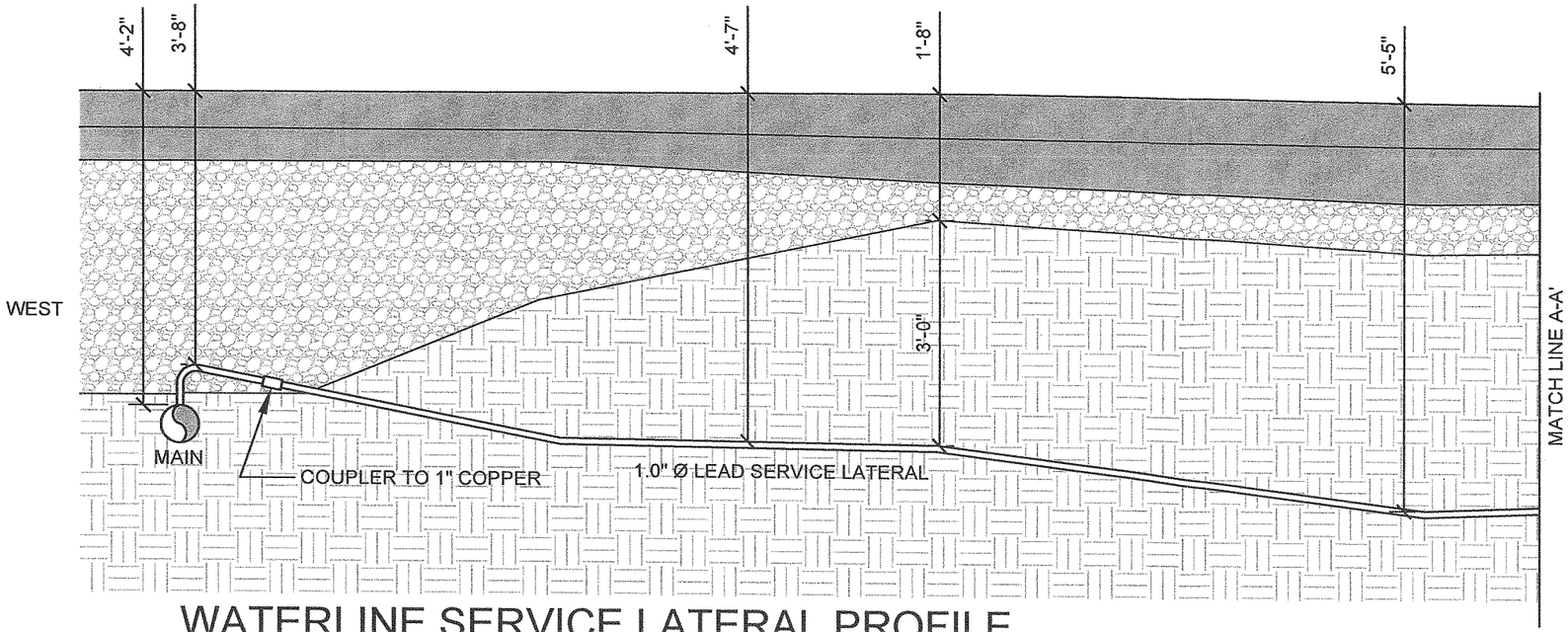
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 2926 ONTARIO AVENUE PROFILE

DWG : P8

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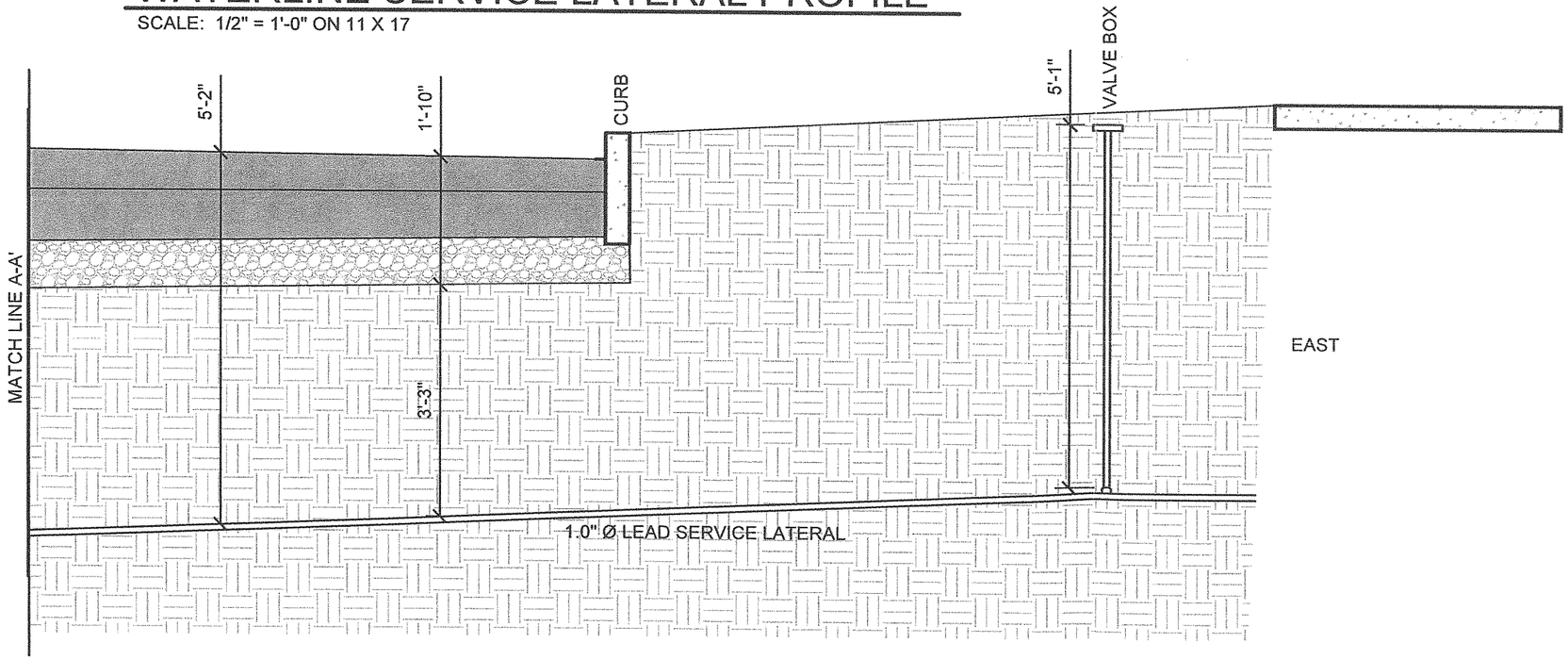


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KEY

- 2" ROC STONE
- CLAY SOIL
- CONCRETE
- ASPHALT PAVEMENT


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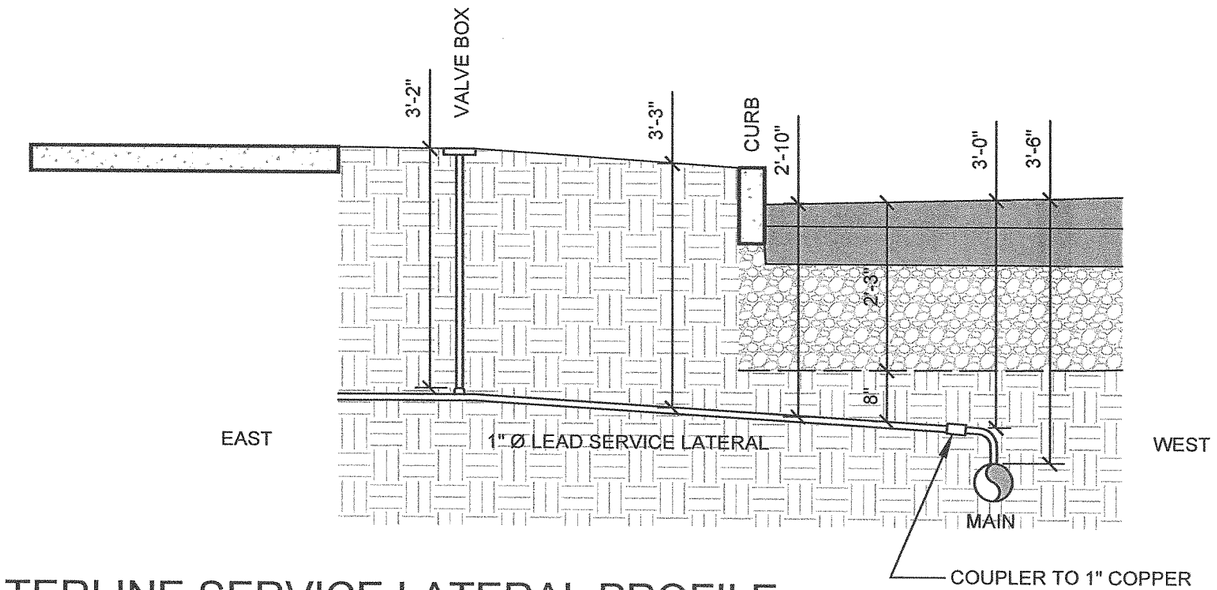
PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 2929 20TH STREET PROFILE

DWG : P9

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KEY

- CLAY SOIL
- CONCRETE
- ASPHALT PAVEMENT
- TOPSOIL
- 2" ROC STONE
- GEOTEXTILE FABRIC


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PROJECT: NIAGARA FALLS WATERLINE INVESTIGATION

TITLE: 571 77TH STREET PROFILE

DWG: P10

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# Appendix B

## Exhibit 1 – 72nd Street Reconstruction Cross Section

**Frozen Waterline Investigation Report**

The Niagara Falls Water Board

GGE 15-1032

September 2, 2015

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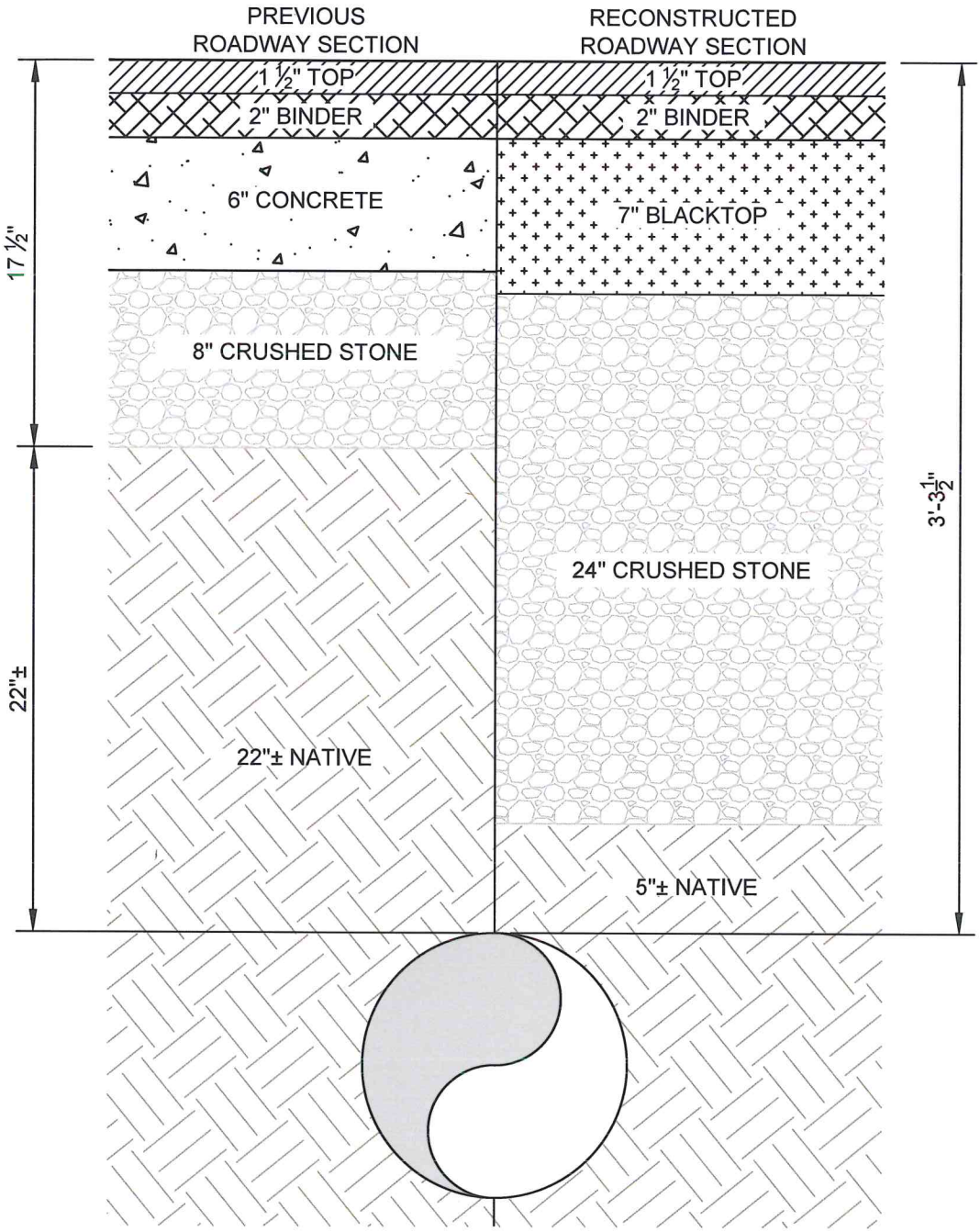


# 72nd STREET RECONSTRUCTION CROSS SECTIONS

A / EX1

SCALE: 1-1/2" = 1'-0"


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| | | | |
|---|---|---|---|
| PROJECT: NIAGARA FALLS WATERLINE | | | SHEET NO.: EXHIBIT 1 |
| SUBJECT: 72nd STREET CROSS SECTION | | | |
| CLIENT: NFWB | | | |
| PROJ. NO.: 15-1032 | SCALE: 1-1/2"=1' | DATE: 9.2.15 | BY: MWG |

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# Appendix C

## Calculation – Insulation Loss

**Frozen Waterline Investigation Report**

The Niagara Falls Water Board

GGE 15-1032

September 2, 2015

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# LATENT HEAT OF BACKFILL MATERIALS

## CRUSHED STONE

- EST. UNIT WT 145 PCF
- EST NATURAL MOISTURE CONTENT 8% - CONSERVATIVE
  8% x 145 = 11.6 PCF
- MINERAL PORTION
  0.2 BTU x 145 PCF = 29 BTU
- WATER PORTION
  144 BTU x 11.6 PCF = 1670.4 BTU
- TOTAL 29 + 1670.4 = 1699.4 BTU/CF

## CLAY / SOIL

- EST UNIT WT. 100 PCF
- NATURAL MOISTURE CONTENT 24% PER GGE LAB TEST
  24% x 100 = 24 PCF
- MINERAL PORTION
  0.2 BTU x 100 PCF = 20 BTU
- WATER PORTION
  144 BTU x 24 PCF = 3456 BTU
- TOTAL 20 + 3456 = 3476 BTU/CF

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| | | | |
|---|---|---|---|
| PROJECT: NFWB FROZEN WATERLINE STUDY | | | SHEET NO: APPEN. 3.0 SHT. 1 of 2 |
| SUBJECT: CALCULATION - INSULATION LOSS | | | |
| CLIENT: NFWB | | | |
| PROJECT NO: 15-1032 | SCALE: N.A. | DATE: 8.27.15 | BY: ~~MWG~~ |

# LATENT HEAT OF BACKFILL MATERIALS

## NEW CONSTRUCTION SECTION

34.5" PAVEMENT = 2.875'

4.5" CLAY SOIL = 0.375'

LATENT HEAT $2.875' \times 1699.4$ BTU/CF + $0.375' \times 3476$ BTU/CF
= 6189.275 BTU

## OLD CONSTRUCTION SECTION

17" PAVEMENT = 1.42'

22" CLAY = 1.83'

LATENT HEAT $1.42' \times 1699.4$ BTU/CF + $1.83' \times 3476$ BTU/CF
= 8774.23 BTU

DECREASE OF LATENT HEAT IN BACKFILL:

6189.3 ÷ 8774.2 = 0.705, 70.5%

100.0% − 70.5% = 29.5% LOSS


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| | | | |
|---|---|---|---|
| PROJECT: NFWB FROZEN WATERLINE STUDY | | | SHEET NO: APPEN. 3.0 SHT. 2 of 2 |
| SUBJECT: CALCULATION - INSULATION LOSS | | | |
| CLIENT: NFWB | | | |
| PROJECT NO: 15-1032 | SCALE: NA | DATE: 8.27.15 | BY: ~~MWG~~ |

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# Appendix D

## Table 2.0 – 72nd Street Frozen Water Services vs Change in Street Level

**Frozen Waterline Investigation Report**

The Niagara Falls Water Board

GGE 15-1032

September 2, 2015

GLYNN GEOTECHNICAL ENGINEERING

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# TABLE 2.0 – 72ND STREET SERVICES
GGE 15-1032

| Report Date | House No. | Change in Street Level |
|---|---|---|
| 2/19/15 | 607 | 6″ |
| 2/19/15 | 572 | No such address |
| 2/20/15 | 502 | Less than 3″ |
| 2/20/15 | 603 | 6″ |
| 2/22/15 | 500 | No such address |
| 2/22/15 | 501 | Less than 3″ |
| 2/22/15 | 512 | Less than 1″ |
| 2/22/15 | 513 | Less than 1″ |
| 2/22/15 | 521 | Less than 1″ |
| 2/22/15 | 546 | Less than 3″ |
| 2/22/15 | 550 | Less than 3″ |
| 2/22/15 | 625 | Less than 3″ |
| 2/22/15 | 629 | Less than 3″ |
| 2/22/15 | 646 | Less than 4″ |
| 2/23/15 | 651 | Less than 1″ |
| 2/23/15 | 602 | 6″ |
| 2/23/15 | 513 | Less than 1″ |
| 2/23/15 | 528 | Less than 1″ |
| 2/25/15 | 636 | Less than 2″ |
| 2/25/15 | 660 | No change |
| 2/26/15 | 622 | Less than 3″ |
| 2/26/15 | 643 | Less than 4″ |
| 3/2/15 | 570 | Less than 3″ |
| 3/2/15 | 650 | Less than 2″ |
| 3/3/15 | 638 | Less than 4″ |
| 3/3/15 | 644 | No such address |
| 3/3/15 | 650 | Less than 3″ |
| 3/5/15 | 532 | Less than 6″ |

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# Appendix E

## Exhibit 2 – Water Service Tap Relocation

**Frozen Waterline Investigation Report**

The Niagara Falls Water Board

GGE 15-1032

September 2, 2015

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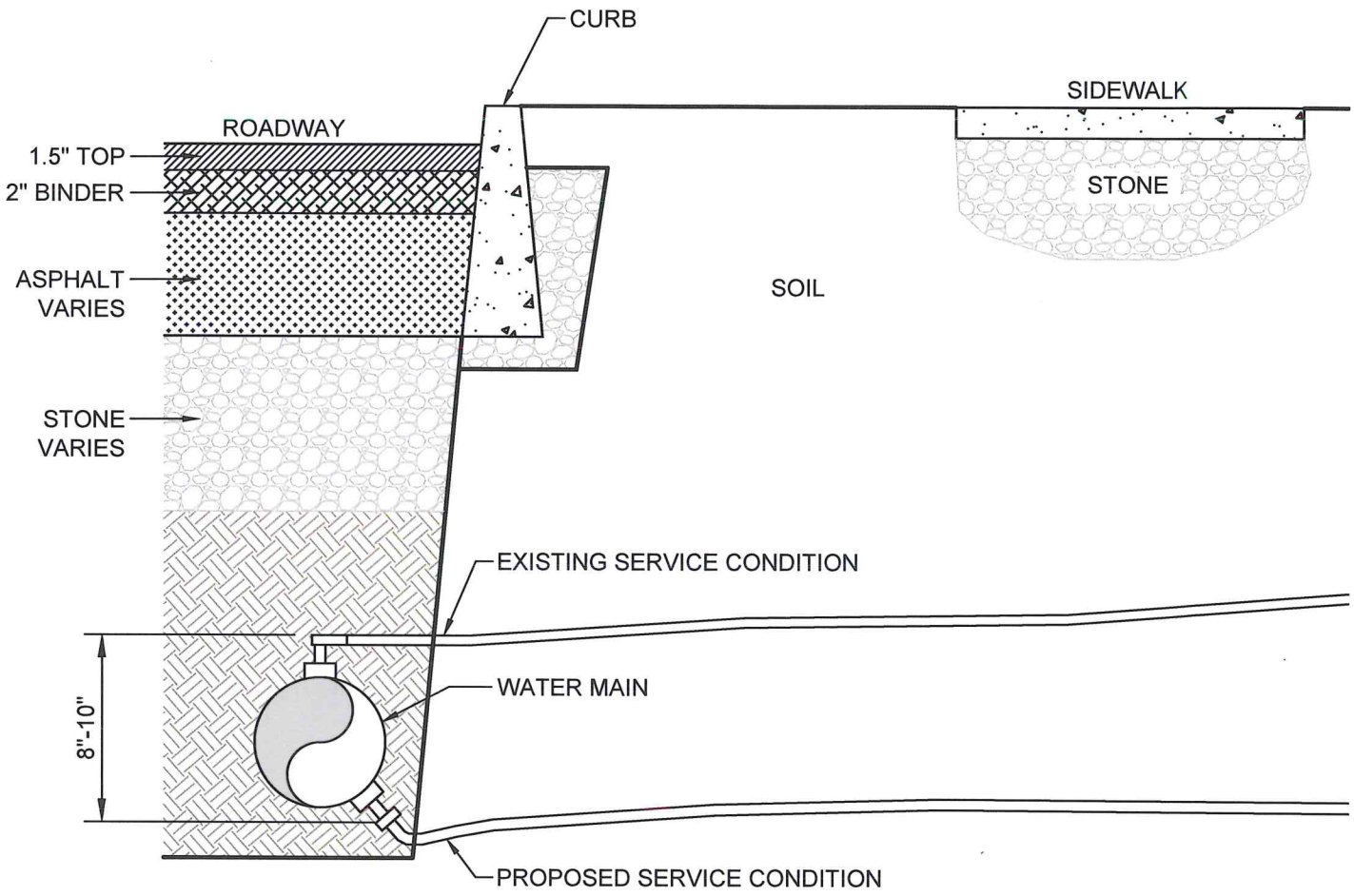


A
EX2

# WATER SERVICE TAP RELOCATION

SCALE: N/A

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| PROJECT: | | | | SHEET NO.: |
|---|---|---|---|---|
| NIAGARA FALLS WATERLINE | | | | EXHIBIT |
| SUBJECT: | | | | |
| SERVICE CONNECTIONS | | | | 2 |
| CLIENT: | | | | |
| NFWB | | | | |
| PROJ. NO.: | SCALE: | DATE: | BY: | |
| 15-1032 | NA | 9.2.15 | GEL/MWG | |

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# Appendix F

## 2015 NFWB Frozen Service Log

**Frozen Waterline Investigation Report**

The Niagara Falls Water Board

GGE 15-1032

September 2, 2015

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# 2015 Frozen Service Log

| | Date | House # | Street | Reported By | On Drip Prog? Yes = 1 | Hose Ran? Yes = 1 | Status |
|---|---|---|---|---|---|---|---|
| 1 | 2/16/2015 | 911 | 22nd | | | | Owner never called back with neighbor info |
| 2 | | 2120 | Hyde Park | | | | Has water was a internal problem |
| 3 | | 1808 | Hyde Park | | 1 | | Can't do a hose run |
| 4 | | 3655 | Ferry Ave | | | | Plumber thawed service |
| 5 | | 2926 | Ontario Ave | | | | Nobody home |
| 6 | | 1605 | Pine Ave | | | | Can't do a hose run |
| 7 | 2/19/2015 | 490 | 77th | | 1 | 1 | |
| 8 | | 631 | 66th | | | 1 | Hose Froze 3 different times - 2 neighbors |
| 9 | | 9115 | Buffalo Ave | | | 1 | |
| 10 | | 3337 | Royal Ave | | 1 | 1 | |
| 11 | | 137 | 76th | | 1 | 1 | |
| 12 | | 607 | 72nd | | 1 | 1 | |
| 13 | | 572 | 72nd | | 1 | 1 | |
| 14 | | 578 | 79th | | | 1 | Hose froze - Replaced 2-25-15 |
| 15 | | 329 | 37th | | 1 | 1 | |
| 16 | | 624 | 28th | | | | House has water was a internal problem |
| 17 | | 2203 | South Ave | | | | Can't do a hose run-broken hose bib |
| 18 | 2/20/2015 | 1616 | Ontario Ave | | | | Can't do a hose run |
| 19 | | 1833 | Pierce Ave | | | | Was a frozen meter |
| 20 | | 140 | 77th | | | | Nobody home |
| 21 | | 832 | 20th | | | | House has water was a internal problem |
| 22 | | 2781 | Main St. | | | | Frozen Meter-Interrior pipes all frozen |
| 23 | | 1921 | Pine Ave | | | | No hose bibs |
| 24 | | 576-578 | 7th | | | | N such address-New building going up here |
| 25 | | 535 | 66th | | | 1 | |
| 26 | | 2246 | Independence | | | | House has water |
| 27 | | 329 | 37th | | 1 | 1 | |
| 28 | | 1901 | Pine Ave | | | | No hose bibs |
| 29 | | 1905 | Pine Ave | | | | No hose bibs |
| 30 | | 1909 | Pine Ave | | | | No hose bibs |
| 31 | | 1421 | 22nd | | | | Frozen Service - Owner is in the hospital |
| 32 | | 7021 | Frontier Ave | | | | House has water |
| #REF! | | 675 | Ashland Ave | | | | Was frozen inside |
| #REF! | | 502 | 72nd | | 1 | | Plumber thawed service |
| #REF! | | 1801 | Niagara St | | | | No neighbor |
| #REF! | | 1224 | 13th | | 1 | | |
| #REF! | | 521 | 29th | | | | House never lost water |
| #REF! | | 521 | Tronolone | | | | No hose bibs |
| | | 7412 | Frontier Ave | | | 1 | |
| #REF! | | 2453 | Independence | | 1 | 1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| #REF! | | 603 | 72nd | 1 | | Can't do a hose run |
| #REF! | | 1107 | 13th | | | Was an internal problem |
| #REF! | | 703 | 66th | | | Plumber thawed service |
| #REF! | 2/22/2015 | 500 | 72nd | | | Plumber thawed service |
| #REF! | | 501 | 72nd | | | Plumber thawed service |
| #REF! | | 512 | 72nd | | 1 | Ran hose then Owner hired plumber to thaw |
| #REF! | | 513 | 72nd | | | Plumber thawed service |
| #REF! | | 521 | 72nd | | 1 | |
| #REF! | | 546 | 72nd | | 1 | 2 hose runs froze |
| #REF! | | 550 | 72nd | | 1 | 2nd hose run done |
| #REF! | | 625 | 72nd | 1 | 1 | |
| #REF! | | 629 | 72nd | 1 | 1 | Nobody home |
| #REF! | | 646 | 72nd | 1 | 1 | |
| #REF! | 2/23/2015 | 3662 | Ferry Ave | | 1 | |
| #REF! | | 3617 | Dudley Ave | 1 | | Nobody home |
| #REF! | | 651 | 72nd | 1 | 1 | |
| #REF! | | 3658 | Ferry Ave | | | Plumber thawed service |
| #REF! | | 4301 | Lewiston Rd | | | Plumber thawed service |
| #REF! | | 1412 1/2 | Ferry Ave | | | Back House frozen.Front house vacant |
| #REF! | | 1429 | 99th | | | Plumber thawed service |
| #REF! | | 619 | Orchard Parkway | | | Plumber thawed service |
| #REF! | | 149 | 22nd | | | Plumber thawed service |
| #REF! | | 2929 | 20th | | | |
| #REF! | | 422 | 77th | 1 | | No hose bibs |
| #REF! | | 521 | Memorial Parkway | | | House has water - was an internal problem |
| #REF! | 2/23/2015 | 8423 | Lindbergh Ave | 1 | | No Neighbor |
| #REF! | | 4225 | Hyde Park | | | Has water was a frozen Meter |
| #REF! | | 3227 | Royal Ave | | 1 | |
| #REF! | | 642 | 21st | | 1 | |
| #REF! | | 3046 | Niagara St | | 1 | |
| #REF! | | 3046 | Frontier | | | No such address |
| #REF! | | 564 | 75th | | | No Neighbor |
| #REF! | | 3425 | Royal Ave | 1 | | No neighbor |
| #REF! | | 602 | 72nd | 1 | | No neighbor |
| #REF! | | 513 | 72nd | | | Owner hired plumber to thaw |
| #REF! | | 528 | 72nd | | | |
| #REF! | | 3662 | Ferry Ave | | 1 | |
| #REF! | | 3668 | Ferry Ave | | | |
| #REF! | | 2460 | Grand Ave | | 1 | Plumber thawed service- re-froze-hose run done |
| #REF! | | 1814 | Hyde Park | 1 | | Can't do a hose run |
| #REF! | | 1225 | 85th | | | |
| #REF! | | 2429 | North Ave | | | Thawed service-Re-froze 3-2 |
| #REF! | | 1421 | Osborne Ct | | | |
| #REF! | | 582 | 77th | 1 | | Vacant house |
| #REF! | | 3659 | Ferry Ave | | | |
| #REF! | 2/24/2015 | 709 | 66th | | 1 | 703-66th can give water |

| | | | | | | |
|---|---|---|---|---|---|---|
| #REF! | | 2311 | Walnut Ave | | 1 | They did their own hose run it loks like 3/4/15 |
| #REF! | | 2524 | Pine Ave | | | Can't do a hose run |
| #REF! | | 519 | Memorial Pkwy | | | 521-Memorial Pkwy can give water |
| #REF! | | 1823 | Ontario Ave | | | Plumber thawed service |
| #REF! | | 7718 | Lindbergh Ave | | 1 | |
| #REF! | | 2526 | Pine Ave | | | Can't do hose run |
| #REF! | | 636 | 72nd | 1 | 1 | Can get water from 628-72nd |
| #REF! | 2/25/2015 | 425 | Vanderbilt Ave | | | |
| #REF! | | 2625 | Ontario Ave | | 1 | They did their own hose run from 2619-Ontario |
| #REF! | | 2735 | Orleans Ave | | | Plumber thawed service |
| #REF! | | 660 | 72nd | 1 | 1 | 664-72nd can give water |
| #REF! | | 3924 | Deveaux St | | | |
| #REF! | | 8516 | Munson Ave | | 1 | 8520-Munson can give water |
| #REF! | | 2739 | Lasalle Ave | | | Plumber thawed service |
| #REF! | | 624 | 76th | | | |
| #REF! | | 2311 | Hyde Park Blvd | | | |
| #REF! | | 306 | 24th | | | Has boiler system |
| #REF! | | 1212 | 96th | | | Plumber thawed service |
| #REF! | | 2470 | Grand Ave | | | Plumber thawed service |
| #REF! | | 2473 | Cudaback Ave | | | |
| #REF! | | 2703 | Lasalle Ave | | | |
| #REF! | | 302 | 24th | | | Can't do a hose run |
| #REF! | | 2015 | 18th | | | |
| #REF! | | 1417 | 22nd | | 1 | Very low pressure |
| #REF! | | 619 | 26th | | 1 | 623-26th can give water |
| #REF! | | 435 | 13th | | | |
| #REF! | | 615 | Buffalo Ave | | | |
| #REF! | | 2240 | Pine Ave | | 1 | |
| #REF! | | 2429 | North Ave | | | Plumber thawed service |
| #REF! | | 1647 | Ontario Ave | | | Plumber thawed service |
| #REF! | | 2473 | Grand Ave | | | House now has water..3/4/15 |
| #REF! | | 8822 | Pear Ave | | | |
| #REF! | | 1235 | 96th | 1 | 1 | |
| #REF! | | 8489 | W. Rivershore Dr | | | They did their own hose run from 8485-W Rivershore |
| #REF! | | 2620 | Walnut Ave | | | |
| #REF! | | 539 | 16th | | | |
| #REF! | | 1419 | Falls | 1 | 1 | |
| #REF! | | 2220 | Walnut Ave | | | |
| #REF! | 2/26/2015 | 622 | 72nd | 1 | 1 | 618-72 can give water |
| #REF! | | 539 | 16th | | | |
| #REF! | | 668 | 77th | | | Plumber thawed service |
| #REF! | | 2533 | Jerauld Ave | | | Plumber thawed service |
| #REF! | | 540 | 77th | | 1 | 548-77th can give water |
| #REF! | | 2217 | Mackenna Ave | | | Plumber thawed service |
| #REF! | | 2920 | 20th | | | |
| | | 8822 | Pear Ave | | | Plumber thawed service |

| | | | | | | |
|---|---|---|---|---|---|---|
| #REF! | | 2529 | Jerauld Ave | | | Plumber thawed service |
| #REF! | | 643 | 72nd | | | Plumber thawed service |
| #REF! | | 2463 | Independence Ave | | | |
| #REF! | | 2209 | Welch Ave | | | |
| #REF! | | 7525 | Frontier Ave | | | Plumber thawed service |
| #REF! | | 780 | Monteagle | | | |
| #REF! | | 624 | 74th St | | | |
| #REF! | | 2951 | North Ave | | | Plumber thawed service |
| #REF! | | 1441 | Ferry Ave | | | Landlord notified |
| #REF! | | 574 | 76th | | | Plumber thawed service |
| #REF! | | 365 | 70th | | | They did their own hose run from 362-71st |
| #REF! | 3/1/2015 | 552 | 18th | | | |
| #REF! | | 202 | 22nd | | | |
| #REF! | | 1522 | Hyde Park | | | |
| #REF! | | 2471 | Independence Ave | | 1 | |
| #REF! | | 2474 | Independence Ave | | 1 | They did their own hose run from 2466-Indep We removed register |
| #REF! | | 1915 | Lasalle Ave | | | Has key to neighbors house for a hose run |
| #REF! | | 7811 | Lindbergh Ave | | | Plumber thawed service |
| #REF! | 3/2/2015 | 236 | 84th | | | Plumber thawed service |
| #REF! | | 527 | 26th | | 1 | |
| #REF! | | 942 | Niagara Ave | | | Service ok- Main break in street |
| #REF! | | 570 | 72nd | | | |
| #REF! | | 440 | 26th | | | |
| #REF! | | 2487 | Grand Ave | | | Nobody home 3/7/15 |
| #REF! | | 335 | Buffalo Ave | | | |
| #REF! | | 9790 | Cayuga Dr | | | |
| #REF! | | 2470 | Independence Ave | | 1 | They did their own hose run from 2466-Indep We removed register |
| #REF! | | 180 | 81st | | | Plumber thawed service |
| #REF! | | 3924 | Deveaux St | | | Plumber thawed service |
| #REF! | | 1726 | Elmwood Ave | | | |
| #REF! | | 2027 | Hyde Park | | | |
| #REF! | | 2911 | Ferry Ave | | | Plumber thawed service |
| #REF! | | 2727 | Livingston Ave | | | They did their own hose run 3/5/15 |
| #REF! | | 702 | 60th | 1 | | Plumber thawed service |
| #REF! | | 2631 | Ontario Ave | | | Can't do a hose run |
| #REF! | | 2468 | Grand Ave | | 1 | |
| #REF! | | 623 | 81st | | | |
| #REF! | | 3070 | Dorchester Rd | | | |
| #REF! | | 650 | 72nd | 1 | 1 | |
| #REF! | | 2213 | Mackenna Ave | | | |
| #REF! | 3/3/2015 | 7806 | Lindbergh Ave | | | Plumber thawed service |
| #REF! | | 2443 | Grand Ave | | 1 | Did there own hose run to 2449-Grand Ave |
| | | 2464 | Grand Ave | | | Plumber thawed service |
| #REF! | | 2659 | Ontario Ave | | 1 | 3 weeks without water |
| #REF! | | 2463 | Grand Ave | | | Nobody home 3/7/15 |
| #REF! | | 638 | 72nd | | | Plumber Thawed service |

| | | | | | | |
|---|---|---|---|---|---|---|
| #REF! | | 644 | 72nd | | | Plumber thawed service |
| #REF! | | 650 | 72nd | 1 | 1 | |
| #REF! | | 918 | 92nd | | | Plumber thawed service |
| | | 740-750 | Haberle Ave | | | |
| #REF! | | 7811 | Lindbergh Ave | | | Plumber thawed service |
| #REF! | | 2478 | Grand Ave | | | Plumber thawed service |
| | | 746 | 92nd | | | |
| | | 603 | Vanderbilt Ave | | | Plumber thawed service |
| | | 742 | 8th | | | |
| | | 2441 | Grand Ave | | 1 | Did there own hose run from 2437-Grand |
| | | 6715 | Lindbergh Ave | | | |
| | | 405 | 38th | | | |
| | | 462 | 20th | | 1 | They did their own hose run |
| | | 2645 | North Ave | | 1 | |
| | | 1030 | 99th | | | Plumber thawed service |
| | | 2201 | Independence Ave | | | |
| | | 2461 | Independence Ave | | | |
| | 3/4/2015 | 2933 | North Ave | | 1 | They did their own hose run-We removed register @ 2935-North |
| | | 2945 | North Ave | | | Plumber thawed service |
| | | 1115 | Vanderbilt Ave | | | |
| | | 1319-1329 | Pine Ave | | | |
| | | 2464 | Grand Ave | | | Plumber thawed service |
| | | 2304 | Pine Ave | | | |
| | | 619 | 17th | | | |
| | | 608 | 72nd | | | Can't do a hose run- broken hose bib |
| | | 825 | 87th | | | Plumber thawed service |
| | | 700 | Park Pl | | | 418-Pine can give water |
| | | 2457 | Independence Ave | | | |
| | | 8001 | Buffalo Ave | | 1 | They did their own hose run |
| | 3/5/2015 | 8503 | Lindbergh Ave | | | Plumber thawed service |
| | | 532 | 72nd | | | Plumber thawed service |
| | | 3339 | Church Ave | | | |
| | | 623 | 35th | | | Plumber thawed service |
| | | 1018 | Hyde Park | | | |
| | | 644 | 75th | | | |
| | | 2705 | South Ave | | | |
| | | 1921 | Pine Ave | | | No hose bibs |
| | | 2903 | Walnut Ave | | | |
| | | 531 | 73rd | | | |
| | | 609 | Orchard Parkway | | | |
| | | 1380 | Willow Ave | | | |
| | 3/6/2015 | 2414 | Grand Ave | | | |
| | | 551 | Main St. | | | Plumber thawed service |
| | | 2486 | Grand Ave | | | Plumber thawed service |
| | | 1322 | Willow Ave | | | They will wait until service thaws itself out |
| | 3/9/2015 | 1401 | Military Rd | | | Reeds Jewelers - Can't do a hose run |

| | | | |
|---|---|---|---|
| | 5657 | Girard Ave | |
| 3/10/2015 | 335 | Buffalo Ave | Trying to thaw service himself |
| | 1621 | Pine Ave | |
| | 136 | 68th | 140-68th can give water |
| 3/11/2015 | 1915 | Pine Ave | Can't do a hose run |
| | 760 | 10th | |
| | 2445 | Independence Ave | |
| | 1906 | Welch Ave | |

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# Appendix G

## 2015 NFWB Frozen Water Service Map

**Frozen Waterline Investigation Report**

The Niagara Falls Water Board

GGE 15-1032

September 2, 2015

GLYNN GEOTECHNICAL ENGINEERING

415 South Transit Street, Lockport, New York 14094
voice 716.625.6933 / fax 716.625.6983
www.glynngroup.com

## Legend

Frozen Water Services

GOAT ISLAND

0 0.5 1 Miles

# 2015 Frozen Water Services

DISCLAIMER:
FOR IMFORMATION ONLY
ACCURACY OF THIS PLAN
SHALL BE CHECKED IN FIELD
NIAGARA FALLS WATER BOARD

NIAGARA FALLS WATER BOARD

Date: 3/16/15