Agenda Item Executive Summary

Title: Northwest Winnetka Stormwater Improvements - Authorization to Solicit Bids

Presenter: Steven M. Saunders, Director of Public Works/Village Engineer

Agenda Date: 07/01/2014

Consent: ☐ YES ☑ NO

☐ Ordinance
☐ Resolution
☐ Bid Authorization/Award
☑ Policy Direction
☐ Informational Only

Item History:

October 2, 2012 Council Meeting
July 2, 2013 Council Meeting

Executive Summary:

On October 2, 2012 the Village awarded a contract to Christopher B. Burke Engineering, Ltd. (CBBEL) to complete detailed plans and specifications suitable for permits and obtaining construction bids for drainage improvements in the Greenwood Avenue/Forest Glen Study Area of northwest Winnetka. The Greenwood and Forest Glen study area is approximately a 170 acre drainage area north of Tower Road roughly bounded by Gordon Terrance on the east and the Skokie River East Diversion Ditch on the west. All of the stormwater runoff in this area drains to the Skokie River East Diversion Ditch through a trunk sewer heading west under Tower Road. The proposed improvement for this area includes an additional trunk sewer along Tower Road, multiple lateral sewers draining Forest Glen, Vernon, Edgewood, Greenwood and Grove areas, and a larger outlet pipe to the pond. The larger storm sewer network will bring runoff to the pond where the flood storage volume within the pond will be utilized.

The engineering work is essentially complete, the Cook County Forest Preserve District has approved the Village's request to construct a new discharge to the Tower Road lagoon, and CBBEL is completing bidding documents. Staff is requesting Council authorization to solicit construction bids for the project.

Recommendation:

Consider authorizing staff to solicit construction bids for the Northwest Winnetka Stormwater Improvements, pending approval by the MWRD of an intergovernmental agreement providing grant funding for approximately 50% of the project cost.

Attachments:

Agenda Report
1. Overall project plans
2. Engineering review documents
3. Tower Road lagoon plan

Agenda Report

Subject: **Northwest Winnetka Stormwater Improvements – Authorization to Solicit Bids**

Prepared By: Steven M. Saunders, Director of Public Works/Village Engineer

Date: June 27, 2014

On October 2, 2012 the Village awarded a contract to Christopher B. Burke Engineering, Ltd. (CBBEL) to complete detailed plans and specifications suitable for permits and obtaining construction bids for drainage improvements in the Greenwood Avenue/Forest Glen Study Area of northwest Winnetka. The Greenwood and Forest Glen study area is approximately a 170 acre drainage area north of Tower Road roughly bounded by Gordon Terrance on the east and the Skokie River East Diversion Ditch on the west. All of the stormwater runoff in this area drains to the Skokie River East Diversion Ditch through a trunk sewer heading west under Tower Road. The specific improvements involved are as follows:

Existing Storm Sewer System.

The existing storm sewer under Tower Road begins as a 24-inch pipe at Forest Glen Drive and increases to a 60-inch pipe heading west to Grove Street. This storm sewer collects runoff from the Vernon, Edgewood, Greenwood and Grove areas along the way. West of Pine Tree Lane, the 60-inch trunk sewer is reduced to two 36-inch storm sewers at a junction chamber where one continues west and outlets at the Diversion Ditch and the other directs water south to outlet at the pond on the south side of Tower Road and east of Forest Way Drive. During large storm events, as the water rises in the Diversion Ditch, the 36-inch outlet to the Diversion Ditch cannot drain by gravity and the pond provides relief via the other 36-inch outlet. A pump station is located at this junction chamber to pump storm water into the Diversion Ditch when the water surface elevation in the Diversion Ditch is too high for gravity runoff.

The CBBEL analysis shows that less than half of the total available storage volume within the pond is used during the 100-year design, such as the July 2011 storm events. This was confirmed by CBBEL and Public Works staff during the April 2013 storm event. This is because the pond outflows to the Diversion Ditch through a flap gate (backflow preventer) that doesn't allow water to enter, or back up, into the pond when the Diversion Ditch is high. Therefore during large storm events, the storage in the pond remains available even though the water in the Diversion Ditch is high.

Proposed Improvements.

The proposed improvement for this area includes an additional trunk sewer along Tower Road, multiple lateral sewers draining Forest Glen, Vernon, Edgewood, Greenwood and Grove areas, and a larger outlet pipe to the pond. The larger storm sewer network will

bring runoff to the pond where the flood storage volume within the pond will be utilized. The outlet from the pond to the Diversion Ditch will continue to drain through a flap gate. This will continue to provide backflow prevention to stop water from the East Diversion Ditch from backing up into the system. The existing pump station and outlet pipe (with backflow prevention) to the Diversion Ditch will remain. From the CBBEL analysis of the proposed improvements, stormwater runoff will flow west more efficiently and water from outside the area will not be able to back-up into the area. A schematic proposed plan is shown in **Attachment #1**.

Engineering Review.

During the design phase, a number of residents in the area adjacent to the Tower Road lagoon and the East Diversion Ditch expressed concern over whether CBBEL's modeling of the protection and overflow levels in the Northwest Winnetka improvements is accurate. Specifically, residents adjacent to the Tower Road lagoon and the East Diversion Ditch questioned whether the proposed improvements would result in significant water level increases in the lagoon and East Diversion Ditch, and whether property damage could possibly result from increased water levels. In addition, Trustee Kates expressed a concern about whether an existing section of storm sewer on Tower Road being left in place has sufficient capacity to handle the increased water being delivered from upstream.

To address these concerns, staff engaged Baxter & Woodman (B&W) to independently run the hydraulic and hydrologic models in order to verify their accuracy. Staff also asked CBBEL to provide documentation of their calculations for the existing section of storm sewer, as well as a statement that pipe has sufficient capacity to handle the design flows, and for B&W to review these calculations. Both engineering firms have confirmed that there is sufficient capacity in the pond to accept the runoff from the improved discharge pipe, and that the overflow elevation of the pond to the west is sufficiently below the elevations on the eastern, developed side of the pond, so that there is no risk of the pond overflowing eastward and causing damage to adjacent properties. Both engineering firms have also confirmed that because the existing pipe between Greenwood Avenue and Vernon Avenue is on a steeper slope than the remaining pipe runs, it has sufficient capacity for the design storm and does not need to be replaced. B&W's and CBBEL's documentation are shown in **Attachment #2**. Although staff and both engineering firms believe that the existing pipe between Vernon and Greenwood will be sufficient to accommodate the additional flows, the project documents will be modified to receive alternate bids to replace the approximately 650 feet of storm sewer and pavement between Vernon Avenue and Greenwood Avenue, so that the actual construction cost can be identified.

Forest Preserve License.

In order to connect to the Tower Road lagoon on Forest Preserve District property, the Forest Preserve requires a license to access and use their property for the reconstructed discharge to the lagoon. After a thorough review by the Forest Preserve District staff and Board, including field meetings with District staff and with County Commissioner Suffredin, the Forest Preserve District approved the Village's license agreement request

on June 17, 2014. The District Board found that the Village's proposed project would reduce flooding without causing flood damage to the District's property, and would benefit the District. The District benefit would primarily accrue from work proposed by the Village to a) re-grade and stabilize the eroding east bank of the lagoon, b) remove leaning and unhealthy trees from the lagoon bank, and c) restore the bluegrass lawn encroachments on District property to native prairie vegetation, to improve water quality in the pond. The improvements around the lagoon are shown in **Attachment #3**.

Project Cost.

The current estimate of cost for constructing the project is $4,040,050, including the cost associated with additional work requested by the Forest Preserve District to restore the pond. The Village has been notified by the Metropolitan Water Reclamation District of Greater Chicago (MWRD) that they will be providing a significant amount of funding for the project, approximately $2,000,000. In order to provide funding for stormwater projects, the MWRD needed modification in its enabling legislation via the State of Illinois Legislature. Governor Quinn recently signed HB 3912 which provides the MWRD with authority to provide grants to municipalities for stormwater funding. The funding will be accomplished through an intergovernmental agreement between the MWRD and the Village. The Village is awaiting a copy of the intergovernmental agreement so that all of the terms can be examined and finalized, and the project can be bid. MWRD staff has indicated that the Village will need to include certain provisions of the MWRD's purchasing specifications in the bidding documents, and that the project cannot be bid nor awarded until the intergovernmental agreement is finalized.

Next Steps.

A significant amount of preparatory work has already been completed for this project. The Village's Water & Electric Department relocated a major duct bank containing the Village's interconnect with the Commonwealth Edison electric grid to allow storm sewer clearance on the west end of Tower Road. AT&T has relocated a duct bank near the intersection of Forest Glen and Tower to allow storm sewer clearance, and North Shore Gas is in the process of relocating gas mains in several areas, including a 10-inch high-pressure line on Greenwood Avenue.

The engineering work is essentially complete, and CBBEL is completing bidding documents. It has been the Village's general strategy to advance the various stormwater projects on parallel tracks as they are ready, and it is reasonable to proceed with bidding and construction of this project at this time. First, this project is a stand-alone project (not dependent on the Willow Road Tunnel), so it can be constructed at any time. Second, this project is relatively straightforward and simple to construct, and could bring much-needed drainage relief to area residents in a timely manner.

The following is an approximate timeline for this project:

- Late July: Completion of bidding documents
- Mid-July: Approval of MWRD intergovernmental agreement
- Late July to late August: Bidding period

- September 2: Contract award
- Mid-September: Construction starts – west end of Tower Road and outlet
- Mid-November: West end/outlet construction complete
- April 2015: Lagoon restoration* and east end construction starts
- August 2015: Project complete

* Due to the specialized nature of the lagoon area prairie restoration this work will be accomplished via a separate contract.

After the project is awarded and the contractor is engaged, staff will schedule a preconstruction meeting with affected residents to discuss project scheduling, traffic control and access, and other construction impacts so that the inevitable construction inconveniences can be minimized. Staff will also work with residents adjacent to the lagoon to minimize disruption and incorporate, to the extent possible, resident input in plant and tree species selection from the Forest Preserve District's approved species list.

Due to the magnitude of this project and its potential disruption, staff is soliciting a proposal from CBBEL to provide onsite construction observation and supervision services, to be supplemented by Village staff and the AT Group. This proposal will be brought to the Village Council for approval shortly.

Recommendation:

Consider authorizing staff to solicit construction bids for the **Northwest Winnetka Stormwater Improvements,** pending approval by the MWRD of an intergovernmental agreement providing grant funding for approximately 50% of the project cost.

Attachments:

1. Overall project plans
2. Engineering review documents
3. Tower Road lagoon plan

Attachment #1 Overall project plans

SCALE 1" = 20'
0 20 40
N

920 910 900 895

PINE TREE LANE

STMH TIF CL, 8'x8'
RIM 625.50
INV. 617.20 E,W,S

PC Sta 10+50.85

L10+00

L11

TOWER ROAD

L13 L14

L15+00

MATCH LINE STA. 15+50

INL TA T3 F&G
RIM 625.44
INV. 621.50

20 LF SS 60" RCP
@ 0.15%, 29 CYTBF

60" RCP

"STOP AHEAD"

STMH 10'Ø TIF CL
RIM 626.50
INV. 617.12

76"x 48" RCP

116 LF 83"x53" RCEP
@ 0.1%, 243 CYTBF

6 LF SS 12" WMO
@ 10%, 2 CYTBF

"1620"

36 LF 66" RCP
@ 0.1%, 63 CYTBF

30 LF COMB. CONCRETE
CURB AND GUTTER

8 LF SS 12" WMO
@ 1.0%, 3 CYTBF

266 LF 83"x53" RCEP
@ 0.1%, 502 CYTBF

CORED CONNECTION
INV. 620.00
8 LF SS 12" WMO @ 12%
5 CYTBF

CORED CONNECTION
INV. 620.00
8 LF SS 12" WMO @ 24%
3 CYTBF

ADJ

CBL SBC

ELECTRIC HH

SIGN

"HEATHER LANE"

GAS MTR

GV

B-BOX

1620

870

875

HEATHER LANE

STMH TIF CL, 10'x10'
RIM 625.50
INV. 617.23 E,W,N
INV. 621.40 N,S

ADJ W/ NEW T3 F&G

56 LF 5'x9' RCBC
@ 0.15%

CAST-IN-PLACE
HEADWALL

CONC. FLOW

EDGE OF WATER AS LOCATED BY CBBEL
SURVEY ON 10-15-12

STONE DUMPED RIPRAP
CL 7, FILTER FABRIC
65 SY

EDGE OF FLAGGED WETLAND AS LOCATED ON THE GROUND

ELEV. 617.00

1585 1575 1565 1555

SCALE 1" = 20'
0 20 40
N

MATCH LINE STA. 15+00

PT Sta 15+58.90

L16 L17 L18 L19

76"x 48" RCP

"NO PARKING"

128 LF 83"x53" RCEP
@ 0.1%, 220 CYTBF

CORED CONNECTION
INV. 620.25
8 LF SS 12" WMO @ 21%
3 CYTBF

CORED CONNECTION
INV. 620.25
8 LF SS 12" WMO @ 20%
3 CYTBF

STMH 10'Ø, TIF CL
RIM 625.15
INV. 617.62

315 LF 83"x53" RCEP
@ 0.1%, 542 CYTBF

CORED CONNECTION
INV. 620.45
8 LF SS 12" WMO @ 16%
4 CYTBF

CORED CONNECTION
INV. 620.45
8 LF SS 12" WMO @ 17%
3 CYTBF

ADJ

TEL PED

APPROXIMATE R.O.W. LINE

B-BOX

FO

8" W

MATCH LINE STA. 20+00

1580 1570 1560 1556

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500

CLIENT:
VILLAGE·OF·WINNETKA
Incorporated in 1869

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CHKD.	LMF
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PLOT DATE:	6/20/2013
CAD USER:	fpaclone
MODEL:	Default

TITLE:

STORM SEWER PLAN
TOWER ROAD

PROJ. NO.	120462
DATE:	03/04/2013
SHEET	OF 39
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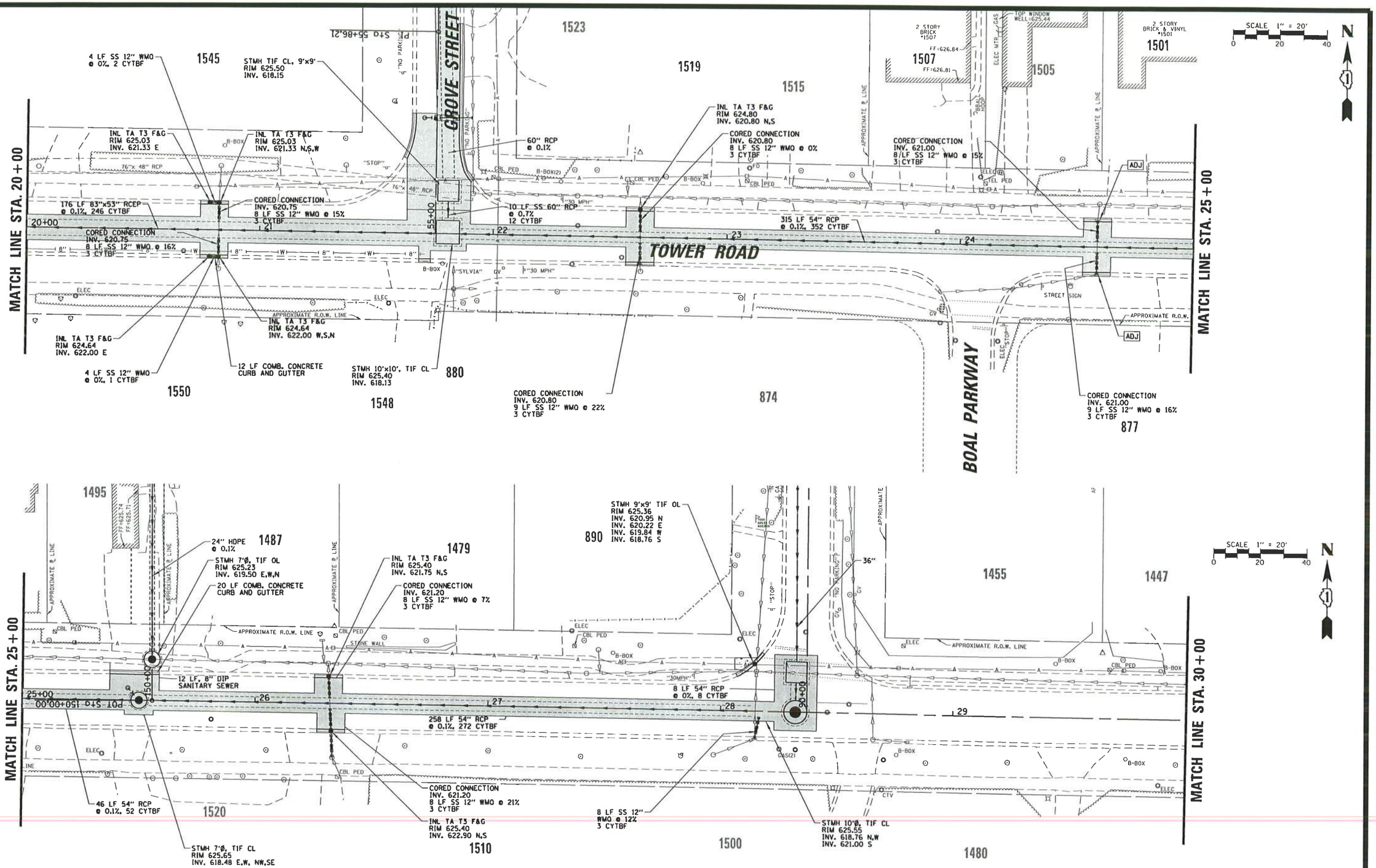

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STORM SEWER PLAN
TOWER ROAD

PROJ. NO.	120462
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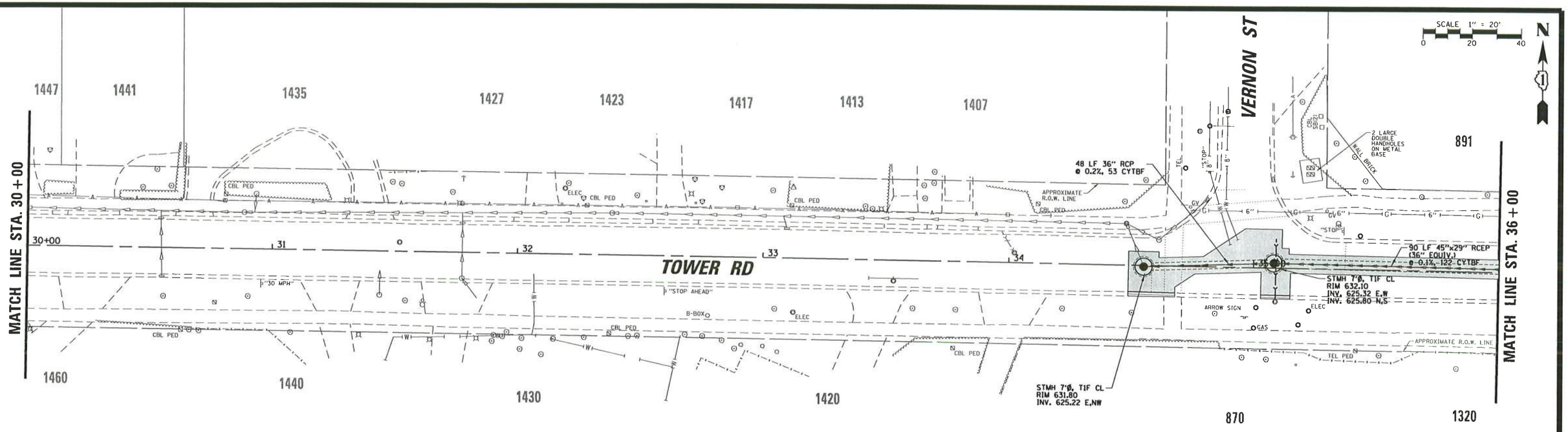

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MODEL:	Default

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STORM SEWER PLAN
TOWER ROAD

PROJ. NO.	120462
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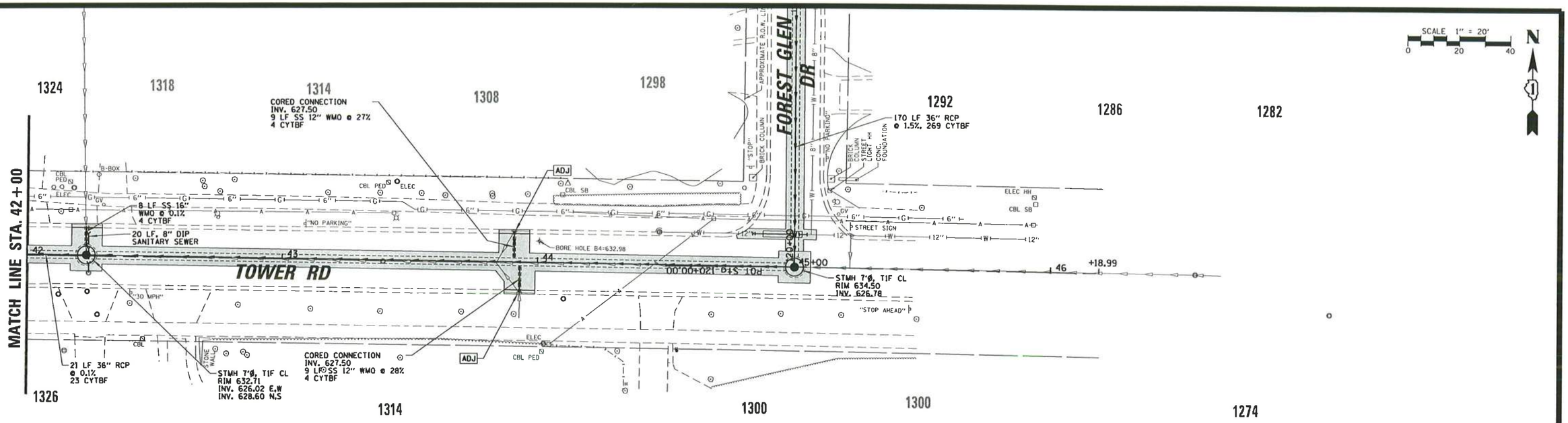

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TOWER ROAD

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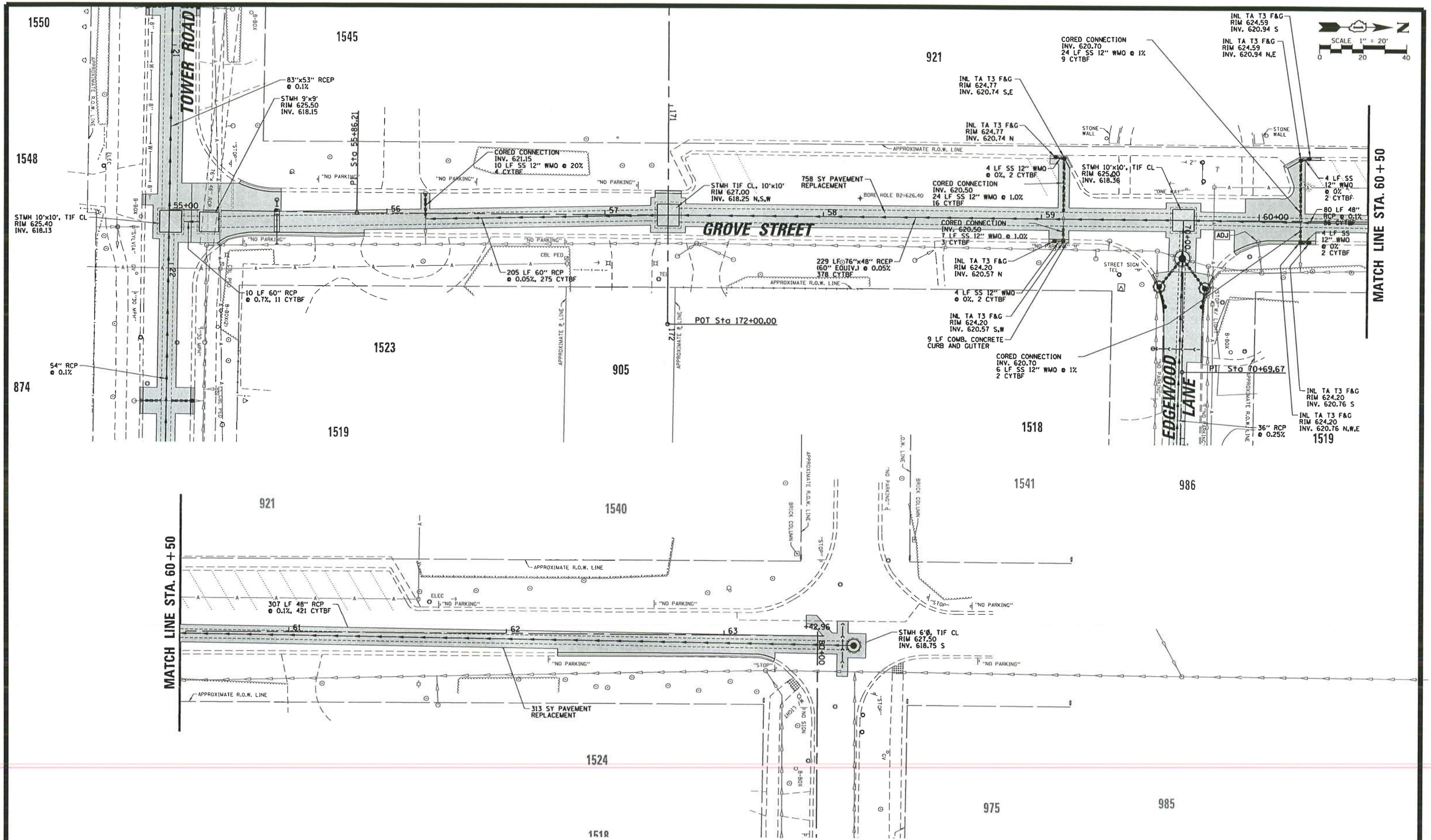

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MODEL:	Default

TITLE:

STORM SEWER PLAN
GROVE STREET

PROJ. NO.	120462
DATE:	03/04/2013
SHEET	OF 39
DRAWING NO.	5

SCALE 1" = 20'
0 20 40
N

921
GROVE STREET
1519
STMH 5'Ø, T3F&G OL
RIM 624.40
INV. 621.38 EW, SW, SE
4 LF SS 12" WMO @ 0%
1 CYTBF
INL TA T3 F&G
RIM 624.40
INV. 621.38 NW
1509
INL TA T3 F&G
RIM 624.11
INV. 620.14 S
1507
1503
1497
1487
CORED CONNECTION
INV. 620.06
8 LF SS 12" WMO @ 1%
3 CYTBF
ADJ W/ NEW T3 F&G
48" RCP @ 0.1%
15 LF SS 12" WMO @ 1%
5 CYTBF
10 LF 36" RCP @ 0.25%, 10 CYTBF
STONE WALL
60+00
APPROXIMATE R.O.W. LINE
B-BOX
GAS B-BOX
"STOP" W/ LIGHT
"NO PARKING"
PI Sta 70+69.62
70+00
71
72
73
74
EDGEWOOD LANE
W/ TRANSFORMER
75 LF 36" RCP @ 0.25%, 65 CYTBF
STMH 10'x10', TIF CL
RIM 625.00
INV. 618.36 N,S,E
STREET SIGN TEL
ELEC HH
CONC. WALL
STMH 6'Ø, TIF CL
RIM 625.40
INV. 619.20 E,W
MATCH LINE STA. 74+20
STMH 7'Ø, TIF CL
RIM 625.00
INV. 620.10 N,S
INV. 618.38 E,W
INV. 621.23 NE, SE
12 LF SS 12" WMO @ 1%
4 CYTBF
INL TA T3 F&G
RIM 624.40
INV. 621.35 W
4 LF SS 12" WMO @ 0%
1 CYTBF
1518
76"x48" RCEP (60" EQUIV.) @ 0.1%
59
STMH 5'Ø, T3 F&G
RIM 624.40
INV. 621.35 NW, NE
INV. 620.79 EW
CORED CONNECTION
INV. 620.06
4 LF SS 12" WMO @ 1%
2 CYTBF
INL TA T3 F&G
RIM 624.30
INV. 620.10 N
1512
1508
1502
1496
1492
1488
APPROXIMATE R. LINE
921

SCALE 1" = 20'
0 20 40
N

940
APPROXIMATE R.O.W. LINE
1455
INL TA T3 F&G
RIM 625.70
INV. 621.36 S
1483
1477
1473
INL TA T3 F&G
RIM 625.60
INV. 621.23 S
CORED CONNECTION
INV. 621.26
10 LF SS 12" WMO @ 1%
7 CYTBF
1455
1447
1443
1437
1433
1427
INL TA T3 F&G
RIM 624.60
INV. 620.66 S
CORED CONNECTION
INV. 621.11
12 LF SS 12" WMO @ 1%
8 CYTBF
"STOP"
95+00
6 LF SS 12" RCP @ 20%, 2 CYTBF
ADJ W/ NEW T3 F&G
APPROXIMATE R.O.W. LINE
B-BOX
FOLDING SIGN
W/ LIGHT
GV
"NO PARKING"
CORED CONNECTION
INV. 620.56
10 LF SS 12" WMO @ 1%
4 CYTBF
75+00
76
77
+67.95
STMH 6'Ø, TIF CL
RIM 627.10
INV. 620.30 W
INV. 623.00 N,S
MATCH LINE STA. 74+20
CORED CONNECTION
INV. 620.56
4 LF SS 12" WMO @ 1%
2 CYTBF
PLAYHOUSE
ADJ
6 LF SS 12" RCP @ 16%, 2 CYTBF
APPROXIMATE R.O.W. LINE
CORED CONNECTION
INV. 621.11
8 LF SS 12" WMO @ 1%
6 CYTBF
920
INL TA T3 F&G
RIM 625.60
INV. 621.19 N
BRICK WALL
CORED CONNECTION
INV. 621.26
9 LF SS 12" WMO @ 1%
6 CYTBF
INL TA T3 F&G
RIM 624.60
INV. 620.60 N
1482
1446
1442
1436
1430
APPROXIMATE R. LINE
1488
921
94

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NO.	DATE	NATURE OF REVISION	CHKD.

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STORM SEWER PLAN
EDGEWOOD LANE

PROJ. NO.	120462
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SHEET	OF 39
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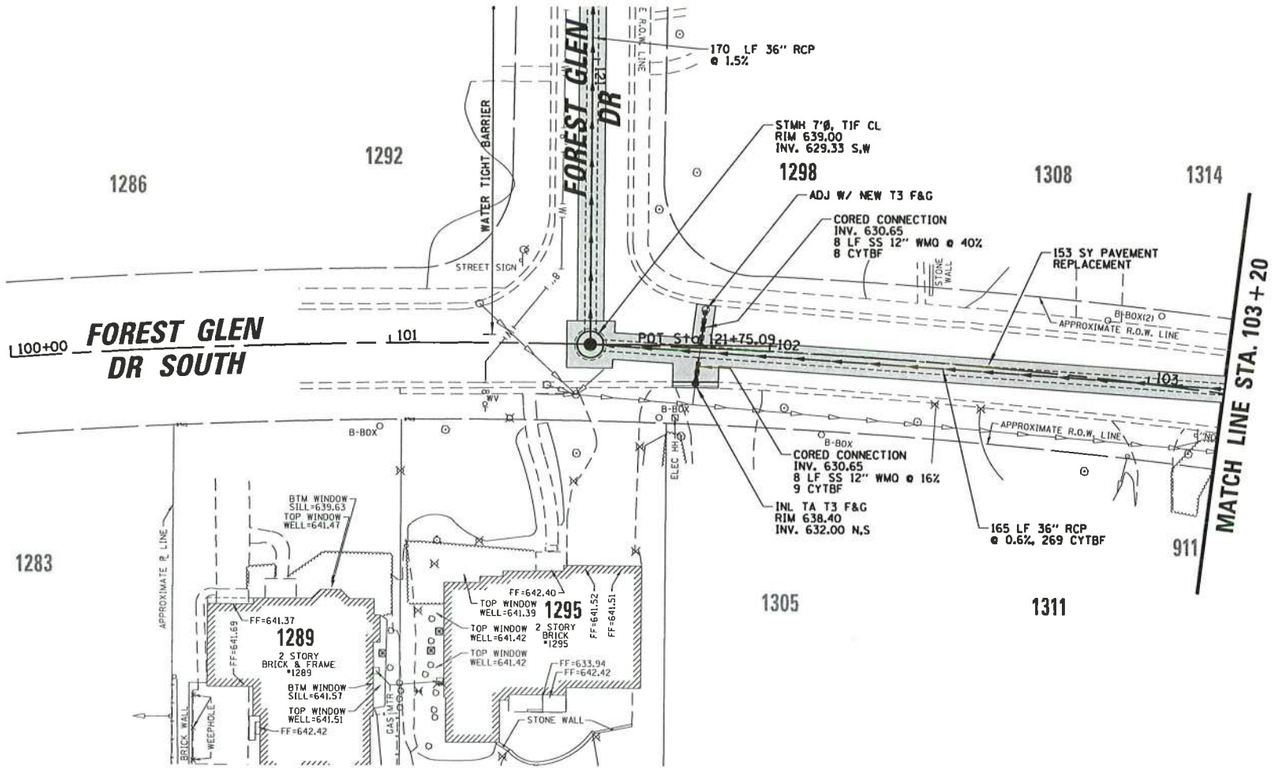

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NO.	DATE	NATURE OF REVISION	CHKD.

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TITLE:

STORM SEWER PLAN
FOREST GLEN DRIVE SOUTH

PROJ. NO.	120462
DATE:	03/04/2013
SHEET	OF 39
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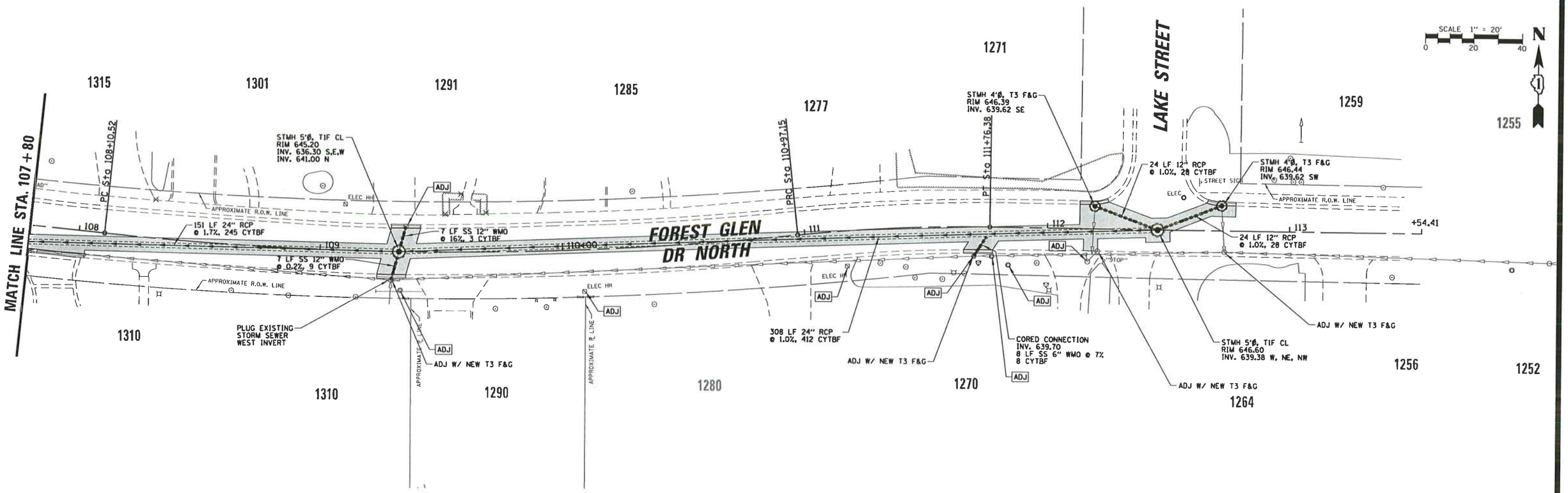

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NO.	DATE	NATURE OF REVISION	CHKD.
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CHKD.	LMF
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PLOT DATE:	6/20/2013
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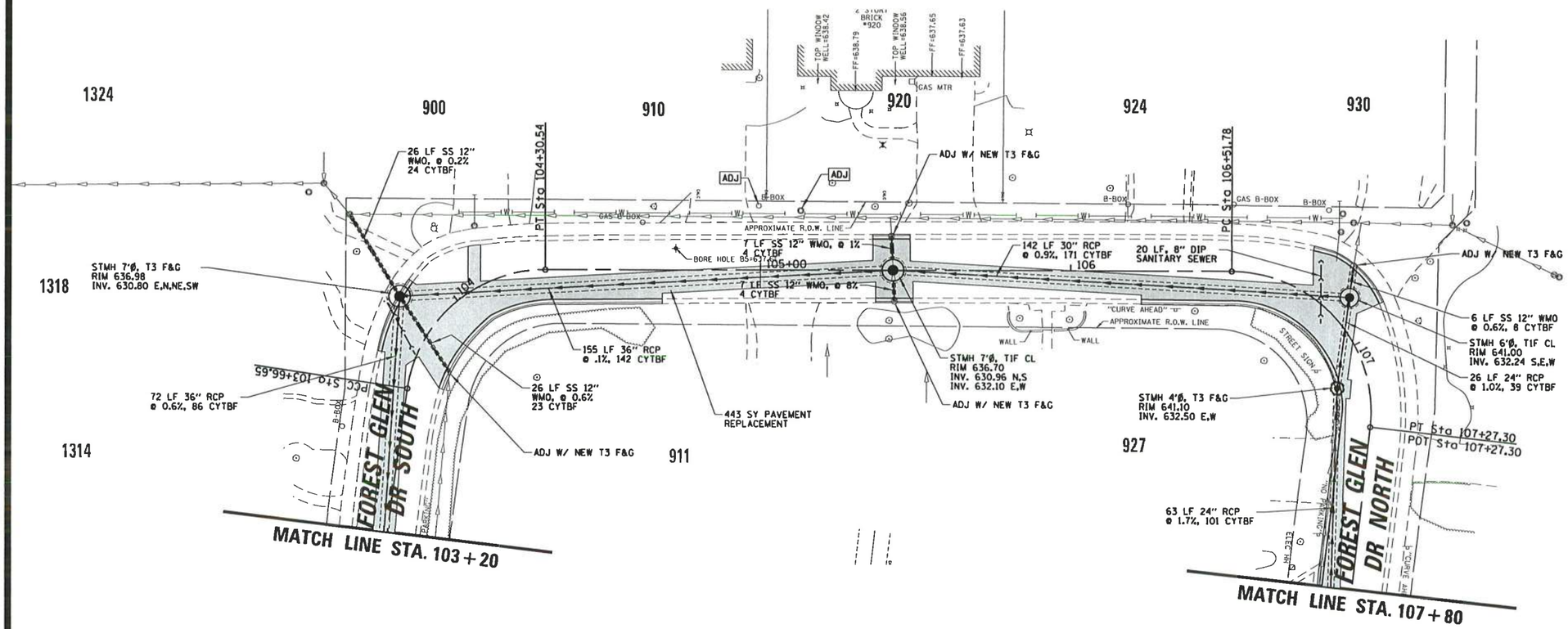
MODEL:	Default

TITLE:

STORM SEWER PLAN
FOREST GLEN DRIVE NORTH

PROJ. NO.	120462
DATE:	03/04/2013
SHEET	OF 39
DRAWING NO.	8



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NO.	DATE	NATURE OF REVISION	CHKD.

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CHKD.	LMF
SCALE:	1" = 40'
PLOT DATE:	6/20/2013
CAD USER:	fpaclone
MODEL:	Default

TITLE:

STORM SEWER PLAN
FOREST GLEN DRIVE SOUTH/ FOREST GLEN DRIVE NORTH

PROJ. NO.	120462
DATE:	03/04/2013
SHEET	OF 39
DRAWING NO.	9

Attachment #2 Engineering review documents

8430 W. Bryn Mawr Avenue
Chicago, IL 60631
815.459.1260
773.444.0312
www.baxterwoodman.com
info@baxterwoodman.com

BAXTER & WOODMAN
Consulting Engineers

Memo

To:	**Mr. Steven M. Saunders, P.E.**	
	Director of Public Works/Village Engineer	
	Village of Winnetka	
From:	**Mark G. Phipps, P.E. and Matthew J. Moffitt, P.E.**	
Date:	**March, 17 2013**	**Project No.: 131057.90**
Subject:	**Northwest Winnetka Hydraulic Model Calibration**	

The Northwest Winnetka Drainage Improvements consist of a new trunk sewer along Tower Road with new lateral sewers that drain several cross streets and a larger outlet pipe to existing pond on Cook County Forest Preserve District (CCFPD) property. The hydraulic modeling of these improvements, prepared by Christopher B. Burke Engineering, Ltd. (CBBEL), is interrelated with the hydraulic modeling prepared by Baxter & Woodman (B&W) as part of the Village's Stormwater Master Plan. In order to ensure consistency between the models, the Village tasked B&W with performing a detailed review of the modeling prepared by CBBEL. The findings of our review are summarized below.

Review of Model Input Data:

- The drainage area boundaries shown on the exhibit titled *Existing Storm Sewer Network and Drainage Areas* (not dated) are appropriately sized and accurately drawn.
- XP-SWMM Model Hydrologic Data (Existing and Proposed Conditions)
    - The Runoff Curve Numbers are appropriate for the types of ground cover within each drainage area.
    - The Times of Concentration are reasonable for the size of the drainage area and for a subdivision served by a storm sewer system.
    - Rainfall data consisted of Bulletin 70 rainfall depths distributed according to the appropriate Huff quartile, as well as rain gage data for the July 23, 2011 storm event.

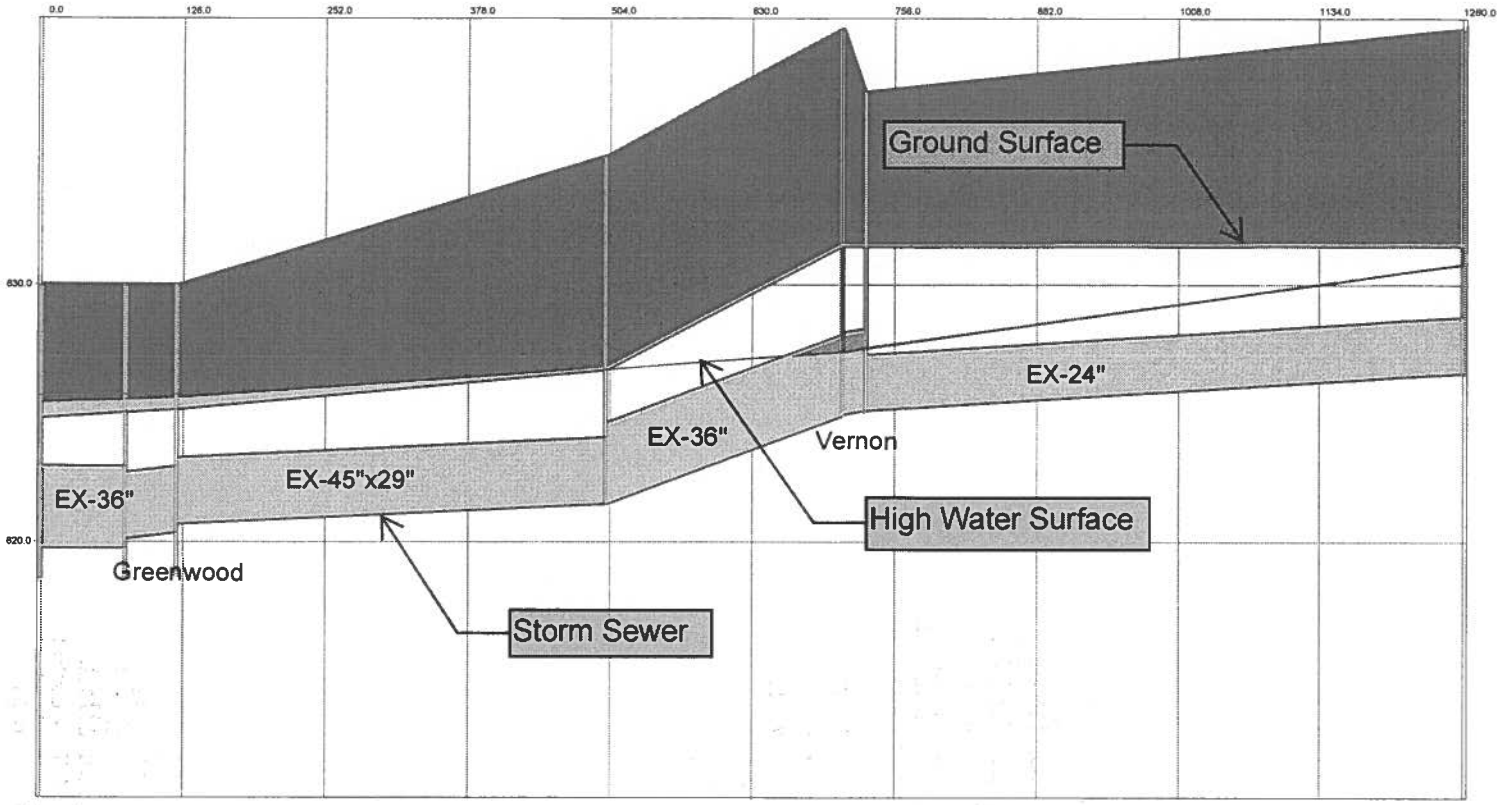
- XP-SWMM Model Hydraulic Data (Existing and Proposed Conditions)
    - The sizes and elevations of storm sewer pipes match those shown in the engineering plans titled *Forest Glen and Greenwood Avenue Stormwater Improvements*, dated November 26, 2013.
    - The elevation-area data for the existing pond on CCFPD property matches Village contour data. The overflow elevation for the pond matches the data shown on the *Additional Survey Exhibit* (not dated).
    - The dimensions of overland flow paths are supported by Village contour data.

Review of Model Output Data:

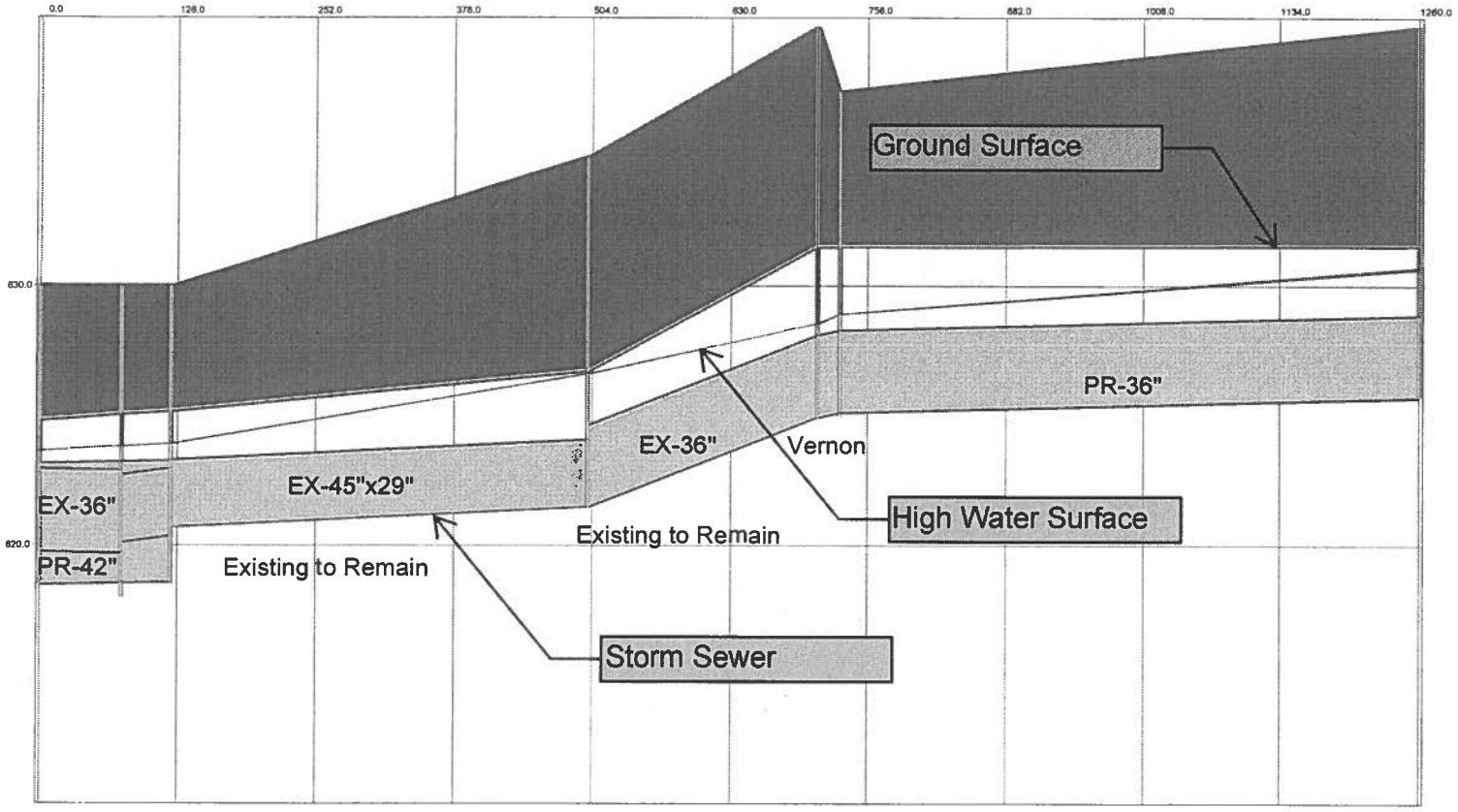
- The installation of the proposed storm sewer parallel to the existing storm sewer will result in a significant increase in sewer capacity.
- The proposed improvements would leave an existing section of storm sewer in place between two sections of proposed storm sewer. This section of storm sewer is located along Tower Road, between Greenwood Avenue and Vernon Street. The existing section of storm sewer has sufficient capacity and does not need to be replaced, provided that it is not structurally deficient.
- The CBBEL modeling assumes no outflow from the existing pond on CCFPD property. This is a conservative assumption and likely overestimates the high water elevation in the pond. Therefore, a factor of safety is incorporated when comparing the modeled high water elevation with the ground elevation on adjacent properties.
- The CBBEL modeling demonstrates that the proposed improvements would increase the high water elevation of the pond by 3.2-feet in the July 23, 2011 storm event and by 1.7-feet for the 100-year storm event. Both of these results are based on the conservative outflow assumption described above. According to Village contour data, the highest pond high water elevation modeled by CBBEL would not encroach upon the properties adjacent to the pond. The surveyed low-opening elevations of the residences adjacent to the pond, as shown on the *Additional Survey Exhibit* (not dated), are several feet above the highest pond high water elevation modeled by CBBEL.

Name	Invert	Rim	Max Water Elevation	EGL Relative to Ground
Existing Conditions Node Data				
N732	618.62	630	625.72	4.237
AA2-10	625	640	627.41	12.463
AA2-12	626.5	640	630.825	7.541
N747	618.67	630	625.735	4.092
N748	621.55	635	626.698	7.931
N732.1	618.53	630	625.709	4.253
AA2-12.1	625	637.5	627.547	9.524
Proposed Conditions Node Data				
N732	618	630	623.82	6.057
AA2-10	625	640	628.554	11.098
AA2-12	625.79	640	630.719	8.563
N747	618.5	630	623.94	5.359
N748	621.55	635	626.623	7.641
N732.1	618.5	630	623.631	6.225
AA2-12.1	625	637.5	628.931	8.207

Name	Diameter (Hieght)	Upstream Node	Upstream Invert	Downstream Invert	Max Flow
Existing Conditions Link Data					
N732 Prop	6.917	N732	618.62	618.44	63.963
N732 OL	4	N732	625.13	624.91	30.673
N732 SS	3	N732	619.84	619.86	-28.397
AA2-10 SS	3	AA2-10	625	621.58	32.589
AA2-10 OL	4	AA2-10	631.56	626.78	0
AA2-12 SS	2	AA2-12	626.68	625.22	18.326
AA2-12 OL	4	AA2-12	631.62	631.56	0
N748 SS	6.917	N747	618.67	618.62	53.908
N748 OL	4	N747	625.25	625.13	23.863
AA2-12.1 SS	3.75	N747	620.46	620.22	21.645
AA2-12.1 OL	3.75	N748	621.58	620.8	32.587
Proposed Conditions Link Data					
N732 Prop	4.5	N732	618.64	618.56	50.915
N732 OL	4	N732	625.13	624.91	0
N732 SS2	3	N732	619.84	619.86	-20.86
AA2-10 SS	3	AA2-10	625.04	621.58	50.196
AA2-10 OL	4	AA2-10	631.56	626.78	0
AA2-12 SS	3	AA2-12	625.79	625.22	42.09
AA2-12 OL	4	AA2-12	631.62	631.56	0
N747 Prop	4.5	N747	618.69	618.64	43.021
N747 OL	4	N747	625.25	625.13	0
N747 SS2	3.75	N747	620.46	620.22	18.392
N747 SS	3.75	N748	621.58	620.8	50.19
N748 OL	4	N748	626.78	625.25	0
AA2-12.1 SS	3	AA2-12.1	625.22	625.04	42.001
AA2-12.1 OL	4	AA2-12.1	631.56	631.56	0



Existing Pipe Profile along Tower Road
100 yr 2 hr event



Proposed Pipe Profile along Tower Road
100 yr 2 hr event

MEMORANDUM

February 4, 2014

TO: Steven M. Saunders, PE, Director of Public Works/Village Engineer

FROM: Thomas T. Burke, PhD, PE

SUBJECT: Forest Glen and Greenwood Avenue Stormwater Improvements
(CBBEL Project No. 12-0462)

The purpose of this memorandum is to document the findings of Christopher B. Burke Engineering, Ltd.'s (CBBEL) hydraulic analysis with regards to the capacity of a section of storm sewer on Tower Road between Greenwood Avenue and Vernon Avenue. We do not propose to replace the 510 feet of storm sewer as part of the Northwest Winnetka drainage improvements because our proposed conditions analysis demonstrates the existing storm sewer has sufficient capacity. It is our understanding that there is concern that if the existing storm sewer remains, this will cause a "bottleneck" in the Tower Road system and cause flooding immediately upstream of that section of storm sewer.

It is important to understand that the proposed storm sewer system will be under pressure flow for the storm events that we are designing to which include the July 2011 and June 2013 storm events. A storm sewer is flowing under pressure when the water elevation in the storm sewer exceeds the top of the pipe. This can be seen in manholes when the water surface elevation is greater than the top of pipe. Under full flow conditions, the capacity in a sewer is calculated using a simplified equation (Manning's) and under pressure flow conditions the capacity in a sewer is calculated using a modified version of the equation by incorporating the elevation difference between the upstream and downstream manholes. The capacity in a storm sewer will increase with an increase in pressure head. The other important factor to understand is that different sections of the existing storm sewer have different slopes. The greater the slope, the more flow the storm sewer can convey. The section of 36-inch storm sewer between Greenwood and Vernon Avenues has a sufficient slope to convey all the flow feeding into it.

The proposed improvements include replacing the existing 24-inch RCP upstream of Vernon Avenue with a 36-inch RCP east to Forest Glen Drive. According to the XP-SWMM analysis, the proposed flow rate coming to the existing sewer is 51 cfs. The XP-SWMM incorporates both hydrology and hydraulics to dynamically simulate real storm events and determine sewer capacity in storm systems. Therefore the existing storm sewer between Greenwood and Vernon Avenues is required to handle 51 cfs and can only convey what is tributary from upstream. In addition to the XP-SWMM analysis, CBBEL calculated the capacity of the existing storm sewer between Greenwood and Vernon Avenues using Manning's equation for pressure flow. The calculations show that the existing storm sewer between Greenwood and Vernon Avenues has sufficient capacity to convey the flow (51 cfs) coming to the system under proposed conditions. The pressure head elevation used in this calculation is at the pavement elevation. The calculations are included with this

memorandum. The calculations correspond to the XP-SWMM results. If the system has to convey a storm event greater than the 51 cfs, the roadways will convey the excess flow via overland flow. As has been mentioned many times, our design guideline was not to make sure there was no water on the street, but to make sure the proposed improvements avoided house flooding for the given design event. So as an event could happen where the flow from upstream of Vernon is greater than 51 cfs, the roadway will be conveying some of the excess runoff just as it would be doing upstream of Vernon because of the finite capacity of the storm sewers.

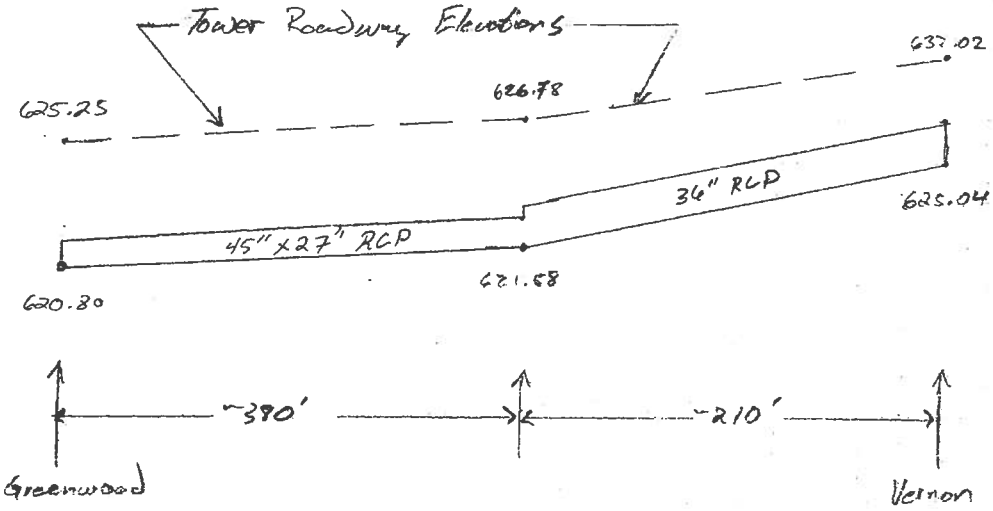
We also analyzed the replacement of the 36-inch RCP with a 48-inch RCP. This analysis showed that there are negligible benefits. It has always been CBBEL's recommendation not to replace the 36-inch with a 48-inch RCP to obtain a decrease of 0.1 feet in the pressure head for the cost of the new storm sewer and roadway replacement. If the Village of Winnetka prefers to go with a 48-inch RCP, we will change the plans accordingly.

N:\WINNETKA\120462\Water\Summary\M_Tower Rd Exisitng Pipe.docx

CHRISTOPHER B. BURKE
ENGINEERING, LTD.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500 Fax (847) 823-0520

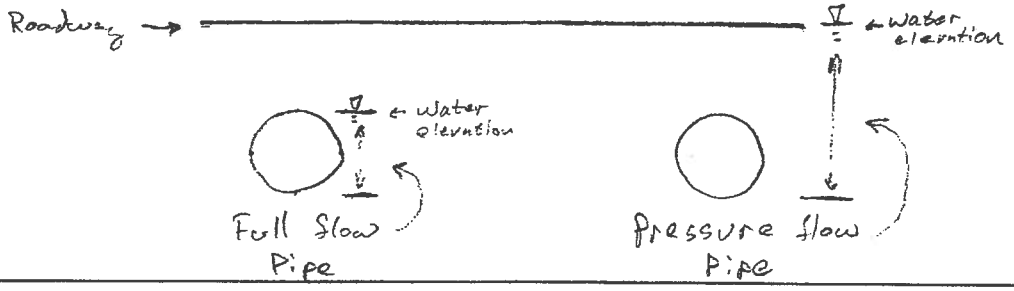
JOB 12-0462
SHEET NO. 1 OF 3
CALCULATED BY DRB DATE 6/27/13
CHECKED BY TTB DATE 6/28/13
SCALE NTS

- Pipe capacity calculations between Vernon and Greenwood



N.T.S.
(Tower Rd) Storm Sewer profile)

- Total length of storm sewer Vernon to Greenwood is approximately 590'.
- Approximately 210' west of Vernon, the existing storm sewer changes from 36" RCP to 45" x 27" RCP and the slope decreases.
- Under full flow conditions, the capacity in the pipes is calculated using Manning's equation, and under pressure flow conditions the capacity in the pipe is calculated using a modified version of Manning's equation for pressure.



CHRISTOPHER B. BURKE
ENGINEERING, LTD.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500 Fax (847) 823-0520

JOB 12-0462
SHEET NO. 2 OF 3
CALCULATED BY DAB DATE 6/27/13
CHECKED BY TTB DATE 6/27/13
SCALE

- A pipe is flowing under pressure when the water elevation in the pipe begins to exceed the top of the pipe through the manholes

- The capacity of a pipe flowing under pressure is given by

$$Q = A_p \left[\frac{h_p}{\frac{K_e + K_o}{2g} + \frac{2.87 n^2 L}{D^{4/3}}} \right]^{1/2}$$

where
- Q = flowrate (cfs)
- A_p = area of pipe (ft^2)
- K_e = entrance loss coefficient
- K_o = outlet loss coefficient
- D = diameter of pipe (ft)
- L = length of pipe (ft)
- h_p = height of water surface above center of pipe opening in (ft)
- g = acceleration due to gravity (32.2 ft/sec^2)
- n = manning's coefficient of roughness. 0.013 conc.

- For the case of the 45"x27" RCP flowing under pressure where the water surface elevation is at the rim of the manhole:

$A_p = 7.4\ ft^2$ ⇒ cross sectional area of elliptical pipe.

$h_p = 626.78 - (621.58 + (27"/2)/12) = 4.08'$

D for an elliptical pipe will be $27"/12 = 2.25'$ (conservative)

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ENGINEERING, LTD.
9575 West Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500 Fax (847) 823-0520

JOB 12-0462
SHEET NO. 3 OF 3
CALCULATED BY PRB DATE 6/27/13
CHECKED BY TJB DATE 6/27/13
SCALE

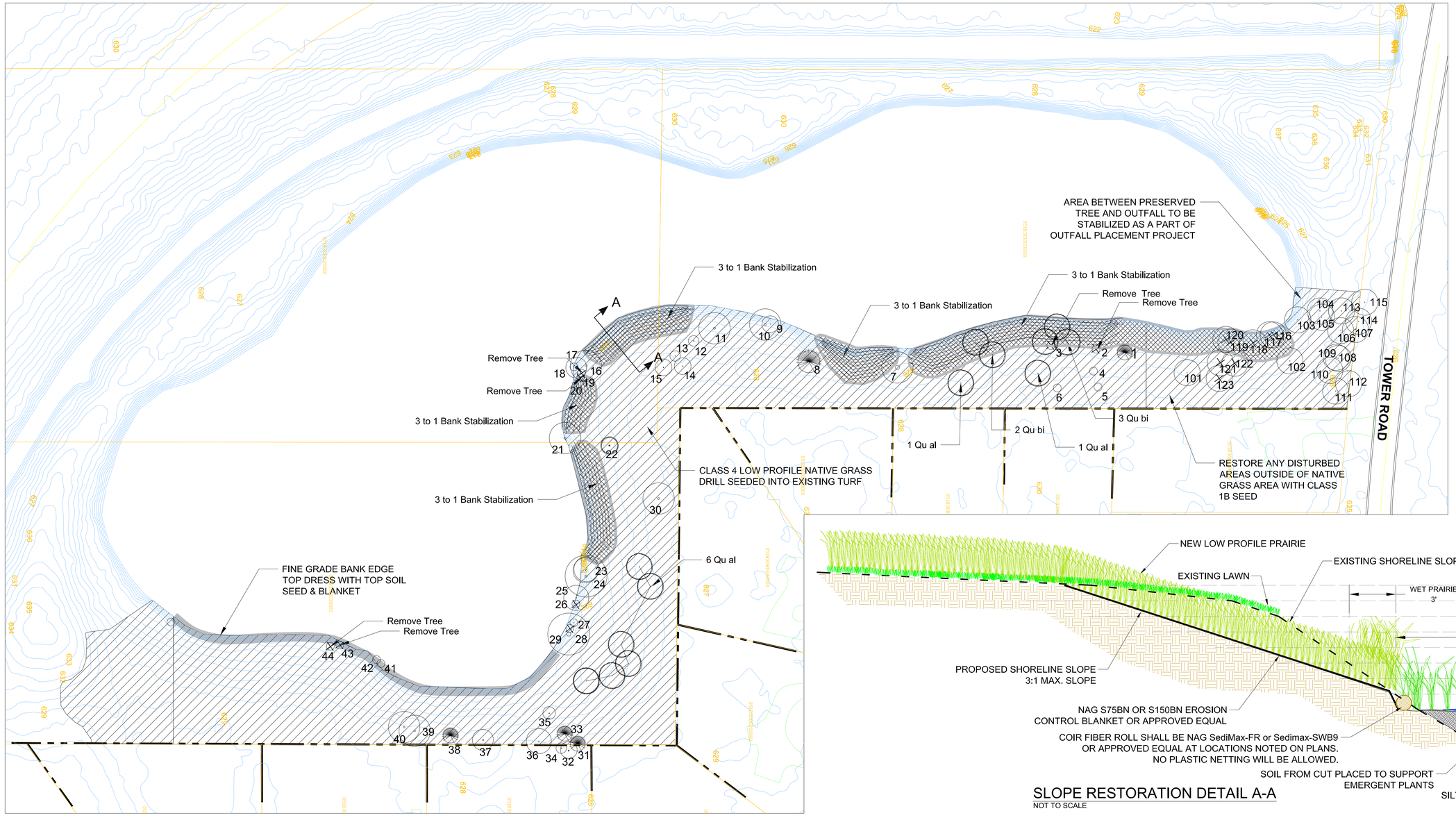
$$Q = 7.4\,ft^2 \left[\frac{4.08\,ft}{\frac{0.5 + 1.0}{2(32.2\,ft/sec^2)} + \frac{2.87(0.013)^2(380ft)}{2.25ft^{4/3}}} \right]^{1/2}$$

$$Q = 7.4\,ft^2 \left[\frac{4.08}{0.0233 + 0.0625} \right]^{1/2}$$

$$Q = 7.4\,ft^2 \left[6.8\,ft/sec \right] = 51\,ft^3/sec \checkmark$$

★ 51 cfs flowing through the 45" x 27" RCP with 4.08 ft of pressure (rim to center of pipe).

Attachment #3 Tower Road lagoon plan



SLOPE RESTORATION DETAIL A-A
NOT TO SCALE

LANDSCAPE PLAN

0 25 50 100

NORTH

LEGEND

- FINE GRADE BANK EDGE TOP DRESS WITH TOPSOIL, SEED AND BLANKET
- CLASS 4A LOW PROFILE NATIVE GRASS DRILL SEEDED INTO EXISTING TURF
- 3:1 BANK STABILIZATION SEE SLOPE RESTORATION DETAIL
- EXISTING TREE (36)
- EXISTING TREE TO BE REMOVED (44)
- PROPOSED TREE
- CLASS 1B SEED OF DISTURBED AREAS

PLANT LIST

Sym,	Botanical Name	Common	Qty.	Size	Cond.
Deciduous Canopy Trees					
Qu al	Quercus alba	White Oak	8	2"	B & B
Qu bi	Quercus bicolor	Swamp W	5	2"	B & B

SUMMARY OF QUANTITIES

ITEM	QTY.	UNIT
CUT AND FILL (ON SITE)	922	CY
COIR FIBER LOG	720	LF
EMERGENT LIVE PLANTS	2,160	SF
CLASS 4B WET PRAIRIE SEED MIX	2,084	SY
CLASS 4A	14,678	SY
TREES TO BE REMOVED	16	EA
NEW TREES	13	EA

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Rosemont, Illinois 60018
(847) 823-0500

CLIENT: VILLAGE OF WINNETKA
Incorporated in 1869

NO.	DATE	NATURE OF REVISION	CHKD.

DSGN.	LMF
DWN.	EDT
CHKD.	LMF
SCALE:	1" = 50'
PLOT DATE:	
CAD USER:	
MODEL:	

FILE NAME: N:\WINNETKA\120462\Landscaping\120462.00002

TITLE: LANDSCAPE PLAN

PROJ. NO. 120462.0002
DATE: 3/14/14
SHEET 1 OF 2
DRAWING NO. L-1