

## Request for Delisting Gem Lake from the Minnesota Pollution Control Agency's 303D Impaired Waters List



Pictured – Brian Corcoran, Water Resource Manager, VLAWMO, paddling Gem Lake

Prepared by Tyler Thompson, GIS Watershed Technician, VLAWMO

August, 2017

*Special thanks to: Kathleen Robins for allowing VLAWMO staff access to her property for sampling, as well as to the Swomley family to allow access to their property for installing Gem's staff gauge*

Gem Lake, located in Gem Lake, MN, was assessed in 2009 as not meeting the standards for nutrients pollutants affecting aquatic recreation use and was placed on the MPCA's Impaired Waters List in 2010. Gem had its highest annual average for nutrients in 2009, and, since then, TP levels have significantly decreased to nearly half the MPCA's standard of 60 µg/L for shallow lakes consistently for the last 5 monitoring seasons. Chl-a levels have gone above MPCA's standard of 20 µg/L for shallow lakes twice since 2009: 24 µg/L in 2010 and 23 µg/L in 2015. The average level of Chl-a from May, 2010 to August, 2017 has been 15 µg/L.

Gem Lake's watershed and catchment area is about 328 acres, and of this, 52.6 acres or 16% of the subwatershed is impervious surface, and just a fraction of that makes its way directly into the lake's basin. Within the Lake's subwatershed, 3.69 acres of U.S. Route 61 drains towards Gem Lake. Since reconstruction of this section of the Highway in 2011, nutrient levels in Gem Lake have dramatically decreased. Reconstruction in this section of the Highway that drains towards Gem Lake, ditches were regraded, erosion issues were mitigated, ditch blocks were installed, and vegetation was established where mowed turf previously existed.

Just to the east of Gem Lake, the sanitary sewer under Scheuneman Road was lined in 2010, which had the potential for impacting nutrient levels in the Lake by mode of shallow ground water transfer before the sanitary sewer was lined. Also in the year 2010, Scheuneman Road south and east of highway 61 was reconstructed, ditches regraded and vegetation established, greatly improving stormwater conditions before discharging by pipe underground to the NB Highway 61 ditch and eventually into Gem Lake. Years after reconstruction, site conditions are much better than before reconstruction.

#### **By the numbers:**

- Gem Lake subwatershed: 328 acres
- Gem Lake basin: 27 acres total, 21 acres open water
- 16% of the land surface in the Gem Lake subwatershed is impervious
- 89 µg/L: the average of TP samples during the 2009 sampling season
- 36 µg/L: the average of ALL TP samples from Gem Lake for the last 8 monitoring seasons, May, 2010 – August, 2017

#### **Highway 61, MNDOT Project 6222-161, 2011**

- Improved grading and removed sediment
- Replaced and improved storm sewer infrastructure
- Ditch block installed in ditches to slow stormwater and increase infiltration before reaching Gem Lake



- Established vegetation (MNDoT seed mix 250) where erosion was once an issue, slowing discharge rates and increasing infiltration in the NB ditches and swales before they flow west to the SB ditch wetland and then into Gem Lake

**Scheuneman Road (north and west of Hwy 61) sanitary sewer lining, 2010**

- Lined sanitary sewer lines, potentially ceasing shallow groundwater nutrient loading from leaking lines into Gem Lake

**Scheuneman Road (south and east of Hwy 61) reconstruction, 2010**

- Re-grading of the west ditch, including re-seeding and the addition of rip-rap at the end of the ditch. Years later, post-construction, the vegetation is much healthier than before reconstruction
- Storm water from this ditch routes underground and over to the east ditch of the NB lane of Highway 61

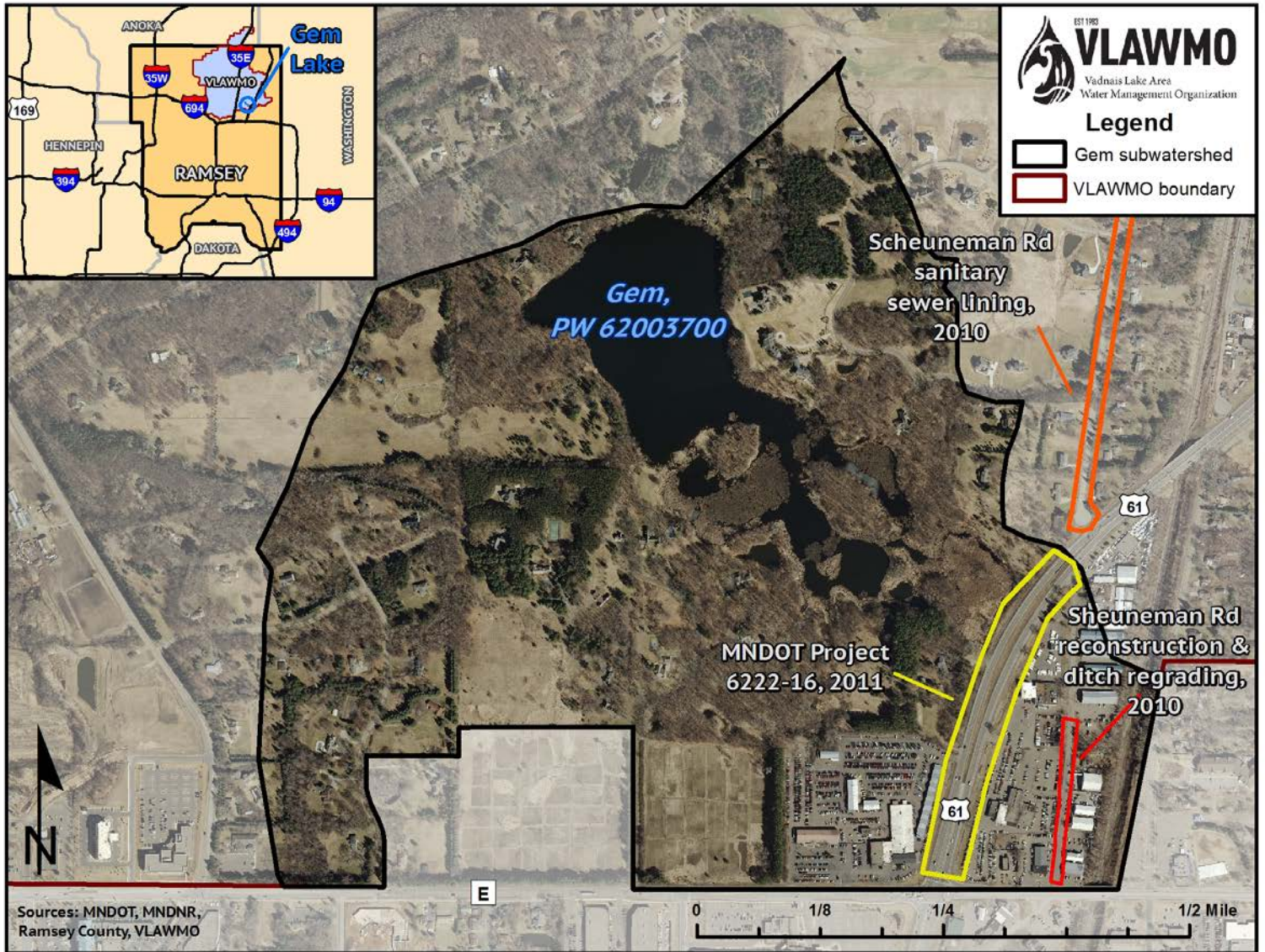
**Tables 1 & 2:** Illustrating total phosphorus and chlorophyll-a levels in Gem Lake the last 11 monitoring seasons.

Sample Year	TP avg µg/L	% below standard
2007	48	2.0%
2008	64	6.7% above
2009	89	48% above
2010	53	11.6%
2011	32	46.7%
2012	41	31.7%
2013	35	41.7%
2014	31	48.3%
2015	38	36.7%
2016	30	50.0%
2017 (Aug)	29	51.7%

Sample Year	Chl-a avg µg/L	% below standard
2007	33	65% above
2008	17	15.0%
2009	28	40% above
2010	24	20% above
2011	6.4	68.0%
2012	11	45.0%
2013	17	15.0%
2014	8	60.0%
2015	23	15% above
2016	18	1.0%
2017 (Aug)	12	40.0%



Based on data from the last 8 monitoring seasons, or 76 samples taken per VLAWMO's regularly-scheduled monitoring program, total phosphorus levels in Gem have been reasonably below shallow lake state standard since 2010. Chlorophyll-a levels have been shown to be close to state standard, as well as above standard in 2015 and 2010 since 2009. With the two parameters combined and looking at the trend in water quality data on Gem Lake since monitoring began in 1997 (see appendix A, page 33), the Watershed is asking that Gem Lake be reviewed for removal from the MPCA's 303D Impaired Waters List.



**Figure 1:** Map illustrating Gem Lake's location and subwatershed, as well as the projects as mentioned above that may have led to the reduction of nutrients in the basin.

## Appendix A:

### VLAWMO's 2016 Water Quality Report

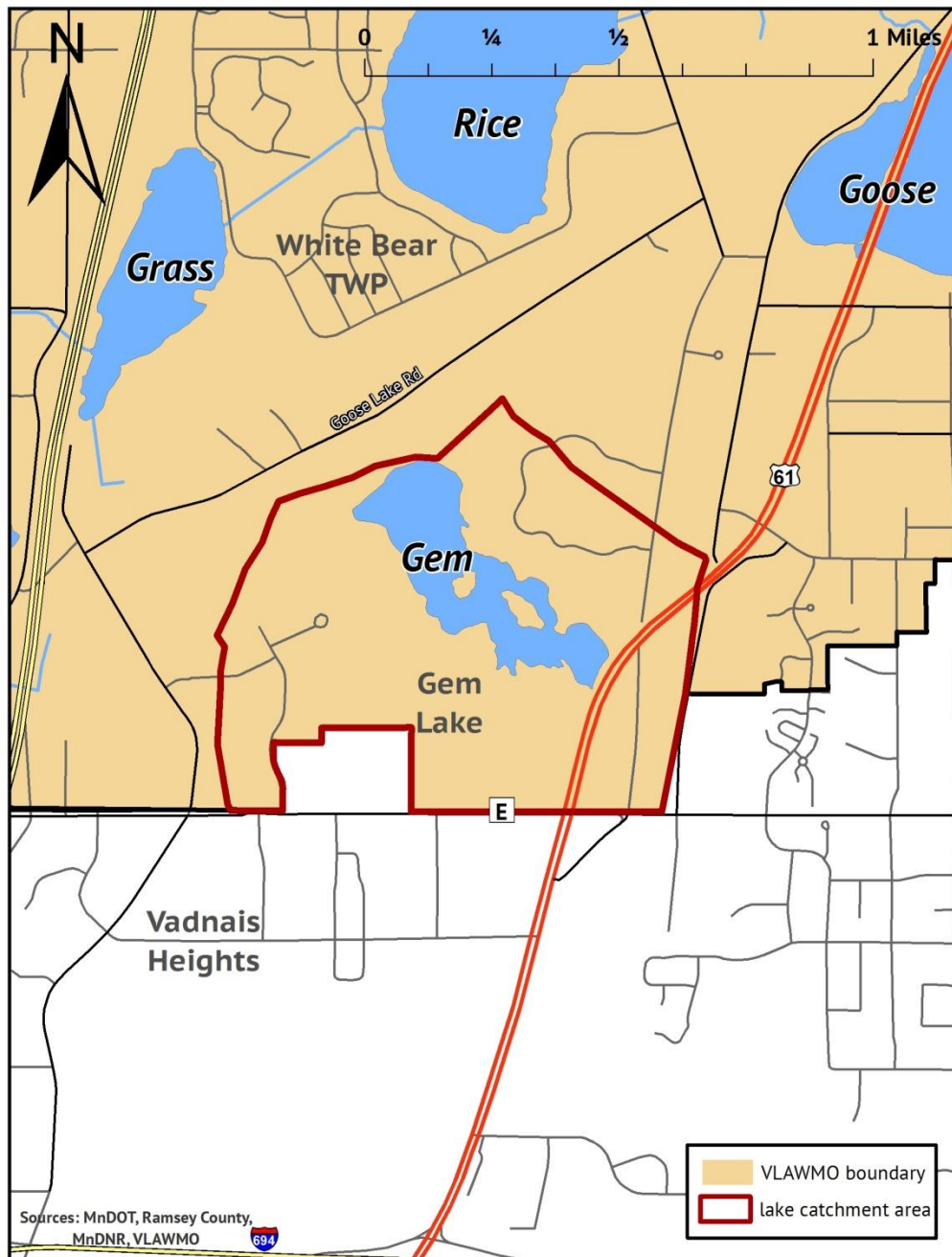
(pages 32-34 excerpted from Report regarding Gem Lake)

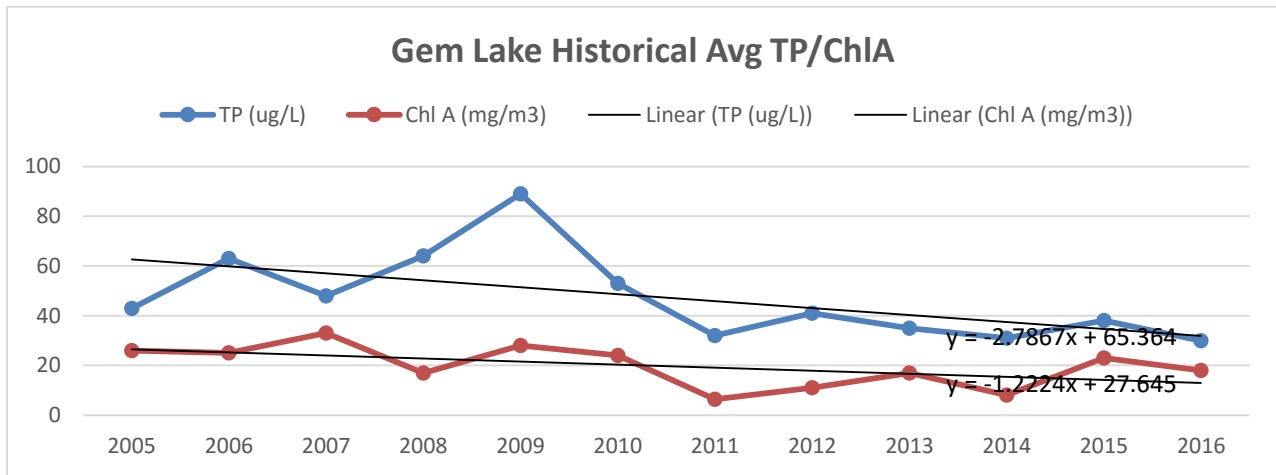


## Gem Lake

Gem Lake is within the City of Gem Lake and has no public access. It is 25 acres in size and is 17 feet deep. There has been development along portions of the lake in recent years. In 2000, volunteers noticed a distinct algae bloom and noted that water clarity was getting poorer. Over the 16 years of monitoring data there is a slight up trend in TP levels with a slight down trend in ChlA levels.

Gem Lake has also been included on the Lambert Creek TMDL study for nutrient impairment. Recent years of monitoring data are suggesting that the trend may be heading down for nutrient levels in Gem Lake and the MN Pollution Control Agency will be assessing the data winter of 2017 for removal from the state impaired waters list. The City of Gem Lake, VLAWMO and stakeholders will be working together to implement the TMDL strategies from the approved 2014 report. MNDOT's Hwy 61 ditch work in 2011 has seemed to improve the water quality in Gem Lake.





#### Gem Lake Data

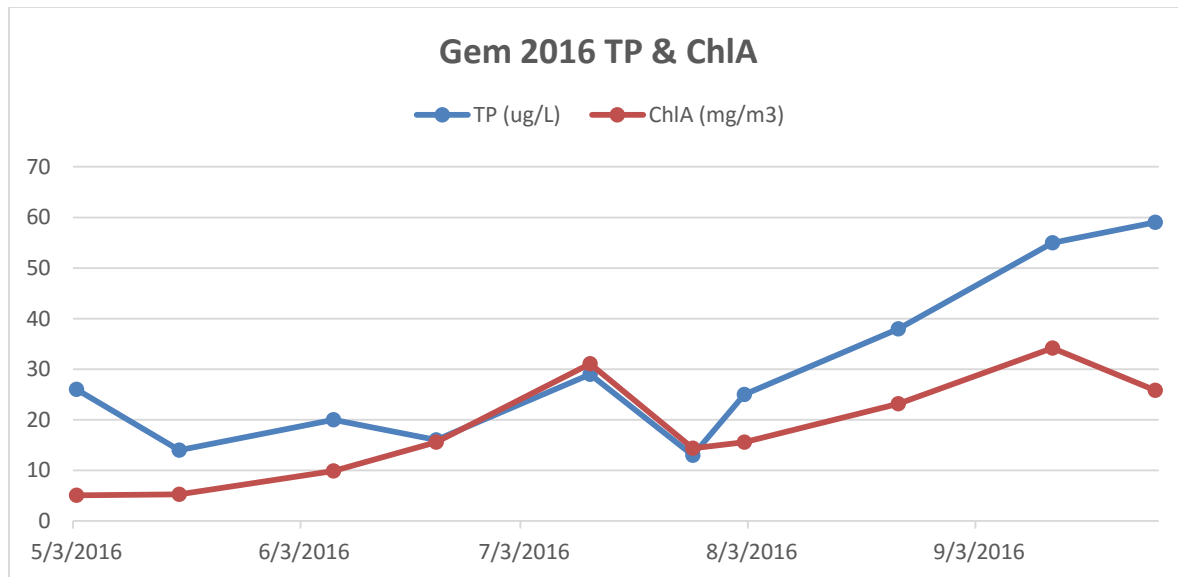
Gem Lake Historical Avg TP/Chl A/SDT				Date	Reading Depth (Bottom/Middle/Top)	Temp °C	Conductivity (mS/cm)	DO (mg/L)	pH
Year	TP (ug/L)	Chl A (mg/m3)	Secchi (m)						
				5/16/2016	b	13.3	0.185	6.83	8.07
1997	54	23	1.2	5/16/2016	m	14.08	0.185	7.11	8.06
1998	33	24		5/16/2016	t	14.31	0.185	7.3	8.15
1999	26	16	1.2	6/10/2016	b	16.16	0.192	1	7.81
2000	36	17	1.1	6/10/2016	m	21.09	0.191	6.93	8.07
2001	56	12	1.8	6/10/2016	t	23.22	0.19	6.79	8.74
2002	39	25	1.3	7/20/2016	b	24.72	0.185	4.66	7.61
2003	52	20	1.4	7/20/2016	t	26.35	0.185	5.92	8.23
2004	49	0	1.5	9/20/2016	b	20.29	0.176	3.28	8.19
2005	43	26	0	9/20/2016	m	20.49	0.176	5.69	8.19
2006	63	25	0	9/20/2016	t	20.58	0.176	5.78	8.15
2007	48	33	1.1						
2008	64	17	1.5						
2009	89	28	1.3						
2010	53	24	1.4						
2011	32	6.4	2.1						
2012	41	11	2						
2013	35	17	2						
2014	31	8	2.9						
2015	38	23	2.2						
2016	30	18	1.6						

- Gem Lake YSI data is similar to that of other metro lakes. Conductivity is pretty low which is good and usually Gem Lake shows signs of stratification. At 17ft, Gem is the deepest lake VLAWMO monitors. Gem usually has a late season algae bloom and that was the case in 2015. TP and ChlA levels are well below state standards for the 5<sup>th</sup> year in a row. Hwy 61 was redone in 2011 and MNDOT did work on the ditches along the Hwy. That work seems to have benefited the water quality in Gem

**Gem Lake 2016 Raw Data**

SITE	DATE	Secchi (ft)	TP (ug/L)	ChlA (mg/m3)	TKN (mg/L)	NH3 (mg/L)	Cl (mg/L)
Gem	3/28/2016						38
Gem	5/3/2016	8	26	5.1	0.71		
Gem	5/17/2016	9	14	5.3			
Gem	6/7/2016	5	20	9.9	1.1	ND	
Gem	6/21/2016	5.5	16	15.6			
Gem	7/12/2016	3	29	31.1	1.5	ND	
Gem	7/26/2016	4	13	14.4			
Gem	8/2/2016	5.5	25	15.6	0.88	ND	
Gem	8/23/2016	4	38	23.2			
Gem	9/13/2016	3	55	34.2	1	ND	
Gem	9/27/2016	4	59	25.8			

- Nitrogen and ammonia levels are below state standards for Gem Lake.





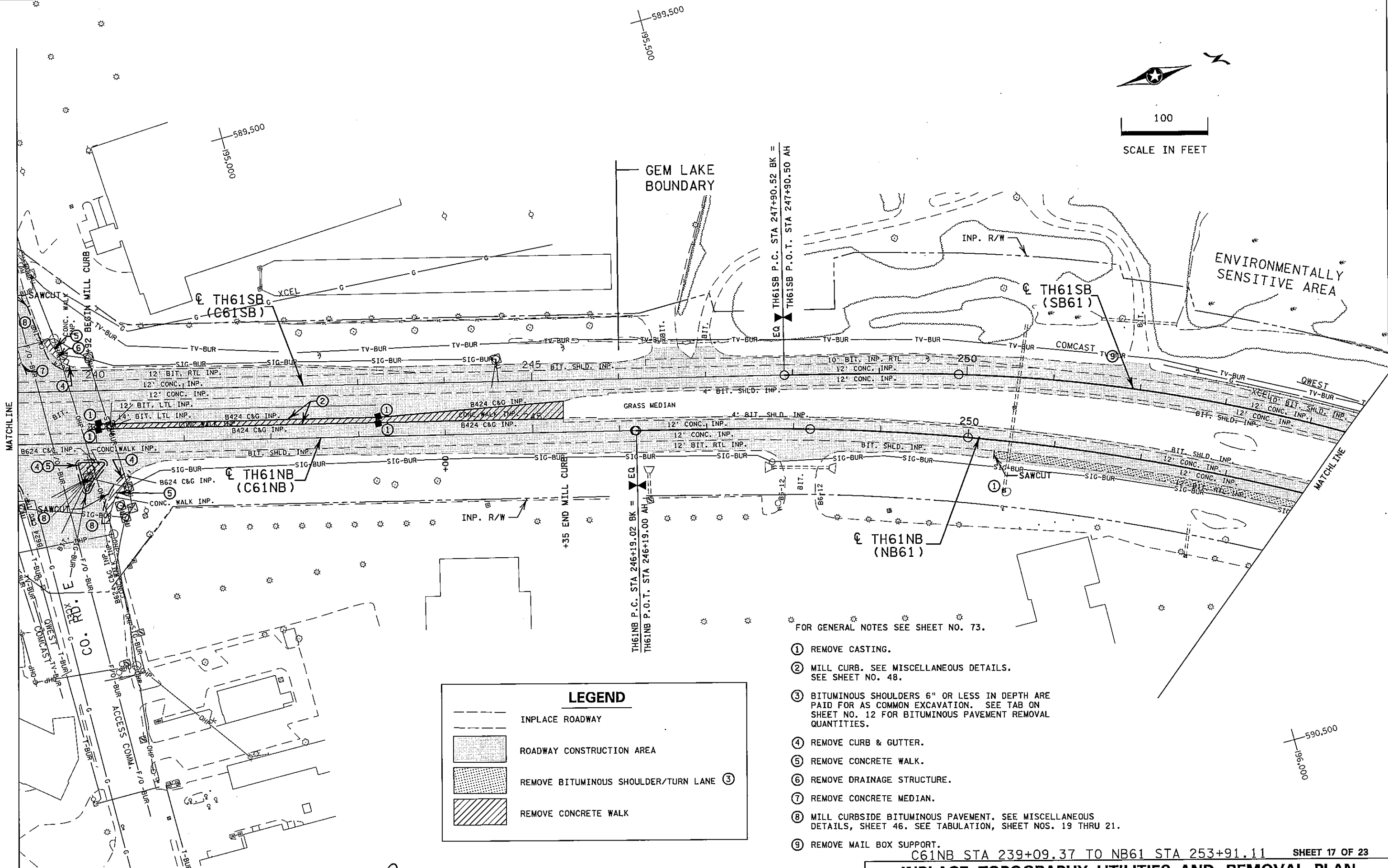
# Appendix B:

## Highway 61 Reconstruction Plans



PLOTTED/REVISED: 16-MAR-2010 10:38

DISTRICT #: METRO  
PLOT NAME: d6222161\_sht\_topol7  
PATH & FILENAME: d6222161\_sht\_topol7.dgn



**LEGEND**

	INPLACE ROADWAY
	ROADWAY CONSTRUCTION AREA
	REMOVE BITUMINOUS SHOULDER/TURN LANE ③
	REMOVE CONCRETE WALK

FOR GENERAL NOTES SEE SHEET NO. 73.

- ① REMOVE CASTING.
- ② MILL CURB. SEE MISCELLANEOUS DETAILS. SEE SHEET NO. 48.
- ③ BITUMINOUS SHOULDERS 6" OR LESS IN DEPTH ARE PAID FOR AS COMMON EXCAVATION. SEE TAB ON SHEET NO. 12 FOR BITUMINOUS PAVEMENT REMOVAL QUANTITIES.
- ④ REMOVE CURB & GUTTER.
- ⑤ REMOVE CONCRETE WALK.
- ⑥ REMOVE DRAINAGE STRUCTURE.
- ⑦ REMOVE CONCRETE MEDIAN.
- ⑧ MILL CURBSIDE BITUMINOUS PAVEMENT. SEE MISCELLANEOUS DETAILS, SHEET 46. SEE TABULATION, SHEET NOS. 19 THRU 21.
- ⑨ REMOVE MAIL BOX SUPPORT.

C61NB STA 239+09.37 TO NB61 STA 253+91.11 SHEET 17 OF 23

**INPLACE TOPOGRAPHY, UTILITIES, AND REMOVAL PLAN**

DRAWN BY: RAS

CHECKED BY: RDK

CERTIFIED BY

LICENSED PROFESSIONAL ENGINEER

LIC. NO. 17962 DATE 3/16/10

STATE PROJ. NO. 6222-161 (T.H. 61)

SHEET NO. 89 OF 173 SHEETS

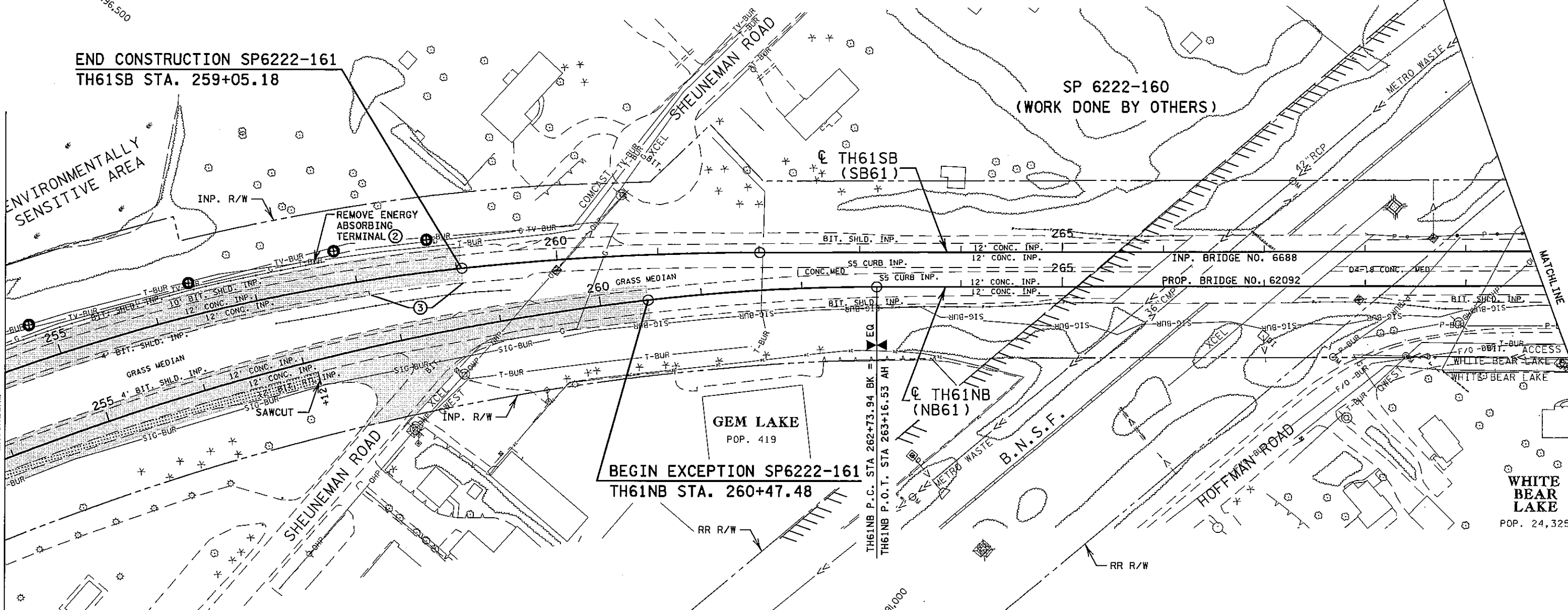
PLOTTED/REVISED: 16-MAR-2010 10:47

590,000  
196,500

END CONSTRUCTION SP6222-161  
TH61SB STA. 259+05.18

SP 6222-160  
(WORK DONE BY OTHERS)

ENVIRONMENTALLY  
SENSITIVE AREA



BEGIN EXCEPTION SP6222-161  
TH61NB STA. 260+47.48

GEM LAKE  
POP. 419

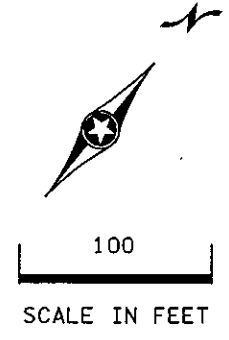
WHITE  
BEAR  
LAKE  
POP. 24,325

FOR GENERAL NOTES SEE SHEET NO. 73.

- ① BITUMINOUS SHOULDERS 6" OR LESS IN DEPTH ARE PAID FOR AS COMMON EXCAVATION. SEE TAB ON SHEET NO. 12 FOR BITUMINOUS PAVEMENT REMOVAL QUANTITIES.
- ② ET-2000.
- ③ INSIDE SHOULDER WORK IN THIS AREA DONE BY OTHERS UNDER SP 6222-160.

**LEGEND**

- INPLACE ROADWAY
- ROADWAY CONSTRUCTION AREA
- REMOVE BITUMINOUS SHOULDER/TURN LANE ①
- CLEAR AND GRUB TREE



DISTRICT #: METRO  
PLOT NAME: d6222161\_sht\_topol8  
PATH & FILENAME: d6222161\_sht\_topol8.dgn

590,000  
196,000

591,000  
196,500

NB61 STA 253+91.11 TO 269+77.16 SHEET 18 OF 23

**INPLACE TOPOGRAPHY, UTILITIES, AND REMOVAL PLAN**

DRAWN BY: RAS

CHECKED BY: RDK

CERTIFIED BY *[Signature]*

LICENSED PROFESSIONAL ENGINEER

LIC. NO. 17962 DATE 3/16/10

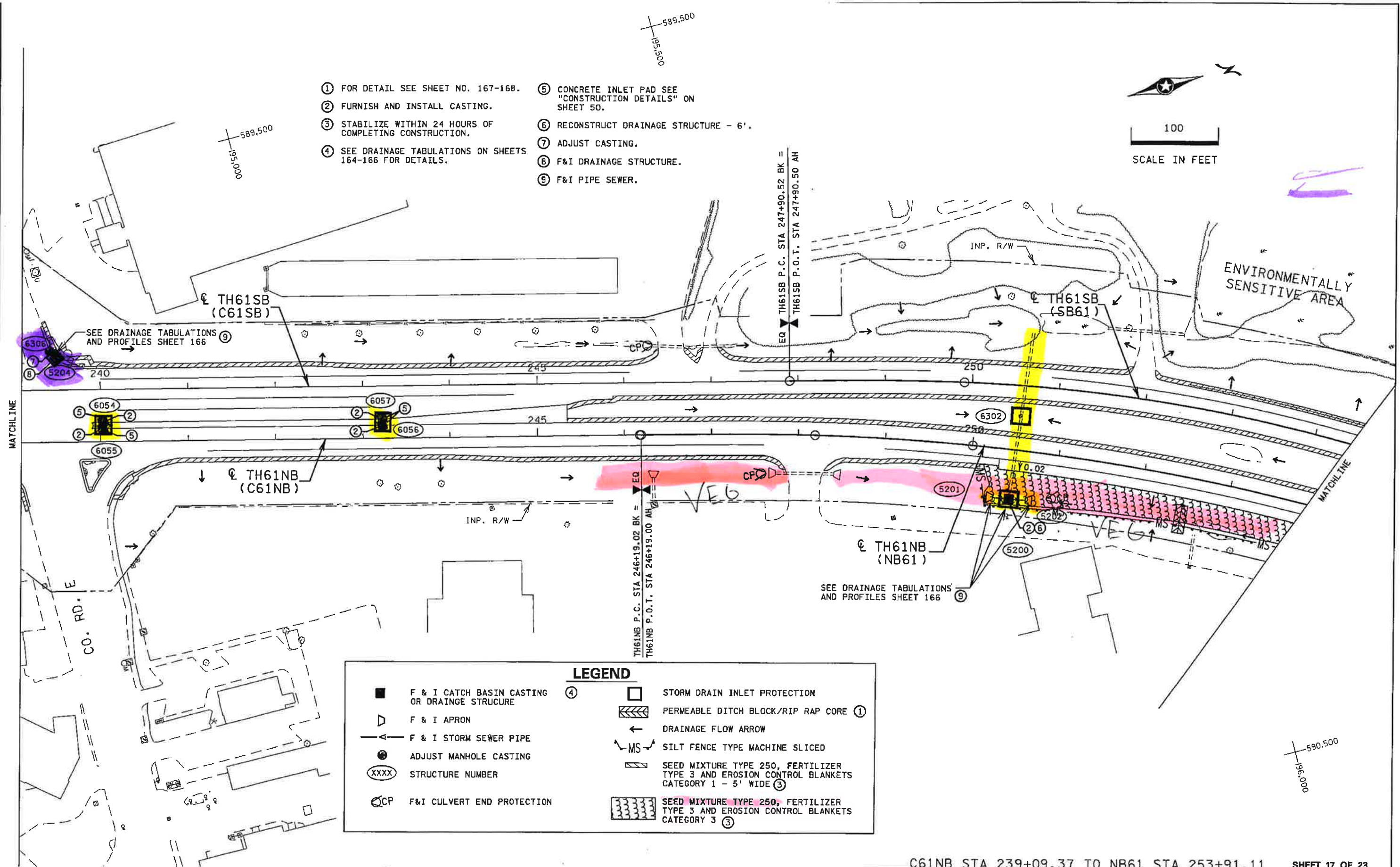
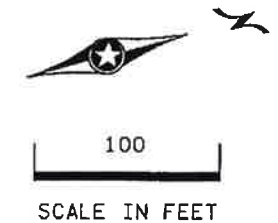
STATE PROJ. NO. 6222-161 (T.H. 61)

SHEET NO. 90 OF 173 SHEETS

PLOTTED/REVISED: 15-MAR-2010 11:58

DISTRICT #: METRO  
PLOT NAME: 6222161\_sht\_d17  
PATH & FILENAME: 6222161\_sht\_d17.dgn

- ① FOR DETAIL SEE SHEET NO. 167-168.
- ② FURNISH AND INSTALL CASTING.
- ③ STABILIZE WITHIN 24 HOURS OF COMPLETING CONSTRUCTION.
- ④ SEE DRAINAGE TABULATIONS ON SHEETS 164-166 FOR DETAILS.
- ⑤ CONCRETE INLET PAD SEE "CONSTRUCTION DETAILS" ON SHEET 50.
- ⑥ RECONSTRUCT DRAINAGE STRUCTURE - 6'.
- ⑦ ADJUST CASTING.
- ⑧ F&I DRAINAGE STRUCTURE.
- ⑨ F&I PIPE SEWER.



LEGEND	
■	F & I CATCH BASIN CASTING OR DRAINAGE STRUCTURE ④
▽	F & I APRON
—▲—	F & I STORM SEWER PIPE
●	ADJUST MANHOLE CASTING
XXXX	STRUCTURE NUMBER
⊙CP	F&I CULVERT END PROTECTION
□	STORM DRAIN INLET PROTECTION
▨	PERMEABLE DITCH BLOCK/RIP RAP CORE ①
←	DRAINAGE FLOW ARROW
MS	SILT FENCE TYPE MACHINE SLICED
▨	SEED MIXTURE TYPE 250, FERTILIZER TYPE 3 AND EROSION CONTROL BLANKETS CATEGORY 1 - 5' WIDE ③
▨	SEED MIXTURE TYPE 250, FERTILIZER TYPE 3 AND EROSION CONTROL BLANKETS CATEGORY 3 ③

C61NB STA 239+09.37 TO NB61 STA 253+91.11 SHEET 17 OF 23

### DRAINAGE, EROSION CONTROL, AND TURF ESTABLISHMENT PLAN

DRAWN BY: R.A.S.    CHECKED BY: R.D.K.    CERTIFIED BY: *[Signature]* LIC. NO. 17962    DATE: 3/16/10

STATE PROJ. NO. 6222-161 (T.H. 61)    SHEET NO. 157 OF 173 SHEETS

PLOTTED/REVISED: 15-MAR-2010 11:58

DISTRICT #: METRO  
PLOT NAME: 6222161\_sht\_dri18  
PATH & FILENAME: 6222161\_sht\_dri18.dgn

TH61 (61NB) STATION 259+05.83  
END CONSTRUCTION

ENVIRONMENTALLY  
SENSITIVE AREA

SHEUNEMAN ROAD

TH61SB  
(SB61)

INP. BRIDGE (NO. 6688)  
PROP. BRIDGE NO. 62092

BEGIN  
EXCEPTION  
NB61 STA.  
260+47.48

GEM LAKE  
POP. 419

TH61NB  
(NB61)







B.N.S.F.

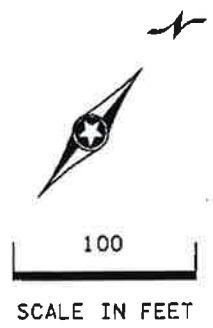
HOFFMAN ROAD

WHITE  
BEAR  
LAKE  
POP. 24,325

- ① STABILIZE WITHIN 24 HOURS OF COMPLETING CONSTRUCTION.
- ② FOR DETAIL SEE SHEET NO. 167-168.

**LEGEND**

-  EXCEPTION AREA
-  DRAINAGE FLOW ARROW
-  SILT FENCE TYPE MACHINE SLICED
-  SEED MIXTURE TYPE 250, FERTILIZER TYPE 3 AND EROSION CONTROL BLANKETS CATEGORY 1 - 5' WIDE ①
-  SEED MIXTURE TYPE 250, FERTILIZER TYPE 3 AND EROSION CONTROL BLANKETS CATEGORY 3 ①
-  PERMEABLE DITCH BLOCK/RIPRAP CORE ②



NB61 STA 253+91.11 TO 269+77.16 SHEET 18 OF 23

**DRAINAGE, EROSION CONTROL, AND TURF ESTABLISHMENT PLAN**

STATE PROJ. NO. 6222-161 (T.H. 61) SHEET NO. 158 OF 173 SHEETS

DRAWN BY: R.A.S.

CHECKED BY: R.D.K.

CERTIFIED BY

*Robert D. K...*  
LICENSED PROFESSIONAL ENGINEER

LIC. NO. 17962

DATE 3/16/10

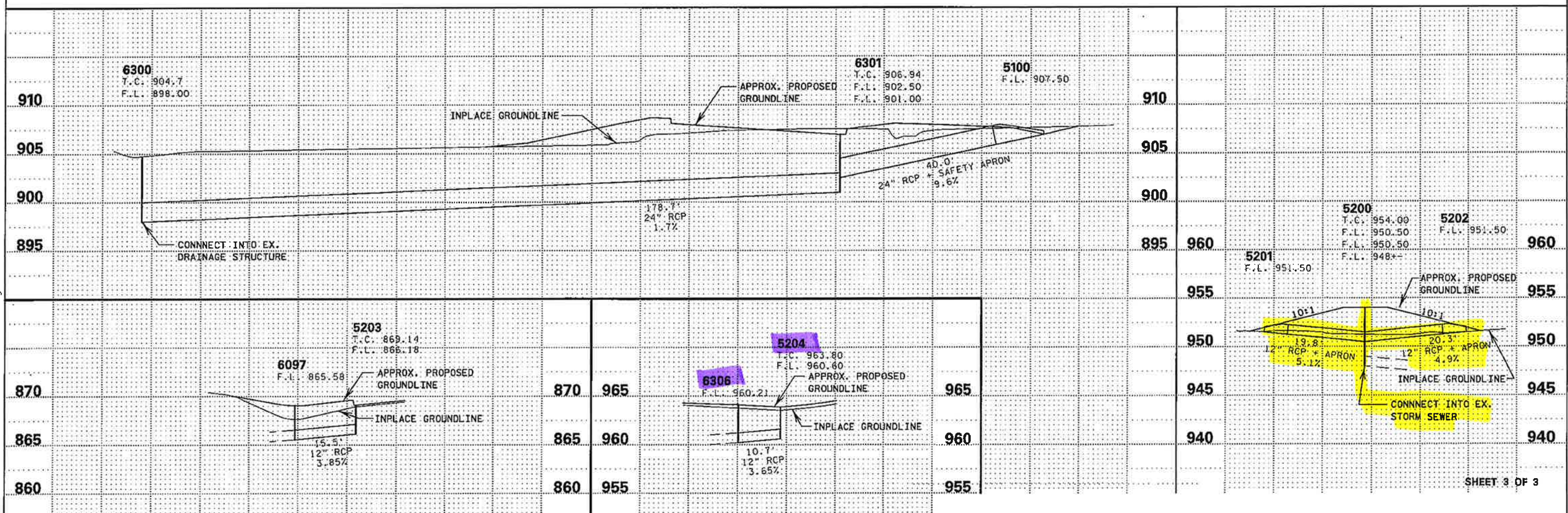
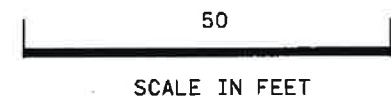
PLOTTED/REVISED: 17-MAR-2010 11:20

### DRAINAGE TABULATION (THIS SHEET ONLY) ⑤

STRUCTURE NO.		STRUCTURE LOCATION			DRAINAGE STRUCTURES												12" RCP CL II	24" RCP CL II	APRON	APRON TYPE	GUIDE POSTS TYPE B	CONNECT INTO EXISTING STORM SEWER	CONNECT INTO EXISTING DRAINAGE STRUCTURE	REMARKS															
					REMOVE PIPE CULVERTS	REMOVE METAL APRON	REMOVE DRAINAGE STRUCTURE	REMOVE CASTING	TYPE	DESIGN/PAY HEIGHT	DESIGN/PAY HEIGHT	RECONSTRUCT STRUCTURE	CASTING ASSEMBLY TYPE	CONE TYPE	STEPS REQ'D	TOP OF CASTING ELEV.									OUTLET ELEV.	INLET ELEV.													
										A OR F	H																LIN FT	LIN FT	LIN FT	①	④								
5203	6097	61NB	65+94	51 RT					CB		3.0					869.14	866.18	865.58	16																				
6097	6305	61NB	65+79	55 LT					DROP INLET			4.0				869.20																					1		
5204	6306	C61SB	239+50	37 LT					1	1	CB		3.2			963.80	960.60	960.21	11																				
5100	6301	C61NB	215+16	25 LT	64	1			APRON							907.50	902.50			40	1	24" RC SAFETY	1																
6301	6300	C61NB	214+64	28 LT		1			CB		5.9			B-4	A	YES	906.94	901.00	898.00																				
6300		C61NB	212+85	28 LT					CB					M-11																								1	
5201	5200	NB61	250+22	57 RT					APRON							951.50	950.50	950.50	20		1	12" RC APRON	1																
5202	5200	NB61	250+75	75 RT					APRON							951.50	950.50	950.50	20		1	12" RC APRON	1																1
5200	6302	NB61	250+48	48 RT					CB			6.0		M-11	A	YES	954.00	948.00																				③	
<b>TOTALS</b>					<b>64</b>	<b>2</b>	<b>1</b>	<b>1</b>			<b>5.9</b>	<b>6.2</b>	<b>10.0</b>	<b>5</b>						<b>67</b>	<b>219</b>	<b>3</b>		<b>3</b>								<b>3</b>	<b>1</b>	<b>4</b>					

NOTES: - STATION AND OFFSET ARE AT CENTER OF STRUCTURE UNLESS OTHERWISE NOTED.  
 - FLOWLINE (F.L.) ELEVATIONS ARE AT CENTER OF STRUCTURE ON PROFILES, EDGE OF STRUCTURE ON TABULATIONS, OR END OF APRON.  
 - ALL CONCRETE PIPE SEWER IS DESIGN 3006 GASKET JOINT PIPE.  
 - TOP OF CATCH BASIN CASTING ELEVATIONS COMPUTED USING A SUMP OF 0.1 FT.  
 - MANHOLE REQUIRES NO SUMP.

- ① FOR CASTING ASSEMBLY KEY & SUMMARY, SEE SHEET NO. 15.
- ② INLET ELEVATION AT DOWN-STREAM STRUCTURE.
- ③ EXISTING STORM SEWER.
- ④ INCIDENTAL.
- ⑤ SEE DRAINAGE SUMMARY FOR COST SPLITS.



I HEREBY CERTIFY THAT SHEET 166 WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.  
 PRINT NAME: **JEFFREY D. GIBBENS** LICENSE # **22117**  
 DATE: **3-17-10** SIGNATURE: *Jeffrey D. Gibbens*

**DRAINAGE TABULATIONS AND PROFILES**  
 STATE PROJ. NO. 6222-161 (T.H. 61) SHEET NO. 166 OF 173 SHEETS

DISTRICT #: METRO  
 PLOT NAME: d6222161.dwg  
 PATH & FILENAME: d6222161.dwg