



Memorandum

To: Ross Bintner
From: Dan Nesler, Brian LeMon, and Michael McKinney
Subject: GrandView Area Sanitary Sewer Analysis
Date: February 21, 2014
c:

Purpose

The purpose of this memorandum is to provide an analysis of the sanitary sewer capacity in the GrandView Area of the City of Edina (City). The GrandView area is served primarily by Lift Station 9 (LS9). The analysis was focused on the LS9 sewershed and the trunk lines down stream of LS9 to determine if the existing system has sufficient capacity to handle the anticipated flow from the expansion.

Previous work related to the City's Comprehensive Plan included the development of a computer-based sanitary sewer system model. The City's sanitary sewer model was created in 2006 as a part of an effort to analyze system capacity under various development scenarios and to help prioritize projects to reduce inflow and infiltration to the sanitary sewer. In 2013, the model was recalibrated based on historic sanitary sewer flows from 2006-2012 (*Sanitary Sewer Model Recalibration*, Barr Nov. 2013). For the current analysis, the recalibrated model was used to identify pipe capacity for each pipe segment within the study area.

Project Area

The GrandView area is shown in Figure 1. In general, the area is bounded by Highway 100 on the east, West 50th Street to the north, Vernon Avenue to the west, and Richmond Drive to the south. Currently sanitary sewer in this area drains to LS9. From LS9 it is pumped via a forcemain to the north into a gravity trunk line, which roughly follows Minnehaha Creek to the east until it leaves the City and discharges into MCES interceptor 1-MN-345. The location of the lift station, forcemain and trunk line are shown on Figure 3.

Background

The City is currently working on plans for potential redevelopment of the GrandView area. The potential redevelopment includes a mix of high density residential, commercial, and civic buildings. The City's public works facility was relocated from the GrandView area to its current location in southern Edina.

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This relocation made a large area available for redevelopment. Also located in the GrandView area is a Edina school district bus garage site, which is in the process of being relocated outside of the area. Redevelopment of these two properties is the main portion of Phase 1 of the GrandView redevelopment, and is currently planned to occur in the next one to five years. Ultimate redevelopment of the rest of the GrandView area is planned to occur in the next 10 plus years. Further detail can be found in the “*GrandView District Development Framework, April 5, 2012, Cunningham Group*”.

Projected Flows

Based on the land use information presented in the GrandView District Development Framework, projections were made for sanitary sewer flows that may be expected as result of development in the area. A flow of 75 gallons per day per person was used for the residential portion of the phase 1 redevelopment. It was assumed that apartments would have 2 occupants, condominiums would have 4 occupants, and townhomes would have 4 occupants. For the Office/Commercial land use, a unit flow of 25,000 gpd/ac was used. For the community land use, a unit flow of 15,000 gpd/ac was used. Unit flow projections are based on ASCE Manual of Practice No. 60, 2007 and Metcalf and Eddy, Waste Water Engineering, 1991. A daily average phase 1 flow of 48,700 gpd and peak flow of 140 gpm is projected, as shown in Table 1. Figure 2 shows the planned redevelopment that is included in phase 1.

Less detailed plans were provided in the development planning document for the ultimate redevelopment of the GrandView area. An ultimate projected flow was estimated based on the planned land use of the areas that may be redeveloped. Based on this information, projections were estimated and are summarized in Table 1. A unit flow of 10,750 gpd/ac was used for the residential development areas. This flow is based on the previous references and is consistent with flow estimates from other proposed developments in the City. A daily average ultimate flow of 197,700 gpd and peak flow of 520 gpm is projected, as shown in Table 1. Figure 2 shows the planned redevelopment that is included in ultimate redevelopment.

Modeling

The recalibrated City XP-SWMM sanitary sewer model (model) was used as a base for the GrandView redevelopment analysis. The existing model, developed in 2006, accounts for all sanitary inflows into the sanitary sewer based on 2005 winter quarter water sales. Sewer infiltration, determined from city-wide metering efforts during model construction, was also accounted for by incorporating pipe infiltration rates

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into the post-modeling results. In 2013, the model was recalibrated based on observed sanitary sewer flows from 2006-2012.

Projected phase 1 and ultimate flows were added to the model at LS9. An analysis of the pipes within the LS9 sewershed suggested that there are no flow restrictions within the sewershed with the increased flows.

Sewer availability, in terms of gpm units, was determined as the difference between total peak pipe flow (*cumulative infiltration + mean flow * peaking factor*) and the theoretical maximum pipe capacity. The nominal pump capacity of existing pumps was used in place of the mean flow from lift stations upstream in the study area and was not peaked. Discharge from LS9 was assumed to match the projected flow if the existing lift station pump's output was not adequate.

Results and Analysis

Figure 3 shows the remaining capacity, in gpm, of all pipe segments in the trunk line downstream of LS9 with Phase 1 redevelopment in place. Figure 4 shows the percent capacity utilization of pipe segments in the trunk line again with Phase 1 development in place. Based on the recalibrated model and the Phase 1 projected flows, the majority of pipes would be operating at 40-70% of their theoretical capacity. The predicted peak flow from the Phase 1 redevelopment (140 gpm) is also within the range of flows that can be handled by LS9. The City has indicated that LS9 currently has Flygt NP 3127 MT-438 pumps installed with a single pump discharge capacity of approximately 225 gpm. Thus LS9 has the capacity for the predicted flows produced during Phase 1 with the pumps currently installed.

Figure 5 shows the remaining capacity, in gpm, of all pipe segments in the trunk line downstream of LS9 assuming ultimate development is complete. Figure 6 shows the percent capacity utilized of pipe segments in the trunk line. Based on the recalibrated model and the ultimate projected flows, the majority of pipes would be operating at less than their theoretical capacity. The predicted peak flow from the ultimate redevelopment (520 gpm) is beyond the range of flows that can be handled by LS9.

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If the ultimate level of redevelopment were to occur in the GrandView area, LS9 would need to be upgraded. Required upgrades may include:

- Lift station (larger diameter for larger pumps)
- Pumps
- Electrical and controls upgrades

During the modeling analysis, one section of pipe was found to have a negative slope. A section of the trunk line just east of Highway 100 (G-1140) has a slope of negative 0.12-percent according to City provided as-built drawings. Under all modeled conditions, including current conditions, it appears that this pipe will be surcharged. Under the ultimate development of the GrandView area, a surcharge of approximately 6-inches could occur.

Under ultimate development several pipes are flowing at or above 80% of their theoretical maximum capacity. While the pipes can handle these flows it should be noted that only minor flow blockages can result in sanitary backups. The flows modeled include peaking and maximum projected to I&I and so would not be expected to produce a problem under normal flows. However, under peak flow events it will not take much of a blockage to create a problem in some of these pipes under ultimate development. The City may want to consider increasing the cleaning and inspection frequency on pipes as they approach 80% of capacity.

Conclusions and Recommendations

Based on the current plans for the Phase 1 redevelopment of the GrandView area, the model suggests that no sanitary sewer upgrades are needed to accommodate the type of redevelopment described in the *GrandView District Development Framework*. As plans for the area progress, projected sanitary sewer flows should be reevaluated and the City may consider confirming the existing flows to LS9 with flow monitoring.

Based on the ultimate redevelopment plans for the GrandView area, upgrades to LS9 will be required. As redevelopment plans for the area progress, it is recommended that the further refined plans be evaluated for potential sanitary sewer flows to determine if and when upgrades to the sanitary sewer are needed. Because of this future maintenance that requires major pump work on LS9 should be performed with the potential upgrades and the status of the GrandView redevelopment in mind.

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It is also recommended that the City investigate the pipe invert elevations around the Highway 100 crossing (pipe segment G-1140) to confirm if the existing pipe is actually constructed with a negative slope. If the pipe does have a negative slope, the City could consider reconstruction of the sewer in this area. Based on the as-builts, there is adequate elevation drop if the three pipe segments (~1.33 feet of drop in ~830-feet) were reconstructed, a slope of ~0.16-percent could be achieved. This slope would provide enough capacity for the anticipated ultimate development flows and minimize the chance of surcharging.

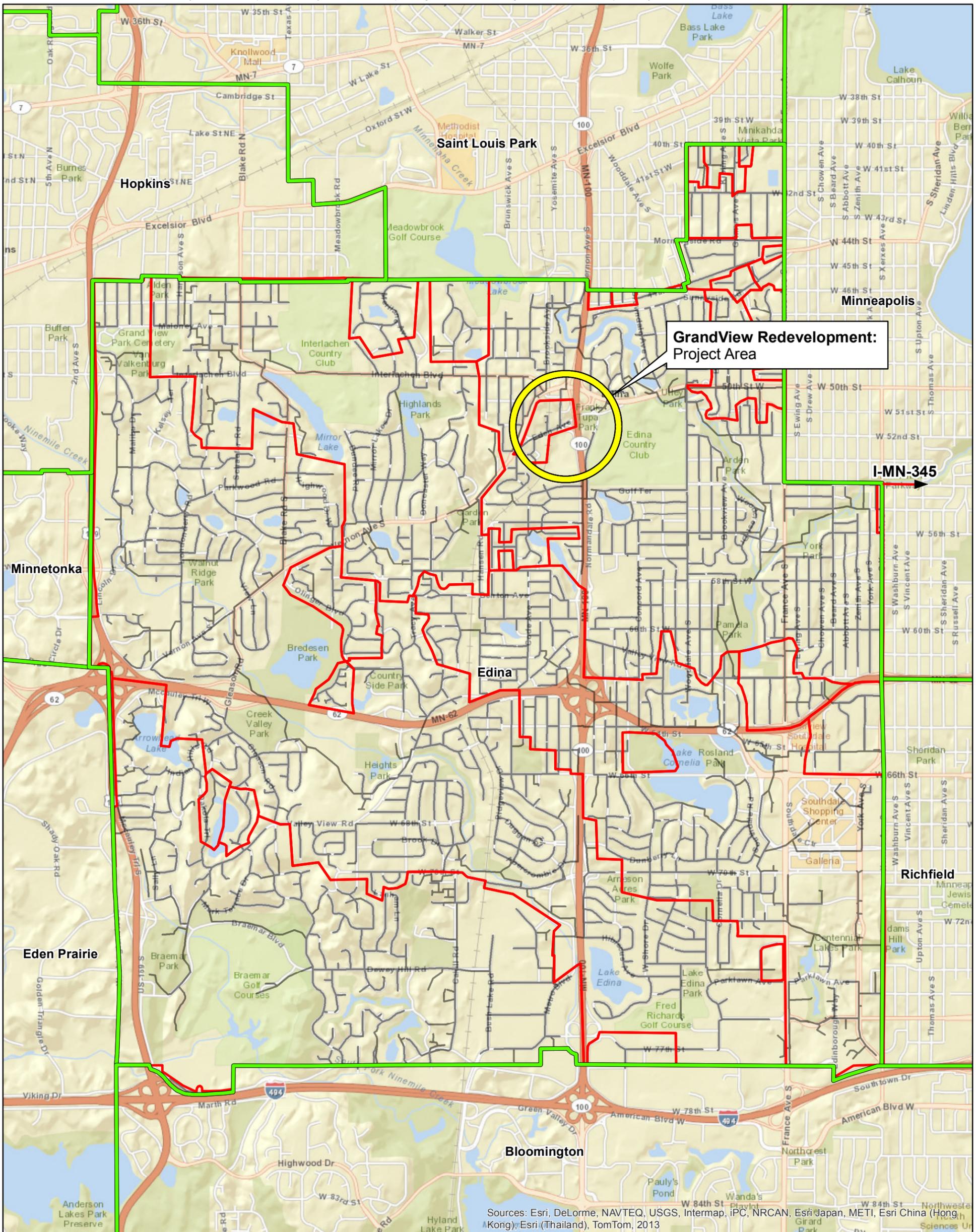
Table 1. Projected Sanitary Sewer Flows

Phase 1 Redevelopment

Residential				
Housing Type	Planned Units	Assumed Residents per unit (persons)	Flow/Person (gpd/person)	Planned Flow (gpd)
Townhome	16	4	75	4,800
Apartment	42	2	75	6,300
Condominium	24	4	75	7,200
Total Residential Flow				18,300
Non Residential				
Land Use	Area (ac)	Unit Flow (gpd/ac)	Planned Flow (gpd)	
Office	0.11	25,000	2,870	
Commercial	0.96	25,000	24,100	
Community	0.23	15,000	3,400	
Total Commercial/Civic Flow				30,400
Total Phase 1 Planned Flow (gpd)				48,700
Peaking Factor				4
Phase 1 Planned Peak Flow (gpd)				194,800
Phase 1 Planned Peak Flow (gpm)				140

Ultimate Redevelopment

Land Use	Area (ac)	Unit Flow (gpd/ac)	Planned Flow (gpd)
Residential	2.7	10,750	29,000
Community	8	15,000	120,000
Phase 1 Development			48,700
Total Ultimate Redevelopment Flow (gpd)			197,700
Peaking Factor			3.8
Ultimate Planned Peak Flow (gpd)			751,300
Ultimate Planned Peak Flow (gpm)			520



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

- Sanitary Sewer
- Sewersheds
- Municipal Boundaries

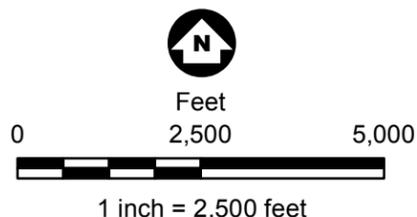
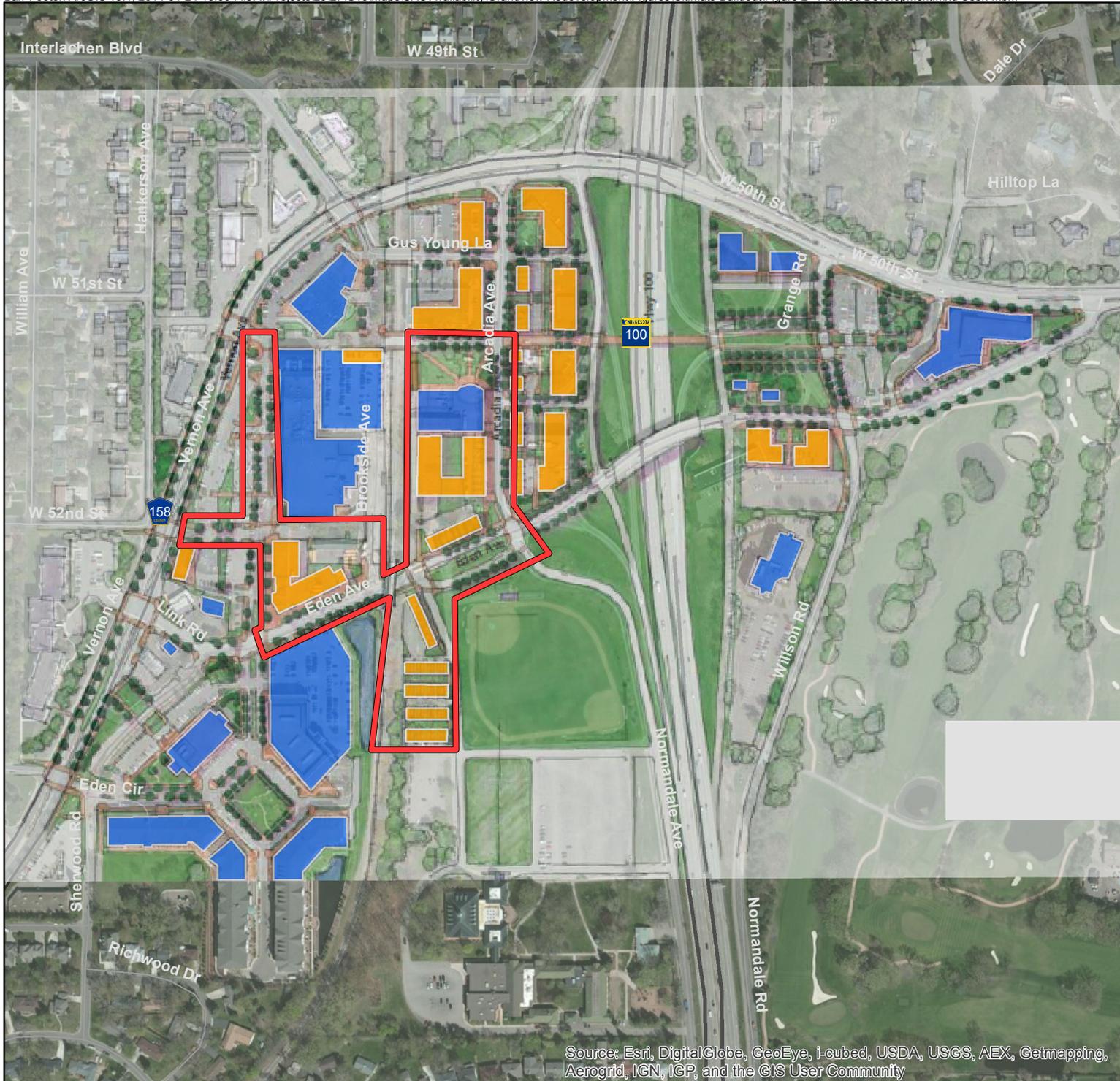


Figure 1

PROJECT AREA
GrandView Redevelopment
City of Edina
Edina, MN



-  Grandview Redevelopment: Phase 1
-  Civic Community Buildings
-  Proposed Development

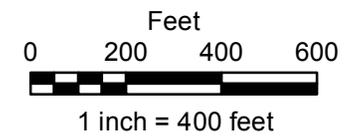


Figure 2

PLANNED DEVELOPMENT
GrandView Redevelopment
City of Edina
Edina, MN

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

G-1151:
469 GPM

G-1140:
0 GPM

G-647:
495 GPM

G-682:
1,634 GPM

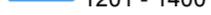
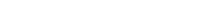
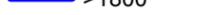
G-5331:
1,712 GPM

LS-09
Sewershed

LS-09

Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Pipe Capacity Remaining (GPM)

- | | |
|--|---|
|  <0 |  501 - 600 |
|  1 - 50 |  601 - 800 |
|  51 - 100 |  801 - 1000 |
|  101 - 150 |  1001 - 1200 |
|  151 - 200 |  1201 - 1400 |
|  201 - 300 |  1401 - 1600 |
|  301 - 400 |  1601 - 1800 |
|  401 - 500 |  >1800 |

-  LS-09
-  Sewersheds
-  Existing Sanitary Sewer (LS-09)

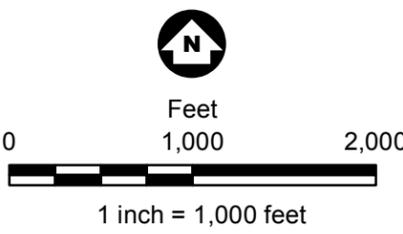
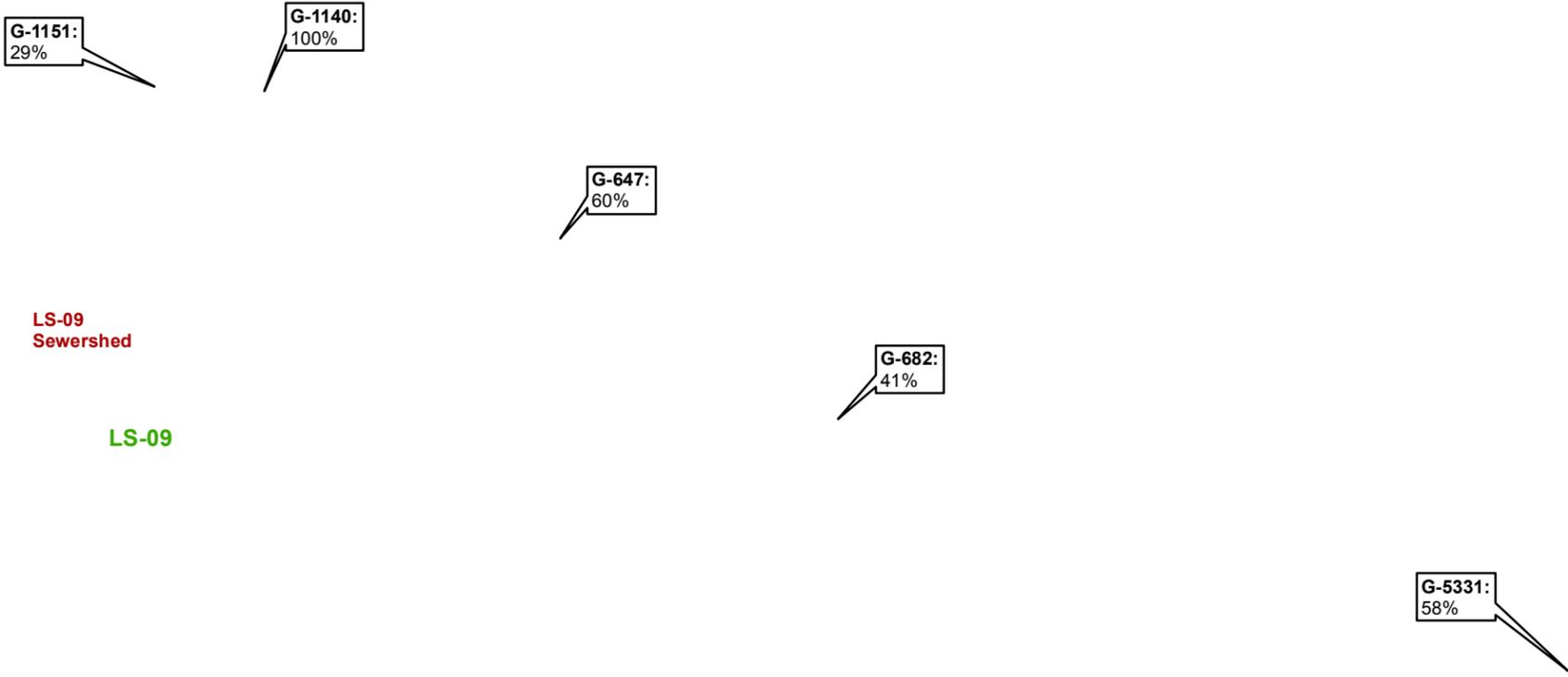


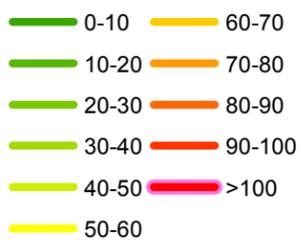
Figure 3

PHASE 1 DEVELOPMENT
PIPE CAPACITY REMAINING (GPM)
GrandView Redevelopment
City of Edina
Edina, MN



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Pipe Capacity Utilized (%)



- LS-09
- Sewersheds
- Existing Sanitary Sewer (LS-09)

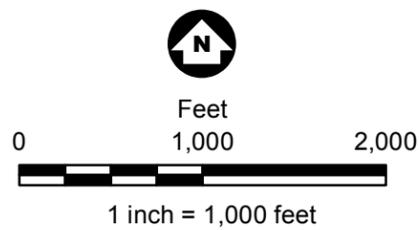
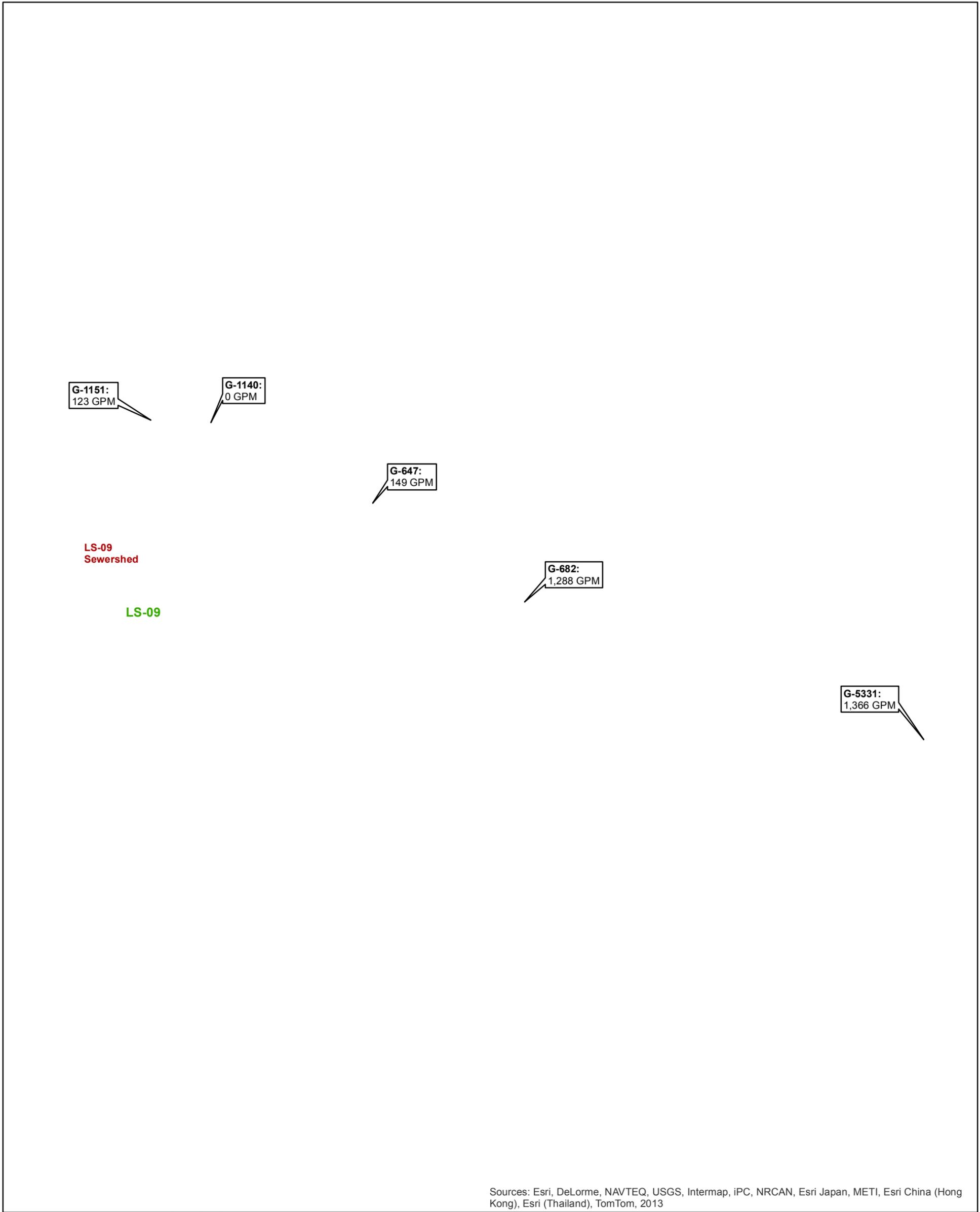


Figure 4

PHASE 1 DEVELOPMENT
 PIPE CAPACITY UTILIZED (%)
 GrandView Redevelopment
 City of Edina
 Edina, MN



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Pipe Capacity Remaining (GPM)

- | | |
|--|---|
|  <0 |  501 - 600 |
|  1 - 50 |  601 - 800 |
|  51 - 100 |  801 - 1000 |
|  101 - 150 |  1001 - 1200 |
|  151 - 200 |  1201 - 1400 |
|  201 - 300 |  1401 - 1600 |
|  301 - 400 |  1601 - 1800 |
|  401 - 500 |  >1800 |

-  LS-09
-  Sewersheds
-  Existing Sanitary Sewer (LS-09)

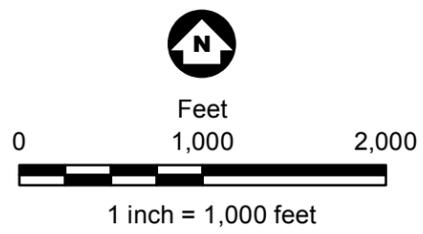
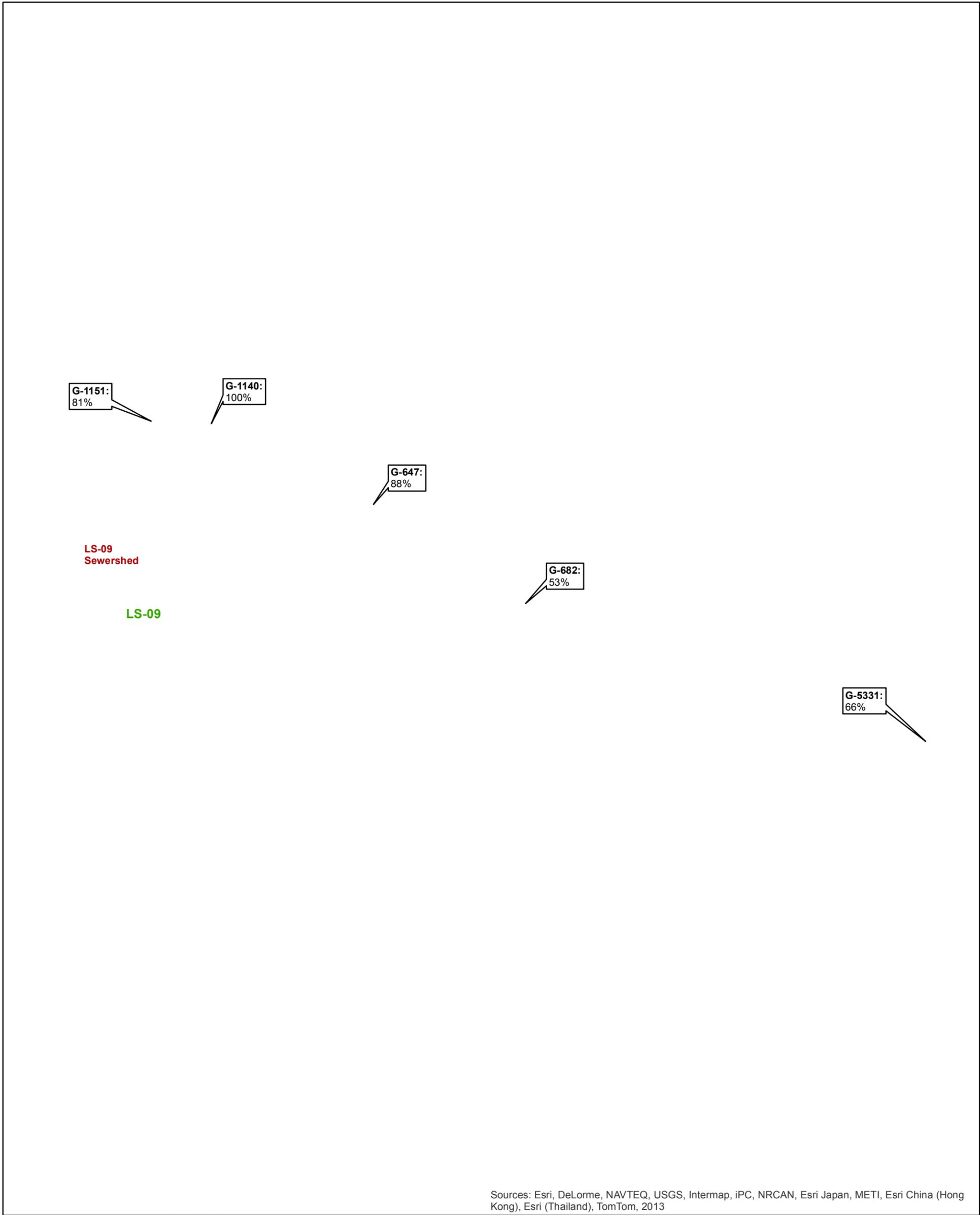


Figure 5

ULTIMATE PLANNED DEVELOPMENT
 PIPE CAPACITY REMAINING (GPM)
 GrandView Redevelopment
 City of Edina
 Edina, MN



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Pipe Capacity Utilized (%)

- 0-10
- 10-20
- 20-30
- 30-40
- 40-50
- 50-60
- 60-70
- 70-80
- 80-90
- 90-100
- >100
- LS-09
- Sewersheds
- Existing Sanitary Sewer (LS-09)

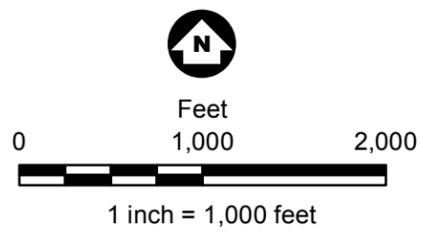


Figure 6

ULTIMATE PLANNED DEVELOPMENT
 PIPE CAPACITY UTILIZED (%)
 GrandView Redevelopment
 City of Edina
 Edina, MN