CHAPTER 4

SYSTEM CAPACITY PERFORMANCE

This chapter describes the hydraulic performance of the collection system under several flow conditions using the hydraulic model. Model runs were performed to reflect system capacity performance for existing and future land use conditions, and the 24- and 72-hour storm durations defined in Chapter 3. System performance measures are based on hydraulic grade line (HGL) elevation relative to the ground surface for the pipelines, and peak flow rates compared to firm capacity at pump stations.

EXISTING PIPELINE DEFICIENCIES

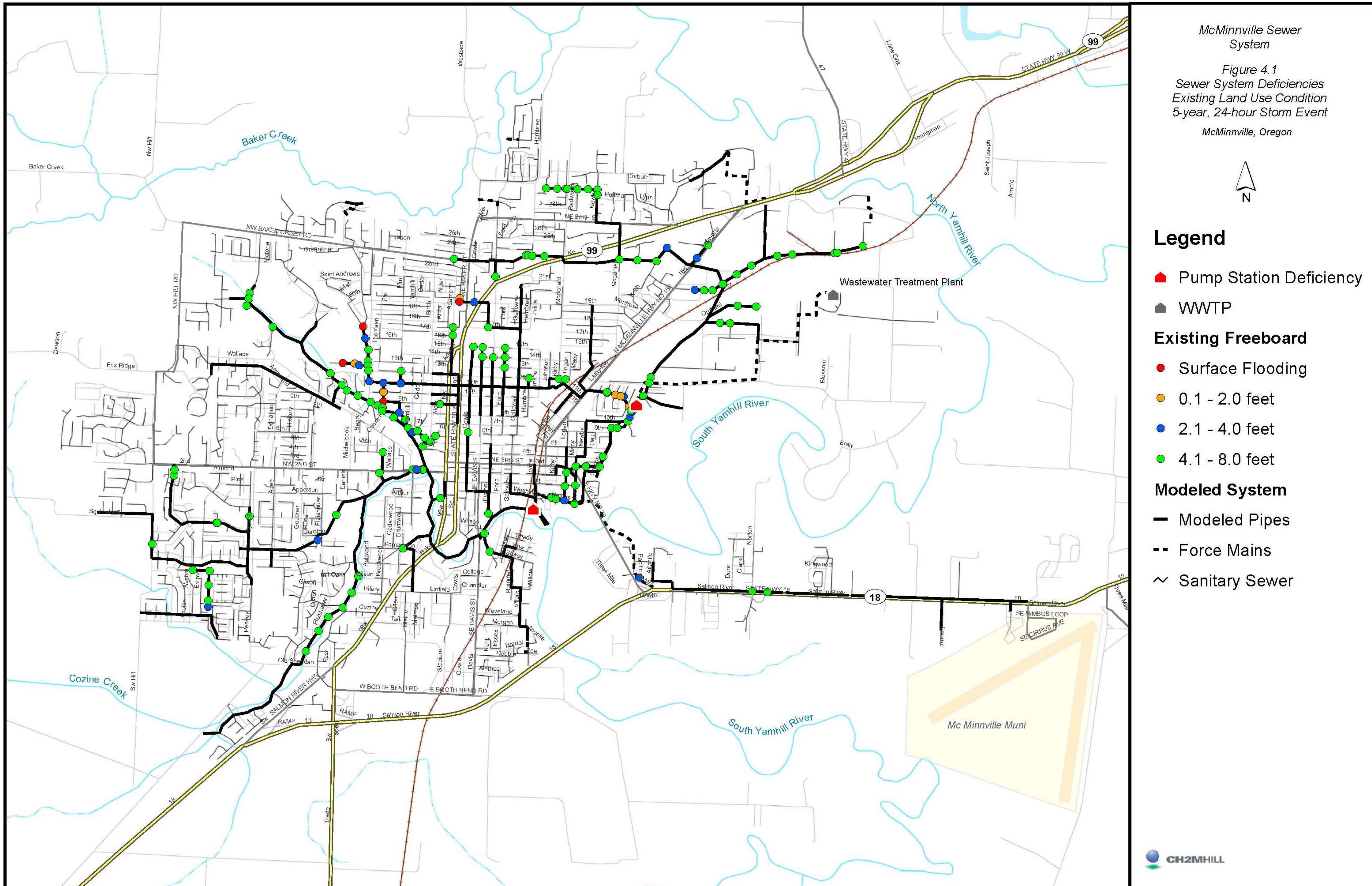
Deficiencies are defined as locations where sewer system overflows (SSOs) occur and flow does not reach the treatment plant, or where a pipe is surcharged and the HGL is within a specified distance of the ground surface for the 5-year wet season design storm. For purposes of this analysis, pipe surcharge is allowed, and when the modeled HGL reached a level less than 2 feet from the ground surface (freeboard less than 2 feet) a deficiency is identified. Deficiency criteria developed for previous plans simply did not allow overflows. There was no stated surcharge or freeboard criteria. The 2-foot freeboard deficiency criteria was discussed at collection system workshops with the City as an appropriate combination of allowed pipe surcharge for short term peak flows and protection from overflows. Basement flooding was not considered to be a likely given their relatively limited number and therefore additional freeboard (more than 2 feet) was not included as part of the criteria. The flows associated with these “shallow” HGLs can back up into adjacent basements or potentially produce surface overflows in the City’s collection system.

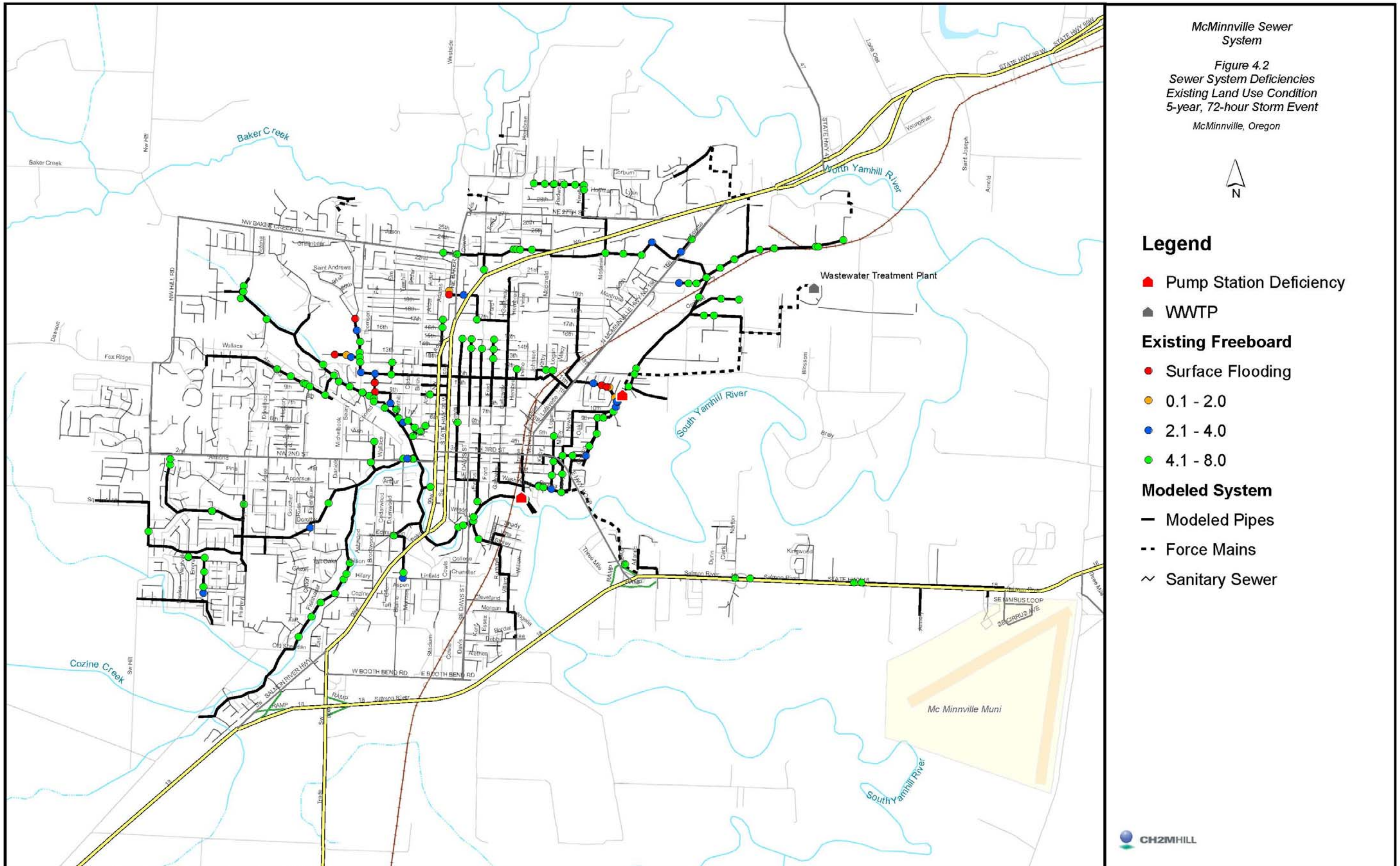
The capacity deficiencies identified by the hydraulic analysis indicate where improvements may be needed to reduce the frequency of future sewer system overflows within the City. Such action may include replacing the existing pipe with a larger diameter pipe, diversion of flows to nearby pipelines, construction of parallel pipelines, or reduction of peak flow rates through pipeline rehabilitation. These improvement options are analyzed in Chapter 6.

Figures 4-1 and 4-2 show collection system freeboard (the distance between the ground surface and the water surface) at each surcharged manhole for the 5-year, 24-hour and 72-hour wet season design storm events, respectively.

For both storm durations, the existing collection system deficiencies were identified in the:

- Michelbook Basin, between 9th Street and 10th Street, West of Michelbook Lane, at 13th Street, East of Michelbook Lane, Michelbook Lane near 17th Street.
- High School Basin, along the parallel 21-inch lines on Allis Drive between Lafayette Ave. and the RSPS, 19th Street near Baker Street.


McMinnville Sewer System
Figure 4.1
Sewer System Deficiencies
Existing Land Use Condition
5-year, 24-hour Storm Event
McMinnville, Oregon
N
Legend
Pump Station Deficiency
WWTP
Existing Freeboard
Surface Flooding
0.1 - 2.0 feet
2.1 - 4.0 feet
4.1 - 8.0 feet
Modeled System
Modeled Pipes
Force Mains
Sanitary Sewer
CH2MHILL
Wastewater Treatment Plant
Baker Creek
North Yamhill River
South Yamhill River
South Yamhill River
Cozine Creek
Mc Minnville Muni
99
18
STATE HWY 99 W
NW BAKER CREEK RD
NW HILL RD
NW 2ND ST
NE 3RD ST
W BOOTH BEND RD
E BOOTH BEND RD
SALMON RIVER HWY
SE NIMBUS LOOP
SE CIRRUS AVE
Fox Ridge
Wallace
Saint Andrews
Three Mile
Kingwood
Blossom
Braly


McMinnville Sewer System
Figure 4.2
Sewer System Deficiencies
Existing Land Use Condition
5-year, 72-hour Storm Event
McMinnville, Oregon
N
Legend
Pump Station Deficiency
WWTP
Existing Freeboard
Surface Flooding
0.1 - 2.0
2.1 - 4.0
4.1 - 8.0
Modeled System
Modeled Pipes
Force Mains
Sanitary Sewer
Wastewater Treatment Plant
Baker Creek
North Yamhill River
South Yamhill River
Cozine Creek
Mc Minnville Muni
CH2MHILL

High HGLs and surface flooding between 9th and 10th streets and at Michelbook Lane near 17th Street are caused by downstream capacity constraints. The downstream pipes are surcharged beginning at approximately 7th and Yamhill continuing upstream to Michelbook Lane at 17th Street. With the exception of one pipe segment, the pipes between 7th and Yamhill and Michelbook Lane at 17th Street are conveying more than their gravity capacity. The existing pipe capacity constraints in the vicinity of 10th Street are known to the City, and improvement plans were being developed at the time of this analysis to eliminate these deficiencies. Figure 4-3 provides a profile of this section of the collection system, and includes the maximum hydraulic grade line for the 5-year, 72-hour storm as an example.

Surface flooding and high HGLs along 13th Street, west of Michelbook Lane are caused by backwater from the surcharged pipes along Michelbook described above. These pipes appear to have adequate capacity to convey upstream flows, however the pipes are shallow compared to those along Michelbook Lane, and therefore provide a path of least resistance to flow. Figure 4-4 shows a profile of the pipeline and maximum HGL for the 5-year, 72-hour storm between 7th and Yamhill and the 13th Street pipeline west of Michelbook Lane.

Surface flooding and high HGLs are also predicted along 19th Street, west of Baker Street. This is also caused by downstream capacity limitations, with pipe flows exceeding gravity capacity and surcharging beginning at 17th and Evans streets and extending upstream to 19th and Baker streets. Figure 4-5 shows the profile and maximum HGL for this pipeline for the 5-year, 72-hour storm.

High HGLs and surface flooding was also observed downstream from the Lafayette bypass along Allis Drive. Figure 4-6 shows the profile and maximum HGL for this pipeline for the 5-year, 72-hour storm. Downstream capacity restrictions beginning at the 42-inch pipe just upstream from the RSPS combined with several shallow pipe segments are the cause of these deficiencies. The profiles in Figures 4-3 through 4-6 are for the 72-hour event. The profiles for the 24-hour event are similar so are not duplicated.

Table 4-1 gives the volume of surface flooding at locations where the hydraulic grade line reaches the ground surface.

Table 4-1. Existing Condition Flooding Locations and Volumes

Manhole ID	Basin	Location	Overflow Volume (MG)	
			5-year, 24-hour Storm	5-year, 72-hour Storm
H-6-5	Michelbook	Michelbook Ln at 17th Street	1.54	6.31
H-7-1	Michelbook	13th Street, West of Michelbook Ln	0.06	0.35
H-7-9	Michelbook	10th Street, East of Michelbook Ln	0.00	0.12
H-7-10	Michelbook	9th Street, East of Michelbook Ln	0.34	1.07
I-6-1	High School	19th Street, West of Baker Street	0.00	0.02
I-6-2	High School	19th Street, West of Baker Street	0.00	1.15
J-7-106T	High School	Allis Dr. at Oliver Dr.	0.00	2.58
J-7-80T	High School	Allis Drive	0.00	0.01
TOTAL			1.94	11.61

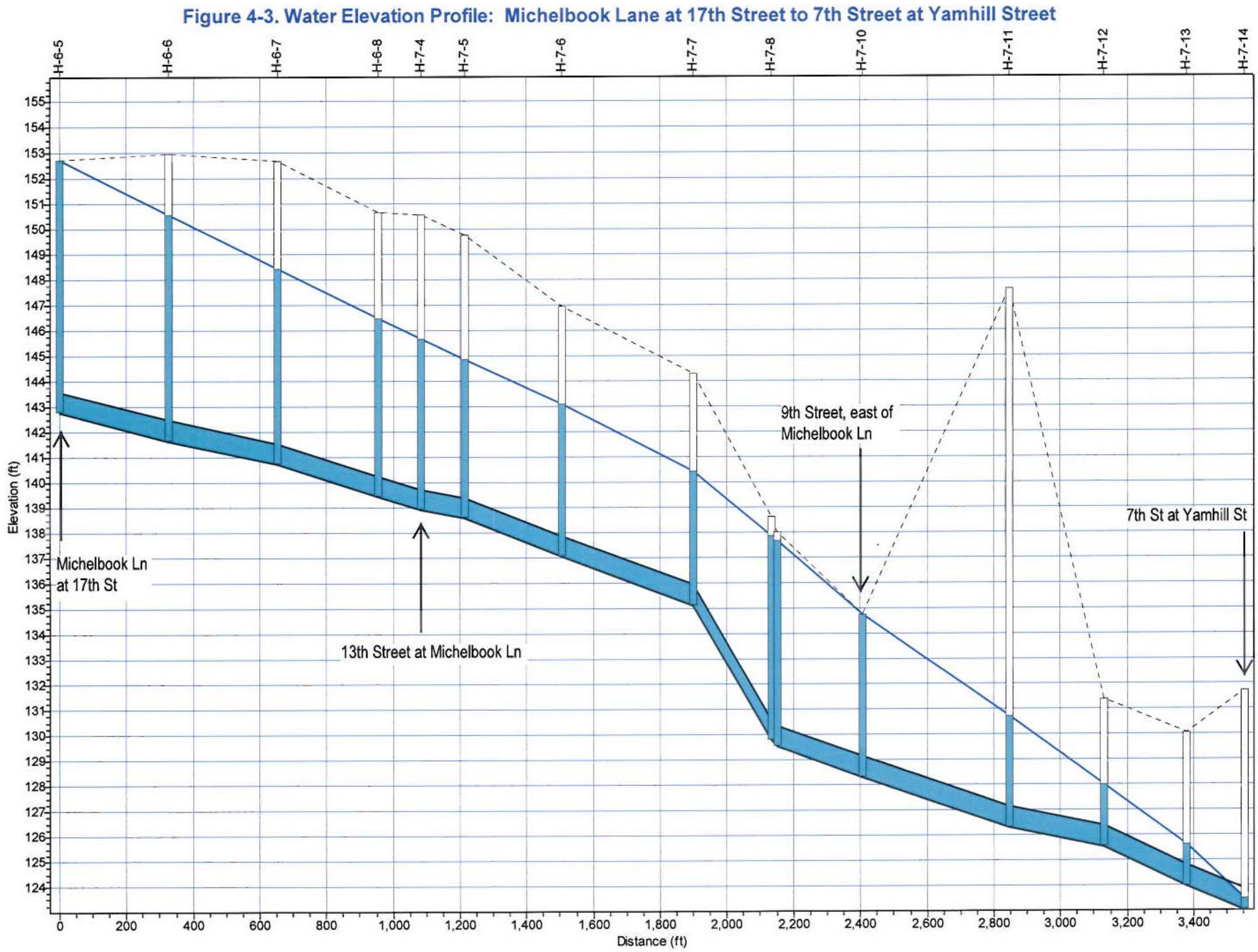


Figure 4-3. Water Elevation Profile: Michelbook Lane at 17th Street to 7th Street at Yamhill Street
H-6-5
H-6-6
H-6-7
H-6-8
H-7-4
H-7-5
H-7-6
H-7-7
H-7-8
H-7-10
H-7-11
H-7-12
H-7-13
H-7-14
Elevation (ft)
Distance (ft)
Michelbook Ln at 17th St
13th Street at Michelbook Ln
9th Street, east of Michelbook Ln
7th St at Yamhill St

Figure 4-4. Water Elevation Profile: Michelbook Lane at 17th Street to 7th Street at Yamhill Street

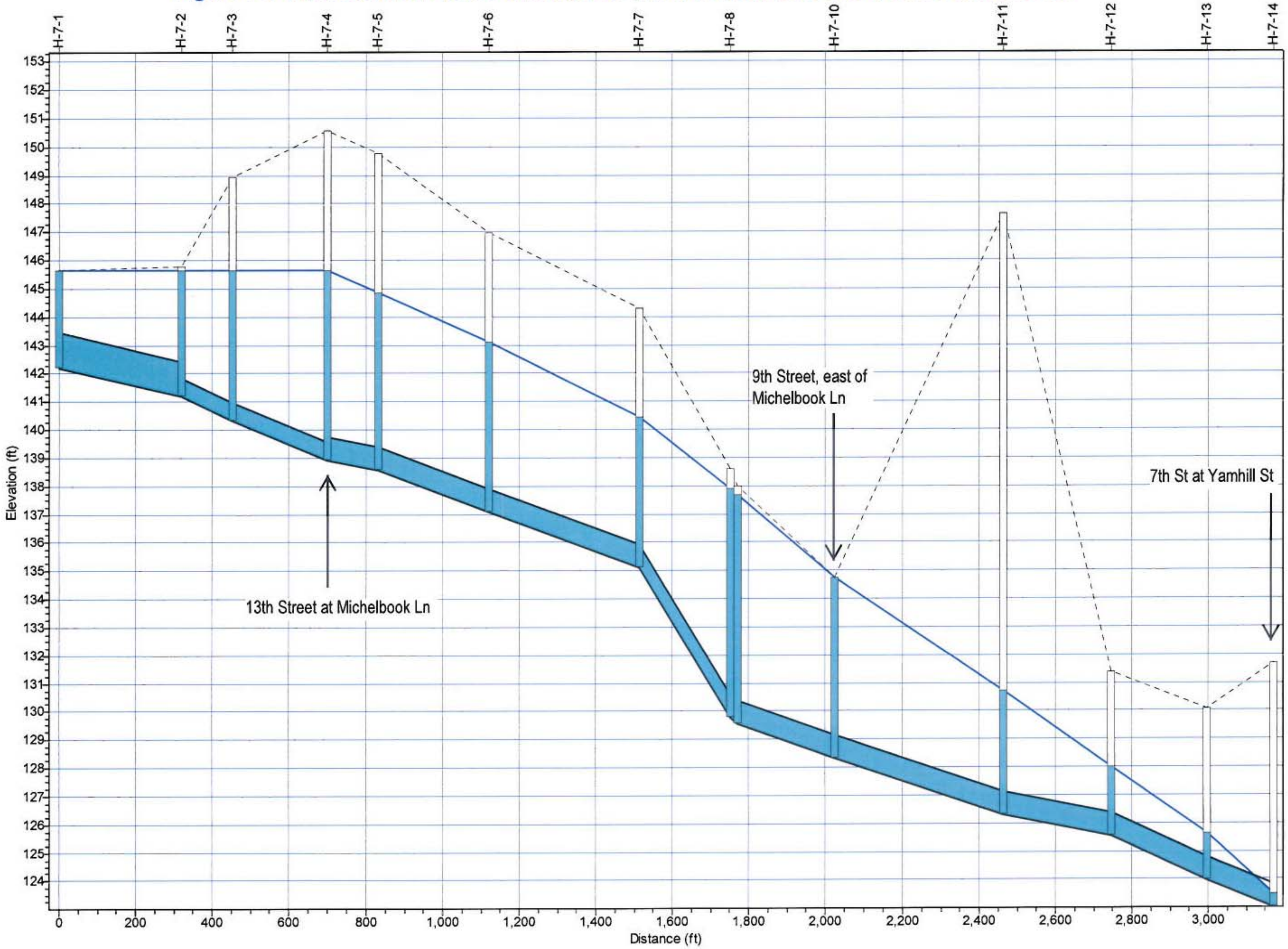


Figure 4-5. Water Elevation Profile: 19th Street at Baker Street to 17th Street at Evans Street

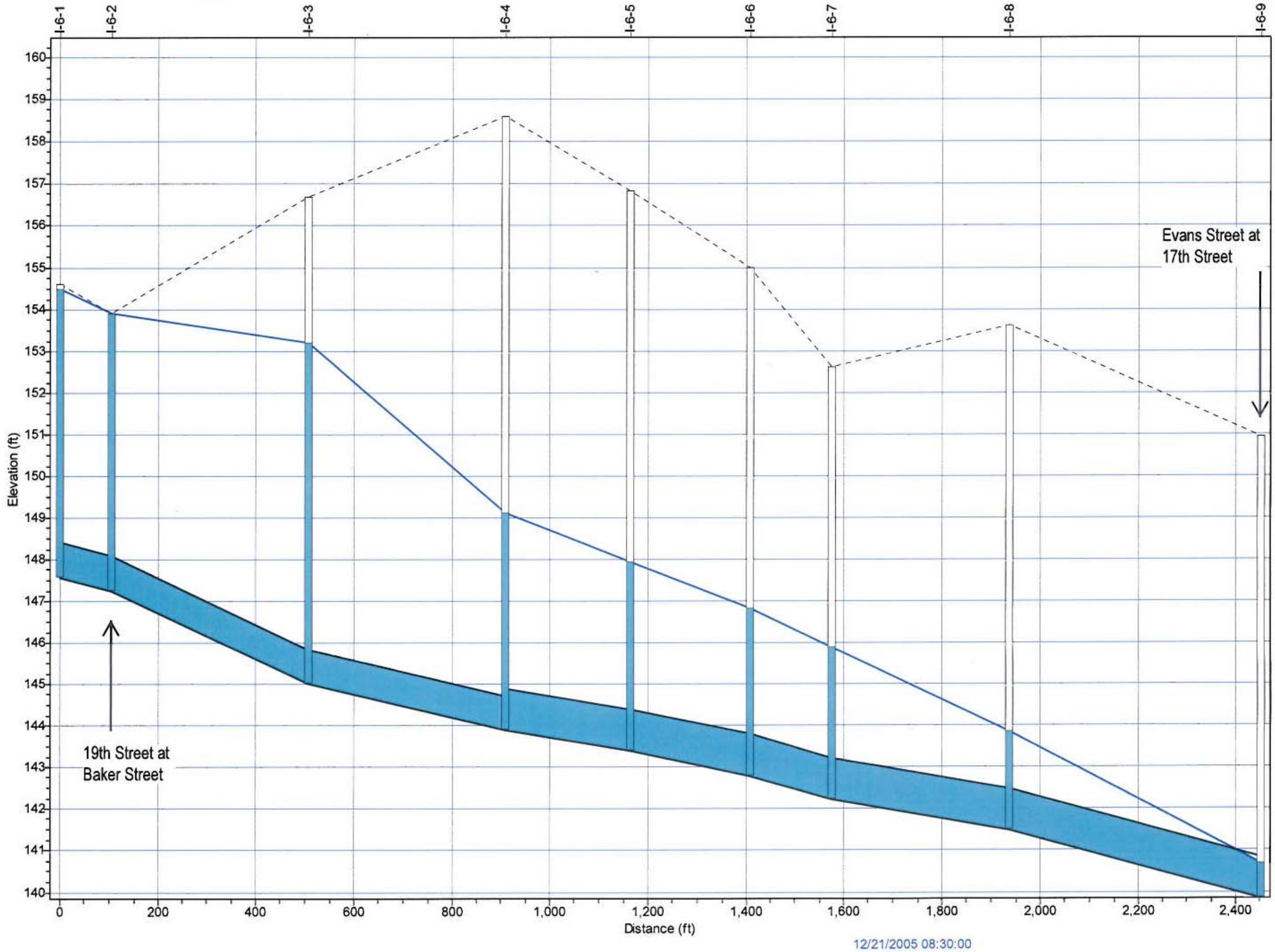


Figure 4-6. Water Elevation Profile: Lafayette Ave at 13th to RSPS

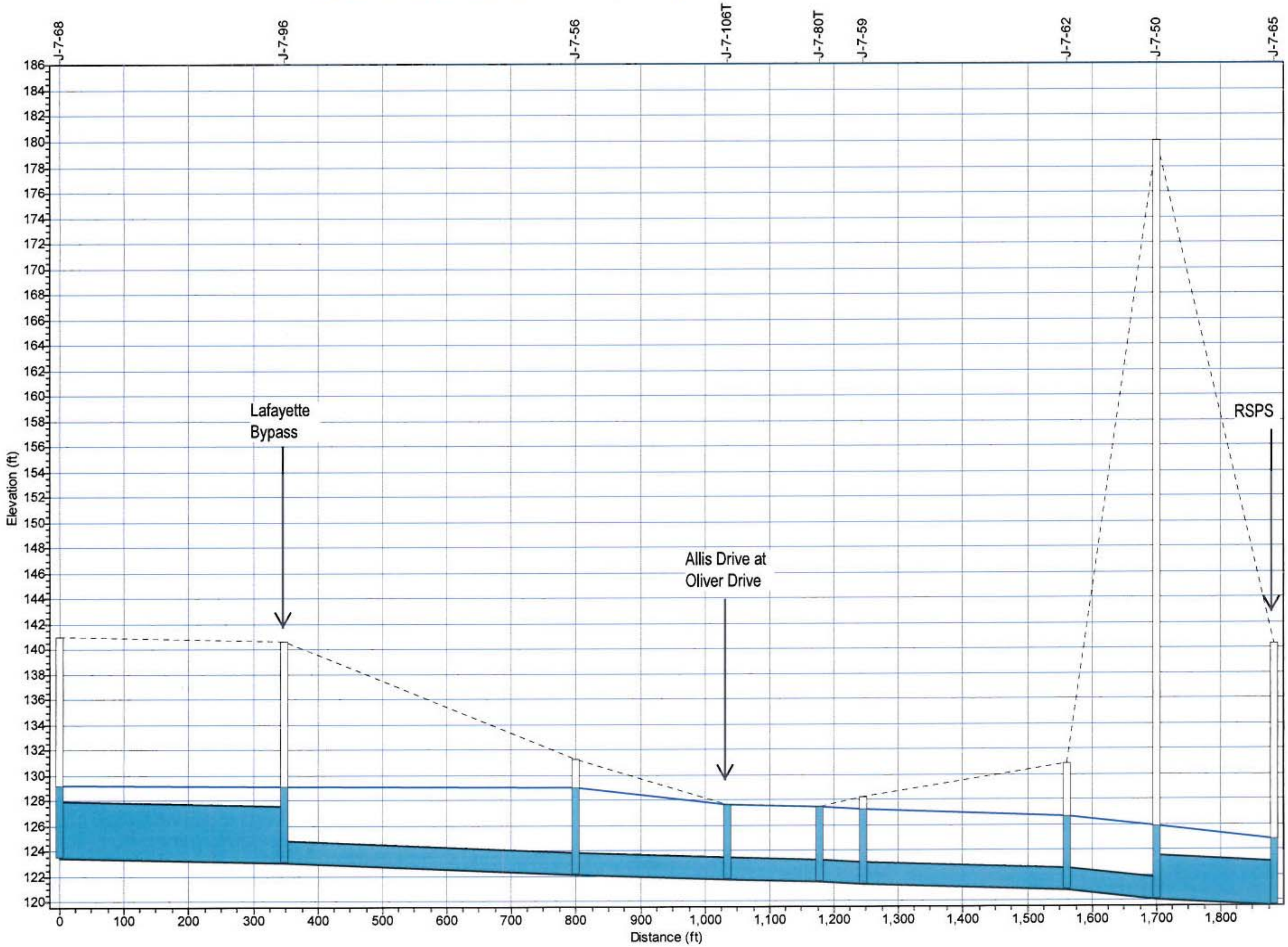


Table 4-1 shows a significant difference in overflow volume between the 24-hour and 72-hour design storms. The hydraulic model assumes that the overflow volume is lost and does not re-enter the collection system. As a result, the magnitude of downstream deficiencies would be underestimated if improvements were made to contain all flows. However, the current analysis is intended to estimate how the existing system would perform under the flow conditions analyzed. Collection system improvements would eliminate the overflow losses, resulting in increased peak flows and flow volumes in downstream pipes and at the RSPS. The improvements proposed in Chapter 6 will account for all flows and meet the requirement for no overflows for the design event.

BUILDOUT PIPELINE DEFICIENCIES

Hydraulic simulations were performed using the existing collection system model with estimated buildout flows for the 5-year, 24- and 72-hour wet season design storms.

Figures 4-7 and 4-8 categorize the collection system freeboard in surcharged manholes for the 5-year, 24-hour and 72-hour design storm events under buildout conditions. As these figures show, the locations of future collection system deficiencies are the same as for existing land use conditions. The main difference between existing and buildout conditions is the volume of surface flooding.

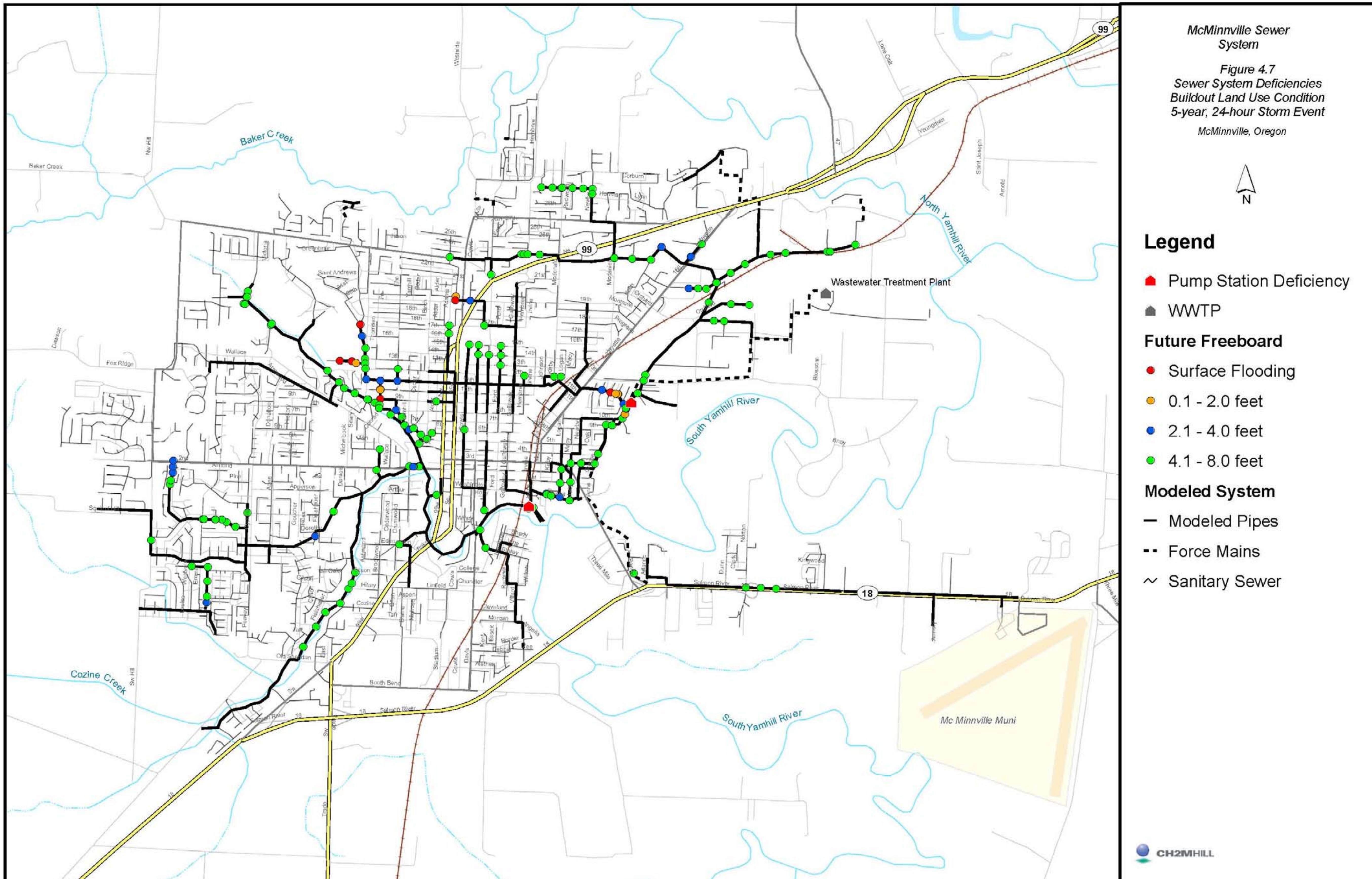
Similar to the existing land use results, collection system deficiencies were identified in the:

- Michaelbook basin in the vicinity of 10th Street and east of Michelbook Lane and continuing upstream
- High School Basin along 19th Street at Baker Street, the parallel 21-inch lines along Allis Drive between Lafayette Ave and the RSPS and the 42-inch pipe just upstream from the RSPS.

Table 4-2 summarizes surface flooding volume at buildout with no improvements were made to the existing collection system.

Table 4-2. Buildout Condition Flooding Locations and Volumes

Manhole ID	Basin	Location	Overflow Volume (MG)	
			5-year, 24-hour Storm	5-year, 72-hour Storm
H-6-5	Michelbook	Michelbook Ln at 17th Street	1.62	6.54
H-7-1	Michelbook	13th Street, West of Michelbook Ln	0.08	0.38
H-7-9	Michelbook	10th Street, East of Michelbook Ln	0.00	0.13
H-7-10	Michelbook	9th Street, East of Michelbook Ln	0.42	1.17
I-6-1	High School	19th Street, West of Baker Street	0.00	0.03
I-6-2	High School	19th Street, West of Baker Street	0.01	1.16
J-7-106T	High School	Allis Dr. at Oliver Dr.	0.01	4.64
J-7-80T	High School	Allis Drive	0.00	0.15
		TOTAL	2.14	14.2


McMinnville Sewer System
Figure 4.7
Sewer System Deficiencies
Buildout Land Use Condition
5-year, 24-hour Storm Event
McMinnville, Oregon
N
Legend
Pump Station Deficiency
WWTP
Future Freeboard
Surface Flooding
0.1 - 2.0 feet
2.1 - 4.0 feet
4.1 - 8.0 feet
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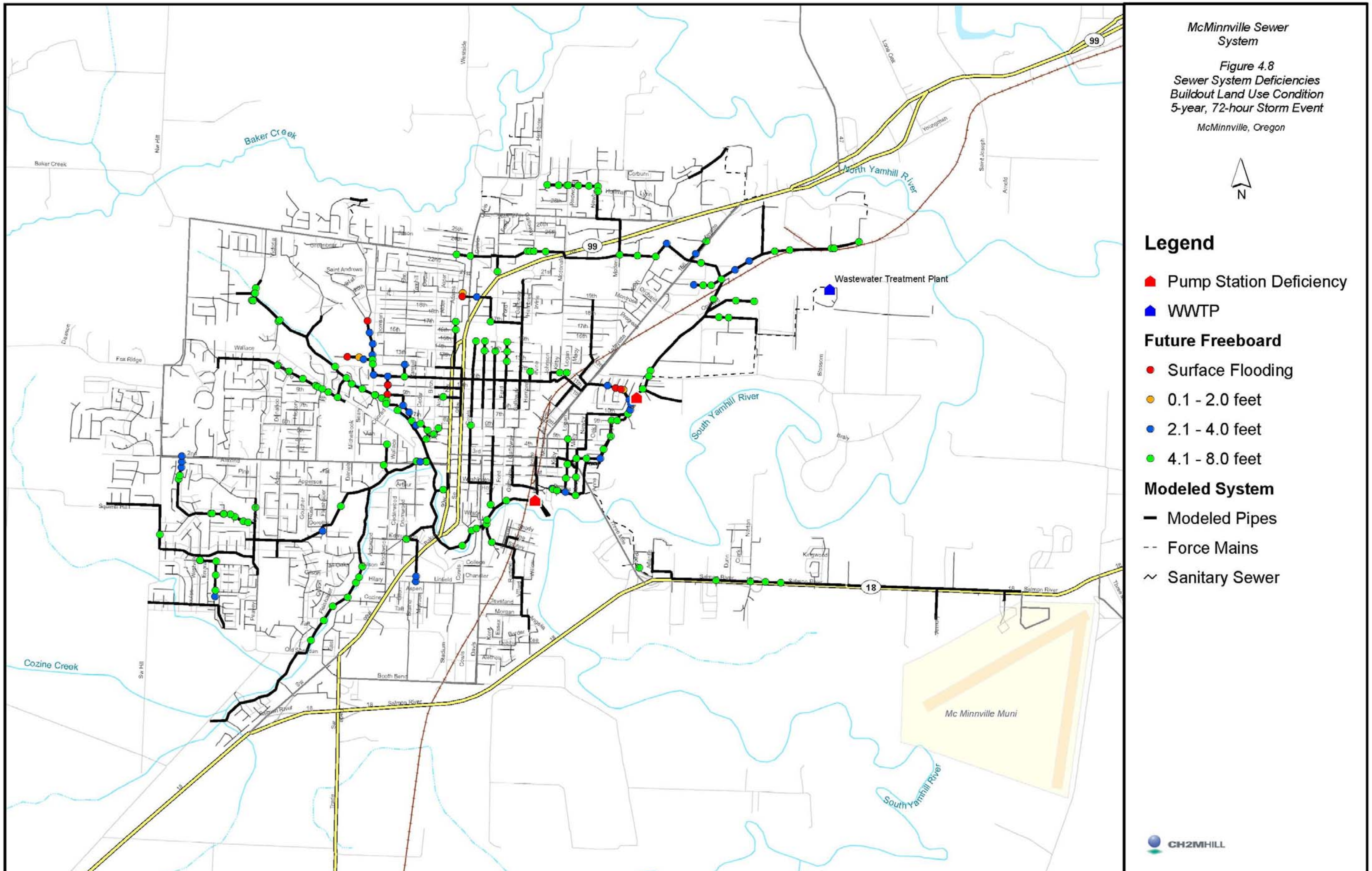
South Yamhill River
Cozine Creek
Wastewater Treatment Plant
Mc Minnville Muni
99
18


McMinnville Sewer System
Figure 4.8
Sewer System Deficiencies
Buildout Land Use Condition
5-year, 72-hour Storm Event
McMinnville, Oregon
N
Legend
Pump Station Deficiency
WWTP
Future Freeboard
Surface Flooding
0.1 - 2.0 feet
2.1 - 4.0 feet
4.1 - 8.0 feet
Modeled System
Modeled Pipes
Force Mains
Sanitary Sewer
CH2MHILL
Baker Creek
North Yamhill River
South Yamhill River
Cozine Creek
Wastewater Treatment Plant
Mc Minnville Muni
99
18

PUMP STATION DEFICIENCES

Flows for both storm event durations and land use scenarios exceed the firm capacity at the Cozine and Raw Sewage Pump Stations. Table 4-3 provides the peak flow rates and firm capacity (capacity with largest pump out of service to meet DEQ redundancy requirements) at these locations for each of the conditions modeled. In order to estimate the peak flow at the stations, the 5-year flow rates for each land use condition are based on a scenario where no overflows are allowed and all flow reaches the pump station.

Table 4-3. Firm Capacity Versus Peak 5-year Flow

	Firm Capacity[1] (mgd)	Existing Flow (mgd)		Buildout Flow (mgd)	
		24-hr	72-hr	24-hr	72-hr
RSPS	38.0	43.3	52.0	48.9	62.0
Cozine	11.5	14.2	16.9	20.3	23.2

[1] Capacity with largest pump out of service.

CONCLUSION

The collection system generally has capacity to convey flow to the RSPS with several relatively isolated areas of inadequate conveyance capacity in the Michelbook and High School Basins. The deficiency areas are similar for all land use and storm durations analyzed. The most significant elements of the system with deficiencies upstream of the RSPS are the 21-inch line downstream of the Lafayette bypass and at the Cozine Pump Station. While the volume of overflow in the Michelbook Basin is large, the cause is due to relatively small diameter sections (10 inches) of undersized pipelines over a length of approximately 1,300 feet. Finally, the system generally has capacity (with limited conveyance improvements) to deliver peak flows much greater than the RSPS and existing treatment capacity. Therefore, improvements will consider storage and I/I reduction improvements to reduce flows as well as increasing capacity at the RSPS and WRF.

The alternatives analysis in Chapter 6 identifies improvement options to eliminate overflows and high HGLs (within two feet of the ground surface) for both existing and buildout land use conditions. The 24 and 72-hour duration storms are evaluated in terms of the improvements required for each of these storm durations.