

# **APPENDIX N**

## **Smoke Testing Study\***

\*The following is a summary of the Smoke Testing Study. A complete copy of the findings and results are on file at the City.





## **Smoke Test Report and Summary**

*Puyallup, WA*

### **Background**

Hydromax USA's Sanitary Sewer Assessment project for The City of Puyallup was completed during the months of August and September of 2015.

Smoke testing identifies defects that allow extraneous flow into the collection system. Smoke testing is performed during dry weather periods so that soil moisture does not prevent the smoke from permeating through the soil. This approach helps to maximize the number of defects that can be identified.

This report includes the following items:

- Smoke Test Field Procedures
- Summary of Findings
- Sewer Lines With Defects Identified
- Severe Defects
- Defective Pipe Segment Summaries
- Pipe Segment Detail Sheets

### **Smoke Test Field Procedures**

Prior to conducting smoke testing field work, notification was provided to the public located in the study area. The notices were distributed via door hangers. The public notices provided information about the purpose of smoke testing the sewers, the schedule, and what to do if smoke entered the house. The local fire and police departments were also notified of the smoke testing effort and schedule.

The door hangers were distributed to residents in the study area at least two to three days prior to the start of the smoke testing effort. Each morning during the smoke testing, the police and fire departments were notified of exact areas where smoke testing would be conducted that day.

Smoke was blown into the areas sanitary sewer system at the manholes using a high-volume, gasoline-fueled smoke blower. Non-hazardous smoke was produced by introducing petroleum hydrocarbon smoke fluid on the hot manifold of the blower. This permitted the continuous supply of smoke during the test, providing enough time for defects to be found and identified.

Each smoke test setup was conducted over a maximum of 1,000 ft of sanitary sewer pipeline. Complete overlap of smoked pipe segments occurred for all segments when possible. Photos were captured of each defect that was observed. The locations where smoke was observed were recorded with handheld, sub-meter accuracy GPS data collectors. Information regarding the characteristics of the defect and its surrounding area was also recorded. GPS coordinates



were collected for each of the manholes in the study area to document smoke coverage and provide precise measurements of the footage tested in this study. The location of each defect is presented with dimensions referenced to the nearest upstream manhole and pipe segment in the Detailed Findings section of the report.

**Summary of Findings**

Smoke testing was conducted from 8/24/2015 to 9/2/2015 on 96,575 linear feet of mainline gravity sewers. 213 defects were identified and documented during the smoke testing effort.

Shapefiles have been provided with the electronic copy of the reporting. These shapefiles document the pipe segments smoke tested and the location of defects. They show the pipe segments that were successfully smoke tested and the locations of defects that were identified.

Table 1 presents a summary of the smoke test results, including line segment count, total linear feet of sewer line smoke tested, and the number of defects identified.

**Table 1: Smoke Test Results Summary**

<b>Smoke Test Results Summary</b>	
Total Number of Pipe Segments	413
Total Linear Ft of Sewer Line Smoke Tested	96,575
Total Number of Defects Identified	188

**Sewer Lines with Defects Identified**

Table 2 presents a list of pipe segments which were found to have defects. It displays the number of defects observed per pipe segment. Table 2 is sorted by “Number of Defects” to present the pipe segments with the most defects observed first.

**Table 2: Sewer Lines with Defects Identified**

<b>Upstream Manhole</b>	<b>Downstream Manhole</b>	<b>Number of Defects</b>
S5-02498	S5-02499	6
S5-01539	S5-01541	6
S5-03216	S5-02349	6
S5-02236-ST	S5-02236	6
S5-02503	S5-02504	5
S5-02618	S5-02620	5
S5-02460	S5-02461	5
S5-02497	S5-02498	5
S5-01543	S5-01542	5



Upstream Manhole	Downstream Manhole	Number of Defects
S5-02625	S5-02628	4
S5-02464A	S5-02464	4
S5-02465	S5-02466	4
S5-02520	S5-02452	4
S5-02277	S5-02349	3
S5-02519	S5-02520	3
S5-02332	S5-02330	3
S5-01348	S5-01346	3
S5-02632-ST	S5-02632	2
S5-02504	S5-02505	2
S5-02617	S5-02618	2
S5-02540	S5-02541	2
S5-02541-ST	S5-02541	2
S5-02601	S5-02602	2
S5-02568	S5-02569	2
S5-02469	S5-03231	2
S5-01541	S5-01542	2
S5-02345-ST	S5-02345	2
S5-02534	S5-02556	2
S5-02535	S5-02531	2
S5-02517	S5-02518	2
S5-02491-ST	S5-02491	2
S5-02487-ST	S5-02487	2
S5-02334	S5-02335	2
S5-02339	S5-02270	2
S5-02424	S5-02423	2
S5-02427	S5-02341	2
S5-02237-ST	S5-02237	2
S5-02448	S5-02449	2
S5-01554	S5-01632	2
S5-02592	S5-02593	1
S5-02631	S5-02632	1
S5-02632	S5-02633	1
S5-02509-ST	S5-02509	1
S5-02439	S5-02438	1
S5-02442	S5-02443	1
S5-02453	S5-02454	1
S5-02454	S5-02455	1



Upstream Manhole	Downstream Manhole	Number of Defects
S5-02455-ST	S5-02455	1
S5-02533	S5-02534	1
S5-02503-ST	S5-02503	1
S5-02503	S5-02509	1
S5-02437-ST	S5-02437	1
S5-02635	S5-02578	1
S5-02624	S5-02623	1
S5-02623	S5-02625	1
S5-02653	S5-02654	1
S5-02657	S5-02618	1
S5-02616	S5-02617	1
S5-02626	S5-02627	1
S5-02502	S5-02510	1
S5-03232	S5-03233	1
S5-02446	S5-02438	1
S5-02479	S5-02480	1
S5-02474	S5-02475	1
S5-02541	S5-02542	1
S5-02498A	S5-02498	1
S5-02611	S5-02608	1
S5-02494	S5-02495	1
S5-02511	S5-02512	1
S5-02545	S5-02546	1
S5-02546	S5-00001	1
S5-01535	S5-01536	1
S5-01537	S5-01536	1
S5-01538	S5-01539	1
S5-02558	S5-01625	1
S5-01618	S5-01619	1
S5-02385-ST	S5-02385	1
S5-02276	S5-02277	1
S5-02462	S5-02463	1
S5-02466-ST	S5-02466	1
S5-02549	S5-02550	1
S5-02531	S5-02530	1
S5-02527	S5-02530	1
S5-02537	S5-02518	1
S5-02521	S5-02520	1



Upstream Manhole	Downstream Manhole	Number of Defects
S5-02486-ST	S5-02486	1
S5-02524	S5-02529	1
S5-02529	S5-02525	1
S5-02525	S5-02526	1
S5-02330	S5-02334	1
S5-02335	S5-02339	1
S5-02270	S5-02271	1
S5-02344	S5-02281	1
S5-02422	S5-02423	1
S5-02342	S5-02343	1
S5-02596	S5-02597	1
S5-02600	S5-03231	1
S5-02273-ST	S5-02273	1
S5-01368	S5-01369	1
S5-01378	S5-01344	1
S5-01382-ST	S5-01383	1
S5-01550	S5-01551	1
S5-01634	S5-01611	1
S5-01611	S5-01614	1
S5-01440	S5-01441	1
S5-02430	S5-02517	1

**Severe Defects**

A severe defect is regularly associate with one of three different types of defects: Catch Basins, Downspouts, and Drainage Ditches. Based on our findings, there are 82 severe defects to report at this time.

**Table 3: Severe Defects Identified**

Defect Type	Upstream MH	Downstream MH	Defect Location	Comments
Catch Basin	S5-02533	S5-02534	905 8th Ave NW	N/A
Catch Basin	S5-02455-ST	S5-02455	816 8th St NW	N/A
Catch Basin	S5-02454	S5-02455	825 8th St NW	N/A
Catch Basin	S5-02632	S5-02633	315 4th Ave	N/A
Catch Basin	S5-02631	S5-02632	308 4th Ave NE	N/A
Catch Basin	S5-02618	S5-02620	813 4th St NE	N/A
Catch Basin	S5-02625	S5-02628	816 4th St NE	N/A



Defect Type	Upstream MH	Downstream MH	Defect Location	Comments
Catch Basin	S5-02617	S5-02618	703 4th St NW	N/A
Catch Basin	S5-02616	S5-02617	703 4th St NW	N/A
Catch Basin	S5-02617	S5-02618	704 4th St NW	N/A
Catch Basin	S5-02618	S5-02620	714 4th St NW	In the driveway.
Catch Basin	S5-02624	S5-02623	4th St NW & 10th Ave NE	N/A
Catch Basin	S5-02511	S5-02512	100 River Rd	Major leak potential because it is located in a car wash.
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02611	S5-02608	711 North Meridian	N/A
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02498	S5-02499	711 North Meridian	N/A
Catch Basin	S5-02498A	S5-02498	711 North Meridian	N/A
Catch Basin	S5-02497	S5-02498	711 North Meridian	N/A
Catch Basin	S5-02541-ST	S5-02541	408 2nd St NW	Parking lot.
Catch Basin	S5-02474	S5-02475	239 West Stewart Ave	Loading dock.
Catch Basin	S5-02494	S5-02495	100 River Rd	A large access panel is smoking.
Catch Basin	S5-02497	S5-02498	606 N Meridian	N/A
Catch Basin	S5-02466-ST	S5-02466	3rd Ave NW	N/A
Catch Basin	S5-02465	S5-02466	2308 5th St NW	N/A
Catch Basin	S5-02464A	S5-02464	W Main Ave	N/A
Catch Basin	S5-02464A	S5-02464	601 W Main Ave	N/A





Defect Type	Upstream MH	Downstream MH	Defect Location	Comments
Catch Basin	S5-02464A	S5-02464	601 W Main Ave	N/A
Catch Basin	S5-02385-ST	S5-02385	330 4TH St SW	N/A
Catch Basin	S5-01543	S5-01542	1128 8th Ave NW	N/A
Catch Basin	S5-01535	S5-01536	1201 West Stewart	N/A
Catch Basin	S5-01543	S5-01542	1216 8th Ave NW	Driveway.
Catch Basin	S5-01539	S5-01541	208 7th Ave NW	N/A
Catch Basin	S5-01541	S5-01542	208 7th Ave NW	N/A
Catch Basin	S5-02527	S5-02530	1106 7th Ave NW	N/A
Catch Basin	S5-01543	S5-01542	1214 8th Ave NW	N/A
Catch Basin	S5-01543	S5-01542	1125 8th Ave NW	N/A
Catch Basin	S5-02534	S5-02556	820 9th St NW	N/A
Catch Basin	S5-02534	S5-02556	820 9th St NW	N/A
Catch Basin	S5-02521	S5-02520	617 9th St NW	N/A
Catch Basin	S5-02520	S5-02452	804 7th Ave NW	N/A
Catch Basin	S5-02491-ST	S5-02491	517 8th St NW	N/A
Catch Basin	S5-02517	S5-02518	9th St NW & 5th Ave NW	N/A
Catch Basin	S5-02517	S5-02518	9th St NW & 5th Ave NW	N/A
Catch Basin	S5-02537	S5-02518	9th St NW & 5th Ave NW	N/A
Catch Basin	S5-02519	S5-02520	617 9th St NW	N/A
Catch Basin	S5-02519	S5-02520	606 9th St NW	N/A
Catch Basin	S5-02519	S5-02520	606 9th St NW	N/A
Catch Basin	S5-02486-ST	S5-02486	400 8th St NW	N/A
Catch Basin	S5-02334	S5-02335	635 4th Ave NE	N/A
Catch Basin	S5-02334	S5-02335	635 4th Ave NE	N/A
Catch Basin	S5-02237-ST	S5-02237	Orchard St	N/A
Catch Basin	S5-02422	S5-02423	2nd Ave NW	N/A
Catch Basin	S5-02487-ST	S5-02487	511 6th St NW	N/A
Catch Basin	S5-02487-ST	S5-02487	518 6th St NW	N/A



Defect Type	Upstream MH	Downstream MH	Defect Location	Comments
Catch Basin	S5-02236-ST	S5-02236	911 W Pioneer	N/A
Catch Basin	S5-02524	S5-02529	1011 W Stewart Ave	N/A
Catch Basin	S5-02273-ST	S5-02273	West Pioneer & 2nd St SE	In the middle of splash water park.
Catch Basin	S5-01348	S5-01346	1907 13th Ave NW	N/A
Catch Basin	S5-01348	S5-01346	1114 20th St NW	N/A
Catch Basin	S5-01440	S5-01441	1702 10th Ave NW	N/A
Downspout	S5-02453	S5-02454	812 8th St NW	N/A
Downspout	S5-02592	S5-02593	410 2nd Ave NE	Piping from disconnected downspout.
Downspout	S5-02437-ST	S5-02437	512 7th Ave NW	Multiple gutters.
Downspout	S5-02632-ST	S5-02632	417 4th Ave NE	N/A
Downspout	S5-02509-ST	S5-02509	717 3rd St NW	N/A
Downspout	S5-02504	S5-02505	728 2nd St NW	Left and center downspouts.
Downspout	S5-02626	S5-02627	510 3rd St NE	N/A
Downspout	S5-02503	S5-02504	721 2nd St NW	N/A
Downspout	S5-02503	S5-02504	721 2nd St NW	N/A
Downspout	S5-02503	S5-02504	723 2nd St NW	Multiple downspouts.
Downspout	S5-03232	S5-03233	122 5th Ave NW	N/A
Downspout	S5-02653	S5-02654	504 5th St NW	N/A
Downspout	S5-03216	S5-02349	W Meeker St	N/A
Downspout	S5-02469	S5-03231	427 North Meridian	N/A
Downspout	S5-02491-ST	S5-02491	710 6th Ave NW	N/A
Downspout	S5-02236-ST	S5-02236	911 W Pioneer	N/A
Downspout	S5-02600	S5-03231	436 2nd St NE	N/A
Downspout	S5-01554	S5-01632	820 15th St NW	N/A



## **Defective Pipe Segment Summaries**

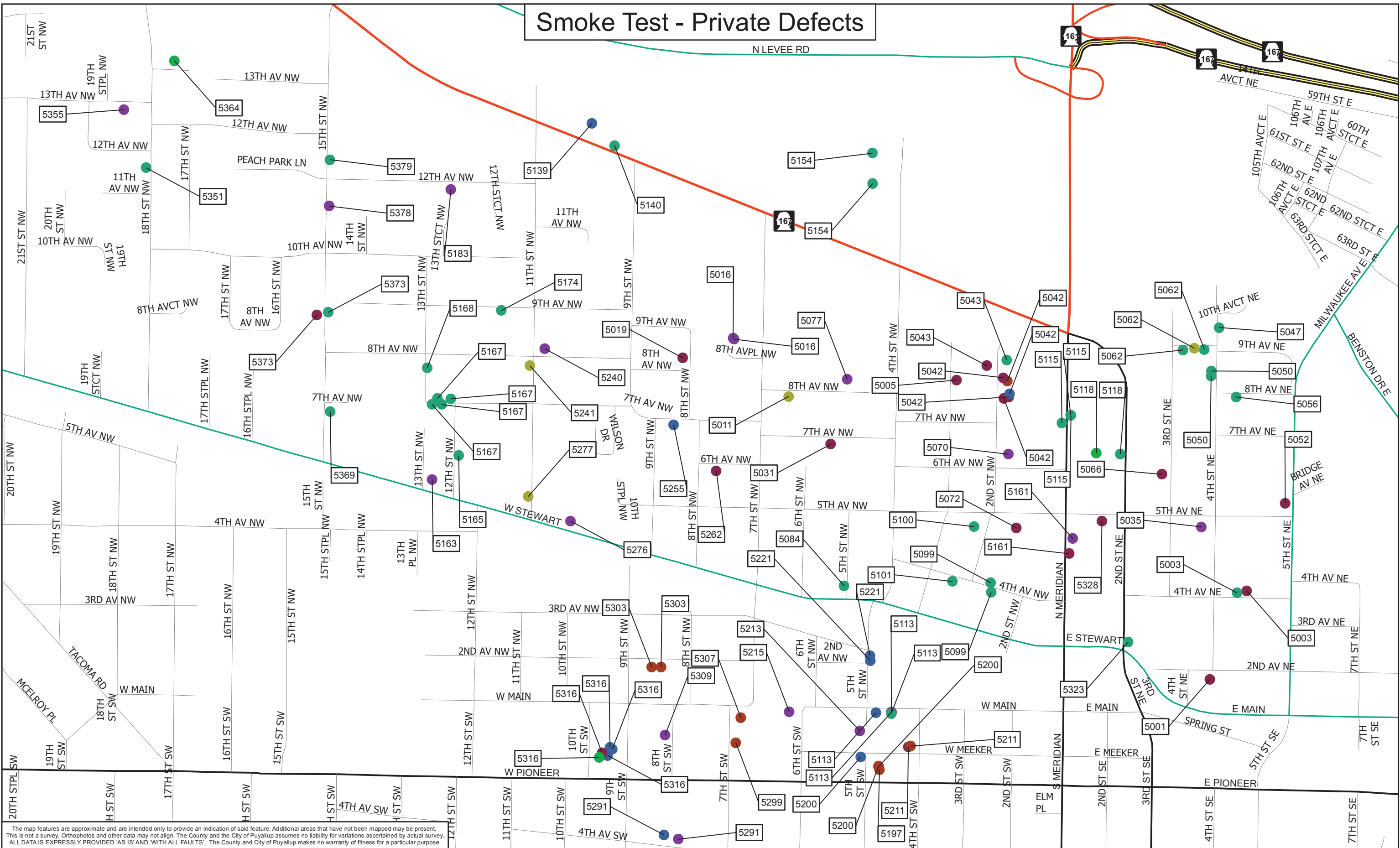
Prior to each basin's detail sheets, a defective or non-defective summary table is provided in order to quickly reference those pipe segments with or without defects in each basin, as well as their pipe lengths and number of defects.

## **Pipe Segment Detail Sheets**

Detail sheets for each pipe segment are presented to show the location of the pipe segment and any associated defects that were found during the smoke test inspection. The defects are presented with detailed dimensions from the nearest pipe segment and upstream manhole to facilitate easy location in the field. Other details such as defect type, smoke rate, drainage area, elevation, address, comments, and photos are provided. The supplementary volumes of this report contain the pipe segment detail sheets. The detail sheets for the project are grouped by the pipe segments with defects and those without. The purpose of the detail sheets showing no defects is to document the full coverage of the smoke testing and record that no defects were found when appropriate.



# Smoke Test - Private Defects

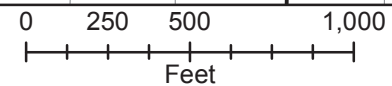


The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. Orthophotos and other data may not align. The County and the City of Puyallup assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'AS IS' AND 'WITH ALL FAULTS'. The County and City of Puyallup makes no warranty of fitness for a particular purpose.

Public Works  
Collections Division  
1100 39th Ave SE, Bldg A  
Puyallup, WA 98374  
253.770.3341

- Defect Type**
- Cleanout Cap Broken
  - Cleanout, Defective
  - Hole In Ground
  - See Comments
  - Cleanout Cap Missing
  - Downspout
  - No Smoke From Vent

#### = Pipe Segment Information Number



Drawn by: Jonathan Wikander on September 30, 2015  
Points provided by Hydromax USA  
file location: H:\jwikand\Sewer\Smoke Test\Private Defect Points.mxd

