Scoping of Lateral Loading Study
Lower Duwamish Waterway, WA

Site Reconnaissance Report

FINAL

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

Washington State Department of Ecology
Toxics Cleanup Program
300 Desmond Drive
Lacey, WA 98504

Prepared by

SAIC
From Science to Solutions

Science Applications International Corporation
18912 North Creek Parkway, Suite 101
Bothell, WA 98011

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List of Acronyms

CSO	combined sewer overflow
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
gpm	gallons per minute
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
MLLW	mean lower low water
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRP	potentially responsible parties
QAPP	quality assurance project plan
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RM	river mile
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SPU	Seattle Public Utilities

1.0 Introduction

Science Applications International Corporation (SAIC) is assisting the Washington State Department of Ecology (Ecology) with the development of a study to measure contaminant concentrations and estimate lateral sediment loading from significant municipal storm drain outfalls in the Lower Duwamish Waterway (LDW).

A wide range of contaminants are present in a 5.5-mile reach of the LDW, a Federal Superfund site. These include polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals. Ecology leads source control efforts in coordination with local government and supports the Environmental Protection Agency (EPA) efforts on the remedial investigation/feasibility study (RI/FS) and early actions. Ecology and EPA are currently implementing a two-phase RI/FS with the Lower Duwamish Waterway Group (LDWG), listed as potentially responsible parties (PRPs) by EPA. The LDWG members are: City of Seattle, The Boeing Company, Port of Seattle, and King County.

The LDWG has estimated contaminant loading through stormwater runoff into the LDW based largely on data from catch basin and in-line solids samples. Ecology, in its oversight role, is evaluating these estimates. As part of this evaluation, Ecology plans to measure contaminant concentrations and loading in stormwater for significant municipal stormwater outfalls within the LDW study area.

The goals of the lateral loading study include:

- Collection of data to model contaminant loading from significant municipal stormwater outfalls;
- Estimation of maximum allowable concentrations of contaminants in stormwater that will not recontaminate sediments to levels above sediment cleanup levels; and
- Correlation of in-line sediment trap, storm drain solids, and catch basin solids data with stormwater data, to the extent feasible.

SAIC is assisting with scoping of the lateral loading study by identifying and recommending storm drain outfall sampling locations, reviewing existing stormwater and storm drain solids data for these sampling locations, summarizing the methodology used in similar studies to calculate sediment loading, and preparing a sampling and analysis plan (SAP) and quality assurance project plan (QAPP) for conducting stormwater and solids sampling at the selected outfall locations. The purpose of this Site Reconnaissance Report is to describe and document SAIC's field activities regarding the identification of LDW storm drain outfalls that would be suitable for sampling for the lateral loading study. In addition to outfall identification, appropriate locations to access and sample these drainage lines were determined in the field. The data contained in this report will be used in the development of the SAP.

2.0 Site Reconnaissance

Before the initiation of field activities, SAIC created a list of 34 candidate storm drain outfall locations along the LDW to be located and described during field reconnaissance (Figure 1). The target area was from approximately river mile (RM) 0.0 to RM 5.0, as measured from the southern tip of Harbor Island. This initial list of potential sampling locations was based on an existing outfall inventory created by Seattle Public Utilities (SPU) in 2007, as amended. The selection criteria for candidate outfalls consisted of outfalls that were public and having pipe diameters greater than 24 inches. Reconnaissance activities consisted of:

1. In-waterway identification of outfalls, and
2. Upland identification of locations to access and sample drain lines associated with each outfall.

2.1 In-Waterway Outfalls

In-waterway field reconnaissance to identify and describe outfalls was conducted from the R/V *Growler*, owned and operated by SAIC, on May 28, 2009. This day was chosen due to the low afternoon tidal height of -2.1 feet mean lower low water (MLLW), allowing the greatest visibility of outfalls located at intertidal elevations. Proper identification of an outfall was confirmed by matching field GPS coordinates and physical characteristics with those provided by SPU. Observations recorded at each identified outfall included GPS coordinates, elevation, outfall dimensions, flow conditions, type of covering over the pipe end, possible sampling locations, and impediments to installing sampling equipment (Table 1). Digital photographs of outfalls and of potential sampling locations were taken to document field conditions (Appendix A).

All station coordinates were recorded in Northing and Easting (feet) based on the Washington North Zone of the North American Datum of 1983 (NAD83). Outfall elevations relative to MLLW were determined by measuring the vertical distance from the bottom of the outfall pipe to the current water level and adjusting by the current tidal height.

2.2 Upland Sampling Locations

Following the field identification of LDW outfalls, SPU and King County drain line delineations were used to ascertain manhole locations along the drain lines that could potentially serve as sampling access points. In the case of stormwater drain lines that empty into combined sewer overflows (CSOs), care was taken to ensure that the access location to the drain line was upgrade of the CSO. These manhole access locations were investigated during two upland reconnaissance expeditions on June 1 and 5, 2009. Proper identification of manhole access and drain lines were confirmed by matching field GPS coordinates and proximity to other geographic features with those provided by SPU. Observations recorded at each potential sampling site included GPS coordinates, depth to the bottom of the drain, and impediments to installing sampling equipment. The elevation of the drain bottom was determined by subtracting the depth to the bottom of the drain from the street surface elevation. Digital photographs of the manhole access locations and surface terrain in proximity to the manhole were collected to evaluate suitability for sampling (Appendix A).

Table 1. LDW Outfalls Visited During Field Reconnaissance

	RI Outfall #	SPU Outfall #	Outfall Identified	Easting[1]	Northing[1]	Elevation (feet MLLW)	Outfall Diameter (inch)	Approximate Flow (gpm)	Opening Cover
East Bank	--	105	N	1266991.3	210057.02	--	--	--	--
	2155	106	Y	1267147	209072	-1.40	144	Partially Submerged	None
	2153	107	N	1267207	209036	--	36	--	--
	2244	119	N	1268022.6	206128.82	--	--	--	--
	2223	121	Y	1268177	205981	--	--	1	Tide gate
	2503	138	Y	1269661	201959	16.25	36	None	None
	--	142	Y	1269791.8	201635.15	0	14	5	None
	--	144	Y	1270333.6	201114.13	2.20	30	10	None
	2026	151	Y	1271302.4	200329.49	13.00	30	None	Pinch Valve
	2035	153	Y	1271520.7	199792.64	12.00	30	None	Pinch Valve
	2046	157	Y	1273450.4	199485.49	6.00	72	None	Tide gate
	2047	156	Y	1273472.1	199491.84	-1.00	72	None	Grate
	2048	158	Y	1273518.6	199474.19	10.50	24	None	None
	2049	159	Y	1273556	199466.33	8.00	60	5	None
	--	160	N	1273584.4	199438.65	--	36	--	--
	3032	186	N	1274635.4	196875.56	--	12	--	--
	2062	227	Y	1276177.3	194741.84	9.00	48	20	None
	2080	234	Y	1277423.3	193059.84	10.00	24	30	Pinch Valve
	2095	253	Y	1278630.9	190179.95	3.90	84	50	Tide gate
West Bank	2149	300	N	1265146.5	210889.04	4.80	24	Partially Submerged	--
	2147	305	Y	1266120.9	209890.62	4.67	72	5	None
	--	310	N	1266421.6	209127.62	--	36	--	--
	2127	332	Y	1268208.5	203621.81	2.10	48	50	Tide gate
	2220	333	Y	1268617	202385	5.80	24	10	None
	2125	335	Y	1268802.6	201931.41	0.00	72	Partially Submerged	Grate
	2122	338	Y	1269042.5	201764.47	13.00	24	5	Tide gate
	2506	1	Y	1269541	201164	-0.30	36	Partially Submerged	None
	2120	347	Y	1269733.2	200361	--	36	5	None
	2118	349	Y	1269981.4	200293.01	-1.20	24	5	None
	2112	355	N	1271932.4	198565.17	--	--	--	--
	2107	356	Y	1272541.5	198216.65	-3.50	36	Partially submerged	None
	2210	368	Y	1275539	195379	10.00	4	None	None
	2100A	374	Y	1276001.9	192698.76	2.00	72	50	None
	2100B	375	Y	1276001.9	192698.76	14.00	6	None	None

1. Washington State Plane North, NAD 83, feet
gpm = gallons per minute

3.0 Site Descriptions

This section contains summarized descriptions of the identified LDW outfalls and the most suitable location of manhole access to the drain lines for the installation of sampling equipment. Specific data regarding outfalls can be found in Table 1. An automated sampler is proposed for stormwater sampling and consists of a flow/salinity triggered peristaltic pump that stores flow-weighted samples in a glass bottle carousel. The entire sampling package is self-contained and can be securely suspended from a harness below the manhole, above the drain line. A more detailed description of this equipment will be provided in the SAP.

Descriptions of the outfalls and drain line access sites are best understood when used in conjunction with Appendix A, which photo-documents the sites. Individual outfalls and their drain lines are primarily identified in this report by their LDW Remedial Investigation (RI) identification number (e.g., RI #2155). However, if an RI identification number was not available or not applicable, the outfall's secondary SPU identification number (e.g., SPU #332) was used. Outfalls are organized by location (east or west bank), and are ordered downstream to upstream. All locations scouted in the field are contained in this report, including those not found.

3.1 East Bank Outfalls

Outfall SPU #105

Outfall SPU #105 was not identified in the field, possibly due to its being located either behind riprap or below the water level. The most appropriate manhole access to this outfall's drain line is found at the western end of S Nevada Street (see Figure 2 and Appendix A, p. A-1). Although the outfall was not identified, water flowing westward in the drain line suggests that the outfall is actively emptying into the LDW.

Outfall RI #2155

Outfall RI #2155 is a 144-inch diameter, open-ended pipe located within a concrete housing platform. Atop the platform are two manholes that allow access to the mouth of the outfall (see Figure 3 and Appendix A, p. A-2). Hinges at the entrance to the outfall may have once held a tide gate. The most suitable site for accessing the drain line is a manhole found northeast of the intersection of S Oregon Street and Colorado Ave S. This access location is found in the corner of a parking lot, just south of railroad tracks.

Outfall RI #2153

Outfall RI #2153 was not identified in the field. Intertidal riprap was found at the location noted by SPU.

Outfall RI #2244

Outfall RI #2244 was not identified in the field. SPU coordinates place the outfall underneath a pier amongst riprap. This area was searched on foot, but the outfall was not found.

Outfall RI #2223

Outfall RI #2223 consists of a large concrete structure on the riverbank. Stormwater that passes through this outfall first collects in a cistern located underneath a small building atop a concrete platform (see Appendix A, p. A-3). Water overflowing the cistern collects in an overflow chamber on the south side of the building. Water can escape the overflow chamber through a tide gate, where it is then funneled into a pipe that discharges to the LDW at a subtidal elevation. A hydraulic floodgate on the west side of the building may be opened during storm events to allow direct discharge from the cistern. No suitable manhole access to the drain line upgrade of the CSO was found.

Outfall RI #2503

Outfall RI #2503 consists of a 36-inch diameter, open-ended drain pipe that discharges into a ditch underneath the southbound 1st Avenue S Bridge onramp (see Figure 4 and Appendix A, p. A-4). The outfall is located above the Duwamish high water line. Although currently dry, the outfall pipe is partially in-filled with gravel and sand. Manhole access to the drain line is found on S Michigan Street underneath the 1st Avenue S Bridge. An alternative sampling location closer to the outfall is found in a gravel lot near the train tracks that pass under the 1st Avenue S Bridge. Unlike the S Michigan Street access site, the alternative location receives stormwater draining from the bridge's roadway. However, the drain line located at the alternative access is very shallow (4 feet), likely requiring sampling equipment to be placed on the ground surface rather than underneath the manhole.

Outfall SPU #142

Outfall SPU #142 consists of a 14-inch diameter, open-ended, iron pipe that discharges to the LDW amongst riprap underneath the 1st Avenue S Bridge, adjacent to a public boat launch (see Figure 4 and Appendix A, p. A-5). Flow through the outfall was approximately 5 gallons per minute (gpm) at the time of observation. Manhole access to the drain line is found along S River Street near the boat launch, in front of a chain-link gate on Muckleshoot property.

Outfall SPU #144

Outfall SPU #144 consists of a 30-inch diameter, open-ended concrete pipe that emerges from a bulkhead underneath a pier (see Figure 5 and Appendix A, p. A-6). Flow through the outfall was approximately 10 gpm at the time of observation. The most appropriate sampling access manhole is located just west of the intersection of S Brighton Street and Fox Avenue S, outside of the Delta Marine North gate.

Outfall RI #2026

Outfall RI #2026 consists of a 30-inch diameter concrete pipe capped with a pinch valve (see Figure 6 and Appendix A, p. A-7). The pipe emerges from riprap in a small cove at the end of S Myrtle Street. Suitable access to the drain line is found at a manhole located in the turnaround at the west end of S Myrtle Street.

Outfall RI #2035

Similar to Outfall RI#2026, Outfall RI #2035 consists of a 30-inch diameter concrete pipe capped with a pinch valve (see Figure 6 and Appendix A, p. A-8). The pipe emerges from riprap adjacent to a pier. Access to this drain line is available at a manhole found in the turnaround at the west end of S Garden Street.

Outfall RI #2046

Outfall RI #2046 drains a portion of the I-5 Freeway. The outfall is located in Slip 4 and consists of a 72-inch diameter pipe that emerges from the bank riprap at a concrete wall with wing walls (see Appendix A, p. A-9). The pipe opening is covered by a tide gate attached to the wall. Suitable manhole access to this drain line was not found.

Outfall RI #2047

Outfall RI #2047 is located just east of Outfall RI #2046 in Slip 4. The 72-inch diameter pipe opening is partially in-filled with miscellaneous debris and is covered by a grate (see Appendix A, p. A-10). This outfall drains a flume on the northeast side of E Marginal Way. Suitable manhole access to this drain line was not found.

Outfall RI #2048

Outfall RI #2048 consists of a 24-inch diameter, open-ended concrete pipe that emerges from bank riprap (see Appendix A, p. A-11). No flow was occurring at the time of observation. Manhole access to this drain line is found northeast of the outfall, amongst brush adjacent to railroad tracks. This drain line has recently been plugged on Boeing property and is therefore not suitable for sampling.

Outfall RI #2049

Outfall RI #2049 is a 60-inch diameter, open-ended pipe that empties into Slip 4 at a concrete wall with wing walls (see Appendix A, p. A-12). Flow through the outfall was approximately 5 gpm at the time of observation. Suitable manhole access to this drain line was not found.

Outfall SPU #160

Outfall SPU #160 was not identified in the field. Intertidal riprap and brush were found at the location noted by SPU.

Outfall RI #3032

Outfall RI #3032 was not identified in the field but is believed to empty into the LDW under the 16th Avenue S Bridge (see Figure 7 and Appendix A, p. A-13). The most appropriate manhole access to this outfall's drain line is found on the sidewalk along southbound 16th Avenue S. Although the outfall was not identified, water flowing southward in the drain line suggests that the outfall is actively emptying into the LDW.

Outfall RI #2062

Outfall RI #2062 consists of a 48-inch diameter, open-ended steel pipe that protrudes from a bulkhead (see Figure 8 and Appendix A, p. A-14). Water flow was approximately 20 gpm at the time of observation. This outfall drains the northern portion of the King County Airport. The most suitable manhole access to this outfall's drain line is located in the roadway of S 87th Place, a King County Airport access road parallel to East Marginal Way S.

Outfall RI #2080

Outfall RI #2080 is a 24-inch diameter, riveted, steel pipe with a pinch valve closure at its end (see Figure 9 and Appendix A, p. A-15). The pipe extends out from bank riprap near the high water mark. Water flow was approximately 30 gpm at the time of observation. The most appropriate manhole access to the drain line is found in a grassy median east of East Marginal Way S.

Outfall RI #2095

Outfall RI #2095 consists of an 84-inch diameter pipe that empties into the LDW at a concrete wall with wing walls (see Figure 10 and Appendix A, p. A-16). The opening is covered by a tide gate that hangs from the concrete wall. Drain water pours over a concrete platform before reaching the LDW. The most suitable manhole access to the drain line upstream of the CSO is found along a Boeing access road parallel to E Marginal Way. A bottle-type sediment trap was observed within the drain line attached to the wall of the pipe.

3.2 West Bank Outfalls

Outfall RI #2149

Outfall RI #2149 consists of a 24-inch diameter pipe emptying into a swale at a roadside park (see Appendix A, p. A-17). Locations of drain lines and access sites for the outfall are unknown.

Outfall RI #2147

Outfall RI #2147 consists of a 72-inch diameter pipe that empties into the LDW at a concrete wall (with wing walls) surrounded by bank riprap (see Figure 11 and Appendix A, p. A-18). The opening of the pipe is partially blocked by the remnants of a metal gate. The most appropriate access to the drain line is found at a manhole located outside the T-105 gate along SW Idaho

Street. This manhole is found between railroad tracks and along the T-105 fence line. A bottle-type sediment trap was observed within the drain line attached to the wall of the pipe.

Outfall SPU #310

The location of Outfall SPU #310 noted by SPU is located at the corner of a bulkhead underneath a pier. This area was searched, but the outfall was not identified.

Outfall RI #2127

Outfall RI #2127 consists of a 48-inch diameter pipe that empties into the LDW at a concrete wall (with wing walls) surrounded by bank riprap (see Figure 12 and Appendix A, p. A-19). The opening of the pipe is covered with a tide gate attached to the wall. At the time of observation, flow out of the pipe was approximately 50 gpm. The most appropriate manhole access to the drain line is located outside the exit gate of the Port of Seattle. This manhole is located in a roadway used by truck traffic exiting the Port.

Outfall RI #2220

Outfall RI #2220 consists of a 24-inch diameter, concrete pipe that emerges from riprap underneath a pier (see Appendix A, p. A-20). Water flow from the outfall was approximately 10 gpm at the time of observation. No manhole access locations were identified for this outfall.

Outfall RI #2125

Outfall RI #2125 consists of a 72-inch diameter pipe that emerges from riprap at a concrete wall (see Figure 13 and Appendix A, p. A-21). The pipe opening is securely covered by a grate. The most appropriate manhole access to this drain line is located along SW Front Street, behind a guard house inside the entrance to the Port of Seattle.

Outfall RI #2122

Outfall RI #2122 consists of a 24-inch diameter, concrete pipe that emerges from bank riprap at the high water line (see Appendix A, p. A-22). Water flow from the outfall was approximately 5 gpm at the time of observation. No manhole access sites were identified for this outfall.

Outfall RI #2506

Outfall RI #2506 consists of a 36-inch diameter, open-ended, concrete pipe that emerges from bank riprap underneath the southbound lanes of the 1st Avenue S Bridge (see Appendix A, p. A-23). Manhole access to the drain line is located along the dead end road SW Peninsula Place. This drain line is a CSO and therefore is not suitable for sampling.

Outfall RI #2120

Outfall RI #2120 consists of a 36-inch diameter, open-ended, concrete pipe that empties into the head of an intertidal swale (see Appendix A, p. A-24). Water flow from the pipe was approximately 5 gpm at the time of observation. No definite drain lines for this outfall were

identified from SPU data, but a storm grate west of the outfall may provide access to the drain line.

Outfall RI #2118

Outfall RI #2118 consists of a 24-inch diameter, open-ended, concrete pipe that empties onto the southern bank of an intertidal swale (see Appendix A, p. A-25). No manhole access sites were identified for this outfall.

Outfall RI #2112

Based upon SPU data, Outfall RI #2112 is believed to empty into the LDW in a small cove (see Figure 14 and Appendix A, p. A-26). River access to the outfall is blocked by piers and barges, while upland access is blocked by a chain-link fence. Manhole access to the drain line is found next to a fence in a gravel lot at the end of 7th Avenue S.

Outfall RI #2107

Outfall RI #2107 consists of a 36-inch diameter, open-ended, concrete pipe that emerges from bank riprap (see Appendix A, p. A-27). The outfall is located at a public park at the end of 8th Avenue S. Manhole access is found along a sidewalk within the 8th Avenue S Park. This drain line is a CSO and therefore is not suitable for sampling.

Outfall RI #2210

Outfall RI #2210 consists of a 4-inch diameter, open-ended, plastic pipe that emerges from bushes on the bank of Terminal 117 (see Appendix A, p. A-28). No manhole access sites were identified for this outfall.

Outfall RI #2100A

Outfall RI #2100A consists of a 72-inch diameter, open-ended pipe that emerges from bank riprap in the southwest corner of the Duwamish Yacht Club Marina (see Appendix A, p. A-29). Water flow from the outfall was approximately 50 gpm at the time of observation. No manhole access sites were identified for this outfall.

Outfall RI #2100B

Outfall RI #2100B consists of a 6-inch diameter, open-ended, PVC pipe that emerges from brush in the same corner of the Duwamish Yacht Club Marina as Outfall #374 (see Appendix A, p. A-30). No manhole access sites were identified for this outfall.

4.0 Sampling Location Recommendations

After field evaluation of the 34 candidate outfalls and drain line access locations, 15 outfalls were deemed suitable for stormwater sampling under the scope of the lateral loading study (Table 2). These 15 recommended sampling locations:

- Allow minimally obstructed access to drain lines that empty to the LDW,
- Provide adequate conditions for the long-term installation of stormwater sampling equipment, and
- Are representative of a variety of industrial land use types and drainage basin sizes.

Criteria for rejecting outfalls included:

- The inability to identify the outfall and drainage in the field,
- Highly obstructed access to drain lines, or
- Drain line access being located too far upgrade from the outfall to be representative of the total drainage basin.

Table 2. Access Location Information for LDW Outfalls Recommended for Stormwater and Solids Sampling

	RI Outfall #	SPU Outfall #	Name	Easting[1]	Northing[1]	Elevation of Drain Bottom (feet MLLW)	Manhole Marking
East Bank	--	105	--	1267430.9	210049.8	9.6	DRAIN
	2155	106	Diagonal Ave S CSO/SD	1269250.4	209114.3	0.3	DRAIN
	2503	138	--	1269780.8	202150.4	10.7	DRAIN
	--	142	--	1269926.2	201715.4	4.1	DRAIN
	--	144	S Brighton CSO/SD	1271076.2	201126.4	4.6	DRAIN
	2026	151	S Myrtle St SD	1271370.1	200335.5	9.8	DRAIN
	2035	153	S Garden St SD	1271943.7	199825	13.5	DRAIN
	3032	186	--	1274778.4	197450	12.5	DRAIN
	2062	227	CSO 156/KC airport #2	1277674	194845.1	12.0	DRAIN
	2080	234	KC airport #1	1278214.4	193884.6	4.0	SEWER
	2095	253	Norfolk CSO/SD #178	1279322	190883	6.3	Pacific Foundry Co., Seattle
West Bank	2147	305	SW Idaho St SD	1265352.9	209905.9	8.5	DRAIN
	2127	332	SW Kenny St SD	1267608.2	203631.8	6.6	DRAIN
	2125	335	Highland Park SD	1267970.3	201212.1	2.6	STORM
	2112	355	7th Ave S SD	1271890.1	198500	-0.4	DRAIN

1. Washington State Plane North, NAD 83, feet

Figures

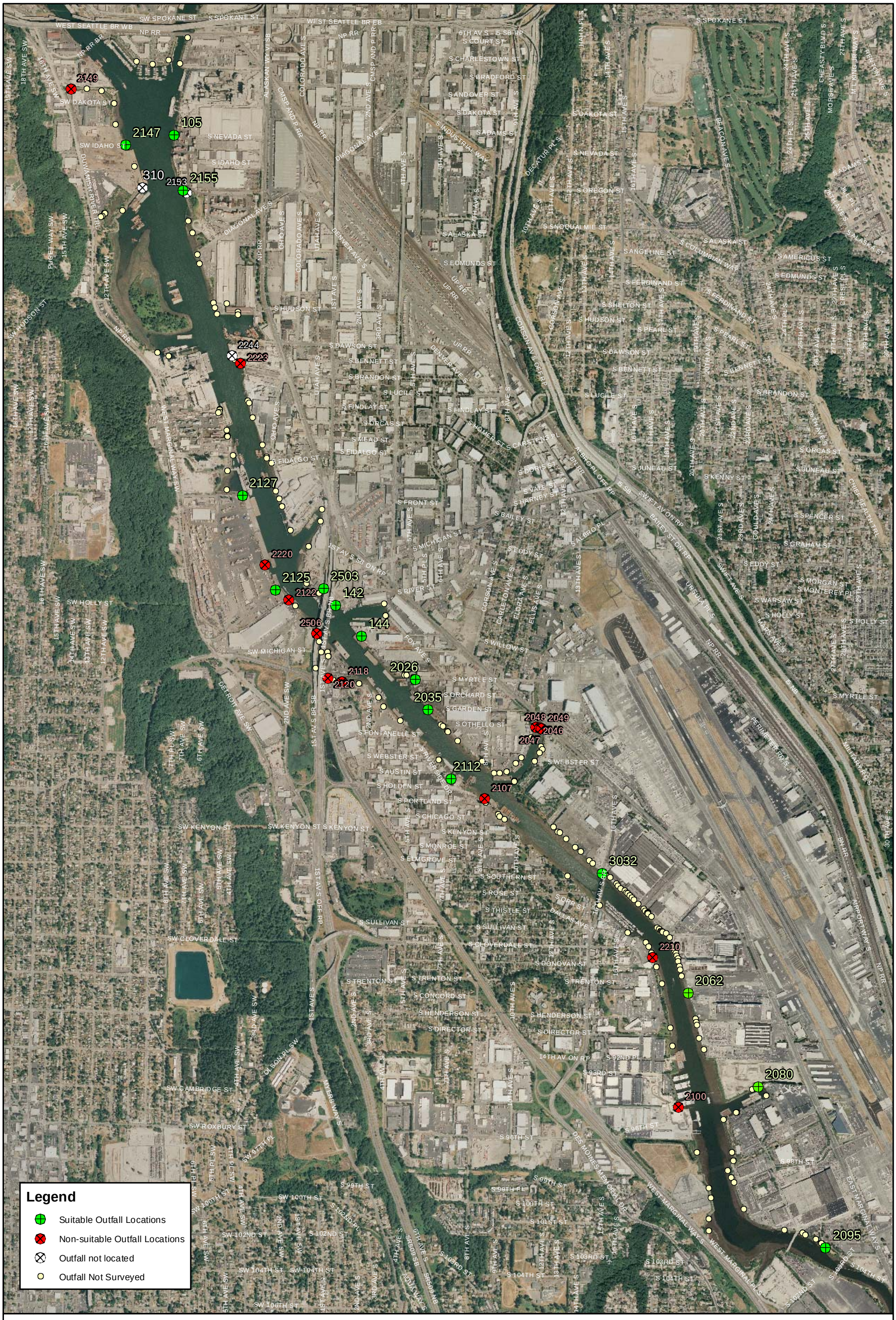

Figure 1. LDW Outfalls Studied During Field Reconnaissance

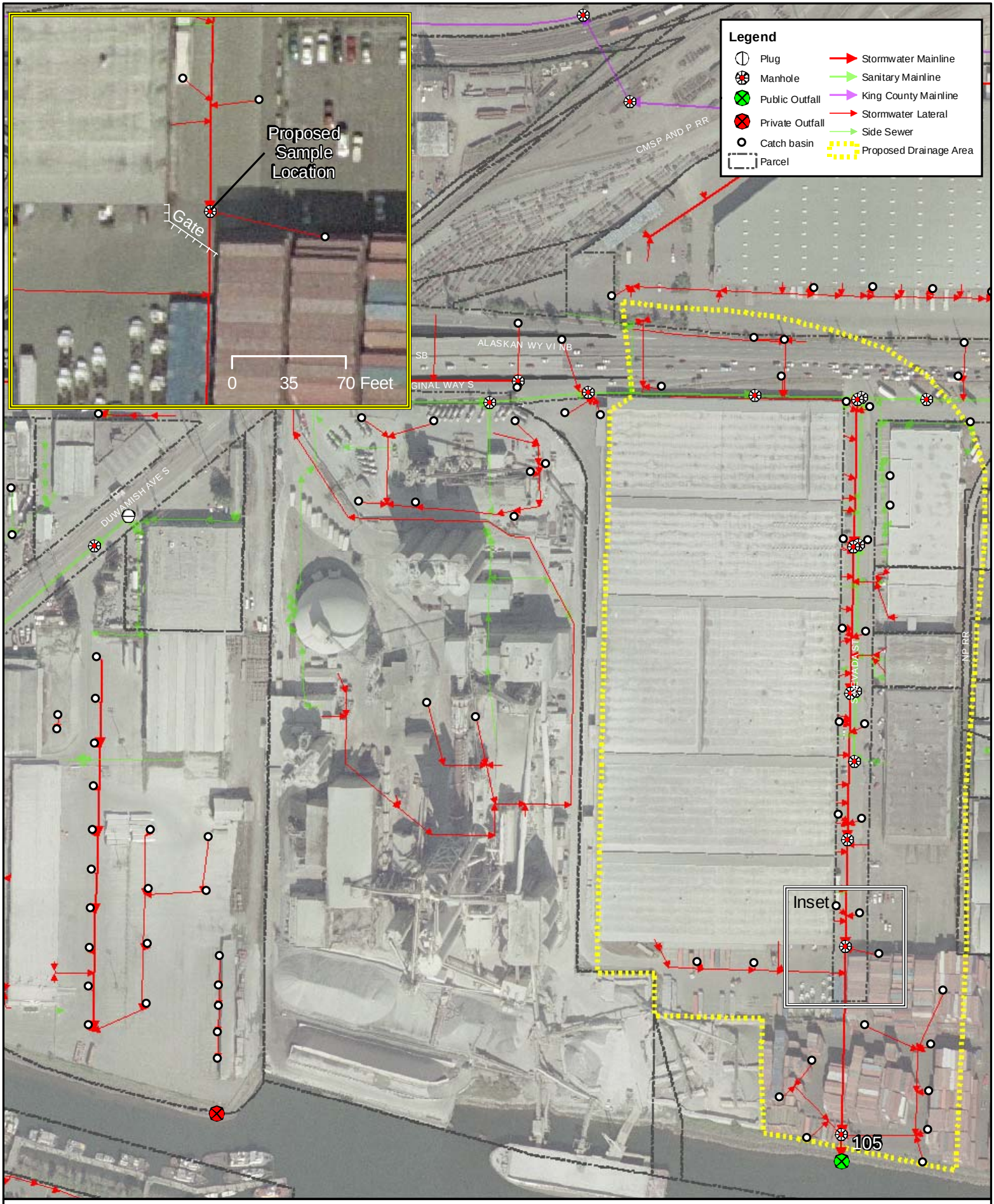

Figure 2. Locations of SPU #105 Outfall and Access

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N

1 inch = 250 feet

0 200 400 800 Feet

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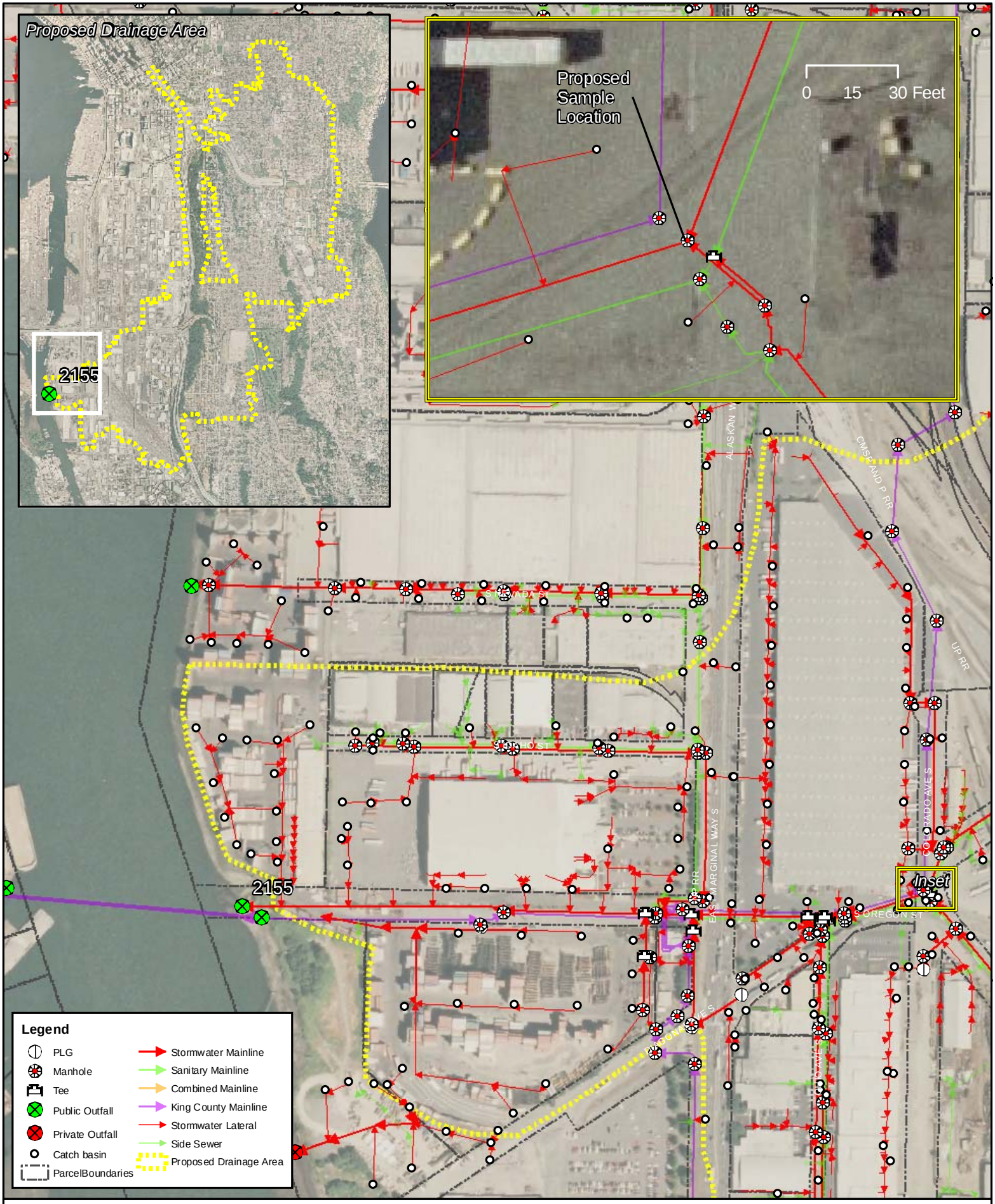

Figure 3. Locations of RI #2155 Outfall and Access

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N

1 inch = 375 feet

0 250 500 1,000 Feet

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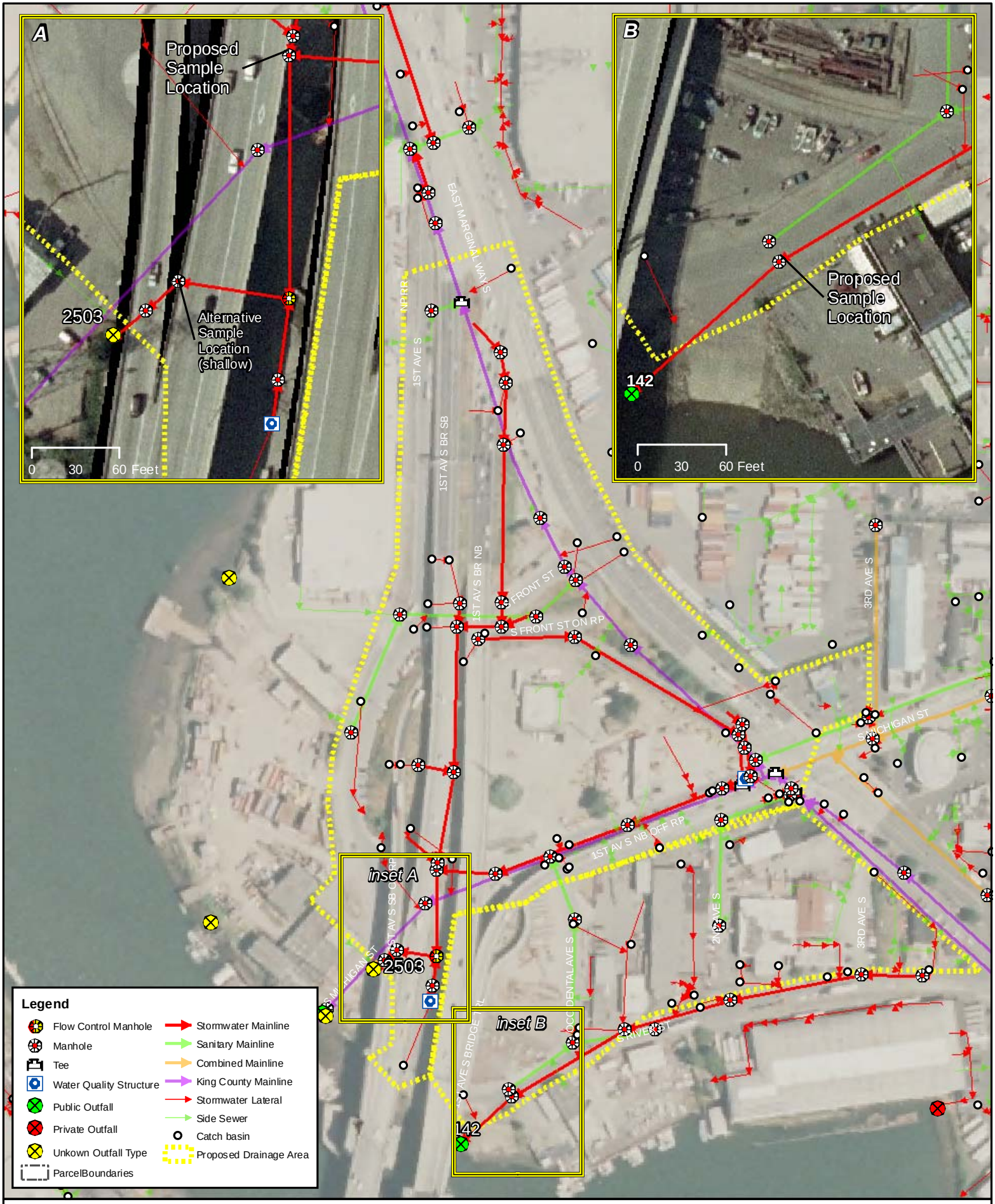

Figure 4. Locations of RI #2503 and SPU #142 Outfalls and Access

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N

1 inch = 233 feet

0 150 300 600 Feet

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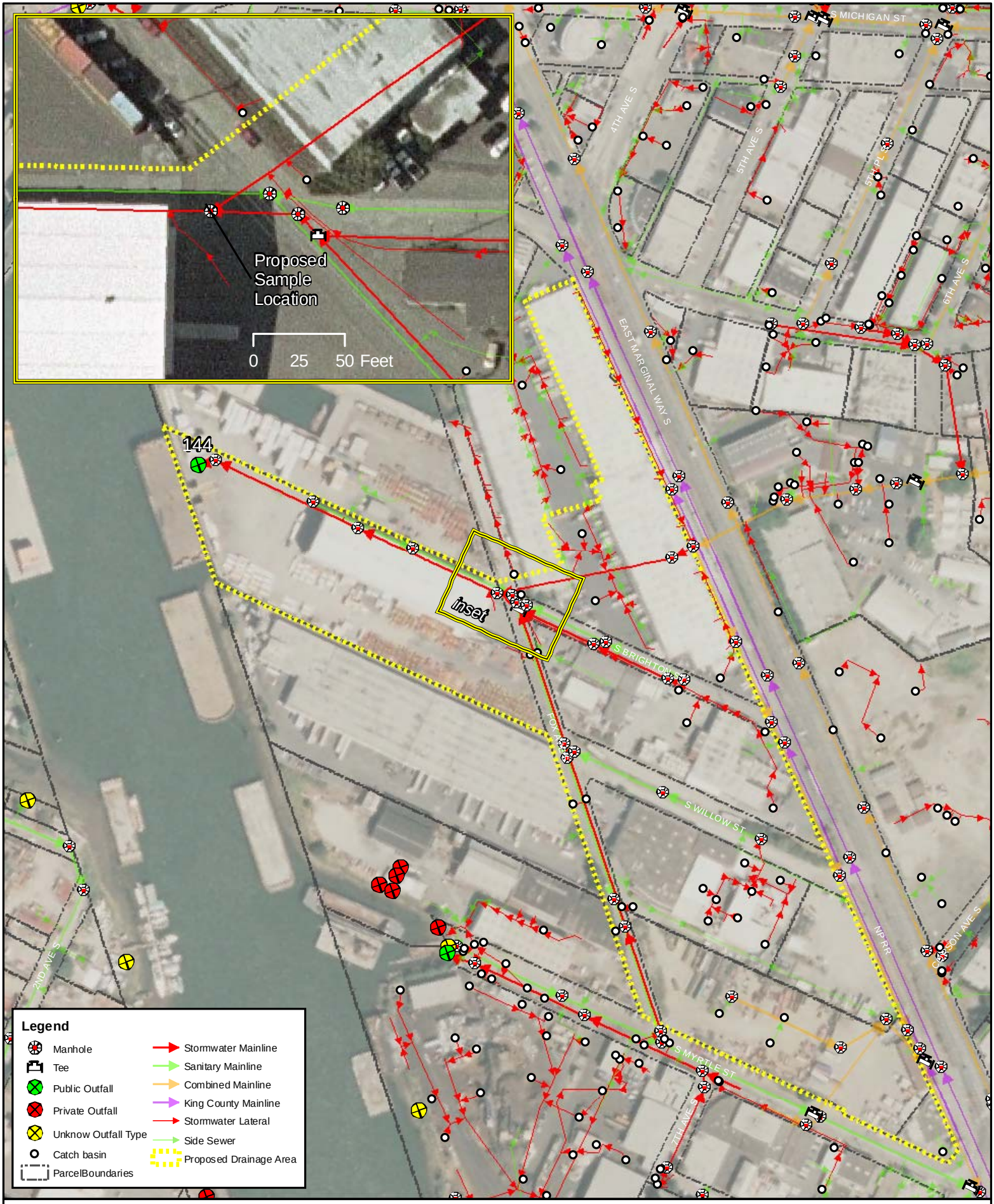

Figure 5. Locations of SPU #144 Outfall and Access

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1 inch = 278 feet

0 200 400 800 Feet

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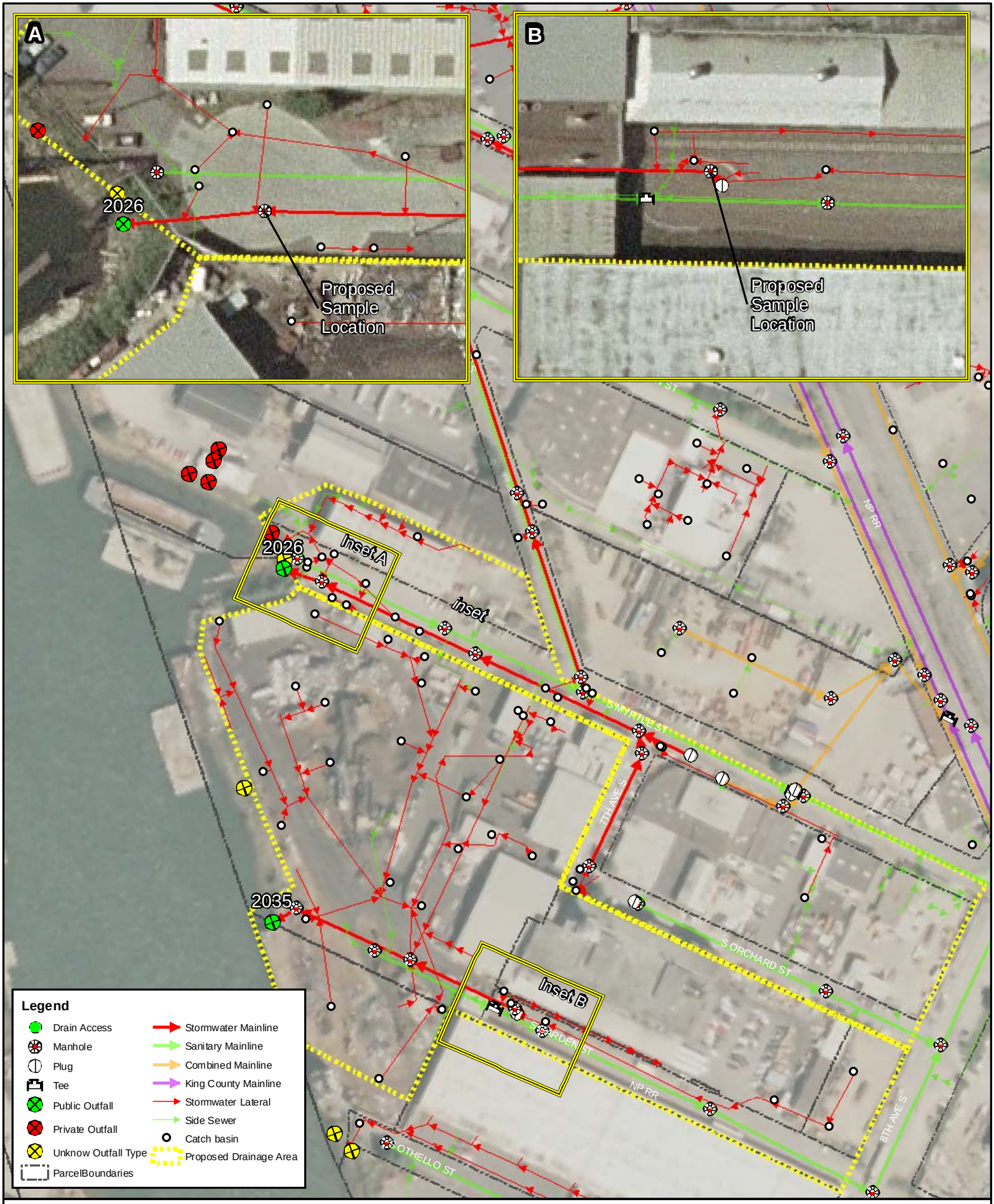

Figure 6. Locations of RI #2026 and RI #2035 Outfalls and Access

1 inch = 200 feet

0 150 300 600 Feet

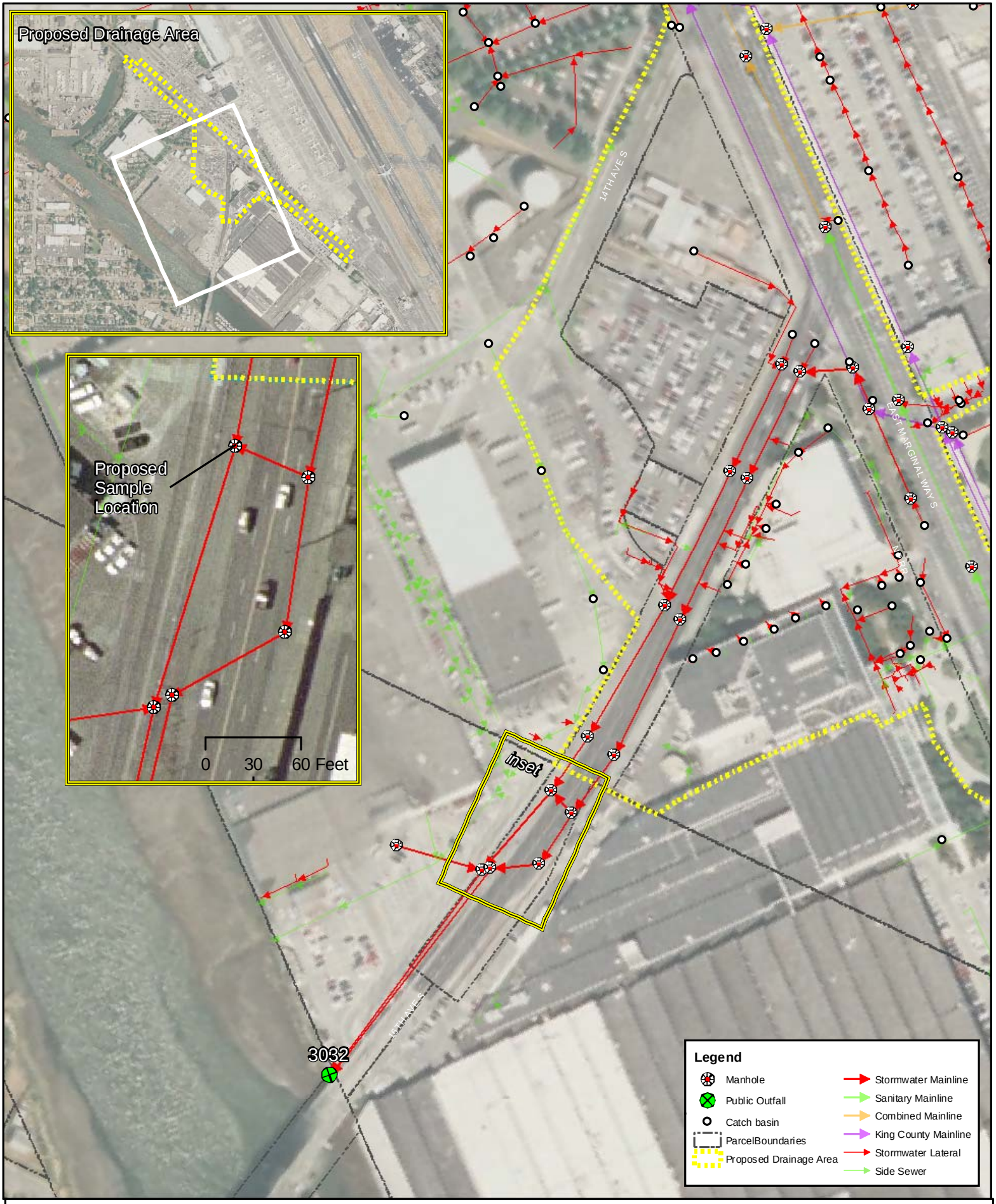

Figure 7. Locations of RI #3032 Outfall and Access

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1 inch = 200 feet

0 150 300 600 Feet

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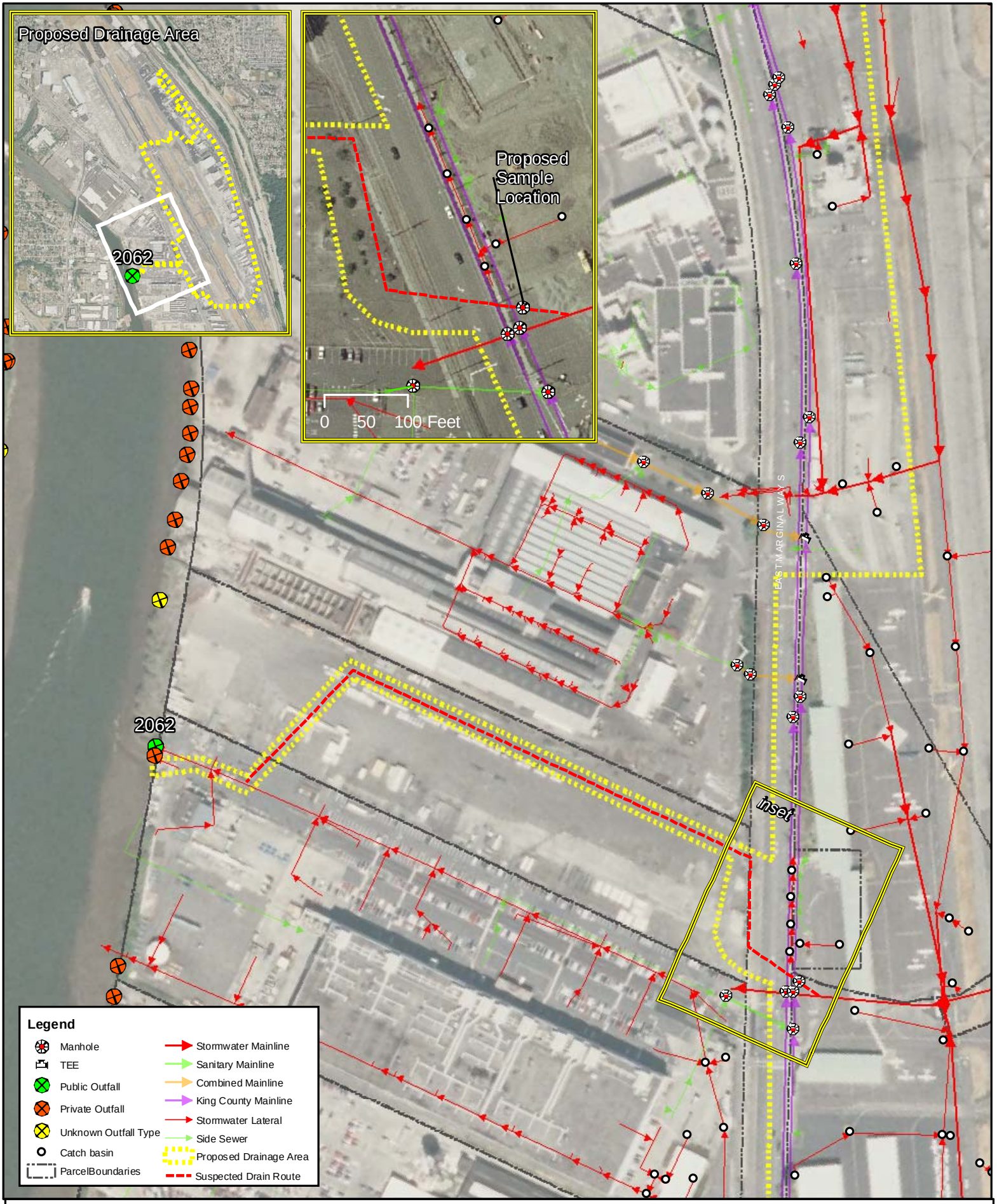


Figure 8. Locations of RI #2062 Outfall and Access

DEPARTMENT OF ECOLOGY State of Washington

1 inch = 267 feet

0 200 400 800 Feet

SAIC From Science to Solutions

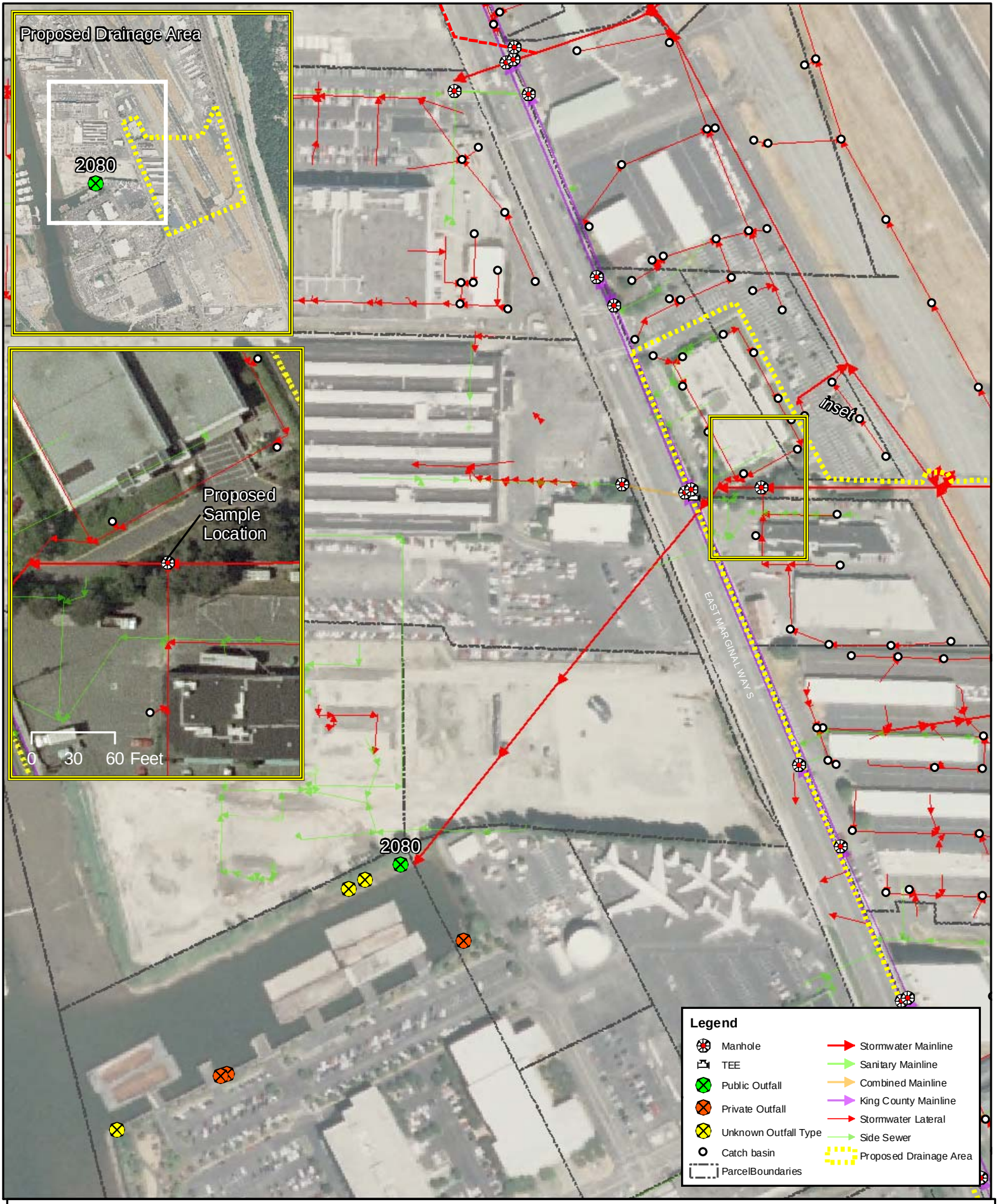


Figure 9. Locations of RI #2080 Outfall and Access

DEPARTMENT OF ECOLOGY State of Washington

N

1 inch = 267 feet

0 200 400 800 Feet

SAIC From Science to Solutions

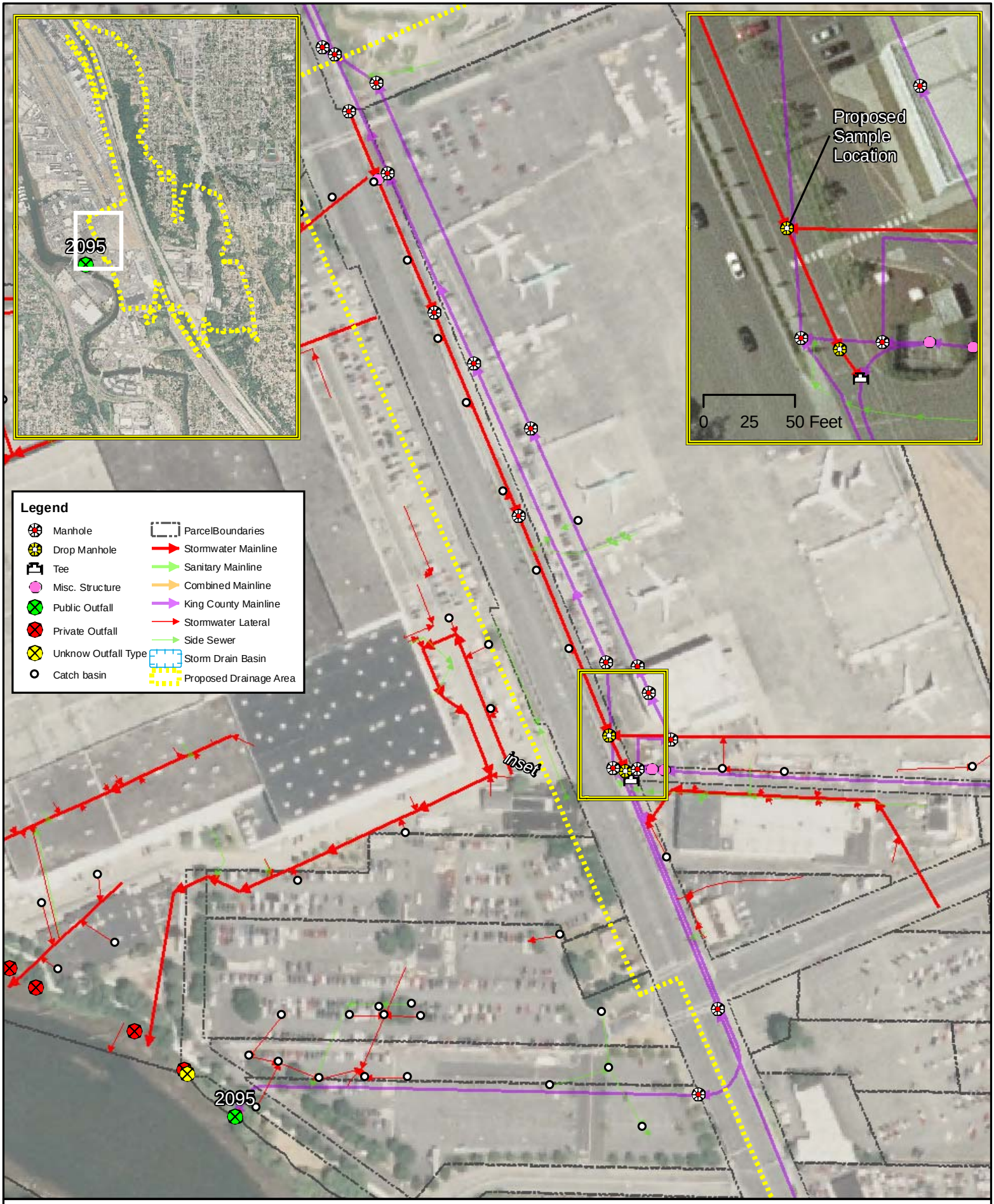


Figure 10. Locations of RI #2095 Outfall and Access

Figure 11. Locations of RI #2147 Outfall and Access

DEPARTMENT OF ECOLOGY State of Washington

N

1 inch = 200 feet

0 150 300 600 Feet

SAIC From Science to Solutions

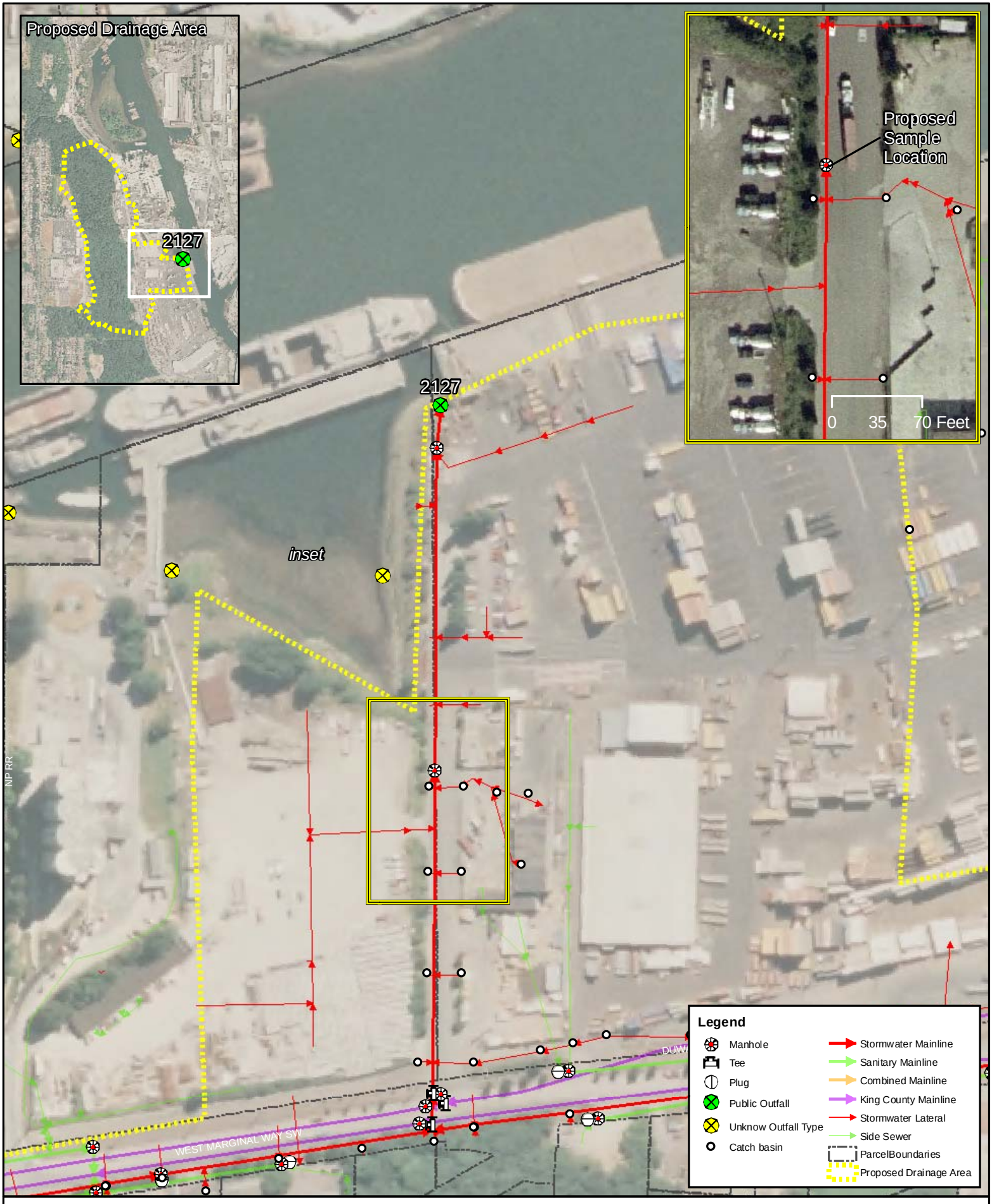


Figure 12. Locations of RI #2127 Outfall and Access

DEPARTMENT OF ECOLOGY State of Washington

N

1 inch = 200 feet

0 150 300 600 Feet

SAIC From Science to Solutions

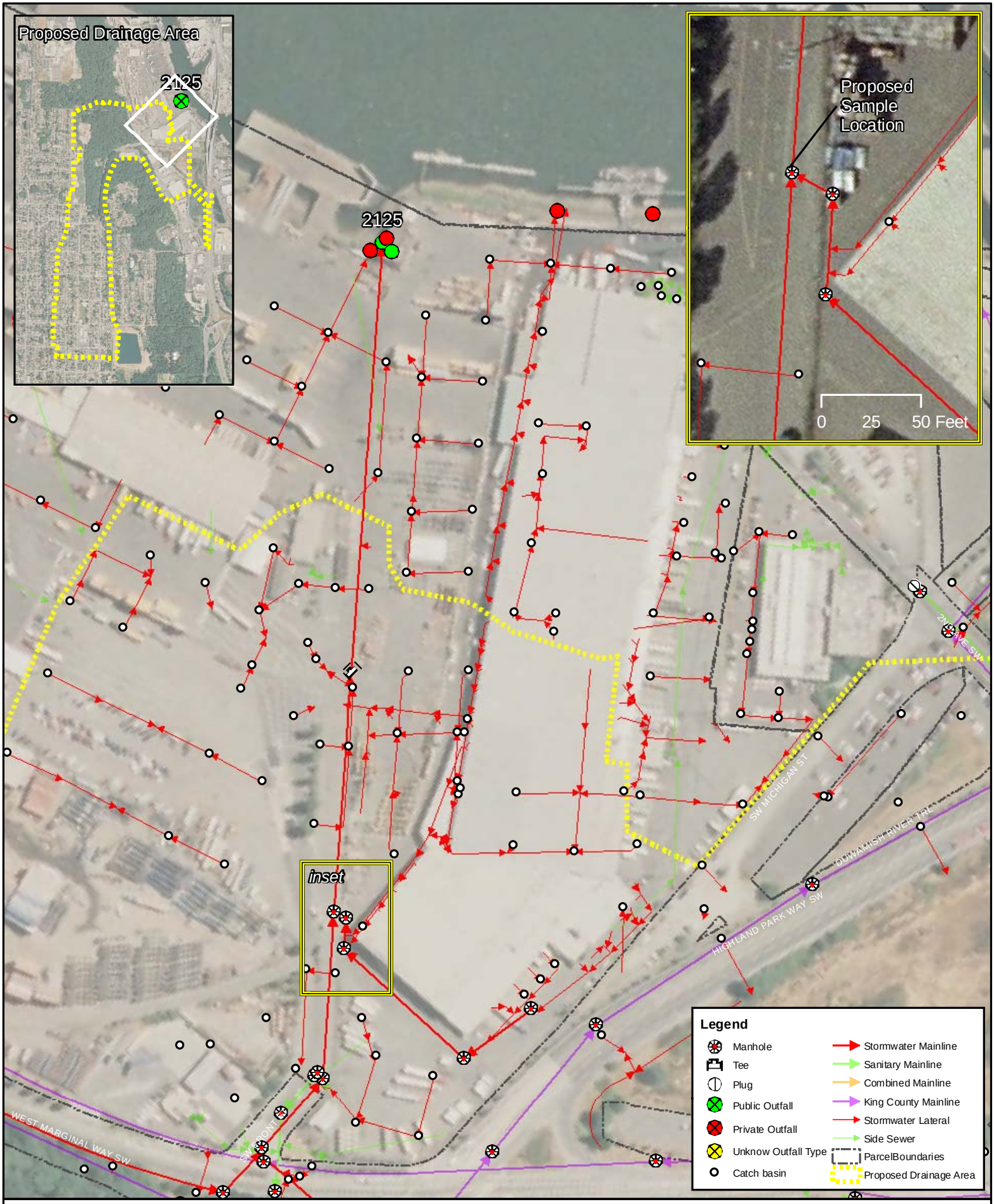


Figure 13. Locations of RI #2125 Outfall and Access

DEPARTMENT OF ECOLOGY State of Washington

1 inch = 200 feet

0 150 300 600 Feet

SAIC From Science to Solutions

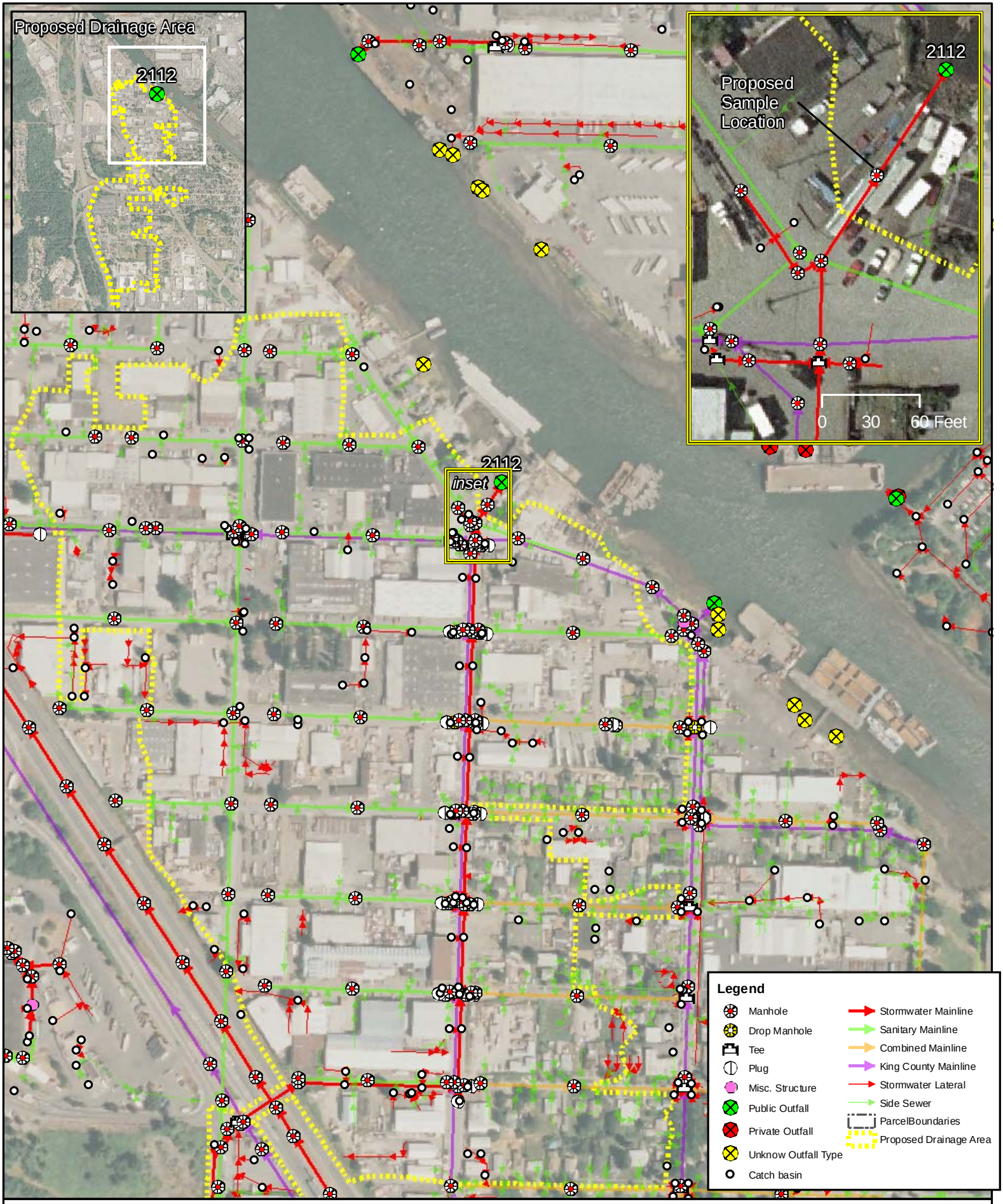


Figure 14. Locations of RI #2112 Outfall and Access

DEPARTMENT OF ECOLOGY
State of Washington

N

1 inch = 350 feet

0 250 500 1,000 Feet

SAIC
From Science to Solutions

Appendix A

Photographs of Outfalls and Potential Sampling Locations

SPU #105

RI #2155


PIPELINE
CROSSING
DO NOT ANCHOR
BETWEEN SIGNS


APEX


UNION PACIFIC RAILROAD
SEATTLE MECHANICAL
SO DIAGONAL AVE. S.

RI #2223

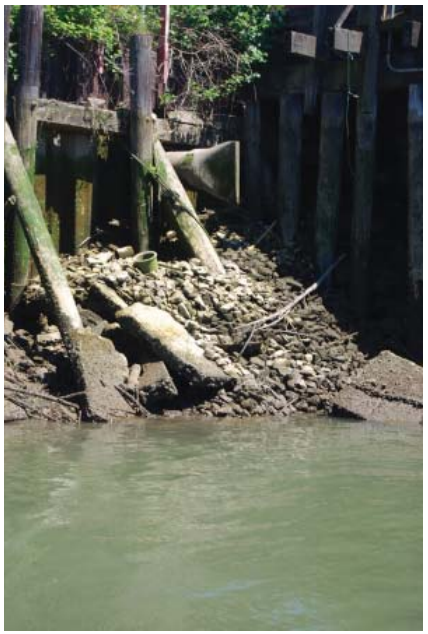
RI #2503

SPU #142

SPU #144

RI #2026

RI #2035



RI #2046

RI #2047

RI #2048

RI #2049

RI #3032

RI #2062

RI #2080

RI #2095

RI #2149

RI #2147

RI #2127


CAUTION
EXIT ONLY
WRONG WAY
CAUTION
AUTOMATIC GATE
KEEP CLEAR
EXIT ONLY
DO NOT ENTER

RI #2220

RI #2125

RI #2122

RI #2506

RI #2120

RI #2118

RI #2112

RI #2107

RI #2210

RI #2100A

RI #2100B