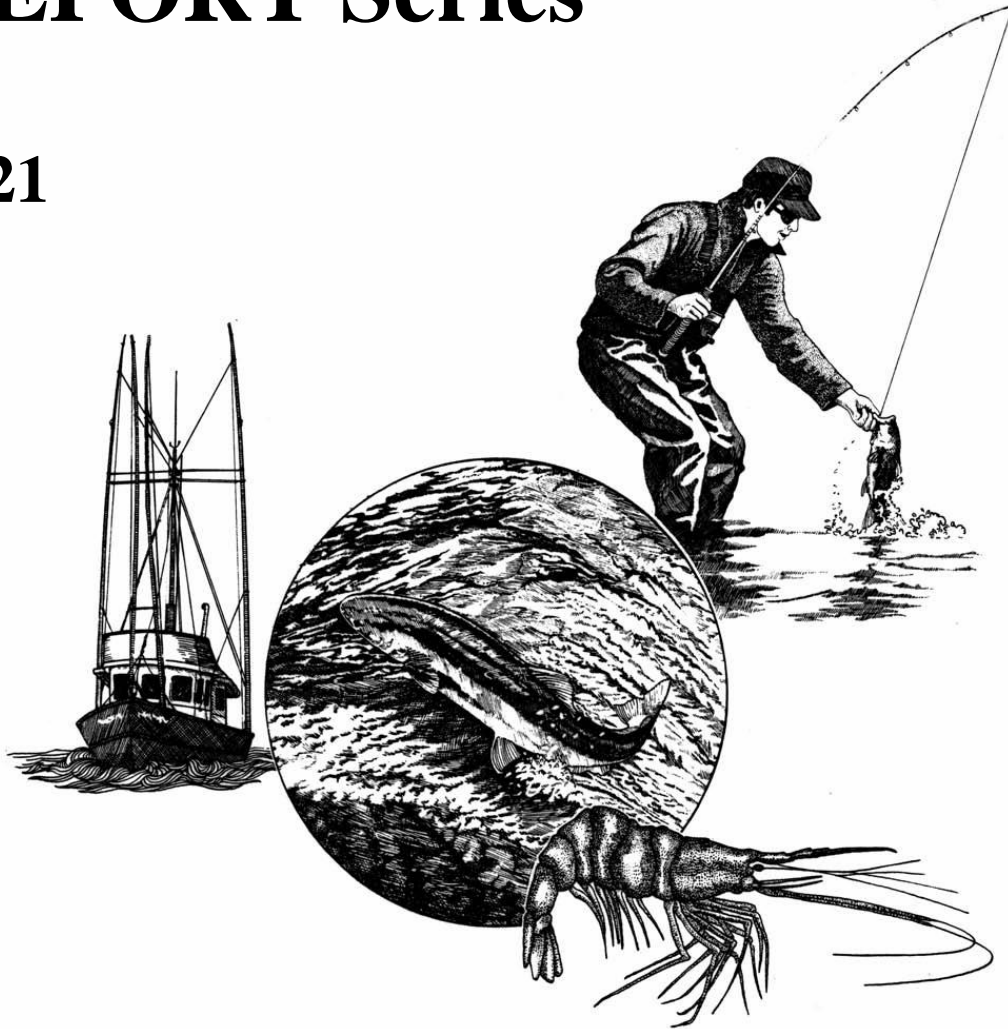


ODFW PROGRESS REPORT Series

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Oregon Department of Fish and Wildlife

*2020 Monitoring Report for the Clackamas Focused Investment
Partnership*

Progress Report No. OPSW-ODFW-2021-7

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Background

The Oregon Department of Fish and Wildlife's Aquatic Inventories Project and UAS Operations are providing monitoring support for the Clackamas Focused Investment Partnership (FIP) in order to describe stream habitat condition and fish occupancy. Long-term monitoring surveys will occur within specified sites proposed for restoration action and selected control channels. Three control sites at different locations within the basin have been selected to monitor secondary channels not associated with prescribed restoration. Main river surveys will occur, but at less frequent intervals, in order to document any habitat change associated with restoration treatment across defined reaches and within the basin. Proposed restoration sites, control channels, and main river surveys will be used to evaluate restoration influence and effectiveness at the individual site, reach, and basin scale.

In 2020, habitat surveys were conducted primarily from March through May. The exceptions being the Cazadero survey (North Fork Deep Creek) which occurred in July, and the Johnson Creek site (Willamette Basin) took place in June of 2019. Snorkel surveys were conducted during July and August with the one exception being the Middle Control which was surveyed October 1st. Outside of the Cazadero and Johnson Creek sites, all surveys occurred within the Clackamas River valley floor downstream of River Mill Dam. Aerial winter pre-restoration surveys could not be conducted because of state park closures due to COVID-19 precautions. A pre-restoration summer aerial survey was flown at the Eagle Creek Complex in May and the control sites were flown in late summer.

Methods

This report discusses findings from a survey design developed for both wadeable and non-wadeable habitat types. Attributes collected and summarized at the reach level described channel morphology, substrate composition, instream wood, and fish species. Due to the nature and size of the channels and habitat characteristics, the Aquatic Inventories Project adhered to protocols developed by Moore et al. (2007) within wadeable areas and utilized a side-scan sonar and methods developed by Kaeser and Litts (2010) in non-wadeable areas. Assessments of fish presence were conducted by snorkel surveys and adhered to methods described in Constable et al. (2012).

In non-wadeable habitats and areas where visual observation was not feasible, we employed an 1199CI HD Humminbird side imaging system set to obtain continuous sonar data. The sonar transducer was positioned on the bow of an inflatable raft via a custom mount and set at an operating frequency of 455 kHz. The side beam range was set relative to channel width. Data were recorded while maintaining a mid-channel position at approximately 8.0 km/h. Data were downloaded using SonarTRX version 17.1 and visually displayed using Google Earth Pro. A more detailed and comprehensive report on how sonar data are captured and described can be found in Strickland et al. (2019).

Aerial surveys were used to supplement visual and sonar data. Structure from Motion with Multi-View Stereo (SfM-MVS) reconstruction in Agisoft Metashape was used to create point clouds, digital elevation models, and orthorectified photomosaics. Measurements and counts were made in Agisoft Metashape and ESRI ArcGIS Pro.

The purpose of this report is to provide a background for monitoring and a description of methods used to assess the varying habitat types. Data provided should be viewed as base condition for control channels and main river habitat, or pre-treatment condition for those sites proposed for restoration

activity. For each surveyed area within this report we (1) describe reach boundaries and general characteristics (2) channel area and depth profiles, (3) structure and complexity, and (4) general fish species composition.

Study Area and Results

Eagle Creek Complex

The Eagle Creek Complex started at the confluence with the Clackamas River and extended approximately 0.5 kilometers upstream to an end point just west of a bridge at SE Dowty Road (Figure 1). The primary channel flowed westerly and entered a secondary channel of the Clackamas River in the southwest section of the study area, while two secondary channels split off and flowed primarily northwest and entered the same Clackamas secondary channel further downstream in the northwest section of the study area. The entire complex occurs entirely within Bonnie Lure State Recreation Area.

A physical habitat survey was conducted on two separate days; May 7, 2020 and May 19, 2020. The Eagle Creek Complex is largely constrained by terraces, and the primary channel has the ability to move approximately 200 meters across the valley floor. Over 38% of the complex area was secondary channel habitat (Table 1) and over 48% was pool habitat across all channel types (Table 2). Overall large wood volume throughout the complex was 442.96 m³ (Table 2) or when standardized, 88.73 m³ per 100 meters of primary channel length. In addition, 28 key pieces (≥ 12 m length and ≥ 60 cm diameter) were measured throughout the surveyed area. Observed substrate types throughout the complex were primarily composed of gravel (37.19%) and cobble (43.53%) (Table 3).

On July 16, 2020 a snorkel survey was conducted and over 68% of available pool habitat was snorkeled (Table 4). Observations included: juvenile coho, steelhead, Chinook salmon, and trout fry. Dace, shiner, northern pikeminnow, and suckers were also observed.

Lower Control Channel

The Lower Control Channel is located approximately 1 km downstream of the Carver Bridge on the southwest side of the Clackamas River primary channel (Figure 2). The majority of the control channel flows generally northwest into a large alcove, while a single, small secondary channel flows northeast back to the Clackamas main channel.

A physical habitat survey was conducted April 27, 2020. Potential movement of the Lower Control Channel is limited to 80 meters between a high constraining terrace on the west bank and the main channel of the Clackamas River. Secondary channel habitat accounted for 4.8% of the Lower Control Channel (Table 1), and pool habitat accounted for 89.33% across all channel types (Table 2). Overall large wood volume throughout the channel was 26.97 m³ (Table 2) or when standardized, 15.23 m³ per 100 meters of primary channel length. In addition, one key piece (≥ 12 m length and ≥ 60 cm diameter) was measured. The Lower Control Channel habitat was primarily composed of cobble substrate (59.50%), with a mix of fine sediments (19.82%) and gravels (16.05%) (Table 3).

On August 20, 2020 a snorkel survey was conducted during which 99.5% of available pool habitat was snorkeled (Table 4). Observations included: dace, shiner, northern pikeminnow, and juvenile suckers. In addition, two juvenile Chinook salmon were observed in the large alcove at the outlet end of the channel.

Middle Control Channel

The middle control channel is located on the east side of the Clackamas River main channel and flows north 318 meters to form the southwest boundary of the Eagle Creek Complex (Figure 3). The middle control channel flows entirely within Bonnie Lure State Recreation Area.

A physical habitat survey was conducted April 9, 2020. Potential movement of the Middle Control Channel is restricted to 220 meters of movement between the main channel of the Clackamas River to the west and the hillslope to the east. Secondary channel habitat accounted for 15% of the Middle Control Channel (Table 1), and pools accounted for 70% of habitat across all channel types (Table 2). Overall large wood volume throughout the channel was 39.58 m³ (Table 2) or when standardized, 12.45 m³ per 100 meters of primary channel length. No key pieces (≥ 12 m length and ≥ 60 cm diameter) were measured. Observed substrate types throughout the Middle Control Channel were primarily composed of cobble (41.79%), although fine sediments composed 29% and gravels made up over 26% (Table 3). On October 1, 2020 a snorkel survey was conducted and during the survey a glide habitat unit type ($< 0.5\%$ gradient) was snorkeled causing the total surveyed area to exceed the total pool area (Table 4). Observations included: dace, shiner, northern pikeminnow, and suckers. In addition, four juvenile coho and eight juvenile Chinook salmon were observed.

Upper Control Channel

The upper control channel is located on the east side of the Clackamas River main channel immediately adjacent to the Kingfisher side channel (Figure 4). The upper control channel flows north 164 meters and begins approximately 400 meters downstream of the mouth of Dog Creek and is accessed through Milo McIver State Park.

A physical habitat survey was conducted March 17, 2020. The Upper Control Channel is largely constrained to its current channel location due to a high constraining island terrace to the west and a steep hillslope on the east. These features limit the available lateral movement of the channel to 30 meters. The Upper Control Channel contained no secondary channel habitat (Table 1), but 59.55% of the primary channel was made up of pool habitat (Table 2). Overall large wood volume throughout the channel was 5.18 m³ (Table 2) or when standardized, 3.16 m³ per 100 meters of primary channel length. No key pieces (≥ 12 m length and ≥ 60 cm diameter) were measured. Observed substrate types throughout the Upper Control Channel were primarily composed of cobble (63.17%), although boulders and bedrock each made up over 12%, and gravels were approximately 11% (Table 3). There were no fine substrates observed in the Upper Control Channel.

On July 30, 2020 a snorkel survey was conducted and during the survey 100% of available pool habitat was snorkeled (Table 4). Observations included: dace, shiner, and trout fry. In addition, 75 juvenile coho and two juvenile Chinook salmon were observed.

Cazadero (North Fork Deep Creek)

The Cazadero North Stream and Wetland Restoration Project is within the North Fork of Deep Creek. The site occurs entirely within land owned by Metro and flows generally southwest with the upper extent of the site bound by a culvert under Richie Rd (Figure 5). The west side of the site is bordered by the Cazadero Trail adjacent to the town of Boring.

A physical habitat survey was conducted July 14, 2020. The Cazadero site channel is largely constrained by high terraces on each bank. A valley width index (VWI) suggests the active channel could potentially move 16 times between hillslope toes, although, this is highly unlikely due to current land use and existing structure. The Cazadero site contained no secondary channel habitat (Table 1), but almost half of the primary channel was made up of pool habitat (45.77%) (Table 2). Overall large wood volume throughout the site was 6.28 m³ (Table 2) or when standardized, 3.54 m³ per 100 meters of primary channel length. No key pieces (≥ 12 m length and ≥ 60 cm diameter) were measured. The Cazadero site channel substrate was primarily composed of cobble (50.37%), with a mix of fine sediments (22.50%), boulder substrate (17.29%), and gravels (9.70%) (Table 3). Bedrock contributed less than 1% to the bedload.

A snorkel survey was conducted concurrently with the physical habitat survey and during the survey 100% of available pool habitat was snorkeled (Table 4). Observations included one cutthroat trout and dace throughout the surveyed area.

Johnson Creek

The Lower Johnson Creek Habitat Enhancement site is located within the city of Milwaukie. Within the site, Johnson Creek flows generally south for 228 meters and is bound to the east by Highway 99 (Figure 6). The site is crossed by Highway 224 near the beginning of the survey.

A physical habitat survey was conducted June 26, 2019 as part of a larger basin scale survey effort funded by the City of Portland (Kavanagh 2019). Data were trimmed and analyzed specifically within the Lower Johnson Creek Habitat Enhancement site. The Johnson Creek channel is largely constrained by high terraces on each bank. A valley width index (VWI) suggests the active channel could potentially move greater than 20 times between hillslope toes. Current land use and existing structure will likely keep Johnson Creek in its current channel location. The Johnson Creek site contained no secondary channel habitat (Table 1) and the site also contained no pool habitat (Table 2). In addition, no countable wood pieces (≥ 3 m length and ≥ 15 cm diameter) were measured throughout the surveyed area. The Johnson Creek site substrate was primarily composed of gravel (48.92%), with a mix of cobble (33.18%), boulder substrate (10.4%), and fine sediments (7.48%) (Table 3). Bedrock was not observed within the site.

Due to water quality and health concerns, a snorkel survey was not conducted at the Johnson Creek site.

Lower Clackamas River

The Lower Clackamas River survey was unique to others described in this report in that it was neither a FIP restoration site nor control site. All control reaches and several future restoration sites were

encompassed while conducting this basin scale survey. Using non-wadeable sampling techniques across main channel areas and wadeable methods within secondary channels, habitat conditions were described with the ultimate purpose for assessing baseline condition and restoration influence across the basin for the duration of the project. Survey work began with characterizing habitat from March through May and concluded with snorkel surveys describing fish presence from July through August.

The Clackamas River downstream of River Mill Dam was divided into five distinct reaches. Reach 1 was entirely within the bounds of Milo McIver Park. The survey started approximately at the upper boat ramp and extended 4.6 km downstream. Reach 2 was from the lower boundary of Milo McIver Park approximately 5 km downstream to the confluence with Eagle Creek. Reach 3 extended from Eagle Creek approximately 7 km downstream to the confluence with Deep Creek, just downstream from Barton Park. Reach 4 began at the confluence with Deep Creek and extended 6.9 km downstream to the confluence with Clear Creek, immediately within Carver Park. Reach 5 was from Clear Creek downstream 13.2 km to the confluence with the Willamette River.

Every reach had low terraces that could be inundated by high flow events, along with higher constraining terraces beyond. The valley width index (VWI) was consistent for each reach and suggests the Clackamas River has the opportunity to move laterally across the valley floor approximately 1.2 kilometers between constraining hillslope toes. Reach 3 contained the greatest amount of secondary channel habitat and Reach 5 contained five times more off-channel pool habitat compared to the other reaches (Table 1). Interestingly, secondary channel length in both Reach 1 and Reach 3 exceeded the primary channel length. Percent of pool habitat ranged from 18.75% in Reach 3 to over 46% in Reach 5, and the wood volume and number of key pieces were both greatest in Reach 3 (Table 2). Substrate type percentages remained relatively similar with the one exception being percent gravel generally increasing with movement downstream (Table 3).

Snorkel surveys in the Lower Clackamas River were confined to secondary and off-channel pool habitats, as such, comparisons to areas snorkeled were contained to those channel areas rather than any primary channel pool habitat. The number of pools snorkeled compared to total number of pools in a reach ranged from 9% (Reach 3) to 24% (Reach 1). Aquatic Inventories snorkel protocol for wadeable streams in Western Oregon requires at least 20% of pool habitat in any particular reach be snorkeled to be a valid survey when making abundance estimates (Constable et al. 2012). We only assessed sampled reaches for fish presence, but still fell short of sampling goals in four out of five reaches. Juvenile coho and Chinook salmon were observed in Reaches 1-3, while only Chinook were observed in Reach 5, and none were observed in Reach 4 (Table 4). A small school of mountain whitefish were observed in Reach 4 and dace were consistently observed across all reaches. Adult and juvenile suckers, shiners, and northern pikeminnow were commonly observed species.

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Table 1. Channel lengths and area across Clackamas Focused Investment Partnership survey locations during spring of 2020 using Aquatic Inventory stream habitat survey methods described in Moore et al. 2007.

Site Location	Primary Channel Length (m)	Secondary Channel Length (m)	Primary Channel Area (m ²)	Secondary Channel Area (m ²)	Off-Channel Area (m ²)*
Eagle Creek Complex	499.20	1,007.20	11,749.80	7,350.75	108.0
Lower Control	177.0	37.0	2,732.0	138.20	13,350.0
Middle Control	318.0	97.0	4,668.0	826.10	443.10
Upper Control	164.0	0	1,729.70	0	0
Cazadero**	177.65	0	1,258.54	0	0
Johnson Creek	228.50	0	2,135.0	0	0
Lower Clackamas Reach 1	4,636.0	6,644.40	287,261.0	157,391.12	8,851.70
Lower Clackamas Reach 2	5,050.0	2,835.90	315,092.0	58,421.0	13,393.10
Lower Clackamas Reach 3	7,030.0	8,092.50	419,805.0	168,959.40	47,420.60
Lower Clackamas Reach 4	6,890.0	2,661.0	491,207.0	75,907.20	2,507.0
Lower Clackamas Reach 5	13,196.0	3,035.0	811,449.0	80,983.20	253,150.0

*Alcoves, Backwaters, and Isolated Pools; **North Fork Deep Creek

Table 2. Physical habitat summary across Clackamas Focused Investment Partnership survey locations during spring of 2020 using Aquatic Inventory stream habitat survey methods described in Moore et al. 2007.

Site Location	% Pool Habitat	Residual Pool Depth (m)	Riffle Depth (m)	Wood Volume (m ³)	# of Key Wood Pieces
Eagle Creek Complex	48.16	0.57	0.23	442.96	28
Lower Control	89.33	0.58	0.20	26.97	1
Middle Control	70.89	1.16	0.28	39.58	0
Upper Control	59.55	1.0	0.30	5.18	0
Cazadero*	45.77	0.48	0.15	6.28	0
Johnson Creek	0	N/A	0.33	0	0
Lower Clackamas Reach 1	36.94	1.24	0.37	523.47	20
Lower Clackamas Reach 2	25.90	1.21	0.49	252.33	9
Lower Clackamas Reach 3	18.75	0.77	0.42	1,339.30	21
Lower Clackamas Reach 4	31.68	2.00	0.70	344.90	13
Lower Clackamas Reach 5	46.62	1.93	0.58	307.90	11

*North Fork Deep Creek

Table 3. Description of stream bed substrate within wetted channels across Clackamas Focused Investment Partnership survey locations during spring of 2020 using Aquatic Inventory stream habitat survey methods described in Moore et al. 2007.

Site Location	% Fines*	% Gravel	% Cobble	% Boulder	% Bedrock
Eagle Complex	16.42	37.19	43.53	2.86	0
Lower Control	19.82	16.05	59.50	4.63	0
Middle Control	29.10	26.55	41.79	2.55	0
Upper Control	0	11.41	63.17	12.84	12.58
Cazadero**	22.50	9.70	50.37	17.29	0.14
Johnson Creek	7.48	48.92	33.18	10.42	0
Lower Clackamas Reach 1	6.88	12.75	55.03	14.78	10.55
Lower Clackamas Reach 2	7.48	15.92	60.42	7.03	9.13
Lower Clackamas Reach 3	11.02	19.07	56.99	8.93	3.98
Lower Clackamas Reach 4	8.76	25.25	51.80	8.13	6.03
Lower Clackamas Reach 5	7.40	41.56	38.16	10.64	2.22

*Combined observed values of silt and sand; **North Fork Deep Creek

Table 4. Results of snorkel surveys within pool habitats across Clackamas Focused Investment Partnership survey locations during summer of 2020 using methods described in Constable et al. 2012.

Site Location	Pool Area (m ²)	Snorkeled Area (m ²)	Sum of Coho	Sum of Cutthroat	Sum of Steelhead	Sum of Chinook	Other Fish Observed
Eagle Complex	9,250.7	6,348.2	164	8	109	154	0+ trout*, dace, shiner, NPM**, sucker
Lower Control	14,489.8	14,421.0	0	0	0	2	dace, shiner, NPM**, juvenile sucker
Middle Control	4,209.1	4,426.0***	4	0	0	8	dace, shiner, NPM**, sucker
Upper Control	1,030.0	1,030.0	75	0	0	2	0+ trout*, dace, shiner
Cazadero****	576.01	576.01	0	1	0	0	dace
Johnson Creek	0	N/A	N/A	N/A	N/A	N/A	Did not snorkel due to health concerns
Lower Clackamas Reach 1	70,858.3	9,266.0	121	0	4	38	0+ trout*, dace, NPM**, sucker, peamouth
Lower Clackamas Reach 2	34,653.2	4,426.0	4	0	0	8	dace, shiner, NPM**, sucker
Lower Clackamas Reach 3	109,086.8	9,927.0	102	0	0	52	dace, shiner, NPM**, peamouth
Lower Clackamas Reach 4	25,883	6,596.0	0	0	0	0	dace, shiner, NPM**, sucker, whitefish
Lower Clackamas Reach 5	285,768.1	17,594.0	0	0	0	7	dace, NPM**, sucker

*Trout fry < 90 mm in fork length; **Northern Pikeminnow; ***Snorkeled a glide habitat unit type; ****North Fork Deep Creek

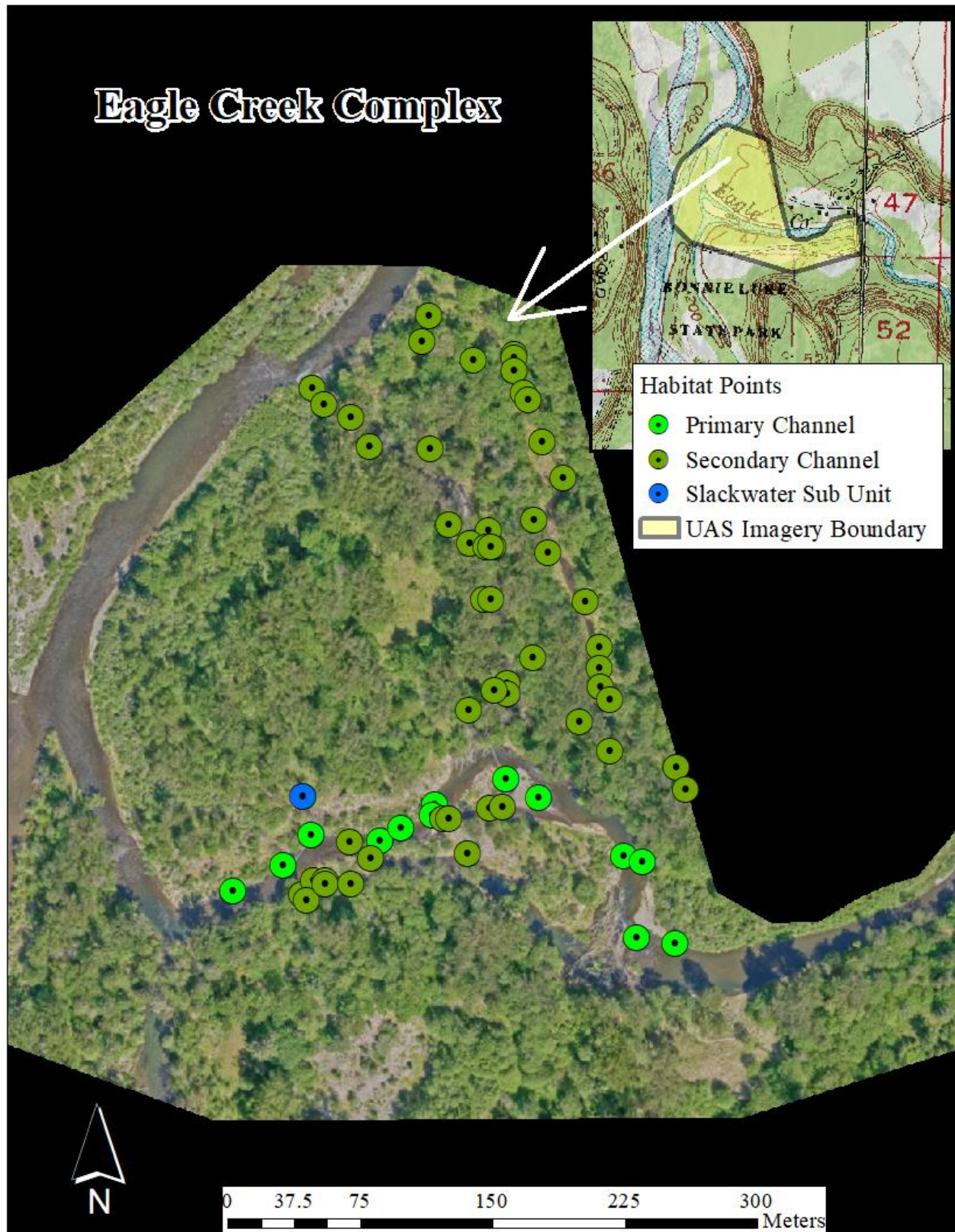


Figure 1. 2020 Eagle Creek Complex surveyed area with UAS imagery and individual ground survey points.

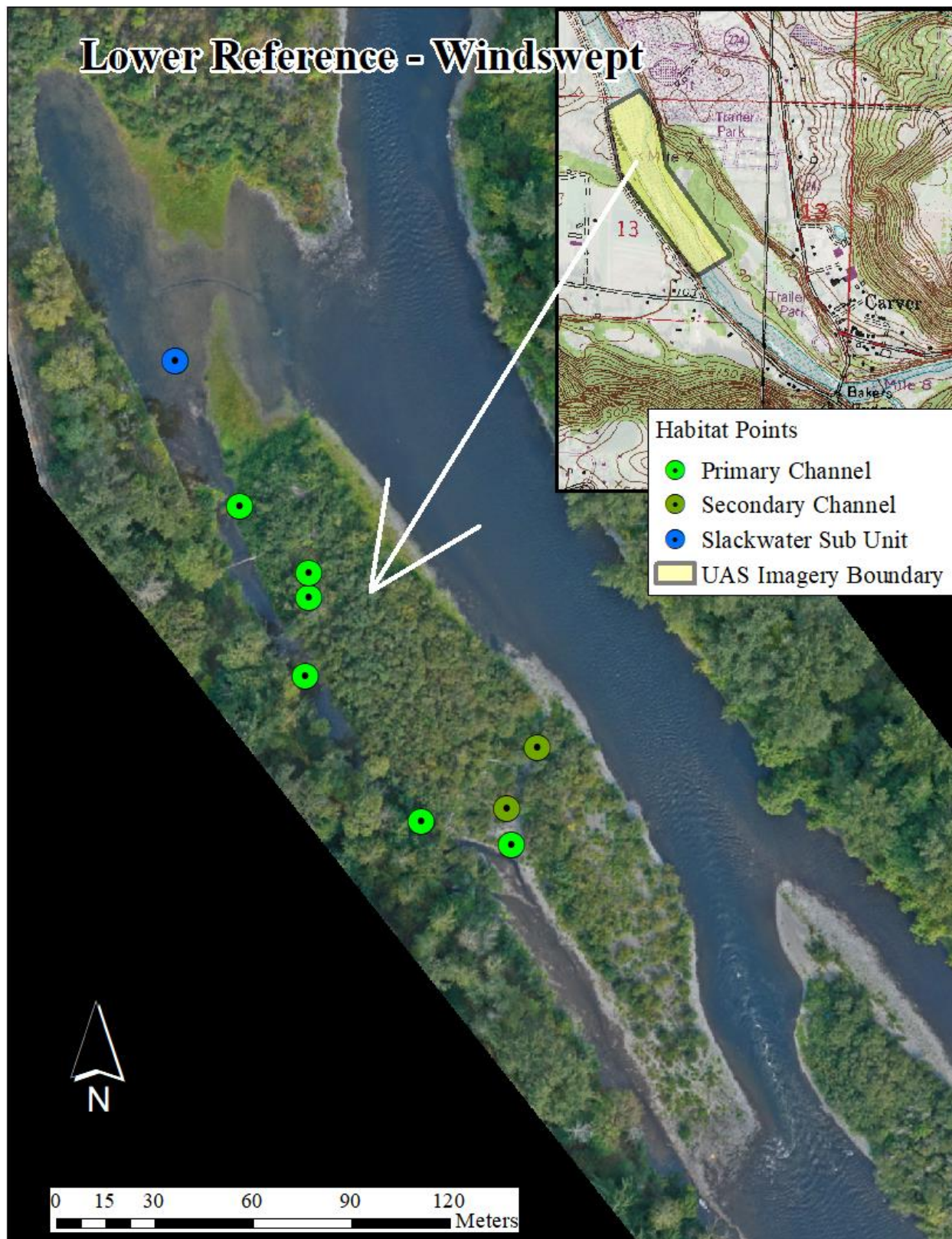


Figure 2. 2020 Lower Control Channel surveyed area with UAS imagery and individual ground survey points.

Middle Control Channel - Bonnie Lure

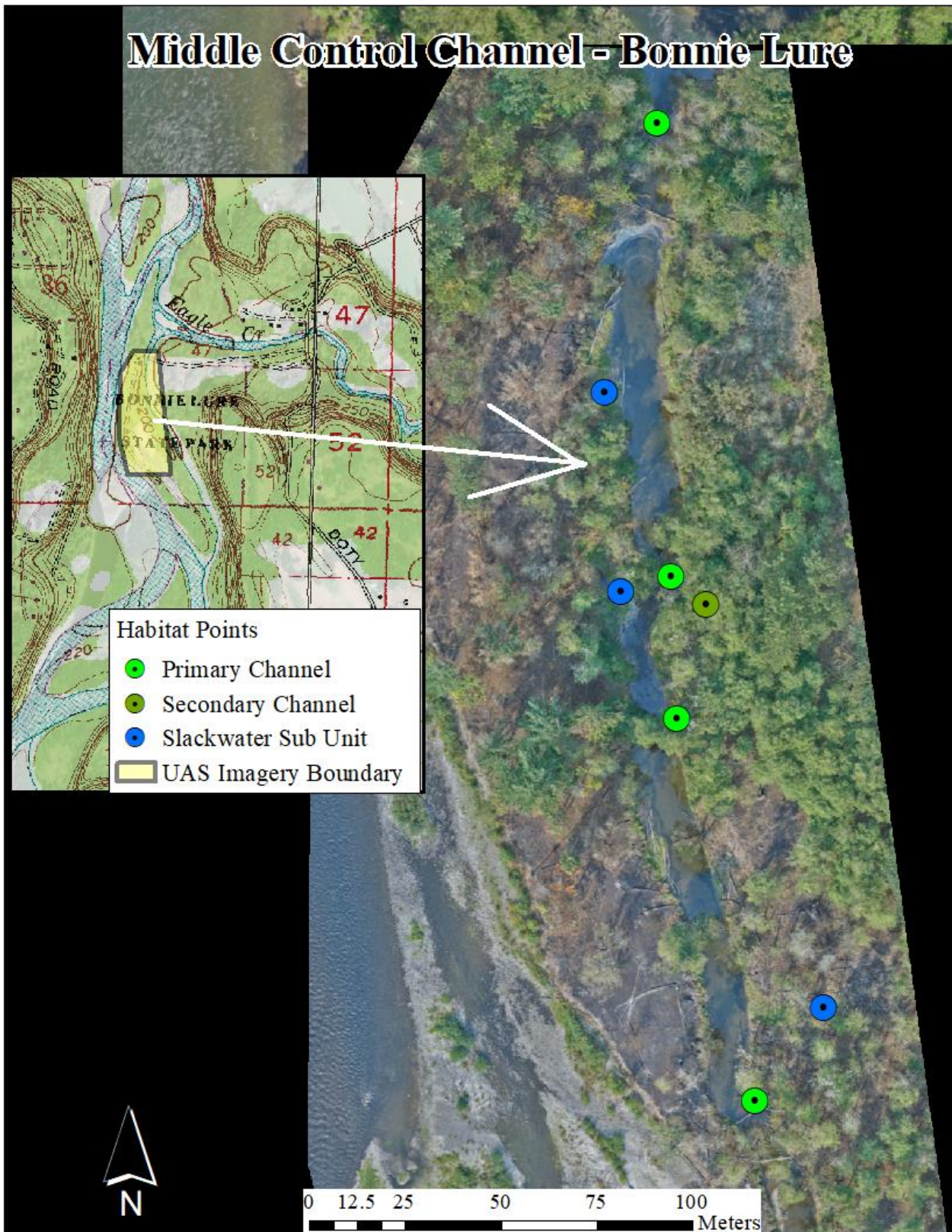
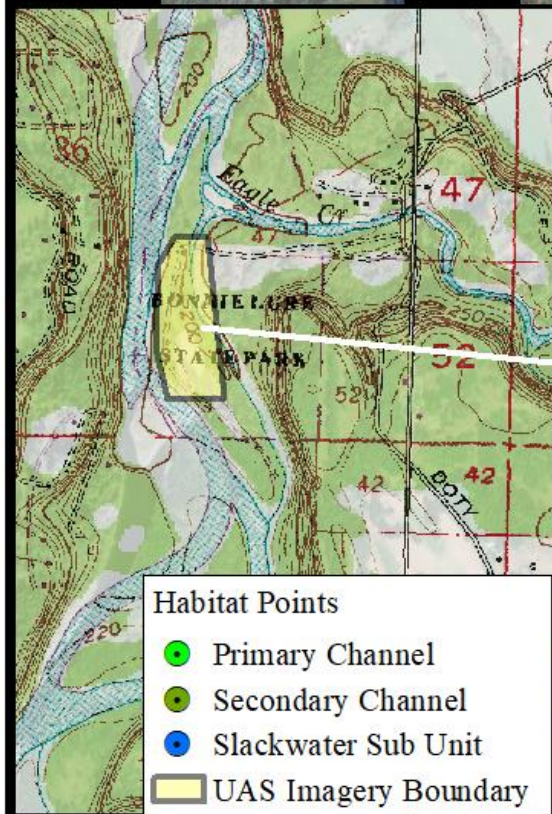


Figure 3. 2020 Middle Control Channel surveyed area with UAS imagery and individual ground survey points.

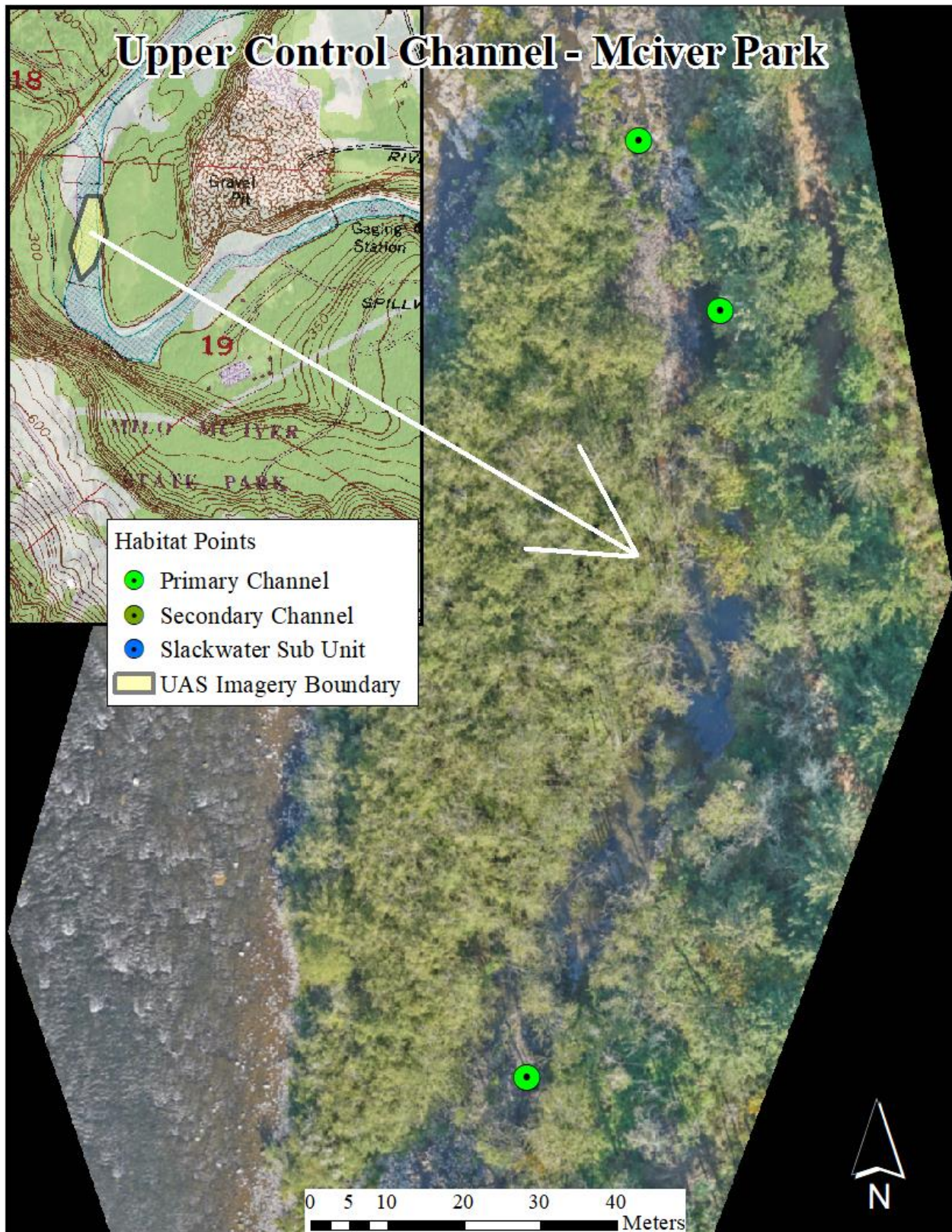


Figure 4. 2020 Upper Control Channel surveyed area with UAS imagery and individual ground survey points.



Figure 5. 2020 Cazadero (North Fork Deep Creek) surveyed location (Google Earth) and individual ground survey points.

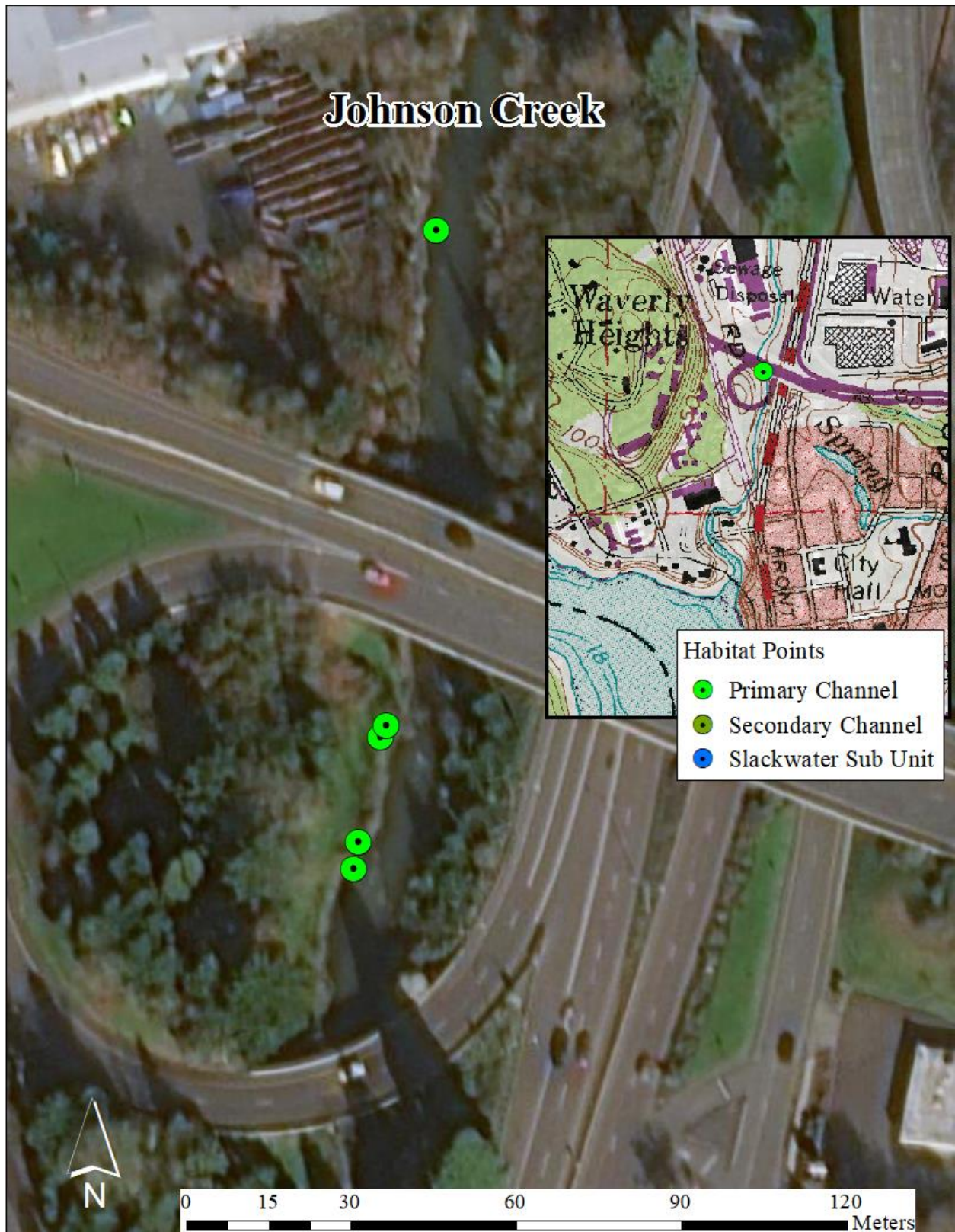


Figure 6. 2019 Johnson Creek surveyed location (Google Earth) and individual ground survey points.