2019 Annual Monitoring Results and Maintenance Plan for San Acacia Reach Restoration Sites



Prepared for:
New Mexico Interstate Stream Commission
5550 San Antonio
Albuquerque, New Mexico 87109

Prepared by:
GeoSystems Analysis, Inc.
3150 Carlisle Blvd. NE,
Albuquerque, NM 87110
www.gsanalysis.com

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Name	Affiliation	Role
Chad McKenna	GeoSystems Analysis, Inc.	Senior Ecologist, GIS Analyst
Todd Caplan	GeoSystems Analysis, Inc.	Project Manager, Senior Ecologist
William Widener	GeoSystems Analysis, Inc.	Field Biologist

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Introduction

This technical memo presents results from effectiveness monitoring completed in 2019 at eight habitat restoration sites located along a 20-mile segment of the San Acacia Reach of the Middle Rio Grande (MRG) between the San Acacia Diversion Dam (River Mile [RM] 116) and the Rhodes property at RM 93; **Figure 1**). Five of the eight projects were designed by the New Mexico Interstate Stream Commission (NMISC), while the other three were designed by the U.S. Bureau of Reclamation's (Reclamation). Reclamation's Socorro Field Division completed construction at all eight project sites in winter 2019 (**Table 1**).

While some restoration design details differed between NMISC and Reclamation projects (see **Table 1**), the overarching project objectives for all eight projects were similar: to physically lower elevated floodplain terraces so they could become inundated during low to moderate river discharges (i.e., begin inundating at approximately 800 cfs and be fully inundated at approximately 2,000 cfs) and provide physical conditions conducive to spawning and rearing for the federally endangered Rio Grande silvery minnow (*Hybognathus amarus*; Caplan & McKenna 2019; Reclamation 2019). None of the sites were revegetated with native riparian species due to concerns of impacts by uncontrolled livestock grazing. Instead both NMISC and Reclamation adopted an experimental approach to evaluate whether and to what extent native riparian vegetation (mostly cottonwood and willow) would naturally establish, survive and grow.

GeoSystems Analysis, Inc. (GSA) developed a monitoring plan in 2019 titled *Monitoring and Adaptive Management Plan for New Mexico Interstate Stream Commission Habitat Restoration Projects in the San Acacia Reach of the Middle Rio Grande* (herein Monitoring & AM Plan; Caplan & McKenna 2019). The Monitoring & AM Plan was developed in close coordination with Reclamation so that similar physical and biological response variables can be compared across all eight restoration project sites.

The Monitoring & AM Plan provides tiered linkages between project goals. SMART (**S**pecific, **M**easurable, **A**ttainable, **R**elevant, **T**ime-Bound) objectives (Bjerke & Renger 2017), monitoring methods, and quantitative success criteria. Standard Operating Procedures (SOPs) for each monitoring component are provided in Appendix A, and addresses procedures for:

- Mapping inundation extent at 800 cfs and 2,000 cfs
- Measuring inundation depth, velocity and water temperature at 2,000 cfs
- Monitoring presence, abundance, and reproductive status of adult Rio Grande silvery minnow (RGSM) and presence and abundance of larval RGSM[1]

[1] SWCA Environmental Consultants is the technical lead on fish monitoring and only summary information is provided regarding RGSM monitoring methods in the GSA monitoring and adaptive management plan. For detailed descriptions of field monitoring procedures see SWCA 2019 in Appendix H.

- Evaluating presence of isolated pools of water (i.e., not draining back to the river channel) and potential to strand silvery minnow
- Presence and distribution of New Mexico state listed noxious weeds
- Presence and distribution of native and non-native woody riparian vegetation
- Post-runoff sediment deposition trends and volumetric estimates

The remainder of this report focuses on presenting and summarizing results from each of these monitoring components and on proposing adaptive management strategies for ensuring project sites continue to function as designed.

Table 1. Restoration Project Sites

Project Name*	Acres	Designed by	General Design Features
RM 114	1.7	NMISC	Two backwater channels, inundation initiated at approximately 800 cfs
RM 112	1.5	NMISC	One backwater channel, inundation initiated at approximately 800 cfs
RM 104.5 (Escondida East)	3.2	Reclamation	One backwater channel, inundation initiated at approximately 300 cfs
RM 103 (Escondida West)	10.5	Reclamation	Four backwater channels and one high-flow channel, inundation initiated at approximately 300 cfs
RM 100.5	8.2	NMISC	Two backwater channels, inundation initiated at approximately 800 cfs
RM 100	1.4	NMISC	One backwater channel, inundation initiated at approximately 800 cfs
RM 99.5	3.5	NMISC	Two backwater channels, inundation initiated at approximately 800 cfs
RM 93 (Rhodes)	17.2	Reclamation	Eleven embayments and one high-flow channel, inundation initiated at approximately 300 cfs

*RM = river mile markers from the 2012 USBR centerline, sites named according to the nearest half river mile.

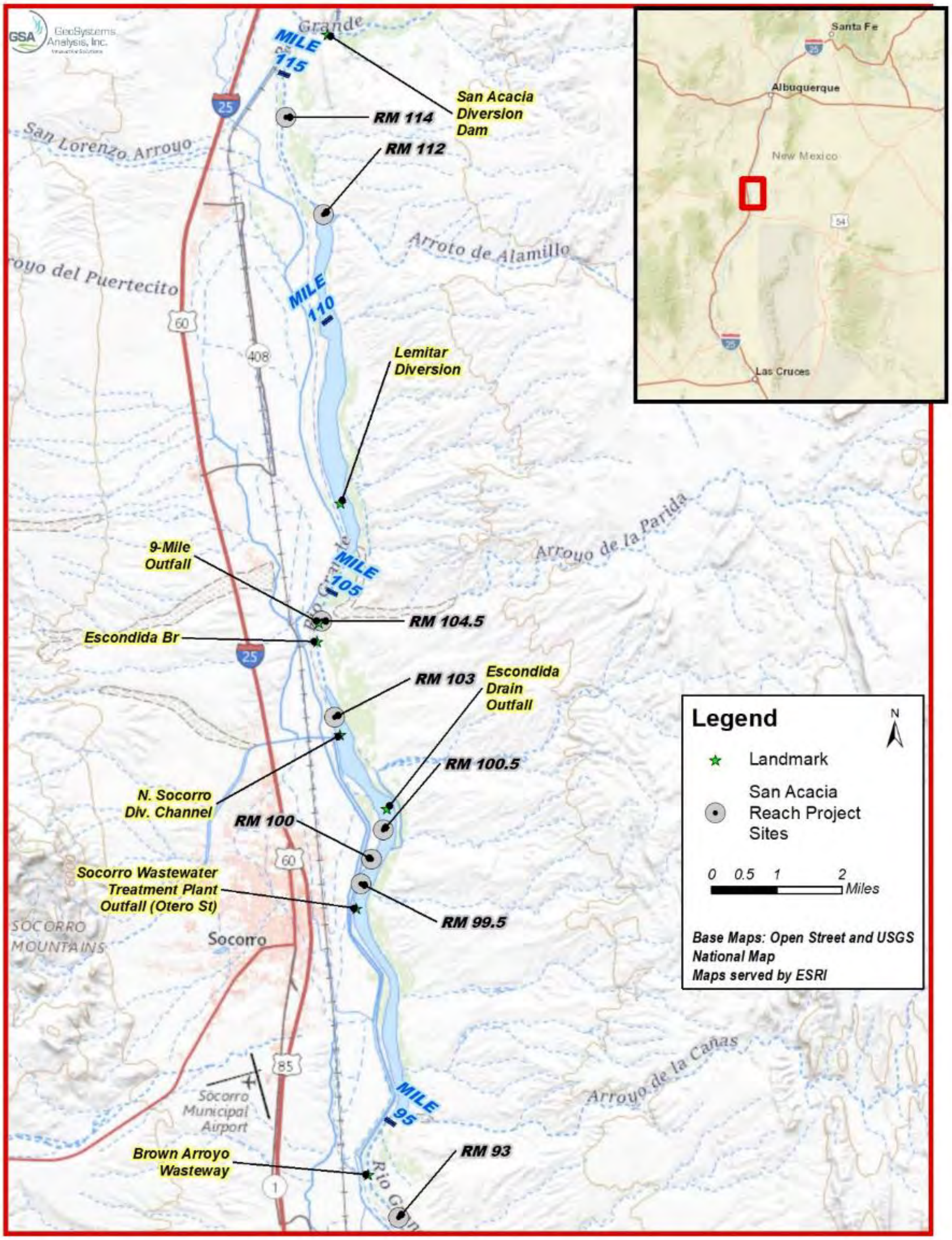

Figure 1. Restoration project site location map

Methods

Detailed monitoring methods are described in SOPs contained in Caplan & McKenna (2019) and are referenced but not repeated in this report. However, general descriptions of 2019 monitoring methods are presented below. Monitoring dates and activities implemented at each site are displayed in **Table 2**.

Inundation Mapping

NMISC project sites were designed to begin inundating at approximately 800 cfs and be almost completely (>75%) inundated when discharge at the nearest gage reached approximately 2,000 cfs (Caplan & McKenna 2019). Accordingly, the Monitoring & AM Plan recommended that inundation mapping should occur at NMISC restoration project sites when discharge at the nearest corresponding gage[2] is between approximately 800 to 1,000 cfs, and again at approximately 2,000 cfs. However, above average snowmelt conditions prevailed in 2019 and discharge levels ascended rapidly in late March and were sustained above 2,000 cfs between approximately mid-April and mid-July (**Figures 2 & 3**). Accordingly, the first field measurements occurred on March 14th when mean daily discharge was approximately 1,310 cfs and 1,190 cfs at the San Acacia gage (USGS 08354900) and Escondida gage (USGS 08355050), respectively. GSA mapped the inundation perimeters at NMISC restoration project sites only (RM 114, RM 112, RM 100.5, RM 100 and RM 99.5)[3].

The second round of inundation mapping took place from April 23 to April 26, when mean daily discharge ranged between 2,530 and 3,160 at the San Acacia gage (**Figure 2**) and between 2,560 and 3,110 cfs at the Escondida gage **(Figure 3**). Inundation mapping was performed by Save Our Bosque Task Force (SOBTF) and GSA at all eight restoration sites following methods described in the *Standard Operating Procedures for Mapping Inundation Perimeters at San Acacia Reach Restoration Sites* (Caplan & McKenna 2019). Inundation maps for both discharges at all sites are provided in **Appendix A**.

In addition to mapping inundation in the field, the inundation area was also interpreted from five geo-spatial imagery datasets acquired by federal agencies between April 29 and June 15, 2019 (**Appendix B**). During this process, imagery was visualized as both true color and (when near infrared wavelengths were captured) in false color infrared with the near infrared spectrum displayed in the visible green band. Locations with visible standing water were *heads up* digitized at 1:1,000

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[2] The USGS Gage at San Acacia Diversion Dam (located at RM 116) is closest to restoration project sites RM 114 and RM 112. The USGS Gage at Escondida (located near RM 105) is the most proximal gaging station to all other project sites.

[3] Project sites RM 104.5, RM 103 and RM 93 were designed by Reclamation to begin inundating at considerably lower discharges (300 cfs, A. Rudolf, Reclamation, personal communication).

scale. The available imagery, acquisition date, source, and mean daily discharge at San Acacia included:

- April 19, 2019: Four-band, 50 cm spatial resolution, 16-bit pixel depth image acquired by the Airbus Pleiades sensor; 1320 cfs. Product funded by U.S. Army Corps of Engineers Albuquerque District.
- May 7 and May 8, 2019: True color, ~0.10-foot spatial resolution, 8-bit pixel depth image acquired by an Unmanned Aerial Vehicle (UAV); 4130 cfs on May 7 and 4310 cfs on May 8. Product funded by U.S. Bureau of Reclamation, Albuquerque Area Office. Data not acquired for site RM 104.5.
- May 12, 2019: Four-band, 50 cm spatial resolution, 16-bit pixel depth image acquired by the Airbus Pleiades sensor; 3970 cfs. Product funded by U.S. Army Corps of Engineers Albuquerque District.
- May 31, 2019: Four-band, 50 cm spatial resolution, 16-bit pixel depth image acquired by the Airbus Pleiades sensor; 3020 cfs. Product funded by U.S. Army Corps of Engineers Albuquerque District.
- June 14, 2019: Four-band, 50 cm spatial resolution, 16-bit pixel depth image acquired by the Airbus Pleiades sensor; 3800 cfs. Product funded by U.S. Army Corps of Engineers Albuquerque District.
- June 15, 2019: Four-band, 6-inch spatial resolution, 16-bit pixel depth orthophotography acquired by aircraft mounted UltraCam Falcon Prime camera; 3840 cfs. Product funded by U.S. Army Corps of Engineers Albuquerque District.

Inundation Depth, Velocity, and Water Temperature

NMISC project sites were designed to support shallow inundation depths (approximate average depth of < 2 feet) and slow water velocities (<0.5 ft/second) when discharge at the nearest gage is approximately 2,000 cfs (Caplan & McKenna 2019). Accordingly, SOBTF and GSA measured inundation depth and velocity at all five NMISC project sites and at three Reclamation sites on the same day as the second inundation mapping event (**Table 2**). These hydrologic variables, along with water temperature, were measured using a *SonTek FlowTracker2®* handheld discharge measurement instrument following step-by-step instructions described in the *Standard Operating Procedures for Documenting Flow Conditions at San Acacia Reach Restoration Sites* (Caplan & McKenna 2019). Cross-section locations are displayed on April inundation maps in **Appendix A**.

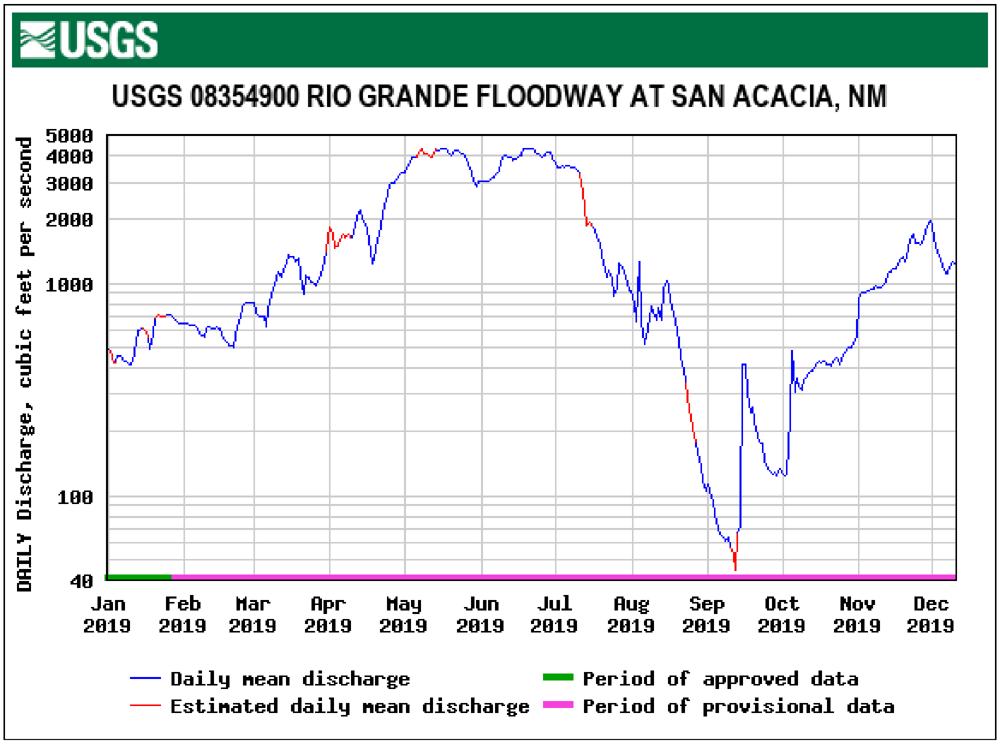

Figure 2. Mean daily discharge at the San Acacia Gage in 2019

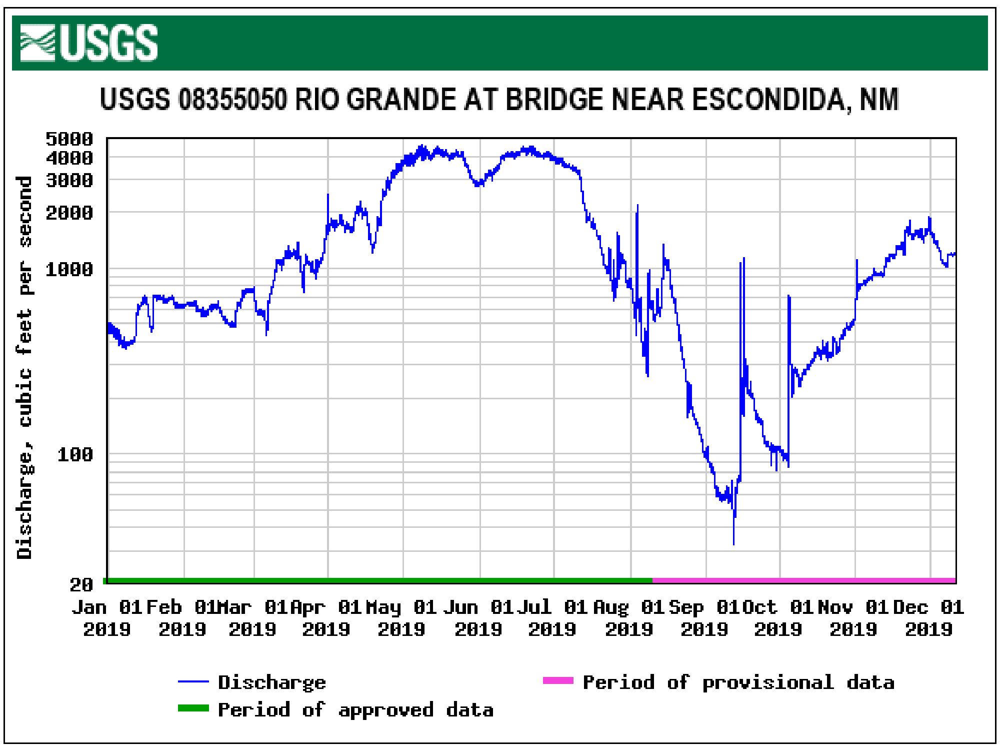

Figure 3. Mean daily discharge at the Escondida Gage in 2019

Isolated Pools

Although river discharge levels were above the recommended discharge threshold (1,500 cfs) proposed in Caplan & McKenna 2019, Reclamation reported the prolonged spring runoff was promoting excessive sediment deposition within at least one of restoration project sites, raising concerns for potential RGSM stranding. Accordingly, isolated pool monitoring was initially implemented by SOBTF and GSA at all sites on June 6, 2019 when mean daily discharge was approximately 3,230 cfs and 3,030 cfs at the San Acacia and Escondida gages, respectively (**Figures 2 & 3**). The isolated pool monitoring was repeated on July 22 when mean daily discharge at the San Acacia gage and Escondida gage were 1,070 cfs and 1,010 cfs, respectively. Isolated pools observed within each restoration project site were documented using an electronic field form (EFF) in the *Fulcrum® Mobile Data Collector* (*Fulcrum)* application following the *Standard Operating Procedures for Documenting Isolated Pools at San Acacia Reach Restoration Sites* (Caplan & McKenna 2019).

Noxious Weeds

Noxious weeds can invade and spread rapidly across newly created restoration sites, so early detection and treatment was recommended in the Monitoring & AM Plan (Caplan & McKenna 2019). The SOBTF and GSA surveyed for presence and distribution of noxious weeds at all eight restoration sites on May 16th and 22nd and again towards the end of the growing season on October 9th (**Table 2**). Surveys were conducted by documenting observed noxious weed populations in the *Fulcrum* EFF in accordance with the *Standard Operation Procedures for Documenting Noxious Weed Occurrences at San Acacia Reach Restoration Sites* (Caplan & McKenna 2019).

Woody Vegetation

Woody vegetation monitoring was implemented through September and into early October at all sites (**Table 2**) to evaluate establishment and spatial distribution of both native and non-native woody plant seedlings and root-sprouts across the project sites. These data are used to determine if native cottonwood (*Populus deltoides ssp. wislizeni*) or willow (*Salix spp*.) seedling recruitment goals are being achieved or if supplemental cottonwood-willow planting should be considered. These data are also to be used to determine if (and where) non-native woody plant control treatments are needed, and if native woody plants need to be removed from channel maintenance zones at different project sites (see Table 3, Row 6, in Caplan & McKenna 2019). Monitoring methods followed the *Standard Operating Procedures for Documenting Presence and Distribution of Native and Non-Native Woody Plant Species at San Acacia Restoration Sites* (Caplan & McKenna 2019).

Post-Runoff Topographic Surveys

Topographic surveys were performed at all restoration sites using RTK-GPS survey equipment in mid-late September (**Table 2**) to assess flow and sediment-induced topographic changes at each site between as-built surveys performed in February 2019 and post-runoff conditions in September

2019. During the survey, elevation data were recorded along semi-regular cross-sections traversed approximately 40 feet apart. Supplemental points were added to increase point density in locations with higher topographic variability (e.g. inlets, new depositional features, etc). The survey points were post-processed in Trimble Business Center® and then used to develop three-dimensional grid surfaces in Global Mapper® and ESRI ArcGIS Spatial Analyst®. Deposition was quantified via differencing the surface elevation between the as-built and post-runoff surfaces within the "channel maintenance zones". The Monitoring & AM Plan recommends removal of sediment accumulations in backwater channel inlets/outlets when needed to ensure inundation at design discharge levels continue to occur. These areas are designated as "channel maintenance zones". In alignment with the monitoring plan, sediment deposition volume was determined for channel maintenance zones within each inlet/outlet to guide sediment maintenance.

Fish

Fish monitoring was performed between 17 April and 30 May 2019 by SWCA Environmental Consultants, Inc. (SWCA) at NMISC project sites RM 114, RM 112, RM 100.5 and RM 100 (**Table 2**). Field methods are described in SWCA 2019 (**Appendix H**).

Table 2. 2019 monitoring activity, location and date. Shaded cells represent NMISC project sites.

Monitoring Activity	Project Site: RM 114	RM 112	RM 104.5	RM 103	RM 100.5	RM 100	RM 99.5	RM 93
Inundation Mapping	14-Mar	14-Mar	-	-	14-Mar	14-Mar	14-Mar	-
	23-Apr	23-Apr	25-Apr	25-Apr	24-Apr	24-Apr	24-Apr	25-Apr
Flow Depth, Velocity, Water Temp	23-Apr	23-Apr	25-Apr	25-Apr	24-Apr	24-Apr	24-Apr	26-Apr
Isolated Pools	6-Jun	6-Jun	6-Jun	6-Jun	6-Jun	6-Jun	6-Jun	6-Jun
	22-Jul	22-Jul	22-Jul	22-Jul	22-Jul	22-Jul	22-Jul	22-Jul
Noxious Weeds	17-May	22-May	16-May	16-May	16-May	16-May	16-May	16-May
	9-Oct	9-Oct	9-Oct	9-Oct	9-Oct	9-Oct	9-Oct	9-Oct
Woody Vegetation	11-Sep	11-Sep	12-Sep	13-Sep	23-Sep	3-Oct	20-Sep	7-Oct
Post-Runoff Topographic Surveys	24-Sep	24-Sep	25-Sep	26-Sep	6-Sep	17-Sep	17-Sep	18-Sep
Fish Monitoring (see Appendix G)	17-Apr–30-May	17-Apr–30-May	-	-	17-Apr–30-May	17-Apr–30-May	-	-

Results

Inundation Mapping

Monitoring performed on March 14 found that all sites were partially inundated when the gage at San Acacia and Escondida were at 1,310 and 1,190 cfs, respectively. Project sites RM 112 and RM 100 had a greater percentage of their excavated project footprint inundated at these lower discharges than other sites. RM 114 was the least inundated (**Table 3)**. As expected, inundation extent increased at all sites during late April (**Table 4**), but none of the NMISC sites were 100% inundated as predicted (GSA 2015). Inundation extent at RM 114 was only 29% of the project design footprint, although all other NMISC projects were at least 50% inundated. Note also that at NMISC sites RM 100.5 and RM 99.5, the inundation extent expanded significantly beyond the original perimeter **(Table 4)**. Maps showing inundation extent at both measurement events are displayed in **Appendix A**.

Table 3. Inundation extent at five NMISC restoration sites monitoring on March 14, 2019. Inundation maps are provided in Appendix A.

Restoration Site	Date Monitored	Discharge (cfs)	Total Project Acres	Total Acres Inundated	Percent Inundated
RM 114	March 14, 2019	1,310*	1.7	0.2	12%
RM 112	March 14, 2019	1,310*	1.5	0.7	47%
RM 100.5	March 14, 2019	1,190**	8.2	2.5	30%
RM 100	March 14, 2019	1,190**	1.4	0.6	43%
RM 99.5	March 14, 2019	1,190**	3.5	0.8	23%

*mean daily discharge at San Acacia gage
** mean daily discharge at Escondida gage

Table 4. Inundation extent at eight restoration sites monitored in late April 2019. Shaded cells represent NMISC project sites. Inundation maps are provided in Appendix A.

Restoration Site	Date Monitored	Discharge (cfs)	Total Project Acres	Total Acres Inundated	Percent Inundated
RM 114	April 23, 2019	2,530*	1.7	0.5	29%
RM 112	April 23, 2019	2,530*	1.5	1.0	67%
RM 104.5	April 25, 2019	2,830**	3.2	2.7	84%***
RM 103	April 25, 2019	2,830**	10.5	4.5	43%
RM 100.5	April 24, 2019	2,740**	8.2	6.74	82%***
RM 100	April 24, 2019	2.740**	1.4	0.7	50%
RM 99.5	April 24, 2019	2,740**	3.5	2.92	83%***
RM 93	April 25, 2019	2,830**	17.2	12.0	71%

*mean daily discharge at San Acacia gage
** mean daily discharge at Escondida gage
***inundation expanded beyond the excavated project footprint, but portions of the original excavation area were not inundated

Geo-spatial image interpretation indicates that all sites were partially inundated on April 19 when mean daily discharge at the San Acacia gage was 1,320 cfs **(Table 5; maps in Appendix B**); however, the inundation percentage decreased at each site compared to March 14, when inundation was field mapped while San Acacia reported similar flow volume (1,310 cfs, **Table 3**). Similarly, a comparison of inundation area on April 23 to 25 (**Table 4**) and May 31, shows a reduction in inundation area from late-April to late-May even though flows were about 500 cfs greater during late-May. It's likely these reductions in inundation area were caused by sedimentation of the sites (particularly inlets) through spring runoff.

At most sites, the highest inundation percent detected from available imagery was delineated off the June 15 image, when San Acacia reported mean daily discharge of 3,840 cfs. Percent inundation notably declined through the sustained runoff season at RM 93, as only 13% of the excavation area appears inundated on the June 15 orthophotography. Conversely, the percent of area inundated at sites RM 100.5, RM 100 and RM 99.5 notably increased between early-May and mid-June. These dramatic shifts in inundation area indicate dynamic sediment deposition and redistribution processes were occurring throughout the protracted snowmelt runoff period and, with the exception of RM 93, implies that the approximately 1,000 cfs flow spike (from approximately 3,000 to 4,000 cfs -see **Figure 2)** between late-May and mid-June flushed sediment accumulations in many of the channel inlets at different project sites.

Table 5. Percent of excavation footprint inundated as interpreted from available high flow imagery acquired during Spring 2019. Note that inundation also expanded beyond the project footprint at most sites, particularly when discharge exceeded ~3,500 cfs but results in table below were clipped to the excavation area.

Restoration Site	Total Project Acres	Image Acquisition Date					
		4/19/19	5/7/2019-5/8/2019	5/12/19	5/31/19	6/14/19	6/15/19
		Mean Daily Discharge (cfs) at San Acacia					
		1320	4220	3970	3020	3800	3840
RM 114	1.7	3%	74%	80%	14%	70%	80%
RM 112	1.5	28%	93%	89%	54%	77%	94%
RM 104.5	3.2	36%	N/A	65%	28%	70%	74%
RM 103	10.5	36%	51%	46%	27%	44%	50%
RM 100.5	8.2	3%	70%	64%	5%	89%	91%
RM 100	1.4	19%	64%	54%	30%	77%	88%
RM 99.5	3.5	14%	77%	88%	9%	95%	96%
RM 93	17.2	7%	49%	33%	3%	9%	13%

Flow Tracker Monitoring

Mean depth and velocity measurements recorded along transects at the five NMISC projects sites were consistent with the range predicted by the design model (GSA 2015). Average flow velocity was low across the transects and sites during late-April 2019 (**Table 6**). Several backwater sites had an average measured velocity of 0 ft/s while the flow through channel at RM 103 (Escondida West) measured 1.4 ft/s. Shallow habitats were also abundant at the sites. Average depth ranged from as low as 0.4 ft at the RM 114 backwater to 1.6 ft the RM 103 (Escondida West) flow-through channel. Water temperature typically ranged from about 60˚F to 65˚F.

Table 6. Average depth, velocity and temperature measured in late April 2019 along transects established at all eight restoration sites. Bold values represent site averages. Shaded cells represent NMISC project sites. Monitoring cross-section locations are displayed on April inundation maps in Appendix A.

Site/Transect	Monitoring Date	Mean Daily Discharge (cfs) at Nearest Gage	Average depth (ft)	Average velocity (ft/s)	Average temperature (°F / °C)
RM 114.0	23 April	2,330*	**0.4**	**0.0**	**60.1 / 15.6**
114.0-1			0.6	0.1	60.4 / 15.7
114.0-2			0.2	0.0	59.6 / 15.3
114.0-3			0.0	0.0	NA
RM 112.0	23 April	2,330*	**0.7**	**0.0**	**64.0 / 17.7**
112.0-1			0.9	0.1	60.8 / 16.0
112.0-2			0.8	0.0	62.8 / 17.1
112.0-3			0.4	0.0	68.9 / 20.5
RM 104.5 (Escondida East)	25 April	2,830**	**1.5**	**0.9**	**60.2 / 15.6**
Escondida 4			1.6	0.1	59.2 / 15.1
Escondida 5			1.3	1.7	61.3 / 16.3
RM 103 (Escondida West)	25 April	2,830**	**1.6**	**1.4**	**61.4 / 16.3**
Escondida 1			1.5	0.0	60.1 / 15.6
Escondida 2			1.5	2.3	61.7 / 16.5
Escondida 3			1.9	2.2	62.4 / 16.9
RM 100.5	24 April	2,740**	**0.8**	**0.7**	**60.4 / 15.8**
100.5-1			0.7	0.5	61.2 / 16.2
100.5-2			0.9	0.2	61.0 / 16.1
100.5-3			0.9	1.3	59.2 / 15.1

Table 6. continued

Site/Transect	Monitoring Date	Mean Daily Discharge (cfs) at Nearest Gage	Average depth (ft)	Average velocity (ft/s)	Average temperature (°F)
RM 100.0	24 April	2,740**	**1.1**	**0.0**	**63.7 / 17.6**
100.0-1			0.8	0.1	62.3 / 16.8
100.0-2			1.2	0.1	62.6 / 17.0
100.0-3			1.2	0.0	66.3 / 19.0
RM 99.5	24 April	2,740**	**0.7**	**0.3**	**65.4 / 18.6**
99.5-1			0.7	0.3	65.4 / 18.6
99.5-2			1.0	-0.1	65.4 / 18.6
99.5-3			0.3	0.7	65.3 / 18.5
RM 93 (Rhodes Property)	26 April	3,110**	**0.9**	**0.4**	**65.5 / 18.6**
Rhodes 1			1.1	1.1	62.1 / 16.7
Rhodes 2			0.8	0.3	62.9 / 17.2
Rhodes 3			0.9	0.3	63.9 / 17.7
Rhodes 4			0.7	0.4	64.6 / 17.8
Rhodes 5			0.9	0.3	65.5 / 18.6
Rhodes 6			1.1	0.2	67.6 / 19.8
Rhodes 7			0.9	0.1	67.5 / 19.7
Rhodes 8			0.8	0.8	65.3 / 18.5
Rhodes 9			0.8	0.8	65.8 / 18.8
Rhodes 10			1.2	0.2	67.4 / 19.7
Rhodes 11			1.1	0.3	67.6 / 19.8

*mean daily discharge at San Acacia gage

** mean daily discharge at Escondida gage

Isolated Pools

Isolated pools were documented on June 6 at all project sites except at RM 112, RM 104.5 and RM 103 (**Table 7**), primarily because these project sites were almost completely inundated. One small pool at RM 114 appeared to be where a relatively small hole (<100 ft²) had been dug. The downstream outlet had disconnected from the river, but the upstream inlet was still connected. RM 100 was completely disconnected from the river due to formation of a new sediment bar at the backwater inlet/outlet.

One moderate sized (100-500 ft²) pool was documented at RM 100.5 within a topographic depression. Multiple isolated pools of various sizes were recorded at RM 99.5 and RM 93.

Table 7. Isolated pools and associated attributes documented at each restoration site on June 6 (left side of /) and July 22 (right side of /). Shaded cells represent NMISC project sites. Maps showing pool location and size class are provided in Appendix B.

Attributes	**RM 114**	**RM 112**	**RM 104.5**	**RM 103**	**RM 100.5**	**RM 100**	**RM 99.5**	**RM 93**
Mean Discharge at Nearest Gage (June 6 / July 22)	San Acacia Gage 3,120 cfs / 1,070 cfs		Escondida Gage 3,170 cfs / 1,010 cfs					
Number of Isolated Pools	1/1	0/3	0/3	0/14	1/6	1/2	5/5	7/7
Approximate size <100 ft²	1/1	0/1	0/2	0/9	0/5	0/1	3/5	5/4
Approximate size 100-500 ft²	0/0	0/1	0/0	0/4	1/1	0/0	1/0	2/2
Approximate size >500 ft²	0/0	0/1	0/1	0/1	0/0	1/1	1/0	0/1
Primary Cause: Drainage impeded by sediment accumulation	0/0	0/2	0/2	0/0	0/3	1/2	2/0	3/1
Primary Cause: Within topographic depression	1/1	0/1	0/1	0/14	1/3	0/0	3/5	4/6
Primary Cause: Other	dug	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Isolated pools were documented on July 22 at all sites when monitoring was repeated during the descending limb of the snowmelt hydrograph. The greatest number of isolated pools was documented along the high-flow channel RM 103 (Escondida West) (**Table 7**). At least one relatively large isolated pool (pools > 500 ft²) was documented at several project sites, including RM 112, RM 104.5, RM 103, RM 100 and RM 93 (**Table 7**). Factors contributing to pool formation included combinations of topographic depressions (e.g., scour zones) and drainage impediments from sediment deposition near channel outlets. Maps showing location and distribution of isolated pools documented on both June and July monitoring dates are presented in **Appendix C**.

Noxious Weeds

Noxious weeds were identified in six of the eight restoration sites during 2019 field surveys (**Table 8;** also see maps in **Appendix D**). Note that the numbers in **Table 8** and location markers on the maps in **Appendix D** refer to populations and not individual plants. Some mapped populations may overlap but were recorded using best professional judgement to depict overall distribution of noxious weed infestations within each site and guide maintenance prioritization and implementation. As indicated on **Table 8**, a total of five noxious weed species were observed within the restoration sites.

The greatest number of noxious weed populations (a total of 66) were documented at the RM 93 (Rhodes) project site. The RM 93 site also contained the highest number of noxious weed species observed (3). The most common noxious weed recorded at RM 93 was perennial pepperweed (*Lepidium latifolium*). This species was also documented at restoration sites RM 104.5, RM 103, and RM 100.5 (**Table 8**). The next most common was Russian knapweed (*Acroptilon repens*), which was recorded at restoration sites RM 112, RM 103.0 and RM 93. Twelve Ravenna grass (*Saccharum ravennae*) plants were observed at RM 99.5. Six of the Ravenna grass plants were in the rosette stage while the other six were mature plants with seed heads. Two populations of whitetop (*Cardaria draba*) were identified at RM 93 (**Table 8**).

Table 8. Number of noxious weed populations documented at each restoration site during 2019 (includes both the May and October site visits). Shaded cells represent NMISC project sites. Maps showing location of noxious weed species detections are provided in Appendix D.

Site	**Perennial pepperweed**	**Ravenna grass**	**Russian knapweed**	**Whitetop**	***Grand Total***
RM 112			15		***15***
RM 104.5	4				***4***
RM 103	4		1		***5***
RM 100.5	2				***2***
RM 99.5		12			***12***
RM 93	40		24	2	***66***
Grand Total	50	12	40	2	**104**

Woody Vegetation

Native cottonwood and willow seedlings were present at all restoration sites, although the proportion of 20ft. x 20ft. monitoring grid cells with cottonwood seedlings were far greater than those with willow seedlings (**Table 9**). Cottonwood seedlings were most widely distributed (more individual grid cells) at RM 114 than other sites, while RM 103 (Escondida West) had the lowest distribution. Overall, coyote (*Salix exigua*) and Goodding's willow (*S. gooddingii*) seedlings were documented in very few grid cells although they were considerably more widely distributed at the RM 93

(Rhodes) site than other project sites (**Table 9**). Maps showing spatial distribution of cells containing native woody riparian plants are provided in **Appendix E**.

Non-native woody vegetation was also documented at all project sites, with saltcedar (*Tamarix sp.*) seedlings and root-sprouts found in more monitoring grid cells than all other woody exotic species (Siberian elm [*Ulmus pumila*] and Russian olive [*Elaeagnus angustifolia*]) combined (**Table 10**). The monitoring did not distinguish between exotic plant seedlings or root-sprouts. Maps showing spatial distribution of cells containing non-native woody plants are provided in **Appendix F**.

Table 9. Proportion of total monitoring grid cells (before the slash) and grid cells outside of designated channel maintenance zones (after the slash) containing cottonwood and/or willow seedlings. Shaded cells represent NMISC project sites. Maps showing approximate location and distribution of native woody riparian plants at different sites are provided in Appendix D.

Site	Cottonwood	Coyote Willow	Goodding's Willow	Both Cottonwood & Willow
RM 114	19%/13%	6%/5%	1%/1%	20%/15%
RM 112	12%/12%	2%/2%	1%/2%	13%/12%
RM 104.5	7%/not applicable	2%/not applicable	1%/not applicable	9%/not applicable
RM 103	5%/5%	2%/2%	0%/0%	6%/6%
RM 100.5	12%/12%	1%/1%	0%/0%	13%/12%
RM 100	12%/10%	2%/1%	0%/0%	13%/10%
RM 99.5	13%/11%	2%/2%	0%/0%	14%/12%
RM 93	10%/8%	21%/16%	9%/7%	26%/21%

Table 10. Proportion of monitoring grid cells containing exotic woody species. Shaded cells represent NMISC project sites. Maps showing approximate location and distribution of non-native woody riparian plants at different sites are provided in Appendix F.

Site	Saltcedar	Siberian Elm	Russian Olive	Any Exotic Species
RM 114	29%	0%	13%	42%
RM 112	11%	0%	6%	17%
RM 104.5	40%	0%	0%	40%
RM 103	13%	0%	2%	16%
RM 100.5	24%	1%	10%	35%
RM 100	26%	0%	3%	28%
RM 99.5	19%	0%	9%	28%
RM 93	45%	0%	4%	49%

Post-Runoff Sediment Deposition

The RTK-GPS surveys results indicate most sediment deposition occurred within or near backwater channel inlets/outlets (see maps in **Appendix G**). However, for sites with multiple backwater channel inlets (i.e., RM 100.5, RM 99.5, RM 93), the volume of sediment deposition was variable between inlets. Furthermore, some inlets (i.e., RM 100.5 and RM 93) lost sediment (compared to the as-built condition) via scouring (**Table 11**).

The site with the largest volume of sediment deposition was RM 103 (Escondida West), however, total deposition volume is not presented in Table 10 for that site because channel maintenance zones were not delineated. Maps in **Appendix G** show that sediment deposition occurred along the entire length of the channel feature, thus, it appears that restoring inundation extent near the design discharge would require sediment cleanout beyond the inlets. It is worth noting that this was the only project site designed to function as a flow through channel at low to moderate discharges (< 2,000 cfs).

Despite the prolonged volume and duration of snow-melt runoff, the volume of sediment deposition at project sites RM 100.5, RM 100 and RM 99.5 was relatively small compared to the volume of sediment removed during construction (**Table 12**). Conversely, the post-runoff sediment deposition was relatively high (39%) at RM 114 compared to the volume removed during construction (**Table 12**).

Table 11. Sediment deposition volume (cubic yards) at different inlets within each restoration project site. Cells with parentheses indicate sediment loss (scour). Shaded cells represent NMISC project sites. Maps showing sediment deposition and scour are provided in Appendix G.

	SITE						
Inlet #	**RM 114**	**RM 112**	**RM 104.5**	**RM 100.5**	**RM 100**	**RM 99.5**	**RM 93**
Inlet 1	299	387	1,714	153	67	93	(130)
Inlet 2	482	-	-	117	-	219	128
Inlet 3	-	-	-	(5)	-	77	4
Inlet 4	-	-	-	-	-	49	192
Inlet 5	-	-	-	-	-	-	221
Inlet 6	-	-	-	-	-	-	161
Inlet 7	-	-	-	-	-	-	39
Inlet 8	-	-	-	-	-	-	16
Inlet 9	-	-	-	-	-	-	(5)
Inlet 10	-	-	-	-	-	-	100
Inlet 11	-	-	-	-	-	-	528
Total	**781**	**387**	**1,714**	**265**	**67**	**438**	**1,253**

Table 12. Cubic yards of sediment deposited at channel inlets compared to the volume removed during site construction

Sediment Volume (yds^3)	Site						
	RM 114	RM 112	RM 104.5	RM 100.5	RM 100	RM 99.5	RM 93
Removed During Construction	2,000	3,500	15,000	15,000	7,000	21,000	45,000
Post-Inundation Deposition at Inlets	781	387	1,714	265	67	438	1,253
% of Construction Volume	**39%**	**11%**	**11%**	**2%**	**1%**	**2%**	**3%**

Fish

Results from monitoring of adult fish were prepared by SWCA (2019) and are presented in **Appendix H**. Larval fish data were also collected at project sites RM 114, RM 112, RM 100.5 and RM 100, although those results were not available at the time of this report. Those data will be prepared by SWCA in a separate report (Steve Zipper, SWCA, personal communication).

Adaptive Management & Maintenance Recommendations

Caplan & McKenna (2019) provided quantitative metrics for determining whether habitat restoration goals and objectives are being achieved. If monitoring results demonstrate that these metrics were not achieved in a monitoring year, the Monitoring & AM Plan recommends adaptive management actions be implemented, or at least be discussed, by the AM team (NMISC, Reclamation, GSA and SOBTF). In keeping with these recommendations, the AM team met on January 23rd and 30th to review monitoring results and discuss AM actions. Notes from these meetings are provided in **Appendices I & J.** Summary tables showing linkages between Monitoring & AM Plan success criteria, 2019 monitoring results, and planned AM actions are provided below in **Table 12** and **Table 13**. SOPs for implementing site maintenance treatments are provided in **Appendix K**.

Table 13. Monitoring results summary and AM actions to be implemented in CY 2020 to meet stated objectives for restoration Goal #1. Adapted from Table 3 in Caplan & McKenna 2019.

GOAL 1: Create & maintain off-channel nursery habitat for RGSM at low to moderate discharges (800-2,000 cfs)				
SMART Management Objective	**Monitoring Method**	**Adaptive Management Trigger**	**2019 Monitoring Result**	**CY 2020 AM Recommendations**
For NMISC project sites: Surface water begins inundating the project site near the backwater channel inlet(s) when snowmelt discharge at the San Acacia gage is approximately **800-1,000 cfs**	Inundation Mapping	No (0%) inundation when discharge at nearest gage is approximately 800-1,000 cfs	Percent Area Inundated RM 114 – 12% RM 112 – 47% RM 100.5 – 30% RM 100 – 43% RM 99.5 – 23%	Success criteria achieved at all sites in 2019. *Sediment deposition at some channel inlets may prevent inundation at similar discharges in 2020 and subsequent years without AM action. This is addressed below in **Table 14**
For Escondida project sites: Surface water begins inundating the project site near the backwater channel inlet(s) when snowmelt discharge at the San Acacia gage is between **300 and 700 cfs**	Inundation Mapping	No (0%) inundation when discharge at nearest gage is approximately 300 cfs	No formal monitoring occurred in 2019, but general observation indicates both sites were partially inundated at/near target discharge	*Based on October 2019 survey data, sediment deposition within some channel inlets are predicted to preclude inundation at early runoff discharges in 2020. Sediment removal is recommended at channel inlets to promote backwater function at both RM 103 and RM 104.5. Volume of recommended sediment removal for RM 104.5 is provided in **Table 14.**
For RM 93 project site: Surface water begins inundating the project site near the backwater channel inlet(s) when snowmelt discharge at the San Acacia gage is between **300 and 700 cfs**	Inundation Mapping	No (0%) inundation when discharge at nearest gage is 300-700 cfs	No formal monitoring occurred in 2019, but general observation indicates both sites were partially inundated at/near target discharge	*Based on October 2019 survey data, sediment deposition within some channel inlets are predicted to preclude inundation at early runoff discharges in 2020. Sediment removal is recommended to maintain site function at RM 93.Volume of recommended sediment removal for RM 93 is provided in **Table 14.**
For NMISC project sites: Surface water has inundated **at least 75%** of the project site when snowmelt discharge at the San Acacia gage is **approximately 2,000 cfs.**	Inundation Mapping	Less than 75% of project area inundated at approximately 2,000 cfs	Percent Area Inundated RM 114 – 29% RM 112 – 67% RM 100.5 – 82% RM 100 – 50% RM 99.5 – 83%	*NMISC will consider using heavy equipment in 2020 to reshape RM 114, RM 112, or RM 100 to increase area of inundation at 2,000 cfs. *Sediment deposition within some channel inlets (termed "channel maintenance zones) are predicted to preclude inundation at similar discharges in 2020 without AM action. This is addressed below in **Table 14**
For Escondida project sites: No specific percent-surface inundation target for RM 103 and RM 104.5 was developed prior to the 2019 monitoring season.	Inundation Mapping		Percent Area Inundated RM 104.5 – 84% RM 103 – 43%	*Develop a target for percent-of-surface inundated during 2000 cfs. *Based on 2019 survey data, sediment deposition within some channel inlets are predicted to preclude inundation at similar discharges in 2020. Sediment removal is recommended to maintain site function at RM 103 and 104.5. Volume of recommended sediment removal for RM 104.5 is provided in **Table 14.**
For Rhodes project site: Surface water has inundated **at least 60%** of the project site when snowmelt discharge at the San Acacia gage is approximately **2,000 cfs.**	Inundation Mapping		Percent Area Inundated RM 93 – 71%	*Based on October 2019 survey data, sediment deposition within some channel inlets are predicted to preclude inundation at early runoff discharges in 2020. Sediment removal is recommended to maintain site function at RM 93.Volume of recommended sediment removal for RM 93 is provided in **Table 14.**
Flow depths within the project site are variable and do not exceed 2-feet when snowmelt discharge at the SA gage is approximately 2,000 cfs.	Flow Tracker Measurements	Mean inundation depth during monitoring exceeds 2 feet	Mean depth at all sites less than 2 feet	No AM action required
For NMISC project sites: At least 50% of flow velocity measurements recorded across the project footprint are less than 0.5 ft/sec when snowmelt discharge at the San Acacia gage is approximately 2,000 cfs For RM 93 project site: At least 25% of flow velocity measurements recorded across the project footprint are less than 0.5 ft/sec when snowmelt discharge at the San Acacia gage is approximately 2,000 cfs	Flow Tracker Measurements	Mean flow velocity during monitoring exceeds 0.5 ft/sec	Mean velocity at all sites less than 0.5 ft/sec	No AM action required

Table 12 continued.

GOAL 1: Create & maintain off-channel nursery habitat for RGSM at low to moderate discharges (800-2,000 cfs)				
SMART Management Objective	**Monitoring Method**	**Adaptive Management Trigger**	**2019 Monitoring Result**	**CY 2020 AM Actions**
No isolated pools of standing water greater than approximately 100ft^2 will remain on project sites when discharge at the nearest gage is less than 1,000 cfs.	Isolated Pool Mapping	At least one isolated pool of standing water greater than approximately 100ft^2 is present at a project site	Number of isolated pools > 100ft^2 RM 114 – 0 RM 112 – 2 RM 104.5 – 1 RM 103 – 5 RM 100.5 – 1 RM 100 – 1 RM 99.5 – 0 RM 93 – 3	At least one isolated pool > 100 ft^2 was observed at most sites during July 2019 monitoring. AM team agreed that no specific physical maintenance action will be implemented in 2020 to prevent isolated pool formation beyond removing restrictive sediment plugs within channel maintenance zones (see **Table 14**). *The AM team agreed that field crews performing monitoring in 2020 will notify NMISC and Reclamation project managers regarding presence of pools >100 ft^2
Designated channel maintenance zones will remain void (0%) of any woody vegetation over the life of the project	Woody vegetation mapping	Presence of any woody plant seedlings/saplings within the designated channel maintenance zone(s)	Woody plant seedlings detected in channel maintenance zones of all project sites	*Woody plant seedlings will be physically removed from channel maintenance zones during sediment plug removal in winter/spring 2020. Exceptions include channel maintenance zones that do not require sediment plug removal (see **Table 14**). In these zones woody plant seedlings will be physically removed by SOBTF field crews using shovels.

Table 14. Monitoring results summary and AM actions to be implemented in CY 2020 to meet stated objectives for restoration Goal #2. Adapted from Table 3 in Caplan & McKenna 2019.

Goal	SMART Management Objective	Monitoring Method	Adaptive Management Trigger	2019 Monitoring Result	CY 2020 AM Actions
Project sites will experience natural recruitment of native riparian vegetation dominated by cottonwood and willow	Native cottonwood and willow will naturally establish within at least 25% of the excavated project footprint area (outside of the designated channel maintenance zone) within the first three years following project construction	Grid-based vegetation monitoring	Native riparian plant recruitment (outside of designated backwater channel maintenance zone) is documented in fewer than 25% of grid cells after 3rd year of monitoring	Percent of Grid Cells Containing Cottonwood-Willow RM 114 – 15% RM 112 – 12% RM 104.5 – 9% RM 103 – 6% RM 100.5 – 12% RM 100 – 10% RM 99.5 – 12% RM 93 – 21%	No adaptive management actions will be decided until after data has been collected for 3 consecutive growing seasons (after 2021 monitoring)
	Invasive woody plant species found growing in the excavated project footprint shall be eradicated within 8 months of detection	Grid-based vegetation monitoring	Percent of monitoring grid cells containing invasive woody species: **>0% of Grid Cells** Siberian elm, Tree of Heaven **>5% of Grid Cells** Saltcedar, Russian olive, Mulberry	Percent of Grid Cells Containing Non-Native Species RM 114 – 42% RM 112 – 17% RM 104.5 – 40% RM 103 – 16% RM 100.5 – 35% RM 100 – 28% RM 99.5 – 28% RM93 – 49%	*Management treatments will be implemented at all project sites by SOBTF in CY 2020 per methods presented in the SOP in **Appendix K**
	Invasive non-native herbaceous plant species found growing within and immediately surrounding the excavated project footprint will be treated within 8 months of detection.	Systematic Visual Observation Surveys	Observed presence of any of the following invasive, non-native herbaceous species: Ravenna grass, perennial pepperweed, whitetop, Russian knapweed, camelthorn, bull thistle, Canada thistle	Noxious weed species documented at project sites: RM 114 – no RM 112 - yes RM 104.5 – yes RM 103 – yes RM100.5 – yes RM 100 – no RM 99.5 – yes RM 93 - yes	*Management treatments will be implemented at all project sites by SOBTF in CY 2020 per methods presented in **Table 16** and the SOP in **Appendix K**

Sediment Removal

As indicated in the maps presented in **Appendix G**, *channel maintenance zones* were designated for each backwater inlet within each project site. The number of inlets varies between sites and range between one inlet at RM 112 and RM 104.5 to as many as eleven inlets at RM 93. Not all inlets require sediment removal. The volume of sediment to be removed from specified channel maintenance zone inlets is listed in **Table 15**.

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Steps to be implemented by GSA and SOBTF to support sediment removal include:

- Stake channel maintenance zone boundaries in the field using a high accuracy (e.g. sub-meter) GPS
- Stake excavation grade with RTK-GPS. The recommended target grade for each site is indicated in **Table 15**.
- Provide field support to equipment operators charged with removing and disposing of sediment
- Survey post-excavation channel maintenance zone topography with RTK-GPS to validate that elevations are consistent with targets indicated in **Table 15** and ensure the grade promotes drainage back to the Rio Grande.

Table 15. Volume of sediment to be removed from channel maintenance zone inlets at different project sites. Inlet numbers for each site are arranged in order from upstream to downstream.

Inlet #	RM 114	RM 112	RM 104.5	RM 100.5	RM 100	RM 99.5	RM 93
Inlet 1	299	387	1,714	153	67	93	*
Inlet 2	482	-	-	117	-	219	128
Inlet 3	-	-	-	*	-	77	*
Inlet 4	-	-	-	-	-	49	192
Inlet 5	-	-	-	-	-	-	221
Inlet 6	-	-	-	-	-	-	161
Inlet 7	-	-	-	-	-	-	39
Inlet 8	-	-	-	-	-	-	16
Inlet 9	-	-	-	-	-	-	*
Inlet 10	-	-	-	-	-	-	100
Inlet 11	-	-	-	-	-	-	528
Total	**781**	**387**	**1,714**	**270**	**67**	**438**	**1,385**

*denotes need for hand removal of woody plant species by SOBTF field crews

Table 16. Target elevations for inlets at NMISC project sites and RM 93 (Rhodes)

Site	Inlet Number	Target Elevation
114	1 and 2	4648.0
112	1	4639.4
100.5	1	4597.0
	2	4596.0
100	1	4595.5
99.5	1	4594.5
	2	4594.0
	3	4593.5
93	1	4571.3
	2	4571.0
	3	4570.7
	4	4570.5
	5	4570.2
	6	4569.8
	7	4569.5
	8	4569.4
	9	4569.1
	10	4569.0
	11	4568.4

Woody Plants in Channel Maintenance Zones

Channel maintenance zones (backwater inlets) that do not require sediment removal will require woody plant management/removal by SOBTF field crews. As stated in **Table 14**, these woody plants should be removed using shovels or other hand tools in winter 2020. These inlets are marked with a red asterisk in **Table 15**. Each channel maintenance zone perimeter is shown on maps in **Appendix F**. GSA will provide SOBTF with Avenza™ Maps to assist with site navigation during woody plant treatments. An SOP for implementing and documenting native woody plant control treatments within channel maintenance zones is provided in **Appendix K**.

Noxious Weeds

Noxious weeds documented at project sites should be treated using species specific treatments presented in **Table 17**. GSA will provide SOBTF with Avenza™ Maps to assist with site navigation during noxious weed treatments. An SOP for implementing and documenting non-native herbaceous plant control treatments is provided in **Appendix K**.

Table 17. Management recommendations for controlling noxious weeds documented at different restoration sites

Species	Location	Treatment Method	Treatment Timing
Perennial pepperweed	RM’s 100.5, 93	2% Imazapyr foliage treatment	Once per year, April-May
Ravenna grass	RM 99.5	Hand dig	Whenever detected
Russian knapweed	RM 112, 99.5, 93	10% Glyphosate foliage treatment	Twice per year, first mid-July, secondly mid-September
Whitetop	RM 93	2% Imazapyr foliage treatment	Once per year, April-May

Woody Non-Native Vegetation

Woody non-native vegetation documented at project sites should be treated using a cut-stump or foliar herbicide treatment with an aquatic approved imazapyr (e.g. Arsenal or Habitat) or glyphosate (Rodeo, AquaMaster) formulation. Cut stump application should be used on individuals with greater than one-inch basal stem diameter (bsd) and could be implemented year-round (as allowable per environmental compliance guidelines). A July-September foliar application is recommended for smaller individuals (i.e. seedlings with <1 inch bsd). GSA will provide SOBTF with Avenza™ Maps to assist with site navigation during non-native woody plant treatments. An SOP for implementing and documenting non-native plant control treatments is provided in **Appendix K.**

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GeoSystems Analysis (GSA). 2015. Habitat Restoration Analysis and Design, River Mile 130-99: Final Conceptual Design, Phase 1. Prepared for the New Mexico Interstate Stream Commission. Prepared by GeoSystems Analysis, Inc. Albuquerque, NM. November 2015. NMISC Work Order RG-15-2.

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SWCA. 2019 Stephen Zipper, personal communication.

APPENDIX A – INUNDATION MAPS

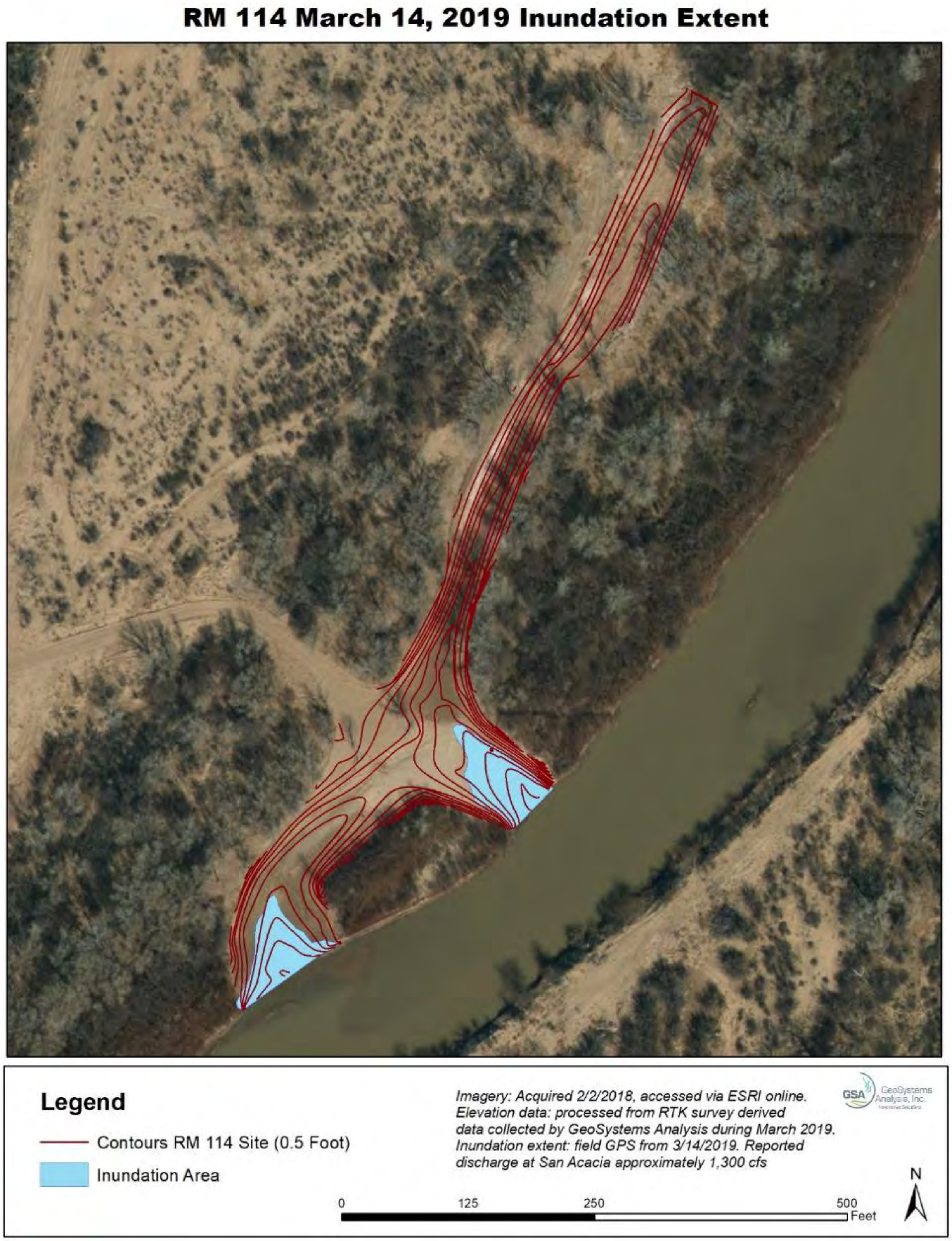

Figure A-1. Inundation extent documented at RM 114 on March 14, 2019. Mean daily discharge at San Acacia gage was 1,310 cfs.

Figure A-2. Inundation extent documented at RM 114 on April 23, 2019. Mean daily discharge at San Acacia gage was 2,530 cfs.

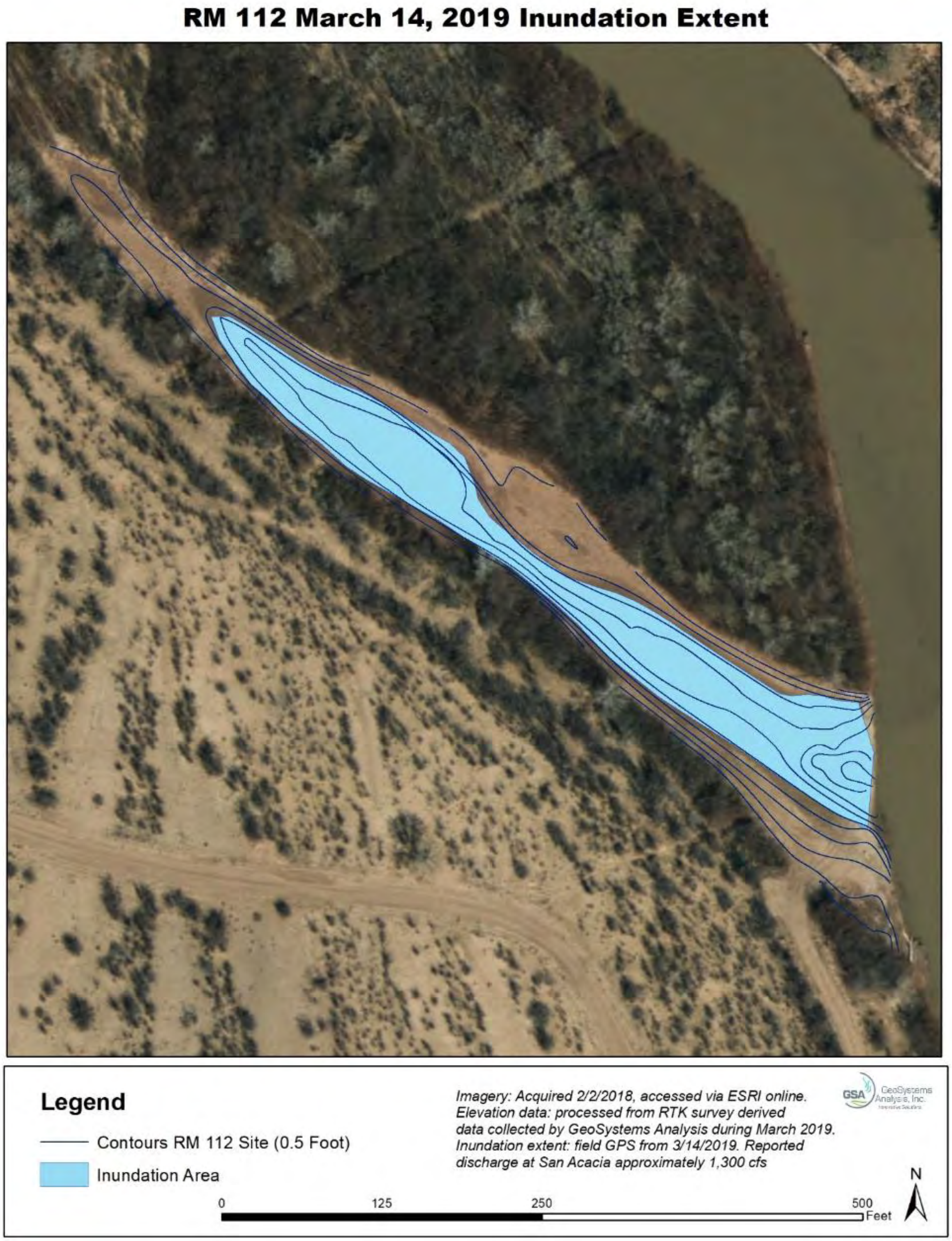

Figure A-3. Inundation extent documented at RM 112 on March 14, 2019. Mean daily discharge at San Acacia gage was 1,310 cfs.

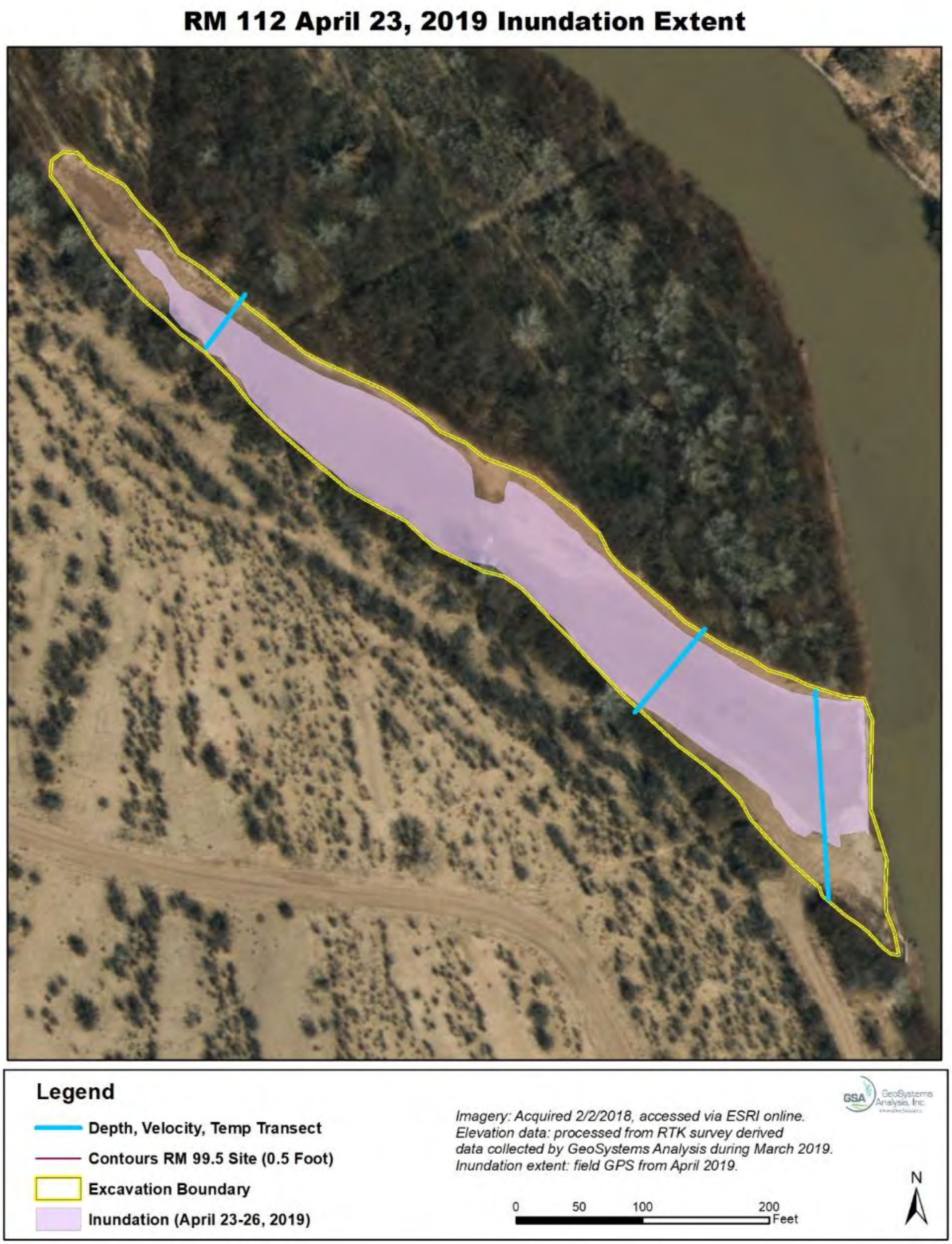

Figure A-4. Inundation extent documented at RM 112 on April 23, 2019. Mean daily discharge at San Acacia gage was 2,530 cfs.

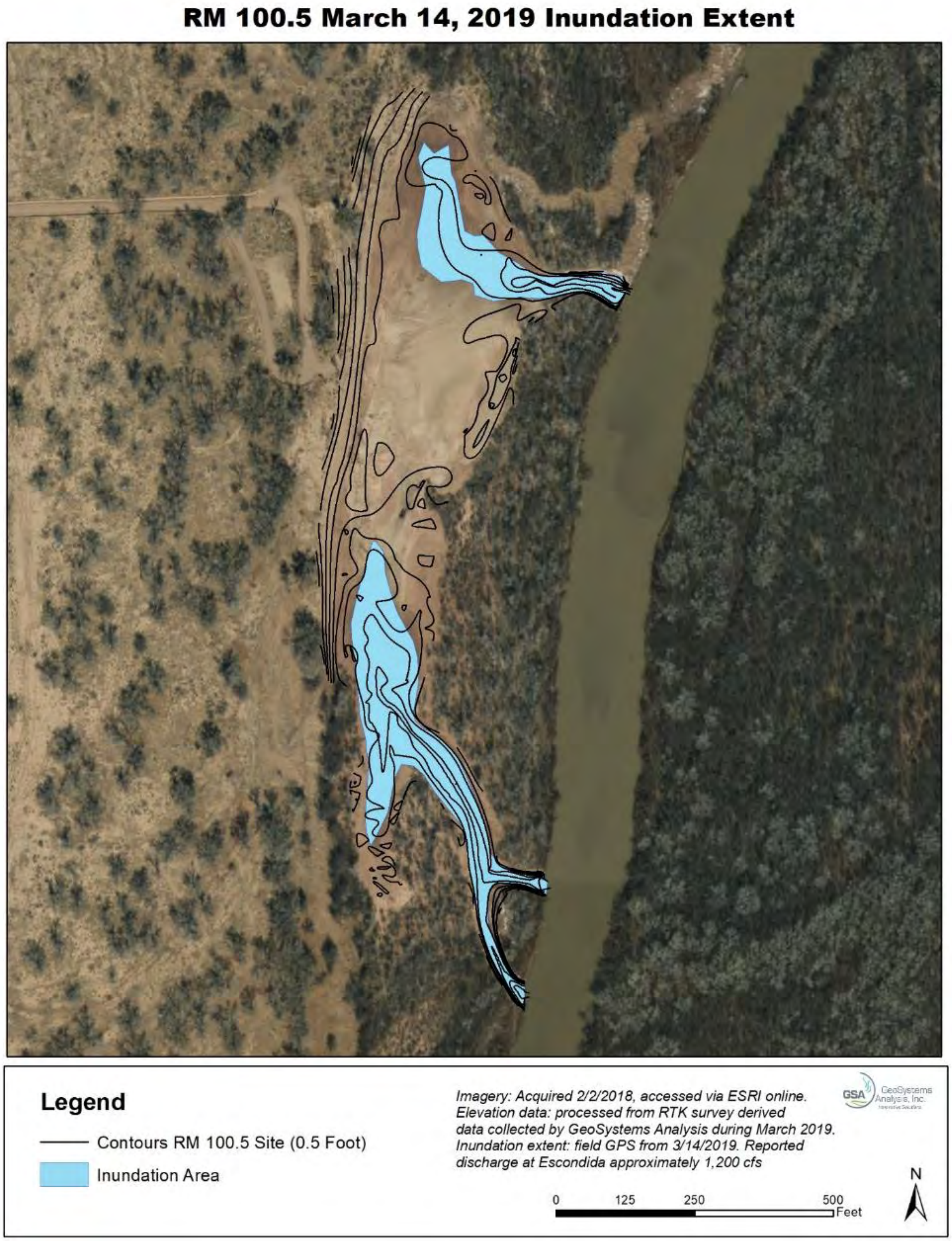

Figure A-5. Inundation extent documented at RM 100.5 on March 14, 2019. Mean daily discharge at the Escondida gage was 1,190 cfs.

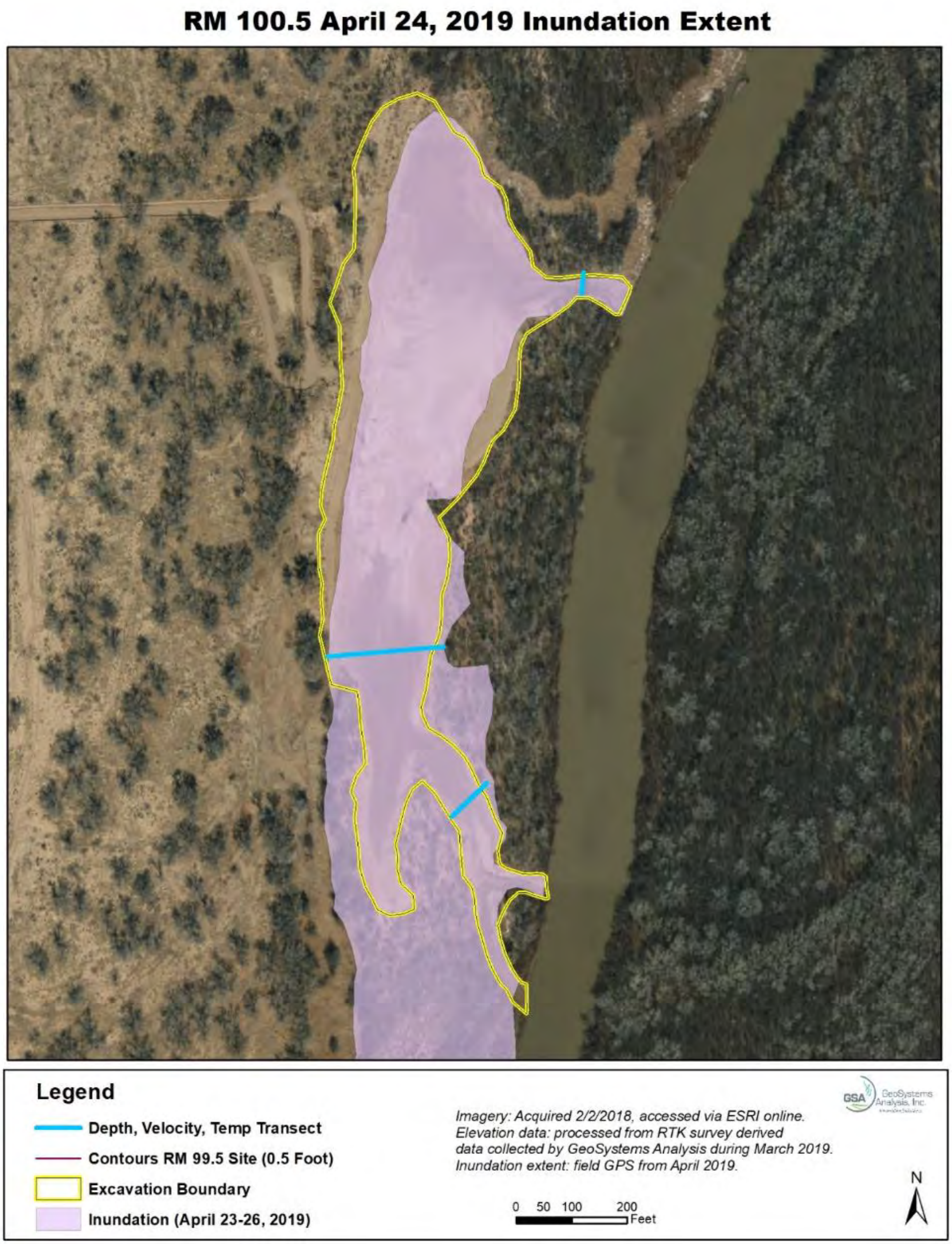

Figure A-6. Inundation extent documented at RM 100.5 on April 23, 2019. Mean daily discharge at the Escondida gage was 2,560 cfs.

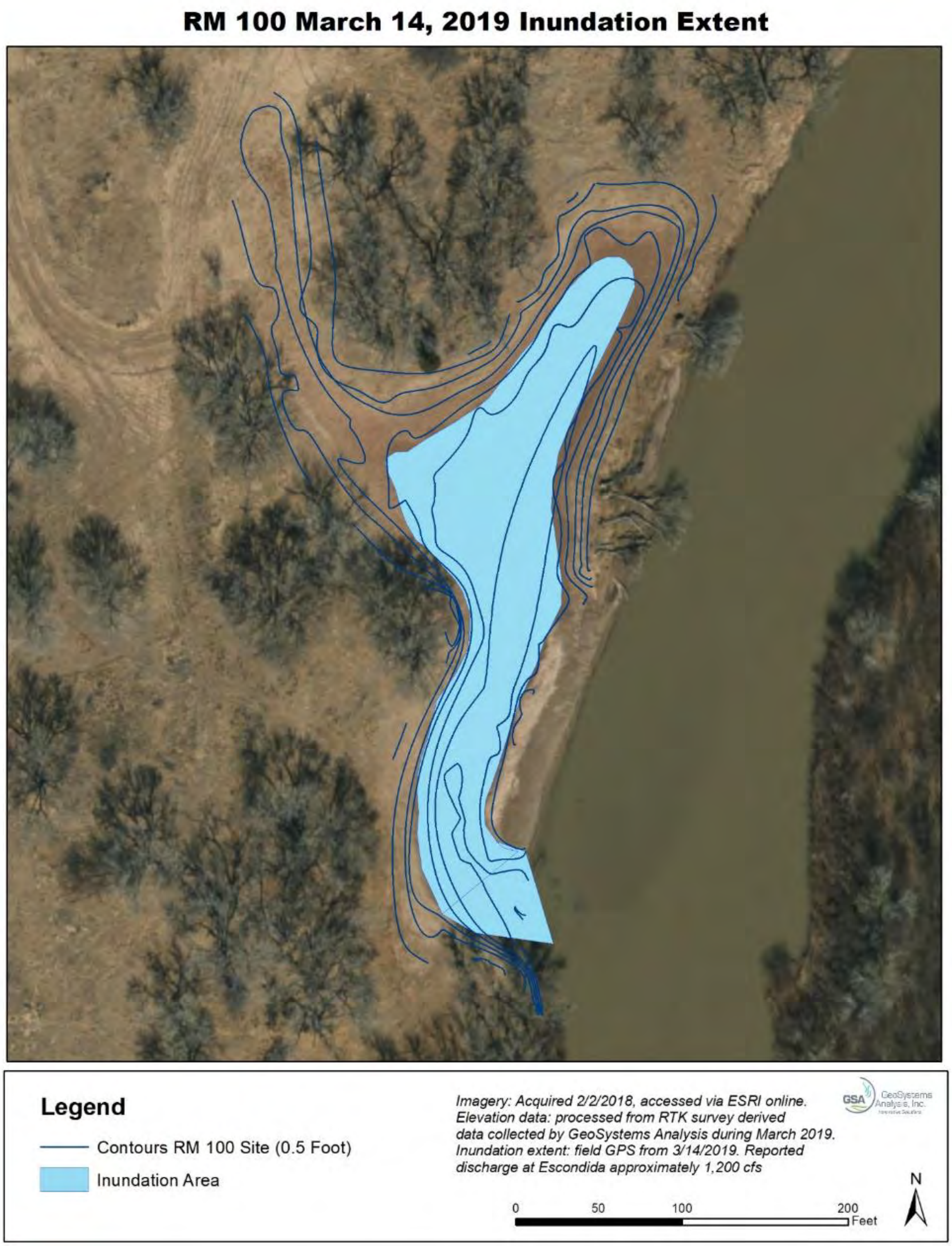

Figure A-7. Inundation extent documented at RM 100 on March 14, 2019. Mean daily discharge at the Escondida gage was 1,190 cfs.

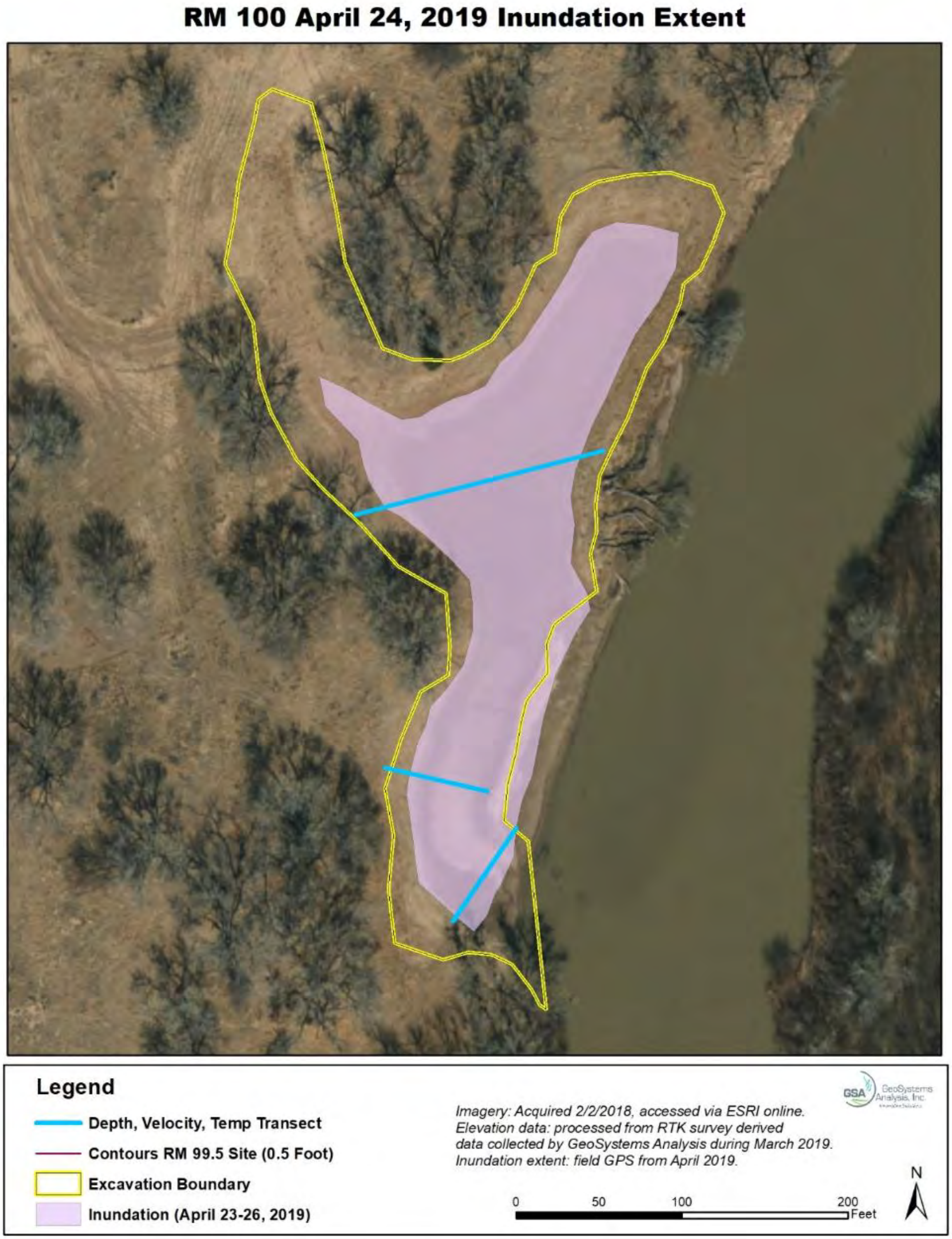

Figure A-8. Inundation extent documented at RM 100 on April 24, 2019. Mean daily discharge at the Escondida gage was 2,740 cfs.

Figure A-9. Inundation extent documented at RM 99.5 on March 14, 2019. Mean daily discharge at the Escondida gage was 1,190 cfs.

Figure A-10. Inundation extent documented at RM 99.5 on April 24, 2019. Mean daily discharge at the Escondida gage was 2,740 cfs.

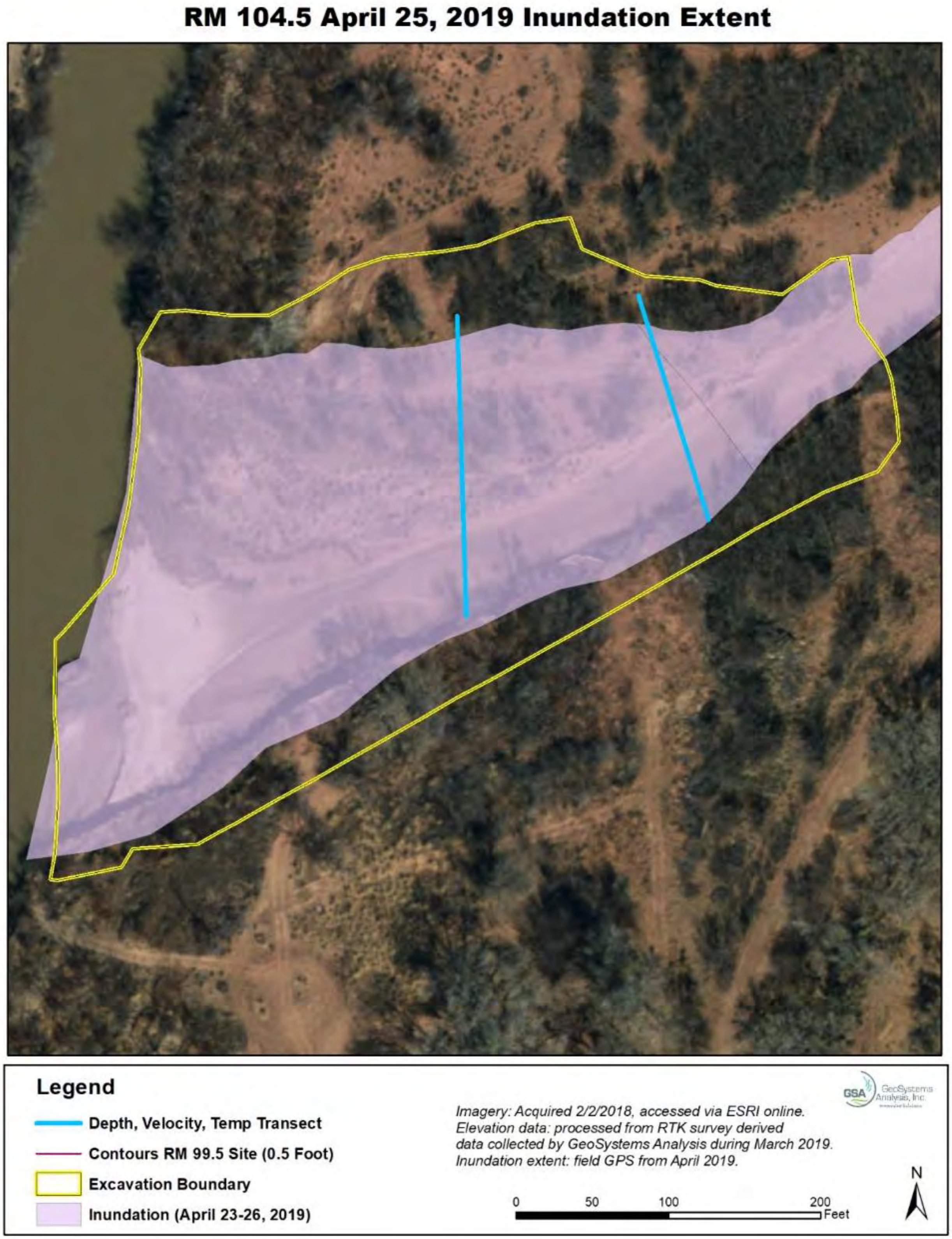

Figure A-11. Inundation extent documented at RM 104.5 on April 25, 2019. Mean daily discharge at the Escondida gage was 2,830 cfs.

Figure A-12. Inundation extent documented at RM 103 on April 25, 2019. Mean daily discharge at the Escondida gage was 2,830 cfs.

Figure A-13. Inundation extent documented at RM 93 on April 25, 2019. Mean daily discharge at the Escondida gage was 2,830 cfs.

APPENDIX B – IMAGERY-BASED INUNDATION INTERPRETATION

Figure B-1. Interpreted inundation area at RM 114 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

Figure B-2. Interpreted inundation area at RM 112 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

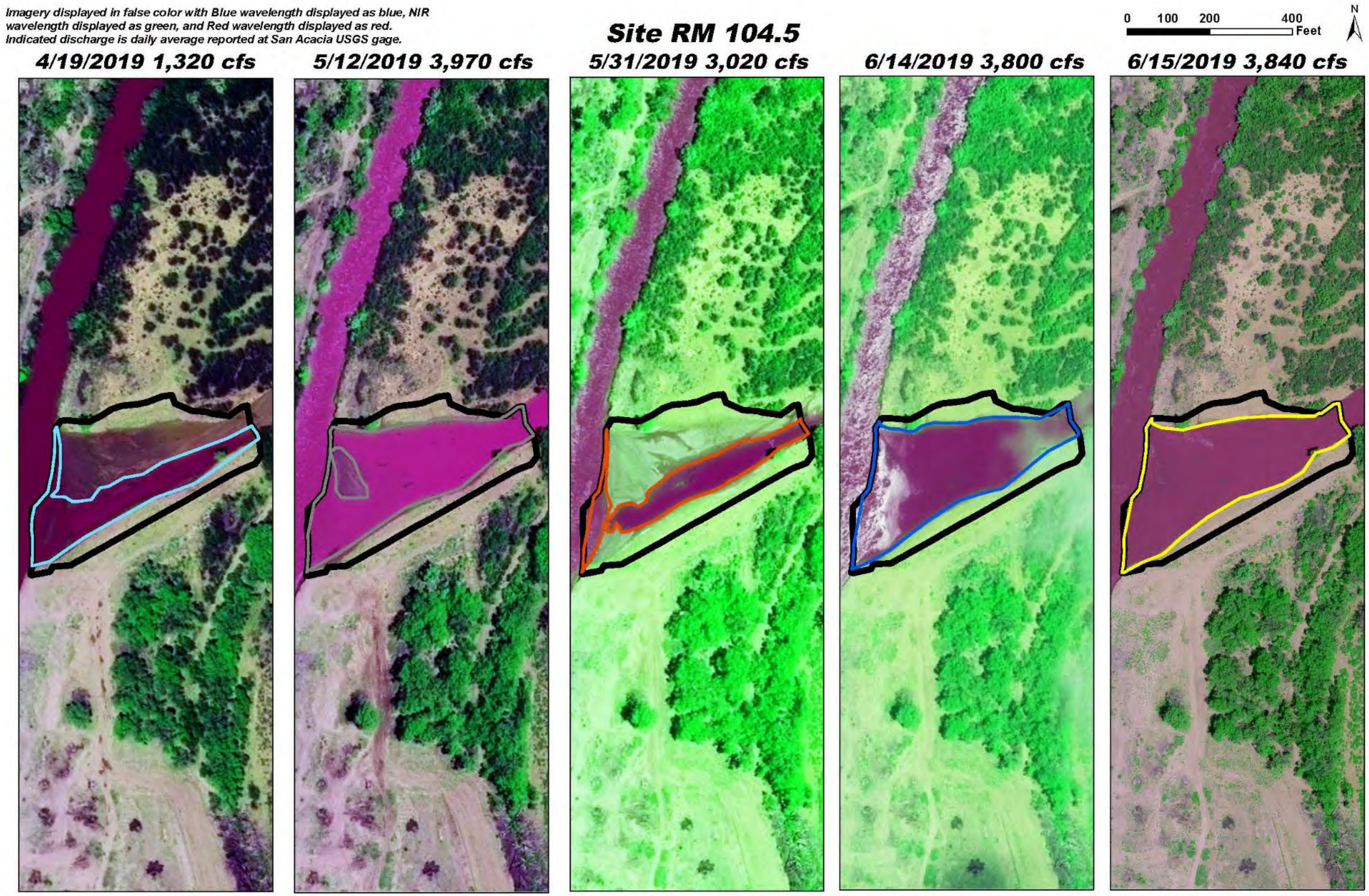

Figure B-3. Interpreted inundation area at RM 104.5 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

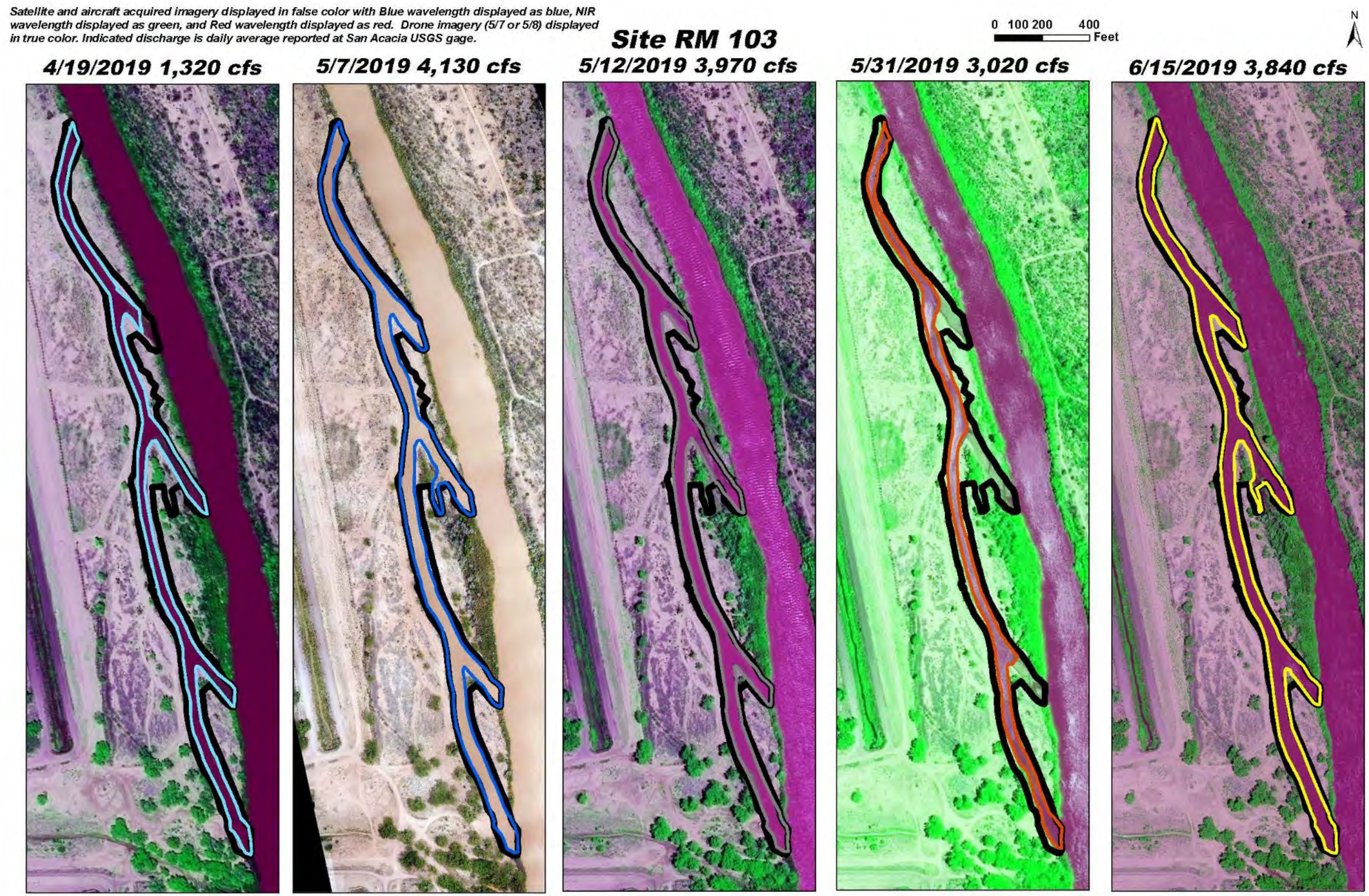

Figure B-4. Interpreted inundation area at RM 103 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

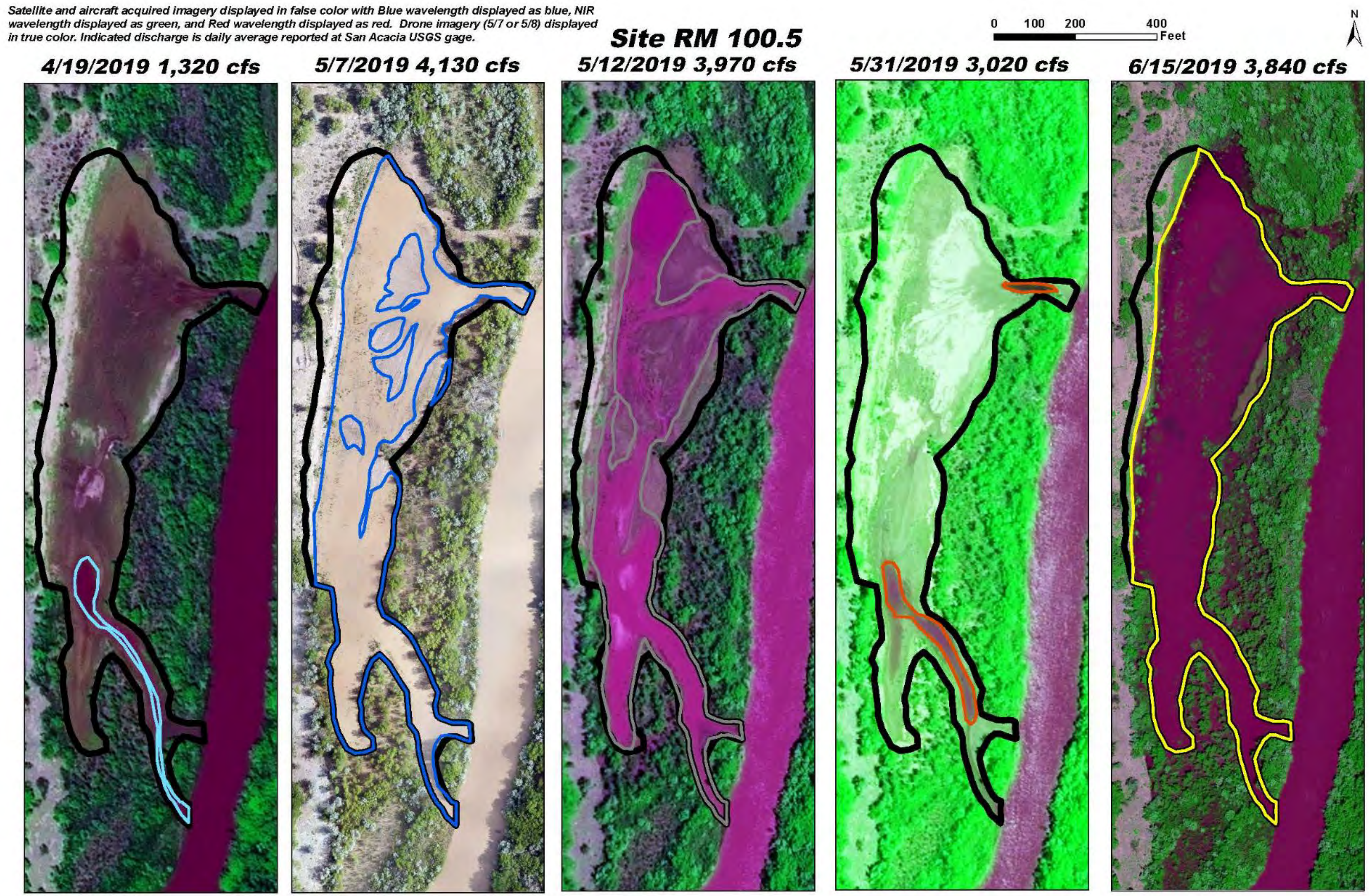

Figure B-5. Interpreted inundation area at RM 101.5 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

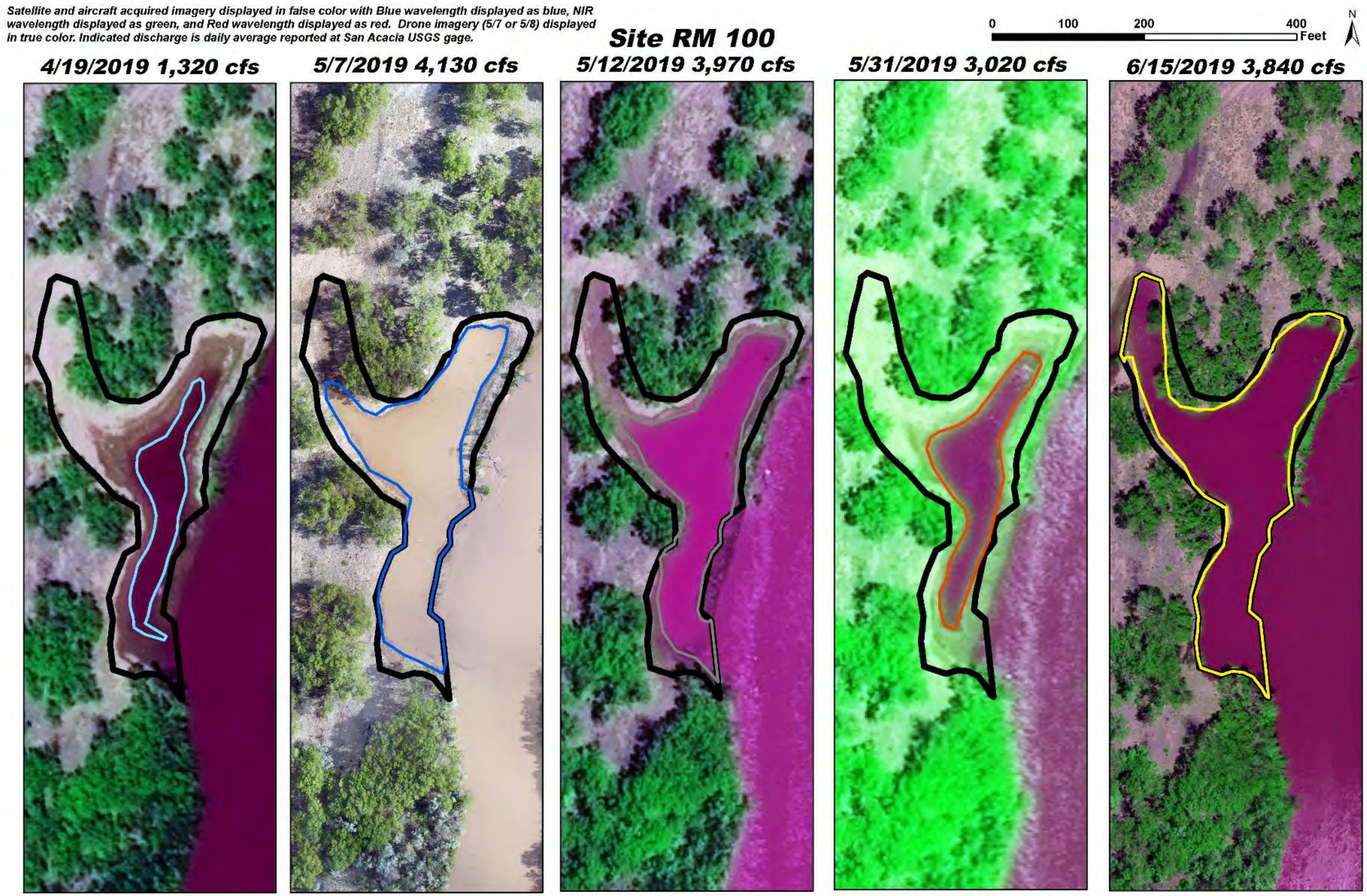

Figure B-6. Interpreted inundation area at RM 101.5 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

Figure B-7. Interpreted inundation area at RM 99.5 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

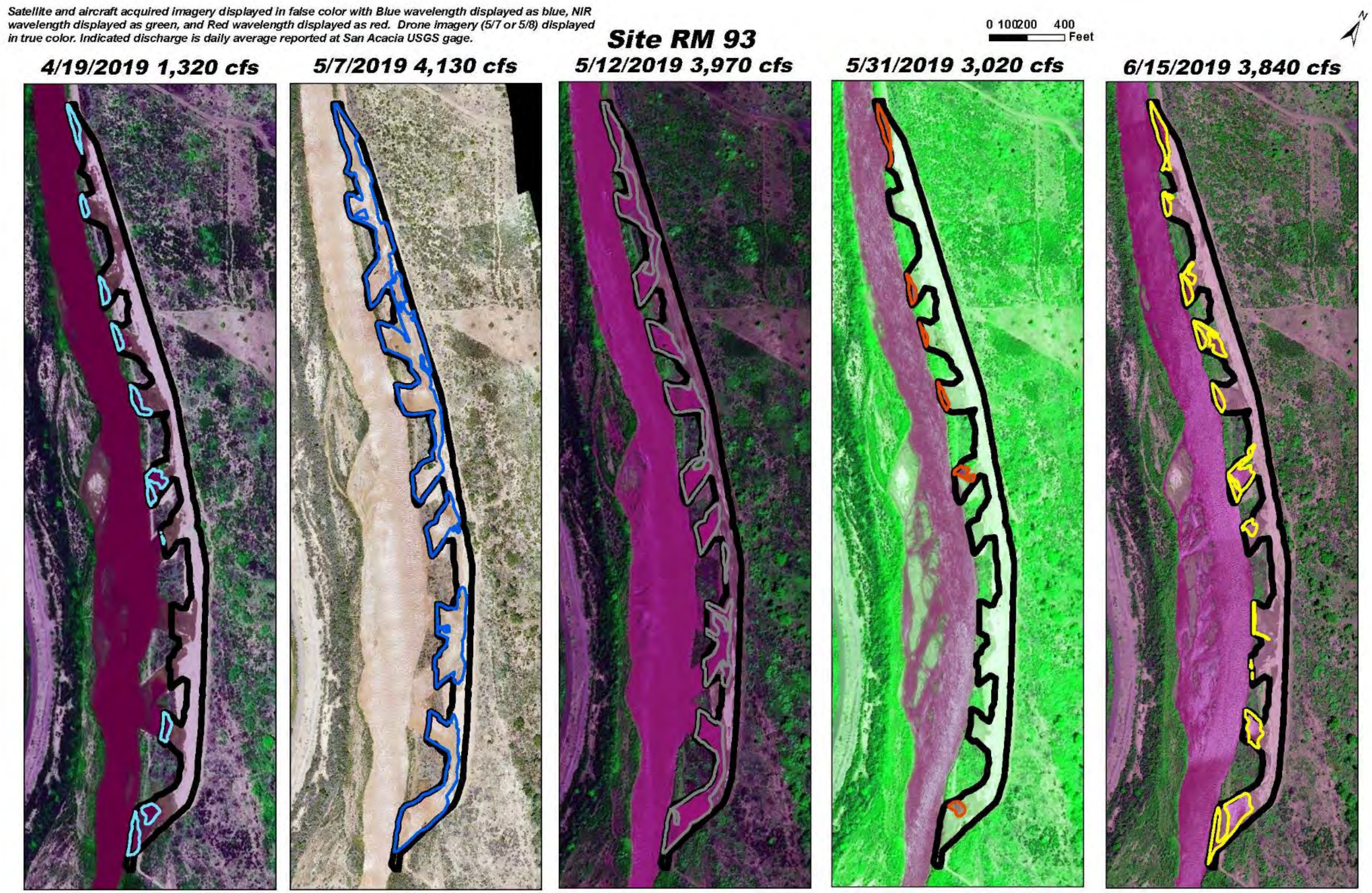

Figure B-8. Interpreted inundation area at RM 93 from five different geospatial image sources and dates during 2019 snowmelt runoff. Black polygons indicate project excavation footprint. Different colored polygons represent interpreted inundation areas during "heads-up" digitizing.

APPENDIX C – ISOLATED POOL LOCATIONS

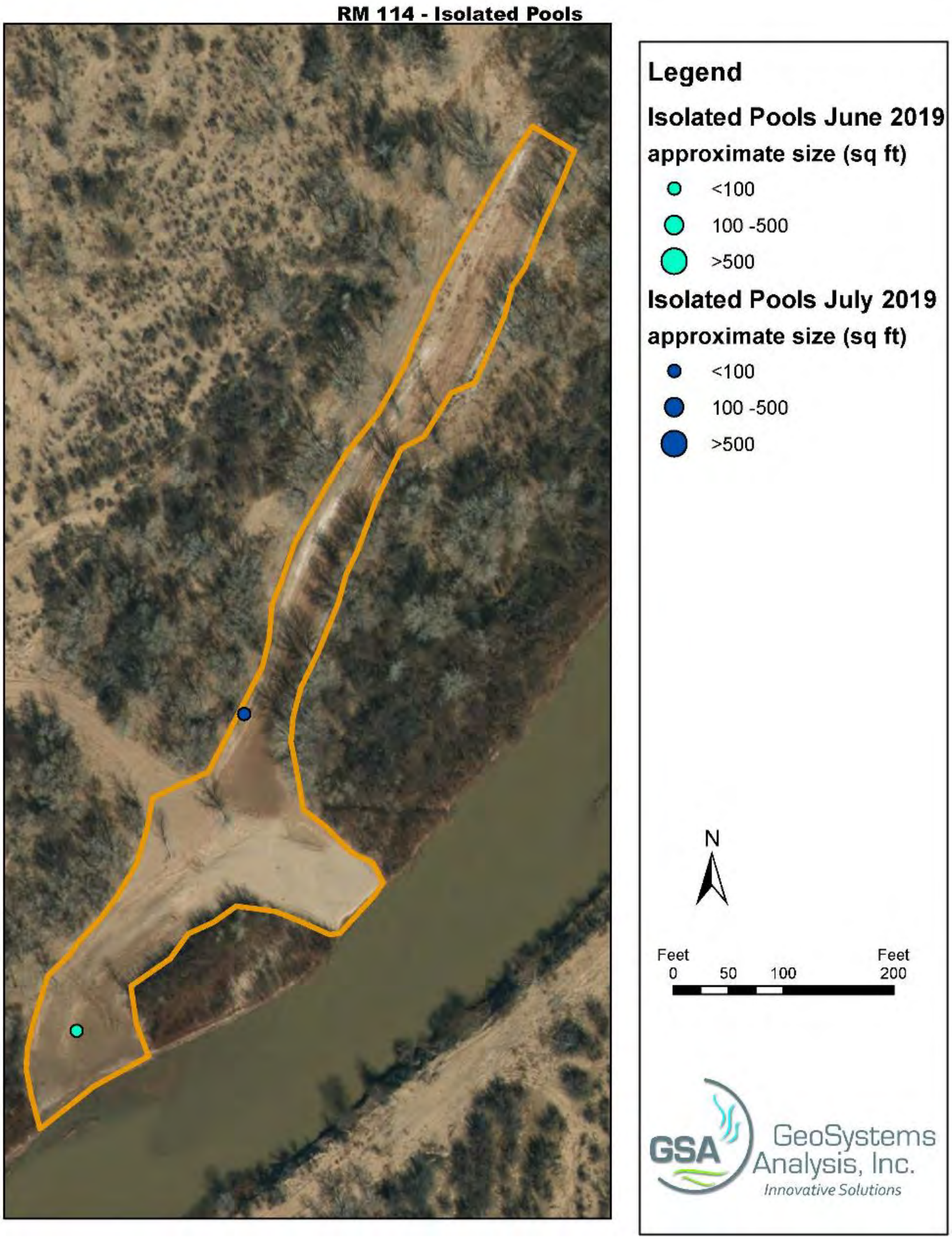

Figure C-1. Maps showing location and size class of isolated pools documented at RM 114 in June and July 2019.

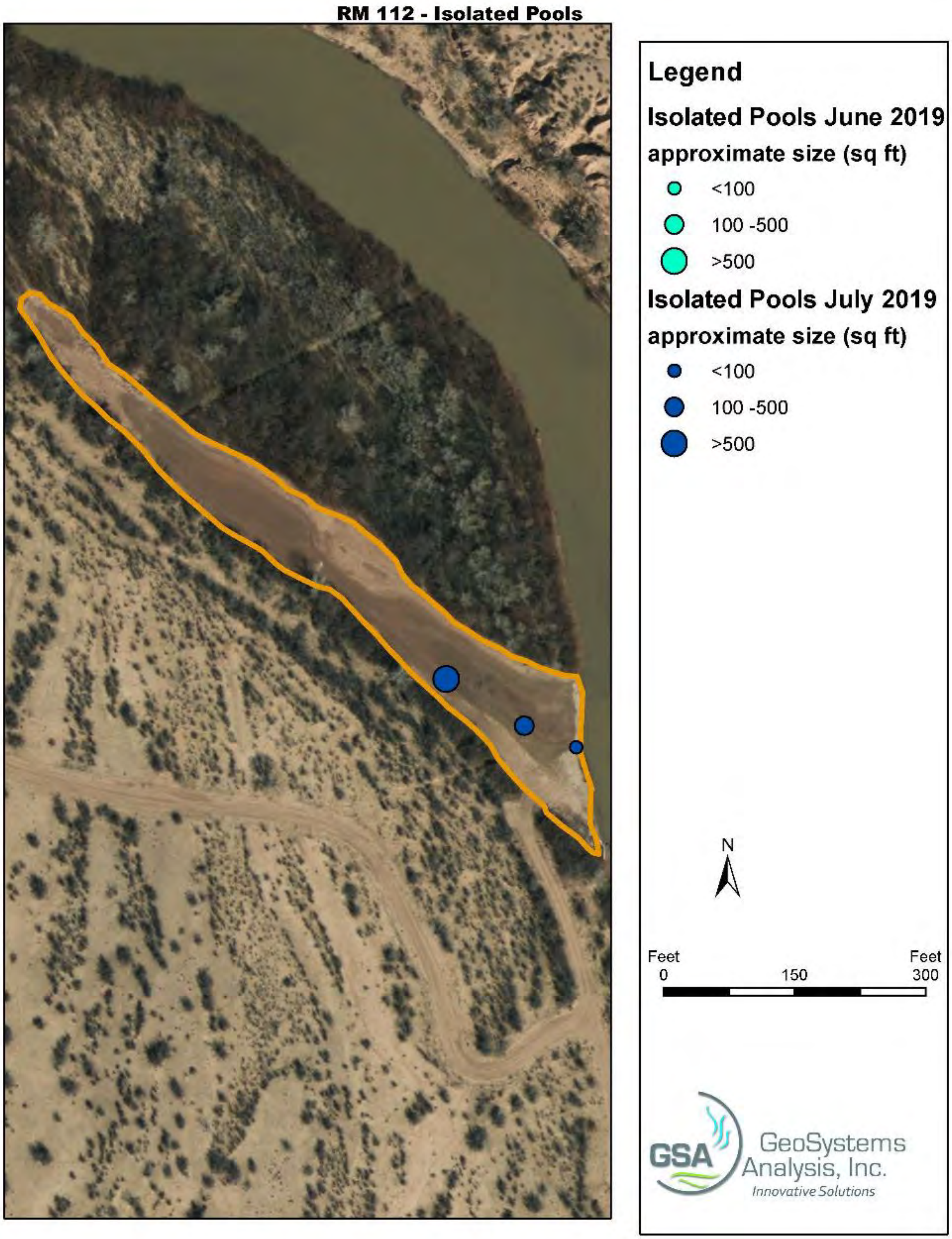

Figure C-2. Maps showing location and size class of isolated pools documented at RM 112 in June and July 2019.

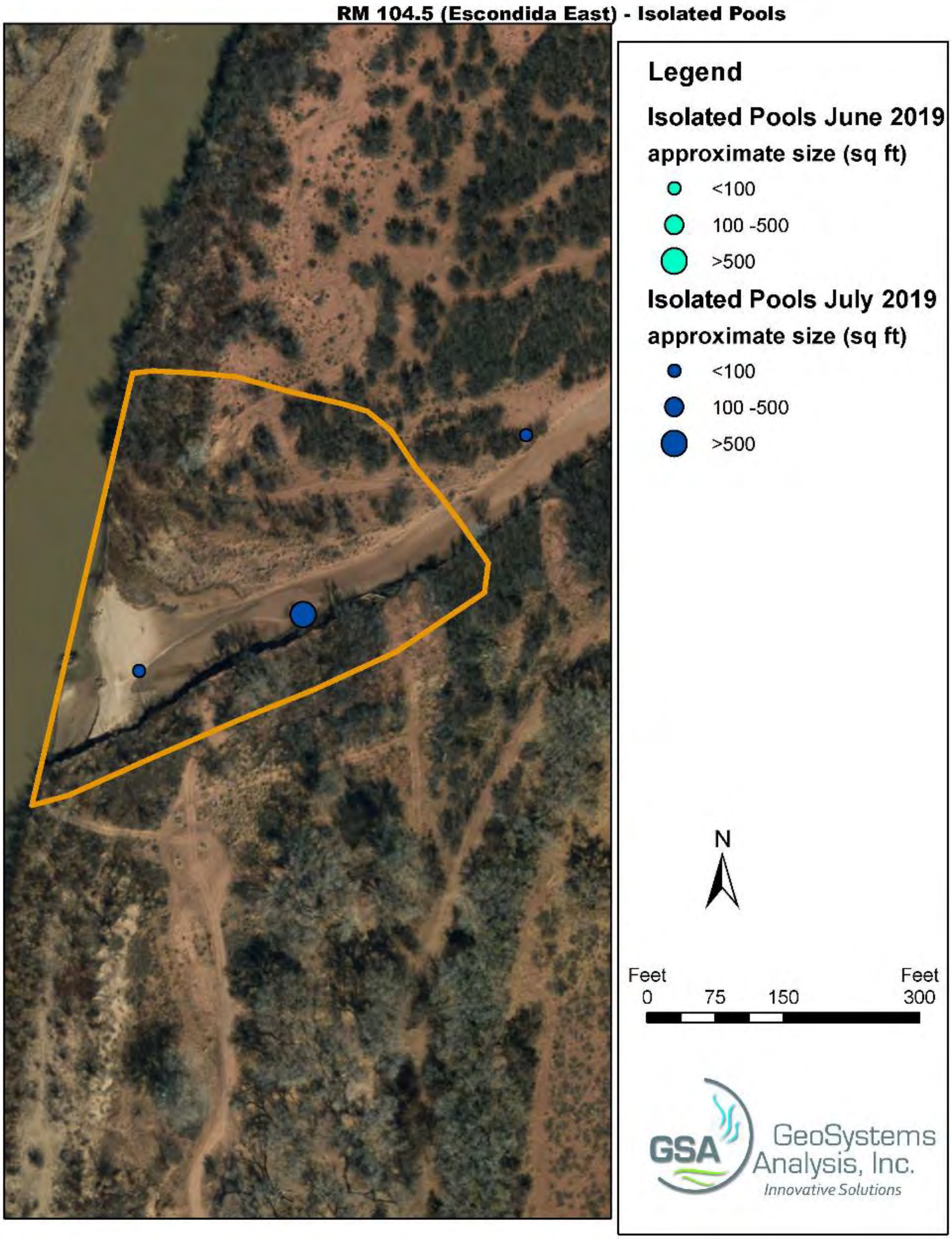

Figure C-3. Maps showing location and size class of isolated pools documented at RM 104.5 in June and July 2019.

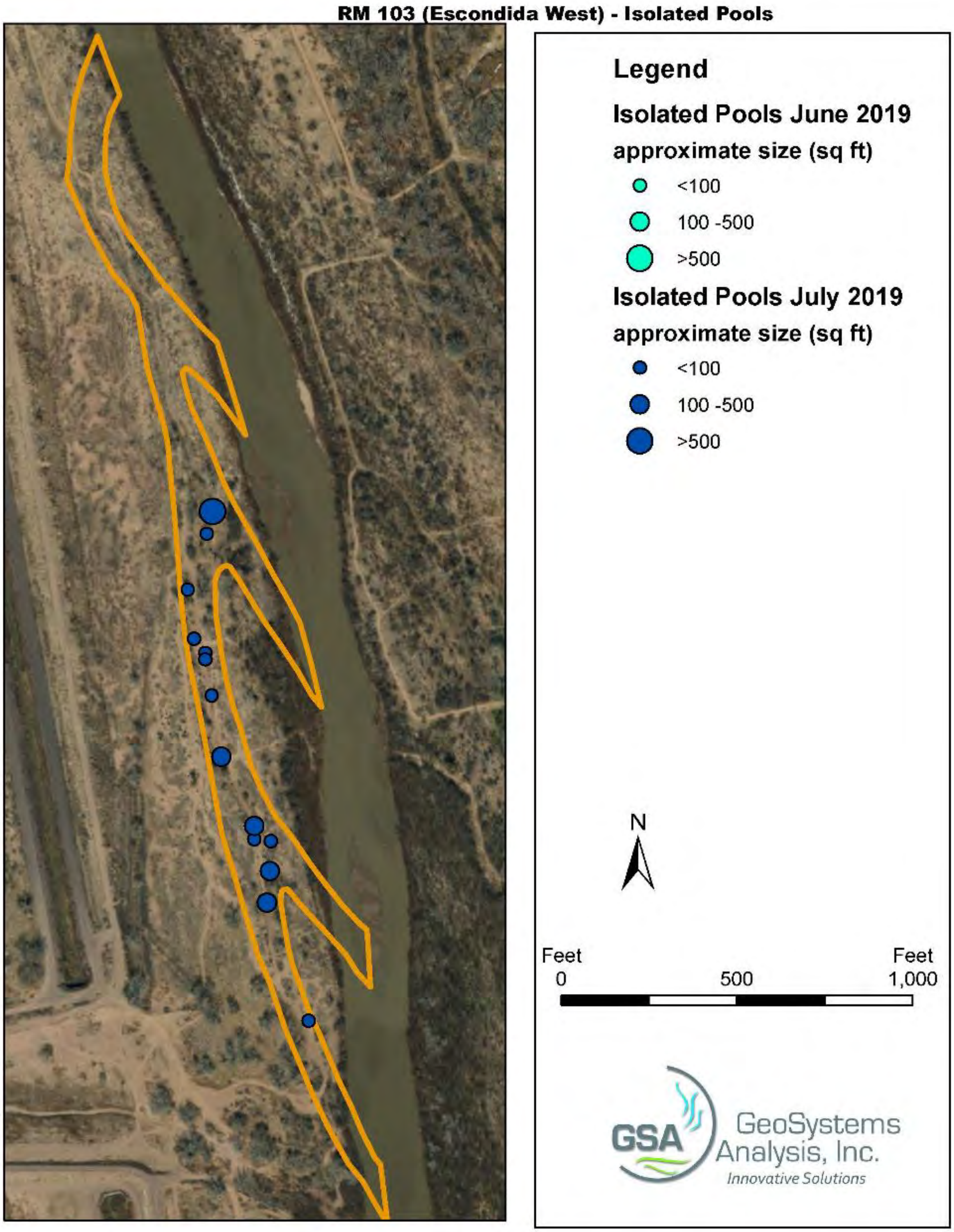

Figure C-4. Maps showing location and size class of isolated pools documented at RM 103 in June and July 2019.

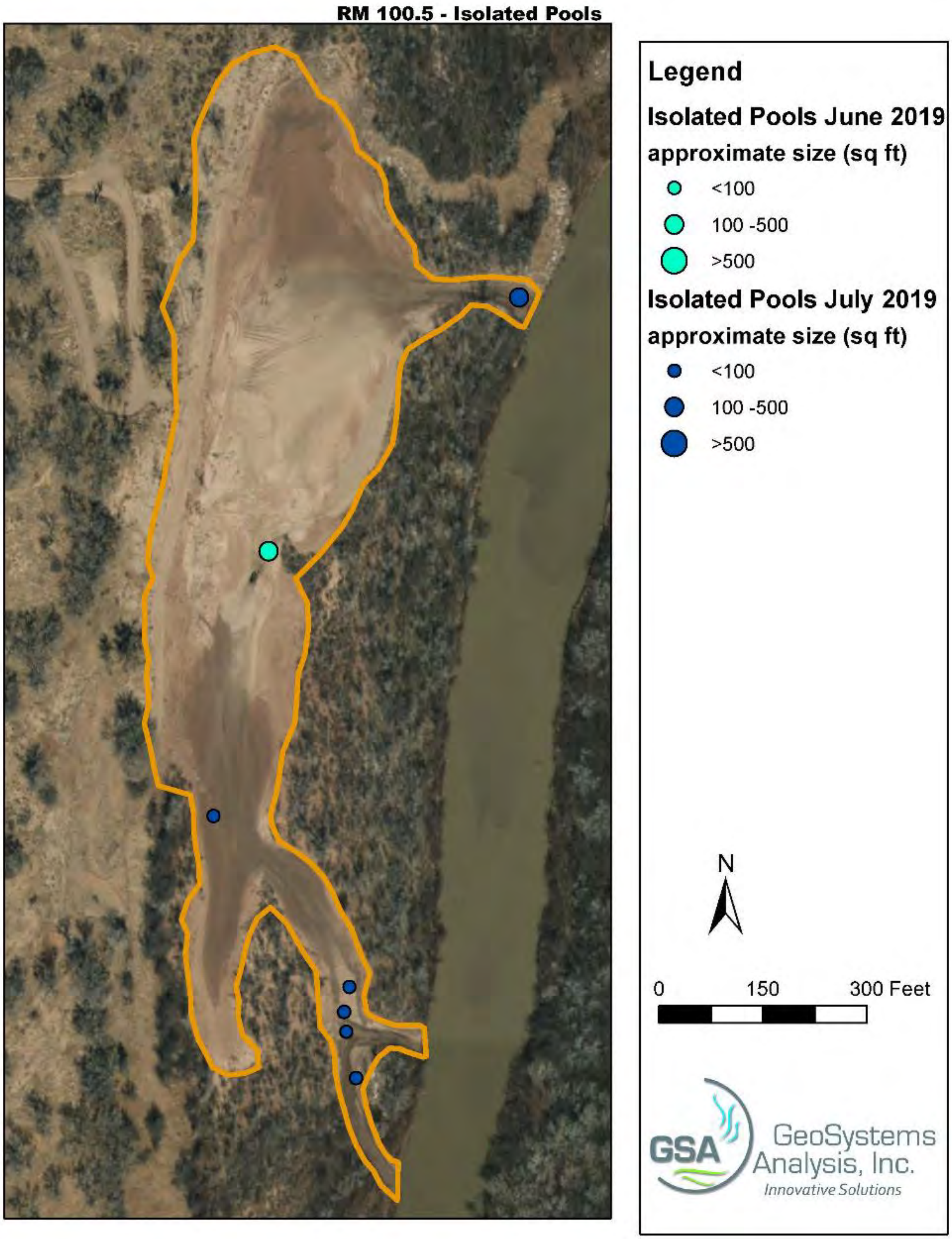

Figure C-5. Figure B-3. Maps showing location and size class of isolated pools documented at RM 100.5 in June and July 2019.

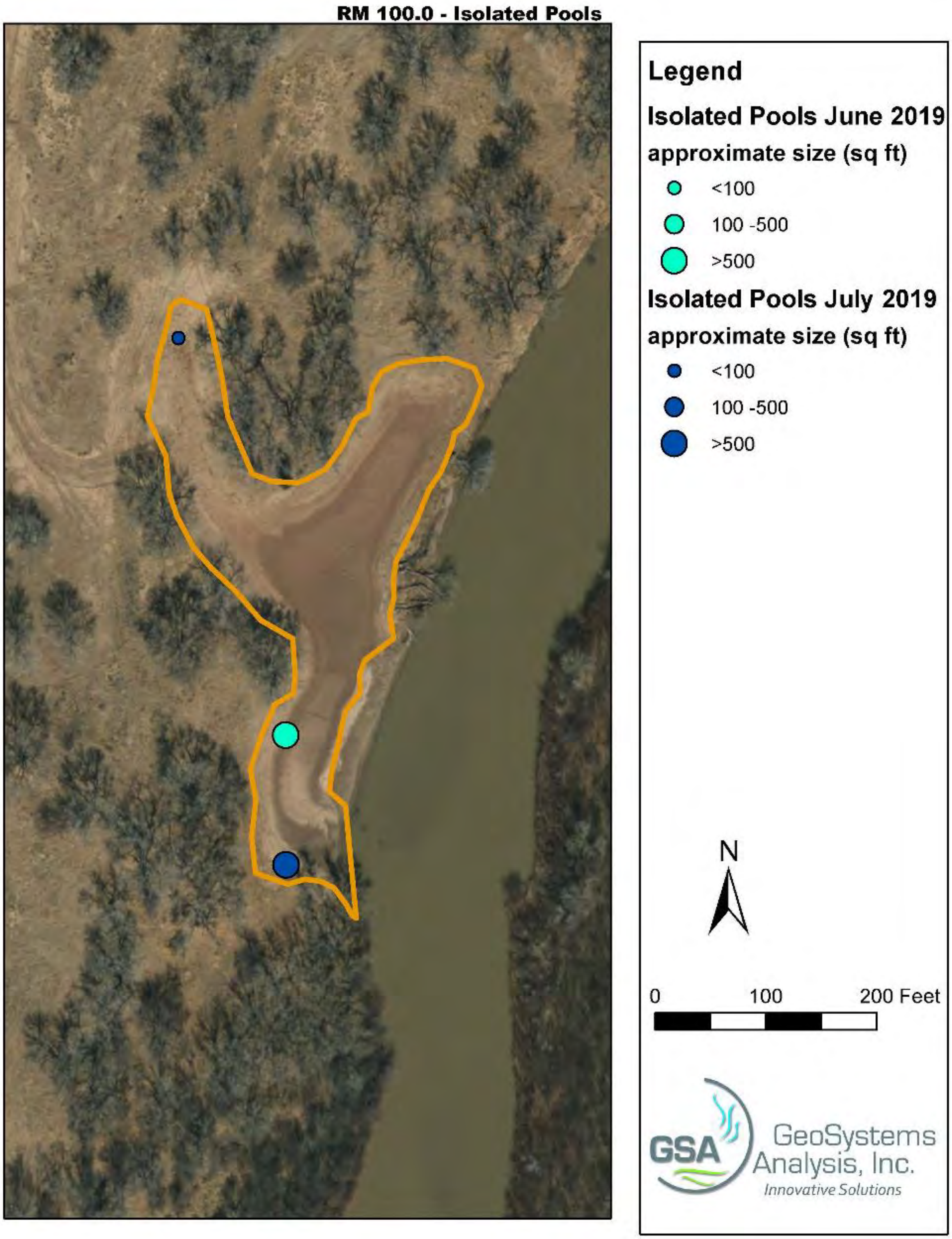

Figure C-6. Figure B-3. Maps showing location and size class of isolated pools documented at RM 100 in June and July 2019.

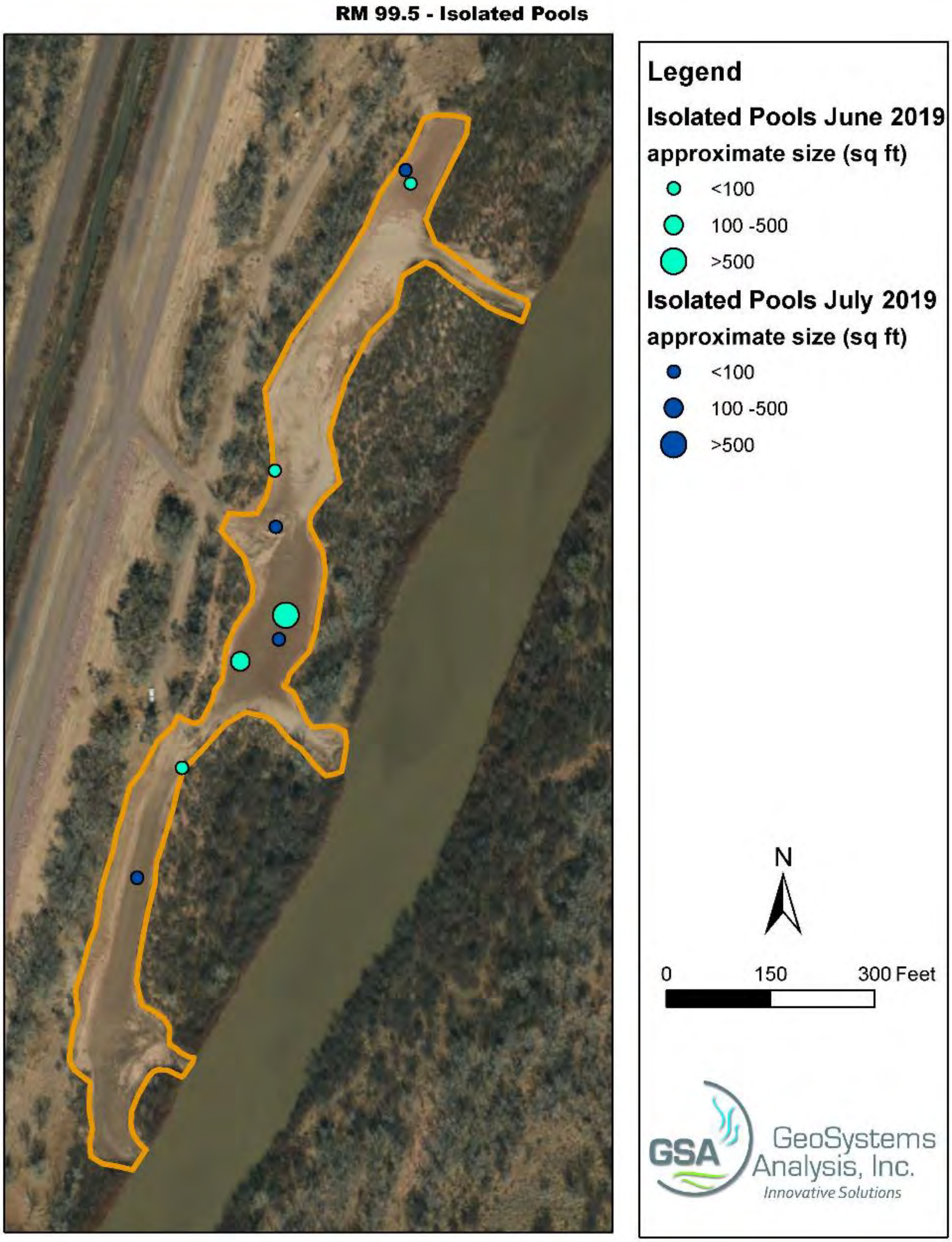

Figure C-7. Maps showing location and size class of isolated pools documented at RM 99.5 in June and July 2019.

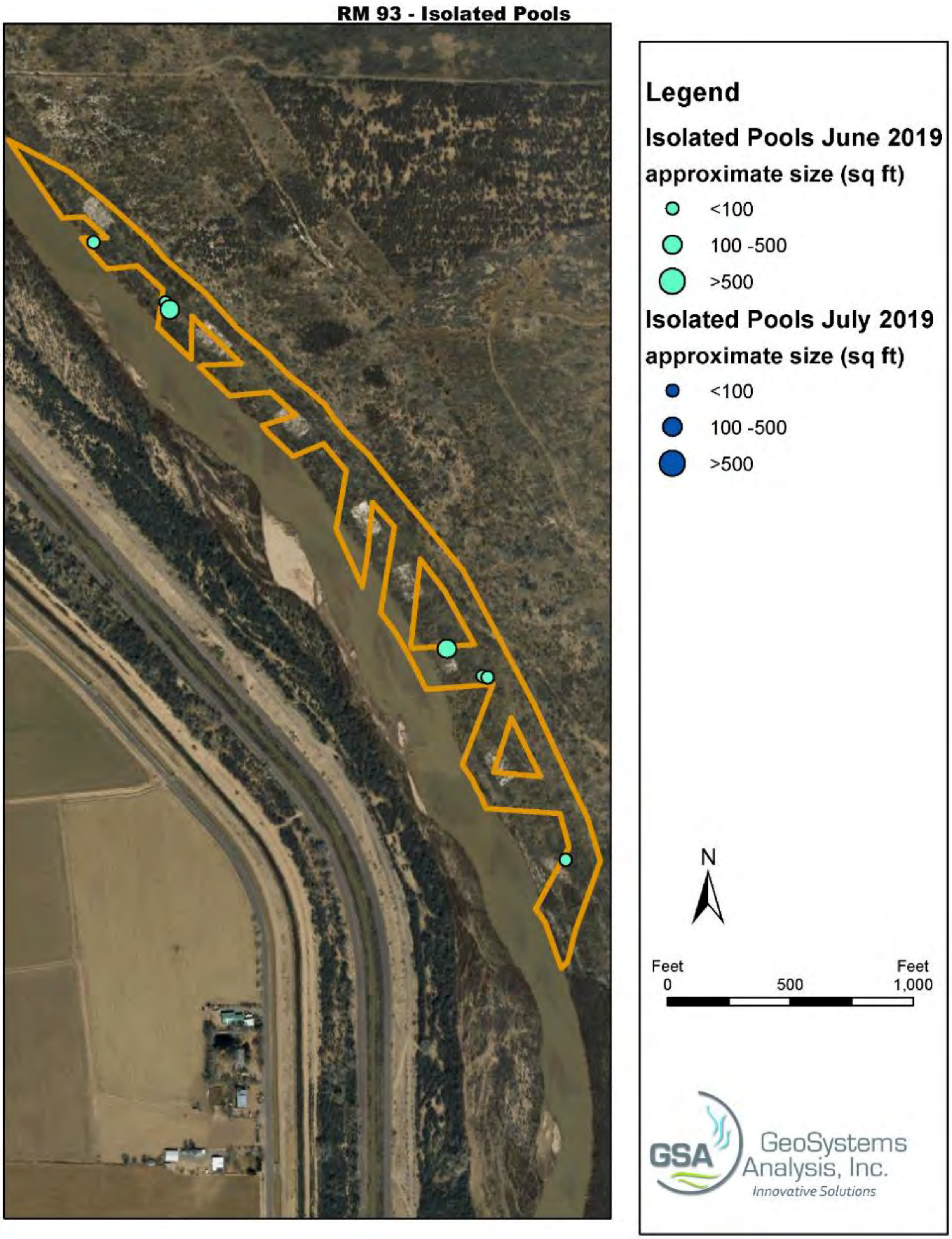

Figure C-8. Maps showing location and size class of isolated pools documented at RM 93 in June and July 2019.

APPENDIX D – NOXIOUS WEED POPULATIONS

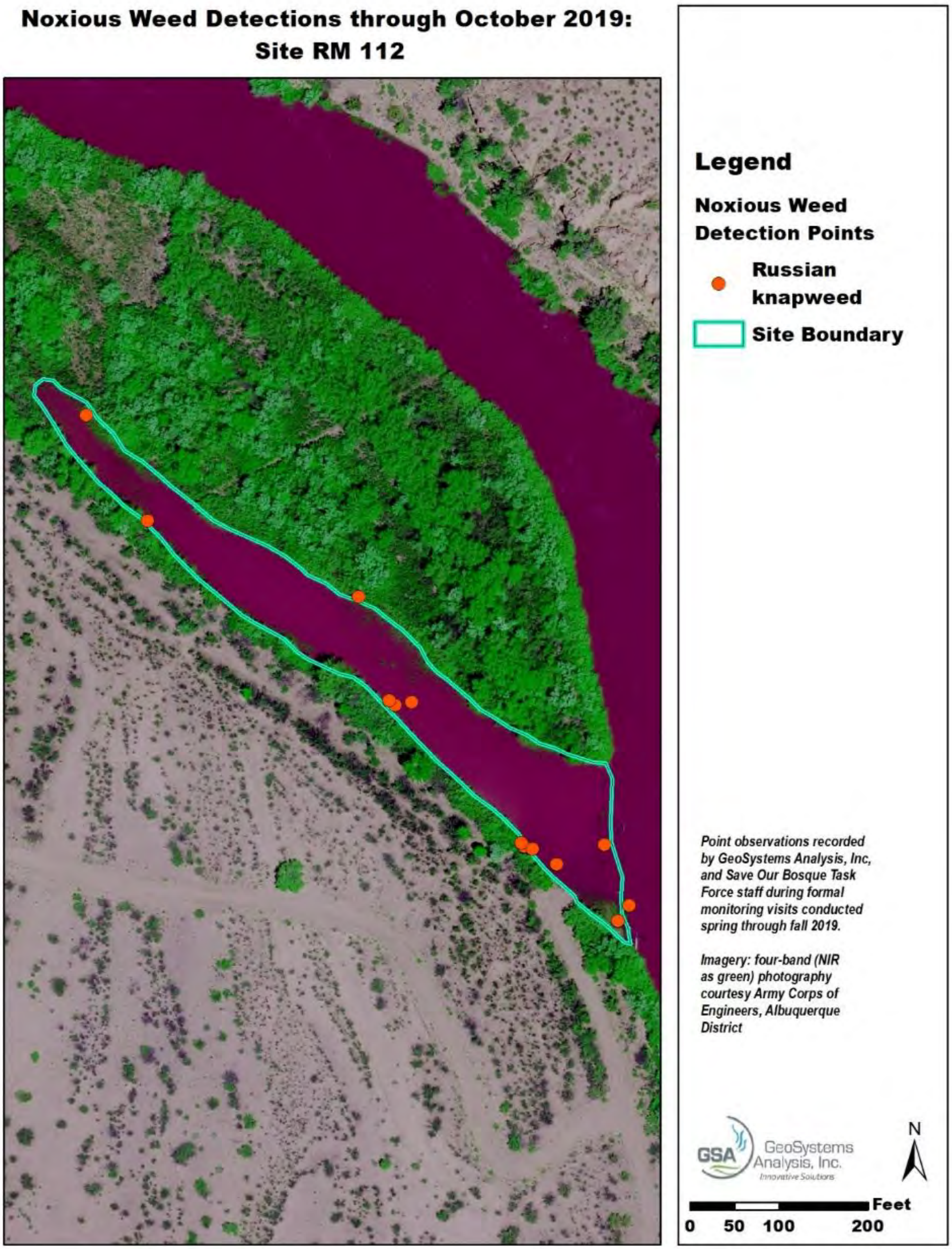

Figure D-1. Noxious weed species populations documented at RM 112.

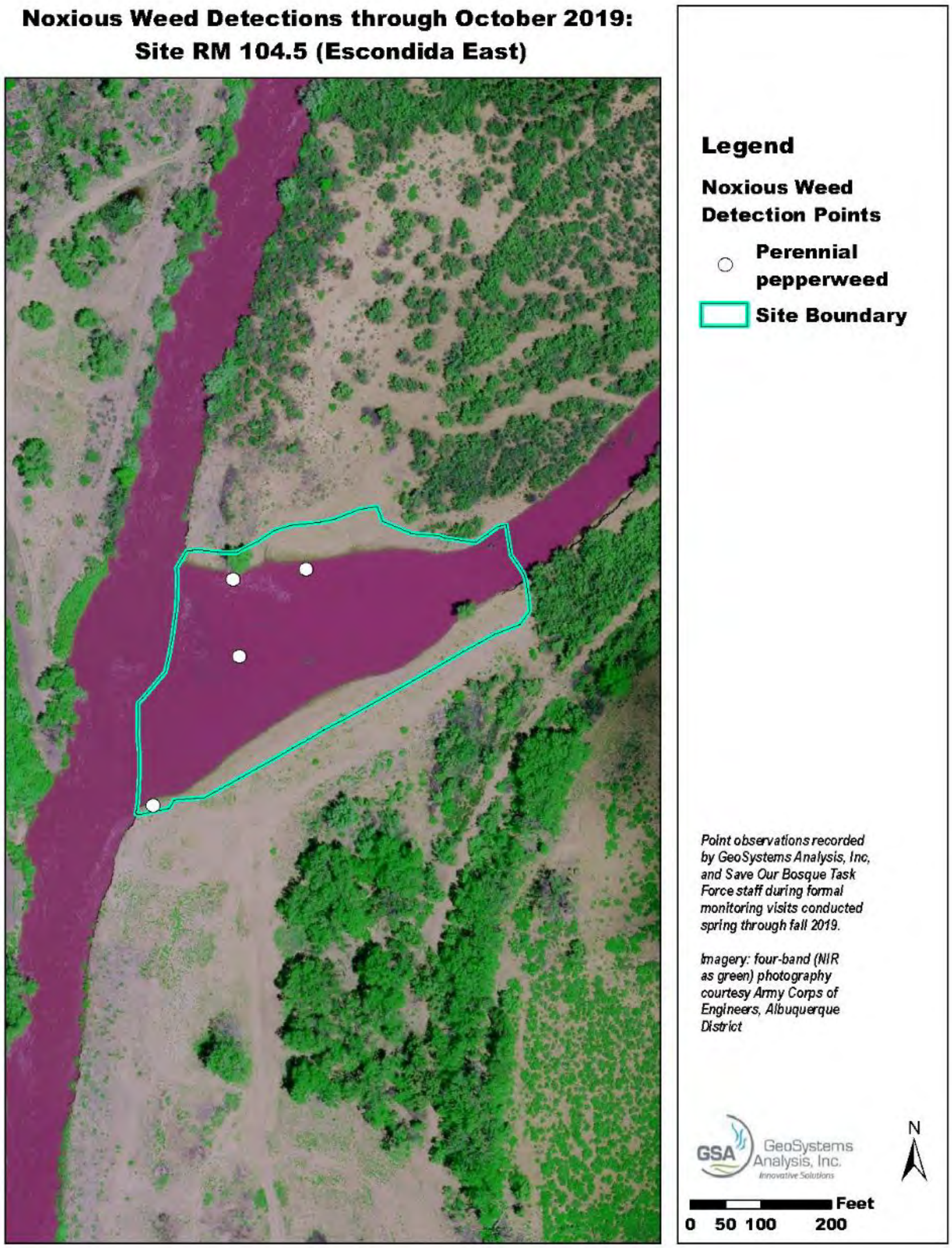

Figure D-2. Noxious weed species populations documented at RM 104.5.

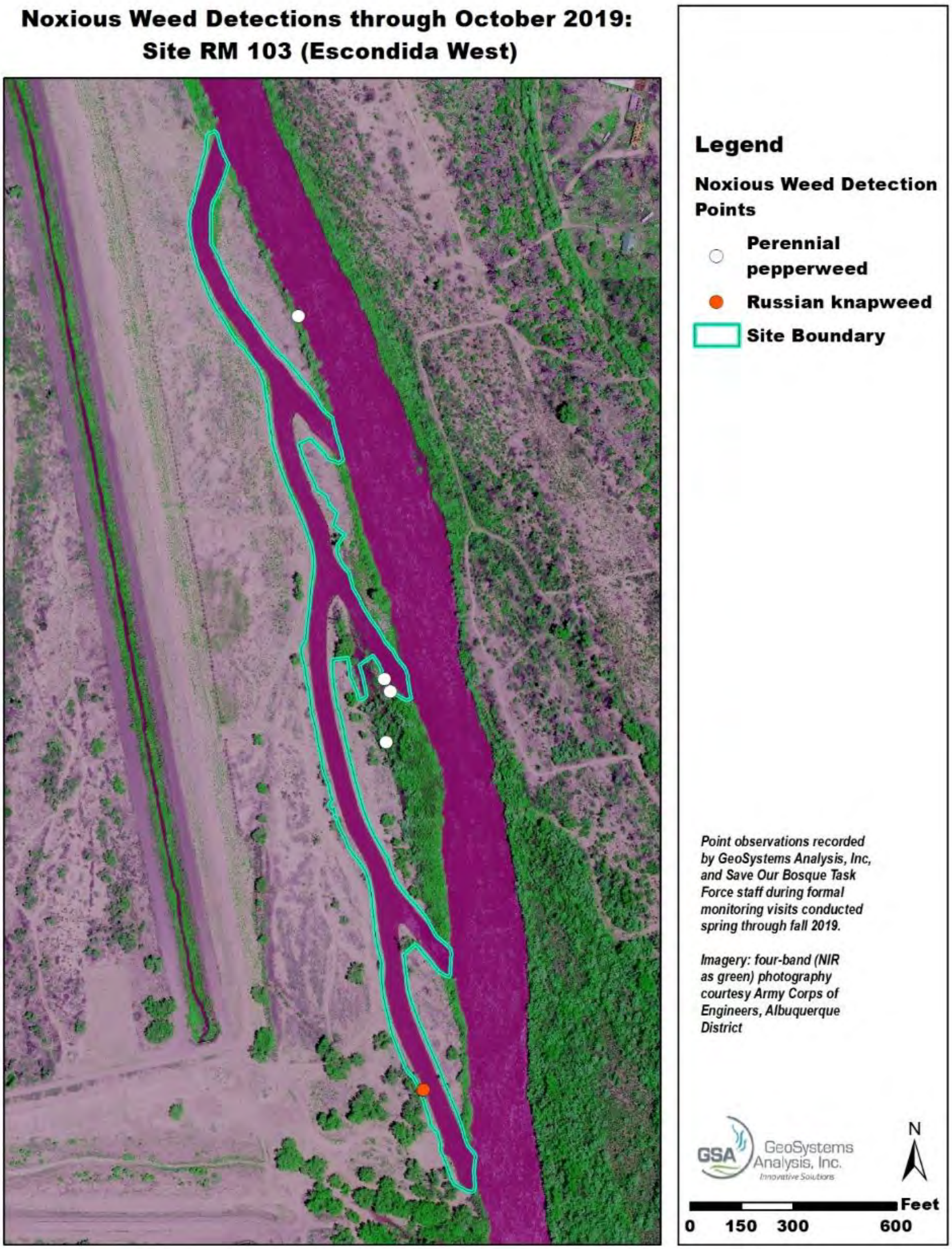

Figure D-3. Noxious weed species populations documented at RM 103.

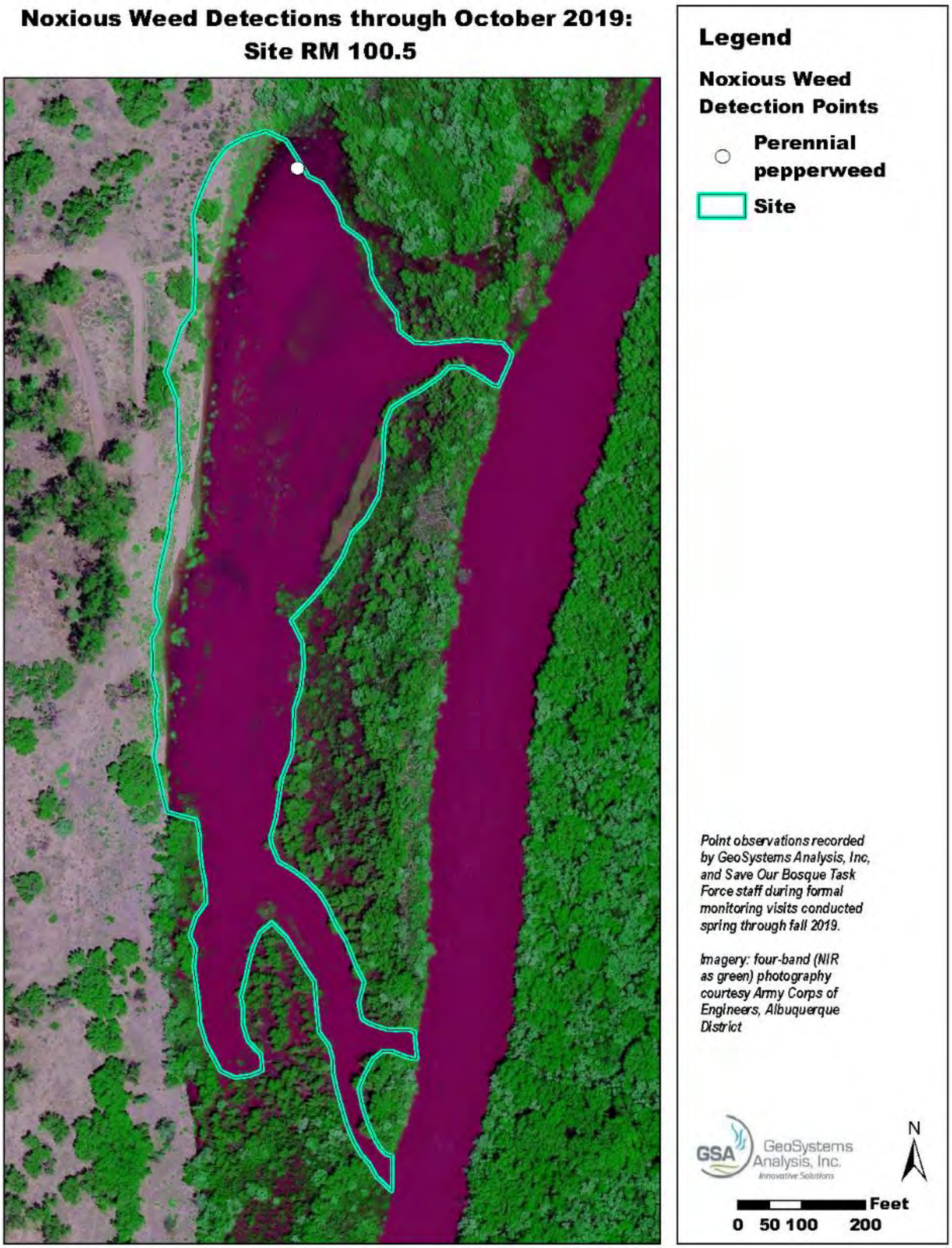

Figure D-4. Noxious weed species populations documented at RM 100.5.

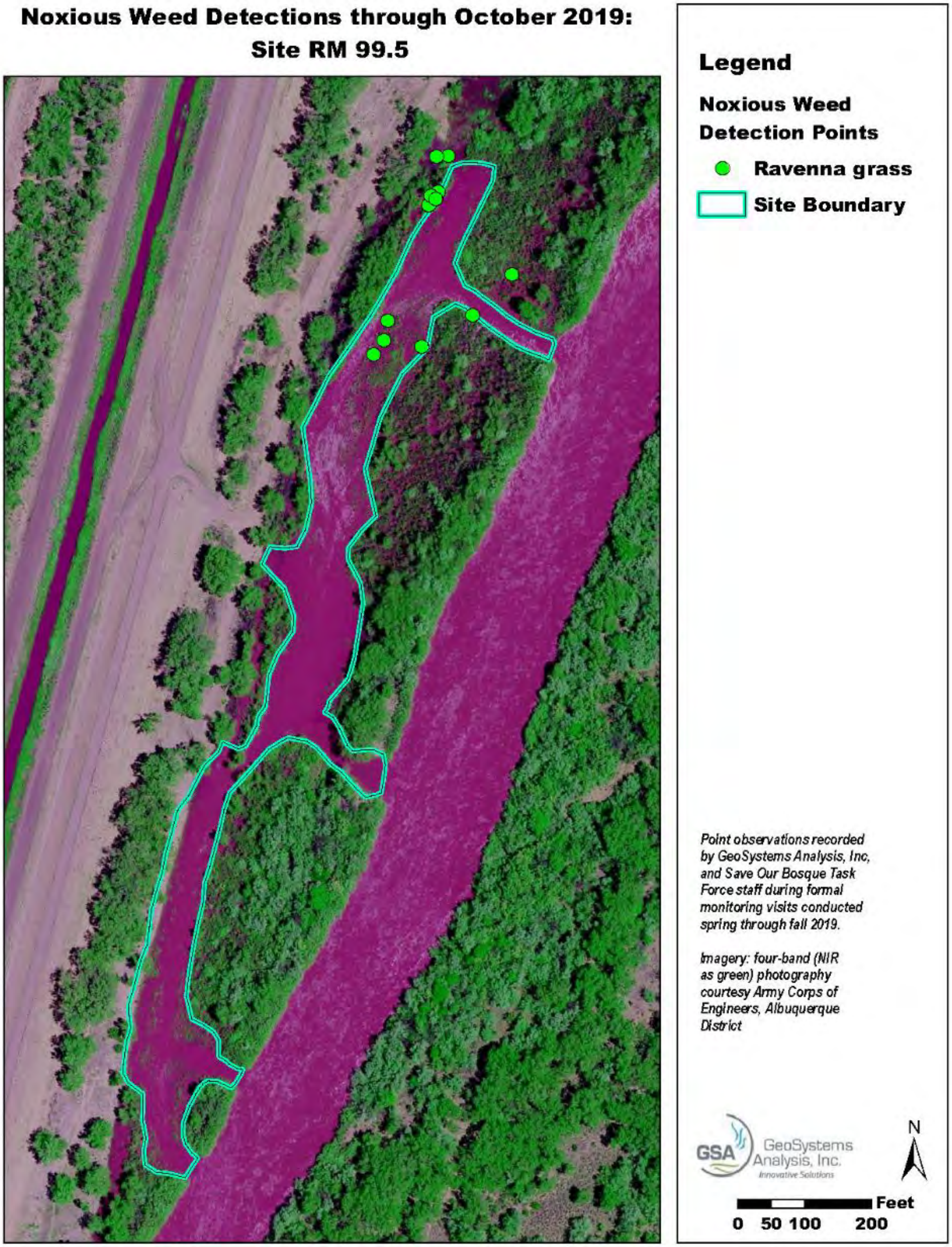

Figure D-5. Noxious weed species populations documented at RM 99.5.

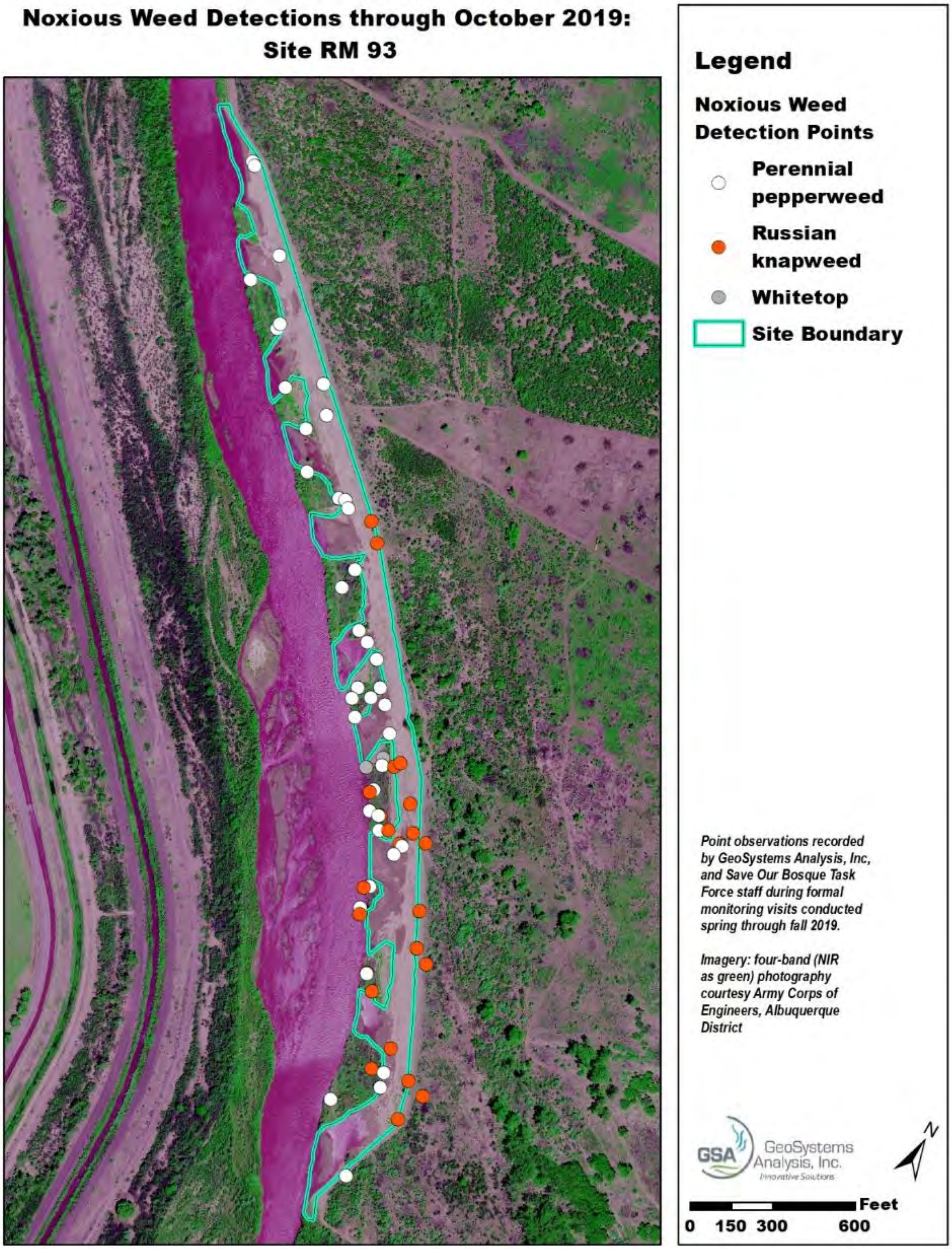

Figure D-6. Noxious weed species populations documented at RM 93.

APPENDIX E – NATIVE WOODY PLANT OCCURRENCES

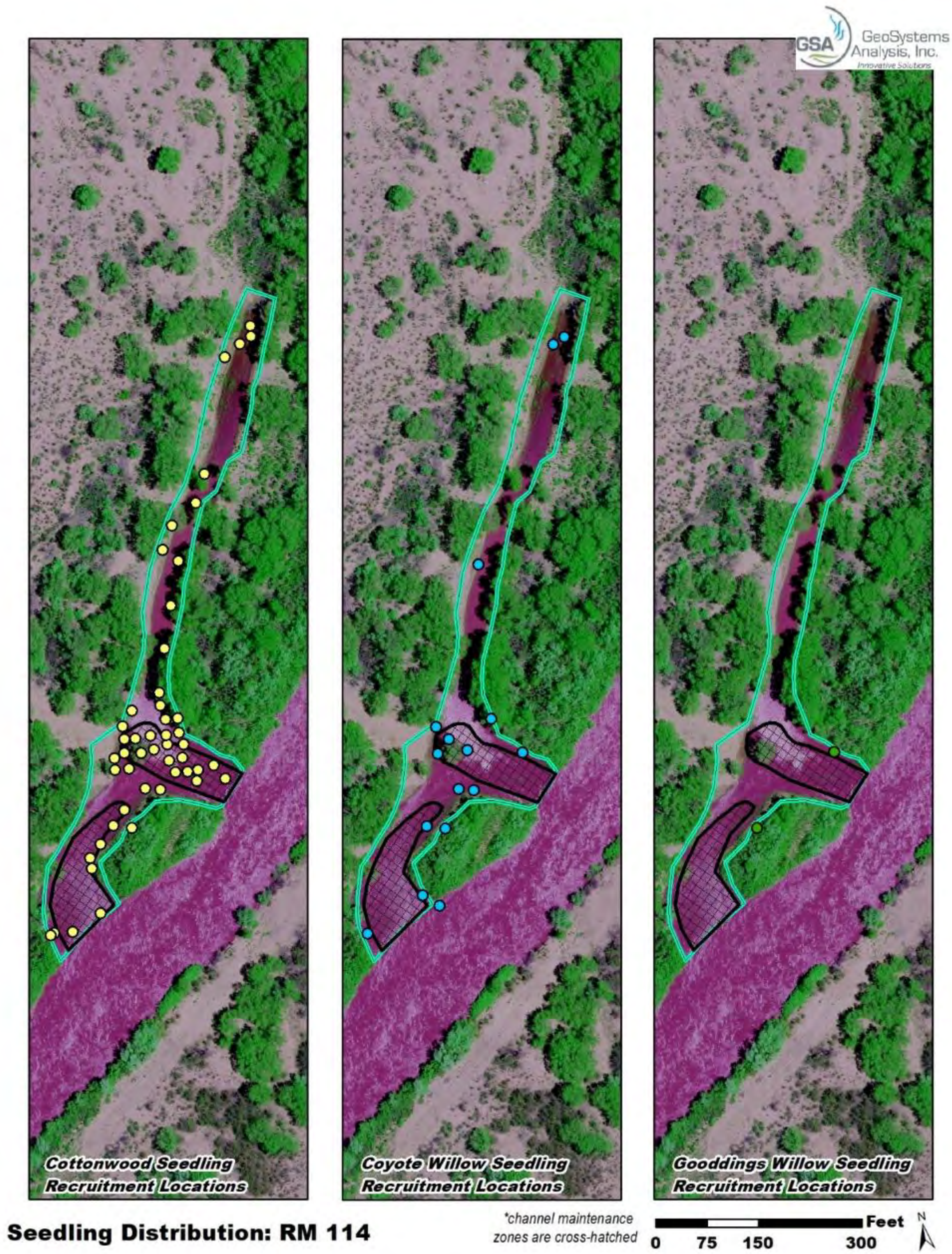

Figure E-1. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 114.

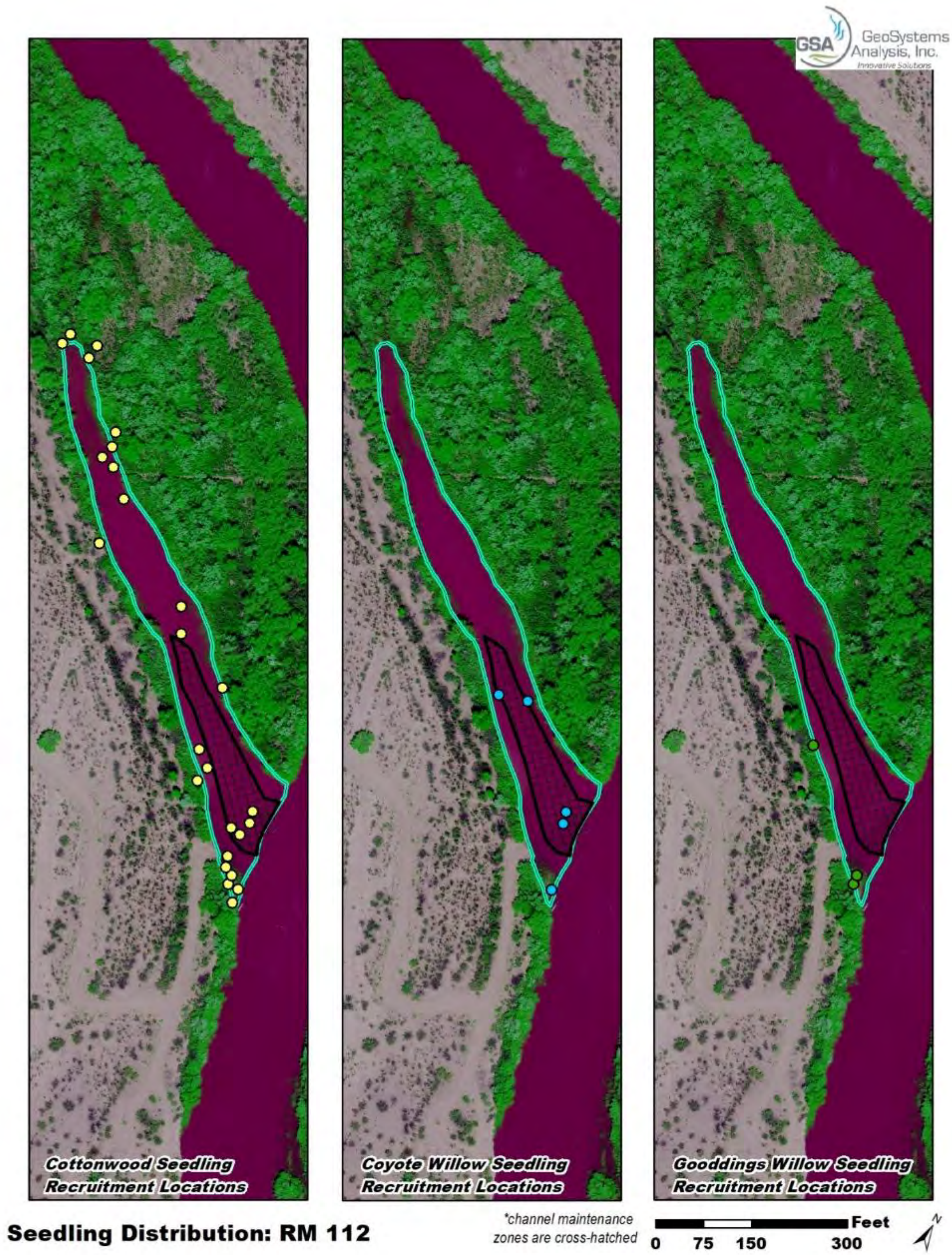

Figure E-2. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 112.

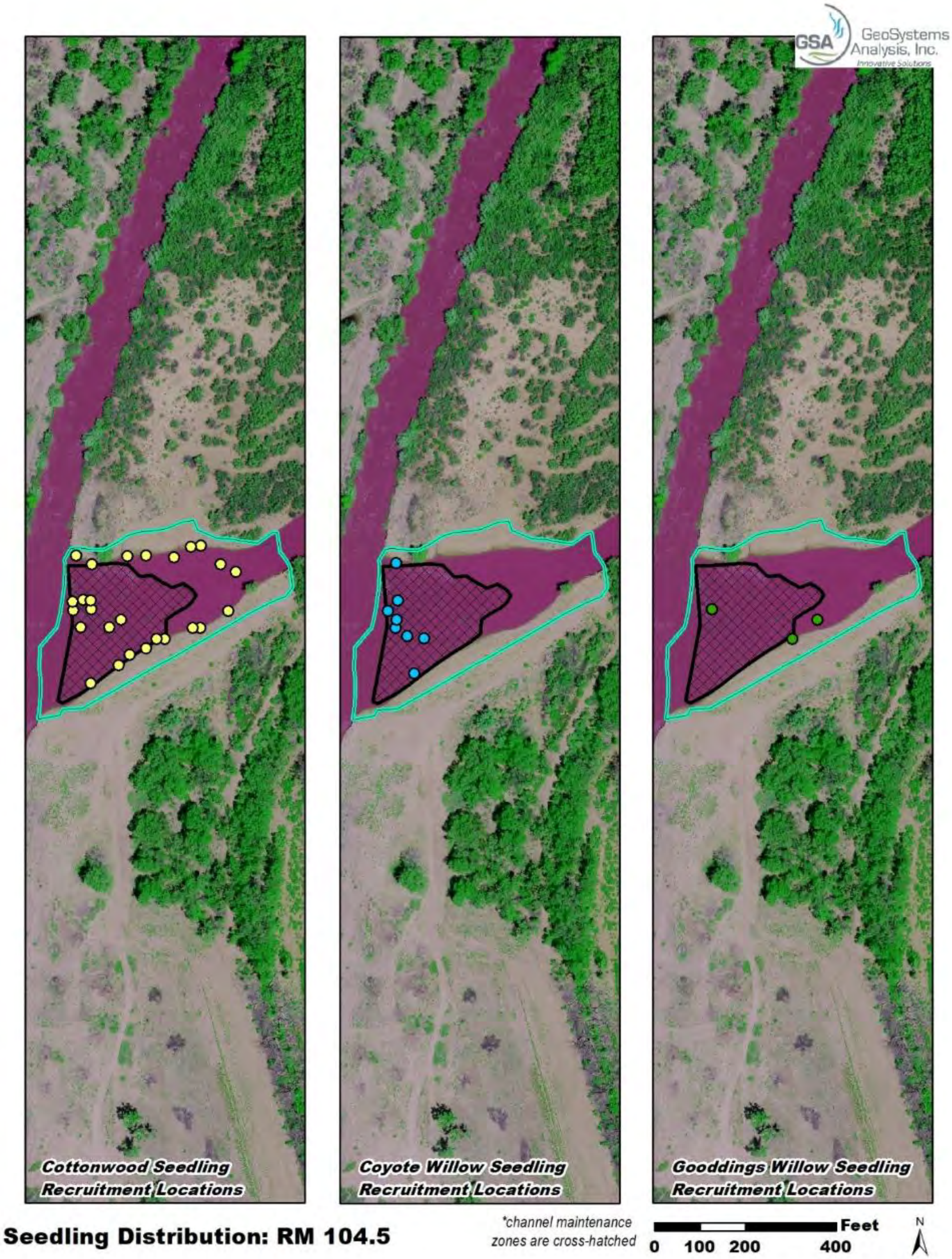

Figure E-3. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 104.5.

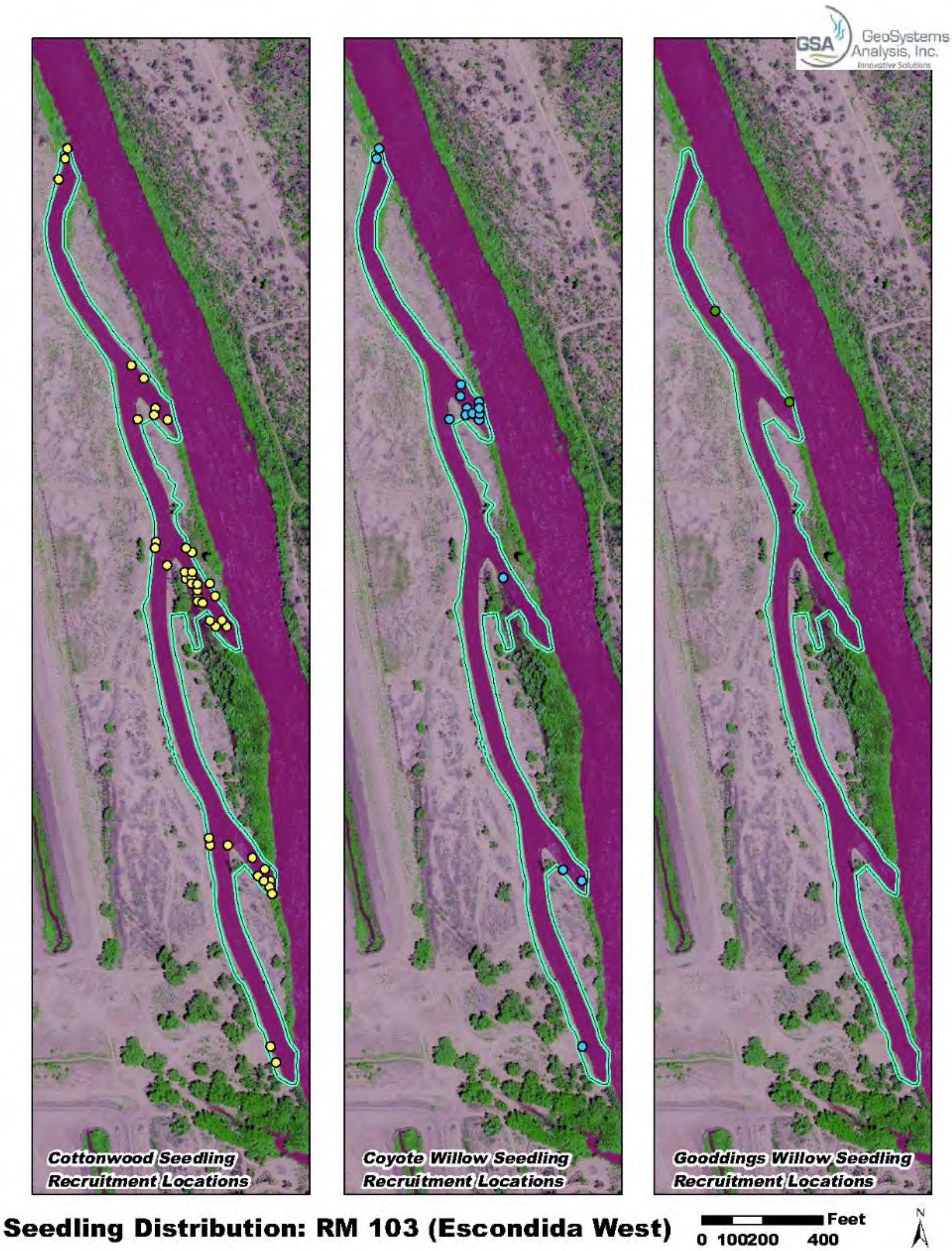

Figure E-4. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 103.

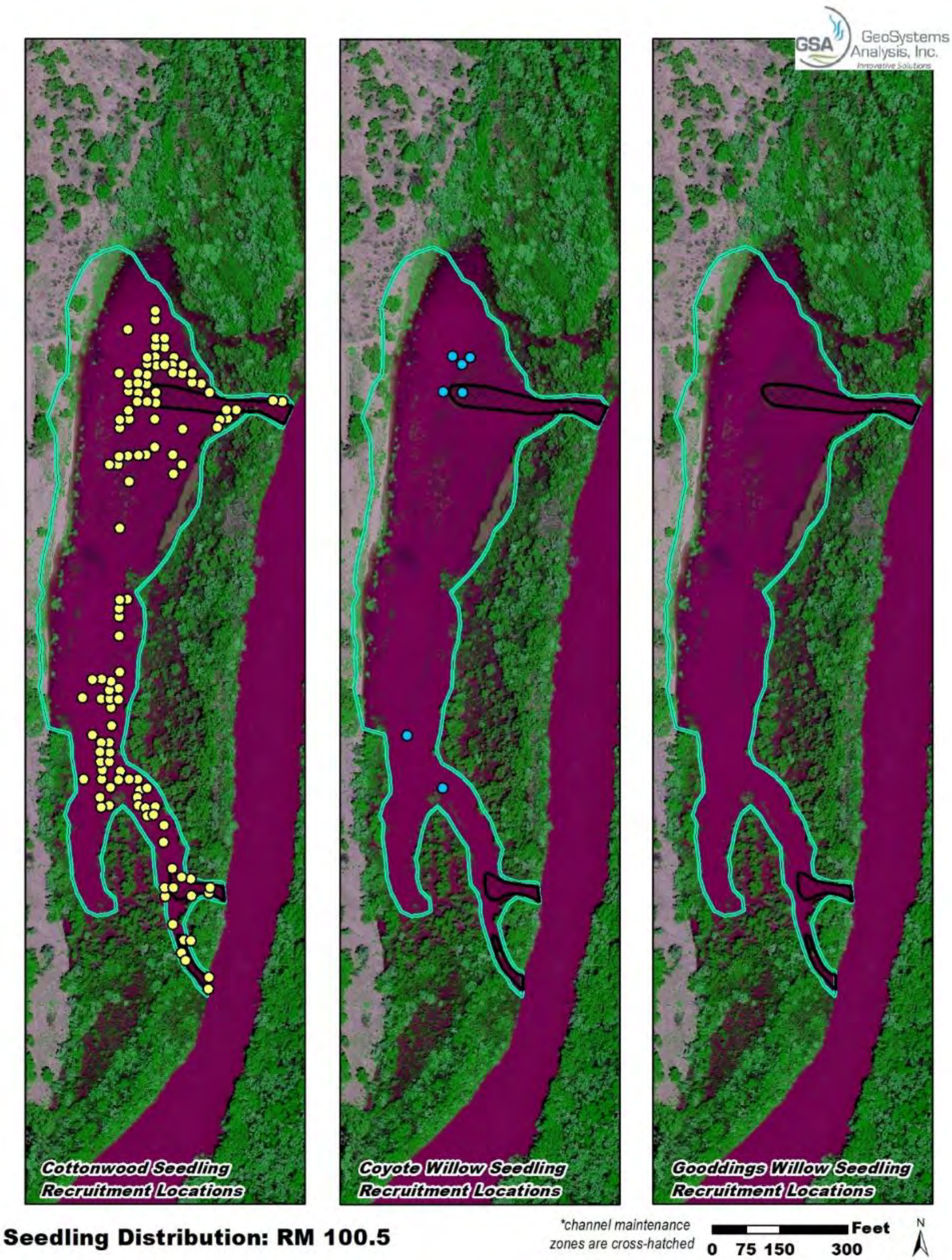

Figure E-5. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 100.5.

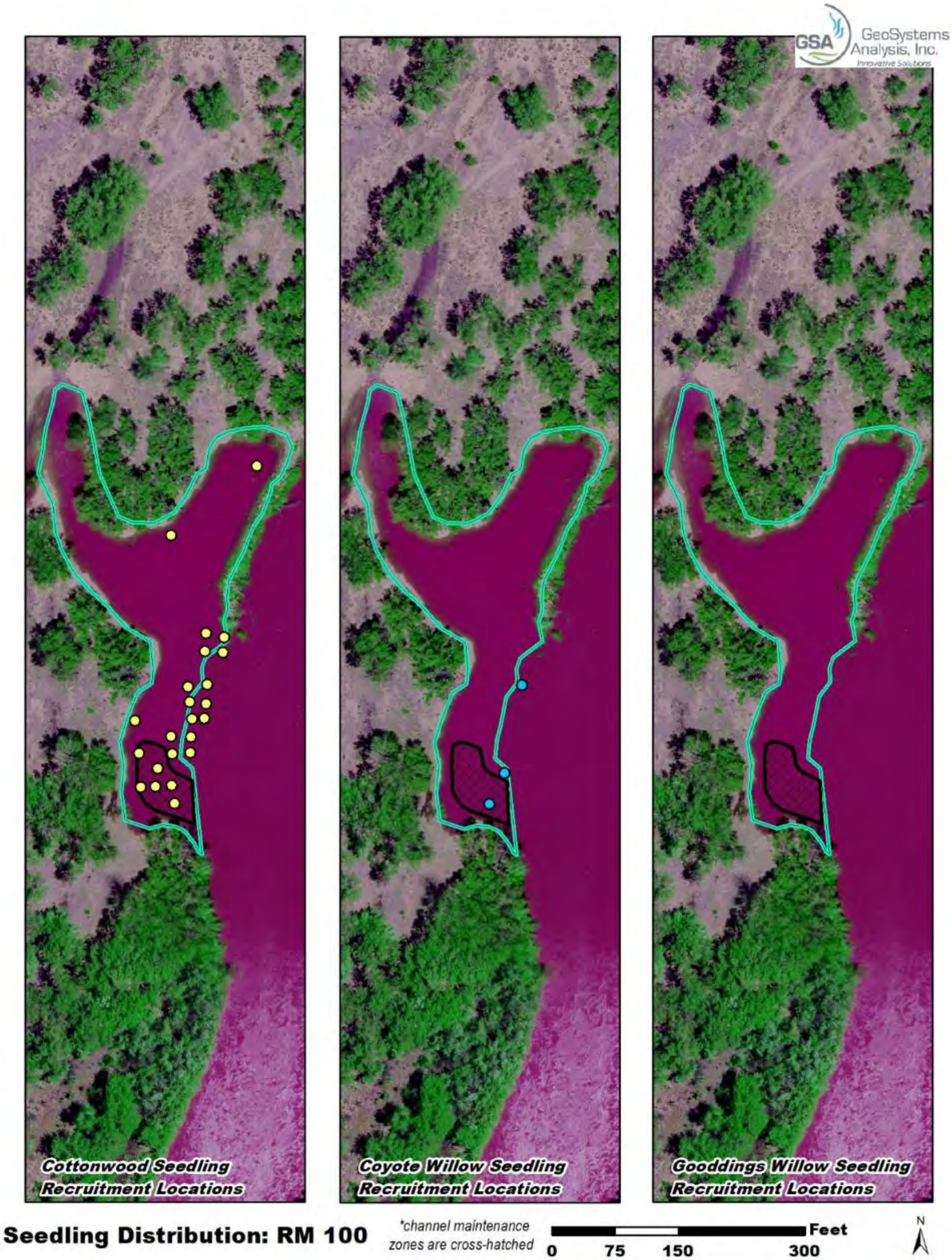

Figure E-6. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 100.

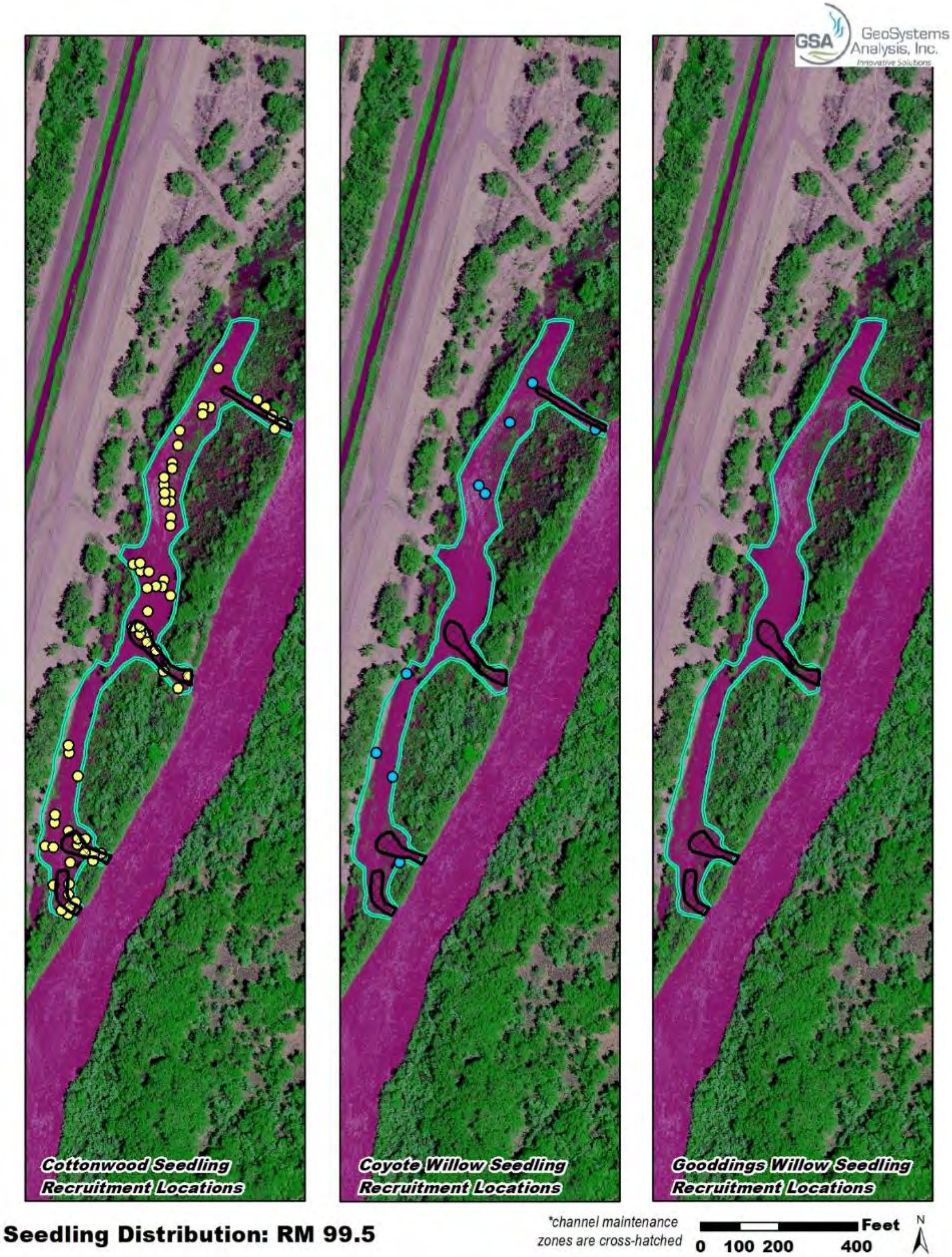

Figure E-7. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 99.5.

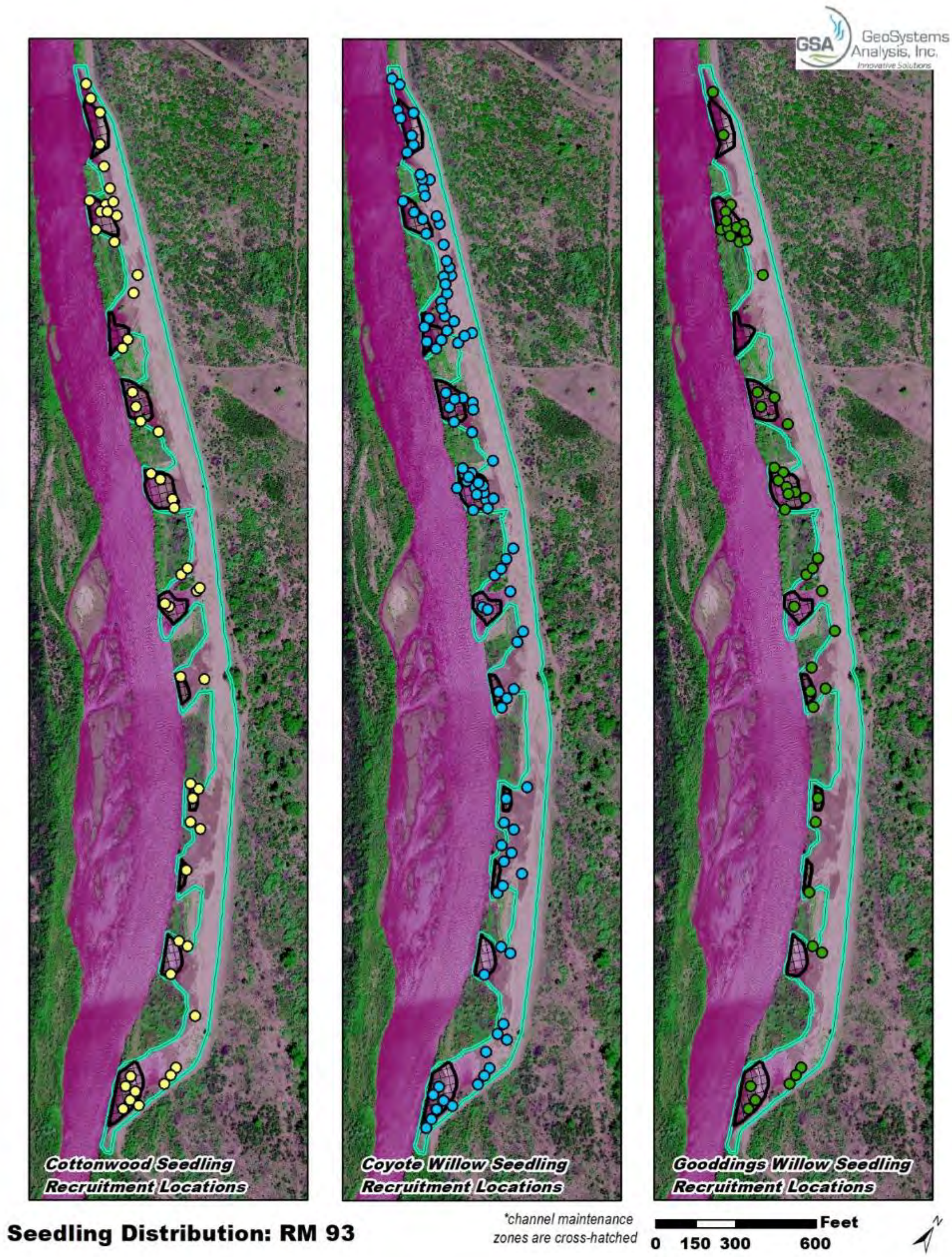

Figure E-8. Distribution of native cottonwood (left), coyote willow (center) and Gooddings willow (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 93.

APPENDIX F – NON-NATIVE WOODY PLANT OCCURRENCES

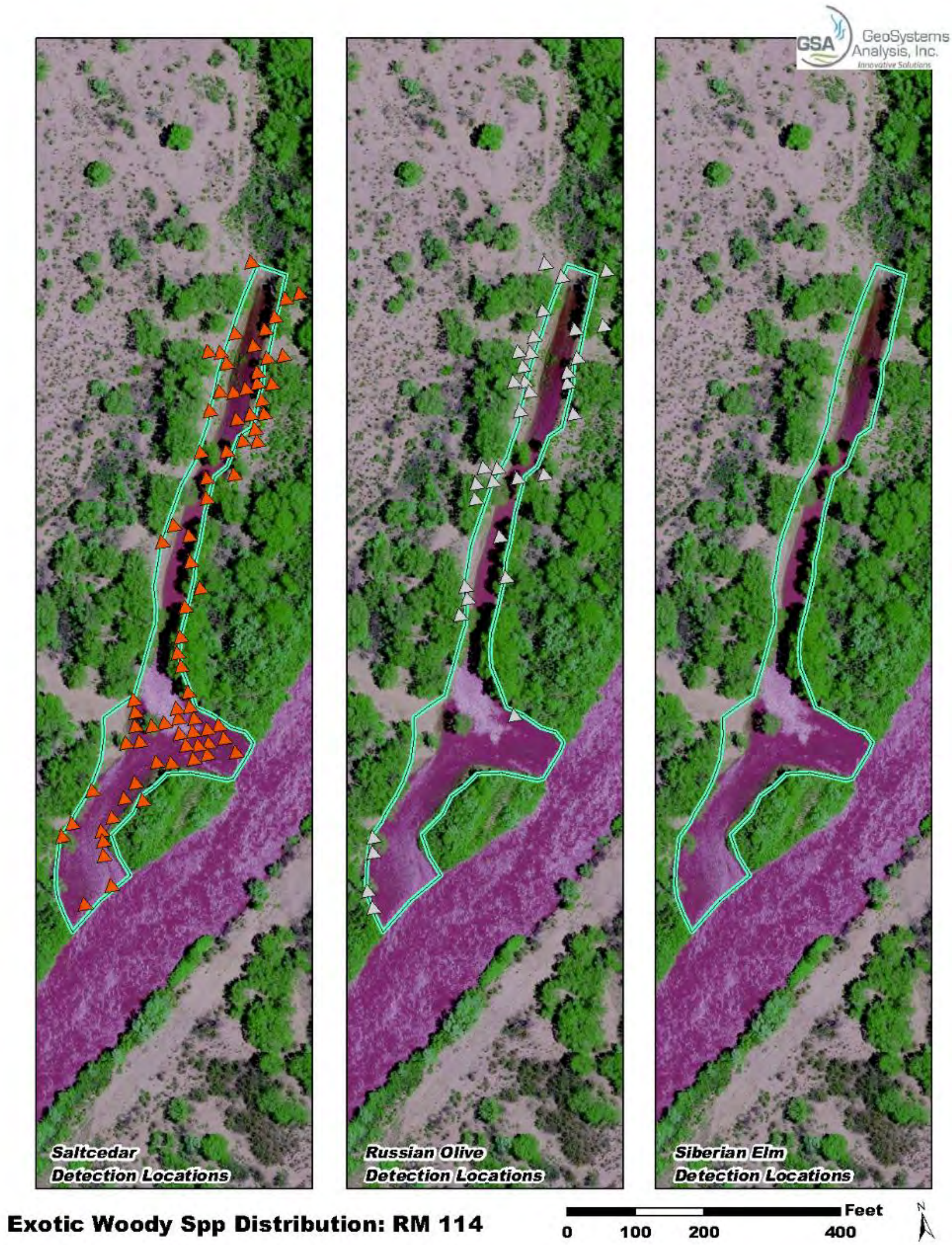

Figure F-1. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 114.

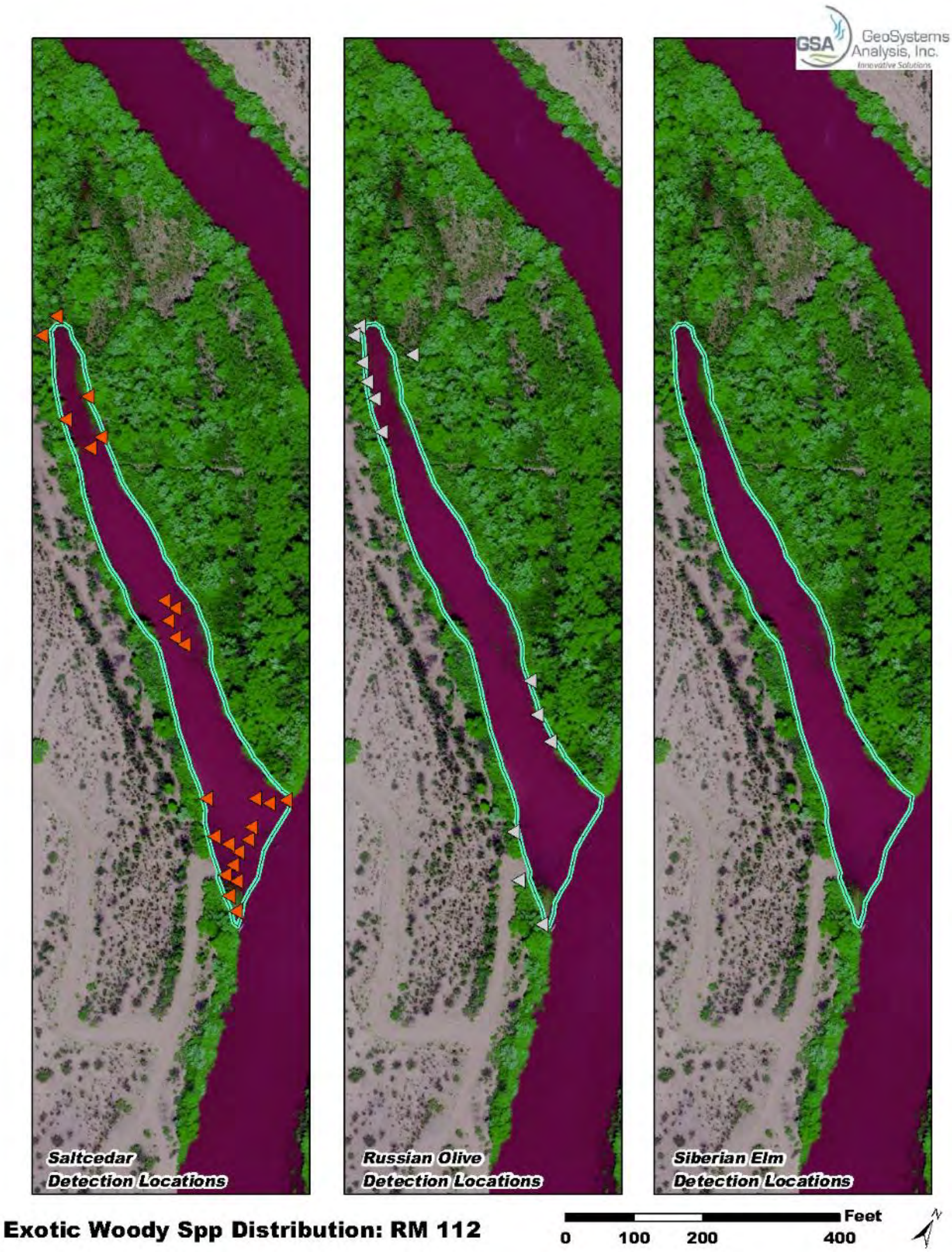

Figure F-2. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 112.

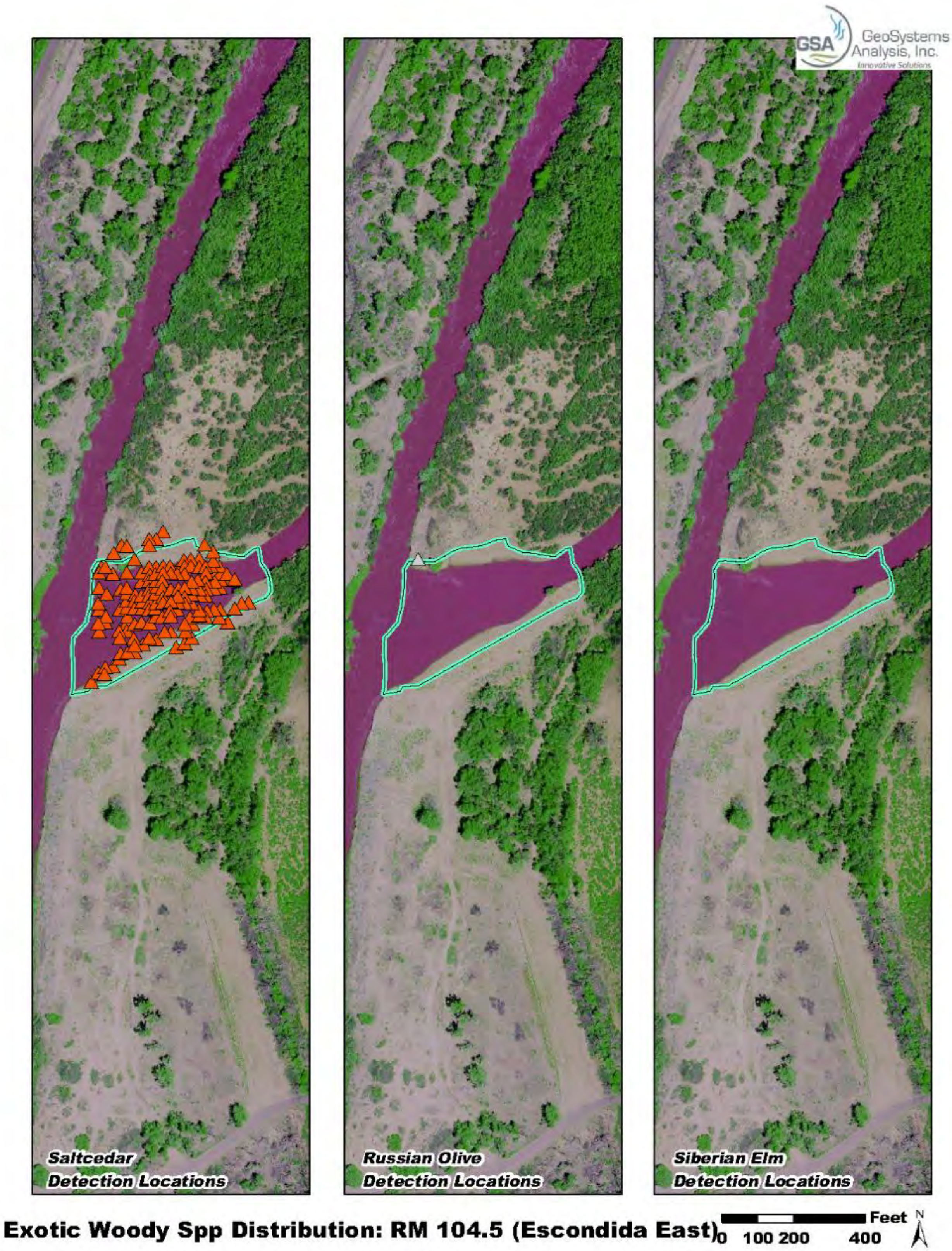

Figure F-3. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 104.5.

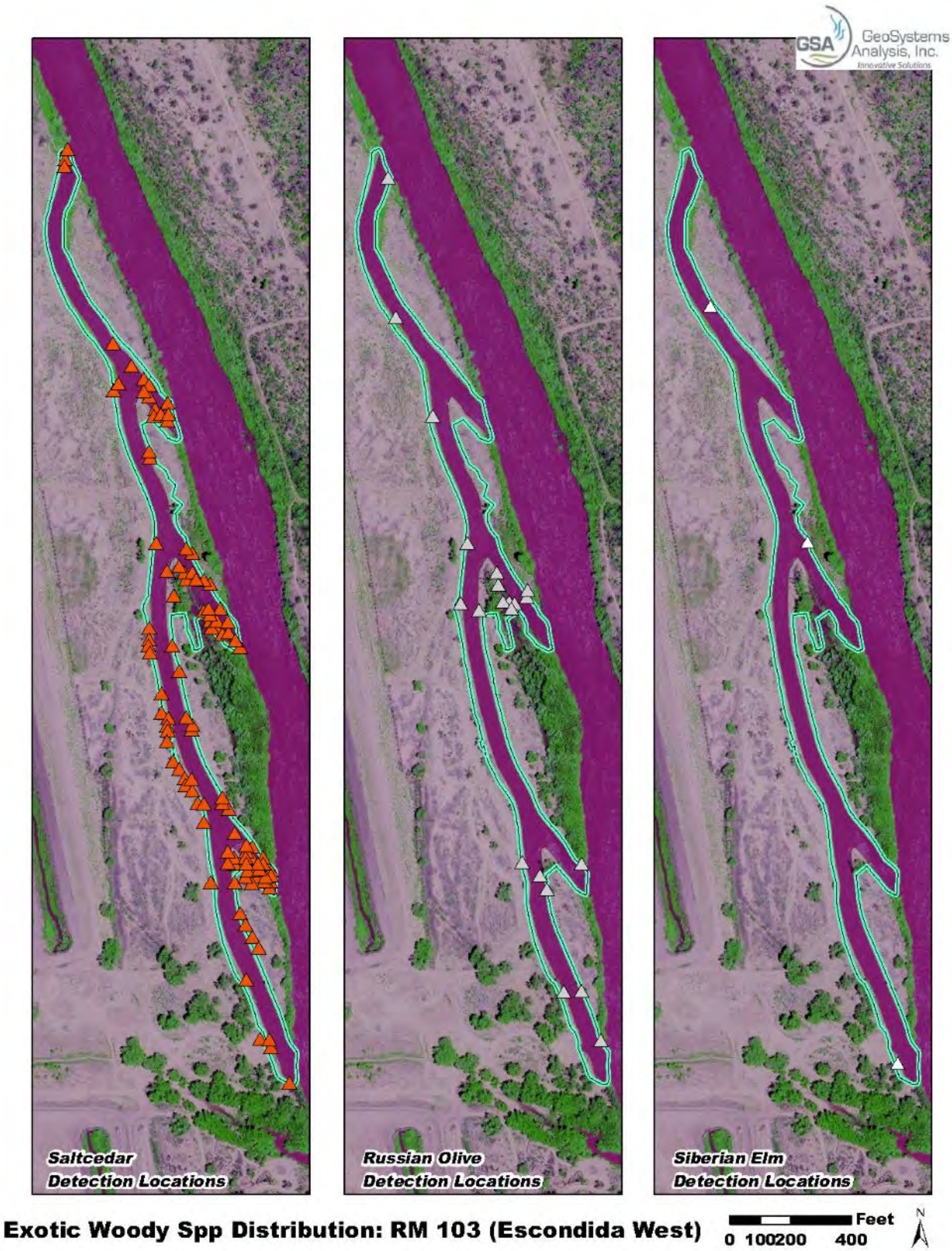

Figure F-4. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 103.

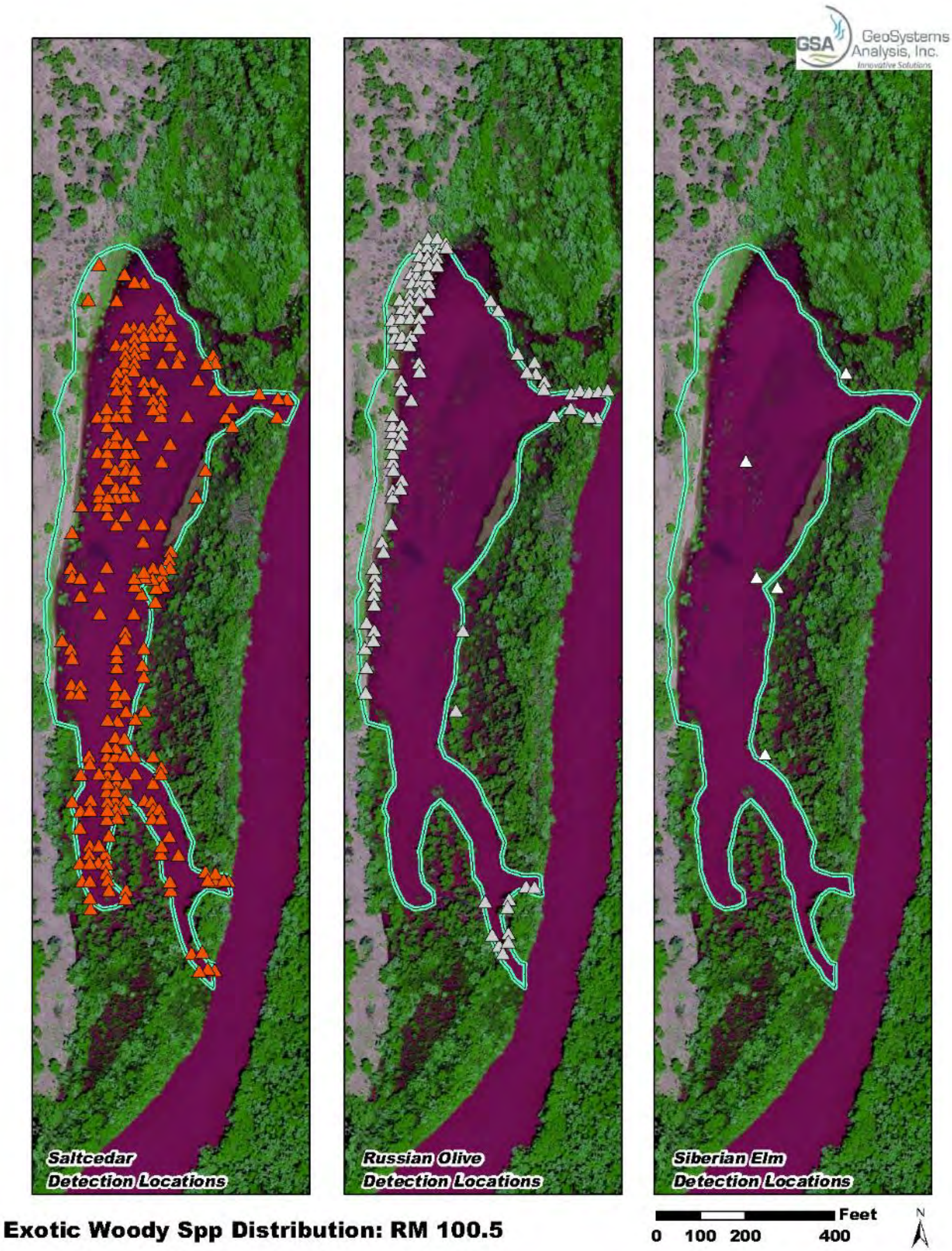

Figure F-5. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 100.5.

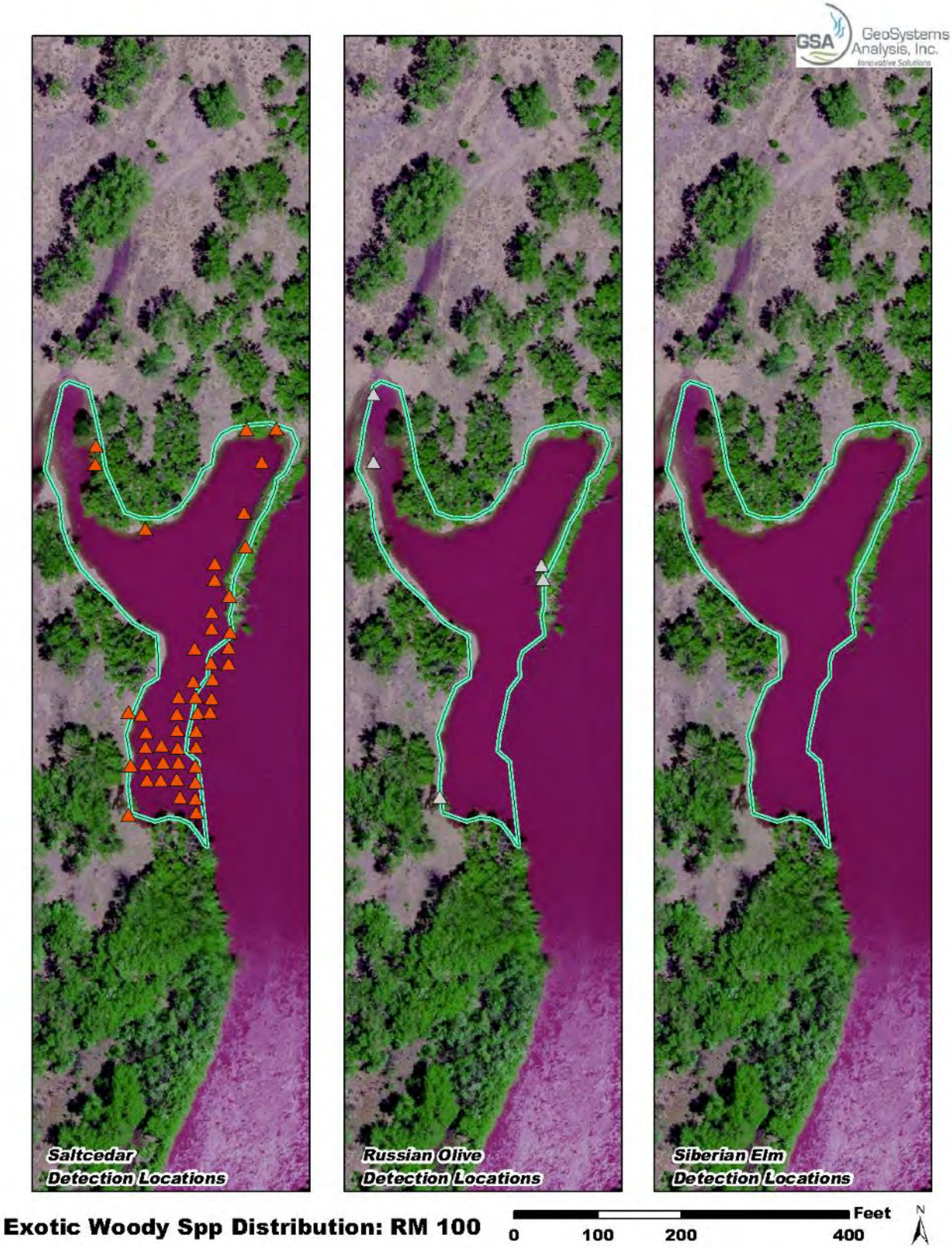

Figure F-6. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 100.

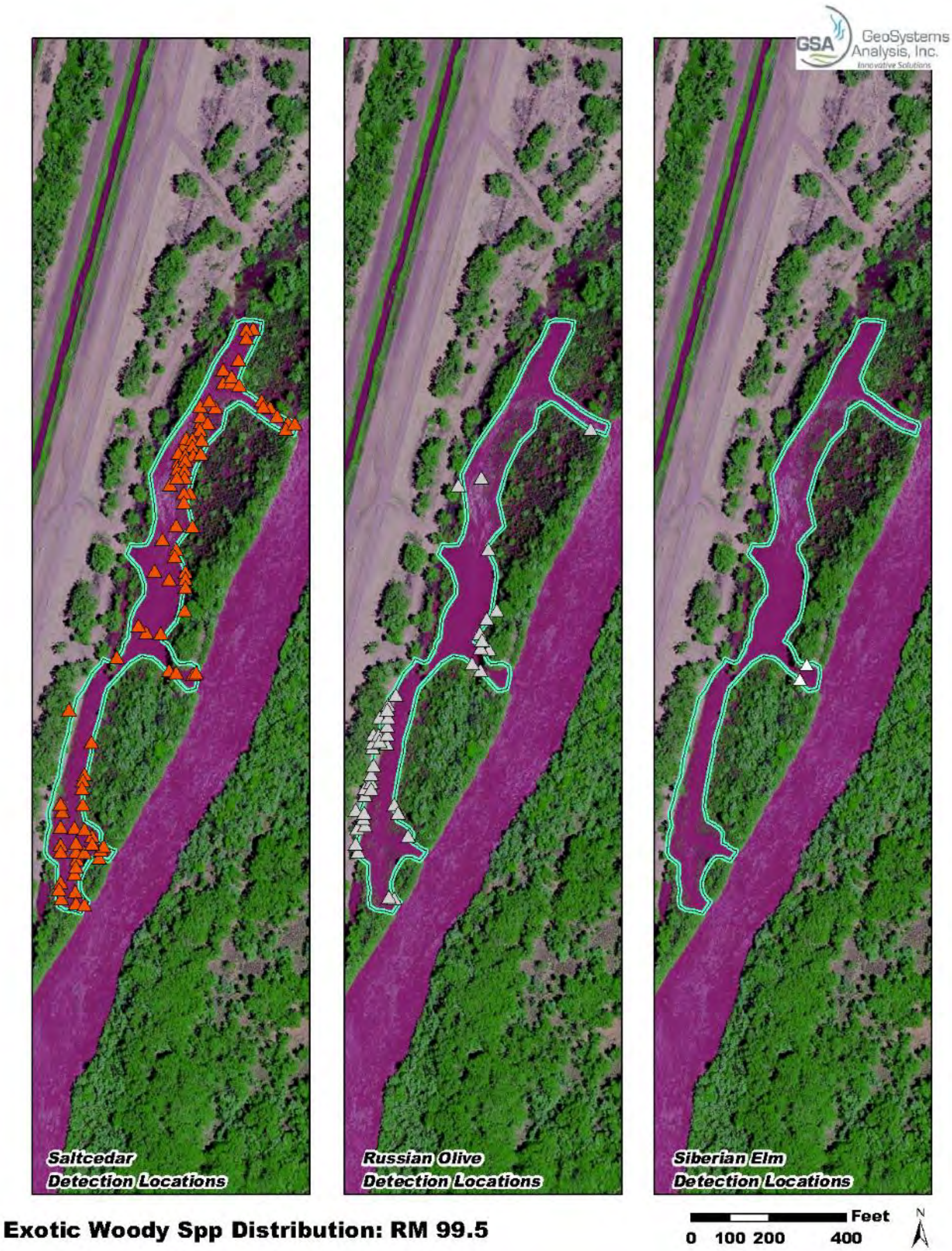

Figure F-7. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 99.5.

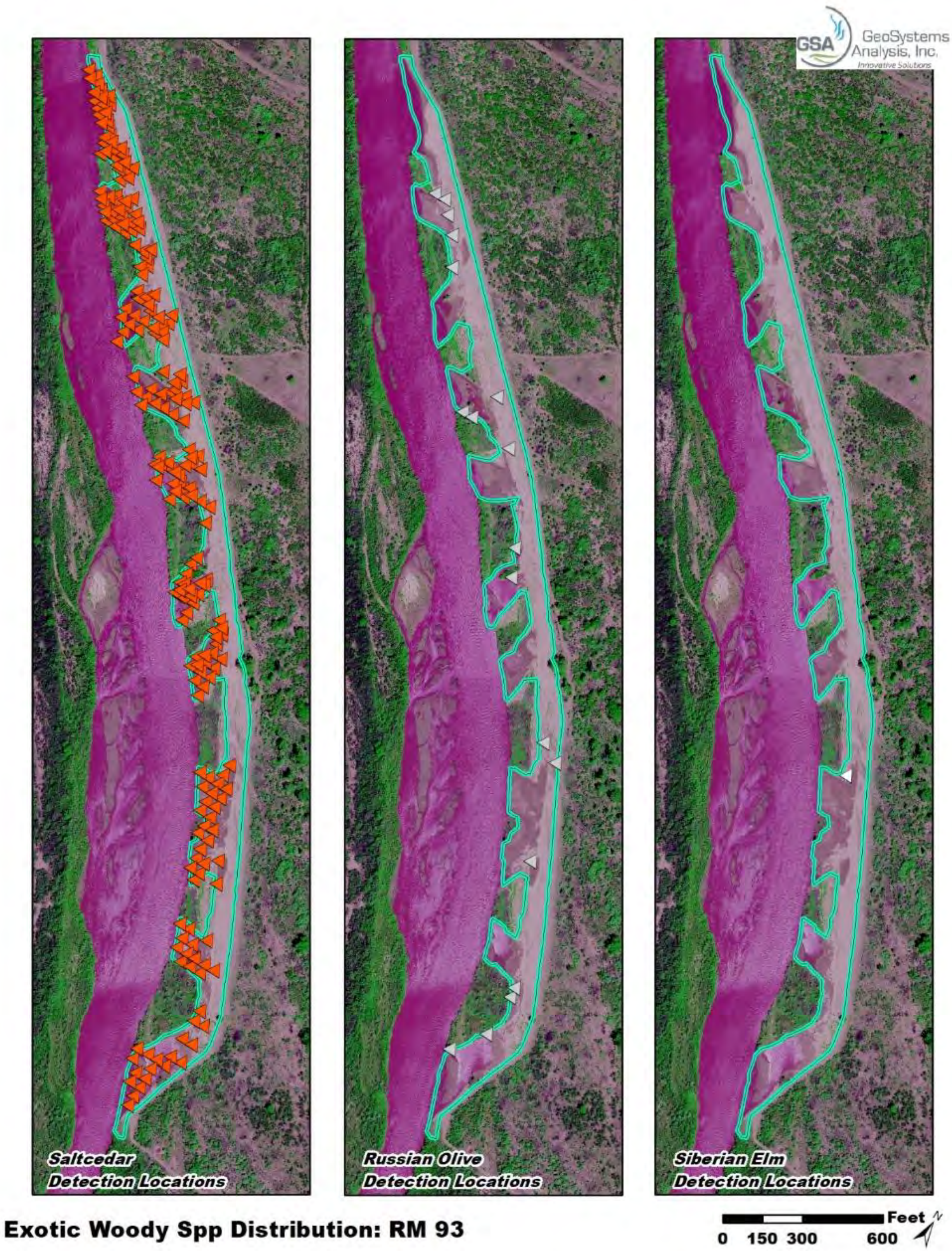

Figure F-8. Distribution of non-native saltcedar (left), Russian olive (center) and Siberian elm (right) seedlings recorded at evenly spaced monitoring stations (20 x 20 ft) at RM 93.

APPENDIX G – POST-RUNOFF SEDIMENT DEPOSITION AND SCOUR

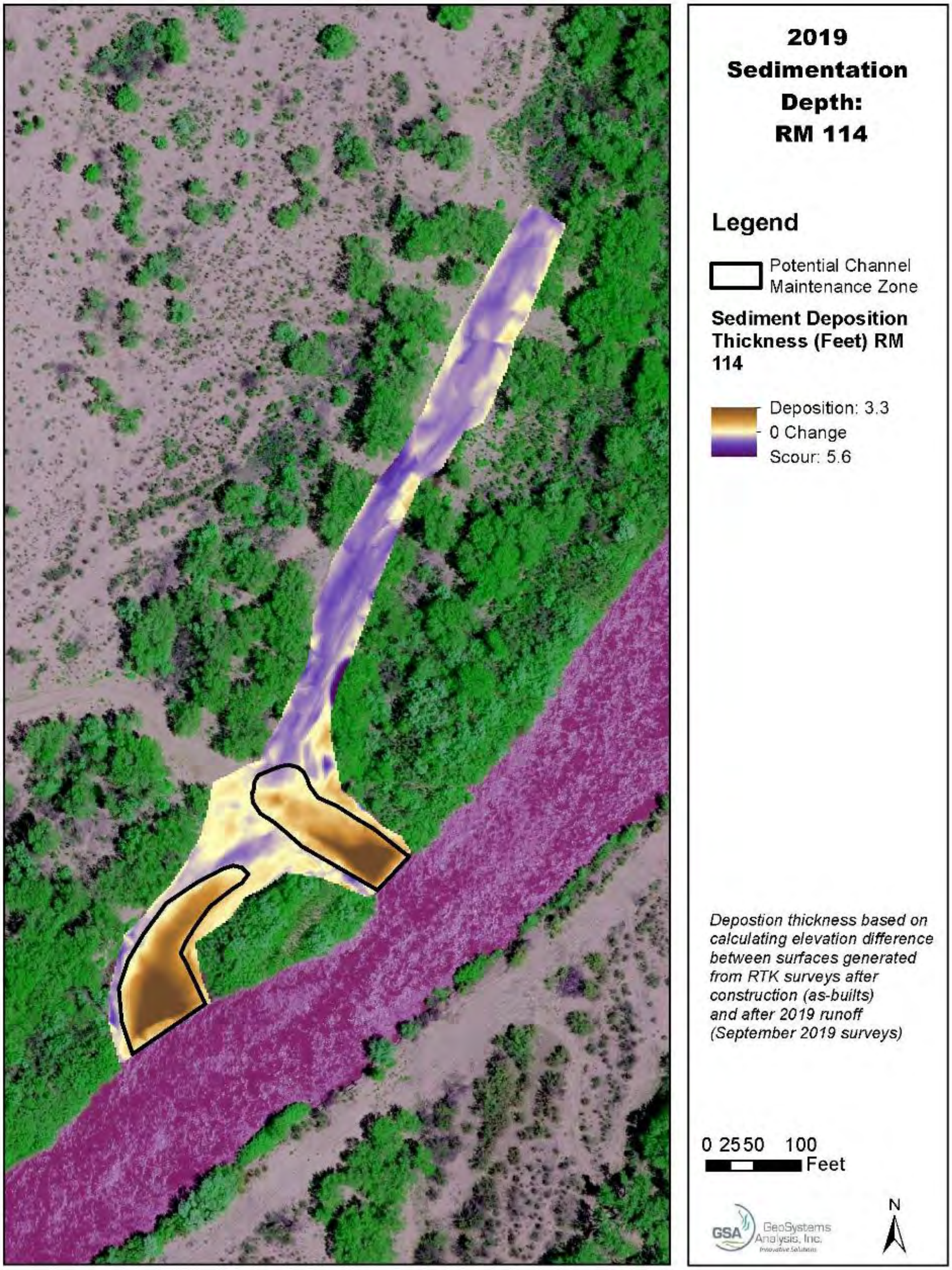

Figure G-1. Post-runoff sediment deposition and scour at project site RM 114.

Figure G-2. Post-runoff sediment deposition and scour at project site RM 112.

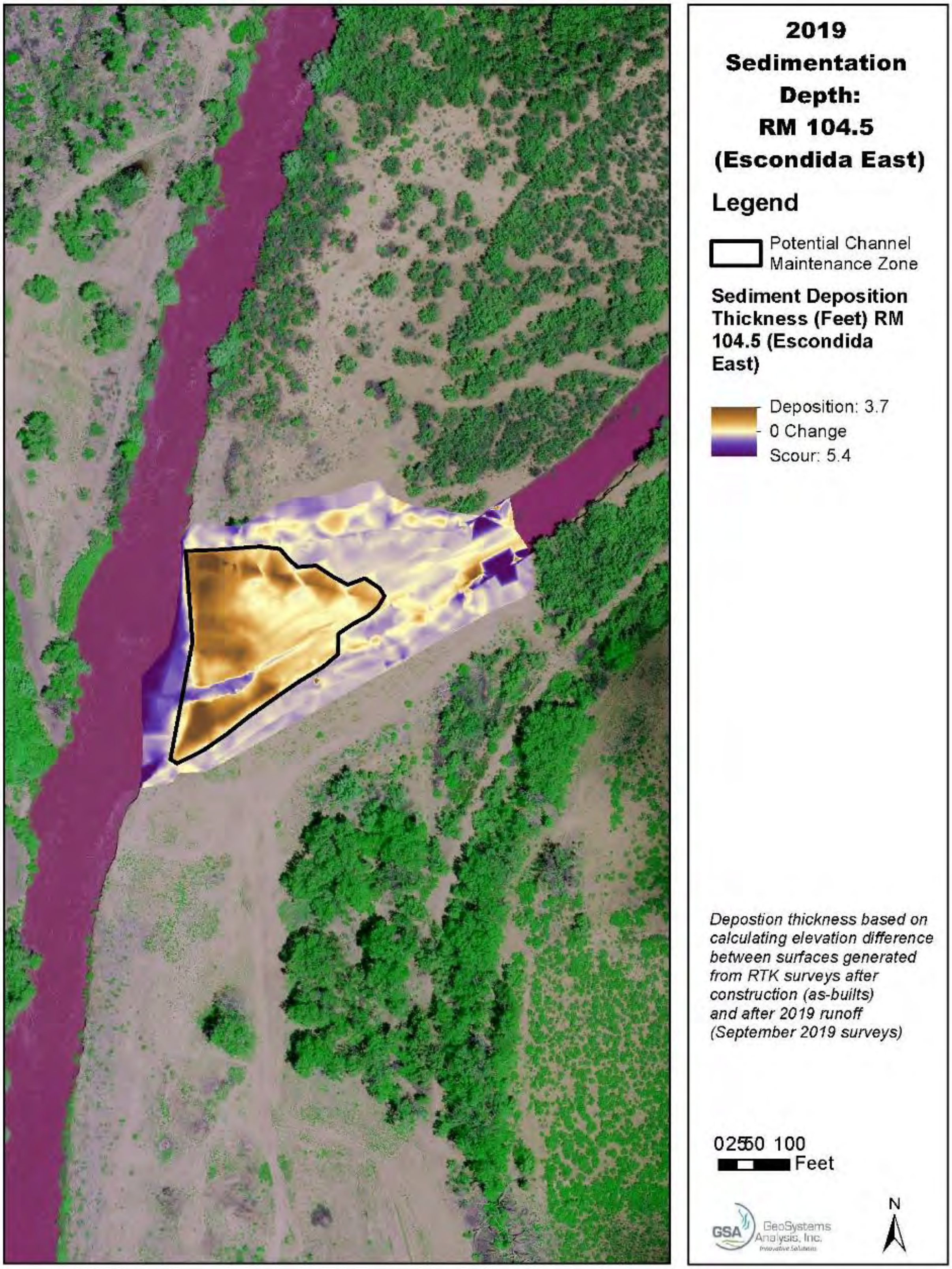

Figure G-3. Post-runoff sediment deposition and scour at project site RM 104.5.

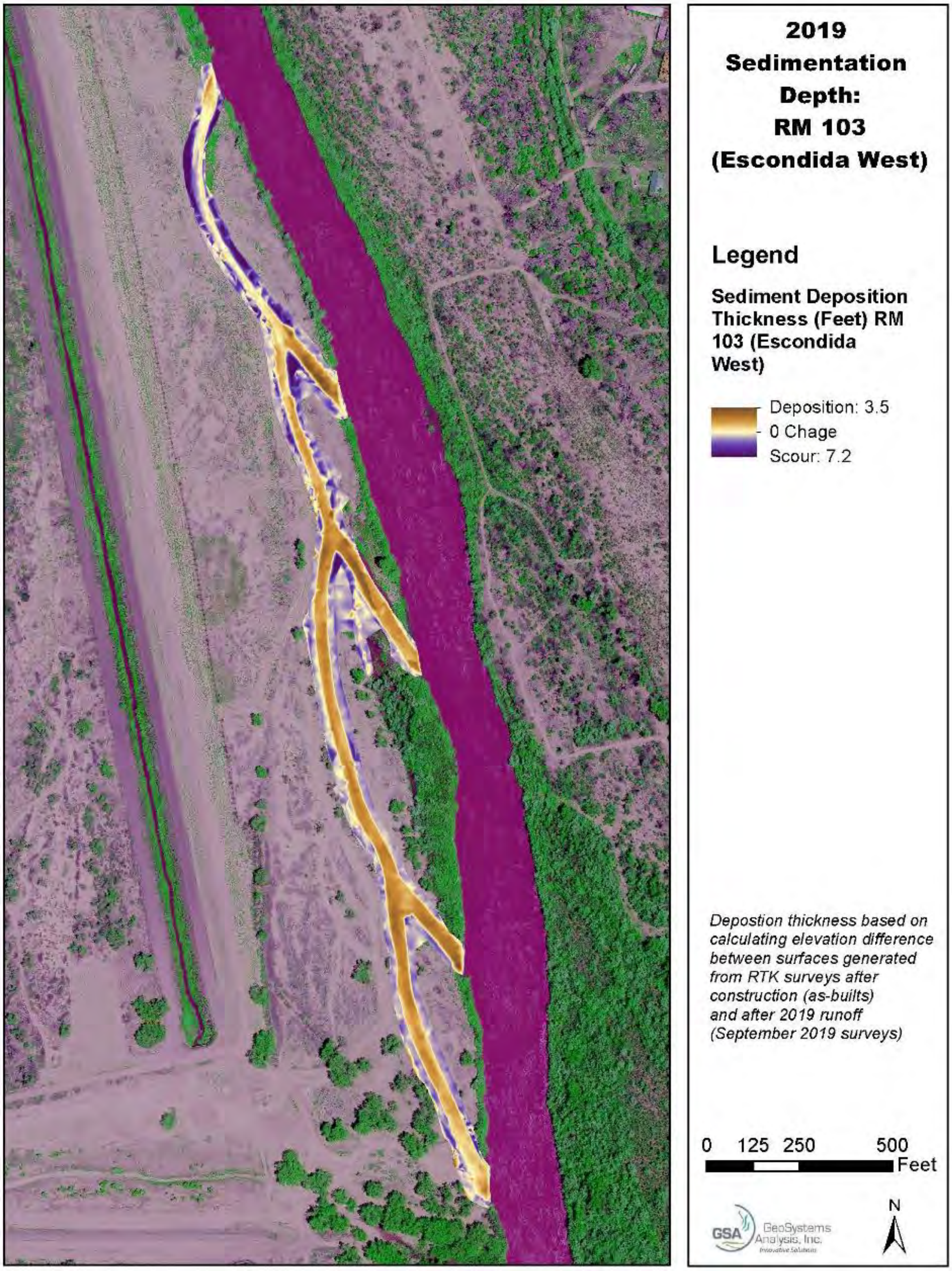

Figure G-4. Post-runoff sediment deposition and scour at project site RM 103.

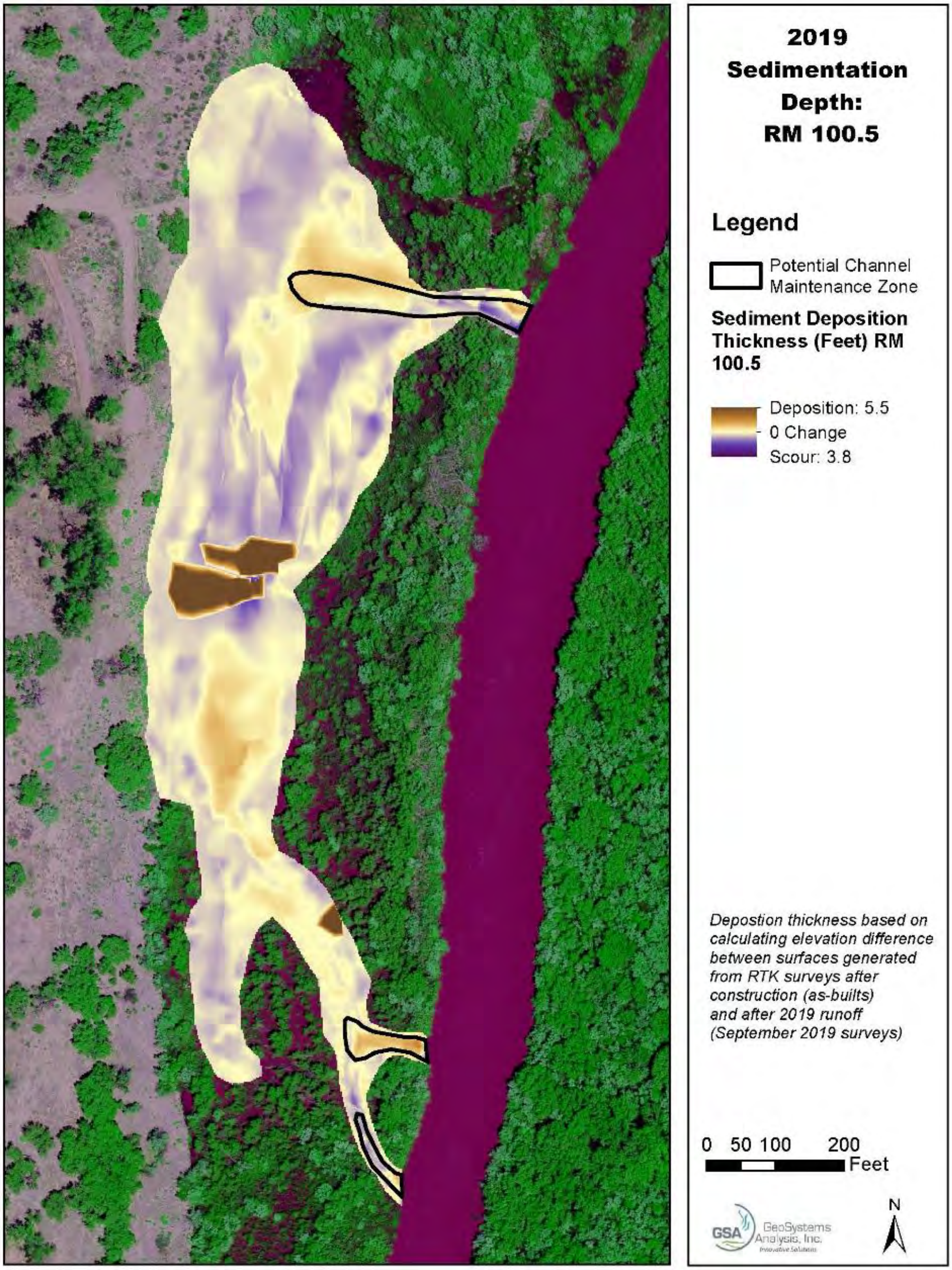

Figure G-5. Post-runoff sediment deposition and scour at project site RM 100.5.

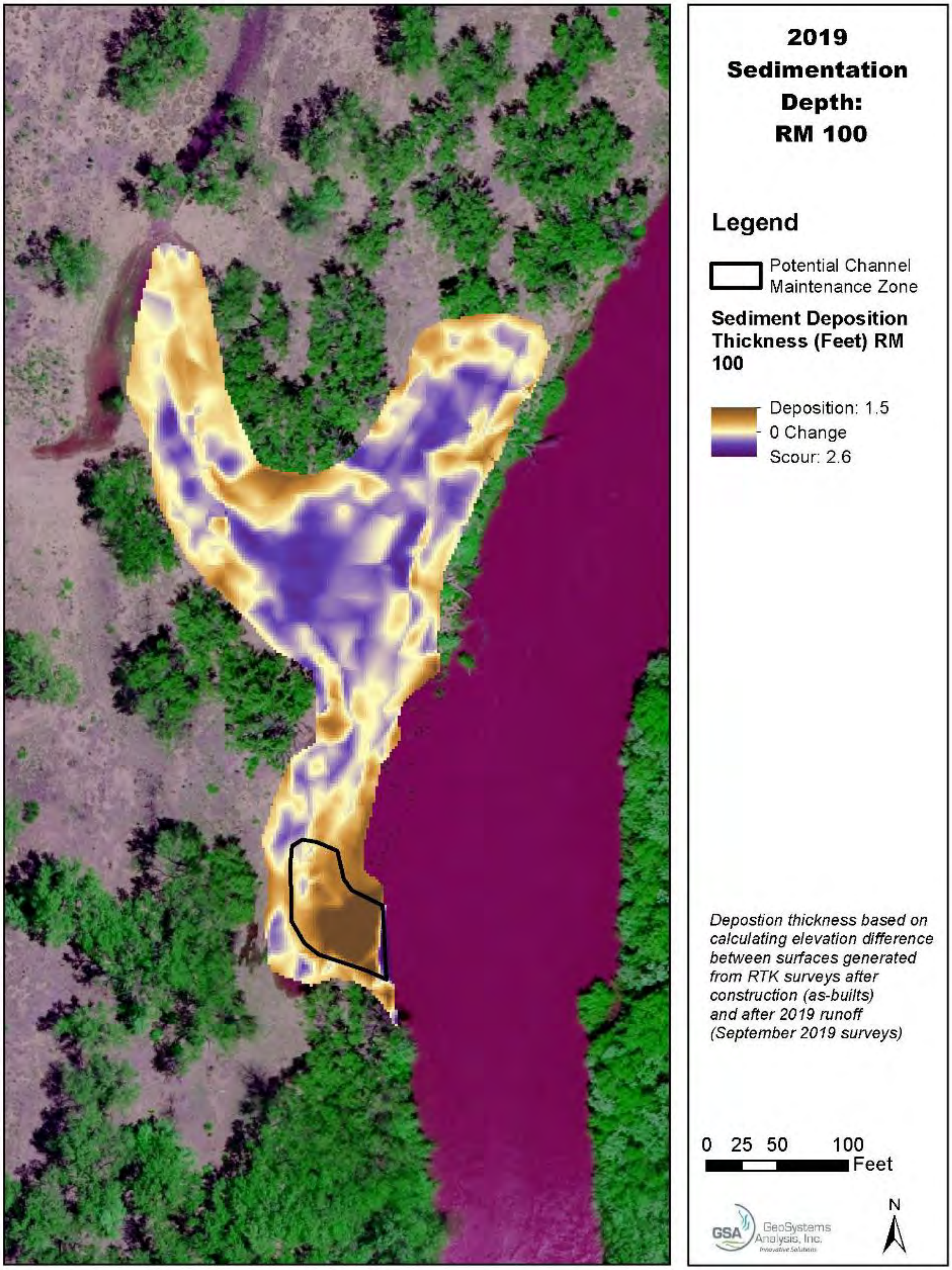

Figure G-6. Post-runoff sediment deposition and scour at project site RM 100.

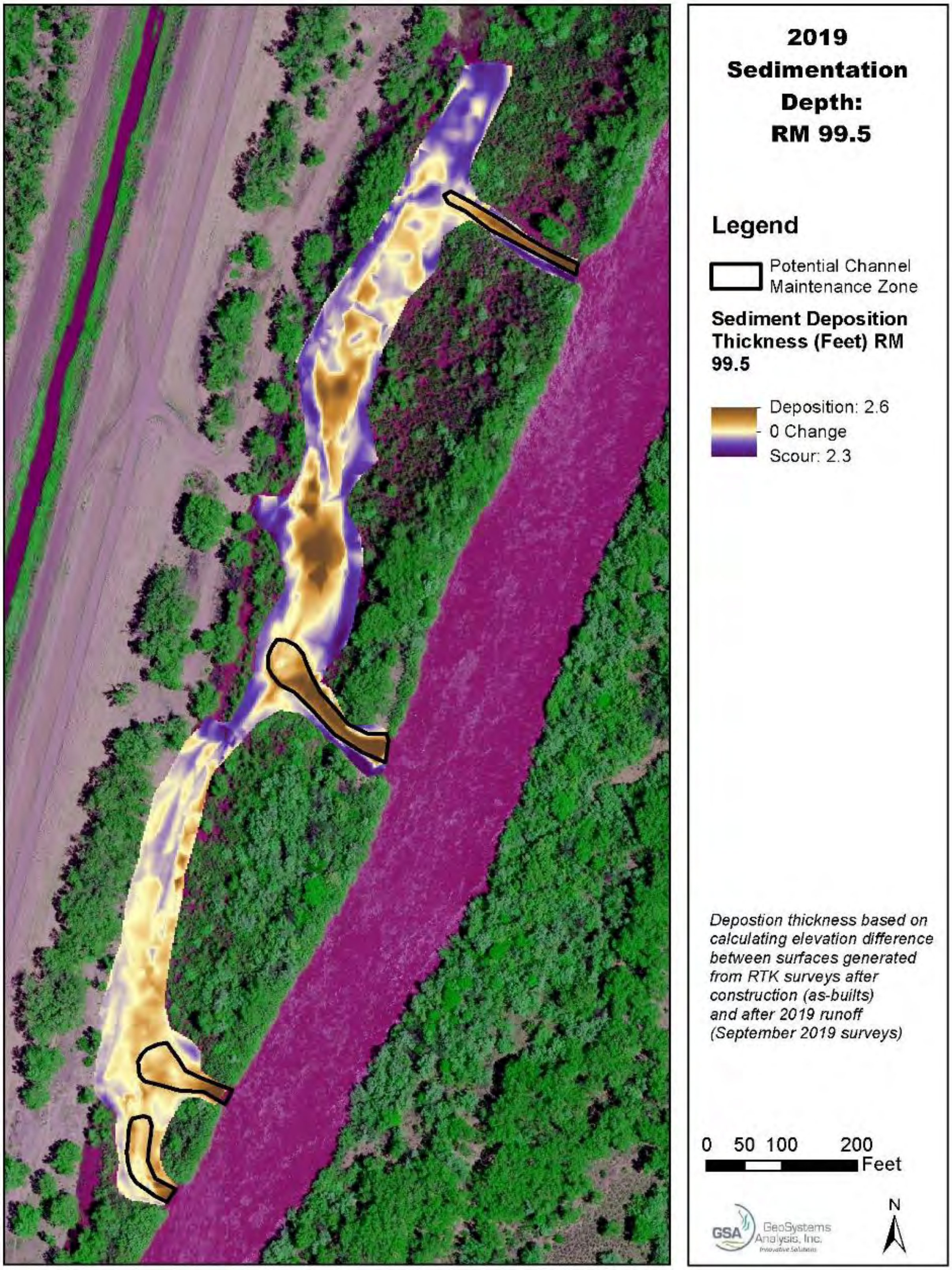

Figure G-7. Post-runoff sediment deposition and scour at project site RM 99.5.

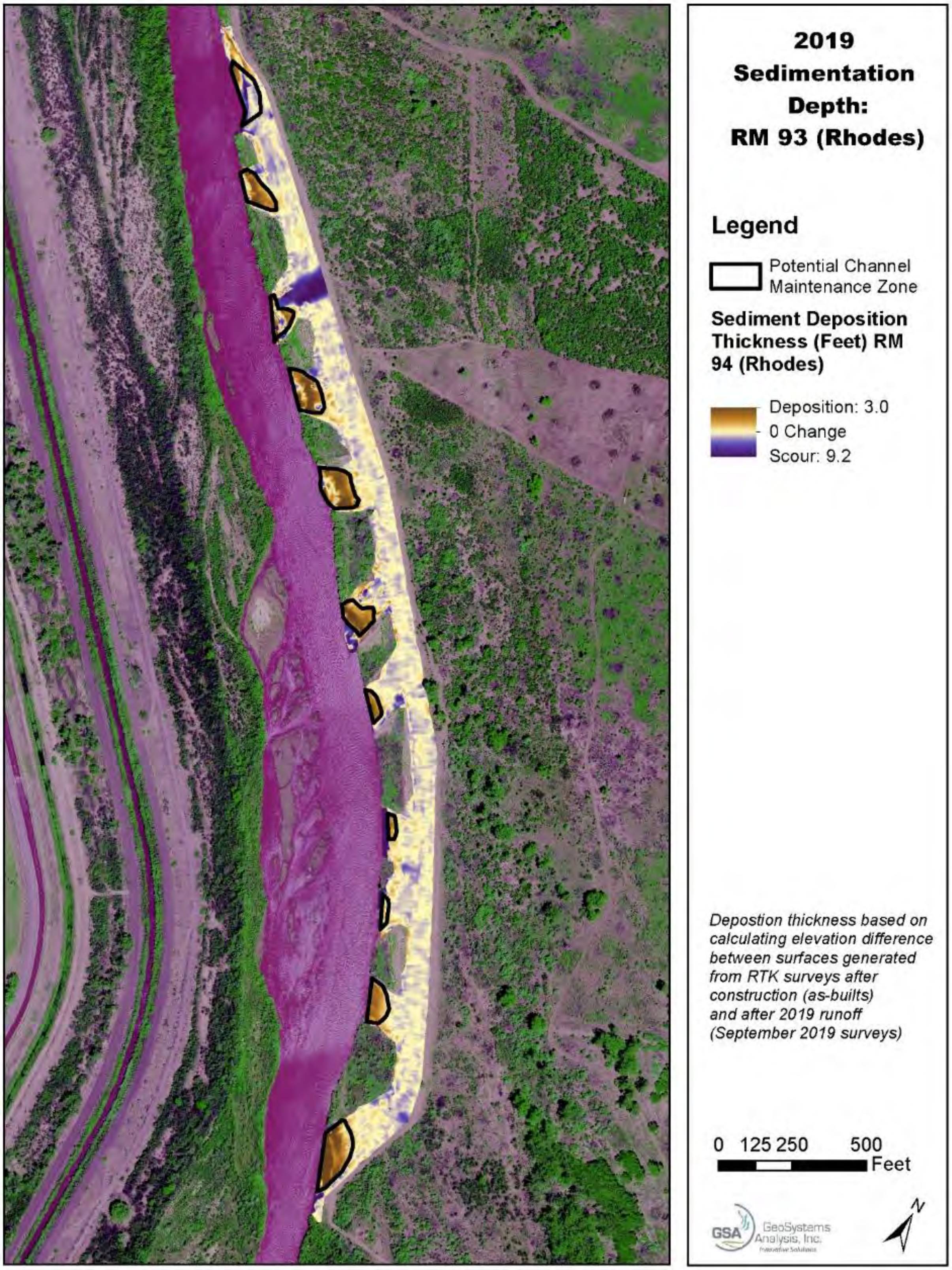

Figure G-8. Post-runoff sediment deposition and scour at project site RM 93.

APPENDIX H

Technical Memorandum for Rio Grande Silvery Minnow Spawning and Nursery Habitat on Restored Floodplain Sites in the Middle Rio Grande / SWCA Project No. 54371

Technical Memorandum

To: Grace Haggerty
New Mexico Interstate Stream Commission
550 San Antonio Drive NE
Albuquerque, NM 87109

From: Stephen A. Zipper, M.S., SWCA Environmental Consultants

Date: 30 June 2019

Re: **Technical Memorandum for Rio Grande Silvery Minnow Spawning and Nursery Habitat on Restored Floodplain Sites in the Middle Rio Grande / SWCA Project No. 54371**

INTRODUCTION

This technical memorandum summaries the activities conducted under the 2019 Rio Grande Silvery Minnow Spawning and Nursery Habitat on Restored Floodplain Sites in the Middle Rio Grande. This study is a continued collaborative effort between the New Mexico Interstate Stream Commission (NMISC) and Albuquerque Bernalillo County Water Utility Authority (Water Authority) to investigate floodplain use by all life stages of the Rio Grande Silvery Minnow (*Hybognathus amarus*; RGSM) in the Middle Rio Grande. Floodplain habitat restoration is one of the critical components for avoiding jeopardy and improving the status of the RGSM as directed in the 2016 Biological Opinion (USFWS 2016). The results included in this technical memorandum are preliminary. Data has not undergone quality control at this time, and results are subject to change following the completion of the quality control process.

Life cycle monitoring for RGSM was conducted using fyke nets to capture adults and dip nets to capture larvae. A total of eight sites were sampled using both methods (Figure 1). These sites included two sites in the Angostura Reach: Paseo del Norte – Southeast and Paseo del Norte – Southwest. In the San Acacia Reach, six sites were sampled. These sites included floodplain restoration sites at river miles 114, 112, 100.5, and 100. The floodplain restoration sites at river miles 114 and 112 served as experimental sites, where vertical pilings of willow were installed at 10 locations within each site. Additionally, two natural floodplain sites were sampled in the Angostura Reach at river mile 106.5 and 100.8.

Data collected under this study will help identify important factors that contribute to the presence of larval RGSM within floodplain habitat. This information will be used to evaluate and adjust sampling and analysis methods for floodplain monitoring, demonstrate the life history of RGSM to inform the water management of the Middle Rio Grande, adaptively manage the species to meet the requirements set forth in the 2016 Biological Opinion, and support the Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program).

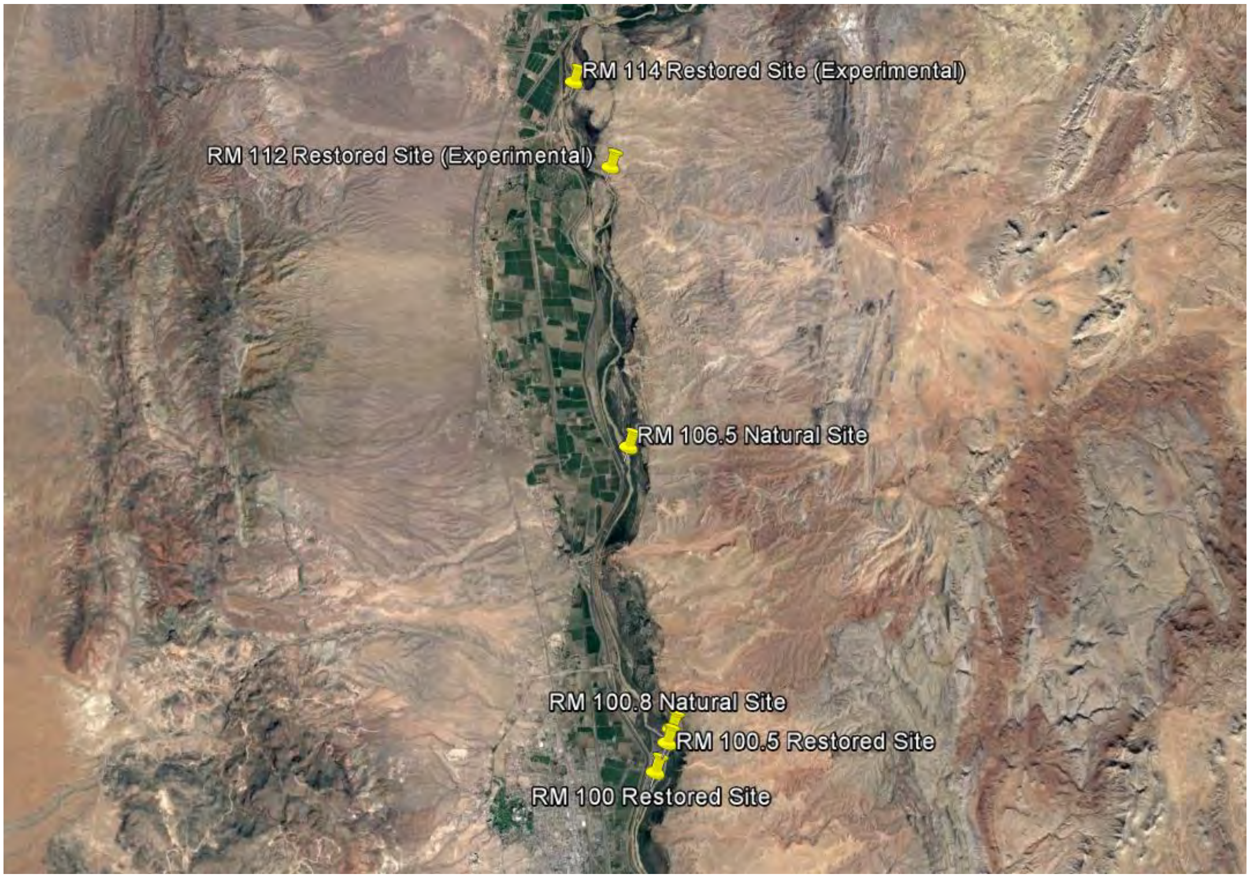

Figure 1. Map of all San Acacia sites sampled during 2019.

PROJECT DESCRIPTION

The purpose of this study was to identify key habitat features utilized by RGSM in floodplain sites within the San Acacia and Angostura Reach. The floodplain restoration sites within the San Acacia Reach were recently constructed under the NMISC, and therefore are relatively new sites that lack substantial vegetation. Fyke nets were used to capture adults or juveniles at all sites. Data from fyke net captures provides information on the proportion of augmented versus wild spawned fish and the proportion of females to males. During dip net sampling, habitat variables included water temperature (˚C), water velocity (m/s), canopy cover percentage, depth(m), instream cover percentage, dominate substrate type, distance to the nearest wetted edge (m), and vegetation type (i.e., woody terrestrial, herbaceous terrestrial, aquatic vegetation, none) were measured or estimated. Habitat variables and presence or absence of RGSM larvae will be analyzed to determine if certain variables correlate with the presence or RGSM larvae.

METHODS

On 17 April 2019, SWCA Environmental Consultants (SWCA) initiated floodplain sampling within the San Acacia Reach. Initially, fyke nets were set at various floodplain sites within the San Acacia Reach. All captures were identified to species and promptly released. All RGSM were measured for standard length in millimeters (Figure 2) and weighed to the nearest tenth of a gram. Additionally, RGSM were assessed for health conditions, sex, and observed for both visible implant elastomer (VIE) and passive integrated transponder (PIT) tags. Photographs were taken of each RGSM, where available. On 29 April 2019, two sites within the Angostura Reach

(Paseo del Norte floodplain restoration sites Southwest and Southeast) were added to monitoring efforts using fyke nets. Dip net sampling for larval fishes was initiated on 29 April 2019 at all sites. Dip net sampling consisted of sampling approximately 25 locations within each site. Each of these locations were randomly selected prior to the initiation of sampling. Where water levels resulted in dry locations, the nearest location with water was sampled. All sampling concluded on 30 May 2019.

Figure 2. Rio Grande Silvery Minnow with Standard Length of 59 mm and Weight 3.5 grams.

Discharge was relatively high during the sampling period with peak discharge at the Alameda Gage (USGS Gage #08329918) ranging from 1,180 cfs on 17 April to 5,560 cfs on 5 May 2019 (Figure 3). Discharge measured at the San Acacia Gage (USGS Gage #08354900) ranged from 1,180 cfs on 18 April to 4,530 cfs on 23 May 2019. Most sites remained connected and inundated during the entire study. However, fluctuations in discharge and sediment deposition at the inlets of some sampling sites caused non-contiguous flow through some of sites and created large isolated pools.

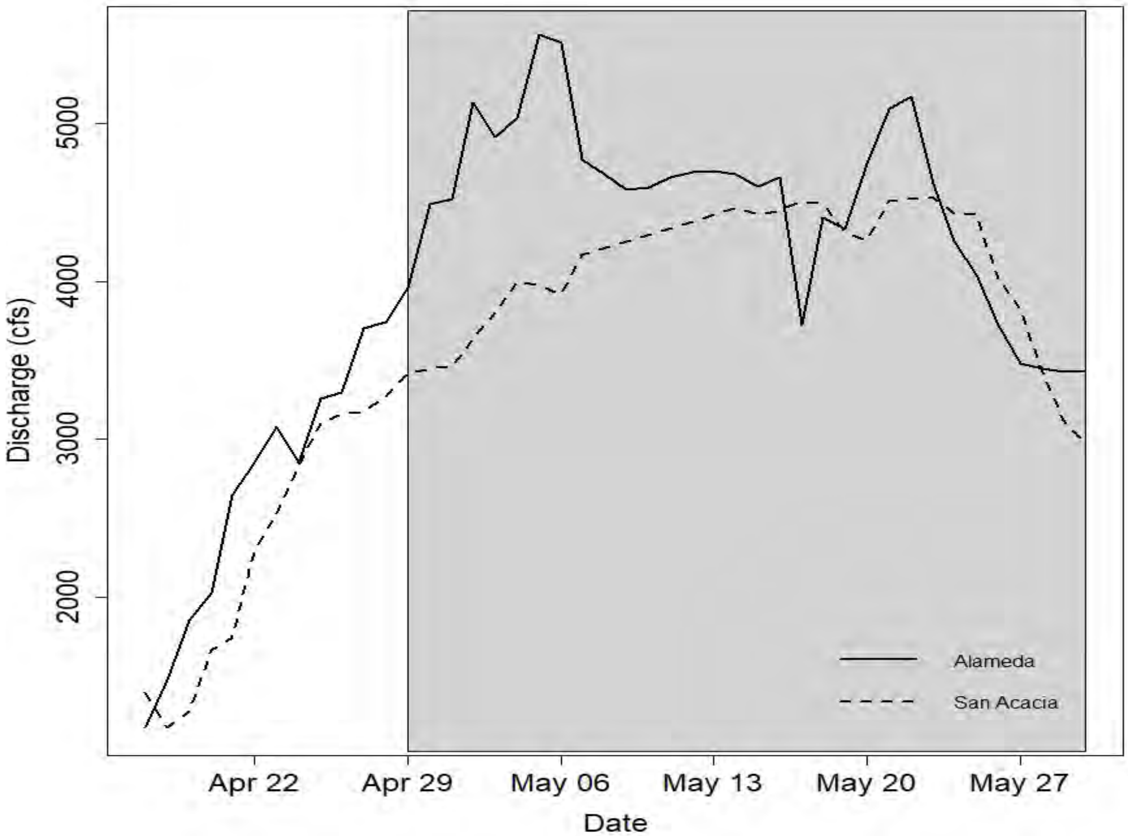

Figure 3. Discharge at USGS Gage at Alameda and San Acacia, gray square denotes period of sampling with dip netting and fyke netting.

RESULTS

Fyke Net Sampling

The number of fyke nets sets at each location was dependent upon water connectivity and available sampling area. Therefore, not all sites had the same number of fyke net sets. A total of 170 fyke net sets were conducted between 17 April and 30 May 2019 (Table 1). Typically, both Paseo del Norte sites were sampled on the Monday and Friday of each week, and the San Acacia sites were sampled on Tuesday through Thursday.

Fyke nets captured at total of 994 fish, representing 13 species (Table 2). The two most abundant species were RGSM and Red Shiner (*Cyprinella lutrensis*). All other species cumulatively represented 3.9 percent of all fish captured in fyke nets during the study. Of the 471 RGSM captured using fyke nets, 197 did not have a visible VIE tag and 274 had visible VIE tags (Table 3). The most common VIE colors observed were white and yellow. The majority of smaller RGSM (≤ 60 mm standard length) had a visible tag and represented 96 percent of fish in this length category (Table 4). Conversely, the majority of RGSM that were greater than 60 mm standard length did not have a visible tag, representing 72 percent of all fish in this length category. The majority (42 percent) of RGSM were adults while 23 percent were females (Table 5).

Table 1. Summary of fyke net sets at each site by date (* denotes experimental site).

Date	Paseo del Norte - SE	Paseo del Norte - SW	RM 100 Floodplain Restoration Site	RM 100.5 Floodplain Restoration Site	RM 100.8 Natural Floodplain	RM 106.5 Natural Floodplain	*RM 112 Floodplain Restoration Site	*RM 114 Floodplain Restoration Site	Daily Totals
4/17/2019	0	0	0	2	0	1	0	0	3
4/18/2019	0	0	0	2	0	0	0	0	2
4/19/2019	0	0	0	2	0	0	0	0	2
4/22/2019	0	0	0	0	0	0	2	2	4
4/23/2019	0	0	0	0	0	1	2	2	5
4/24/2019	0	0	0	0	0	0	2	3	5
4/25/2019	0	0	0	0	0	0	2	3	5
4/26/2019	0	0	0	0	0	0	2	3	5
4/29/2019	2	2	0	0	0	0	0	0	4
4/30/2019	0	0	2	2	1	2	2	3	12
5/1/2019	0	0	2	2	2	2	0	0	8
5/2/2019	0	0	2	0	2	0	2	3	9
5/3/2019	2	2	0	0	0	0	0	0	4
5/6/2019	2	2	0	0	0	0	0	0	4
5/7/2019	0	0	2	2	1	2	2	3	12
5/8/2019	0	0	2	3	1	2	0	0	8
5/9/2019	0	0	2	0	1	0	2	3	8
5/10/2019	2	2	0	0	0	0	0	0	4
5/13/2019	2	2	0	0	0	0	0	0	4
5/14/2019	0	0	2	2	0	2	0	3	9
5/15/2019	0	0	0	2	1	2	2	0	7
5/16/2019	0	0	2	0	0	0	2	2	6
5/17/2019	2	2	0	0	0	0	0	0	4
5/20/2019	2	2	0	0	0	0	0	0	4
5/21/2019	0	0	2	2	0	2	0	2	8
5/22/2019	0	0	0	2	0	2	2	0	6
5/23/2019	0	0	2	0	0	0	2	2	6
5/24/2019	2	2	0	0	0	0	0	0	4
5/27/2019	2	2	0	0	0	0	0	0	4
5/30/2019	2	2	0	0	0	0	0	0	4
Totals	20	20	20	23	9	18	26	34	170

Table 2. Fyke net captures at each site by species (FRS = floodplain restoration site, NF = natural floodplain).

Common Name	Paseo del Norte - SW	Paseo del Norte - SE	RM 100 FRS	RM 100.5 FRS	RM 100.8 NF	RM 106.5 NF	RM 112 FRS	RM 114 FRS	Total
Rio Grande silvery minnow	23	9	17	144	68	137	43	30	471
red shiner	2	3	42	210	3	157	15	9	441
black bullhead							2		2
channel catfish			1	3			1	2	7
common carp						1			1
fathead minnow				1					1
flathead chub	1			1		1			3
longnose dace	1	1							2
river carpsucker				2	1	3		1	7
western mosquitofish				4					4
white crappie		1							1
white sucker		1		1					2
yellow bullhead						1	1		2
Grand Total	27	15	60	366	72	300	62	42	944

Table 3. Total number of Visible Implant Elastomer (VIE) tags in captured RGSM with fykes.

Site	none	blue	green	green/red	orange	red	white	yellow	Grand Total
PDN_SW	15		1				2	5	23
PDN_SE	3							6	9
RM 100 Floodplain Restoration Site	2				1		8	6	17
RM 100.5 Floodplain Restoration Site	17	2	2		6		65	52	144
RM 100.8 Natural Floodplain	7				1		36	24	68
RM 106.5 Natural Floodplain	96	2	3	1	1	1	8	25	137
RM 112 Floodplain Restoration Site	36	2			1		2	2	43
RM 114 Floodplain Restoration Site	21	2			1		5	1	30
Grand Total	197	9	6	1	11	1	126	120	471

Table 4. Visible VIE tag versus no tag in Rio Grande Silvery Minnow by standard length (mm).

Tag/No tag	<=60-mm	>60-mm	Totals
Visible Tag	262	12	274
Non-Visible Tag	55	142	197
Totals	317	154	471

Table 5. Reproductive condition of adult Rio Grande Silvery Minnow captured in fykes.

Reproductive Condition	Number	Percentage
gravid	107	23
milt	197	42
spent	52	11
unknown	115	24
Total	471	100

Dip Net Sampling

Larval fishes are presented in this document as unknown species at this time. All larval specimens were preserved in 95 percent ethanol in the field. All identifications to species will be conducted under a subsequent work order.

A total of 1,693 dip net samples were conducted throughout the study, capturing approximately 3,944 unknown larvae (Table 5). In addition, 47 additional dip net samples were conducted under targeted non-random sampling, resulting in an additional 390 larvae for a total of 4,334 unknown larvae. One RGSM egg was captured at the natural floodplain at river mile 106.5. Most larvae were captured at the natural floodplain at river mile 100.8.

Table 6. Total number of larvae captured by site.

Sampling Scheme	Site	Common Name	Quantity	Total
Random Sampling Locations	Paseo del Norte - SE	unknown larvae	146	3944
	Paseo del Norte - SW	unknown larvae	271	
	RM 100 Floodplain Restoration Site	unknown larvae	250	
	RM 100.5 Floodplain Restoration Site	unknown larvae	125	
	RM 100.8 Natural Floodplain	unknown larvae	3122	
	RM 106.5 Natural Floodplain	unknown larvae	4	
	RM 112 Floodplain Restoration Site	unknown larvae	21	
	RM 114 Floodplain Restoration Site	unknown larvae	5	
Targeted Non-Random Sampling	San Acacia Targeted	unknown larvae	169	390
	Angostura Targeted	unknown larvae	33	
	PDN-SE Targeted	unknown larvae	91	
	RM 100 Floodplain Restoration Site	unknown larvae	5	
	RM 100.5 Floodplain Restoration Site	unknown larvae	88	
	RM 112 Floodplain Restoration Site	unknown larvae	3	
	RM 114 Floodplain Restoration Site	unknown larvae	1	

CONCLUSION

The continued capture of RGSM gravid females and nuptial males over several years of monitoring provide evidence that RGSM are likely spawning on floodplain habitat. Following identification of larvae, the presence of RGSM and habitat variables where they were captured will be analyzed to determine if their presence is associated with the same habitat features identified from 2017 sampling. The data collected under this study is important in building a long-term data set to determine which habitat features are important for nursey habitat. In addition, the 2019 data represents another high-water year where comparisons can be made to 2017. While no RGSM larvae were captured in 2018 sampling, it is important that continued monitoring be conducted in years where water levels are lower than 2017 and 2018.

REFERENCES

U.S. Fish and Wildlife Service (USFWS). 2016. Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico (02ENNM00-2013-F-0033). U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

APPENDIX I
Project Adaptive Management Team Summary Notes
January 23, 2020

2019 Monitoring Results

Location: Reclamation, Pecos Conference Room

Date: January 23, 2020

Time: 10:00 am-12:00 pm

Attendees: SOBTF: Gina Dello Russo, Sarah Anderson; ISC: Grace Haggerty, Trevor Birt; GSA: Todd Caplan, Chad McKenna; Reclamation: Ashlee Rudolph; SWCA: Steve Zipper

Notes from meeting:

1. GSA presented 2019 Monitoring Memo Draft results.
   - ACTION ITEM: Comments on draft report due by Feb 6th. Bring discussion points to meeting on January 30 if needed.
   - Inundation Mapping
     - DISCUSSION: High flow interval data collection can be considered part of Long Term Plan to analyze change in area of inundation over time
     - DECISION: Continue to monitor at 800 and 2000-2500 cfs in 2020
     - ACTION ITEM: Ashlee and Grace will talk with Lynette and John Peterson about capturing satellite imagery during 2020 runoff season
       - Questions still remain as to what data we should ask for –
     - ACTION ITEM: GSA will add the 2019 imagery to the report
     - ACTION ITEM: GSA will digitize maximum extent of inundation from 2019 satellite imagery and add to 2019 draft report
   - Flow Tracker Monitoring
     - DISCUSSION: Should we revise questions and cfs at which this data is collected? There is merit in continuing at least for one additional year since 2019 was unusual year. Consider the first two years as “as builts” and add cross sections as needed after reviewing imagery from 2019 and as this runoff develops. SWCA gathers pertinent information when they are doing their fish monitoring.

- DECISION: Velocity/depth/temp measurements will be collected in 2020 at similar discharges to 2019
- Isolated Pools
  - DISCUSSION: Should fish presence be observed and documented?
    - *RM 112 had a plug in 2019 but has an outlet, we will watch it in 2020 to determine if management needs to be taken or if this natural outflow works*
  - DECISION: Fish presence will not be documented in 2020 and beyond
  - ACTION ITEM: All reference to fish will be removed from the draft report and instead SWCA's fish report will be included as an appendix to monitoring report and referenced as needed
  - DISCUSSION: Should isolated pool monitoring be modified or discontinued. There is still merit in observing the descending limb of the hydrograph to see how water comes off these features. There is limited time committed to gathering this information. There could be a need to report information immediately if larger isolated pools are observed. Size of minimum pool to be reported still tbd and finalize SOP. For this and other monitoring parameters, field cameras additional could be useful.
  - DECISION: Isolated pools will be documented one time at 1500 cfs in 2020, additional monitoring as needed.

- Noxious Weeds
  - DISCUSSION: In the case of the Rhodes Property, it was assumed early on that noxious weeds would be an issue because of their occurrence adjacent to the project area. NRCS is beginning a round of maintenance on the greater Rhodes Property project and we could coordinate with them and the landowner to assure that adjacent areas are also treated.
  - ACTION ITEM: SOBTF will follow up with NRCS and landowner on adjacent area noxious weed control.
  - ACTION ITEM: Sarah and Chad will meet to discuss electronic data/veg data available for estimating noxious weed and woody invasive maintenance effort
  - DECISION: Hand-digging of priority noxious species:
    - Ravenna grass (RM 99.5): anytime
    - Whitetop (RM 93): April/May
- Woody Vegetation
  - DISCUSSION: Further discussion needed at next meeting, possibly a fieldtrip on using fencing and signage to control trespassing on these sites. Groundwater wells could be installed if needed to determine rate of decline of shallow groundwater after spring flooding and native woody species

germination. There is the question of rather rate of decline will be too great for certain native woody species that would impact survival of both seedlings and planted materials.

- ACTION ITEM: Incidental data such as evidence of grazing, evidence of ATV use of areas will be documented. SOBTF interns can collect and Sarah and Chad will determine how best to document this in GSA app.
- ACTION ITEM: Further discussion is required to decide on piezometer installation prior to spring runoff. GSA has 5 drive points, some galvanized pipe but approximately $200 would be needed to buy additional pipe. Need data loggers for this monitoring. Need to determine best location and timing to collect this data if we don't have loggers, etc.
- ACTION ITEM: next meeting continue discussion of priority non-native woody species control and techniques suggested.

- Post-Runoff Sediment Deposition
  - DISCUSSION: There was sediment deposition at all sites to varying degrees. Discussion focused on the functioning of each project area feature and whether maintenance would be useful (RM 93 downstream embayment as an example had deposition but still maintained a narrow outlet that limited isolated pools in the project area.
  - ACTION ITEM: continue discussion at January 30 meeting.

From the agenda items at the January 23 meeting that will be topics for January 30 meeting:

Discuss 2020 schedule including:

Maintenance needs: Adaptive Management recommendations for noxious weeds, woody non-native vegetation, and sediment removal will be discussed further and final decisions made. Suggest sending out GSAs table of requirement that were submitted to Reclamation NEPA staff to SOBTF and ISC (if they didn't receive them for discussion purposes).

Compliance Requirements and Timeline

- CWA
- NEPA

Review Monitoring and Reporting Schedule for 2020

- DISCUSSION: proposed schedule for 2020 final reporting: provide draft monitoring report for 2020 by end of November at the latest, comments due back by the end of December in time for a January meeting to discuss results and 2021 needs.
- ACTION ITEM: SOBTF will get interns scheduled ASAP based on the discussions to date – one intern beginning early April through June, second intern beginning early June through August.

APPENDIX J
Project Adaptive Management Team Summary Notes
January 30, 2020

2020 HR Monitoring Prep with SOBTF

Location: Rio Grande Conference Room

Date: January 30, 2020

Time: 1:00 pm-3:30 pm

Attendees: SOBTF: Gina Dello Russo, Sarah Anderson; GSA: Todd Caplan, Chad McKenna; Reclamation: Ashlee Rudolph, ISC Grace Haggerty, Trevor Birt

Notes:

General discussion of documentation – how to best document the compiled data, which is in the monitoring report, the discussions and decisions made through the process of deciding on Adaptive management recommendations. We can provide meeting notes in a standard format as appendices so that discussions are captured.

If recommendations are formatted in the “NEPA format” that could be time efficient in the future. Maybe have a table where there is an adaptive management threshold where if it passes that threshold, then there are the SOPs, referring back to the AMP. Do this table for every site and then it would be easy to review the transition of each site over years.

DECISION: A table would be added to the report for 2019, this is the tool we will use to discuss and decide on AM actions, and in future years it will be used to document the transition of each project.

Adaptive Management Recommendations

- Noxious Weeds –

Species	Location	Treatment Method	Treatment Timing	Decisions
Perennial pepperweed	RM's 104.5, 103, 100.5, 94	2% Imazapyr foliage treatment	Once per year, April-May	Careful of brand, Habitat preferred. Hand clearing where possible. Will have rosettes and some flowering in April
Ravenna grass	RM 99.5	Hand dig	Whenever detected	ASAP
Russian knapweed	RM 112, 99.5, 94	10% Glyphosate foliage treatment	Twice per year, first mid-July, secondly mid-September	Hand dig if possible. Rhodes may be the exception. Where we may hire a contractor to spray when required.
Whitetop	RM 93	2% Imazapyr foliage treatment	Once per year, April-May	Careful of brand, Habitat preferred. Hand clearing where possible. Will have rosettes and some flowering in April

DISCUSSION: Final report for 2020 will have both monitoring and maintenance actions for the year. How will we document the efficacy of the treatment? Weed visits will occur throughout the growing season to observe weeds before and after treatment. When we do these site visits, if we see a new patch of these weeds, treat immediately. If we state in our write ups for NEPA then we are covered for these additional treatments. Final deliverable for each field season will be a single report that includes all monitoring and management actions taken plus intern weed visits and any treatments that they do in that calendar year.

DISCUSSION: Streamline reporting so there is one report and Maintenance SOPs are consistent and thorough, so they don't have to be reiterated. Developing SOPs that are easy guides for SOBTF and interns to use in the field

Woody Non-native Vegetation

DISCUSSION: Aquatic-approved herbicide applied after stem is cut with loppers or saw. Thresholds for each species should be low, less than 5% for all species? Timing of treatment would be similar for all species.

Part of the reason why we assigned thresholds is because we didn't know what we were going to see in terms of exotic woody species. For exotic woody species, monitoring was just presence absence so we may not be targeting mature trees. Treatment will be opportunistic. If one species is greater than 5% we will be going out there anyway so all found out there in the same visit will be treated. The assumption is that treatment of exotic woody species would be more significant in the first few years after construction and in subsequent years more natives would establish and limit exotics. Goal written for natives was 25% of passive establishment over time. Exotics goal was to remove to 5% maximum.

How best to represent and track native versus exotic presence on the site? Maybe list them in order of dominance in Fulcrum.

DECISION: Track this monitoring procedure over time and refine as needed.

ACTION ITEM: Create table with new lower thresholds and recommendations and add to report (GSA)

Site	Saltcedar	Siberian Elm	Russian Olive	Any Exotic Species
RM 114	29%	0%	13%	42%
RM 112	11%	0%	6%	17%
RM 104.5 (Escond. East)	40%	0%	0%	40%
RM 103 (Escond. West)	13%	0%	2%	16%
RM 100.5	24%	1%	10%	35%
RM 100	26%	0%	3%	28%
RM 99.5	19%	0%	9%	28%
RM 93 (Rhodes)	45%	0%	4%	49%

Sediment Removal

DISCUSSION: native trees growing in channel maintenance zone, how will they be treated? In the channel maintenance zones, if vegetation becomes established in these zones, it is best to remove both vegetation and sediment.

DECISION: Remove native vegetation in channel maintenance zones each year even if there is no sediment deposition.

DECISION: All inlets cleared before flows come up.

ACTION ITEMS: ISC and GSA will meet to discuss what maintenance needs for sediment removal. 75% after 2,000 cfs inundation is the threshold used in the AMP.

ACTION ITEM: SOBTF and Socorro Field Division will need the quantities and locations for these requirements. SOBTF will look at report for quantities and will get estimates of costs from local contractors.

ACTION ITEM: After SOBTF gets cost estimates Ashlee will take locations and quantities to Chris Torres

Maintenance Needs Compliance Requirements and Timeline

DISCUSSION: Compliance will be done yearly and on each project individually because it is quicker, not a lengthy process. For this year compliance will be done to allow us to do the sediment removal prior to spring runoff and do the earlier noxious weed treatments.

DECISION: All inlets will be cleaned out before spring flow

2. Upcoming tasks/expectations for SOBTF in 2020 (group discussion)
    - Training and Tasks Timeline
        - February – Chad will get with Sarah on high level data management, begin training
        - March – be prepared for 800 cfs inundation mapping – GSA will assist Sarah this year
        - 2000 cfs or higher inundation mapping and flowtracker training will occur on the same day – SOBTF intern will need to be on board by early April
        - Mid-June or later Will will assist with noxious weed survey – may do just one survey instead of two this year
        - Woody vegetation training with Will in June before GSA contract expires; SOBTF monitoring August –September 2020
        - GSA has contract to guide maintenance – cut stakes and spot check maintenance, will provide recommended elevations for inflow, outflow features

DISCUSSION: There are designated spoil sites on some of the sites, check with Reclamation if these areas were seeded and if so are there alternate sites.

Photopoint Monitoring

ACTION ITEM: Sarah and Chad will work together to set up SOP and get the protocol set up for photopoint monitoring.

Groundwater Monitoring

ACTION ITEM: ISC and GSA will work on getting parts together. We will schedule a field trip for installation and discussion on grazing and UTV disturbance. Data log management by SOBTF or Trevor.

Satellite Imagery for 2020

DISCUSSION: Ashlee spoke to COE about requesting coverage for 2020. Follow up with the appropriate group to see if this is possible.

Deliverables and Sharing Information

DISCUSSION: How do we want to share information? Maybe two layers of information sharing. One with the internal meeting between ISC, FWS, and Reclamation when they meet on the BO. Second meeting would be for general information sharing would be with the MRGESCP and others to share what has been done to date.

ACTION ITEM: Grace will get on the agenda for the Biological Opinion Partners Meeting in April to share our data/project

ACTION ITEM: Ashlee will work with WEST to set up a series of talks on monitoring and AM.

1) Standardized Habitat Monitoring in the San Acacia Reach
2) Fish Monitoring at Habitat Restoration Sites on the Middle Rio Grande
3) Habitat Suitability Index Modeling for Habitat Constructed in the San Acacia Reach

Want people to know that this data is being collected and we have developed protocols for monitoring habitat.

Tentative schedule: February 21, 11 am-1 pm.

Update as of Feb. 4, 2020 – Talked with Debbie about doing a series of talks about habitat monitoring in the San Acacia Reach. She liked the idea and said she would get back to me on available dates. I'm not opposed to just advertising these talks through the program email list and hosting at Reclamation, then providing presentation slides for posting on the Program's website. Will need to make a decision on this by Thursday, February 6 if we plan to meet the February 21st date for the first talk. Thinking 11 am – 12 pm, Feb 21, Mar 20, April 17.

SOBTF Deliverables

- Shapefiles for inundation mapping at 800 & 2000 cfs and isolated pools
- Collection of depth, velocity, temperature data (Flowtracker II) (with GSA? Depending on discharge)
- Collection of noxious weed data (Fulcrum)
- Collection of woody vegetation data
- Report on maintenance tasks accomplished and observations during the season.

APPENDIX K
Standard Operating Procedures for Monitoring and Documenting Site Maintenance Treatments

STANDARD OPERATING PROCEDURES
FOR DOCUMENTING NON-NATIVE PLANT SPECIES TREATMENTS
AT SAN ACACIA REACH RESTORATION SITES

VERSION 1: MARCH 11, 2020

Below is a step-by-step guide for documenting non-native species treatments performed within restoration sites along the Middle Rio Grande. This information will be maintained in a detailed database that logs maintenance and adaptive management actions implemented during a project's lifespan. The purpose of the SOP is to ensure that treatment implementation is documented with sufficient consistency and detail to enable assessments of treatment effectiveness over time.

Version 1 of this SOP and associated EFF was developed to record non-native species treatments, regardless of patch size, within excavated floodplain features along the Isleta and San Acacia Reaches of the Middle Rio Grande. According to the current *Monitoring and Adaptive Management Plan* (GSA 2019a), a formal vegetation assessment is conducted annually, and the results of the vegetation survey are used to guide the location and necessity of non-native vegetation species treatment. The *Monitoring and Adaptive Management Plan* (GSA 2019a) also specifies adaptive management "triggers" which represent measurable thresholds to guide when specific maintenance treatments should be implemented. In practice, annual monitoring results are published in a *Draft Annual Monitoring Results Report* (e.g. GSA 2019b) and the information in that report is used to facilitate project adaptive management team discussions and prioritize annual maintenance treatments, if necessary. The recommended maintenance treatments are then compiled into a *Final Annual Monitoring Results and Maintenance Plan* (e.g. GSA 2020).

The specific adaptive management trigger (GSA 2019a) varies by non-native species as follows:

- Siberian elm (*Ulmus pumila*) and tree of heaven (*Ailanthus altissima*) treatment initiated when detected at >0% of grid cells.
- Saltcedar (*Tamarix spp*), Russian olive (*Elaeagnus angustifolia*), Mulberry (*Morus spp*) treatment initiated when detected at >5% of grid cells.
- Presence of any noxious herbaceous plant. Species of primary concern include: Bull thistle (*Cirsium vulgare*), Camelthorn (*Alhagi maurorum*), Canada thistle (*Cirsium arvense*), Perennial pepperweed (*Lepidium latifolium*), Ravenna grass (*Saccharum ravennae*), Russian knapweed (*Acroptilon repens*), Whitetop (*Cardaria draba*).

The following step-by-step procedures were developed to document details associated with non-native plant treatments across restoration project sites, including species, treatment method, treatment timing, site name, etc. **We assume that monitoring personnel are walking along-side the treatment crews and using the Avenza Maps to guide them to target plant locations. Thus, monitoring will be implemented at the same time that control treatments are being implemented.** This SOP Version 1 and the associated EFF should be amended as needed to improve efficiency and/or management application.

STEP 1: Review the non-native species distribution maps, recommended treatment methods, and recommended treatment timing described in the *Final Annual Monitoring Results and Maintenance Plan* to plan the treatment and monitoring schedule. Examples of treatment timing and treatment methods tables are shown below along with a sample noxious weed distribution map (examples extracted from GSA 2020).

Table 1. Number of patches of different New Mexico state listed noxious weed species documented at NMISC project sites

Site	Perennial pepperweed	Ravenna grass	Russian knapweed
RM 112			15
RM 100.5	2		
RM 100			
RM 99.5		12	
Treatment Method	2% Imazapyr foliage treatment	Hand dig	10% Glyphosate foliar treatment
Treatment Timing	Once per year, April-May	Before seed-set	Twice per year, first mid-July, secondly mid-September

Table 2. Proportion of monitoring grid cells containing exotic woody plant species

Site	Saltcedar	Siberian Elm	Russian Olive
RM 114	29%	0%	13%
RM 112	11%	0%	6%
RM 100.5	24%	1%	10%
RM 100	26%	0%	3%
RM 99.5	19%	0%	9%
Recommended Treatment Method and Timing	All non-native woody species should be treated using a cut-stump or foliar herbicide treatment with an aquatic approved imazapyr (e.g. Arsenal or Habitat) or glyphosate (Rodeo, AquaMaster) formulation. Cut stump application should be used on individuals with greater than one-inch basal stem diameter (bsd) and could be implemented year-round (as allowable per environmental compliance guidelines). A July-September foliar application is recommended for smaller individuals (i.e. seedlings with <1 inch bsd).		

STEP 2: Gather required gear – pinflags, a site map and tablet (GPS enabled, Fulcrum app, and Avenza Map app installed).

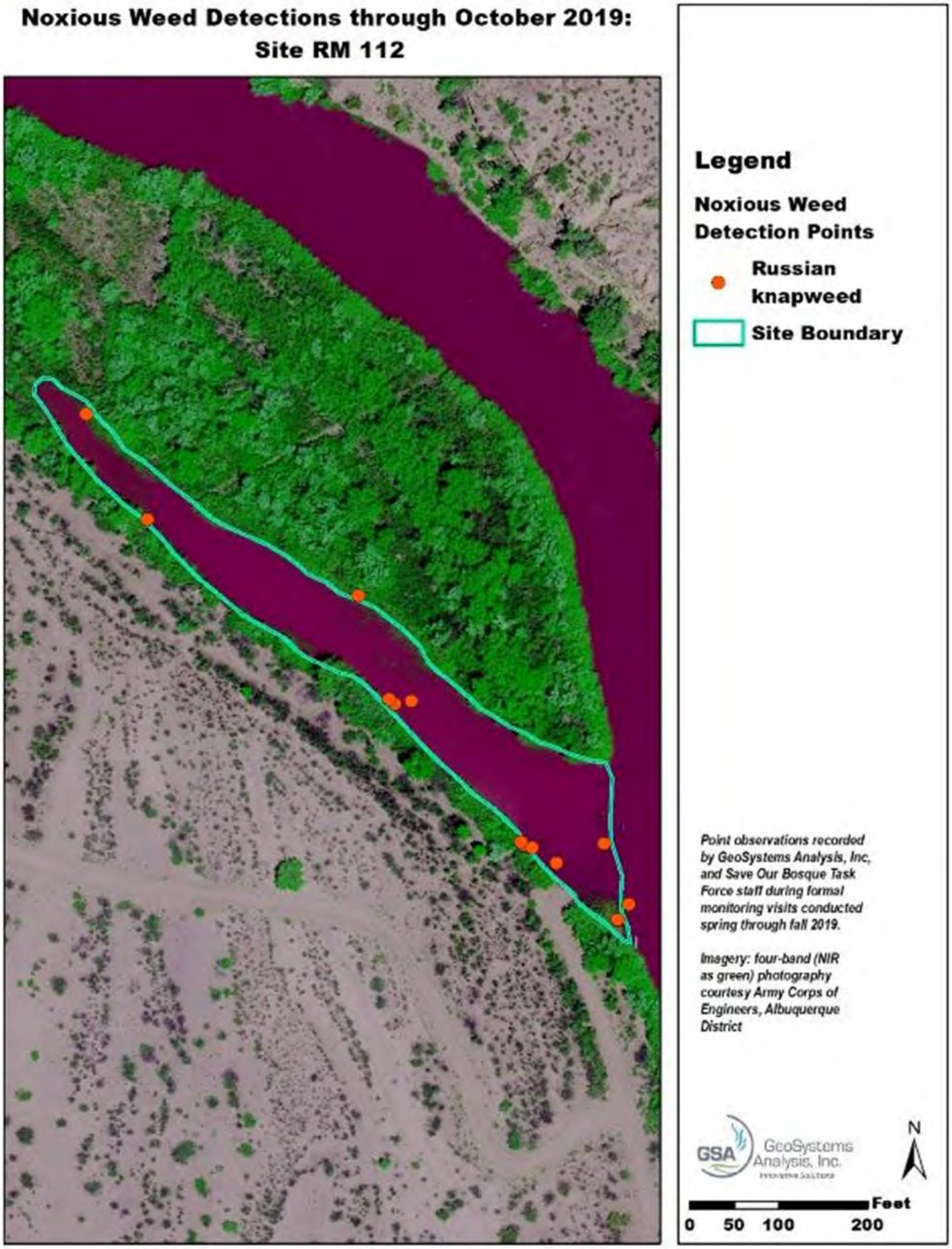

Figure 4. Noxious weed species populations documented at RM 112.

STEP 3: Once onsite, open the non-native species distribution map in Avenza Maps. Note that herbaceous noxious weed and non-native woody species detections are shown on separate maps. Avenza Maps will show your current location as a blue dot on the map. In the sample map shown above, monitoring personnel would locate Russian knapweed populations documented at the RM 112 site (shown as red dots on the map) via the Avenza Maps app.

STEP 4: Ensure that crews implementing control treatments follow the species-specific recommended treatment methods and timing described in the *Final Annual Monitoring Results and Maintenance Plan*. When herbicide treatments are recommended, confirm that implementation crews add a blue dye to the specified herbicide formulation so treatment quality can be accurately assessed.

STEP 5: While detection maps are expected to be accurate and representative of current site conditions, also treat additional target species populations that may not be shown on the map, if identified.

STEP 6: After the treatment is applied through the entire site, use Avenza Maps to conduct a quality control inspection of herbicide treatments and ensure blue dye is visible on all individuals within the target population. Use pinflags to mark the location of untreated individuals as identified and return with implementation crews to spray untreated individuals as quickly as possible (ideally within a few hours).

STEP 7: General notes, photos, and other observations will be recorded on an Electronic Field Form (EFF) via the Fulcrum App. This information is critical for documenting treatment implementation and promoting the assessment of treatment effectiveness. Representative field photos should be recorded with each record. Open the Fulcrum App on your mobile device.

STEP 8: Select the App titled *San Acacia HR Maintenance App*. Once open, the App will display the list of existing records logged using this App.

STEP 9: Press the + sign on the App to create a new field record. Begin filling out the EFF. All relevant fields must be completed, or the App will not allow you to save the electronic record. Required fields are specific to the type of treatment logged and indicated by an asterisk (*).

STEP 10: Complete all general fields at the top of the form (site, date, observer(s), entity implementing treatment). Under *Type of Adaptive Management Treatment Implemented*, select 'Non-Native Species Treatment' and then press Done to return to the field form.

STEP 11: Select the *General Type of Treatment* (woody or herbaceous) being implemented. A new section automatically becomes visible on the form depending on the type of treatment selected. Fill out all relevant fields.

<u>Save the Record:</u> Click *Save* in the upper right corner of the screen (left screenshot below). The App will not allow you to save the record if any required fields have not been completed. If you receive this message, follow prompts to complete missing fields and then press *Save*. When the record is successfully saved you will see your record in the list containing all records saved in the *San Acacia HR Maintenance App*.

STANDARD OPERATING PROCEDURES
FOR IMPLEMENTING AND DOCUMENTING ADAPTIVE MANAGEMENT ACTIVITIES
IN CHANNEL MAINTENANCE ZONES
AT SAN ACACIA REACH RESTORATION SITES

VERSION 1: MARCH 11, 2020

Below is a step-by-step guide for implementing and documenting adaptive management activities in channel maintenance zones within restoration sites along the Middle Rio Grande. This information will be maintained in a detailed database that logs maintenance and adaptive management actions implemented during a project's lifespan. Version 1 of this SOP and associated EFF was developed to record channel maintenance zone (CMZ) vegetation and/or sediment removal. According to the current *Monitoring and Adaptive Management Plan* (GSA 2019a), a formal vegetation assessment is conducted annually, and the results of the vegetation survey are used to guide the location and necessity of CMZ vegetation removal. Additionally, the inundation perimeter is field documented with Global Positioning System (GPS) when the rising limb of the spring hydrograph reaches 800-1,000 cfs and again when the ascending limb hits 2,000 cfs. The results of the inundation mapping help guide whether sediment removal would be required to maintain hydrologic function.

The *Monitoring and Adaptive Management Plan* (GSA 2019a) also specifies that 1) "designated CMZs near backwater channel inlets/outlets will remain void (0%) of any woody vegetation over the life of the project"; and, 2) Surface water begins inundating the project site near the backwater channel inlet(s) when snowmelt discharge at the San Acacia gage is approximately 800-1000 cfs". When the site inundation targets are no longer achieved, real-time kinematic (RTK) GPS surveys should be performed to pinpoint and quantify sediment accumulation within the site(s).

In practice, annual monitoring results are published in a *Draft Annual Monitoring Results Report* (e.g. GSA 2019b) and the information in that report is used to facilitate project adaptive management team discussions and prioritize annual maintenance treatments, if necessary. The following step-by-step procedures were developed to assist with guiding vegetation and/or sediment removal from CMZ and documenting implementation details associated with these activities so the information can be seamless integrated with the project database.

VEGETATION MAINTENANCE IN CMZS

The following procedures assume that woody vegetation is young and suitable for hand treatment. For hand removal to be realistically implemented, treatment needs to occur on an annual basis. However, the site preparation and documentation process are still applicable if mechanical removal (e.g. scraping and/or excavation) is required because woody vegetation has matured beyond the point that hand treatment is applicable. If sediment removal is scheduled, woody vegetation removal may not be necessary because vegetation would be removed during sediment excavation.

STEP 1: Review the distribution of woody vegetation relative to designated CMZs published in maps contained in the *Final Annual Monitoring Results and Maintenance Plan.*

STEP 2: Gather required gear – wood lathe, tape flagging, hand tools (hoop hoe, shovel, etc), mallet, a site map and tablet (GPS enabled, Fulcrum app, and Avenza Map app installed).

STEP 3: Once onsite, open the CMZ map in Avenza Maps. The app shows your current location as a blue dot on the map. Use Avenza Maps to navigate to the CMZ(s) targeted for vegetation management.

STEP 4: Via referencing the CMZ perimeter on Avenza Maps, stake the boundary of each CMZ with wood lathe and tie tape flagging on top of the lathe to improve visibility.

STEP 5: Locate and remove woody vegetation species growing within the CMZ. Use hand tools to completely remove (including roots) all native woody species rooted within the CMZ. Note that this SOP assumes that non-native woody species would also be maintained (primarily via herbicide application) throughout the sites. Thus, young non-native seedlings should only be removed by hand when the entire root system can be confidently removed or destroyed. When in doubt, herbicide treatment is preferred over hand treatment for non-native woody species.

STEP 6: After the treatment is applied through the entire CMZ, conduct a quality control inspection and ensure all native woody species have been removed. Remove untreated individuals as identified.

SEDIMENT REMOVAL FROM CMZS

STEP 1: Review the maps in the *Final Annual Monitoring Results and Maintenance Plan* showing the volume and distribution of sediment relative to within CMZs. The *Final Annual Monitoring Results and Maintenance Plan* also includes recommended elevation targets for each inlet, as shown below.

STEP 2: Gather required gear – RTK-GPS, wood lathe, survey hubs, survey control data, elevation target table, spray paint, tape flagging, mallet, permanent marker, a site map and tablet (GPS enabled, Fulcrum app, and Avenza Map app installed).

STEP 3: Once onsite, open the CMZ map in Avenza Maps. The app shows your current location as a blue dot on the map, use Avenza Maps to navigate to the CMZ(s) targeted for sediment removal. Via referencing the CMZ perimeter indicated on Avenza Maps, stake the boundary of each CMZ with wood lathe and tie tape flagging on top of the lathe to improve visibility.

Table 18. Target elevations for NMISC project sites and RM 93 (Rhodes).

Site	Inlet Number	Target Elevation
114	1 and 2	4648.0
112	1	4639.4
100.5	1	4597.0
	2	4596.0
100	1	4595.5
99.5	1	4594.5
	2	4594.0
	3	4593.5
93	1	4571.3
	2	4571.0
	3	4570.7
	4	4570.5
	5	4570.2
	6	4569.8
	7	4569.5
	8	4569.4
	9	4569.1
	10	4569.0
	11	4568.4

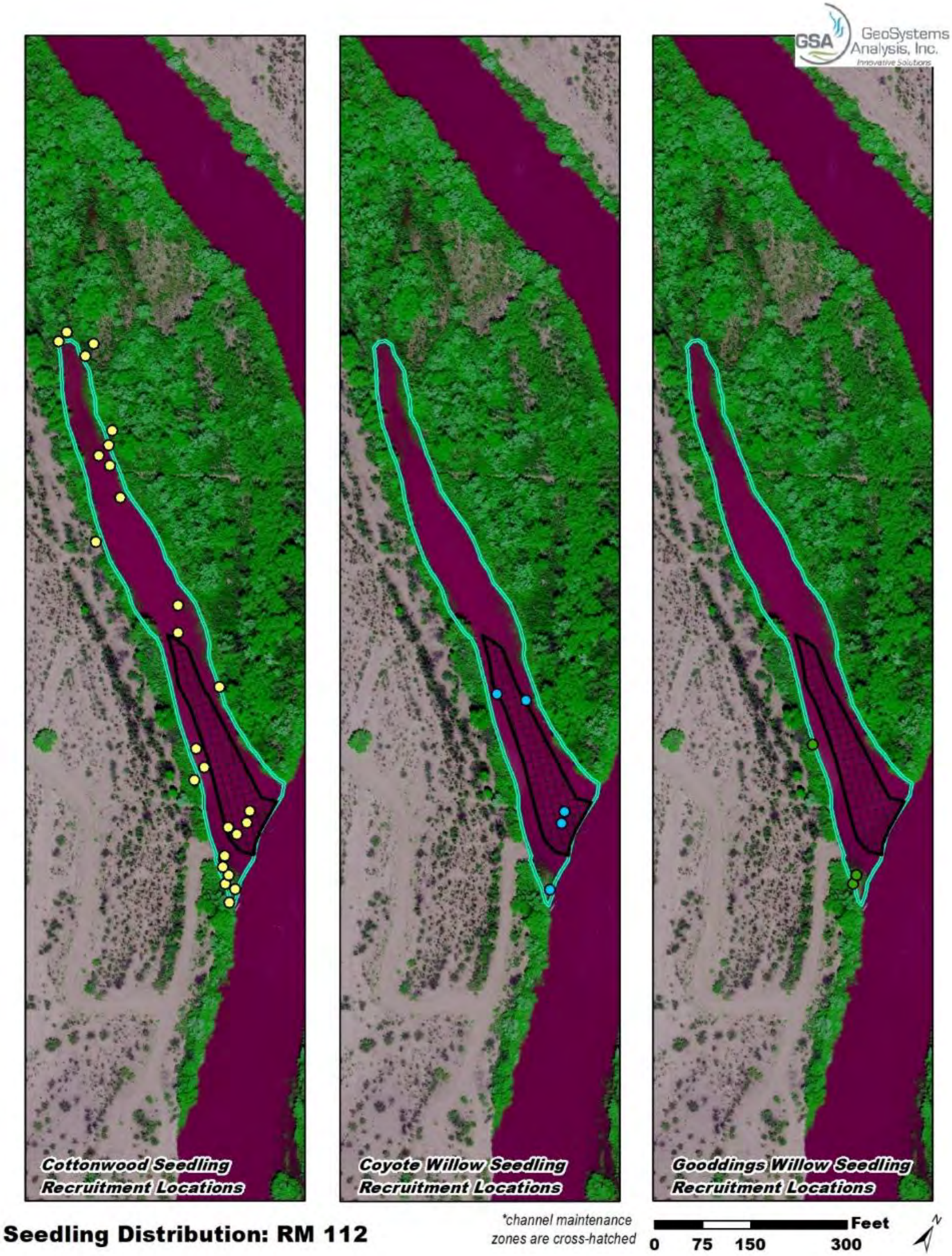

Figure 5. Woody vegetation species distribution relative to CMZs at RM 112.

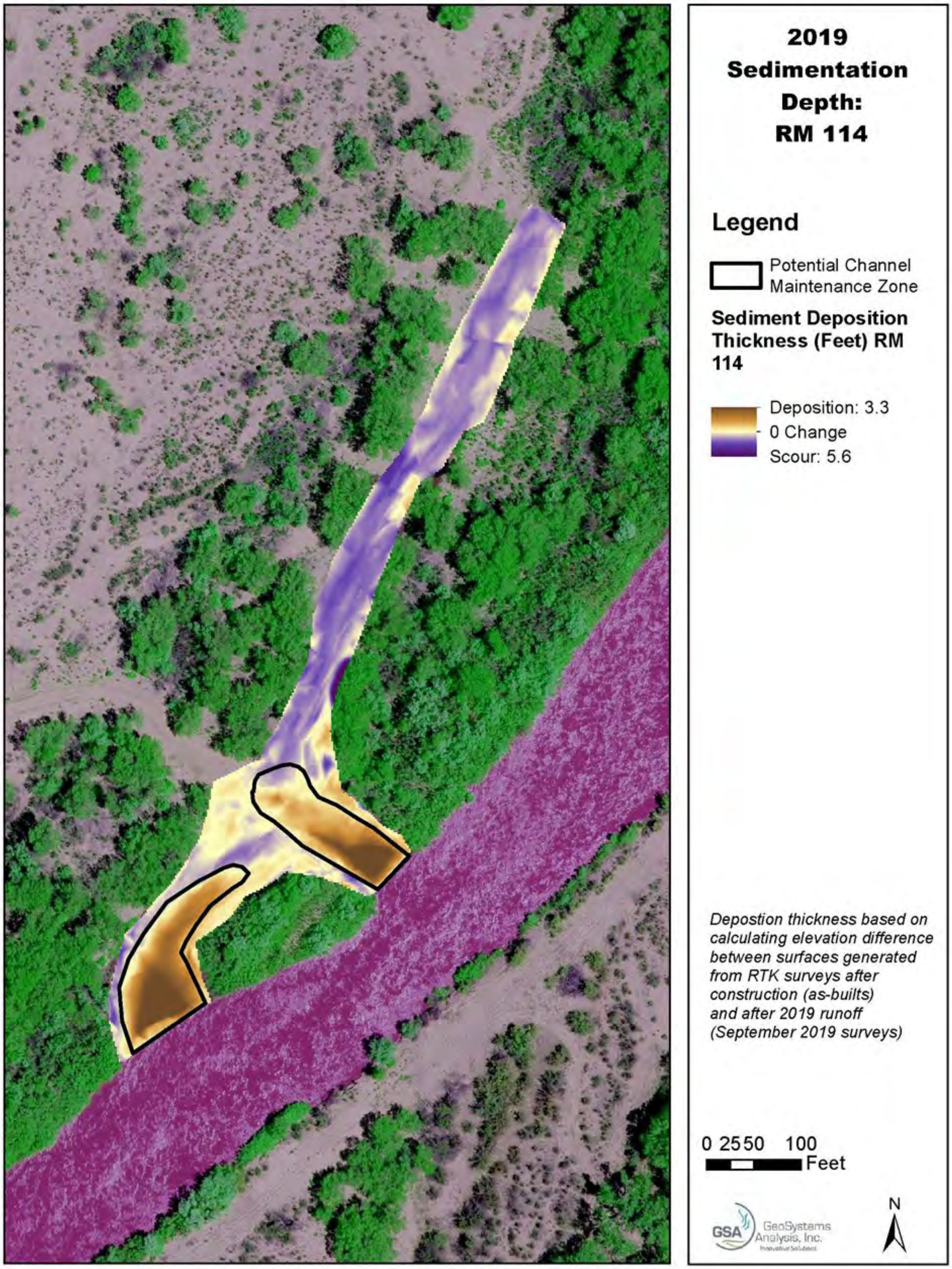

Figure 6. Post-runoff sedimentation and scour at the RM 114 site.

STEP 4: Setup the RTK-GPS base and establish survey controls. Most sites have nearby U.S. Bureau of Reclamation rangeline endpoints or other pre-established survey controls. Initialize the RTK-GPS rover, walk to each inlet, and pound a survey hub in the ground along the river bankline. Spray paint the survey hub to improve visibility. Use the stakeout commands and traditional survey practices to install and label a cut stake at the inlet/river interface. The cut/fill depth should be clearly marked to the nearest 0.1 foot. Use tape flagging and spray paint to improve cut stake visibility. Establish survey offsets and/or additional cut stakes as needed or requested by the heavy equipment operator.

STEP 5: The heavy equipment operator will then remove sediment from the inlet down to target grade. The CMZ edges should have smooth landform transitions that blend with the natural terrain oustside the CMZ.

STEP 6: Utilize RTK-GPS to spot check grade during and after sediment removal. Ensure that target elevations are achieved (typically within 0.25 foot), the inlet slopes back towards the river to promote drainage, and the CMZ does not contain sinks or depressions that may trigger formation of a remnant pool.

CMZ MAINTENANCE DOCUMENTATION

STEP 7: General notes, photos, and other observations will be recorded on an Electronic Field Form (EFF) via the Fulcrum App. This information is critical for documenting implementation of all maintenance activities. Representative field photos should be recorded with each record. Open the Fulcrum App on your mobile device.

STEP 8: Select the App titled *San Acacia HR Maintenance App*. Once open, the App will display the list of existing records logged using this App.

STEP 9: Press the + sign on the App to create a new field record. Begin filling out the EFF. All relevant fields must be completed, or the App will not allow you to save the electronic record. Required fields are specific to the type of treatment logged and indicated by an asterisk (*).

STEP 10: Complete all general fields at the top of the form (site, date, observer(s), entity implementing treatment). Under *Type of Adaptive Management Treatment Implemented*, select 'Channel Maintenance Zone Vegetation Removal' or 'Sediment Removal', depending on the activity completed, and then press Done to return to the field form. Make sure to log detailed relevant notes. If sediment removal occurred, note where the spoils were placed.

Save the Record: Click *Save* in the upper right corner of the screen (left screenshot below). The App will not allow you to save the record if any required fields have not been completed. If you receive this message, follow prompts to complete missing fields and then press *Save*. When the record is successfully saved you will see your record in the list containing all records saved in the *San Acacia HR Maintenance App*.