BUREAU OF RECLAMATION

Technical Report # ENV-2023-021

Middle Rio Grande Yellow-billed Cuckoo Study Results – 2022

Isleta Pueblo to Elephant Butte Reservoir, New Mexico
UCB Region

U.S. Department of the Interior

June 2023

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Cover Photo: Cuckoo habitat along the Rio Grande in the Narrows. (Reclamation/M. White/2023)

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U.S. Department of the Interior June 2023

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UCB Region

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Acronyms and Abbreviations

ft	foot/feet
ha	hectare
km	kilometer
LFCC	Low Flow Conveyance Channel
m	meter
NWR	National Wildlife Refuge
Reclamation	Bureau of Reclamation
RM	river mile
USFWS	U.S. Fish and Wildlife Service
YBCU	Yellow-billed cuckoo

Symbols

%	percent
+/-	plus or minus

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Executive Summary

During the summer of 2022, Bureau of Reclamation personnel conducted presence/absence surveys for the federally threatened Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*; YBCU) within the Middle Rio Grande riparian corridor between the Isleta Pueblo, New Mexico to Elephant Butte Reservoir. In accordance with established protocols, surveys were conducted during the cuckoo breeding season (June 15 to August 15) to determine the distribution and abundance of YBCU throughout this stretch of the Middle Rio Grande.

Within the 2022 breeding season, 480 YBCU detections were recorded within the Middle Rio Grande Survey Area. From these detections, 122 territories were delineated: 50 probable breeding pairs and 72 possible breeding pairs, as defined in Halterman et al. (2016). As in previous years, the San Marcial Reach contained the largest breeding population of YBCUs within the Middle Rio Grande study area, with 317 detections and an estimated 79 breeding territories. Sixty-nine of these territories were in the exposed pool of Elephant Butte Reservoir (EBR) subset of the San Marcial Reach. The Bosque del Apache Reach had the second highest number of territories (14) from 46 detections. The Belen and Sevilleta Reaches each had 11 territories from 40 and 50 detections, respectively. Other river reaches were either not surveyed or surveys were reduced in 2022 due to lack of personnel. The San Acacia Reach was not surveyed in its entirety, but 6 territories were delineated from 24 detections. Only two sites were surveyed in the Escondida Reach in 2022, just north of the Bosque del Apache, with one territory and three detections found. No surveys were conducted in the Tiffany Reach and in the northernmost sites of the San Marcial Reach.

Introduction

The federally threatened Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), hereafter referred to as YBCU or cuckoo, is a Neotropical migratory bird found in the southwestern United States, including along the Middle Rio Grande. Cuckoos typically arrive on breeding grounds in the Southwest by late May and initiate migration to wintering grounds in Central and South America by mid-August (Halterman et al. 2000). During the breeding season, YBCUs establish large territories; radio telemetry studies identified core use areas between 2 and 36 hectares (ha) and home ranges as large as 216 ha in the Middle Rio Grande (Dillon and Moore 2020). Average YBCU nest heights range from 1.3 to 14.5 meters (m; McNeil et al. 2015, Halterman 2001) which correlates with nests found in the Middle and Lower Rio Grande study areas. The nesting pair shares incubation responsibilities, occasionally accompanied by a helper male. The young will fledge approximately 17 days after initial egg laying (Halterman 2001). The cuckoo diet primarily consists of larger insects including green caterpillars, katydids, cicadas and other small prey (Laymon 1998).

YBCUs generally nest in large, dense patches of riparian vegetation, particularly with a cottonwood (*Populus deltoides*) or Goodding's willow (*Salix gooddingii*) overstory (Ehrlich et al. 1988, Hughes 1999, USFWS 2014). YBCU territories often include a dense understory component, comprised of exotic saltcedar (*Tamarix* spp.), Russian olive (*Elaeagnus angustifolia*) or native vegetation (e.g., *Salix* species; Sechrist et al. 2009). Early successional restoration areas may readily attract YBCUs, but occupancy and population growth appear to be short term (Wohner 2021). While Eastern yellow-billed cuckoos (*C. americanus americanus*) extensively use saltcedar along the Pecos River (Sechrist and Best 2014), habitat models suggest increasing saltcedar coverage, and/or the limited presence of native habitat, discourage YBCU occupancy (Johnson et al. 2017). Loss or modification of habitat, changes in hydrology and use of pesticides have all been attributed to population and range declines, while climate change and other unknown factors appear to be hindering range wide recovery (Gaines and Laymon 1984, USFWS 2014, Mayor et al. 2017).

YBCUs are protected under the Endangered Species Act (ESA). Once common across riparian habitats of the western United States up to British Columbia, Canada, its current range is confined to small populations within the Southwest, including the Rio Grande floodplain. In 2001, the U.S. Fish and Wildlife Service (USFWS) determined that the Western Distinct Population Segment was distinct from the Eastern population, with the division being the continental divide from Montana to central Colorado; the eastern boundary of the Rio Grande drainage from central Colorado to Texas; and the mountain ranges that form a southeastern extension of the Rocky Mountains to the Big Bend area in West Texas (USFWS 2009; Figure 1). After being proposed for listing in 2013, on November 3, 2014, the YBCU's threatened listing became effective under the Endangered Species Act (USFWS 2014). The YBCU is also listed as threatened, endangered, or sensitive by the states of California, Arizona, New Mexico (NM), Colorado, and Utah.

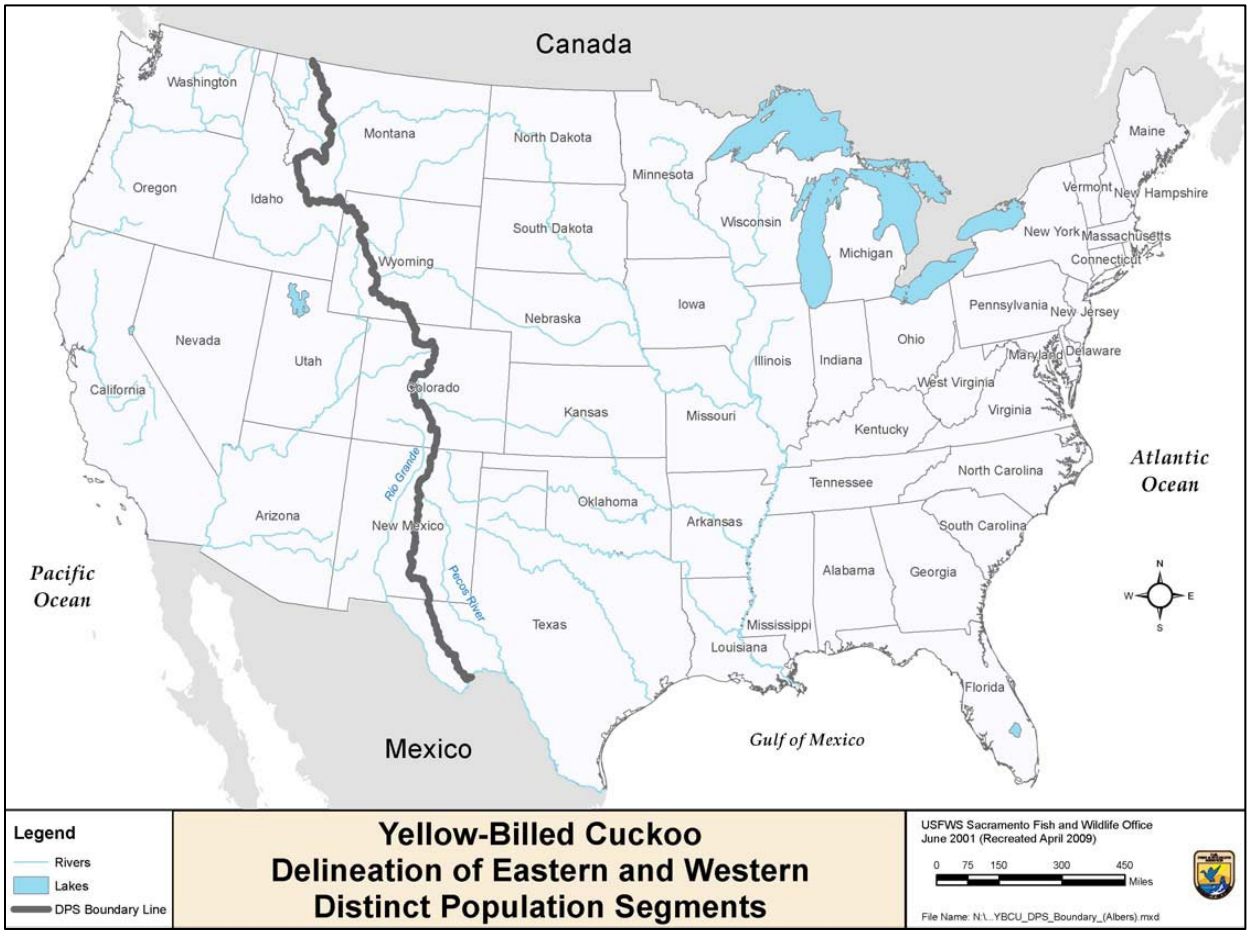

Figure 1. Delineation of distinct population segments of YBCUs (USFWS 2009).

Critical Habitat for the Western Distinct Population was published in 2021 and includes Rio Grande floodplain habitat from Los Lunas, NM to Elephant Butte Reservoir, NM. Although most of the detections and territories in the Middle Rio Grande study area have been found within the exposed pool of Elephant Butte Reservoir, most of the reservoir delta was excluded from Critical Habitat. Given Reclamation's Western Yellow-billed Cuckoo Management Plan, current management practices and ongoing commitments, USFWS determined that the benefits of exclusion outweigh the benefits of inclusion.

Cuckoos were observed the Middle Rio Grande between 1998 and 2005 during Southwestern Willow Flycatcher (*Empidonax traillii extimus*) surveys. To determine the distribution and abundance of YBCUs in the Middle Rio Grande, Reclamation initiated formal presence/absence surveys in 2006 within the exposed pool of the Elephant Butte Reservoir, when 3 surveys were conducted per season. By 2014, the survey area had expanded to the southern boundary of the Isleta Pueblo. The current protocol, which includes 4 surveys per season, began in 2009. This report covers all current year results and reach summaries for prior years.

Methods

Study Area

Reclamation's Middle Rio Grande survey area covers the Rio Grande riparian corridor between the southern boundary of the Isleta Pueblo to Elephant Butte Reservoir. It is divided into 7 river reaches that include 153 survey sites. In 2022, 109 sites within 6 reaches were surveyed (Figure 2). Most survey sites lie within the active floodplain except for the Low Flow Conveyance Channel (LFCC) sites in the San Marcial Reach that lie to the west of the active floodplain. Riparian vegetation comprised of native willows and cottonwoods, or exotic saltcedar and Russian olive, dominates most sites and varies in height, age, and density. Most reaches contain Critical Habitat, which extends from within the Belen Reach (river mile [RM] 163.5) to one mile south of the confluence between the LFCC and Rio Grande (RM 54; Figure 2; USFWS 2021).

The Belen Reach is the northernmost reach, extending 39.5 RM downstream from the south boundary of the Isleta Pueblo (RM 166) to the confluence of the Rio Grande and Rio Puerco (RM 126.5). Approximately 2,889 ha of riparian habitat was mapped within this reach. Native-dominated overstory covers approximately 63 percent of the total survey area, mostly open cottonwood galleries (Siegle and Moore 2022). Only 14 percent of the total reach is considered suitable YBCU breeding habitat. Much of the reach lacks annual overbank flooding and remains dry throughout the breeding season. However, widespread overbank flooding occurred in the spring and summer of 2010, 2017 and 2019. Willows and other native understory have developed in low-lying areas, islands, and riverbanks. The entire reach was surveyed in 2022.

The Sevilleta Reach extends 10.5 RMs from the confluence of the Rio Grande and Rio Puerco (RM 126.5) to San Acacia Diversion Dam (RM 116) and includes areas of the Sevilleta National Wildlife Refuge (NWR) and the La Joya Wildlife Management Area. Of the 1,449 ha of mapped area, only 8 percent was considered suitable YBCU habitat (Siegle and Moore 2022). Monotypic stands of saltcedar or Russian olive are common, but native vegetation is established on exposed riverbanks and lower terraces adjacent to the active channel where overbank flooding typically occurred during high flows prior to 2010. Subsequent river incision restricts overbank flooding to lower terraces. Native canopy dominates 36 percent of the habitat (Siegle and Moore 2022). The entire reach was surveyed in 2022, aside from SV-08, which is never surveyed.

The San Acacia Reach extends downstream approximately 12 river miles from San Acacia Diversion Dam (RM 116) to Escondida Bridge (RM 104) comprising 951 ha of riparian vegetation. This is a long narrow reach constricted by riverside levees and upland vegetation. Typical habitat consists of dense saltcedar and/or Russian olive, with occasional New Mexico olive (*Forestiera pubescens*). There are also several large cottonwood galleries in this reach, with native-dominated canopy comprising 32 percent of the area. Although limited in extent, several patches of higher quality YBCU habitat can be found on the lower terraces (2 percent, Siegle and Moore 2022). Two sites between RMs 116 and 108 were surveyed in 2022 where habitat is considered unsuitable but continues to be occupied by YBCUs.

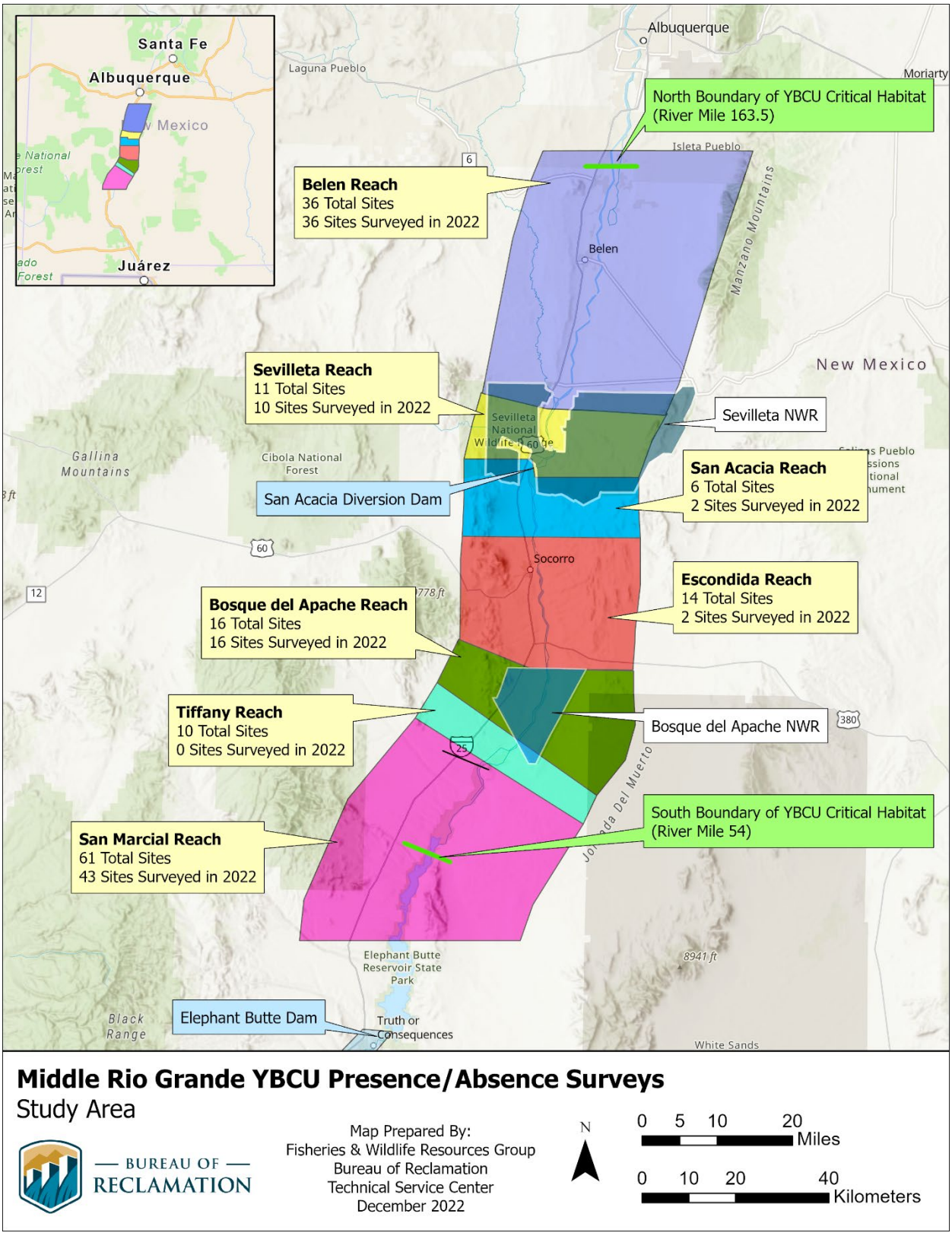

Figure 2. Middle Rio Grande survey reaches.

The Escondida Reach extends 20 river miles downstream from Escondida Bridge (RM 104) to the north boundary of the Bosque del Apache National Wildlife Refuge (NWR; RM 84) and encompasses 1,769 ha of riparian habitat and 2 percent YBCU suitable habitat (Siegle and Moore 2022). River dynamics in the reach are limited by the San Acacia Diversion Dam, with periodic flooding on lower terraces. Persistent drought and frequent river drying have caused the native habitat to show signs of stress and a decline in suitability. The drier portions of this reach support sparse, shrubby saltcedar and seep willow (*Baccharis salicifolia)* with intermittent cottonwood overstory. The Escondida Fire burned approximately 212 ha in the northern end of the reach in June 2016. Only two sites were surveyed in 2022, bordering the Bosque del Apache NWR between RMs 87 and 84.

The Bosque del Apache Reach comprises 1,227 ha of riparian habitat within the active floodplain of the Bosque del Apache NWR (RMs 84 to 74; Siegle and Moore 2022). A large component of the riparian habitat within this reach is native canopy (58 percent). Twenty-four percent of habitat is considered suitable for YBCU breeding (Siegle and Moore 2022). Occasionally, extensive overbank flooding occurs in this reach during high river flows, particularly during the 2017 and 2019 breeding seasons. However, the river regularly dries during low-flow periods in the summer. Following the channel realignment to the east in 2019 and 2020, habitat developed on the eastern side of this Reach while native habitat along the old channel to the west died off. The entire reach was surveyed in 2022.

The Tiffany Reach extends from the southern boundary of the Bosque del Apache Reach to the San Marcial railroad trestle (RMs 74 to 69). The 2017 Tiffany Fire severely burned most of the vegetation within this reach and no surveys have been conducted since that time due to lack of suitable avian habitat.

The San Marcial Reach extends from the San Marcial railroad trestle (RM 69) to the Elephant Butte Reservoir Delta (RM 37) and has both the largest expanse of riparian habitat of any reach in the study area (6,198 ha) and the greatest abundance of suitable YBCU habitat (1,944 ha; Siegle and Moore 2022). Vegetation in the upstream portion of the reach (RM 60 to 69) has become increasingly decadent and dominated by saltcedar and overbank flooding is nearly nonexistent. The Tiffany (2018), Fort Craig 1 (2020) and RM 60 (2022) fires burned large tracts of habitat west of the river between RM 60 to 69.

The exposed pool of Elephant Butte Reservoir, south of RM 60, included both several hundred ha of Goodding's and coyote willow habitat that developed as the reservoir receded, some of which continues to provide high quality cuckoo breeding habitat, as well as monotypic saltcedar stands that developed where hydrology became unsuitable for native vegetation. Habitat south and west of the LFCC outfall was more frequently flooded or wetted by flows from an unmaintained drainage downstream of the LFCC which supports native and occupied habitat. Although, over time, saltcedar has expanded in this stretch. Much of the native habitat within the upper pool has begun to show signs of stress, resulting in a reduction in foliage density and subsequently a decline in habitat suitability. This reach has been surveyed annually since 2006, with subtle increases in the extent of the survey area downstream as the reservoir receded over the past several years. In 2022, all sites south of RM 60 were surveyed, as well as select sites north of RM 60.

Presence/Absence Surveys

Cuckoo surveys were conducted using methodology outlined in the 2016 Cuckoo Natural History Summary and Survey Protocol (Halterman et al. 2016). All surveyors were required to attend protocol training prior to conducting formal surveys.

For each survey, surveyors used the repeated call-playback method throughout all suitable habitat in their designated survey site. The prerecorded "*kowlp*" call was broadcast using a wireless speaker for 20 to 30 seconds, followed by a one-minute pause to allow for a YBCU response. This procedure was repeated five times, or until a YBCU response was detected. If no response was detected, surveyors walk 100 m and repeat the call/pause sequence. If a response was heard, the observer stopped playback, recorded their observations, and walked 300 m before repeating the procedure, in order to reduce the potential for duplicate counting of individuals.

Four surveys were conducted at least 12 days apart within three survey periods between 5:30 am and 11:00 am (Table 1). Multiple surveys were conducted to increase the likelihood of detections, the probability of positively identifying occupied locations during the breeding season, and to aid in the determination of breeding status.

Table 1. YBCU survey periods

Survey number	Survey period
1	June 15 to June 30
2 & 3*	July 1 to July 31
4	August 1 to August 15

* Mid-season start and end dates can be +/- three days.

All four surveys were conducted within the YBCU resident period and, therefore all detections were assumed to be those of resident paired or unpaired cuckoos and not of migrants. A single individual may have multiple detections over the season. Survey data were recorded on field forms which were subsequently transferred to electronic survey forms, a digital spreadsheet, and a geospatial database. The actual location of the detected cuckoo was derived from the surveyor's location, the compass bearing to the detected YBCU, and an estimated distance.

Territory Estimation

Defining territory boundaries is complicated by several factors. YBCUs have large, undefended territories that can overlap with other pairs. Individuals can travel more than 500 m per day and more than 3 kilometers (km) during the breeding season based on telemetry data (Sechrist et al. 2009). Determining which birds belong to a single territory is further complicated by being unable to differentiate males and females by call as they both make 'coo', 'kowlp', and 'knocker' calls, and the possibility a third adult (helper male) may be present (Halterman, pers. comm. 2008). Surveys conducted later in the breeding season (i.e., Surveys 3 and 4) could also detect hatch year fledglings that have dispersed from the nest site into surrounding areas, resulting in an overestimation of breeding pairs based on detections. Projected YBCU locations are calculated from surveyor UTM coordinates, distance, and compass bearing, all of which have inherent estimation errors, particularly with aural detections.

The following rules are used to estimate breeding YBCU territories based on survey detections:

1. A YBCU territory must have a minimum of 2 detections less than 500 m apart during at least 2 surveys of the 4 total surveys (Figure 3, Example 1). If these conditions are not met, the detections are not considered to be part of a breeding territory, but rather to be floater detections.

2. No more than 3 detections within 300 m during the same survey period can be included within a single YBCU territory. More than 2 YBCU detections during the same survey period in an area less than 300 m apart suggests multiple breeding territories (Figure 3, Example 2).

3. YBCU clumping patterns should be evaluated based on the number and proximity of detections during individual survey periods. Ideally, multiple discrete detections within 300 m of each other over multiple surveys are needed to confirm a breeding territory (Figure 3, Example 3).

4. Although YBCU territories can overlap, "natural breaks" between detection clumps, regardless of distance, should be considered when delineating territories (Figure 3, Example 4).

5. "Best biological judgment" should prevail when delineating and estimating YBCU territories. Habitat suitability and abundance, as well as the distribution of YBCU detections over the entire breeding season should be considered when delineating breeding territories.

Territories are categorized as Possible breeding territories (PO), for two or more distinct YBCU detections over two survey periods, Probable breeding territories (PR) for three or more detections over three survey periods or Confirmed breeding territories (CO) for finding a nest or observing nest building, copulation, or fledglings (Halterman et al. 2016). A center point for each territory was assigned for mapping purposes.

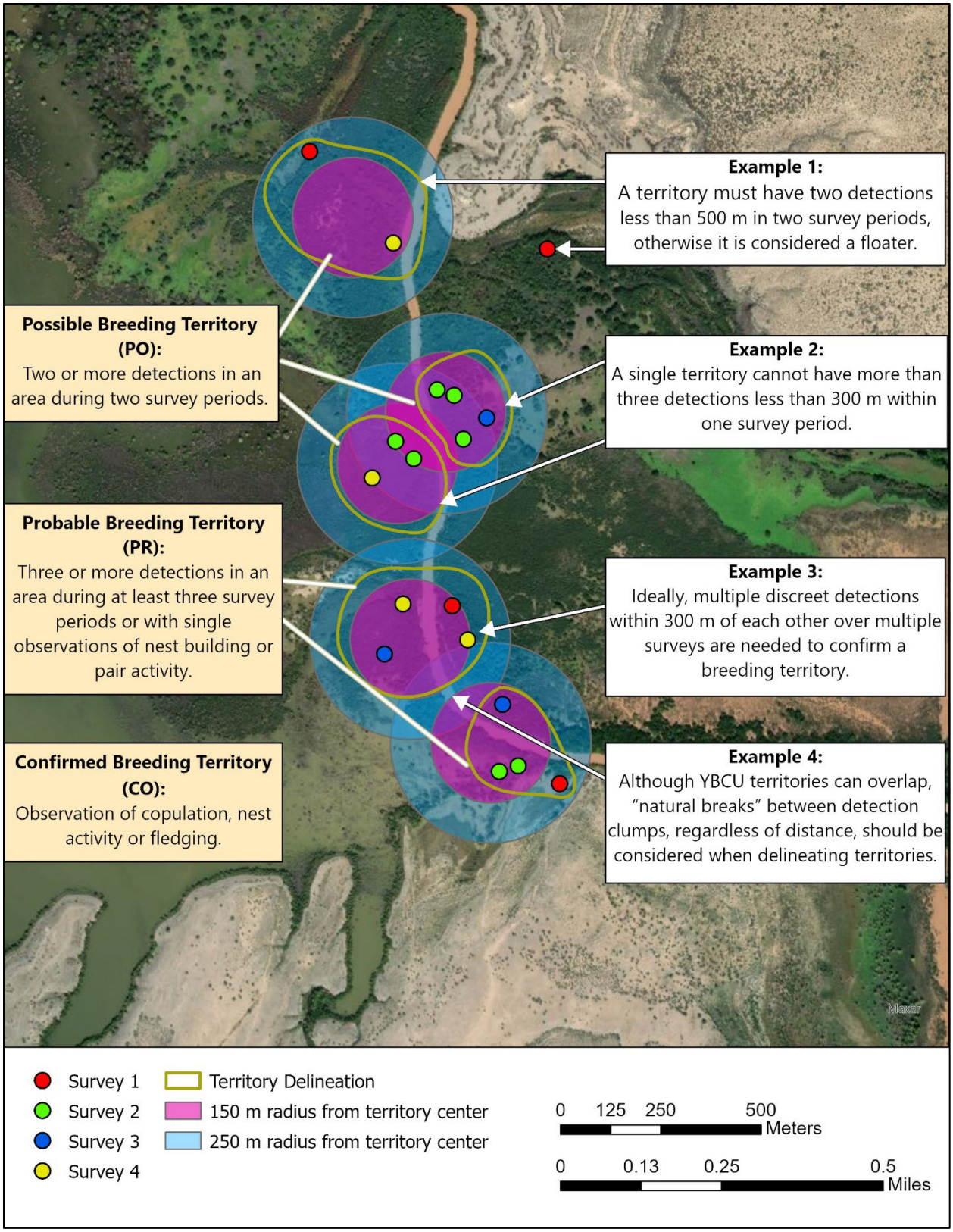

Figure 3. Examples of YBCU territory estimations.

Results

Presence/Absence Surveys

During the 2022 breeding season, 480 YBCU detections were recorded within the Middle Rio Grande study area. These detections were delineated into 122 estimated breeding territories, including 72 possible territories and 50 probable territories (Table 2). As in previous years, most detections (66.0 percent) and territories (64.8 percent) were located within the San Marcial Reach, mostly within the Elephant Butte Reservoir sites south of RM 60 (56.6 percent of total, Table 2). The Bosque del Apache Reach supported the highest number of territories outside of the San Marcial Reach. While eleven territories were delineated in both the Sevilleta and Belen Reaches, the Sevilleta includes a much smaller stretch of the Rio Grande.

Table 2. Number and percentage of 2022 YBCU detections and territories by river reach

River Reach	Detections	%	Territories	%
Belen	40	8.3	11	9
Sevilleta/La Joya	50	10.4	11	9
San Acacia	24*	5	6	4.9
Escondida	3*	0.6	1	0.8
Bosque del Apache	46	9.6	14	11.5
Tiffany	NS	0	NS	0
San Marcial	317*	66	79	64.8
Total	**480**	**100**	**122**	**100**
Elephant Butte Reservoir**	278	57.9	69	56.6

*Select sites surveyed in Reach

**Elephant Butte Reservoir is a subset of the San Marcial Reach

Spatial distribution and abundance of the 2022 YBCU detections and territories throughout the study area is presented in Appendix A. Sections of the study area where no sites were surveyed in 2022 were not mapped in the figures.

Discussion

Presence/Absence Surveys

Since 2009, surveys documented a persistent YBCU population, particularly within the San Marcial Reach (Table 3). However, trends in population and range need to be interpreted carefully. Following the expansion of the Belen and San Marcial Reaches in 2014, survey effort remained relatively consistent until budget shortfalls (2019), limitations imposed by the COVID-19 pandemic (2020 and 2021) and staff shortages (2022) reduced the number of sites surveyed. After a fire in 2017, most of the Tiffany Reach and the northernmost sites of the San Marcial Reach were burned and excluded, for the most part, from surveys. The entire San Marcial Reach was not surveyed in 2022, but most sites historically occupied by YBCUs were surveyed.

Table 3. YBCU detections by river reach from 2009 to 2022 within the Middle Rio Grande Study Area

	Number of Detections							
Year	**Belen**	**Sevilleta**	**San Acacia**	**Escondida**	**Bosque del Apache**	**Tiffany**	**San Marcial**	**Total**
2009	1	4	8	29	47	10	257	**356**
2010	3	1	3	6	14	2	249	**278**
2011	16	6	6	15	17	4	202	**266**
2012	44	36	19	68	36	10	202	**415**
2013	20	19	20	80	29	4	219	**391**
2014	24*	9	15	27	34	2	190**	**277**
2015	39	18	27	62	40	2	215	**403**
2016	54	32	23	58	32	9	220	**428**
2017	34	12	50	44	43	2[F]	227[F]	**410**
2018	51	31	47	55	46	0	193	**423**
2019***	NS	NS	29	50	59	0	190	**328**
2020***	16	NS	NS	16	52	NS	69[F]	**153**
2021***	22	NS	NS	13	70	NS	198	**303**
2022	40	50	24	3	46	NS	317[F]	**480**

*35.5 additional River Miles of survey area added to Belen Reach

** additional 4 River Miles added within Elephant Butte

***Reduced survey efforts within reaches due to budget constraints and COVID-19 related impacts

(Shading) Reach only partially surveyed

[F] Large fires removed occupied and potential habitat in some survey sites

NS = no part of this reach was surveyed

Fewer detections after 2019 in Belen and Escondida are likely due to reduced survey efforts in theses longer reaches, as detections historically can span the entire reach (Table 3). Detections and territories rebounded in Belen when the entire reach was surveyed in 2022 (Tables 3 and 4). This effect did not appear in the Bosque del Apache, where detections and territories were highest in 2021 when half the reach was surveyed.

Total territory numbers within the Middle Rio Grande have fluctuated since 2009 but, importantly, territories have been identified in all surveyed reaches through 2022 (Table 4). In 2022, 79 territories were delineated in the San Marcial Reach, the highest on record for any reach (Table 4). Despite limited survey efforts in the San Acacia reach, detections and territories remain relatively consistent (Tables 3 and 4), but the current population cannot be determined until the entire reach is surveyed again, and despite containing minimal suitable habitat, it consistently contains cuckoos.

Table 4. YBCU territories by river reach from 2009 to 2022 within the Middle Rio Grande Study Area

	Number of Territories							
Year	**Belen**	**Sevilleta**	**San Acacia**	**Escondida**	**Bosque del Apache**	**Tiffany**	**San Marcial**	**Total**
2009	0	2	1	9	11	3	69	**95**
2010	0	0	0	2	3	0	70	**75**
2011	4	2	1	3	4	1	58	**73**
2012	15	12	4	21	10	2	57	**121**
2013	6	6	5	23	8	1	70	**119**
2014	5*	2	4	7	12	0	61**	**91**
2015	10	5	8	16	12	0	59	**110**
2016	12	10	8	16	11	0	59	**116**
2017	4	4	13	11	10	0 [FF]	56 [FF]	**98**
2018	10	10	14	10	13	0	49	**106**
2019***	NS	NS	8	11	14	0	42	**75**
2020***	3	NS	NS	5	11	NS	17 [F]	**36**
2021***	5	NS	NS	2	15	NS	45	**67**
2022	11	11	6	1	14	NS	79 [F]	**122**

*35.5 additional River Miles of survey area added to Belen Reach

** additional 4 River Miles added within Elephant Butte

***Reduced survey efforts within reaches due to budget constraints and COVID-19 related impacts

(Shading) Reach only partially surveyed

[F or FF] Large fires removed occupied and potential habitat in some survey sites (F) or many survey sites (FF)

NS = no part of this reach was surveyed

The following section discusses historical trends by reach. Maps of all YBCU territories from 2009 and 2022 are presented in Appendix B.

The Belen Reach (Figure 4) was partially surveyed (south of Highway 60 at RM 130.5) from 2009 to 2013 and surveyed in its entirety from 2014 to 2018, as well as 2022. The reach was excluded from surveys in 2019 and only a small number of priority sites were surveyed in 2020 and 2021. Since 2011, the reach has supported between 4 and 15 cuckoo territories annually, predominately in the southern portion of the reach around Highway 60. However, YBCUs have been detected throughout the reach, including the northernmost sites. Fires in 2021 and 2022 burned portions of the middle of this reach near Belen, NM and removed some native canopy.

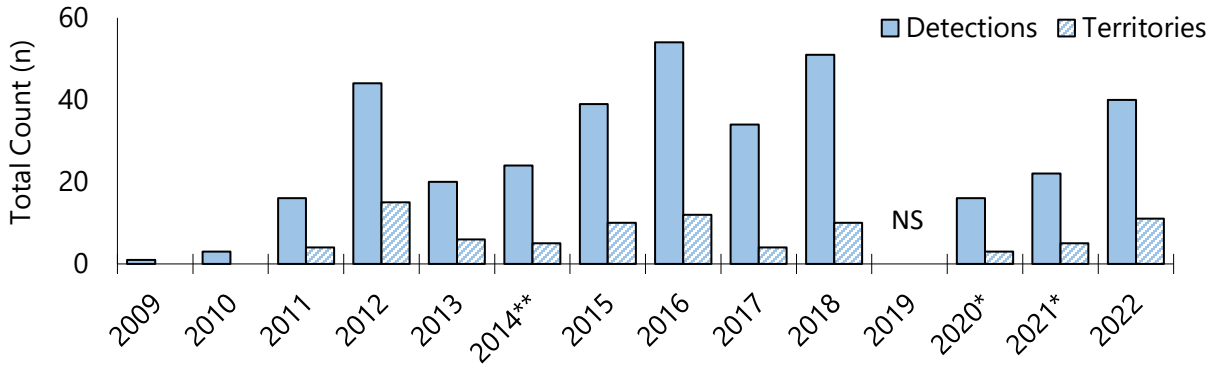

Figure 4. The number of YBCU detections and territories in the Belen Reach from 2009 to 2022.
NS = Not Surveyed.
*Reduced number of sites surveyed in 2021 and 2022.
** Survey area expanded from RM 130.5 to Isleta Pueblo.

The Sevilleta/La Joya Reach (Figure 5) was not surveyed from 2019 to 2021 but surveyed completely in all other years. The number of both territories and detections continues to fluctuate; since 2011, annual territories range from 2 to 12. Most detections and territories were found north of RM 121, abutting the population in the Belen reach. While territories in 2018 and 2022 were similar, more detections were found in 2022 and were distributed across more survey sites.

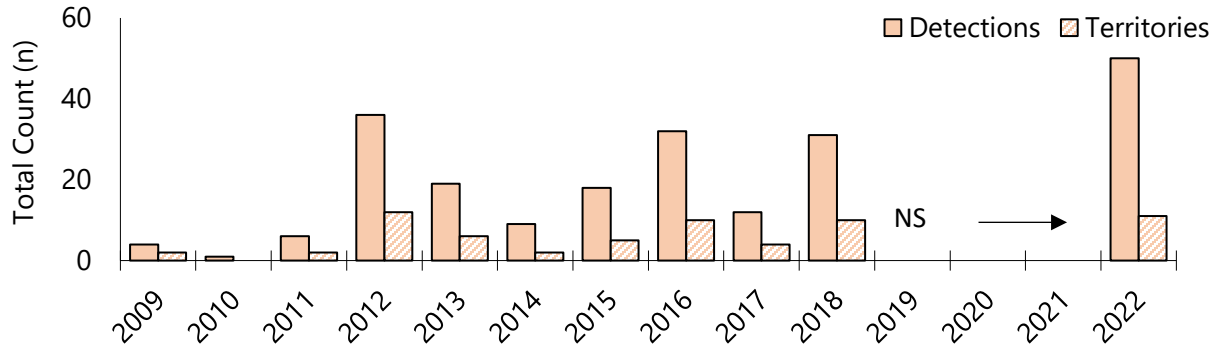

Figure 5. The number of YBCU detections and territories in the Sevilleta/La Joya Reach from 2009 to 2022. NS = Not Surveyed.

The San Acacia Reach (Figure 6) was surveyed in its entirety from 2009 to 2019 and not surveyed in 2020 and 2021. In 2022, only half of the sites were surveyed. The number of cuckoo territories per season gradually increased through 2018, peaking at 14 territories. A single nest, which successfully fledged young, was found in 2019. This gradual increase appears to continue; the two sites surveyed in 2022 had 24 detections and 6 territories, these same sites had 16 detections and 4 territories in 2019. However, because this reach was not surveyed in 2020 and 2021, recent trends in the San Acacia population are unknown.

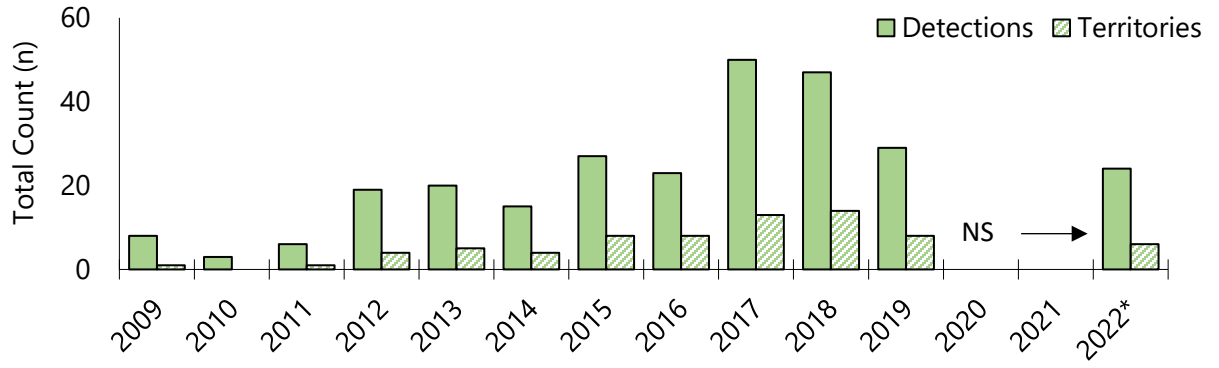

Figure 6. The number of YBCU detections and territories in the San Acacia from 2009 to 2022. NS = Not Surveyed. *Reduced number of sites surveyed in 2022.

The Escondida Reach (Figure 7) was surveyed completely between 2009 and 2019. Three sites were surveyed in 2020 and two sites in 2021 and 2022. Several territories were found since 2012, with a high of 23 territories observed in 2013. In 2019, the last year the entire reach was surveyed, 11 cuckoo territories were delineated from 50 detections, and 2 nests were located (1 fledged). The 2016 Escondida Fire burned approximately 212 ha in the northern end of this

reach. No cuckoo territories were previously documented in this area, suggesting that it had minimal impact on the cuckoo population. The 2021-2022 survey area represents a small section of the Escondida reach that supported zero to three territories annually. Additional surveys across the entire reach are needed to assess population trends within this reach.

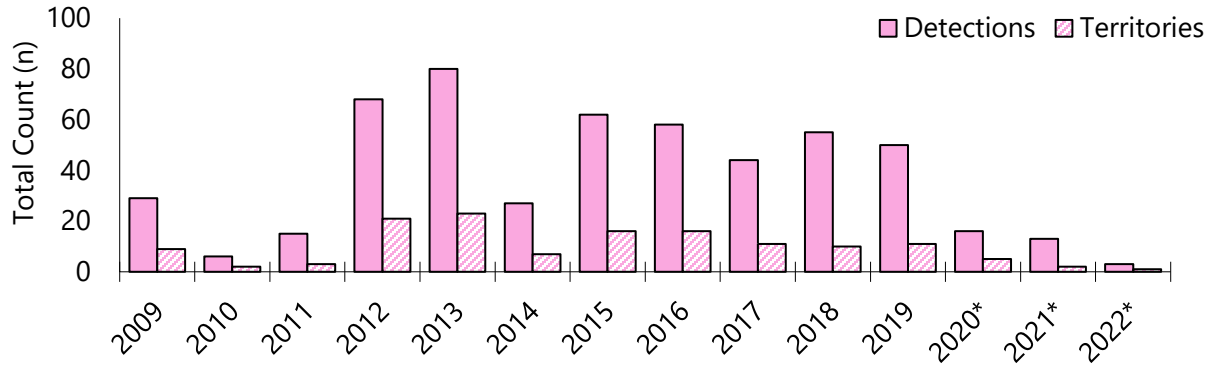

Figure 7. The number of YBCU detections and territories in the Escondida Reach from 2009 to 2022. *Reduced number of sites surveyed in 2020, and further reduced in 2021 and 2022.

The Bosque del Apache Reach (Figure 8) was also surveyed in its entirety from 2009 to 2019, and again in 2022. Only the northern half of the reach was surveyed in 2020 and 2021.The Bosque del Apache Reach competes with the Escondida Reach in often supporting the second highest number of territories after the San Marcial Reach. Ten or more territories have been found since 2014, regardless of how many sites were surveyed. Despite excluding more than a third of sites from surveys in 2020 and 2021, 11 and 15 territories were delineated from 52 and 70 detections, respectively. Territories in 2022 dispersed throughout the entire reach and it is unclear what caused the high number of detections in 2021 concentrated in the north sites.

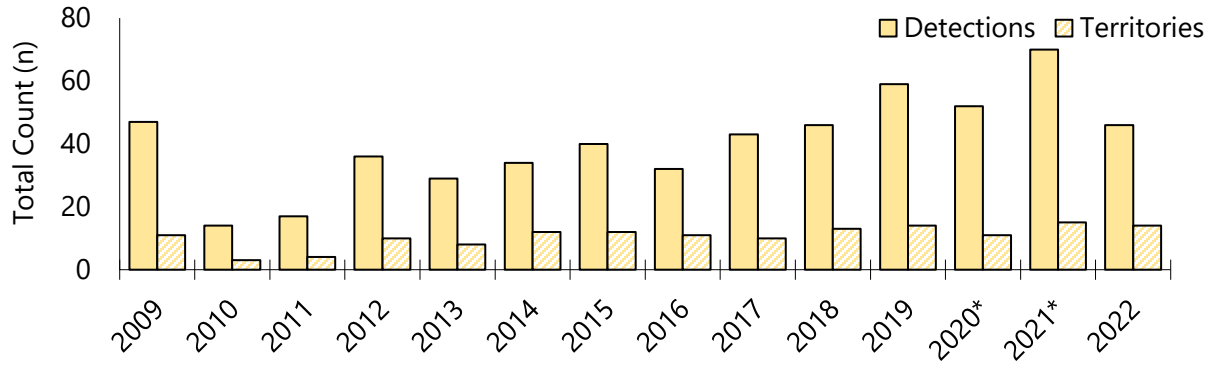

Figure 8. The number of YBCU detections and territories in the Bosque del Apache Reach from 2009 to 2022. *Reduced number of sites surveyed in 2020 to 2021 to north end.

The Tiffany Reach (Figure 9) was surveyed entirely from 2006 to 2017 but no YBCU territories have been delineated in the reach since 2013. Most of the reach was severely burned in the 2017 Tiffany Fire, and only one site (LF-26) was surveyed in 2018 and 2019. No surveys were conducted from 2020 to 2022. Patches of native canopy and mixed understory persist and habitat within this reach will be assessed annually to determine whether surveys are warranted.

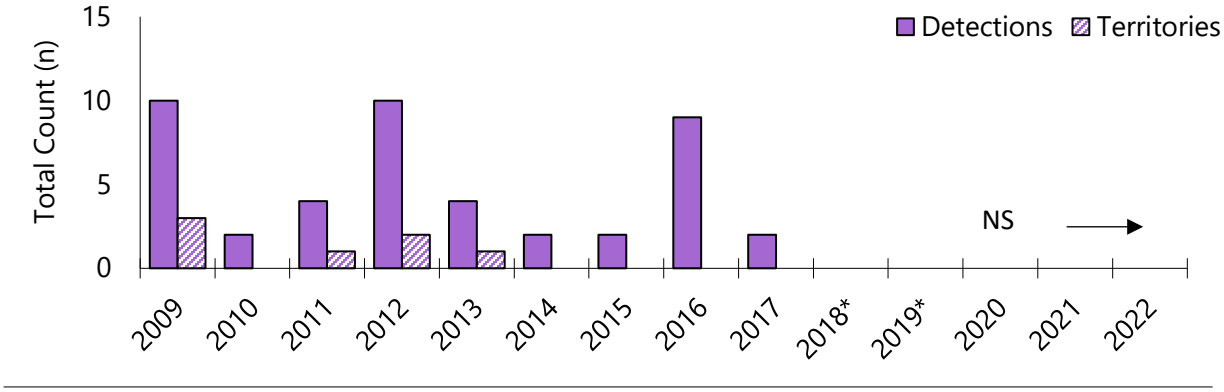

Figure 9. The number of YBCU detections and territories in the Tiffany from 2009 to 2022.
NS = Not surveyed. *Reduced sites (1) surveyed in 2018 and 2019 following fire.

The San Marcial Reach (Figure 10) supports the largest number of cuckoos in the study area, averaging 61 percent of all territories and detections observed annually. The record low number of territories (n = 17) in 2020 was a result of more extensive reduction in survey effort across the reach than seen before. In 2022, there were 79 territories from 317 detections: the highest recorded in the study's history. Ninety percent of all YBCU territories and detections were found south of RM 60. Prior to 2014, surveys only extended through the Narrows. Boundaries were extended four river miles south in 2014 to include developing habitat and survey sites LF17, LF17a and DL-01(near RM 60) were added as habitat was considered suitable. The current boundaries of the San Marcial Reach were only surveyed in full between 2014 and 2017, but the Elephant Butte Reservoir subset has been surveyed every year between 2014 and 2022 except 2020. Nests were found south of the LFCC confluence in 2007 (3 nests), 2017 (2 nests) and 2018 (3 nests), with an average success rate of 50 percent.

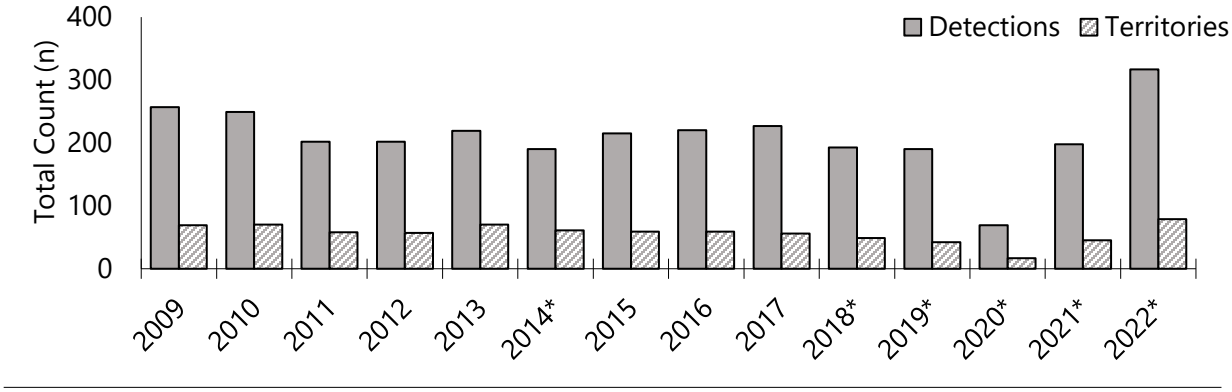

Figure 10. The number of YBCU detections and territories in the San Marcial Reach from 2009 to 2022.
* Reduced number of sites surveyed 2018 to 2022. Lowest number of sites surveyed in 2020.

YBCU Distribution within Elephant Butte Reservoir

Large stands of native Goodding's willow-dominated habitat developed as Elephant Butte Reservoir receded between 1995 and 2004 (Figure 11). LFCC flows and overbank flooding of the river channel maintained this habitat. However, much of the habitat in the upper portion of the exposed reservoir pool has declined in quality due to a dropping water table, infrequent flooding, and a lack of recruitment of young willows. Habitat in the southern portion of the exposed reservoir pool continues to develop due to fluctuating reservoir levels and more frequent flooding, although expansion of habitat is limited by increasing incision of the river channel due to river maintenance activities and relatively low reservoir levels.

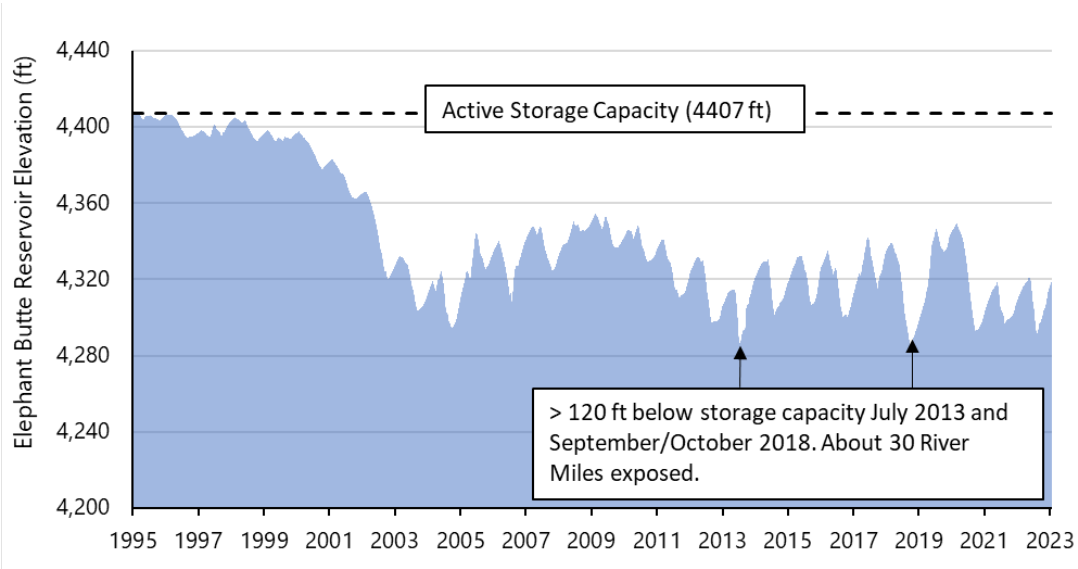

Figure 11. Surface elevation of Elephant Butte Reservoir 1995 to 2022.

During the summer of 2013, and again in September 2018, Elephant Butte Reservoir dropped to 4,286 feet (ft), its lowest elevation since 1972. The reservoir was approximately 120 vertical ft below the spillway and nearly 1.9 million acre-ft from full capacity on these occasions. Heavy rain events and high winter flows periodically raised reservoir levels that flooded newly established habitat in the southern end of the exposed reservoir (Figure 11).

Most YBCU detections in the Elephant Butte Reservoir were historically located within the elevational range of 4,355 and 4,360 ft (Figure 12). This five-foot contour corresponds to The Narrows and the area immediately upstream of The Narrows (Figure 13). YBCUs began colonizing lower elevations soon after habitat was considered suitable enough to be surveyed. Detections were first recorded at less than 4,340 ft in 2014 and comprised over 15 percent of annual detections between 2016 and 2020. Between 2021 and 2022, increased detections were found above 4,380 ft (Figure 12) while the elevation of the active pool remained below 4,320 ft (Figure 11).

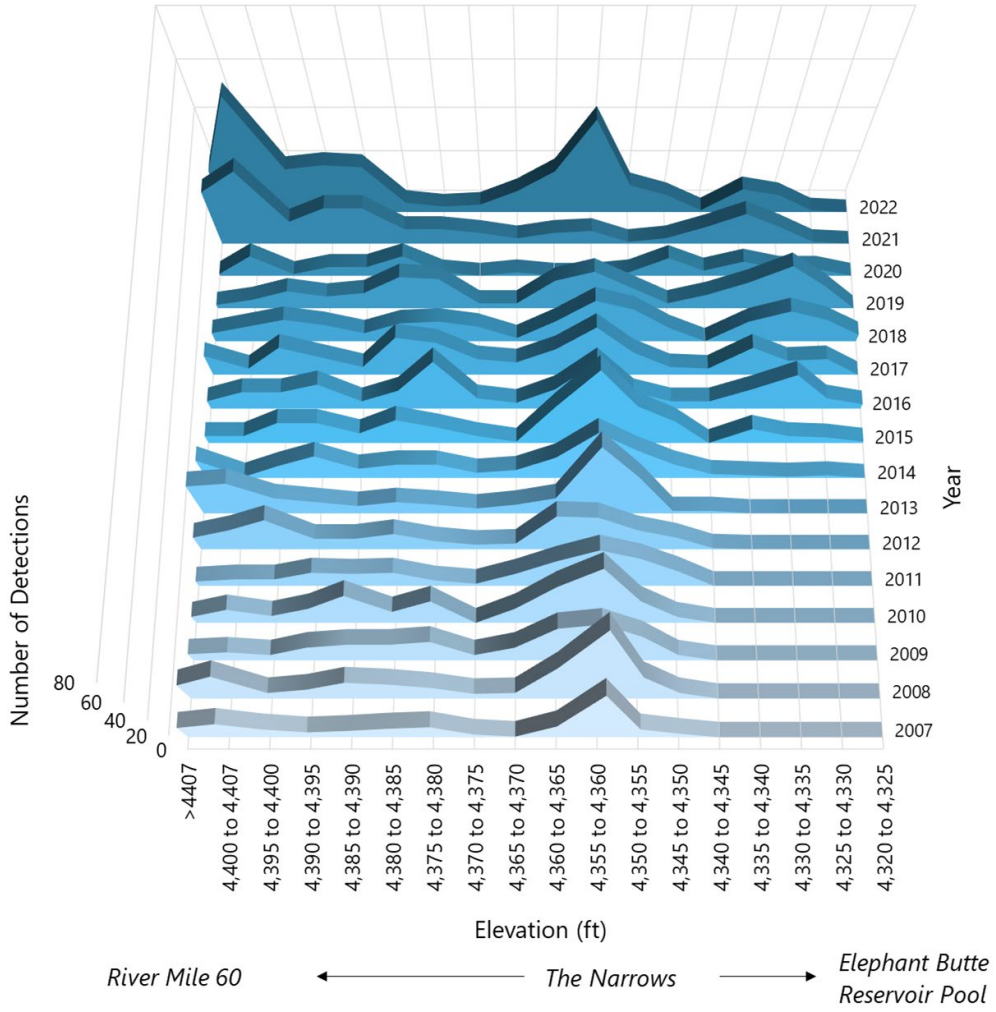

Figure 12. Elevational distribution (x-axis) of YBCU detections (y-axis) in the Elephant Butte Reservoir pool between 2007 and 2022 (z-axis, tilted). Elevation range covers RM 60 to the Elephant Butte Reservoir pool. Sites closest to the pool not surveyed until 2014. *Reduced survey effort in 2020 across the study area.

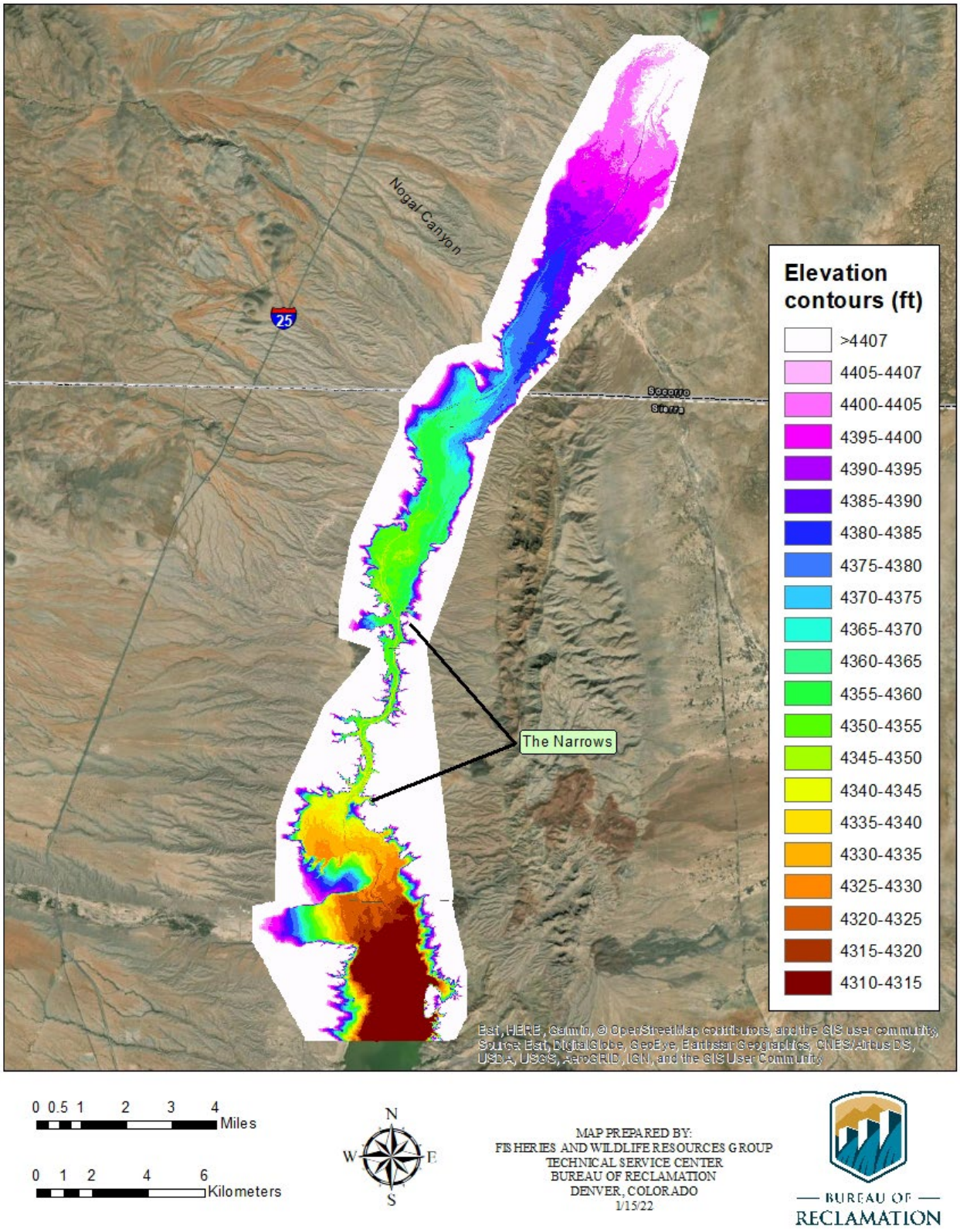

Figure 13. Elephant Butte Reservoir surface elevation intervals.

Conclusions

A persistent cuckoo population has been documented in the Middle Rio Grande since 2009. Significant reduction in survey area between 2019 and 2021 skewed comparisons of overall population size within those years, but results from 2022 still showed YBCU occupation within the Rio Grande floodplain from Elephant Butte Reservoir to the Isleta Pueblo. Although reach-specific population trends can be extrapolated from years when an entire reach was surveyed, overall population trends cannot be determined in the absence of a complete survey effort. Fifty-four percent of all cuckoo territories and detections in the Middle Rio Grande from 2009 to 2022 have been located within the exposed pool of Elephant Butte Reservoir within the San Marcial Reach. Although this population fluctuated annually, it appears to be well established and likely serves as a source population for sites both upstream and downstream. Survey data across the entire Middle Rio Grande survey area suggest that certain areas were continually occupied by YBCUs, while occupations in other stretches was erratic. Habitat in other reaches did not support as many territories as in San Marcial, but several reaches upstream consistently retained smaller populations. Complete surveys in future years will be a valuable monitoring tool for the Middle Rio Grande cuckoo population as a whole and will help determine if these habitat patches and populations expand or change their distribution.

Recommendations

1. Continue annual surveys within all areas where active projects are being conducted to meet Biological Opinion mandates.
2. Continue and expand the telemetry program to determine whether vegetation changes are affecting home range characteristics, to locate nests, and to determine and quantify critical nest site selection variables.
3. Monitor any documented cuckoo nests to gain insight into nesting variables. YBCU nests are rarely found without the use of radiotelemetry so there is currently minimal information about cuckoo productivity, nest success and site fidelity on the Rio Grande.
4. Update the GIS database with annual YBCU territory locations to monitor population trends based on detection and territory abundance.
5. Update vegetation maps at 4-to-5-year intervals to document changes in habitat quality and identify potential restoration opportunities when needed.

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Appendix A: YBCU Detections and Territories 2022

Reach	Figures	Pages
Belen	A-1 to A-9.....	...25 to 33
Sevilleta/La Joya.....	A-10 to A-12.....	...34 to 36
San Acacia.....	A-13.....	37
Escondida.....	A-14.....	38
Bosque del Apache.....	A-15 to A-17.....	...39 to 41
San Marcial.....	A-18 to A-24.....	...42 to 48

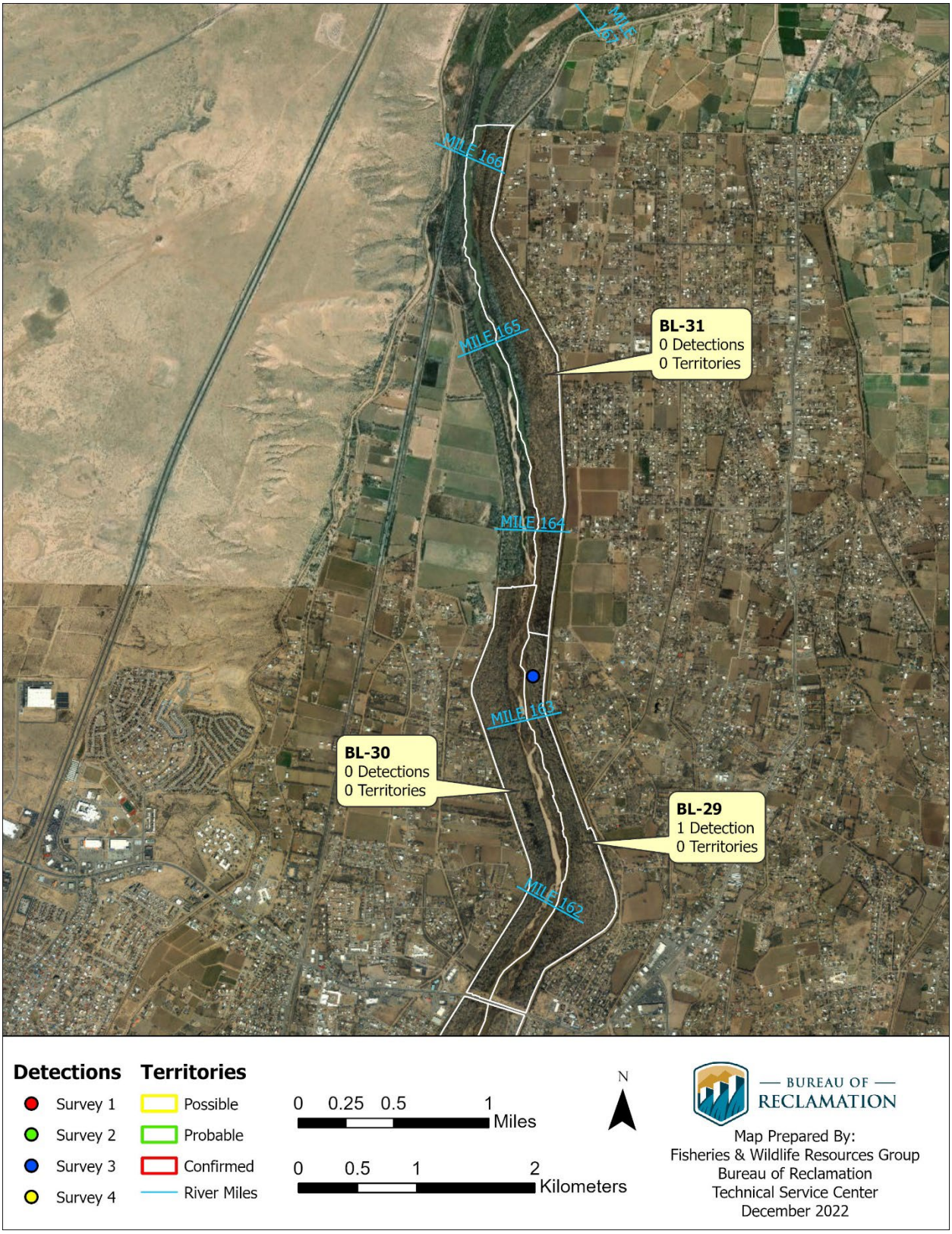

Figure A - 1. 2022 YBCU detections and territories in the Belen Reach (1 of 9).

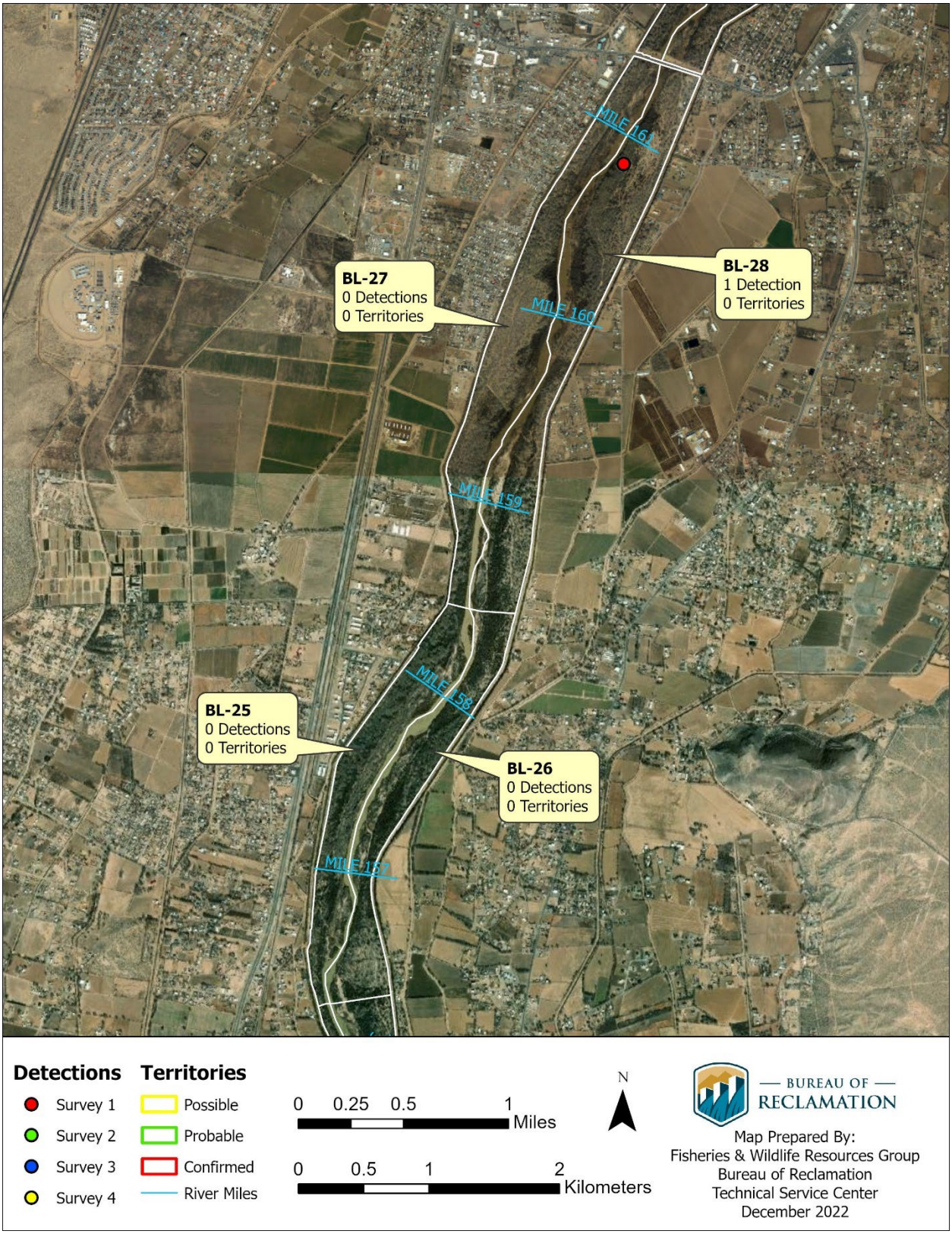

Figure A - 2. 2022 YBCU detections and territories in the Belen Reach (2 of 9).

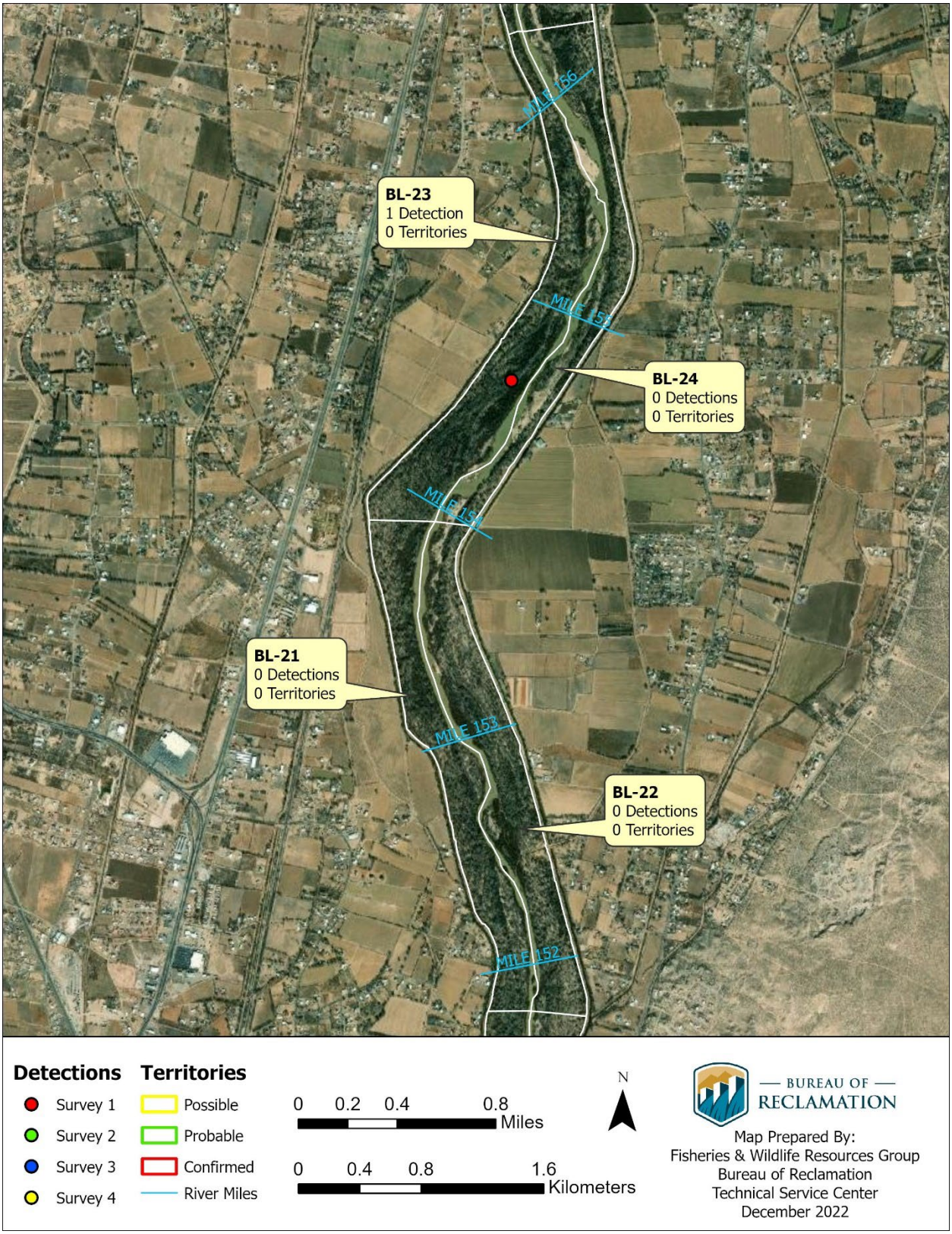

Figure A - 3. 2022 YBCU detections and territories in the Belen Reach (3 of 9).

Figure A - 4. 2022 YBCU detections and territories in the Belen Reach (4 of 9).

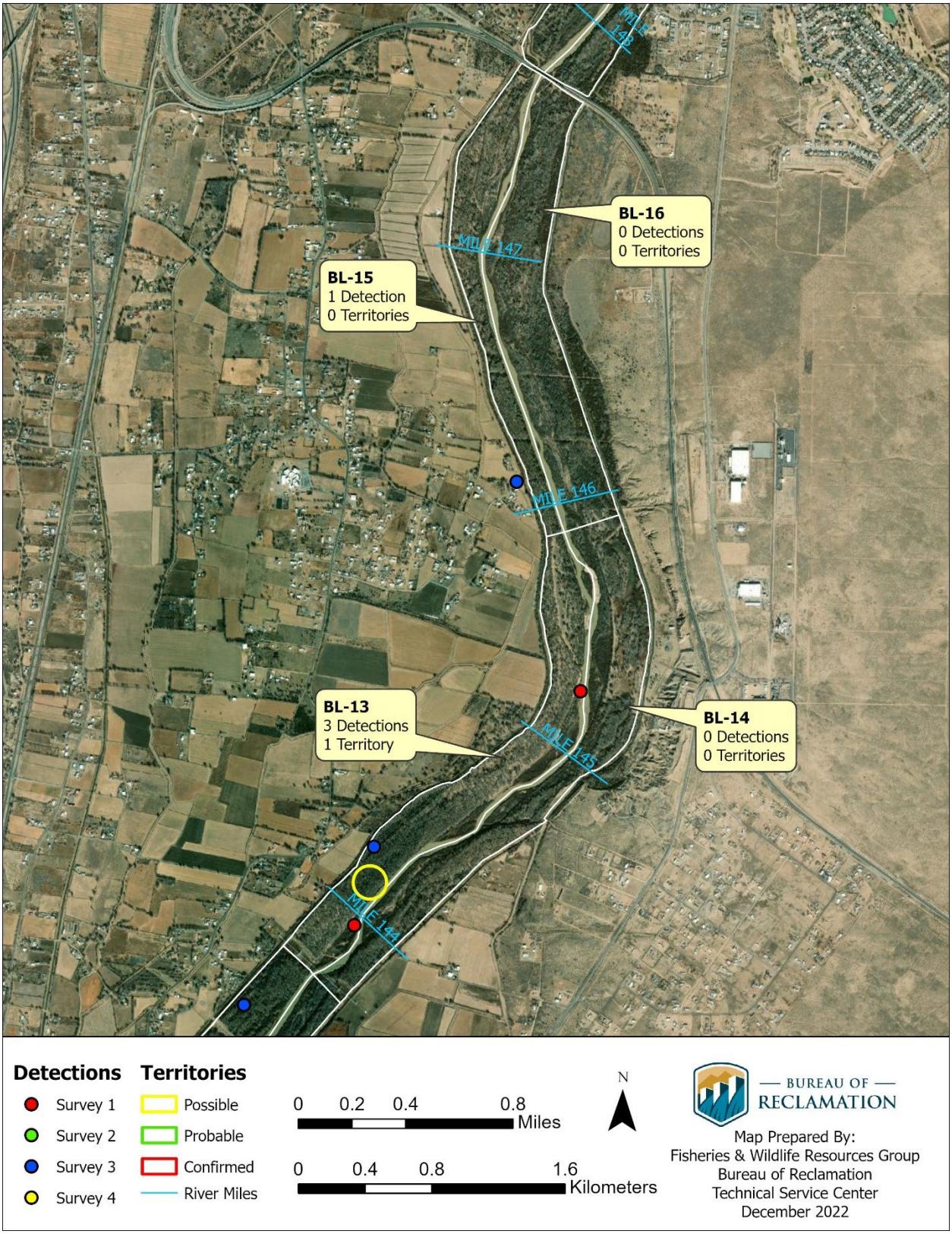

Figure A - 5. 2022 YBCU detections and territories in the Belen Reach (5 of 9).

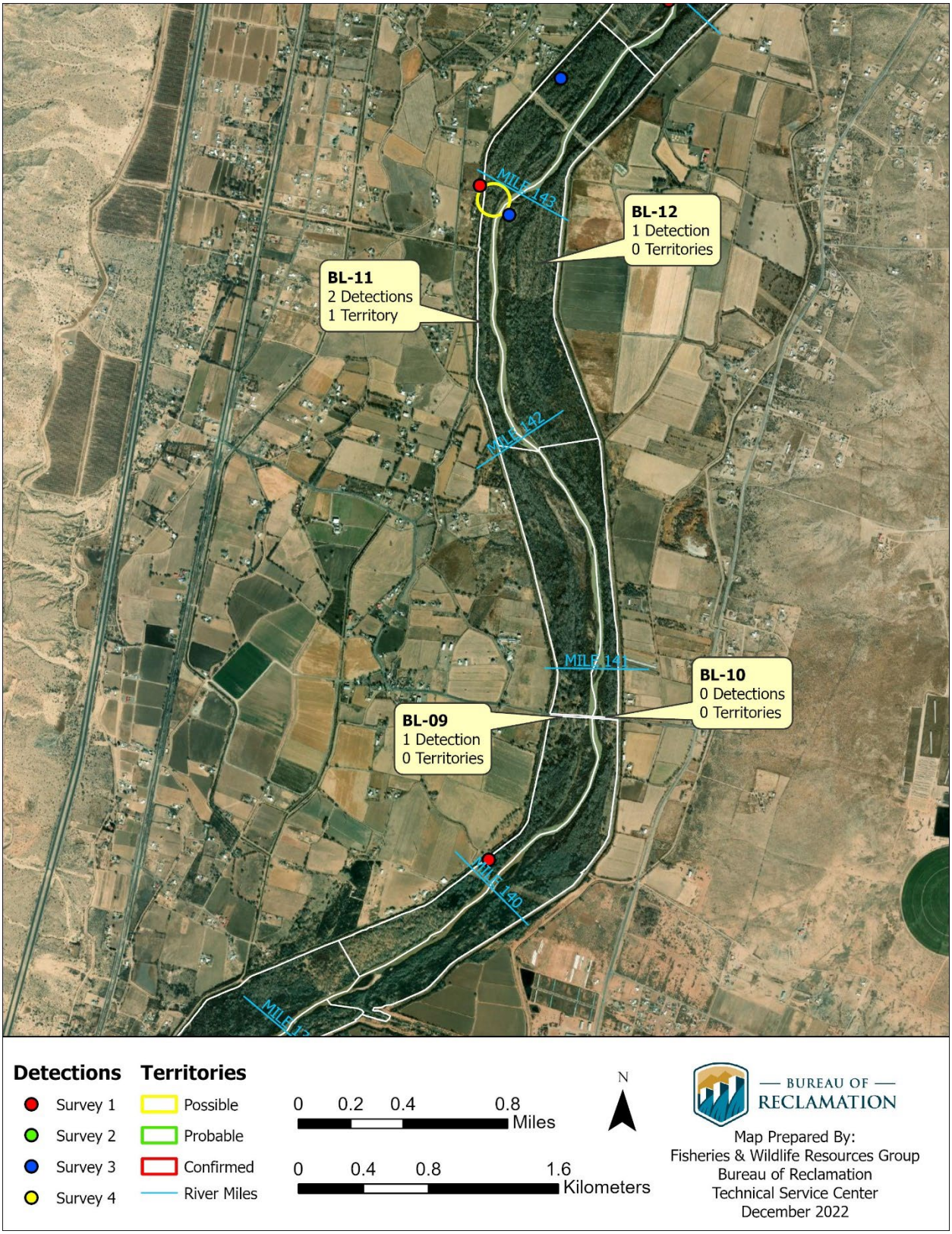

Figure A - 6. 2022 YBCU detections and territories in the Belen Reach (6 of 9).

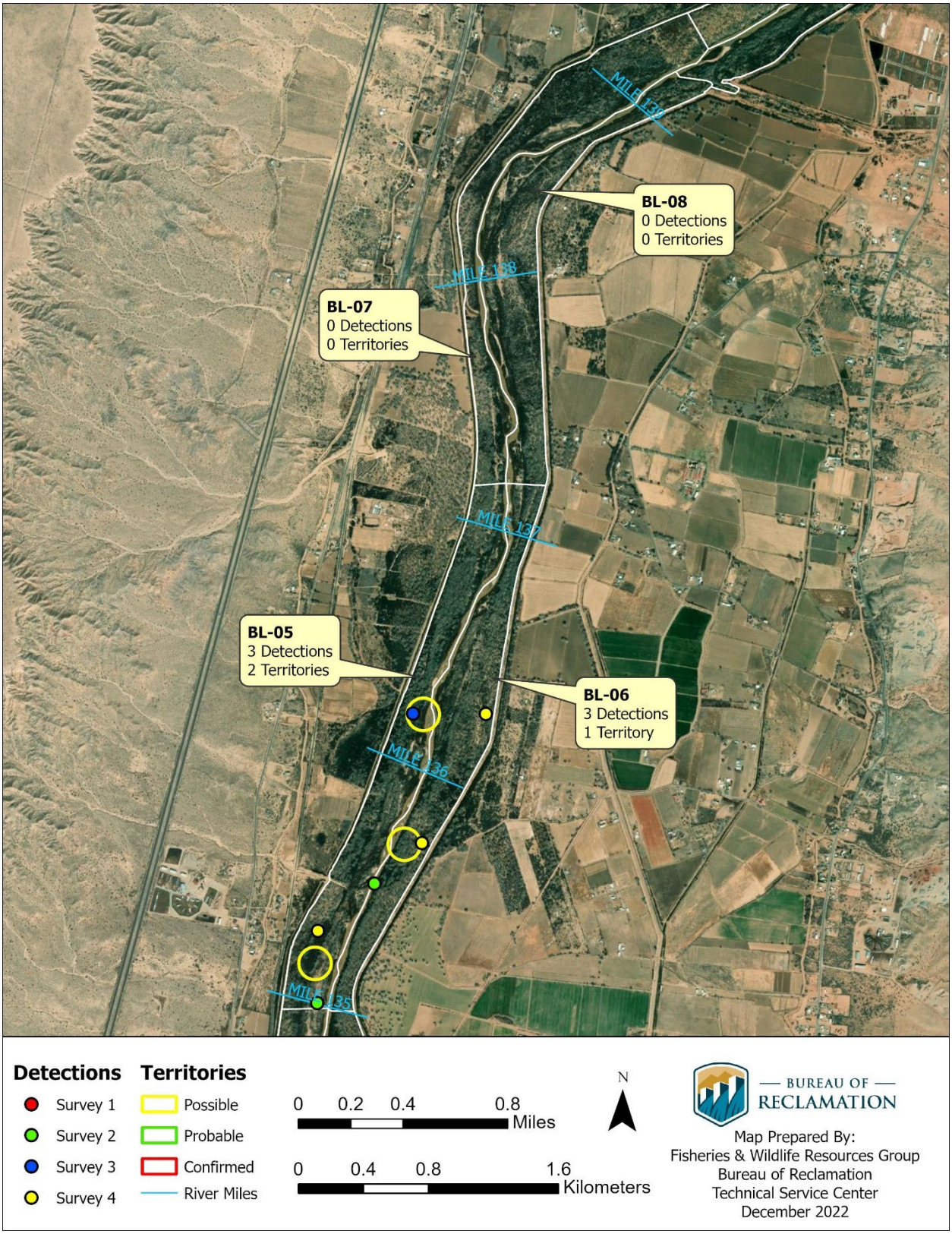

Figure A - 7. 2022 YBCU detections and territories in the Belen Reach (7 of 9).

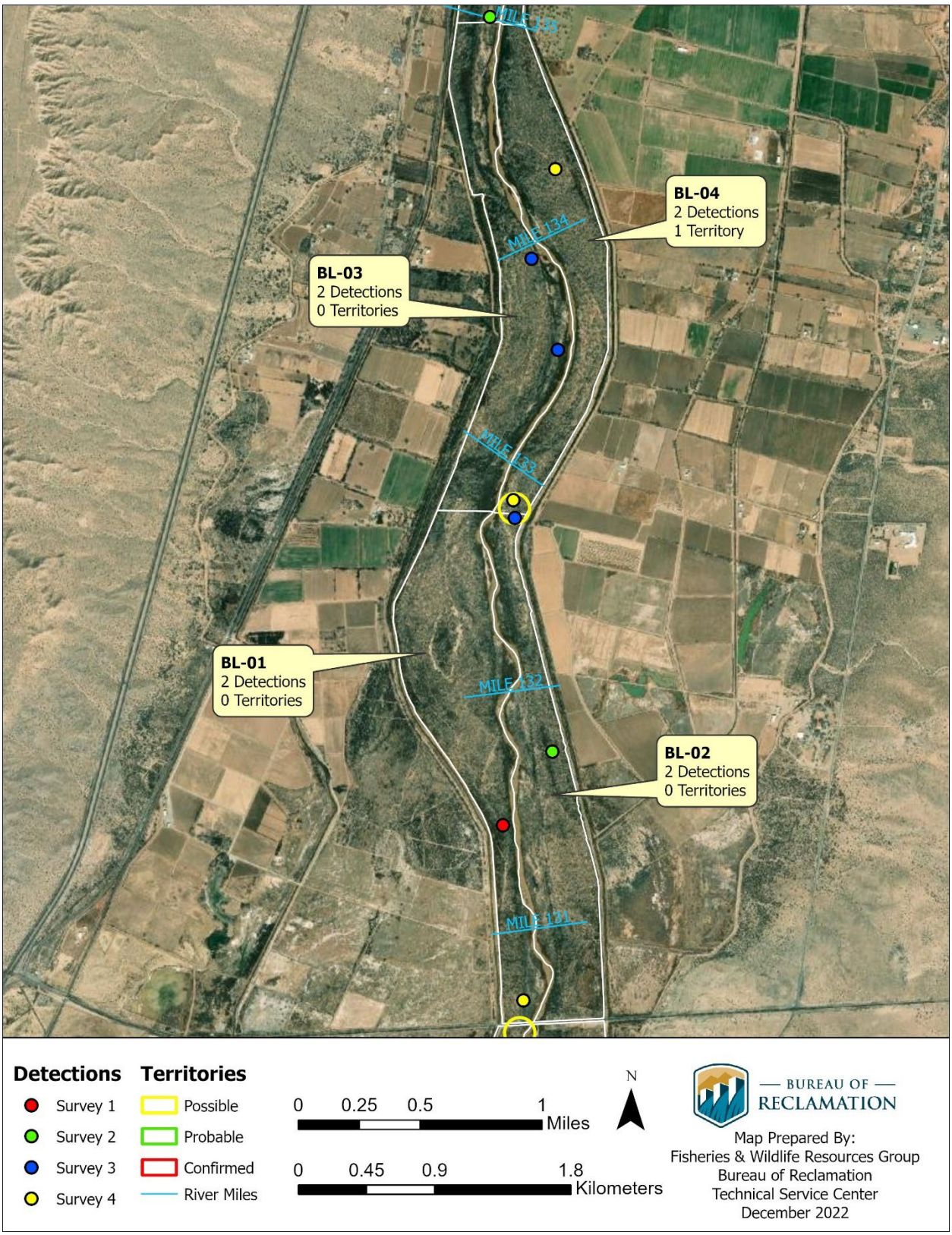

Figure A - 8. 2022 YBCU detections and territories in the Belen Reach (8 of 9).

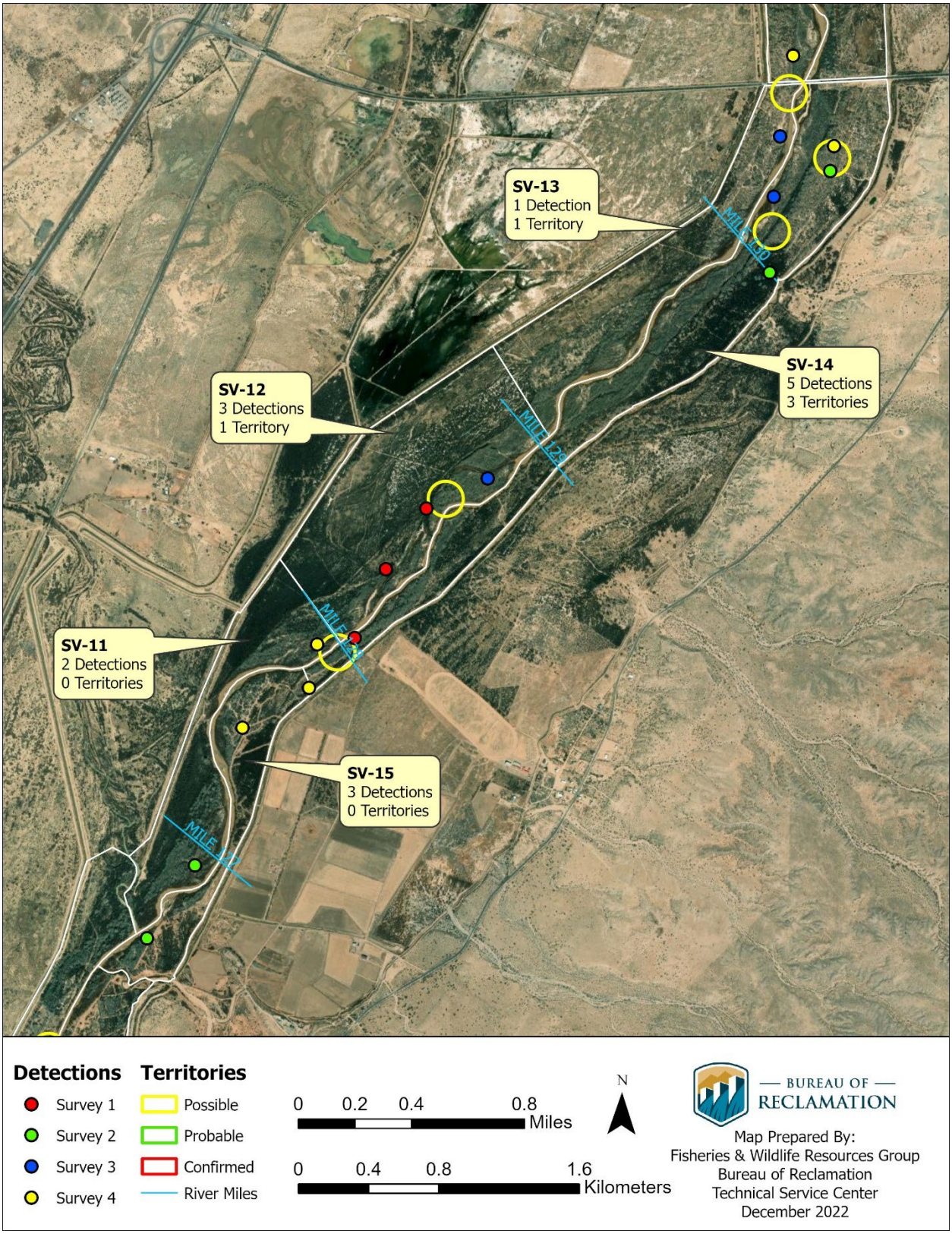

Figure A - 9. 2022 YBCU detections and territories in the Belen Reach (9 of 9).

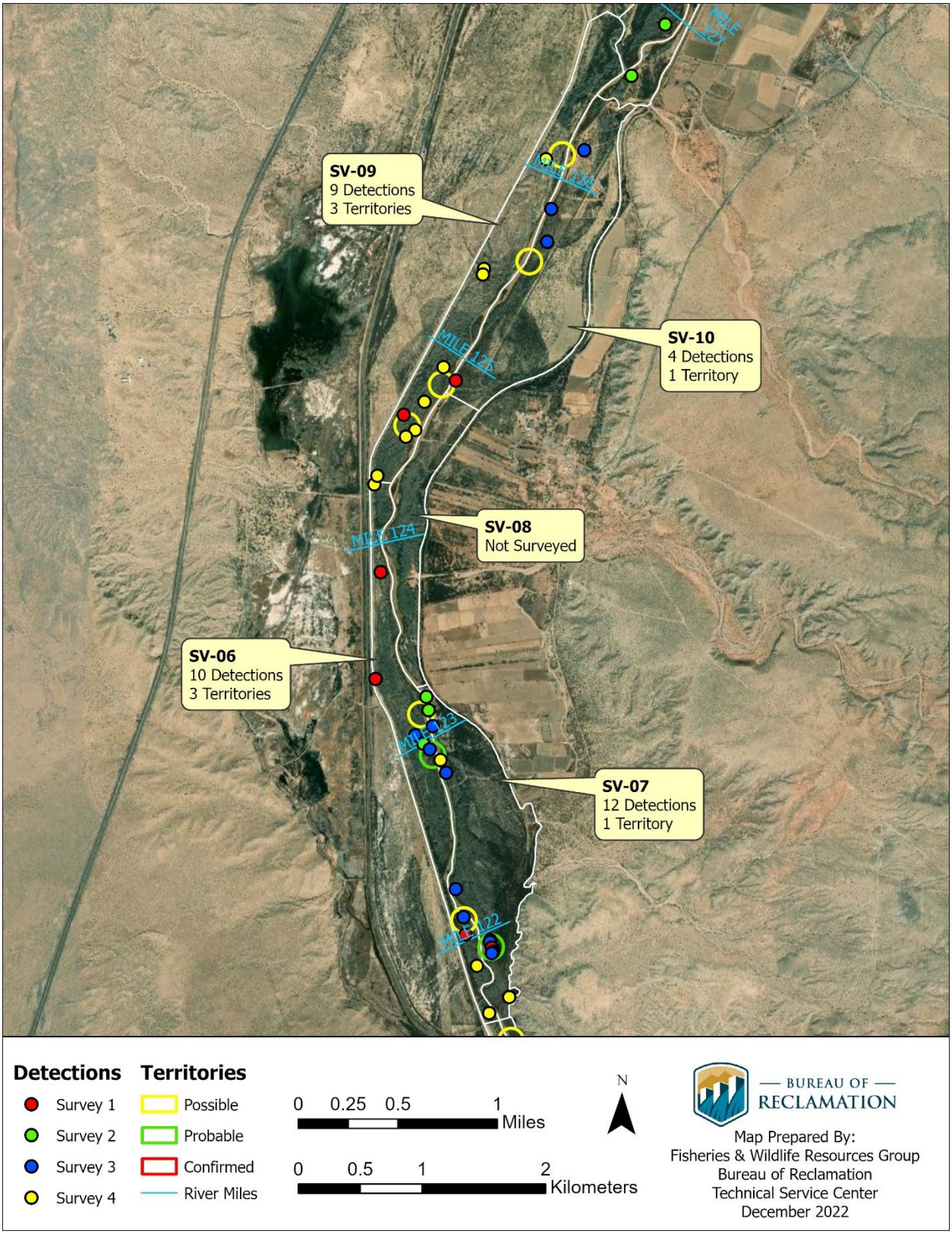

Figure A - 10. 2022 YBCU detections and territories in the Sevilleta/La Joya Reach (1 of 3).

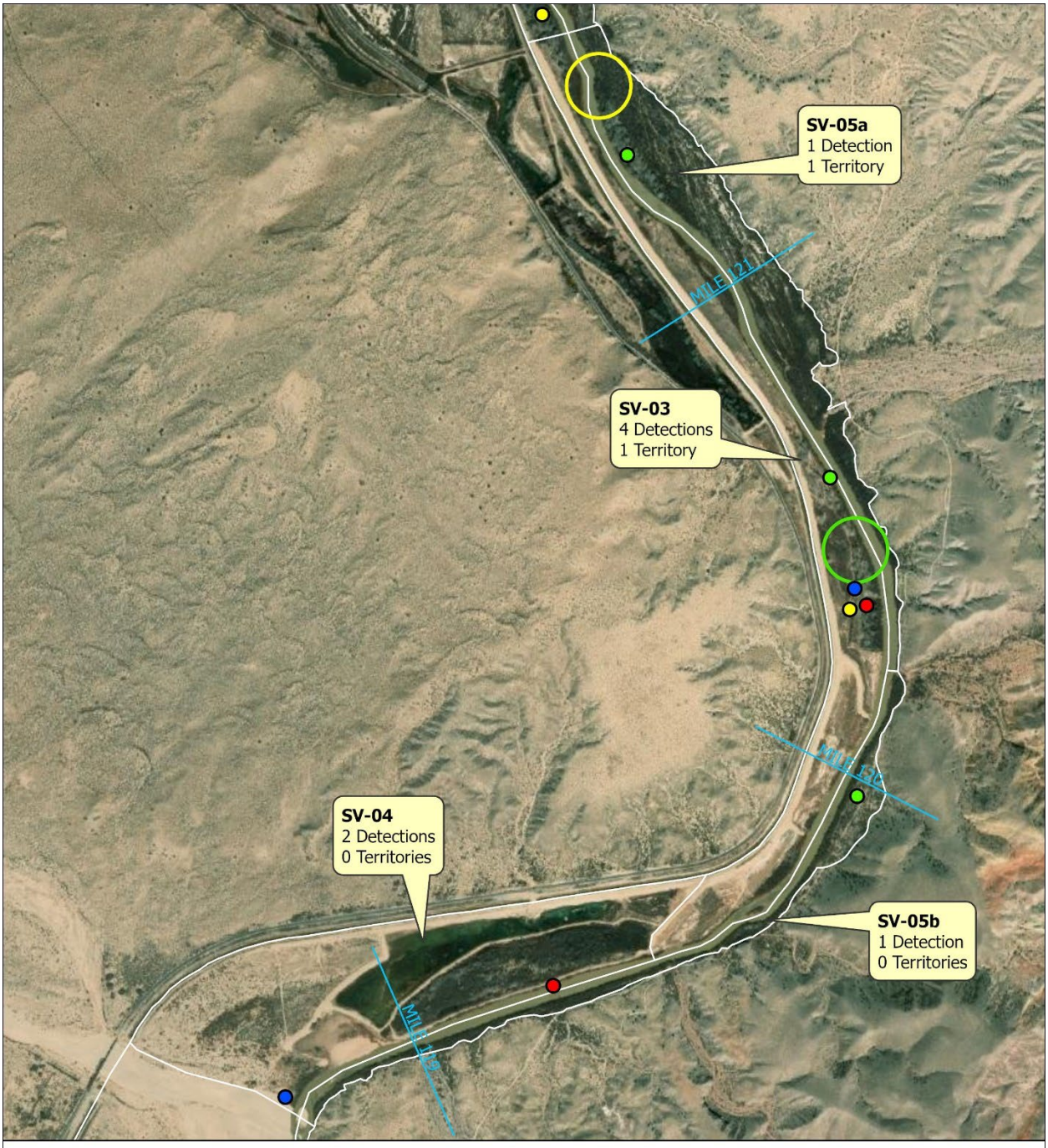

Figure A - 11. 2022 YBCU detections and territories in the Sevilleta/La Joya Reach (2 of 3).

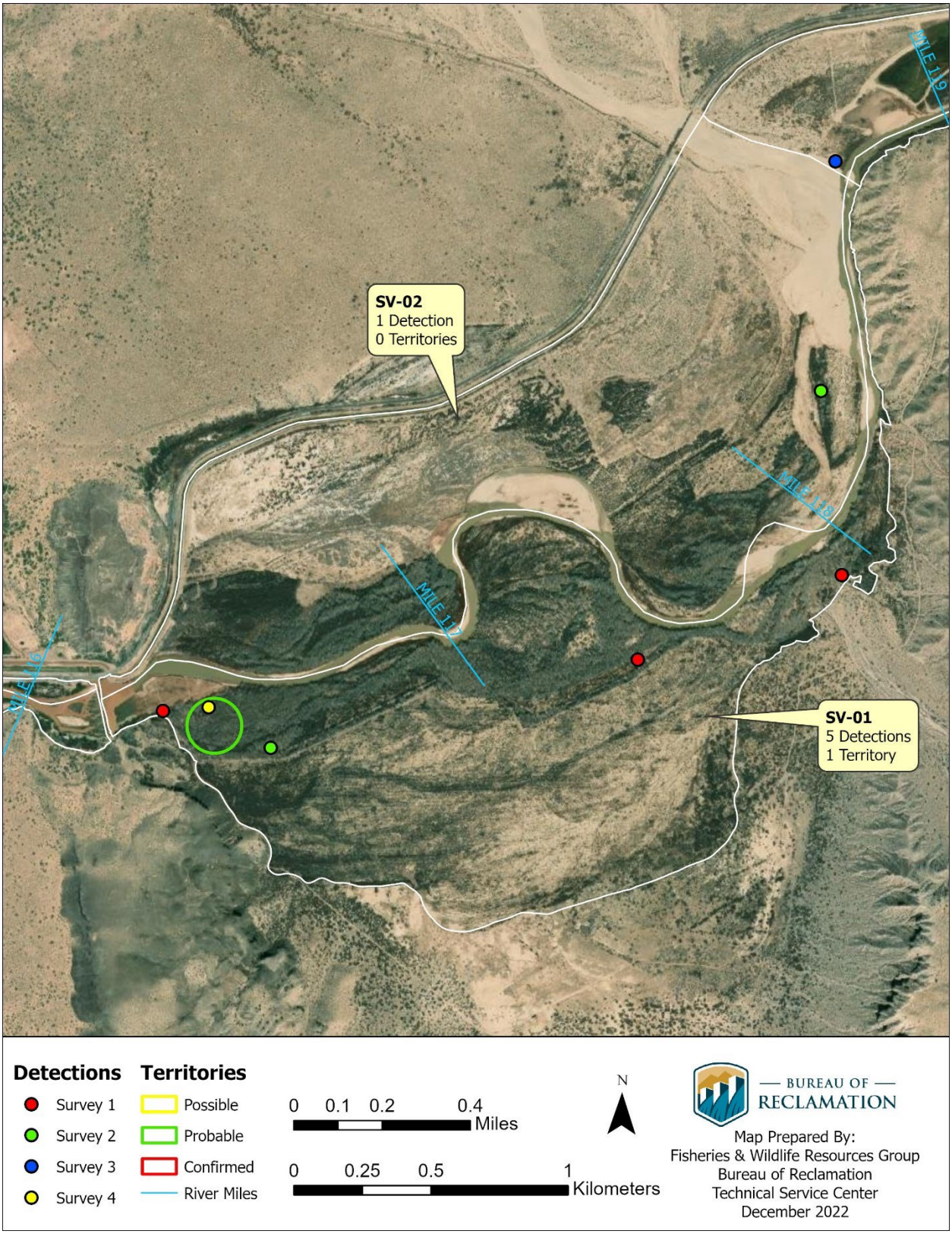

Figure A - 12. 2022 YBCU detections and territories in the Sevilleta/La Joya Reach (3 of 3).

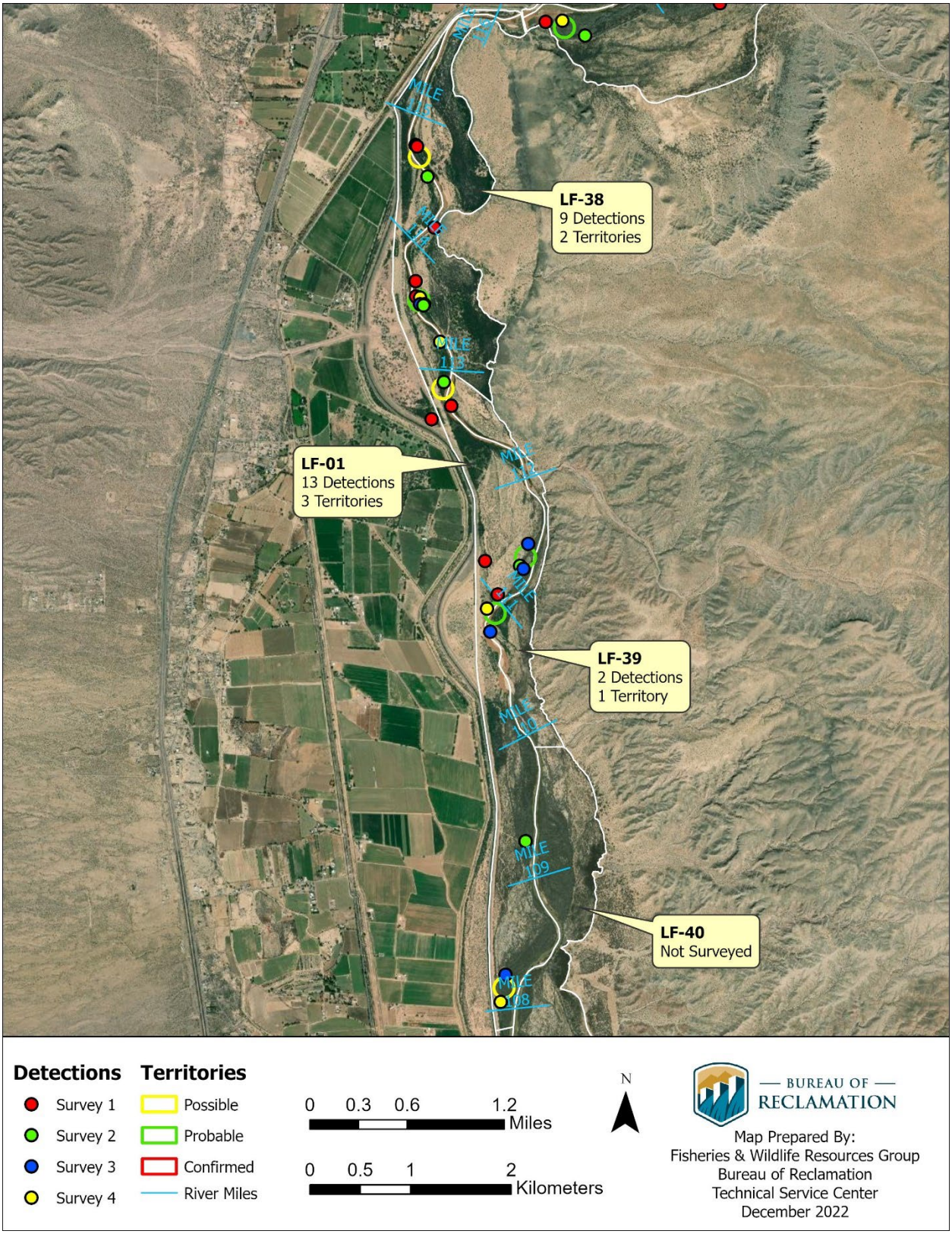

Figure A - 13. 2022 YBCU detections and territories in the San Acacia Reach (1 of 1). No surveys were conducted between river miles 108 and 104.

Figure A - 14. 2022 YBCU detections and territories in the Escondida Reach (1 of 1). No surveys conducted between river miles 104 and 87.

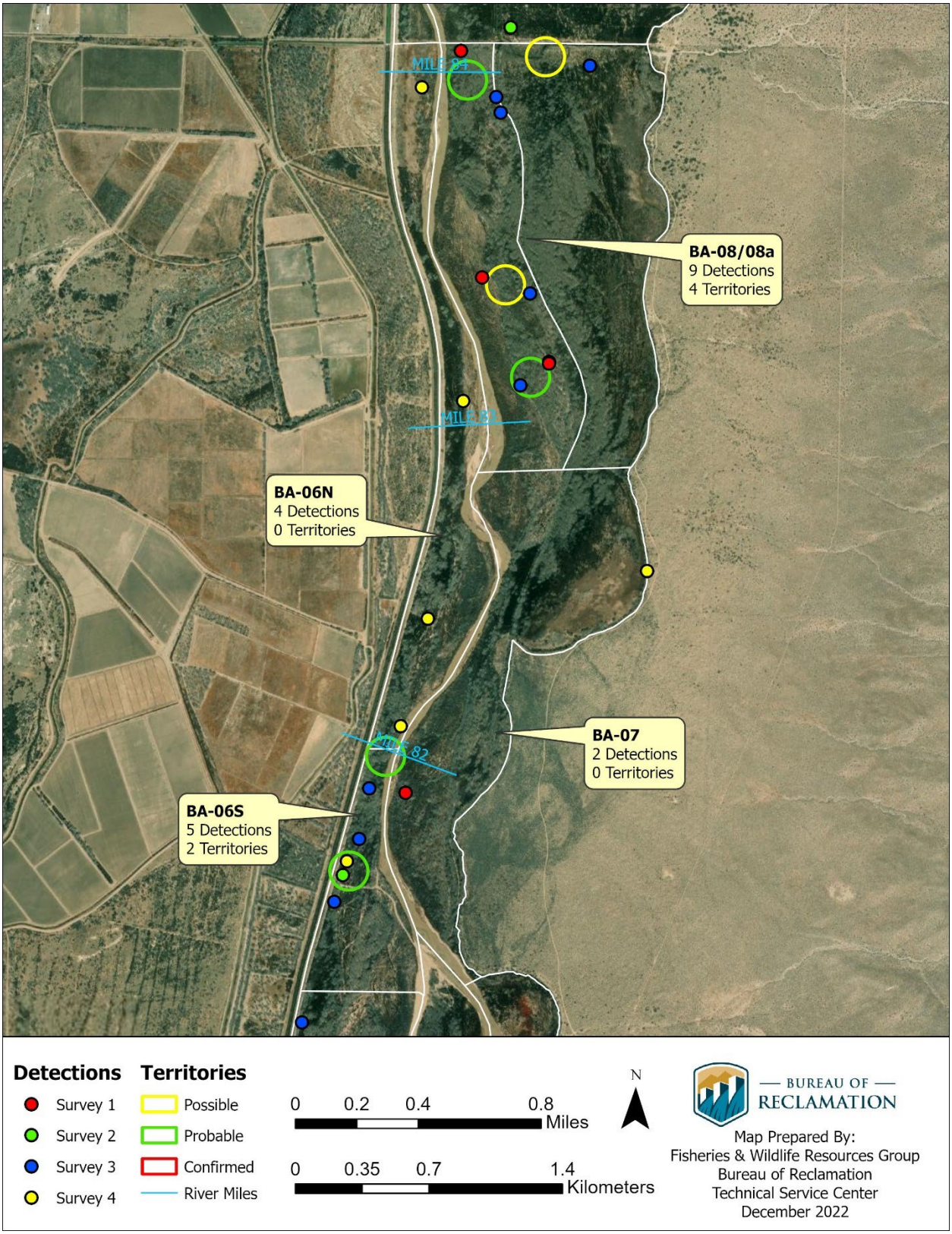

Figure A - 15. 2022 YBCU detections and territories in the Bosque del Apache Reach (1 of 3).

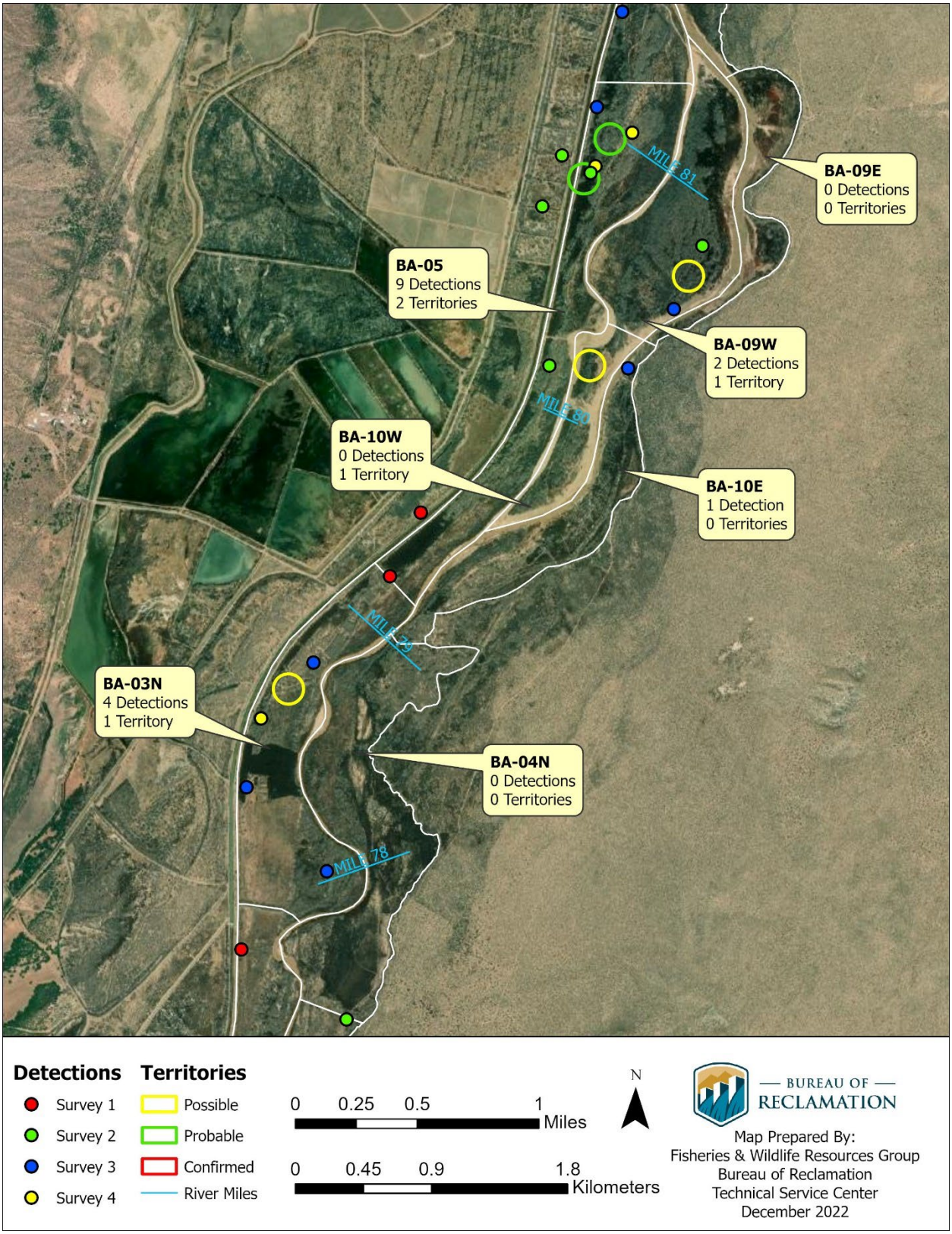

Figure A - 16. 2022 YBCU detections and territories in the Bosque del Apache Reach (2 of 3).

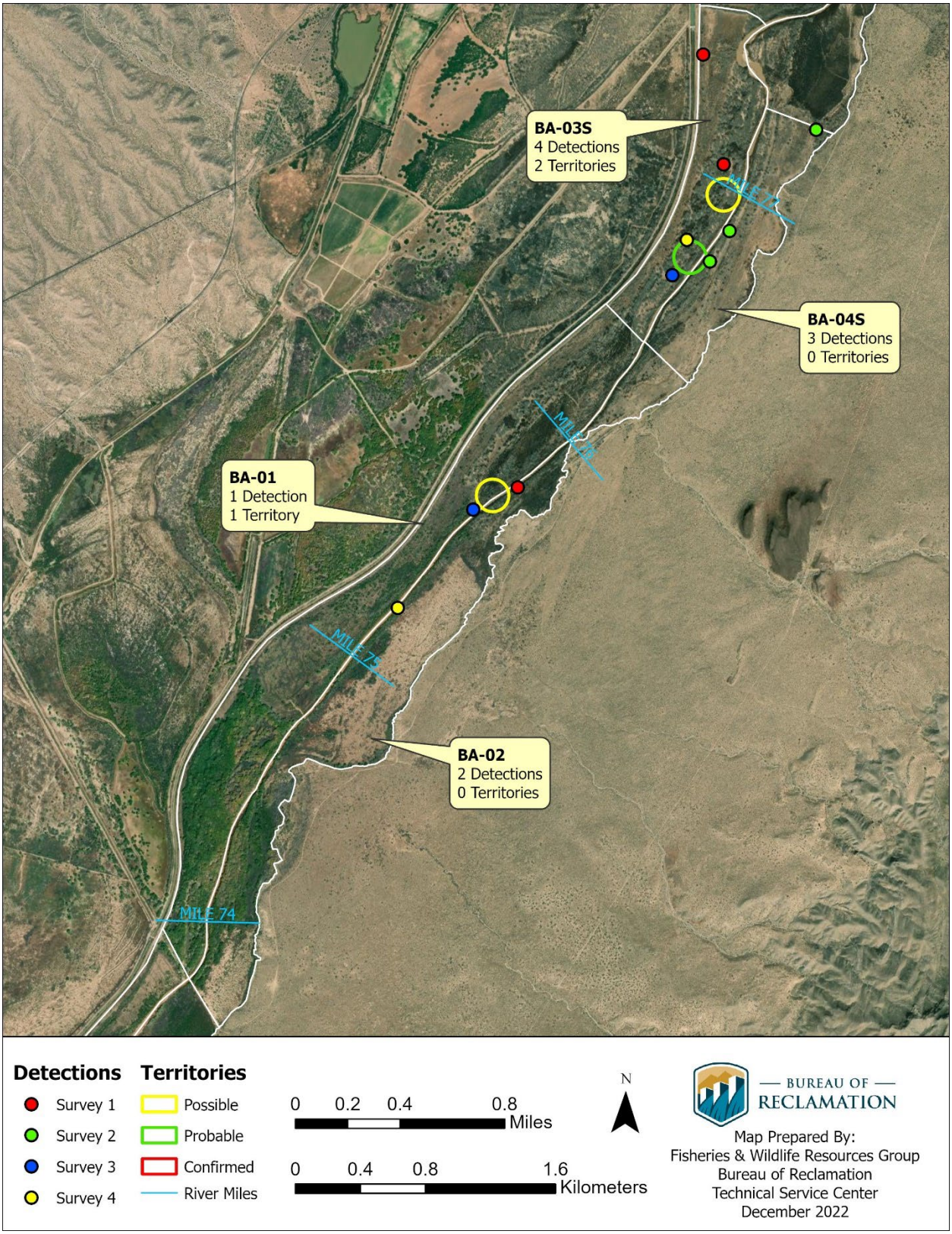

Figure A - 17. 2022 YBCU detections and territories in the Bosque del Apache Reach (3 of 3).

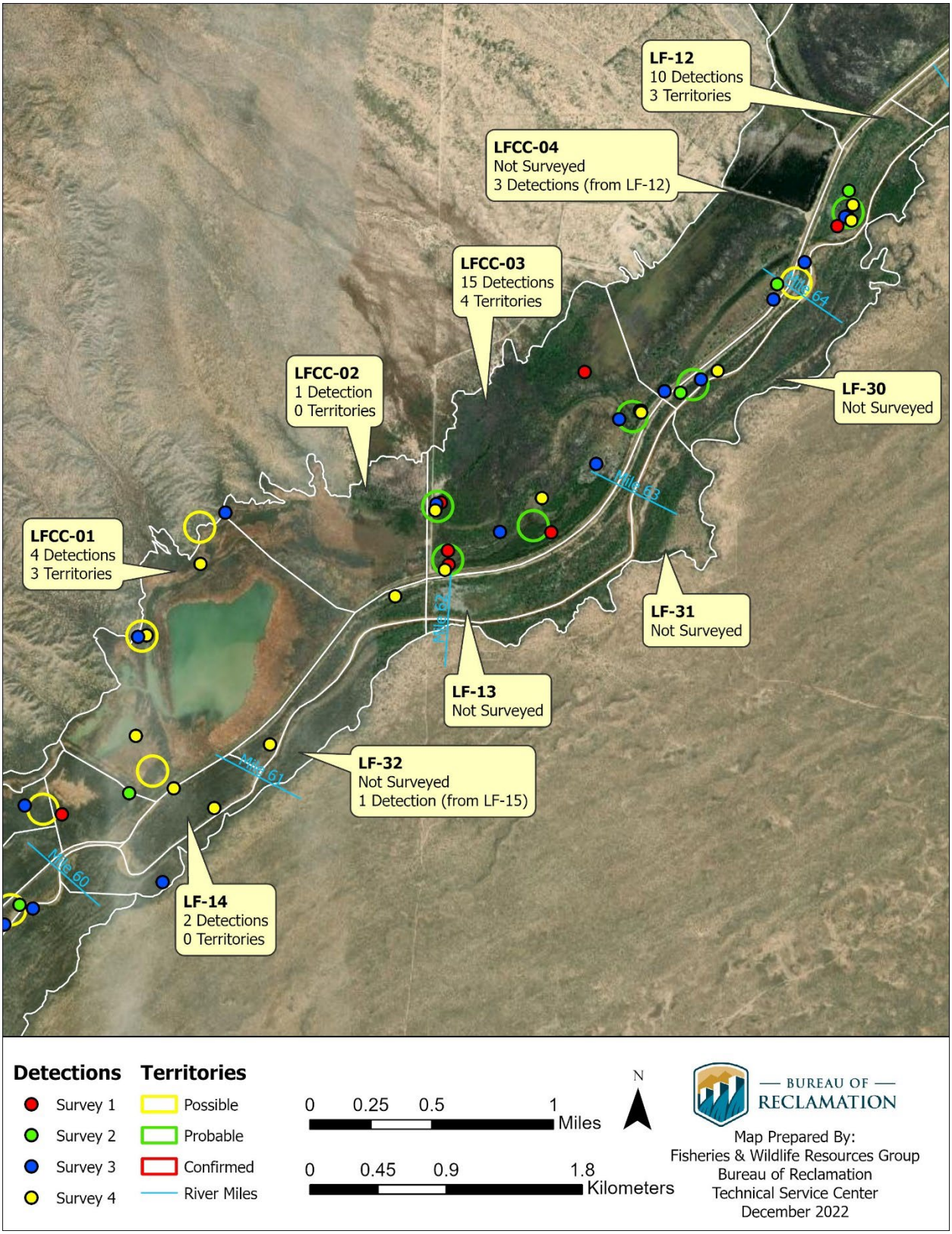

Figure A - 18. 2022 YBCU detections and territories in the San Marcial Reach (1 of 7).

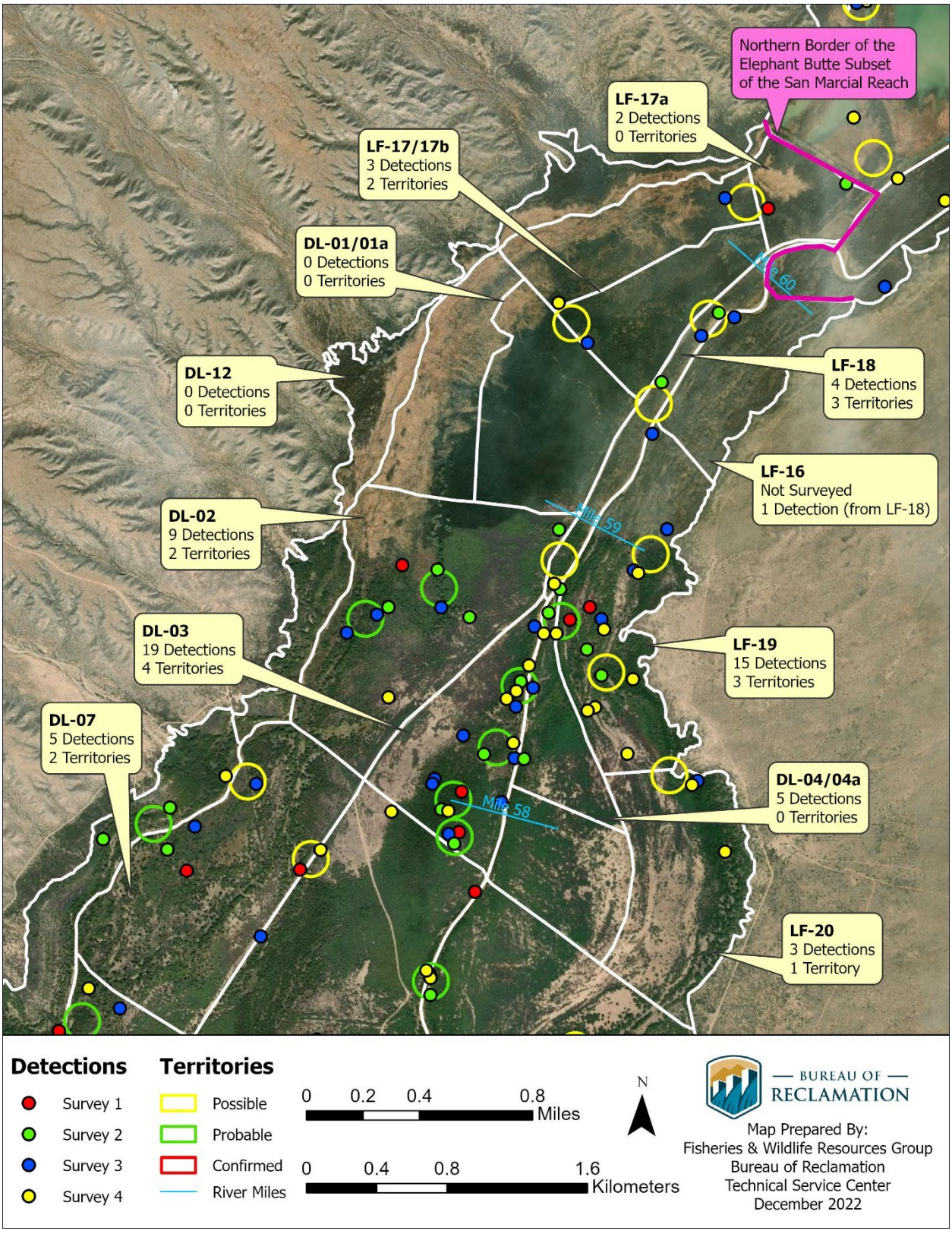

Figure A - 19. 2022 YBCU detections and territories in the San Marcial Reach (2 of 7).

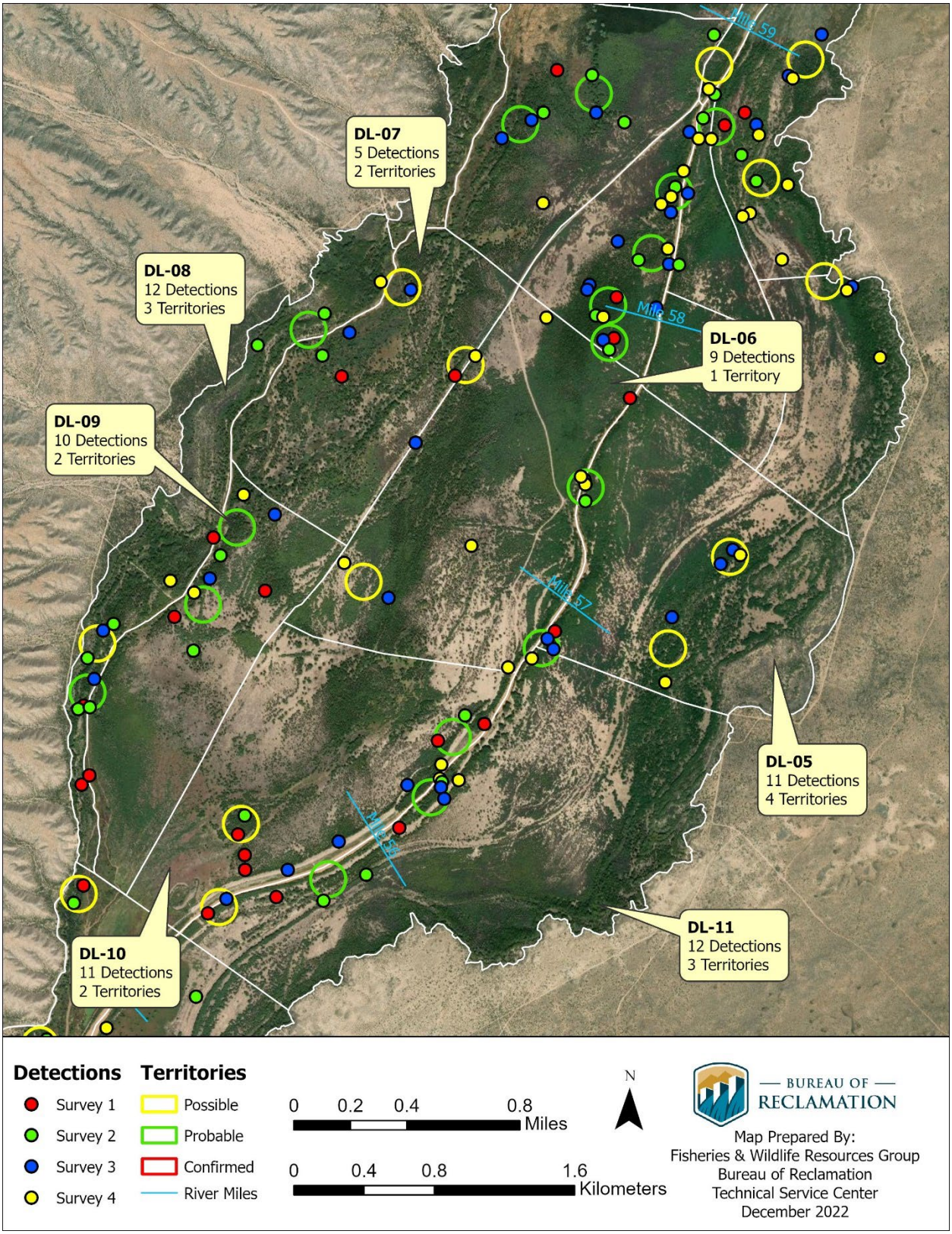

Figure A - 20. 2022 YBCU detections and territories in the San Marcial Reach (3 of 7).

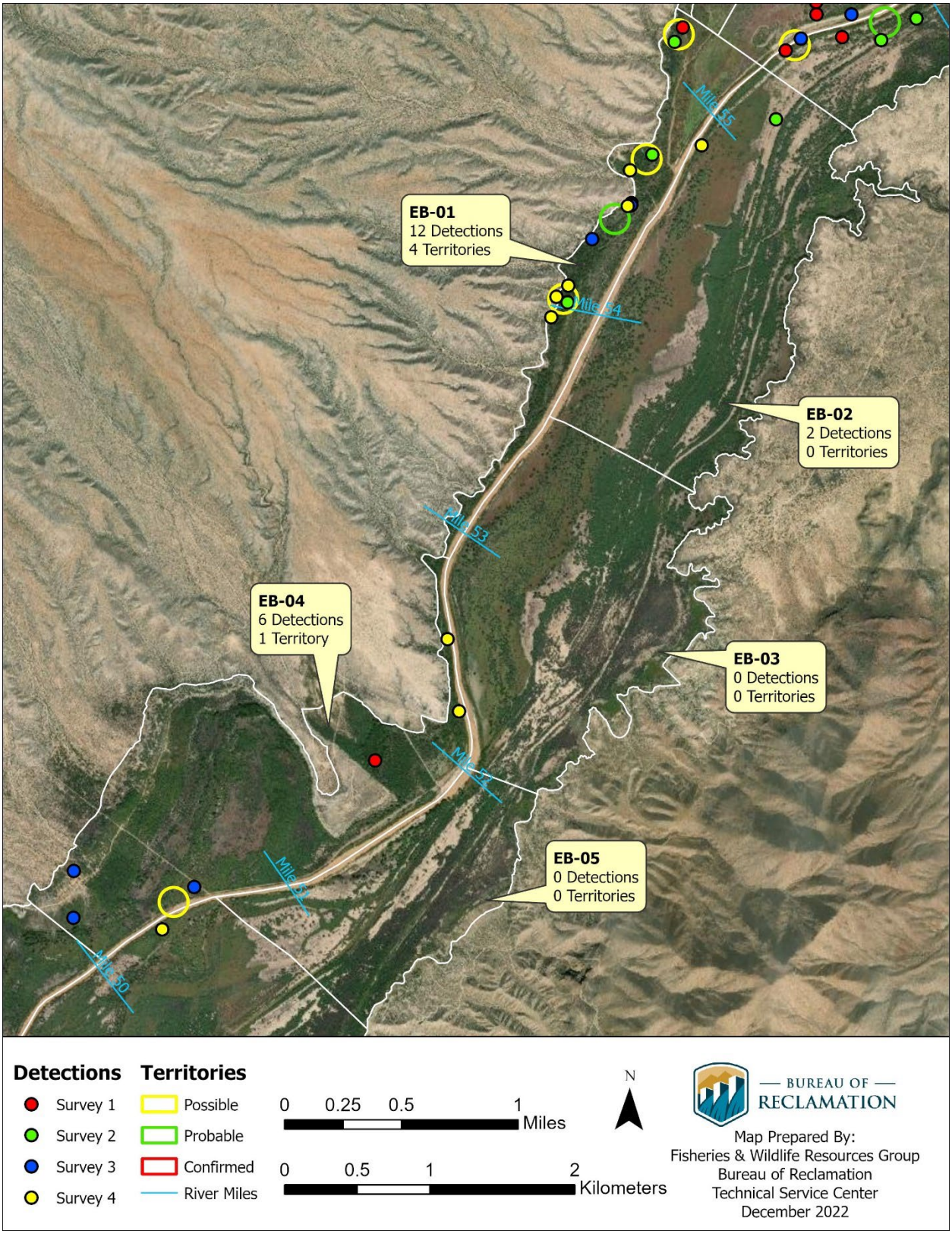

Figure A - 21. 2022 YBCU detections and territories in the San Marcial Reach (4 of 7).

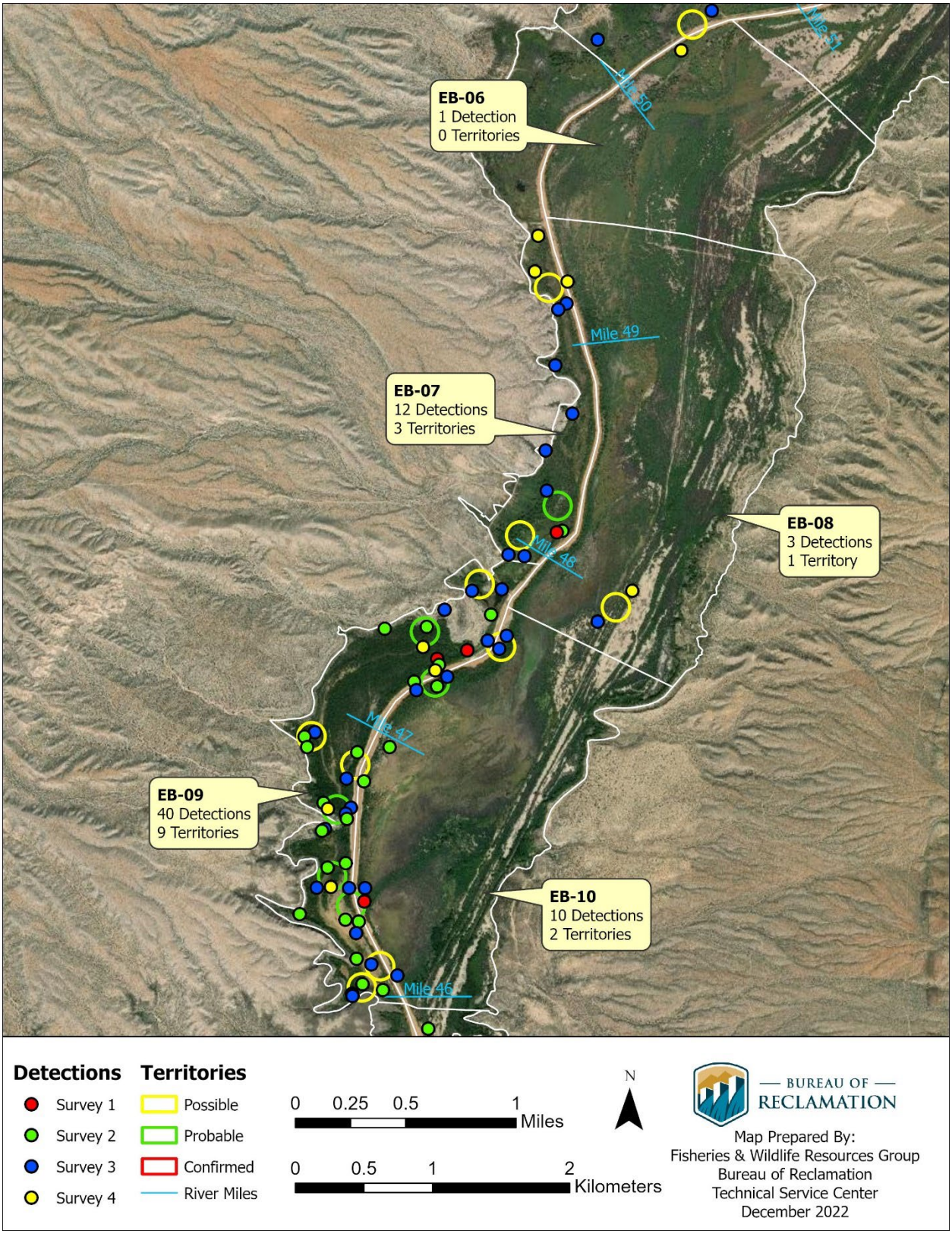

Figure A - 22. 2022 YBCU detections and territories in the San Marcial Reach (5 of 7).

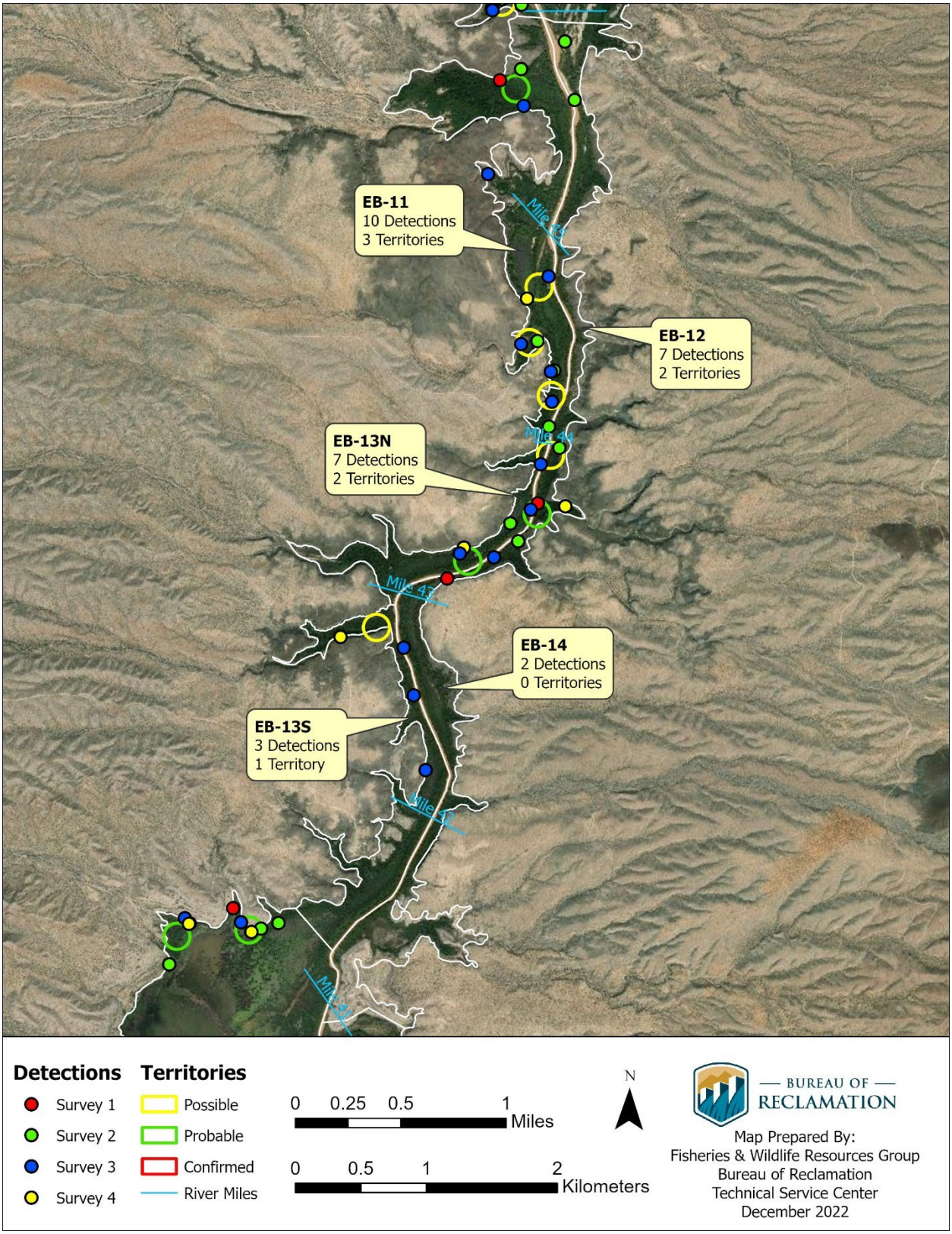

Figure A - 23. 2022 YBCU detections and territories in the San Marcial Reach (6 of 7).

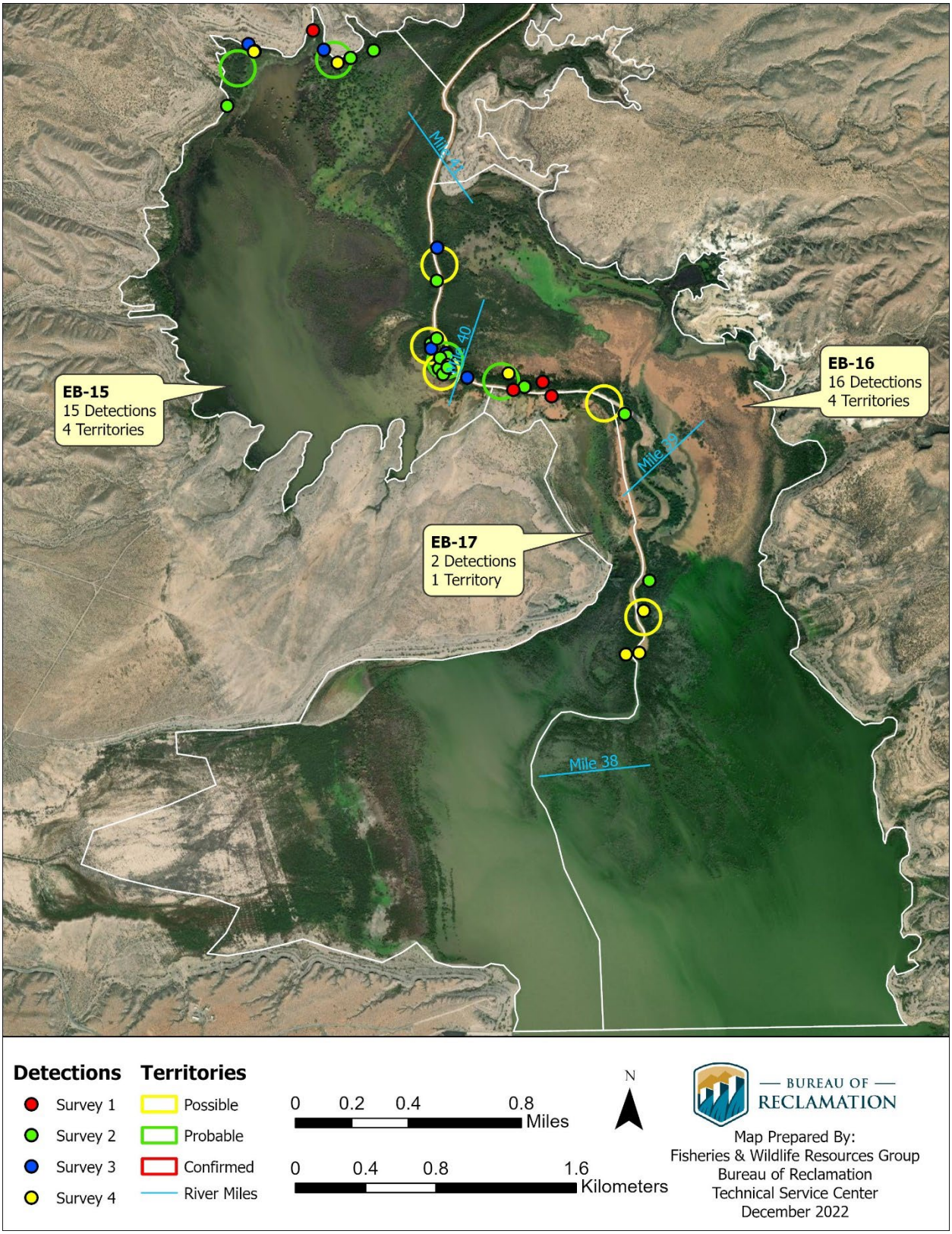

Figure A - 24. 2022 YBCU detections and territories in the San Marcial Reach (7 of 7).

Appendix B: YBCU Territories 2009 to 2022

Reach	Figures	Pages
Belen	B-1 to B-3.....	...51 to 53
Sevilleta/La Joya.....	B-4.....	54
San Acacia.....	B-5.....	55
Escondida.....	B-6 to B-8.....	...56 to 58
Bosque del Apache.....	B-9 to B-10.....	...59 to 60
Tiffany.....	B-11.....	61
San Marcial.....	B-12 to B-16.....	...63 to 66

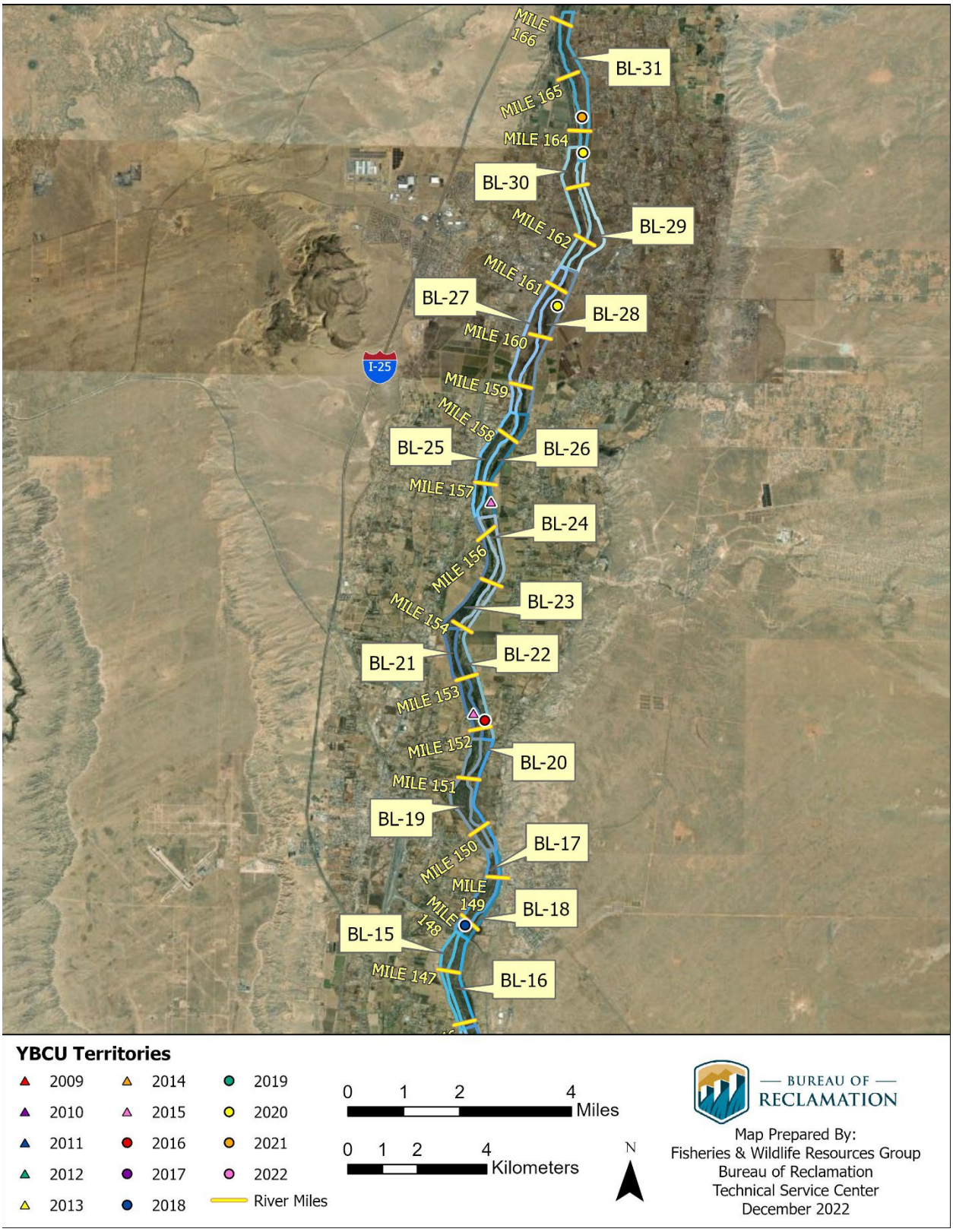

Figure B - 1. Belen Reach YBCU territories from 2009 to 2022 (1 of 3). These sites first surveyed in 2014 and not surveyed in 2019. Only sites BL-15, BL-25 and BL-27 thru BL-31 surveyed in 2020 and 2021.

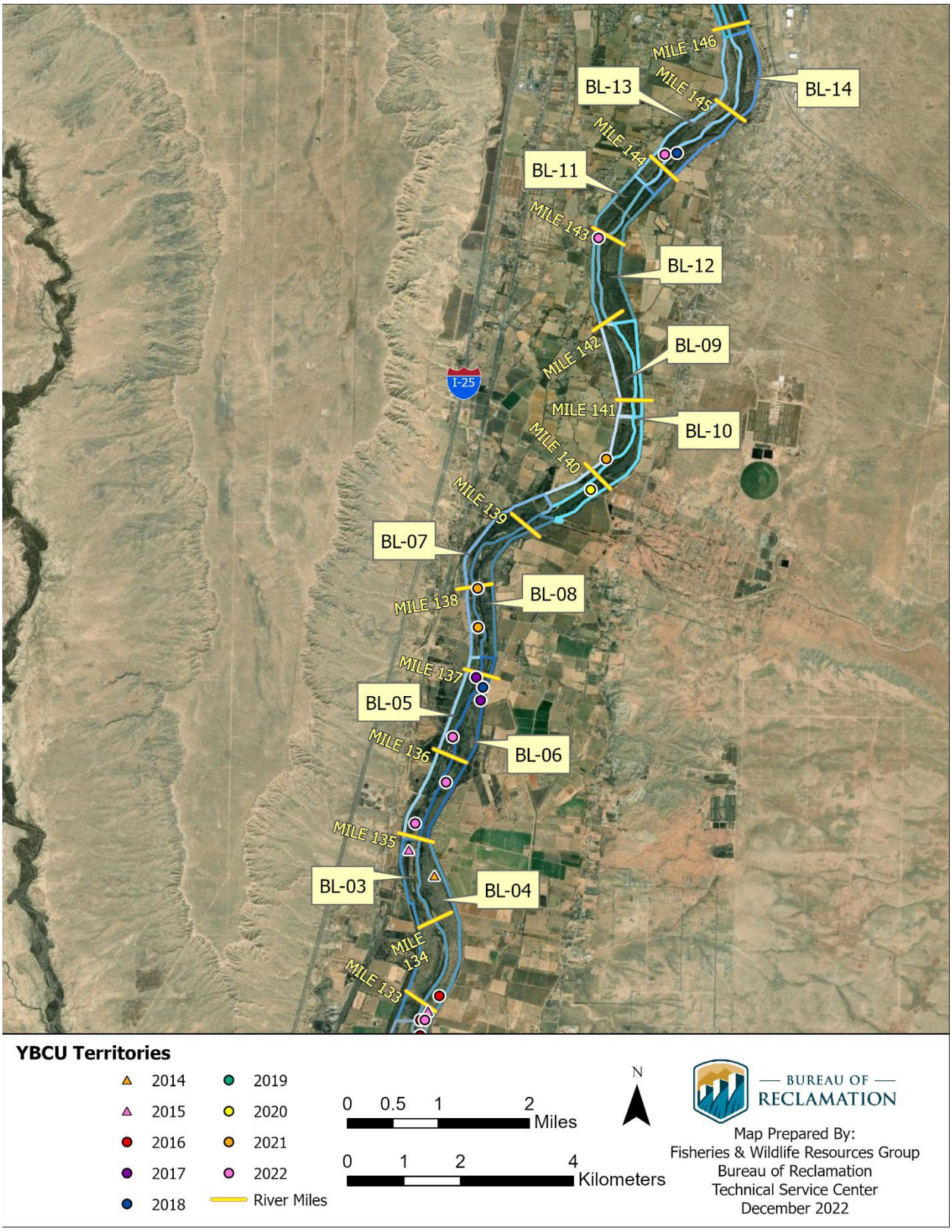

Figure B - 2. Belen Reach YBCU territories from 2009 to 2022 (2 of 3). These sites first surveyed in 2014. Only BL-10 and BL-14 surveyed in 2020 and BL-05 thru BL-10 surveyed in 2021.

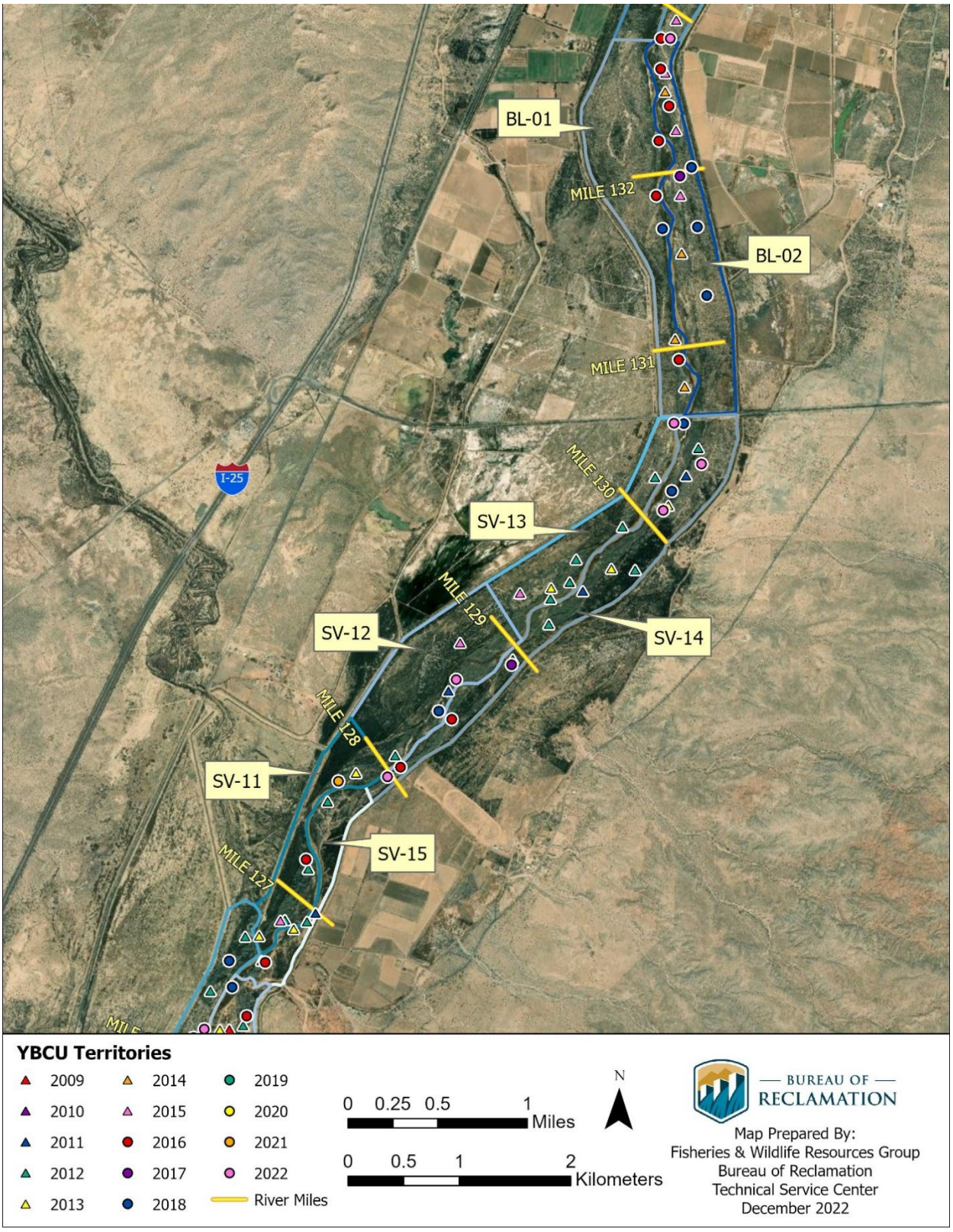

Figure B - 3. Belen Reach YBCU territories from 2009 to 2022 (3 of 3). Sites SV-11 thru SV-15 were first surveyed in 2009, sites BL-01 and BL-02 first surveyed in 2014. None of these sites were surveyed in 2020 and only SV-11 was surveyed in 2021.

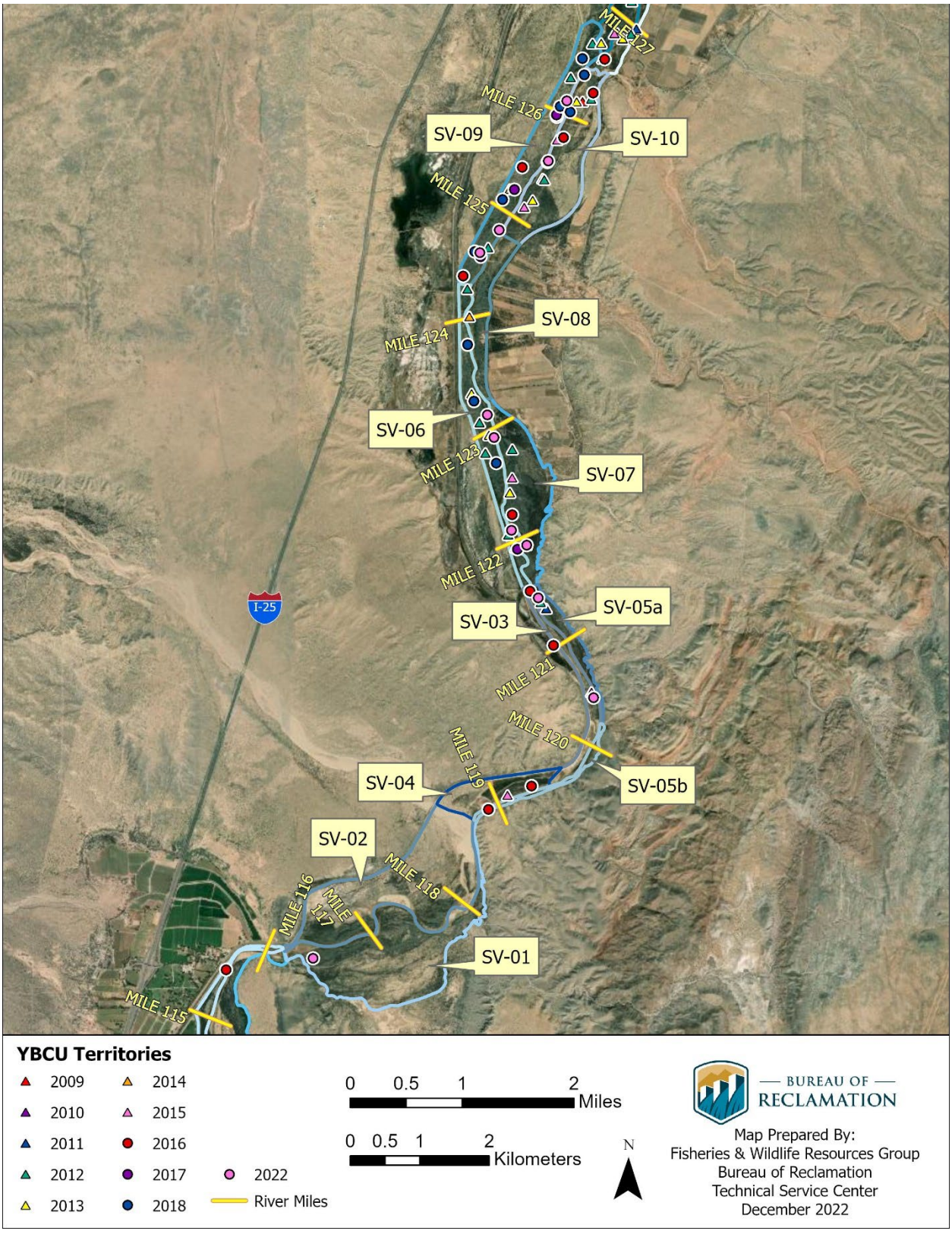

Figure B - 4. Sevilleta/La Joya Reach YBCU territories from 2009 to 2022 (1 of 1). No sites surveyed 2019 to 2021.

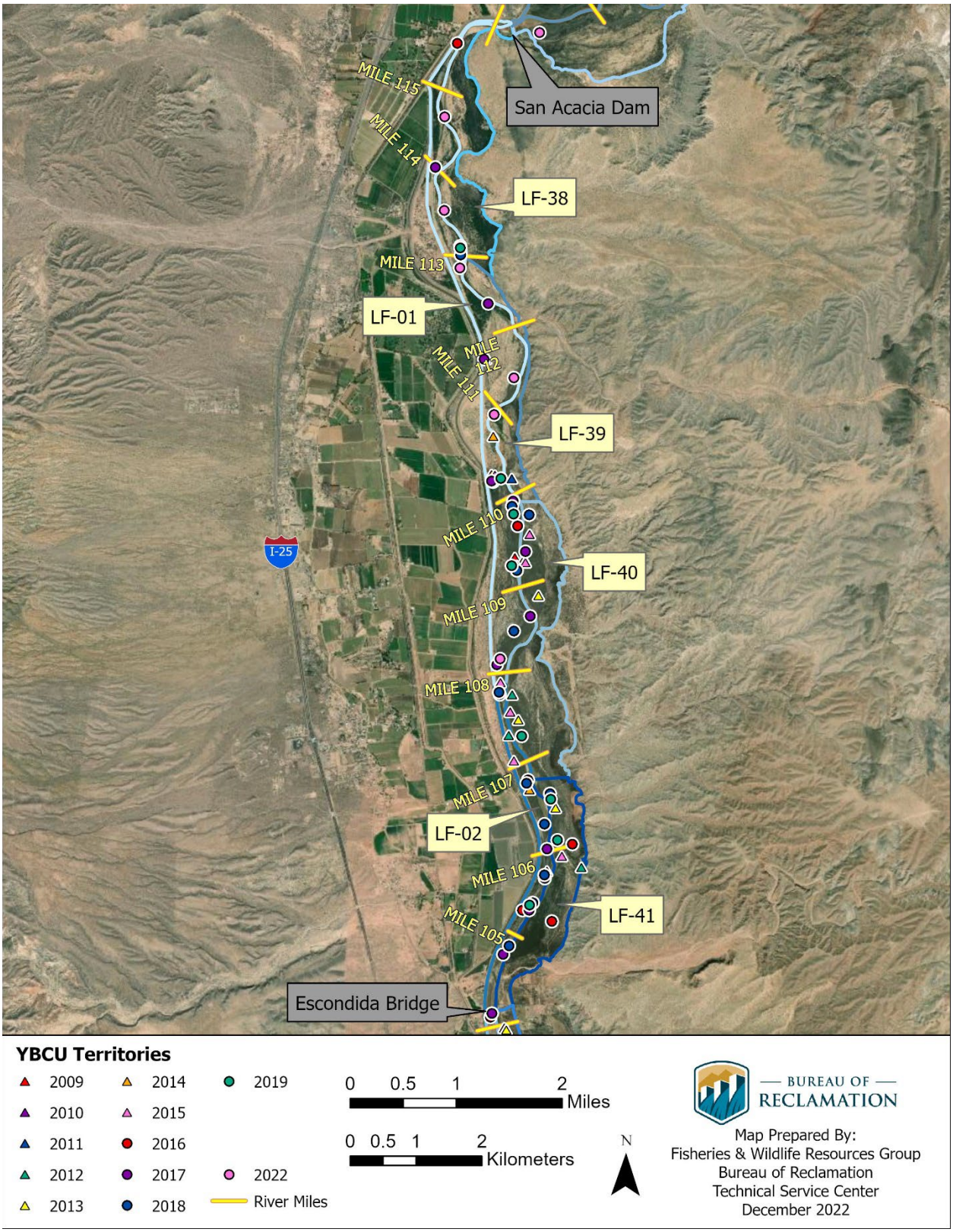

Figure B - 5. San Acacia Reach YBCU territories from 2009 to 2022 (1 of 1). Not surveyed in 2020 and 2021. Only LF-01 and LF-38 surveyed in 2022.

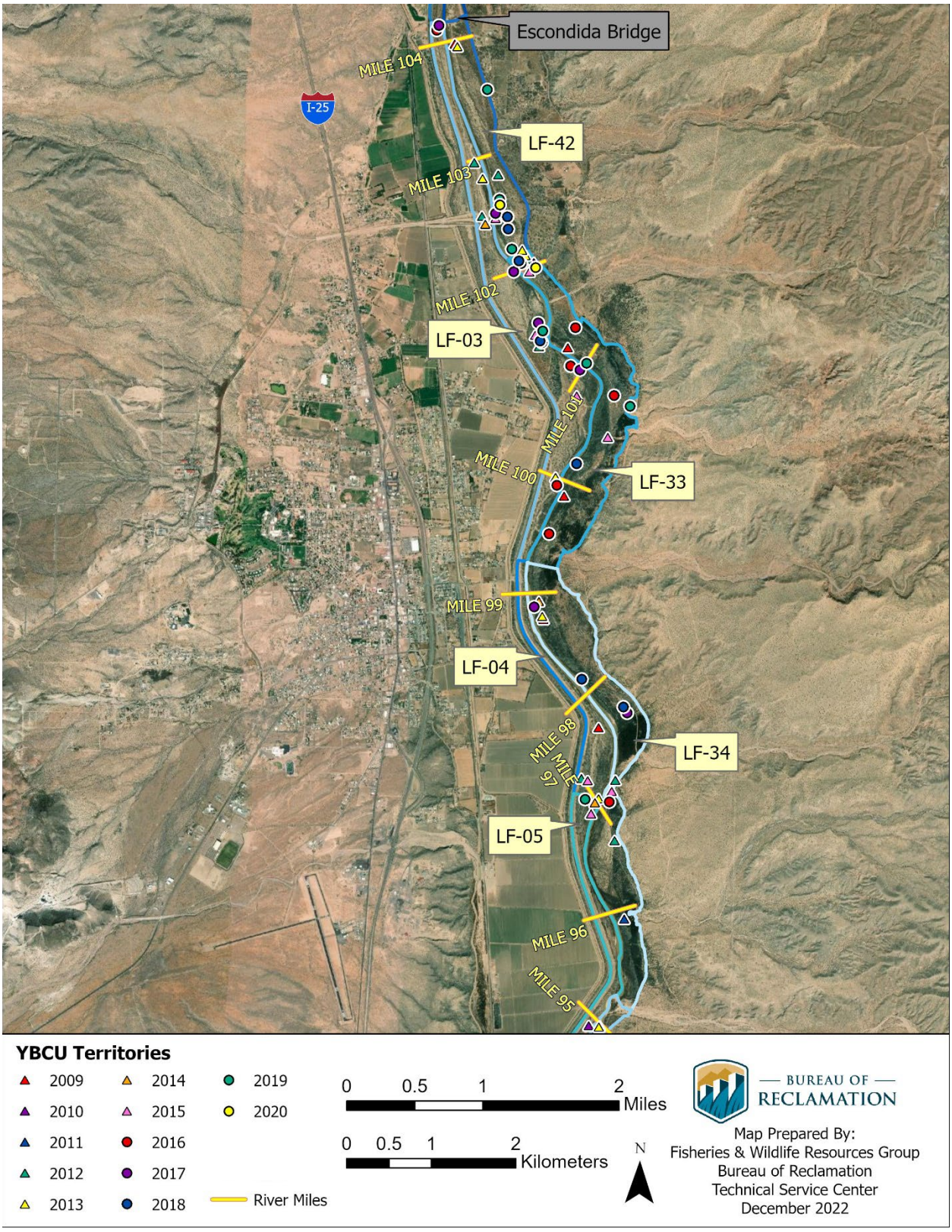

Figure B - 6. Escondida Reach YBCU territories from 2009 to 2022 (1 of 3). These sites not surveyed 2021 to 2022. Only LF-42 surveyed in 2020.

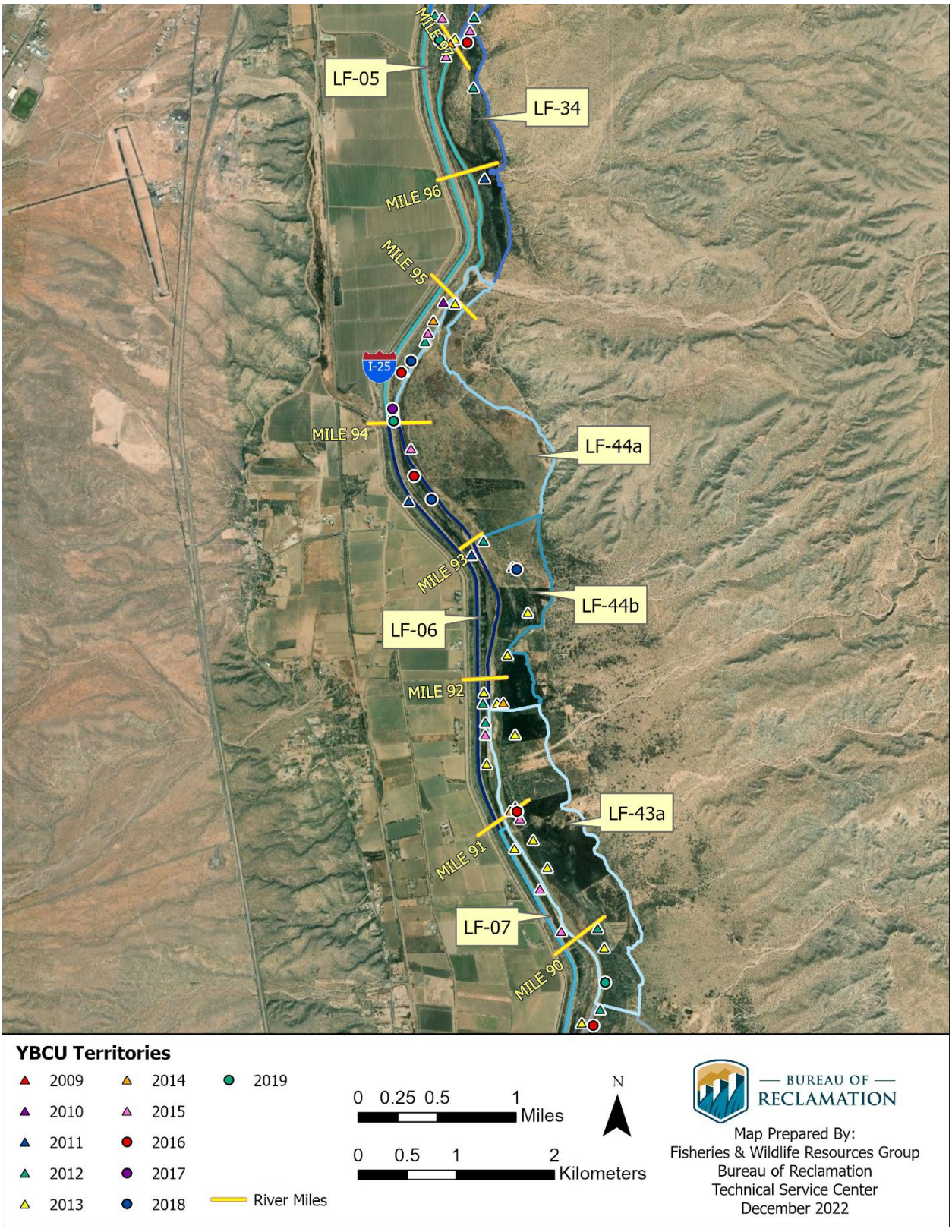

Figure B - 7**.** Escondida Reach YBCU territories from 2009 to 2022 (2 of 3). These sites not surveyed 2020 to 2022.

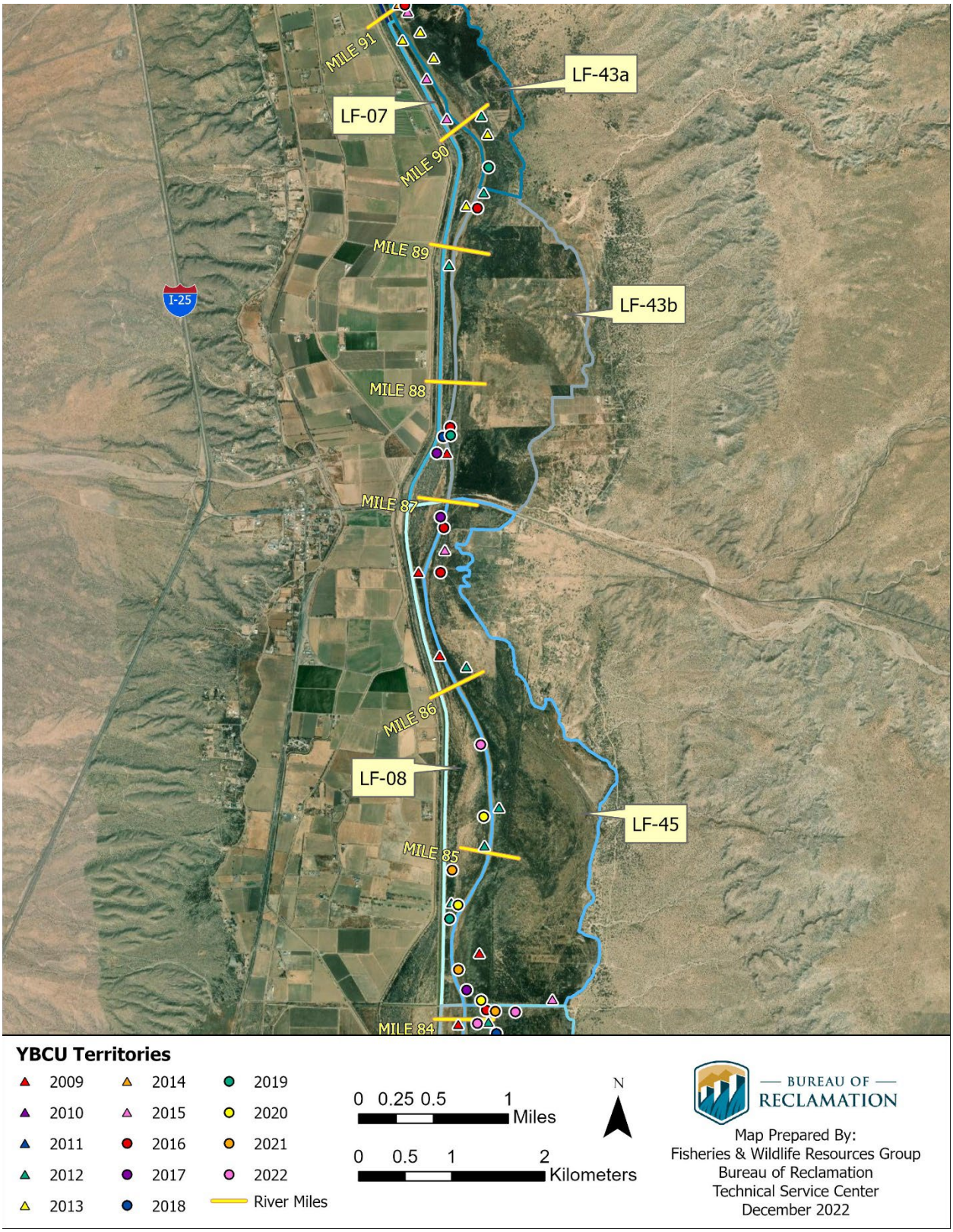

Figure B - 8. Escondida Reach YBCU territories from 2009 to 2022 (3 of 3). Only LF-08 and LF-45 surveyed 2021 to 2022.

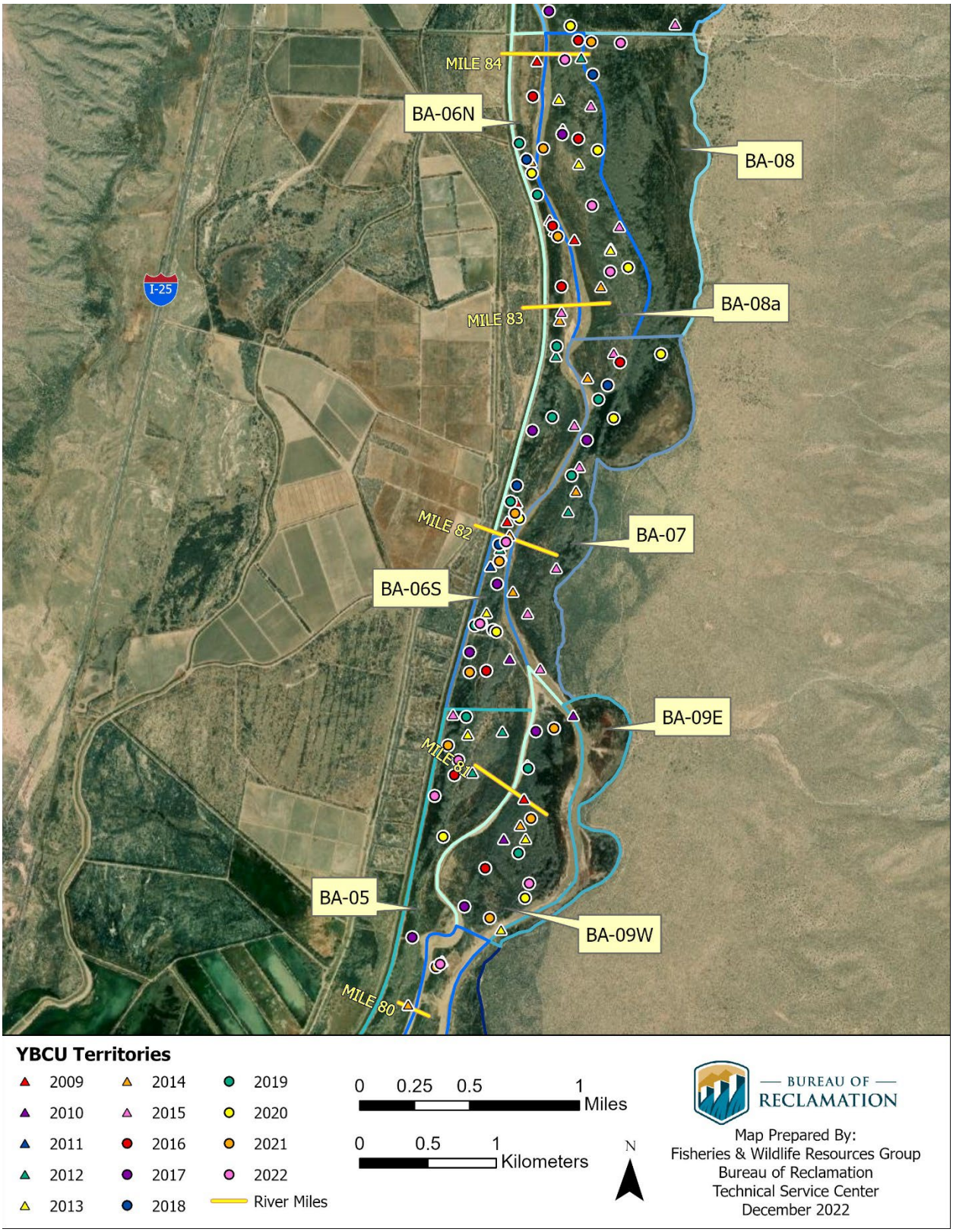

Figure B - 9. Bosque del Apache Reach YBCU territories from 2009 to 2022 (1 of 2). BA-06N not surveyed in 2020.

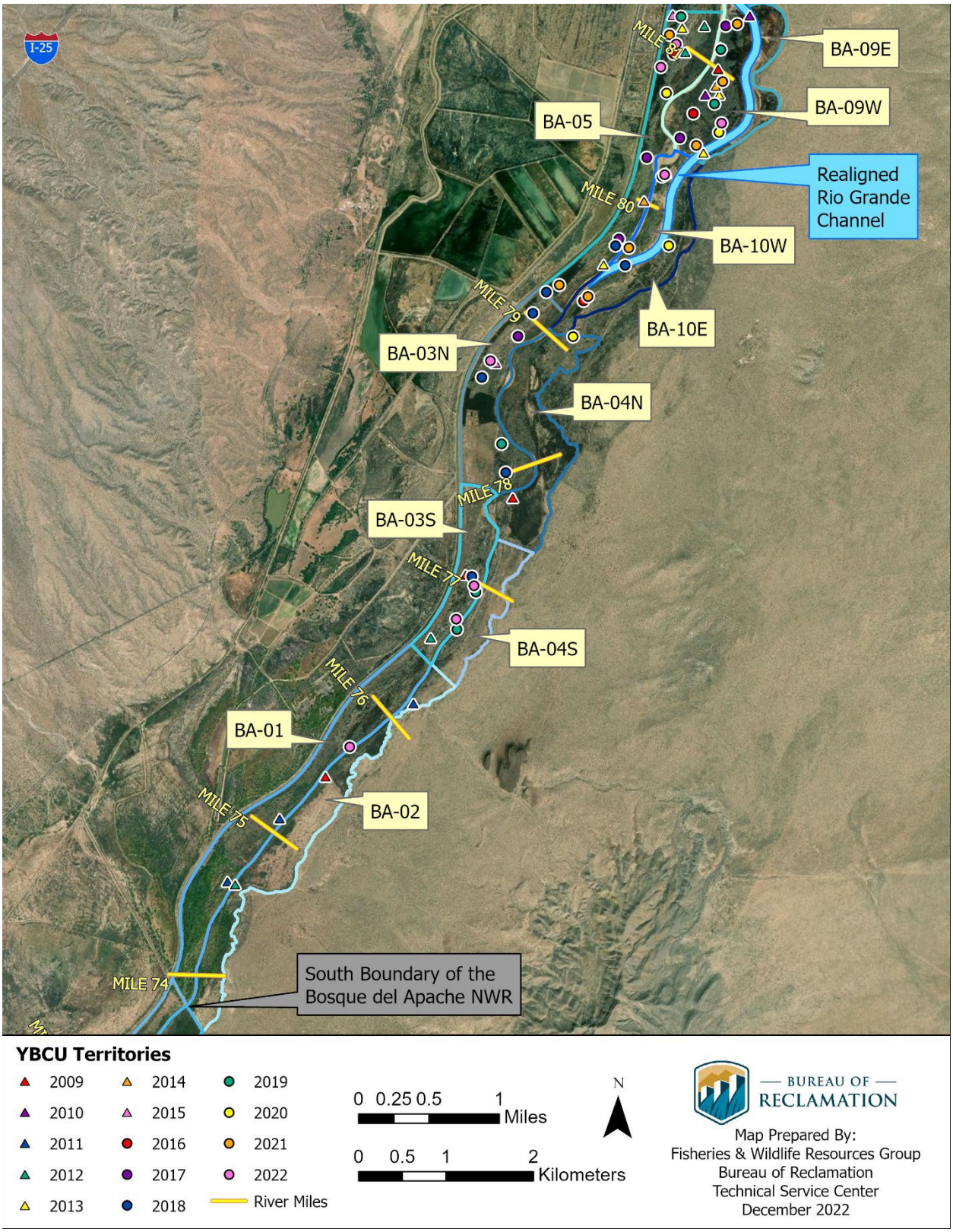

Figure B - 10. Bosque del Apache Reach YBCU territories from 2009 to 2022 (2 of 2). Only BA-05, BA-09E, BA-09W, BA-10E and BA-10W surveyed 2020 to 2021.

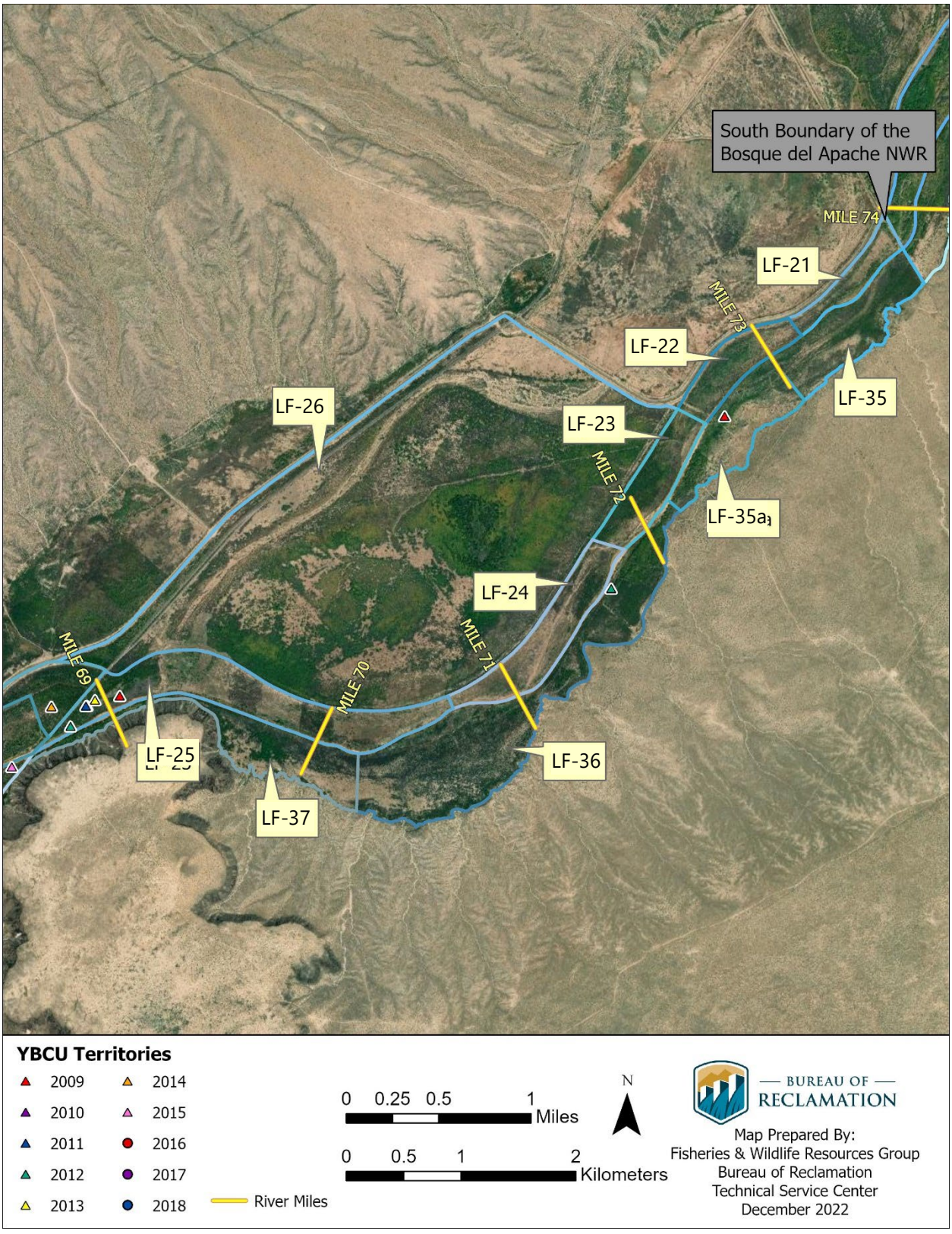

Figure B - 11. Tiffany Reach YBCU territories from 2009 to 2018 (1 of 1). Only site LF-26 was surveyed in 2018. Reach not surveyed 2019 to 2022.

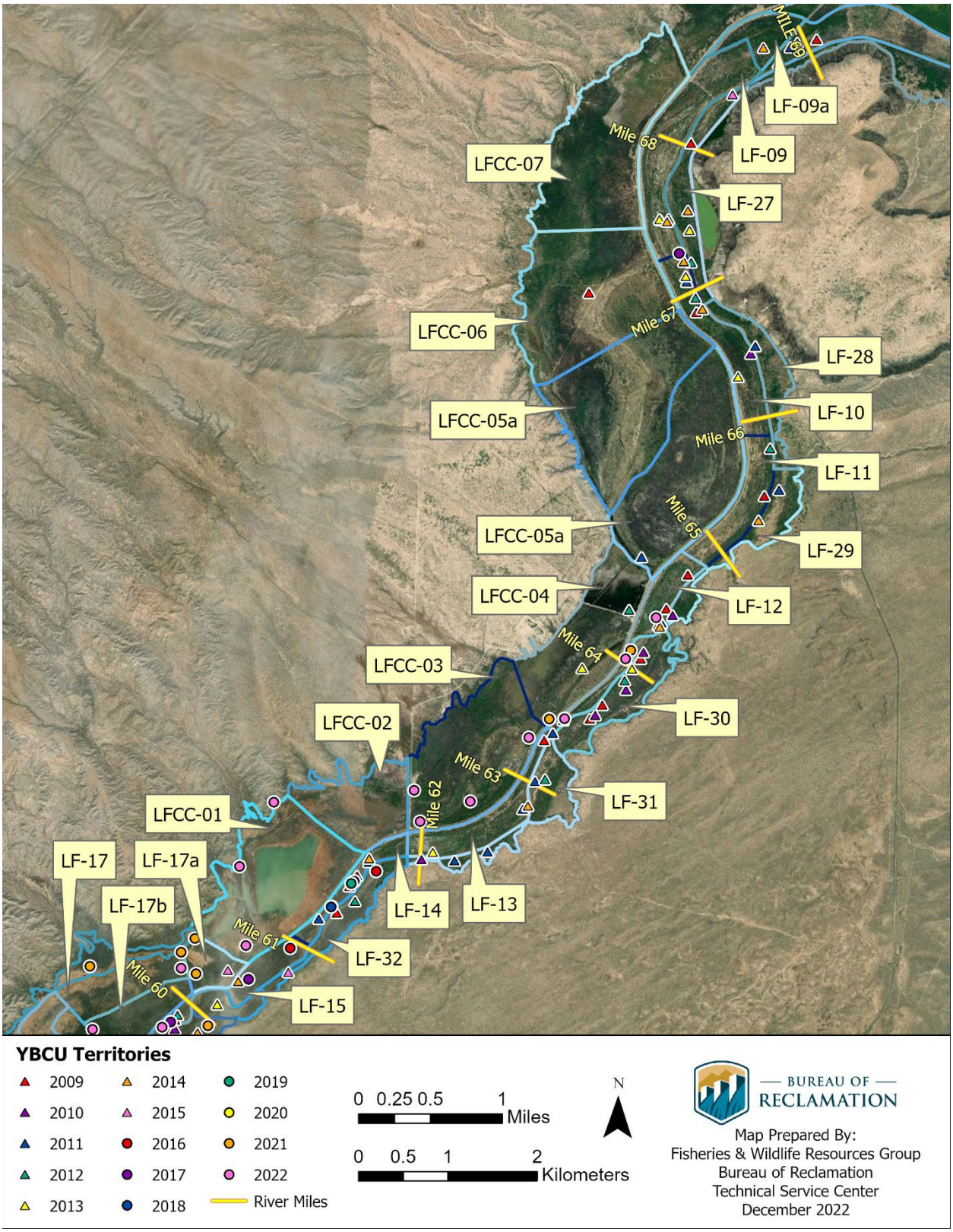

Figure B - 12. San Marcial Reach YBCU territories from 2009 to 2022 (1 of 5). Only site LFCC-01 was surveyed in 2020 and only sites LF-12, LF-16, LF-17a, and LF-17/17b were surveyed in 2021.

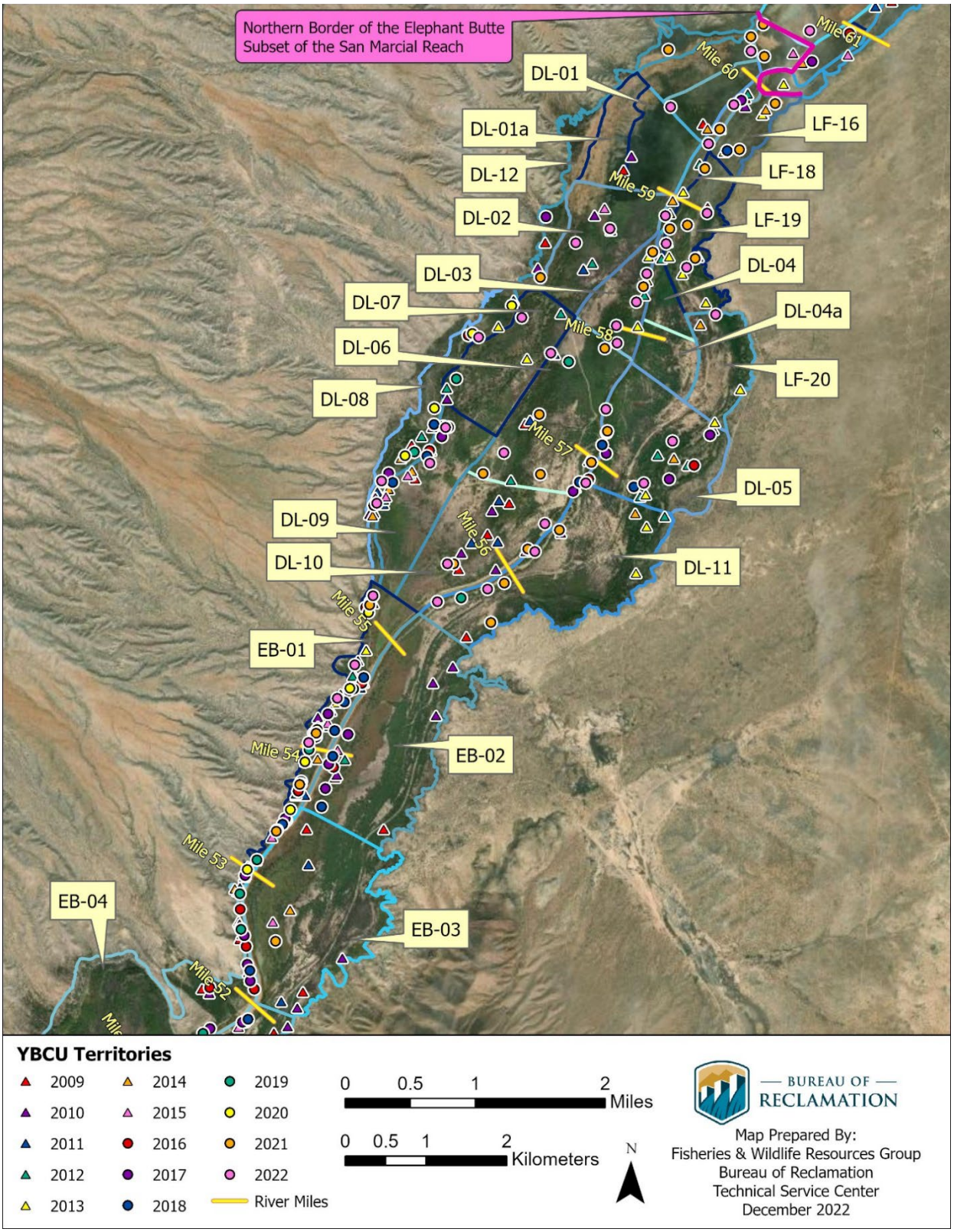

Figure B - 13. San Marcial Reach YBCU territories from 2009 to 2022 (2 of 5). Only sites DL-08, DL-12 and EB-01 were surveyed in 2020. All sites except DL-01, DL-02, DL-07, DL-08 and DL-09 were surveyed in 2021.

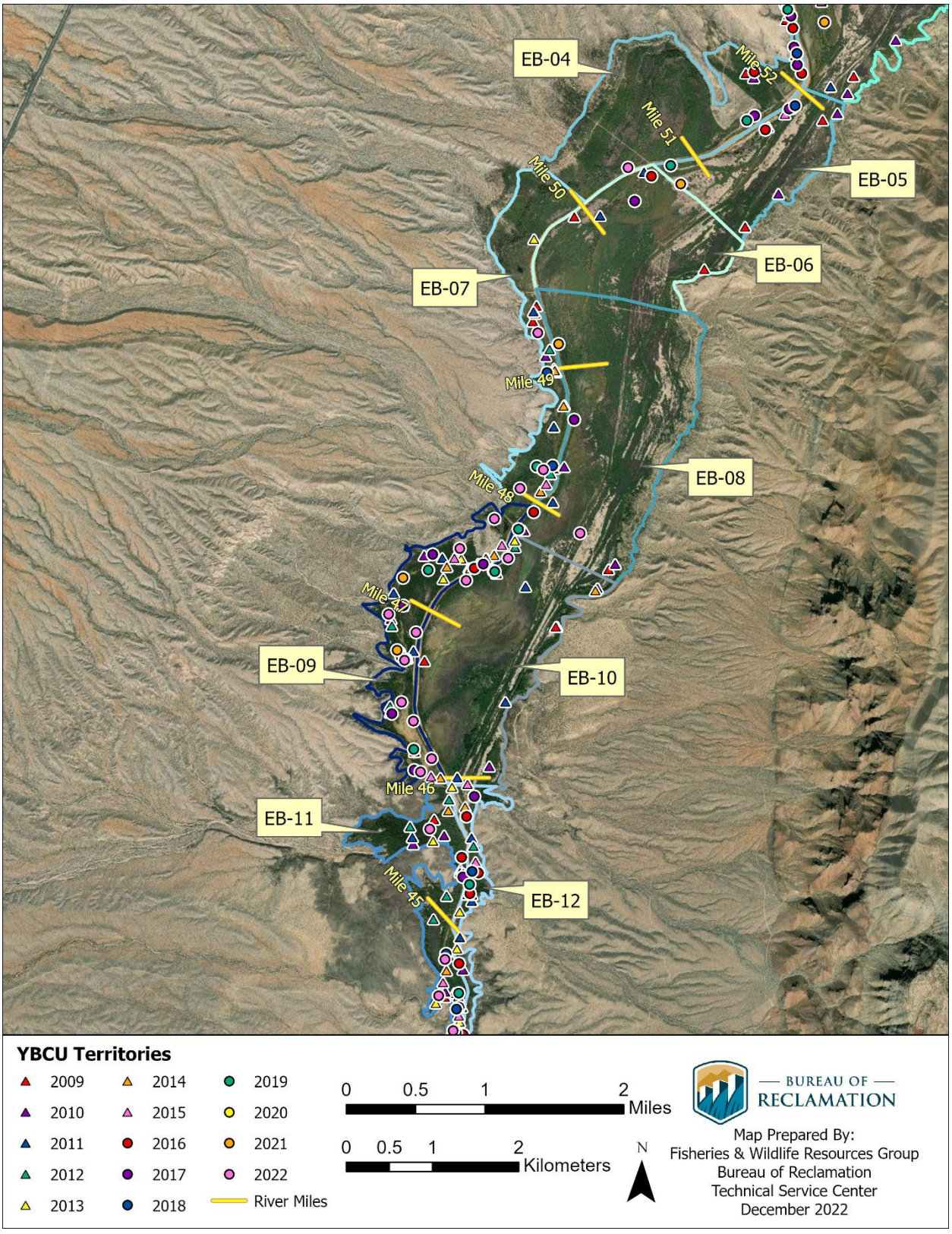

Figure B - 14. San Marcial Reach YBCU territories from 2009 to 2022 (3 of 5). Only site EB-07 was surveyed in 2020.

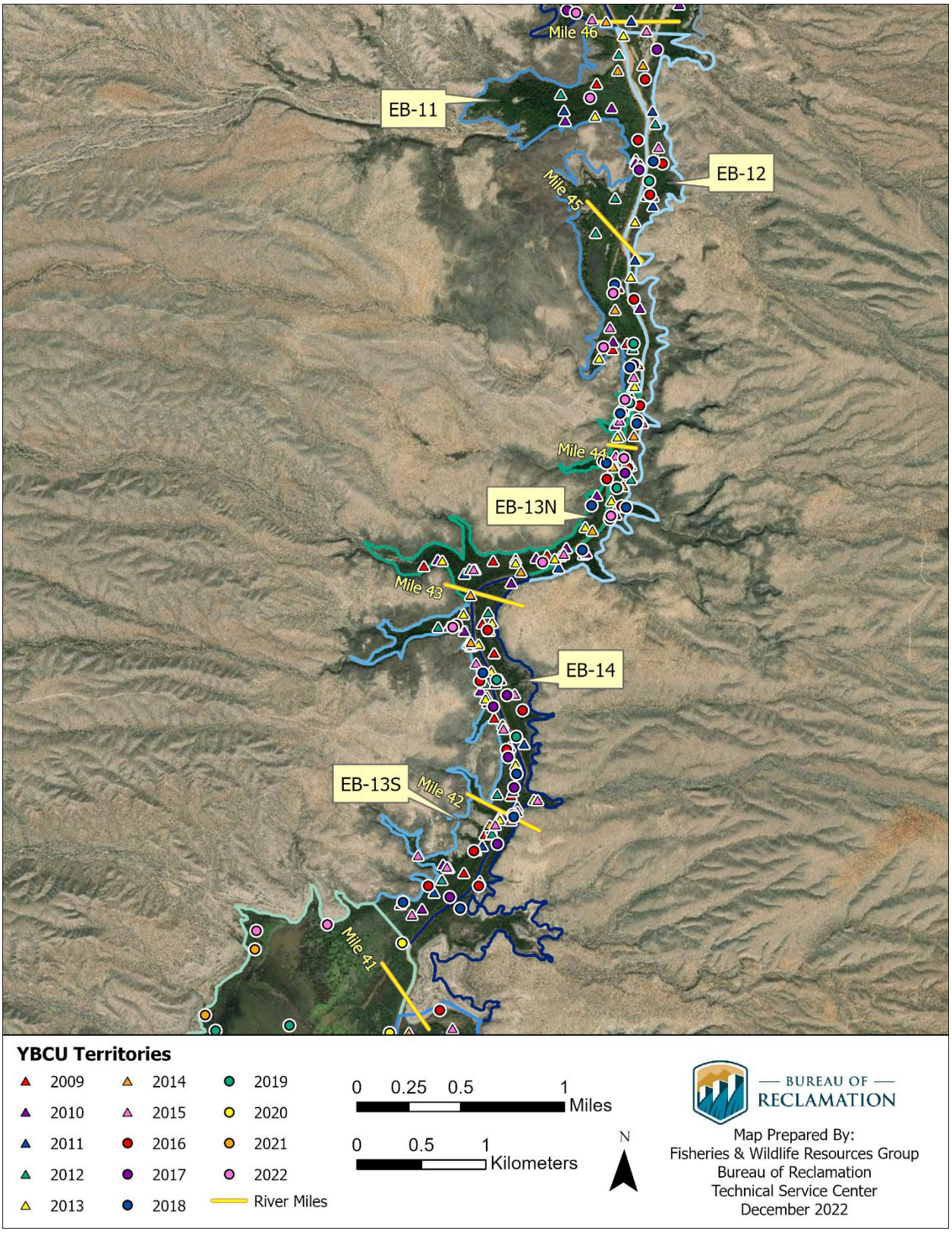

Figure B - 15. San Marcial Reach YBCU territories from 2009 to 2022 (4 of 5). These sites not surveyed in 2020 and 2021.

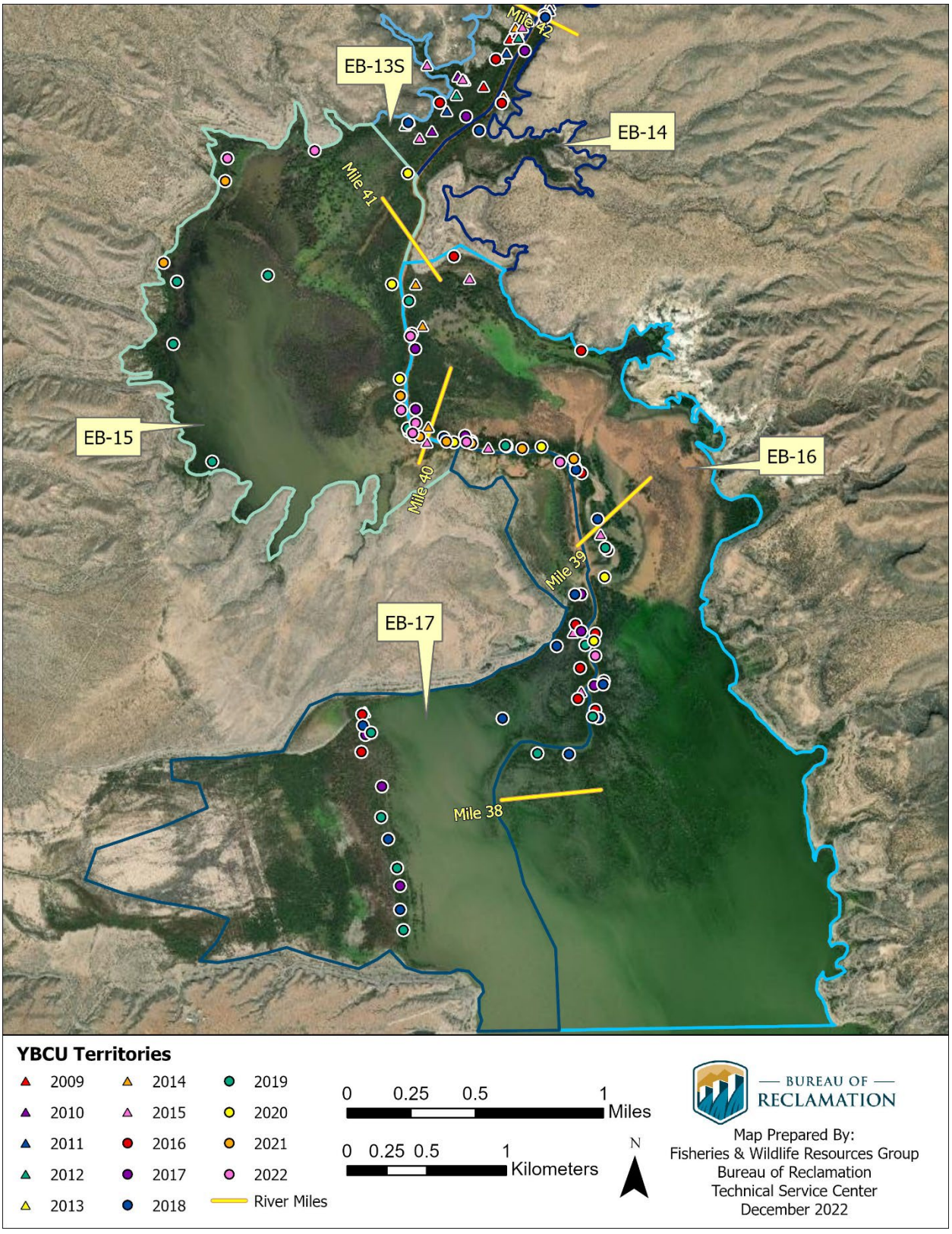

Figure B - 16. San Marcial Reach YBCU territories from 2009 to 2022 (5 of 5). Only sites EB-15 and EB-16 surveyed in 2020 and 2021.