

BIA Rt 19: SR 86 to End of Road Road Safety Assessment



Prepared for:
The Tohono O'odham Nation



Prepared by:



Funded by:



U.S. Department
of Transportation
Federal Highway
Administration

NOT FOR CONSTRUCTION: Recommendations contained in this document are intended **ONLY** for use by the local agency determining possible future changes at the RSA location.

May 2023

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Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected to identify, evaluate, or plan the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or to develop any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.”

Project Request

The Road Safety Assessment (RSA) of the BIA Indian Route 19 was conducted at the request of the Tohono O'odham Nation. It should be noted that this RSA focused explicitly on the safety aspects of the BIA Rt 19 corridor from State Route 86 to its southern terminus, to include BIA Route 191.

RSA Team

Mike Blankenship of Greenlight Traffic Engineering led the independent, multi-disciplinary RSA team. The RSA team included:

- Adam Larsen, Federal Highway Administration
- Jeff King, Federal Highway Administration
- Richard Nassi, Pima Association of Governments
- Gabe Thum, Pima Association of Governments
- Felipe Ladron de Guevara, Kittelson & Associates
- Josh Barger, Greenlight Traffic Engineering

RSA Process

A Road Safety Assessment is a formal examination of user safety of a roadway by an independent, multi-disciplinary team that includes experienced and knowledgeable members. RSAs help promote safety by identifying a range of safety issues; promoting awareness of safer transportation planning, design, construction, and maintenance practices; integrating multimodal interests; and, more directly, considering the effect of human factors, enforcement and education activities, and emergency responder practices.

The RSA team conducted this assessment to the best of its abilities within the time allotted. The initial recommendations for the Nation to consider are based on the background information provided during the Start-Up and Preliminary Findings Meetings, an evaluation of recent crash data, stakeholder and community feedback, and day and night field reviews, as discussed in the following paragraphs. This information helped the RSA team identify potential opportunities to improve the expected safety performance of the BIA Route 19 corridor. While every attempt has been made to identify potential safety issues, it is essential to note that the safety performance of the roadway remains the responsibility of the roadway owner and the roadway users.

Start-Up Meeting

The assessment team met with the Nation and stakeholders to discuss background information on December 21, 2021, virtually at a Microsoft Teams conference and in person at the Sells District Conference room in the Tohono O'odham Nation. In addition to the RSA team members, participants included Damascus Francisco (Planning and Economic Development (PEDD)), Ophelia Patten (Baboquivari District), Idella Stanley (Baboquivari District), Richard Saunders (Natural Resources Department), Vivian Saunders (Chukut Kuk District), Councilwoman Marlakay Henry (Chukut Kuk District), Andy Lopez (Gu-Achi District), Samuel Orozco (PEDD Roads Program), Rafael Castillo (US Border Patrol), Leo Porter (PEDD), Mary Lopez (Sif Oidak District), Vernon Smith (District Council), Martin Arnold (Nation Fire Department), Mary Ann Ramirez, Mario Saraficio (Nation Police Department), Kerry Wilcoxon (ADOT), Don Sneed (ADOT), Joshua Aalbert (Sif Oidak District), Rita Wilson (Sif Oidak District), Roger Manuel (San Lucy District), Allery Antone (Nation Police Department), Denise Williams (Head Start), and Elaine Delahanty (Chukut Kuk District)

Safety concerns that were noted by the stakeholders to be considered in the RSA request include the following:

- Road departure crashes
- Roadway flooding
- Shoulder erosion
- Roadside vegetation
- Animals in the roadway
- Speeding

Specific priority locations, issues, and concerns noted by stakeholders follow.

Assistant Chief Martin Arnold with the Fire Department added that many crashes (rollovers) at the road curves have a cattle guard across the roadway. This is possibly due to a combination of speed and road departure.

The stakeholder group also noted concerns that the washes south of the Baboquivari District are problem areas that need signage. Additionally, the roadway signs could be more visible and present for first responders to help locate incidents. There is a curve by Cold Fields that needs signage for the curve. Bus stops need to be signed on this route. Animal signs could also help, in addition to speed limit- signs.

A Baboquivari District representative noted that speed is a factor in a few fatal crashes at the mentioned curves. This is due to drivers who are not familiar with the area. This route appears to have many drivers who are not familiar with the area. There is also an issue with aggressive driving on the route, such as illegal passing. She also mentioned that there are no fences on the sides of this route.

Elaine Delahanty mentioned vegetation overgrowth down to the New Fields community. She also noted that speeding in residential areas is occurring. She would also like to see shoulders on the side of the road to increase the refuge areas for drivers. Flooding in the washes in the southern region of the route has caused blocked travel. There need to be

more speed limit signs. Additionally, the mile marker signs are largely absent. Communities are being developed in the Cowlic community area and other areas along the route.

Denise Williams noted that vegetation is overgrown between mile markers 8 and 9, and washes need depth signs. Gabe pointed out that the shoulders of the roadway appear to be eroding, and there appear to be less recoverable areas for run-off road drivers.

The Acting Chief of Police commented that the DUI checkpoints had recently disappeared. The only other checkpoints are related to border patrol. Additionally, he noted that DUI crashes by the schools in the south of the roadway are mostly runoff road types. He said that most crashes are also animal involved. He suggested edge of the roadway reflectors and increased lighting.

Vivian Saunders mentioned that she had taken photos of erosion along the roadway, causing problems for bus drivers and road users. She also asked if speed humps could be installed on the street and if a marker for the end of route 19 could be placed on the south end.

The Lieutenant and Patrol Commander of the Nation's Police in Sells mentioned that the road widening had encouraged speeding. There also appears to be criminal damage to the road signs that hampers convictions for speeding. Rafael Castillo said that the shoulders in the southern area had been repaired slightly. But the shoulders need to be improved overall.

Kerry Wilcoxon noted that the school area described earlier needs speed feedback signs that could help reduce speeds in the school area.

Richard Saunders commented that the state has daytime and nighttime speed limits. This may be applicable for this route to encourage slower travel at night. Richard Nassi mentioned that Tucson has these types of speed limits and seconds the use of them on route 19.

Field Reviews

A daytime field visit was conducted on Tuesday, December 21, starting at approximately 1:00 PM, and an evening/nighttime field visit was conducted the same day at approximately 5:00 PM. The weather was hot and dry. The site review involved driving and walking the study area and observing road users.

The RSA team noted several existing roadway features that appear to enhance safety in the study area, including the following:

- Signs generally in good condition
- Pavement width is appropriate
- Curve warning signs
- Striped passing and no-passing zones
- Roadside object markers
- Wash depth gauges
- 12' lanes
- Reflective Pavement Markers (RPMs)
- No passing zone signs
- Road curve advance warning signs



Chevron warning signs



Centerline reflective pavement markers

Evaluation of Crash Data

The most recent ten years of available crash data (2011 through 2020) for this 29-mile section of BIA Route 19 was obtained from ADOT's ACIS crash report database. A total of 291 crashes occurred over the 10-year period. The crashes on the route are broken down by crash severity, crashes by year, and crashes by time of day in **Figure 1** through **Figure 3**.

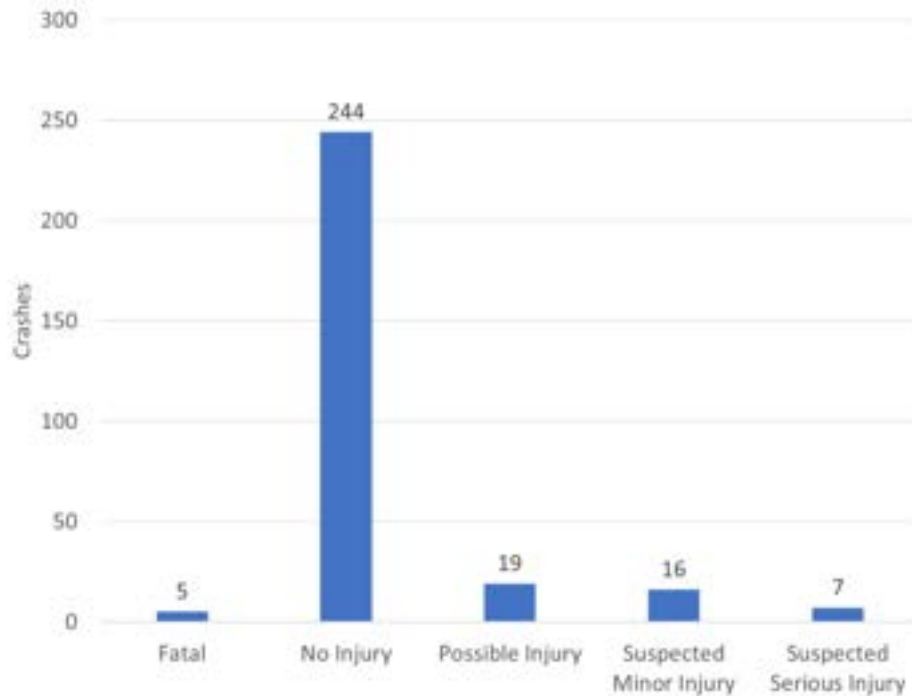


Figure 1: Route 19 Crash Severity

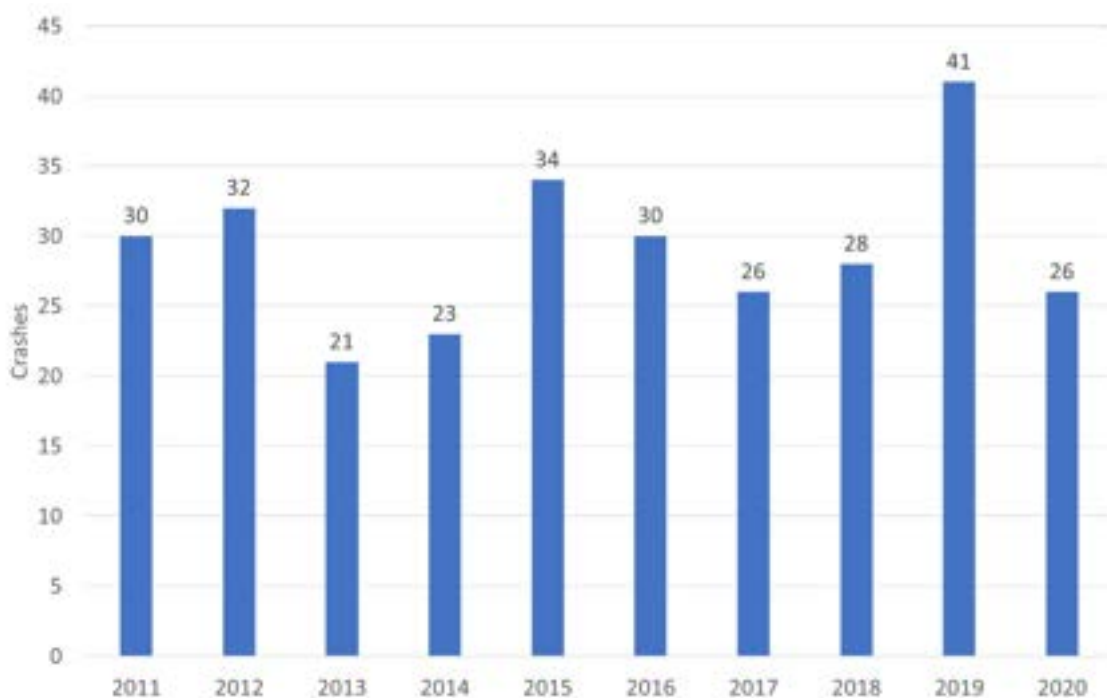


Figure 2: Route 19 Crashes by Year

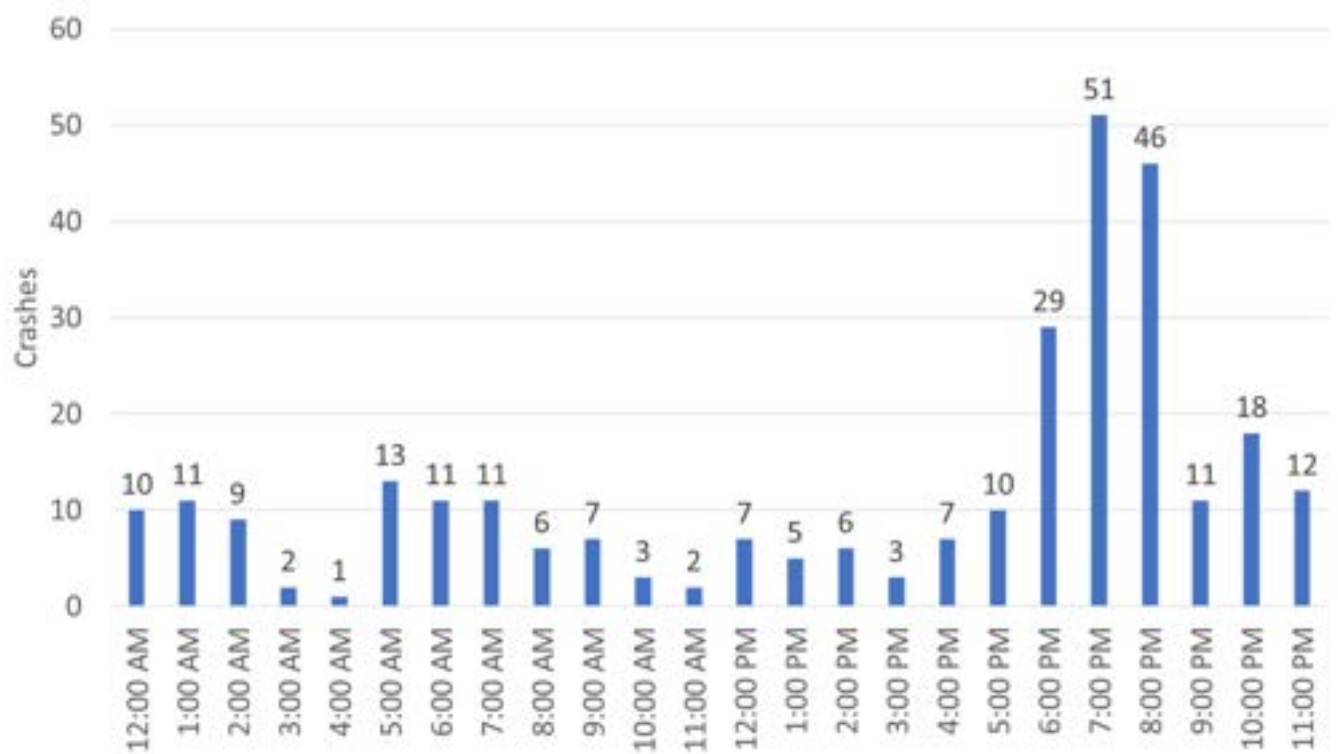


Figure 3: Route 19 Crashes by Time of Day

The crashes on the route are broken down by crash manners are shown in **Table 1**.

Table 1: Route 19 Crashes by Collision Manner

Collision Manner	Crashes	Percent of Total
Single Vehicle	269	92%
Rear End	7	2%
Left Turn	4	1%
Other	4	1%
Sideswipe Same Direction	4	1%
Sideswipe Opposite Direction	2	1%
Angle (Front To Side)(Other Than Left Turn)	1	<1%
Total	291	100%

The first harmful event frequency is shown in **Figure 4**. Animal crashes make up 80% of the total crashes.

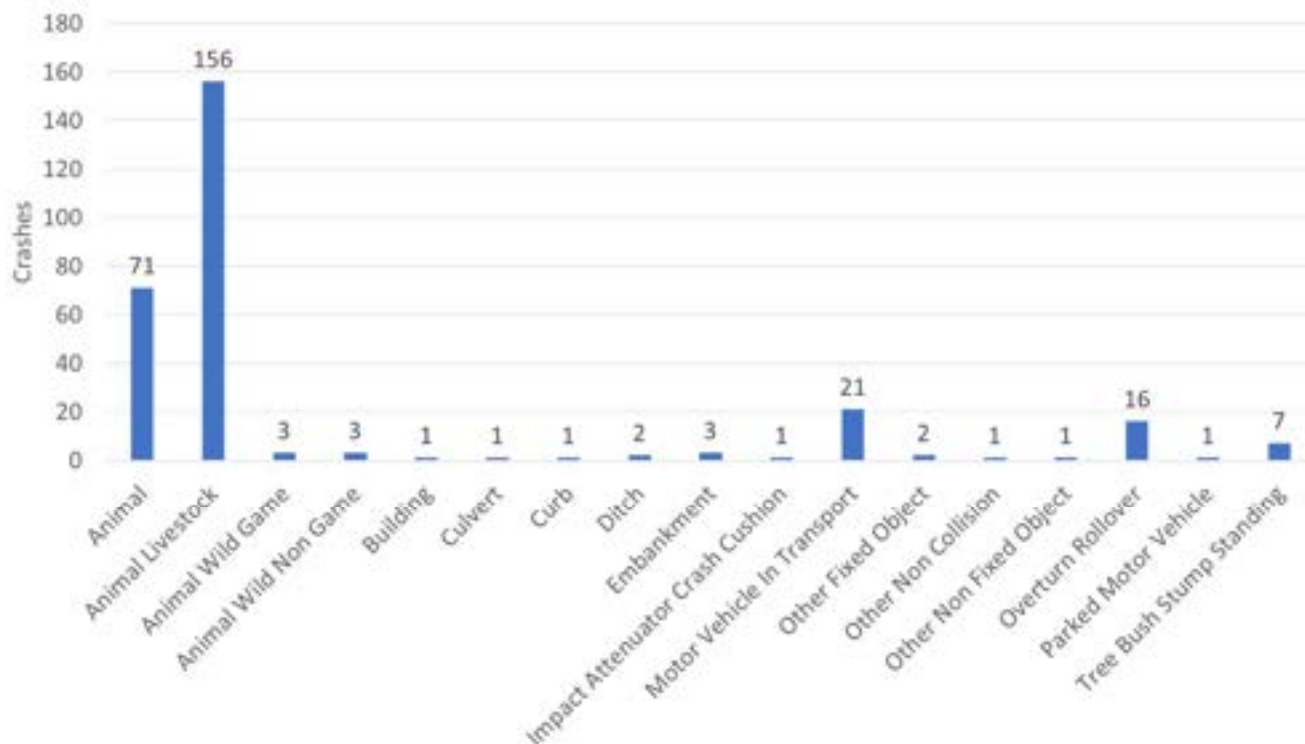


Figure 4: Route 19 Crashes by First Harmful Event

The route's crashes by the first harmful event compared to crash severity are shown in **Table 2**.

Table 2: Route 19 First Harmful Event by Crash Severity

Severity	Animal	Cross Centerline	Fail to Yield ROW	Left Turn	Rear End	Roadway Departure	Sideswipe – Same Direction	Other	Total
Fatal						5			5
Suspected Serious Injury	1				1	5			7
Suspected Minor Injury	9				1	5	1		16
Possible Injury	12	2				5			19
No Injury	211	1	1	4	6	16	3	2	244
Total	233	3	1	4	8	36	4	2	291

The route's crashes that involved violations related to impaired drivers are shown in Table 3.

Table 3: Route 19 Crashes by Impairment

Impairment	Percent of Total
Alcohol	6%
Drugs	1%
Fell Asleep/Fatigue	1%

There were five fatal crashes and seven suspected serious injury crashes. The location of crashes by severity are shown in **Figure 5**, and the crash density or heat map is shown in **Figure 6**.



Figure 5: BIA Route 19 crashes between 2011 and 2020 by crash severity



Figure 6: BIA Route 19 crash density (heat map) for crashes from 2011 to 2020

Public Outreach and Comment

Following the team's field review of the corridor, the Nation completed a public outreach initiative to garner public comments regarding safety on the BIA Route 19 corridor.

The public had a chance to review reported crashes and take a 360-degree virtual tour of the route. The public was encouraged to comment by clicking on the map at the spot where they have concerns at the following link:

<https://fhwapolicy.maps.arcgis.com/apps/CrowdsourceReporter/index.html?appid=3307bc8a86e14ca7b81d5487e12cffac>

The public also had the option to send comments by email to TORoadsProgram@tonationnsn.gov, including the route number, location (nearest milepost), and brief description of the safety concern. The last day for public comments was Friday, February 18, 2022.

These public comments can be found in **Appendix A**.

Additionally, presentations of the RSA's findings were given at District Meetings during their January, February, and March 2023 sessions.

Observations and Recommendations

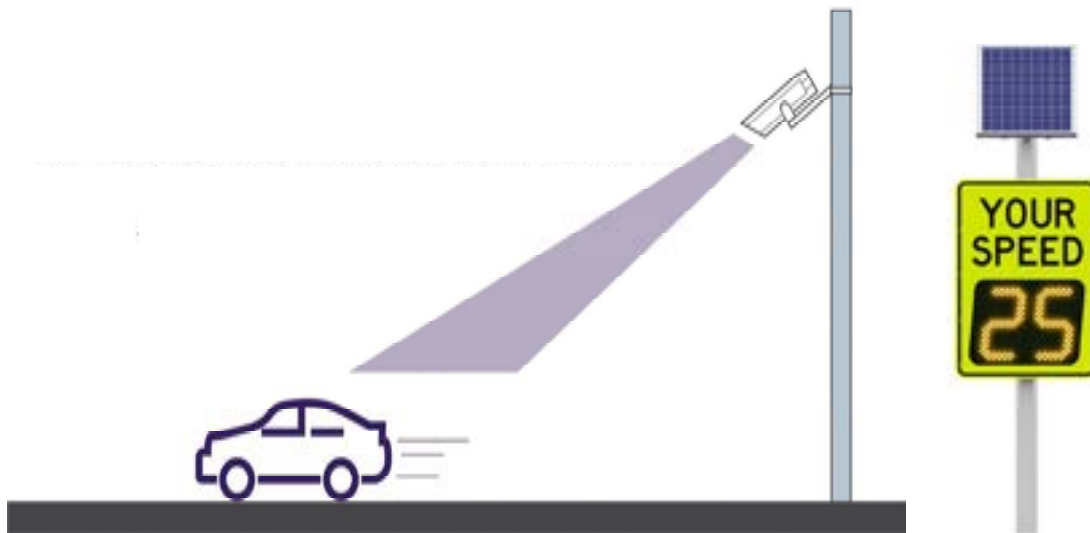
Specific safety issues and recommendations for consideration are discussed in the following sections. Additionally, the locations of the existing safety issues and hazards, as determined by the RSA team, are displayed in the maps found in **Appendix B**.

Corridor Speed

Law enforcement indicated that extremely high vehicle speeds are typical on BIA Rt 19, and the Nation has limited resources available for speed enforcement. Speeding was a factor in 10% of the crashes and 42% of the fatal and serious injury crashes in this corridor. Several vehicles were also observed traveling above the posted speed limit by the RSA team.

Speed management recommendations along the study corridor include:

- Reduce speed limit near communities
- Consider installing a roundabout at community intersections to encourage lower speeds
 - Install a roundabout at the intersection of Route 19 and Topawa School Road
 - Install a roundabout at mile marker 11.7 near the South Komelik community's center driveway
- Consider establishing a strategic speed management program
 - Speed feedback signs
 - Targeted speed enforcement
 - Photo enforcement



Speed camera demonstration and speed feedback sign example

Fencing

The RSA team observed intermittent no fencing along both sides of the roadway. In the crash data from 2011 to 2020, animal-related crashes appear to be the top crash type, with animal-related crashes throughout the corridor. The locations with animal-related crashes are shown in **Figure 7** below.



Figure 7: BIA Route 19 2011 to 2020 animal-related crashes



Cattle warning sign (MUTCD W11-4)

It was also observed that cattle were periodically wandering in the roadway. The RSA team observed other cattle congregating on the side of the roadway where vegetation could potentially obstruct their view.

Recommendations include:

- Continuous fencing

Lighting

The lighting in the corridor was observed to be absent throughout the team's nighttime review. The observed low lighting conditions appear to allow for the potential of cattle to congregate on the roadway unseen by vehicles until they approach. No driveways or unsignalized intersections were observed to have lighting.



End of the road of Route 19 in low-level lighting conditions and sample solar-powered streetlight

Recommendations include:

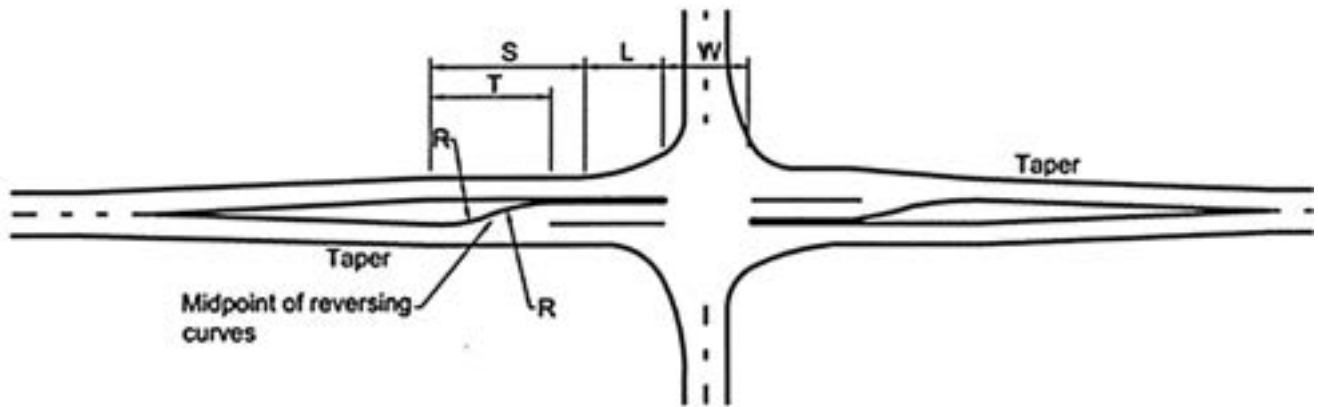
- Continuous lighting
 - At approaches to communities
 - At approaches to schools and bus stops
- Intersection lighting at major intersections

Turn Lanes

Few turn and acceleration lanes are on many of the route's intersections. Some side roads to communities and developments appear to receive adequate turning traffic to justify turn lanes and/or acceleration lanes at them. Turn lanes would have the effect of reducing conflicts between turning and through traffic on the route. This conflict was seen at the southern driveway of Baboquivari High School.

Recommendations include:

- Turn lanes and acceleration lanes at Baboquivari High School



Example of a driveway right turn lane and acceleration lane

Pavement and Shoulder

The pavement on most of the route appears to have dropped to a “poor” level of repair.

During the daytime and nighttime reviews, vegetation was observed obstructing the view of the shoulder of the roadway and signs. The locations at mile markers 1, 2.5, 3.75, 15.25, and 17 were noted to be in the worst condition.



Pavement potholes and cracking on the shoulder of Route 19



Cracking and pitting on Route 19

Roadside and sub-road soil erosion was discovered at mile markers 1.5, 3.75, and 4.75 near most roadside culverts. At mile marker 18.25, sub-road soil erosion may begin to compromise the roadway pavement.



Sub road soil erosion at mile marker 18.25 on Route 19

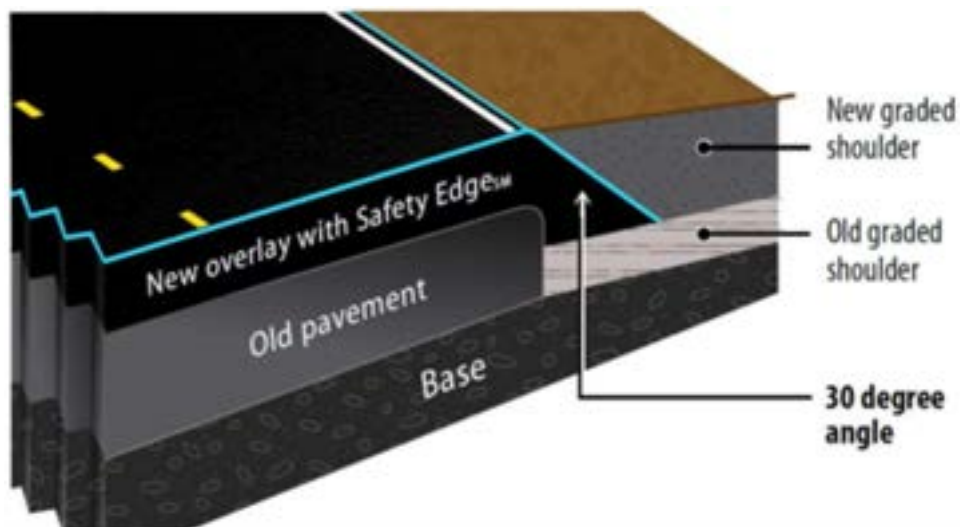
Hard shoulder edges and drop-offs were observed throughout the corridor. A driveway in a roadway curve is also observed at the intersection of Route 19 and Route 191.



Driveway in a curve at the intersection of Route 19 and Route 191

Recommendations include:

- Conduct pavement maintenance (i.e., Chip Seal)
- Ensure a 4 ft paved shoulder minimum
- Improve all shoulder recovery zones to AASHTO standards
- Repair eroded soil and shoulder pavement
- Restore shoulder and side slope where the soil has eroded
- Rumble strips
- Safety EdgesSM
- Relocate driveways located in curves



Example of the use of Safety EdgesSM

Road Curves

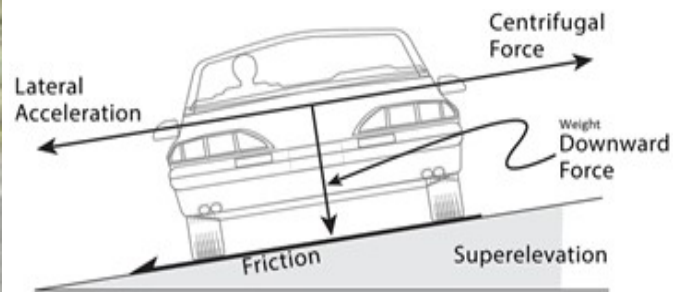
The RSA team observed a cattle guard in a curve at mile marker 23.5. Some areas have low superelevation at tight curves throughout the route, primarily at mile marker 23.5. Areas with tight curves did not have any advance notice of the curves.



Existing cattle guard in the curve at mile marker 23.5 on route 19

Recommendations included:

- Increased or added superelevation (a.k.a. banking) to tight curves
- Advanced rumble strips and warning signs advanced of curves
- Reduced speeds in advance of cattle guards in the roadway and install cattle guard warning signs



Examples include advanced rumble strips, warning signs, and increased superelevation.

Guard Rails

The RSA team observed damaged guard rails at mile markers 25.5, 20.5, 19, and 9.5. Some of the damages appear to be the result of a crash. The damaged rails pose a safety hazard to pedestrians and provide reduced safety effects for the guard rail countermeasures.



Existing damaged guard rails at mile markers 25.5, 20.5, 19, and 9.5 on route 19

Recommendations included:

- Repair damaged guard rails
- Reflectors on guard rails close to the roadway

Drainage

The RSA team observed clogging of existing wash drainage culverts in general. In general, the existing culverts on the route appear to be undersized for the apparent drainage volume they experience and need object markers. Culverts at mile markers 18.25 and 17 are covered by vegetation and appear damaged.



Existing wash drainage culverts at mile markers 18.25 and 17 under route 19

Recommendations include:

- Sized-up culverts at sag curves that experience flooding
- Install culvert or bridge crossings at washes that experience excessive flooding
- Remove vegetation and clogging in culverts

Signage and Vegetation

Most signs were visible during the daytime and appeared to have adequate retroreflectivity at night. Signs near mile markers 12, 17, and 18 are obstructed with paint.

There was non-standard or no community signage found on the route. These communities do not have any advanced warning of their driveways onto route 19. Areas with culverts lack object markers to warn motorists of the object hazard.



Sample intersection warning sign (W2-2) from the MUTCD



Roadside object marker sign example (OM-3R) from the MUTCD

A non-standard mounting and placement of a stop sign are found outside of the US Border Patrol facility driveway near mile marker 2.5.



Roadway signage is obscured with paint.

Recommendations include:

- Install standard community signs
- Install roadside object marker signs
- Install advanced cattle guard warning signs
- Intersection warning signs
- Replace nonstandard signage
- Install pedestrian warning signs with a supplemental sign stating "next XX miles" every 10 miles
- Install flash flood signs next XX miles
- Install a pedestrian crosswalk with advance warning signage at the driveway of the Baboquivari High School on Route 19

Roadway Striping

The roadway striping on the route appears in good condition on Route 19 but is in poor condition or absent on Route 191. Route 191 has high enough speeds to justify the installation of centerline markings to ensure the separation of opposing traffic.

The nighttime reflectivity of pavement markings appears good on Route 19. It is observed that there are passing zones marked in some horizontal curves.



The blank pavement on Route 191

Recommendations include:

- Remove passing zones in curves
- Install centerline on route 191

Suggested Improvements/Countermeasures for Consideration

The following table summarizes the RSA team's observations and potential opportunities to improve safety. The locations of the recommended improvements are displayed in the maps found in **Appendix C**. These suggested improvements/countermeasures are presented as options for consideration; the road owner may also identify other effective alternative improvements and countermeasures. While every attempt has been made to identify potential safety issues and provide countermeasure options, the safety performance of the roadway remains the responsibility of the roadway owner and roadway users.

LOCATION/ISSUE	DESCRIPTION	COUNTERMEASURES FOR CONSIDERATION
Corridor Speed	<ul style="list-style-type: none"> Speeding-related crashes account for 10% of corridor crashes Law enforcement indicated the proclivity of high vehicle speeds on the corridor 	<ul style="list-style-type: none"> Reduce speed limit near communities Consider installing a roundabout at community intersections to encourage lower speeds <ul style="list-style-type: none"> Install a roundabout at the intersection of Route 19 and Topawa School Road Install a roundabout at the intersection of Route 19 and West Topawa Drive Install a roundabout at mile marker 11.7 near the South Komelik community's center driveway Consider establishing a strategic speed management program <ul style="list-style-type: none"> Speed feedback signs Increase speed enforcement Install reduced nighttime speed limits Photo enforcement
Fencing	<ul style="list-style-type: none"> Animal-related crashes account for the most crashes on the corridor Animal-related crashes were recorded at every mile of the corridor 	<ul style="list-style-type: none"> Install continuous fencing

LOCATION/ISSUE	DESCRIPTION	COUNTERMEASURES FOR CONSIDERATION
Lighting	<ul style="list-style-type: none"> • The corridor has no existing lighting • No lighting exists at intersections or bus stops 	<ul style="list-style-type: none"> • Continuous lighting <ul style="list-style-type: none"> ○ At approaches to communities ○ At approaches to schools and bus stops • Install intersection lighting at major intersections
Turn Lanes	<ul style="list-style-type: none"> • High volumes from the Babouivari High School may warrant turn lanes 	<ul style="list-style-type: none"> • Install turn lanes and acceleration lanes at Baboquivari High School
Pavement and Shoulder	<ul style="list-style-type: none"> • Poor pavement conditions were observed throughout the route • Pavement pitting, cracking, and potholes were observed • Large shoulder drop-offs were observed • Some shoulder and sub-roadway soil erosion were observed 	<ul style="list-style-type: none"> • Conduct pavement maintenance (i.e., Chip Seal) • Ensure a 4 ft paved shoulder minimum • Improve all shoulder recovery zones to AASHTO standards • Repair eroded soil and shoulder pavement • Restore shoulder and side slope where the soil has eroded • Install rumble strips • Install Safety EdgeSM • Relocate driveways located in curves
Road Curves	<ul style="list-style-type: none"> • Tight curves with low or no superelevation and high speeds were observed • Long straight road segments proceed tight curves with no advanced warning devices • A cattle guard is observed in a tight curve 	<ul style="list-style-type: none"> • Increase or add superelevation (a.k.a. banking) to tight curves • Add advanced rumble strips and warning signs in advance of curves • Reduce speeds in advance of cattle guards in the roadway and install cattle guard warning signs
Guard Rails	<ul style="list-style-type: none"> • Damaged guard rails are observed throughout the corridor 	<ul style="list-style-type: none"> • Repair damaged guard rails • Install reflectors on guard rails close to the roadway

LOCATION/ISSUE	DESCRIPTION	COUNTERMEASURES FOR CONSIDERATION
	<ul style="list-style-type: none"> Guard rails appear to be placed too close to travel lanes in some areas 	
Drainage	<ul style="list-style-type: none"> Areas experiencing roadway flooding during storm events appear to have undersized culverts Generally, the culverts on the route appear to have vegetation and other blockages 	<ul style="list-style-type: none"> Size up culverts at sag curves that experience flooding Install culvert or bridge crossings at washes that experience excessive flooding Remove vegetation and clogging in culverts
Signage and Striping	<ul style="list-style-type: none"> Most communities appear not to have a community place sign or have non-standard place signs All culverts on the route do not have object marker signs No intersections have advanced warning signs on the route Passing zones are observed marked in horizontal road curves No centerline marking currently exists on Route 191 	<ul style="list-style-type: none"> Install standard community signs Install roadside object marker signs Intersection warning signs Replace nonstandard signage Remove passing zones in curves Install centerline on Route 191 Install advanced cattle guard warning signs Install flash flood signs next XX miles Install pedestrian warning signs with a supplemental sign stating "next XX miles" every 10 miles Install a pedestrian crosswalk with advance warning signage at the driveway of the Baboquivari High School on Route 19

Suggested Projects and Associated Unit Estimates for Consideration

PROJECT	PROJECT TYPE	SCOPE	CONSTRUCTION UNIT COST ESTIMATE
Sign and stripe	Sign and Marking	1 mile of sign and marking Improvements	\$180,000 per mile
Round-about intersection	Intersection	Installation of one round-about intersection	\$2,300,000 per intersection
Speed feedback signs	Sign and Marking	Installation of one pair of speed feedback signs	\$50,000 per sign pair
Fencing and cattle guard	Clear Zone	Installation of 1 mile of continuous fencing inspection, repair, cattle guard repair/replacement	\$200,000 per mile
Street lighting	Intersection	Installation of one intersection of street lighting and community area lighting	\$ 180,000 per intersection
Pavement maintenance	Pavement	Installation of 1 mile of pavement maintenance (slurry seal)	\$210,000 per mile
Superelevation	Pavement	Install 2% superelevation for 100 feet at tight horizontal road curves	\$150,000 per 100 feet
Rumble strips	Pavement	Installation of 1 mile of centerline rumble strips	\$40,000 per mile
Paved shoulders	Pavement	Installation of 1 mile of 4-foot paved shoulders	\$1,550,000 per mile
Driveway relocation	Intersection	Relocate one driveway away from horizontal curvature	\$140,000 per driveway
Clear zone maintenance	Clear Zone	1 mile of 32-foot clear zone clearing and grubbing	\$80,000 per mile
Culvert maintenance	Drainage	1 wash crossing culvert maintenance	\$50,000 per crossing
Culvert installation	Drainage	1 wash crossing culvert installation	\$1,500,000 per crossing
Drainage maintenance	Drainage	1 wash crossing erosion control and riprap gabions	\$1,140,000 per crossing
Turn Lanes	Intersection	Installation of one turn lane at an intersection	\$550,000 per intersection

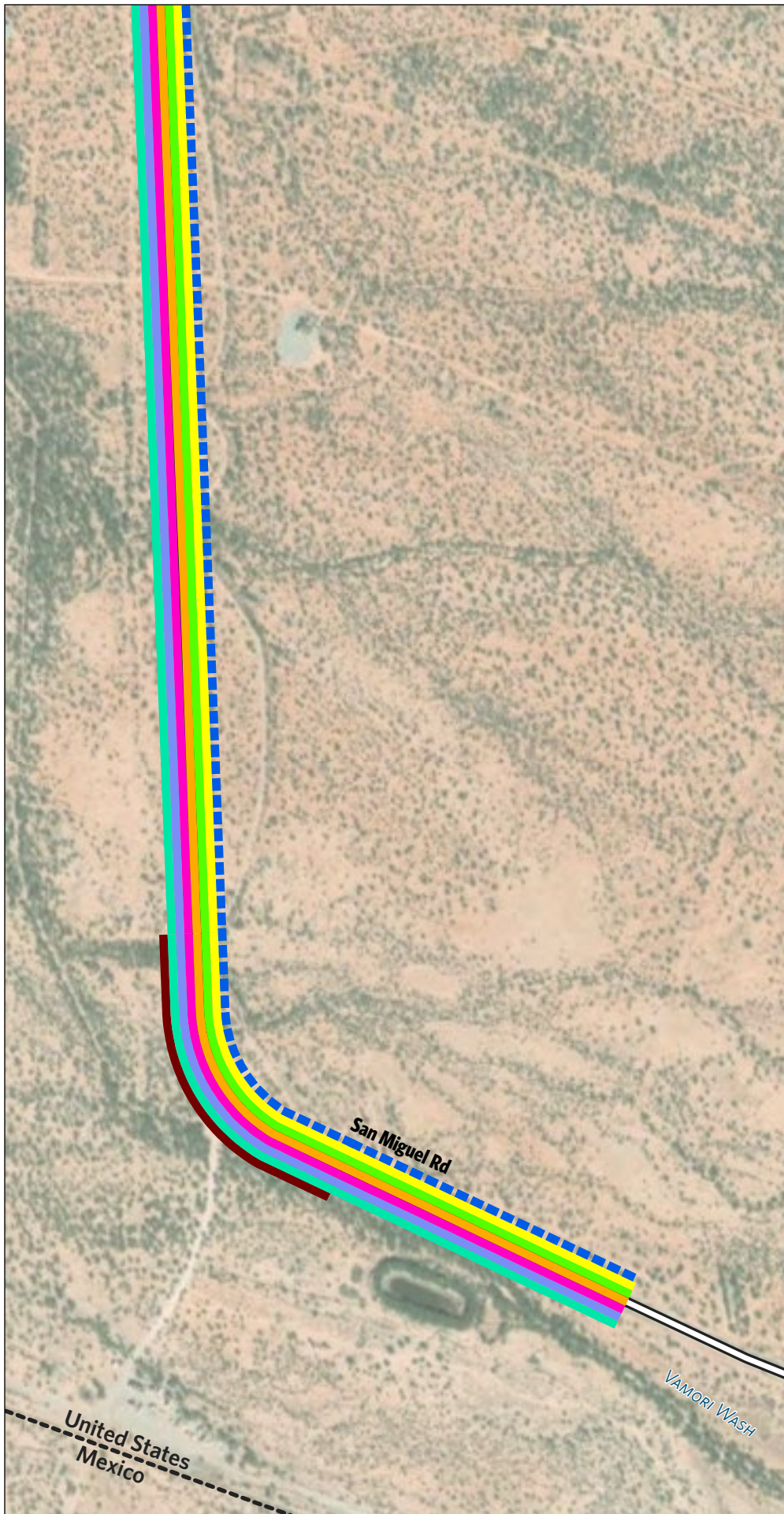
Appendix A

BIA Route 19 Public Outreach Safety Comments

OBJECTID	IssueType	Comments	GlobalID
1	Curve	too many curves in this area	{65B1E6FC-0825-4BD4-89C0-75CAB1E5CDA5}
2	Other (Please Specify Below)	kjasjdfpasddfijadtest	{9CF3DBCF-AED5-4EFD-A3F7-5F08B997B1D8}
3	Pavement Edge Dropoff	Pavement drop off very dangerous in Coldfields around mile 10 all the way down to bridge. Also the bridge barrier needs to be repaired damage caused by vehicle accident several years ago.	{D09073C7-9CF5-45A8-98A7-0ED3E685BC20}

Appendix B

Route 19 Existing Issues Map



Existing Issues

Route 19

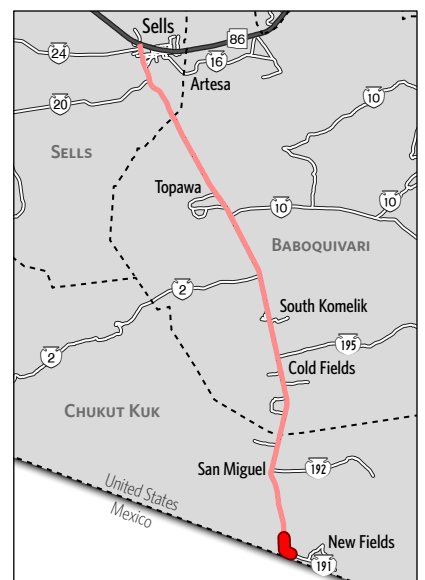
Potential Safety Concerns

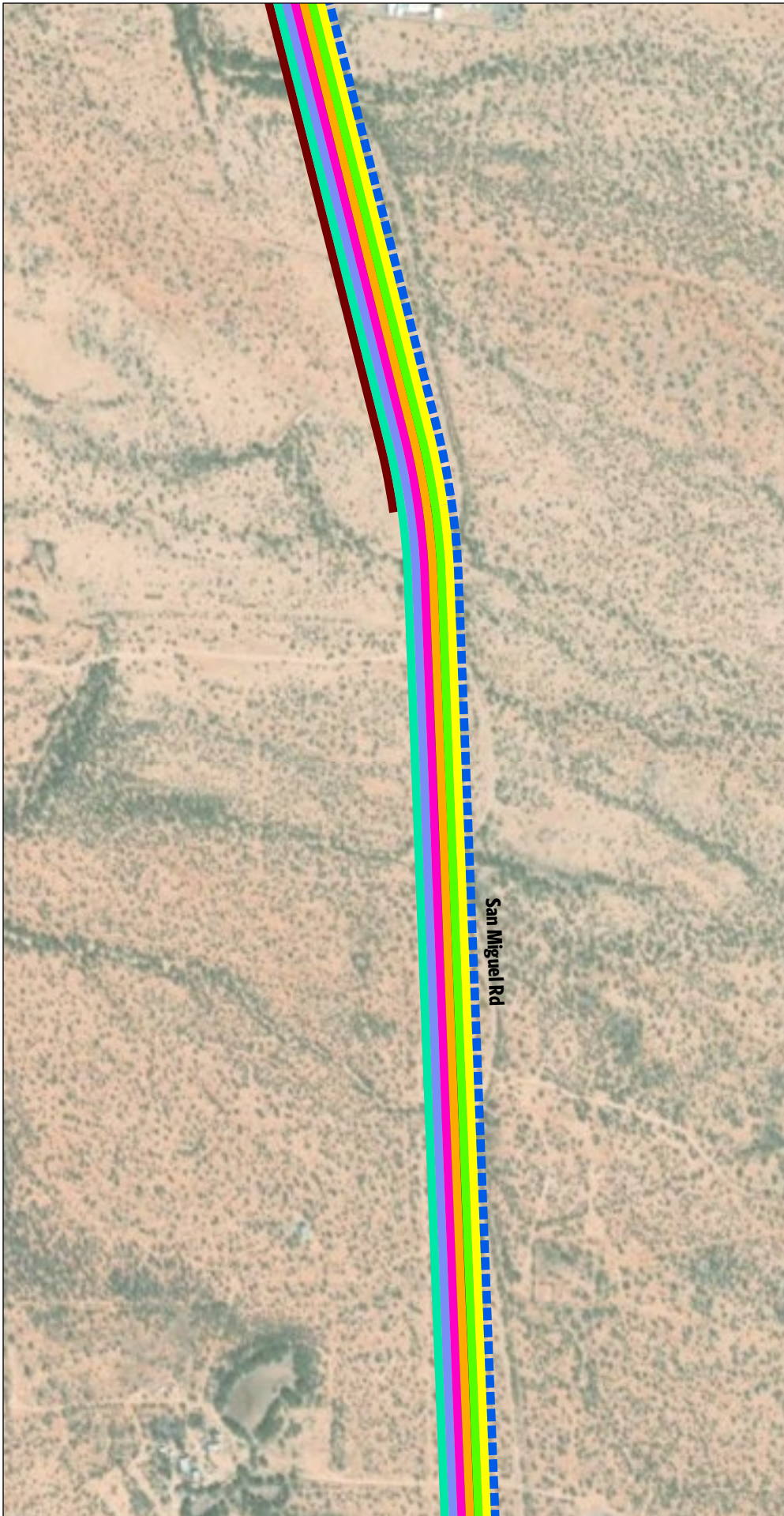
- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Existing Issues

Route 19

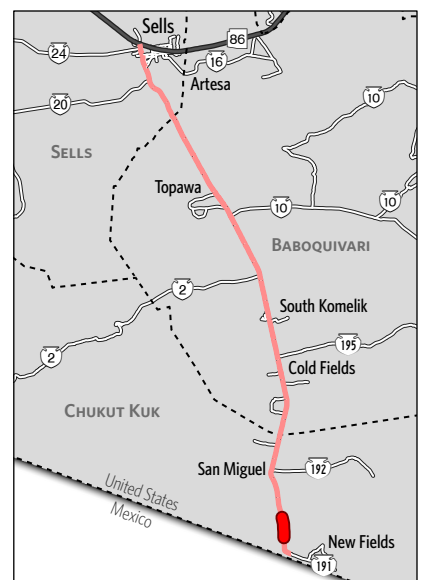
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1 inch equals 600 feet





Existing Issues

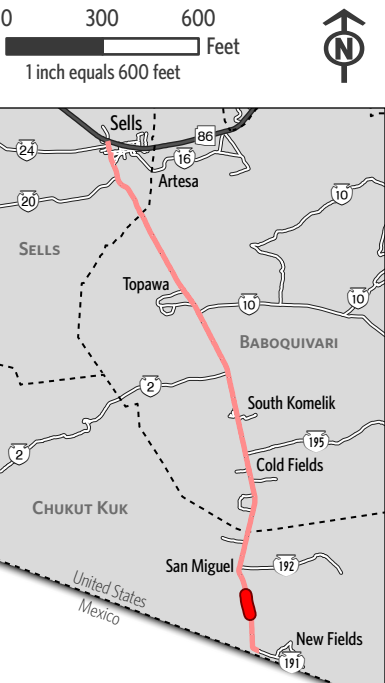
Route 19

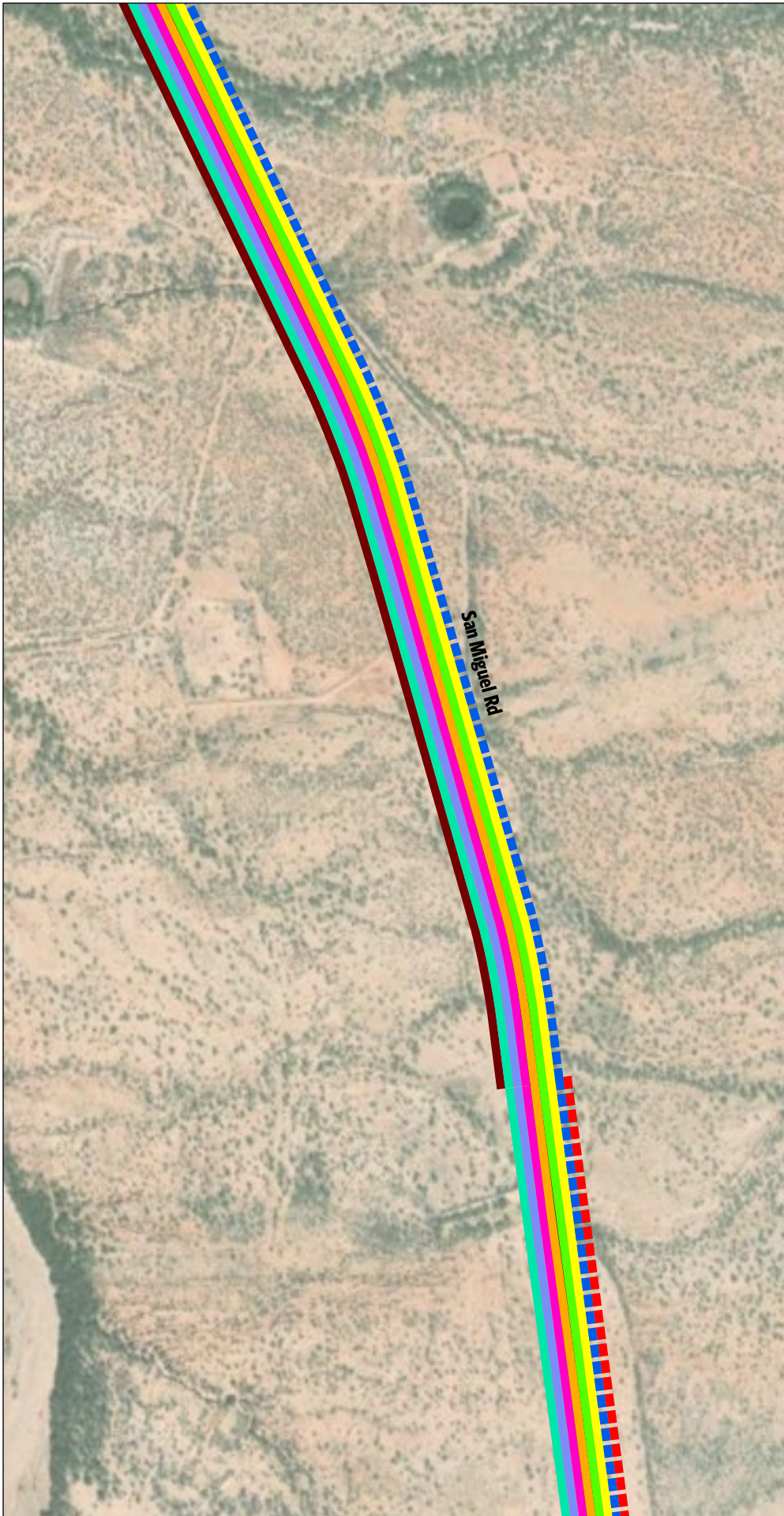
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Existing Issues

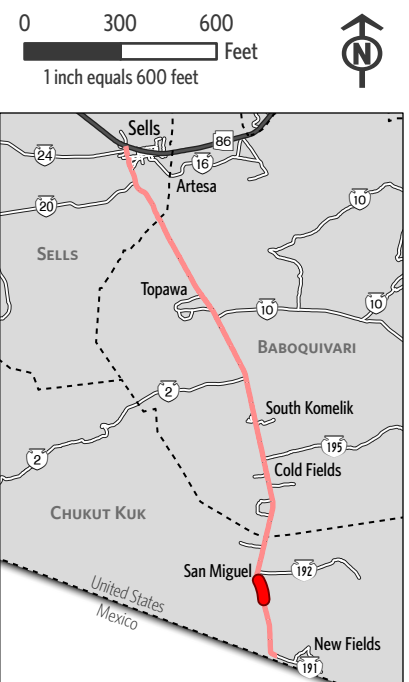
Route 19

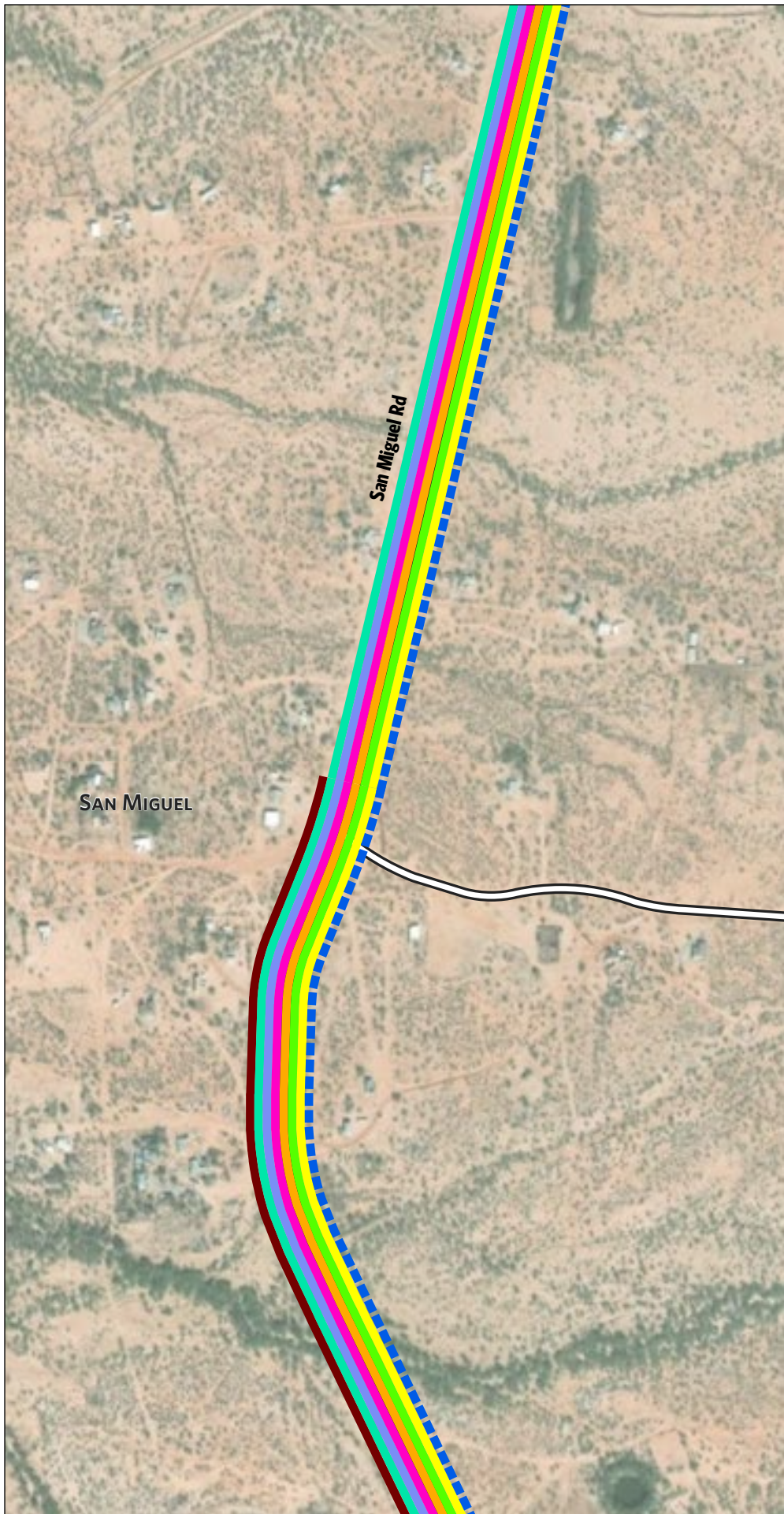
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

Route 19

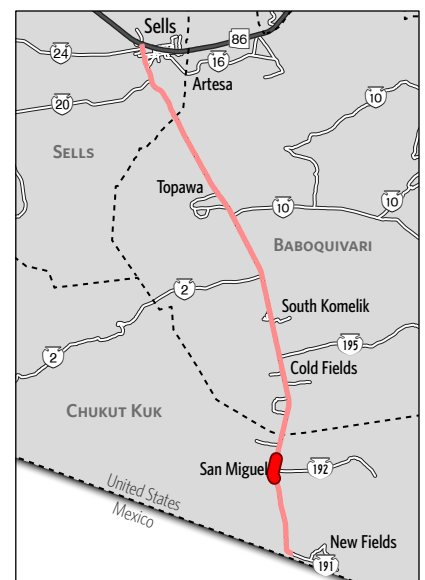
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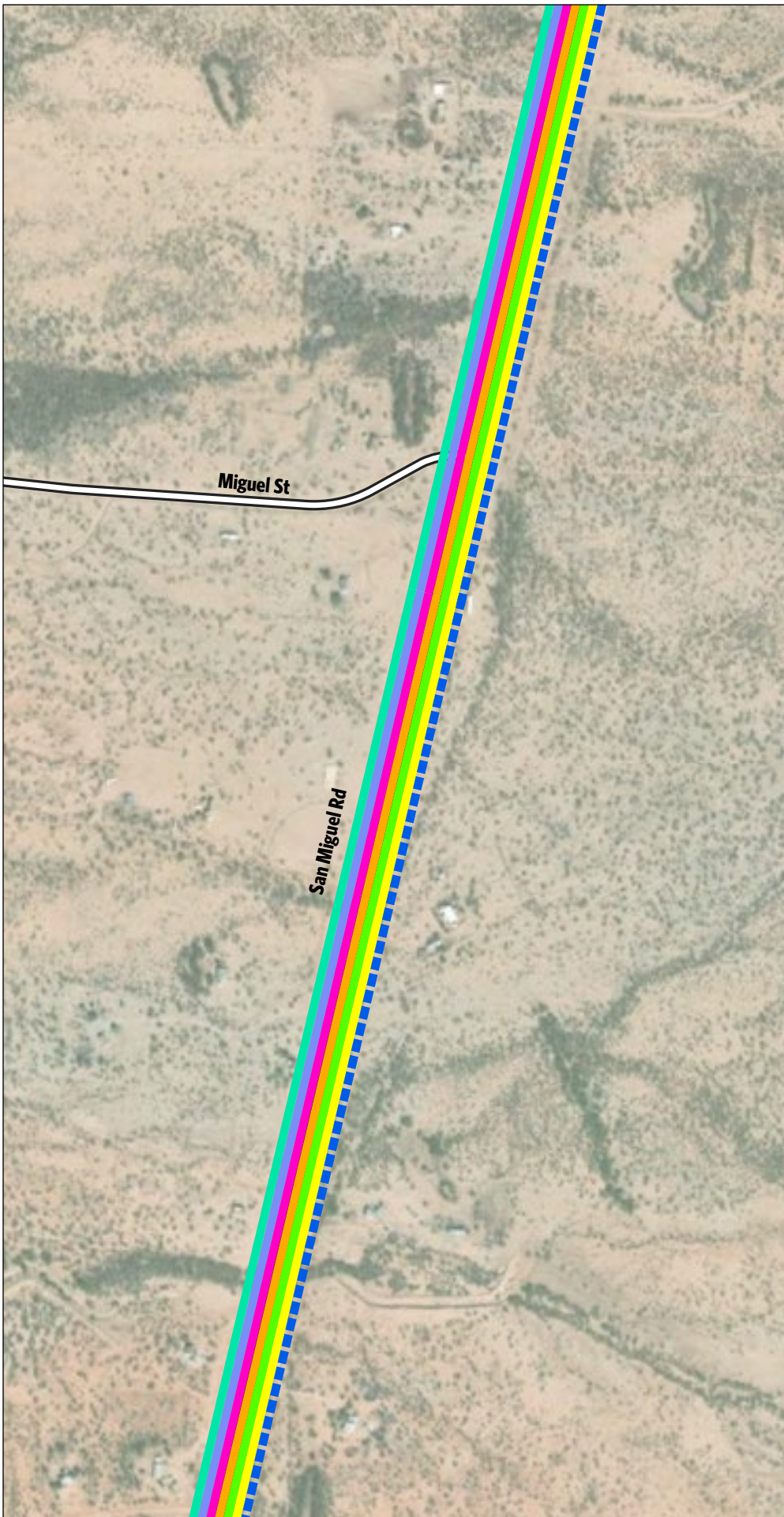
- High Crash Corridor
- Flooding Issue
- No Sidewalks
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- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Existing Issues

Route 19

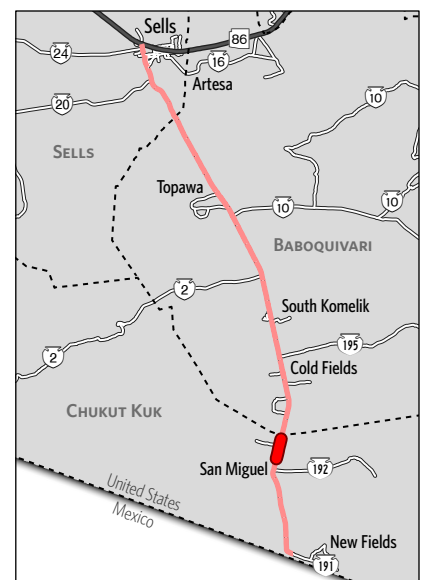
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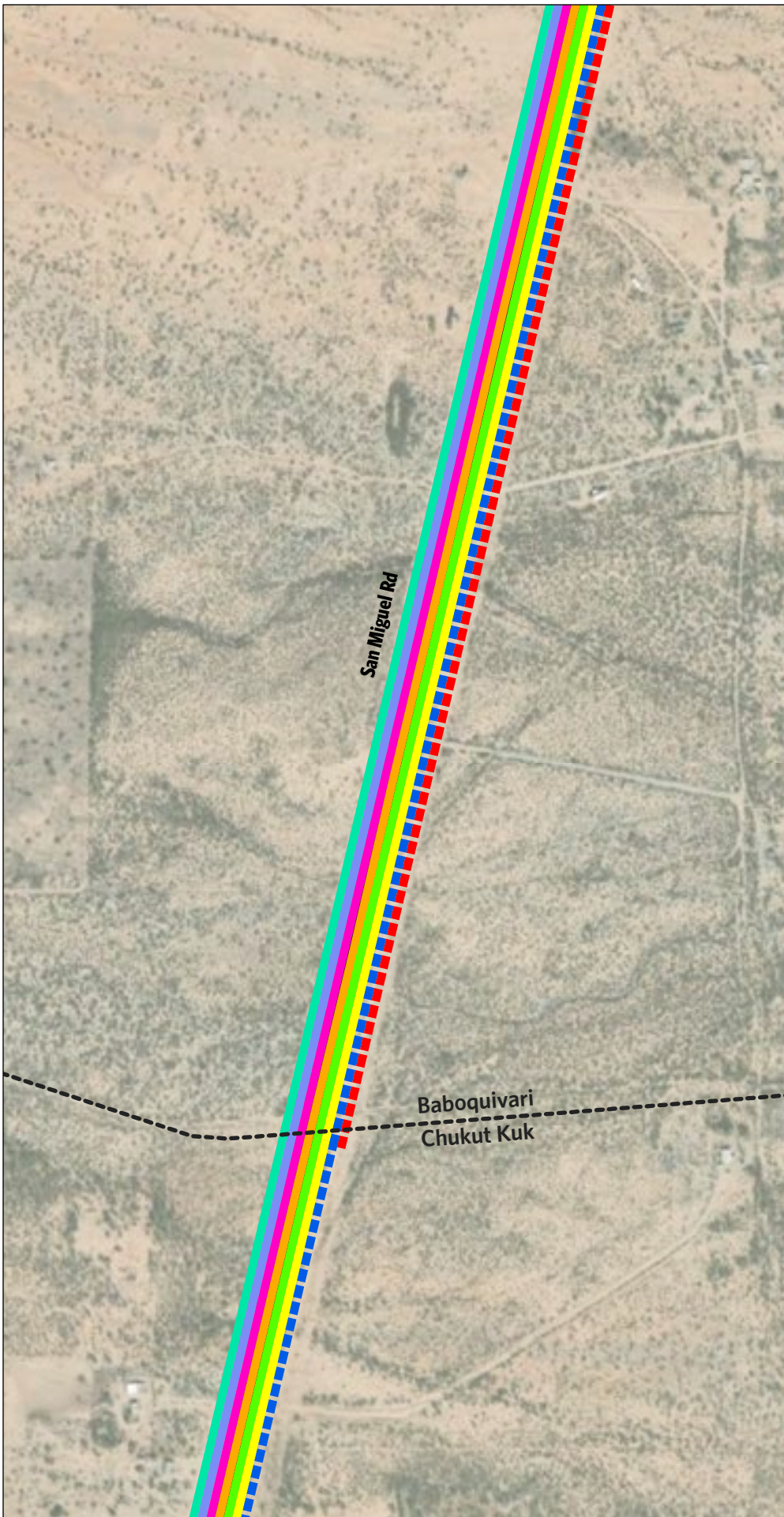
- High Crash Corridor
- Flooding Issue
- No Sidewalks
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- No Lighting
- Poor Pavement
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Reference

- Tohono O'odham District Boundary

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Existing Issues

Route 19

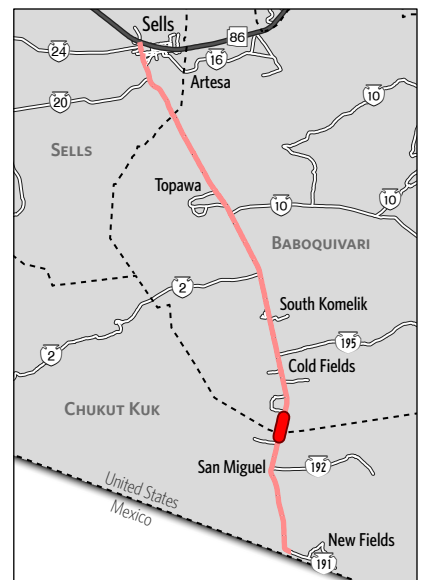
Potential Safety Concerns

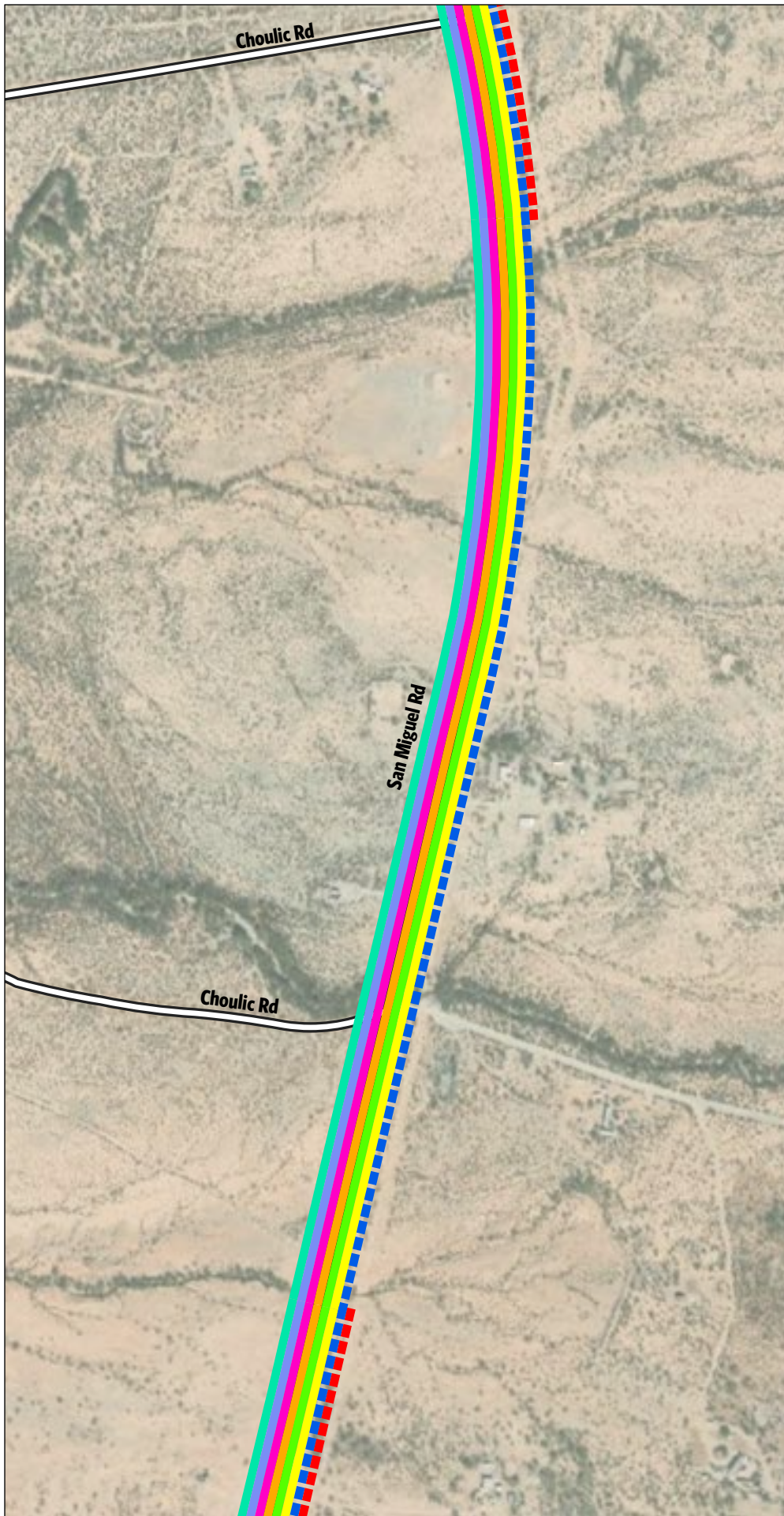
- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
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- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary

0 300 600 Feet
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Existing Issues

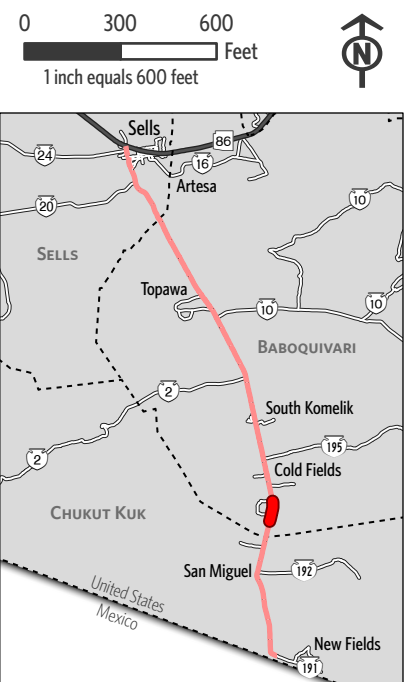
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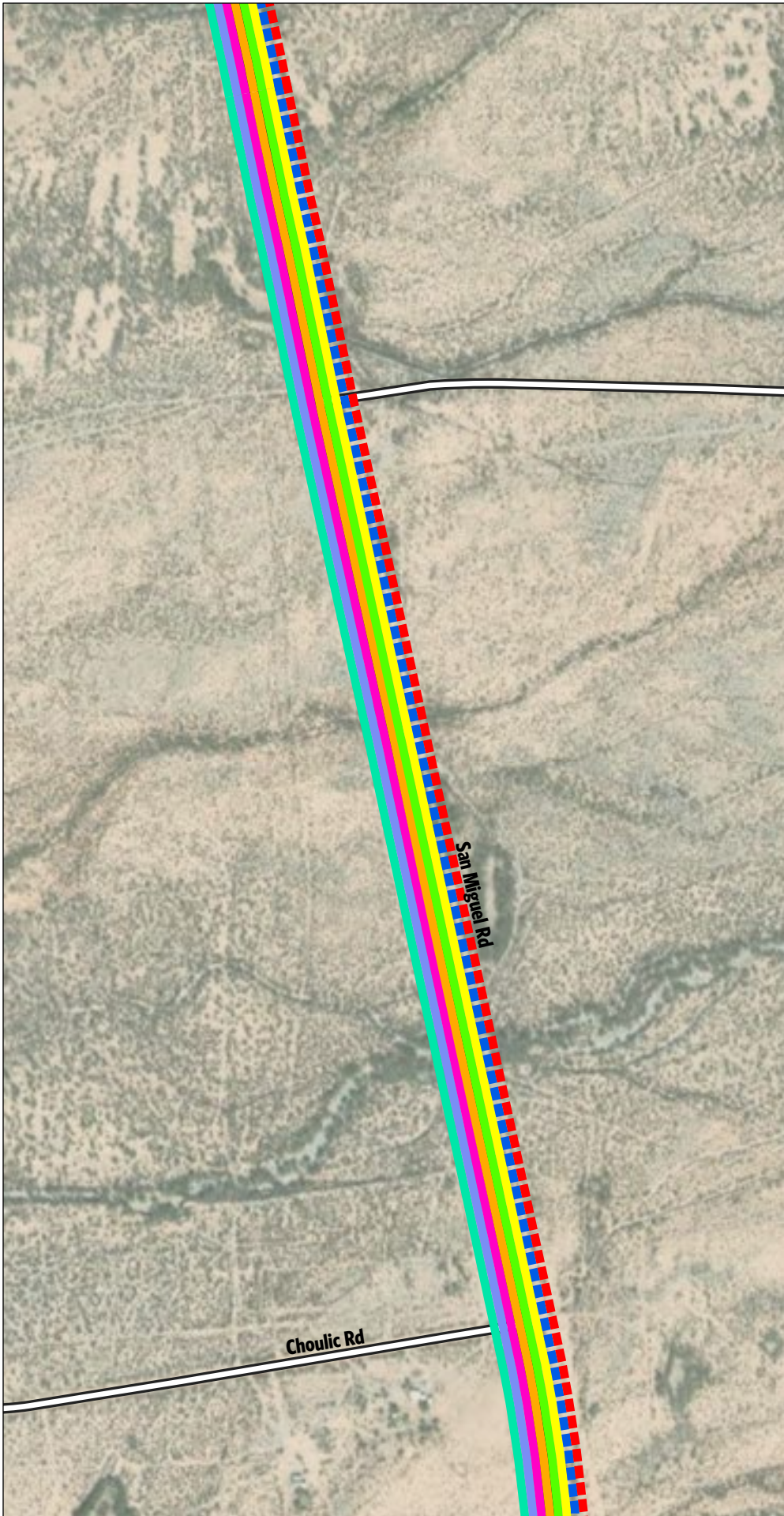
Potential Safety Concerns

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Reference

- Tohono O'odham District Boundary





Existing Issues

Route 19

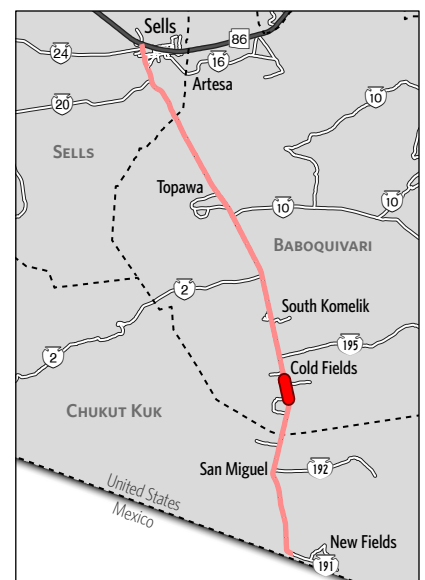
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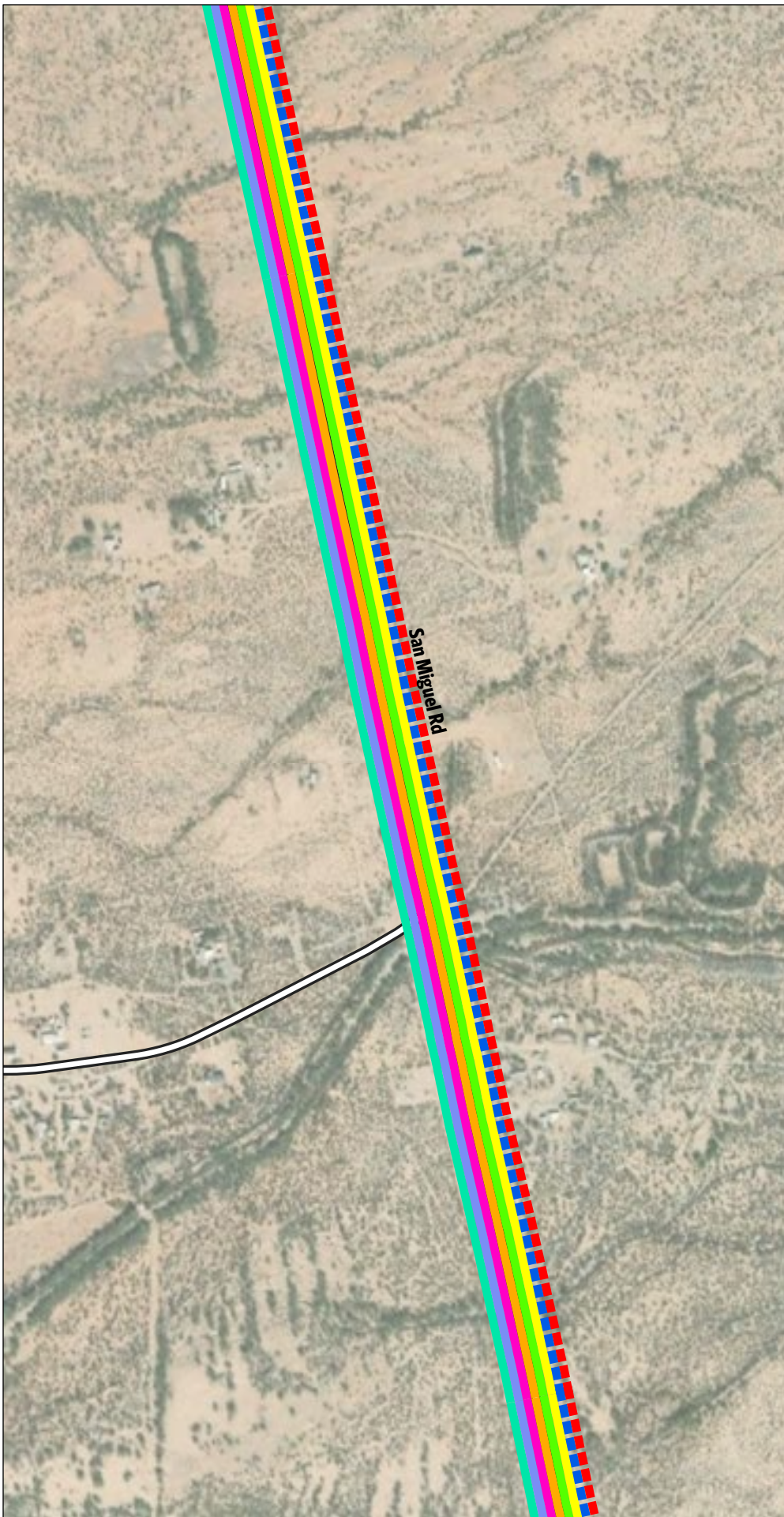
- High Crash Corridor
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Reference

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Existing Issues

Route 19

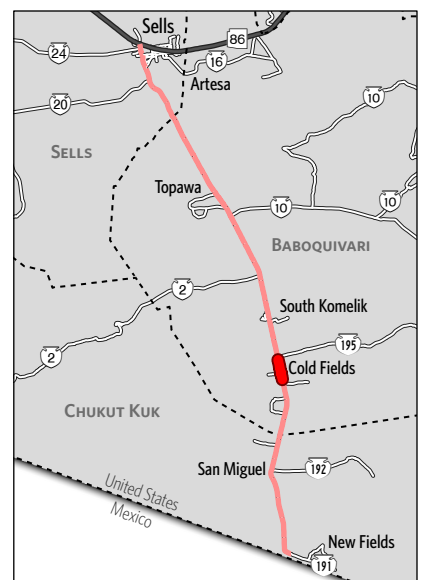
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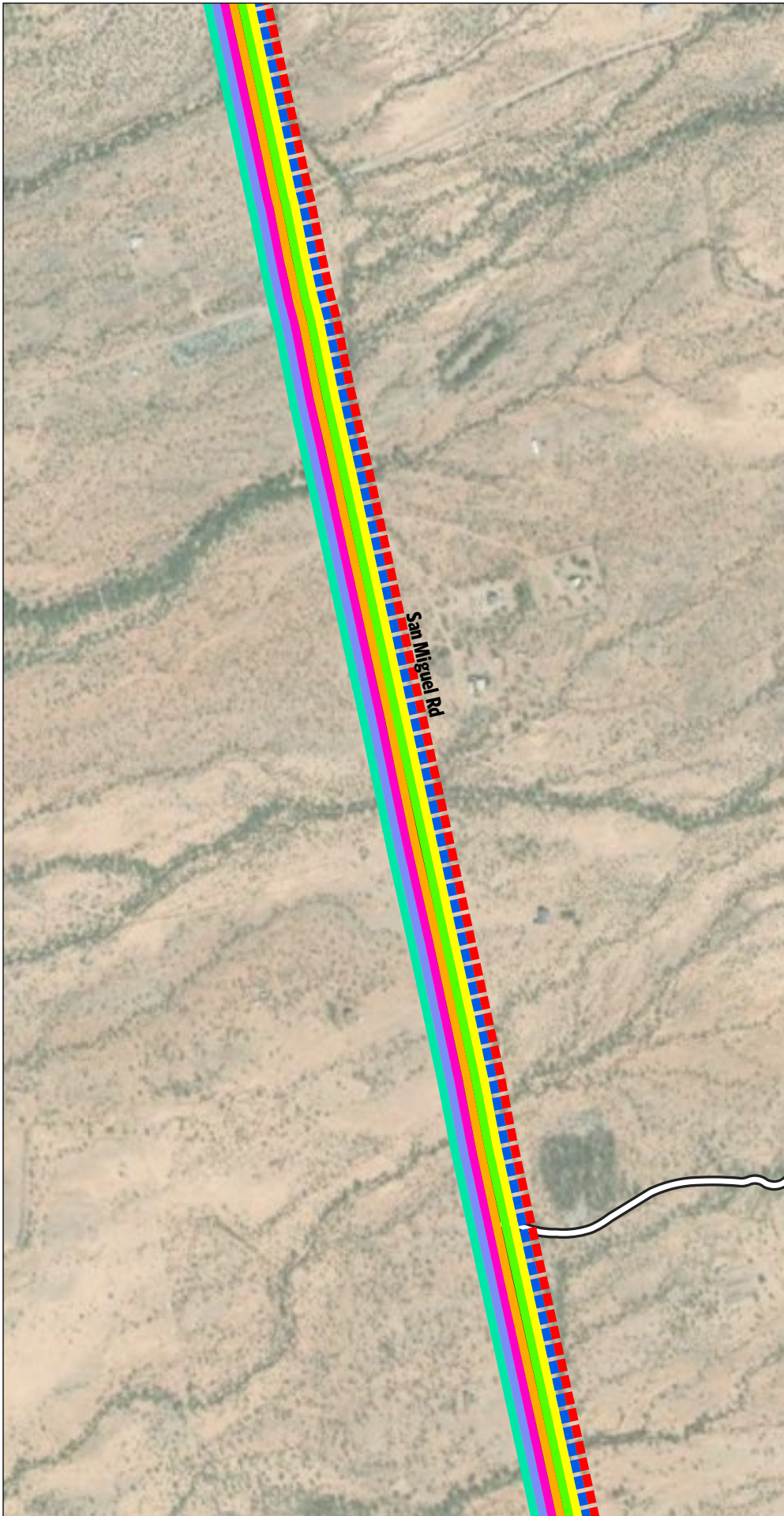
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Existing Issues

Route 19

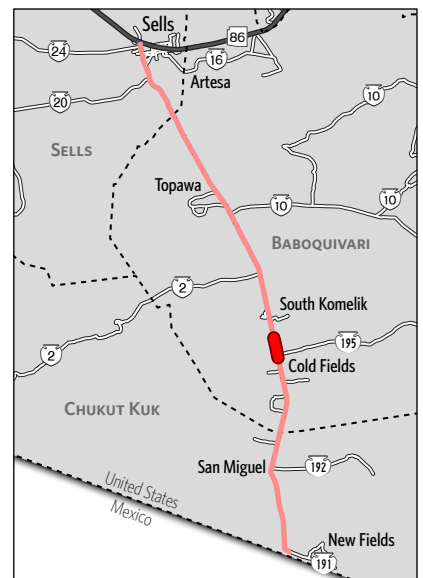
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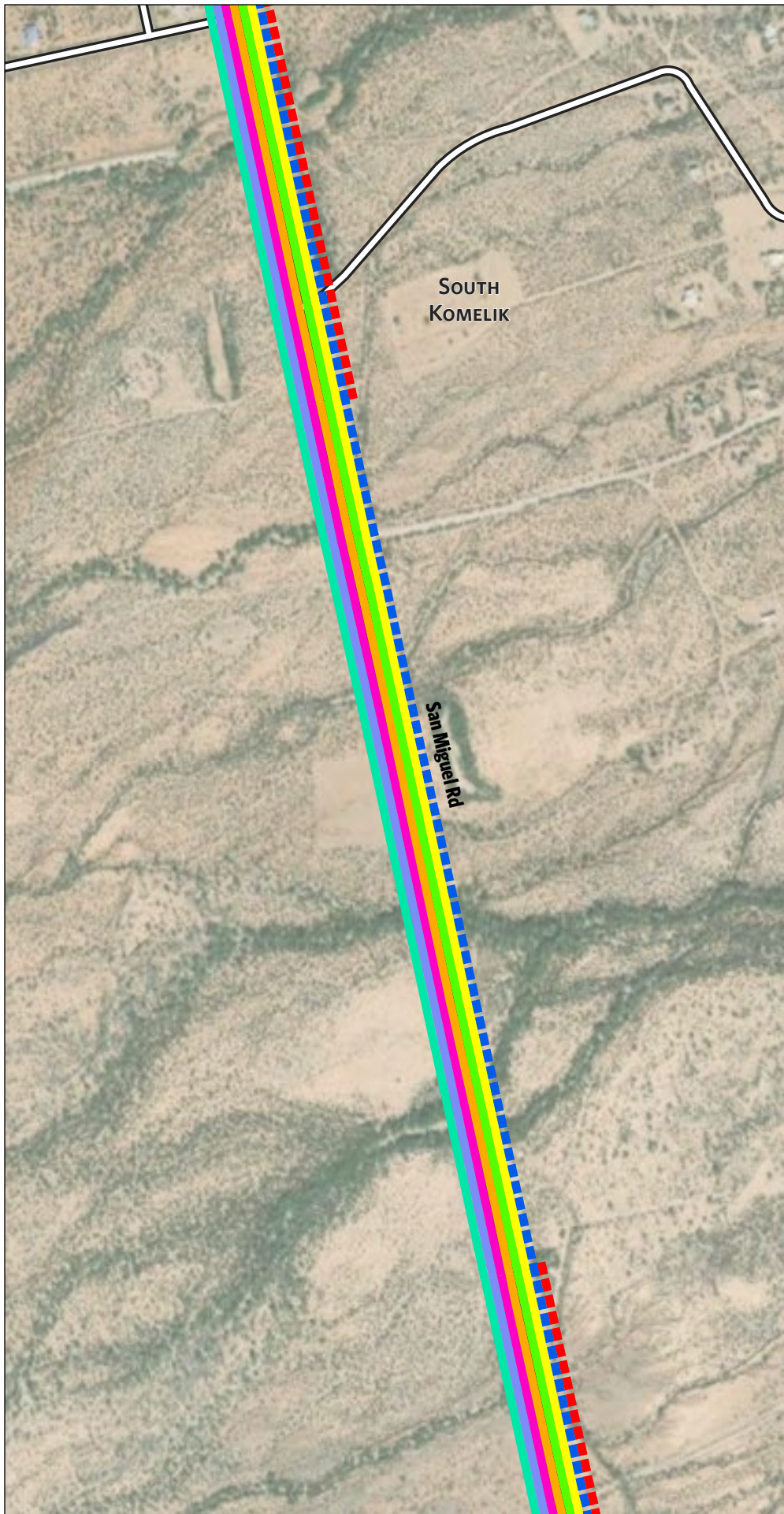
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- No Lighting
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- Curvy Roadway

Reference

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Existing Issues

Route 19

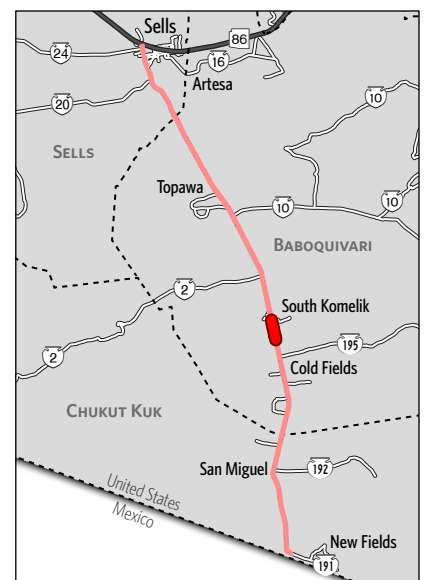
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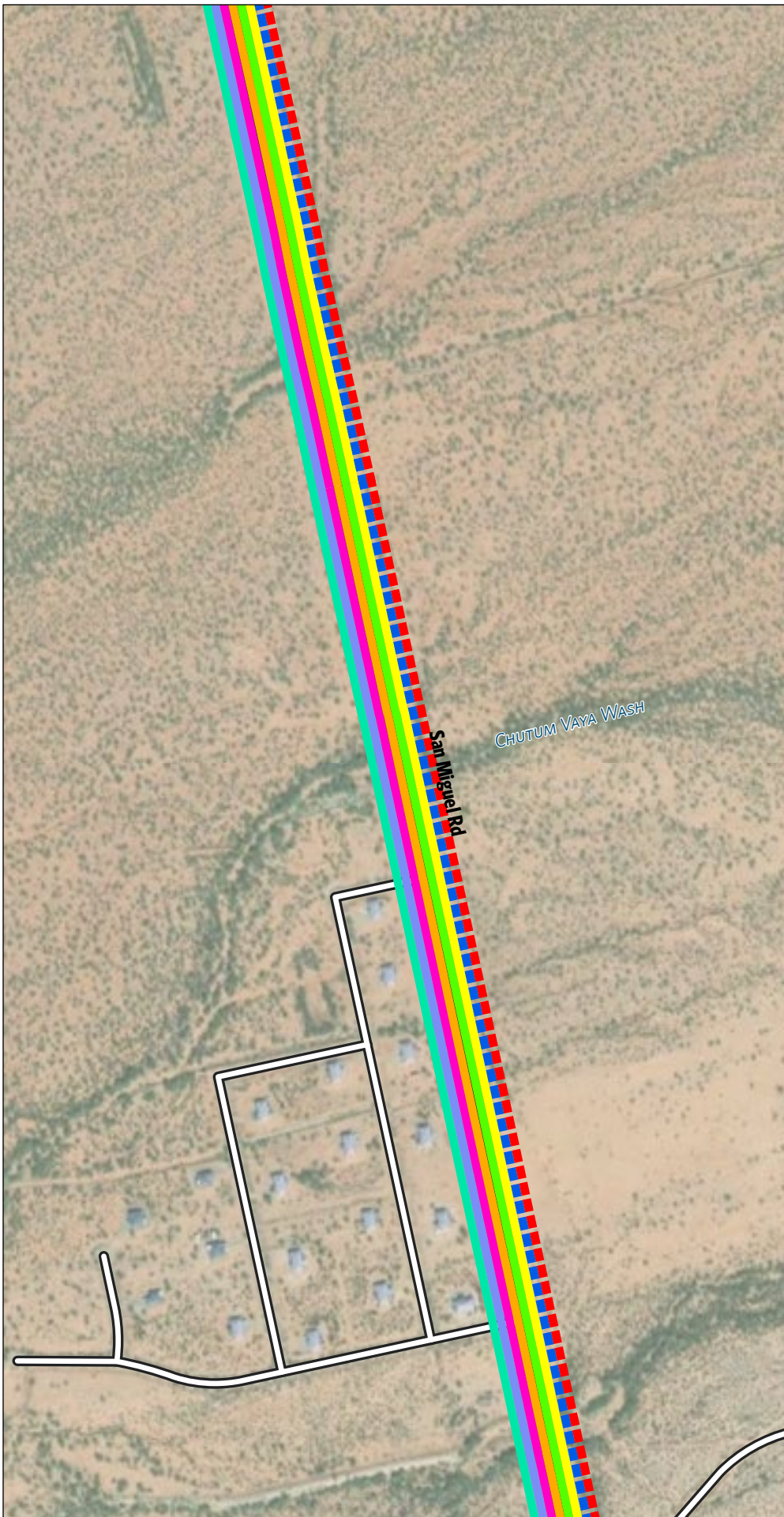
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- Poor Pavement
- Curvy Roadway

Reference

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Existing Issues

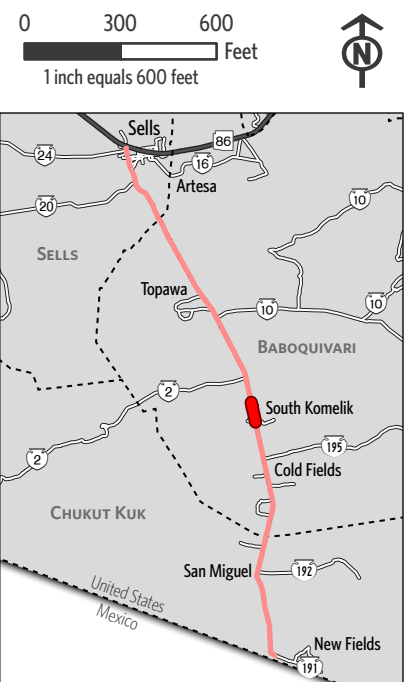
Route 19

Potential Safety Concerns

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Reference

- Tohono O'odham District Boundary





Existing Issues

Route 19

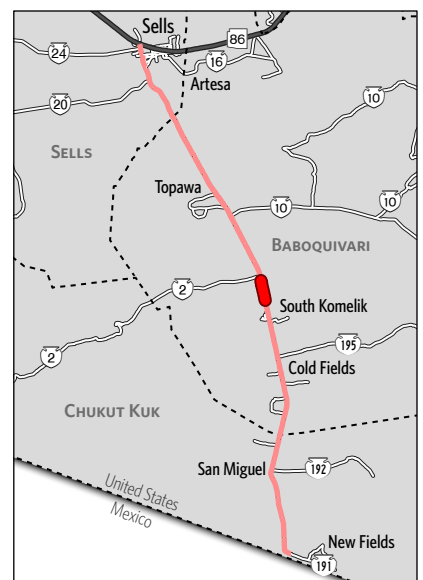
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Reference

- Tohono O'odham District Boundary

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Existing Issues

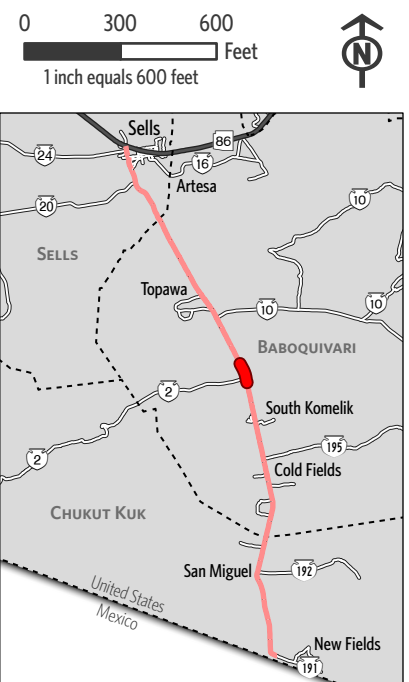
Route 19

Potential Safety Concerns

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- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

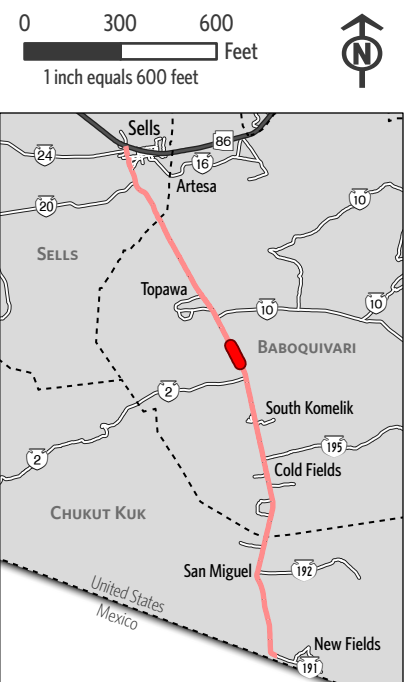
Route 19

Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
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- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

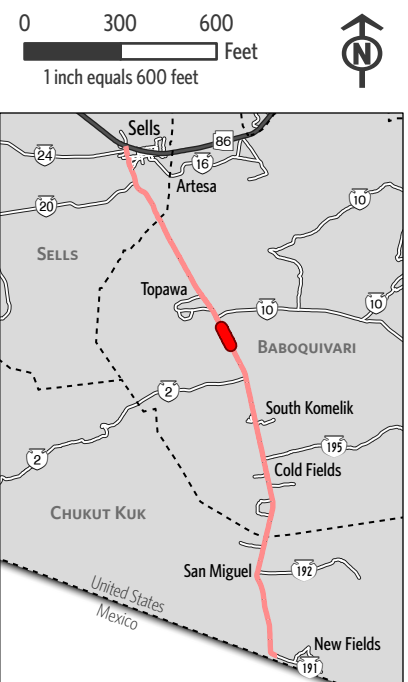
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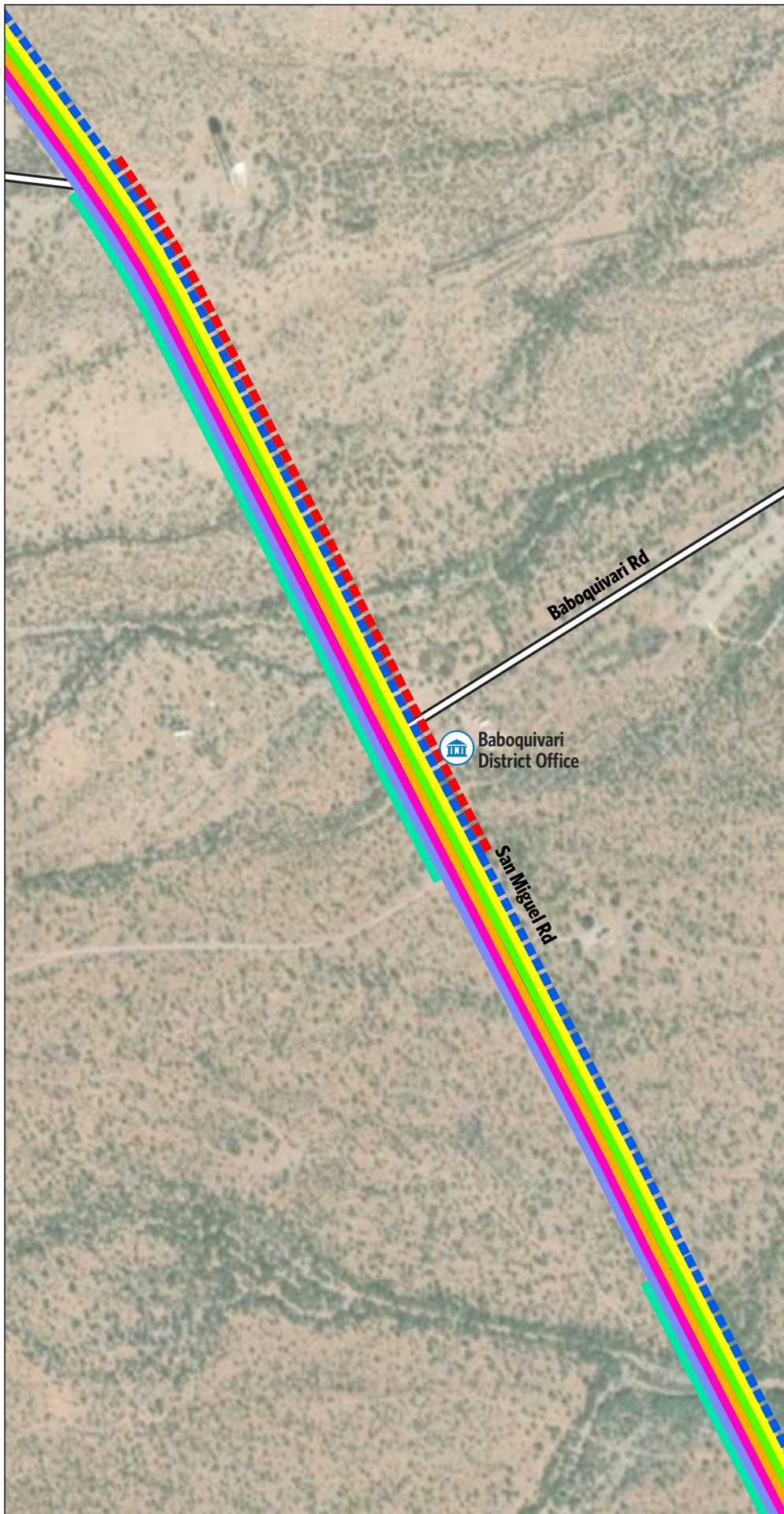
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary






Existing Issues

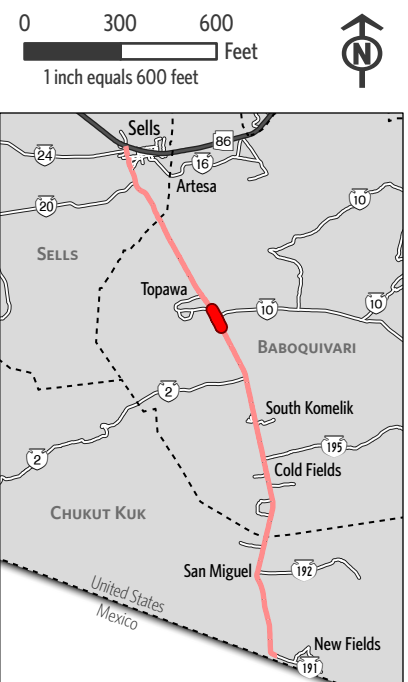
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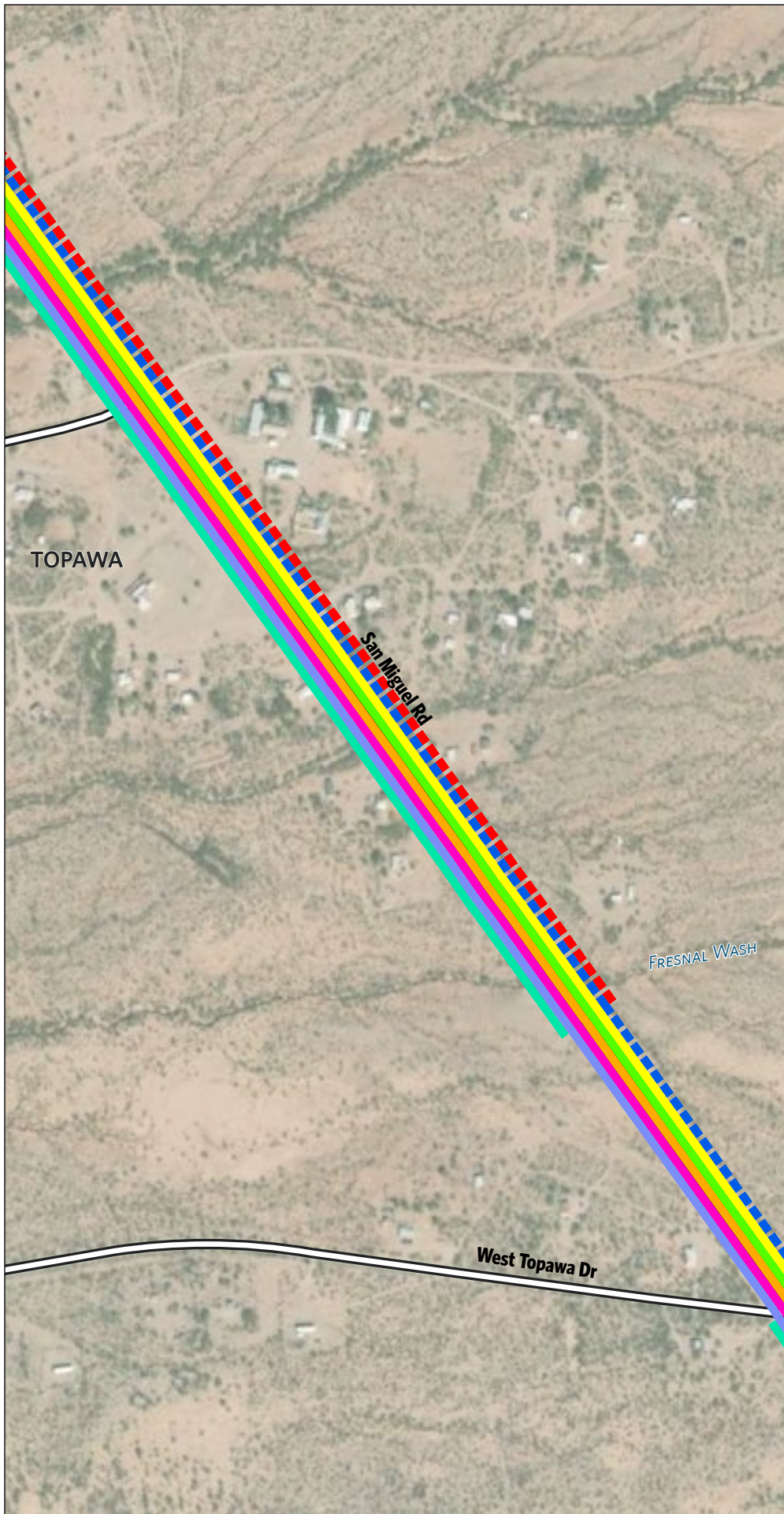
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

-  Government Office
- Tohono O'odham District Boundary





Existing Issues

Route 19

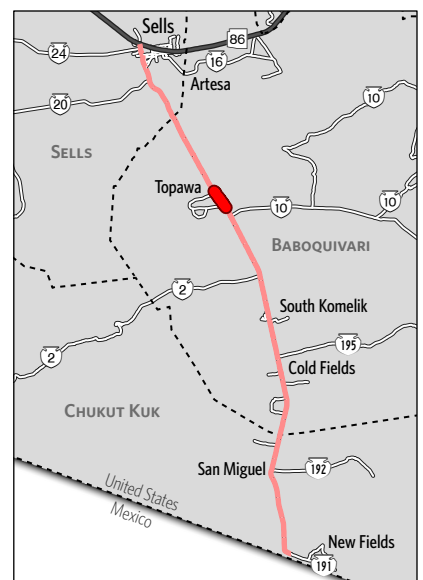
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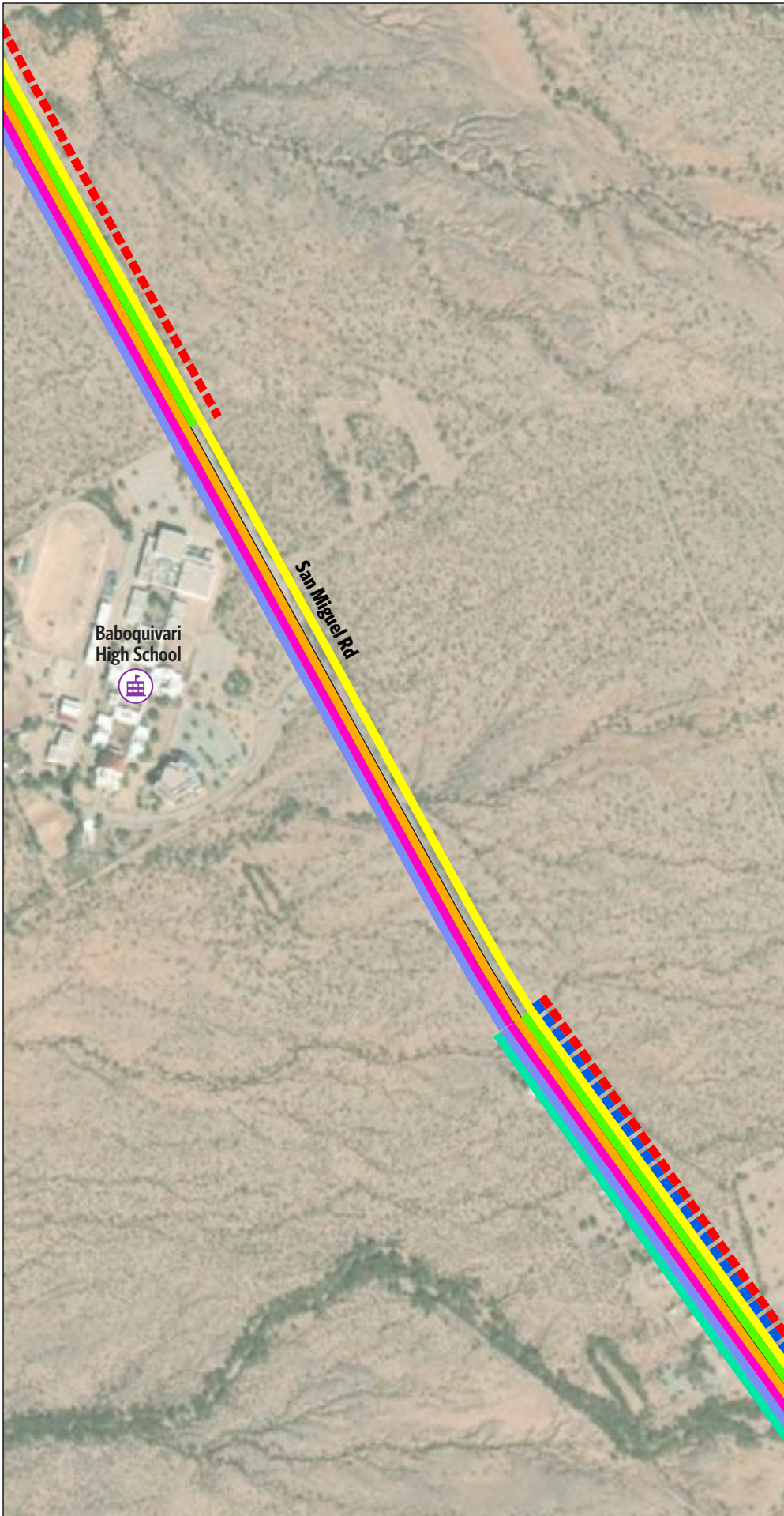
- High Crash Corridor
- Flooding Issue
- No Sidewalks
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- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary

0 300 600 Feet
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Existing Issues

Route 19

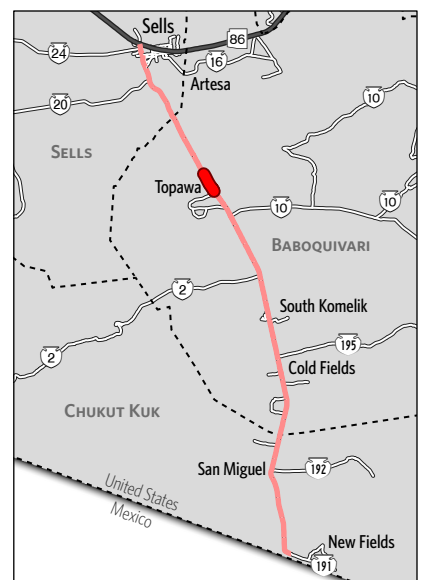
Potential Safety Concerns

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- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

-  School
- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Existing Issues

Route 19

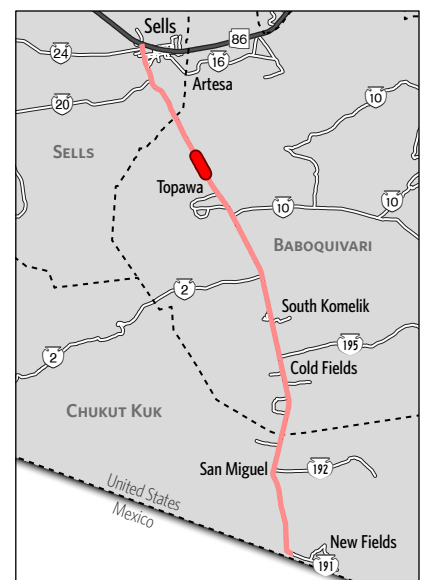
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Existing Issues

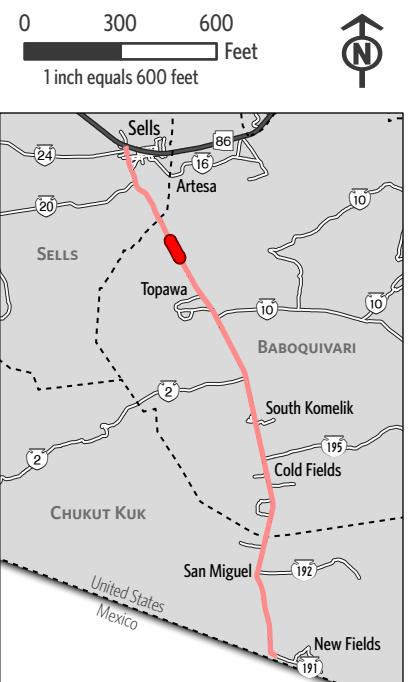
Route 19

Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

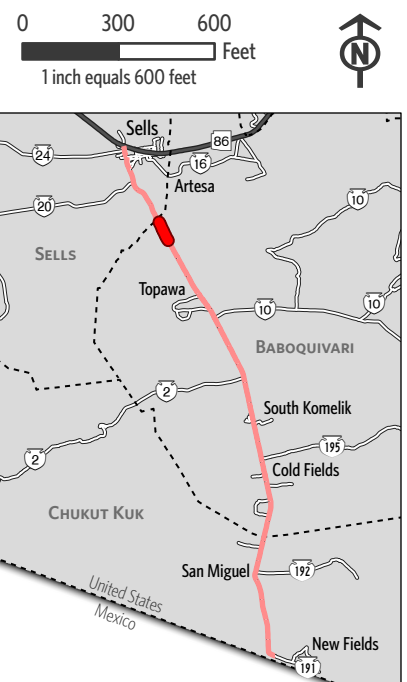
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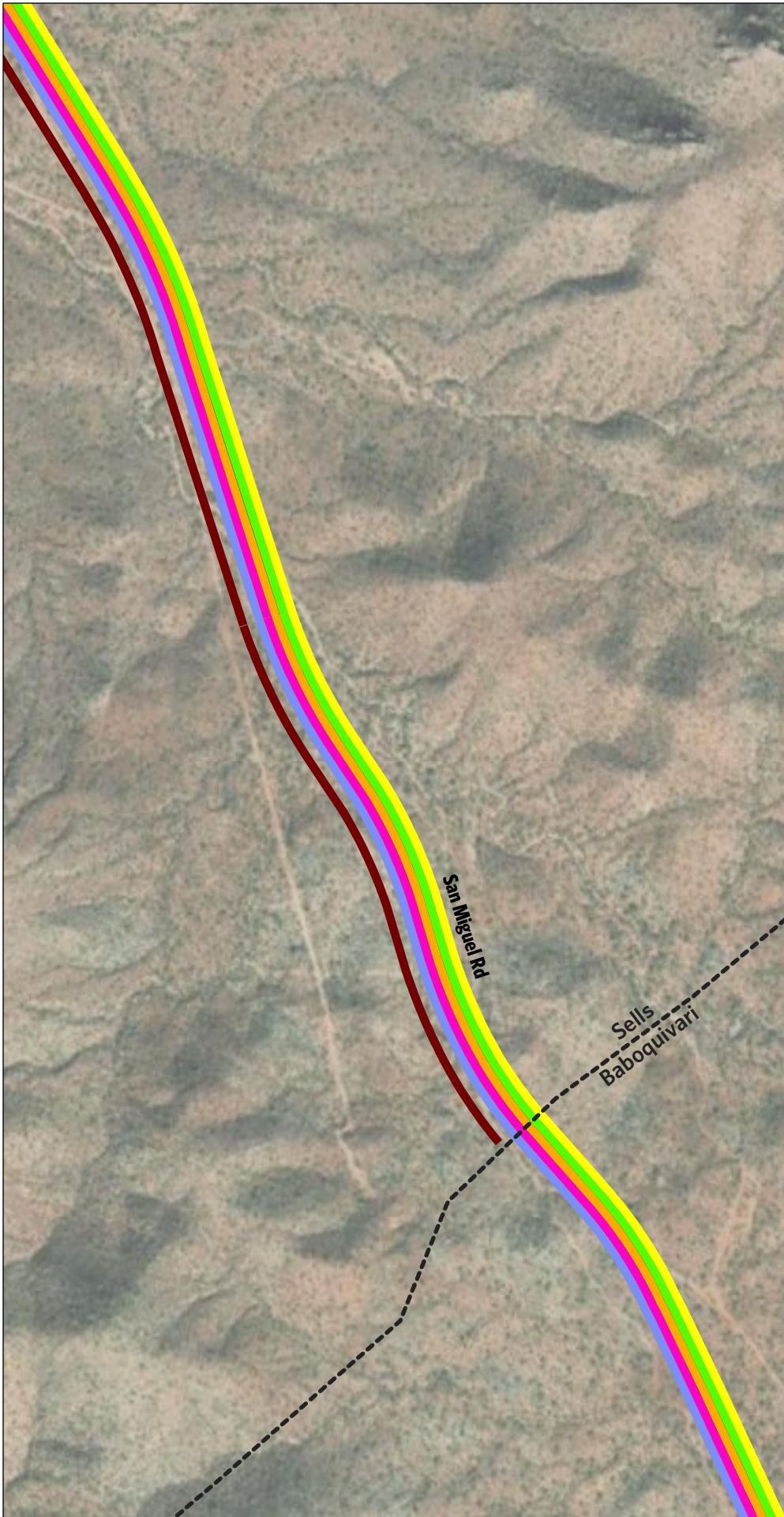
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

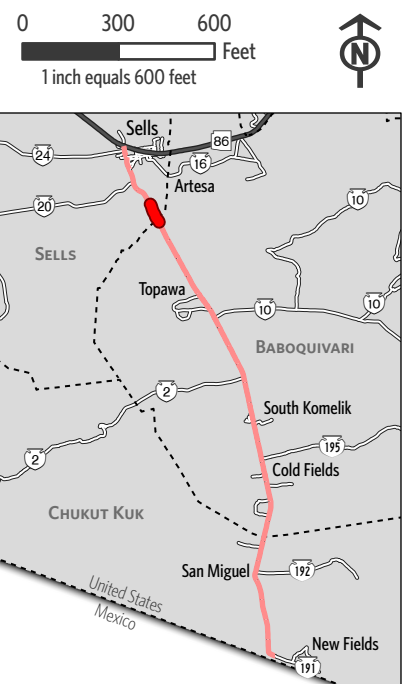
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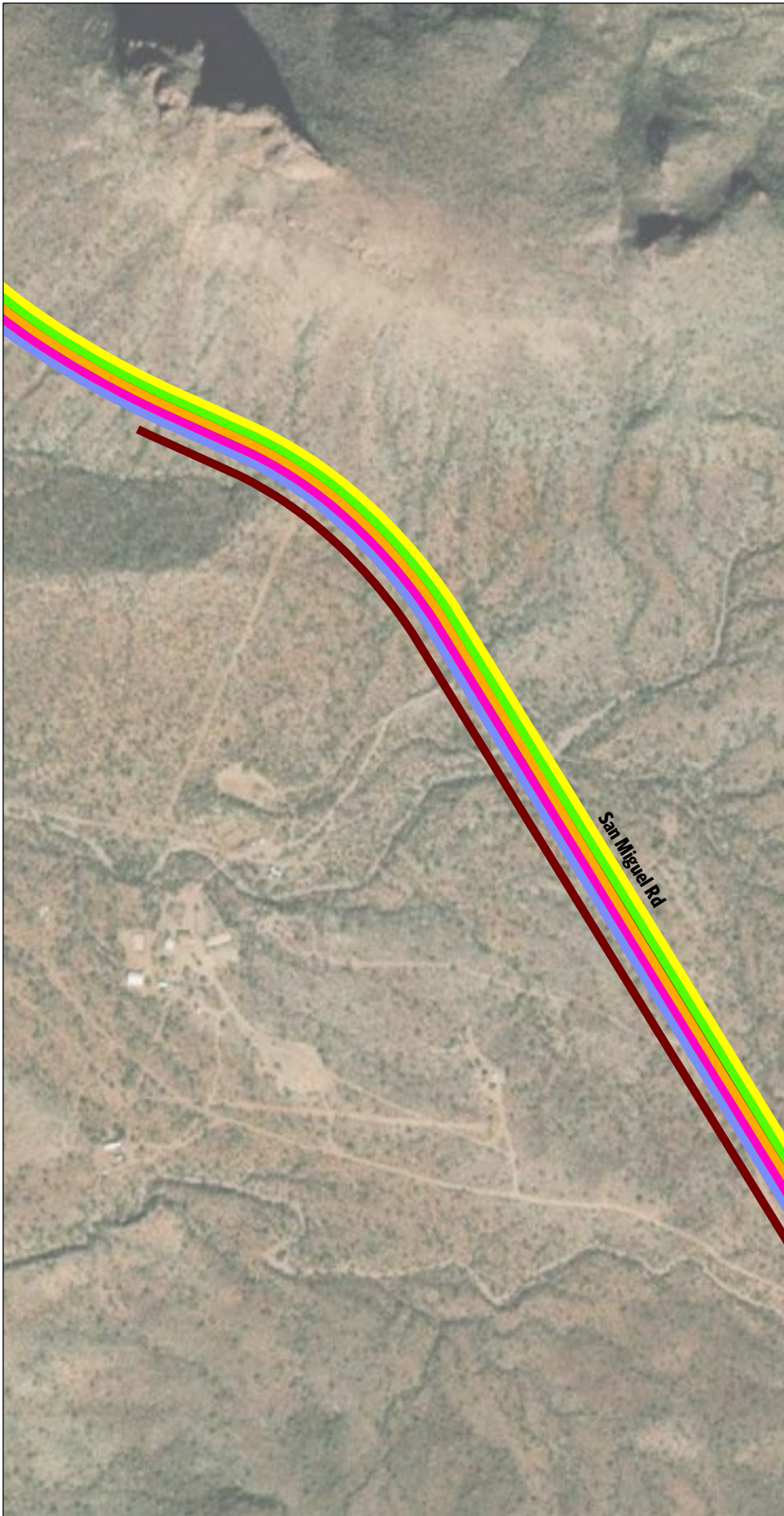
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

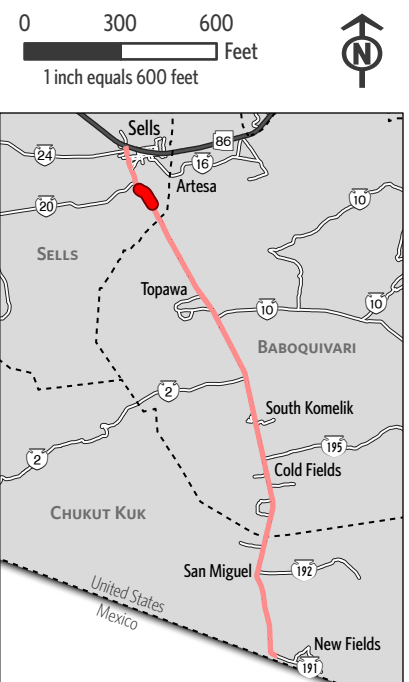
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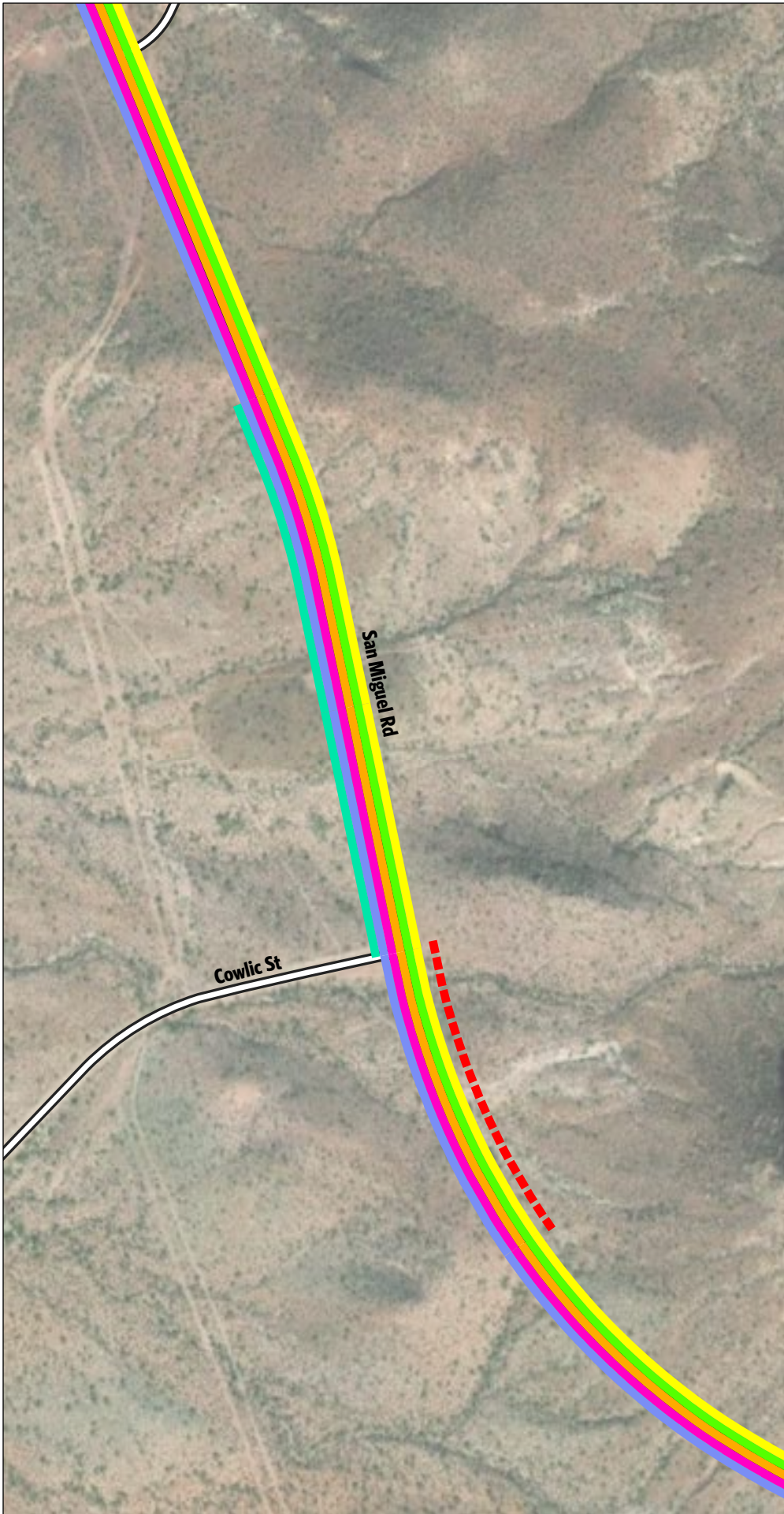
Potential Safety Concerns

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- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
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- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

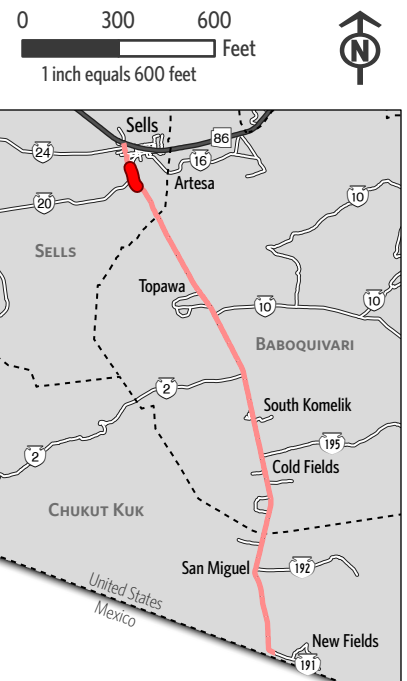
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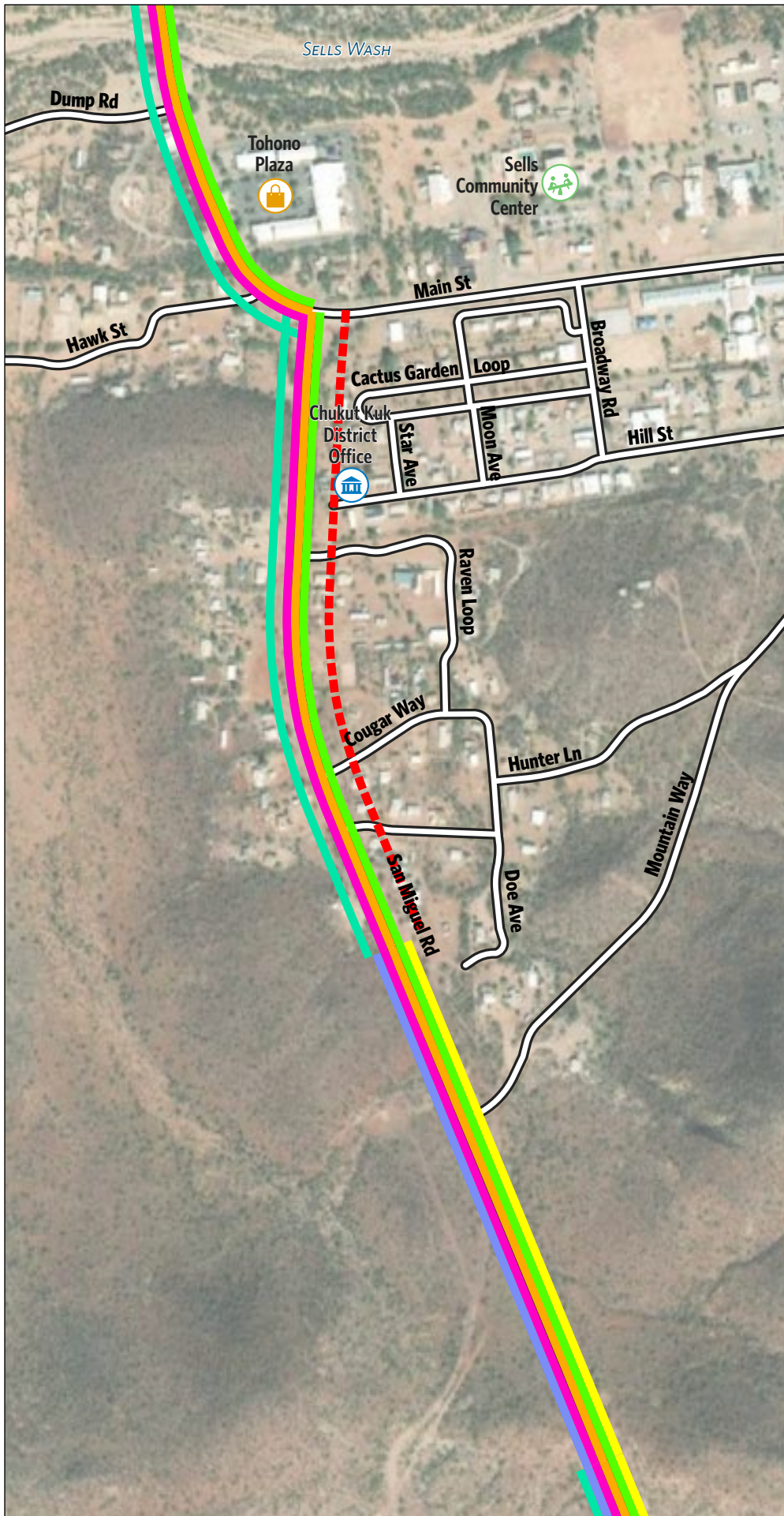
Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

- Tohono O'odham District Boundary





Existing Issues

Route 19

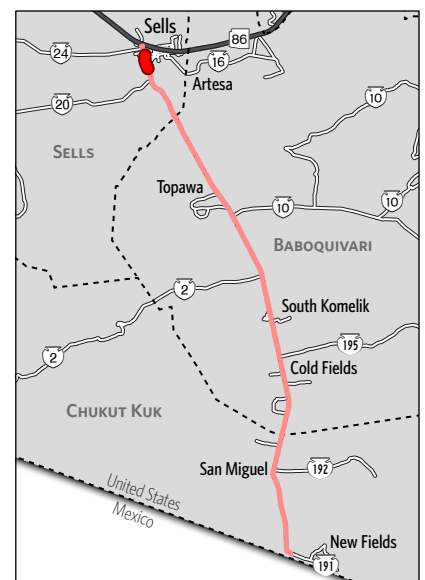
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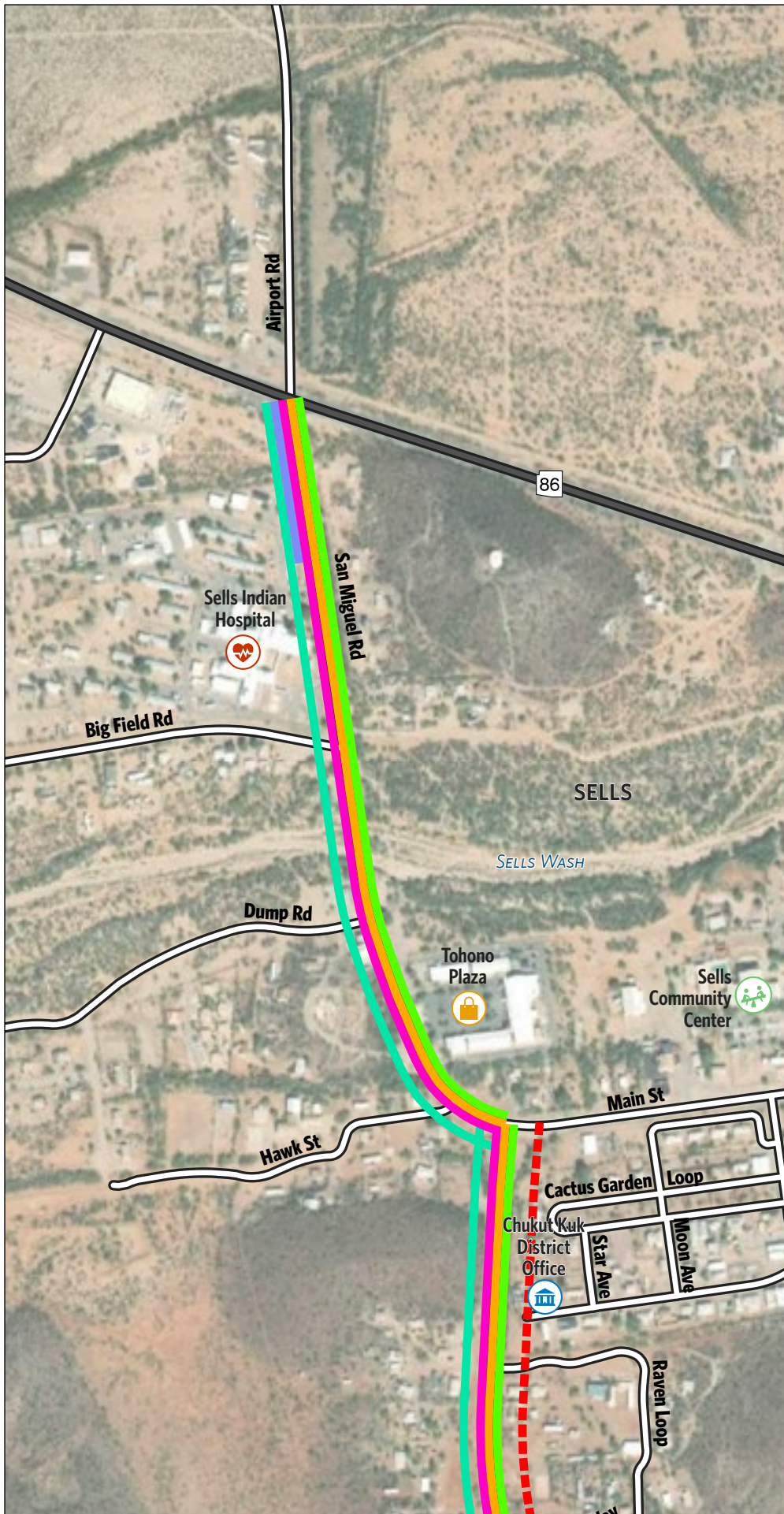
- High Crash Corridor
- Flooding Issue
- No Sidewalks
- Open Range, No Fencing
- No Shoulders
- Deteriorating Striping
- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

-  Government Office
-  Recreation
-  Shopping Center
- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Existing Issues

Route 19

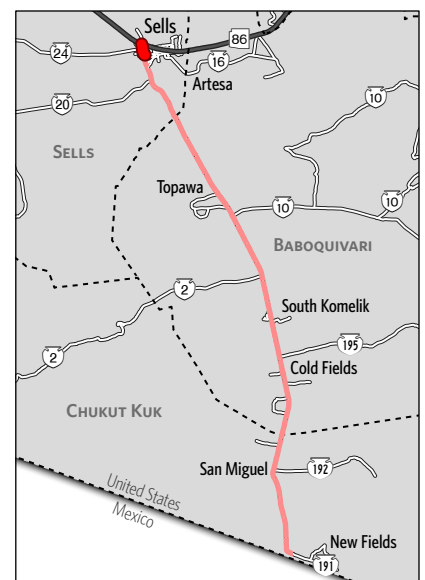
Potential Safety Concerns

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- Flooding Issue
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- No Shoulders
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- No Lighting
- Poor Pavement
- Curvy Roadway

Reference

-  Government Office
-  Hospital
-  Recreation
-  Shopping Center
-  Tohono O'odham District Boundary

0 300 600 Feet
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Appendix C

Route 19 Recommended Improvements Atlas

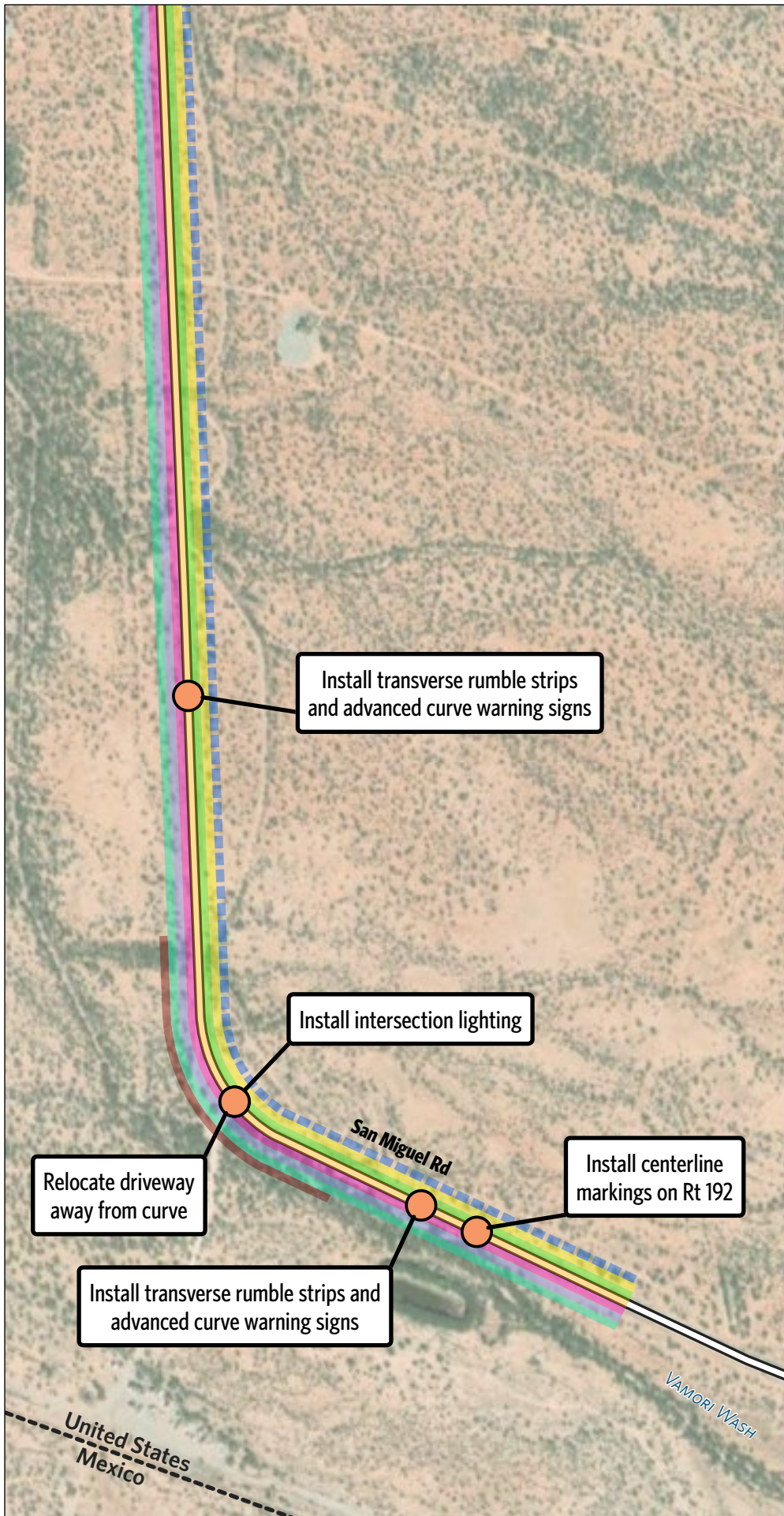
Recommended Improvements - Overview Map

Route 19



Recommended Corridor-wide Improvements

- Install continuous fencing
- Complete chip seal in poor pavement areas
- Install 4 foot shoulders with Safety - Edge throughout
- Replace damaged signage and undersized signage per current MUTCD sizing criteria
- Install W11-4 (Cow) and W11-19 (Donkey) warning signs with supplemental plaque W7-3aP every 10 miles
- Install centerline rumble strips
- Remove all vegetation in the clear zone
- Install reduced nighttime speed limits
- Install pedestrian warning signs (W11-2) with a supplemental sign (W16-4P) stating "next XX miles" every 10 miles along entire route
- Install depth gauge signs (W8-19), one in each direction, at all wash crossing sag curves



Recommended Improvements

Route 19

Potential Safety Concerns

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- No Lighting
- Poor Pavement
- Curvy Roadway

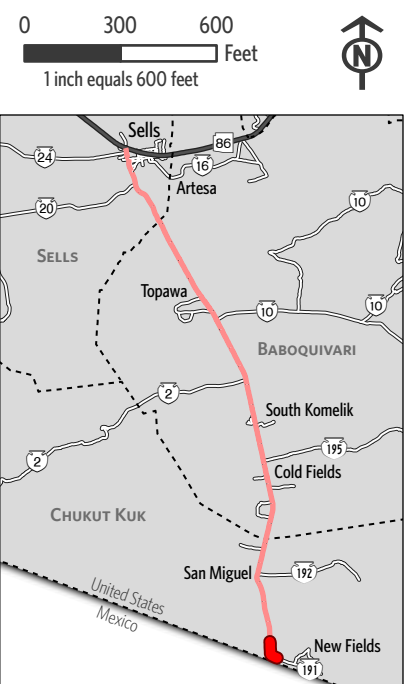
Recommended Improvement *

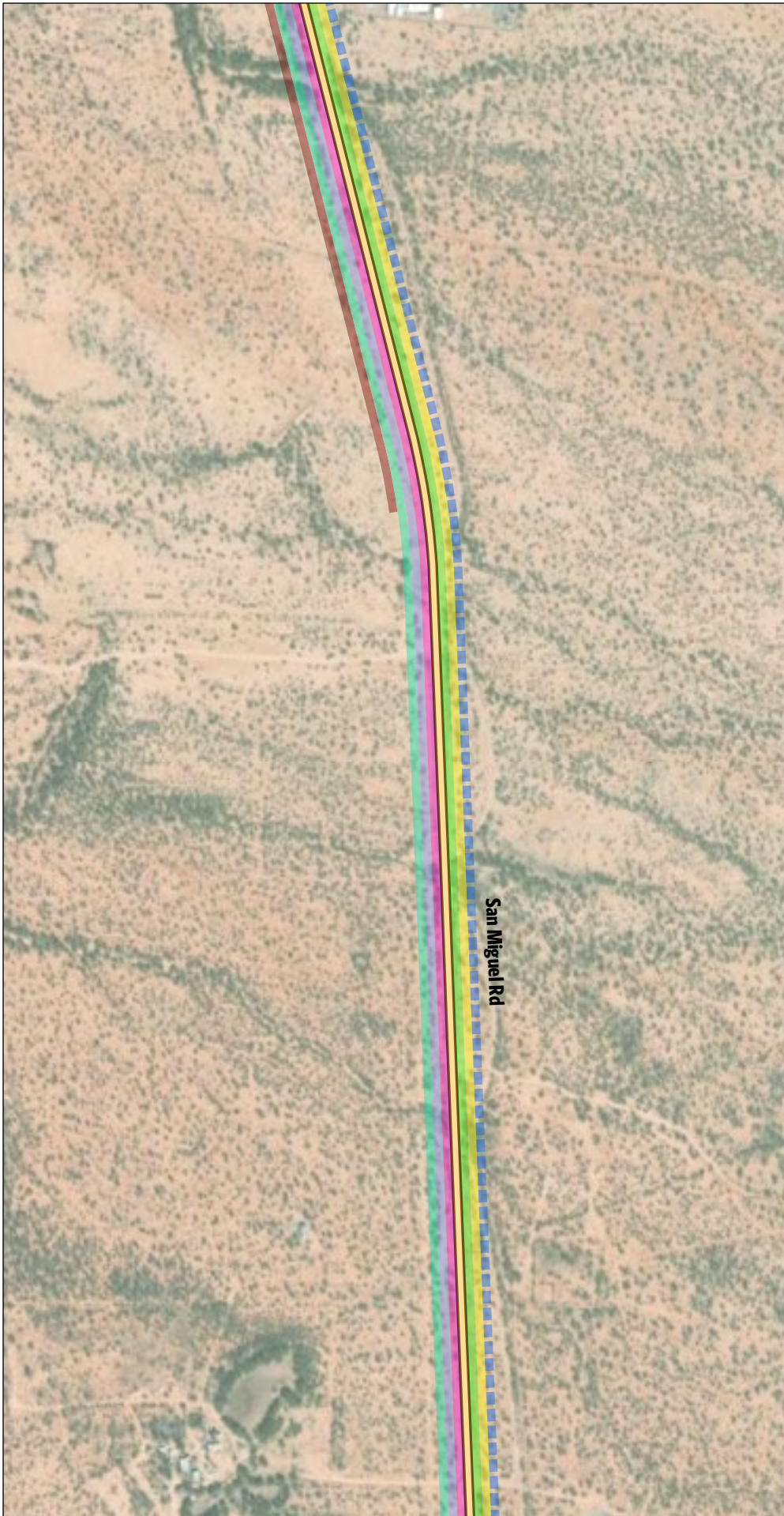
- Spot Improvement

* Also reference overview page for corridor-wide improvement recommendations

Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

Potential Safety Concerns

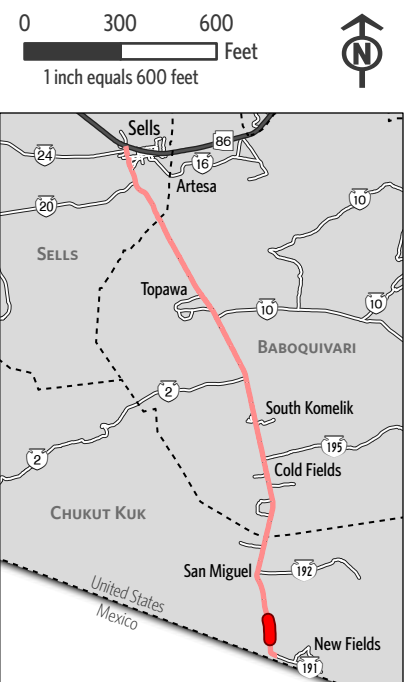
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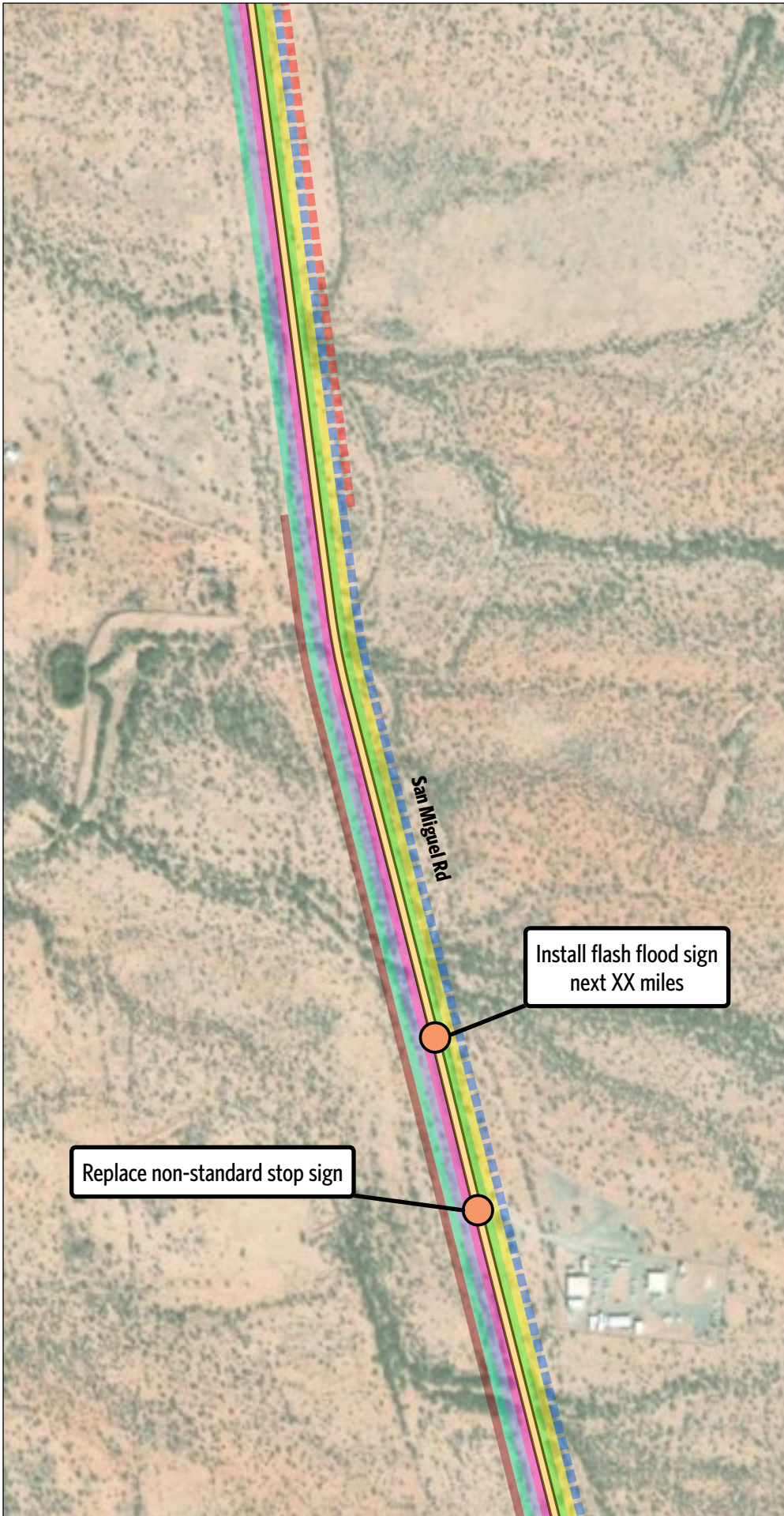
Recommended Improvement *

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Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

Potential Safety Concerns

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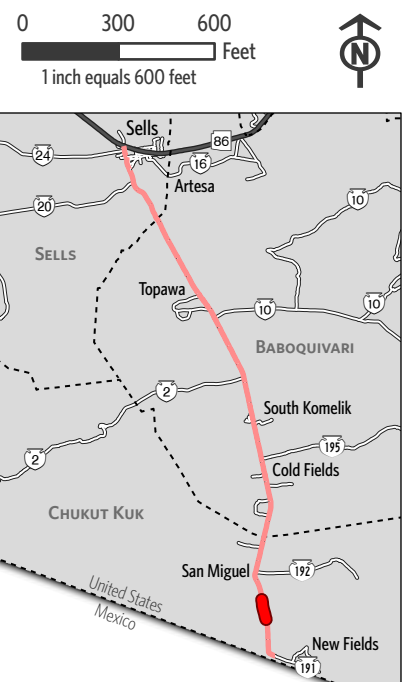
Recommended Improvement *

- Spot Improvement

* Also reference overview page for corridor-wide improvement recommendations

Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

Potential Safety Concerns

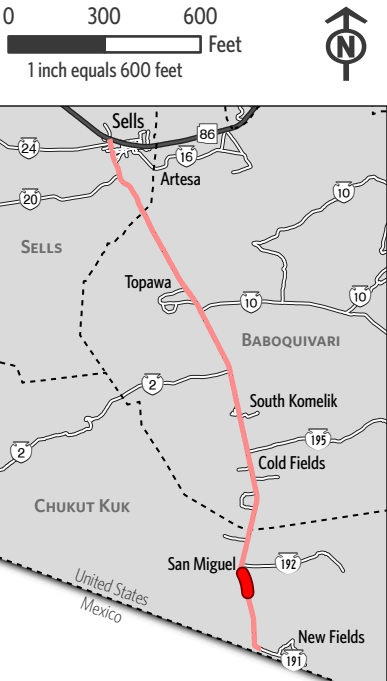
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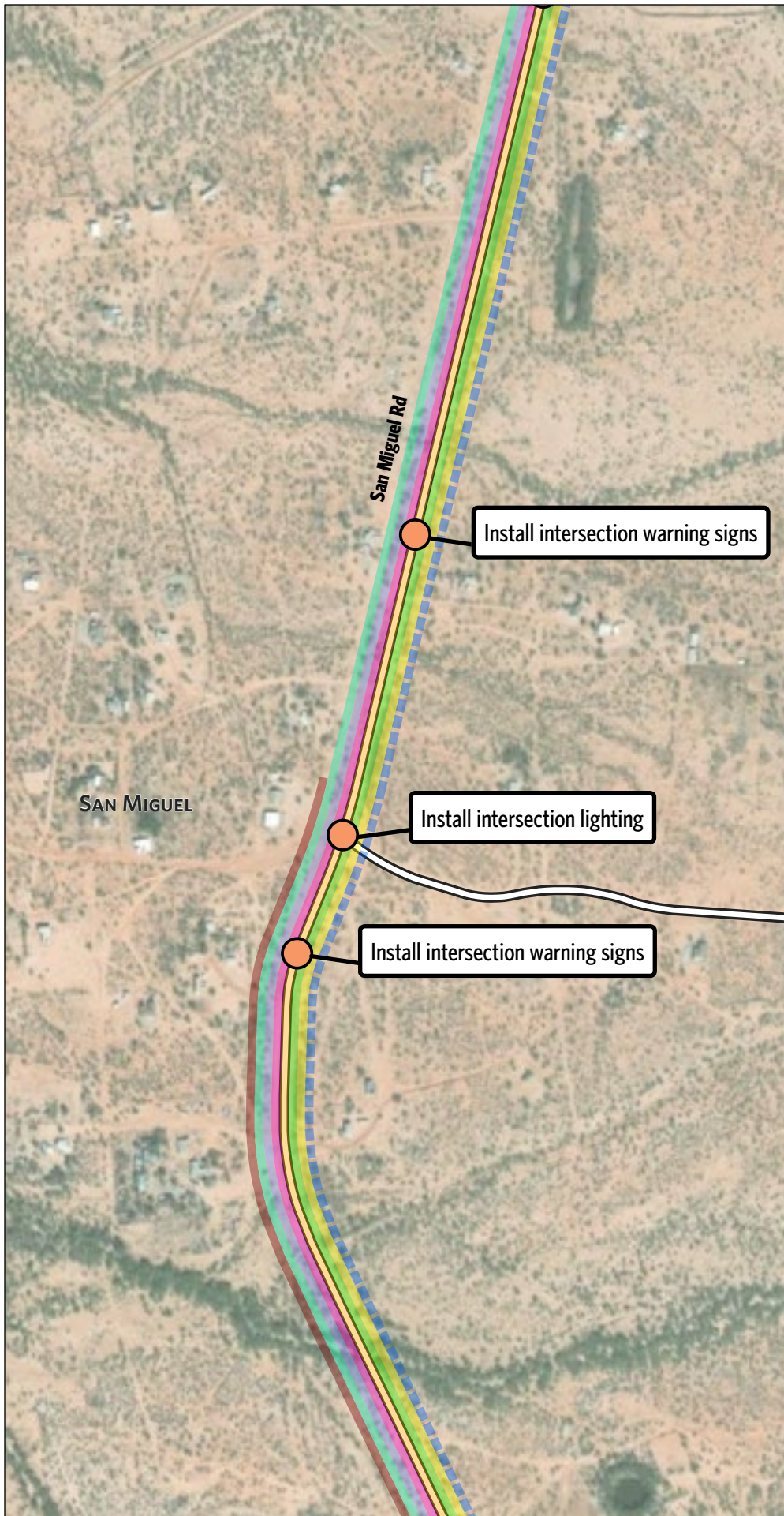
Recommended Improvement *

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Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

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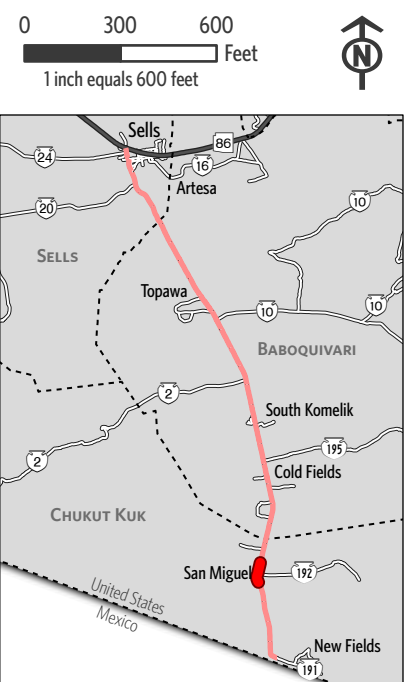
Recommended Improvement *

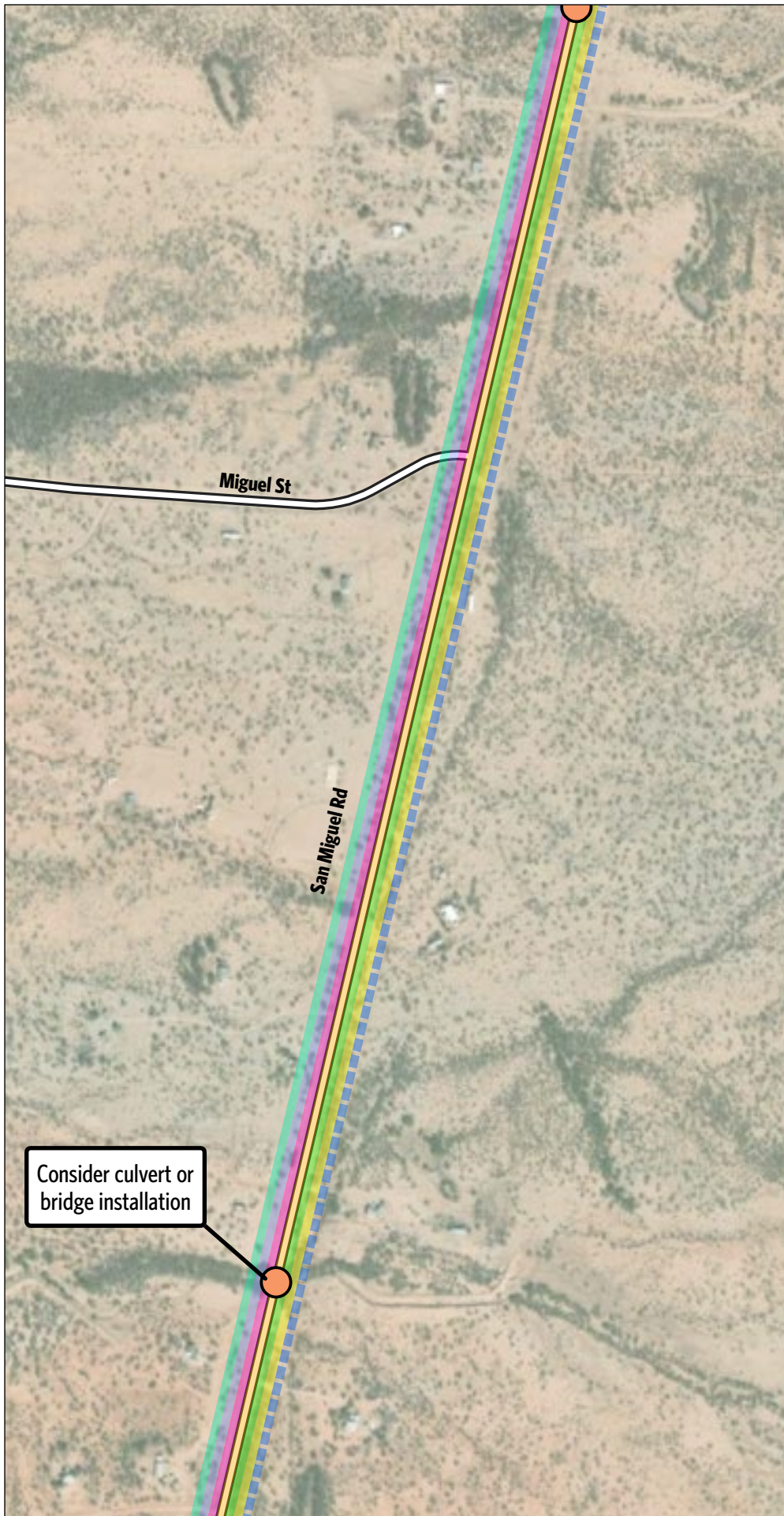
- Spot Improvement

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Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

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Recommended Improvement *

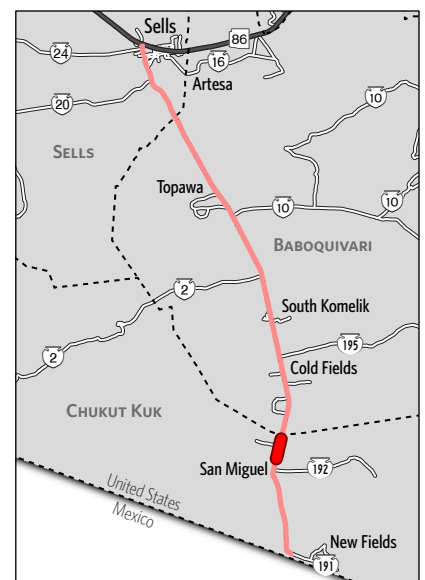
- Spot Improvement

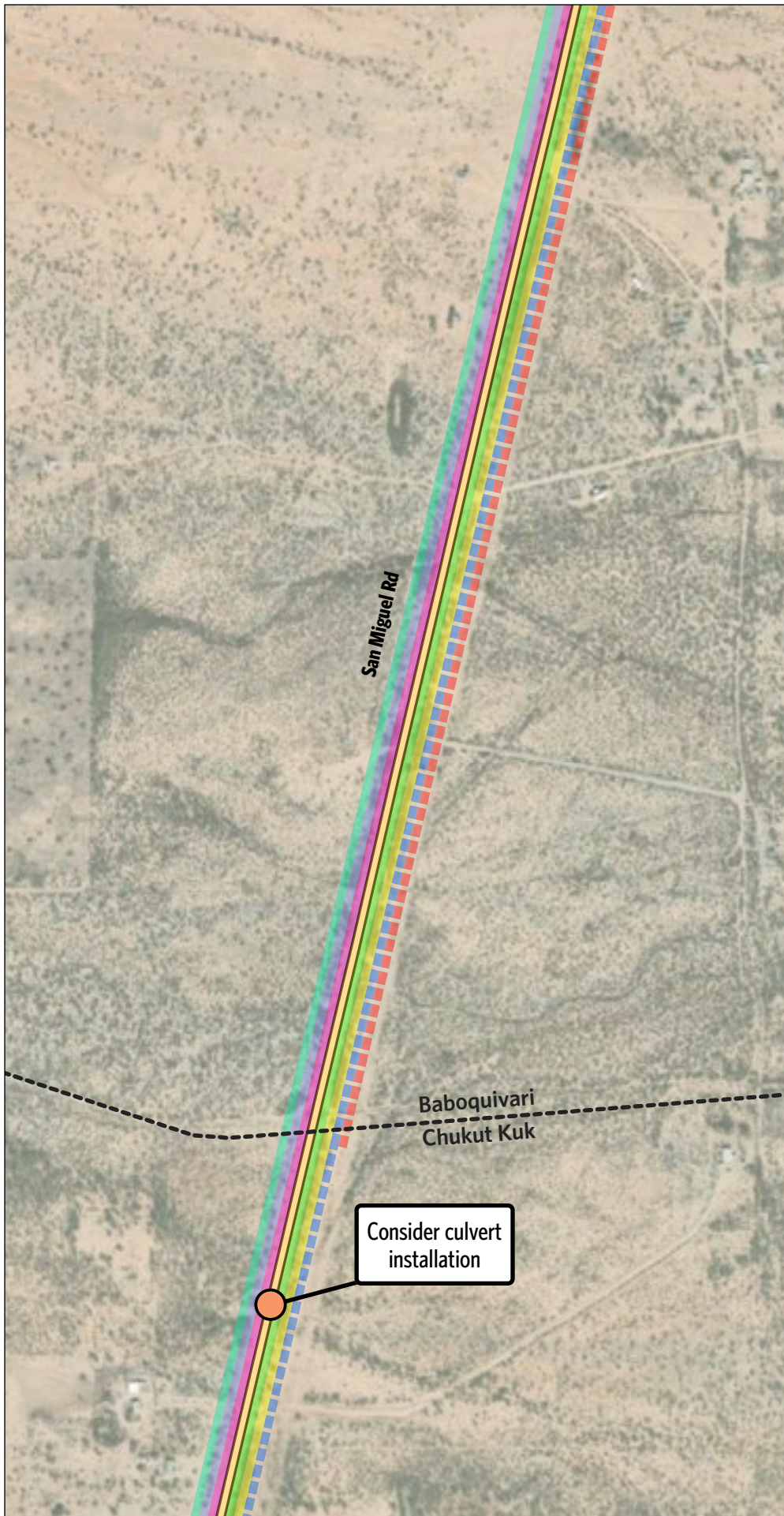
* Also reference overview page for corridor-wide improvement recommendations

Reference

- Tohono O'odham District Boundary

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Recommended Improvements

Route 19

Potential Safety Concerns

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- Flooding Issue
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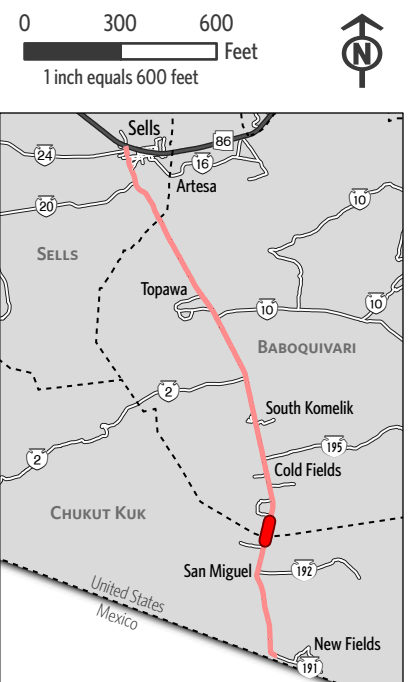
Recommended Improvement *

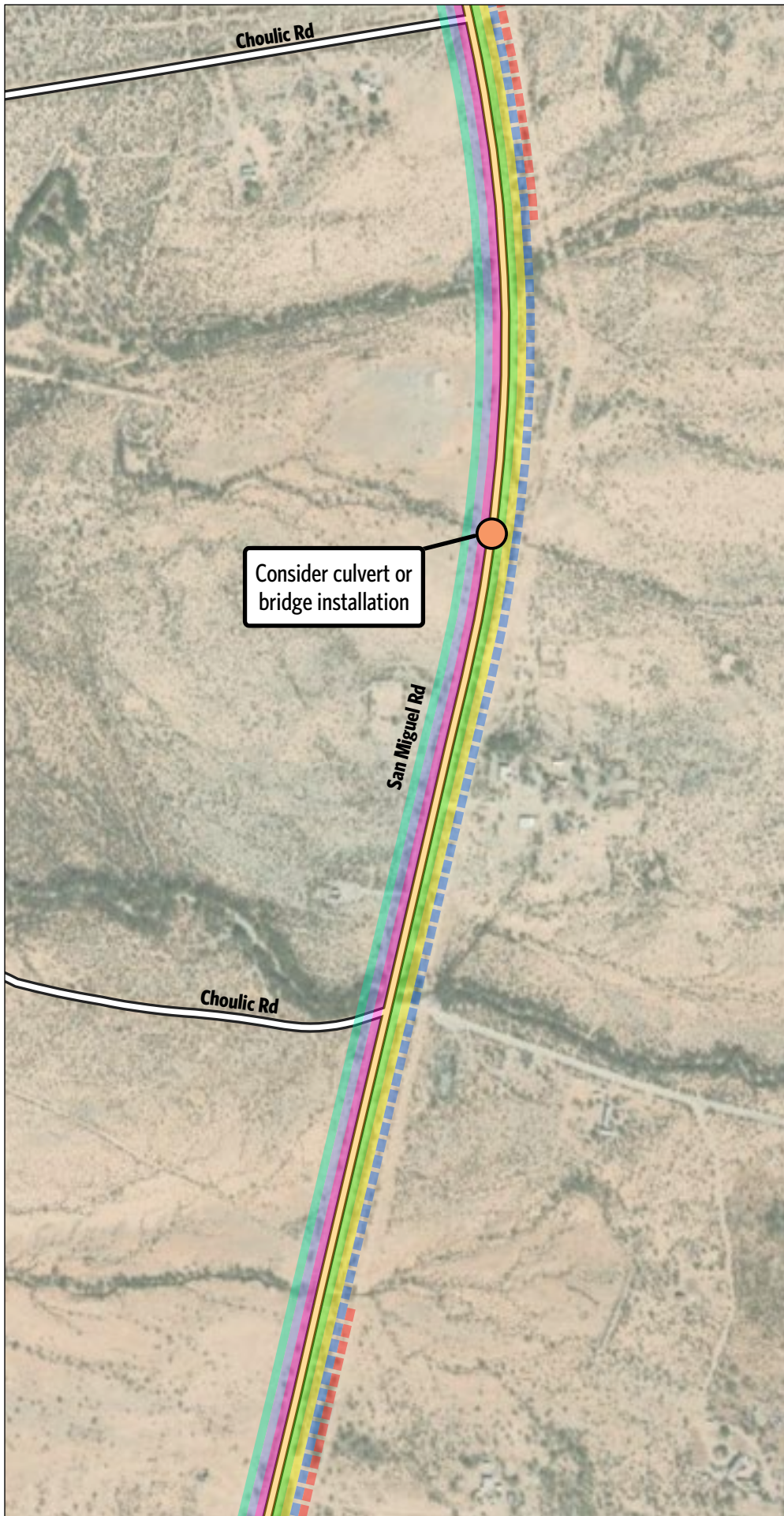
- Spot Improvement

* Also reference overview page for corridor-wide improvement recommendations

Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

Potential Safety Concerns

- High Crash Corridor
- Flooding Issue
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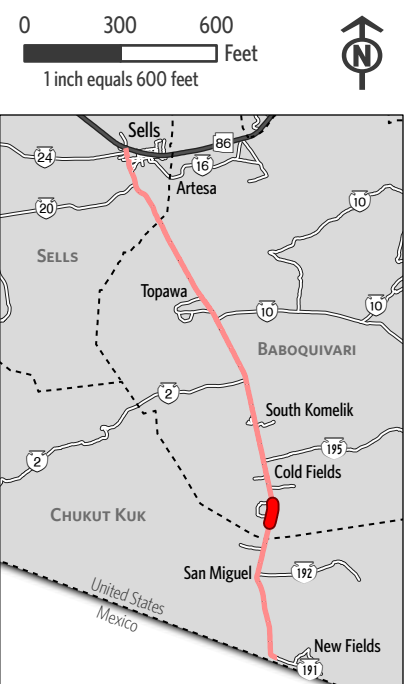
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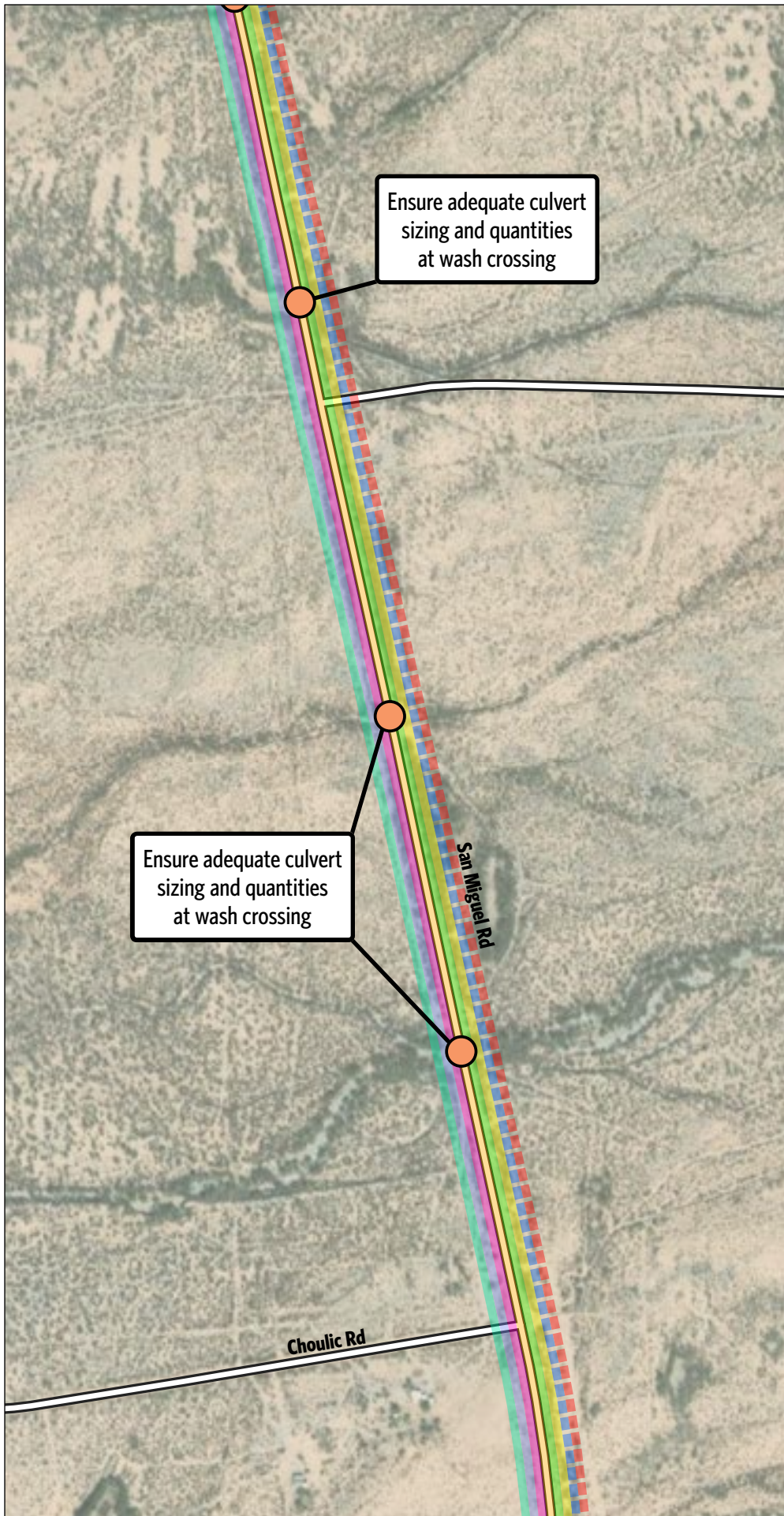
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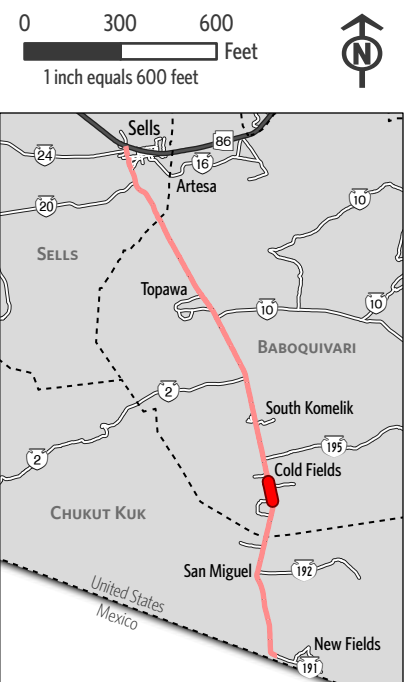
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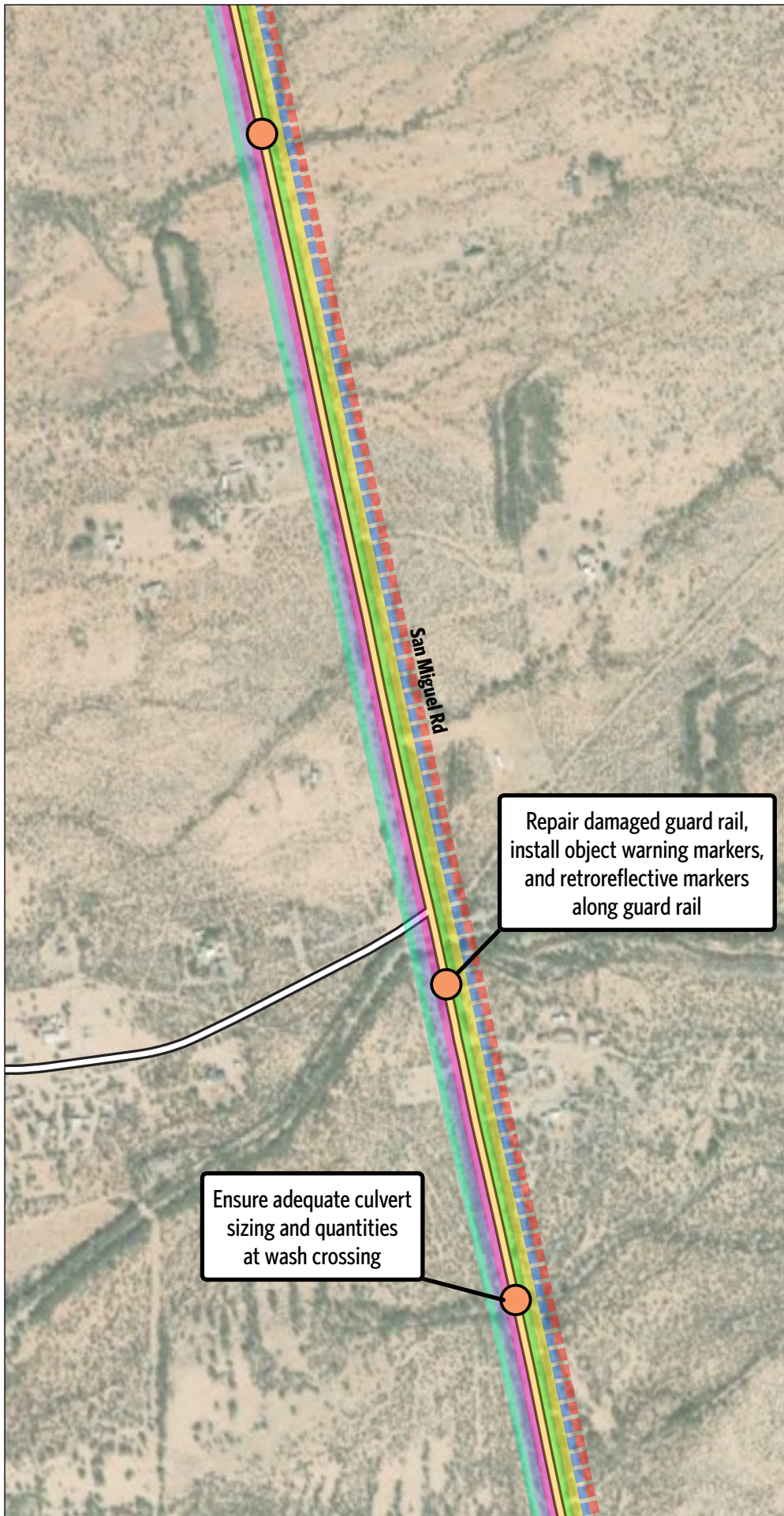
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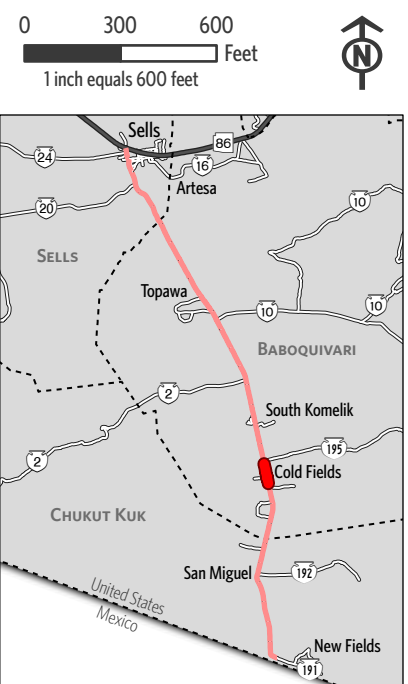
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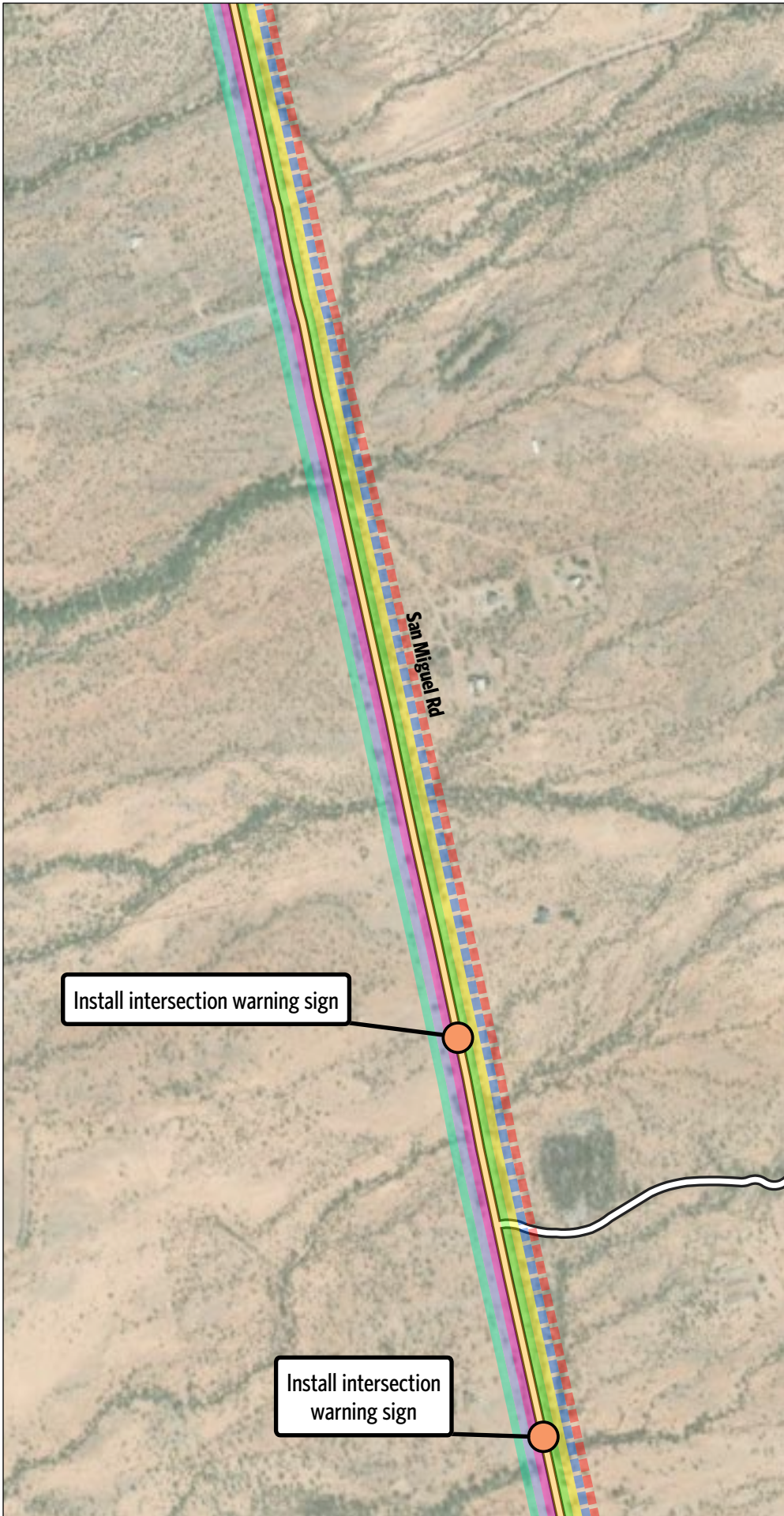
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Recommended Improvements

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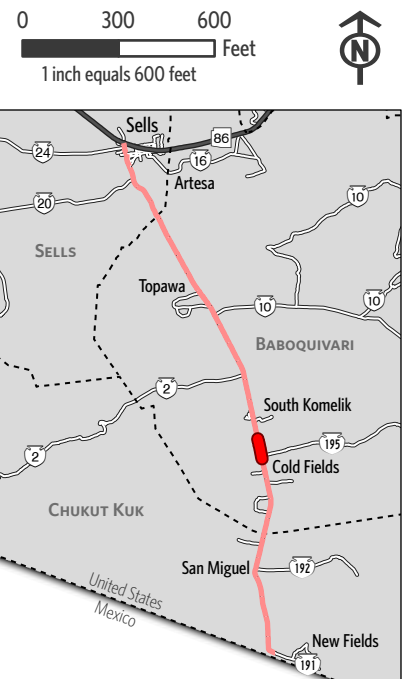
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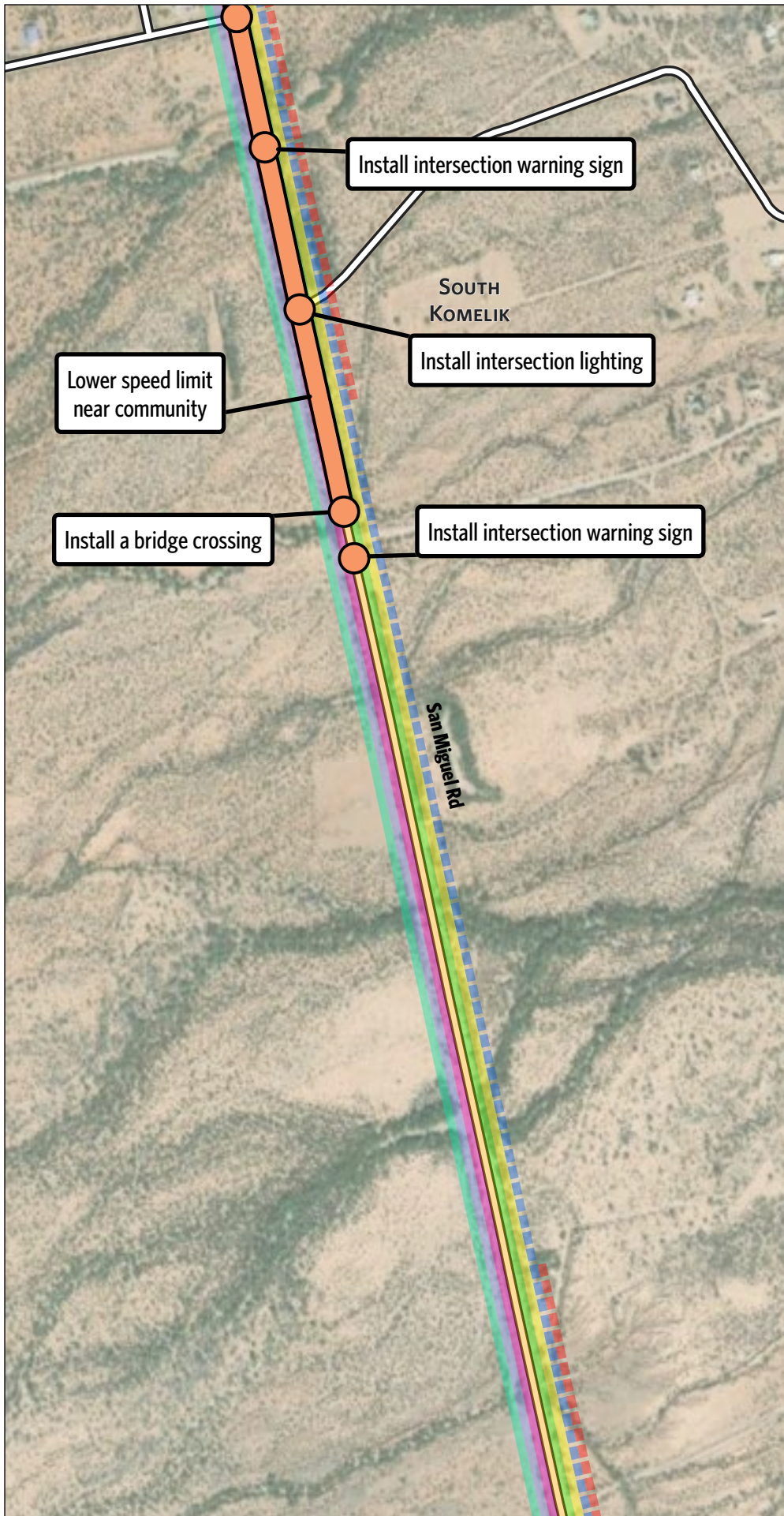
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Recommended Improvements

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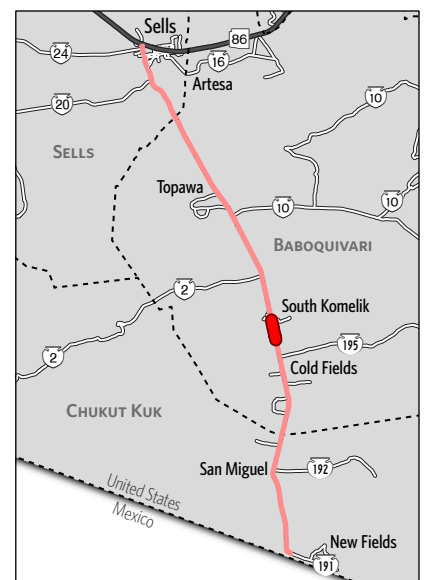
- Spot Improvement
- Linear Improvement

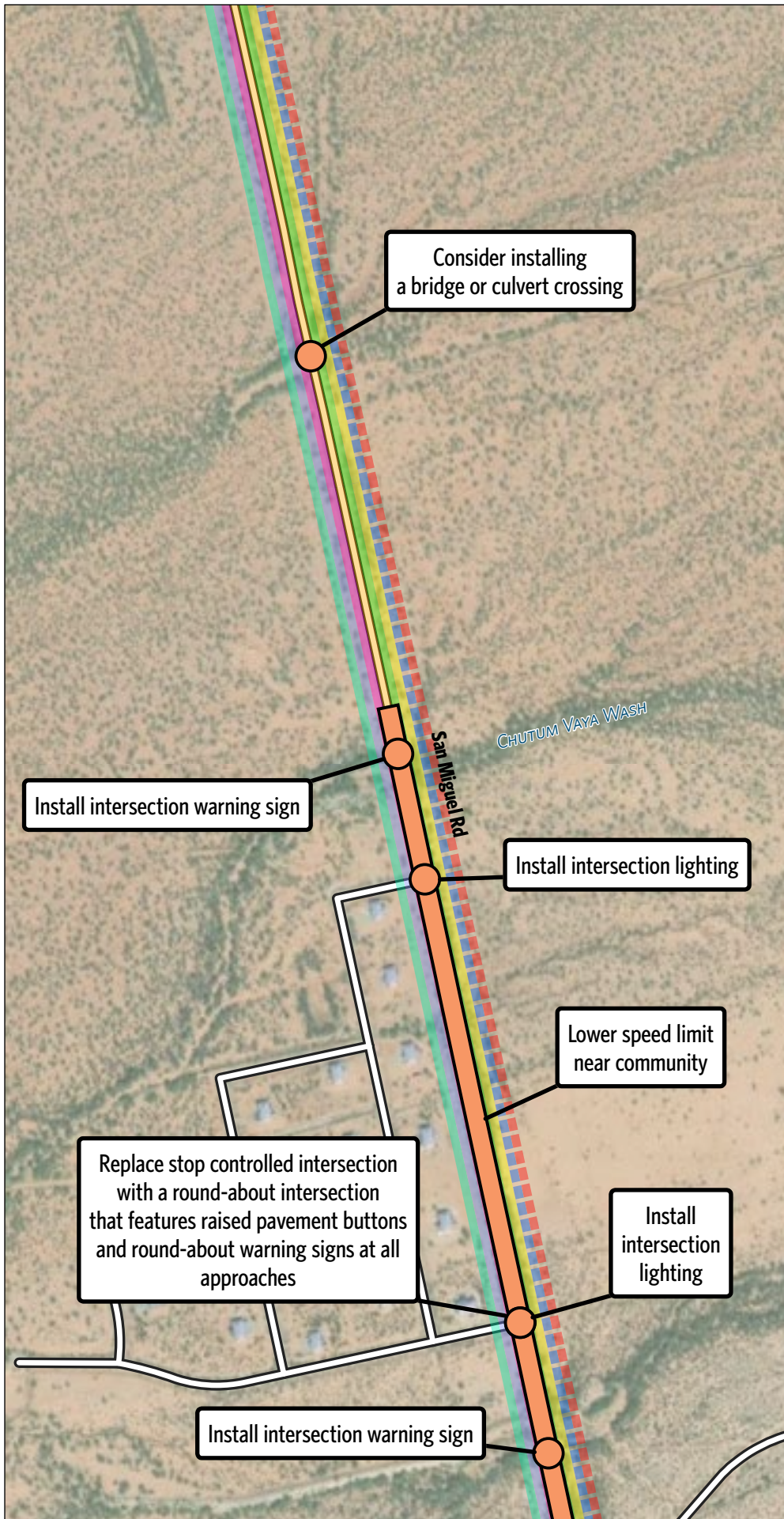
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Reference

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0 300 600 Feet
1 inch equals 600 feet





Recommended Improvements

Route 19

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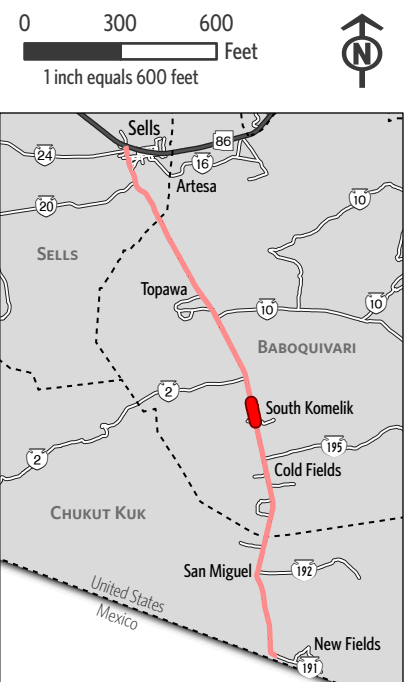
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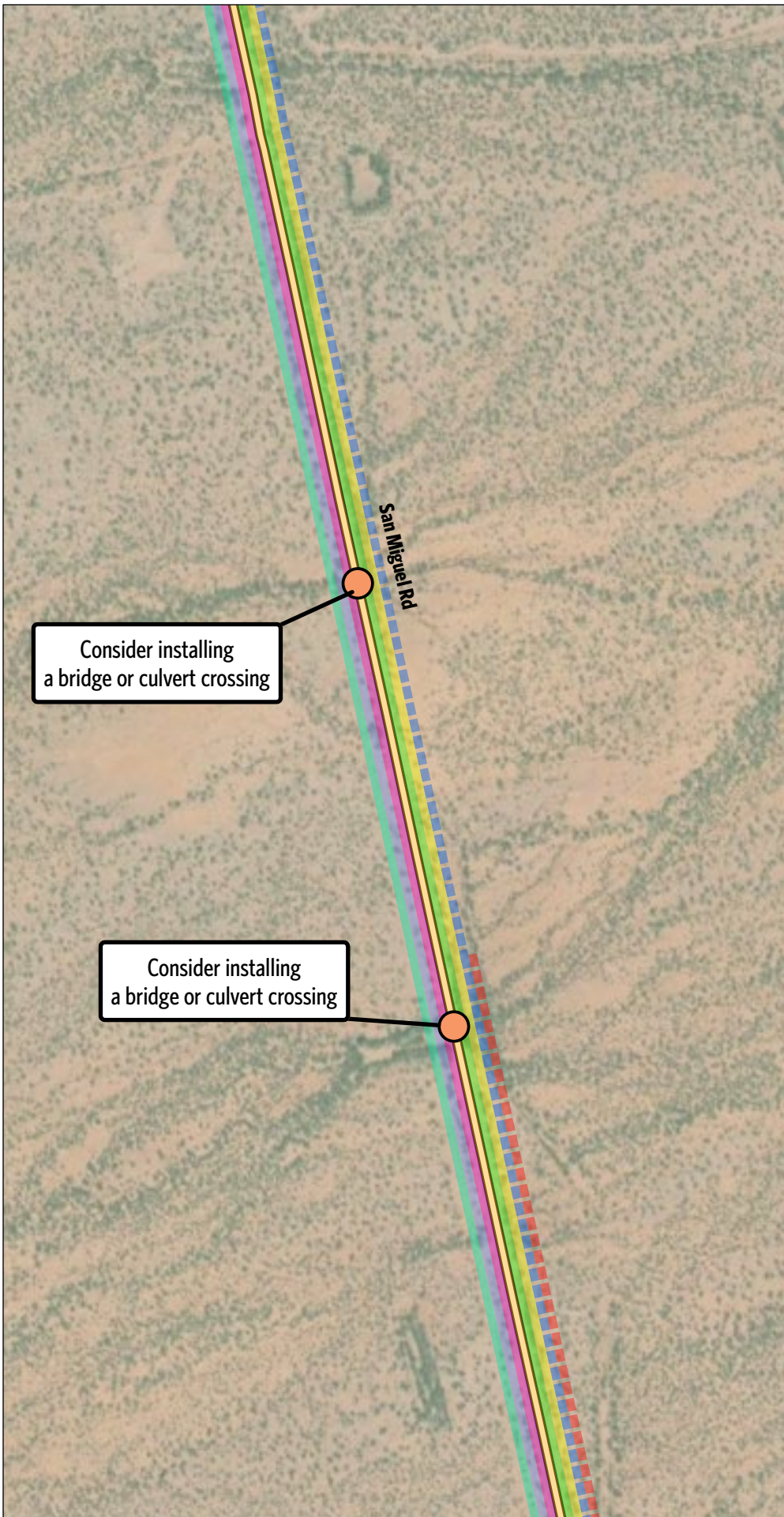
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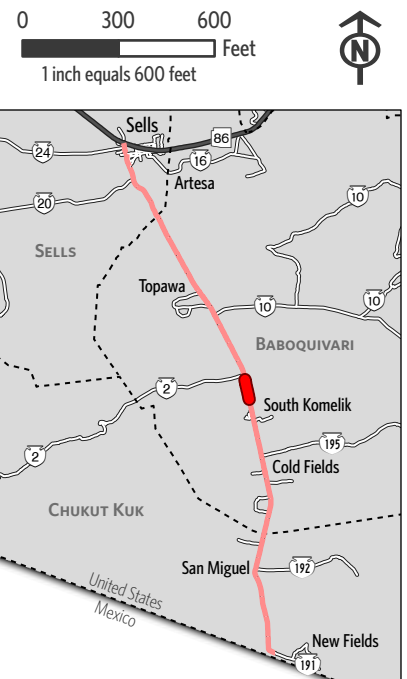
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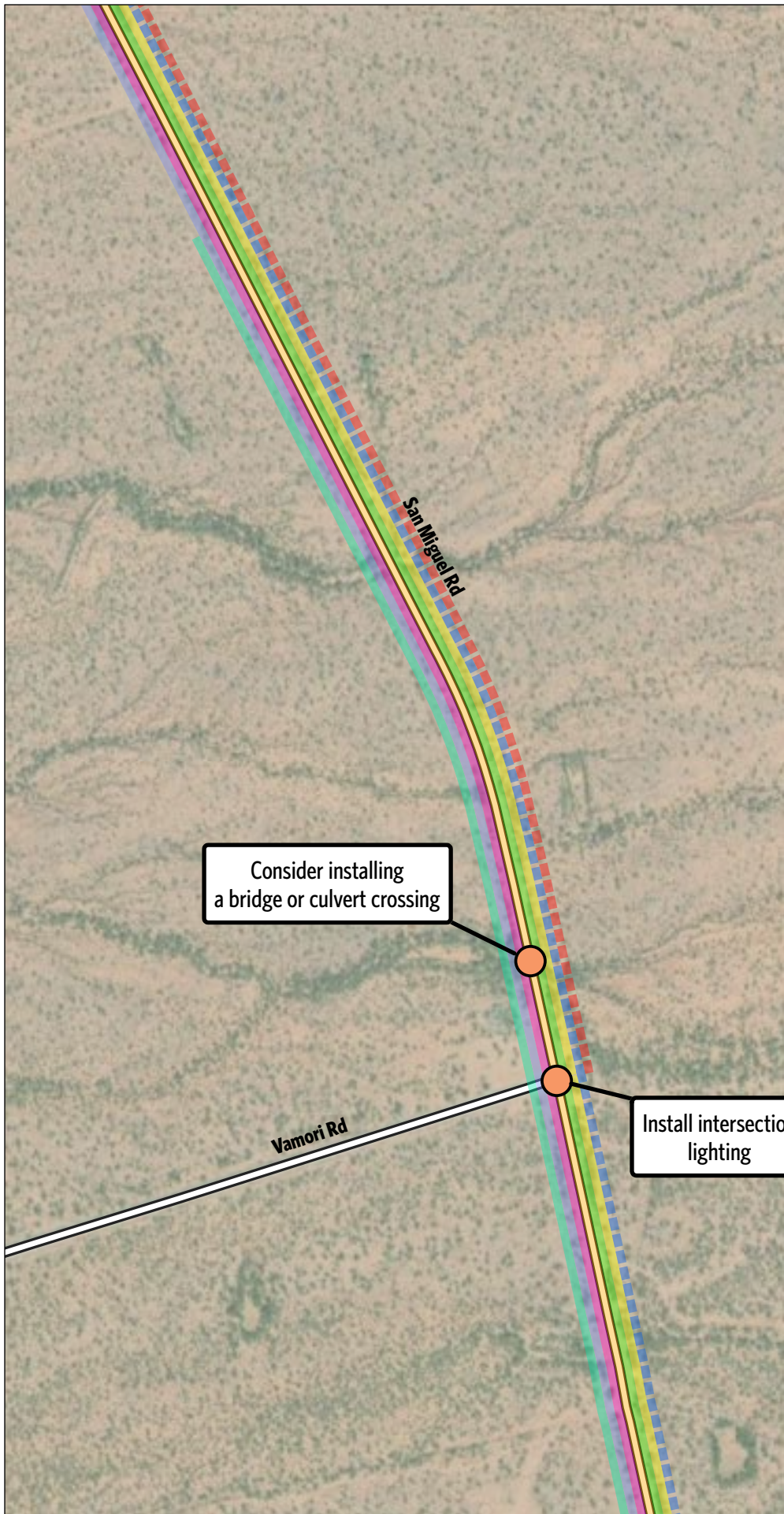
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Recommended Improvements

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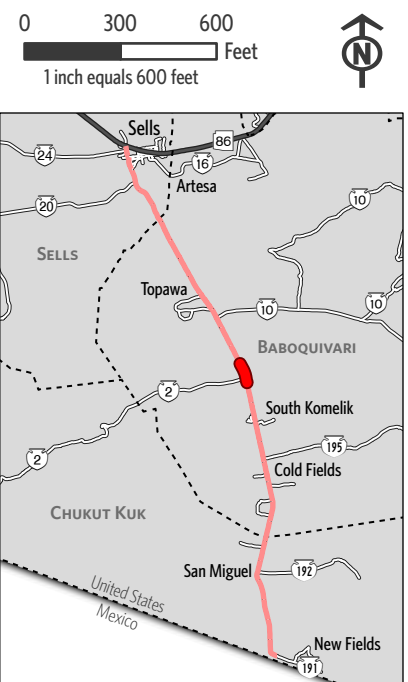
Recommended Improvement *

- Spot Improvement

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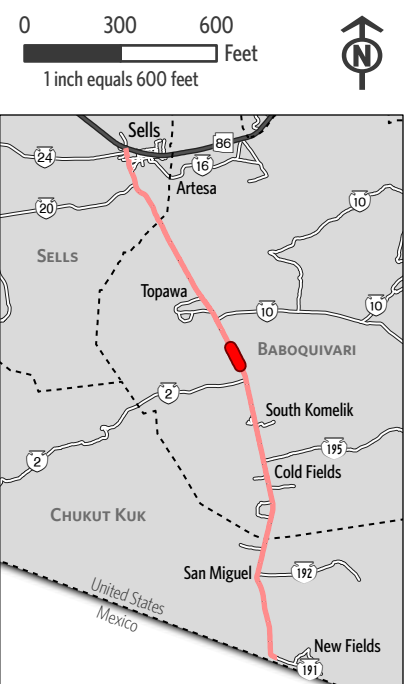
Recommended Improvement *

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Recommended Improvements

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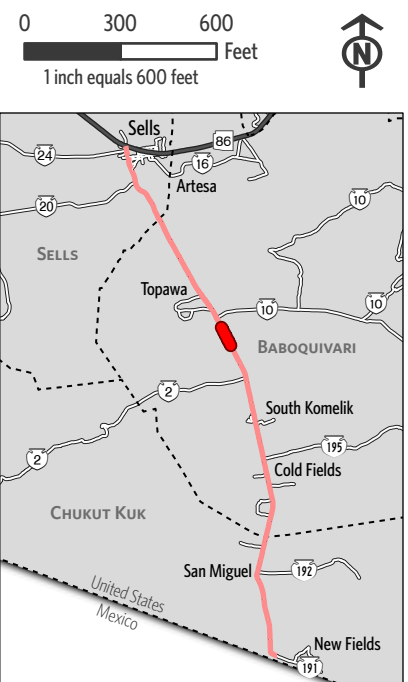
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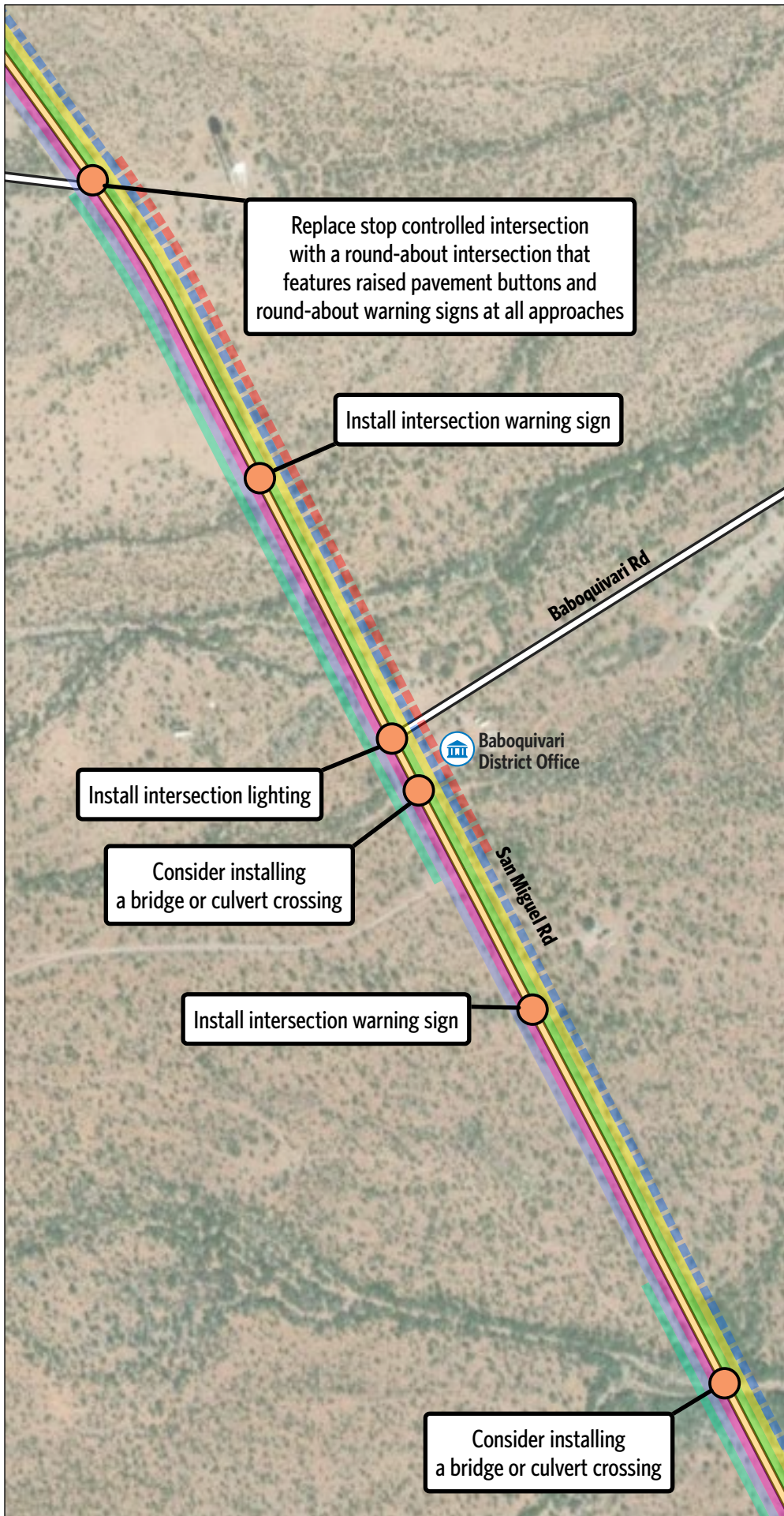
- Spot Improvement

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Recommended Improvements

Route 19

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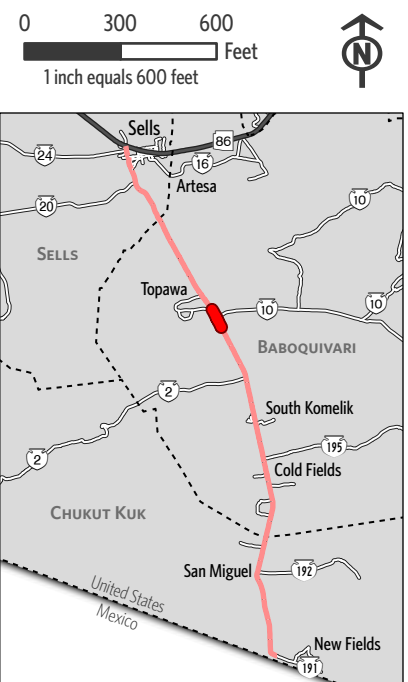
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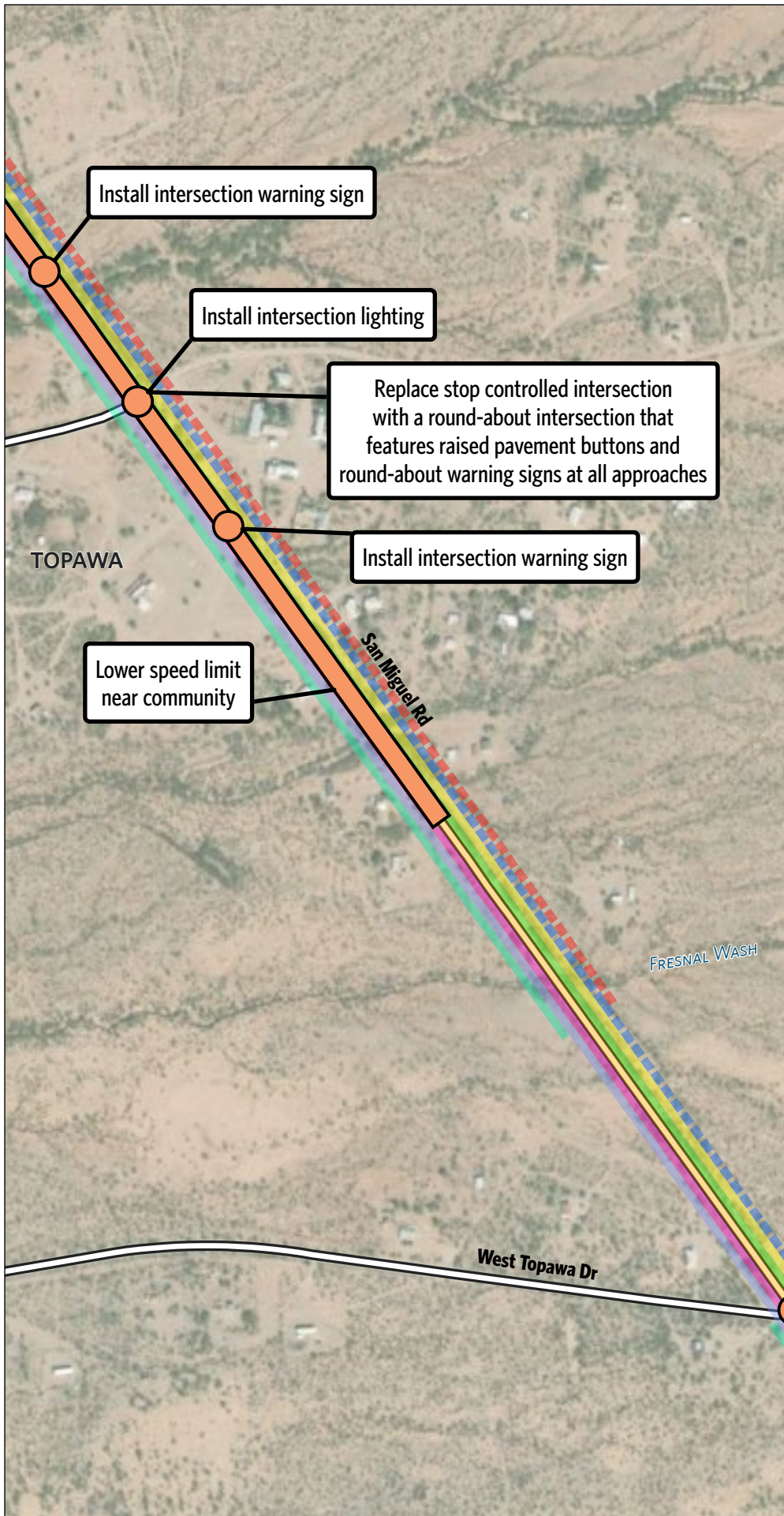
- Spot Improvement

* Also reference overview page for corridor-wide improvement recommendations

Reference

- Government Office
- Tohono O'odham District Boundary





Recommended Improvements

Route 19

Potential Safety Concerns

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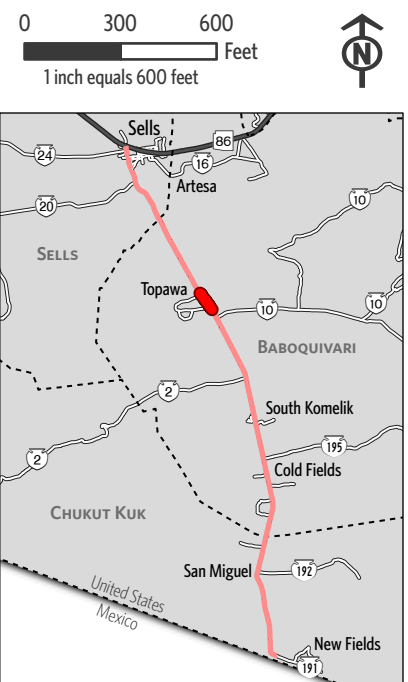
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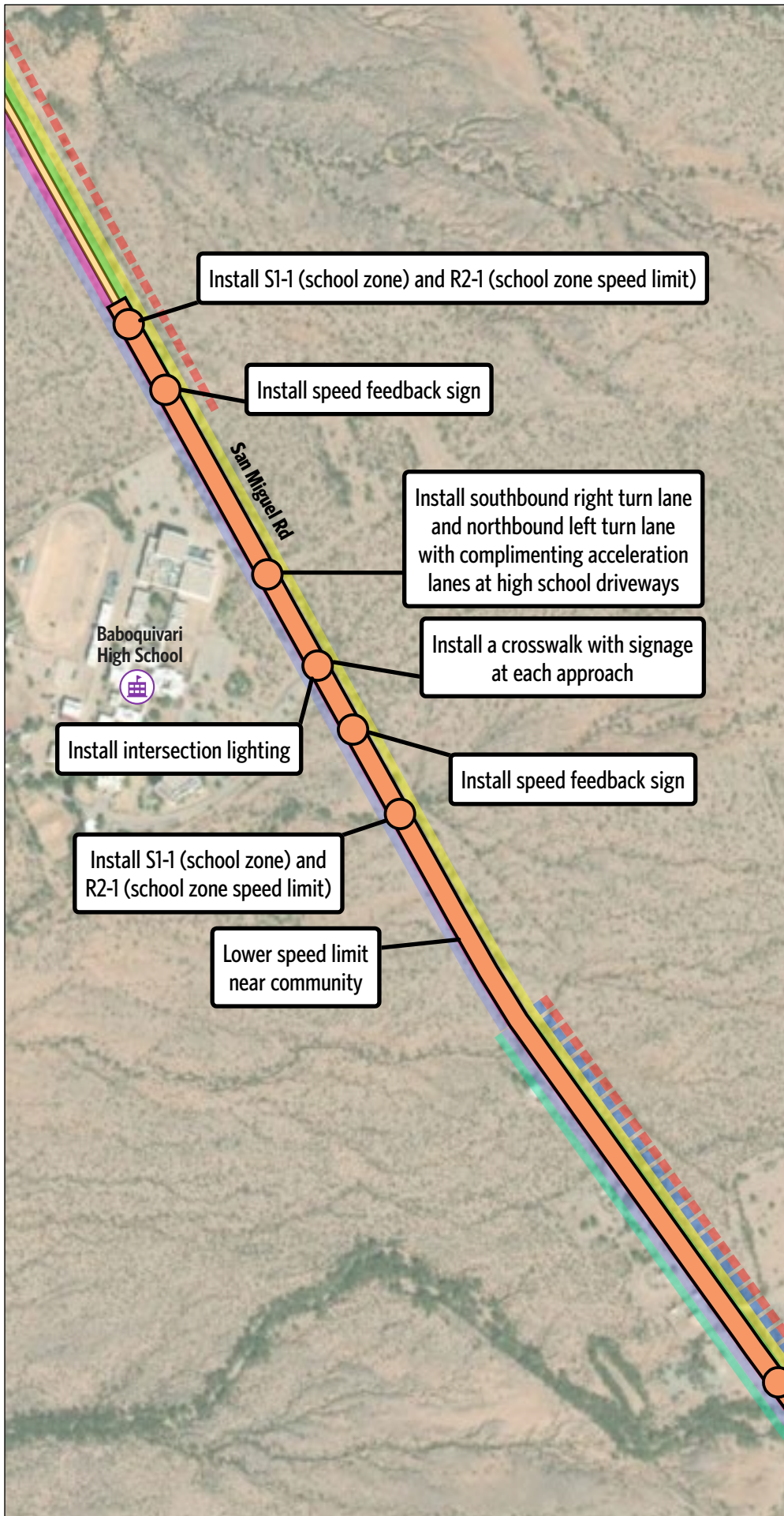
- Spot Improvement
- Linear Improvement

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Reference

- Tohono O'odham District Boundary





Recommended Improvements

Route 19

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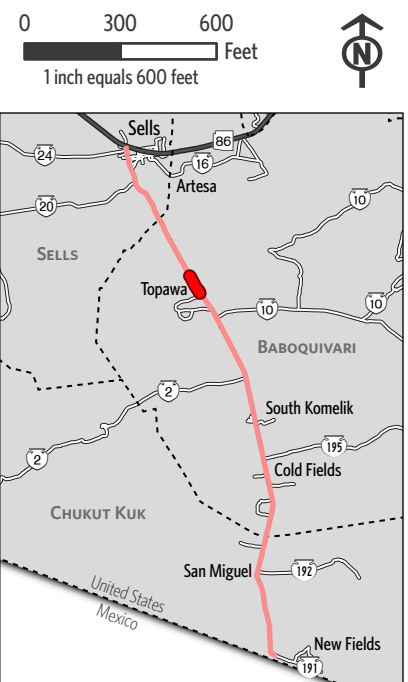
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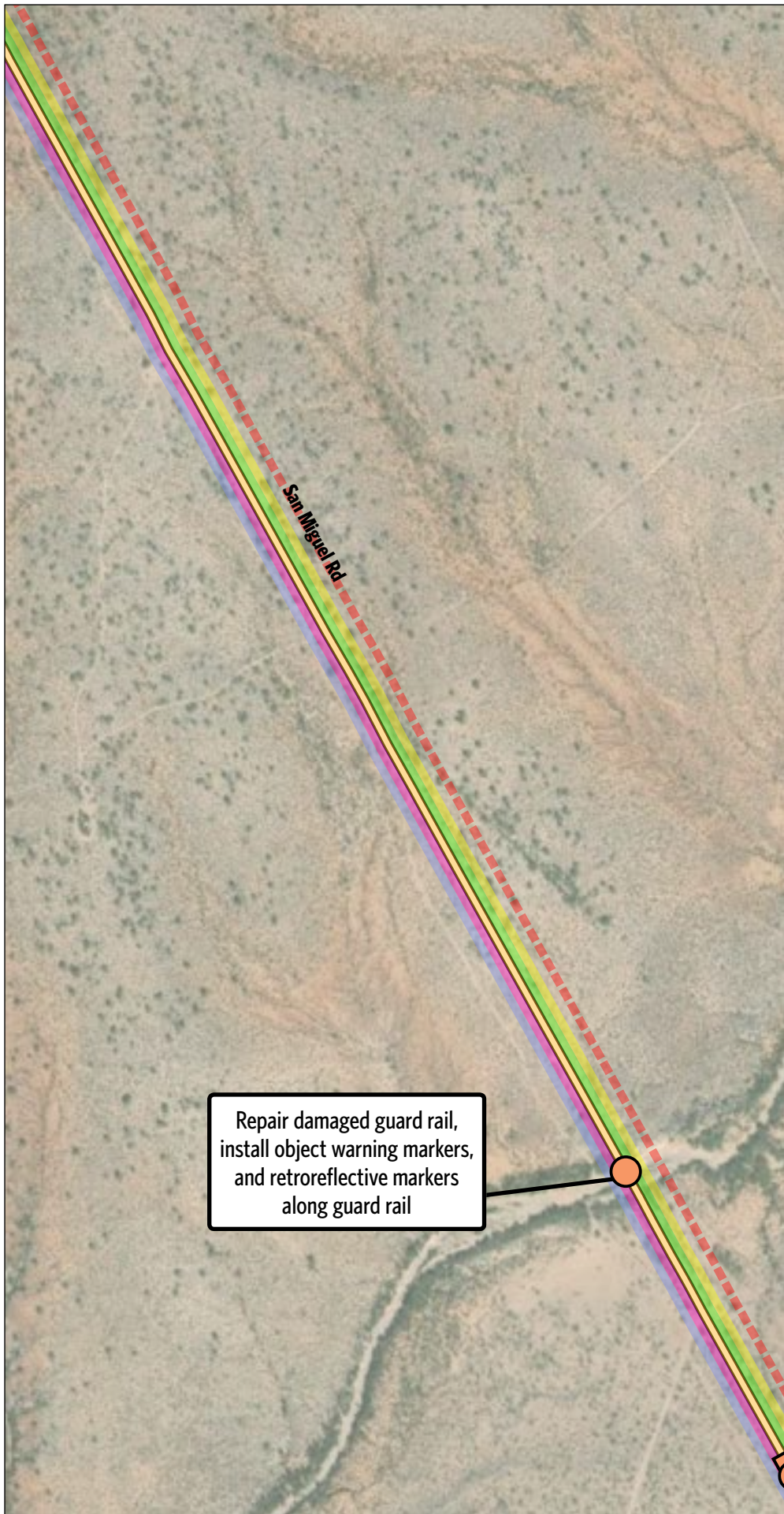
- Spot Improvement
- Linear Improvement

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Reference

- School
- Tohono O'odham District Boundary





Recommended Improvements

Route 19

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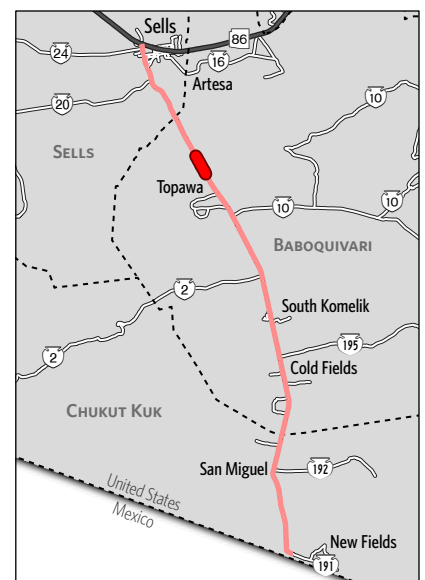
- Spot Improvement
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Reference

- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Recommended Improvements

Route 19

Potential Safety Concerns

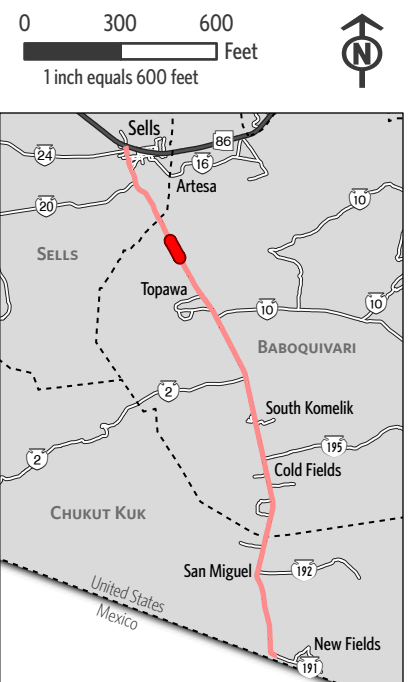
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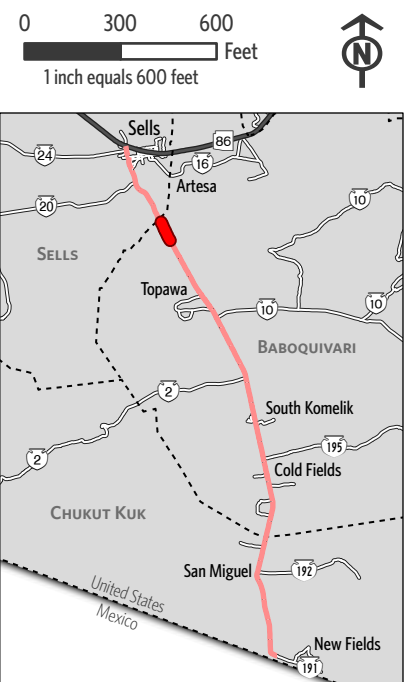
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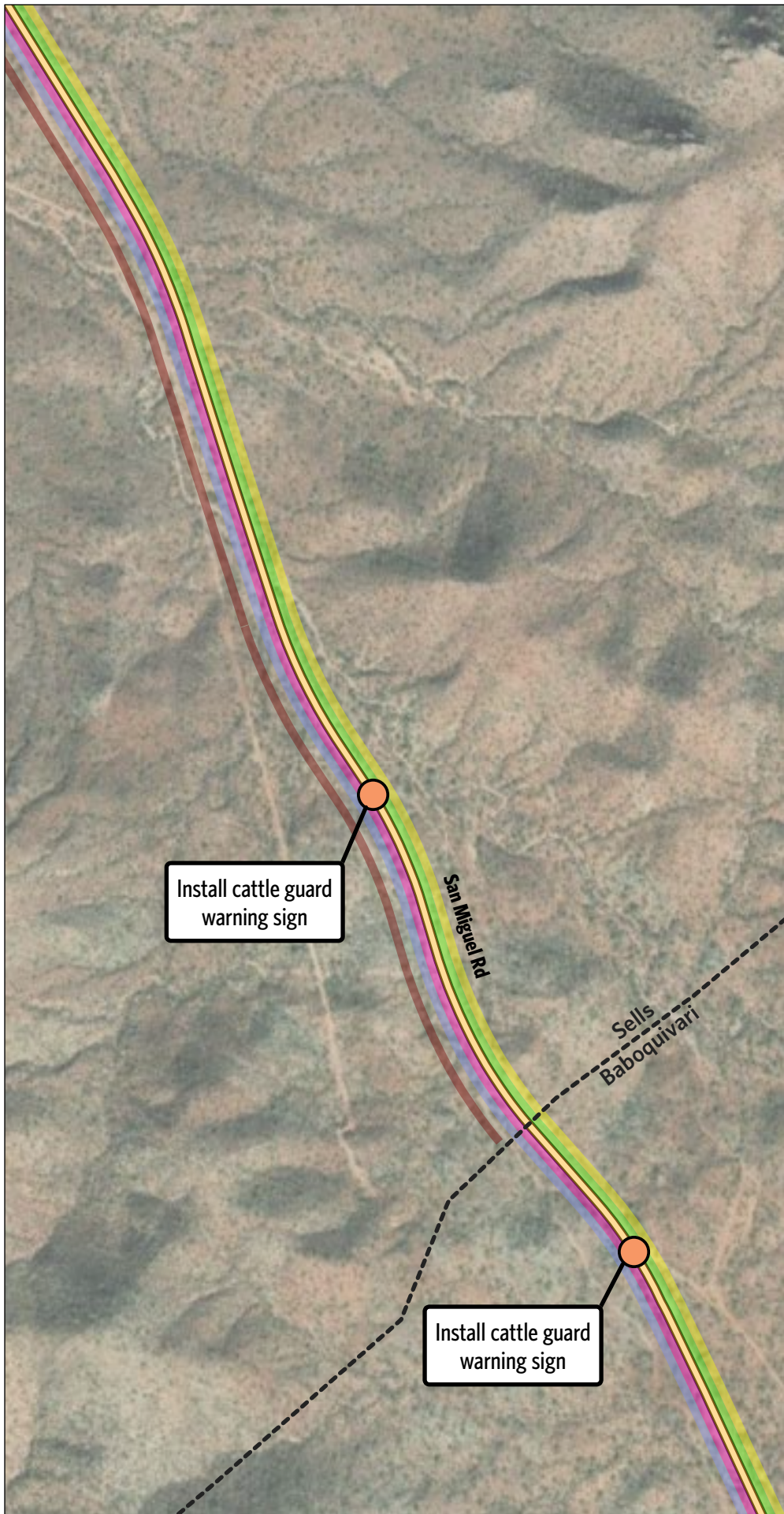
- Spot Improvement

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- Tohono O'odham District Boundary





Recommended Improvements

Route 19

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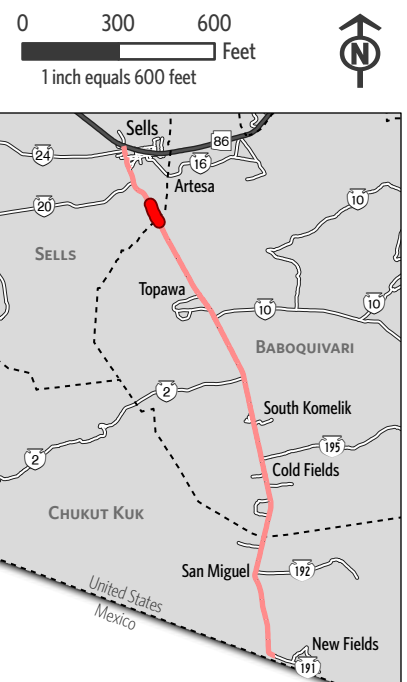
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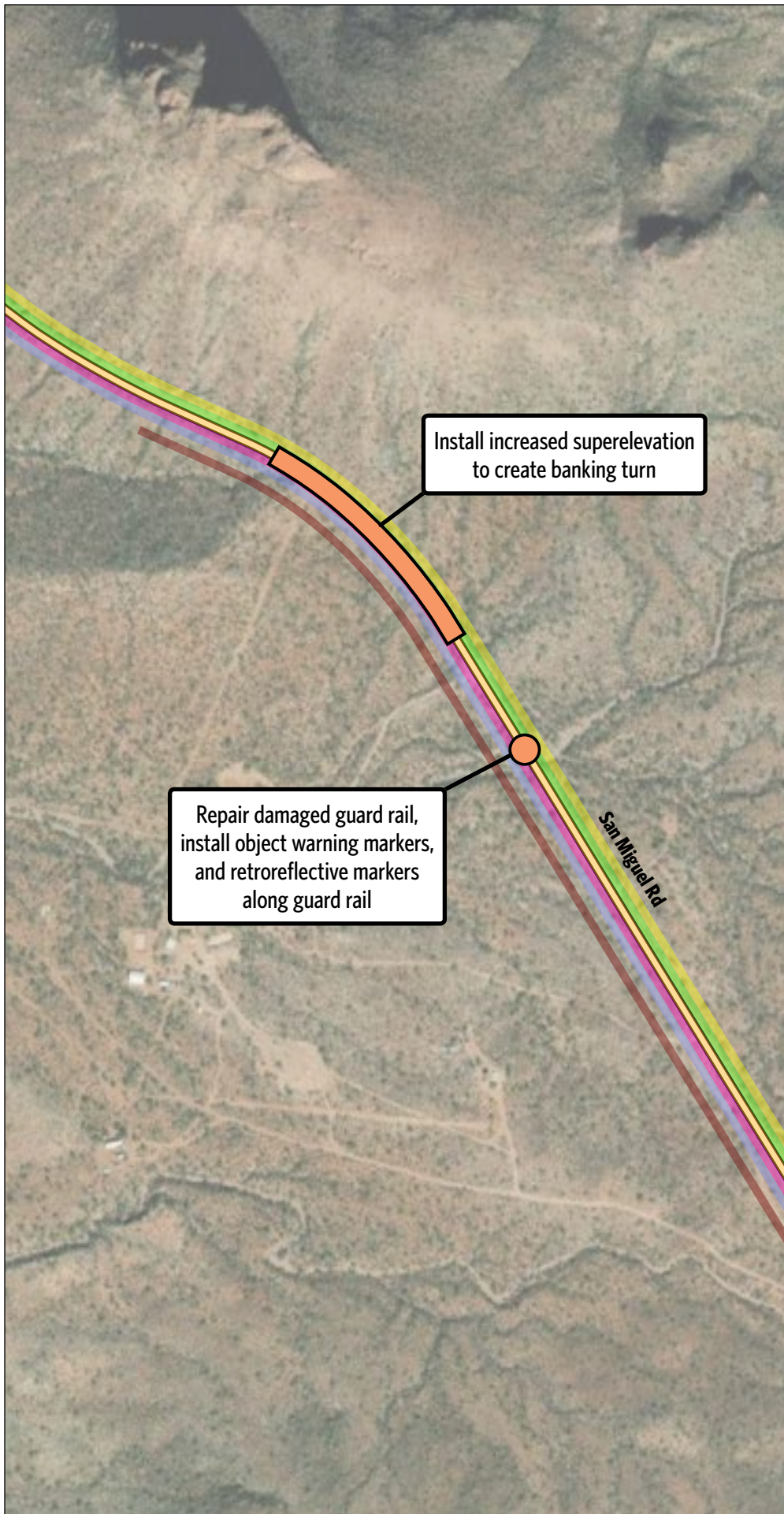
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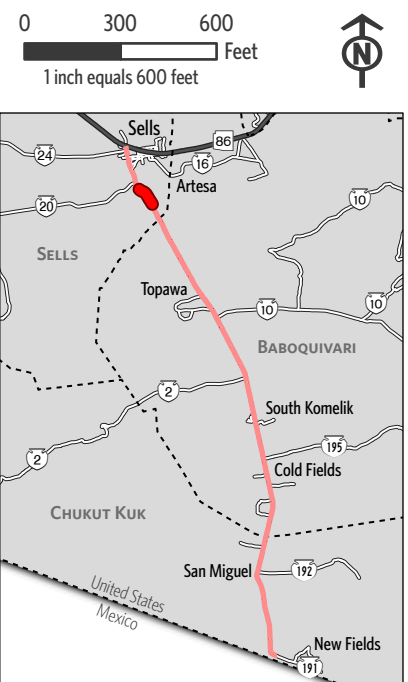
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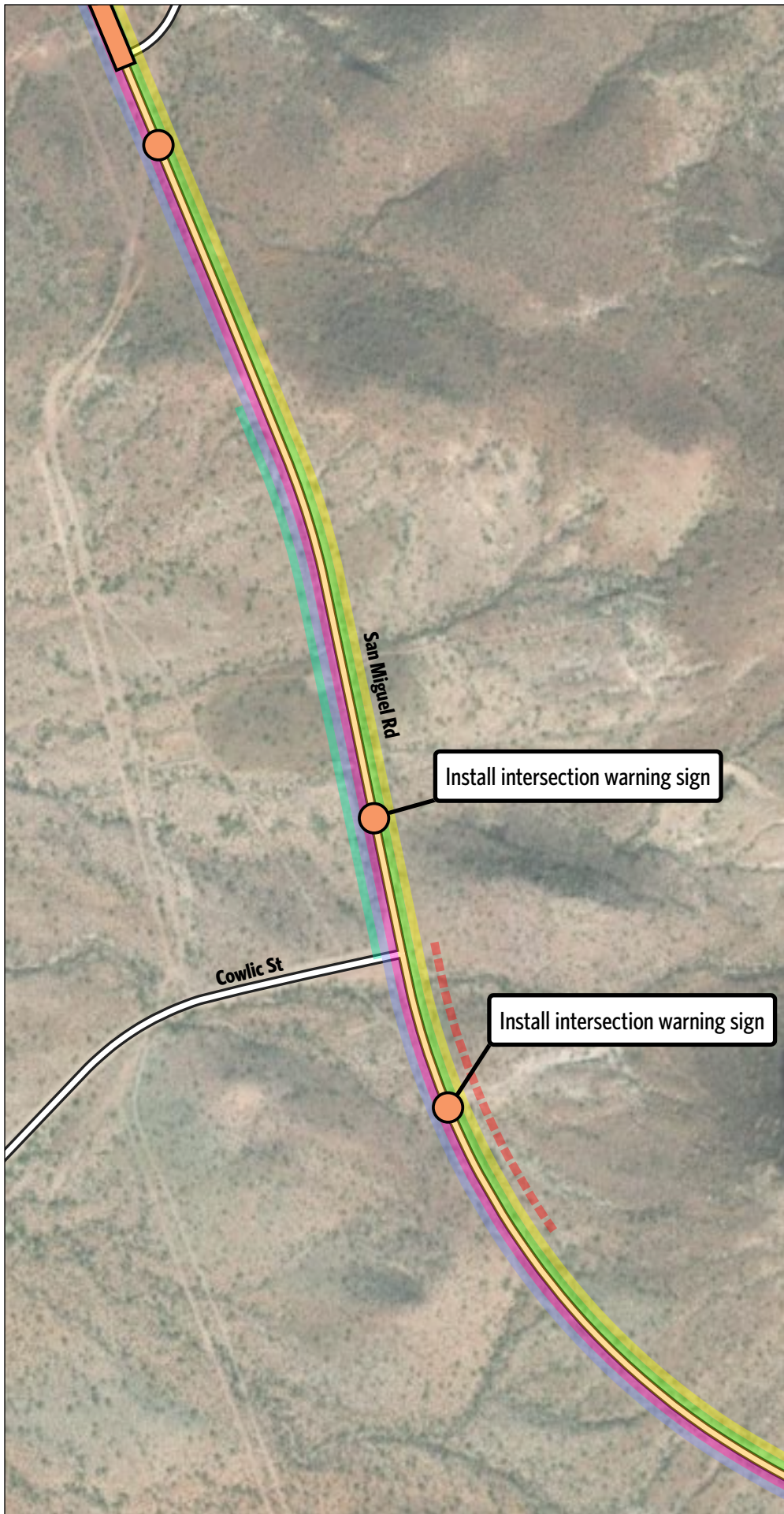
- Spot Improvement
- Linear Improvement

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Reference

- Tohono O'odham District Boundary





Recommended Improvements

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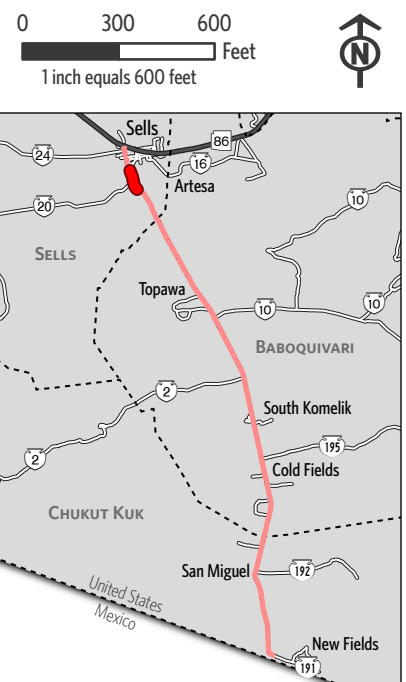
Recommended Improvement *

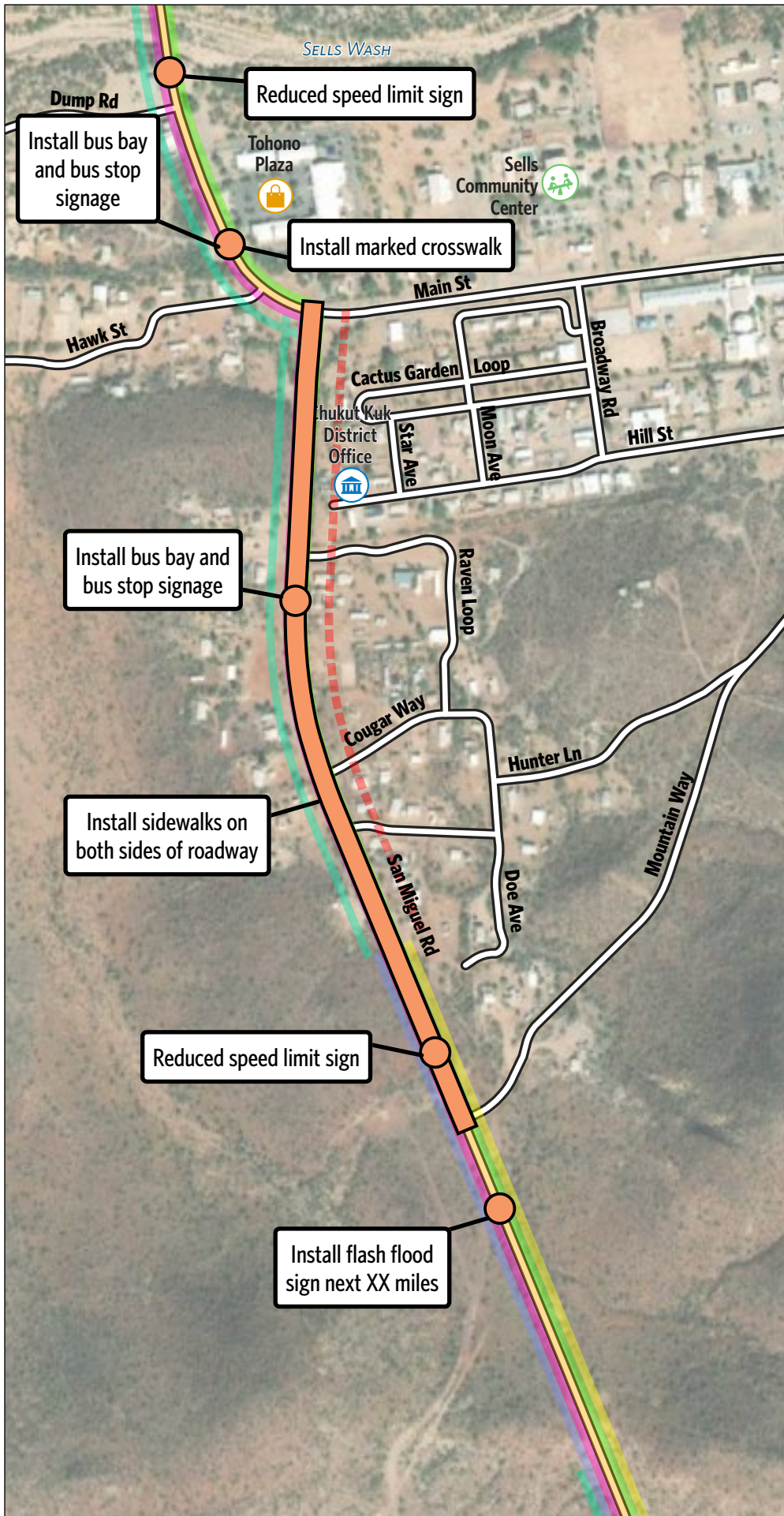
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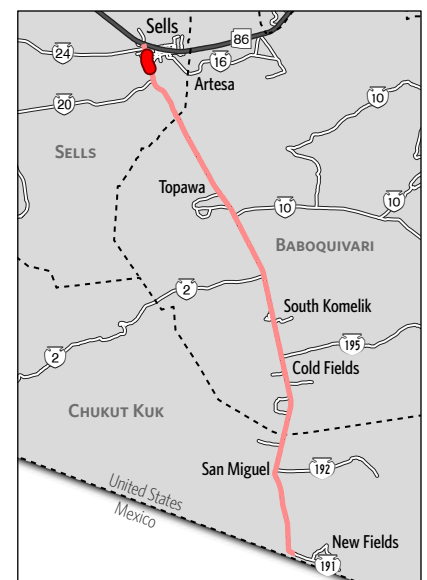
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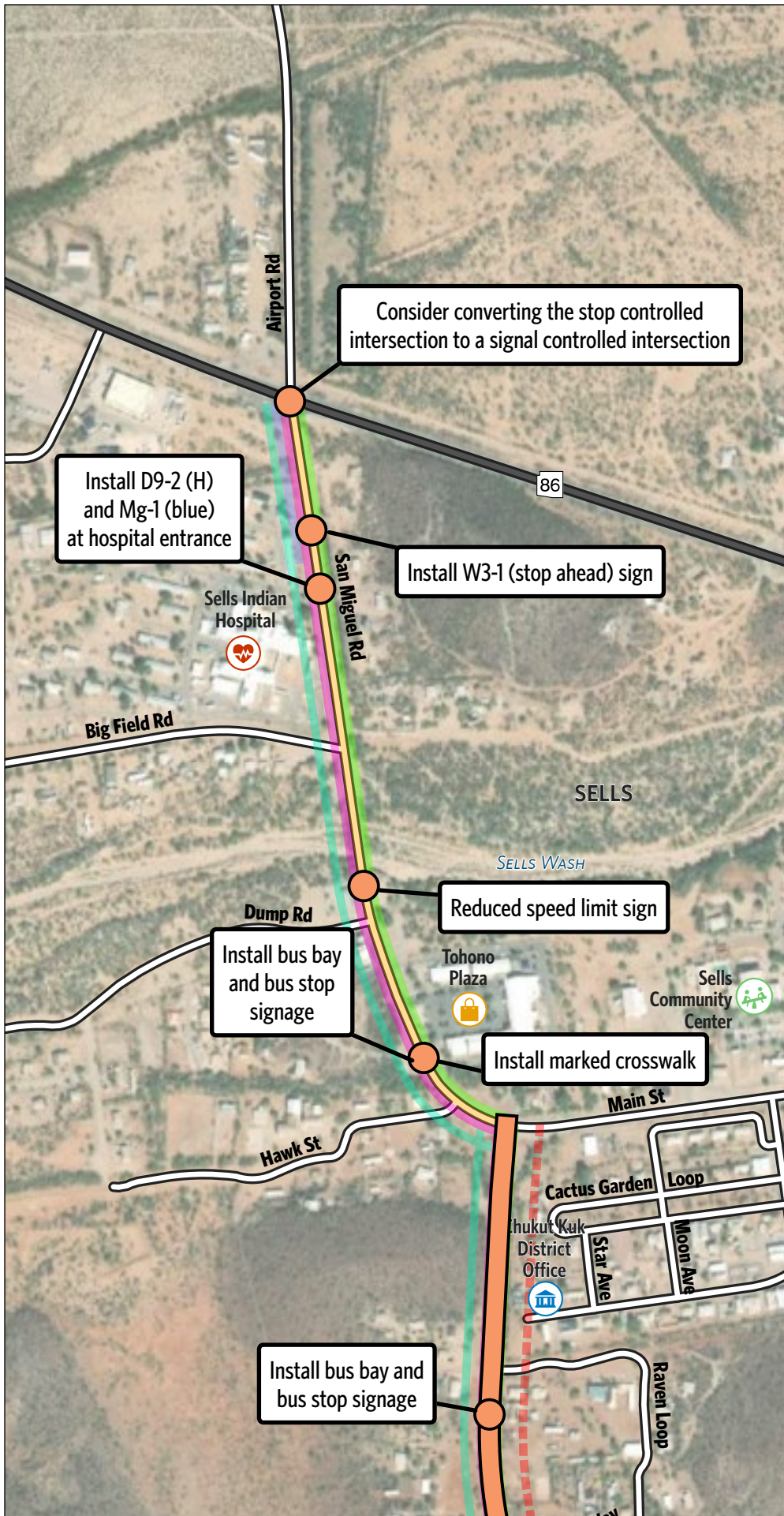
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Reference

- Government Office
- Recreation
- Shopping Center
- Tohono O'odham District Boundary

0 300 600 Feet
1 inch equals 600 feet





Recommended Improvements

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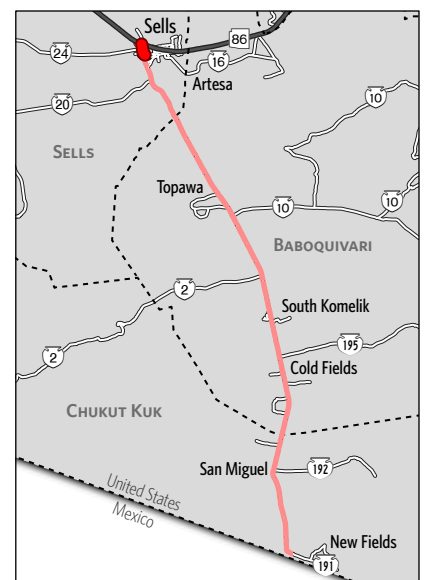
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Reference

- ⓘ Government Office
- ⚡ Hospital
- ⚽ Recreation
- 🛍 Shopping Center
- Tohono O'odham District Boundary

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Appendix D

Agency Response to Suggested Projects

Suggested Projects and Associated Unit Estimates for Consideration

PROJECT	PROJECT TYPE	SCOPE	CONSTRUCTION UNIT COST ESTIMATE	TOHONO O'ODHAM NATION RESPONSE
Sign and stripe	Sign and Marking	1 mile of sign and marking Improvements	\$180,000 per mile	In agreement with suggested projects. Projects will be considered for future Tribal Transportation Improvement Plan and/or Grant Applications.
Round-about intersection	Intersection	Installation of one round-about intersection	\$2,300,000 Per intersection	
Speed feedback signs	Sign and Marking	Installation of one pair of speed feedback signs	\$50,000 per sign pair	
Fencing and cattle guard	Clear Zone	Installation of 1 mile of continuous fencing inspection, repair, cattle guard repair/replacement	\$200,000 per mile	In agreement with suggested project. 2023 Tribal Transportation Program Safety Fund Grant Application has been submitted for this project. Currently awaiting notification from funding source.
Street lighting	Intersection	Installation of one intersection of street lighting and community area lighting	\$ 180,000 per intersection	In agreement with suggested project. Project will be considered for future Tribal Transportation Improvement Plan and/or Grant Applications.
Pavement maintenance	Pavement	Installation of 1 mile of pavement maintenance (slurry seal)	\$210,000 per mile	In agreement with suggested project. Project will be addressed through the Road Maintenance Program.
Superelevation	Pavement	Install 2% superelevation for 100 feet at tight horizontal road curves	\$150,000 per 100 feet	
Rumble strips	Pavement	Installation of 1 mile of centerline rumble strips	\$40,000 per mile	In agreement with suggested projects. Projects will be considered for future Tribal Transportation Improvement Plan and/or Grant Applications.
Paved shoulders	Pavement	Installation of 1 mile of 4-foot paved shoulders	\$1,550,000 per mile	
Driveway relocation	Intersection	Relocate one driveway away from horizontal curvature	\$140,000 per driveway	In agreement. Will consider requesting for Tribal Funding and add to the Nations Tribal Transportation Facility Inventory.
Clear zone maintenance	Clear Zone	1 mile of 32-foot clear zone clearing and grubbing	\$80,000 per mile	In agreement with suggested projects. Projects will be addressed through the Road Maintenance Program.
Culvert maintenance	Drainage	1 wash crossing culvert maintenance	\$50,000 per crossing	
Culvert installation	Drainage	1 wash crossing culvert installation	\$1,500,000 per crossing	In agreement with suggested projects. Projects will be considered for future Tribal Transportation Improvement Plan and/or Grant Applications.
Drainage maintenance	Drainage	1 wash crossing erosion control and riprap gabions	\$1,140,000 per crossing	
Turn Lanes	Intersection	Installation of one turn lane at an intersection	\$550,000 per intersection	In agreement with suggested project. Project will be addressed through Discretionary Congressional Funding. Currently awaiting contract.