

Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Figure 5.7. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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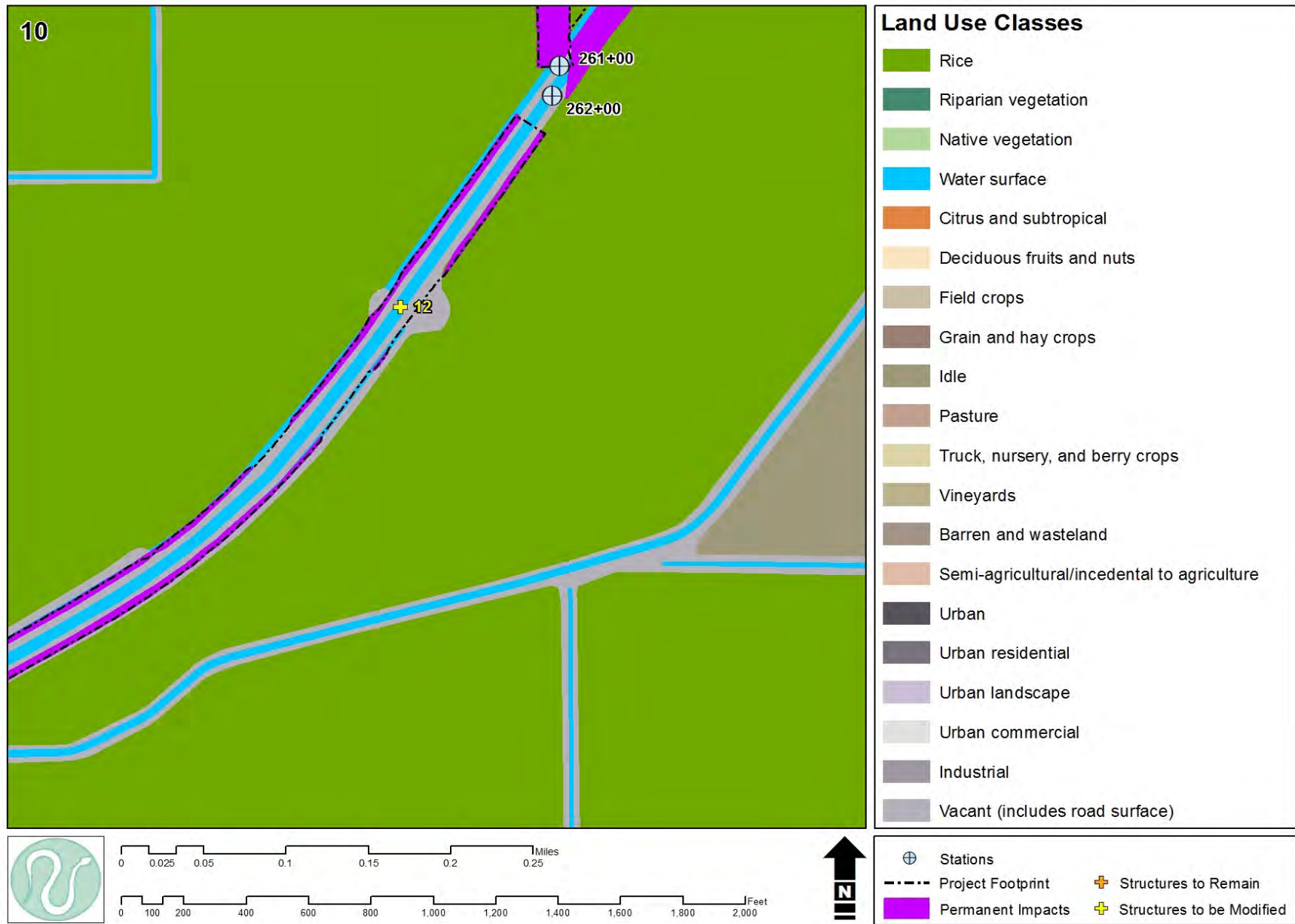
Figure 5.8. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

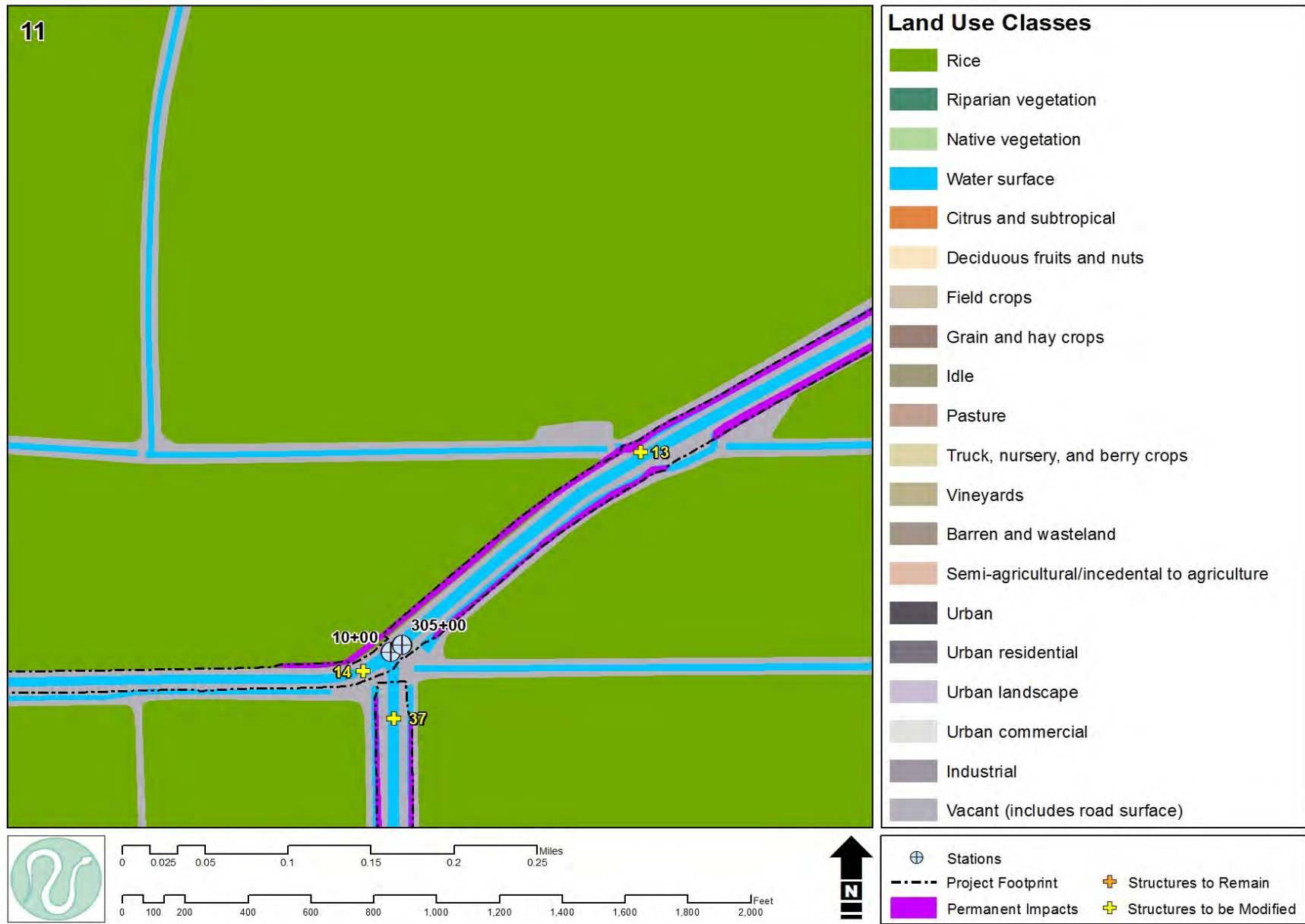
Created January 9, 2012

Figure 5.9. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.11. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

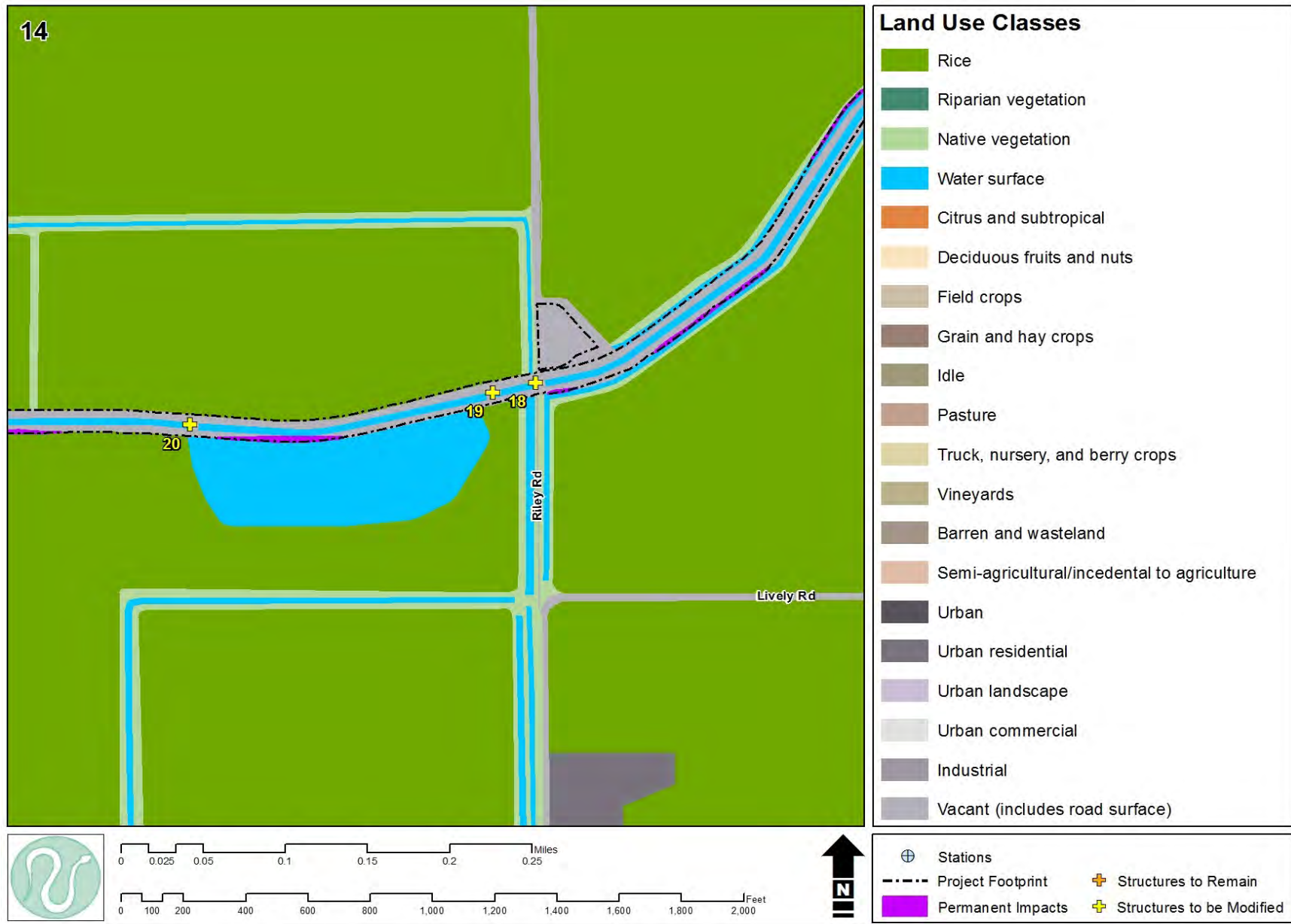
Figure 5.12. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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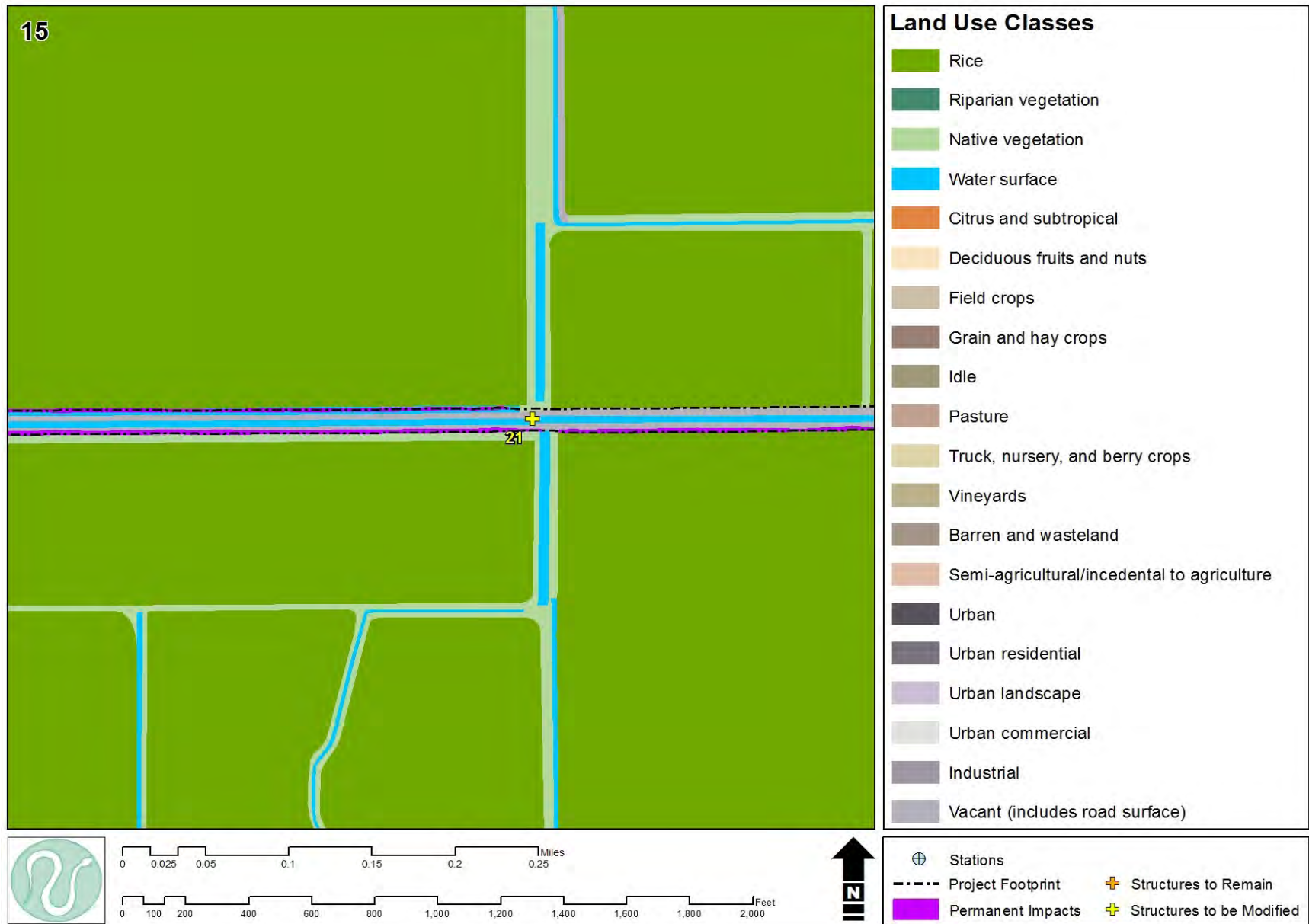
Figure 5.13. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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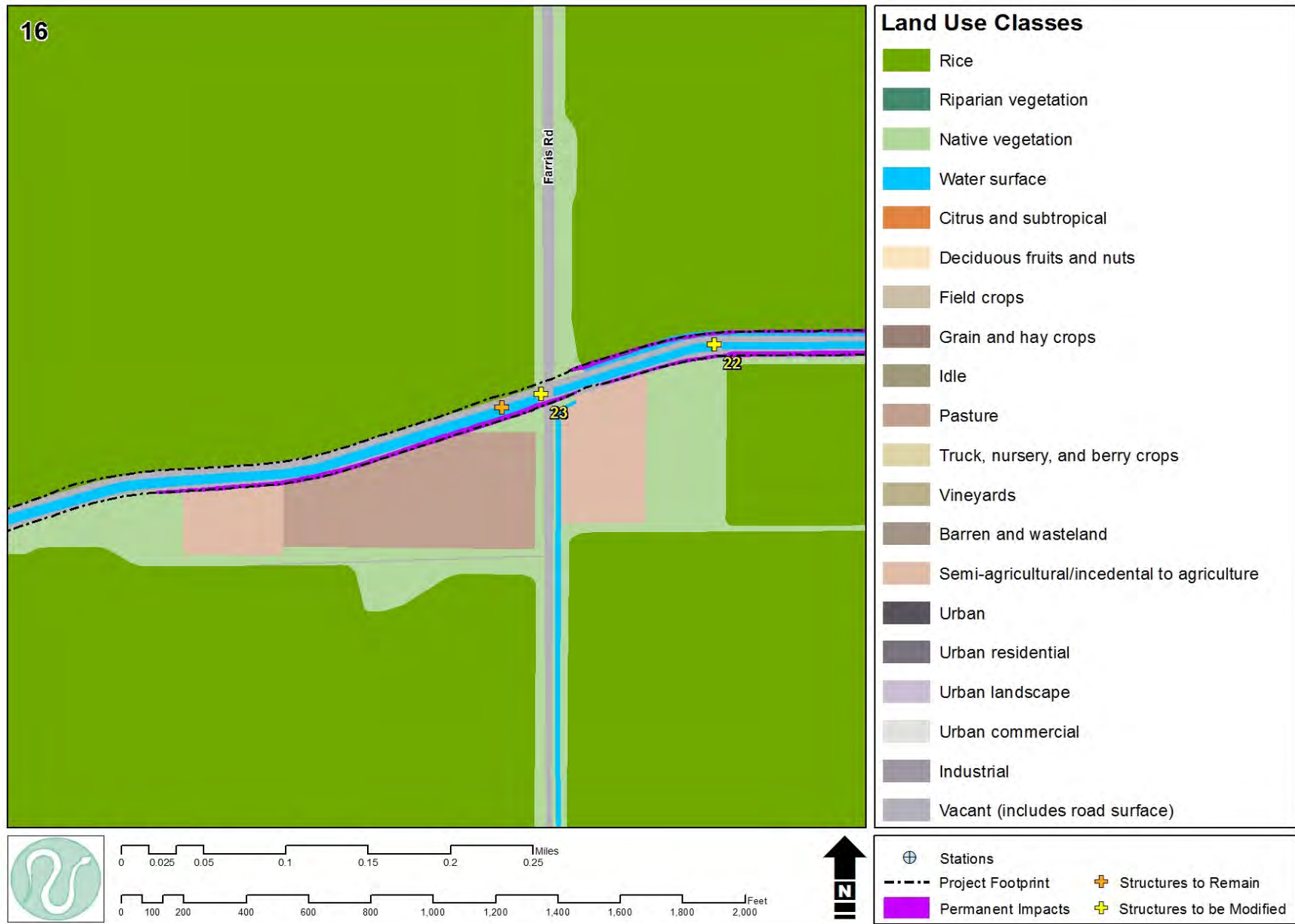
Figure 5.14. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

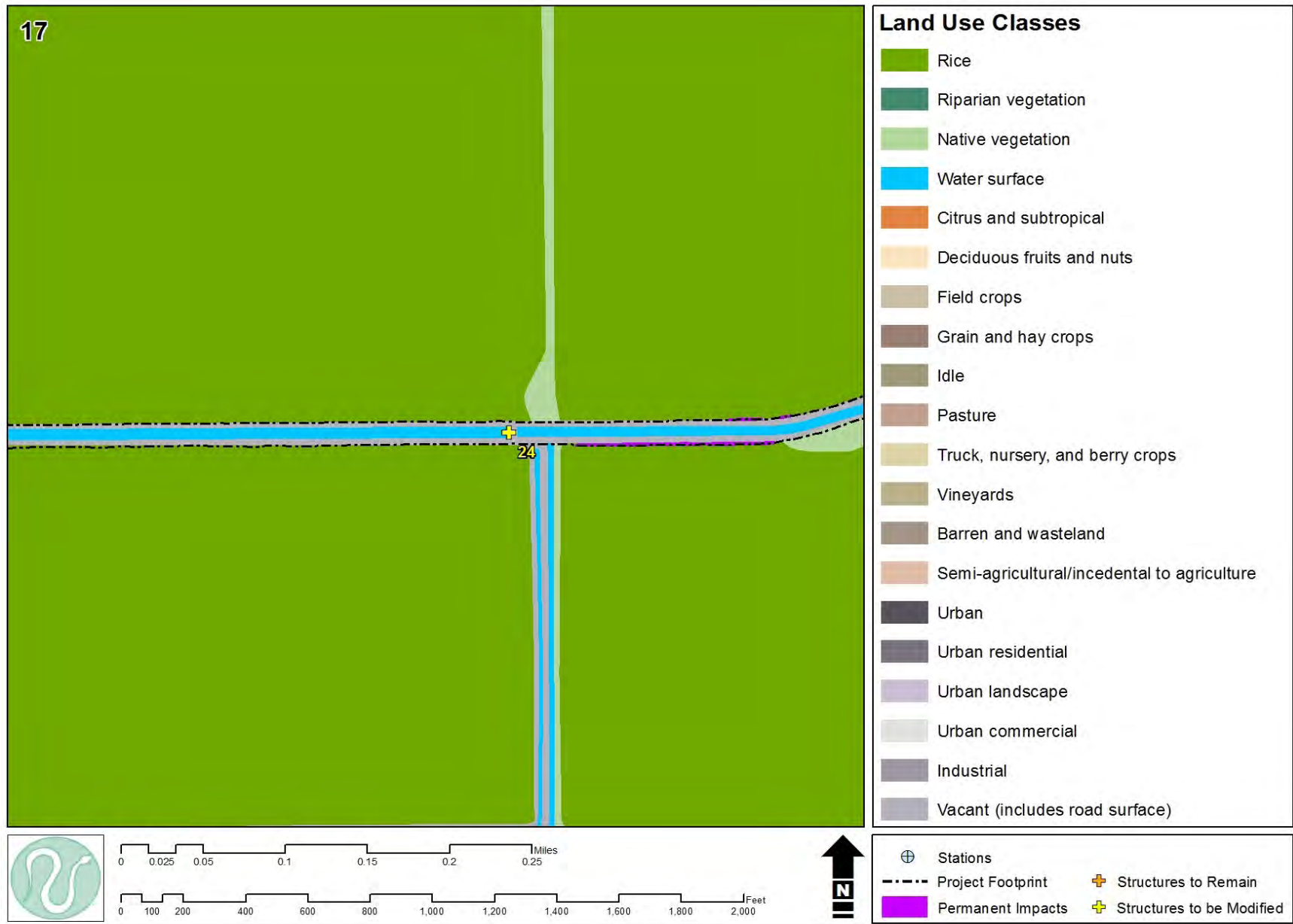
Figure 5.15. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.16. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

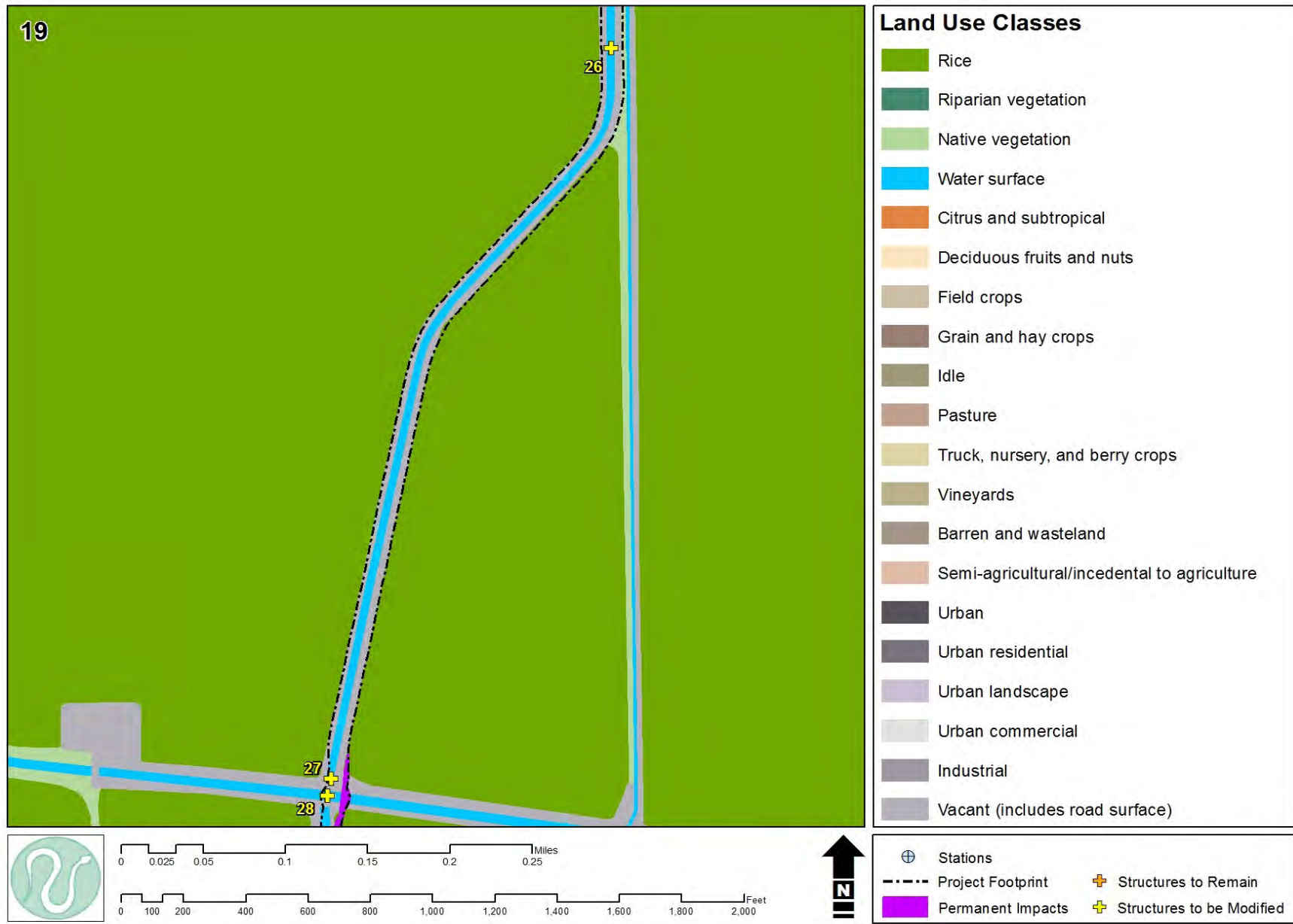
Figure 5.17. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.18. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Figure 5.19. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.20. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

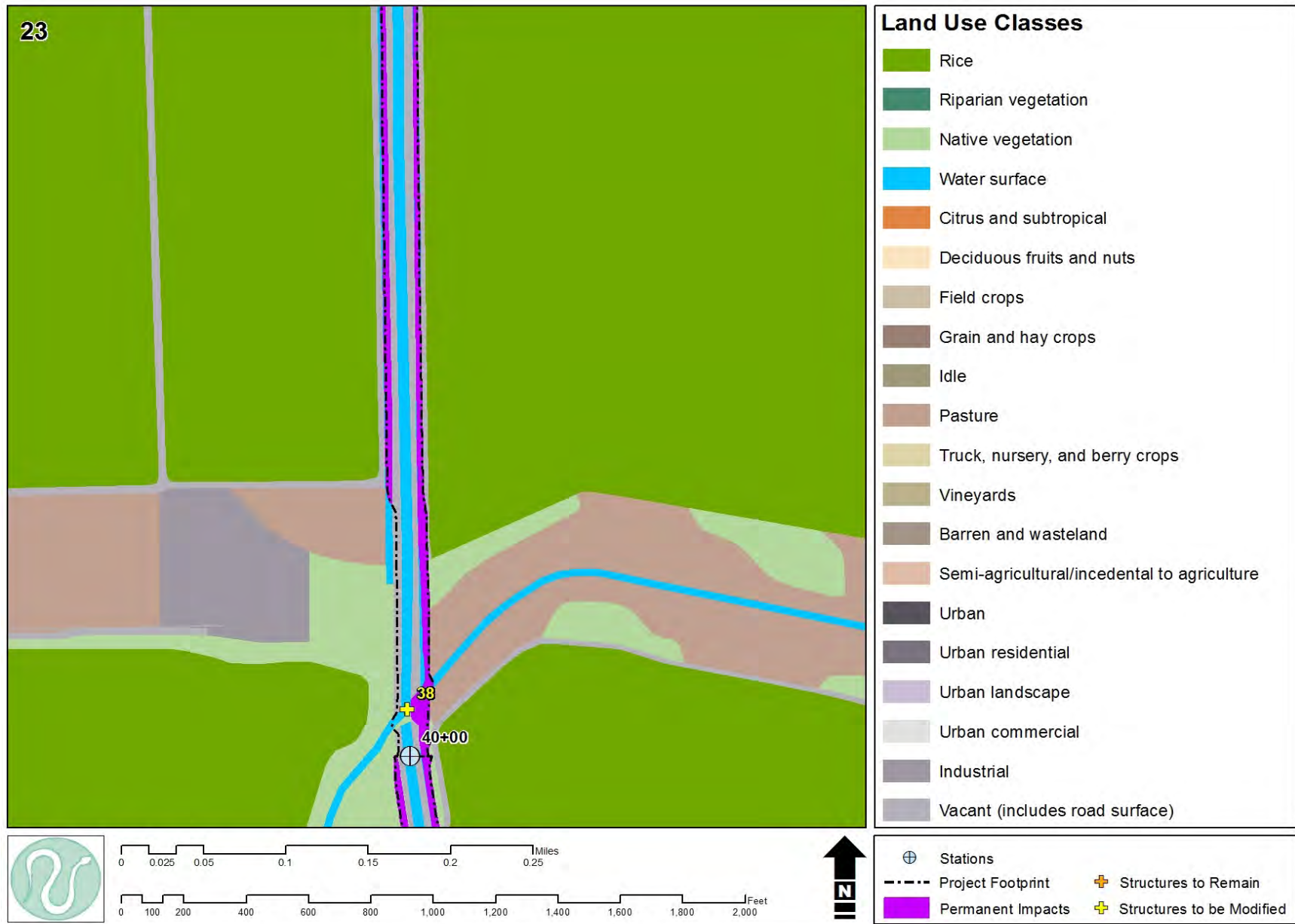
Figure 5.21. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.22. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.23. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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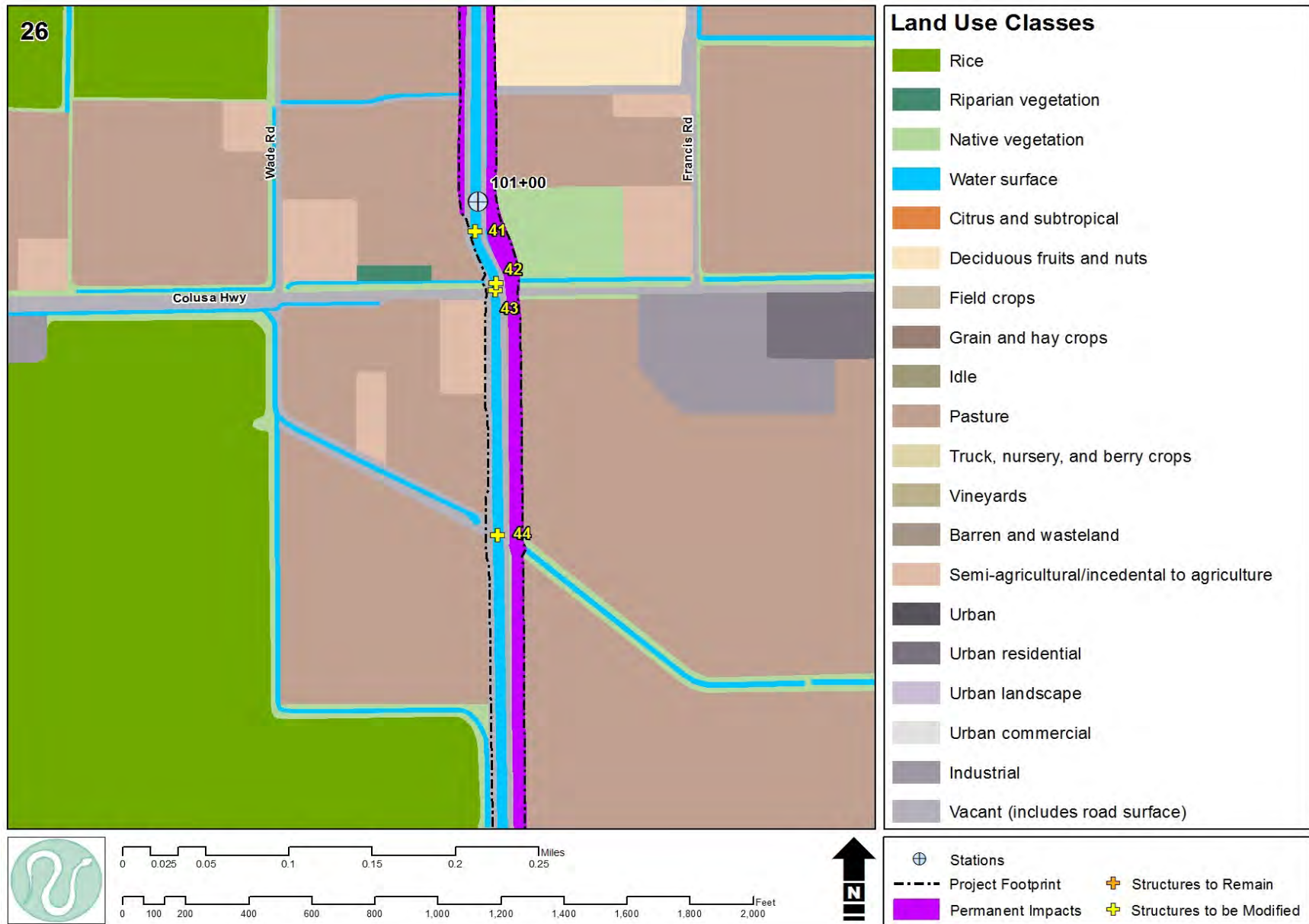
Figure 5.24. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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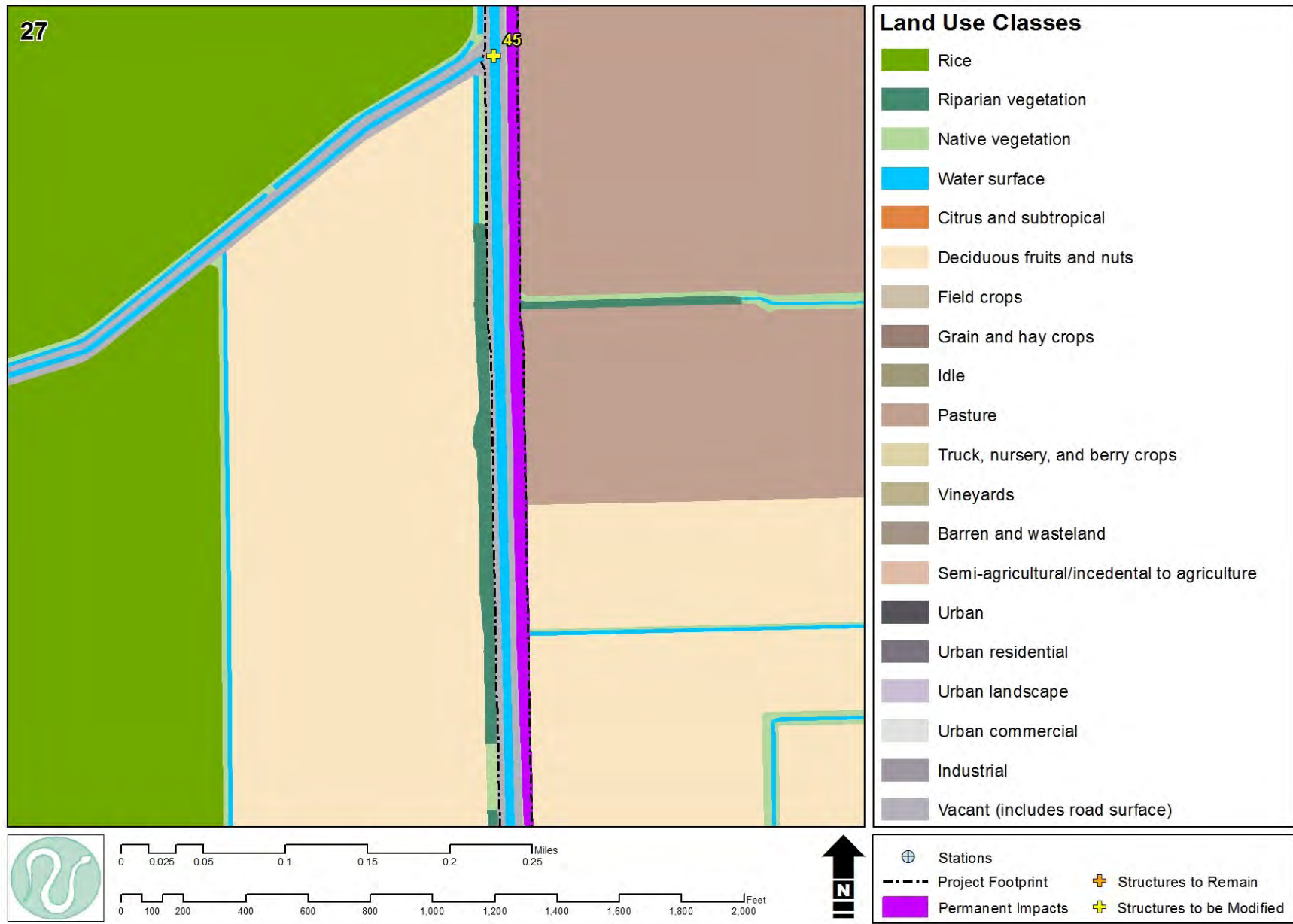
Figure 5.25. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

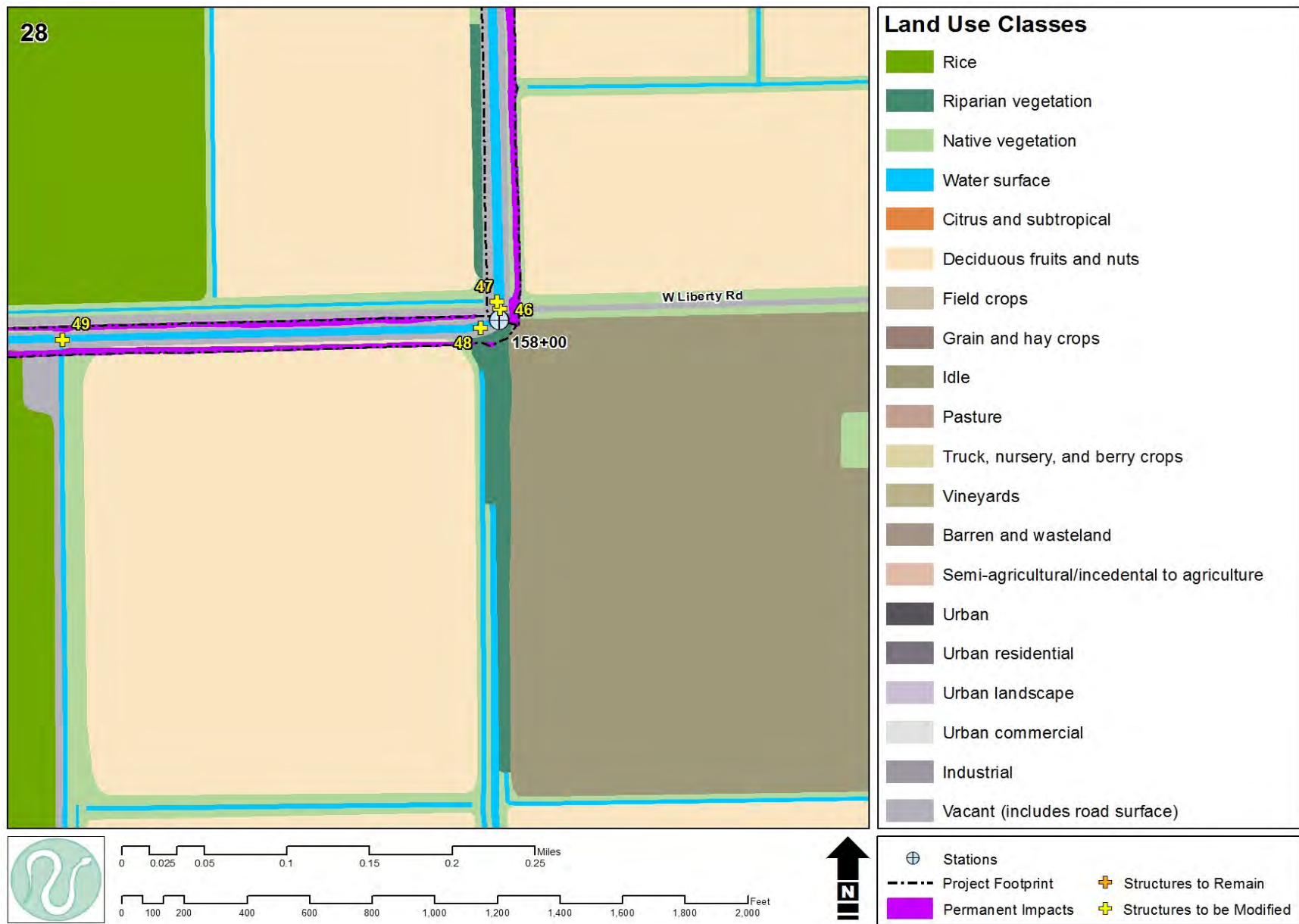
Figure 5.26. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

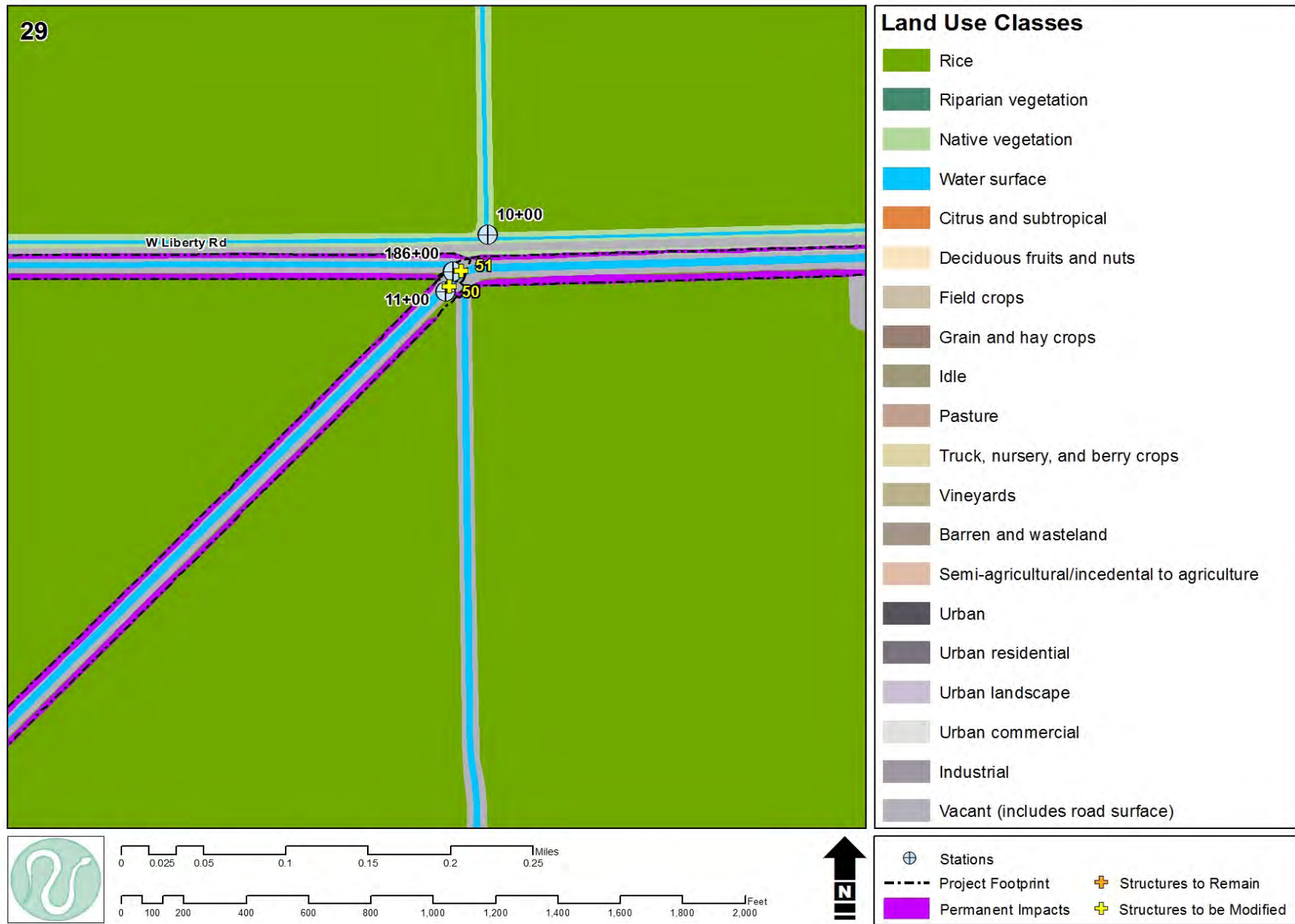
Figure 5.27. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.28. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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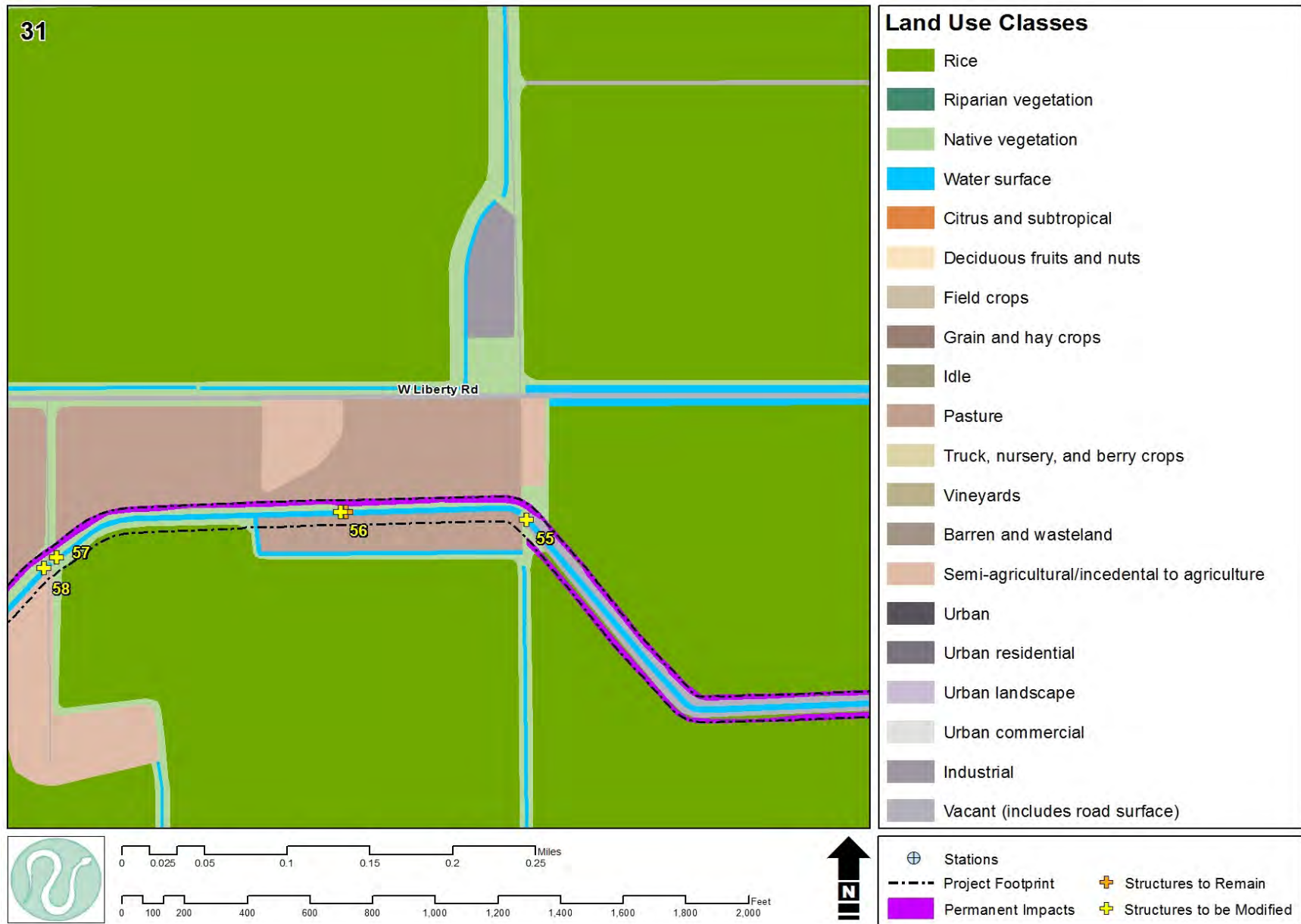
Figure 5.29. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.30. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

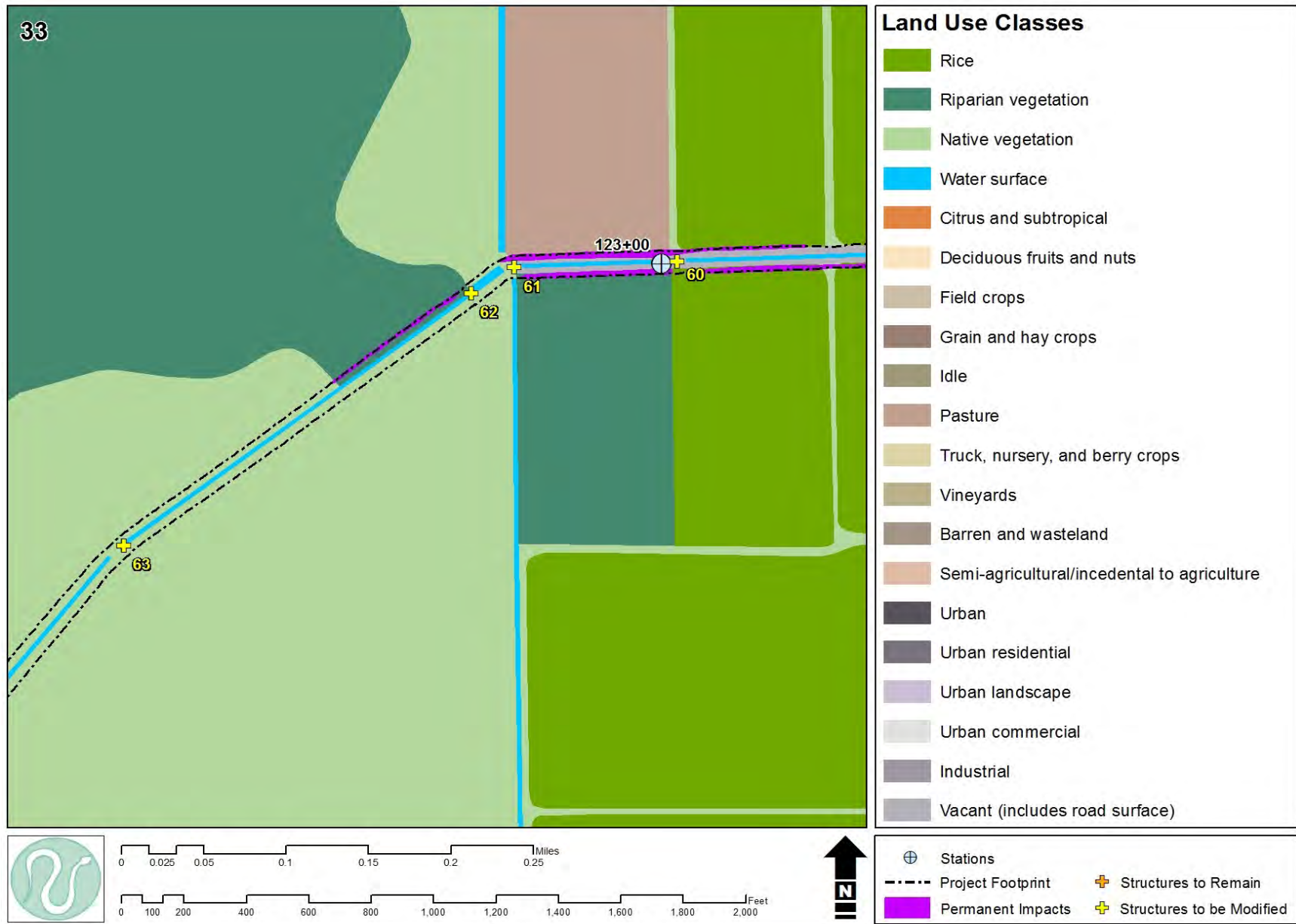
Figure 5.31. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

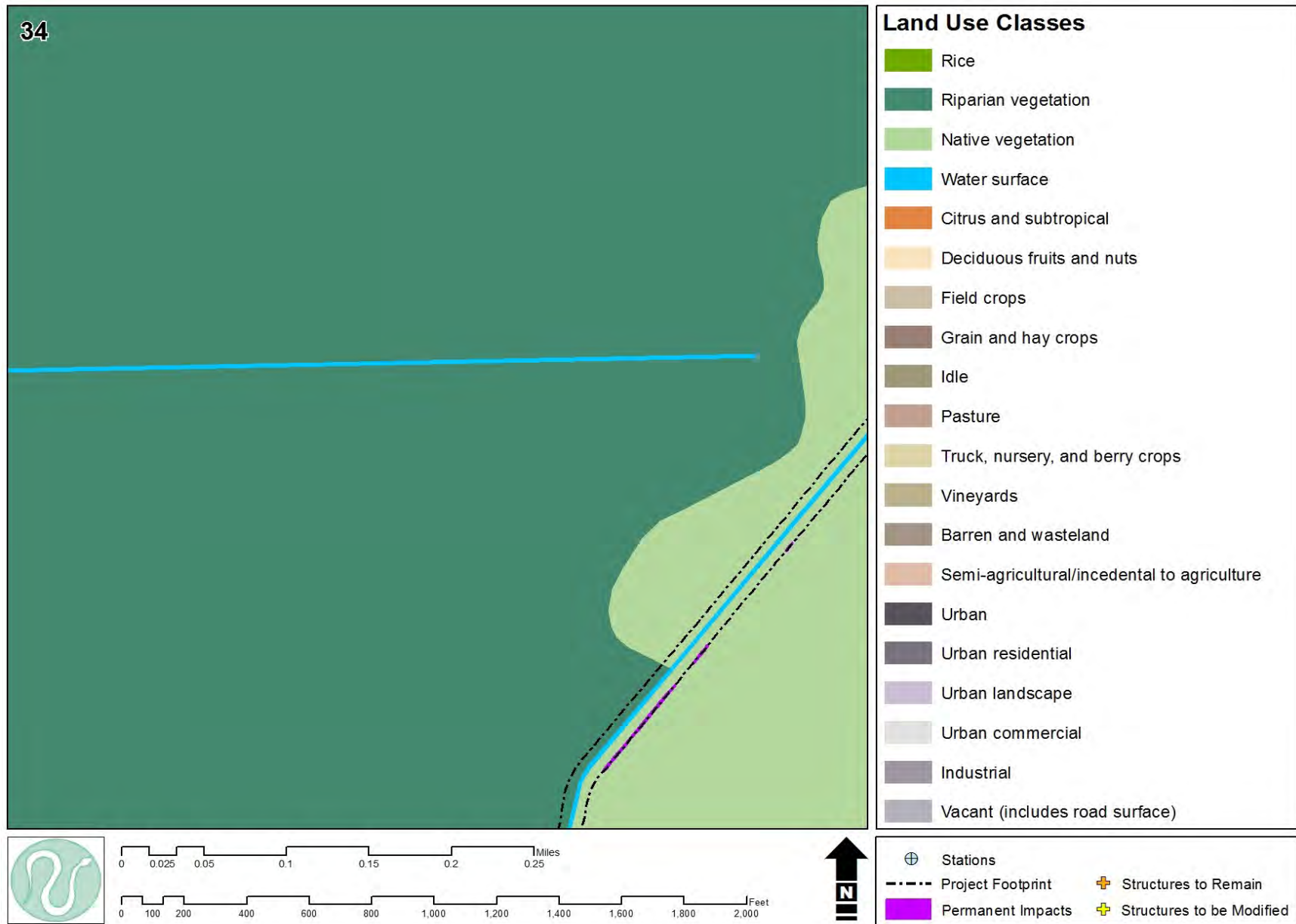
Figure 5.32. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

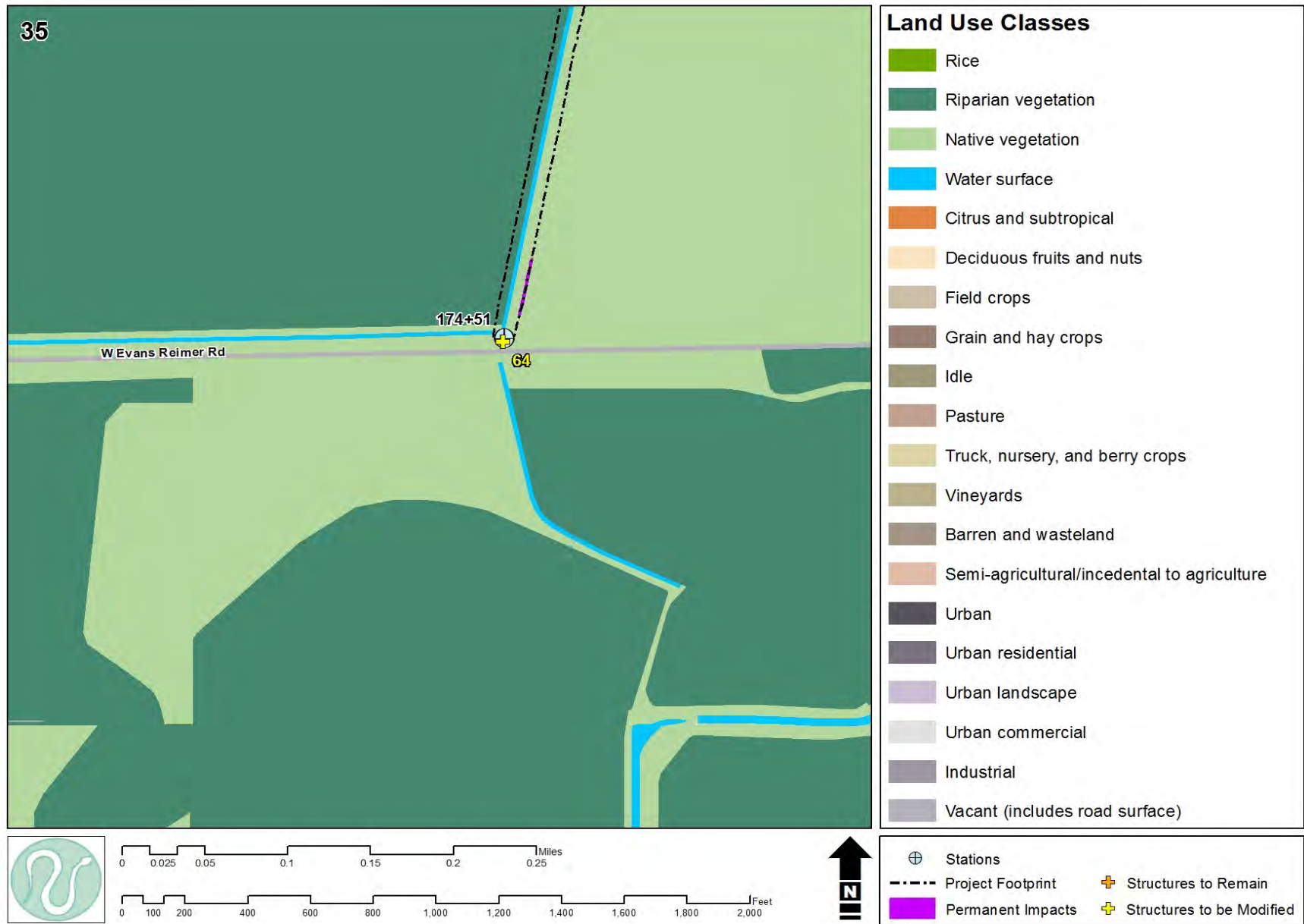
Figure 5.33. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

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Figure 5.34. Land Use Cover and Proposed Action Features



Sources: CNDDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

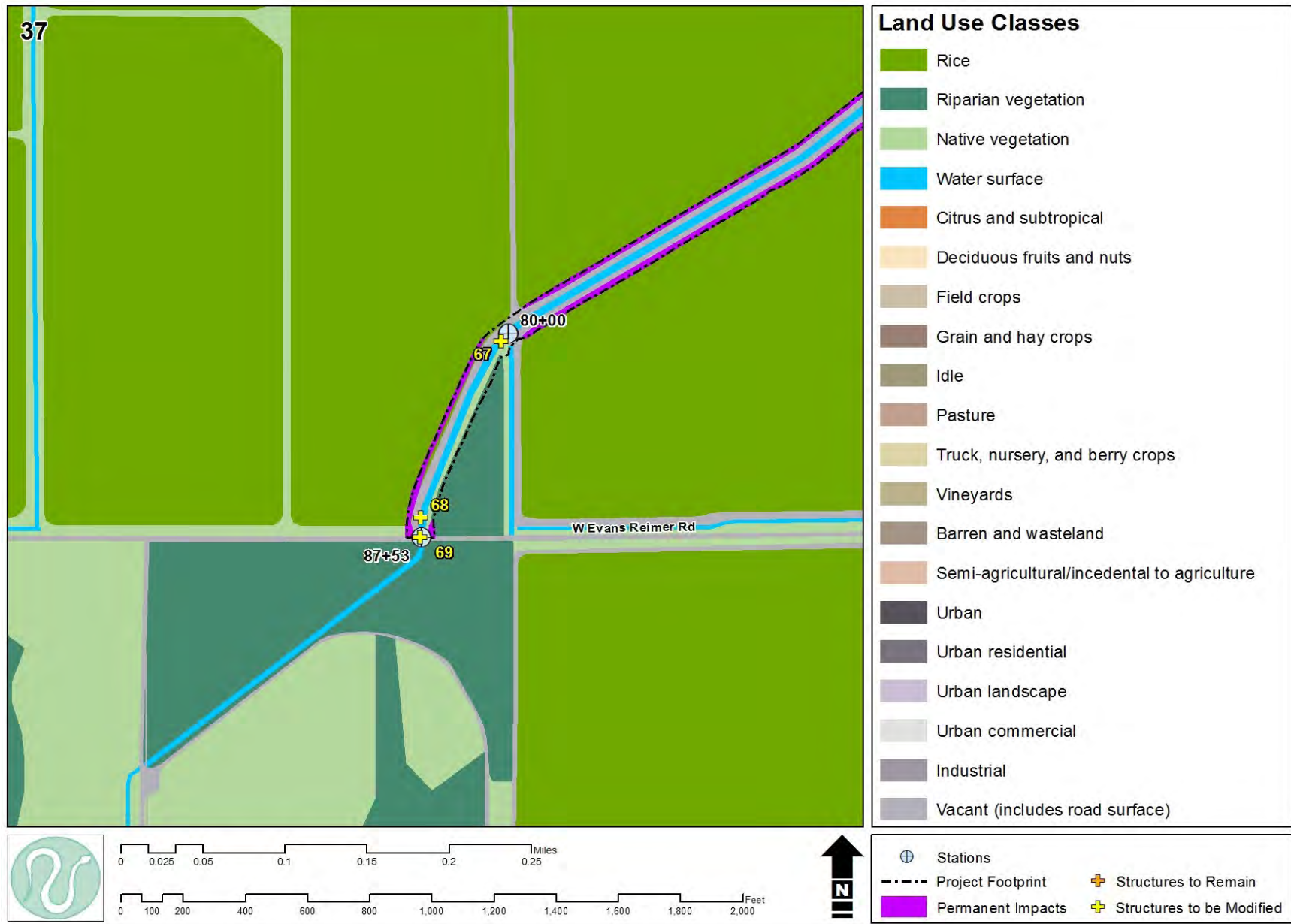
Figure 5.35. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

Figure 5.36. Land Use Cover and Proposed Action Features



Sources: CNDDB 2011; Dahl Consultants, Inc.; DWR 2004; NAIP 2010; Provost and Pritchard Consulting Group

Created January 9, 2012

Figure 5.37. Land Use Cover and Proposed Action Features

6. ENVIRONMENTAL COMPLIANCE

Incidental Take Statement²

Section 9 of the Endangered Species Act (Act) and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the Opinion's Incidental Take Statement, below:

"The measures described below for the giant garter snake are non-discretionary, and must be implemented by Reclamation so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to adhere to the terms and conditions of the incidental take statement, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse."

Amount or Extent of Take

"The Service anticipates that incidental take of giant garter snakes will occur. Giant garter snakes are secretive, and individual snakes are difficult to detect unless they are observed at a distance, undisturbed. Close-range observations are usually chance encounters, and are difficult to predict. It is therefore difficult to accurately estimate the number of snakes that will be harassed, harmed, or killed during construction activities."

² For consistency, the Incidental Take Statement and its Terms and Conditions are quoted directly from the Opinion

In instances where take is difficult to detect, the Service estimates take in terms of the amount of habitat lost as a result of the action.

Effect of the Take

In its Opinion, the Service has determined that, for the levels determined in 1997, the level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

Reasonable and Prudent Measures

The Opinion provides the following reasonable and prudent measures to minimize incidental take of giant garter snakes.

1. Take of giant garter snakes during construction activities shall be minimized (refer also to the Standard Avoidance and Minimization Measures During Construction Activities in Giant Garter Snake Habitat.)
2. Temporary and permanent loss of giant garter snake habitat shall be minimized. Temporarily disturbed habitat shall be restored to a level of quality that is equal to, or greater than, the pre-project condition. Permanent loss shall be compensated through habitat preservation at a 3:1 replacement ratio.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Opinion stipulates that Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure number one, to minimize take of giant garter snakes during construction activities:
 - a. For the major structural modifications, all construction activity within giant garter snake habitat shall be conducted between May 1 and October 1. This is the active period for giant garter snakes and direct impacts are lessened, because snakes are actively moving and avoiding danger. More danger is posed to snakes during their inactive period, because they are occupying underground burrows or crevices and are more susceptible

to direct effects, especially during excavation. Between October 2 and April 30, Reclamation shall contact the Sacramento Fish and Wildlife Office (SFWO) to determine if additional measures are necessary to minimize and avoid take. The minor structural modifications can take place between October 2 and April 30, when necessary, if a Service-approved biologist is present on-site to detect any snakes within the impact area and, if giant garter snakes are encountered, to stop construction until the Service is contacted and advises Reclamation on how to proceed.

- b. Any dewatered habitat must remain dry for at least 15 consecutive days prior to excavating or filling of the dewatered habitat.
- c. Construction personnel shall participate in a Service-approved worker environmental awareness program. Under this program, workers shall be informed about the presence of giant garter snakes and habitat associated with the species and that unlawful take of the animal or destruction of its habitat is a violation of the Act. Prior to construction activities, a qualified biologist approved by the Service shall instruct all construction personnel about (1) the life history of the giant garter snake; (2) the importance of irrigation canals, marshes/wetlands, and seasonally flooded areas, such as rice fields, to the giant garter snake; (3) the terms and conditions of the biological opinion. Proof of this instruction shall be submitted to the Sacramento Fish and Wildlife Office within two weeks after construction has commenced at each site.
- d. Within 24 hours prior to commencement of construction activities, each site shall be inspected by a qualified biologist who is approved by the Service's SFWO. The biologist shall provide the Service with a field report form documenting the monitoring efforts within 24 hours of commencement of construction activities. The monitoring biologist must be available thereafter during construction; if a snake is encountered during construction activities, the monitoring biologist shall have the authority to stop construction activities until appropriate corrective measures have been completed or it is determined that the snake will not be harmed. Giant garter snakes encountered during construction activities should be allowed to move away from construction activities on their own. Capture and relocation of trapped or injured individuals can only be pursuant to section 10(a)1(A) of the Act. The biologist shall be required to report any incidental take to the Service immediately be

telephone and by written letter addressed to the Chief, Endangered Species Division, within one working day. The project area shall be re-inspected whenever a lapse in construction activity of two weeks or greater has occurred.

- e. Movement of heavy equipment to and from each construction site shall be restricted to established roadways to minimize habitat disturbance.
 - f. Clearing of wetland vegetation will be confined to the minimal area necessary to excavate toe of bank for riprap or fill placement. Any channel excavation in toe drains shall be accomplished by using equipment located on and operated from the top of the bank, with the least interference practical for emergent vegetation.
2. The following terms and conditions implement reasonable and prudent measure number two, to (a) minimize temporary giant garter snake habitat loss; (b) restore habitat to a level of quality that is equal to, or greater than, the pre-project condition; and (c) offset permanent habitat loss through habitat preservation at a 3:1 ratio.
- a. Habitat disturbance shall be confined to the minimal area necessary for completing each activity associated with the Proposed Action. When construction has been completed at each site, the exact acreage of temporary and permanent habitat loss shall be quantified and reported to the Service at the SFWO.
 - b. After completion of construction activities, any temporary fill and construction debris shall be removed and any temporarily disturbed areas shall be restored in a manner consistent with the attached *Mitigation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat*.
 - c. Permanent habitat loss shall be compensated at a 3:1 ratio and meet the criteria listed in the attached *Mitigation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat*. The preserved habitat shall include both upland and aquatic habitat components, at a ratio of 2 acres upland habitat to each acre of aquatic habitat. The site to be preserved for mitigation shall be subject to Service approval. On-site habitat creation can be counted toward the mitigation requirement, at the Service's discretion, if it can be demonstrated that the habitat will be successfully

created, will have long-term value for the giant garter snake, and will be preserved in perpetuity.

- d. All aquatic and upland mitigation areas provided for the giant garter snake shall be protected in perpetuity by a Service-approved conservation easement or similarly protective covenants in the deed. The conservation easement shall be recorded at the county recording office prior to any ground breaking for major modifications. The minor structural modifications may proceed prior to recordation of a conservation easement, but the entire preservation acreage for mitigation of all minor and major structural modifications must be in place, with recorded conservation easement, prior to any ground breaking associated with any of the 25 major structural modifications. The easement/deed shall be provided to the Service within 30 days after recordation. Standard examples of deed restrictions and conservation easements are available from the Service upon request.

Supplemental Avoidance and Minimization Measures

In its Opinion, the Service anticipates that incidental take of giant garter snakes will occur, but determines that the level of anticipated take associated with the Project is not likely to result in jeopardy to the species. However, in order to meet these assumptions and to remain exempt from the prohibitions of section 9 of the Act, the Opinion stipulates that Reclamation must comply with the aforementioned terms and conditions. As stated, the measures included in the Opinion are non-discretionary, and must be implemented by Reclamation so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) of the Act to apply. These measures must be implemented in order to satisfy the terms of the December 1997 Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) and Initial Study (IS)/Mitigated Negative Declaration (MND).

Foremost among these measures is the condition that, for the major structural modifications, all construction activity within giant garter snake habitat shall be conducted between May 1 and October 1 (Condition 1.a.). This is the active period for giant garter snakes and direct impacts are lessened, because snakes are actively moving and avoiding danger. This condition cannot be met under the current design schedule for the Proposed Action.

For the Proposed Action, construction sequencing and staging is subject to constraints that prevent the major structural modifications from being completed between May 1

and October 1. Because the District *must* provide water to its users during the irrigation season (directly benefitting water users and indirectly benefitting crop-dependent species like giant garter snake), work can proceed only during “dry” periods (generally the end of January to the middle of April each year) when the District’s system is dewatered and accessible for construction within the canal prism. The majority of construction work must be carried out during the months of February, March, and April when the canal system is dewatered, and will be completed over at least two annual construction periods.

During the winter months giant garter snakes are most likely to occupy burrows and crevices within the banks of the primary delivery canals, the banks of the exterior toe drains, and the intervening uplands. The major modifications consist primarily of canal work involving raising, reshaping, or widening the canal banks, which will occur on either one or both sides of the canal depending on the engineering requirements.

In order to proceed with work during the giant garter snake inactive season without increasing significant direct impacts, the project will need to incorporate measures that discourage giant garter snakes from overwintering within the proposed winter work areas during each construction season. These measures must function on a principal similar to that of dewatering, which removes habitat elements that are attractive to giant garter snakes, therefore reducing the likelihood that they are present during construction. The proposed measures include, but are not necessarily limited to: 1) Erecting barriers or exclusion fencing to exclude access to the project area by giant garter snakes during the work period; 2) encouraging giant garter snakes to vacate the area by reducing suitable active season habitat by scraping, grading, and removing vegetation and concentrated prey; and 3) reducing cracks and crevices in overwintering areas by scraping, grading, or otherwise preparing anticipated work areas so that overwintering habitat is eliminated.

Exclusion fencing — Exclusion or barrier fencing can prevent giant garter snakes from entering a work area and may be especially useful when the barrier can be installed prior to overwintering. For this project, fencing could provide a substantial benefit by excluding snakes from staging areas, the majority of which are within or adjacent to active rice fields. However, exclusion fencing would be neither feasible nor beneficial for the entirety of the project due to the nature and extent of the work area, which includes the principal supply channels, their levees, and the associated toe drains interspersed within active rice fields. Successful barriers should exclude snakes from entering the project area from the rice fields and toe drains, but barriers along the principal supply channels would interfere with agricultural operations since they cannot be installed until rice harvest is completed in the fall. Not only would barriers along canals serve little

purpose following harvest due to reductions in giant garter snake movement at this time of year, they could also prevent giant garter snakes from escaping harm when fields are harvested and disked. Furthermore, fencing could prevent snakes occupying banks of the principal supply channels from escaping the work area, thereby increasing the potential for direct effects during project construction.

Reducing Suitability — Direct impacts during the inactive season may also be reduced by encouraging giant garter snakes to vacate work areas by removing suitable habitat by scraping, grading, and removing vegetation and concentrated prey during the active season. Similar to dewatering, which is intended to force snakes to seek alternative habitat during the active season, reducing burrows and cover vegetation can reduce local habitat value, thereby inducing snakes to move elsewhere. Under this scenario, the disturbance would occur during the active period for giant garter snakes, when direct impacts are lessened because snakes are actively moving and avoiding danger. Furthermore, eliminating overwintering habitat substantially reduces the likelihood that giant garter snakes will occupy the work area during the inactive season, when more danger is posed because they are occupying underground burrows or crevices and are more susceptible to direct effects, especially during excavation.

3. The following, supplemental avoidance and minimization measures are proposed to reduce impacts to giant garter snake resulting from work conducted between October 2 and April 31:
 - a. In order to exclude giant garter snakes from work areas, semi-permeable silt fencing shall be installed around all staging areas where staging area margins fall within 200-feet of aquatic giant garter snake habitat (as determined by the monitoring biologist). Fencing will be buried at least 6-inches below ground and extend at least 24-inches above the ground surface. Fencing shall be inspected daily by the monitoring biologist to ensure that the integrity of the fence is maintained.
 - b. For all areas possessing aquatic habitat for giant garter snakes and for all uplands within 200-feet of aquatic habitat margins (as determined by the monitoring biologist), ground will be disturbed prior to September 15 of the year in which work is expected to occur. Disturbance will include, but not necessarily limited to, scraping and grading to remove vegetation and eliminate cracks and crevices that provide giant garter snake overwintering habitat. This disturbance will include all toe drains, canal banks, and the intervening uplands where winter work is anticipated.

Reporting Requirements

The Service-approved monitoring biologist shall notify the Service immediately if giant garter snakes are found on site as detailed in term and condition 1.d, and will submit a report including date(s), location(s), habitat description, and any corrective measures taken to protect the snake(s) found. The Service-approved biologist shall submit locality information to CDFG, using completed California Native Species Field Survey Forms or their equivalent, no more than 90 calendar days after completing the last field visit of the project site. Each form shall have an accompanying map of the site such as a photocopy of a portion of the appropriate 7.5 minute U.S. Geological Survey map and shall provide at least the following information: township, range, and quarter section; name of the 7.5' or 15' quadrangle, dates (day, month, year) of field work; number of individuals and life stage (where appropriate) encountered; and a description of the habitat by community-vegetation type.

7. TECHNICAL APPENDICES

- A. Giant Garter Snake Species Description
- B. References
- C. Photographs
- D. Habitat Evaluation and Scoring Form for Geographic Information Systems (GIS)
- E. Instructions for Completing Habitat Evaluation and Scoring Form for Geographic Information Systems (GIS) - Linear Model
- F. Table of attributes for the Linear Habitat Evaluation
- G. CNDDDB forms for GGS occurrence records within 5 miles of the Project alignment
- H. Assumptions and Methodology Used to Calculate Impacts
- I. Minor Modifications - Description, habitat suitability, and impact quantification
- J. Major Modifications - Description, habitat suitability, and impact quantification

APPENDIX A. GIANT GARTER SNAKE SPECIES DESCRIPTION

Overview - The giant garter snake is a federal- and state-listed species precinctive to California's Great Central Valley. Described as among California's most aquatic garter snakes (Fitch 1940), giant garter snakes are associated with low-gradient streams and the wetlands and marshes of the valley floor. The conversion of Central Valley wetlands for agriculture and urban uses has resulted in the loss of as much as 95% of historical habitat for the giant garter snake (Wyllie et al. 1997). In some instances where wetlands have been reclaimed, giant garter snakes have adapted successfully to rice agriculture and the irrigation infrastructure supporting its practice (G. Hansen and Brode 1993; G. Hansen 1998; USFWS 1999; Wyllie et al. 1997). Giant garter snakes once ranged from Buena Vista Lake near Bakersfield, Kern County, north toward the vicinity of Chico in Glenn and Colusa Counties (G. Hansen and Brode 1980). Due mainly to loss or degradation of aquatic habitat resulting from agricultural and urban development, the giant garter snake has been either extirpated or else suffered serious declines throughout much of its former range.

Distribution - The current known distribution of giant garter snakes is patchy, extending from near Chico, Butte County, south to Mendota Wildlife Area, Fresno County. Giant garter snakes are not known from the northern portion of the San Joaquin Valley north to the eastern fringe of the Sacramento-San Joaquin River Delta, where the floodplain of the San Joaquin River is limited to a relatively narrow trough (G. Hansen and Brode 1980, USFWS 1993). The resulting gap of approximately 100 kilometers (62.3 miles) separates the southern and northern populations, with no giant garter snakes known from the lowland regions of Stanislaus County (CNDDDB 2011, G. Hansen and Brode 1980). Scattered records suggest that giant garter snakes may have occupied the Sacramento-San Joaquin River Delta at one time, but longstanding reclamation of wetlands for intense agricultural applications has eliminated most suitable habitat (CNDDDB 2011, G. Hansen 1986). Recent sightings within the Sacramento-San Joaquin Delta are haphazard, and repeated surveys have failed to identify any extant population clusters west of the eastern inland fringe (G. Hansen 1986, Patterson and E. Hansen 2004, Swaim 2004). Current locality records indicate that within this range, giant garter snakes are distributed in as many as 13 unique population clusters coinciding with historical flood basins, marshes, wetlands, and tributary streams of the Central Valley (R. Hansen 1980, Brode and G. Hansen 1992, USFWS 1993, USFWS 1999). These populations are isolated, without protected dispersal corridors to adjacent populations, and are threatened by land use practices and other human activities, including development of wetland and suitable agricultural habitats.

Habitat Requirements - Habitats occupied by giant garter snakes contain permanent or seasonal water, mud bottoms, and vegetated dirt banks (Fitch 1940, G. Hansen and

APPENDIX A. GIANT GARTER SNAKE SPECIES DESCRIPTION

Brode 1980). Prior to reclamation, these wetlands probably consisted of freshwater marshes and low gradient streams. Giant garter snake habitat includes all of the following four characteristics: 1) sufficient water during the snake's active season (typically early spring through mid-fall) to supply cover and food such as small fish and amphibians; 2) emergent, herbaceous wetland vegetation, such as cattails (*Typha* spp.) and bulrushes (*Schoenoplectus* [= *Scirpus*] spp.), accompanied by vegetated banks to provide basking and foraging habitat and escape cover during the active season; 3) upland habitat (e.g., bankside burrows, holes, and crevices) to provide short-term refuge areas during the active season; and 4) high ground or upland habitat above the annual high water mark to provide cover and refuge from flood waters during the dormant winter period (G. Hansen and Brode 1980, G. Hansen 1998).

This species appears to be absent from most permanent waters that support established populations of predatory game fishes, from streams and wetlands with sand, gravel, or rock substrates, and from riparian woodlands lacking suitable basking sites, prey populations, and cover vegetation (G. Hansen and Brode 1980, Rossman and Stewart 1987, Brode 1988, USFWS 1999). The species also appears to be absent from natural or artificial waterways that undergo routine mechanical or chemical weed control or compaction of bank soils (G. Hansen 1988, G. Hansen and Brode 1993).

Reproduction - Upon emerging from overwintering sites, male giant garter snakes immediately disperse in search of mates and will continue breeding from March into early May. Female giant garter snakes brood young internally, giving birth to live young from late July through early September (R. Hansen and G. Hansen 1990). Young immediately disperse and seek shelter to absorb their yolk sacs, after which they molt and begin feeding on their own. Brood size ranges from 10 to 46 young, with a mean of 23.1 (n=19) (R. Hansen and G. Hansen 1990). Averaging 3-5 grams with a snout-to-vent length averaging 8.1 inches (20.6 cm), young giant garter snakes will double their size within their first year (R. Hansen and G. Hansen 1990, USFWS 1999). Sexual maturity probably averages 3 years in males and 5 years in females (G. Hansen personal communication, USFWS 1999).

Longevity - Survivorship and longevity of giant garter snakes is unknown, with few quantitative studies of survivorship available for the genus as a whole. The best proxy comes from data on individual survival rates for a population of valley garter snakes (*Thamnophis sirtalis fitchi*) at a mountain lake in northern California. Snakes from this population exhibited first year survivorship among neonates ranging from 28.7 to 43.0 percent, with a second year neonate survivorship of 16.4 percent. Survival of yearling

APPENDIX A. GIANT GARTER SNAKE SPECIES DESCRIPTION

snakes was greater than that of juveniles at 50.8 percent, while that of snakes 2 years and older decreased to 32.7 percent (Jayne and Bennett 1990).

Sources of Mortality - Giant garter snakes are subject to mortality through the loss or degradation of habitat, predation of juvenile giant garter snakes by introduced predators, elimination of giant garter snakes or prey species by pesticides and other toxins, road mortality, maintenance and modification of agricultural ditches and drains and flood control systems, and flooding (G. Hansen 1986, USFWS 1999).

Behavior - Giant garter snakes typically emerge from winter retreats from late March to early April after spending the cool winter months in dormancy or periods of reduced activity. They remain active through October, with the timing of annual activity subject to varying seasonal weather conditions. Daily activity consists of: 1) emergence of burrows after sunrise, 2) basking to increase body temperatures, 3) foraging or courting for the remainder of the day (G. Hansen and Brode 1993). Activity generally peaks during spring emergence and courtship from April into June, whereupon observations of giant garter snakes diminish significantly until a second peak is observed after females give birth during late July into August (G. Hansen and Brode 1993, Wylie et al. 1997, USFWS 1999, E. Hansen 2004). Giant garter snakes then remain active foraging and occasionally courting until the onset of cooler fall temperatures.

Movement – Giant garter snakes are strongly associated with aquatic habitats, typically over-wintering in burrows and crevices near to their active-season foraging habitat (E. Hansen 2003a,b). Individuals have been noted using burrows as far as 164 feet (50 meters) from marsh edges during the active season, and retreating as far as 820 feet (250 meters) from the edge of wetland habitats while overwintering, presumably to reach hibernacula that are located above the annual high water mark (G. Hansen 1986, Wylie et al. 1997, USFWS 1999).

Changing agricultural regimes, development, and other shifts in land use create an ever-changing mosaic of available habitat. Giant garter snakes move around in response to these changes in order to find suitable sources of food, cover, and prey. Connectivity between regions is therefore extremely important for providing access to available habitat and for genetic interchange. In an agricultural setting, giant garter snakes rely largely upon the interconnected network of canals and ditches that provide irrigation and drainage to provide this connectivity.

Data based on radiotelemetry studies show that home range varies by location, with median home range estimates varying between 23 acres (9.2 hectares) (range 10.3 to

APPENDIX A. GIANT GARTER SNAKE SPECIES DESCRIPTION

203 acres [4.2 to 82 hectares], n=8) in a semi-native perennial marsh system and 131 acres (53.2 hectares) (range 3.2 to 2,792 acres [1.3 to 1,330 hectares], n=29) in a managed refuge (USFWS 1999). Differential dispersal and home range patterns between males and larger females who spend the majority of the active season gestating young are not reported. Lifetime dispersal patterns of both neonates and adults of this species are unknown.

Ecological Relationships - Giant garter snakes feed on small fishes, tadpoles, and small frogs (Fitch 1940, G. Hansen and Brode 1980, USFWS 1999), specializing in ambushing prey underwater (Brode 1988). Historically, giant garter snakes probably preyed on native species such as the thick-tailed chub (*Gila crassicauda*) and California red-legged frog (*Rana aurora draytonii*) which have been extirpated from the snake's current range, as well as the Pacific chorus frog (*Pseudacris [=Hyla] regilla*) and Sacramento blackfish (*Orthodox microlepidus*) (Cunningham 1959, Rossman et al. 1996, USFWS 1999). Giant garter snakes now prey upon introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio*), and mosquitofish (*Gambusia affinis*). While juveniles probably consume insects and other small invertebrates, giant garter snakes are not known to consume larger terrestrial prey such as small mammals or birds.

Large vertebrates, including raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), red foxes (*Vulpes vulpes*), gray foxes (*Urocyon cinereoagentius*), river otters (*Lontra [=Lutra] canadensis*), opossums (*Didelphis virginiana*), northern harriers (*Circus cyaneus*), hawks (*Buteo* spp.), herons (*Ardea herodias*, *Nycticorax nycticorax*), egrets (*Ardea alba*, *Egretta thula*), and American bitterns (*Botaurus lentiginosus*) prey on giant garter snakes (USFWS 1999). In areas near urban development, giant garter snakes may also fall prey to domestic or feral housecats (G. Hansen personal communication). In permanent waterways, introduced predatory game fishes such as black and striped bass (*Micropterus* spp.), sunfish (*Lepomis* spp.), and catfish (*Ictalurus* spp.) probably prey on giant garter snakes and compete with them for smaller prey (G. Hansen 1988, USFWS 1993).

Giant garter snakes coexist with the valley garter snake and, in limited instances, both may be found together with the mountain garter snake (*Thamnophis elegans elegans*), a western terrestrial garter snake subspecies, where this species' range extends to the Central Valley floor. The extent of competition among these species is unknown, but it is likely that differences in habitat use and foraging behavior allow their coexistence (Brode 1988, USFWS 1999).

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APPENDIX C. PHOTOGRAPHS



1. Looking south along canal at east end of Belding Extension



2. Looking north along canal at east end of Belding Extension



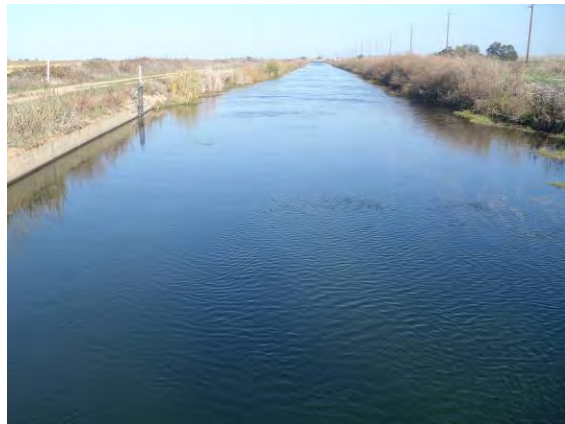
3. Belding Extension looking west from eastern terminus



4. Belding Extension looking east from approximately 1,000 feet east of SR99



5. Belding Extension looking west from approximately 1,000 feet east of SR99



6. Looking north along canal intersecting Belding Extension just west of SR99

APPENDIX C. PHOTOGRAPHS



7. Upper Belding Lateral looking southwest from just west of SR99



8. Looking southwest along ditch adjacent to and south of Upper Belding Lateral from just west of SR99



9. Upper Belding Lateral approximately 650 feet southwest of SR99 showing gravel/cementitious soil typical of this reach



10. Looking east along ditch adjacent to and north of Upper Belding Lateral from approximately 650 feet west of SR99



11. Upper Belding Lateral looking east from Razorback Siphon



12. Looking southwest along drain intersecting Upper Belding Lateral at Razorback Siphon