4. KLAMATH MOUNTAINS VERNAL POOL REGION

Only the vernal pool fairy shrimp is known to occur within the Klamath Mountains Vernal Pool Region.

4.1. Vernal Pool Habitat

The Oregon Natural Heritage Program (ONHP; now the Oregon Biodiversity Information Center) mapped vernal pool habitat within 20,628 acres surrounding the Agate Desert in Jackson County, Oregon using 1996 aerial imagery (ONHP 1997). Almost 12,000 acres had already been leveled or developed by that point, and ONHP further refined the mapping on the 8,801 acres of remaining vernal pool habitat using improved 1998 aerial imagery and videography (ONHP 1999). The refined imagery classified an additional 2,855 acres as developed, leveled, or otherwise having no vernal pools, leaving only 5,946 acres of vernal pool habitat in 1998 (**Figure 4.1**; ONHP 1999). This remaining vernal pool habitat varied in condition. No fully intact vernal pool habitat remained, but the highest quality habitat type (hydrology/topography intact, but vegetation altered) was present on 3,621 acres, or 17.6% of the historical distribution (ONHP 1999; Service 2012b). The *Recovery Plan for Rogue and Illinois Valley Vernal Pool and Wet Meadow Ecosystems* (Rogue and Illinois Valley Recovery Plan), published in 2012, mentions that there are approximately 5,000 acres of vernal pool habitat in the Rogue Valley (Service 2012b). The Service is currently funding a new vernal pool mapping assessment in Oregon, so more current data on the distribution of vernal pools in the Klamath Mountains Vernal Pool Region is expected by 2023 (S. Friedman, Service, *in litt*. 2022a).

As of 2012, the Rogue and Illinois Valley Recovery Plan identified approximately 2,293 acres of vernal pool habitat that had been protected for the vernal pool fairy shrimp (Service 2012b; Table II-6 incorrectly sums the total to 2,333 acres). The formal section 7 consultation on the Agate Bay Solar Project, issued by the Service on October 24, 2018, identifies 2,593 acres of protected lands in the Status of the Species section of the biological opinion (Service 2018a). Additional information collected for this 5-year review has refined this number and clarified differences between the total acres of land protected within each core area and the acreage of vernal pool habitat protected within each core area. In total, 2,758.74 acres of total land has been preserved within the core areas, as well as one 352-acre preserve that is outside of the core areas; 2,504.31 acres of vernal pool habitat has been preserved (**Figure 4.2**, **Table 4.1**).This means that somewhere between 42% (using the total acreage of 5,946 acres; ONHP 1999) and 50% (using the total acreage of 5,000 acres; Service 2012b) of the remaining vernal pool habitat in this region has been protected.

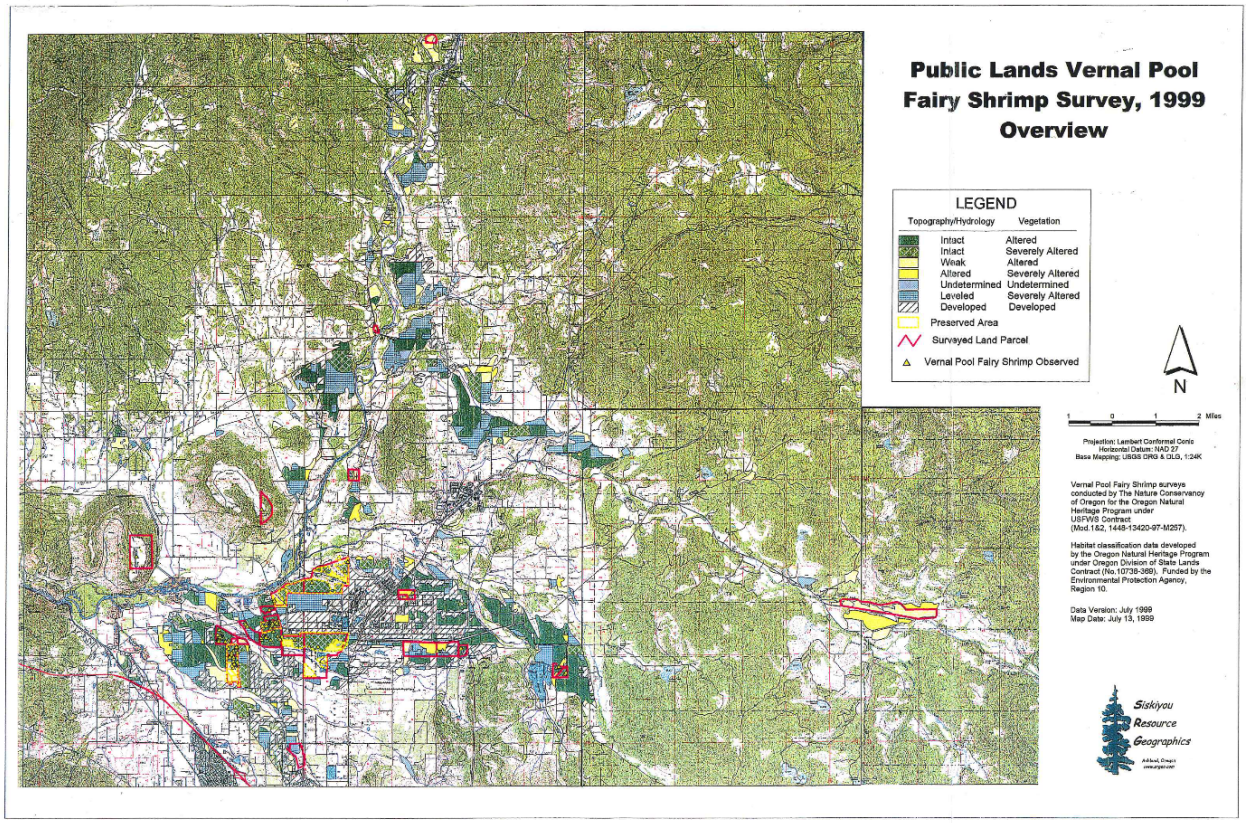

Figure 4.1. Map of vernal pool habitat in Jackson County, Oregon, in 1998. Taken from the *Revised Assessment and Map of Vernal Pool Systems on the Agate Desert, Jackson County, Oregon* submitted to the Service (ONHP 1999).

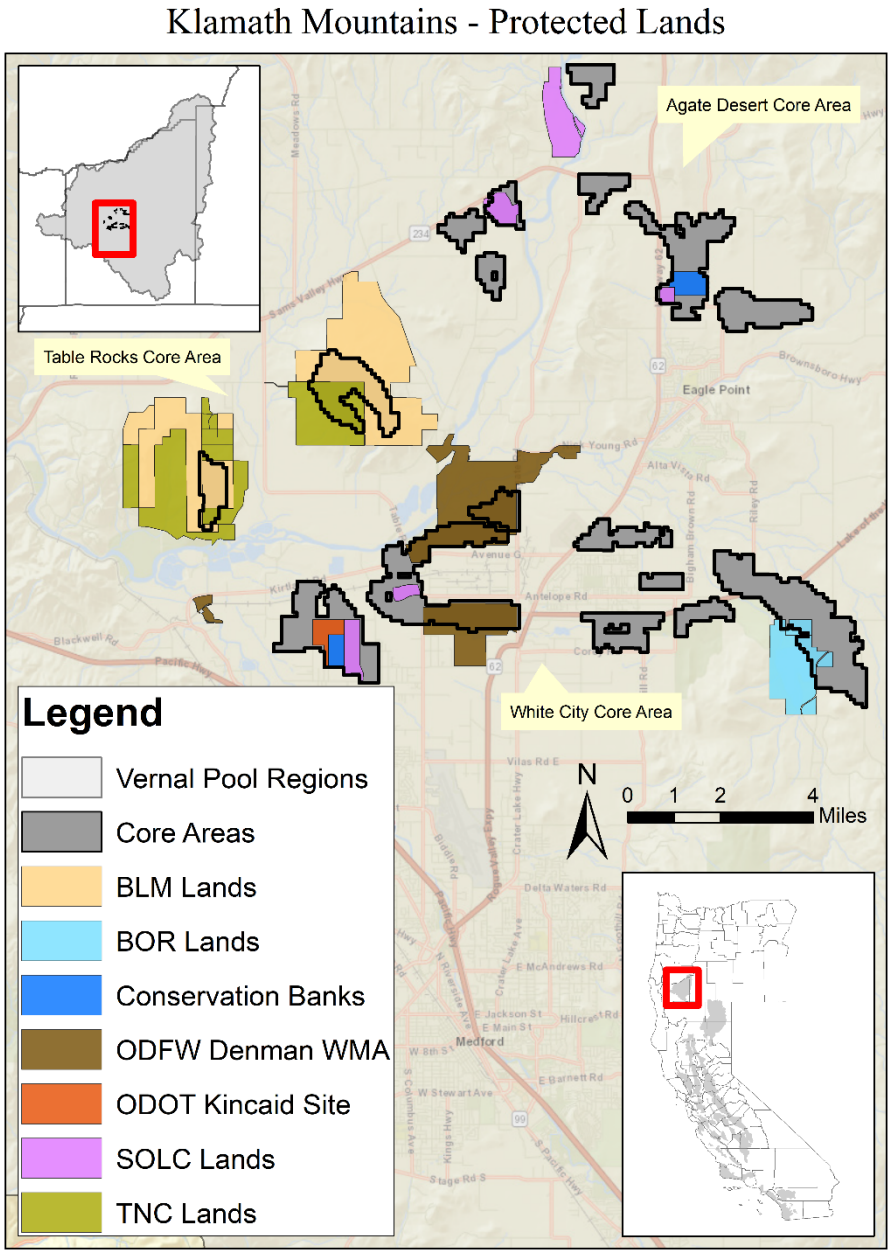

Figure 4.2. Map of protected areas that contain vernal pool grassland habitat and/or vernal pool fairy shrimp within the Klamath Mountains Vernal Pool Region. Seven small parcels throughout White City that have been protected as compensatory mitigation associated with section 7 consultations, described in the Other Preserves section below, are not displayed here as shapefiles were not obtained. BLM = Bureau of Land Management, BOR = Bureau of Reclamation, ODFW Denman WMA = Oregon Department of Fish and Wildlife Denman Wildlife Management Area, ODOT = Oregon Department of Transportation, SOLC = Southern Oregon Land Conservancy, TNC = The Nature Conservancy

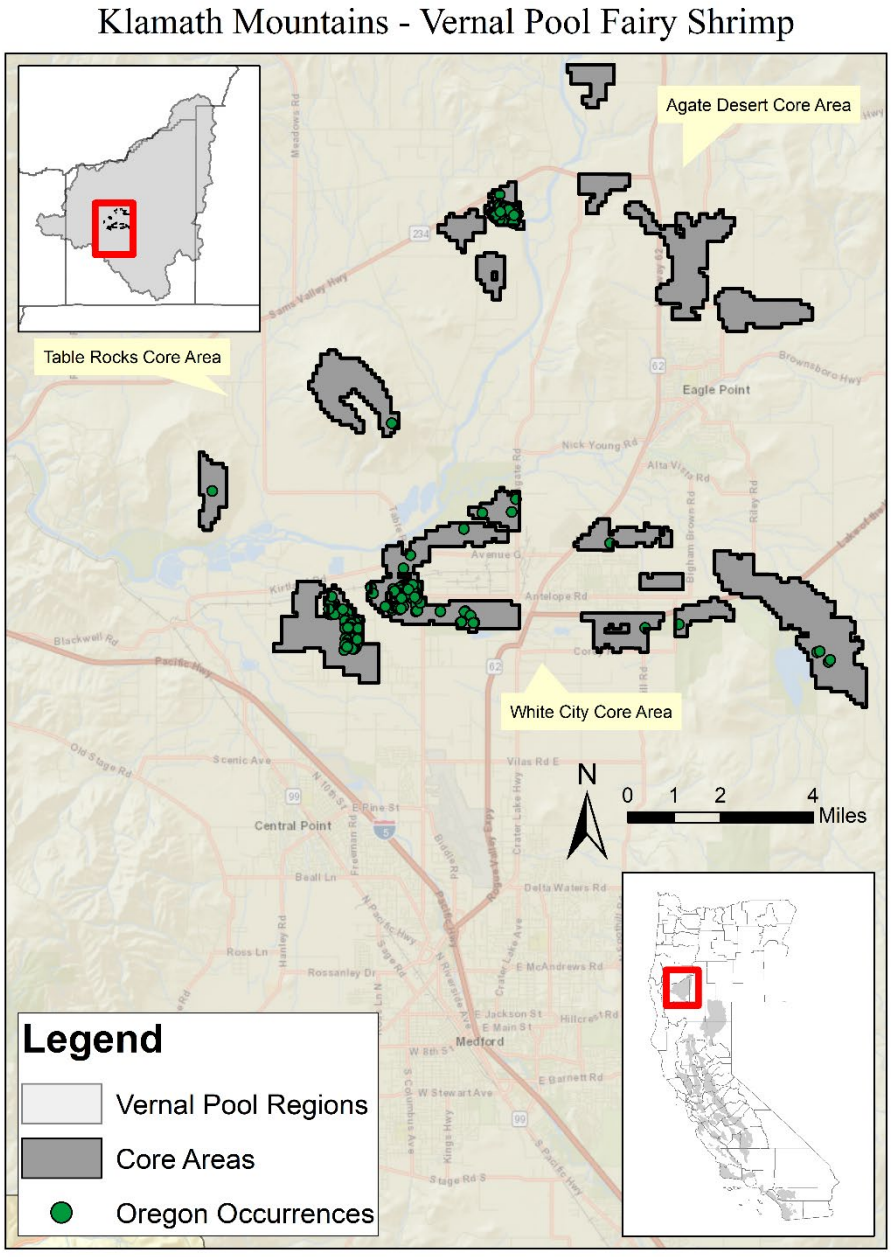

Figure 4.3. Map of known occurrences of vernal pool fairy shrimp in the Klamath Mountains Vernal Pool Region provided by the Roseburg Fish and Wildlife Office (Friedman, *in litt*. 2021). Points represent individual vernal pools. The entire extent of the vernal pool region is displayed at the top left.

Table 4.1. Total acreage of preserve lands and preserved vernal pool habitat for all protected lands within the Klamath Mountains Vernal Pool Region. Preserve acreage within core areas does not include portions of the protected lands that extend outside of the designated core areas, except for the one preserve that occurs entirely outside of a core area. BLM = Bureau of Land Management, BOR = Bureau of Reclamation, JCURA = Jackson County Urban Renewal Agency, ODFW Denman WMA = Oregon Department of Fish and Wildlife Denman Wildlife Management Area, ODOT = Oregon Department of Transportation, TNC = The Nature Conservancy

Core Area	Preserve Name	Preserve Acreage within Core Area	Vernal Pool Habitat Acreage
Agate Desert	Rogue Plains Preserve	346	252
Agate Desert	Wood House	38	38
Agate Desert	Rogue Valley Mitigation/Conservation Bank	131.43	115
Table Rocks	BLM and TNC lands	892	708
White City	Whetstone Savanna Preserve	140	140
White City	ODOT Vernal Pool Mitigation/Conservation Bank	80.23	80.23
White City	ODOT Kincaid Property Mitigation Site	116	116
White City	Agate Desert Preserve	53	53
White City	Agate Lake BOR land	154	154
White City	ODFW Denman WMA	720	720
White City	JCURA/ODOT Dutton Road Mitigation Site	3.3	3.3
White City	Eagle Point School District Mitigation Site	25	25
White City	JCURA/Jackson County Parks Mitigation Site	10.93	10.93
White City	Hornaker Mitigation Site	5	5
White City	Bear Valley Sanitary District Mitigation Site	4.85	4.85
White City	City of Medford Mitigation Site	3	3
White City	Medford Water Commission Mitigation Site	36	36
N/A	Rogue River Preserve	352[1]	40
Klamath Vernal Pool Region Total		**2,758.74[2]**	**2,504.31**

[1] This is the complete size of the preserve, but this preserve is not within any of the core areas.
[2] This total does not include the 352 acres on the Rogue River Preserve that are not within a core area. With this preserve, the total would come to 3,110.74 acres.

4.2. Species Occurrences

4.2.1. Vernal Pool Fairy Shrimp

There are 243 occurrence records of the vernal pool fairy shrimp documented within the Klamath Mountains Vernal Pool Region that have been collected by the Service's Roseburg Fish and Wildlife Office (**Figure 4.3**; Friedman, *in litt*. 2021). Unlike the Diversity Database, this data contains points instead of polygons, generally representing individual vernal pools. The vernal pool fairy shrimp was first observed at these 243 locations between 1998 and 2004, and the species has only been found within the core areas identified in the Recovery Plan. In addition to these locations, the vernal pool fairy shrimp is also known to occur on the Rogue Valley Mitigation/Conservation Bank and the Wood House property (**Figure 4.2**). The ONHP had documented 11 occurrences of the vernal pool fairy shrimp (larger areas of occurrence, not individual pools) as of 2012 (Service 2012b). The previous 5-year review for the species from 2007 mentions occurrences from Upper and Lower Table Rock, three preserves owned by The Nature Conservancy (TNC) (now owned by Southern Oregon Lands Conservancy), Bureau of Reclamation land around Agate Lake, and Oregon Department of Fish and Wildlife's Denman Wildlife Management Area (Service 2007a), all of which are included in the data provided by the Roseburg Fish and Wildlife Office.

Of the 243 vernal pool fairy shrimp occurrences collected by the Roseburg Fish and Wildlife Office, 192 (79%) are within mapped protected lands (**Figure 4.2**), and the vernal pool fairy shrimp has also been found on the Rogue Valley Mitigation/Conservation Bank and the Wood House property. Shapefiles of seven small parcels throughout White City that have been protected as compensatory mitigation associated with section 7 consultations, described in the Other Preserves section below, were not obtained, so several of the remaining 51 occurrences may be within these unmapped protected lands. However, it is very likely that the vernal pool fairy shrimp may occur on other areas of protected vernal pool, but no surveys have been conducted on most unprotected private lands. In addition, projects that have provided mitigation for the loss of vernal pool fairy shrimp habitat, either in the form of mitigation lands or purchasing conservation credits from a bank, typically assume presence without surveying for the species; therefore, it is reasonable to expect that some occurrences of the vernal pool fairy shrimp have been lost even though survey data is not available. Still, based on all the information collected here, it does seem that conservation within the Klamath Mountains Vernal Pool Region has been successful or nearly successful in meeting the Recovery Plan's goal of protecting at least 80% of vernal pool fairy shrimp occurrences (that were known as of 2005) across the species range, including extreme edges, in order to preserve the geographic, genetic, and ecological diversity of the species.

4.3. Federal Lands

4.3.1. National Wildlife Refuges

There are no National Wildlife Refuges with known occurrences of the vernal pool fairy shrimp in the Klamath Mountains Vernal Pool Region.

4.3.2. Military Lands

There are no military lands with known occurrences of the vernal pool fairy shrimp in the Klamath Mountains Vernal Pool Region.

4.3.3. Bureau of Land Management

The vernal pool fairy shrimp is known to occur on both Upper Table Rock and Lower Table Rock, which are within the U.S. Bureau of Land Management's (BLM) Table Rocks Management Area. Different parts of the Table Rocks are either owned and administered by BLM, owned by TNC, or have conservation easements held by TNC, totaling 4,864 acres (see **Figure 4.2**; BLM 2013; M. Morison, TNC, *in litt*. 2022). However, the vernal pool fairy shrimp is only known to occur in areas owned and administered by BLM. Vernal pool-mounded prairie complexes occur on the flat tops of the Table Rocks, 246 acres on Lower Table Rock and 462 acres on Upper Table Rock (BLM 2013). Baseline surveys from 2004 to 2006 documented the vernal pool fairy shrimp in 8 of 38 pools sampled across Table Rocks (ESA Associates 2006a). No additional surveys have been conducted since 2006 (D. Roelofs, BLM, *in litt*. 2022). A management plan for the Table Rocks was created in 2013; management recommendations related to the vernal pool fairy shrimp included maintaining native plant communities in the vernal pool-mounded prairie complex, monitoring vernal pool species, and restricting foot traffic and educating the public to stay on trails where the trails are adjacent to vernal pools (BLM 2013). Since 2013, some of the TNC-owned lands have been transferred to BLM, and other TNC-owned lands are proposed for transfer to BLM in the future (Morison, *in litt*. 2022). In 2016, TNC conducted an assessment of restoration opportunities across Table Rocks, which included mapping the extent of vernal pools using both LiDAR and aerial imagery (TNC 2016). This mapping allows for planning of protection or restoration management activities, such as identifying historical disturbance to hydrologic patterns, prioritizing target areas for invasive plant control, and planning the location of trails that will avoid disturbance to vernal pools (TNC 2016).

4.3.4. Other Federal Lands

The Agate Lake Reservoir is located southeast of White City and south of Highway 140 and is managed by the U.S. Bureau of Reclamation (BOR) in conjunction with the Jackson County Roads and Parks Services (see **Figure 4.2**; BOR 2000). Approximately 154 acres of vernal pool grasslands occur on the northeast side of Agate Lake, within the White City Core Area (BOR 2000; Service 2018a). The vernal pool fairy shrimp was first observed within the Agate Lake Reservoir in four vernal pools during the 1998-1999 wet season by ONHP (BOR 2000). At the Service's recommendation, the BOR's Agate Lake Resource Management Plan (BOR 2000) did not include plans for trails or interpretive sites in vernal pool habitat. This plan also recommended that a specific vernal pool management plan be developed for the Agate Lake Reservoir (BOR 2000), but the Service is unaware if such an effort has been completed.

4.4. Conservation Banks

There are two conservation or mitigation banks within the Klamath Mountains Vernal Pool Region that provide credits for preserved vernal pools that support the vernal pool fairy shrimp

(see **Figure 4.2**; RIBITS 2021). The Rogue Valley Mitigation/Conservation Bank is located north of the City of Eagle Point in the Agate Desert Core Area. The bank is 131.43 acres and protects 115 acres of vernal pool and swale complex, including 38.3 acres of preserved vernal pools for the vernal pool fairy shrimp (Resource Environmental Solutions 2019; RIBITS 2021). During surveys in 2016, the vernal pool fairy shrimp was identified in 19 of 50 sampled pools (Running W Land & Cattle 2016). The Oregon Department of Transportation (ODOT) Vernal Pool Mitigation/Conservation Bank is located west of The Nature Conservancy's Whetstone Savanna Preserve in the western part of the White City Core Area. The bank is 80.23 acres and protects prairie and woodland habitat which support 20.95 acres of vernal pools (ODOT 2009). This bank is owned by TNC and managed by ODOT, and it is a single-client bank which only provides credits for ODOT projects that affect vernal pools. Successful restoration of vernal pools within the bank and on adjacent preserved lands occurred between 2011 and 2019 and is described in the Other Preserves section below (Perchemlides et al. 2020). Together, these two banks have sold a total of 27.82 acres of vernal pool preservation credits for the vernal pool fairy shrimp (RIBITS 2021).

4.5. Habitat Conservation Plans

There are no Habitat Conservation Plans (HCPs) within the Klamath Mountains Vernal Pool Region that includes the vernal pool fairy shrimp as a Covered Species.

4.6. Other Preserves

There are several vernal pool preserves outside of federal lands and banks that have been established in this vernal pool region. The 336-acre Whetstone Savanna Conservation Area consists of three properties: the 140-acre Whetstone Savanna Preserve (originally acquired and owned by TNC, transferred to the Southern Oregon Land Conservancy [SOLC] in February 2022), the 80-acre ODOT Mitigation/Conservation Bank described above, and the 116-acre Kincaid Property Mitigation Site owned and managed by ODOT (ODOT 2009; ODOT 2021; Perchemlides et al. 2020; TNC 2021a). Some vernal pool habitat within the Whetstone Savanna Conservation Area had been degraded by historic activities, and a large restoration effort occurred between 2011 and 2019. Compared to a four-year baseline prior to restoration, vernal pool habitat within the Whetstone Savanna Conservation Area has now doubled in area and occupancy by vernal pool fairy shrimp increased to four-times the baseline level (Perchemlides et al. 2020). The vernal pool fairy shrimp has been documented in pools throughout all three properties in surveys from 2020-2022 (see **Figure 4.4**, **Figure 4.5**; ODOT 2021; R. Bergkoetter, SOLC, *in litt*. 2022; P. Benton, ODOT, *in litt*. 2022). The two ODOT properties have management plans which address vernal pools (ODOT 2009; ODOT 2021); the Whetstone Savanna Preserve has only a very brief general management plan (TNC 2021a), but SOLC is in the process of preparing a more comprehensive management plan (Bergkoetter, *in litt*. 2022).

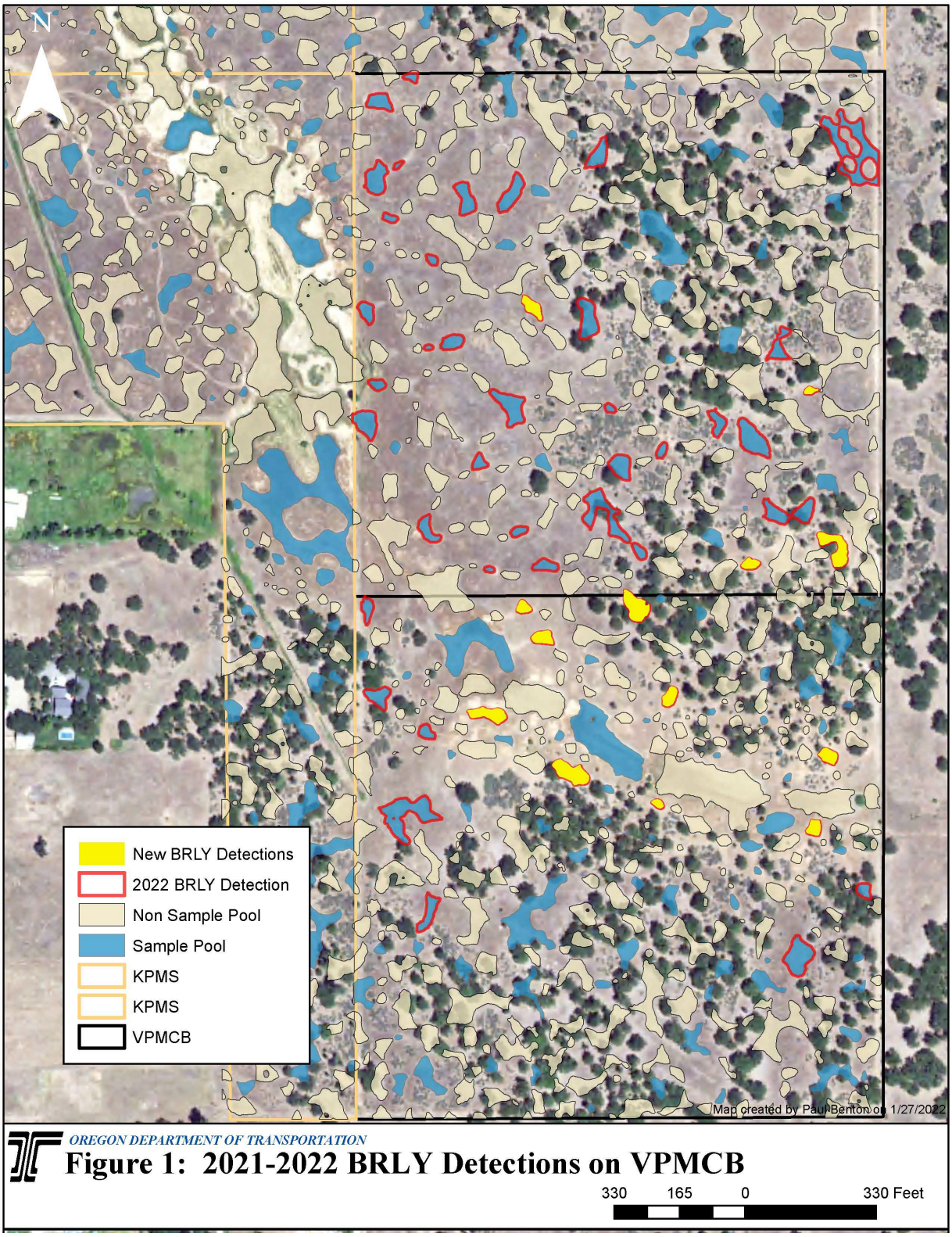

Figure 4.4. Map of vernal pool fairy shrimp occurrences from ODOT's Vernal Pool Mitigation/Conservation Bank from 2022 surveys. Provided by Paul Benton from ODOT (Benton, *in litt*. 2022).

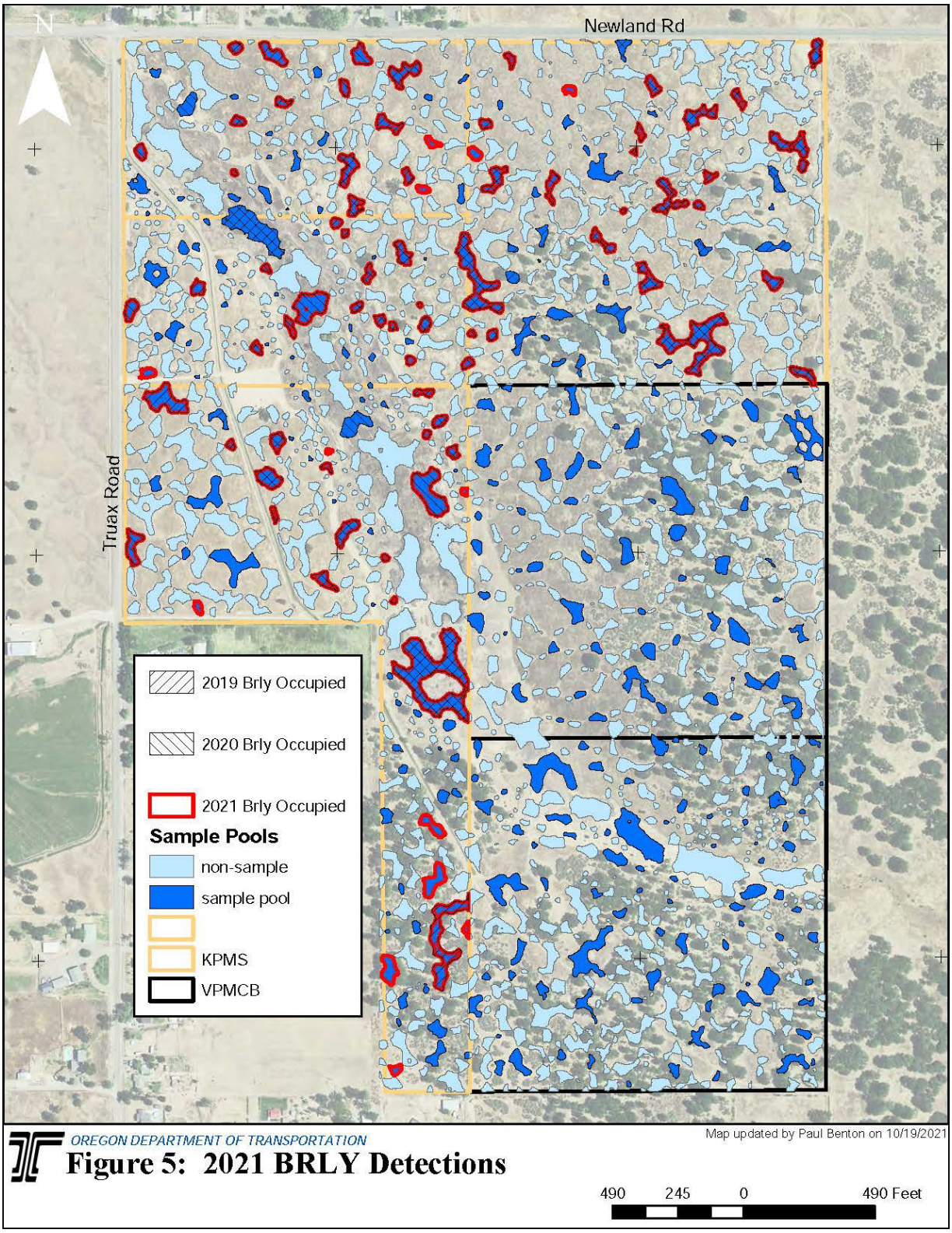

Figure 4.5. Map of vernal pool fairy shrimp occurrences from ODOT's Kincaid Property Mitigation Site from 2019-2021 surveys. Taken from Figure 5 of the 2021 monitoring report (ODOT 2021).

Besides the Whetstone Savanna Preserve, the SOLC also has two other preserves that were transferred from TNC in February 2022: Agate Desert Preserve and Rogue Plains Preserve. The 53-acre Agate Desert Preserve is located in western White City, is owned by SOLC in fee title, and has a very brief general management plan inherited from TNC (TNC 2021b). Management activities for 2022-2023 include vegetation and listed species monitoring, conducting a prescribed burn, surveying and controlling invasive plant species, and general preserve maintenance (TNC 2021b). The vernal pool fairy shrimp has been identified in various vernal pools throughout the preserve during surveys conducted between 1998 and 2022 (Bergkoetter, *in litt*. 2022). The Rogue Plains Preserve (a.k.a., Rogue River Plains Preserve) is located north of Eagle Point, has a conservation easement held by SOLC, and does not currently have a management plan, though SOLC is in the process of developing one since receiving the property from TNC in February 2022 (Bergkoetter, *in litt*. 2022). This preserve is 346 acres in total, of which 252 acres are vernal pool habitat (Service 2012b). The vernal pool fairy shrimp has been identified in various vernal pools throughout the preserve during surveys conducted in 2002, 2003, 2019, and 2020 (Bergkoetter, *in litt*. 2022).

The SOLC also has two other preserves: Rogue River Preserve and Wood House. The Rogue River Preserve is a 352-acre preserve owned by SOLC along the western bank of the Rogue River north of Highway 234, of which 40 acres support vernal pool mounded prairie complex (SOLC 2021). This preserve is not within any of the core areas designated by the Recovery Plan. The vernal pool fairy shrimp has not been detected at this site despite multiple survey attempts in 2015-2017 and 2017-2018 (SOLC 2021). The Wood House property is a historic property north of Eagle Point with an approximately 38-acre conservation easement held by SOLC. The Service identified the vernal pool fairy shrimp onsite in 2008 (C. Tuss, Service, *in litt*. 2008) and the species was named in the conservation easement. The only current management plan for Wood House is a grazing management plan (NRCS 2009).

The Oregon Department of Fish and Wildlife's (ODFW) Denman Wildlife Management Area (WMA) is 1,858 acres in size and located at the confluence of Little Butte Creek and the Rogue River in White City (ODFW 2017). There are 720 acres of vernal pool complex within the Denman WMA (**Figure 4.6**), all of which is within the White City Core Area. Past management practices involved attempts to improve the soil for agriculture by deep ripping the hardpan and filling pools with bark mulch; these practices were stopped in the 1980's when the value of the vernal pools was realized (ODFW 2017). Since 1995, TNC and the Service have surveyed for the vernal pool fairy shrimp on Denman WMA; as of 2017, the surveys showed no population decline, good recruitment, and good physical condition (ODFW 2017). Management practices for the vernal pools include controlled burns and seeding of native species. The 2017 management plan for Denman WMA includes the objective to protect and restore the 720 acres of vernal pool complex by continuing to monitor vernal pool species and by coordinating with TNC and the Service to implement habitat improvement projects (ODFW 2017).

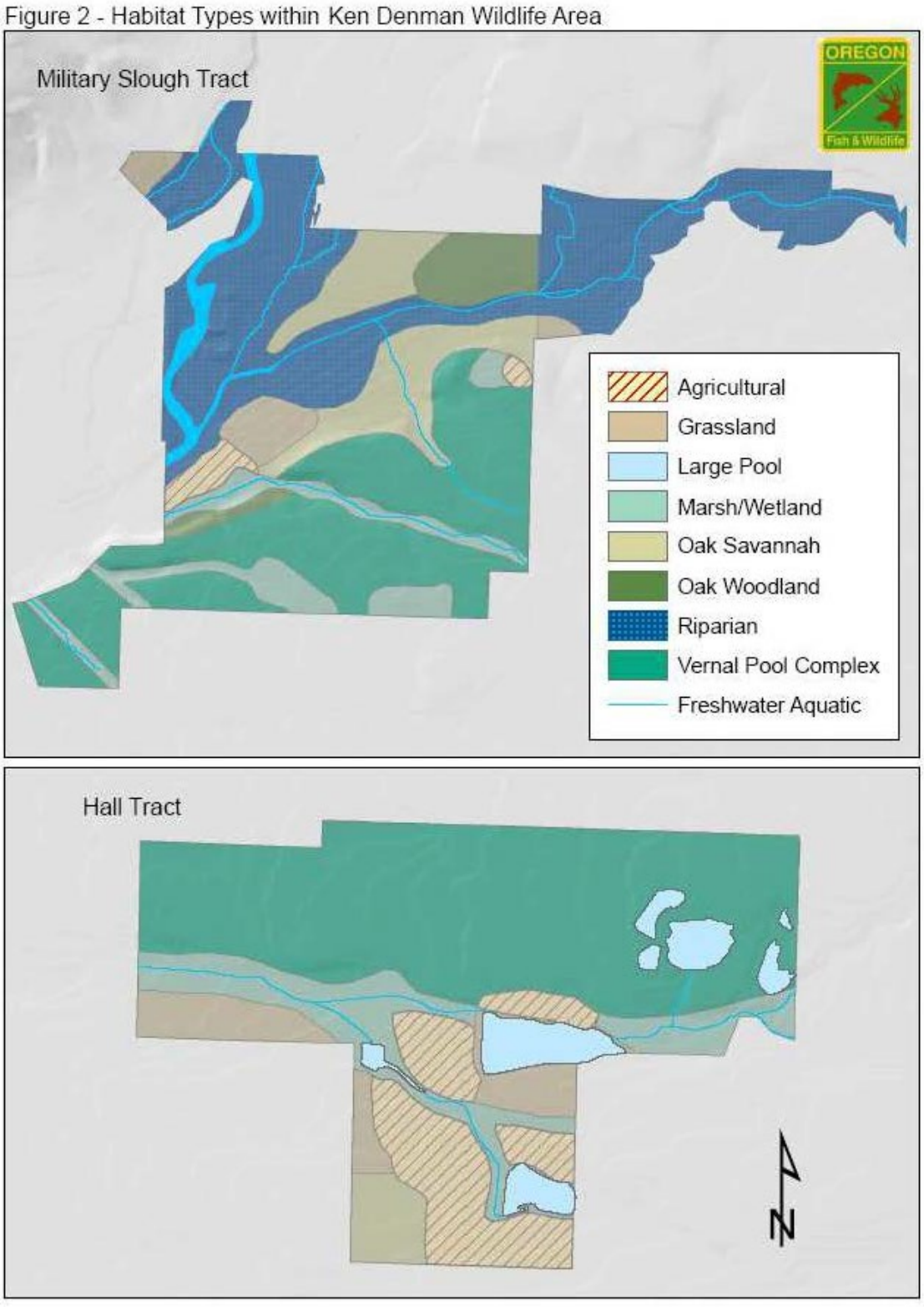

Figure 4.6. Map of vernal pool habitat within Oregon Department of Fish and Wildlife's Denman Wildlife Management Area. Taken from Figure 2 of the management plan (ODFW 2017).

Seven other small parcels throughout White City have been protected as compensatory mitigation associated with section 7 consultations (S. Friedman, Service, *in litt*. 2022b). These seven parcels total 88.08 acres, four parcels totaling 44.23 acres in east White City and three parcels totaling 43.85 acres in west White City. The Eagle Point School District owns 25 acres of restored and protected vernal pools which are managed using rotation grazing (Friedman, *in litt*. 2022b). The Jackson County Urban Renewal Agency (JCURA) and ODOT own a mitigation property at the intersection of Highway 62 and Dutton Road which includes 1.048 wetted acres of vernal pools within an approximately 3-acre area in the western corner of the property (Terra Science 2010; Friedman, *in litt*. 2022b). All mitigation performance standards were met in 2010 after five years of monitoring. Survey efforts have not yet identified the vernal pool fairy shrimp onsite (Terra Science 2010). The JCURA also has a 10.93-acre vernal pool restoration site on a property owned and managed by Jackson County Parks; management activities focus on invasive plant control (Friedman, *in litt*. 2022b). The Hornaker restoration and mitigation site contains 5 acres of vernal pool habitat protected under a deed restriction (Friedman, *in litt*. 2022b). There are three restoration sites on property owned by the City of Medford: a 4.85-acre site for the Bear Valley Sanitary District, a 3-acre City of Medford site, and a 36-acre site for the Medford Water Commission. The Medford Water Commission site has a long-term management plan, has been managed with prescribed burning, and federally-listed vernal pool plant species have been planted onsite; management of the other sites consists of periodic grazing or mowing (Friedman, *in litt*. 2022b).

4.7. Vernal Pool Core Areas

There are three Core Areas within the Klamath Mountains Vernal Pool Region that are designated in the Recovery Plan for the vernal pool fairy shrimp: Agate Desert, Table Rocks, and White City. One of the three core areas have met the target of 85% of vernal pool habitat protected (**Table 4.2**).

The 2012 *Recovery Plan for Rogue and Illinois Valley Vernal Pool and Wet Meadow Ecosystems* (Rogue and Illinois Valley Recovery Plan) also designated core areas for two endangered vernal pool plant species (Service 2012b). These core areas were based on species occurrences and the presence of vernal pool habitat as determined by aerial imagery, topography, and soil types. These core areas generally correspond to core areas identified in the Recovery Plan, but differ slightly due to more accurate delineation of habitat areas and differing habitat needs of the two endangered plant species (see **Figure 4.7**; Service 2012b). All currently known occurrences of the vernal pool fairy shrimp fall within the core area boundaries delineated by both recovery plans. This 5-year review uses the original core areas from the Recovery Plan, but we recommend that these be officially updated to reflect the more accurate delineations from the Rogue and Illinois Valley Recovery Plan.

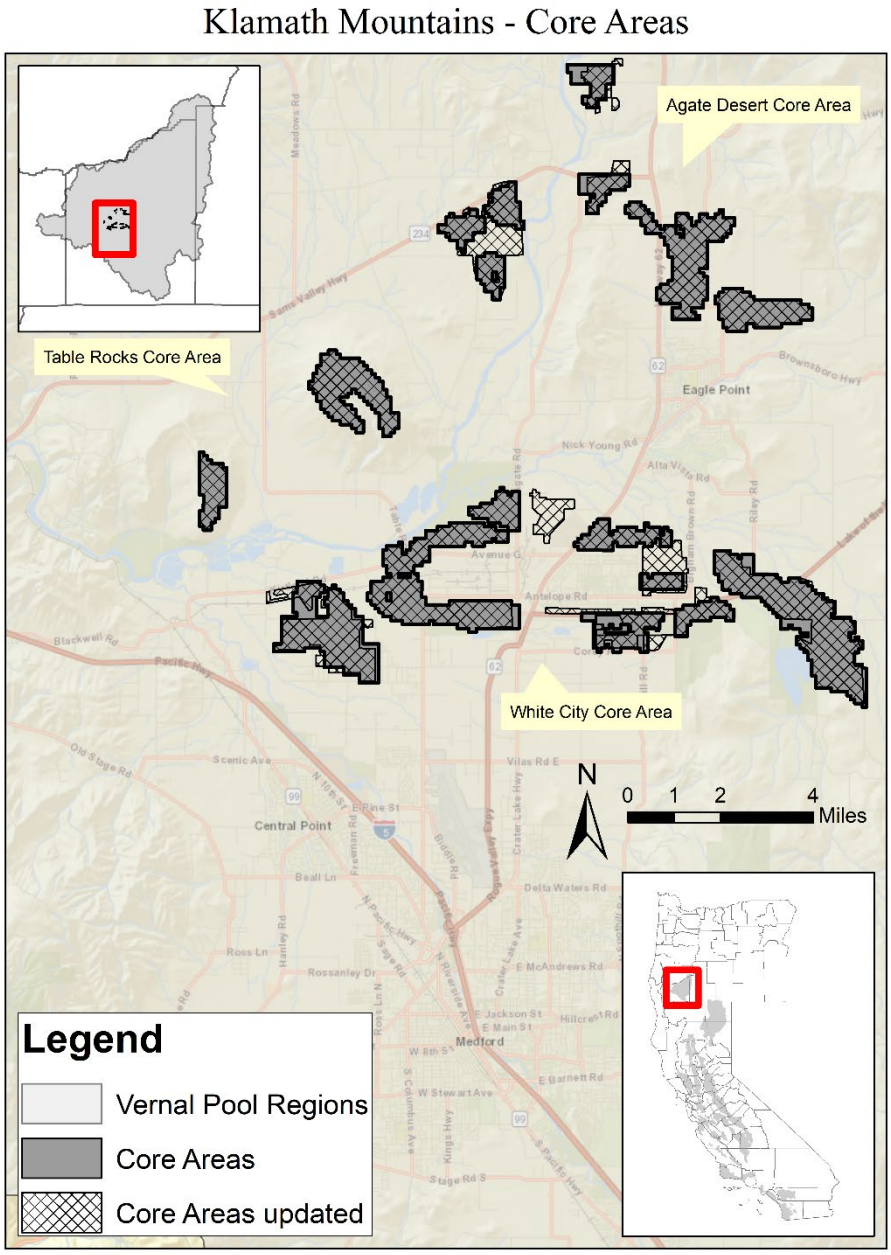

Figure 4.7. Comparison of the core areas delineated by the Recovery Plan in 2005 and the updated core areas for vernal pool fairy shrimp in the 2012 Rogue and Illinois Valley Recovery Plan.

Table 4.2. Total acreage and acreage of vernal pool habitat protected within each core area of the Klamath Mountains Vernal Pool Region. Core area total acreage is based on the updated core areas from the Rogue and Illinois Valley Recovery Plan. Core area vernal pool acreage estimate is taken from the estimates provided in the Rogue and Illinois Valley Recovery Plan. Total acreage protected and vernal pool acreage protected are based on the information in **Table 4.1**.

Core Area	Core Area Total Acreage	Core Area Vernal Pool Acreage Estimate	Total Acreage Protected (% of Core Area Total)	Vernal Pool Acreage Protected (% of Core Area Vernal Pool Estimate)
Agate Desert	2,211	2,130	515 (23.3%)	405 (19.1%)
Table Rocks	892	892	892 (100%)	708 (100%[1])
White City	4,762	4,552	1,351 (28.4%)	1,351 (29.7%)

4.7.1. Agate Desert

This is a zone 2 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp. The core area is composed of seven polygons which are located north of the City of Eagle Point on both sides of the Rogue River. This core area corresponds to the Rogue Plains, Hammel Road, and North Eagle Point Core Areas from the Rogue and Illinois Valley Recovery Plan (Service 2012b). The biggest difference in the boundaries is the inclusion of the area in between the three polygons west of the Rogue River (**Figure 4.7**).

Based on the core area boundaries from the Rogue and Illinois Valley Recovery Plan, this core area is 2,211 acres in size, of which 2,130 acres was estimated to be vernal pool habitat (Service 2012b). The Rogue Plains Preserve, Rogue Valley Mitigation/Conservation Bank, and Wood House property protect approximately 517 acres of land within this core area, of which 407 acres are vernal pool habitat. Thus, an estimated 19.1% of vernal pool habitat has been protected within this core area (**Figure 4.8**, **Table 4.2**). The Rogue River Preserve is outside of, but very close to, this core area and contains 40 acres of vernal pool habitat.

4.7.1.1.Vernal Pool Fairy Shrimp Occurrences

All known occurrences of the vernal pool fairy shrimp in this core area are within protected lands (**Figure 4.8**). Although occurrences records collected by the Service's Roseburg Fish and Wildlife Office only include 56 points within the Rogue Plains Preserve (Friedman, *in litt*. 2021), the vernal pool fairy shrimp is also known from the Rogue Valley Mitigation/Conservation Bank (Running W Land & Cattle 2016) and the Wood House property (Tuss, *in litt*. 2008), which is protected under a conservation easement held by SOLC. Practically all of the land in this core area is privately owned (99%; Service 2012b), so it is very likely that the vernal pool fairy

[1] This was determined to be all of the vernal pool habitat in this core area based on mapping of landcover types (BLM, 2013). Differences in acreage between estimates may reflect refined data or may simply be due to different methods of acreage calculations.

shrimp may occur on other areas of vernal pool habitat outside of these three protected properties, but no surveys have been conducted on these unprotected private lands.

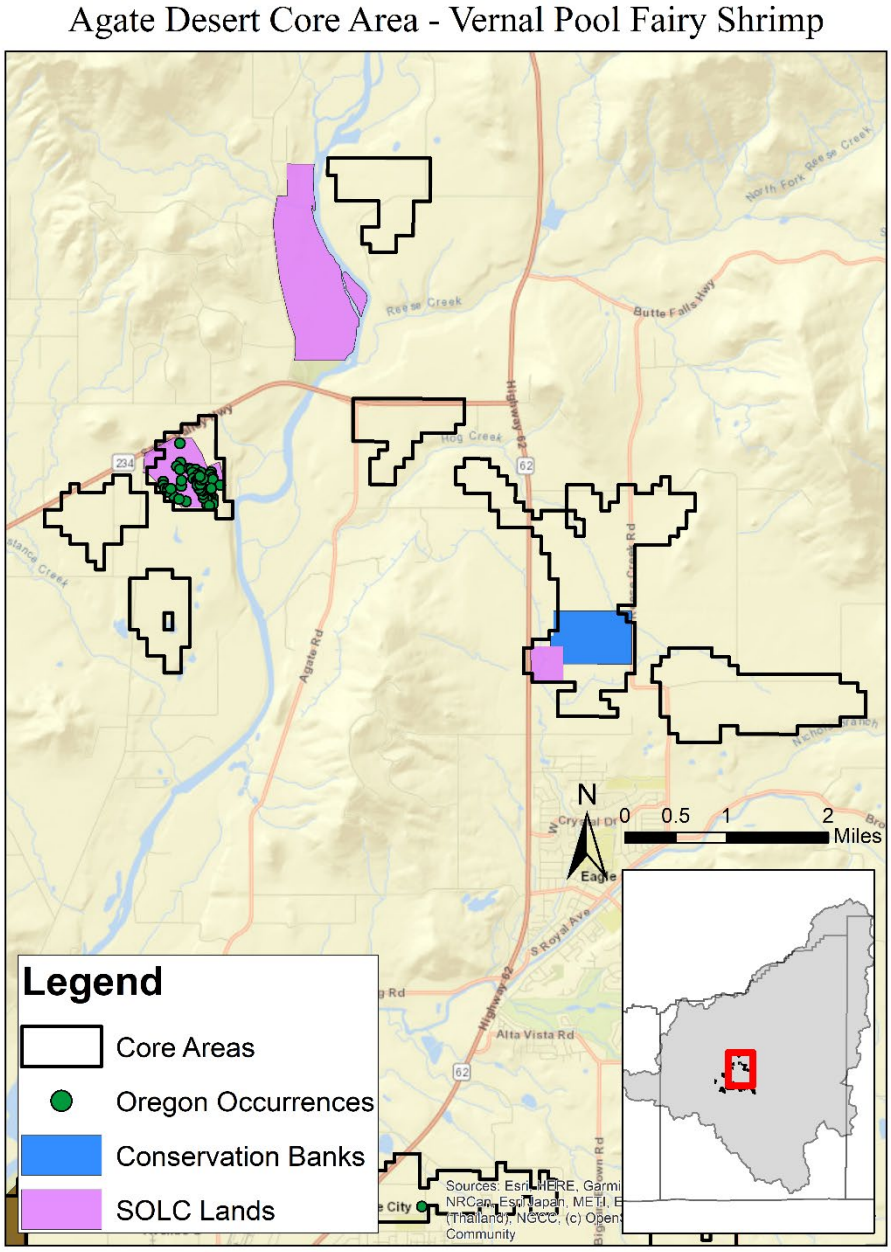

Figure 4.8. Map of known occurrences of vernal pool fairy shrimp provided by the Roseburg Fish and Wildlife Office (Friedman, *in litt*. 2021) and of all protected lands within the Agate Desert Core Area. The vernal pool fairy shrimp is also known to occur on the Rogue Valley Mitigation/Conservation Bank and the Wood House property. SOLC = Southern Oregon Land Conservancy

4.7.2. Table Rocks

This is a zone 2 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp. The core area is composed of two polygons which encompass the tops of Lower Table Rock and Upper Table Rock, northeast of White City and the Rogue River. This core area corresponds to the Upper Table Rock and Lower Table Rock Core Areas from the Rogue and Illinois Valley Recovery Plan, which have identical boundaries (see **Figure 4.7**; Service 2012b).

This core area is 892 acres in size, all of which was estimated to be vernal pool habitat based on the Rogue and Illinois Valley Recovery Plan (Service 2012b). More refined habitat estimates show a total of 708 acres of vernal pool habitat in this core area (246 acres on Lower Table Rock and 462 acres on Upper Table Rock), all of which is protected on BLM or TNC lands (see **Table 4.2**; BLM 2013). A management plan for the Table Rocks was created by BLM and TNC in 2013; management recommendations related to the vernal pool fairy shrimp included maintaining native plant communities in the vernal pool-mounded prairie complex, monitoring vernal pool species, and restricting foot traffic and educating the public to stay on trails where the trails are adjacent to vernal pools (BLM 2013). Vernal pools have been precisely mapped on Table Rocks using a combination of aerial imagery and LiDAR (TNC 2016).

4.7.2.1. Vernal Pool Fairy Shrimp Occurrences

All vernal pool fairy shrimp occurrences and vernal pool habitat within this core area have been protected. The core area is entirely within lands in BLM's Table Rocks Management Area that are owned and administered by BLM, owned by TNC, or have a conservation easement held by TNC (**Figure 4.9**). Although occurrences records collected by the Service's Roseburg Fish and Wildlife Office only include two occurrence points within this core area (Friedman, *in litt*. 2021), BLM surveys from 2004 to 2006 documented the vernal pool fairy shrimp in 8 of 38 pools sampled across Table Rocks (ESA Associates 2006a). These occupied pools are found across both Upper and Lower Table Rocks (**Figure 4.10**) and are all protected within BLM lands.

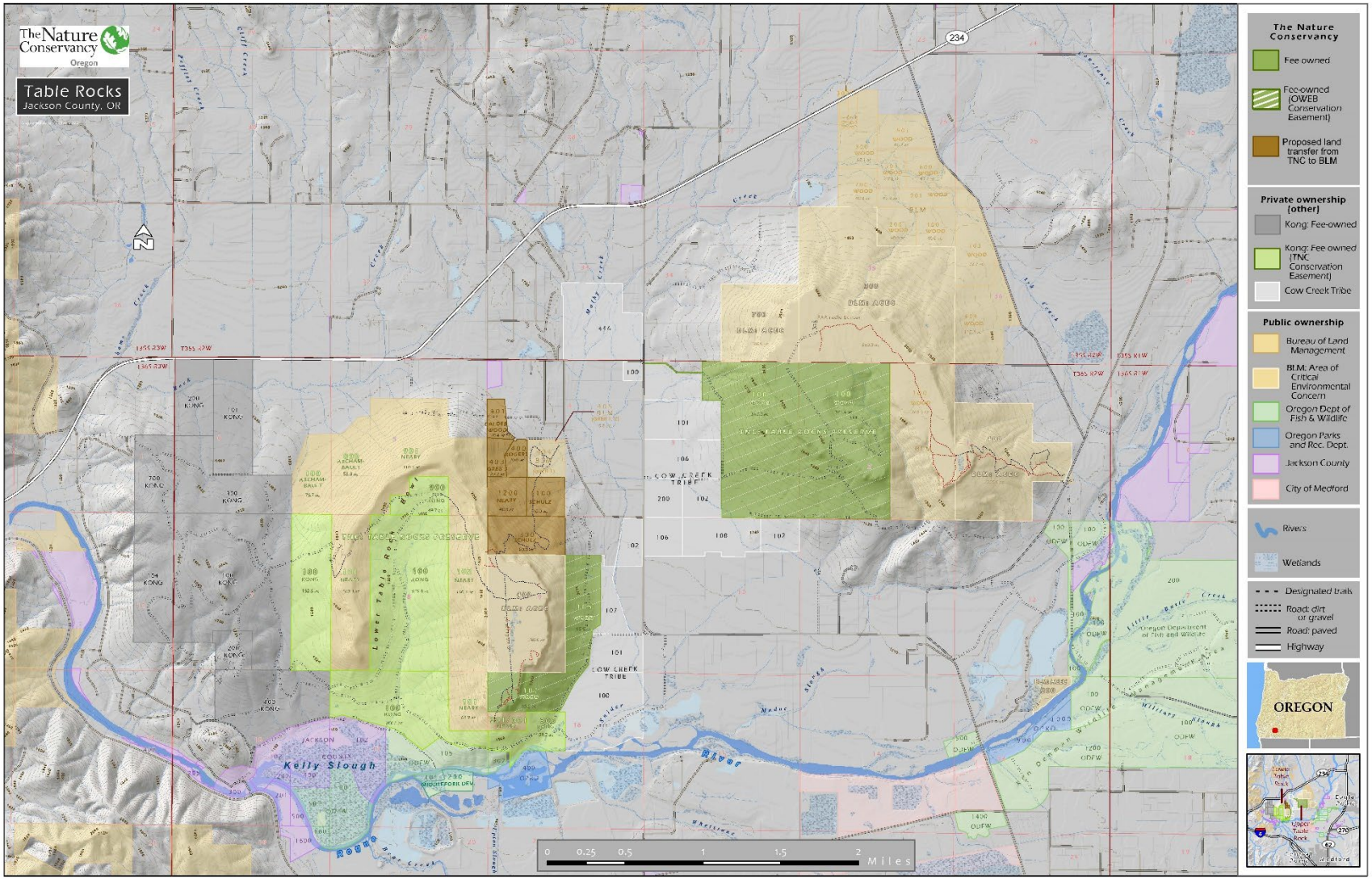

Figure 4.9. Map of protected lands in and around the Table Rocks Core Area. Figure provided by The Nature Conservancy (Morison, *in litt*. 2022).

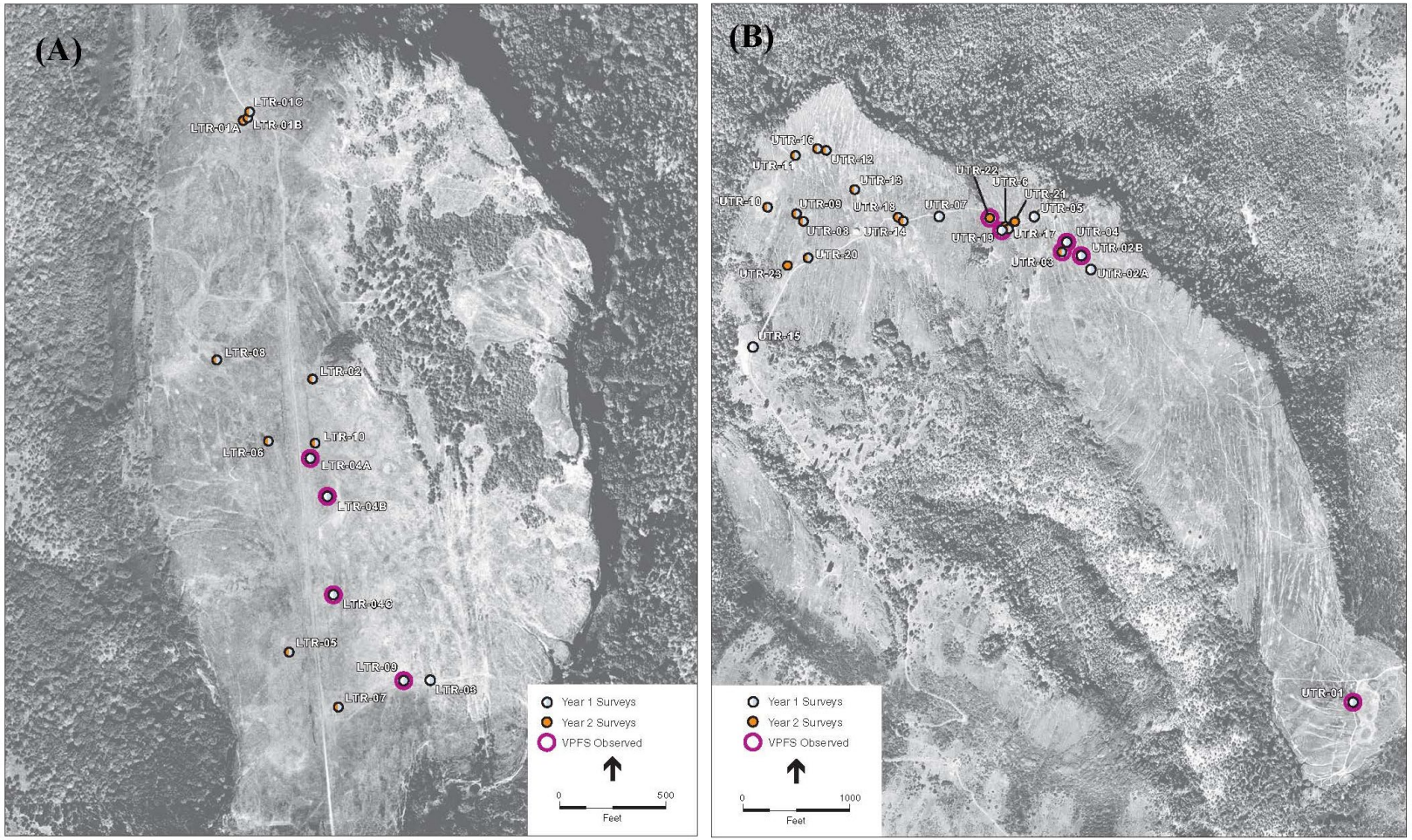

Figure 4.10. Map of vernal pools occupied by the vernal pool fairy shrimp within the Table Rocks Core Area during 2004-2006 surveys. (A) Lower Table Rock, taken from Figure 3 of ESA Associates (2006a). (B) Upper Table Rock, taken from Figure 5 of ESA Associates (2006a).

4.7.3. White City

This is a zone 2 core area with a goal of protecting 85% of vernal pool habitat for the vernal pool fairy shrimp. The core area is composed of eight polygons which are located throughout White City. This core area corresponds to the Whetstone Creek, Agate Desert, and Agate Lake Core Areas from the Rogue and Illinois Valley Recovery Plan (Service 2012b). The biggest differences in the boundaries are the addition of a polygon in the north-central portion of White City and the inclusion of the area between the two polygons on the east side of White City (**Figure 4.7**).

Based on the core area boundaries from the Rogue and Illinois Valley Recovery Plan, this core area is 4,762 acres in size (2,358 acres White City East, 2,368 acres White City West), of which 4,552 acres was estimated to be vernal pool habitat (2,251 acres White City East, 2,301 acres White City West) (Service 2012b). There are 13 different preserved areas for vernal pools in this core area (**Table 4.1**). These preserved areas protect approximately 1,351 acres of land within this core area, all of which is vernal pool habitat. Thus, an estimated 29.7% of vernal pool habitat has been protected within this core area (**Figure 4.11**, **Figure 4.12**, **Table 4.2**).

4.7.3.1. Vernal Pool Fairy Shrimp Occurrences

Of the 186 occurrence records within this core area provided by the Roseburg Fish and Wildlife Office (Friedman, *in litt*. 2021), 135 (73%) are within mapped protected lands and 51 (27%) are outside of mapped protected lands (**Figure 4.11**, **Figure 4.12**). Shapefiles of seven small parcels throughout White City that have been protected as compensatory mitigation associated with section 7 consultations were not obtained, so several of the remaining 51 occurrences may be within these unmapped protected lands. And though the occurrence records only show the vernal pool fairy shrimp within the Whetstone Savanna Preserve, it is also known to occur in pools throughout the adjacent ODOT Vernal Pool Mitigation/Conservation Bank and ODOT Kincaid Site Mitigation Property as well.

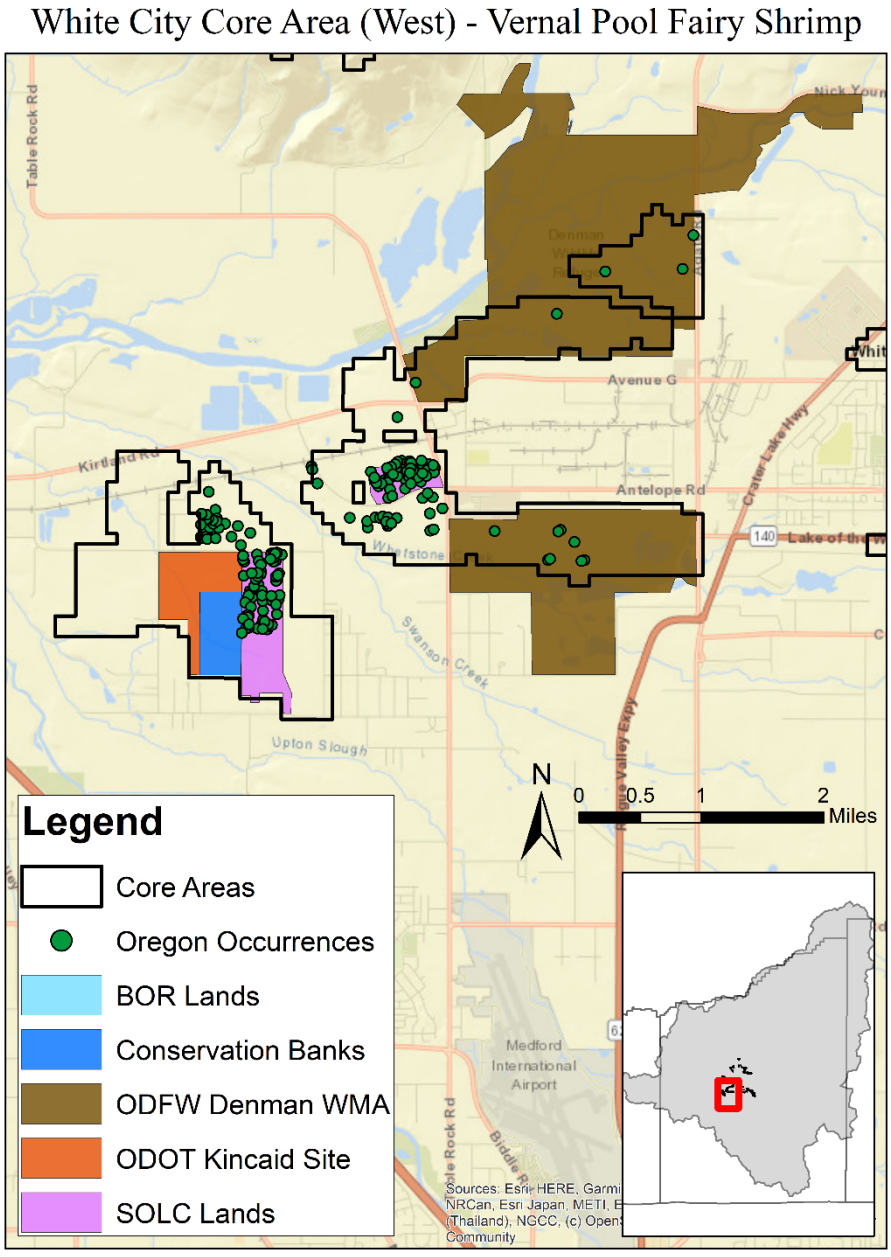

Figure 4.11. Map of known occurrences of vernal pool fairy shrimp provided by the Roseburg Fish and Wildlife Office (Friedman, *in litt*. 2021) and of protected lands within the western part of the White City Core Area. The vernal pool fairy shrimp is also known to occur on the ODOT Vernal Pool Mitigation/Conservation Bank and the ODOT Kincaid Property Mitigation Site. Shapefiles for three small mitigation parcels in western White City were not obtained. BOR = Bureau of Reclamation, ODFW Denman WMA = Oregon Department of Fish and Wildlife Denman Wildlife Management Area, ODOT = Oregon Department of Transportation, SOLC = Southern Oregon Land Conservancy

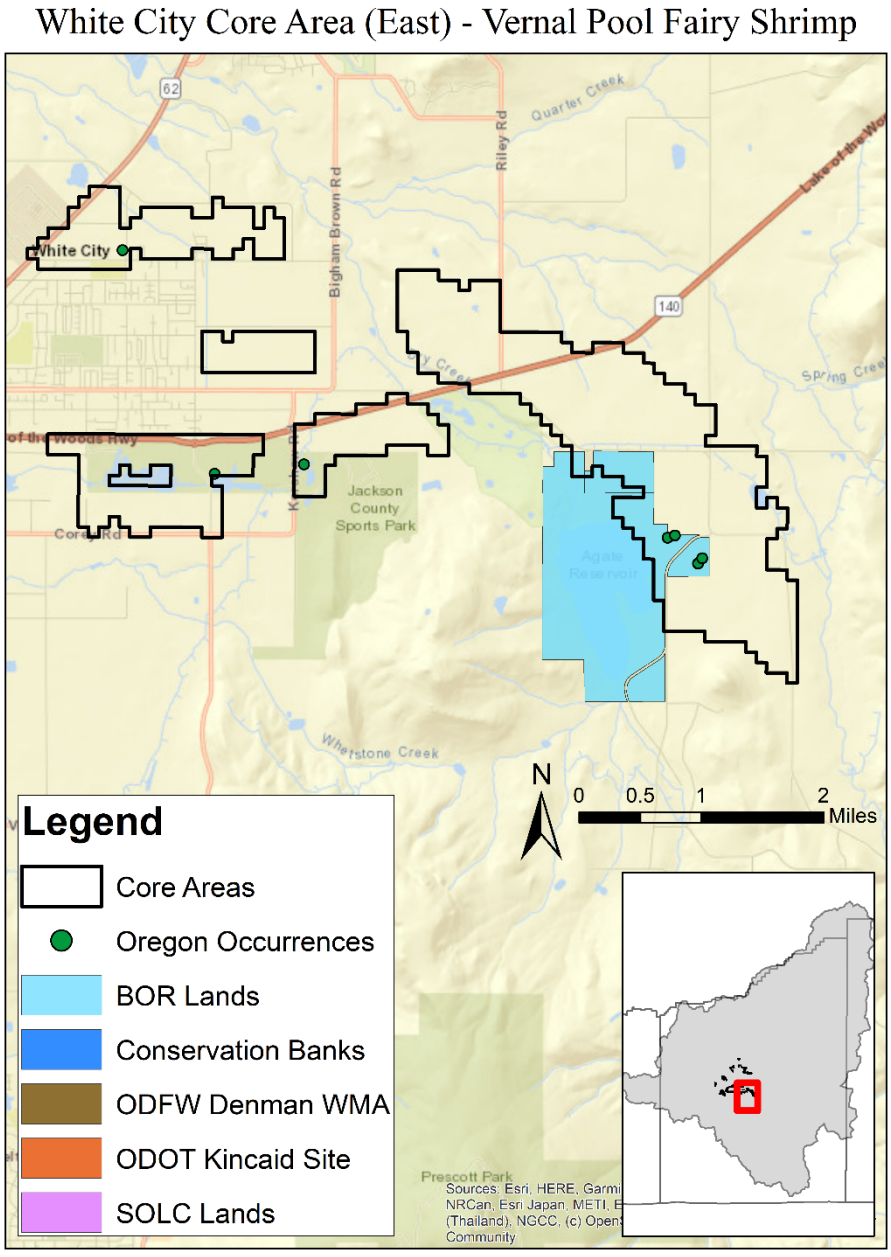

Figure 4.12. Map of known occurrences of vernal pool fairy shrimp provided by the Roseburg Fish and Wildlife Office (Friedman, *in litt*. 2021) and of protected lands within the eastern part of the White City Core Area. Shapefiles for four small mitigation parcels in eastern White City were not obtained. BOR = Bureau of Reclamation, ODFW Denman WMA = Oregon Department of Fish and Wildlife Denman Wildlife Management Area, ODOT = Oregon Department of Transportation, SOLC = Southern Oregon Land Conservancy